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# From Silos to Systems: Issues in Clean Energy and Climate Change

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# From Silos to Systems: Issues in Clean Energy and Climate Change

## A report on the work of the REIL Network, 2008-2010

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YALE SCHOOL OF FORESTRY & ENVIRONMENTAL STUDIES 2010

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# *Dedication*

Ms. Janet Hall, who passed away in late January 2009, was an early supporter and contributor to the REIL Network. Ms. Hall, a former U.S. Foreign Service Officer, Vice President at Westinghouse Corporation, and Counselor to the U.S. Trade Representative, spent much of her professional career immersed in the policy issues that influenced economic development strategies, energy use – both conventional and renewable, and international trade. As a Senior Policy Advisor to the International Bioenergy Initiative at the United Nations Foundation, Janet was a tireless advocate for bringing solutions to people with problems. Janet knew the power of contacts and engagement among a variety of people – in fact, she recognized that "network" was a verb long before the IT revolution – and that revolution only brought her in closer contact with people she knew who could share ideas, policy perspectives and best practices anywhere in the world. Engaging in the REIL Network was an early priority for her, and it has led to any number of formal and informal sessions that have produced new insights and highlighted best practices among a variety of players in this transformative international dialogue. All of us who knew her miss her wit, cogent insights, and guidance very much – and for that reason we are dedicating this volume to her memory.

*Melinda Kimble, United Nations Foundation*

# Preface

Brad Gentry observed a few years ago that we by design do not attempt to fit our work to a pre-existing structure or paradigm but rather let the purpose and form "magically evolve as we do this dance of a network...."

So far, we feel, the intention has worked and allowed for outcomes we could not have planned in advance.

This year, therefore, we decided to have the volume reflect both the diversity of our eclectic band and its cohesion. This volume is meant as a forum for the ongoing expression of the individual thoughts of the members – but also hopes to be a reflection of the content of the group mind.

To express the varying forms of output, we divided the book into 4 sections:

1) essays and thought pieces by REIL; 2) analyses we requested of our own members; 3) analyses contracted by external organizations; and 4) pieces written by group members for other publications. All the opinions expressed herein reflect only those of the authors. Furthermore, REIL members belong to the group as individuals and not as representing any organization or entity.

I am incredibly grateful for the members of the group, for the fact that we get to work together and for the work we do together.

°It means a great deal to me to dedicate this volume to one of the first members of our group, Janet Hall. I met her in 2005 at a hearing of the International Trade Commission. We were instant colleagues and friends! To a lovely, kind, thoughtful woman, whom we all miss very much. Her energy and spirit will always be part of REIL and our work.

Leslie

*Leslie Parker*
*Director, REIL*

# Foreword

**Brad Gentry**, *Director, Yale Center for Business and the Environment*
**James Cameron**, *Founder and Vice Chairman, Climate Change Capital*
**Leslie Parker**, *Managing Director, REIL*
**Martijn Wilder**, *Partner, Head of Global Climate Change and Environmental Markets Practice, Baker & McKenzie*
**Rachel Maxwell**, *Deputy Director, REIL*
**Richard Saines**, *Partner, Head of North American Practice, Global Climate Change and Environmental Markets Practice, Baker & McKenzi*

To the participants of REIL/REEEP/Yale Roundtables and to the Governing Board of REEEP and to REIL:

This publication is a further compilation of much of the work REIL has done to date focusing on clean energy and climate change law, policy, and finance. REIL arose out of a "think piece" for the IEA Renewable Energy Working Party, in the run-up to the September 2002 World Summit on Sustainable Development – at which Prime Minister Tony Blair launched REEEP.

The past year, 2009, has seen a continued concerted focus on stimulus and private investment in clean energy despite the economic downturn. It saw further public finance and development of domestic laws to drive investment in renewable energy with many countries now endorsing industry development through government-backed measures that include, among others, feed-in tariffs, government loans and grants and renewable energy targets. This past year ended on a somewhat muted note with the achievement of the Copenhagen Accord – a modest, albeit important step forward, which for the first time establishes specific targets for major developing and developed countries and a desired objective to limit global temperature rise to below 2 degrees Celsius. Whether Copenhagen will ultimately be viewed as a watershed moment is yet to be determined. However it is clear that Copenhagen and its aftermath will impact the future strategies for growth of the global renewable energy markets. The success and failure of Copenhagen presents an important opportunity to the climate change and clean energy community, as it reflects on what remain and will be the best ways to catalyze the low carbon economy going forward – building on work being done on all levels – international, regional, national, subnational, and local. The challenges of achieving global consensus on this point highlight the imperative to ensure that any policies that are adopted at any level of government align with and leverage off of economic realities. 2009 has reminded us that the long-term, sustained financing toward scaled low-carbon solutions will be achieved only if it is underpinned by clear, long-term and economically robust policy systems. The policies and actions that make clean energy development the rational economic decision are going to be the ones that deliver the scale needed to solve the climate problem.

This Yale publication and our Roundtables are outputs of REIL's mission to both provide content for and to foster the dialogue between these various allies, to help stakeholders move from silos to systems in order to accelerate the international shift to clean energy.

As we have said before, we are very grateful to have all of you as our partners in what has been a rewarding and fun endeavor to date. We look forward to continuing to work with you and thank you sincerely for both the keen insights and thoughtfulness that you have brought to the table!

Sincerely,

Leslie, Martjin, Rick, James, Brad, Rachel

*"The currents and eddies of right and wrong, I can't navigate.*
*I'm no voyager. But in the thickets of the law, there I am a forester. . .*
*This country's planted thick with laws . . . and if you cut them down,*
*d'you really think you could stand upright in the*
*winds that would blow then?"*

– Thomas More on the importance of the
rule of law in Robert Bolt's play, *A Man for All Seasons*

# Acknowledgements

The REIL Network would like to gratefully acknowledge our associates: the Renewable Energy and Energy Efficiency Partnership (REEEP), the Yale Center for Business & the Environment, the Yale Project on Climate Change, the Yale Center for Environmental Law & Policy, Baker & McKenzie's Global Climate Change and Environmental Markets Practice, and Climate Change Capital.

We would very much like to thank our partners for the annual REIL/REEEP/Yale Roundtables on Clean Energy and Climate Change Law and Policy held at the Yale School of Forestry & Environmental Studies beginning in 2006 – the UN Foundation, the Blue Moon Fund, the Wege Foundation, the German Marshall Fund, Symbiocycles, the Australian Greenhouse Office, and the Doris Duke Charitable Trust – for their material and nonmaterial support. Also, of course, our thanks to Jane Coppock, editor of the Yale School of Forestry & Environmental Studies Publication Series, and Dorothy Scott, who does page layout, without whom this report would not be possible! And our core team and editors: Martijn Wilder, Brad Gentry, James Cameron, Rick Saines, our Deputy Director, Rachel Maxwell, and all of our authors. Thanks to all for their very hard work, great ideas, and dedication to REIL and to the Yale events!

*Leslie Parker, Managing Director, REIL*

# *I.*

# *Essays written for this volume*

# Introduction

*Mark Nicholls*
*Editor,* Environmental Finance

How different things look in 2010 for renewable energy advocates. Last year, in the run-up to the Copenhagen climate talks, hopes were high that the world was approaching a tipping point. As momentum built ahead of the 'make-or-break' negotiations, many argued that progress towards an ambitious post-2012 international climate change agreement would drive dramatic investment into renewable energy and other low-carbon technologies.

Enough ink has been spilt about those two fractious – and profoundly disappointing – weeks for me not to need to rehearse the arguments here. Suffice to say, the conclusion of a legally binding global treaty to extend or replace the Kyoto Protocol looks as far off now as at the conclusion of the Copenhagen talks. Negotiators are already playing down expectations for the next set of negotiations, to take place in Cancún, Mexico, in December.

And, in sharp contrast to the second half of 2009, climate change has slipped significantly down the global agenda. It is perhaps inevitable that the intense media interest ahead of Copenhagen could not be sustained, but the issue's prominence has also suffered from the 'Climategate' controversy, where climate change sceptics have seized upon leaked emails to claim that climate change scientists have misled their peers and the public about the degree of global warming that can be observed.

Furthermore, with the industrialised world struggling to emerge from the greatest economic convulsion since the Second World War, it is proving difficult to make the case for generous government support for low-carbon technologies. All this is conspiring to generate significant headwinds for those seeking to promote renewable energy around the globe.

But while those in the climate change and clean energy communities may not be basking at the centre of the world's attention this year, as last, the outlook for renewable energy and low-carbon development is not as grim as many suppose.

For a start, as many commentators have noted, Copenhagen could have been judged a success before the first negotiator set foot in the city's Bella Centre. The lead-up to the talks generated unprecedented policy development, especially in the major fast-developing economies where, frankly, the battle against climate change will be won or lost. China and India, especially, have introduced far-reaching climate change policies, with significant targets for increasing renewable energy penetration and improving energy efficiency.

Second, commitments among most industrialised economies remain intact. While the EU did not feel able to move from a 20 percent greenhouse gas reduction target to a 30 percent target – as it had promised to do if other industrialised countries made similarly ambitious pledges – it has stuck to its stretching 2007 climate and energy package. There has been surprisingly little push-back at the policy level against the additional costs that are likely to be incurred by the EU's 2020 renewable energy targets.

Third, the more optimistic commentators are becoming more positive about the Copenhagen Accord. Many initially decried it as a toothless, voluntary agreement that fell outside the formal UN negotiating process. However, hopes are growing that it could prove a useful vehicle to break down the Kyoto barriers between industrialised signatories and the developing world.

Moreover, many observers are coming to the conclusion that a comprehensive, top-down agreement along the lines of the Kyoto Protocol may prove to be impossible: the implications for energy use and economic development implied by a serious effort to control climate change may mean the stakes are simply too high for a UN process to handle.

Nonetheless, and if you'll pardon the pun, some of the heat has undoubtedly gone out of the climate change debate. In certain respects, that will make the job harder for some, in terms of garnering the attention of time-poor policy-makers, or the investment dollars of agnostic investors.

In other respects, however, it's business as usual. Investment will continue to flow – but at a lower and more considered velocity. Policy will continue to be made, and – and this is where the REIL network's value is especially to be found – an enormous amount of the detail still needs to be elaborated.

Despite the fads and fancies of the world's media, the hysteria of the climate change sceptics, and today's relative lack of lip-service from politicians, climate change is not going away as an issue, and renewable energy's growing role in the world's energy mix is assured.

Indeed, the post-Copenhagen comedown has one clear outcome. The debate around the low-carbon economy has returned to being an argument much more about economics, rather than environmentalism and ethics. What will drive policy and investment over the next few years will be concerns over capturing the low-carbon economy, rather than saving the world.

# Biosketches of Authors and Editors

**Lisa Alejandro** is a Lead International Trade Analyst at the United States International Trade Commission. She analyzes trade in services, with particular emphasis on renewable energy and financial services. Ms. Alejandro orchestrated a report that examined U.S. and foreign markets for renewable energy services (USITC publication Renewable Energy Services: An Examination of U.S. and Foreign Markets), and is currently working on a study assessing the global competitiveness of U.S. solar and wind power service providers. She has written on several other environmental services topics (USITC publications Solid and Hazardous Waste Management Services: An Examination of U.S. and Foreign Markets; Remediation Services: An Examination of U.S. and Foreign Markets; and Air and Noise Pollution Abatement Services: An Examination of U.S. and Foreign Markets), as well as on banking and securities services in numerous markets including China, Malaysia, Korea, India, Panama, Morocco.

Ms. Alejandro holds a Bachelors degree in English and a Masters degree in International Trade from George Mason University. Prior to working for the U.S. International Trade Commission, she conducted trade development assistance in the Balkans as a consultant with Booz Allen & Hamilton.

**James Cameron** is an Executive Director and Climate Change Capital's (CCC) Vice Chairman. He is responsible for strategic and sector development and represents the firm at the highest levels of business and government.

He is a pre-eminent expert in developing policy responses to climate change. Prior to CCC he was Counsel to Baker & McKenzie and was the founder and the head of their Climate Change Practice. He has spent much of his legal career working on climate change matters, including negotiating the UNFCCC and Kyoto Protocol as an adviser to the Alliance of Small Island States. He has held academic positions at Cambridge, London, Bruges and Sydney and is currently affiliated with the Yale Centre for Environmental Law and Policy. As a barrister he appeared in several of the leading cases in environmental law.

Mr. Cameron is Chairman and a Trustee Member of the Carbon Disclosure Project, Chairman of China Dialogue, a Board Member of the Worldwatch Institute, a treasurer of REEEP, a member of Oxfam's development board and a Senior Advisor to The Climate Group. He is a member of the board of GE Ecomagination, a member of the

Copenhagen Climate Council, a member of the development board of the Smith School and a member of the World Economic Forum's Climate Council.

**Paul Curnow** is one of the world's leading legal experts on climate change, having specialised since 2000 in carbon, renewables, and environmental markets. He advises government, multilateral and private sector clients on domestic and international climate and renewable energy regulation and policy, cross-border project development and financing under the Kyoto Protocol and domestic and regional trading schemes, and structured carbon financing deals in OTC and exchange-traded markets. Between 2001 and 2004 he was an international climate change negotiator with the Australian Government (as part of the Australian Greenhouse Office). A partner with Baker & McKenzie since 2007, he is a Visiting Fellow in Environmental Markets at the University of New South Wales and Chair of the Australian Working Group, Carbon Markets & Investors Association (CMIA).

Paul Curnow has a masters degree in Public Policy and Environmental Law from the Australian National University, where he also obtained his LLB and BA. He has published widely in climate change law including as co-editor of *Implementing CDM Projects: A Guidebook to Host Country Legal Issues*, and editor of the CDM and JI Rulebooks.

**Henry Derwent** became the President and CEO of the International Emissions Trading Association (IETA) in February 2008. Previously, as international climate change Director for the UK Government, he oversaw the UK's role in the international negotiations, in the G8 (especially as Prime Minister's special representative during the UK G8 Presidency in 2005) and in other forums. He has been closely associated with the development of greenhouse gas trading in the UK and Europe from its earliest days. He previously had responsibilities for all aspects of climate change and sustainable energy in the UK as well as air quality and industrial pollution control. Before that, he was an international corporate finance executive at a major investment bank.

**Bradford Gentry** is the Director of the Yale Center for Business and the Environment, as well as a Senior Lecturer and Research Scholar at the Yale School of Forestry & Environmental Studies. Trained as a biologist and a lawyer, his work focuses on strengthening the links between private investment and improved environmental performance. He is also an advisor to GE, Baker & McKenzie, Suez Environnement and the UN Climate Secretariat, as well as a member of Working Lands Investment Partners and Board Chair for the Cary Institute of Ecosystem Studies. He received his B.A. from Swarthmore College (Phi Beta Kappa) in 1977 and his J.D. from Harvard Law School (Magna Cum Laude) in 1981.

**Colin High** is the Chairman and co-founder of Resource Systems Group, Inc, an energy environment and transportation consulting firm based in White River Junction, Vermont. He is the leader of RSG's climate and energy group and specializes in lifecycle air emissions modeling in the electric power sector. He has worked on a wide range of projects in the environment and energy fields including renewable energy, energy efficiency, and carbon accounting.

Dr. High holds a PhD in Geography and Earth Sciences from the University of Bristol in England and for many years taught environmental science at Dartmouth College, Columbia University and the University of Ibadan in Nigeria. He also helped develop environmental foreign study programs in Kenya and in Russia.

**Debra Jacobson** is Co-Director of the Solar Institute at The George Washington University (GW), a Research Professor of Energy at GW, and a Professorial Lecturer in Energy Law at GW Law School. Since 2001, she also has served as the owner and principal of DJ Consulting LLC, a consulting firm specializing in energy and environmental issues.

She has worked on issues involving energy and environmental law and policy for more than 30 years, including senior staff positions in the U.S. House of Representatives and the U.S. Department of Energy. She currently serves on the Strategy Committee for the Department of Energy's Wind Powering America Program, as an Advisor to the Renewable Energy and International Law Project, and was a member of the founding Board of Directors of the Women's Council on Energy and the Environment in Washington, D.C. She received her B.A. in Environmental Studies from the University of Rochester and her law degree from GW Law School.

**Sean P. Jamieson** is an energy attorney with the law firm, Van Ness Feldman, P.C., where he primarily provides counsel to clients on matters relating to natural gas, electricity, transportation, and energy policy. He has previously worked in a legal capacity at Squire Sanders & Dempsey LLP, and as a law clerk to Commissioner Irving A. Williamson of the U.S. International Trade Commission.

Prior to law school, he worked as a corporate governance management consultant at a Washington, DC-based consulting firm, in an advisory role for a national brand media campaign, and also as an intern at the United Nations headquarters in New York. He holds a bachelor's degree from The George Washington University, where he was a presidential academic scholar. He received his juris doctor degree from Howard University School of Law and resides in Washington, DC.

**Richard L. Kauffman** recently stepped down as the Chief Executive Officer of Good Energies, since 2007 having built it during that time into one of the largest investors in renewable energy. He led $750MM in equity investments in over 30 renewable energy technology companies and solar and wind project developments. He also served on the board of Q-Cells, one of the world's largest producers of solar cells.

He currently serves as Chairman of the Board of Levi Strauss and was previously a Partner of Goldman Sachs, where he was chairman of the Global Financing Group, a member of the firm's Partnership Committee, Commitments Committee, and Investment Banking Division Operating Committee. Before joining Goldman Sachs, he was vice chairman of Morgan Stanley's Institutional Securities Business and co-head of its Banking Department.

He is a member of the board of The Brookings Institution, the Yale School of Management Board of Advisors, and Co-Chairman of the Advisory Board of the Yale Center for Business and the Environment. He is a member of the Council on Foreign Relations.

**Melinda Kimble** is a senior vice president at the United Nations Foundation, and oversees their International Bioenergy Initiative. She joined the UN Foundation in May 2000 as Vice President for Programs and worked to develop Foundation partnership programs in the areas of Children's Health; Energy & Climate Change; Biodiversity; Peace, Security, and Human Rights; and Women's Health. Prior to the Foundation, Ms. Kimble served as a state department foreign service officer, attaining the rank of minister-counselor. She served in policy-level positions in the Bureau of Economic and Business Affairs, overseeing multilateral development issues and debt policy and in the Bureau of Oceans, International Environment and Scientific Affairs (OES), leading environmental negotiations.

She has served or is serving on several key international boards and commissions, including the Board of International Science Organizations for the National Academy of Sciences, the U.S. National Commission for UNESCO and the Regional Environment Center for Central and Eastern Europe (REC). She also serves as an adjunct professor at the Maxwell School of Syracuse University. She speaks French and Arabic and holds two master's degrees: Economics (University of Denver) and MPA (Harvard's Kennedy School of Government).

**Rachel Maxwell** is the Deputy Director of REIL. She joined REIL in 2005. Rachel worked as the Vice President of Maxwell Statistics from 2000 to 2005 and as an Independent Education and Administration Consultant. She has worked on analysis projects for various organizations, from Microsoft and Xerox to the Early Learning Center of Snohomish, WA. Ms. Maxwell has extensive experience as an independent editor. She was co-editor of, From Debate to Design: Issues in Clean Energy and Climate Change Law and Policy A report on the work of the REIL Network 2007-2008. She earned her bachelors degree from Bryn Mawr College and is currently working on an MBA in Sustainable Business at the Bainbridge Graduate Institute.

**Mark Nicholls** is editor of *Environmental Finance* magazine, which covers the growing relevance of environmental and social issues to the financial community and its corporate clients. Launched in 1999, *Environmental Finance* specialises in coverage of emerging markets in environmental goods – such as greenhouse gas emissions allowances and renewable energy certificates. It also covers socially responsible investment, corporate social responsibility, renewables financing and weather derivatives. He is also editor of *Carbon Finance*, a specialist newsletter focusing on carbon trading, greenhouse gas emissions management, and the impact of climate policies on business and finance.

Over the last nine years, he has developed a particular specialty in business and policy responses to climate change, specifically in the emerging carbon markets created by, or linked to, the Kyoto Protocol. In 2000, he was named Socially Responsible Investment Journalist of the Year (trade press), in an award sponsored by Friends Provident. Prior to co-founding *Environmental Finance*, he was the Hong Kong-based Asia editor for *Risk* magazine, which is the leading financial derivatives and risk management publication. He has a degree in politics from Durham University and a master's degree in European Politics and Policy from the London School of Economics.

**Robert Nordhaus** is a member of the Washington, DC law firm of Van Ness Feldman, P.C., where he specializes in energy and environmental regulation. He also serves on the adjunct faculty of the George Washington University Law School. He originally joined Van Ness Feldman in 1981, after serving three years as the Federal Energy Regulatory Commission's first General Counsel. He practiced with the firm until 1993, when he was appointed General Counsel of the Department of Energy by President Clinton. He rejoined the firm in 1997. In 1977, prior to his service at FERC, he was a member of the Energy Policy and Planning Office in the Carter White House. In 1975 and 1976, he was counsel to the House Interstate and Foreign Commerce Committee, and from 1963 to 1974, he served in the House Legislative Counsel's Office. He is a graduate of Stanford University and Yale Law School and a member of the New Mexico, District of Columbia and Supreme Court bars.

**Leslie Parker** is the founder and managing director of REIL (Renewable Energy and International Law), an international policy and law network for clean energy, in association with the Renewable Energy and Energy Efficiency Partnership, the Yale Center for Environmental Law and Policy, the Yale Center for Business and the Environment, and Baker & McKenzie's Global Clean Energy and Climate Change Practice. REIL is a network of policy makers, business and finance, thought leaders, lawyers, and technical experts, addressing policy and law and technical issues arising in the mainstreaming of clean energy and the development of the clean energy market. REIL was founded in 2003 from a 2002 initiative of the International Energy Agency's (IEA) Renewable Energy Unit where she interned. Prior to that she held various posts in New York City government, notably, as division director in the Finance office of the Department of Social Services where she was responsible for developing and enhancing City revenue and working with the Mayor's Office on the agency's 12 billion dollar budget, and as an Assistant Director of the budget at the Administration for Children's Services where she oversaw 1.2 billion dollars of the NYC city budget. She has a Masters in Art History, and worked for 11 years at the Metropolitan Museum of Art, including seven in the Department of European Sculpture and Decorative arts. She attended Bryn Mawr College and New York University.

**Richard Saines** heads the North American Climate Change and Environmental Markets Practice at Baker & McKenzie. He is widely published and globally recognized as a leading climate change lawyer, bringing over a decade of experience on climate change law matters advising multinational companies, financial institutions, funds and project sponsors on carbon and environmental market transactions within the international, regional and voluntary markets. He also advises major global corporations on climate change policy, sustainable development and global corporate greenhouse gas compliance and management. He is recognized by *Chambers USA* and *Chambers Global* as a leading climate change lawyer.

**Paul Savage** is the CEO of Nextek Power Systems, where he is the architect of the company's IP, financial, and partnering strategy. He is also a Founding Governing Member of the Emerge Alliance Corporation, a current Member of the Clinton Global Initiative, and a member of the Board of Directors of Winrock International, a non-profit entity that seeks to advance and improve the lives of people around the world. His experience includes Bond Trading at CS First Boston and risk management at Lehman Brothers before joining the start-up operations of Caterpillar's dealership in Vietnam filling 2 roles as the Director of Customer Finance and Marketing. He helped grow this green-field start-up to 87 employees, 5 offices and $22 million in sales in 2 years. He graduated from Haverford College with a Philosophy degree in 1983.

**Martijn Wilder** is head of the Baker & McKenzie's Global Environmental Markets (Climate Change) practice. He is regarded as a legal pioneer in the development of legal mechanisms and regulations underpinning the emergence of international carbon markets. He has been ranked as one of the leading climate change lawyers by *Chambers Global* and is listed among the best lawyers in his field by *Best Lawyers Australia 2009*. He founded serves as chair and/or board member of numerous climate change and emissions trading advisory groups and taskforces, including the International Renewable Energy and Energy Efficiency Partnership (REEEP), the Carbon Trust (Australia) and the NSW Carbon Markets Taskforce. Martijn is also a Professor of Climate Change Law at the Australian National University.

Mr. Wilder has advised governments and international agencies on the development and design of climate change and emissions trading laws, the building of market infrastructure and the procurement of carbon assets. He regularly works on international carbon transactions and has advised on a broad range of investments and fund raisings in, and the establishment of funds for the broader environmental markets areas. He continues to be a key adviser to governments and clients on post-2012 carbon markets and funds and the development of polices and transactions in relation to reducing emission from deforestation and degradation (REDD++). He has honours degrees in both Economics and Law and a LLM (Master of Laws) from the University of Cambridge where he studied as a Commonwealth Trust Scholar. He has published widely in the climate change and international law area.

# The Flight from the Rational: Why Emissions Trading Fell from Grace and Why It Needs to be Restored

*Henry Derwent, President and CEO*
*International Emissions Trading Association (IETA)*

On 25 March 2010, the *New York Times* published an obituary of emissions trading. In a piece entitled "Cap and Trade Loses its Standing as Energy Policy of Choice," John Broder set out how, in little over a year, the policy so firmly endorsed by the new President Obama was now "in wide disrepute," and expected that any new legislation that crawled out of the Senate would be at best a pale shadow of the muscular economy-wide system that had been introduced with such fanfare into the House.

A week earlier, it was the *Economist* pronouncing the last rites. In "Cap and Trade's Last Hurrah – The Decline of a Once Widely Popular Idea," their lead writer spoke of it as a 1990s idea, and said that market-based approaches were losing relevance. The *Economist* has also been tracking the difficulties with the Carbon Pollution Reduction Scheme (carefully named so as to not use the words cap or trade) in Australia as well as the tough politics surrounding the issue in the U.S.

These news items may turn out to look premature if in fact a cap and trade bill does manage, despite the odds, to make its way onto the U.S. statute book, and if Kevin Rudd's manipulation of broader Australian election issues clears the way for the Australian scheme to take effect. Nevertheless cap and trade as a policy has encountered furious and effective resistance not just in those two countries but also in Japan and Korea, where the final shape of government plans to introduce serious emissions trading systems remains very doubtful. The emissions trading scheme introduced in New Zealand has also been the subject of strong criticism and calls for its repeal or postponement. Only in Europe has the scheme, introduced with what looks with hindsight to have been remarkably little fuss, become a part of the policy landscape, even if arguments continue about the level of ambition of the next targeted emissions reduction total, about allocation methodology and about a variety of more technical issues.

Why has this happened? Why is a policy widely regarded in the academic community as a success where it has been tried suddenly become so contentious?

Why has a policy originally intended to reduce costs to industry to a degree regarded as suspicious by environmentalists become so unacceptable to industry? Why has a market approach invented and proven in the U.S. for regional pollutants become so contentious there when it is applied to global ones?

To answer these questions we need to go through the advantages claimed for emissions trading when it was in favour in the U.S. and introduced in the EU. We need to see whether there is real evidence that those advantages are illusory or what other elements of the case in favour have become politically unacceptable.

There are perhaps eight reasons why trading seemed such an obviously tailor-made solution for greenhouse emissions.

1. Governments accepting the need for significant emissions reductions would be keen to find low-cost solutions to their obligations. The Kyoto mechanisms were constructed precisely in order to allow countries with targets to keep their costs down, within the negotiated supplementarity limits.

2. IPCC and other cost data showed clearly that the cost of emissions reduction opportunities differed significantly across the globe; on the back of these figures, U.S., European and Australian economic models of global trading and the use by developed countries of project opportunities in lower-cost developing countries showed significant benefits from trading.

3. There was no environmental reason to object to non-domestic locations for emissions reductions or to the principle of major polluters offsetting their pollution by equivalent amounts of traded or bought project-based emissions. It follows from the physical and chemical nature of $CO_2$ and other greenhouse gases that it is the total level of emissions, not the location on the surface of the globe of the emission sources, that counts. Therefore GHGs, being also generally non-noxious around the source of their emission, are tailor-made for trading, more so than most other regional or local pollutants.

4. Trading was almost universally acknowledged to be the most economically efficient means of imposing an emissions reduction target, on the grounds that the market will be much better at distributing the undoubted economic burden than regulators and the precise distribution (see the points above) was a matter of indifference from the perspective of the objective of the regulation.

   This is even more the case when there is a bewildering variety of different actions and investments possible that have the effect of reducing GHG emissions. The notion of a single marginal cost curve, however useful in terms of high-level explanation, gives a misleading impression of a priori knowledge available to regulators about the investments and sectors where action would be most economic at different stages of a national or global emissions reduction trajectory.

Many economists had earlier said that a tax is preferable to a price. The main reason was that the potential economic damage that could be done by fluctuating prices was seen as being greater than the benefit to the planet achieved by the earlier emissions reduction that could be achieved by accepting a fluctuating price. But as there was wider recognition that the damage caused by climate change was going to be greater and sooner than originally thought, the reason for preferring tax on economic grounds diminished. The political arguments against a tax and in favour of flexible regulation with an element of trading have, meantime, remained constant.

5. A further reason for supporting trading, implicit in the economic advantages referred to in 4 above but worth drawing out on its own, stems from the recognition that companies all have their own abatement cost curves that can for historic or process reasons be very different from each other. Trading allows companies to come to their own "make or buy" decisions depending on their own existing capital stock, their own efficiency potential, their own cost of capital, and their own competitive and demand circumstances.

   Trading recognizes that there may be circumstances where it is economically rational for a company to continue to be a major emitter of greenhouse gases, and reduces that calculation to a price of carbon below which it makes sense to use the market to fulfill regulatory obligations, and above which it makes sense to spend money at home in order to keep the net cost of the regulatory obligations lowest, and perhaps produce emissions reductions that have a sale potential beyond the simple compliance with obligations.

6. Again implicit in both 4 and 5, but worth drawing out because it is so often missed or misunderstood, is the temporal flexibility provided by trading. The timing of investments is a hugely important part of the investment decision, and stranded assets can radically affect companies' overall profitability. It makes perfect sense for a company faced with an emissions reduction obligation that requires major capital investment to undertake that investment at the time that is economically optimal for the business, and use the markets in the meantime to deal with the regulator's demands. Because of point 3 above, the earth's atmosphere is none the wiser.

7. A global regime needs global standards and global values, and both can usually only be achieved by global institutions. This applies as much to trading as to any other activity. Without trust in a common set of institutions and systems, willingness to trade diminishes and potentially expensive market failures prevent the capturing of the economic benefits. The UNFCCC system and the Kyoto mechanisms were founded on a common set of standards for measuring emissions and monitoring emissions reductions, and a common set of institutions – particularly the International Transaction Log and the CDM Executive Board – aimed at

setting standards for, and keeping the books on, international trading of emissions reductions and credits.

While the day to day efficiency and throughput of the CDM system had been a source of complaint by much of the private sector from the very start, and the controversies of offsetting as a legitimate route for emissions reduction have never entirely gone away, the UN regime was broadly trusted by environmental, development and financial stakeholders alike, if only as a base on which to build.

8. Finally, flexible trading schemes allow the emissions reductions to be captured even when they occur outside the boundaries of the trading scheme itself, by allowing the contribution of savings on a project basis. The calculation of the baseline from which the project savings are measured, and the distribution of the risk that the savings would have occurred anyway, are issues that have affected governments' willingness to make use of supply-only projects, though both issues are in fact also present in the establishment of targets and baselines at sectoral and national economy levels.

   There is also considerable political attraction in extending trading so as to make it potentially economically interesting for countries without (temporarily or otherwise) formal emissions reduction targets in a global scheme. That the economic incentive flows from private sector funds, rather than from aid-like funds contributed by developed country governments, was seen as another great advantage of global emissions trading.

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Every one of these reasons for making use of trading has in the past couple of years experienced considerable push-back from different groups of stakeholders, often with very different motives. It is instructive to consider in each case what the criticisms are, where they come from, and why they have grown so strong.

1. Firstly, keeping the cost of emissions reductions low. The premise here, of course, is that is accepted that there should be emissions reductions at a level that raises the question of keeping the associated costs low at all. Unfortunately there is much less political support for this now than before. The economic recession increases the volume of the voices who say that the climate will just have to wait, and that in a time of economic difficulty the most important thing is to eliminate costs wherever possible. This links with the familiar, though previously not widely supported, argument that economic growth is good for the economy because in time it will lead to levels of prosperity such that people will be willing to trade off further conventional growth for public goods, including environmental benefits.

   The very companies who would stand to benefit from the introduction of the flexibilities of trading feel that they would do better from defending a more forward position – that there should not be serious levels of imposed emissions reduction or regulation at all. It is logically inconsistent for them then to say much about trading such reductions.

2. Secondly, the availability of lower cost opportunities abroad has been counterweighed by growing objections to the idea of doing anything abroad that could provide employment, when jobs at home are under pressure. The objectors using this argument tend to be those who have always been interested in protectionist approaches in times of economic recession – not companies but politicians responding to the political impact of recession, and organized labour. The degree to which the modern global economy, and supply chains used by almost everyone, depend on the use of global comparative advantage and global outsourcing, seems to have been forgotten. This is part of the anti-globalisation agenda.

3. Third, the scientific reasons for indifference to the location of emissions reductions have not been assailed (though other scientific arguments have – see below). But the substitutability of emissions reductions abroad has come under attack on two fronts, from mainly environmental but also development-oriented NGOs and other stakeholders. There has been a growing suspicion of the bona fides of emissions reduction projects in countries perceived as untrustworthy, and this awakens sympathy from a public with an underlying tendency to believe in scams, fanned by a media which knows that scams have good news value.

   There has also been some re-emergence among environmental and development stakeholders of the argument that offsets or purchases from far away are like the purchase of indulgencies – that there is a moral obligation on polluting firms to stop polluting, rather than make calculations of the economic cost, to the companies concerned or even to society, of stopping polluting. This has some public and political traction on its own, but usually has to be joined with the suspicion of scams to be truly potent.

4. The fourth area – the efficiency of trading – has perhaps seen the greatest reverses. This is deeper than the moral outrage over the behaviour of traders in other markets, particularly when those markets have failed spectacularly. This moral outrage is a deeply-rooted political response from a public which does not understand what has happened in those markets and is looking for someone to blame. That is naturally amplified by politicians who often have little better understanding of which particular aspects of the financial market turmoil are blameworthy and which are not, and which markets are susceptible to a repeat and which are not.

   But there are rather deeper failures of confidence in trading at work, leading to criticisms by politicians, companies and a variety of other stakeholders. A series of problems affecting the only example of a full emissions trading system currently in operation, the EU emissions trading scheme, has been occurring for some time. Some of them, however, are not really problems that can fairly be described as intrinsic to cap and trade. Excess supply in the preliminary, experimental phase of the EUETS, leading to a price collapse, was caused by poor information, non-harmonised allocation methodologies and allocation generosity to some classes of companies subject to the EUETS, a short compliance period and the non-availability of banking into subsequent periods. Generous free allocations intended to ease in the economic changes implicit in the system led to windfall profits. Apparent excess supply in the second phase has been caused by the reduction in energy use and therefore of carbon emissions owing to the recession, though as a result of the availability of banking through to 2020 prices have stayed firm.

Volatility of prices has been claimed, though the claim does not stand up when movements in carbon prices are compared with movements in other commodity prices over the same period. Poor security of account-holders' details in unharmonised national details was exploited by fraudsters. Value Added Tax frauds have occurred as a result of different tax liability between the countries covered by the EUETS. A loophole in the EUETS registration regulations allowed some surrendered credits to be recycled, some legally, some fraudulently.

These can be characterised as a bad run of luck for the EUETS or teething problems that do not detract from trading per se, but the impression of repeated problems has taken its toll of confidence in the scheme.

Some rather more well-founded criticism has been directed at the low prices in the EUETS, clearly insufficient on their own to stimulate investment in low-carbon capital goods. Partly because of the low prices, carbon trading in the EUETS has appeared to be just a low-value add-on to prices of fossil fuels and electricity. A large proportion of trading has occurred in the power sector, with industrial companies unwilling to trade, apparently in defiance of economic logic. And there is not much policy coherence between the intended impact of the carbon price and the many EU regulatory and subsidy interventions designed to nudge companies into technologies and other investment decisions favoured by regulators and Governments.

It can be countered that these are all the result of Governmental choices made within the framework of the EUETS that are again not the fault of the trading system. Furthermore assumptions about what companies should be doing to reduce carbon, in particular investing, are not consistent with the confidence in market decisions that is an essential part of a trading regime.

Judged according to the principal objective of the EUETS, which is to achieve a given level of emissions reductions, the better view, as confirmed by recent full economic analysis of the performance of the scheme, is that the targets were unambitious but the EUETS has done what it was asked to do. But again the number and variety of criticisms has left question marks over its overall performance, and the process of explanation has left the impression of needless complexity.

Meanwhile the greater importance of a steady emissions reduction performance vis a vis a steady price has also been shaken by the recession, leading to the resurgence of arguments in favour of tax (which is even said to be less complex, though the features such as derogations and phasing leading to EUETS complexity are unlikely to be any less politically attractive if the imposition of a price is achieved by a tax rather than cap and trade system).

5 and 6. The fifth and sixth advantages of trading, the flexibility for companies to choose whether and when to make or buy emissions reductions, have been criticized as part of the rather ill-founded objections to the EUETS record of achieving low-carbon investments. Here the criticism comes mainly from the environmental side, for whom the availability of alternative means of emissions reductions has allowed companies to get away without major new expenditure on an immediate fundamental change in investment policy. So the argument builds up that these flexibilities must be withdrawn, though it does not take much thought to see that the problem here, if there is one, is about the level of ambition of emissions reduction targets rather than the means available to companies to achieve them.

7. Argument number seven concerns the reliability of the UNFCCC systems in providing the basis for a trusted global system of measurement and monitoring. The main focus of criticism here is the performance of the CDM, objected to by companies and environmental stakeholders alike, but for quite contradictory reasons. For many companies, the slow speed, opaque processes and poor management of the CDM Executive Board add transaction costs and detract from the promised availability of offsets as a source of flexibility and reduction in the overall cost of meeting targets.

   For those on the other side of the argument, the continued drip-feed of stories about questionable additionality of some projects or types of projects, and poor implementation of other safeguards built into the CDM process, suggest that far from speeding up and standardizing, the CDM needs to be run with ever tighter levels of scrutiny to ensure maximum environmental integrity, which is taken as being the most important criterion against which to judge the success of the system.

8. Finally, the basis for allowing supply-only injections of offset projects has come under increased pressure from Government parties to the UNFCCC negotiations, on the grounds that the majority of the developing countries that have provided most of the CDM projects so far have now developed their economies to such an extent that they ought to take economy-wide or sectoral targets themselves rather than continuing to get the benefits that accrue to them under the current CDM system. This again is hardly the fault

> of trading or the principle of offsetting, but rather of the lack of a durable and accepted methodology for categorizing countries between those taking caps and those only supplying offsets. But the controversy and dissatisfaction rub off on the whole international trading system.

Acting as a background to all these criticisms is the increasing general public suspicion of the global emissions reduction enterprise which is engendered by increasing stories about holes in the science of climate change, doubt about the importance of human activities as a cause of climate change, and therefore decreasing confidence in the justification for expensive programmes and policies of which cap and trade systems form an important part. Some of this represents wishful thinking on the part of the general public about not needing to incur economic costs in a time of recession; but some companies and politicians have fed or amplified these thoughts by contributing material intended to reignite debates (loved by the media because of the attractions of reporting conflicting opinions) which many had thought were over for good. The generally heightened uncertainty about climate change is fertile soil for criticisms of all emissions reduction policies.

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The list of new and rejuvenated objections to the arguments in favour of cap and trade systems is a long one, and setting them out in full helps understanding of why the New York Times, the Economist and others have been tempted to conclude that the tide has turned and cap and trade is on the way out.

But careful analysis of the arguments shows them to be incoherent, both in terms of the differing degrees of logic behind them and in terms of the different and often contradictory perspectives from which they come. Some of the objections are fair, or at least raise questions about the expectations of cap and trade systems and the importance of cost reduction against other objectives. Other objections come from perspectives generally regarded by economists as invalid, if seductive in times of hardship. Others arise from expectations that were never reasonable, at least given the choices so far made within the EUETS. Yet others are based on problems that have nothing to do with trading but which have occurred or are feared to be occurring around emissions trading schemes being designed or already in operation.

But the issue that seems to lie deepest is that, in a recession, the public and politicians are less willing to accept the cost and disruption associated with carbon pricing. This is a legitimate political viewpoint, requiring the re-examination of the total costs of combating climate change vis a vis the benefits that society and the planet will get from success in doing so. It does not, however, affect the question of the superiority of cap and trade as a means of delivering whatever level of emissions reduction that society is happy with. Few of the arguments now being deployed raise real doubts about the justifications previously thought sufficient to settle that point.

It is to be hoped that clear thinking about what is now being objected to will avoid the potential disaster of treating trading as a scapegoat and condemning future action on climate change to unnecessary additional costs.

# Obstacles to Renewable Energy and Energy Efficiency

*Richard L. Kauffman*
*Former CEO, Good Energies*

In spite of a flood of articles about green energy and global warming, renewable energy accounts for only a tiny percentage of total power generated in the U.S. Together, wind and solar power contributed less than 3 percent of power produced last year. In fact, as a percentage of power produced, the U.S. produced less renewable power than it did in 1950. Surely, if the U.S. is to do its part to tackle climate change, create those much discussed "green" jobs, and to achieve energy independence, it must do more.

So what are the obstacles? I suspect that they are not what most of us think.

### The problem isn't technology.

Some policy makers have advocated a "Manhattan-type" Project to solve our energy problem, meaning a government intensive R&D effort to come up with a silver bullet technology solution. After all, if renewable energy is more expensive than traditional sources, then surely we need more innovation to reduce costs. In fact, in spite of having been starved for years, the renewable energy innovation engine in the U.S. is working adequately. U.S. universities, National Labs, and corporations have substantial intellectual property in renewable energy and energy efifciency technology; in fact, many of the technologies now being deployed outside the U.S. were developed here. Many European countries have substantially more renewewable energy than the U.S., showing that renewables can make up a significant portion of power production by promoting technology available today.

### We've got the innovation deployment cart and horse backwards.

By providing markets, the European renewable energy industry lowered costs by getting scale. We know from the PC industry where computer chips are ever cheaper and have greater performance that innovation follows commercialization, not the reverse. Moore's Law is not an independent law of physics but rests on the role of markets; without a vibrant market into which to sell integrated circuits, the shape of the performance curve would look very different. However, in renewable energy technology, we keep waiting for breakthrough technology that will achieve cost parity with conventional sources before deployment. Because most renewable energy technology is by definition capital intensive, much of cost reduction per unit produced stems from manufacturing scale advantages; these manufacturing scale advantages will rely more on extant manufacturing capabilities in other industries than on fundamental underlying renewable energy technology. A good example is the wind turbine where costs have declined dramatically; large market opportunities created by favorable European electricity rates encouraged established industrial players – in this case Siemens and General Electric – to enter the market with initially "good enough" technology, and through these firms' manufacturing and engineering expertise, they were able to produce larger and larger windmills at lower costs per watt. In the U.S., we instead direct policy attention to innovation over deployment. Providing government funding to an early stage technology company makes a good photo op, but without large scale markets, the barriers to cost competiveness are nearly insurmountable since the manufacturer has to find a technology solution that is cost competive without manufacturing scale benefits.

**The energy problem isn't production, it's inefficiency.**

Americans use more than twice the energy per capita as Europeans. And the biggest source of energy use is in our buildings. Our built environment generates more than 40 percent of greenhouse gases because our buildings use lots of electricity. Because electricity seems clean as it comes out of the socket, we don't appreciate that most of our electricity comes from burning coal. More than 90 percent of energy is lost from its conversion to electricity, transmission, and inefficiency loss in the building before it is used for heating, cooling and lighting. If we want to solve our energy problems, we need to tackle energy efficiency in buildings. And we don't need a Manhattan Project to get people to change lightbulbs or to get restaurants and shops to close their doors to the outside in the summer. We have national fire codes, but we don't have national building standards for energy efficiency. India has an energy efficiency standard for buildings that exceeds ours.

**Markets aren't working properly.**

Renewables are expensive relative to traditional forms of energy. But the playing field isn't level. There isn't yet a cost of carbon for fossil fuels. While a cap and trade bill will help, there are other areas where renewable energy is put at a competitive disadvantage. Traditional energy industries get much more substantial government support, in the form of $10 billion in annual tax incentives, or in the case of the nuclear industry, insurance. Solar appears "expensive", yet its costs for 30 years are known, while the costs of providing peak power from conventional sources is high and future costs are unknown. Political support for renewables is uncertain. It is ironic that after nearly expiring in 2008, federal tax credits for renewables were added at the last minute to the TARP bill. Advocates of a cost of carbon treat it as a its own silver bullet solution, but a cost of carbon is only one part of putting renewable energy and energy efficiency on a level market playing field.

**Utility regulation doesn't encourage renewable energy adoption or efficiency.**

Although in a few states such as California regulators have provided economic incentives that permit utilities to get an equivalent economic return for investing in efficiency, in most states, the sad fact is that utiltities get paid more when consumers use more electricity. Utilites and regulators continue to favor centralized power plants, rather than distributed solutions such as solar and small scale wind. Even though we have observed an evolution towards distributed solutions in telephony and IT, we have resisted this transition in energy, In contrast to these other industries where incumbents saw potential opportuntiies and threats of new technology and therefore helped change the regulatory environment, most utilities are happy with the regulatory status quo. The "intermittancy problem"—that the wind doesn't blow all the time and the sun doesn't shine at night—is belied by examples in Europe where wind and solar energy represent a much higher percentage of power production than in the U.S. American utilities prefer centralized production because it is easier to "store' energy in unburnt coal sitting by the power plant. However, unfortunately the bias in favor of centralized production makes it much more difficult to implement efficiency solutions at the building level, which, by their nature, are local problems. Put differently, it may be that the best attribute of solar power is that policy and political infrastructure to support it—a regulatory regime and smart grid that permits time of use metering and net metering—are the very things that will enable efficiency; and it is effciency that is the problem we are trying to solve.

**We don't have the infrastructure.**

The scale of infrastructure investment is enormous, and little will be done if there is inadequate government direction as to our energy future. Capturing carbon dioxide from burning of coal? It would require a pipeline system for handling $CO_2$ greater than the current U.S. gas pipeline system. The Plains states could be the Saudi Arabia of wind. The problem is that the electric grid doesn't go there. Solar power in the Southwest which can be transported to the Midwest and East? There's no grid there either. Nor do we have a "smart grid" that would allow for more distributed power generation or time of use pricing that would provide incentives for consumers to shut off certain appliances at peak periods or to sell renewable power over the grid. The stimulus bill providing some funding for the grid, but it a tiny downpayment on the total cost.

**Getting debt to finance renewable energy projects is difficult.**

Many renewable energy projects are developed by smaller companies, not by big utilities. In the past, these projects were financed by banks. Because of the financial crisis, banks are not lending as much. These projects, however, will provide 20+ years of fixed returns that bonds investors might like. While the bond market has replaced bank lending in mortgage and in long term corporate debt, the bond market has yet to replace bank lending for renewable energy projects.

Put most simply, the obstacles to great adoption of renewable energy and energy efficiency in the U.S. relate mostly to improper market signals and to poor regulation. The bad news in this conclusion is that many of the classical problems in economics are represented: There are agency problems in the differences between building owners and tenants that lead to avoided investments in energy efficiency. Then, there are economic problems associated with regulation. Electric utilities are regulated entitities whose profits are determined by the amount of capital deployed; as a result, there is more profit to be gained by utilities from investment in generation assets than in efficiency. Economists also have to wrestle with the way consumers seem to act illogically in applying very high discount rates on investments that pay back later (in this way, investments in energy efficiency are like investments in disease prevention). And, of course, the issue of climate change raises the fundamental problem of externalities. The good news is that policies can be put in place to address these market failures, and, in so doing, can quickly unleash human and financial capital.

Finally, a key part of the solution is to get consensus on the problem we are trying to solve. Reading a list of proposed policy solutions makes one wonder whether we are trying to solve a production problem or an efficiency problem, an innovation problem, a cost problem, a transportation problem, a fuels problem or an electrical problem. That the degree of global policy intervention during the recent financial crisis occured at such magntiude and at such speed without ideological debate suggests that policymakers, academics and the private sector generally had common understanding of the problem they were trying to address; it is not likely that this shared view of the world would have existed even a few decades ago and is no doubt a result of years of debate, common study, and policy trial and error. We need to recognize that in the area of overcoming the barriers to renewable energy and energy efficiency adoption, this global community of shared views has not yet coalesced. We can take heart from the financial crisis that it is possible to develop such common purpose, but must also recognize that we do not have decades to do so.

# The Road from Copenhagen: Next Steps in Climate and Energy Policy

*This paper synthesizes discussions held by REIL in the lead-up to the UNFCCC Climate Negotiations at Copenhagen in December 2009, and discussions post-Copenhagen that have sought to make sense of the outputs of the UNFCCC process. REIL is a group of individuals from diverse backgrounds including finance and investment, technology, regulation, policy and research, who share a common interest in issues relating to climate change and in particular the deployment and financing of low carbon technology. In their discussions on various topics the group has sought to address the key issues at stake in the global effort to reduce greenhouse gas emissions. This account attempts to capture those issues, analyze to what degree the Copenhagen negotiations mark progress, and set out what steps need to be taken, both within and outside the UNFCCC, in 2010 and beyond. Written by James Davey, Martin Devine, and Leslie Parker, April 2010.**

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## CONTEXT: NEGOTIATIONS WITHIN THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC)

### The emerging shape of a global climate deal and the need to go beyond Kyoto

The Bali Action Plan, agreed at the end of 2007, launched two strands of negotiation under the UNFCCC. One (the *ad hoc* Working Group on the Kyoto Protocol, or AWG-KP) considers the future of the Kyoto Protocol and, critically, targets for developed countries. The other, the *ad hoc* Working Group on Long-term Cooperative Action (AWG-LCA) considers what wider measures are necessary to facilitate implementation of the Framework Convention on Climate Change, including emission reductions across *all* countries (developed *and* developing).

The rationale behind launching the LCA discussions from a developed country point of view was that the Kyoto protocol does not provide the emissions reductions necessary to address climate change as it contains targets for only a limited set of countries, which account for less than 40% of the global emissions. Action will be required by all countries, or at least all the major economies, which include India, China, Brazil and South Africa, to tackle climate change. Developed countries believe that what is needed therefore is a new framework to incentivise action in developing countries through targets and enhanced support on finance and technology from

*The views and opinions expressed in this paper are the synthesis of a diverse group discussion conducted in a range of fora and do not necessarily reflect the views of the authors, REIL, its members and contributors or any government or organization. See addendum at the end of the article for a list of some of those who were part of this conversation over the past year.

developed countries as well as fair and equitable commitments among developed countries themselves. However, many developing countries would argue that *such a framework already exists*, namely the Convention, and that it is full *implementation* of the Convention (with the implication that it is the *developed*, rather than developing, countries that are not implementing their obligations) that is required, rather than the negotiation of a new agreement.

This situation is further complicated by the fact that the U.S. has not ratified the Kyoto Protocol, nor is it ever likely to do so. This puts the remaining developed countries in a difficult position. They do not want to be seen to 'kill' the Kyoto Protocol, but they need the U.S. to enter into an 'equivalent' legal instrument, to ensure that the U.S. delivers a quantified emissions reduction target internationally, and by extension, participates in a global carbon market.

From a European viewpoint, a satisfactory outcome would lead to all developed countries (i.e. those currently listed in Annex I of the Convention) taking an *economy wide* ambitious[1] mitigation commitment, together with some form of legally binding *actions* from major developing countries, with all commitments (whether economy-wide caps, or mitigation actions) open to international scrutiny and verification. Whether this means a continuation of the KP or not is an issue of secondary importance to the EU. What is critical is that the *aquis* of the KP (including economy wide targets, a 1990 base year, inventories & registries, and the carbon market) are maintained.

[1] The EU would define 'ambitious' in line with the science, which suggests Annex I would collectively have to reduce their emissions by the upper end of the range of 25% - 40% below 1990 levels by 2020 in order to have a reasonable chance to meet the 2 degree objective.

The U.S. viewpoint is less focused on the KP (since it is not a party to it) or numbers, but is concerned about legal form. It has stated it will not be bound by any legal instrument unless China is also bound by the same instrument. The nature of commitments is up for discussion (e.g. U.S. could take an emissions cap, China could commit to 'actions') but the *legal nature* (i.e. bindingness) must be equivalent for all parties.

The Japanese viewpoint is close to that of the U.S. even though it is formally a Party to the Kyoto Protocol. Although Japan is not interested in "destroying" the Protocol which bears the name of its ancient city, it has made its position clear; that Japan would not accept any new legally binding instruments without the active, fair and equitable participation from all major economies, particularly the U.S. and China. While respecting the spirit and achievements made under the Kyoto framework, Japan supports a single legal instrument incorporating all relevant elements of the Kyoto Protocol where the US, EU countries, and all other major economies take commitments based on their capabilities.

Developing countries, in general, see no need for a new legal framework. Their view is that the U.S. should ratify Kyoto and be bound by it, and that developing countries should be supported to take mitigation and adaptation actions supported by the provision of finance and technology.

Throughout 2008 and 2009 the AWG-LCA considered a large number of suggestions and contributions for the text that might form the basis for negotiation at Copenhagen. Fears rose during 2009 that Copenhagen would not lead to a full legal agreement. Too much was left to do. Whilst there is some convergence among Parties on adaptation and technology, the key issues of mitigation and finance were not progressed as they should have been. Immediately before Copenhagen, therefore, the key question was whether countries would put enough on the table in terms of commitments to reduce emissions, and the provision of finance, in order to reach a critical mass that would allow a strong initial political agreement, followed soon after by a more detailed discussion of numbers and legal text in 2010. We shall consider later whether this outcome was achieved.

### Slow progress – the need for collective action, hampered by the desire to see someone else move first

Progress towards an agreed solution under the UNFCCC in 2009 was slower than many would have liked. Developing countries wanted to see strong early signals (i.e. emission reduction and finance commitments) on the part of developed countries before committing to any actions for themselves; whilst some developed countries, such as the U.S. and Japan, were looking for clear prospects of action being taken in the developing world before adopting targets at home stringent enough to have a significant impact on climate change. Historically, many developed country politicians have shied away from anything other than grand long term targets, which could only be judged many years into the future – avoiding the need to take difficult action in the short term, but also failing to convince others that action is necessary.

Much of 2009 seemed to be wasted in circular arguments. However, through 2009 commitments began to emerge, such as the UK Prime Minister's call for climate finance flows to developing countries of $100 billion per annum to be generated by 2020, the Japanese Prime Minister's pledge for reducing Japan's emissions by 25% by 2020[2] and the EU's offer to move to a 30% reduction by 2020[2] if others 'do their fair share'.

[2] Compared to 1990 levels.

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## REIL ANALYSIS: CHALLENGES, BARRIERS, AND A POSSIBLE WAY FORWARD

### Agreeing on public finance – concerns over governance, transparency, timing and origin

Historically there has been a split between developed countries and the G77 group.[3] The G77 want to see predictable and credible funds for technology, mitigation and adaptation, all under direct control of the UNFCCC, whilst many developed countries want to see a range of vehicles, many of which would *not* be under the UNFCCC. The centralized technology fund in the G77 model might cover research and development, deployment support and IPR acquisition, but some, recognising that public finances are unlikely to ever be able to cover all of the costs of the transition to a low carbon world, question if such a model can effectively engage the private sector at the scale necessary. The EU counter offer is of a model that contains some public finance, but also a large component of private finance, driven, by mitigation targets, through the carbon market as a means of engaging with the

[3] The G77 is the negotiating group that represents the majority of developing countries. Membership, initially 77, now stands at 130.

private sector. Also on the table is the approach taken by the U.S. and others of focussing on a myriad of specific actions and initiatives on the ground. Whilst the EU's offer seems the clearest path to unlocking finance and distributing it in an efficient way, a lack of clarity (particularly on scale, sources of finance, and governance) suggests that the EU and its allies need to do more to sell the benefits of their approach if it is to succeed.

Most of the technology discussions focus on finance, and developing and deploying new technology will be expensive, so finding a solution to this difference in views is critical. A 'good deal' on technology can only be effective if it is complimented by an effective deal on finance. In addition, national action plans are likely to need support to get off the ground, but a critical part of ensuring that plans are forthcoming and ambitious is having the support in place to provide capacity building and technical assistance.

The 2009 Major Economies Forum leader's statement suggested a multiplicity of financing sources, suggesting some broadening of the G77 position. It is clear that donors want all their financing activities to count, even if they are outside a central UNFCCC fund. In the same way that we can think of emissions reductions being comprised of wedges of different measures, financial support might also be seen as being made up of different forms and modes of contribution.

There likely needs to be a blend of finance instruments that reflects the various different needs. National mitigation strategies for developing countries will likely be grant funded; indeed this can be seen as a political requirement for reaching a deal. Such a capacity fund could be small (hundreds of millions), on a GEF type model using implementing agencies such as the UNDP under a holistic UNFCCC programme. Unfortunately this needed to begin 5 years ago, for countries to have developed plans, identified barriers to technology transfer and deployment and worked out how to address them all, to be ready for 2013 when the money could start to flow – in that light, 2013 is very close. To compound this problem, developed country governments' finances are suffering the effects of the global slump, so it will be harder than usual to find money in 2010 to get the capacity building fund going. But UNEP's blueprint for a capacity building fund suggests a requirement of around only $300m per year. Such a capacity building fund is not so large as to be unobtainable and so could be the first element of a deal, placed on the table by developed countries.

Such an offer would undoubtedly be a good step forward as it's needed to build the capacity to allow countries to develop their plans; but it needs to start in 2010 so that developing countries are able to begin to use larger scale finance in 2013. If contributions are reliant on proceeds from emissions trading that won't begin until 2013 then progress will be hampered.

Official Development Assistance (ODA) funding is another potential source for the capacity building fund, but there are political concerns for the G77, due to previous commitments and pledges remaining unfulfilled which makes talk of the ODA in UNFCCC difficult, and ODA itself remains bound by OECD governance.

### The role of public finance – what is the best way to use it to develop private markets?

Companies seek investment opportunities, primarily at the project level. In order to influence the investments that companies make, the equation needs to be rebalanced in favour of low carbon technology. Sometimes these are issues that negotiators don't think about as they are not running businesses or raising finance.

Questions the private sector are asking when making decisions on renewable technology include: is there a long term market for the power (hence the popularity of renewables quotas and feed in schemes) and is the return enough to pay back in the terms of the finance, i.e. what are you going to be paid and for how long? Is the customer credit worthy? The last question is always important, but often a critical barrier in the developing world.

Technology transfer can only work if there is demand in the target markets and a lack of appropriate policy frameworks to drive demand is a key barrier to technology transfer. It is therefore difficult to separate discussions on mitigation from discussions on technology transfer. If countries are serious about being on the receiving end of technology transfer, they need to ensure that they have the right policy environment; which means not just transparency and rule of law, but also the types of policies that clearly favour low carbon technologies. This is a key element of the EU's position in the negotiations and it drives their wish to see countries develop national strategies for low carbon tech. But developed countries need to do this too and as yet their potential for renewable energy deployment and energy efficiency is far from realised.

Developing countries need to own their national policies. They can't just come to UNFCCC and be told what to go home and do to build markets for low carbon technology. There has to be a process of discovery and learning: making a national climate strategy, looking at the cost effectiveness of the measures, prioritising and refining. But this can be accelerated through co-operation and experience sharing, especially between regional groups of countries, as occurred successfully under the Montreal Protocol and there are good examples emerging, such as the Asia Pacific Partnership's compendium of State and Local Best Practices on Energy Efficiency and Renewable Energy, which seeks to define and share subnational best practices of Asia Pacific Partnership members.

Increasingly the discussions under the UNFCCC are looking at novel approaches to developing low carbon technologies. In part this is driven by the U.S. and others' desire to throw technology related actions into the mix of commitments under discussion, but has the potential to help achieve the necessary acceleration of deployment and the development of technologies that will benefit new markets in developing and developed countries. The standard model whereby a nation develops a technology for use in its home markets, which might after some years begin to spread globally, will not provide the rapid deployment needed. In addition to the more conventional bi and multi-lateral agreements on R&D, there is increasing interest in developing hubs or centres of excellence for technology development. These may be regionally based or centre on a particular technology or sector.

Experience in the private sector has shown that it is important that such hubs relate directly to markets, suggesting that a technological focus may work well and could result in the investment opportunities that would be needed to see newly developed technologies to fruition.

However technology development is not a silver bullet, in that there is no single technology that will allow U.S. to avoid dangerous climate change, nor does the existence of a range of clean technologies mean they will be deployed. As expressed by one member, "*We've got the innovation deployment cart and horse backwards.* By providing markets, the European renewable energy industry lowered costs by getting scale. We know from the PC industry, where computer chips are ever cheaper and have greater performance, that innovation follows commercialization, not the reverse. Moore's Law is not an independent law of physics but rests on the role of markets; without a vibrant market into which to sell integrated circuits, the shape of the performance curve would look very different, however, in renewable energy technology, we keep waiting for breakthrough technology that will achieve cost parity with conventional sources before deployment. Because most renewable energy technology is by definition capital intensive, much of cost reduction per unit produced stems from manufacturing scale advantages; these manufacturing scale advantages will rely more on extant manufacturing capabilities in other industries than on fundamental underlying renewable energy technology."

When we consider development and adaptation too, it's important to remember that finance only looks at the bottom line. Positive external benefits (clean air, clean water, flood protection) are not part of the revenue stream for power, so get ignored because the market is not designed to capture them. There needs to be a clear value placed on these wider environmental values, then the finance community may take an interest. (Doubtless, this is much further in the future than a value for carbon.) Negotiators need to recognise that investors are not philanthropists (generally speaking) and that the solution is for governments to shape the market in a way that facilitates investment in sustainable activities.

Recognising the scale of the challenge posed by climate change is also critical in moving markets on the right long term path. The shift required to keep emissions down at a level unlikely to push climate change beyond 2°C is seismic and long term, and because of the nature of energy use requires not just technological change, but systemic change in behaviour across society. In developing private markets and encouraging investment, it will be necessary to ensure that short terms targets for the next decade place technology investment on a pathway to long term deep emissions cuts. Whilst much needs to be done to meet 2020 targets, the decades after 2020 are when we need to see very significant decarbonisation of infrastructure to meet long term targets of 80% reduction, especially given the inevitability of continuing emissions from sectors such as agriculture and aviation. The period from 2010 to 2020 will be important therefore, not just to achieve reductions, but set the stage for the further reductions that need to follow.

Renewable energy technology is a long term asset, but in the aftermath of the financial crisis banks are slow to lend to renewable energy projects. Investors have seen a tightening of terms which does not favour the long return period of renewable energy investments and credit for investments in developing countries is particularly affected (financing terms across the world have shortened with the impact of the global finance crisis and the consequent reduced risk tolerance on the part of banks, from 10-12 years to 5-7 years; terms in the developing world are even more challenging). Governments could play a role here by guaranteeing finance over longer periods and providing reliable subsidies to ensure ongoing revenue. In part this could be done through the carbon market, but that still leaves a gap which feed in tariffs or renewables quotas can fill. In other areas such as long term corporate debt and the mortgage market, bonds have begun to replace bank lending as a source of finance. This has not yet happened for renewables, but with the long term returns of renewable energy projects, often over 20 years or more, this could prove an interesting area for bond markets which are well suited to blending public and private finance over long timescales.

**Carbon finance – a driver for change, but in what form will it exist in the future?**

The contribution of the carbon market is limited at present by uncertainty over the value of carbon beyond 2012. Everyone expects there to be a value beyond 2012, but lack certainty as to what it will be.

There is no clear agreement on CDM at present. India and China see it as vital, but it's unpopular in the U.S. and there are other approaches, such as sectoral and regional schemes that are also currently being explored. It is likely that there will be some sort of project based mechanism, but it might look different to the current CDM and sit within a suite of other measures.

The EU has provisions in its Emissions Trading Scheme for CDM to carry on post-2012 and envisages a single carbon market architecture, whilst in the US, where is seen as intrusive, the prospects for agreement on joining a fully fledged international market are unclear. It's possible that we may see a number of different schemes emerging / evolving that could gradually coalesce into a network of linked schemes.

But given the scale of reductions needed and the as yet inadequate numbers put forward by some key developed countries, it would seem that the CDM is the only viable way for such countries to acquire the sorts of volumes necessary to meet the targets being contemplated. At the same time, McKinsey's report said that two thirds of the reductions that could be achieved for less than $60 per tonne were to be found in developing countries, so there is a clear economic rationale for trade in carbon to make emissions reductions in the cheapest way. Despite the many arguments put forward against carbon markets, there has been no real alternative put forward that embodies the same degree of choice and flexibility or that does not move down the path of autocratically setting limits on emissions. It could be said that the carbon market is akin to democracy: the worst idea, except for all the other ones.

To add a further dimension of complexity and uncertainty to the carbon market picture, forestry is now also being thrown into the mix with as a source of credits.

One possible future for the CDM is to move more towards a programmatic approach based on national policies and programmes. But private investors invest in companies, products, services and projects – they do not invest in programs or sectors. If the effort to scale-up the response to climate change results in only national or sectoral plans, then the only private investment that will follow will be the service of lending money to governments. Only by translating those national or sectoral plans into incentives for a huge array of individual, investable opportunities – at the company, product/service and project level – will the amount of private capital joining the response to climate change continue to increase. Only by using market rules such as a price on or rights to carbon, to create a space within which private investors will experiment, succeed and certainly sometimes fail, will we spark the innovation and creativity needed to address climate change in a rapid and cost-effective manner.

**Institutional and market barriers are still waiting to be addressed with much of the existing low carbon technology not deployed as widely as it could be – why?**

The price of carbon and other externalities is not yet properly factored into the price of fossil fuels, and support, in the form of tax incentives and, in the case of nuclear, insurance subsidies, unbalance the playing field for renewables.

But possibly the greatest single problem for low carbon investments is uncertainty. Uncertainty over the return on investments, stemming from transient and fragmented support schemes, portfolio standards and feed in tariffs, means that whilst costs are relatively easy to predict, revenues can be less certain. On the global scale, the lack of clarity over commitments beyond 2012 means that carbon revenues are hard to rely on. On a national and state level the different timeframes, qualifying criteria and returns for the various schemes reduce the ability to assess investments and make it less easy to invest. Where schemes provide an uncertain revenue flow, it is hard to factor them into an investment package, meaning that the incentive they attempt to offer is greatly reduced in value, and often, especially in light of the credit crunch, investors are willing to trade some degree of return for greater certainty. Integration of the various schemes and, most importantly, clear guarantees that such incentives are here to stay, can unlock much of the investment that is willing, but unable, to flow into low carbon technology.

In providing energy for development, especially in countries and rural areas where energy can be very expensive, there is ample technology to provide low carbon solutions; the issue is that price signals and regulations do not provide proper incentives. But it is also important that the basic underlying investment environment is robust enough to attract business. If the private sector wouldn't make a conventional investment in a country, why would they consider any investment?

Centralized generation infrastructure, that favours neither renewable nor energy efficiency, is often still encouraged by energy regulators, and although states like California and countries like the UK have begun to incentivise investment in energy efficiency measures by energy companies, most still make more money by selling more kWh. In some markets the price of power is artificially low, making it even harder to make renewables cost competitive.

As noted by one REIL contributor: "The infrastructure required to shift to clean energy on a large scale is enormous and not yet in place – from the pipeline network that could allow transportation and storage of carbon from CCS plants to the distribution grids that could take power from renewable sources such as solar in North Africa or the south-west U.S. to centres of population such as Europe or the mid-west cities, whilst accommodating distributed generation and sophisticated time of use pricing – there is a huge gap in what is needed to achieve a low carbon energy system and the current levels of investment or policy support. If countries had an appropriate price for carbon, time of use pricing for electricity, building and appliance efficiency standards and incentives for utilities to invest in efficiency, we would see very substantial capital flows.

Energy efficiency is critically important. The energy problem isn't production, it's inefficiency. The U.S. uses more than twice the energy per capita as Europeans and the biggest source of that energy use is in buildings. The built environment generates more than 40 percent of greenhouse gases because our buildings use lots of electricity. Because electricity seems clean as it comes out of the socket, we don't appreciate that most of our electricity comes from burning coal. More than 90 percent of energy is lost from its conversion to electricity, transmission and inefficiency loss in the building before it is used for heating, cooling and lighting. If we want to solve our energy problems, we need to tackle energy efficiency in buildings. And we don't need a Manhattan Project to get people to change light bulbs or to turn down the air conditioning.

Policy makers understand many of these issues, but in the past have often avoided making hard choices. It's a lot easier (and cheaper) to fund more R&D on energy scattered around the country than take on the more prosaic, tougher and more expensive problems of figuring out how to build transmission lines across state lines and to tackle electric utility regulatory reform. The current "let the market decide" approach won't work because market signals are wrong, vested interests are strong, and the scope of the problem requires clearer direction."

## Trade and politics – barrier or opportunity?

There are wider issues around barriers to trade in low carbon technology than the price of carbon and feed in tariffs. Tariff barriers such as the U.S. import duty on ethanol, designed to protect the domestic industry, can hamper the development of markets for low carbon tech elsewhere. This is an issue that the UNFCCC cannot address alone and it needs to be raised in the WTO and other economic fora.

Some in the U.S. are seeking an international element to cap and trade legislation which is being developed, but there is resistance to this. Progressive elements were very keen to see a bill on the table in time for Copenhagen but this was not achieved. Fears in the U.S. remain that it will be hard to 'give money to China' in the current economic climate and in awareness of a misconception in America that all of China is as developed as a visit to the Olympics or Shanghai might suggest. But strengthening the market for U.S. exports of low carbon tech is a strong counter argument, if it can be deployed.

Much of this is an issue of perception. China sees pledges to reduce emissions substantially by 2050, but little short term action, which makes the pledges seem implausible and invites a cynical interpretation that western governments are using climate as a tool to limit the growth of China. For the US, the move of manufacturing to China is a concern, but all countries are keen to build their capacity in new technologies – from America, to Europe, to Asia.

Addressing these wider issues of trade politics is vital. We want to see a global shift to low carbon, innovations in technology and a development of the capacity to manufacture that technology. This brings with it politically charged questions of job loss and creation which can dominate political thinking and raise the spectre of protectionism. If a transition to low carbon can be achieved consistently in a balanced way then the emergence of winners and losers will be minimized. But whilst countries may fear becoming losers, the possibility of becoming a winner may be an incentive to move towards low carbon; indeed many nations sell the low carbon agenda on the basis that it provides an opportunity to develop a new advantage in technology and manufacturing. Any international framework needs to help balance these tensions if it is to succeed. Politicians in any country, no matter how rich, can't sell a job loss argument to their electorates.

### Unlocking inertia – the role of MEF and other fora?

To unlock the inertia currently dogging the negotiations there needs to be a demonstration of effort by all major economies. Forums such as the Major Economies Forum (MEF) need to do more than simply produce reports and analyses or G8 style reaffirmations of what has already been said, they need to develop flagship initiatives involving collective action that can demonstrate commitment on all sides. In these discussions China is not a recipient, but an equal partner. Such flagship initiatives need to have a significant impact, so might cover things such as: CCS deployment – in both developed and developing countries; deploying 10Gw of advanced solar in less developed countries in the next 5 years; supporting the development of low carbon cities; or, deploying X thousand electric cars. Whatever their precise nature, these would need to provide clear benefits to both sides, beyond carbon reduction, e.g. China and India could both become major manufactures and consumers of low carbon vehicles. Given the need for technology investment to shift onto a long term low carbon pathway, of the kind identified in the IEA's Blue Roadmap, this kind of intervention from the MEF and others could prove a tool to drive future commitments beyond the next decade, and in the absence of a deal in Copenhagen, the role of smaller groupings such as the MEF could be a last chance for securing action. However at this point in time, key countries, such as China, India, and Brazil do not seem attracted to the idea of making the MEF or G8 these decision making entities.

### Developing and deploying new technologies

Meeting the challenge of reducing emissions will require a massive deployment of low carbon technologies across every sector. The metaphor of the Apollo project is often used to indicate the scale of the task, but low carbon technology may require a different approach. The technologies that emit carbon now are embedded across every part of daily life, and the change needed is not only one of new technology, but also of new behaviours. While the end goal can be readily predicted now, in terms of the total amount of carbon tolerable in the atmosphere, the technologies that will be in place to achieve this decades in the future are less certain. To enable the development of technologies there needs to be quick learning – adopting new technologies, learning from failures and problems, and changing plans when they are proved to be wrong.

In looking at the type of technological change needed, the existing infrastructure for distributing energy and providing basic services presents both a major challenge and an opportunity. Buildings are slow to be replaced and much of the existing stock contains technology that dates back to the start of the 20th Century. Innovative work on intelligent grids that manage power in a much smarter way, scalable local DC grids, and technologies such as LED lighting and energy efficient building design, which offer major savings over their predecessors, are beginning to become main stream, but face major barriers to achieving full market penetration. In addition to the new technologies there will be a need for new skills and business models (e.g. builders, electricians, energy service companies) to equip and service and infrastructure that could operate very differently to today's.

Such a transformation of our energy systems seems daunting, but there are clear signs that it is beginning to occur. The rate of change in investment in low carbon technology is accelerating already, albeit not yet as quickly as the models of growth and emissions would suggested is needed.

## Intellectual Property – an issue of perception or a real barrier?

A key concern for many private sector organisations observing the climate negotiations is Intellectual Property (IP). In the negotiations themselves IP is a sticking point, as some view it as an integral part of a deal, whilst others see IP as wholly separate and not something that the UNFCCC should tackle. Some question whether it is an issue UNFCCC is even equipped to tackle, but there is a strong argument that a UNFCCC IP fund, developing new technology, is necessary for political reasons, even if it is unlikely to result in significant new innovations.

A pragmatic approach seems plausible; tackling IP on a project by project basis, with prior agreement on the part of the parties involved to share, or otherwise allocate, any IP resulting. This sort of activity might happen outside of the UNFCCC, but could be seen and counted as part of a wider effort. And it is important to recognise that IP in itself is only part of the equation – the knowledge and know-how to manufacture complex technological products may in many cases be a bigger barrier than IP itself.

Efforts to centrally develop new IP might be more appropriate where there is little commercial market, e.g. technologies for least developed countries and for adaptation technology where there is currently little or no market demand that can drive technological development, often because the people who need the technology are too poor to pay for it. Equally, the current IP process can be slow and act as a disincentive for quick dissemination of technology – being able in some way to overcome the slow pace of IP, for climate technologies at least, would be extremely valuable. Demonstrating action in this area is particularly important to address the concerns of developing countries in the negotiations, especially those whose views may often be overshadowed by the main voices in the G77.

But ultimately it is clear that private companies prefer licensing and protection of IP to having to hand it over as part of a deal – but it does not matter if the licensing is financed with public money by bodies such as the World Bank, so long as its paid for and protected.

### How to best engage with the private sector?

Much is made of engaging with the private sector, and it is clearly a vital part of implementing emission reduction, but it's important to look at the motivation of whoever from the private sector you are considering. Elements of the private sector, seeking to preserve the status quo, have in the past done much to hamper progress and prevent any deal being struck, but increasingly a significant part of the private sector sees potential change as opportunity rather than threat and can engage in a constructive way. A key message that comes across consistently from those looking to invest in low carbon technology is that whilst the detail of any policy that aims to engage the private sector to facilitate a transition to low carbon is important, the stability and longevity of that policy is even more so. The greater the risk, the greater the return that is required in order for business to be able to make the investment. Stable policy reduces risk and opens the door to being able to finance projects with lower returns over longer periods of time. This allows the required step change from speculative short term investment to scaled long term investment that builds the markets.

Ultimately the investment decisions that will determine future emissions will be made on much the same basis as any other investment decisions, and this means that terms of the deal for low carbon technology needs to be on par with the alternatives.

The carbon market is the most convincing mechanism around to translate the undesirability of those alternatives into the language of investment decision making. Unfortunately there is no effective carbon market without a framework of multiple national legislation, whether or not in pursuit of internationally binding targets, incentivising companies on whom a new regulatory imposition is placed to look across the world to source their carbon reductions. Despite the efforts of economists and enthusiasts in the private and public sectors, in most countries there is profound resistance from much of the industry whose emissions must be limited, either to the level of regulatory emissions constraint consistent with meeting global targets, or to any new regulatory constraint at all.

From the perspective of protecting shareholder value, and safeguarding competitiveness, market share and jobs, the instinctive reaction from these industries is easy to understand. On the whole climate change still affects future public goods, which are the concerns of Governments, far more than today's share prices, which remain primary motivating factors for businesses. And in addition, Governments seem susceptible to secondary objections to carbon trading, such as objections to foreign sourcing or sourcing from particular processes, that most gave up long ago in other fields as business and industry became globalised.

Faced with these objections, it seems at present to many dispassionate business observers that Governments are crumbling: they do not see enough political advantage to action, in terms of rewards from their voters who seem increasingly uncertain whether the climate problem exists or is important to overcome the natural resistance from their industry. And the lack of support for trading schemes, and the political squabbling over design features, suggests that carbon pricing, whatever its advantages in terms of efficiency, is no more secure against political changes of mind or tack than any other Government scheme intended to skew investment away from normal economic choices, such as support schemes, regulation or tax treatment.

At the same time, however, many businesses are putting much effort into renewable and other energy technologies that have no economic justification until carbon is priced or substantial new regulation and support is assured. This may seem inconsistent; but for some industries the downside of being left back down the track if Governments somewhere in the world really do create major markets for low-carbon investment is too great to ignore. However, transforming that mindset into a willingness among a rather different grouping of industries, to voluntarily accept substantial and costly emissions reduction obligations is a task that at global level largely remains to be done. Until all the industries and businesses involved genuinely believe that Governments collectively are serious, and will not be diverted by lobbying or the prospect of some economic dislocation, progress will be very hard.

Engaging with the private sector has to be seen in this light: it is not sufficient to talk about collaboration on research and technology transfer, since there has to be communication, based on evidence, of worldwide Governmental commitment to early and significant regulatory action, whether that action takes the form of a price and a market, or something else.

## Achieving a global climate deal

Bringing the above analysis together, we arrive at some interesting conclusions. Ultimately, at the most basic level, there are two parts to a global climate deal.

First there is the political deal needed to deliver an international agreement – to bring both the G77 and the developed countries to the table with mutually (and hopefully environmentally) acceptable commitments and contributions. For many this is, on the one hand, about clear support and political recognition of developed countries' responsibility manifested in the transfer of resources under whatever governance structure can be agreed upon and, on the other hand, clear commitments by all countries to make significant efforts to reduce or limit the growth of emissions.

Secondly, there is a more complex and organic deal, with the private sector. But the private sector is not a single actor. It is the result of the actions of a myriad of individuals, companies and corporations, each looking for their own opportunity to invest and put their business models into action. The private sector is responsive to ideas that directly influence the environment for investment – feed in tariffs, loan guarantees, carbon pricing and other things pertinent to specific transactions – so for this element of the deal to work, the international framework needs to promote the sorts of policies and measures that really alter the decision making of the private sector.

The technology needs assessments and national action plans are, in theory, where this all comes together – funded and facilitated by the international framework, but developed by nations for themselves, the success of these will be measured by the extent to which they facilitate private sector investment. Private sector involvement in their development could help to ensure they are successful.

High level negotiations such as Copenhagen are unlikely to be the forum where such specifics are decided – but getting the right deal on public finance (i.e. the transfer of resources from developed to developing countries) will allow deals on commitments which in turn translate into policy frameworks which will engage the private sector and affect investment. So although the public finance component of the overall picture is small, it can be seen as critical in unlocking a deal.

## Some key elements that could be incorporated in a global climate deal

### *Economy-wide emissions caps for developed countries*

Building on those targets established at Kyoto, developed countries should take the lead in delivering global emissions reductions. The Fourth Assessment Report of the IPCC suggest that collectively developed countries need to reduce their emissions by 25% to 40% (measured against a 1990 baseline) by 2020 in order maximize the chances of global mean temperatures not rising by more than two degrees.

### *Country-led plans of action*

Developing countries (especially the large emerging economies such as China, India, South Africa and Brazil) need to put forward their own self-designed and country led plans of action, including the implementation of clear policy frameworks to build markets for clean technology. With these in place, finance support can then flow in. However, the effectiveness of this approach depends to some extent on what commitments developed countries are willing to make on the provision of finance. The better the deal on support, the higher the level of ambition in the national plans is likely to be. The recent growth, fourfold globally during 2004-8, of investment in renewable energy, driven by those countries that have strong policy frameworks for renewables shows how vital and effective such frameworks are.

### *Technology road maps*

Technology roadmaps that highlight what needs to be done in terms of research, development and deployment, are required in order to push forward the top technologies (maybe 20 or 30 technologies) to be commercially competitive. A lot of this work already exists (e.g. under the International Energy Agency), but needs to be recognised internationally under the UNFCCC. This raises an important point; that the majority of things that are happening, or will happen on the ground in the sphere of technology, will be outside of the UNFCCC. There needs then to be a mechanism to identify such initiatives and account for them in the UNFCCC discussions – or to put it another way, to glue UN ‘blue berets’ on to those initiatives that already represent part of the solution. This would then facilitate action to address the identified development & deployment needs and barriers – a point widely accepted by negotiators.

### *A research and development fund*

The development of technology roadmaps would highlight technologies whose development is lagging behind others. A relatively small (possibly around $0.5-2bn p/a) R&D fund under the UNFCCC, which could take the form of a prize fund, a challenge fund, or just straight out R&D grants, could address the laggards identified in the roadmap, plugging the gaps in private sector and national government funding. Models such as the CGIAR programme for agricultural research (which facilitates collaboration on agricultural technology to develop local solutions) could provide a template for spurring R&D to develop locally appropriate applications for new and existing technologies.

### *A demonstration and deployment fund*

A larger pot of money is needed to finance demonstration and deployment of technologies that are not commercialised, or not present in a particular market. Figures of $5bn a year have been discussed, but it is acknowledged that such a fund might start smaller and take time to work up to that level. Such a fund needs to avoid supporting things that already happen in the market but at the same time needs to be demand-led. This could be seen as an upgrading of the existing Clean Technology Fund, but it would likely be a wider range of financial tools than simply grants and/or loans. The World Bank would seem the logical home for this, but that will require working through political issues of trust around the World Bank and there is a clear desire for whatever mechanism emerges to be transparent and open in its governance. Key to the concept of a deployment fund is that the money should be used not simply to support the project but to incentivise the private sector to invest. Incentives might include project insurance, forward purchase commitments or other instruments – but a critical and unanswered question is ‘what is the most effective way to use public money to incentivise private sector investment?’ Due to its limited supply, public money needs to be spent on significant change, not just incremental improvements and needs to leverage private finance. Some existing initiatives such as the Private Finance Advisory Network (PFAN) may provide good models here that could be repeated and scaled up.

The acceleration of deployment, along with research and development is critical. In other technology fields, such as the micro-processor, innovation has been driven by increasing market share and economies of scale, not the other way around. But some technologies, in particular carbon capture and sequestration (CCS), are seen as both too important and too far from commercialisation to be left without assistance to support demonstration and deployment. While the contentious nature of CCS means a big global deal on CSS is unlikely, it could be well suited to government support on a deal by deal basis for demonstration plants.

### *Carbon markets*

Ultimately, a global carbon market would be a way to achieve global emissions reduction in a way that reduces overall costs (though it is not the only global approach to pricing carbon – Switzerland, for example, have proposed a global carbon tax, revenues raised by which could be recycled to support mitigation and adaptation).*

*Although its compatibility with some of the existing aspects of the Kyoto protocol such as the CDM would need to be addressed. In addition, achieving sectoral trading for one or two global industries at the expense of an economy wide cap and trade system is not necessarily the optimum outcome.

One way in which a deal could be seen to have made progress on carbon markets is for it to stimulate (through domestic legislation) the establishment of cap and trade schemes in the US, Japan and other economies that could *trade* with the EU scheme and buy in credits from the CDM. The role of the UNFCCC in this system would be to set the rules regarding the credits to be traded, ensuring so far as is possible the equivalence of emissions reductions (so-called 'environmental integrity') in different schemes.

For an ambitious deal (i.e. one that is compatible with the EU 2 degree target) the volumes of carbon finance flows become very large (several tens of billions of dollars per annum by 2020). It is difficult to see how project-by-project generation of credits through the CDM, as it currently exists, could deal with this volume of trading. Furthermore, the U.S. and EU would want to see the production of many internationally traded commodities (most obviously steel and other metals) treated in a way that did not disadvantage their industry. This suggests 'sectoral trading' where, for example, the steel sector in India, China, Brazil etc. entered into a cap and trade scheme compatible with international trading. The advantage, from a developing country perspective, of such an approach is that (in theory) new plant in emerging economies is very efficient, and net positive carbon market flows into these markets could be expected. However, developing countries are understandably suspicious of this – since it involves taking on legally binding emissions caps, even if only on part of their economies. And the promise of 'finance flows' looks a rather empty one while the U.S. and Japan have not yet established cap and trade schemes. Nonetheless establishing the principle of 'sectoral trading' would be a major achievement in a global deal.

## Negotiating the deal – UNFCCC versus delivery elsewhere

Other than the country led action plans, the possible elements of the deal set out above are focused on technologies and policies, rather than countries. But, is a forum of 194 countries the best place to try and drive forward R&D? Might it be more effective to leave countries and groups of countries to come together around specific needs? And politically it is not clear that all countries would be willing to put money under a UNFCCC banner, meaning activity will occur outside of the direct influence of UNFCCC, but how can this be reconciled against the need for global action under UNFCCC?

These questions highlight the need for a mechanism to account for wider efforts that are going on now, and in the future, outside of the auspices of the UNFCCC. Any UNFCCC fund envisaged would become a coalition of the willing additional to these efforts, to plug the gaps that exist and not duplicate existing work.

Whilst considering the prospects for a UNFCCC deal it is important to remember that many of the things considered below can be done with or without a deal and on their own merit. In addition to helping meet carbon reduction targets, renewables and energy efficiency provide energy security benefits, cost savings, air quality and other environmental co-benefits and can channel expenditure on energy away from foreign towards domestic enterprises.

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## BEYOND COPENHAGEN

### December 21, 2009 – The day after

The analysis presented so far largely summarizes thinking within REIL in the lead up to the climate negotiations at Copenhagen. It is clear that, in the light of what actually happened in the negotiations at Copenhagen, it is necessary to reassess this analysis, and consider what future steps can be taken to address climate change – unless of course we come to the conclusion that Copenhagen was such a success that further action is no longer necessary.

There are as many assessments of what occurred at Copenhagen as there are viewpoints on the issue of climate change generally.

From the perspective of an environmental NGO (or Small Island Developing State) Copenhagen was an unmitigated disaster. The EU failed to commit to a KP second commitment period or move from its unilateral offer to reduce emissions by 20% on 1990 levels, a U.S. offer amounting to only a 4% reduction on 1990 levels, no REDD mechanism was agreed, there was no agreement on long-term finance and, above all, a series of national offers were made but no legally binding commitments signed up to.

From the U.S. negotiators perspective Copenhagen can be considered a reasonable success. The Accord, which was their preferred conclusion to Copenhagen, was agreed, China agreed to some form of monitoring, reporting and verification of their emissions and emissions reductions actions, and, critically, the U.S. negotiation team did not find themselves ahead of the Senate (unlike at Kyoto).

Like the U.S., China got what it wanted (principally not being bound by any commitments) but seemed genuinely surprised at the flak it took in the media in the immediate aftermath. It is factually correct to say that China blocked some key elements of a potential deal, including references to global emissions peaking by 2020 and a 50% global emissions reduction by 2050. However, one should also consider what China was getting from any deal on offer at Copenhagen. In terms of concrete offers on finance to assist China, or concrete offers on technology collaboration, the answer is “very little”, which may explain the position they took in negotiations.

If the U.S. and China got key elements of what they wanted, EU did not. While some of the EU's ideas are reflected in The Accord, the Accord does not reflect EU aspirations for Copenhagen. The EU does not see strong action from the U.S. or China, which makes it very difficult for ambitious voices to push for the EU to move to a 30% emissions reduction, and the failure to agree anything on sectoral trading does not help the carbon market. Worst of all, where the U.S. was seen to speak with one strong voice, and with China effectively dominating the negotiations, the EU was perceived as ineffective and became associated by some with the role of the Danes, who presided as Chair of the negotiations and became a focus for criticism.

From a business perspective, the outcome of Copenhagen is worrying for those with investments in carbon trading. There was no commitment to a second commitment period of the KP (the first will end on 31 Dec 2012), no move to sectoral trading (which may never yet had any real supporters other than the EU anyway), and no sign as to when (or indeed whether) Japan and the U.S. would move to international trading.

At any rate, what mechanisms are used is secondary to the overall demand in the market, which will be quite small given the woefully inadequate level of existing Annex I pledges.

Environmentally, it is clear that Copenhagen does not go far enough, and in that we are all 'losers'. It is clear that all major emitters, developed and developing, will either have to significantly increase their mitigation ambitions for 2020 beyond their Copenhagen Accord commitments *or* take very strong mitigation commitments *after* 2020 in order to achieve the 2 degree C objective. Therefore, those parties or groups that might consider they 'won' at Copenhagen may need to re-evaluate this 'victory' on the basis of the long-term damage climate change will do to the global economy and the heightened cost of deferring action to the future, as identified by Lord Nicholas Stern and others.

## Can we achieve climate stabilization or is the world doomed?

The value of The Copenhagen Accord, as an agreement that drives emissions reductions, depends largely on one's faith in voluntary 'pledges'. On the one hand, some very significant offers (including those of Brazil, Indonesia, Japan, Mexico and South Africa) have been tabled. However, one only has to look at the performance of Canada and a number of EU countries since Kyoto[4], to see that 'pledges' are not always met. It would be unfair to say that any of these countries did not take *actions* to reduce their emissions. But they have found that reducing their emissions is very much more difficult than they had hoped.

Therefore, the Copenhagen Accord is significant, in that it contains pledges from all major emitters to constrain emissions, and signals future ambitious commitments, particularly on finance, and on 2 degrees, that will need further commitments to be delivered. However, the Accord is limited, because it is not clear how these further commitments will be delivered, and it does not set out a timetable for agreeing them.

One thing is clear. A pathway to 2020 and then to 2050 that would see temperature rise stabilized at 'safe' levels is needed, and this has not yet been agreed.

[4] The EU, collectively, will meet its Kyoto target. However, it is clear that some countries in the EU will not be able to meet, in terms of their national emissions reductions, the targets they set themselves at Kyoto.

## Lessons for future negotiations

From the somewhat surreal perspective of someone who was at Copenhagen (people who, by definition, have spent far too much time locked in windowless rooms with nothing but piles of negotiation text to look at), Copenhagen is a *contradiction.* A process that ended with recriminations around whether the Accord document represented an accepted outcome because it was negotiated by a non-representative group but which, at the end of the day, was largely dominated by the relationship between only two nations, with all others (even India, and certainly the EU) playing a lesser role in determining the eventual outcome. It is not, therefore clear, that a push towards more 'open and transparent' negotiations solves anything.

- The 'consensus' approach may prove to be broken, because there will always be a small group of nations willing to block process on any issue.
- An inclusive process does not change the nature of the US/China dynamic. It doesn't matter if one country, or 100 countries, disagree. If China and the U.S. cannot agree, there will be no deal. However, Copenhagen also shows that agreement between China and the U.S. may be a necessary condition, but it is clearly not a sufficient one. From a scientific perspective, the mitigation offers China and the U.S. tabled at Copenhagen are not sufficiently ambitious in terms of the 2 degree objective.

In short, the challenge that could not be resolved in 1997, when the U.S. Senate rejected Kyoto, remains unresolved in 2009. The US, the world's largest economy, is not party to a legally binding emissions reductions commitment. And the emergence of China as a world superpower makes the issue more, and not less, difficult to resolve.

At some stage, China and the U.S. will have to make a deal. Both will have to sign up to commitments that they can accept, trusting that the other will make good on its offer. This did not happen at Copenhagen. Rather, China and the U.S. committed, unilaterally, to actions they were already resolved to do for domestic reasons (and in fact, as was true at Kyoto, any U.S. commitment is meaningless until and unless passed by Congress). Neither pledge is, of itself, compatible with stabilization of emissions at 'safe' levels, but it should be noted that the U.S. aspiration to reduce emissions by 42 per cent by 2030, and 83 per cent by 2050, would be consistent, broadly, with a 2 degree outcome. It is hard to see a future U.S. administrations delivering this aspiration, however, if Chinese emissions continue to rise post-2020.

## Prospects for 2010

Can a deal, that proved so elusive at Copenhagen, be achieved at the UNFCCC negotiations in Cancun in December? Probably not – though it's not out of the question. Economic recovery may make governments more ambitious, but the recovery remains fragile, especially in the developed world. U.S. legislation would certainly change the negotiations, but it is questionable as to whether legislation will pass this year, and cap and trade may not be included in legislation in the short-term.[5]

[5] As one policymaker noted, though, lawmaking is like financial day trading, following it minute to minute can make one insane: A tempestuous process does not negate the possibility of effective legislation at the end of the day.

A U.S. bill without cap and trade, even if it contained fairly ambitious domestic efficiency and renewables obligations, might well weaken the ambitions of others, and would certainly not help the carbon market. And, of course, none of this changes the position of China. They were unwilling in Copenhagen to commit to anything that might imply long-term emission reductions in China. The leadership in China is naturally cautious. A radical change of philosophy as regards climate seems therefore unlikely to occur in a year. However, at the same time, China is increasingly aware of the need to reduce emissions given the impact climate change will have on China. It remains a challenging balancing act.

Copenhagen established a High-Level Advisory Group on climate financing, to be co-chaired by UK Prime Minister Brown and President Meles of Ethiopia this year. This group is to consider a range of approaches to securing $100 billion finance flows for climate change per annum by 2020. It is difficult to imagine, given the history of finance discussions within the UNFCCC to date, that this group will be able to come up with a mechanism that will please both the developed, and developing, countries. Possible options to generate public finance to pay for adaptation, technology and REDD include the auctioning of emissions permits to raise revenues, a banking transaction tax, or a levy on airfares. The difficulties of agreeing any of these are marked. Private finance flows could be considerable, given a fully functioning carbon market, and ambitious emissions caps, but as already discussed, the prospects of achieving this in 2010 are remote, and G77 countries which have been averse to the whole concept of emissions trading would have to agree to reconsider this position.

What does all this mean for the UNFCCC process, and the EU, which has staked so much on it? The nightmare scenario is that 2010 sees the disintegration of the Copenhagen Accord, as negotiations are dominated not by issues of substance, but rather by disagreements about the legal status of the Accord. If such 'process' debates dominate proceedings, there is a danger that the UNFCCC could fail as an organization in 2010, thus possibly damaging the nascent carbon market. The EU, in particular, needs to find a narrative which, in the absence of a binding deal that includes China and the US, prevents such a collapse and maintains the relevance of the UNFCCC process, and moves discussions forward. Two challenges present themselves:

- The immediate challenge is to rescue the Kyoto Protocol, the concept of a global carbon market and, by extension, private investment in emissions trading. Carbon markets could be significantly assisted by the introduction of cap and trade legislation in Japan and demand for emissions reductions credits in the US, via trading schemes like RGGI.
- The second challenge is to deliver actions that address climate change. Financing of REDD activities is needed to halt the rate of deforestation, therefore minimizing global GHG emissions. Adaptation actions need to be supported, to demonstrate to developing countries that the developed world is serious about dealing with their climate problems (and not just demanding that they reduce their emissions). And the EU needs to drive a step-change in the way clean technology is developed and deployed,

internally through meeting its own targets (such as the target of achieving 20% of primary energy production from renewable resources by 2020), externally through stimulating international cooperation and 'technology transfer'. In short, the EU needs to put its money where its mouth is, through demonstrating what each member state will commit on fast-start, and beyond, and convince others to do likewise. Demonstration of real action is far more likely to change the minds of leaders than any amount of pious lecturing and economic 'models' highlighting the benefits of trading schemes for all.

## Two possible routes to a global deal

Two very different possible narratives emerge from Copenhagen, both of which result (eventually) in a global climate deal. These two routes should therefore not be seen as mutually exclusive, since in reality there will be some "cross-talk" between them, and each can strengthen the other. What can be achieved through bottom-up processes can and should reinforce a more ambitious UNFCCC deal; at the same time a UNFCCC deal is necessary to galvanise the bottom-up activities and ensure that they do not dissipate over time.

The narrative where the world fails to take actions to reduce emissions, and emissions grow on a 'business-as-usual' path is not reflected, though it has clearly been considered, and found wanting in many ways.

### *The UNFCCC deal*

The political climate changes in such a way that China and India are willing to enter into some form of legally binding commitment, and the developed world, led by the US, commits to ambitious, legally binding, economy-wide emissions caps that stimulate real action at domestic level. Major developing countries sign up to sectoral trading, which links their heavy industries to cap and trade schemes in developed countries, resulting in significant investment in clean technologies, globally, thus driving 'technology transfer'. The global carbon market is overseen by the UNFCCC which ensures environmental integrity and the equivalence of traded units. The developed world agrees to a funding mechanism that can cover the costs of REDD activities, and pay for adaptation for the most vulnerable. The prospect of global de-carbonization drives significant investment in innovation which results in the development and global spread of new low-carbon technologies.

### *The bottom-up deal*

Progress in the UNFCCC is stalled following the Copenhagen meeting. Domestic efforts in the EU, U.S. and other major economies (both developed, and developing) drive emissions reductions (or at least retard emissions growth). A REDD mechanism is agreed, on the basis that all countries recognize deforestation is a threat, and there is political will on all sides to commit public finance to address it. Adaptation is not dealt with through the UNFCCC, but rather is mainstreamed into the conventional official development assistance (ODA) process. Investment in renewables significantly increases, driven by domestic concerns around security of fossil fuel supply, long-term sustainability, economic growth and air quality. CCS is demonstrated in the EU and the US. Japan and Australia (although the latter looks increasingly unwilling and it would appear this may be out of the cards till at least 2013.) pass cap and trade legislation, which, together with EU demand for CDM credits, allows the carbon market to survive (if not thrive). These schemes link, since it is economically sensible to do so, and some form of arbitrage system ensues. Eventually, the US, having driven emissions down through efficiency and stimulus measures is able to pass cap and trade legislation (or, alternatively, regional schemes gain critical mass) and links to the other schemes. A global carbon market therefore begins to emerge, at a pace determined both by the political *process* (i.e. how long it takes to get the schemes in place) and the degree of *ambition* (i.e. how deep the cuts are). Technology competition gives way to technology *cooperation* as the impacts of climate change become more apparent, and more severe. This eventually allows all major economies to return to the UNFCCC and commit to a binding deal, which is largely simply a way of putting their domestic efforts into an internationally recognized form. The UNFCCC maintains countries GHG inventories, and thus is able to take an overview of what global emissions are, but otherwise its roles have largely been replaced by domestic, and bilateral, decision making processes.

## SUMMARY

Much thinking was done on how to address climate change, particularly around how to reduce global GHG emissions in a practical, and politically acceptable, way. The issues that were considered in the lead-up to Copenhagen have not all been resolved, as can be evidenced by the lack of legislation in the US, the lack of a binding deal at Copenhagen, the low carbon price and, most critically, the continued growth of global emissions. However, Copenhagen at the very least, marked the moment when all major world leaders engaged on the issue of climate change. There are many challenges to be faced over the next decade and this analysis suggests that some of the important ones are

- National policy frameworks will have critical importance in driving emissions reductions – how can these be developed in the most effective way? How can we share best practices and lessons learnt? How can governments use private sector expertise to implement these?
- A step change in investment in clean technologies in developed countries is needed, to bring about changes in infrastructure and drive emissions reductions. How can this be achieved?
- How do we address the systemic barriers to investment in least developed countries?

- How can we scale up investment in emerging technologies, such as solar and CCS, in order to ensure these technologies become commercially competitive in the near future?
- Perhaps most critically, what steps are needed to change the political dynamics, particularly in the U.S. and China, that could lead to these two superpowers committing to ambitious mitigation actions, and cooperating on clean technology development and deployment?

Negotiators had hoped that Copenhagen might mark the end of a process to address many of these problems, but like Berlin, Kyoto and Bali before it, the process continues, with no end in sight. It is clear that many of these issues will *not* be resolved through the UNFCCC process, but rather within domestic processes and bilateral agreements. The exact role of the UNFCCC is unclear.

All of this is daunting. But the international community will continue to work on a variety of fronts and in various multilateral and bilateral fora. Forging ahead is critical. As will be good will and generosity of spirit – neither of which has been absent from the process to date, even if they have been obscured by media reporting and the demands of the negotiations.

Finally, if we could make one plea on the future of climate discussions, it would be for a far more intelligent, two-way conversation between decision-makers in government, and (from a climate perspective) the decision-makers who really matter, the ones who build the coal-fired power stations, and air-conditioning units, and cars, and also the wind-turbines, solar panels, insulation, and design the products of tomorrow, in short, the decision-makers in business and finance. A low-carbon future is possible, but only if we invest in it, globally.

§

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# *II.*
# *Analyses written at the request of REIL*

# DC Microgrids: Benefits and Barriers

*Paul Savage, Robert R. Nordhaus, and Sean P. Jamieson*[1]

## I. OVERVIEW

Our electric power system was designed to move central station alternating current (AC) power, via high-voltage transmission lines and lower voltage distribution lines, to households and businesses that used the power in incandescent lights, AC motors, and other AC equipment. Today's consumer equipment and tomorrow's distributed renewable generation requires us to rethink this model. Electronic devices (such as computers, florescent lights, variable speed drives, and many other household and business appliances and equipment) need direct current (DC) input. However, all of these DC devices require conversion of the building's AC power into DC for use, and that conversion typically uses inefficient rectifiers. Moreover, distributed renewable generation (such as rooftop solar) produces DC power but must be converted to AC to tie into the building's electric system, only later to be re-converted to DC for many end uses. These AC-DC conversions (or DC-AC-DC in the case of rooftop solar) result in substantial energy losses.

One possible solution is a DC microgrid, which is a DC grid within a building (or serving several buildings) that minimizes or eliminates entirely these conversion losses. In the DC microgrid system, AC power converts to DC when entering the DC grid using a high-efficiency rectifier, which then distributes the power directly to DC equipment served by the DC grid. On average, this system reduces AC to DC conversion losses from an average loss of about 32% down to 10%.[2] In addition, roof top photovoltaic (PV) and other distributed DC generation can be fed directly to DC equipment, via the DC microgrid, without the double conversion loss (DC to AC to DC), which would be required if the DC generation output was fed into an AC system.

This paper describes the operation of DC microgrids, potential national benefits, barriers to deployment, and policy measures that could accelerate this deployment.

## II. DC MICROGRID TECHNOLOGY

The Energy Independence and Security Act of 2007, Title XIII, identifies the elements that characterize the "Smart Grid" policy goals. In summary, these are[3]:

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[2] See Section III below for discussion of 68% average efficiency (32% loss) of the current AC to DC conversion.

[3] Energy Independence and Security Act of 2007 § 1301 et seq., 42 U.S.C. § 17381 et seq.

- reliability; security; storage; distributed generation
- energy efficiency; sustainability; renewable inputs
- IT/communications leverage/full cyber-security
- load awareness; demand side management; plug-in vehicles
- lowering unnecessary barriers to achieving the above

Each of these goals can be advanced through the use of DC microgrids, and often at lower cost with greater effectiveness than measures applied to the greater AC grid.

The national power grid system in the U.S. and around the world was not designed to handle the energy demands of the modern economy. To meet the contemporary needs of the grid's customers today, we should consider the tools available through DC microgrids, which can optimize the use of electronic devices, electrical storage, and distributed generation.

The national Smart Grid discussion should thus focus on ensuring that the grid optimally balances what we refer to as the "Power Equation" (power generated, less line and conversion losses, equals power used). The interest in DC microgrids over the past 10 years has been growing. The U.S. Department of Energy (DOE), the California Energy Commission (CEC), the Electric Power Research Institute (EPRI), several utilities and many entrepreneurs and investors have sought through Smart Grid initiatives to upgrade the interface between the utility grid. The vast majority of these efforts have been designed to operate in the AC currency of the national grid. The present discussion focuses on DC microgrids as a way to improve the efficiency, reliability and security of the implementation of the Smart Grid

### A. What is a DC microgrid?

Defining "microgrid" is important for our discussion, but not necessarily simple. The DOE and the CEC jointly commissioned a report from Navigant Consulting in 2005 that wrestled with this very definition. The final report identified two "Points of Universal Agreement" of what constitutes a microgrid, which remain valid today:

> A *microgrid* consists of interconnected distributed energy resources capable of providing sufficient and continuous energy to a significant portion of internal load demand.
>
> A *microgrid* possesses independent controls, and intentional islanding takes place with minimal service interruption (seamless transition from grid-parallel to islanded operation).[4]

These two definitions work easily in both the AC and DC domain, so we will borrow them both.[5]

DC microgrids can be deployed in a portion of a building, building-wide or covering several buildings. We will refer to these systems (whatever their scale) as "DC microgrids" in the balance of this paper.[6]

[4] There followed seven "Points of Varying Agreement", and a survey of who was doing what with microgrids at that time; survey available at http://www.electricdistribution.ctc.com/pdfs/Microgrid_Vision_ Workshop_ Presentation.pdf (last visited March 15, 2010).

[5] MISSING

[6] While for simplicity's sake, we refer in the paper to DC microgrids, these systems can be further defined as follows: *Nanogrids* – defined as an electrical power system as described in the two universal points of agreement that serves a defined space in onebuilding; Microgrid – defined as an electrical power system as described in the two universal points of agreement that serves one building; and *Minigrid* – defined as an electrical power system as described in the two universal points of agreement that serves more than one building.

This defined physical area that the DC microgrid serves is an important element when considering the deployment– more so than power level – because an important design consideration of DC networks at these voltages has to do with scale. DC power is highly susceptible to impedance (or resistance) losses, which are those imposed by the transmission medium itself, usually wire. The nature of DC is such that resistance can quickly sap power, but the efficiencies of DC systems—as we shall see—are dramatic and must be considered in deciding the scale of a DC system.

All of these grids have the common need to adopt standards to guarantee interoperability. These standards are essential to the efficient development of the grid and the successful achievement of the key goals of the Smart Grid at a lower cost than possible in the AC domain, as discussed above.

## B. What can DC microgrids do?

How would the grid look if its architecture optimized solar PV inputs, and maximized the efficiency of all of our electronic devices? What benefits would be gained by further accelerating these two fast growing elements of the Power Equation?[7] Let us start with DC-powered electronic devices—which represent 50% of the electric load in many buildings today. In the 50 years following the advent of semiconductors in consumer products, electronic devices have become ubiquitous. Computing and Internet connectivity is showing up in many appliances, incandescent lights are giving way to electronic ones (either fluorescent or LED) and portable electronic devices continue to proliferate. Another element of the growing DC load is the Variable Speed Drives (VFD) for electric motors.

These electronic devices have been deployed in the millions to improve the efficiency of the nearly ubiquitous AC induction motor. By installing VFDs in front of their AC motors, building owners and operators are able to control the speed of the motor, which delivers an outsized benefit: for every one-eighth the motor slows in speed, one-third of the energy is saved. Therefore, when a pump, fan or blower motor can opportunistically be throttled back, a great deal of electricity is saved for the customer. The grid benefits too, by not suffering the demand spikes that are caused when regular AC motors are turned off and on because they cannot modulate their speed.

A VFD is not just an AC device that has AC going into it from the grid, and AC leaving it to the motor; instead the electricity must pass through a DC state, meaning that the AC motor connected to a VFD can become a DC consuming device, just like your cell phone, laptop, LCD or plasma TV and overhead lights.

Let us imagine these loads distributed throughout a building as they are now and imagine how we should power them, again borrowing the Smart Grid's guiding principles for our better-optimized Power Equation. Because we are looking for reliability and redundancy, we will want to create a DC environment to deliver power to these loads as the telecommunications has done historically in switching stations, and more recently to support servers in data center applications.[8]

But better redundancy is only the beginning benefit a DC network brings because a DC Network does not need the ubiquitous AC to DC converting power supply (like

[7] See, e.g., Report of International Energy Agency at (per capital consumption and energy use by appliance), available at http://www.iea.org/papers/2005/AIXGapplianceenergyeff_TG.pdf (last visited April 15, 2010); 2007 Energy Information Administration Estimate, available at http://www.eia.doe.gov/emeu/rec/contents.html (last visited April 15, 2010).

[8] Nippon Telephone & Telegraph (NTT) of Japan conducted a great deal of research in the 1990s about how to support the large amounts of new data running over its networks. NTT discovered that when it comes to reliability, AC does not come close to the reliability realized in DC power systems. Over nine years later, with more than two times the DC systems observed versus the AC systems, the DC systems delivered better uptimes by an 8:1 ratio. Given the trend of increasing data (which, thanks to Voice Over Internet Protocol, VOIP, most phone calls are digital rather than analog) NTT has deployed hundreds of new DC systems to support their data centers. A group convened by the U.S. utilities trade organization, Electric Power Research Institute (EPRI), has implemented such a demonstration in California and is working with interested parties to do more.

the brick that plugs into your laptop) for every electronic device. Assumed to be a necessity, power supplies currently on the market impose losses on the power going to the device, typically 15% to 40%.[9] This range of losses in a DC microgrid can be readily lowered to 10% to 15% by using a higher efficiency conversion for multiple loads. This topology will persistently win out due to the superior economics of bulk conversion versus converter at every point-of-use.

[9] Lawrence Berkeley National Laboratory (LBNL) estimates that the average loss in the installed base of internal and external power supplies (2008) is 32%.

Another benefit of the decision to incorporate DC microgrids is the superior compatability of the DC power with electricity storage. During every major grid blackout (or brown-out, as periods of insufficient power production are called) experts note that further development of grid-scale power storage would vastly improve the stability of the grid. This concept, while technically possible, appears implausible because it evokes an image of some giant C-Cell Battery in the desert that would sustain the grid in case of emergency. This would simply be too expensive to make much sense. On the other hand, using distributed batteries connected to a DC network maximizes the battery's power by avoiding the conversion of its output, but also equals the sum of its parts precisely, such that 1000 small battery banks each having 10 hours of capacity to run a laptop needing 100 watts equals 1 megawatt hour just as if it came from a giant battery owned by the utility. But this analogy is too generous to the latter: power from the distant battery would suffer other losses the local battery would not. These include inversion losses (going from the DC in the battery to the AC of the grid), transmission and distribution losses (estimated to be 7 to 11% by the U.S. Department of Energy) and finally rectification losses when it gets to your electronic load. Collectively, these losses could add up to as much as 41% of the energy ultimately delivered to a DC device.[10]

[10] This assumes a 5% inverter loss, 9% transmission and distribution loss (DOE range is 7 to11%) and a rectifier loss at the device on an average of 32%, resulting in an overall loss of 41%. Note that with more efficient rectifiers supplying the electronic device, this loss can be reduced.

These conversion losses and line losses can largely be avoided by use of distributed batteries in a DC microgrid. Thus, although the DC network improves the economics of batteries (which are themselves DC devices) by marrying them closely to the DC devices they back-up in a highly distributed fashion, storage can be added to our developing DC microgrid in preference to large centralized battery storage schemes.

Fortunately, adding DC storage to a DC microgrid is a comparatively simple piece of engineering compared to the complications of integrating DC storage in the AC domain where additional hardware is required. The oldest continuously operating electrical systems in the world, stretching back to the origins of Bell Telephone, use DC storage. Those early exchanges formed the model of reliability, if not universal connectivity — it took over 30 years to resolve barriers between exchanges so that callers could reach customers of other exchanges.

Moreover, we have in this set of DC building loads the opportunity to integrate – at higher efficiency – other renewable energy generators that are intrinsically DC sources such as solar PV, small wind turbines, or fuel cells. Unlike an AC system, these various DC elements can work in concert without regard to matching phases. In a DC system, only the voltage needs to be considered, whereas AC systems require each element to have identical wave shapes—or be synchronized—to operate. This coordination is achieved through a complex device called an inverter, which provides the perennial weak link in distributed generation systems.

The DC microgrid thus can accommodate DC inputs because they enjoy a common currency. Therefore, given a suitably robust generator and ample storage, we now have quite an efficient local grid network that uses solar PV and integrates electrical storage at higher efficiencies than are possible in a conventional AC system. Existing plug-in devices pose a transitional challenge for DC microgrids because until these products are replaced by ones using a standard voltage, not all can be plugged in without a DC to DC converter.

The DC microgrid can also simplify and raise the efficiency of how plug-in hybrid electric vehicles (PHEV) and electric vehicles (EV) connect to the grid. Rather than automatically requiring the grid to negotiate opportunistic givers or takers of electric power, which could have large adverse impacts on the grid's stability, a DC microgrid can act like a high-efficiency buffer, optimizing generation and storage and increasing grid reliability. Moreover, because DC power has no phase to match, the connection to the vehicle is simplified, providing a more efficient path to its DC battery. As a system, the DC microgrid also creates more possibilities for the vehicle's stored or generated power by enabling either high efficiency on site use, or the more marginal economics of sending the power to the grid. This option is valuable and will help create more efficient markets for all DG connected in this manner throughout the system.

By locally managing sources and loads, a DC microgrid can optimize its net surplus of power (output to the grid) or deficit (input from the grid). This greater local management of both supply and demand creates a buffer to the grid and relieves some of its burden. Conventional means of Demand Side Management (DSM) do not accomplish these ends as efficiently. This becomes possible because of better exploitation of DC's natural characteristics, which remains the lifeblood of all electronic devices and the de facto fuel of the digital economy.

### C. Perspective on the AC vs. DC battle

Looking back a century at the struggle for dominance in the business of electricity, a great battle was fought over which paradigm would hold sway, AC or DC. A great deal of business history was written about these a\ttacks and counter-attacks, as well as a few torrid battlefield accounts, which all boil down to, for our purposes, four important points: (1)wholesale power production in large plants was cheaper than many distributed small ones; (2) AC could travel long distances with low losses, unlike DC; (3) incandescent lamps were the majority of the load and they operated on AC or DC; and (4) semi-conductors had not yet been invented.

These facts led to Westinghouse's triumph over Edison in many ways; however, they are also the reason why we need to resurrect some of Edison's arguments to better serve the load today. As the Smart Grid guiding principles remind us, our Power Equation has to protect the environment more, and has a growing need for Distributed Generating DC inputs like solar PV and DC Storage. Meanwhile, electronic devices are the fastest growing segment of the load, showing decades of momentum.

Examples of the convergence of the DC microgrids and the Smart Grid include the work of over 50 companies that have come together in a non-profit organization called the EMerge Alliance to promote low-voltage DC power standards for device manufacturers and systems integrators. This group expects the momentum of LEDs as a light source for common lighting applications to continue and eventually dominate the lighting market. LEDs typically plug into a 110-volt or 208-volt AC power supply that converts that power to 24-volt DC which is what the light source consumes to make visible light. Not coincidently, 24-volt DC is the first DC power standard promulgated by the EMerge Alliance.[11]

The companies that participate in the EMerge Alliance have developed products compatible with this DC power standard that enable a new kind of suspended ceiling that distributes low-voltage 24-volt DC power through the metal grid support structure in which ceiling tiles sit. This innovation in DC power distribution through the ceiling provides a new highly efficient channel for DC power generators to serve DC loads like electronically ballasted or LED lighting. If all of the new ceilings that are installed in the U.S. every year were specified to distribute DC in this new way, with solar inputs, these systems would accommodate over a Gigawatt of solar PV in the first two years.[12] Similarly, roof-top solar could be incorporated in its native DC form at 99% efficiency to a portion of offset air handling loads, potentially providing over 50 TWh of annual avoided peak load in the U.S. per annum.[13] This is power that, as in the lighting example, brings both the user and the grid consumer base benefits which the AC paradigm does not, avoiding transmission and distribution losses as well as conversion losses at the building site.

[11] See (public) Executive Summary of 1.0 version the standard, available at http://www.emergealliance.org (last visited March 22, 2010).

[12] This assumes 600 million square feet of ceilings installed providing 1 watt per square foot of power, equaling 600 MW of solar PV.

[13] See, e.g., Commercial, Industrial and Manufacturing Ventilation savings in the following tables.

## III. ANALYSIS OF POTENTIAL NATIONAL BENEFITS FROM WIDESPREAD DC MICROGRID DEPLOYMENT

Identifying efficiency benefits that will come from widespread DC microgrid deployment involves gross estimates of the nation's highly diverse load set. On the aggressive end, we note the estimate from Virginia Polytechnic Institute's Center for Power Electronic Systems (CPES) which estimates that 80% of all electricity used in 2010 will pass through power electronic systems.[14] Because this estimate relies on a measure of the status quo which is mainly AC, we can confidently assume that these conventional systems could all be improved in terms of efficiency by instituting higher-efficiency conversions of AC to DC networks, instead of converting the AC power at each point-of-use. More conservatively, however, we can identify specific benefits DC microgrids can bring to loads like lighting and adjustable speed drives for induction motors, and multiply that number by the best estimates of the total load used for those segments. The latter underestimates the full efficiency benefits of DC microgrids in action; the former suggests efficiency savings that, by using DC microgrids, they would approach over time.

[14] Power electronics in this sense refer to systems that use semiconductor components usually found mounted on printed circuit boards. These ubiquitous devices control electrons through transistors, resistors, capacitors, diodes and the like to amplify, convert or otherwise transform the power input to them.

What are our expectations for this new paradigm? Instead of the vertical, top-down, hierarchically driven grid we have today, we are presenting a horizontal, highly distributed architecture that is open to innovation. We should expect similar pay-offs to the users of the system to resemble those achieved by information seekers via the Internet.

### A. Energy savings (MWH)

The Lawrence Berkeley National Laboratory (LBNL) has estimated that the total amount of energy flowing into external power supplies for electronic devices in the U.S. is about 290 TWh/year.[15] The U.S. Environmental Protection Agency (EPA) and the DOE's Energy Star program estimates that one-third to one-half of the power sent to these devices is lost as heat. This ultimately means that around 100-150 TWh/year are currently being lost in these conversions.[16]

Most of the comprehensive national electric power data available is about the output from the grid, not how that power is used. Borrowing largely from the U.S. Energy Information Administration's (EIA) categories and data, we can begin to build a ground-up, load-by-load assessment of the energy savings possible through the use of DC microgrids. Where savings are derived from improved power supply efficiency only, 70% or 75% efficiency is used as an average range for AC power supplies, which is generous given the LBNL estimates,[17] and 90% is used for the bulk high-efficiency rectifier that would be used in a DC microgrid. These rectifiers are currently available in the market. The table below shows these sectors, the relevant loads, and the potential savings:

**Residential power consumption by addressable load, 2006**[18]

| Device | MWh used | Potential DC microgrid savings | MWh saved |
|---|---|---|---|
| Refrigerators | 160,158,600 | 40%[19] | 64,063,440 |
| Indoor/Outdoor Lighting | 103,113,000 | 15% | 15,466,950 |
| Furnace Fan | 39,193,200 | 25% | 9,798,300 |
| Microwave | 19,801,800 | 15% | 2,970,270 |
| Color TV | 33,960,600 | 15% | 5,094,090 |
| VCR / DVD | 11,593,800 | 15% | 1,739,070 |
| Cable Boxes | 2,975,400 | 15% | 446,310 |
| Satellite Dish | 1,846,800 | 15% | 277,020 |
| Desktops | 17,647,200 | 15% | 2,647,080 |
| Laptops | 1,333,800 | 15% | 200,070 |
| Printers | 4,617,000 | 15% | 692,550 |
| Pool Filter Pump | 10,054,800 | 25% | 2,513,700 |
| Ceiling Fan | 9,849,600 | 30% | 2,954,880 |
| Water Pump | 5,643,000 | 25% | 1,410,750 |
| Stereo Systems | 5,130,000 | 15% | 769,500 |
| Evaporative Cooling | 3,283,200 | 25% | 820,800 |
| Portable Stereos | 718,200 | 15% | 107,730 |
| Cordless telephones/answer | 4,514,400 | 15% | 677,160 |
| Rechargeable tools | 2,154,600 | 15% | 323,190 |
| Residual[20] | 82,285,200 | 10% | 8,228,520 |
| Total | 519,874,200 | | 121,201,380 |

[15] Lawrence Berkeley National Laboratory Symposium, *What the Real World Tells Us About Saving Energy In Electronics*, available at http://eetd.lbl.gov/ea/nordman/docs/e3s_nordman.pdf (last visited March 22, 2010).

[16] U.S. Environmental Protection Agency, Information About External Power Supplies, *available at* http://www.energystar.gov/index.cfm?c=archives.power_supplies (last visited March 22, 2010).

[17] Lawrence Berkeley National Laboratory (LBNL) estimated average efficiency of 68%.

[18] This 2001 data has interpolated for 2006 using the growth of households from U.S. Census data as proxy.

[19] While 40% appears to be a large number, only US-manufactured DC refrigerators were discovered to actually deliver an 80% improvement, but not without some compromises such as more insulation leading to smaller cubic storage, necessary periodic defrosting, etc. This efficiency benefit discount is meant to accommodate these variations in the serviceability between AC and DC refrigerators.

[20] This residual load is uncategorized, but significant; therefore, this modest expectation of efficiency improvement of 10% should be *de minimus*.

Potential percentage savings for the residential sector's addressable load: 25.32%; corresponding reduction in the total U.S. load: 2.98%. Addressable load refers to load that can be connected to a DC microgrid.

**Commercial building power consumption by load 2006**[21]

| Device | MWh used | Potential DC microgrid savings | MWh saved |
|---|---|---|---|
| Ventilation | 128,000,000 | 33% | 42,240,000 |
| Lighting | 393,000,000 | 15% | 58,950,000 |
| Office Equipment | 20,000,000 | 15% | 3,000,000 |
| Computers | 46,000,000 | 15% | 6,900,000 |
| Residual | 61,000,000 | 20% | 12,200,000 |
| Total | 648,000,000 | | 123,290,000 |

Potential percentage savings for the commercial building sector's addressable load: 19.03%; corresponding reduction in the total U.S. load: 3.03%.

**Manufacturing sector power consumption by addressable load 2006**

| Device | MWh used | Potential DC microgrid savings | MWh saved |
|---|---|---|---|
| Ventilation | 64,274,133 | 20% | 12,854,827 |
| Lighting | 64,274,133 | 20% | 12,854,827 |
| Office Equipment | 64,274,133 | 20% | 12,854,827 |
| Computers | 64,274,133 | 20% | 12,854,827 |
| Robotics | 64,274,133 | 20% | 12,854,827 |
| Residual | 64,274,133 | 20% | 12,854,827 |
| Total | 385,644,800 | | 77,128,960 |

Potential percentage savings for the manufacturing sector's addressable load: 20.00%; corresponding reduction in the total U.S. load: 1.09%.

**Data center power consumption 2005**[22]

| Device | MWh used | Potential DC microgrid savings | MWh saved |
|---|---|---|---|
| Total Load | 53,654,594 | 28%[23] | 15,023,286 |
| Total | 53,654,594 | | 15,023,286 |

Potential percentage savings for the data center sector's addressable load is 28.00%, which corresponds to the reduction in the total U.S. load of 0.37%.

Two dimensions of this large potential savings number are notable: first, that data center power consumption doubled from 2000 to 2005 and is expected to double again by 2010, which highlights the urgency of achieving efficiency gains in this sector; and second, one-half of data center building-wide efficiency gain is due to the avoided cooling load from fewer watts escaping as heat inside the building envelope.

[21] Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, C, and E of the 2003 Commercial Buildings Energy Consumption Survey.

[22] Marianne Kolbasuk McGee, Data Center Electricity Bills Double, INFORMATIONWEEK, Feb. 19, 2007, available at http://www.information-week.com/news/infrastructure/management/showArticle.jhtml?articleID=197006830 (last visited March 22, 2010).

[23] DC Power for Improved Data Center Efficiency Report, Lawrence Berkeley National Laboratory (Mar. 2008), available at http://hightech.lbl.gov/documents/DATA_CENTERS/DCDemoFinalReport.pdf (last visited April 15, 2010).

This avoided cooling is easily measured in the extremely high-density power environment of a data center, but is nevertheless present in all DC microgrid installations at a smaller scale. This is mentioned in the "Additional Benefits" Section 3, following.

**Summary table in terawatts**[24]

| Sector | Potential TWh saved | Potential efficiency gain in sector(s) | Potential reduction in U.S. national load |
|---|---|---|---|
| Residential | 121 | 25.32% | 2.98% |
| Commercial | 123 | 19.03% | 3.03% |
| Manufacturing | 77 | 20% | 1.90% |
| Data Centers | 15 | 28% | 0.37% |
| Total | 337 | 21.50% | 8.28% |

[24] *Id.*; please note that columns do not add up due to rounding; also, the summary table is the sum of the table results preceding it.

### *1. Generation capacity savings (MW)*[25]

These large potential benefits from efficiency would have an immediate positive impact on capacity, and capacity planning benefitting all grid stakeholders. Using contemporaneous data from 2006 for our load analysis, we can see how a lower load would deliver large benefits. The avoided 337 TWh of power generation, for example, could have allowed grid operators to shut down or avoid construction of about 75 GWof generating capacity.[26]

[25] http://www.eia.doe.gov/cneaf/electricity/epa/epa_sum.html

[26] This calculation assumes peak load decreases in the same percentage as total load. Thus 8.28% X (2008 U.S. noncoincident peak load + 15% reserve margin) = 75.2 MW. *See, e.g.*, http://www.eia.doe.gov/cneaf/electricity/epa/epa_sum.html (last visited Apr. 14, 2010).

### *2. Transmission and distribution*

The key strength of the AC is its un-matched efficiency as an inexpensive long-haul operator. Lowering end-use loads and facilitated on-site generation reduces loads on the transmission and distribution systems. We should therefore use the AC currency of the grid to the maximum benefit, as we have done with DC. Because DC microgrids reduce end-use loads and facilitate on-site generations, they can significantly reduce loads on the transmission and distribution system.

Other high-voltage DC transmission schemes are outside the scope of this analysis. It is interesting to note, however, that short high-voltage DC power lines do regularly operate between large service territories of the grid so that these large synchronized pools of AC power can stay connected to each other without the burden of precisely matching the phase of their neighbor. This buffer is important when a large section of the grid is brought down for any reason. With DC connections to its neighboring grid territories, coming back on-line is easier when the reviving generator does not have to synchronize with a connected systems' precise phase.

### *3. Additional benefits for on-site power generation from DC Sources (e.g. solar PV, small wind turbines, fuel cells and variable DC generators)*

Because DC microgrids are more efficient, they produce less heat inside the building envelope. As we saw in the data center application, this electrical efficiency benefit can double due to the avoided cooling load. This benefit is present in all DC microgrids, but has not been modeled outside the data center application in this analysis.

It should also be noted that multiple DC power inputs to the microgrid can be more simply integrated. No phase matching is required as in AC systems, and the efficiency observed extends to batteries, small wind turbines, fuel cells and variable speed DC generators. The latter has great potential in that they could respond in near real time to increased load demand, providing more battery-like surge capacity.

Combining multiple inputs raises the likelihood that several different fuels could be used at the building site, which increases the intrinsic security of the system.

## IV. BARRIERS TO DC MICROGRID DEPLOYMENT AND RECOMMENDED PUBLIC POLICY INITIATIVES

Current federal environmental law and utility regulatory practices in many states do not recognize the full societal value of energy efficiency and renewable energy investments in general, or of DC microgrids in particular. The systemic flaws in our current regulatory framework are well-recognized; they include the failure of the current regulatory framework to internalize the social costs of greenhouse gas emissions. A price on carbon and other GHGs will increase the cost of fossil fuel generation and thus make both energy efficiency and zero-carbon renewable generation more cost-effective.

Further, many state utility commissions have not decoupled utility profits from volume of sales, leaving in place substantial disincentives for utilities to promote energy efficiency and distributed generation if they decrease utility demand. These issues are familiar ones and ones that we discuss only in summary fashion in this paper. Instead this paper focuses on the specific issues related to DC microgrid deployment. These specific issues include (1) information and education programs for construction industry and building code officials; (2) codes and standards; (3) federal tax law; (4) federal financial assistance programs; (5) utility rate design and regulation; and (6) renewable electricity standards.

### A. Information and education program for construction industry and code officials

We recognize the importance of good communications about the benefits of DC microgrids. Historically, consumers have not appreciated their electrical service in its complexity, but that is changing rapidly with increasingly higher energy prices and innovations in time-of-use (TOU) pricing. Likewise, the awareness of environmental issues, such as carbon emissions and global warming, have piqued the interest of power industry professionals and prompted legislation to address these issues. Collectively, these forces have created an atmosphere of uncertainty around the future of our electrical system.

These facts highlight the need for an organized effort to disseminate information about the benefits DC microgrids offer. Some of this work has already begun by the EMerge Alliance through outreach to utilities, universities, the electrical trades and other interested parties. A "road-show" may be necessary to reach authorities having jurisdiction (AHJs), so that federal, state and local government can play an important role in supporting this effort. State and local governments, as primary regulators for buildings, will find that conversion to a DC microgrid system provides a cost-effective method to further energy efficiency goals. Because local building inspectors have the responsibility to interpret the National Electric Code, advocates of DC microgrids should conduct informative presentations to the trade organizations and conferences that cater to these inspectors.

### B. Codes and standards

The National Electric Code® (NEC)[27] is a living body of work that grows every few years through the efforts of thousands of electrical and electronics engineers and administrators. Fortunately, most of the work of putting together a DC microgrid falls under the existing code. Occasionally, however, the NEC remains silent on DC power installations below 600-volts DC, so that DC power is accommodated under rules that govern either AC or DC power systems of the same voltage. This is true, for example, for the insulation and shielding requirements for wires carrying electricity under 600 volts.

[27] NFPA 70, National Electric Code (2008)® is a United States standard for safe installation of electrical wiring and equipment, and part of the National Fire Codes series published by the National Fire Protection Association (NFPA).

While often not prohibited, a lack of references to DC can give both electricians and AHJs reason for concern; therefore, newly articulated descriptions of DC systems should be considered, even when no new rules are established in their narrative. Well-established sections of the code in place for decades have defined the 48-volt DC domain that was once ubiquitous as the voltage in plain old telephone service (POTS). Twenty-four volt DC has had no such history, but systems operating below 30-volts DC, which strictly limit current to under 100 volts-amps are designated "Class 2," denoting them as intrinsically safe from shock or fire hazard, which is an obvious advantage. The 24-volt DC standard promoted by the EMerge Alliance is in this category. That effort, coordinated with NEC committees' input and guidance, will spread the word, but a timely roll-out would benefit greatly from some coordinated efforts from interested areas of the government and standards bodies such as National Institute of Science and Technology (NIST), the American National Standards Institute (ANSI), the National Electrical Manufacturers Association (NEMA), the U.S. Department of Energy, and its system of National Laboratories and Technical Centers.

### C. Federal tax law

Federal tax law provides a range of tax credits and other tax incentives for energy efficiency, renewable energy and other low- or zero-carbon technologies.[28] However, these tax incentives do not provide any significant financial benefit for DC microgrid technology even though, as we note above, these microgrids can provide extensive savings in energy use and result in significant reductions in GHG emissions. Two specific changes in Federal tax law could help close this gap: a "negawatt credit" for DC microgrid systems, and a clarification of the production tax credit.

[28] 26 U.S.C. §§ 45, 48(a)-(c) (2009).

#### *1. DC microgrid negawatt credit*

Under this proposal, the owner of a DC microgrid would be allowed the equivalent of a production tax credit (currently about 2¢ per kWh) for each kWh of avoided conversion losses attributable to the operation of a DC microgrid. These avoided losses would encompass (1) savings from a centralized AC-to-DC conversion at the point where AC grid power enters the DC microgrid, and (2) avoidance of AC to DC to AC conversion for on-site renewable generation.

*2. Production tax credit*

Section 45 of the Internal Revenue Code of 1986 provides for a production tax credit of electricity produced by renewable generation facilities. The credit currently is set at 2¢ per kWh, and is adjusted for inflation. Tax credit qualification remains subject to numerous technical limitations, including a requirement in section 45(a)(2)(D) that requires that the output of the facility be sold to an unrelated person. This limitation disqualifies self-generation; that is, renewable generation that is consumed by the owner of the facility (or an affiliate of the owner).[29] One of the attractions of DC microgrids is their ability to use the DC output of on-site renewable generation without the double conversion loss (from DC output to AC to DC for equipment use) that occurs when on-site renewables must be integrated into an AC grid. We would recommend that section 45(a)(2)(D) be amended to make the sale-to-unrelated-party requirement inapplicable to on-site renewable output delivered into a DC microgrid and consumed on-site.

[29] "Self-generation" means renewable generation that is consumed by the owner of the facility (or an affiliate of the owner).

**D. Federal financial assistance programs**

DOE administers a series of federal financial assistance programs for advanced energy technologies. These include basic research and development under the ARPA-E program, various programs administered by DOE's National Laboratories, cost-sharing grants administered by DOE's program offices (in particular, the Office of Energy Efficiency and Renewable Energy and the Office of Fossil energy), and a massive loan guarantee program under title XVII of the Energy Policy Act of 2005. DC microgrid projects are eligible for assistance under most of these programs. However, because of the projects' low visibility and the fact that they cut across jurisdiction of various DOE program offices, they have never been a major funding priority. The following changes in DOE's financial assistance programs would advance the DC microgrid technology.

*1. Designate responsible DOE program office*

As noted above, responsibility for DOE's DC microgrid programs, to the extent they exist, are scattered among a number of program offices, with none responsible for coordinating DOE's support for the development and deployment of these systems. Designating a single program office (such as EERE) as responsible for coordinating DOE's efforts in this area could significantly advance the pace and effectiveness of DOE's efforts in this realm.

*2. Strengthen DOE funding for demonstration projects*

While commercial deployment of DC microgrid systems is proceeding in individual buildings, demonstrating multi-building and community-scale systems could benefit from more effective DOE financial support, in the form of cost-share demonstration grants. DOE has ample authority under its organic RD&D statutes;[30] however, an appropriation specifically for this purpose (but not for any specific project or projects) would significantly advance demonstration of the technology and economics of these larger scale projects.

## E. Utility rate design and regulation

### *1. Ratemaking issues*

(a) DC Microgrids Under Conventional Utility Regulation

The traditional electric utility regulatory model is cost-of-service regulation of a vertically integrated power supplier who has a local retail monopoly. This model is still the norm in about half of the U.S.[31] A DC microgrid system that (i) is end-user-owned, (ii) is behind-the-meter, and (iii) supplies no output back to the grid does not prevent regulatory issues under this model. The DC microgrid is simply another means of the customer's internal distribution of power purchased from the utility supplier. However, if any of the three conditions are not met, then, absent regulatory accommodation to this new technology, regulatory barriers (which incumbent utilities may exploit) can retard deployment of these systems. These potential barriers include:

*Third-party systems*—One attractive model for large-scale DC microgrids is a system which is owned by a third party (rather than the end-user), and which purchases AC power from the utility, converts it to DC, and resells it to individual users. This configuration raises two important questions under conventional utility regulation. First, is the utility sale to the system operator a wholesale sale regulated by FERC under the Federal Power Act, rather than a retail sale regulated by a state utility commission under state law? Second, is the sale to the end-user a retail sale that contravenes the utility's retail monopoly? No clear answer exists to either question because the answer relies on inconsistent FERC precedent relating to "submetering,"[32] and vagaries of state law on exclusive retail service areas.[33] Because answering these questions on a case-by-case basis expends both time and money, a federal statutory solution would be the most efficient resolution. One approach would be to exempt utility sales to third-party DC microgrid systems from wholesale regulation under the Federal Power Act, conditioned on the state's regulating the utility sale to the third-party microgrid operator, permitting the operator to resell to end-users, and ensuring that the utility's rates to the microgrid are not unduly discriminatory.

*Sales back to grid.*—Another key benefit of a DC microgrid is the ability to collect distributed renewable generations (or other on-site DC generation), to efficiently convert it to AC and to sell it back to the grid. The sale to the grid is a wholesale sale and ordinarily falls subject to wholesale rate

[30] *See* Federal Nonnuclear Energy Research and Development Act, 42 U.S.C. § 5919 (2008); Energy Reorganization Act §§ 101-107, 42 U.S.C. §§ 5811-5817 (2008).

[31] *See, e.g.*, U.S. Energy Information Administration, "Status of Electricity Restructuring By State" (Jan. 2010), *available at* http://www.eia.doe.gov/cneaf/electricity/page/ restructuring/ restructure_elect.html (last visited Mar. 8, 2010).

[32] *El Paso Elec. Co.*, 114 FERC ¶ 61,175 (2006) (FERC has no jurisdiction over a customer that traditionally purchased its power under a state-regulated retail tariff, and has provided primarily a submetering function, because the customer is not reselling that power and thus no sale for resale exists); *see also Alabama Power Co.*, 95 FERC ¶ 61,002 (2001) (disclaiming jurisdiction); *Cf. City of Oakland*, 31 FERC ¶ 61,139 (1985), *rev'd on appeal, Oakland Bd. Of Port Comm'rs v. FERC*, 754 F.2d 1378 (185).

[33] *See, e.g.*, state law retail restructuring programs for utilities in Florida, California, and Massachusetts.

regulation under the Federal Power Act (FPA), unless exempt under the Public Utility Regulatory Policies Act (PURPA).[34] PURPA generally exempts small renewable power generation and certain cogeneration ("qualifying facilities") from regulation under the FPA. However, large renewable systems (above 20 MW)[35] and other on-site generation, (such as fuel cells and micro-turbines) are not exempt and sales of their output to the grid likely fall subject to FPA regulation.[36]

PURPA also requires utilities to purchase the output of qualifying facilities. However, significant limitations exist both on the utility's federal law obligation to purchase from these facilities and on a state's ability to require purchase at rates above avoided cost. In major competitive wholesale markets (such as PJM, NY ISO, ISO New England), FERC rules have relieved utilities of their purchase obligations.[37] In addition, the federal purchase obligation, where it exists, is limited to "avoided cost"[38] – which is the cost the utility would have incurred if it had generated the power itself or purchased it elsewhere, as determined by the state utility regulatory commission. In most states, avoided cost is well below retail rates and may be insufficient to support many types of renewable generation.

Another issue relates to a state's authority to require utilities to pay higher-than- avoided-cost rates. FERC precedent from 1995 purports to preempt certain state rules requiring utilities to pay qualifying facilities rates in excess of avoided cost.[39] To the extent these rules raise a problem for DC microgrids, they can be dealt with, at least in part, by changes in federal law that (1) permit these systems to sell output at avoided cost rates without regard to size, and (2) give states clear authority to require above avoided-cost rates.

(b) DC Microgrids in Restructured Electric Power Markets

In much of the U.S., electric power regulation has been restructured to allow retail competitions. DC microgrids face fewer issues in the markets than in cost-of-service areas. While their sale of AC power by a utility or other seller may be subject to FERC regulation, the resale of DC power to end-users will not raise questions under exclusive services area laws (which no longer apply). However, sales back to the grid in restructured markets raise similar issues to those discussed in retail cost-of-service markets.

### *2. Feed-in tariffs*

A feed-in tariff is a standing offer by a utility to purchase the output of a renewable generator at a fixed or formula rate. A feed-in tariff applicable to DC microgrid renewable generation sold into the grid could significantly improve the economics of these systems.

PURPA's avoided cost purchase obligation, discussed above, represents one form of a feed-in tariff—albeit a complicated one because in many circumstances it requires a case-by-case determination of the utility's avoided cost. A more useful feed-in tariff

34 PURPA § 210(e); 16 U.S.C. § 824a-3(e)(1) (2009) (requiring the FERC to "prescribe rules under which geothermal small power production facilities of not more than 80 megawatts capacity, qualifying cogeneration facilities, and qualifying small power production facilities are exempted in whole or part from the Federal Power Act, the Public Utility Holding Company Act, and state laws and regulations" with respect to rates or financial or organization regulation of electric utilities if the Commission determines that such an exemption would be necessary to encourage cogeneration and small power production); *see also Sun Edison LLC*, 129 FERC ¶ 61,146 at P. 20 (2009) (finding that because the end-use customer makes no net sale to the local load-serving utility within which it has a net metering agreement, the sale of electric energy to the end-use customer in such circumstances does not constitute a sale for resale and thus not subject to FERC's jurisdiction).

35 18 CFR § 292.601(c) (2009).

36 16 U.S.C. § 824a-3(e)(2) (2009) (establishing that no qualifying small power production facility exceeding 30 megawatts may be exempted under the rules prescribed pursuant to PURPA § 210(e)(1), unless that facility produces electric energy solely by the use of biomass as a primary energy source).

37 FERC Order No. 688 (Oct. 2006), 18 C.F.R. § 292.309(a) (2009) (implementing PURPA § 210(m), 16 U.S.C. §824a-3(m) (2009)).

arrangement would entail a standardized rate set on the basis of the incentive necessary to deploy the resource rather than on the basis of the purchasing utility's avoided cost. However, this type of tariff is not permissible under federal law if it sets a rate above avoided cost, and a significant question has been raised as to whether it is permissible under state law, as we note in the discussion above.[40] Clarifying that PURPA does not preempt higher than "avoided cost" feed-in tariffs should provide grounds for states to move forward with innovative feed-in tariff proposals, which could benefit DC microgrids and other renewable systems.

In addition, feed-in tariffs should be designed to permit DC microgrid renewable generation to receive feed-in tariff credit for its entire renewable output, whether or not consumed within the DC microgrid. In return, the DC microgrid would pay the utility's retail rate for its entire internal load. This type of arrangement allows the DC microgrid to take advantage of the feed-in tariff for its full renewable output without incurring conversion losses that would be necessary if it physically delivered its full output to the grid and physically supplied its full internal load from the grid.

### *3. Utility ownership of DC microgrids*

An alternative to third-party ownership of large scale DC microgrids is utility ownership of the microgrid. This model could be an effective means of deploying systems that sell DC power from a multi-building network to multiple end-users, particularly in states that have exclusive retail service territory laws. If the incumbent utility is the retail seller, then no retail service exclusivity issue arises; however, the DC microgrid service must still be authorized either under the general terms of the state's utility laws or by action of the state regulator. A more important issue is whether the utility will provide a useful and cost-effective DC microgrid service to end-users and whether the public is better served by having competitive offerings from a number of prospective microgrid operators.

## F. Renewable Electricity Standard

Current proposals for a Renewable Electricity Standard (RES) require retail electric utilities to generate or purchase a minimum percentage of renewable energy resources each year. Generators of clean renewable energy resources are issued tradable renewable energy credits (RECs). Utilities may purchase RECs for use for compliance purposes, or they may produce renewable energy from their own facilities. Electricity savings from energy efficiency may also be used for compliance purposes.

The RES as currently formulated would provide full credit for renewables delivered into a DC microgrid system; however, the treatment of the efficiency gains from these systems is unclear. An RES provision specifically tailored to DC microgrids that provides explicit credit for efficiency gains (from lower conversion losses) for DC microgrids would resolve any confusion related to the applicability of the general provisions for computing electricity savings. Such a provision would direct DOE to determine electricity savings by rule, based on the difference between conversion losses for the average AC system minus demonstrated lower conversion losses for the DC microgrid.

[38] 16 U.S.C. § 824a-3(b) (2009) (explaining that no rule prescribed in PURPA Section 210(a) shall provide for a rate which exceeds the "incremental cost" to the electric utility of alternative electric energy). In the context of electric energy purchased from a qualifying cogenerator or qualifying small power producer, PURPA § 210(d) defines incremental cost as the "cost to the electric utility of the electric energy which, but for the purchase from such cogenerator or small power producer, such utility would generate or purchase from another source." 16 U.S.C. § 824a-3(d).

[39] *Cf. Conn. Light & Power*, 70 FERC ¶ 61,012 (1995) finding that the Federal Power Act preempted the Connecticut Department of Public Utility's ability to order a utility to enter into a contract at a state-set price because otherwise it would be impossible for the utility to simultaneously comply with the state mandate and the FERC mandate); *Midwest Power Systems*, 78 FERC ¶ 61,097 (1997) (finding that the Federal Power Act did not preempt a state law requiring utilities to purchase from state-designated facilities, but the FPA did preempt any order by the Iowa Utilities Board which set rates for wholesale transactions); *see also* Scott Hempling et al., "Renewable Energy Prices in State-Level Feed-In Tariffs," National Renewable Energy Laboratory (Jan. 2010), *available at* http://www.nrel.gov/docs/ fy10osti/47408.pdf (last visited Mar. 9, 2010).

[40] See discussion, supra at note 38.

## V. CONCLUSION

The DC microgrid concept represents a decentralization of the idea of the grid, and one that advances the goals of the current Smart Grid overhaul. The DC microgrid begins to change the paradigm from a centralized generation and distribution system of power delivery to a system that is more flexible and more accommodating of the load that has come to be: one that is more electronic, more ubiquitous, and more essential to our economy and our culture.

DC microgrids can create power systems that are more efficient and more compatible with the fastest growing segment of the load today: electronic devices. In turn, by catering to the needs of digital devices, we naturally expand the networks in which they operate (both power and control) to benefit from – or indeed require – redundant operation that is primarily available today through the other ubiquitous DC device, the battery.

But widespread deployment of DC microgrids will not happen automatically – the impediments to deployment identified above need to be dealt with. Our recommendations can be a first step in doing that.

# Renewable Energy Services in the GATS

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## WHAT ARE RENEWABLE ENERGY SERVICES?

Much attention is paid to trade in renewable energy goods, such as wind turbines, solar PV cells, or dual-use goods such as inverters. Services essential to the development and operation of renewable energy projects, however, tend to receive less attention, due in part to uncertainty about what constitutes such a service. Certain services are widely identified as renewable energy related activities. In the wind sector, for example, project development, financing, construction, engineering, transportation, and operation and maintenance are generally considered to be fundamental services in the lifecycle of a project. A company trying to provide any of these services in a foreign market may face barriers to entry which could ultimately raise project costs, delay implementation, or derail a project altogether. As such, it is important for services providers to be able to clearly understand existing commitments or barriers in a particular country, and for WTO members to expand commitments across the energy services spectrum.

In the World Trade Organization's General Agreement on Trade in Services (GATS), services are divided into general categories and then broken out in greater detail according to the Services Sectoral Classification List (W/120). In most instances, categories are defined according to the Provisional Central Product Classification (CPC). There is no single category for energy services, renewable or otherwise. Most of the services involved in the provision of renewable energy are found in various categories throughout the W/120. In the context of the Doha Development Agenda, the United States offered to liberalize commitments across a selection of services identified in a "checklist" of energy-related services (Table 1). This checklist has been adopted by several countries and is the most comprehensive approach toward liberalization of the energy services sector to date. Because energy negotiations in the WTO are source neutral – that is, the method of generation (e.g., coal, wind, biomass, etc.) is irrelevant – any commitments made to services in the checklist automatically apply to renewable energy unless specifically exempted.

[1] The work in this paper does not represent the views of the United States International Trade Commission or any of its individual Commissioners. This paper is the work of the author only, and not an official Commission document.

**Table 1 Checklist of energy-related services included in the U.S. GATS offer, 2003**

| CPC code | Description |
|---|---|
| 5115, 883 | Services incidental to mining |
| 8675 | Certain related scientific and technical consulting services |
| 887<br>861, 862, 863, 8672, 8673, 9312, 93191, 932 | Services incidental to energy distribution<br>Certain professional services, including engineering and integrated engineering services |
| 6111, 6113, 6121, 621, 622, 631, 632 | Distribution services, including commission agents, wholesale trade, and retail trade services that apply to fuels, related products, and brokerage of electricity |
| 633, 8861-8866 | Maintenance and repair of equipment, except transport-related equipment |
| 865 | Management consulting and related services |
| 511-518 | Construction and related engineering services |
| 7131 | Pipeline transportation of fuels |
| 7422 | Storage and warehouse services, particularly bulk storage services of liquids and gases |
| 8676 | Technical testing and analysis services |

Source: WTO, "Council for Trade in Services – Special Session – Communication from the United States – Initial Offer," TN/S/O/USA, September 4, 2003; and United States International Trade Commission, *Renewable Energy Services: An Examination of U.S. and Foreign Markets*, Publication 3805, October 2005, 1-4.

## HOW ARE RENEWABLE ENERGY SERVICES TRADED?

Most services, including renewable energy services, are traded either across borders or through affiliate transactions. Cross-border transactions occur when money or information is sent from a supplier in one country to a consumer in another (mode 1), a foreign consumer enters the country of a supplier to consume the service (mode 2), or a foreign national enters another country to provide the service (mode 4). Affiliate transactions (mode 3) are conducted when a firm sells its services in a foreign market through an affiliated firm that it has established or acquired a presence in that market. When making commitments in the GATS, countries may choose to fully liberalize market access and/or national treatment across all four modes, partially liberalize by committing to select modes, or make no commitments at all.

## HOW FREE IS TRADE IN RENEWABLE ENERGY SERVICES?

Commitments on renewable energy services are not easily identified or quantified, and as such it is difficult to assess how liberal or restrictive a particular market may be. Further, factors such as policy environment, energy demand, and electricity prices are likely to be more influential in determining whether multinational companies enter a particular market regardless of existing barriers to trade. For that reason, foreign presence in a certain market is not a good gauge of that market's openness. However, it may be useful to examine the commitments that leading countries have made in a number of energy services sectors to get a sense of the general level of liberalization. For illustrative purposes, Table 2 catalogues existing commitments in the checklist categories most relevant to the provision of wind energy services by the 25 leading wind energy markets as measured by installed capacity (EU members are grouped together).

**Table 2 Snapshot of GATS commitments in services related to wind energy**

| Description | United States | European Union | China | India | Canada | Japan | Australia | Turkey | Brazil | Egypt |
|---|---|---|---|---|---|---|---|---|---|---|
| Certain related scientific and technical consulting services | ◉ | ○ | ◉ | ○ | ◉ | ◉ | ● | ○ | ○ | ○ |
| Services incidental to energy distribution | ● | ○ | ○ | ○ | ○ | ○ | ● | ○ | ○ | ○ |
| Certain professional services, including engineering and integrated engineering services | ● | ◉ | ◉ | ◉ | ◉ | ● | ● | ● | ◉ | ○ |
| Distribution services, including commission agents, wholesale trade, and retail trade services that apply to fuels, related products, and brokerage of electricity | ◉ | ◉ | ◉ | ○ | ◉ | ● | ◉ | ○ | ◉ | ○ |
| Maintenance and repair of equipment, except transport-related equipment | ● | ● | ○ | ○ | ● | ◉ | ○ | ○ | ○ | ○ |
| Management consulting and related services | ● | ● | ◉ | ○ | ◉ | ● | ● | ● | ◉ | ○ |
| Construction and related engineering services | ◉ | ◉ | ◉ | ◉ | ◉ | ◉ | ◉ | ◉ | ◉ | ◉ |
| Technical testing and analysis services | ○ | ◉ | ◉ | ◉ | ● | ○ | ○ | ○ | ○ | ○ |

● = full commitments
◉ = partial commitments
○ = no commitments

Most measures regarding the supply of services through the presence of natural persons (mode 4) are addressed in a member country's horizontal commitments. For the purposes of this table, a full commitment is any commitment that grants full market access or national treatment to foreign individuals or firms that provide renewable energy services through cross-border supply (mode 1), consumption abroad (mode 2), and commercial presence (mode 3).

Note: This table is intended as a snapshot of commitments in the listed categories and is in no way a comprehensive assessment of GATS commitments. In many cases, commitments apply to only part of the sector and specific limitations may be in place. For full details regarding commitments, see the GATS schedules of individual countries.

Source: Compiled by the U.S. International Trade Commission from individual countries' GATS Schedules of Specific Commitments

Services commitments vary widely in these countries, with developed countries generally offering a greater degree of liberalization. However, renewable energy firms are pursuing opportunities in all of these markets presumably because the conditions are favorable and the benefits to market participation outweigh perceived risks. GATS commitments may hold greater weight in countries where renewable energy is in its nascent stages. It is important to note that many of the commitments outlined in Table 2 were made as early as 1994, and in some cases current practices are more liberal than what is reflected in the GATS schedules. Such conditions make it even more pressing that countries update their commitments, signaling to services providers that the operating environment will not change unexpectedly.

## WHY IS FREE TRADE IN SERVICES IMPORTANT?

With increasing global demand for both energy and greenhouse gas-reducing technologies, it is important that renewable goods and services be made readily accessible to customers that want them. Because cost remains one of the most prohibitive factors to large-scale adoption of renewable energy technologies, any measures that reduce costs should be implemented. By making full commitments to trade in energy services, nations ensure that consumers in their markets have access to a greater selection of services at competitive prices, which in turn encourages more widespread adoption of renewable energy technologies. That may lead to further economic benefits such as the growth of domestic renewable energy goods and services firms that may eventually export to the world market.

## WHAT IS THE FUTURE FOR TRADE LIBERALIZATION IN RENEWABLE ENERGY SERVICES?

The Doha Round has been underway since 2001, but has yet to reach a satisfying conclusion. Despite the current impasse, efforts to move forward on the liberalization of trade barriers affecting climate-friendly goods and services are underway. Paragraph 31(iii) of the Doha Declaration specifically calls for reduction of tariff and non-tariff barriers to environmental goods and services, and it was under that mantle that the United States and the European Union drafted the Environmental Goods and Services Agreement (EGSA). The EGSA proposes a two-tiered approach to liberalizing those sectors that meet environmental policy goals, with particular emphasis on objectives laid out in the United Nations Framework Convention on Climate Change. The EGSA proposal specifically calls for members to commit to existing levels of market access and national treatment and undertake new liberalization to remove market access barriers on a broad set of environmental and climate-related services, including energy, construction, architectural, engineering and integrated engineering services. Negotiations are still in progress and it is unclear what this particular effort will yield. Further complicating matters, because the services instrumental to the provision of renewable energy are so deeply enmeshed in the general energy services negotiations, it is unclear whether such services can be separated out for extraordinary treatment. At the WTO ministerial meeting in December 2009, trade ministers discussed efforts to fast track negotiations on climate-related goods and services, but no agreement has been made as yet. Some industry groups advocate the pursuit of environmental goods and services liberalization independent of the Doha negotiations, but at this point no plans exist to pursue multilateral liberalization outside of the WTO.

# *III.*

# *Analyses written by REIL members at the request of external organizations*

North America

BAKER & MCKENZIE

# Impact of REC Harmonization on Renewable Investment Decisions

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July 24, 2009

## I. INTRODUCTION

State renewable energy portfolio standards ("RPS") are creatures of state law, created by state legislatures to reflect the policies and priorities of that state. One result of this state-by-state approach is that RPS policies have limited commonality across states. In particular, the most typical differences include: (i) inconsistent definitions of eligible renewable energy resources; (ii) varying definitions of what constitutes a renewable energy credit ("REC"); and (iii) geographic restrictions on the trading of RECs themselves.[1] These differences either unintentionally or explicitly limit the trading of RECs across state boundaries. Often REC trading is further restricted by the requirements of the regional attribute tracking system governing the RECs. This state-based approach to renewable energy development creates a fragmented, local market for RECs and is thought to inhibit investment in renewable energy projects. However, achieving consistency among state RPS policies is not a simple task, as it requires changes to the statutes and regulations of the various states, and modifications to regional attribute tracking systems, or the adoption of a federal RPS.[2]

Much research and thought has been put into the differences among RPS and REC policies and the impediments to harmonizing such policies across states. The underlying assumption is that harmonization of state RPS policies will attract new investors and increase investment in renewable energy. Theoretically, increased REC liquidity should increase the flow of funds to renewable energy generation due to greater transparency in pricing and the additional cash flow associated with REC sales.

However, it is not clear that the price transparency and REC liquidity brought by RPS harmonization would alone be sufficient to significantly increase renewable energy investment in a particular state beyond existing investment levels. While the ability to freely trade RECs should create a more efficient market, it may be that other factors drive renewable energy investment with RECs playing a smaller role. Alternatively, renewable energy investment in the various states may be already maximized with investors are capitalizing on the current market fragmentation.

As the final deliverable for the Commonwealth of Pennsylvania on behalf of the Connecticut Energy Office, the Massachusetts Energy Office, and the Vermont Energy Office, Baker & McKenzie interviewed individuals with experience in REC markets and renewable energy investment. The purpose of these interviews was to gain understanding as to the extent to which the current fragmentation in the REC market and variations in RPS policies influences renewable energy investment decisions and whether harmonization would change those decisions. This paper discusses the opinions

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[1] The differences between state RPS programs are discussed more fully in *Enhancing Markets for Renewable Energy and Energy Efficiency Credits: Interim REC Market Status Report* attached as Appendix A.

[2] Further discussion of the options available for harmonizing state RPS policies can be found in *Legal Options for the Harmonization of State Renewable Credit Policies* attached here as Appendix B.

expressed by these interviewees and draws certain conclusions as a result of such interviews.

## II. PROCESS

Baker & McKenzie interviewed individuals with extensive experience as buyers and/or sellers of RECs or as investors in and developers of renewable energy projects across the U.S. These individuals were selected not only for their experience but also for their knowledge about state RPS policies and how these policies impact REC markets and investments in renewable energy.[3]

Baker & McKenzie conducted an interview with each individual, focusing on the factors critical to their decision to invest in renewable energy projects and what role RECs and state RPS policies played in the decision-making process. The interviews did not focus exclusively on investments that are required by state RPS, in other words utility company investments required to comply with the RPS or renewable projects developed in cooperation with a utility to satisfy such requirements. The interviewees also discussed the implications of a more liquid REC market on energy projects that sell into the "spot market." In particular, each interviewee was asked the following three questions:

- Do investors look to a state's RPS and REC policies when determining where to develop (or invest in) renewable energy? Why or why not? What are the most important factors in making those investment decisions?

- Does the lack of REC liquidity across states negatively (or positively) impact investment in renewables? If the impact is negative, what changes would increase investment?

- Other than changing state RPS legislation, are there other options for harmonizing state REC policies or for creating a more fluid REC market?

Throughout each interview, the interviewees raised issues that they felt were important to a discussion of RPS policies and REC liquidity. These thoughts and comments are incorporated into the discussion below.

For purposes of this paper, the comments and opinions of the interviewees have been summarized and combined so that no one comment may be attributed to any one individual. In addition, the conclusions drawn from these interviews are those of the authors and not necessarily the interviewees. While this is by no means a broad survey of the various opinions regarding REC markets, RPS policies, and the intersection with renewable energy development, it is a representative sample that can help inform state policy makers.

[3] For purposes of this report, all interviewees requested to remain anonymous.

## III. DISCUSSION

The rationale underlying efforts to harmonize state RPS policies is that consistent treatment of RECs and the ability to easily buy and sell RECs across state lines will increase investment in renewable energy. There are reasons to believe that a national or even regional REC market could drive-up such investment. First, a liquid REC market should appeal to investors attracted by the ability to easily commoditize their investments and capitalize on the REC market. At least one interviewee expressed the view that decreased fragmentation in the REC markets would not necessarily increase mainstream investment in renewables, but would attract a broader range of investors. Entities such as hedge funds and other market intermediaries would be attracted to renewable energy projects that such investors might not have otherwise considered. Marginal projects in particular would benefit from the new financial resources. Currently, financial investors target a limited number of projects in a select few states that have robust renewable energy markets. While RECs provide a mechanism for commoditizing a renewable energy investment, RPS policies severely restrict the liquidity and sale of such RECs. The current limitation on REC sales makes them a less attractive investment vehicle for these types of investors and eliminates a potential source of financing for renewable projects.

Second, a broader, more robust, and liquid REC market should provide greater price stability. Renewable energy projects are capital intensive and developers need a known (or at least predictable) revenue stream to allow them to finance and operate their development. While this difficulty is mitigated under power purchase agreements with utilities seeking to meet RPS requirements, developers of merchant facilities do not have the funding stability of a power purchase agreement and a robust, liquid REC market that allows for price discovery may be more critical for such developers. A stable REC price and broader market should encourage independent development of projects.

However, it is not the presence of a larger pool of investors, price stability, or even the liquidity of RECs in and of themselves that would increase renewable energy investment. Instead, ability of RECs to influence renewable development is linked to their role as a mechanism for financing projects and not just a marker for the transfer of environmental attributes. There are a number of reasons why harmonization may not improve investment in renewable energy, including the impact of liquidity on REC prices, the role of RECs as a marker of regulatory compliance, and the existence of other factors that may be more important to the development of renewable energy. These factors are discussed further below.

*Pricing*

The impact of harmonization on REC monetary values is a significant factor in whether harmonization will lead to additional renewable energy investment. Both the absolute value of a project’s REC and the value of those RECs to the cost of the project are important.

With respect to the value of RECs, a liquid REC market does not guarantee that REC prices will increase and in fact, the current market restrictions may be inflating REC prices overall or at least within certain submarkets. Because most RPS impose geographic limitations on the local REC market, REC buyers cannot reach outside of those boundaries, limiting the supply of available RECs. Markets with restricted supply typically experience higher prices depending on the local demand. Thus, opening the market may actually depress REC prices overall. If the local REC markets have varying prices, not all markets will benefit from harmonization. A true market, even just regional, will likely drive REC prices toward a mean price. Thus, submarkets with higher REC prices will find their REC price decrease. If RECs help subsidize renewable projects in those submarkets, then development may be negatively impacted.

This price decrease is likely to have the most financial impact on high cost renewables that may be more reliant on the cash generated by REC sales to help offset the cost of producing energy from that resource. RPS set asides for such technologies help address this difficulty for compliance RECs, but do little for any additional merchant development. Lower REC price might make financing harder especially if the resource relies on the sale of RECs as part of its cash flow.

On the other hand, submarkets with REC prices that start out below the mean will benefit by a move to the higher mean price. Further, a regional REC market would allow utilities to buy resource specific RECs from generators that can efficiently produce certain types of renewable energy either due to the ready availability of the resource in a particular geographic area or due to technological advantage. This could drive funding toward renewable development in those areas or toward specific technology. While there would be little or no immediate benefit to the development of all types of renewable in each state, it could lead to more overall renewable energy development in the U.S.

Even if REC prices do increase as the result of RPS harmonization, the increase may not be sufficient to allow RECs to play a substantial role in financing renewable development so as to actually increase such development. While RECs currently provide some level of financial support for certain renewable projects, they likely do not provide enough cash flow alone to be critical to any one project's success. Other sources of financing such as grants and tax credits are typically as, if not more, important.

Developers must still sell the energy from their projects and unless that energy can be sold at a competitive price, there may be few takers. Of course, the incremental value of the RECs may help finance projects for which tax credits and other financing mechanisms are not sufficient to make the energy price competitive. Certainly, RECs along with tax credits and grants can provide the financing necessary to make renewable energy cost competitive. However, the key issue is whether the relative value of RECs matter to a development and whether a liquid REC market increases the value of RECs sufficiently for them to drive additional investment.

A notable outcome of the interviews was the common opinion that while eliminating REC market fragmentation and the inconsistency among state RPS policies would lead to some increase in renewable energy investment, differing RPS policies and illiquid RECs are not the primary barrier to increasing investment. Instead, the financial fundamentals of a renewable energy project are more important to investment decisions and RECs do not substantially impact these fundamentals. The individuals interviewed agreed that harmonizing state RPS and REC policies could increase investment in renewable energy generation, although none believed that harmonization alone without broader policy reform would result in a substantial increase in such investment.

*Resource Availability*

Another factor impacting renewable energy investment, and one raised by all of the interviewees, is the availability of renewable resources. The ready availability of cost-effective renewable resources available within a state or region is critical to the development of renewable resources. Resource availability is unaffected by RPS harmonization. Investors will target states with readily available renewable resources that can cost-effectively produce energy regardless of that state's REC policies. Although states with limited resources should have higher REC prices, these prices need to be high enough to offset the additional cost associated with the energy source. The geographic limitations contained in many RPS are a direct response by state legislators to the concern that the ability to buy RECs from other states would decrease renewable investment in their states. The interviewees understood the concern for states with limited renewable energy resources or resources that are expensive to develop. However, they felt that most renewable investment is, and will continue to be, directed toward states with readily available renewable resources. States with limited renewable resources are not likely to attract investment beyond the minimum required under their RPS even with a liquid REC market.

*Price Caps*

A truly liquid REC market will require changes to state RPS beyond just harmonizing the definition of a REC and an eligible renewable energy resources or removing the geographic restrictions. Development of market pricing for RECs is further complicated by the presence of price caps or emergency price relief provisions. Price caps, which exist in many RPS, commonly provide that if the price of RECs exceeds a pre-established amount the utility may pay a fixed dollar amount to the state in lieu of purchasing the required RECs. These price caps are intended to protect local utilities from high REC prices, which would result if insufficient renewable energy sources were developed to meet RPS requirements. However, these relief mechanisms have the unintended consequence of depressing investment in renewable energy resources.

Renewable energy projects, like conventional energy projects, are capital intensive and require a longer-term financial commitment for the purchase of energy and RECs. Buyers have no incentive to hedge against cost increases in RECs by locking into long term contracts because RPS price caps provide a guaranteed maximum price. Further, these price caps set the upper limit on REC prices. Additionally, these price caps negatively impact the development of a secondary REC market in which investors that purchase RECs speculate on rising prices. All of the individuals interviewed mentioned prices caps as a deterrent to a stable, liquid REC market and stated that the removal of price caps would have a greater impact on investment decisions than increased REC fungibility.

*Regulatory Stability*

One additional factor that could deter renewable investment even in a liquid REC market is the frequency of the modifications to RPS policies and regulations by both state legislators and administrative agencies. Regulatory stability was felt by the interviewees to be a particular deterrent to long-term stable REC markets and thus to investment in renewable resources. As a result of these changes, investors had little confidence that the regulatory scheme underlying their investment will not change in the short-term, making them reluctant to make substantial long-term investments. Even if the current policies are not ideal, it may be better for a state to resist changing them. Further, the current state-based approach for renewable investment was thought to be unsustainable over the long term and modifications inevitable.

*Power Market*

A final factor that may limit renewable energy investment even in a liquid REC market is the role that the current structure of the power market plays in limiting investment in renewable energy. For some of the interviewees, this was the key deterrent to investment and, unless addressed, investment would continue to lag. Issues such as wheeling charges and the short length of power purchase agreements were key concerns. These issues can be addressed without harmonizing state RPS policies and could have a bigger impact in renewable investment.

## FEDERAL RPS

Ultimately, the underlying difficulty with transforming RECs into a financing tool that helps stimulates renewable development is that RECs have no value outside of their role as a marker of compliance with RPS standards for utilities. RECs are creatures of regulatory compliance and without the RPS compliance requirements, there would be no market for RECs. Thus, a liquid REC market will only drive renewable development to the point at which RPS compliance is achieved.

The adoption of a federal RPS may be the best mechanism for increasing the development of renewable resources. A nationwide renewable portfolio standard sets a floor for renewable development and requires additional renewable energy development to the extent that state-specific RPS have a renewable percentage lower than the federal RPS. However, depending on its structure, a federal RPS may or may not lead to harmonization of the REC markets. A federal RPS may interact with the existing state RPS in several ways including: pre-empting the state program, remaining silent, or recognizing the state RPS. Under the pre-emption approach, since the state RPS would cease to exist a fully harmonized REC market would exist.

To the extent that a federal RPS recognizes the state level RPS programs or permits states to maintain parallel programs, the REC market will remain fragmented at the state level. In fact, a federal RPS may create a more complex two-tiered system with RECs for federal RPS compliance trading on a national market and RECs for state RPS compliance trading only within the parameters defined by that RPS.

Several pieces of legislation have been introduced by Congress over the past several years seeking to create a federal RPS.[4] The American Clean Energy Leadership Act recently approved by the Senate Energy and Natural Resources Committee is an example of the Congressional efforts to move forward a Federal RPS. The House Energy and Commerce Committee has passed its own version of a federal RPS in the American Clean Energy and Security Act.

Regardless of the approach used under a federal RPS, a clear integration or pre-emption of the state RPS will be critical to maintaining the REC market. Additional discussion of the potential structures and the issues associated with a federal RPS are contained in our earlier report *Legal Options for the Harmonization of State Renewable Credit Policies* attached as Appendix B.

## IV. CONCLUSION

The general consensus among the individuals interviewed was that the most gains in renewable development could be made by addressing the issues discussed above and creating some degree of interoperability between state RPS policies; interoperability in which RPS do not work against each other but were not identical.

Further, the harmonization does not need to be nationwide. Instead, the interviewees felt the development of regional renewable energy and REC markets have the greatest potential for increasing renewable energy investment and bringing additional investment. Regional liquidity is most likely to bring economic development and renewable energy development to a region as a whole, and to those states that do not have sufficient renewable resources to develop robust renewable markets of their own.

Liquidity in any market, including the REC market, is valuable, as liquidity should provide greater transparency in pricing and attract additional investment in renewable energy development. However, harmonization of the various state RPS may not have the intended, or hoped for, consequences. As discussed in this report there are a variety of policy, regulatory, and market forces that otherwise hinder the creation of an efficient market for RECs. Further, these forces may not be addressed by creating identical or even compatible RPS policies across states. Harmonization of state RPS would require reconciling inconsistent definitions of eligible renewable energy resources and the varying definitions of what constitutes a REC as well as eliminating geographic restrictions. Thus harmonization may be a difficult goal to achieve, absent federal action, as it requires that all states in a region act in concert. Nonetheless there are steps, other

[4] Such as the Bingaman Amendment to the 2007 Energy Act H.R. 6 (2007).

than attempting to create a liquid REC market, that individual states can take such as addressing price caps, regulatory stability, and the dynamics of the local power market that could be as, or more, critical to advancing renewable energy development within their borders.

# APPENDIX A

## Enhancing Markets for Renewable Energy and Energy Efficiency Credits: Interim REC Market Status Report.

## Enhancing Markets for Renewable Energy and Energy Efficiency Credits: Interim REC Market Status Report

### Introduction

State created Renewable Portfolio Standards ("RPS") and the establishment of Renewable Energy Credits ("RECs") that may be traded in markets as a mechanism to comply with RPS targets has attracted private investment in renewable energy systems and technologies. A similar, but less well established system for Energy Efficiency Credits is beginning to emerge. The degree to which the REC markets (and nascent Energy Efficiency Markets) can catalyze significant additional private investment in renewable energy and energy efficiency technology remains to be seen and will depend largely on whether current barriers to liquidity in the REC markets can be overcome and the degree to which the energy efficiency policies avoid placing similar institutional barriers to market liquidity.

As part of the project proposal "Enhancing Markets for Renewable Energy and Energy Efficiency Credits" (the "Project") submitted by the Commonwealth of Pennsylvania on behalf of the Connecticut Energy Office, the Massachusetts Energy Office, the Vermont Energy Office, the Alliance to Save Energy and the Renewable Energy and International Law Network, Baker & McKenzie has prepared the following summary report on the status of REC markets and RPS. The Project seeks to analyze market barriers to RECs and Energy Efficiency Credits in Connecticut, Massachusetts, Pennsylvania and Vermont (the "Partner States") and develop strategies and legal options for overcoming these barriers.

This report is the first in a series of deliverables addressing the status and harmonization of REC markets. It is intended to serve as a concise overview of RPS and REC activities occurring in the four Partner States. As there has been substantial work done in the area of REC markets and RPS programs[5], this report does not replicate that work but instead provides a summary of the status of the Partner State programs, identifies barriers that limit the fungibility of RECs and the harmonization of the REC markets across the four Partner States, and serves as a foundation for the next phase of the Project which will focus on potential legal solutions to those barriers.

### RPS and REC Markets Overview

As of the end of 2007, 25 states and Washington, D.C. had adopted a mandatory RPS. Four additional states have voluntary renewable energy goals. Generally these programs establish renewable energy purchase obligations for electricity generators, distributors and suppliers within the state. Almost all RPS allow generators, distributors, and suppliers to achieve compliance with their renewable energy obligations through the

[5] A resource list including some of the recent papers discussing REC markets and RPS programs is attached to this report.

purchase of RECs. Allowing the use of RECs to achieve compliance with the RPS has resulted in compliance-based REC markets throughout the United States.[6]

Three of the four Partner States – Connecticut, Pennsylvania, and Massachusetts – have mandatory renewable energy programs while Vermont has adopted a voluntary program.[7] Although the specifics differ, the three mandatory programs require covered entities to achieve a specified level of renewable energy within their portfolios by set dates.[8] The percentage of renewable energy required by each state escalates over time.

Vermont has established a voluntary renewable portfolio goal under which retail energy suppliers are encouraged to meet the growth in energy demand with renewable energy resources. If the public utility board finds that the programs goals are not achieved by 2012, the voluntary goal converts into a mandatory RPS.

A chart summarizing the key aspects of the Partner States renewable energy programs is attached.

**Key Barriers**

A review of the Partner State's renewable and alternative energy portfolio requirements and prior research into the RPS programs identify several programmatic and structural barriers to liquid REC markets. In particular:

*Generation Mix and Renewable Attributes*: In each of the four Partner States (that define RECs) a REC is defined to represent a unit of renewable energy. However, a REC can represent both a unit of renewable energy and also the environmental attributes associated with that unit. In practice, the environmental attributes will vary depending on the mix of energy sources replaced by the renewable energy (e.g., a MWh of displaced coal generation has a different environmental attribute than a MWh of displaced hydro generation). As the Partner States sit within different regional energy markets, the generation mix and thus the environmental attributes of the RECs vary to some degree. The PJM generation mix is largely reliant on coal as compared to ISO-NE which relies more heavily on natural gas. The differing generation mixes creates different environmental attributes for RECs on a per MWh basis and thus is a practical limitation on the fungibility of the RECs between PJM and ISO-NE.

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[6] While RPS compliance is the underlying driver for the compliance-based REC market, a voluntary REC market also exists. However, unlike the compliance-based market which is driven by the desire to provide renewable energy (along with the various environmental and energy supply benefits derived therefrom), the voluntary REC market is primarily a surrogate for carbon reductions. There have been efforts in Congress to adopt a federal RPS which would impact voluntary as well as compliance-based REC markets. While this issue is beyond the scope of this status report, a discussion on the impacts of a federal RPS on voluntary markets is attached.

[7] The Connecticut and Massachusetts renewable portfolio requirements are referred to as RPS while Pennsylvania uses the term "Alternative Energy Portfolio Standard."

[8] As shown in the attached table Connecticut's statute covers electric suppliers and distribution companies, Massachusetts' RPS applies to retail electricity suppliers selling electricity to end-use customers, Pennsylvania's AEPS applies to electric distribution companies and electric generation suppliers, and Vermont's program covers electric suppliers.

*Renewable Energy Resource Definitions*: RECs typically represent a MWh or generation from a renewable energy resource. The definition of what constitutes a renewable energy resource varies among the Partner States, as it does among most states. Two of the Partner States – Connecticut and Pennsylvania – have classes or tiers of renewable energy resources that are eligible under their programs. Massachusetts and Vermont have one class of renewable energy resource. While Connecticut and Pennsylvania's categories of "first tier" renewables are largely similar to the Massachusetts' and Vermont's renewable energy categories, the precise definitions of the categories can vary.[9] More difficult are the "second tier" renewables, which may include energy sources that are not considered renewable in other state programs such as the waste coal included in Pennsylvania's Tier II category. These varying definitions make translating all RECs from one state to another difficult. Synchronized definitions, limitations on trading only RECs from similarly defined renewable energy resources, or an adjustment factor would be necessary to enable an interstate REC market.

*Geographic Restrictions*: Another key barrier to REC fungibility is the fact that many states place restrictions on the geographic location of the renewable energy generation. Because most states seek to encourage generation of renewable energy within their own borders for a variety of economic and environmental reasons, RPS programs typically place boundaries on the source of the renewable energy and any RECs used for compliance with the RPS. Connecticut, Massachusetts and Pennsylvania are not exceptions to this trend, placing some restrictions on the source of RECs for their programs.[10]

*REC Tracking Systems*: Even if states do not impose geographic restrictions in their RPS programs, the REC attribute tracking systems (NEPOOL-GIS and PJM-GATS in this

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[9] For example Pennsylvania defines biomass energy as:

"(i) organic material from a plant that is grown for the purpose of being used to produce electricity or is protected by the Federal Conservation Reserve Program (CRP) and provided further that crop production on CRP lands does not prevent achievement of the water quality protection, soil erosion prevention or wildlife enhancement purposes for which the land was primarily set aside; or

(ii) any solid nonhazardous, cellulosic waste material that is segregated from other waste materials, such as waste pallets, crates, and landscape right-of-way tree trimmings or agricultural sources, including orchard tree crops, vineyards, grain, legumes, sugar and other crop by-products or residues."

In comparison Massachusetts's definition is as follows:

"Fuel sources including brush, stumps, lumber ends and trimmings, wood pallets, bark, wood chips, shavings, slash and other clean wood that are not mixed with other solid wastes; agricultural waste, food material and vegetative material as those terms are defined, … by the Department of Environmental Protection at 310 CMR 16.02; energy crops, biogas, organic refuse-derived fuel that is collected and managed separately from municipal solid waste; or neat biodiesel and other neat liquid fuels that are derived from such fuels sources.

[10] Connecticut's RPS statute permits RECs:

1. issued by NEPOOL GIS f the RECs are for:
    a. energy produced by a unit generating Class I or II energy in ISO-NE
    b. energy imported into control area of ISO-NE; and
2. under contract to serve end-use customers in the state on or before October 1, 2006.

case) often have their own rules that may limit the source of the RECs. For example, the REC tracking system itself may limit the locations of generators for which it will issue RECs. The NEPOOL-GIS requires that the energy associated with certificates issued under the NEPOOL-GIS be delivered into ISO-NE and that the energy be generated in a control area adjacent to ISO-NE. Thus even if a state RPS statutorily allows non-state generated RECs to be traded within the state's REC market and be used for RPS compliance, the attribute tracking system may not permit it.

The above barriers are both legislative and regulatory in nature at the state and regional transmission organization levels. In the next phase, the Project will develop approaches for addressing these barriers specifically looking toward legal options that states may use to address these barriers. These legal options will be accompanied by a briefing paper on the financial community's perspective on REC market design and the current limits on fungibility.

REC Market/RPS State Summaries

Prep d by Baker & McKenzie

| State | Connecticut | Massachusetts | Vermont | Pennsylvania |
|---|---|---|---|---|
| Program | Renewable Energy Portfolio | Renewable Energy Portfolio | Renewable Portfolio Goal | Alternative Energy Portfolio |
| Renewable Requirements | Electric providers must meet requirements according to the following schedule:<br><br>2005: 4.5% (1.5%- Class I, 3%-Class II)<br>2006: 5% (2%- Class I, 3%-Class II)<br>2007: 7.5% (3.5%- Class I, 3%-Class II, 1%- Class III)<br>2008: 10% (5%- Class I, 3%-Class II, 2%- Class III)<br>2009: 12% (6%- Class I, 3%-Class II, 3%- Class III)<br>2010: 14% (7%- Class I, 3%-Class II, 4%- Class III)<br>2011: 15% (8%- Class I, 3%-Class II, 4%- Class III)<br>2012: 16% (9%- Class I, 3%-Class II, 4%- Class III)<br>2013: 17% (10%- Class I, 3%-Class II, 4%- Class III)<br>2014: 18% (11%- Class I, 3%-Class II, 4%- Class III)<br>2015: 19.5% (12.5%- Class I, 3%-Class | Retail electricity providers must utilize new renewable energy sources according to the following schedule:<br><br>2003: 1.0%<br>2 : 1.5%<br>2005: 2.0%<br>2006: 2.5%<br>2007: 3.0%<br>2008: 3.5%<br>2 9: 4.0%<br>+1% each year thereafter<br><br>To qualify as a new renewable resource, systems must have been installed after December 31, 1997; old systems may qualify under "vintage waiver" provision. | Retail electricity providers are encouraged to secure long term contracts for renewable energy to meet the increase in retail e y sales between 2005 and 2<br><br>If the electricity provider's do not contract for renewables 1) equal to the growth in Vermont's e y usage or 2) greater than 10% of Vermont's 2005 e y usage is not renewable then a mandatory RPS becomes effective in 2014.<br><br>In addition there is a separate state goal of 1) 20% of statewide electric retail sales from renewables and 2) 25% of all energy consumed in state produced by renewables by 2025 with an emphasis on farms and forests. | El y generators and suppliers must meet the following alternative energy requirements:<br>2007: 1.5% Tier I (including .0013% Solar), 4.2% Tier II<br>2008: 1.5% Tier I (including .003% Solar), 4.2% Tier II<br>2009: 2% Tier I (including .0063% Solar), 4.2% Tier II<br>2010: 2.5% Tier I (including .012% Solar), 4.2% Tier II<br>2011: 3% Tier I (including .0203% Solar), 6.2% Tier II<br>2012: 3.5% Tier I (including .0325% Solar), 6.2% Tier II<br>2013: 4% Tier I (including .0510% Solar), 6.2% Tier II<br>2014: 4.5% Tier I (including .084% Solar), 6.2% Tier II<br>2015: 5% Tier I (including .144% Solar), 6.2% Tier II<br>2016: 5.5% Tier I (including .25% Solar), 8.2% Tier II<br>2017: 6% Tier I (including .2933% Solar), 8.2% Tier II |

| State | Connecticut | Massachusetts | Vermont | Pennsylvania |
|---|---|---|---|---|
| | II, 4%- Class III)<br>2016: 21% (14%- Class I, 3%-Class II, 4%- Class I )<br>2017: 22.5% (15.5%- Class I, 3%-Class II, 4%- Class III)<br>2018: 24% (17%- Class I, 3%-Class II, 4%- Class III)<br>2019: 26.5% (19.5%- Class I, 3%-Class II, 1%- Class III)<br>2020: 27% (20%- Class I, 3%-Class II, 4%- Class III) | | | 2018: 6.5% Tier I (including .34% Solar), 4.2% Tier II<br>2019: 7% Tier I (including .39% Solar), 8.2% Tier II<br>2020: 7.5% Tier I (including .4433% Solar), 8.2% Tier II<br>2021: 8% Tier I (including .5% Solar), 10% Tier II<br><br>Suppliers that do not meet targets are assessed a penalty of $45 per MWh for Tier I or II, or 200% of average REC price for solar PV. |
| **Definition of renewable energy** | Class I: solar, wind, new sustainable biomass, landfill gas, fuel cells, ocean thermal power, wave or tidal power and some hydropower and biomass.<br><br>Class II: trash-energy and some biomass and hydropower.<br><br>Class III – Customer sited CHP, DSM energy savings, and waste heat recovery systems. | Solar photovoltaic, solar thermal, wind, ocean thermal, wave or tidal, fuel cell, landfill gas, biomass | Energy produced using technology that relies on a resource that is being consumed at a harvest rate at or below its natural regeneration rate.<br><br>Hydropower (up to 200MW), landfills, methane, farm methane, solar energy, wind, bio-diesel, biomass, and geo-thermal and fuel cells using renewables. Waste other than agricultural or silvicultural is excluded as is nuclear fuel.<br><br>Includes only renewables from facilities coming into service | Tier I: solar photovoltaic and solar thermal, wind, low-impact hydropower, geothermal, biomass, biogas, fuel cell, coal mine methane.<br>Tier II: waste coal, demand side (energy efficient technology, load management, industrial byproduct use), distributed generation, some hydropower, municipal solid waste, generation from wood processing byproducts, and integrated combined coal g n t ogy. Includes new and existing sources. |

| State | Connecticut | Massachusetts | Vermont | Pennsylvania |
|---|---|---|---|---|
| | | | after Dec. 31, 2004. | |
| REC Trading | Obligation can be met through purchase of RECs issued by NEPOOL. | Obligation can be met through purchase of RECs issued by NEPOOL.<br>Also, an electricity supplier may discharge its RPS obligation by making an alternative compliance payment to the Massachusetts Technology Park Corporation, which administers the state's Renewable Energy Trust. | The mandatory RPS obligation can be met through the purchase of RECs. | Alternative Energy Credits (AEC) (defined as tradable instruments) may be used to comply with the AEPS. |
| Geographic Restrictions | Electric suppliers and distributers may meet the requirements with:<br>1) RECs issued by NEPOOL GIS if the RECs are for a) energy produced by a unit generating Class I or II energy in ISO-NE or b) energy imported into control area of ISO-NE;<br>2) REC's under contract to serve end-use customers in the state on or before October 1, 2006 | For electrical energy transactions not included in the ISO-NE settlement market system but for which the supplier holds GIS Certificates from NEPOOL, the supplier must document the ownership of the GIS Certificates.<br><br>For electrical energy transactions not included in ISO-NE settlement market system and for which the supplier has not secured GIS certificates, the transaction must be verified by an independent third-party. Off-grid and behind-the-meter generators must be located in Massachusetts. | E y generated inside or outside Vermont may be counted toward the goal. | AECs may be certified for the portion of renewable energy consumed or delivered to PA or the control area of the RO that manages part of PA. AECs from outside PA are eligible for compliance purposes only in the parts of PA that are within the same RTO control area as the generator of the alternative energy. |
| REC | Any electric supplier that seeks to | No explicit provision regarding | No explicit provision regarding | Owned by alternative energy |

| State | Connecticut | Massachusetts | Vermont | Pennsylvania |
|---|---|---|---|---|
| Own p | demonstrate RPS compliance by participating in the renewable energy trading program shall have exclusive ownership of all renewable energy and environmental attributes from such trading programs that are associated with its renewable energy sources. | ownership of RECs. | ownership of RECs. | generator (or customer generator) and may sell or transfer. |
| Generation Mix | 2006 ISO-NE Data<br>Natural Gas – 38.1%<br>Nuclear – 14.4%<br>Coal – 9.2%<br>Oil – 24.4%<br>Hydro – 5.5%<br>Pumped Storage – 5.4%<br>Other Renewables – 3% | 2006 ISO-NE Data<br>Natural Gas – 38.1%<br>Nuclear – 14.4%<br>Coal – 9.2%<br>Oil – 24.4%<br>Hydro – 5.5%<br>Pumped Storage – 5.4%<br>Other Renewables – 3% | 2006 ISO-NE Data<br>Natural Gas – 38.1%<br>Nuclear – 14.4%<br>Coal – 9.2%<br>Oil – 24.4%<br>Hydro – 5.5%<br>Pumped Storage – 5.4%<br>Other Renewables – 3% | 2007 PJM Data<br>Coal – 55.3%<br>Nuclear – 33.9%<br>Natural Gas – 7.7%<br>Oil – 5%<br>Hydro – 1.7%<br>Solid waste – .7%<br>Wind – .2% |
| Covered Entities | E y suppliers and electricity distribution companies | Retail electricity suppliers selling e y to end-use customers | Retail suppliers | E y distribution companies and electricity generation suppliers with respect to energy sold to retail electric customers |
| Attribute Tracking System | NEPOOL GIS | NEPOOL GIS | NEPOOL GIS | PJM GATS |
| Attribute Tracking System Trading Restrictions | NEPOOL-GIS requires that the energy associated with certificates issued under the NEPOOL-GIS be delivered into ISO-NE and that the energy be generated in a control area adjacent to ISO-NE. | NEPOOL-GIS requires that the energy associated with certificates issued under the NEPOOL-GIS be delivered into ISO-NE and that the energy be generated in a control area adjacent to ISO-NE. | NEPOOL-GIS requires that the energy associated with certificates issued under the NEPOOL-GIS be delivered into ISO-NE and that the energy be generated in a control area | PJM GATS will issue certificates for generating units located outside of PJM whether or not the energy is delivered into PJM. If the energy was not delivered into PJM, certificates will only be created if |

| State | Connecticut | Massachusetts | Vermont | Pennsylvania |
|---|---|---|---|---|
| | | | adjacent to ISO-NE. | 1) the generator has been pre-qualified by one of the PJM states for its RPS program, and 2) the state has approved the creation of certificates. |
| Age y — Statutory and/or Regulatory Authority | Connecticut Department of Public Utility Control<br>—<br>Conn. Gen. Stat. §§ 16- 245a, 16-1, and related provisions at Title 16, Chapter 283<br>Regs., Conn. State Agencies, § 16-2 a-1 et seq.<br>NEPOOL-GIS Operating Rules | Massachusetts Division of Energy Resources<br>—<br>Mass. Gen. Laws Ch. 25A § 11F<br>225 CMR 14.00 et seq.<br>NEPOOL-GIS Operating Rules | Vermont Public Service Board<br>—<br>30 V.S.A. § 800 *et seq.*<br>Board Rule 4.300 amended in March 2008 by S.B. 209<br>NEPOOL-GIS Operating Rules | Pennsylvania Public Utility Commission<br>—<br>73 Penn. Stat. §§ 1648.1 *et seq.*<br>SB 1030<br>GATS Operating Rules |

**Additional Background Reading**

Clean Energy States Alliance, New Jersey Board of Public Utilities, Office of Clean Energy & the Center for Energy, Economic and Environmental Policy, *Northeast RPS Compliance Markets: An Examination of Opportunities to Advance REC Trading* (2005).

Ryan Wiser and Galen Barbose, Lawrence Berkeley National Laboratory, *Renewable Portfolio Standards in the United States; S status Report with Data Through 2007* (April 2008).

K.S. Cory, National Renewable Energy Laboratory & B.G. Swezey, Applied Materials, *Renewable Portfolio Standards in the States: Balancing Goals and Implementation Strategies* (2007).

Cliff Chen, Ryan Wiser & Mark Bolinger, *Weighing the Costs and Benefits of State Renewables Portfolio Standards: A Comparative Analysis of State-Level Policy Impact Projections* (2007).

Edward A. Holt, Ed Holt and Associates, Inc., & Ryan H. Wiser, Environmental Energy Technologies Division, *The Treatment of Renewable Energy Certificates, Emissions Allowances, and Green Power Programs in State Renewables Portfolio Standards* (2007).

# Appendix B

## Legal Options for the Harmonization of State Renewable Credit Policies

North America

BAKER & McKENZIE

# Legal Options for the Harmonization of State Renewable Credit Policies

June 16, 2008

## V. EXECUTIVE SUMMARY

State renewable energy portfolio standards ("RPS") have a significant impact on the renewable energy credit ("REC") market and the subsequent investment in renewable energy resources. Since RPS are creatures of state law, the RPS have been created to reflect the policies of the various states. This fact has resulted in a fragmented market for RECs.

The fragmentation is largely caused by (i) inconsistent definitions of eligible renewable energy resources; (ii) varying definitions of what constitutes a REC; and (iii) geographic restrictions on the trading of RECs themselves. There are several options for achieving harmonization among the state RPS and increasing REC market liquidity. These options include changes to the statutes and regulations of the various states, modifications to the regional attribute tracking systems, and the adoption of a federal RPS. While no one option provides a complete and simple resolution, this paper explores the benefits and potential negatives of these options.

## VI. INTRODUCTION

This paper is the second in a series of deliverables on the harmonization of state-based REC policies for the Commonwealth of Pennsylvania on behalf of the Connecticut Energy Office, the Massachusetts Energy Office, and the Vermont Energy Office (the "Partner States"). RPS programs and RECs are a strong force behind renewable energy development in the U.S. and the Partner States are seeking to advance both their RPS and development of renewable resources.[11] The Partner States requested that the Alliance to Save Energy, the Renewable Energy and International Law Network, and Baker & McKenzie analyze market barriers to RECs and energy efficiency credits in the Partner States.

To date there has been much thoughtful work on the differences between the various state RPS programs and how the state program variations present barriers to the fungibility of RECs. This paper builds on that work by analyzing the legal options for harmonizing state RPS as a means to reduce fragmentation in the REC market. Increasing REC fungibility and market liquidity is viewed by many as an important factor in catalyzing greater investment in renewable energy technologies. This paper identifies several options as possible approaches to expanding the REC market,[12] including: creating identical state RPS programs; harmonizing state RPS programs, including addressing the requirements of the regional attribute tracking systems; creating a weighted REC scheme; and implementing a federal RPS.

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[11] Ryan Wiser and Galen Barbose, *Renewable Portfolio Standards in the United States, A Status Report with Data Through 2007*, April 2008, Lawrence Berkeley National Laboratory, P. 12. The data do not determine whether the renewable energy was developed because of a state's RPS and do not take into account that some states allow for out-of-state generation to count toward the RPS.

[12] Since the barriers to REC market liquidity are generally consistent across states, we focus our discussion on the Partner States.

## VII. The Status of State RPS and REC Markets

Over twenty-five states have a RPS in place with over half of these implemented since 2004. Most existing RPS allow regulated entities to use RECs for compliance purposes. While the general principle of a RPS—to require retail electricity suppliers to obtain a particular level of renewable energy per year—is consistent across the states, the details of the RPS among the states vary greatly. State programs differ in the type of eligible renewable projects, the ability to use RECs outside of the state's power pool, and even the definition of what qualifies as a REC.

RPS programs in the Partner States are no exception, each taking a different approach. Of the four Partner States, three – Connecticut, Pennsylvania, and Massachusetts – have a mandatory RPS while Vermont has adopted a voluntary program. The details of the three mandatory programs differ but all three require covered entities to include specified, increasing levels of renewable energy within their portfolios by set dates. Vermont established a voluntary renewable portfolio goal which encourages retail energy suppliers to meet the growth in the state's energy demand using renewable energy resources. If the programs goals are not achieved by 2012, the voluntary goal converts into a mandatory RPS. The details of the Partner States' RPS are outlined in Appendix A.

While most states use the term RPS in reference to their portfolio standards, Pennsylvania refers to its portfolio standard as an Alternative Energy Portfolio Standard ("AEPS") and uses the term Alternative Energy Credit ("AEC") in place of REC. The AEPS seeks to increase the use of alternative forms of energy including renewable resources, reflecting the fact that Pennsylvania's program includes energy sources that are not renewable.[13]

States have various economic, environmental, and policy reasons motivating the design of their RPS. For instance, some states may restrict the ability to buy RECs in order to create incentives for the development of local renewable energy sources. Connecticut and Pennsylvania have established preferences for certain types of renewable energy sources by creating different "tiers" of renewable energy resource types and setting targets specific to such tiers. A tiered system functions to encourage higher-cost renewable energy sources that may not otherwise be competitive. A tiered system also allows a state to favor resources that provide particular environmental or economic benefits within its borders. Other states may recognize an energy source as "renewable" that another state views as less environmentally beneficial. For instance, only Pennsylvania recognizes energy generated from waste coal as an eligible alternative energy source. State-specific RPS programs allow each state to customize its RPS to meet its local conditions and politics.

As a result of limited commonality between the states in important program design elements, the REC market is not a cohesive, nationwide market but instead is highly fragmented regional or even state-based market. Even regional markets are restricted due to state RPS and attribute tracking system restrictions. Fragmentation of the REC market inhibits overall investment in renewable energy projects because fragmented markets are less efficient and less liquid and

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[13] Since RPS is the more commonly used term, this paper will generally use RPS to refer to programs that set portfolio standards. However, specific references to Pennsylvania's program will use the terms AEC and AEPS.

therefore have not attracted the capital market investors that require greater liquidity. Fragmentation in the REC market has led to significant price differentials depending on the state, the type of eligible renewable energy sources in a particular state and the level of interstate trading of RECs.[14]

One thesis is that harmonizing the REC market, even on a regional basis, would lead to increased interstate fungibility of RECs and greater liquidity, which in turn would lead to greater investment in renewable energy. Renewable energy projects are often capital intensive and the cash flows related to REC sales are an important consideration in investment decisions. Even limited harmonization could lead to greater clarity in the market, which enables enhanced investment decision-making. Harmonizing state programs may, to some degree, mitigate the price volatility by allowing RECs to flow to areas in need of RECs and with limited renewable energy in-state capacity. A uniform price for RECs is thought to create a more predictable investment environment.

We are mindful, however, that there are potential benefits to individual states in maintaining their locally tailored RPS and the associated fragmented market. First harmonization of state RPS programs may be optimal from a market efficiency standpoint but, as discussed later, would require revisions to state statutes or regulations that created the RPS programs. Such revisions may implicate policy decisions underlying the RPS structure as well as disrupt the REC market in the short term as market participants adjust to the changes. In addition, the market fragmentation may provide development opportunities that would not otherwise exist. Certain investors maybe capitalizing on the existing fragmentation, bringing financial resources to renewable energy development that might not otherwise exist. For the purposes of this analysis, we assume that the benefits of a regional REC market outweigh the benefits of the status quo.

## VIII. IMPEDIMENTS TO HARMONIZATION

The establishment of a more liquid REC market is restricted by the specific provisions of the underlying state regulations and statutes establishing the RPS programs. The state statutes and regulations delineate the REC market by setting forth the definition of renewable energy sources that may be used to create RECs and the geographic restrictions on the trading of RECs. State laws also define what constitutes a REC (e.g., does it include environmental attributes such as avoided emissions). As illustrated below, Connecticut, Massachusetts, Pennsylvania and Vermont have differing approaches to these concepts. Establishing even limited harmonization between the states would require some consistency among the key programmatic elements.

### A. Eligible Renewable Energy Sources

Establishing a consistent definition of the eligible renewable energy sources among states would enable renewable energy projects across the region to meet that element of each state's RPS program. Currently, the Partner States' RPS statutes or regulations outline a positive list of renewable energy sources that are eligible to create RECs. As shown in Appendix A, the Partner

[14] Ryan Wiser and Galen Barbose, *Renewable Portfolio Standards in the United States, A Status Report with Data Through 2007*, April 2008, Lawrence Berkeley National Laboratory, P. 1.

States have some commonality between the eligible categories of renewable resources. All Partner States recognize the following broad renewable energy categories: solar, wind, methane gas, hydroelectric and biomass. Aside from wind, the states further define each broad category. For instance, in the statute establishing Massachusetts's program, eligible biomass must satisfy the following definition: "low-emission, advanced biomass power conversion technologies, such as gasification using such biomass fuels as wood, agricultural, or food wastes, energy crops, biogas, biodiesel, or organic refuse-derived fuel."[15] In comparison, Pennsylvania requires, among other things, that the material used to create biomass energy be "segregated from other waste materials, such as waste pallets, crates and landscape or right-of-way tree trimmings or agricultural sources, including orchard tree crops, vineyards, grain, legumes, sugar and other crop by-products or residues." Therefore, some biomass projects may qualify under Massachusetts' program and not under Pennsylvania's and vice versa.

Aside from further restrictions on the broad renewable energy category, there are other differences between the states' programs. For instance, Pennsylvania recognizes waste coal energy as an eligible alternative energy source while Vermont, Connecticut and Massachusetts do not. Therefore, coal waste "AECs" cannot be used for compliance purposes in Connecticut or Massachusetts or in Vermont's voluntary program. The recognition of such "AECs" may also be against state policies that seek to promote renewable energy sources and not simply alternative energy sources. Harmonizing eligible renewable energy resources in the Partner States would ensure states were comfortable in allowing in out-of-state RECs because they would know the projects creating the RECs in the other state were from acceptable sources. For Pennsylvania, this may mean that not all of its Tier II resources would be fungible.

### B. Geographic Restrictions

A liquid REC market is bolstered by a free flow of RECs across geographic boundaries. Most states with an RPS allow the use of unbundled RECs for compliance purposes. As a result, there is greater flexibility in complying with RPS programs as RECs could theoretically come from across the nation. However, a common feature of RPS programs, including the Partner States, is to restrict the geographic source of RECs,[16] creating an obvious barrier to REC market liquidity.

The Partner States analyzed in this report do not allow the unrestricted purchase of RECs for RPS compliance. *See* Appendix A. For instance, Connecticut recognizes RECs from generators within ISO-NE or from energy imported into ISO-NE pursuant to Rule 2.7(c) of the NEPOOL-GIS operating rules as described below. Massachusetts allows for out-of-state RECs so long as the corresponding energy is delivered into ISO-NE.

In addition, the northeast attribute tracking system – the New England Power Pool-Generation Information System ("NEPOOL-GIS") – has its own operating rules regarding importation of energy, which affect both Massachusetts and Connecticut. NEPOOL-GIS allows only RECs that accompany energy imported into ISO-NE from adjacent states to be eligible to create GIS certificates. The NEPOOL-GIS rules serve to exclude all non-NEPOOL RECs except those from

[15] M.G.L. 25A Sec. 11F(b)(viii).
[16] Clean Energy States Alliance, *Northeast RPS Compliance Markets: An Examination of Opportunities to Advance REC Trading*, October 12, 2005 [hereinafter "CESA Report"].

New York, which is adjacent to ISO-NE. Therefore, even if Connecticut and Massachusetts allowed for freely traded RECs, the NEPOOL-GIS rules would impede the flow of non-NEPOOL, non-New York RECs.

In comparison, Pennsylvania does not allow RECs from outside the regional transmission organizations that serve Pennsylvania (i.e., PJM or MISO) even if energy is also imported. The relevant attribute tracking system in Pennsylvania – PJM-Generation Attributes Tracking Systems ("PJM-GATS") – recognizes out-of-state RECs so long as the RECs have been approved by the receiving state as eligible under the receiving state's RPS. Therefore, unlike with NEPOOL-GIS, only Pennsylvania's state requirements and not PJM-GATS function to restrict the use of RECs in Pennsylvania.

Even if all Partner States had the same definition of eligible renewable energy sources, the geographic restrictions would still restrict REC market liquidity. Eliminating the geographic restrictions in the state RPS programs and NEPOOL-GIS would significantly contribute to the harmonization of the REC market in the Partner States.

### C. Definition of RECs

The attributes included in a REC are not well-defined or universally agreed-upon. Some believe that a REC includes only a certification that one megawatt-hour of energy has been generated from an eligible renewable energy source. Others maintain that RECs include environmental attributes such as the avoided emissions that result from renewable energy generation as compared to the displaced conventional energy generation.

The difference in the REC definitions is important because it may affect the fungibility of the REC as well as the REC value. In theory, if a compliance REC does not include avoided emissions, the avoided emissions portion could be sold to a third-party. A REC that includes avoided emissions should command a different price than RECs that do not include avoided emissions. If the REC definitions in the Partner States are not consistent, it could result in decreased liquidity in the region's REC market.

In recognition of this issue, some states have explicitly stated that RECs used for compliance with the RPS must include the environmental attributes like avoided emissions.[17] Connecticut requires that any electric supplier that seeks to demonstrate RPS compliance by participating in the renewable energy trading program must have exclusive ownership of all renewable energy and environmental attributes that are associated with its renewable energy sources. In other words, a utility submitting RECs for compliance in Connecticut cannot separately sell the avoided emissions from the same megawatt hour to another party. Massachusetts' definition of "Generation Attribute" is less clear and does not explicitly reference environmental attributes or

[17] Edward Holt and Ryan Wiser, *The Treatment of Renewable Energy Certificates, Emissions Allowances, and Green Power Programs in State Renewables Portfolio Standard*, Berkeley National Laboratory, April 2007, P. 14.

avoided emissions.[18] Pennsylvania's current AEC definition is silent with respect to environmental attributes and states only that the AEC "shall equal one megawatt hour of electricity from an alternative energy source."[19] In a proposed rulemaking dated July 25, 2006, Pennsylvania takes a different approach and allows parties to contract to include or exclude environmental attributes in the AECs.[20] If this rulemaking becomes final, an entity in Pennsylvania could sell the environmental attributes separately to a third-party because environmental attributes need not be included in the AEC used for compliance purposes.

The fact that the Partner States do not have consistent REC definitions may impede market liquidity because a Pennsylvania AEC may or may not have the environmental attributes necessary for RPS compliance in Connecticut and potentially required in Massachusetts. Entities and investors would need to differentiate between RECs with or without environmental attributes, which may impact underlying eligibility and pricing for RECs among the Partner States.

## IX. MECHANICS OF HARMONIZATION

Harmonizing the Partner States' RPS and increasing REC fungibility at the state level will likely require (i) changes in the definitions of renewable resource, (ii) changes to the definition of the REC itself; (iii) changes to the geographic restrictions contained in the state RPS programs; and (iv) changes to the attribute tracking rules. These changes will either be administrative or legislative in nature or potentially both. The various state RPS schemes are all authorized by state statute; however, the degree to which the state legislature has defined the RPS versus leaving the specific programmatic requirements up to the rulemaking process of the administrative agency in charge of implementing the RPS varies from state to state.

States which have included most of their RPS provisions in their statutes will have to amend those statutes through their legislative processes, requiring consideration and approval by the state legislature. In states where regulations determine the RPS requirements, the responsible agency will have to amend their regulations through their rulemaking process. In some cases, the states have adopted regulations to further define the statutory requirements and a change in the statute will need to be followed by regulatory changes. Each of the Partner States is discussed briefly below:

*Connecticut's* RPS is defined by legislation adopted by the Connecticut General Assembly.[21] The RPS statute defines the classes of renewables that may be used for RPS compliance, sets the compliance percentages, and provides for geographic restrictions on the source of RECs used to comply with the RPS. The Connecticut Department of Public Utility Control has adopted regulations which provide additional detail regarding reporting requirements, operating rules,

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[18] The NEPOOL-GIS rules, which are relevant in Massachusetts and Connecticut, do not require avoided emissions to be included with the REC and thus do not provide further clarification for the REC definition in Massachusetts.
[19] 73 P.S. § 1648.2.
[20] Pennsylvania Bulletin, Vol. 36, No. 41, October 14, 2006, p. 6299. This rulemaking has not yet been finalized.
[21] Conn. Gen. Stat. §§ 16-1, 16-243q, and 16-245a.

modifications and alternative payments under the RPS.[22] Any change to definitions, geographic restrictions or other key elements of Connecticut's RPS will require legislative changes made by the Connecticut General Assembly and corresponding changes to the Department of Public Utility Control's regulations.

*Massachusetts'* RPS is primarily a creation of state regulation and not state statute. The General Law of Massachusetts directs the Division of Energy Resources to establish an RPS that meets certain basic requirements.[23] The Division of Energy Resources has adopted regulations that define the requirements of the state RPS.[24] As a consequence, Massachusetts may amend its RPS through the rulemaking process. The statute does define the list of eligible renewable resources but further allows the Division of Energy Resources to amend the list by adding technologies with the exception of coal, oil, natural gas[25], and nuclear power. To the extent that harmonization requires removing resources from the Massachusetts renewable definition or adding waste coal, legislative change will be necessary.

*Pennsylvania's* AEPS is largely detailed by legislation.[26] Not only does the statutory language set the portfolio standards, but it also defines the alternative energy sources allowed for compliance and the program's geographic restrictions. The Pennsylvania Public Utility Commission has proposed regulations that further define the State's AEPS. Because the AEPS is governed by statute, the Pennsylvania General Assembly will be required to vote on any amendments to the AEPS. Therefore, any attempts at full or partial harmonization will require legislative changes.

*Vermont's* statute provides the structure of a mandatory RPS, leaving much of the detail to the rulemaking process of the Vermont Public Service Board.[27] Since the RPS will not become effective until and unless the state electricity providers fail to meet the voluntary standard, Vermont has not adopted RPS regulations. Any attempts to harmonize the key elements of the RPS of the Partner States will not likely require legislative action in Vermont. In addition, when and if Vermont adopts mandatory RPS regulations, it will be able to draft it regulations so as to accommodate any harmonization efforts.

## X. OPTIONS TO OVERCOME BARRIERS AND INCREASE MARKET LIQUIDITY

Despite the current fragmented nature of REC markets, there are several ways to overcome barriers and increase market liquidity and REC fungibility throughout the Partner States. Options range from entirely revamping state RPS statutes and regulations to create identical (or nearly identical) programs to implementing a federal RPS. Each option would require different levels of engagement by the state and would have varying levels of harmonization and impact on regional market liquidity.

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[22] Regulations of Connecticut State Agencies, § 16-245a-1 et seq.
[23] M.G.L. c. 25a, § 11F.
[24] 225 CMR 14.00.
[25] The statute includes an exception for use in fuel cells. M.G.L. c. 25a, § 11F(b).
[26] 73 P.S. § 1648.1 et seq.
[27] Vt. Stat. Ann. tit. 30, § 8001 et. seq.

### A. Adopt Identical Programs Across Partner States

One option for creating a more liquid regional REC market is to adopt identical programs in the Partner States. If the Partner States adopted identical programs, there would be certainty regarding the type of renewable resource creating the RECs. This may result in greater acceptance of RECs from anywhere within the region because the energy sources of each REC will be recognized in each state's RPS.[28]

This option may be most preferable from a market liquidity standpoint, but there are several significant obstacles. First, there is no universally preferable RPS design as each state has elements that may be important to it but not acceptable to others. Thus, there may be significant opposition to sweeping changes to the state's RPS program to the extent it implicates policy decisions underlying the design of the initial RPS program.

Even assuming political exigencies are surmountable, there would need to be significant cooperation and coordination among the Partner States to craft consistent law. As described in Section V above, creating identical programs would require legislative change in multiple states, and ensuring that individual legislative processes result in compatibility with the other states' programs would be challenging. Even in the states that could change significant elements of the RPS program by regulation, aspects of the program could be significantly altered in the rulemaking process. Due to the difficulty in passing compatible legislation in the states at issue, the likelihood of implementing identical RPS programs in all Partner States is low and would be a time-consuming undertaking.[29]

### B. Harmonize Treatment of a Common Set of Renewables

While identical programs among the Partner States may result in the greatest level of liquidity, the Partner States' RPS schemes need not be identical to improve market liquidity and REC fungibility. Market liquidity could be enhanced by altering the following key aspects of a state's RPS: the definition of eligible renewable resource, the REC definition, and geographic restrictions on RECs. Harmonization of these key aspects would allow for RECs generated from a common set of renewable energy resources to be more freely traded among the Partner States.

The harmonization of a portion of a state's RPS program allows states to maintain much of their existing RPS program, which lessens the need for potentially sweeping regulatory or legislative changes. Each state also would be able to include or exclude resources that are critical to that state (e.g., waste coal, ocean thermal energy). While the harmonization of several types of

[28] However, as discussed in more detail below, attribute tracking system rules in NEPOOL-GIS may also function to restrict movement of RECs even if the Partner States have identical RPS programs.

[29] For example, the Regional Greenhouse Gas Initiative ("RGGI") is an effort to establish a regional carbon cap-and-trade program for electricity generators in the Northeast. It took over three years from the initiation of the effort to reach agreement on a Model Rule. After the Model Rule was determined, each participating state had to implement the Model Rule (or significant design elements from it) by legislative or regulatory means. Now, two years after the Model Rule was decided upon, some states are still implementing the necessary framework for RGGI. The cap-and-trade program is expected to commence January 1, 2009.

renewable energy sources does not achieve complete market liquidity, it would create a set of fully fungible RECs between the Partner States and result in greater liquidity in the RECs which are recognized in more than one state.

### 1. Eligible Renewable Energy Sources

One key aspect that would need to be harmonized among the Partner States is the definition of eligible renewable energy types. As previously stated, the Partner States recognize different renewable energy sources as eligible under their RPS programs. While identical renewable energy types across the Partner States would most improve market liquidity the choice of eligible renewable energy sources is informed by local conditions and preferences. Therefore, agreeing upon all eligible renewable energy sources among the Partner States may be difficult.

However, there are five types of renewable energy sources that are common to the Partner States' RPS programs: solar, wind, methane gas, hydroelectric and biomass. Within these broad categories, there may be a greater likelihood of finding common ground between the Partner States and creating a set of consistent renewable energy types.[30]

After the Partner States have agreed upon a set of eligible renewable energy sources that are acceptable to each state, RECs generated from such sources should be equivalent (e.g., hydro RECs from Pennsylvania should be based on the same criteria and thus equally as acceptable as hydro RECs from Connecticut). Agreeing upon a set of consistent renewable energy sources (in conjunction with eliminating other impediments discussed below) would improve liquidity of the market with respect to the common renewable energy sources. This option would also allow the states to continue to recognize for in-state RPS compliance those renewable or alternative energy sources that may be specific to the particular state.

### 2. REC Definition

Along with consistent eligible renewable energy sources, the definition of the REC itself must also be compatible between the states. Connecticut's REC definition is the most stringent because it requires that a REC include all environmental attributes. Massachusetts may require a REC to include environmental attributes; however, the regulations are ambiguous. Pennsylvania's current AEC definition is silent with respect to environmental attributes but it is considering proposed regulations that would allow parties to transfer or sell environmental

[30] The Partner States include further restrictions relating to solar, methane gas, hydroelectric and biomass renewable energy sources. The CESA Report provides an in-depth review of the details of each state's eligible renewable energy source definitions and the differences between some of the common renewable energy sources. CESA Report, pp. 18-29. The different restrictions on eligible types of biomass projects are especially variable among the Partner States and the nuances likely reflect the particular state's preference for or local availability of feedstock material. The Partner States would need to agree to harmonize the additional restrictions in order to create a common set of eligible renewable energy sources.

attributes separately from the underlying AEC. Consistent REC definitions across the four states would promote the greatest fungibility between RECs from the Partner States. However, if Pennsylvania or Massachusetts allowed RECs to exclude some environmental attributes, Pennsylvania and Massachusetts RECs could still be used in Connecticut but the buyers would need to ensure that the particular RECs being bought included all environmental attributes.[31]

### 3. Geographic Restrictions

After agreeing upon compatible renewable energy and REC definitions, the Partner States would need to revise any restrictions relating to recognizing out-of-state RECs. As described in Section IV.C, these restrictions are either state-specific restrictions or related to the attribute tracking systems. Options to alter restrictions related to the attribute tracking systems are described in the following section. Removing both types of restrictions would improve the liquidity of RECs in the Partner States.

As described in Section IV.B above and outlined in Appendix A, all of the Partner States restrict the eligibility of out-of-state RECs. These restrictions may be directives in regulation or statute or indirect restrictions by virtue of references to attribute tracking systems. Some restrictions on out-of-state RECs may relate to an underlying policy concern about what type of renewable energy source creating the REC in the first place. If a set of eligible renewable categories were harmonized as described above, this concern may be mitigated because all Partner States would have agreed on the common eligible renewable energy sources.

Pennsylvania directly restricts RECs by recognizing some out-of-state RECs but only if the associated energy was generated within MISO or PJM. This restriction prohibits all RECs from the Partner States. In order to allow for trading of the common set of RECs between the Partner States, Pennsylvania would need to amend its restrictions that function to prohibit the recognition of RECs from NEPOOL.

Connecticut and Massachusetts and NEPOOL-GIS restrict non-NEPOOL RECs. As stated, the NEPOOL-GIS rules allow imported RECs only from adjacent states. Thus, the NEPOOL-GIS rules function to restrict the flow of RECs into NEPOOL except those from New York. Even if Connecticut and Massachusetts changed their laws to freely recognize non-NEPOOL RECs but still relied on GIS certificates, NEPOOL-GIS rules would prohibit RECs from Pennsylvania (and from other non-adjacent states). Therefore, any efforts to remove geographic restrictions on RECs in Connecticut and Massachusetts must also include revisions to NEPOOL-GIS rules as described below.

### 4. Attribute Tracking Systems

[31] We note that these differences required the drafters of the model ABA/ACORE/EMA REC Master Agreement for the trading of RECs to include a complicated schedule with multiple attribute scenarios from which to choose.

Lastly, along with revising state geographic restrictions on RECs, the geographic restrictions in the attribute tracking systems must also be amended. Ideally, such harmonization would occur in tandem with efforts to revise the state-based geographic restrictions. Harmonizing the attribute tracking systems and state RPS programs to remove geographic restrictions would improve market liquidity between the Partner States.

#### a. NEPOOL-GIS

As stated, the rules require that the energy associated with RECs issued under the NEPOOL-GIS be delivered into ISO-NE and the energy must be generated in a control area adjacent to ISO NE.[32] Essentially, these requirements result in recognizing only non-NEPOOL RECs from New York. Therefore, even if Connecticut and Massachusetts remove any out-of-state restrictions in their RPS programs, the operating rules of the NEPOOL-GIS attribute tracking system remain a barrier.

Altering the operating rules of NEPOOL-GIS would require amending the existing NEPOOL GIS rules. The NEPOOL-GIS operates according to the GIS Operating Rules, which may be amended according to the Restated NEPOOL Agreement. Rule 1.3 of GIS Operating Rules states that an amendment of the GIS rules must be in accordance with Sections 6, 7 and 10 of the Restated NEPOOL Agreement. Under these sections of the Restated NEPOOL Agreement, the NEPOOL Participants Committee or its delegatee may in its discretion adopt new GIS Operating Rules or amend existing GIS Operating Rules after such amendments or new GIS Operating Rules have been reviewed by the Markets Committee.

#### b. PJM-GATS

In comparison to NEPOOL-GIS, PJM-GATS is more flexible and will issue certificates for generating units located outside of PJM whether or not the energy is delivered into PJM. However, if the energy was not delivered into PJM, certificates will only be recognized if (i) the generator has been pre-qualified by one of the PJM states for its RPS programs; and (ii) the state has approved the creation of certificates.[33] As a result, Pennsylvania's limitations on RECs are more stringent than its attribute tracking system, and any changes to PJM-GATS would not alter Pennsylvania's state restrictions.

PJM-GATS operates according to the GATS Operating Rules. Changes to the PJM-GATS Operating Rules are typically made in coordination between state regulators and the PJM-Environmental Information Services ("PJM-EIS"). There is no formal decision-making process, and the system was designed to be flexible to accommodate multiple state policies. With respect to geographic restrictions on RECs, it does not appear that any changes to the GATS Operating Rules would be necessary.

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[32] New England Power Pool Generation Information System Operating Rules, § 2.7(c)(w).

[33] PJM-EIS, Generation Attribute Tracking System (GATS) Operating Rules, § 11 (2006).

The harmonization of NEPOOL-GIS to recognize non-NEPOOL RECs would allow Massachusetts and Connecticut to recognize RECs beyond those generated in New York. PJM-GATS already recognizes RECs from other states so long as they are approved by the non-PJM state. Therefore, any changes to PJM-GATS would not affect Pennsylvania's geographic restrictions on RECs. As a result, amending NEPOOL-GIS to recognize non-adjacent RECs would improve market liquidity but would need to occur in coordination with changes in Pennsylvania's state restrictions in order to achieve the greatest level of REC fungibility between the Partner States.

### C. Create a Weighted REC Scheme

A third approach to improving the liquidity of the REC markets is to provide for a common REC exchange platform (REC-EX) by which states could freely transfer RECs among each other.[34] Under this idea, state RPS regulators would agree to recognize other state's RECs for RPS compliance but could discount the incoming RECs at a rate determined by the state. Adjustments would also be made based on the generator's ability to deliver electricity into the relevant control area as well as the state's preference regarding particular eligible renewable energy sources. The creation of a weighted REC scheme would require either regulatory or legislative changes to the Partner State's RPS programs.

Similar to the options described above, the definition of a REC and restrictions on out-of-state RECs would need to be modified. Unlike both options described above, in the weighted REC scheme option, consistent eligible renewable energy project definitions among the Partner States would not be necessary. Under a weighted REC scheme, a state could assert its preference for different renewable energy sources vis-à-vis a discount rate, which would be applied to out-of-state RECs. For instance, if Massachusetts does not perceive Pennsylvania waste coal AECs to be consistent with Massachusetts' RPS, it could value the waste coal AEC at a percentage of its value in the Pennsylvania AEP system.

Under a weighted REC scheme, market liquidity could theoretically be improved if states were relatively conservative in the level of discounting of out-of-state RECs. If states liberally asserted the discount, a weighted REC scheme could effectively become the same as restricting out-of-state RECs.

### D. Federal RPS

The adoption of a federal RPS would have the effect of harmonizing REC markets and increasing the fungibility of RECs across the U.S. despite the RPS requirements of the states. A federal RPS with a common set of definitions for renewable energy resources and no geographic restrictions could eliminate the fragmentation in the current REC market, created by the varied requirements of the state RPS programs. Entities required to comply with the federal RPS could

[34] Chris Berendt, *Clean Energy Development Strategies, A State-Based Approach to Building a Liquid National Market for Renewable Energy Certificates: The REC-EX Model*, Electricity Journal, Volume 19, Issue 5, June 2006, Pp. 54-68.

meet the renewable energy requirement through the purchase of RECs. However, since the federal RPS would establish a nationwide standard, the RECs could be purchased from anywhere within the United States.

In addition to fully fungible RECs, there are several other advantages to a federal RPS. To the extent that state-specific RPS programs have a renewable percentage lower than the federal RPS, a nationwide standard sets a floor thereby increasing the available renewable energy resources.[35] There is also a potential for lower cost renewable resources, and by extension REC prices, as renewable development presumably will occur where it is most cost effective. In states where generators, suppliers, and distributors recover the costs associated with the RPS from consumers, the federal RPS could translate into lower costs for consumers than a state-specific program.

A federal RPS has several drawbacks, particularly from a state policy perspective:

- A federal RPS is not tailored to the particular resources of each state. Under a state RPS scheme, the state may favor resources that are readily available within that state. For example, the federal definition of biomass may not include the emissions limits established under Connecticut law. The federal RPS limits the ability of state-based special interests from including provisions that do not advance the growth of renewable resources; although federal legislation will suffer from its own special interest problems.

- The nationwide fungibility of RECs may drive renewable development to certain states or regions which have greater renewable resources. Those states in which renewable development is difficult may experience less growth in their local renewable resources than they would under a state-specific RPS even if the availability of renewables increases on a national level.

A federal RPS may interact with the existing state RPS in several ways including: pre-empting the state program, remaining silent, or recognizing the state RPS. Under the pre-emption approach, the state RPS would cease to exist and the renewable energy definitions, REC definitions, renewable percentages, and all other aspects of the RPS would be determined by federal statute. In many ways, this is the simplest approach, as the requirements are known and consistent across all states and for all entities that must comply. A federal RPS could also opt to remain silent on the status of state RPS. This is least preferable approach as it makes the status of the state RPS uncertain and thus is likely to create greater market confusion.

Finally, the federal RPS could recognize the state level RPS programs, integrating them into the federal RPS or permitting the state RPS to continue as parallel programs. Integrating state RPS could occur in a variety of ways including allowing compliance with state level RPS to qualify for all or a portion of the federal RPS. This would allow states to favor renewable resources that are readily available within its boundaries or that guarantee the most local economic development. The Federal RPS might also grant credits to electricity providers required to

[35] According to the Union of Concerned Scientists, a federal RPS with a 20% standard would lead to a six-fold increase in renewable energy generation in the U.S. http://www.ucsusa.org/clean_energy/clean_energy_policies/res_campaign.html

comply with state RPS. Senate Amendment 1538 to the 2007 Energy Act took such an approach.[36]

Alternatively, the federal RPS could recognize the state RPS and allow states to maintain their RPS programs. The Bingaman Amendment to the 2007 Energy Act took this approach in proposing a federal RPS.[37] The Bingaman Amendment specifically stated that the federal RPS did not diminish the authority of the states to impose RPS of their own.[38] This approach has the benefit of allowing states to favor local renewable resources in their state RPS.

However, states would need to address several issues. First, states would need to address the issue of double counting of RECs, determining whether the state will allow compliance with the federal RPS to count toward state level compliance; doing so might decrease the investment in state specific renewable energy resources that are not eligible for the federal RPS. Second, if states do not allow double counting, depending on the level of compliance required at the federal level, states might have to reduce their portfolio standards to assure that the covered entities in their states can comply with both the federal and state RPS.

Regardless of the approach used under a federal RPS, a clear integration or pre-emption of the state RPS will be critical to maintaining the REC market.

## XI. CONCLUSION

The fragmentation in the REC market created by the varying state RPS requirements can be addressed by a combination of changes to Partner State laws and the operating rules of NEPOOL-GIS. At a minimum, the definitions of renewable energy resources, the geographic restrictions and the definition of a REC must be addressed as discussed above. Alternatively, a federal RPS could provide consistency across the states, which would improve REC fungibility and market liquidity.

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[36] S. Amendment 1538, amending S. Amendment 1537, amending S. Amendment 1502, amending H.R. 6 (2007).
[37] S. Amendment 1573, amending H.R. 6 (2007)
[38] Section (h)(1) of S. Amendment 1573, amending H.R. 6 (2007)


North America
Baker & McKenzie
Impact of REC Harmonization on
Renewable Investment Decisions
July 24, 2009

| **St te** | **C cticut** | **Massachusetts** | **Ve mo t** | **Pe sylvania** |
|---|---|---|---|---|
| | 2017: 22.5% (15.5%-Class I, 3%-Class II, 4%- Class III)<br>2018: 24% (17%- Class I, 3%-Class II, 4%-Class III)<br>2019: 26.5% (19.5%-Class I, 3%-Class II, 1%- Class III)<br>2020: 27% (20%- Class I, 3%-Class II, 4%-Class III) | | | (including .39% Solar), 8.2% Tier II<br>2020: 7.5% Tier I (including .4433% Solar), 8.2% Tier II<br>2021: 8% Tier I (including .5% Solar), 10% Tier II<br><br>Suppliers that do not meet targets are assessed a penalty of $45 per MWh for Tier I or II, or 200% of average REC price for solar PV. |
| **Defin tion of renewable energy** | Class I: solar, wind, new sustainable biomass, landfill gas, fuel cells, ocean thermal power, wave or tidal power and some hydropower and biomass.<br><br>Class II: trash-energy and some biomass and hydropower.<br><br>Class III – Customer sited CHP, DSM energy savings, and waste heat recovery systems. | Solar photovoltaic, solar thermal, wind, ocean thermal, wave or tidal, fuel cell, landfill gas, biomass | Energy produced using technology that relies on a resource that is being consumed at a harvest rate at or below its natural regeneration rate.<br><br>Hydropower (up to 200MW), landfills, methane, farm methane, solar energy, wind, bio-diesel, biomass, and geo-thermal and fuel cells using renewables. Waste other than agricultural or silvicultural is excluded as is nuclear fuel.<br><br>Includes only renewables from facilities coming into service after Dec. 31, 2004. | Tier I: solar photovoltaic and solar thermal, wind, low-impact hydropower, geothermal, biomass, biogas, fuel cell, coal mine methane.<br>Tier II: waste coal, demand side (energy efficient technology, load management, industrial byproduct use), distributed generation, some hydropower, municipal solid waste, generation from wood processing byproducts, and integrated combined coal gasification technology. Includes new and existing sources. |
| **REC Trading** | Obligation can be met through purchase of RECs issued by | Obligation can be met through purchase of RECs | The mandatory RPS obligation can be met through the | Alternative Energy Credits (AEC) (defined as tradable |

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| | NEPOOL. | issued by NEPOOL. Also, an electricity supplier may discharge its RPS obligation by making an alternative compliance payment to the Massachusetts Technology Park Corporation, which administers the state's Renewable Energy Trust. | purchase of RECs. | instruments) may be used to comply with the AEPS. |
| **Geographic Restrictions** | Electric suppliers and distributors may meet the requirements with:<br>1) RECs issued by NEPOOL GIS<br>if the RECs are for a) energy produced by a unit generating Class I or II energy in ISO-NE or b) energy imported into control area of ISO-NE pursuant to NEPOOL-GIS Rule 2.7(c);<br>2) RECs under contract to serve end-use customers in the state on or before October 1, 20 6 | For electrical energy transactions not included in the ISO-NE settlement market system but for which the supplier holds GIS Certificates from NEPOOL, the supplier must document the ownership of the GIS Certificates.<br><br>For electrical energy transactions not included in ISO-NE settlement market system and for which the supplier has not secured GIS certificates, the transaction must be verified by an independent third-party. Off-grid and behind-the-meter generators must be located in Massachusetts. | Electricity generated inside or outside Vermont may be counted toward the goal. | AECs may be certified for the portion of renewable energy consumed or delivered to PA or the control area of the RTO that manages part of PA. AECs from outside PA are eligible for compliance purposes only in the parts of PA that are within the same RTO control area as the generator of the alternative energy. |
| **REC O p** | Any electric supplier that seeks to demonstrate RPS compliance by participating in the | No explicit provision regarding ownership of RECs. | No explicit provision regarding ownership of RECs. | Owned by alternative energy generator (or customer generator) and may sell or transfer. |

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|---|---|---|---|---|
| | renewable energy trading program shall have exclusive ownership of all renewable energy and environmental attributes from such trading programs that are associated with its renewable energy sources. | | | |
| **Generation Mix** | 2006 ISO-NE Data<br>Natural Gas – 38.1%<br>Nuclear – 14.4%<br>Coal – 9.2%<br>Oil – 24.4%<br>Hydro – 5.5%<br>Pumped Storage – 5.4%<br>Other Renewables – 3% | 2006 ISO-NE Data<br>Natural Gas – 38.1%<br>Nuclear – 14.4%<br>Coal – 9.2%<br>Oil – 24.4%<br>Hydro – 5.5%<br>Pumped Storage – 5.4%<br>Other Renewables – 3% | 2006 ISO-NE Data<br>Natural Gas – 38.1%<br>Nuclear – 14.4%<br>Coal – 9.2%<br>Oil – 24.4%<br>Hydro – 5.5%<br>Pumped Storage – 5.4%<br>Other Renewables – 3% | 2007 PJM Data<br>Coal – 55.3%<br>Nuclear – 33.9%<br>Natural Gas – 7.7%<br>Oil – 5%<br>Hydro – 1.7%<br>Solid waste – .7%<br>Wind – .2% |
| **C<br>E es** | Electricity suppliers and electricity distribution companies | Retail electricity suppliers selling electricity to end-use customers | Retail suppliers | Electricity distribution companies and electricity generation suppliers with respect to energy sold to retail electric customers |
| **Attribute<br>T<br>Syste** | NEPOOL GIS | NEPOOL GIS | NEPOOL GIS | PJM GATS |
| **Attribute<br>T<br>Syste<br>Trading Restrictions** | NEPOOL-GIS requires that the energy associated with certificates issued under the NEPOOL-GIS be delivered into ISO-NE and that the energy be generated in a control area adjacent to ISO-NE. | NEPOOL-GIS requires that the energy associated with certificates issued under the NEPOOL-GIS be delivered into ISO-NE and that the energy be generated in a control area adjacent to ISO-NE. | NEPOOL-GIS requires that the energy associated with certificates issued under the NEPOOL-GIS be delivered into ISO-NE and that the energy be generated in a control area adjacent to ISO-NE. | PJM GATS will issue certificates for generating units located outside of PJM whether or not the energy is delivered into PJM. If the energy was not delivered into PJM, certificates will only be created if 1) the generator has been pre-qualified by one |

| S te | Co ctic t | Massachusetts | Ve mo t | Pe sylvania |
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| | | | | of the PJM states for its RPS program, and 2) the state has approved the creation of certificates. |
| A y<br>—<br>Statutory and/or R lato A y | Connecticut Department of Public Utility Control<br>—<br>Conn. Gen. Stat. §§ 16-245a, 16-1, and related provisions at Title 16, Chapter 283<br><br>Regs., Conn. State Agencies, § 16-245a-1 et seq.<br><br>NEPOOL-GIS Operating Rules | Massachusetts Division of Energy Resources<br>—<br>Mass. Gen. Laws Ch. 25A § 11F<br>225 CMR 14.00 et seq.<br><br>NEPOOL-GIS Operating Rules | Vermont Public Service Board<br>—<br>30 V.S.A. § 8001 *et seq.*<br>Board Rule 4.300 amended in March 2008 by S.B. 209<br><br>NEPOOL-GIS Operating Rules | Pennsylvania Public Utility Commission<br>—<br>73 Penn. Stat. §§ 1648.1 *et seq.*<br>SB 1030<br><br>GATS Operating Rules |

BAKER & MCKENZIE

# Report on China's Renewable Energy Law

## APP Project REDG-06-09

**May 2009**

reil
renewable energy and international law

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# 1. Introduction and overview

## 1.1 Background to this paper

### Asia-Pacific Partnership

The Asia-Pacific Partnership on Clean Development and Climate (***APP***) is a voluntary multi-national partnership between the Governments of seven nations in the Asia-Pacific region – Australia, Canada, China, India, Japan, Republic of Korea and the United States of America. It was launched on 12 January 2006.

The APP aims to strengthen existing bilateral and multilateral arrangements and create an international framework within which the participant nations will co-operate to pursue development, energy, environment and climate change objectives.

The APP's charter states that the purposes of the APP are to:

- create a voluntary, non-legally binding framework for international cooperation to facilitate the development, diffusion, deployment, and transfer of existing, emerging and longer term cost-effective, cleaner, more efficient technologies and practices among the Partners through concrete and substantial cooperation so as to achieve practical results;
- promote and create enabling environments to assist in such efforts;
- facilitate attainment of our respective national pollution reduction, energy security and climate change objectives; and
- provide a forum for exploring the Partners' respective policy approaches relevant to addressing interlinked development, energy, environment, and climate change issues within the context of clean development goals, and for sharing experiences in developing and implementing respective national development and energy strategies.

### Renewable Energy & Distributed Generation Task Force

APP established eight public-private sectors task forces. The Renewable Energy and Distributed Generation Task Force (***REDGTF***) was formed to focus upon issues associated with renewable energy and distributed generation technologies.

The REDGTF aims to:

- facilitate the demonstration and deployment of renewable energy and distributed generation technologies in Partnership countries;
- identify country development needs and the opportunities to deploy renewable energy and distributed generation technologies, systems and practices, and the enabling environments needed to support wide-spread deployment, including in rural, remote and peri-urban applications;
- enumerate financial and engineering benefits of distributed energy systems that contribute to the economic development and climate goals of the Partnership;

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- promote further collaboration between Partnership members on research, development and implementation of renewable energy technologies including supporting measures such as renewable resource identification, wind forecasting and energy storage technologies;
- Support cooperative projects to deploy renewable and distributed generation technologies to support rural and peri-urban economic development and poverty alleviation; and
- Identify potential projects that would enable Partners to assess the applicability of renewable energy and distributed generation to their specific requirements.

## Our project

This paper forms a component of the REDGTF project: Identifying optimal legal frameworks for renewable energy in China and India (the ***Project***). The Project is undertaken by Baker & McKenzie and the Renewable Energy and International Law project, with assistance from the Chinese Renewable Energy Industry Association (***CREIA***) and the World Institute for Sustainable Energy (India). It has funding support from the Australian Government and the US Government under the APP.

The Project will consider and assess the legal, regulatory, institutional and policy frameworks in China and India, and the barriers and opportunities facing the renewable energy sectors in those countries.

The Project also involved hosting workshops in India and China to identify and promote best practice for laws and policies promoting renewable energy in developing countries. The final reports present results of the Project's investigations and make recommendations.

The ultimate aim of the Project is to encourage and enhance the capacity for emission reduction efforts in India and China, by promoting legal and regulatory measures which create an environment within which renewable energy and distributed generation technologies are viable.

The Project, while focused on India and China, is intended to provide policy options and recommendations that could be implemented in all APP partner countries.

In relation to China, the Project builds on earlier work undertaken under RE Law Assist, a research and capacity-building project on renewable energy law in China, conducted in 2006-2007 by Baker & McKenzie, the Renewable Energy Generators of Australia, CREIA and the Centre for Renewable Energy Development, with funding from the Australian Government under the Australia-China Bilateral Partnership on Climate Change.

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## 1.2 China's Renewable Energy Law and this report

### Introduction to China's Renewable Energy Law

The Renewable Energy Law of the Peoples' Republic of China (***China***) came into effect on 1 January 2006 – a significant milestone not only for China, but for renewable energy industries in countries around the world.

The Chinese renewable energy market represents a significant opportunity for both Chinese and Australian businesses, given the enormous energy demand increases expected within China in the coming decades, and the leading renewable energy technologies that have been developed in Australia over the past decade. The Renewable Energy Law is an essential platform for diversifying China's energy mix. Australian industry, as a leader in a number of renewable energy technologies, is well placed to help China meet the additional demand for renewable energy as established by the Renewable Energy Law and the subsidiary regulations and regional initiatives that put this law into action.

The Renewable Energy Law itself is a brief umbrella document, which provides the provincial governments with a mandate to develop renewable energy feed in tariffs and quotas for the purchase of renewable energy within their locality.

As part of RE Law Assist, a report was prepared in June 2007 which examined the Renewable Energy Law, and its impact on both China and Australian businesses (***June 2007 Report***).[1] This report found that the Renewable Energy Law was an essential platform for diversifying China's energy mix, but that its nature as a framework meant that government regulations and implementing provincial legislation would play a crucial role in the development of China's renewable energy industry.

China's National Development and Reform Commission (***NDRC***) carried out the first official Government review of the Renewable Energy Law in early 2007. The results of the review, including recommendations from Chinese industry stakeholders, were published on 20 April 2007 and were reviewed in the June 2007 Report. However, the June 2007 Report was published too early to consider the NDRC's Medium and Long-Term Development Plan for Renewable Energy in China. In addition, a host of new environmentally-focussed law and policy has been proposed and/or passed by the Chinese Government (see section 2.5 below).

These developments will have a direct impact both within China and on the investment analyses that Australian businesses will need to undertake when considering China as an investment opportunity.

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1 Available at: http://www.bakernet.com/BakerNet/Resources/Publications/Recent+Publications/Renewable+Energy+Law+in+China.htm

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## Aims of this review of the Renewable Energy Law

The purpose of the June 2007 Report was, among other things, to assist the Chinese Government, both at national and regional levels, to implement the detailed regulations under the Renewable Energy Law. In doing so, the June 2007 Report examined aspects of existing Chinese legislation or regulations that needed further elaboration or improvement, based on the needs and practice of Government and industry, and drawing on the experience of Australian renewable energy project developers in developing renewable energy projects in a more mature market.

The purpose of this paper is to review the implementation of the Renewable Energy Law since the publication of the June 2007 Report. As such, it builds on the themes set out in the June 2007 Report, particularly with respect to regulatory achievements, policy challenges, the current state of implementation and future issues that will need to be addressed. It is not intended to be an encyclopaedic guide to investing in Chinese renewable energy projects (potential investors should always take project specific legal advice). However, it does outline key national law and policy, together with selected examples of provincial implementation of which investing businesses should be aware.

## Structure of this paper

Following this summary, this paper is divided into three sections. Section 2 sets out a summary of the Renewable Energy Law. It is intended to provide an introduction to those unfamiliar with the primary legal rules that the Chinese Government has introduced to date. It concludes with an overview of recent developments in law and policy since the publication of the June 2007 Report.

Section 3 examines the law and policy identified in section 2 in more detail, looking at specific aspects of the Renewable Energy Law and its impact on potential investors. In doing so, it first considers regulation at the national level, before examining selected provincial examples that are indicative of how the national rules have been implemented. Each sub-section in this part of the study concludes by highlighting the key issues that are not yet resolved. Section 4 looks at issues arising with wind power, particularly pricing issues. Finally, section 5 sets out information on some broader issues associated with implementing a project in China, including project approvals, project financing and structuring, projects under the Kyoto Protocol, and protection of intellectual property.

Appendix 1 contains a list of abbreviations used in this paper, Appendix 2 sets out summaries of relevant regulations, policies and standards, and Appendix 3 has details of wind power tariffs.

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## 1.3 Overview of RE markets in China

This section sets out some information about the status of certain types of renewable energy in China, with comments on key issues of which investors should be aware before investing in the following types of renewable energy projects in China.

### Wind

Wind power is the fastest growing power generation technology in China. However, the methods for establishing the price paid to wind power generators for the electricity generated are complex. There are two primary pricing methods: prices established by tender under the Central Government's national concession program (for both private and State-owned developers), and prices negotiated on a case-by-case basis for individual wind projects that are not part of the concession program. In addition, provincial governments have established various pricing mechanisms for wind projects. (Wind power pricing is discussed in more detail in Appendix 3 below.)

One issue with the Government's national concession policy is that so far, only Chinese companies have won the tenders to build wind power plants, since the low bid prices appear to have deterred foreign companies from participating due to the low profit margins. The majority of wind power developers in China are Government-owned conventional power generation or energy corporations. These companies can invest in wind projects (which are politically attractive) without receiving commercial returns as the wind projects are typically only a small proportion of their businesses.[2]

The problems with individually negotiated projects are the fact that prices are often 'guided' by the results of the concession bidding and that these projects have been limited to 50MW each (although they have proven to be the main avenue for new installations).[3]

China is working hard to amass a domestic base of engineers skilled in wind projects and wind turbine technologies. This aim is furthered by the 'localization' provision of the national concession program, which requires that 70% of the value of turbines installed under the program be manufactured in China. This manufacturing is often undertaken by joint ventures between Chinese companies and subsidiaries of foreign companies. However, China's wind power technology still lags somewhat behind foreign technology.

A further issue is that to date, attention has been focussed more on increasing wind power capacity, without a corresponding increase in the amount of wind power actually generated. Other issues include a need for more resource assessments and upgrades to the electricity grids so the wind power is able to be used to the maximum extent.

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[2] "Rapid Development of Wind Power Market in China", presentation by Shi Pengfei of the Chinese Wind Energy Association at the Clean Energy Council Conference, Gold Coast 24 November 2008

[3] Martinot, E & Li Junfeng "Powering China's development: The role of renewable energy" *Renewable Energy World*, January 2008

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## Solar PV

The market for solar power in China is currently small. Given the price differential between solar power and fossil fuel power, large subsidies are required to support solar photovoltaic (PV) projects, which the Government is not prepared to provide on a large scale. Many of the grid-connected PV systems currently operating in China are Government-commissioned demonstration projects.[4] However, only approximately 5% of PV systems in China are grid-connected.[5] The majority of solar power in China is in rural off-grid applications, again supported by Government programs.[6]

Although the domestic market for the purchase of solar panels is cool, the solar panel manufacturing sector is in full swing, raising concerns that there will be excess capacity. Total investment by the top three Chinese solar panel manufacturing companies is predicted to exceed $1.3 billion by 2008-2010.[7] Chinese company Suntech, for example, is the world's fourth largest producer of solar cells. The manufacturers currently generate most of their revenues overseas, but the market for solar panels in China is expected to grow.[8]

Other issues facing solar panel manufacturers in China include the shortage of polysilicon, and the relatively low levels of investment in continuing research and development (given the focus on expansion of production capacity).[9]

## Solar hot water

Despite the slow uptake of solar PV, China has made great strides with solar hot water and is now the world's largest market for solar hot water systems. Recent growth has been in urban areas, particularly the southern provinces, whereas historically solar hot water was used in rural areas of China. Solar heating is now relatively affordable in China, due to a combination of low cost labour, cheap materials, and competition among a large number of domestic solar companies.[10]

National and local government departments, architects, and real estate developers are paying attention to solar hot water and working to promote its use. The NDRC's 'Plan on Enforcement of Utilization of Solar Energy Heating Nationwide', issued in mid-2007, mandates solar hot water heating in new construction. As a result of this

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4 *Report on the Development of the Photovoltaic Industry in China (2006-2007)*, China Renewable Energy Development Project, June 2008

5 Report on the Development of the Photovoltaic Industry in China (2006-2007), China Renewable Energy Development Project, June 2008

6 Martinot, E & Li Junfeng "Powering China's development: The role of renewable energy" *Renewable Energy World*, January 2008

7 Martinot, E & Li Junfeng "Powering China's development: The role of renewable energy" *Renewable Energy World*, January 2008

8 Taylor, S "Sun rises slowly on China's solar energy sector", Reuters Carbon Market news, 18 January 2008

9 *Report on the Development of the Photovoltaic Industry in China (2006-2007)*, China Renewable Energy Development Project, June 2008

10 Martinot, E & Li Junfeng "Powering China's development: The role of renewable energy" *Renewable Energy World*, January 2008

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initiative (and other similar provincial policies), solar hot water growth rates are expected to continue at 20%-25% per annum.[11]

### Hydro power

Hydro power makes up by far the greatest proportion of non-fossil-fuel energy in China. In 2005 it formed 16% of China's total power generation (and 23% of China's total installed power capacity).[12] The Government has indicated that it intends to continue developing China's hydro power resources, but that it will take into account environmental and social issues in doing so (see for example the White Paper on China's Energy Conditions and Policy, discussed in section 2.5 below).

Hydro power is not eligible for special support under the Renewable Energy Law, and as such is not discussed in detail in this paper. The pricing and cost-sharing arrangements for hydro power projects are determined on a case-by-case basis, in accordance with existing hydro power policies.

### Biomass / Biofuel

The Central Government has set targets for increased use of biomass for power generation, biomass pellets as a solid fuel, biogas for energy and bioethanol as a transport fuel.[13]

Some large-scale biomass power plants are now being developed, using agricultural wastes.[14]

However, the Government is aware that increases in biomass/ biofuel use may conflict with producing food and protecting the environment. The Development Plan (see section 2.4) states that cultivated land should not be illegally occupied, food grains should not be excessively consumed and the environment should not be destroyed to produce biofuels or biomass for power.

### Geothermal

To date there has been little development of geothermal power projects in China. The Development Plan states that most geothermal resources in China are more suitable for industrial and agricultural heat applications and space heating rather than power generation.

The Beijing Huaqing Geothermal Development Co. Ltd is to develop a geothermal heat pump system for the World Expo 2010 in Shanghai, China.

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11 Martinot, E & Li Junfeng "Powering China's development: The role of renewable energy" *Renewable Energy World*, January 2008

12 *Medium and Long-Term Development Plan for Renewable Energy in China*, section 1.2.1, English version September 2007

13 *Medium and Long-Term Development Plan for Renewable Energy in China*, section 4.2, English version September 2007

14 Martinot, E & Li Junfeng "Powering China's development: The role of renewable energy" *Renewable Energy World*, January 2008008

# 2. Renewable Energy in China – background and developments

## 2.1 Background – Energy in China

### China's current and projected coal consumption and GHG emissions

China's energy sector is in many ways unique, not least because of its high dependence on coal, which accounts for approximately 70% of China's total energy – China has little petroleum and natural gas resources. (By way of comparison, the United States relies on coal for approximately 25% of its total energy.)[15] China's coal production has more than doubled since 1990, from one billion tonnes to approximately 2.62 billion tonnes in 2007, making it the world's largest coal-producer and coal-consumer.

China is now estimated to emit as much, or more, greenhouse gas than the United States, and therefore is (or soon will be) the world's largest emitter of greenhouse gases.

Despite China's low emissions per capita and declining rate of emissions intensity (emissions per unit of GDP), the trend in total emissions growth is likely to continue, as development continues and per capita energy use increases. By 2030 (or earlier) it is thought that China will account for 39% of the worldwide increase in carbon dioxide.

### Energy market reforms

China's State Council approved the plan for structural reform of the power industry in April 2002 (***Reform Policy***). The main tasks identified in the Reform Policy include:

- separation of plant and grid;
- restructuring of power regulatory bodies and establishment of the State Electricity Reform Commission (***SERC***);
- establishment of a competitive electricity market;
- implementation of power tariff reform;
- formulation of environmental cost standards and surcharges for emissions; and
- formulation of a pilot program where generators directly supply power to large subscribers.

Before the Reform Policy period, the State Power Corporation (***SPC***) controlled 46% of China's electricity generation and 90% of China's grid operations, and all provincial and autonomous region power companies were affiliates of the SPC, with exception of the Guangdong Power Group, the Inner Mongolia Autonomous Region Group, and Hainan Province Power.

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[15] Leggett, J, Logan, J & Mackey, A *CRS Report for Congress: China's Greenhouse Gas Emissions and Mitigation Policies*, 10 September 2008

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## Power generation companies

After the reform, the SPC was broken into three parts, which consisted of power generation assets, grid assets and service companies. The SPC's power generation assets were restructured into the following power generating companies, each of which is limited to no more than 20% of the generating capacity in each regional network: China Huaneng Group, China Datong Generation Group, China Huadian Group, China National Power Group, China Power Investment Group, and North China Power Group. Each of these generating companies has one or more China- or Hong Kong-listed companies. However, these companies remain ultimately controlled by the state.

## China's electricity grid

As a result of the separation of plant and grid under the Reform Policy, the SPC's grid assets were restructured into the State Grid Company (a wholly state-owned company) and the Southern Power Grid Company.

The State Grid Company has several subsidiaries, which span most north and central China – the North China Power Grid Company, the Northeast Power Grid Company, the East China Power Grid Company, the Central China Power Grid Company and the Northwest Power Grid Company. In contrast, the Southern Power Grid Company's scope covers south and southwestern China – Yunnan, Guizhou, Guangxi, Guangdong and Hainan provinces.

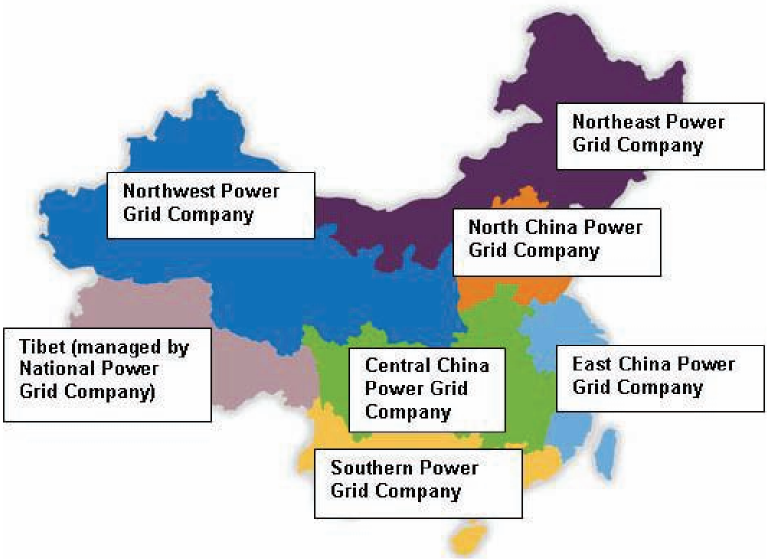


FIGURE 1: GRID COMPANY SUBSIDIARIES

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## 2.2 Introduction to renewable energy in China

### Renewable energy industry profile

China's renewable energy industry is growing. From approximately 8% currently, China's target is to increase renewable energy to 15% of its energy mix by 2020. China invests extensively in renewable energy development. Such spending is largely pragmatic, since the country is becoming increasingly poor in many energy resources in per capita terms.

As well as satisfying pragmatic concerns relating to access to energy, China is also concerned about its international environmental image. Some of China's emissions have been transported to nearby South Korea and Japan by strong winds, which may affect its relations with key trading partners. Indeed, China's "green" Olympics in 2008 were partly designed to showcase its willingness to adopt renewable energy.

The Renewable Energy Law is aimed at ensuring China's energy security while protecting the environment.

### Key government players in renewable energy

It is widely recognised that China's economic growth is linked to energy resources. Premier Wen Jiabao, China's Prime Minister, has indicated that energy supply will be one of the greatest possible inhibitors to the growth of GDP. Given that energy is such a priority, the State Council has appointed an energy coordination task force under the leadership of Premier Wen Jiabao. The State Energy Office, which operates at a ministerial level, will report directly to the task force. This taskforce replaced the Ministry of Energy that was established in 1988.

The key environmental monitor is the Chinese State Environment Protection Agency, which is gaining strength, as demonstrated when it halted construction of several dams and power stations because their full environmental impacts had not been considered.

### Government policy on environment and GHG emissions

While on one hand, several key figures in the Chinese Government have demonstrated a commitment to the environment, such a commitment is tempered by the realities of a still-growing economy and GDP, which have increased energy usage exponentially. The Kyoto Protocol itself notes the potential for conflict between environmental objectives and the need to continue economic growth, since, as a developing nation, China is a signatory to the Protocol without being obliged to take on binding targets to reduce greenhouse gas emissions. China does, however, have institutional and reporting obligations under the Kyoto Protocol.

Nevertheless, China has made some tangible steps towards reducing its emissions. In 1995, the US Department of Energy and the Chinese Government signed a Protocol for Cooperation in the Fields of Energy Efficiency and Renewable Energy Development and Utilisation. China signed Annex II to the Protocol the following year, which signalled its commitment to large-scale deployment of wind energy systems.

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Furthermore, while China's carbon dioxide emissions rose rapidly between 1978 and 1996, the rate of increase slowed between 1996 and 2000, although the Chinese economy grew by 36%. To ensure continued economic growth with decreasing emissions intensity, technology development to implement newer, less-polluting facilities is considered a high priority.

However, the experience of dams and power stations in operation in 2006 suggests that the environmental impact of constructing such facilities may need to be reviewed. In that year, China halted work on building 22 major dams and power stations because the Chinese State Environment Protection Agency stipulated that the projects, worth a total of US$14.65 billion, could not proceed until their environmental effects had been considered.

## History of renewable energy measures

The implementation of China's Renewable Energy Law has not been an overnight proposition. Beginning with State Council policies on rural energy in 1983, measures to support renewable energy have included guidelines for wind farm development (1994), the Electric Power and Energy Conservation Laws (1995), renewable portfolio standards models (2000), studies into feed-in tariffs, quotas and renewable portfolio standards (2002) and other measures implemented recently by the Standing Committee of the National People's Congress. The Renewable Energy Law is the first attempt to implement a national framework for the development of all sectors of the industry and to create targets for the share of the total electricity market held by renewable energy.

## Pollution control

In September 2006, the National Bureau of Statistics and the State Environmental Protection Administration jointly issued a report on adjustments to GDP caused by environmental pollution. According to this report, the economic losses caused by environmental pollution in China in 2004 amounted to 3.05% of China's GDP in 2004.

It is not surprising, then, that pollution control is one of the reasons for the Chinese government's current plan to substantially increase the percentage of high and new energy and renewable energy in its overall energy consumption. The Chinese Government's concerns about pollution control and further implementation of the Renewable Energy Law are likely to lead to more support and access to the relevant markets being provided to private companies in the renewable energy sector in China.

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## 2.3 Formation of the Renewable Energy Law

### Legislative division of responsibilities

Under Chinese law, all powers, unless delegated, are centrally exercised by the State Council, which is led by the Premier. The Premier puts forth laws from the National People's Congress and Standing Committee. Accordingly, the National People's Congress and its Standing Committee pass national laws, while the State Council enacts administrative rules and Local People's Congresses make local regulations.

**THE RENEWABLE ENERGY LAW – IN BRIEF**

The Renewable Energy Law entered into force on 1 January 2006 and covers energy generated from all non-fossil sources (with the exception of nuclear generation). It provides the framework for legislative initiatives, designed to secure the strategic position and future development of renewable energy. These include:

- Renewable energy targets, including both economy-wide and technology-specific targets;
- Compulsory grid connection for renewable energy facilities to the State electricity grid;
- Power pricing arrangements, including feed-in tariffs and competitive tendering systems, to allow renewable energy to compete with traditional, fossil fuel-powered generation; and
- Cost sharing arrangements to divide the costs of renewable energy generation and grid connection equitably amongst utilities and electricity end users.

### Rules comprising the Renewable Energy Law

The Renewable Energy Law is a framework that sets the overarching policies that drive the development of the Chinese renewable energy industry. Its importance stems from the fact that the development of the industry is, for the first, put on a statutory footing. The overarching policies enshrined in the Renewable Energy Law are put into practice through implementing regulations.

In China the Central Government is responsible for formulating national regulations to guide individual provinces during the implementation process. Instructions regarding pricing, cost-sharing, taxation and the project approvals process are stipulated by the Central Government for the provincial government to follow.

However, since there are great disparities between various provinces in terms of resource availability, industrial capacity and demand, in some cases provincial governments have needed to formulate their own detailed provisions for their area within the Central Government's general policy framework. Selected examples of provincial implementing measures are considered in section 3.

Although some national and provincial regulations have been introduced, the implementation of the Renewable Energy Law is an ongoing process. The key recent developments since the publication of the June 2007 Report are set out in sections 2.4 and 2.5 below.

In addition to national and provincial regulations, policy documents and technical standards have been (and continue to be) published, which provide guidance on specific topics. These texts are mentioned in the relevant sections of this paper, and Appendix 2 provides an overview of the national implementing texts.

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## 2.4 Medium and Long-Term Development Plan for Renewable Energy

The NDRC issued the Medium and Long-Term Development Plan for Renewable Energy in China (***Development Plan*** – envisaged in Article 8 of the Renewable Energy Law) in September 2007. It is the most important supporting document issued to date in relation to implementation of the Renewable Energy Law, as it is intended to put forward "guiding principles, objectives and targets, priority sectors, and policies and measures for the development of renewable energy in China up to 2020."

The Development Plan has sections on the renewable energy resource potential, and current level of development, for hydro, biomass, wind, solar and geothermal power. It sets out targets for uptake of these types of renewable energy for 2010 and 2020 – these targets are outlined in section 3.1 below.

However, the other sections of the Development Plan, discussed below, are more general in nature and do not provide a significant level of detail on proposed new measures.

### Guiding principles for RE development

The Development Plan briefly lists the following as "guiding principles" for renewable energy development in China:

1. Conscientiously implement the Renewable Energy Law;
2. Adopt renewable energy development as one of the key strategic measures to achieve China's goals of establishing a resource-saving, environmentally-friendly society and realizing sustainable development;
3. Speed up the development and deployment of hydropower, wind power, solar energy, and biomass energy;
4. Promote technical progress;
5. Increase market competitiveness; and
6. Continuously increase the share of renewable energy in China's overall energy consumption mix.

The Development Plan also discusses the issues of:

- *Coordinating renewable energy development and deployment with economic, social and environmental objectives* – ensuring that renewable energy is developed taking into account the location of resources, social needs (such as lack of energy in rural areas), environmental issues (including waste/recycling and environmental protection) and economic issues, with specific mention of the problems faced by biomass energy in relation to food sources and protection of the environment;
- *Ensuring mutual promotion of the market (demand) and industrial development (supply)* – this should enable a sustainable and stable market for renewable energy; importance is also placed on China developing its own renewable energy technologies;

- *Combining short-term utilization with long-term technology development* – focus should be placed both on renewable energy technologies which are currently relatively mature, such as hydro, biomass and wind power, and on technologies which are less mature but have good prospects, such as solar photovoltaic energy; and
- *Combining policy incentives with market mechanisms* – the Central Government will provide policy incentives to address the issues of energy shortages and lack of access to energy in rural areas, as well as supporting development of a "recyclable economy" (see the Circular Economy Law, adopted on 29 August 2008). The Government will also provide for market mechanisms to promote renewable energy. This dual approach recognises that, while market mechanisms can be efficient, they are not always well suited to solving issues relating to lack of access to energy in poor or remote areas.

## National policies and measures

The Development Plan notes that the following policies and measures will be adopted to meet the objectives and targets set out in the Development Plan:

1. *Establish sustainable and stable market demand* – by means of "favourable price policies, mandated market share (MMS) policies, government investment, government concession programs, and other measures."
2. *Improve the market environment* – by a range of measures to be implemented by the state power grid companies (purchasing renewable energy and constructing power transmission lines for renewable energy plants), power dispatch companies (arranging for priority dispatch of renewable energy), fuel wholesale companies (purchasing biofuels), energy administrative authorities under the State Council (formulating regulations for grid connection), and various administrative bodies (developing national standards for solar systems in buildings).
3. *Set renewable power tariff and cost-sharing policies* – as set out in the Renewable Energy Law.
4. *Increase fiscal input and tax incentives* – including by establishing a renewable energy fund, allocating funding at the local level to support renewable energy development, and putting in place preferential tax policies to support research and development relating to renewable energy, the development and deployment of renewable energy and the manufacture of renewable energy equipment.
5. *Accelerate technology improvement and industry development* – by establishing/integrating renewable energy research institutes, developing human resources, increasing technical innovation capabilities, ensuring national scientific and technological development plans include reference to research on technology development and industrialisation of renewable energy, and including renewable energy projects in programs to support the manufacture of equipment. The goals are to establish a basic system of renewable energy technologies by 2010, so that most renewable energy equipment can be manufactured in China, and for China to establish its own intellectual property rights in renewable energy innovations by 2020, so as to be able to deploy renewable energy on a large scale.

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## 2.5 Other developments relevant to renewable energy – laws and policies

### New Energy Law

A new Energy Law for China has been drafted and is proposed to come into force in 2009. It is intended to be the foundation energy law to guide and co-ordinate other laws in China's energy sector, thus acting as an overlay for other energy sector laws such as the Renewable Energy Law, Energy Conservation Law, Electric Power Law and their associated regulations and measures. The Energy Law will cover all forms of primary energy, including renewable energy, as well as secondary energy products such as electricity and petrol.

The purposes of the Energy Law include:

- creating a stable, economical, clean and sustainable energy supply and service system;
- increasing energy efficiency;
- ensuring energy security; and
- promoting the co-ordinated development of energy, the economy and society.

The "guiding principles" of the Energy Law include several which are intended to reinforce the Renewable Energy law, such as:

- sustainable development and resource conservation;
- market-based allocation of resources;
- ensuring basic energy supplies and services for all;
- incentivised and restrictive pricing policies for renewable energy and new energy; and
- tax incentives to encourage the development and use of renewable and new energy.

Under the Energy Law, a national energy strategy will be established to guide the sustainable development of China's energy resources and safeguard its energy security. The strategy is intended to extend for a period of 20-30 years, revised and amended every five years. Underneath the national strategy will sit five-year national energy plans and local energy plans, all of which must be consistent with the national energy strategy.

Article 5 of the Energy Law encourages renewable energy and low-carbon energy, in accordance with the Renewable Energy Law and China's National Climate Change Program. It does not appear that the Energy Law is intended to make any substantive changes to the way in which the Renewable Energy Law operates. However, a company undertaking renewable energy projects will need to ensure that it complies with the Energy Law as well as the Renewable Energy Law (and associated regulations).

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## Energy Conservation Law

A new Energy Conservation Law came into effect on 1 April 2008. It refers to renewable energy in several places.

Under Article 7, the State is to implement an industrial policy that is conducive to energy conservation and environmental protection, restricting the development of industries that consume large amounts of energy and cause pollution, while developing energy-saving and environmentally-friendly industries. The State encourages and supports the development and utilization of new energies and renewable energies.

Under Article 40, the State encourages the installation and use of solar energy in new buildings and in renovations.

Under Article 59, the State encourages and supports the popularization of renewable energy technologies (eg biomass, solar and wind energy). The State also supports the use of non-arable land for development of energy crops.

No specific incentives for these activities are given under this law. However, Article 78 provides that if an electricity grid enterprise fails to implement relevant State laws on prices of electricity entering the grid (which would include the higher prices payable for renewable energy), the national electricity supervisory authority can order that company to redress the breach and compensate generators for any losses.

## National Climate Change Program

In June 2007, China took a significant step forward in addressing the risks of climate change with the publication of a new National Climate Change Program (prepared by the NDRC).

The Program outlines steps that China will take to meet the previously-announced goals of improving energy efficiency by 20% in 2010 over 2005 levels, raising the proportion of renewable energy in the primary energy supply to 10% by 2010, actively promoting energy price reform and implementing institutional reforms in the energy sector. It also provides for education and public awareness on environmental issues. Public environmental awareness is becoming increasingly widespread and having a deepening impact on Government decision-making.

The Program contains several statements relating to the Renewable Energy Law. It states that the measures set out in the Program will assist in "vigorously developing renewable energy" (section 3.3.1). Section 4.1.1(1) of the Program states that China will promulgate the Renewable Energy Law as early as possible, implement it in a comprehensive manner, and in addition:

- *further intensify preferential policies to develop and utilize clean and low carbon energy*
- *[d]evelop supportive regulations and policies, prepare national and local programs for renewable energy development, identify development objectives and integrate renewable energy development into assessment indicator systems for the construction of resource-conservative and environmentally-friendly society*

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- *[t]hrough legislation and other approaches, [guide and encourage] domestic and international economic entities … to participate in renewable energy development and utilization.*

Furthermore, section 4.1.1(2) asserts that:

> *A stable mechanism for [renewable energy] investment will be established through government investment, government concession and other measures. A sustainable and stably expanding market for renewable energy will be fostered, market environment for renewable energy will be improved and obligation of national electricity grids and petroleum sales enterprises under the Renewable Energy Law to purchase renewable energy products will be implemented.*

## Plan for Environmental Protection

The National Eleventh Five year Plan for Environmental Protection, 2006-2010 (approved by the State government in November 2007) contains a series of priorities and actions regarding protection of the environment. Statements relevant to renewable energy include:

- China will raise the percentage of clean energy in the urban energy mix;
- China will vigorously develop renewable energy;
- China will make more efforts in the development of biogas projects in rural areas;
- China will implement preferential policies for power from renewable energy, including priority grid access or higher electricity prices;
- stricter pollution controls will be imposed on coal-fired plants; and
- the rule of law will be strengthened, with environmental laws to be improved and strictly enforced.

These statements indicate that the State Government sees the development of renewable energy as forming part of its wider efforts to improve the environment in China.

## Catalogue for Guidance of Foreign Investment Industries

The NDRC released the latest *Catalogue for the Guidance of Foreign Investment Industries* on 7 November 2007. This version replaces the 2004 version, and came into force on 1 December 2007. The catalogue lists the following industries (among others) as ones in which foreign investment is encouraged:

- the construction and operation of hydro power stations, with power generation as a major activity;
- the construction and operation of new energy power stations (including using solar, wind, magnetic, geothermal, tidal wave and biological energy);
- the manufacture of special equipment for solar battery manufacturing; and
- scientific research and technical services relating to biomass energy technologies.

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However, it remains unclear what actually constitutes "encouragement" of projects listed in the "encouraged" category.[16]

## Circular Economy Law

A law entitled *Circular Economy Law of the People's Republic of China* was adopted on 29 August 2008, to encourage recycling and efficiency of resource use. Several provisions are relevant to renewable energy.

- Article 23: Where possible, areas shall make sufficient use of solar, geothermal and wind energy, as well as other renewable energy sources.
- Article 32: Grid companies must, according to the relevant State laws, conclude a grid connection agreement with an enterprise which generates power from comprehensive use of resources (eg waste heat, slime, coal bed gas, refuse and other low-calorie fuels), provide grid access services and purchase all the electricity sent to the grid from such enterprises.
- Article 34: Agricultural producers and relevant enterprises are encouraged by the State to take advantage of advanced technologies that use crop straws, livestock and poultry excrements, by-products of the agro-product processing industry and waste agricultural films, to develop and use biogas and other forms of energy from biomass.
- Article 46: The State department responsible for determining energy prices shall determine the prices paid for grid electricity produced by the types of projects mentioned in Article 32, so as to encourage the comprehensive use of resources.

## White Paper on China's Energy Conditions and Policies

In December 2007, the Information Office of the State Council published China's first White Paper on energy issues. It includes discussion of the promotion of renewable energy in China as follows:

- China will continue to boost hydroelectric power and other renewable energy resources, and to develop substitute energy resources in a scientific way (Section II).
- On the conditions that the environment is protected and issues affecting local people are properly settled, energetic efforts will be made to develop hydropower (Section IV).
- China gives top priority to developing renewable energy. The exploration and utilization of renewable energy resources plays a significant role in increasing energy supply, improving the energy mix and helping environmental protection, and is also a strategic choice of China to solve the contradiction between energy supply and demand and achieve sustainable development. China has earmarked special funds for renewable energy development to support resource surveys, research and development of relevant technologies, building of pilot and

[16] As noted in the *European Business in China Position Paper 2008-2009*, Energy Working Group p. 176, published by the European Union Chamber of Commerce in China

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demonstration projects, as well as exploration and utilization of renewable energy in rural China (Section IV).

- China will further the comprehensive development of areas with hydropower resources, speed up the construction of large hydropower stations, develop medium- and small-sized hydropower stations based on local conditions, and construct pumped-storage power stations under appropriate circumstances. It will spread the latest technologies for the utilization of solar energy, methane and other renewable energy sources, and increase their market shares. It will also actively popularize technologies utilizing wind, biomass and solar energy for power generation, and build several million kilowatt wind power bases to achieve industrialization by means of scale power generation. It will actively implement policies supporting renewable energy development, foster a renewable energy market featuring sustained and stable development, and gradually establish and improve an industrial system and a market and service system of renewable energy, so as to promote renewable energy technological advancement and industrial development (Section IV).
- In order to improve energy development in rural areas, China will (among other things):
  - make full use of small-sized hydropower stations, wind energy and solar energy for power generation;
  - actively develop rural household methane and make better use of biomass and solar energy in rural areas;
  - continue popularizing small energy facilities, such as small wind power and hydropower stations, in rural areas; and
  - build green-energy counties for demonstration, and accelerate the exploration and utilization of renewable energy resources in rural areas (Section IV).
- China will encourage foreign investment in exploration and development of unconventional energy resources, and will encourage foreign entities to invest in and operate renewable energy plants (Section VIII).

These are policy statements and do not contain any binding measures in addition to those proposed under the Renewable Energy Law and associated regulations. However, the White Paper indicates the importance the Government places on renewable energy (particularly hydro power).

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## 2.6 Comparison to RE laws in other countries

### Introduction

In addition to China, various countries around the world have recognised the growing importance of renewable energy and have passed specific laws, directives, ordinances or provisions for renewable energy in order to ensure the healthy and robust growth of the sector. These directives usually specify long-term renewable energy targets.

European countries are leading the way in this regard and their laws are an important factor in driving growth, evident in the tremendous growth of renewable energy in Europe.

We summarise below some of the specific renewable energy laws from around the world.

### Australia: *Renewable Energy (Electricity) Act 2000*

Since January 2001 Australia has had a mandatory national renewable energy target. The target itself has been a modest one to date, intended to contribute an additional 9,500 gigawatt hours of renewable energy per year to Australia's generation mix by 2010. (The Government has promised to expand this to 45,000 gigawatt hours by 2020.) However, the framework implemented to impose this target, the Mandatory Renewable Energy Target Scheme (***MRET***), implemented by Australia's Federal Government in the *Renewable Energy (Electricity) Act 2000* (Cth), has demonstrated that mandatory markets for renewable energy can operate successfully.

MRET is a simple trading system based on the creation, trade and surrender of renewable energy certificates (***RECs***), each REC corresponding to one megawatt hour of electricity generated from renewable resources.

#### Operation of MRET

The scheme operates by requiring most wholesale purchasers of electricity and certain deemed wholesale electricity purchasers to surrender a number of RECs that correspond to their required contribution to the renewable energy target. Each entity's required contribution is calculated based on a percentage of their share of acquisitions of liable electricity in Australia.

RECs are created by accredited entities, typically electricity generators that generate electricity using eligible renewable energy resources set out in the table below. RECs can also be generated from a series of solar hot water heaters and small-scale generating units. The administrator of the Scheme, the Office of the Renewable Energy Regulator, reported that by 31 December 2007 there were 253 accredited power stations.

As RECs are tradeable, they can be sold to the liable entities to meet their targets. In theory, given the broad participation in the Scheme and the tradability of RECs, MRET is intended to promote renewable energy projects that meet the target at the lowest cost by allowing the market to decide which projects should be undertaken.

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RECs can be traded separately from the electricity that enabled them to be created. In fact, the MRET model operates entirely independently from any electricity regulation in Australia, over which the State Governments exercise legislative power.

### Eligible renewable energy

Eligible renewable energy sources have been defined under the Act to include:

- hydro
- tide
- wind
- geothermal aquifer
- energy crops
- agricultural waste
- food waste
- bagasse
- biomass based components of municipal solid waste
- sewage gas and biomass based components of sewage
- wave
- ocean
- solar
- hot dry rock
- wood waste
- landfill gas
- food processing waste
- black liquor
- waste from processing of agricultural products
- any other energy source prescribed by the regulations

### Penalties

If the liable entity is not able to surrender the required number of RECs by the year end, then it is liable to pay penalties in the form of renewable energy shortfall charges – $40.00 for each REC by which the liable entity is in shortfall of its target. No penalty is levied if the shortfall is within 10% of the required amount but the shortfall is carried forward to the next year for accounting purposes. The penalty amount has been set out in the *Renewable Energy (Electricity) Charge Act 2000* (Cth).

Another provision in the Act allows for the refund of the shortfall penalty under certain conditions. If the liable entity is able to surrender the required amount of renewable energy certificates (equal to the shortfall amount in the year in which the penalty was paid) within 3 years of paying the penalty, then the entity is liable for a refund of the previously paid renewable energy shortfall charge penalty once administrative fees have been deducted.

### Impact on electricity costs

The need to purchase and surrender RECs (and the resulting income stream for renewable energy project developers) has increased the cost of electricity in Australia. Virtually all businesses in Australia are paying suppliers or service providers for MRET related costs that are passed through the supply chain in the cost of goods or services – principally, to their electricity retailers in their electricity invoices. Electricity retailers in submissions to the Independent Pricing and Regulatory Tribunal in New South Wales have calculated the additional MRET compliance cost per megawatt hour for electricity retailers in New South Wales to be from AUD$1.10 to

AUD$1.25.[17] This is a relatively small percentage of the average cost per megawatt hour in New South Wales of AUD$41.66 in the financial year 2007-2008.[18]

### Potential distortions to the ideal REC market

Electricity retailers pass on to their customers the cost of complying with the MRET, and sometimes the cost that electricity users pay might not reflect the actual costs to the retailer of sourcing RECs.

Unless a company is a large consumer of electricity that negotiates its electricity purchase arrangements with its electricity retailers, there is only limited opportunity for individual companies to take control of the required renewable energy or lower-emissions component of their electricity.

Under MRET, large users of electricity do not ordinarily take control of meeting the renewable energy target for the electricity they purchase. However, such an arrangement could be negotiated contractually between the retailer and user, if the electricity user was able and willing to purchase RECs at a lower price than the cost that their retailer would otherwise pass on to them.

### Design improvements identified from the operation of MRET

In the course of operation of the MRET, opportunities for improvement have arisen in relation to three design features of the Scheme.

The legislation originally allowed accredited renewable energy generators to delay creating RECs for an indefinite period of time after the corresponding electricity was actually generated. This led to an amount of "latent generation" – electricity generation from renewable resources that had not yet been used to create RECs and so which was not known to the market. Without any market signals as to the potential number of RECs available, liable entities had to guess the potential supply of RECs to meet their targets and this made pricing less transparent. Before the end of the last compliance period there was a spike in the price of RECs, potentially because liable entities had assumed that more RECs would be available from this "latent generation" than were actually made available. The legislation has now been amended so that RECs must be created within 12 months of the corresponding electricity generation.

That round of legislative amendments also changed MRET so that RECs could be surrendered voluntarily, without being used to meet the mandatory target. Before this amendment, a number of companies who offered services for electricity consumers to voluntarily purchase renewable energy under the scheme could only promise that RECs would be purchased and transferred to an account in the registry where they would never be used again. Further, companies who created RECs and other environmental products under other voluntary or mandatory schemes could not voluntarily surrender RECs under MRET to demonstrate that they were not "double dipping" under the rules of those other schemes.

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17 Independent Pricing and Regulatory Tribunal of NSW, *NSW Electricity Regulated Retail Tariffs 2004/05 to 2006/07*, June 2004 p.39.

18 NEMMCO average annual price data from www.nemmco.com.au, accessed 6 May 2009.

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MRET allows renewable energy generators to create RECs for additional generation above their electricity generation on 1 January 1997 (the "renewable energy baseline"). This baseline is set using factors that include historical generation. As a result, some generators have been able to generate RECs from existing generation capacity. Renewable energy project developers have broadly criticised this approach, suggesting that setting the baseline according to historical generation dilutes the market and reduces the reward available for new electricity generation capacity.

### MRET framework mirrored for additional targets in States of Australia

Unsurprisingly, the limited additional generation capacity that is likely to be required to meet the small target under MRET has been very quickly achieved.[19] The previous Federal Government declined to increase the target and extend the scheme, which has been an impetus for Australian State Governments to impose their own schemes mirroring MRET.[20]

Queensland and Victoria have each introduced schemes which operate using a similar trading mechanism to impose their own additional targets. Victoria's Renewable Energy Target Scheme (known as VRET) imposes a target of an additional 3,274 gigawatt hours of electricity to be purchased by retailers (and other wholesale purchasers) in that State from renewable energy sources by 2016, while Queensland's Gas Scheme currently requires electricity retailers (and other liable entities) in that State to source 13% of their electricity from generators using certain lower-emissions fossil fuels (principally, natural gas or certain waste gases).

The current Federal Government proposes to increase the renewable energy targets under MRET substantially, to ensure that by 2020 approximately 20% of energy comes from renewable sources. This may mean that State-based target schemes discussed above will terminate.

## Germany: *Renewable Energy Sources Act* 2000 (amended 2004)

The German renewable energy law is a prime example of what properly designed, stable energy policy can do to bolster the growth of renewable energy. It has created a booming internal and external market, for wind and solar technology in particular, and has simultaneously helped Germany towards meeting its greenhouse gas emissions reduction targets.

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19 For example, Dr M Diesendorf of the University of New South Wales, quoted in ABC report by van Santen, J, 20 April 2006; Mascher, S *Right on Target? Australia's Mandatory Renewable Energy Target,* conference proceedings *International Workshop on Legal Issues for Clean Energy and Climate Change*, 21-22 October 2006 Beijing, China p.125 at pp136-9.

20 Stafford, A *Credit where credit's due: A primer of trading schemes for renewable energy and carbon in Australia* (2006) 27(1) Solar Progress 9 at 10.

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The stated objective of the Act, introduced in 2000 and revised in 2004, is to:

> *facilitate a sustainable development of energy supply, particularly for the sake of protecting our climate, nature and the environment, to reduce the costs of energy supply to the national economy, also by incorporating long-term external effects, to protect nature and the environment, to contribute to avoiding conflicts over fossil fuels and to promote the further development of technologies for the generation of electricity from renewable energy sources*.

Additionally the Act helps implement EU directives on renewable energy and contributes to the increase in the percentage of renewable energy sources in the country's power supply to at least 12.5% by 2010 and to at least 20% by 2020.

The Act regulates priority grid connection and transmission for renewable energy and also deals with the purchase and compensation paid for such electricity. Renewable energy sources are defined to include hydropower (including wave power, tidal power, salt gradient and flow energy), wind energy, solar radiation, geothermal energy, energy from biomass including biogas, landfill gas and sewage treatment plant gas as well as the biodegradable fraction of municipal and industrial waste.

The core provision of the Act is to provide priority status for renewable energy, particularly in the compensation paid for such electricity through the mechanism of feed-in laws or minimum price standards. A feed-in law is a legal obligation on utilities to purchase electricity from a renewable source at a preferential purchase price. Producers of renewable energy are guaranteed the sales price and access to market through an obligation from utility companies to purchase the green electricity on an annual fixed-rate basis.  The price paid is subject to periodic adjustments by regulators. The price and the duration of the contract are set at levels that maintain investor confidence, allowing healthy growth in the sector in a low-risk environment.

## Minimum prices for renewable energy

**MINIMUM PRICES FOR RE, 2004 AMENDMENTS (GERMANY)**

| RE SOURCE | MINIMUM PRICE |
|---|---|
| Hydropower | At least 9.67 cents/kWh for plants with a capacity up to and including 500 kilowatts and at least 6.65 cents/kWh for plants with a capacity up to and including 5 megawatts. |
| Landfill Gas, Sewage Treatment Plant Gas and Mine Gas | At least 7.67 cents/kWh up to and including a capacity of 500 kilowatts and at least 6.65 cents/kWh up to and including a capacity of 5 megawatts. The fees paid for electricity from mine gas plants with a capacity of over 5 megawatts are 6.65 cents/kWh. All above the minimum prices shall be reduced annually by 1.5% |
| Biomass | At least 11.5 cents/kWh up to and including a capacity of 150 kilowatts, at least 9.9 cents/kWh up to and including a capacity of 500 kilowatts, at least 8.9 cents/kWh up to and including a capacity of 5 megawatts and at least 8.4 cents/kWh for a capacity of over 5 megawatts and up to 20 megawatts. All above the minimum prices shall be reduced annually by 1.5% |

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| | MINIMUM PRICE |
|---|---|
| Geothermal | At least 15 cents/kWh up to and including a capacity of 5 megawatts, at least 14 cents/kWh up to and including a capacity of 10 megawatts, At least 8.95 cents/kWh up to and including a capacity of 20 megawatts and at least 7.16 cents/kWh for a capacity of 20 megawatts and over. All above the minimum prices shall be reduced annually by 1.0% |
| Wind | 8.7 cents/kWh for first five years till plants achieve 150% of reference yield. After five years the minimum price will be 5.5 cents/kWh. 9.1 cents/kWh for offshore installation for first 12 years for installation before 2010. After 12 years the rate will be reduced to 6.19 cents/kWh. All above the minimum prices shall be reduced annually by 2.0% |
| Solar | 45.7 cents/kWh for ground mounted installations. If the plant is attached to or integrated on top of a building or noise protection wall, the fees shall be at least 57.4 cents/kWh up to and including a capacity of 30 kilowatts, at least 54.6 cents/kWh for a capacity 30 kilowatts and over, and at least 54.0 cents/kWh for a capacity of 100 kilowatts and over. An addition of 5 cents/kWh will be allowed for BIPV systems. All above the minimum prices shall be reduced annually by 5.0% |

Source: WISE, 2007

All the above minimum prices are to be paid from the date of commissioning of the plant for a period of 20 calendar years, or 30 years for hydropower plants.

A nation-wide equalization scheme has been implemented to reduce the cost differentials paid by grid operators in different parts of the country for the purchase of electricity from renewable sources. Under the law, energy from renewable sources commands premium prices. The additional costs are included in household electricity bills. The total additional costs are currently estimated to be only about €1 per month per household.

## Grid connection

Plant operators are to bear the cost of grid connection and metering while costs associated with grid up-gradation are to be borne by the grid operators. Plant operators are defined as anyone who, notwithstanding the issue of ownership, uses the plant for the purpose of generating electricity from renewable energy sources or from mine gas. Grid system operators are defined as the operators of all types of voltage systems for general electricity supply.

## Other issues

Environmental verification organizations are required to issues certificates certifying guarantee of origin of electricity from renewable sources. The Act also requires the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety to prepare progress reports from time to time.

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## Czech Republic: *Act on the promotion of Use of Renewable Sources* 2005

This Act came into effect in 2005 primarily for regulating the promotion of electricity generation from renewable energy sources in the Czech Republic in accordance to the existing EU laws and directives.

The various objectives that this law wishes to achieve are as follows:

- promote the use of renewable energy sources;
- provide for a constant increase in the contribution of renewable sources to consumption of primary energy sources;
- contribute to sound use of natural resources and sustainable development of society;
- create preconditions for fulfilment of the indicative target for the contribution of electricity from renewable sources to the gross consumption of electricity in the Czech Republic equal to 8% by 2010 and create preconditions for further increases in this share after 2010.

Renewable energy sources have been defined in the Act to include wind, solar, geothermal, hydro, biomass, landfill gas, sewage treatment plant gas and biogas.

### Pricing and grid connection

The renewable energy producer has two choices with regard to renewable energy pricing:

- sell the electricity to the grid operator pursuant to the conditions and prices set under this Act; or
- obtain a green bonus for this electricity and sell it on the market.

A green bonus is defined in this Act as a:

> *financial amount increasing the market price of electricity that is paid by the operator of a regional grid system or transmission system to a producer of electricity from renewable sources, taking account of reduced damage to the environment resulting from use of a renewable sources compared to combustion of fossil fuels, of the type and size of the production plant and of the quality of supplied electricity.*

Captive users are also allowed the benefit of the green bonus under the Act. The Energy Regulatory Office is in charge of setting prices for renewable electricity purchase subject to certain conditions laid down in the law. These prices came into effect for the first time in 2007. The above body is also responsible for publishing an annual progress report on the status and progress of renewable energy.  Heavy fines have been laid down for non-compliance both for the grid operator and the electricity producer. Preferential grid connection for renewable energy sources is guaranteed under section 4 of the Act and the costs are to be borne entirely by the grid operator.

Wind power plants located over an area of 1 km2 with a total installed capacity of 20 megawatts are excluded from the purview of this Act.

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## Austria: *Green Electricity Act 2003* (amended 2006)

Austria's Green Electricity Act was established to enact new provisions related to renewable electricity generation and combined heat and power (***CHP***).

This Act regulates various renewable electricity-related matters, including:

- the guarantees of origin of electricity produced from renewable energy sources;
- the obligations to purchase and pay for electricity;
- the preconditions for, and the promotion of, electricity produced from renewable energy sources; and
- the nation-wide equal sharing of costs associated with the promotion of electricity produced from renewable energy sources and from CHP plants.

The objectives of the Act, aimed at protecting the climate and the environment, to:

- achieve the target of 78.1% of electricity from renewable sources by 2010;
- make good use of the means of promoting renewable energy and to try and achieve market maturity for new technologies;
- support CHP plants used for public district heating supply;
- have at least 9% of electricity from hydropower plants with capacity less than 10 megawatts by 2008; and
- promote renewable electricity and provide for a nation-wide burden-sharing scheme for electricity from renewable energy and CHP.

"Renewable energy sources" are defined as renewable non-fossil energy sources (wind, solar, geo-thermal, wave, tidal, hydropower, biomass, waste containing a high percentage of biogenous materials, landfill gas, sewage treatment plant gas and biogases).

The following two areas are eligible for support under this Act:

- Electricity produced from renewable energy sources through minimum price mechanism and the obligation to purchase such electricity. Hydropower plants with a maximum capacity of more than 10 megawatts and electricity from animal meal, spent lye, sewage sludge or waste, save waste containing a high percentage of biogenous materials, are not entitled to the above support.
- Existing and modernized CHP plants used for public district heating are entitled for support in the form of reimbursements for part of the operating costs.

### Grid connection and feed-in tariffs

Grid operators are required to treat all connection applications equally and in a transparent manner. They also require to issue "guarantee of origin" certificates for electricity generated from registered renewable projects. There is an obligation to purchase electricity from solar PV nationwide capacity of up to 15 megawatts and a certain percentage of electricity from hybrid and co-firing plants based on renewable energy. CHP plants are eligible for support only if used for public heating and if

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primary energy use and $CO_2$ emissions are reduced in comparison to separate electricity and heat generation.

The Act requires new feed-in tariffs to be set for all new renewable electricity plants. Customers are also required to pay a nation-wide uniform support fee (per kilowatt hour of energy supplied to final customers) to create a fund to cover the additional costs.

## United Kingdom

The UK has several major Acts covering the use of renewable energy. These are briefly described below.

### *Sustainable Energy Act 2003*

This Act deals with the provisions for the development and promotion of a sustainable energy policy. The Act makes it mandatory for the Secretary of State to publish annually a "sustainable energy report" to indicate progress made towards:

- cutting the United Kingdom's carbon emissions;
- maintaining the reliability of the United Kingdom's energy supplies;
- promoting competitive energy markets in the United Kingdom; and
- reducing the number of people living in fuel poverty in the United Kingdom.

The Act also requires the Secretary of State to specify targets for electricity production from CHP plants.

### *Energy Act 2004*

The Secretary of State is required to publish a strategy for promotion of micro-generation after considering its potential for:

- cutting emissions of greenhouse gases in Great Britain;
- reducing the number of people living in fuel poverty in Great Britain;
- reducing the demands on transmission systems and distribution systems situated in Great Britain;
- reducing the need for those systems to be modified; and
- enhancing the availability of electricity and heat for consumers in Great Britain.

The sources of energy and technologies that are permitted under the micro-generation initiative are:

- biomass;
- biofuels;
- fuel cells;
- photovoltaics;
- water (including waves and tides);
- wind;
- solar power;

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- geothermal sources;
- CHP systems; and
- other sources of energy and technologies for the generation of electricity or the production of heat, the use of which would, in the opinion of the Secretary of State, cut emissions of greenhouse gases in Great Britain.

To qualify as micro-generation, the maximum capacity of the above sources are:

- in relation to the generation of electricity, 50 kilowatts; or
- in relation to the production of heat, 45 kilowatts thermal.

The Act also lays down specific guidelines and regulations for the use of areas outside the territorial sea for exploration and exploitation of energy, especially from water and wind energy. There are regulations for the transmission, distribution and supply of electricity generated in such areas and for de-commissioning of such renewable energy projects. The Government has also reserved the right to declare such an area as a "Renewable Energy Zone" for the above purpose.

### RPS obligation relating to electricity, under s32(9) of *Electricity Act 1989*

The Renewables Obligation order was first introduced in 2002 and subsequently revised in 2006. Electricity distribution companies are required under this order to produce or source a minimum percentage of their electricity from renewable sources. The minimum yearly percentages are specified below.

**MINIMUM PERCENTAGE OF ELECTRICITY TO BE SOURCED FROM RENEWABLE SOURCE 2006 – 2016 (UK)**

| YEAR | RPS % |
|---|---|
| 2006-2007 | 6.7 |
| 2007-2008 | 7.9 |
| 2008-2009 | 9.1 |
| 2009-2010 | 9.7 |
| 2010-2011 | 10.4 |
| 2011-2012 | 11.4 |
| 2012-2013 | 12.4 |
| 2013-2014 | 13.4 |
| 2014-2015 | 14.4 |
| 2015-2016 | 15.4 |

Source: http://www.opsi.gov.uk/SI/si2006/20061004.htm

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The official Government policy as per the law is:

> *to reduce dependence on imported fuels with due regard to the protection of public health, the environment, and natural ecosystems consistent with the country's sustainable economic growth that would expand opportunities for livelihood by mandating the use of biofuels as a measure to:*
>
> - *develop and utilize indigenous renewable and sustainably-sourced clean energy sources to reduce dependence on imported oil;*
> - *mitigate toxic and greenhouse gas emissions;*
> - *increase rural employment and income; and*
> - *ensure the availability of alternative and renewable clean energy without any detriment to the natural ecosystem, biodiversity and food reserves of the country*.

## Compulsory use of biofuels

All liquid fuels for motors and engines sold in the Philippines require locally-sourced biofuels components as follows.

- **Bioethanol**: Within two years from the effective date of the Act, the annual total volume of gasoline fuel actually sold and distributed by each oil company in the country must include at least 5% bioethanol. All bioethanol blended gasoline must also contain a minimum of 5% bioethanol fuel by volume, provided that the ethanol blend conforms to the Philippines National Standards (***PNS***).
- Within four years from the effective date of the Act, the National Biofuel Board (***NBB***) created under the Act is empowered to determine the feasibility and thereafter recommend to the Department of Energy (**DOE**) to mandate a minimum of 10% blend of bioethanol by volume into all gasoline fuel distributed and sold by each oil company in the country.
- **Biodiesel**: Within three months from the effective date of the Act, a minimum of 1% biodiesel by volume must be blended into all diesel engine fuels sold in the country, provided that the biodiesel blend conforms to the PNS for biodiesel.
- Within two years from the effective date of the Act, the NBB is empowered to determine the feasibility and thereafter recommend to DOE to mandate a minimum of 2% blend of biodiesel by volume. This may be increased taking into account considerations including domestic supply and availability of locally-sourced biodiesel components.

The Act also includes incentives for biofuel production in the Philippines.

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The Act also includes incentives for biofuel production in the Philippines.

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# 3. Implementation of the Renewable Energy Law

## 3.1 Renewable energy targets

### Introduction

As noted in the June 2007 Report, China's renewable energy industry is growing rapidly. At the moment, renewable energy (other than hydro power) accounts for roughly 8% of China's energy supplies. However, even though this figure represents a notable increase in the use of renewable energy (even since the publication of the June 2007 Report), it is dwarfed by China's use of coal, which supplies almost 70% of the country's energy needs.[21]

Chinese renewable energy targets originate in Articles 4, 7 and 8 of the Renewable Energy Law:

**Relevant provisions of the Renewable Energy Law**

**Article 4** notes the development of renewable energy as a priority for the Chinese Government, and states that this aim can be promoted by establishing overall generation targets for renewable energy and taking corresponding measures to achieve them.

**Article 7** adds detail to Article 4, by requiring that the State Council sets national medium and long-term targets that will foster the development of renewable energy in China. As part of its remit, the State Council is required to liaise with the relevant authorities in the provinces, regions and/or municipalities.

**Article 8** requires that the State Council prepares a national renewable energy development and utilisation plan, which can be reviewed subject to the approval of the State Council. It also provides for the implementation of that plan by provincial authorities.

### National regulations, policies and technical standards

The central national text that gives substance to the targets enshrined in the Renewable Energy Law is the Development Plan. It sets out targets for 2010 and 2020 for various types of renewable energy, as well as targets for ownership of renewable energy capacity by power companies and use of renewable energy in rural areas.

In summary, the Development Plan sets the targets indicated in the following table.

**TARGETS UNDER MEDIUM AND LONG-TERM DEVELOPMENT PLAN**

| RENEWABLE ENERGY | END 2005 ACTUAL | 2010 TARGET | 2020 TARGET |
|---|---|---|---|
| Proportion of renewable energy in national energy mix | 8% | 10% | 15% |
| Hydropower (gigawatts) | 117 | 190 | 300 |
| Wind power (gigawatts) | 1.31 | 10 | 30 |

[21] "Powering China's development: The role of renewable energy" E. Martinot & Li Junfeng, *Renewable Energy World*, January 2008

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| | ACTUAL | | 2020 TARGET |
|---|---|---|---|
| Biomass power (gigawatts) | 2.0 | 5.5 | 30 |
| Biomass pellets for solid fuel (million tons) | n/a | 1 | 50 |
| Bioethanol (million tons) | 1.02 | 2 | 10 |
| Biodiesel (million tons) | 0.05 | 0.2 | 2 |
| Biogas (billion cubic metres) | 7 | 19 | 44 |
| Solar power (gigawatts) | 0.07 | 0.3 | 1.8 |
| Solar hot water (million square metres) | 80 | 150 | 200 |
| Geothermal energy (annual utilisation, in Mtce) | n/a | 4 | 12 |
| Mandated RE capacity (non-hydro) to be owned by power generators that have more than 5 gigawatts of generation capacity (% of total capacity) | n/a | 3 | 8 |
| Rural households to use renewable energy (% of rural households) | n/a | 30 | 70 |
| Green energy counties (where more than 50% of energy is from renewable sources, and biomass waste is utilised) | n/a | 50 | 500 |

## Progress against targets

Although these targets were initially seen as ambitious, some of the 2010 targets have been reached ahead of schedule and there are plans to increase the targets. An economic stimulus package for renewable energy may be released in the next few months (in addition to the previously-announced stimulus packages which included specific allocations for environmental protection). As part of this package, the overall renewable energy target for 2020 may be doubled.[22]

The 2010 target for wind power was reached in 2008, and has now reached 12 gigawatts. The 2020 wind power target is likely to be vastly increased, perhaps to over 100 gigawatts. The solar power target may also be increased, as capacity is forecast to reach 10 gigawatts by 2020. Use of solar hot water heaters has also been growing rapidly, with 10% of all Chinese households estimated to have this technology.[23]

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[22] Shen, R & Wong, J "China solar set to be 5 times 2020 target – researcher", Reuters News 5 May 2009

[23] Ling Li "China to push use of solar water heaters", Worldwatch Institute 8 May 2007

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## Selected provincial measures

The following table gives examples of provincial measures that will assist in achieving the renewable energy targets.

### TABLE OF PROVINCIAL MEASURES

| REGION NAME | REGULATIONS OR OTHER DOCUMENT | RESPONSIBLE OFFICE |
|---|---|---|
| Shanghai | White book for energy policy, which includes the renewable energy development plan | Local DRC |
| Hainan/ Xintai | Regulation to promote integration of solar hot water into buildings | Provincial construction bureau |
| Shenzhen | Regulation to promote integration of solar hot water into buildings | City construction bureau |
| Baoding/ Kunshan/ Wuxi | Establish industrial base of renewable energy power generation | Local government |
| Yunnan | Certification requirements for installation of solar systems into buildings and set up a regional standards for solar building integration | Provincial construction bureau |
| Beijing | Regulation for promoting solar systems in rural areas | Local DRC |
| Shandong | Measures for promoting biogas and renewable energy in rural areas | Provincial government |
| Hunan | Regulation for renewable energy development in rural areas | Provincial government |
| Guangdong | Measures for promoting solar energy development, set up a fixed price for wind power as 0.68 Yuan/kWh | Provincial government |
| Sichuan | Measures for promoting biogas development in rural areas | Provincial government |
| Mongolia | Measures of the Inner Mongolia Autonomous Region for the Development and Utilization Management of Wind Energy Resources | Provincial government |
| Gansu | First region to enact a provincial-level bidding policy, in parallel with the national policy, to support wind power. | Provincial government |
| Jiangsu | Working on first phase of a 10,000 roof program regarding developments for grid-tied or building integrated solar PV, and discussing a feed-in tariff policy with local utilities. | Provincial government |
| Shenzen | Built 1MW grid-tied solar PV plant on the World Garden Expo building<br>Mandated solar hot water in all new residential buildings below 12 stories in height | Local government |

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## Outstanding issues

| RECOMMENDATIONS FROM JUNE 2007 REPORT |
|---|
| ▪ Consider the implementation of utility-level renewable energy targets and a tradeable certificate scheme to effectively link overall targets with chosen policy mechanisms. |
| ▪ Alternatively, consider strict reporting arrangements to ensure that feed-in tariffs are sufficient to meet established overall renewable energy targets. |
| ▪ A quota system that requires major power generators to develop a certain number of renewable energy projects could be developed and implemented. |
| ▪ Consider a system to ensure that targets and tariffs are complied with, including penalties for breach. |
| ▪ The National Renewable Energy Development Plan should be published as soon as possible, to guide the development of the renewable energy industry and create certainty for investors. |

The third and fifth recommendations above have been fulfilled. Progress could still be made on reporting renewable energy use and ensuring compliance with targets.

In relation to the third recommendation, which has been addressed via the Development Plan's mandated renewable energy quotas for power companies, the European Business in China Position Paper notes that the quota requirement has the (presumably unintentional) effect of making Chinese power companies unwilling to partner with foreign investors in renewable energy projects. The Chinese power companies are concerned that foreign investment will dilute the share of installed renewable energy capacity in their portfolio of installed energy capacity, making it harder for the Chinese power company to reach its renewable energy quota. Therefore the mandated renewable energy quota may act as a de facto barrier to foreign companies taking equity in Chinese renewable energy projects.

It may help to address this issue if joint venture companies with majority Chinese shareholding are allowed to account the joint venture's entire renewable energy capacity towards the quota requirements of the Chinese company.[24]

**Key issues of which potential investors should be aware**

The growth rate of the renewable energy market in China has declined following over-investment in 2006 and 2007. Particular barriers to wind and solar energy growth include restricted access to grid connection, over supply of wind turbines and limited stimulation of solar markets.

In wind power markets, limited grid capacity is the major factor limiting growth. In 2008 nearly 5 GW of additional wind power capacity was installed. Installed wind power capacity is expected to rise to 25-30 GW by 2010 and 35-40 GW by 2012. Current grid capabilities are unable to cope with the expected increased capacity and it is likely grid bottlenecks will reduce the ability of wind power to access the market. Investors should investigate the capacity of the local grid and government support for grid company expansion.

Wind turbine manufacture also faces over-supply. At present there are more than 50 manufacturers with a total manufacturing capacity of 10 GW. By 2012 this is expected to increase to 15-20 GW and generate an oversupply of turbines. Investors should be cautious regarding investment in new manufacturing and investigate future turbine demand.

Solar power also faces barriers to growth. The domestic market has not embraced solar power,

[24] As noted in the *European Business in China Position Paper 2008-2009*, p. 178, published by the European Union Chamber of Commerce in China

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| |
|---|
| and investors should be aware of current slow growth. |
| The Government should explore policies to increase the take-up of solar power, and the ability of wind power to be used on the electricity grid, before further supporting solar and wind equipment manufacturing industries. |

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## 3.2 Price setting

### Introduction

Price is the key barrier to the commercialisation of renewable energy as a form of mainstream energy. Therefore it is crucial that the Renewable Energy Law effectively addresses the differential between the price for fossil-fuel power and for renewable energy.

The price of renewable energy is set in one of two ways: governmental designated price (feed-in tariff) and governmental guided price. The latter is the bidding price proposed by the successful bidder through the tendering process.

The way in which prices are intended to be set for each type of renewable energy is briefly summarised below.

**HOW PRICES ARE SET FOR EACH TYPE OF RENEWABLE ENERGY**

| TYPE OF RENEWABLE ENERGY | PRICE SETTING MECHANISM |
|---|---|
| Wind | A governmental guided price, which is established through the tendering process organized by the price-charging department of the national council. However, in practice prices may be established in other ways, as discussed in more detail in chapter 4. |
| Solar | Determined on a project-by-project basis. The NDRC approved 4 Yuan/kWh for solar PV projects in Inner Mongolia and Shanghai. In March 2009 a generous subsidy for solar PV systems was announced, providing 20 Yuan per watt-peak for solar panels that are attached to buildings and have a capacity of over 50 kilowatt-peak (in addition to some efficiency requirements).[25] This subsidy is estimated to cover more than half the cost of purchasing and installing solar panels.[26] |
| Biomass and Biofuel | While the Renewable Energy Law provides that the price of biomass may be determined by tender, the practice in China is to set a feed-in tariff. |
| Geothermal | Determined on a project-by-project basis. |
| Hydropower | The renewable energy price system does not apply for hydropower. Prices are determined on a project-by-project basis. Projects of 50 MW and above are approved by the NDRC. Projects below that size are approved the provincial DRC. |

25 Shen, R & Wong, J "China solar set to be 5 times 2020 target – researcher", Reuters News 5 May 2009

26 Finamore, B "Solar subsidies in China", Switchboard NRDC 7 April 2009

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**Relevant provisions of the Renewable Energy Law**

**Article 19**—Grid power price of renewable energy power generation projects shall be determined by the price authorities of the State Council in the principle of being beneficial to the development and utilization of renewable energy and being economic and reasonable, where timely adjustment shall be made on the basis of the development of technology for the development and utilization of renewable energy. The price for grid-connected power shall be publicized.

For the price of grid-connected power of renewable power generation projects determined through tender as stipulated in the 3rd paragraph of Article 13 hereof, the bid-winning price shall be implemented; however, such a price shall not exceed the level of grid-connected power of similar renewable power generation projects.

**Article 22**—For the selling price of power generated from independent renewable energy power system invested or subsidized by the Government, classified selling price of the same area shall be adopted, and the excess between its reasonable operation, management expenses and the selling price shall be shared on the basis of the method as specified in Article 20 hereof.

**Article 23**—The price of renewable heat and natural gas that enters the urban pipeline shall be determined on the basis of price management authorities in the principle of being beneficial to the development and utilization of renewable energy and being economic and reasonable.

## National regulations and policies

The *Provisional Administrative Measures on Pricing and Cost Sharing for Renewable Energy Power Generation* (NDRC Price [2006] No. 7) (here called the ***NDRC Price Measure***) sets out details on price setting and cost sharing relating to the feed-in tariffs under the Renewable Energy Law.

The NDRC Price Measure is set out in full below (note that English translations of some terms may differ).

**NDRC Price Measure**

**Chapter 1. General Principles**

**Article 1**. In compliance with the Renewable Energy Law of the People's Republic of China and the Price Law of the People's Republic of China, these Measures are formulated to promote the development of renewable energy power generation industry.

**Article 2**. The scope of application of the Measures includes wind, biomass (including power generation from forest and agricultural waste through direct combustion and gasification, solid waste incineration, landfill gas, biogas), solar, geothermal and ocean power generation.

Prevailing regulations on hydropower tariff are still in effect.

**Article 3**. Renewable energy power generation projects within the boundaries of the People's Republic of China and those to be approved for construction by the relevant governmental authorities in 2006 and beyond shall be governed by the Measures while projects approved for construction by the relevant governmental authorities before December 31, 2005 shall be governed by the relevant existing regulations.

**Article 4.** Code for pricing and cost sharing for renewable energy power generation projects sticks to the principle of development promotion, efficiency enhancement, standardized administration and fair share.

**Article 5**. Tariffs for renewable energy power generation are categorized into Government Fixed Price and the Guidance Price of the Government. The Guidance Price of the Government refers to the awarded tariff of the bid winner through competitive tendering.

The incremental cost of renewable energy power generation over the yardstick feed-in tariff for

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desulphurizing coal-fired generating units shall be shared among the sales volume of electricity in power grids at the provincial or above level.

**Chapter 2**. **Pricing of Electricity**

**Article 6.** The Guidance Price of the Government applies to the feed-in tariff for wind power projects and the pricing standards will be determined through bidding by the price authorities of the State Council.

**Article 7.** For biomass power generation projects where the government fixed price applies, the price authorities of the State Council shall set yardstick tariff by region and the price standard shall be the addition of yardstick feed-in tariff for desulphurizing coal-fired generating units in 2005 in respective provinces (autonomous regions, municipalities directly under the Central Government) and subsidy price.

The subsidy price is 0.25 yuan per kilowatt-hour. 15 years of subsidy price shall be enjoyed for power projects starting from the date of power production; the subsidy price shall be annulled after 15 years of operation.

Since 2010, the subsidy price for power generation projects newly approved for construction by the relevant government authorities each and every year shall be decreased by 2% over that approved for construction in the preceding year.

Mixed-fuel power generation projects with the conventional energy exceeding 20% in heat consumption for power production shall be regarded as conventional energy power generation projects and the yardstick tariff of local thermal power plants shall apply without enjoying the subsidy price.

**Article 8.** For biomass power generation projects with feed-in tariff set through investor bidding, the guidance price of the government shall apply, i.e. the price of the bid winner which shall not be higher than the local yardstick tariff.

**Article 9**. The Government Fixed Price applies to solar, ocean and geothermal power generation projects and the price standard shall be determined in the principle of reasonable costs plus reasonable profits by the price authorities of the State Council.

**Article 10**. Sales price to the end-user for public independent power systems from renewable energy is subject to categorized sales price of the local provincial power grid.

**Article 11**. Power end-users are encouraged to purchase electricity from renewable energy of free will and the tariff is the addition of the power generation price of renewable energy and the average transmission and distribution price of the grid.

**Chapter 3. Cost sharing mechanism**

**Article 12.** The incremental cost of: feed-in tariff for renewable energy power generation over the yardstick feed-in tariff for desulphurizing coal-fired generating units, operation and maintenance (O&M) costs of state-invested or subsidized public independent power systems from renewable energy over the average electricity sales price of the local provincial grid as well as the grid connection cost of renewable energy power generation projects will be settled via tariff surcharge levied on the electricity end-users.

**Article 13**. The renewable energy tariff surcharge shall be levied on the electricity end-users within the service scope of the provincial and above grid enterprises (including wholesale customers of the provincial grid enterprises, auxiliary power plants, and large accounts directly purchasing electricity from the power plants). End-users of county self-provided power grids, end-users in Tibet area and those engaged in agricultural production shall be exempted from such tariff surcharge.

**Article 14**. Renewable energy tariff surcharge shall be verified by the price authorities of the State Council and metered according to the actual power consumption of the end-users adopting the unified standards throughout China.

**Article 15.** Calculation formulas for the renewable energy tariff surcharge:

Renewable energy tariff surcharge = the total amount of renewable energy tariff surcharge / total sales volume of electricity at a price with the tariff surcharge throughout China.

the total amount of renewable energy tariff surcharge = Σ [(renewable energy power generation price - the yardstick tariff for desulphurizing coal-fired generating units of the local provincial

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power grid) * renewable energy power purchased by the power grid + (O&M costs of public independent power systems from renewable energy - the average electricity sales price of the local provincial grid) * sales volume of public independent power systems from renewable energy] + the grid connection cost of renewable energy power generation projects and other reasonable charges]

Therein:

(1) total sales volume of electricity at a price with the tariff surcharge throughout China = total sales volume of electricity of the provincial or above grid enterprises during the planning period - power consumption for agricultural production - sales volume of electricity of the Tibetan grid.

(2) renewable energy power purchased by the power grid = planned power generation from renewable energy – power consumption within the power plant

(3) O&M costs of public independent power systems from renewable energy = operating cost for public independent power systems from renewable energy * (1+VAT rate).

(4) the grid connection cost of renewable energy power generation projects and other reasonable charges refer to the engineering investment and O&M costs incurred specifically for the grid connection system of renewable energy power projects, based on the design documents from the relevant government departments. Before the transmission and distribution cost is defined by the State, the grid connection cost shall be temporarily included in the renewable energy tariff surcharge.

**Article 16**. The total amount of renewable energy tariff surcharge to be apportioned among the provincial grid enterprises is defined according to the proportion of sales volume of electricity at a price with tariff surcharge of the provincial grid enterprises in the total sales volume of electricity at a price with the tariff surcharge throughout China.

Calculation formula as follows:

The total amount of tariff surcharge to be apportioned among the provincial grid enterprises = the national total of renewable energy tariff surcharge * sales volume of electricity at a price with the tariff surcharge within the service scope of provincial grid enterprise / national sales volume of electricity at a price with tariff surcharge.

**Article 17**. The renewable energy tariff surcharge shall be included in the sales price of grid enterprises, levied by the grid enterprises and kept in separate accounts to be used for specific purposes. Subject to the detailed regulations governed by the state council for preferential tax policies concerned.

**Article 18**. The renewable energy tariff surcharge shall be adjusted on a timely basis by the price authorities of the State Council according to the actual situation in the development of renewable energy and the adjustment cycle shall not be less than one year.

**Article 19**. The difference between the subsidy electricity fare actually paid by the provincial grid enterprises and the grid connection costs incurred for renewable energy power generation projects and the apportioned amount of tariff surcharge payable shall be subject to unified allocation in China. Concrete administrative measures will be formulated by the electricity regulatory departments according to the Measures and submitted to the price authorities of the State Council for approval.

**Chapter 4. Miscellaneous**

**Article 20**. Renewable energy power generation and grid enterprises shall record and maintain relevant data such as trade volume, price, and amount of power generated from renewable energy to the grid on a true and complete basis and shall accept the inspection and supervision of price authorities, electricity regulatory institutions and auditing departments.

**Article 21**. Any failure to implement the Measures resulting in loss of corporate and state benefits shall be scrutinized by the price authorities of the State Council, the electricity regulatory departments and auditing departments and the major responsible person shall be tracked down for his responsibilities.

**Article 22.** The Measure shall take effect on January 1, 2006.

**Article 23.** The Measures shall be construed by the NDRC.

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## Government department with price-setting powers

A new National Energy Administration was established in 2008, as part of the creation of a new energy governance system in China. One of its functions is to manage the renewable energy industry. However, it will not have final control over prices for renewable energy, which will continue to be determined by the NDRC. The National Energy Administration may propose new energy prices, but these must be submitted to the NDRC for final approval.

The NDRC will not approve the final feed-in tariff for a renewable energy project until after the project has been constructed.

Furthermore, while the National Energy Administration has the power to approve major investments in overseas energy projects, the NDRC retains the right to make the final decision on major energy projects in China.

## Selected provincial measures

In Guangdong province, a unified feed-in tariff has been implemented for wind power projects since March 2008. The tariff was fixed at 0.68 Yuan per kWh, tax included, and is additional to national wind power concession prices.

## Outstanding issues

| RECOMMENDATIONS FROM JUNE 2007 REPORT |
| --- |
| ▪ A feed-in tariff regime for the wind energy industry should be reintroduced in consultation with industry. |
| ▪ Competitive tendering schemes should be combined with robust technical standards and a floor price to prevent gaming, low contract implementation rates and poor quality projects. |
| ▪ When the solar power industry is considered sufficiently developed (or to assist in its development), separate government approvals should not be required for solar projects and a predictable and sufficient feed-in tariff should be introduced. Alternatively other forms of support such as tax incentives and/or seed funding could be provided. |
| ▪ Clarify any existing feed-in tariffs and other support mechanisms at a provincial level and specify how these will be affected by the implementation of the Renewable Energy Law and regulations. |

In relation to the first recommendation, there have been some changes to the methods for setting tariffs for wind power – see section 0 for a more detailed discussion. However, the pricing situation for wind power is complex and could be streamlined and improved.

Again, the situation with technical standards has improved, but more could be done – see section 3.7.

The third and fourth recommendations remain to be addressed. It may be preferable for feed-in tariffs to be set at a provincial level rather than a national level, to reflect regional variations affecting the viability of renewable energy projects. Feed-in tariffs should be stable (although indexed to inflation) and should be made public.[27]

The fact that the NDRC does not approve final feed-in tariffs for a project until after it has been built means that investors have to decide whether to invest in the project without the benefit of confirmed prices for the power, exposing them to greater risks.[28] This could be addressed by the NDRC providing confirmed feed-in tariffs at an earlier stage in project development.

**Key issues of which potential investors should be aware**

The price of power is set by the NDRC, and the NDRC is unlikely to take into account industry submissions. Therefore some renewable energy feed-in tariffs may still be low by international standards. However, some provinces, including Guangdong, have the right to price power within the province and may allow greater business engagement regarding pricing.

In general, the feed-in tariff for wind power in China is lower than in other countries. International investors should be careful to take this into account when assessing wind project investments.

27 As recommended in the *European Business in China Position Paper 2008-2009*, p.179, published by the EU Chamber of Commerce in China

28 As noted in the *European Business in China Position Paper 2008-2009*, p.178, published by the EU Chamber of Commerce in China

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## 3.3 Cost sharing

### Introduction

The aim of the cost-sharing provisions of the Renewable Energy Law is to share the costs of supporting renewable energy between all energy consumers. This approach is taken by many other renewable energy support programs, such as in Germany and Australia.

**Relevant provisions of the Renewable Energy Law**

**Article 20**—The excess between the expenses that power grid enterprises purchase renewable power on the basis of the price determined in Article 19 hereof and the expenses incurred in the purchase of average power price generated with conventional energy shall be shared in the selling price. Price authorities of the State Council shall prepare specific methods.

**Article 21**—Grid connection expenses paid by grid enterprises for the purchase of renewable power and other reasonable expenses may be included into the grid enterprise power transmission cost and retrieved from the selling price.

**Article 22**—For the selling price of power generated from independent renewable energy power system invested or subsidized by the Government, classified selling price of the same area shall be adopted, and the excess between its reasonable operation, management expenses and the selling price shall be shared on the basis of the method as specified in Article 20 hereof.

### National regulations and policies

The primary regulations/ policies relevant to cost sharing include:

- NDRC Price Measure, discussed above
- Renewable energy surcharge level regulation (NDRC Price [2006] No. 28-33)
- Provisional regulation on renewable energy surcharge balancing (NDRC Price [2007] No. 44)
- Provisional Administrative Measures on Renewable Energy Development Fund (MoF Economic and Construction [2006] No. 237)
- Temporary measures of additional income regulation of renewable energy power (NDRC, November 2007).

Summaries of these measures are set out in Appendix 2.

### Surcharges and subsidies

In September 2007, the surcharge for renewable energy in 2006 was announced. In 2006, a total surcharge amount of 260.24 million Yuan was collected, divided between:

- 38 wind power projects, biomass projects and solar PV projects, in respect of which 251.46 million Yuan was paid as a subsidy from the national surcharge;
- five public stand-alone wind power and solar power projects, in respect of which 7.62 million Yuan was paid; and
- five wind power grid connection projects, in respect of which 1.16 million Yuan was paid.

In 2006, the subsidy was not able to cover the extra cost of renewable energy in four provinces, namely Xinjiang, Jilin, eastern Inner Mongolia and Tibet. The excess renewable energy from plants in those provinces was sold to the utilities of Jiangsu, Zhejiang, Shandong and Henan. The trade amounted to 91.71 million Yuan, representing 35% of the total surcharge in 2006.

In March 2008, the government announced the surcharge and subsidy arrangements for the period from January to September of 2007. During this period, a total surcharge amount of 714.48 million Yuan was collected (much higher than in 2006). This was divided between:

- 75 wind power projects, biomass projects and solar PV projects, which received a total subsidy of 699.37 million Yuan; and
- 35 grid connection projects for wind power, which received 15.11 million Yuan.

However, this was not able to cover the cost of renewable energy in seven provinces, namely Heilongjiang, Jilin, Eastern Inner Mongolia, Northern Hebei, Shandong, Xinjiang and Ningxia. The excess renewable energy from plants in those provinces was sold to the utilities of Shanxi, Zhejiang, Anhui, Jiangsu, Beijing, Sichuan and Henan. This trade amounted to 178.42 million Yuan, representing 25% of the total surcharge during the first nine months of 2007.

## Outstanding issues

| RECOMMENDATION FROM JUNE 2007 REPORT |
| --- |
| ▪ The details of how the cost-sharing revenue will be divided among the 31 provinces, and how the additional costs will be borne by energy utilities, need to be clarified. |

The NDRC measure of November 2007 has assisted in clarifying cost-sharing issues, by setting out further details on cost sharing plans and quota trading issues.

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## 3.4 Connecting renewable energy to the grid

### Introduction

Providing for renewable energy plants to be connected to the electricity grid, and for the grid to be able to use the power supplied, is crucial. The Renewable Energy Law sets out the basic provisions: grid companies must provide grid-connection services for renewable energy plants, and must buy the renewable energy that is produced and supplied to the grid. Costs can be passed down to the energy consumers.

However, there is some more progress which can be made, particularly in relation to sharing the costs of grid connection and ensuring grids are technically and physically able to accept and use the renewable energy supplied to them.

**Relevant provisions of the Renewable Energy Law**

**Article 14**—Grid enterprises shall enter into grid connection agreement with renewable power generation enterprises that have legally obtained administrative licence or for which filing has been made, and buy the grid-connected power produced with renewable energy within the coverage of their power grid, and provide grid-connection service for the generation of power with renewable energy.

**Article 16**—If the gas and heat produced with biological resources conform to urban fuel gas pipeline networks and heat pipeline networks, enterprises operating gas pipeline networks and heat pipeline networks shall accept them into the networks. ... Gas-selling enterprises shall, on the basis of regulations of energy authorities of the State Council or people's government at the provincial level, include biological liquid fuel conforming to the national standard into its fuel-selling system.

**Article 21**—Grid connection expenses paid by grid enterprises for the purchase of renewable power and other reasonable expenses may be included into the grid enterprise power transmission cost and retrieved from the selling price.

**Article 29**—If the power grid enterprises breach Article 14 hereof and fail to purchase renewable power in full, which results in economic loss to the renewable power generation enterprises, such power grid enterprises shall be liable for compensation, and the national power supervisory institutions shall order them to make correction within a stipulated period of time; in case of refusal to make correction, a fine of less than the economic loss of the renewable power generation enterprises shall be imposed.

**Article 30**—In case that enterprises of natural gas pipeline network and heat pipeline network breach paragraph 2 of Article 16 hereof and do not permit the connection of natural gas and heat that conform to the grid connection technical standard into the network, which results in economic loss to the gas and heat production enterprises, relevant enterprises shall be liable for compensation, and energy authorities of the people's government at the provincial level shall order them to make correction within a stipulated period of time; in case of refusal to make correction, a fine of less than said economic loss shall be imposed against them.

### National regulations

It is the intention of the Renewable Energy Law is that renewable energy will enjoy priority access to the electricity grid, and some regulations are already in force to assist with this. Relevant regulations include:

- Regulation on the administration of power generation from renewable energy (NDRC Price [2006] No.7); and
- Measures on Supervision and Administration of Grid Enterprises in the Purchase of Renewable Energy Power (SERC [2007] Order No.25).

The NDRC Regulation provides that utilities are obliged to allow renewable energy facilities to connect to the grid.

The SERC Order, which came into force on 1 September 2007, requires the national grid authority and national standards authority to draft grid connection and power purchase standards to ensure the safety of the grid when it receives electricity from renewable energy sources. It also governs the supervision of power grid enterprises' purchase of electricity generated by renewable sources. The SERC and local agencies are now responsible for supervising such purchases. Power distributors are required to use all available renewable electricity in their power grid, including hydro, wind, solar, biomass and geothermal power.

Furthermore, power grid enterprises and electricity distributors are held responsible for any misconduct that causes losses to producers of renewable energy. Some examples of misconduct include:

- a failure to construct necessary facilities to connect the electricity to the power grids, or failure to do so in time;
- refusal to sign electricity purchase and distribution agreements with the producers or intentionally obstructing the conclusion of those agreements;
- failure to provide services related to the connection of electricity or failure to do so in time; and
- failure to give priority to electricity from renewable energies in electricity distribution.

The penalties for such misconduct will be fines calculated by reference to the losses suffered by the renewable energy generators as a result of the misconduct.

## Technical standards

There are various technical standards which apply to grid connection, including:

- Technical code for wind farms to connect to the grid;
- Technical code for geothermal power plants to connect to the grid; and
- Technical code for PV power plants to connect to the grid.

## Outstanding issues

| RECOMMENDATIONS FROM JUNE 2007 REPORT |
| --- |
| ▪ Favourable grid connection and pricing regulations for small hydropower projects, which are usually rejected by power grids, need to be developed. |

In addition to specific grid connection issues for small hydro plants, there is still progress to be made in ensuring the grid can receive renewable energy. While the SERC Order (discussed above) is a welcome development, in practice the ability of the grid to receive electricity from variable sources, such as most types of renewable energy, is still a concern.

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The Energy Working Group of the EU Chamber of Commerce in China notes that:

> *Renewable energy developers face a series of grid interconnection difficulties. These difficulties create delays, reduce profits and increase risks and uncertainty to the detriment of the development of the renewable energy sector in China. ... Grid companies often use technical reasons for not complying with their [grid connection] obligations under the Renewable Energy Law.*[29]

Looking specifically at wind power, Shi Pengfei notes that power grid issues will be the major constraint to the further development of wind power in China.[30] However, in 2008 there was increased investment in the power grid to help to address these issues.[31]

It may help if a new set of grid codes for renewable energy sources are developed to reflect the specific technical features of those sources, as traditional, inflexible codes are not appropriate for renewable energy. In addition, publication of a model grid connection agreement and model power purchase agreement would assist.[32]

**Key issues of which potential investors should be aware**

Although the Renewable Energy Law has provisions on grid connection and power purchase for renewable energy projects, in practice renewable energy companies may encounter difficulties in achieving satisfactory connection to the grid and in selling all their power to the grid.

[29] *European Business in China Position Paper 2008-2009*, p. 178

[30] "Rapid development of wind power market in China", presentation by Shi Pengfei of the Chinese Wind Energy Association at the Clean Energy Council Conference, Gold Coast 24 November 2008

[31] "China blasts through wind energy target", 15 January 2009, Environmental Finance Online News

[32] *European Business in China Position Paper 2008-2009*, p. 178, published by the EU Chamber of Commerce in China

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## 3.5 Regulatory approvals

### Introduction

The uncertainty, cost and time associated with obtaining the regulatory approvals required for a renewable energy project have a considerable impact on the attractiveness of such projects to investors. If an investor/ developer must obtain approvals from different levels and departments of government, if it is not certain until a late stage whether all approvals will be obtained, if it takes some effort to complete the required forms and if it will take some time to receive responses, the investor/ developer will be less willing to proceed with a project. To a greater or lesser extent, all of these issues apply in relation to approvals for renewable energy projects in China (in common with many other countries).

In addition to approvals relating to land use, development and price setting, foreign investors will also need to go through the foreign investment approvals process.

Local knowledge is important in navigating the approvals process. The Renewable Energy Law does not set out the full approvals process, but instead refers to the administrative permits and filings required by the State Council.

**Relevant provisions of the Renewable Energy Law**

**Article 2**— Application of this Law in hydropower shall be regulated by energy authorities of the State Council and approved by the State Council.

**Article 13**— For the construction of renewable energy power generation projects, administrative permits shall be obtained or filing shall be made in accordance with the law and regulations of the State Council.

In the construction of renewable power generation projects, if there is more than one applicant for project license, the licensee shall be determined through a tender.

### Outstanding issues

| RECOMMENDATIONS FROM JUNE 2007 REPORT |
|---|
| ▪ Clarify the responsibilities of each level of government in the approvals process. |
| ▪ Clarify and streamline the overlap between the renewable energy approvals process and the foreign investment approvals process. |

Some progress remains to be made in streamlining the approvals process for renewable energy projects, particularly for foreign investors who may not have a good understanding of the approvals process.

**Key issues of which potential investors should be aware**

Foreign investors will need to obtain local advice and assistance in navigating the approvals process for establishing a renewable energy project. It may take some time to obtain all required approvals.

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## 3.6 Investment incentives

### Introduction

Investment incentive are vital to the renewable energy industry, as the costs of renewable energy are still greater (in most cases) than fossil fuel power generation, particularly in the project construction phase. The Renewable Energy Law sets out various incentives for renewable energy. The most important of these is commonly the feed-in tariff, guaranteeing the renewable energy developer an above-market rate for the renewable energy it generates – see section 3.2. However, certain other incentives are also available, such as access to low-interest loans and tax benefits.

**Relevant provisions of the Renewable Energy Law**

**Article 19**—Grid power price of renewable energy power generation projects shall be determined by the price authorities of the State Council in the principle of being beneficial to the development and utilization of renewable energy and being economic and reasonable, where timely adjustment shall be made on the basis of the development of technology for the development and utilization of renewable energy. The price for grid-connected power shall be publicized.

**Article 25**—Financial institutions may offer preferential loan with financial interest subsidy to renewable energy development and utilization projects that are listed in the national renewable energy industrial development guidance catalogue and conform to the conditions for granting loans.

**Article 26**—The Government grants tax benefits to projects listed in the renewable energy industrial development guidance catalogue, and specific methods are to be prepared by the State Council.

### National regulations and policies

The requirement in the Development Plan that power generators have a certain percentage of their power generation capacity in the form of renewable energy generation capacity (see section 3.1) provides an additional incentive for those companies to invest in renewable energy.

### Outstanding issues

| RECOMMENDATIONS FROM JUNE 2007 REPORT |
|---|
| ▪ Clarify the details of financial incentive programs for solar photovoltaic power generation and biofuels, as well as the tax and loan arrangements. |
| ▪ Consider international best practice for effective tax incentives, loans and funding for renewable energy projects, including tying assistance to technical standards and project lifetime output goals. |
| ▪ Ensure that the process for applying for and the criteria for receiving such incentives are clear and easily available, in several languages. |

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Progress still remains to be made in addressing the above recommendations, particularly the third recommendation on making information on the available incentives easily available. The Energy Working Group of the EU Chamber of Commerce in China states that:

> *China's support mechanism for renewable energies has evolved from providing direct subsidies to the supplier to a more complicated system that also includes tax reductions and exemptions, preferential price and credit guarantees and other subsidies implemented by central and local governments.*
>
> *There is no transparent and systematic policy on these incentives nor is there information to help investors understand how to benefit from these incentive policies.*[33]

The government may consider establishing a website and hotline with information on renewable energy incentives available in some key languages, with links to information resources of provincial governments where required.

The incentives at central and provincial levels may benefit from a review for gaps, inconsistencies and overlaps, and to ensure that the desired outcome is being promoted. For example, the incentives should prioritise the actual generation of power from renewable energy plants (operational incentives), rather than merely the establishment of renewable energy capacity (investment incentives).

**Key issues of which potential investors should be aware**

In addition to the feed-in tariffs, some valuable renewable energy incentives may be available to renewable energy investors under State or provincial laws, but it may be difficult for foreign investors to locate full information on these incentives. Local advice will be useful.

[33] *European Business in China Position Paper 2008-2009*, p. 178-179

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## 3.7 Technical standards

### Introduction

Technical standards are crucial to ensure components for renewable energy plants are safe and reliable, and reduce the long-term risks of renewable energy equipment. Standards need to be developed and then a system must be put in place to ensure that components meet those standards, with penalties for manufacturers, importers or retailers that provide products that do not meet the standards.

The Renewable Energy Law provides for standards to be developed, particularly for solar power:

**Relevant provisions of the Renewable Energy Law**

**Article 11**—Standardization authorities of the State Council shall set and publicize technical standard for renewable energy electric power and the technical standards for relevant renewable technology and products for which technical requirements need to be standardized at the national level.

For those technical requirements not dealt with in the national standard in the previous paragraph, relevant authorities of the State Council may establish relevant industrial standard, which shall be reported to the standardization authorities of the State Council for filing.

**Article 17**— Construction authorities of the State Council shall cooperate with relevant authorities of the State Council in establishing technical economic policies and technical standards with regard to the combination of solar energy utilization system and construction.

Real estate development enterprises shall, on the basis of the technical standards in the previous paragraph, provide necessary conditions for the utilization of solar energy in the design and construction of buildings.

For buildings already built, residents may, on the condition that its quality and safety is not affected, install solar energy utilization system that conform to technical standards and product standards, unless agreement has been otherwise reached between relevant parties.

### National technical standards

Many standards are still under development. As noted in the June 2007 Report, two wind power generation standards have been published, as well as technical codes for wind farms, geothermal power plants and solar PV plants to connect to the electricity grid.

Several solar PV standards and codes have been or are in the process of being developed by the Solar Energy Photovoltaic Products Certification Technical Committee. Some of the more recent PV standards are:

- Photovoltaic systems - Characteristics of the utility interface (serial number GB/T20046-2006)
- Photovoltaic module safety qualification - Part 1: Requirements for construction (serial number GB/T20047.1-2006).

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Solar PV standards in the process of being developed include the "Technical Specifications for PV-use Valve Control Sealed Lead-Acid Storage Batteries" and the "Implication Rules for Certification of Stand-alone Photovoltaic Systems".[34]

The Ministry of Construction has completed the "Technical Regulations on the Application of Solar Water Heating Systems in Civil Construction" and the "Technical Regulations on the Application of Geothermal Pumping Engineering".[35]

The Development Plan notes (in section 5(2)) that the administrative authorities under the State Council responsible for the construction industry and the Standards Administration of China will develop national standards for solar systems in buildings, and will update the relevant construction standards, engineering specifications and management regulations of urban construction to create good conditions for the development of solar systems in buildings.

## Provincial technical standards

Only Yunnan and Hainan have developed standards for integrating solar power with building development.

## Outstanding issues

| RECOMMENDATIONS FROM JUNE 2007 REPORT |
|---|
| ▪ Implement further technical standards to build China's renewable energy in light of its limited experience (e.g. standards for the bio-fuel productions to allow for larger scale application). Australian technical bodies and consultants may be able to assist with developing appropriate standards. |
| ▪ Require manufacturing and consultant companies to provide warranties to government authorities that products meet technical standards, and require independent verification of estimates and designs, to put commercial pressure on companies to deliver high-quality products. |
| ▪ Environmental protection regulations for large hydropower projects need to be clarified. |

While some progress has been made in this area, further development and enforcement of technical standards would be useful in ensuring the efficiency and reliability of the renewable energy industry.

Although there is an authorised certification authority for the certification of renewable energy products, the China General Certification Centre, China's renewable energy testing levels are generally not recognised internationally.[36] This is an area for further development.

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[34] *Report on the Development of the Photovoltaic Industry in China (2006-2007)*, China Renewable Energy Development Project, June 2008

[35] *China Renewable Energy Development Overview*, March 2008, Energy Bureau and Energy Research Institute of the NDRC

[36] *Report on the Development of the Photovoltaic Industry in China (2006-2007)*, China Renewable Energy Development Project, June 2008

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The lack of technical standards for wind turbines is a serious issue. Standards should be set at the national level, based on international practices.

In relation to the third recommendation above, the White Paper on China's Energy Conditions and Policies notes, in general terms, that hydro power projects will be developed on the conditions that:

- the environment is protected; and
- problems affecting local people are properly settled (Section IV).

Further detail on these protections would assist.

**Key issues of which potential investors should be aware**

Technical standards for renewable energy products in China may not be the same as standards in other countries. In some cases standards have yet to be developed or are not regularly enforced. Foreign investors in renewable energy manufacturing industries may wish to consider adopting and promoting the standards used in their country of origin.

## 3.8 Resource data

### Introduction

Electricity generation from renewable sources can be very sensitive to small changes in the renewable resource. It is important to make investment decisions based on the best available data on the availability of the selected renewable energy, whether that be wind, sunlight, water flow or available biomass fuel.

The Renewable Energy Law provides that national resource surveys should be conducted, and the results made public.

**Relevant provisions of the Renewable Energy Law**

**Article 6** — Energy authorities of the State Council are responsible for organizing and coordinating national surveys and management of renewable energy resources, and work with related departments to establish technical regulations for resource surveys.

Relevant departments of the State Council, within their respective authorities, are responsible for related renewable energy resource surveys. The survey results will be summarized by the energy authorities in the State Council.

The result of the survey of renewable energy shall be released to the public, with the exception of confidential contents as stipulated by the Government.

**Article 24** —The Government budget establishes renewable energy development fund to support the following:

(1) Scientific and technological research, standard establishment and pilot project for the development and utilization of renewable energy;

(2) Construction of renewable energy projects for domestic use in rural and pasturing areas;

(3) Construction of independent renewable power systems in remote areas and islands;

(4) Surveys, assessments of renewable energy resources, and the construction of relevant information systems;

(5) Localized production of the equipment for the development and utilization of renewable energy.

### Current status of resource assessments

The Development Plan goes some way towards the resource assessment goals set out in the Renewable Energy Law by noting the potential resources of hydropower, biomass energy, wind energy, solar energy and geothermal energy. However, this information is not detailed.

The White Paper on China's Energy Conditions and Policies notes that the Government has earmarked special funds for a renewable energy resource survey (Section IV). The NDRC has completed an assessment of China's hydro power resources, including estimates of the remaining hydro power resources. In 2008 the NDRC conducted a national wind energy resource investigation, wind site assessment and biomass energy resource assessment.[37] As of January 2009, the results of this assessment were not publicly available in English.

[37] *China Renewable Energy Development Overview*, March 2008, Energy Bureau and Energy Research Institute of the NDRC

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## Outstanding issues

| RECOMMENDATION FROM JUNE 2007 REPORT |
|---|
| ▪ Implement a national approach to resource assessment such as wind mapping. Conduct training in resource assessment and make methods and results available to developers. |

While the Government has undertaken some resource surveys, it would assist if detailed results were made more widely available and if resource assessment methods were disclosed. To be most helpful, assessments should take into account not just the physical resource, but also factors such as terrain, traffic, proximity to grid, proximity to sources of demand for energy, infrastructure and social conditions.[38]

**Key issues of which potential investors should be aware**

Not all publicly-available renewable energy resource assessments are complete and up-to-date. Investors may need to conduct some level of resource assessment themselves before committing to renewable energy projects, in order to obtain recent, detailed data on the resources at their proposed sites.

[38] "Rapid development of wind power market in China", presentation by Shi Pengfei of the Chinese Wind Energy Association at the Clean Energy Council Conference, Gold Coast 24 November 2008

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# 4. Wind power – key issues

## 4.1 Wind power capacity

While there has already been significant development of wind power in China, there remains substantial potential for further wind power projects in several provinces. However, not all of this resource potential is ideally located with respect to load centres and grid infrastructure. The table below sets out some estimates of installed capacity and potential wind power capacity in various provinces. (Note that installed capacity is expressed in megawatts and potential capacity is expressed in gigawatts.)

**POTENTIAL AND INSTALLED WIND POWER CAPACITY IN PROVINCES**

| PROVINCE | POTENTIAL (IN GW) | INSTALLED (IN MW) |
|---|---|---|
| Beijing Municipality | N/a | 49.5 |
| Tianjin Municipality | N/a | 1.5 |
| Hebei Province | 77.9 | 491.45 |
| Shanxi Province | 49.3 | 5 |
| Inner Mongolia Aut. Region | 786.9 | 1563.19 |
| Liaoning Province | 77.2 | 507.81 |
| Jilin Province | 81.2 | 612.26 |
| Heilongjiang Province | 219.5 | 405.25 |
| Shanghai Municipality | N/a | 28.9 |
| Jiangsu Province | 30.3 | 293.75 |
| Zhejiang Province | 20.8 | 47.35 |
| Fujian Province | 17.5 | 237.75 |
| Shandong Province | 50.1 | 350.2 |
| Henan Province | 46.8 | 3 |
| Hubei Province | 24.6 | 13.6 |
| Hunan Province | 31.4 | 1.65 |
| Guangdong Province | 24.8 | 287.39 |
| Hainan Province | 8.2 | 8.7 |
| Gansu Province | 145.6 | 338.3 |
| Ningxia Aut. Region | 18.9 | 343.2 |
| Xinjiang Aut. Region | 437.3 | 299.31 |
| Hong Kong | N/a | 0.8 |
| Source: CREIA | **Total** | **3236** |

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## 4.2 Recent developments and major projects

Wind power capacity in China increased by 127% from 2007 to 2008. By the end of 2008, installed wind power capacity reached approximately 12.8 GW, according to a report by the China Electricity Council.

The wind power industry in China is dominated by five big State-owned electric power companies, which are required to have a certain percentage of renewable energy in their portfolios (see section 3.1).

**Case studies**

- One of the most important wind farm development areas is Inner Mongolia, which generates approximately 40% of the national total wind power. Installed wind power reached approximately 1563 W at the end of 2007 and is estimated to reach 30 to 40 GW by 2020. Several gigawatt-size wind farms have been identified in the region.
- The area with the second largest wind power potential is the three North-east provinces. The total wind turbine installation amounts to 1524 MW with expected installation to reach 10 to 15 GW by 2020. Three gigawatt-size wind farms have been identified in the region.
- The third largest potential wind power area is in Gansu. Current power generation is approximately 145 GW. Total wind power installation is 338 MW. The provincial government is attempting to develop a 20 GW wind farm by 2020. A 5 GW project has been approved and a 3.6 GW project has passed the bidding tender process.
- The region with the fourth-highest wind potential is Jiang. The Government has indicated that it wishes to build a 20 GW wind farm there by 2020. To date, approximately 294 MW of wind power has been installed.

## 4.3 Tariffs for wind power

Wind power prices are intended to be set by the government in the form of a feed-in tariff, as noted in section 3.2. In principle, this regulation should apply to all the projects. However, there is a vast difference in wind resources and individual projects across China. In practice, the regulation is only applied to national concession (tender) projects. After the release of the NDRC Price Measure, several price establishing methods, pertaining to non-concession projects, were approved.

1. *Non-concession projects following the concession prices*: Individual projects that have not been developed as national concession projects but which present similar resource conditions and terrain may apply for the development right and authorisation by the NDRC under the concession program by promising to accept the price already determined under a national concession project. Examples of projects where this has occurred include projects in Jiangsu, Inner Mongolia, Jilin and Gansu provinces. In Jiangsu Province, a series of projects have been approved by this method. Developers accepted the online reference price level established by concession projects and projects were subsequently approved by local government authorities.
2. *Local tender*: The local tender price level is generally higher than the national tender price, estimated to be 5-10 cents more per kWh. Local tendering is generally organized by the Provincial Development and Reform Committee or county government organizations, and is for projects up to 50 megawatts only. Examples of provinces which have established a wind power tariff through tendering include Fujian, Inner Mongolia and Shandong and Hebei provinces.
3. *Price approved by the local government*: Pricing at a local level can often be influenced by lobbying the appropriate government departments in charge of project and pricing approval. For example in Jilin and Inner Mongolia some project tariffs were approved by the local government despite there being a national concession tender price that could act as a reference. Other projects were approved by the central government. In Liaoning, Shandong, Heilongjiang and Fujian Provinces local governments also adopted tendering as a pricing method for projects, without using a standardised reference tender price.
4. *Set tariff in Guangdong*: In Guangdong province, a unified "Feed-in tariff" is available for wind power projects. All projects, including those that are not national wind power concession projects, are able to access the feed in tariff. In March 2008 the tariff was raised to 0.68 Yuan per kWh. No other province has a specifically identified tariff.

National concession projects are large projects awarded by tender, for which the Central Government often gives favourable terms. The national concession price is, theoretically, only applicable to these tendered projects, but due to tariff alignments the national concession price may also affect other wind power projects close to the national concession projects. Other types of renewable projects however are unlikely to be affected by national concession projects policies.

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Usually, project owners submit project documents, which include suggested tariffs, to the provincial department in charge of energy (generally the transportation and energy division of the provincial development and reform committee). The government departments in charge of approving pricing are the Pricing Department of the NDRC and the provincial Bureau of Commodity Prices. The difference between the preliminary opinion of the Bureau of Commodity Prices and the final approved tariff is normally determined by discussion. When approving a power project, the NDRC and the local Bureau of Commodity Prices normally recommend a tariff. When the project construction is completed the tariff takes into account the actual construction cost.

The wind power pricing system is very complicated. However, in summary there are two channels to establish the wind power price:

- Bidding price – there are currently 4 phases of bidding with a total of 2400 MW generated by approximately 15 projects. These projects are national wind concession projects and are priced from 0.38 Yuan/kWh to about 0.519 Yuan/kWh. The average price of bidding projects calculated at the end of 2007 is 0.471 Yuan/kWh with 8.5% of valued added tax (***VAT***) by end of 2007.
- Prices adopted by local price bureaus at the provincial level. The price is mainly based on the wind resource with some reference to the bidding project price. The price ranges from 0.42 Yuan/kWh to 0.78 Yuan/kWh with an average price of approximately 0.59 Yuan/kWh.

The wind price includes 8.5% of VAT. Local approval prices are generally higher than the prices under the National Bidding program, with an average difference of 0.12 Yuan/kWh.

The highest price paid is for a project located in Shandong, which pays approximately 0.681Yuan/kWh. The lowest price paid is a project located in Jiangsu where all the prices come through the bidding channel. The current wind power prices in various provinces of China are shown in the tables in Appendix 3.

In 2007 and 2008, the Pricing Division of the NDRC approved prices for more than 60 wind power projects, in more than 10 provinces/ cities, taking into account the renewable energy resources of the area and the construction costs. Prices differ between regions, but are generally consistent for projects within the same region. Tariffs fixed by the NDRC in this way tend to be higher than prices established under tender for concession projects, but are still lower than wind power prices in other countries.

The table below compares prices set by tender for concession projects to the prices set by the NDRC for wind power in different areas.

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**PRICES FOR WIND POWER PROJECTS – CONCESSION AND FIXED**

| REGION | CONCESSION TARIFF | TARIFF FIXED BY NDRC | |
|---|---|---|---|
| Inner Mongolia | 0.382-0.5216 | West 0.51 | East 0.54 |
| Hebei | 0.5006-0.5510 | North 0.54 | South 0.61 |
| Jilin, Shandong, Liaoning, Heilongjiang, Henan, Shanxi and Hubei | 0.509-0.52 | 0.61 | |
| Gansu | 0.4616-0.5206 | 0.54 | |
| Ningxia | NA | 0.56 | |
| Xinjiang | NA | 0.51 | |
| Fujian | NA | 0.585 | |
| Jiangsu | 0.4365-0.4877 | NA | |
| Guangdong | 0.5013 | 0.68 (set by local government) | |

Source: based on the website of NDRC. Tariffs include VAT.

At a provincial level, pricing has also become increasingly standardised for projects within the province, by way of a unified tariff. Uniform prices set by individual provinces have been used as a standard and are expected to indicate price trends in approved wind projects.

In addition, trends in awarding tenders indicate the highest and lowest bids will be deleted and the bid closest to the median will determine the final concession price.

When a tariff is applied to either a national concession project or a non-concession project, it is applied for 30,000 hours. This is only applicable for wind projects.

To date, most foreign investors have adopted a joint venture model with domestic partners for wind power development. However, the approved tariff is not affected by whether the development is owned by domestic or foreign investors.

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## 4.4 Other issues

**Key issues of which potential investors should be aware**

Some general information is available on wind resources in China. Jiangsu, Inner Mongolia, Jilin and Gansu provinces are the most important wind farm development areas. However, other provinces including Xijiang, which is the second largest wind resource region in China, Fujian and Guangdong are also attractive wind development areas. However, there is an urgent need to develop detailed wind resource assessments, incorporating consideration of factors such as terrain, traffic, proximity to grid, proximity to sources of demand for energy, infrastructure and social conditions.[39]

Availability of land near major sources of demand is increasingly an issue. In Inner Mongolia, Gansu and Xinjiang, there are good wind resources and available land, but not much demand. The efficient transmission of wind power to centres of demand is crucial, and improvements may be required to the grid infrastructure to achieve this. Power grid issues will be the major constraint.[40]

The goals in the Development Plan are to increase wind turbine installation to 10 GW by 2010 (already achieved) and 30 GW by 2020. However, it is likely that the total installation will be greater than these amounts, and it may reach 25 GW by 2010 and 100 to 150 GW by 2020. Revised targets may be announced soon.

Recent rapid growth in the wind power sector has been associated with turbine unreliability and underperforming wind power projects. The industry is starting to address this by doing further testing.

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[39] "Rapid development of wind power market in China", presentation by Shi Pengfei of the Chinese Wind Energy Association at the Clean Energy Council Conference, Gold Coast 24 November 2008

[40] "Rapid development of wind power market in China", presentation by Shi Pengfei of the Chinese Wind Energy Association at the Clean Energy Council Conference, Gold Coast 24 November 2008

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# 5. Undertaking a project in China – broader issues

## 5.1 Corporate structuring

### Possible investment structures

Foreign investors keen to enter the renewable energy market in China may, under current Chinese laws and regulations, only do so under a joint venture (***JV***) arrangement in China and not as a wholly foreign owned enterprise (except in certain encouraged industries), or under an arrangement which combines both structures. Determining which JV investment structure will be adopted and being alert to the advantages and disadvantages of each will be essential to effectively manage business and legal risk.

China has a number of national laws relevant to JV foreign investment and the renewable energy industry. The types of corporate structure available to foreign investors in China are:

- Representative office;
- Equity joint venture (***EJV***);
- Contractual joint venture (***CJV***); and
- Wholly foreign-owned enterprise (***WFOE***).

### JV structure – distributing profit

The different features and requirements that apply to EJVs and CJVs are significant for investors seeking to undertake renewable energy projects in China. CJVs may provide a flexible structure via which investors might make their contributions to registered capital, manage the JV, and distribute its profits. By contrast, EJVs are typically viewed as less flexible than CJVs. For instance, management control and profit distribution are typically proportionate to each party's respective contribution to the EJV's total registered capital.

For both CJVs and EJVs, however, central government regulations may influence and/or determine significant factors, such as the amounts of the parties' capital contributions to the JV, the types of foreign investors that are permitted to invest in certain types of projects, and the type of JV structure which might be used for foreign investment in certain sectors. For instance, in CDM projects, the percentage of foreign shareholding is restricted and, currently, only EJV structures can be used.

### JV structure – managing joint ventures

Foreign parties should be aware of certain management issues associated with a JV structure. For example, under relevant laws and regulations in China, changes to the JV's amount of registered capital, as well as changes to the articles of association and JV Contract, may be made only with unanimous consent of the JV's board of directors.

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These requirements might pose a problem in a situation where, for example, one investor wishes to add capital to the JV and the other partner does not.

An advantage of a CJV is that, subject to approval by the relevant government authorities, it may be possible for the foreign investor to achieve early recoupment of the capital that it has invested. In an EJV, on the other hand, investors usually cannot recover their capital, except in certain circumstances, which might include liquidation of the JV, transfer of their equity interest in the registered capital of the JV, which would require government approval and is subject to the other JV partners' pre-emptive rights, or reduction of the JV's registered capital, which is subject to approval by the relevant government authorities (such approval is often difficult to obtain).

### WFOE structure

Foreign investment in the construction and operation of power stations using new sources of energy (including solar energy, wind energy, magnetic energy, geothermal energy, tidal energy, biomass energy and so on) is encouraged by China's foreign investment policies, and the establishment of WFOEs in such industries is permitted.

A WFOE can be a limited liability company or, upon approval by the relevant Chinese government authorities, may take another form. Currently, most WFOEs in China are established by a single foreign investor, although the relevant regulations allow two or more foreign investors to apply jointly to establish a WFOE.

Foreign investors often prefer WFOEs, since, unlike for an EJV or a CJV, there is no requirement for the investor to partner with a Chinese party. Thus, the WFOE provides foreign investors with the opportunity to completely control and manage the daily operations of the entity.

### Acquire shares or assets?

A JV could result from a foreign investor buying into an existing domestic Chinese enterprise by acquiring an equity interest in the registered capital of that enterprise. Alternatively, the foreign investor and the investors in the Chinese enterprise could agree to jointly establish a new EJV or CJV.

If the parties opt for a buy-in by the foreign investor, the equity acquisition should be structured to address hidden liabilities. Such hidden liabilities might include the tax liabilities arising from the enterprise's operation prior to the buy-in, and the feasibility of the effective assignment of all business contracts, government permits and concessions.

Regardless of whether a foreign investor opts to establish a new enterprise in China or to acquire interests in or assets of an existing enterprise in China, it will be subject to approval by the relevant Chinese government authorities and to applicable requirements under relevant laws and regulations in China concerning limits on foreign investor shareholding, permissible shareholding structures, required registered capital amounts, and anti-trust filing requirements. In addition, it will be important for the foreign investor to know if the transaction involves any state-owned assets, since the sale of state-owned assets is subject to a special regulatory regime in China.

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## Taxation

For JVs and WFOEs (collectively, foreign investment enterprises or ***FIEs***) that were approved and established before 16 March 2007, the following tax principles apply:

> An FIE is subject to 30% national income tax rate, plus a 3% local income tax rate. Manufacturing FIEs with a term of 10 years or more are eligible for a 100% tax exemption for the initial two profit-making years and a 50% reduction during the subsequent three years. Longer tax holidays are available to export-oriented enterprises and technologically advanced enterprises. Even more preferential tax incentives are available in certain development zones and for special industries.

No withholding tax is levied on dividends remitted to the foreign investor outside of China. A 10% withholding tax applies to royalties, rental and interest income. FIEs are also subject to other taxes, including value added tax, business tax, real estate tax, land value added tax, customs duties, stamp tax and vehicle and vessel license tax. Whether a particular FIE will be subject to all or some of these taxes depends on the nature of its activities.

## Foreign exchange controls

There are limits on the amount of foreign exchange that an FIE may borrow. These limits will vary and will depend primarily on the particular financial, total investment, and registered capital circumstances of the FIE.

FIEs are subject to "debt-equity" ratio requirements which regulate the percentage of registered capital which must be paid in by the investors in WFOEs and JVs. For example, where the total investment for an FIE is more than US$3 million but less than or equal to US$10 million, at least 50% of the total investment must be in the form of registered capital (which must be paid in to the FIE by its investors).

Investors' capital contributions to FIEs can take the form of cash, machinery, equipment, industrial property, proprietary technology or, upon approval, Renminbi profits derived from their other investments in China. It will be important to ensure that the non-cash contributions are appropriately valued.

One of the reasons many investors consider utilizing a CJV instead of an EJV is that the investors are able to make their contributions to the JV in forms other than those typically allowed for an EJV. For example, the Chinese party to a CJV might, as part of its contribution to the registered capital of the CJV, locate and pay for the local labour required by the CJV.

## Debt financing restrictions for foreign companies

Currently, foreign companies are limited to a maximum of 66% debt financing of the capital cost of a project (compared to domestic projects which are permitted 80% debt financing), a restriction which automatically results in a lower return on investment for foreign companies over the life of the project. It has been reported that lower than anticipated leveraged rates of return for development, construction and operation of projects is adversely affecting foreign investment in new renewable energy facilities.

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## 5.2 Project approvals

In China, different categories of projects (encouraged, permitted, restricted or prohibited) are subject to different government approval requirements. The table below summarises these requirements.

**FOREIGN INVESTMENT CATEGORIES AND APPROVAL REQUIREMENTS**

| | FOREIGN INVESTMENT CATEGORIES | TOTAL INVESTMENT (INCL. ANY CAPITAL INCREASE) | VERIFICATION AND APPROVAL AUTHORITY |
|---|---|---|---|
| 1 | Encouraged or permitted | US$500 million or above | State Council |
| | Restricted | US$100 million or above | |
| 2 | Encouraged or permitted | US$100 million – US$500 million | NDRC and Ministry of Commerce at the central level |
| | Restricted | US$50 million – US$100 million | |
| 3 | Other foreign investment projects | | Local counterparts of NDRC and Ministry of Commerce |

The effect of these categorisations is to streamline the approval requirements for, and thereby encourage, those projects that are seen as high priority projects for Chinese development (in encouraged, and to a lesser extent, permitted categories). Renewable energy projects can benefit from these distinctions, since for the most part such projects are encouraged and therefore subject to less stringent requirements.

The category of 'encouraged' projects includes the following project types:

- Construction and operation of power stations using technology for clean burning of coal;
- Construction and operation of thermo-electric cogeneration power stations;
- Construction and operation of hydroelectric power stations; and
- Construction and operation of power stations using new sources of energy (including solar energy, wind energy, magnetic energy, geothermal energy, tidal energy, biomass energy etc).

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## 5.3 Clean Development Mechanism (CDM)

### Introduction

The CDM is intended to be, among other things, a vehicle for investment and technology transfer between developed countries and developing countries including China. However, the international rules concerning the CDM as well as China's domestic CDM legislation have resulted in some barriers which must be overcome if the CDM is to be a meaningful driver for significant market growth in the renewable energy sector. Renewable energy investors in China seeking to develop renewables projects under the CDM should also be aware of some practical issues and difficulties that should be considered early in the project cycle, as well as some specific corporate structuring requirements for CDM projects in China.

### International CDM rules

*Additionality* is a key eligibility criterion, and must be proved using the "additionality tool" provided by CDM Executive Board. Chinese policies encouraging renewable energy (e.g. the Renewable Energy Law) are not to be taken into account when assessing baseline (type E- under CDM rules). This benefits developers in China because it is easier to meet the requirement of additionality. Developers should consider additionality early and document the decision-making process to enable them to substantiate additionality arguments later.

However, Chinese policies and regulations encouraging renewable energy are not to be taken into account when calculating the baseline scenario (this is known as 'Type E-additionality'). The baseline is calculated as the hypothetical scenario without the regulations being implemented. This benefits developers in China because it is easier to meet the requirement of this additionality.

Developers should consider additionality early and document the decision-making process to enable them to substantiate additionality arguments later.

Host Countries (i.e. the Chinese Designated National Authority) must issue approvals of potential CDM projects confirming their contribution to the country's "sustainable development". Entities wishing to receive certified emissions reductions (***CERs***) directly must also obtain authorisation from a developed country that is party to the Kyoto Protocol.

### Chinese CDM rules

CDM regulations in China impose a number of specific requirements on renewable energy projects conducted as CDM projects.

#### Corporate structuring

In relation to corporate structuring, the Chinese CDM rules impose restrictions on the involvement of foreign companies in Chinese projects. Specifically, the rules state that only enterprises in China which are wholly Chinese-owned or those in which the

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Chinese party or parties hold a controlling interest (i.e. at least a 51% stake) may undertake CDM projects with foreign parties. This is understood to mean that the Project Entity must be a Chinese individual or entity or controlled by a Chinese individual or entity.

It has been reported that this restriction is resulting in a number of projects not being developed, as many investors are unwilling to cede control of a project to an unknown or inexperienced domestic partner. This is particularly the case for large projects which need strong operational skills and experience to ensure profitability.[41]

The CDM rules also impose restrictions on the form of joint ventures that can be used for CDM projects in China. Currently, only equity joint ventures will be approved by Chinese Government authorities; cooperative joint ventures cannot be used at this time.

### Terms of emissions reduction purchase agreement (ERPA)

In addition, the Chinese CDM rules provide that Chinese government authorities, principally the NDRC, must review and approve the terms on which CERs are sold and the contents of the CER sale agreement. This review includes approval of the specific buyer and the specific price at which CERs are sold under the ERPA or other CER sales agreement.

In its implementation of the CDM Measures, the Chinese government has effectively set a "minimum floor price" for the sale of CERs in China, which is currently €8.00. The Chinese Government has stated that in conducting its mandatory review of the terms of CER sale agreements, it will not approve CDM projects with a CER price lower than these floor price amounts. Moreover, since the NDRC generally takes the unit price agreed under an ERPA as the minimum unit price to be paid by a buyer of CERs generating by the project covered by that ERPA, the Government may not be willing to approve ERPAs which contain provisions where under an agreed unit price could be reduced.

While these provisions appear to limit the ability of CDM project participants to determine prices, in practice the Chinese Government has allowed some flexibility where justified by the particular contractual arrangements. For example, where the buyer's contribution to the CDM project is comprised both of payments for CERs and technology or consulting services, the Government may approve a purchase price that is lower than the established floor price.

### Preferential tax treatment

Finally, the Chinese CDM rules also provide for preferential tax treatment for renewable energy projects. The tax on renewable energy projects is just 2% of total CER benefits, while revenues from HFC-23 (industrial gas) projects, which have a lower sustainable development benefit, are taxed at 65%. The funds collected from these taxes are contributed to a fund used to finance sustainable development in China.

[41] O'Flynn, B "A Study on the Pricing Policy of Wind Power in China: Airtricity Comments and Perspectives"

## Renewable energy and the CDM – what are the issues?

Despite the favourable tax treatment of renewable energy-derived CER revenues in China and the ever-expanding opportunities for carbon financing, renewable energy projects still face some unique hurdles that should be considered by project proponents.

### Lower emissions reduction potential of renewable energy projects

Firstly, due to the differentiated global warming potentials of greenhouse gases (carbon dioxide, which is displaced by renewable energy, being the least "potent" in terms of its global warming effect), the volume of emission reductions from renewable energy projects is much smaller per unit of output than the volumes created by projects which abate other greenhouse gases such as nitrous oxide, HFC or methane. Conversely, the equipment cost of most renewable energy projects is significantly higher per emission reduction than the cost of other types of potential CDM projects, such as agricultural methane flaring projects. The overall contribution of the revenue stream from CERs is therefore comparatively smaller for renewable energy projects than for other types of potential CDM projects.

As the CDM is essentially a market, CDM project equity investors will tend to go to where "manufacturing costs" are cheapest, and purchasers will tend to seek out a plentiful supply of CERs for minimum transaction costs. Renewable energy projects are therefore at a comparative disadvantage in the CDM compared to projects which reduce other types of greenhouse gases.

### Long lifespan of renewable energy plant / short commitment period

In addition, renewable energy projects such as wind farms have a long operation life, which (for projects being constructed today) will extend far beyond the Kyoto Protocol's first commitment period. There is uncertainty as to whether the Kyoto Protocol will be continued beyond the end of its first commitment period (i.e. 2012). CER purchasers have therefore been reluctant to make binding commitments to purchase CERs post-2012, such that the financial incentive created by CERs has in many cases been insufficient to support renewable energy projects for their entire operational life.

## Effect of these issues on renewable energy projects

As a result of the issues discussed above, many renewable energy projects which may be eligible under the CDM have had difficulty attracting project finance to support the projects. CER purchasers have tended to restrict their involvement in CDM projects to a commitment to pay for CERs upon delivery, rather than provide financial support for the underlying project. Registration as a CDM project does not necessarily mean that a renewable energy project will achieve project finance and become operational. Issues such as perceived regulatory and political risk in developing countries and the higher level of technology risk involved in renewable energy projects (as opposed, for example, to traditional fossil fuel projects) have meant that those renewable energy projects which have achieved external finance have tended to be smaller scale projects, rather than projects to create the optimum number of CERs.

Therefore, the transaction costs of developing projects as CDM projects (including the costs of external auditors, registration fees, consultants' fees and legal fees for the negotiation of CER purchase agreements and power purchase agreements) may be prohibitively high compared to the volume of CERs expected to be generated by the projects.

Some local host country regulations (such as grid connection, distribution or electricity tariff arrangements) may not provide renewable energy projects with the priority or support needed to make them feasible in the existing electricity market. In China, however, additional policy support for renewables provides unique double financing opportunities and other avenues of financial support.

## How these issues are being addressed

A number of important steps have already been taken which should mitigate some of these barriers.

### Taxation measures

One of the most innovative steps is China's differential tax treatment of renewable energy projects as compared to other projects that are less beneficial for sustainable development – a system that is the first of its kind in domestic CDM regulation worldwide.

### Bundling CDM projects

The international CDM rules now explicitly allow the "bundling" of large-scale projects (not just small-scale projects) to further reduce transaction costs. This additional flexibility in the CDM rules should reduce transaction costs for renewable energy projects.

### Programmatic CDM

Programmatic CDM projects have the potential to assist in overcoming some of the barriers to renewable energy projects carried out under the CDM. Although local, national or regional policies and standards cannot be registered as CDM projects, small greenhouse gas reduction activities carried out under a formal program of activities can be collectively registered as a single CDM project activity. This facility is known as "programmatic CDM".

Programmatic CDM involves the aggregation of a number of small greenhouse gas reduction activities into a larger program, which is then submitted to the CDM Executive Board as a single activity (using one baseline and monitoring methodology). The facility is designed to overcome the cost barriers identified above, which are particularly prohibitive for small renewable energy projects, and which might otherwise prevent small projects from being implemented.

Small renewable energy projects which are implemented as part of a "program of activities" (e.g. the installation of solar lighting in a community or the financing of a number or biomass plants in rural areas) can now be eligible under the CDM as a single project.

As another example, the costs of a CDM project involving the conversion of a small number of vehicles to biofuels would only generate a small number of CERs, and so would not be economically viable even with the generation of additional carbon revenue. If, however, the project could be expanded to involve the conversion of multiple fleets of public transport vehicles, the number of CERs generated may be sufficient to offset the costs of the project and enable it to be implemented.

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## 5.4 Protecting intellectual property

### Introduction

A major concern for many companies entering China is ensuring adequate protection of intellectual property (***IP***). In fact, it is a common misconception that there is no IP law in China. However, China introduced its first IP laws in the mid-1980s and has since updated them in conformity with its international obligations under the World Trade Organisation (to which it acceded in 1994) and the Madrid Protocol (to which it became a party in 1995). China has comprehensive legislation in place dealing with trademarks, copyright and patents, with the latter covering design patents (often called industrial designs), invention patents and utility patents. Despite the promising content of the black-letter law, enforcement difficulties remain the principal issue for IP owners.

### Obtaining protection: trademarks

Trademarks are primarily governed by the *Trademark Law of the PRC*, as amended in 2001. The responsible government agency is the China Trademark Office. Registration of trademarks is vital since China adopts a "first-to-file" system. This means that the person who gets their trademark application in first is entitled to register it. In comparison, the person who uses a trademark first is entitled to register in Australia.

A mark is *prima facie* registrable in China if it is a visually perceptible sign capable of distinguishing the goods of one natural person, legal person or other organisation from those of another. In order to file a trademark application, a Chinese government-approved trademark agency must act on your behalf and can only do so with a signed power of attorney. Furthermore, the applicant must provide its name and address in Chinese. It typically takes up to two years to obtain a trademark registration in China, with protection generally effective on the date of registration, rather than retroactive to the filing date (as is the case in Australia and many other countries). Once registered, protection is afforded for ten years and can be renewed for successive ten year periods.

Registration confers upon the owner the exclusive right to use and exploit a trademark in relation to the goods or services in respect of which use of the mark is approved. The law permits trademark owners to licence others to use the mark or to transfer ownership of the mark. Where a licensing arrangement is entered into, it is important to remember that the owner of a trademark is responsible for the quality of the goods on which the mark appears.

### Obtaining protection: patents

The main legislation dealing with patents is the *Patent Law of the PRC*. Local patent administrative offices are responsible for processing patent applications and enforcing patents, while the State Intellectual Property Office issues all final approvals. Patents are granted on a "first-to-file" basis rather than a "first-to-invent" basis.

There are three types of patents in China:

- *design patents* are used to register a new design of a shape or pattern;
- *invention patents* are used to register new technical solutions for a product or process; and
- *utility patents* are used to register new technical solutions related to shape or structure.

Invention patents are likely to be most relevant in a renewable energy context. For eligibility, these patents require novelty, inventiveness and practical applicability.

As is the case with trademark applications, patents can only be obtained via a state-approved patent agent. Although only a preliminary examination by the patent administrative office is required for design and utility patents, a supplementary substantive examination is conducted for invention patents. Patent registration can be obtained for design and utility patents within as little as twelve to eighteen months and is valid for ten years. It can take up to three years for registration of invention patents, which remain valid for twenty years. Notably, protection is afforded from the application filing date, provided that annual maintenance fees are paid.

A patent owner has the exclusive right to make, use, offer for sale, sell or import the patented product or process. Patents and the right to apply for a patent are assignable. A licence is required for third party use of a Chinese registered patent in China and must be registered with the State Intellectual Property Office.

If registration is not obtained, control over overseas patents in China must be exercised through contractual provisions. Registration is highly recommended, however, since contractual provisions do not provide the same degree of protection or possible remedies.

## Obtaining protection: copyright

The *Copyright Law of the PRC* governs copyright protection in China and the responsible government agency is the National Copyright Association. Works attracting copyright protection include written works, oral works, graphic works such as drawing of engineering designs and product designs, schematic drawings, model works, and computer software.

Registration is not required for copyright protection, although it may be desirable for enforcement purposes. Copyright automatically vests in works of Chinese citizens, legal persons and other organisations. Since China is party to the Berne Convention, works originating in Australia (which is also a party) are given at least the same level of protection in China as that given to works created by Chinese citizens.

Copyright is generally owned by the author of a work. However, where the creation of a work is sponsored by, represents the will of, and is the responsibility of a legal person or other organisation, that legal person or other organisation is deemed to be the author. A citizen's rights in respect of his or her work – which include publication, reproduction, distribution and sale – are protected for the life of the author plus fifty

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years. Works of legal persons or other organisations are protected for fifty years from first publication.

Copyright is capable of being assigned or licensed. It is not a legal requirement that licences be registered, although it is often considered prudent to do so.

### Enforcement issues

IP enforcement remains an issue in China despite improvements in the legal regime. In particular, there may be concerns about the adequacy of remedies, the ability and willingness of the relevant authorities to control ongoing infringements and local protectionism. The Chinese Government at higher levels widely and openly recognises the problems associated with local protectionism. Its occurrence is nonetheless often reported and is facilitated in part by the fact that most administrative enforcement authorities are funded by local governments rather than national authorities.

In China, IP rights can be enforced through administrative agencies, through the civil courts or via criminal action. Administrative enforcement procedures tend to be most effective for prompt and inexpensive action against small infringers. However, there is normally not financial compensation for losses and fines are generally very low, meaning that deterrence is not always achieved.

Civil litigation, on the other hand, is a useful method to take action against large, well-organised infringers. Possible remedies include compensation and an injunction. The court system's handling of IP disputes has improved dramatically, although there continue to be problems with inconsistency and the lack of judicial training in technical issues. Foreign plaintiffs also encounter difficulties and high costs in fulfilling procedural requirements imposed by the courts (e.g. translation of all foreign-sourced evidence). There have also been complaints about the lack of discovery and other valuable means for gathering evidence.

Criminal action may be taken by requesting the police to investigate. Counterfeiting a patent and infringing business secrets are crimes punishable by up to seven years' imprisonment. Again, however, there may be issues with bias and lack of training in the judiciary.

### Techniques to maximise protection

IP rights are generally territorial, meaning that registration of a trademark or patent in, say, Australia, does not automatically result in protection in China. It is important to note that China, Hong Kong, Macau and Taiwan are separate jurisdictions for the purpose of IP protection and therefore have separate systems of registration. Here we focus on China's system.

For maximum protection, trademark and patent applications should be filed as early as possible, and preferably well before entering the Chinese market. Although it is not legally necessary, trademark owners should register and actively use a Chinese-language counterpart for English language trademarks since Chinese consumers tend to refer to the Chinese versions of foreign brands.

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Regular due diligence is required to ensure that registrations are in place for all relevant pieces of IP and have not lapsed. Rather than solely relying on the authorities to deal with potential infringements, IP owners should actively monitor their rights. IP owners are normally advised to send a strong message from the start by taking "zero-tolerance" approach to IP infringements.

The theft of trade secrets – including both patented and non-patented technology and other valuable business information – is of particular concern where a foreign company has established a joint venture or licensing relationship with a Chinese partner. Business partners and employees should be selected carefully and practical steps may be taken to maintain confidentiality. Such steps could include teaching employees about IP rights and utilising physical security measures. It is particularly important to ensure that contracts with business partners and employees are stringently drafted in order to deter theft of IP and to ensure maximum protection under local law.

China is making concerted efforts to address IP enforcement issues through raising public awareness, establishing the necessary institutions, educating personnel and imposing harsher penalties. The attitude at the top levels of the Chinese Government is encouraging, with a definite realisation that stringent protection of IP rights is vital to encourage foreign investor confidence. Nonetheless, the full implementation of China's relatively comprehensive IP laws will require a great deal of effort and expenditure.

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# 5.5 Project planning and implementation

## Introduction

Practical issues associated with the implementation of a project can be the difference between a viable project and an unprofitable one. The availability of the necessary renewable resources, a site for the project with appropriate land tenure, obtaining necessary project approvals and having arrangements in place to ensure the project outputs can be sold at the right price, are all essential factors in any renewable energy project. Having partners with local knowledge in China and in investing in existing project proposals implemented at a local level can help. Ultimately, as is the case for projects undertaken in jurisdictions outside of China, sheer commercial will, good local advice, and early planning, can help to ensure that projects in China overcome the practical and regulatory issues arising when implementing a project.

## Land use rights

In China, there are two types of land ownership – state ownership and collective ownership. Historically, there has been no "private" land ownership in China. State land ownership means the relevant land is owned by the Chinese Government, while collective land ownership means the relevant land is under the control of a local "rural collective of peasants". Basically, land in urban areas is under state ownership, whereas land in rural and sub-urban areas is under collective ownership. The Chinese Government may acquire and convert collective land in rural and sub-urban areas into state land pursuant to a statutory "land requisition procedure".

Commercially speaking, "land use rights" rather than "land ownership" is the relevant legal concept. China's land laws and regulations permit the Chinese government (acting through its local land bureaus) and other land owners to transact "use rights" in their land. Generally, there are four different types of land use rights in China, namely:

- granted land use rights;
- leased land use rights;
- allocated land use rights; and
- collective land use rights.

Granted land use rights are freely transferable – they have a limited duration and require payment of a fee which is normally paid in one lump sum prior to any transfer of the land use rights. Allocated land use rights are not transferable, and may be taken back by the Chinese government without compensation.

Once the type of land use right is known, investors can determine how best to structure the legal arrangements for the planned project.

For construction, the land administration department reviews a feasibility study and issues a pre-certification report. If acceptable, rights to use the land are issued and a land use rights contract is entered into, usually by and between the enterprise controlling the project and the relevant land administration bureau.

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A new Property Rights Law was approved in 2007, which strengthens legal protections for privately owned land. This law creates a registration system for real property ownership and transfer, provides a mechanism for creating securities over property and sets out clearer provisions for enforcement of private property rights. It represents China's first comprehensive national framework for the protection of property.

## Environmental approvals process

Key environmental laws in China are enacted at the national level, with most enforcement and implementation occurring at the local level. As a result, environmental protection laws can be enforced differently in different provinces or municipalities. Local regulations are also allowed to be more stringent than national regulations.

Projects could be impacted by a range of different laws and regulations, including those which govern conservation, pollution, contamination, and employee health and safety. Enforcement of these laws and regulations is undertaken by the relevant government authority and remedies may include warnings, fines, administrative sanctions, civil compensation for losses, restraints on construction or operation, or criminal prosecution.

Generally, environmental laws in China adopt a "polluter pays" approach. However, pursuant to other laws and regulations, liability for pollution on the land can extend to others, especially in cases when the polluter cannot be located or cannot be clearly determined. For instance, companies which acquire or merge with another company that holds land use rights can be held responsible for environmental harm connected with that land – that is, "buyer beware" principles can apply.

Depending on the type and size of the project, environmental assessments are approved by either the State Environmental Protection Administration (***SEPA***) or Environmental Protection Bureaus (***EPBs***) at the provincial or municipal levels.

Since environmental laws are enforced by EPBs at the provincial/municipal level, it can be important to engage local authority support for the project (sometimes this is made easier where the project involves local companies and/or where the project generates local benefits). However, SEPA may suspend approvals for new projects if local governments do not comply with the applicable requirements under environmental laws and regulations, so risks remain even if a project has broad local support.

The following diagram shows the environmental approvals process for projects in China – note that final approval is not granted until after work is commenced, which could be expensive for developers who commence work but do not receive final approval.

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FIGURE 2: ENVIRONMENTAL APPROVALS PROCESS IN CHINA

### Power purchasing agreement / concession contract

It is important to secure a buyer for the energy output and any CERs on terms that take account of regulatory, market or resource risks, as well as meeting any prerequisites for favourable tax treatment, tariffs or other concessions.

Buyers will generally be seeking a renewable energy supply that will comply with regulatory obligations or consumer demand. Therefore, they will want terms that limit or compensate for compliance risks and ensure the buyer will not have financial commitments for energy supply that fall short of expectations. Project proponents (and their financiers) will ordinarily seek to see a secure and constant revenue stream (with tolerable variation for resource, market or regulatory risks).

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# Appendix 1 – Abbreviations

| ABBREVIATION | DEFINITION |
|---|---|
| CDM | Clean Development Mechanism of the Kyoto Protocol |
| CER | Certified Emission Reduction from a CDM project |
| CJV | Contractual Joint Venture |
| CREIA | Chinese Renewable Energy Industry Association |
| Development Plan | Medium and Long-Term Development Plan for Renewable Energy in China, issued by the NDRC in September 2007 |
| DRC | Development and Reform Commission, eg of a province |
| EJV | Equity Joint Venture |
| EPB | Environmental Protection Bureau |
| ERPA | Emissions Reduction Purchase Agreement |
| FIE | Foreign Investment Enterprise |
| June 2007 Report | Report on China's renewable energy law, prepared as part of the RE Law Assist project (discussed in section 1.2). It was circulated in June 2007 and is available at: http://www.bakernet.com/BakerNet/Resources/Publications/Recent+Publications/Renewable+Energy+Law+in+China.htm |
| JV | Joint Venture |
| MRET | Mandatory Renewable Energy Target (Australia) |
| NDRC | National Development and Reform Commission of China |
| NDRC Price Measure | Provisional Administrative Measures on Pricing and Cost Sharing for Renewable Energy Power Generation (NDRC Price [2006] No.7) |
| REC | Renewable Energy Certificate |
| SEPA | State Environmental Protection Administration |
| SERC | State Electricity Regulatory Commission of China |
| SPC | State Power Corporation |
| State Council | National council led by the Chinese Premier, responsible for exercising all powers (unless delegated to provincial governments). The State Council enacts administrative rules. |
| WFOE | Wholly foreign-owned enterprise |

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# Appendix 2 – Summaries of implementing measures, regulations and policies

## 1. Overview of implementing measures

| AREA | SECTIONS OF RENEWABLE ENERGY LAW | REGULATIONS, POLICIES, GUIDANCE AND TECHNICAL STANDARDS |
|---|---|---|
| **Targets** | 4, 7, 9 | Medium and Long-Term Development Plan for Renewable Energy in China |
| **Price Setting** | 19, 22, 23 | Provisional administrative measures on pricing and cost sharing for renewable energy power generation (NDRC Price [2006] No. 7) |
| **Cost Sharing** | 20, 21 | Provisional administrative measures on pricing and cost sharing for renewable energy power generation (NDRC Price [2006] No. 7)<br>Renewable energy surcharge level regulation (NDRC Price [2006] No. 28-33)<br>Provisional regulation on renewable energy surcharge balancing (NDRC Price [2007] No. 44)<br>Temporary measures of additional income regulation of renewable energy power (NDRC November 2007) |
| **Grid Connections** | 21, 29, 30 | Measures on supervision and administration of grid enterprises in the purchase of renewable energy power (SERC [2007] No. 25) |
| **Approvals** | 2, 13 | Guiding catalogue for development of the renewable energy industry (NDRC Energy [2005] No. 2517) |
| **Investment Incentives** | 24, 25, 26 | Provisional administrative measures on the Renewable Energy Development Fund (MoF Economic and Construction [2006] No. 237) |
| **Technical Standards** | 11, 17 | Various – see section 3.7 |
| **Resource Data** | 6, 24 | Not yet established |

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## 2. Overview of regulations

| TITLE | STATUS | DATE | PUBLISHED BY / REFERENCE | TYPE OF RE | DESCRIPTION |
|---|---|---|---|---|---|
| **Provisional administrative measures on pricing and cost sharing for renewable energy power generation** | Provisional | 2006 | NDRC Price [2006] No.7 | All | Sets out the principles for renewable energy power pricing and cost sharing. In particular, it identifies the level of wind and biomass power pricing and clarifies all costs related to renewable energy power that will be covered by the renewable energy surcharge. |
| **Renewable energy surcharge level regulation** | Approved | 2006 | NDRC Price [2006] No.28-33 | All | Establishes the tax-exempt renewable energy surcharge (¥0.001 per kWh) payable by end users of electricity. This cost sharing arrangement mandates that end users pay a proportion of the higher cost of providing renewable energy, as well as the cost of connecting renewable energy facilities to the grid. |
| **Provisional regulation on renewable energy surcharge balancing** | Provisional | 2007 | NDRC Price [2007] No.44 | All | Identifies the procedure for provincial power utilities to collect the renewable energy surcharge, the methodology for allocating this revenue amongst the provinces, and the role of the monitoring body in this process. |
| **Temporary measures of additional income regulation of renewable energy power** | Provisional | 2007 | NDRC, November 2007 | All | Provides definitions and instructions relating to renewable energy additional income, additional taxation, taxation scope, quota trading and cost sharing plans.[42] |
| **Regulation on the administration of power generation from renewable energy** | Approved | 2006 | NDRC Energy [2006] No.13 | All | Sets out approval procedures for renewable energy projects and further identifies the responsibilities of utilities and power generators. Provides that utilities are obliged to allow renewable energy facilities to connect to the grid. |
| **Guiding catalogue for the renewable energy industry development** | Approved | 2005 | NDRC Energy [2005] No.2517 | All | Identifies the renewable energy technologies that will be supported by the government and identifies the economic policy instruments that will apply to these. |
| **Provisional administrative measures on the renewable energy development fund** | Provisional | 2006 | MoF Economic and Construction [2006] | All | Sets out the criteria for the use of the Renewable Energy Development Fund, identifies "priority areas", and provides application and approval procedures. |

[42] *Report on the Development of the Photovoltaic Industry in China (2006-2007)*, China Renewable Energy Development Project, June 2008

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| | | | REFERENCE | OF RE | DESCRIPTION |
|---|---|---|---|---|---|
| | | | No.237 | | |
| **Regulation governing the use of the renewable energy development fund to promote renewable energy integration in buildings** | Approved | 2006 | MoF and MoC [2006] No. 460 | All | Together with the 'Notice on the approach to appraisement of pilot projects for renewable energy integration in buildings', sets out how the Renewable Energy Development Fund will be used to promote the integration of renewable energy in buildings, the application and approval procedures and the criteria for project selection. |
| **Regulation on the management of bio-ethanol projects** | Approved | 2006 | MOF Construction [2006] No. 460 | Biofuel | Sets out the policy for bio-ethanol development, imposes stricter market-entrance standards, project management and supervision requirements, and streamlines the administration system |
| **Regulation of the construction and management of wind farms** | Approved | 2006 | NDRC Energy [2006] No. 1204 | Wind | Obliges local government authorities to develop local wind energy development plans (for facilities smaller than 50MW) according to wind resource availability. The wind tariff is still determined by the State Council through a tender process. |
| **Medium and long-term development plan for renewable energy in china** | Approved | September 2007 | NDRC | All | Sets renewable energy targets by technology type, sets out guiding principles for the development of renewable energy, and notes the national policies and measures to achieve these objectives. |
| **Measures on supervision and administration of grid enterprises in the purchase of renewable energy power** | Approved | 2007 | SERC [2007] No. 25 | All | This regulation requires the national grid authority and national standards authority to draft grid connection and power purchase standards to ensure the safety of the grid when it receives electricity from renewable energy sources. |
| **Rural biomass industry development plan for 2007-2015** | Approved | May 2007 | Agriculture Plan No. 18 [2007] | All | The Ministry of Agriculture will draft a rural bioenergy plan, as required by the Renewable Energy Law, for the development of rural bioenergy for the period 2007-2015. It will cover biogas utilization, biomass power generation and other areas. |

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## 3. Overview of policy guidance

| TITLE | PUBLISHED BY / DATE | TYPE OF RE |
|---|---|---|
| Opinion on the use of the renewable energy development fund to promote the wind industry | NDRC & MoF | Wind |
| Notice to promote the development of the biofuel industry through support for project construction | NDRC & MoF | Biofuel |
| Notice on appraisement approach on pilot projects of renewable energy applied buildings | MoF and MoC, 2006 | All |
| Opinion on fiscal supporting measures to promote bio-energy and bio-chemical industry development | MoF | Biofuel / Biomass |
| Notice to strengthen solar water heating system utilization | NDRC and MoC, 2007 | Solar |
| Subsidy for renewable energy electricity price and quota trade | 2007 | All |

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# Appendix 3 – Wind power tariffs

**Source: CREIA**

### APPROVED PROJECTS AND TARIFFS (BEFORE 2006)

| PROJECTS APPROVED | PRICE (AVERAGE TARIFF IN THE OPERATION PERIOD) YUAN/KWH, INCL TAX |
|---|---|
| Zhurihe, Inner Mongolia | 0.5918 |
| Huitengxile, Inner Mongolia | 0.5918 |
| Shangdu, Inner Mongolia | 0.5918 |
| Xilinhaote, Inner Mongolia | 0.6291 |
| Dale, Inner Mongolia | 0.6574 |
| Zhangbei, Hebei | 0.984 |
| Factory No.1 Dabancheng, Xinjiang | 0.4 |
| Factory No. 2, Dabancheng, Xinjiang | 0.66 |
| Donggang, Liaoning | 0.9154 |
| Dalian Hengshan, Liaoning | 0.9 |
| Cangnan, Zhejiang | 1.2 |
| Hainan Dongfang | 0.56 |
| Guangdong Nan'ao | 0.74 |
| Guangdong Nan'ao Zhenneng | 0.62 |
| Guangdong Nan'ao Dannan | 0.46 |
| Fujian Dongshang Aoziaishan | 0.46 |
| Gansu Yumen | 0.73 |
| Jilin Tongyu | 0.9 |
| Shanghai Chongming | 0.773 |

### CONCESSION TARIFF (2006, YUAN/KWH)

| LOCATION | WITHOUT VAT | WITH VAT (8.5%) |
|---|---|---|
| Jiangsu Rudong, Huarui Co., Ltd | 0.402 | 0.437 |
| Guangdong Shbeishan, Yuedian, Group Co., Ltd | 0.462 | 0.501 |
| Inner Mongolia, Huitengxile, Beijing International Power New Energy Co. | 0.352 | 0.382 |

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| | | WITH VAT (8.5%) |
|---|---|---|
| Jinlin Tongyu, Longyuan Power Group Co. | 0.470 | 0.510 |
| Jilin baicheng, Huaneng | 0.470 | 0.510 |
| Jiangsu Rudong, Longyuan | 0.478 | 0.519 |
| Jiansu Dongtai, Huadian International | 0.449 | 0.487 |
| Gansu Anxi, Huanghe Power | 0.425 | 0.462 |
| Inner Mongolia, Huitengliang, Guangdong Nuclear | 0.374 | 0.406 |
| Inner Mongolia, Baotou Bayin, Longyuan | 0.429 | 0.466 |
| Heibei Danjinghe, China Energy conservation | 0.461 | 0.501 |
| **Average** | **0.434** | **0.471** |

**WIND POWER PRICE BY REGION (2006, YUAN/KWH)**

| REGION | PROJECT | WITHOUT VAT | WITH VAT (8.5%) |
|---|---|---|---|
| Shandong | Qixia 49.5MW | 0.719 | 0.780 |
| | Rongcheng 49.5MW | 0.700 | 0.760 |
| | Laizhou 49.5 MW | 0.599 | 0.650 |
| | Zhanhua 49.5 | 0.618 | 0.670 |
| | Hekou 49.5 MW | 0.645 | 0.700 |
| | Dawang 49.5 MW | 0.487 | 0.529 |
| | **Average** | **0.628** | **0.681** |
| Inner Mongolia | Chifeng Saihanba West 30.6 MW | 0.507 | 0.550 |
| | Huitengxile Windfarm Project | 0.461 | 0.500 |
| | Huitengliang 49.5MW | 0.525 | 0.570 |
| | Chifeng Dongshan 49.3MW | 0.502 | 0.545 |
| | Saihanba East 45.05 MW | 0.507 | 0.550 |
| | Saihanba North 45.05 MW | 0.507 | 0.550 |
| | **Average** | **0.502** | **0.544** |

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| | | | WITH VAT (8.5%) |
|---|---|---|---|
| Jiangsu (bid prices) | Rudong Huangang 200 MW | 0.478 | 0.519 |
| | Dongtai 200 MW | 0.449 | 0.487 |
| | Jiangsu dongtai 200 MW | 0.449 | 0.487 |
| | Jiangsu rudong 100 MW | 0.402 | 0.437 |
| | other 4 projects with 200 MW each | 0.449 | 0.487 |
| | **Average** | **0.445** | **0.483** |
| Fujian | Dongshan Wujiaobay 30MW Wind Power Project | 0.599 | 0.650 |
| | Zhangpu Liuao 30.6 MW Wind Power Project | 0.496 | 0.538 |
| | **Average** | **0.548** | **0.594** |
| Ningxia | Helanshan Wind-farm Project 49.5 MW | 0.524 | 0.568 |
| | Ningxia Tianjing 50.25MW | 0.470 | 0.510 |
| | Tianjing Shenzhou 30.6MW | 0.516 | 0.560 |
| | **Average** | **0.503** | **0.546** |
| Hebei | Chengde Songshan 49.5 MW | 0.553 | 0.600 |
| | Zhangbei Manjing 49.5MW | 0.602 | 0.653 |
| | Kangbao Wolongtushan 30 MW | 0.553 | 0.600 |
| | Zhangbei Mijiagou 49.5 MW | 0.553 | 0.600 |
| | Hebei Shangyi Manjing East 49.4 MW | 0.553 | 0.600 |
| | **Average** | **0.563** | **0.611** |
| Xinjiang | Sanchang First Phase 34.5 MW | 0.433 | 0.470 |
| | Tuoli Wind-Farm 30 MW | 0.399 | 0.433 |
| | **Average** | **0.416** | **0.452** |
| Heilongjiang | Huafu Muling 49.5 MW | 0.607 | 0.659 |
| | Yichun Erduoyan 28.05 MW | 0.612 | 0.664 |
| | Yichun Daqingshan | 0.612 | 0.664 |
| | Liaoning Kangping 24.65MW | 0.645 | 0.700 |
| | **Average** | **0.619** | **0.672** |

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| REGION | PROJECT | WITHOUT VAT | WITH VAT (8.5%) |
|---|---|---|---|
| Liaoning | Changtu Windfarm Project | 0.604 | 0.655 |
| | Zhangwu 24.65MW | 0.645 | 0.700 |
| | **Average** | **0.624** | **0.678** |
| Jilin | Taobei Huaneng 49.3MW | 0.559 | 0.607 |
| | Datang Shuangliao 49.5 MW | 0.544 | 0.590 |
| | Taobei Fuyu 49.5MW | 0.512 | 0.556 |
| | Changling Wind 24 MW | 0.599 | 0.650 |
| | Taonan 49.5 MW | 0.546 | 0.592 |
| | **Average** | **0.552** | **0.599** |
| Guangdong with fixed price | | 0.487 | 0.528 |
| | **Overall average** | **0.544** | **0.590** |

# *IV.*
# *Pieces written by REIL members for other publications*

# Linking Energy Policy and Land Conservation in the U.S.

*Bradford Gentry*
*Yale School of Forestry & Environmental Studies*

U.S. energy infrastructure is unquestionably expanding. This may be in response to recent years' steep rises in energy prices and concerns about energy security or the 2009 focus on using infrastructure projects to help stimulate the economy and address climate change.

At a minimum there is tension, if not direct conflict, between the expansion of energy infrastructure (even "green" energy such as wind) and efforts to conserve open space. New turbines and transmission lines consume land – often land of high amenity and ecosystem value. Similar issues arise around the production of biofuels – do they offer sustainable uses for rural areas or are they just another form of intensive, destructive agricultural production? Do the efforts to increase domestic gas and oil production offer only threats or are there ways to couple these activities with new mitigation/conservation efforts? Is there such a thing as "clean coal" and what might be its footprint – through mining, transportation, combustion, carbon dioxide capture, transportation, and underground injection?

For many U.S. land trusts, issues regarding energy infrastructure provide one of their first, most direct links to the impacts of global warming and possible responses. Should we support the expansion of wind energy? If so, where? Should we amend existing easements to allow the construction of new turbines? Should we support the expanded use of woody biomass or will doing so degrade the health of our soils and forests? Are mitigation credits – from wetlands, streamsides, forests and other ecosystems – a valuable source of conservation finance to be pursued or an illusion that distracts our attention from the real impacts of expanded energy production and transmission?

Only by stepping back from the day-to-day effort to protect land and engaging with others from outside the land conservation community can U.S. conservation leaders hope to develop strategic responses to these questions. The Obama administration's efforts to link energy and environmental policies also offer an opportunity to address these issues in new and more effective ways.

The purpose of the 2009 Berkley workshop was to explore these opportunities and threats, as well as to develop creative ways forward. The workshop convened a diverse range of leaders in land conservation and energy policy (see Box 1). The facilitated discussions and free time for thought/conversation on the grounds of the Pocantico Conference Center were designed to stimulate innovative thinking on new approaches to these issues. As part of a multi-year effort involving Yale, the Land Trust Alliance, and other conservation leaders, several mechanisms for follow-up from the ideas and actions identified during the workshop are already in place.

**Box 1 Workshop participants**

Judy Anderson, President, Community Consultants
Forrest Berkley, Board Member, Maine Coast Heritage Trust
Aimee Christensen, Board Member, American Council on Renewable Energy
Ernest Cook, Director of Conservation, Trust for Public Land
Kaarsten Turner Dalby, Senior Director Ecological Services, The Forestland Group LLC
Jim Dooley, Senior Staff Scientist, Joint Global Change Research Institute
Kim Elliman, CEO, Open Space Institute
Jay Espy, Executive Director, Sewall Foundation
Brad Gentry, Senior Lecturer and Director, Yale Program on Strategies for the Future of Conservation, Yale School of Forestry & Environmental Studies
Nathanael Greene, Director, Renewable Energy Policy, NRDC
Frank Hebbert, Associate Planner GIS, Regional Plan Association
Janet Keating, Executive Director, Ohio Valley Environmental Coalition
Gil Livingston, President, Vermont Land Trust
Andy Loza, Executive Director, Pennsylvania Land Trust Association
Nancy McLaughlin, Professor of Law, University of Utah
Chris Miller, President, Piedmont Environmental Council
Casey Pickett, Masters Student, Yale School of Forestry & Environmental Studies
David Higby, Director Federal Government Relations, The Nature Conservancy of NY
Christopher Recchia, Executive Director, Biomass Energy Resource Center
Dan Reicher, Director, Climate and Energy Initiatives, Google.org
Paul Risser, Chair, National Research Council Committee on the Environmental Impacts of Wind Energy Projects, CEO, University of Oklahoma Research Cabinet
Marc Smiley, Partner, Decisions Decisions
Peter Stein, General Partner, The Lyme Timber Company
Randy Swisher, Former Executive Director, American Wind Energy Association
Buzz Thompson, Professor of Law and Co-Director Woods Institute for the Environment, Stanford University
Laurie Wayburn, President, Pacific Forest Trust
Rand Wentworth, President, Land Trust Alliance

This is the fourth in a series of workshops providing convening and research support for efforts to expand and apply most effectively the resources (financial, political, personnel) available for land conservation in the US. It is made possible by

gifts from Forrest Berkley and Marcie Tyre to the Yale School of Forestry & Environmental Studies, as well as additional support from the Overhills and Pequot Capital Foundations. The structure and background papers for the workshop also build from the clean energy and land use dialogue during the REIL Network meeting in 2008 sponsored by the Blue Moon Fund and the UN Foundation. Marc Smiley, our facilitator, once again did a wonderful job making sure that the conversation was lively and productive, while offering everyone an opportunity to share their thoughts. Many thanks as well to Amy Badner for all of her help organizing the administrative aspects of the gathering. Our deepest appreciation also goes to Judy Clark, Regina Creegan and their colleagues at the Rockefeller Brothers Foundation for allowing us to use the magnificent facilities at the Pocantico Conference Center. Finally, it is important to note that the views expressed in this publication are solely those of the editors and individual authors and do not necessarily reflect the views of Yale University, The Rockefeller Brothers Fund or any of the other participants. Lastly, our gratitude is extended to the F&ES Publication Series for making this publication possible.

## SUMMARY OF MAJOR THEMES

Over the course of the three days, a massive amount of learning occurred and a remarkable set of connections were made. The purpose of this section is to summarize some of the major themes of the discussion, along with the next steps participants identified as ones that they will or others should pursue.

### Themes from the discussion

*The conservation and clean energy communities need each other.*

Probably the most important theme to emerge was how much the land conservation and clean energy communities in the U.S. need each other. Land trusts need help ensuring that the effort to build new energy infrastructure does not target already conserved land. This requires that they have a seat at the clean energy/climate change table, as that is where the policy momentum currently resides. Helping to reduce emissions of greenhouse gasses will also allow land trusts to benefit from mitigation funding opportunities as they arise and, hopefully, reduce the scale of the adaptation efforts that will be required in the future.

At the same time, the clean energy community needs help siting "good" projects quickly. This requires not only connections at the federal level, but also effective grassroots/tops, bi-partisan, community-based networks – one of the key strengths of the land trust movement. Local conservation networks need to see the value of specific projects to help speed their siting and deployment. In addition, the conservation community can help implement cost-effective mitigation techniques, from storing carbon in forests/grasslands/geologic formations to substituting current carbon (in the form of woody biomass) for fossil carbon.

These mutual needs also underscore how much the clean energy and conservation communities have to learn from each other – especially as they increasingly come together as part of the broader climate change community. This could be seen in the different tone of the discussions this year as compared to previous years. This year there were fewer arguments that any particular position should be adopted and many more questions about new areas as the participants tried to get their arms around the technologies, policies, business realities and ethics of the topics being considered. This was particularly true of climate change – and all of the attendees owe Jim Dooley a debt of gratitude for his agreement to offer a superb update on climate science and potential responses on extremely short notice.

### *Land trusts need to pursue a more dynamic model of "permanent conservation."*

The focus on climate change also poignantly poses the question of what "permanent" land conservation means in practice. A view that the land trust community should be trying to stop all change clearly cannot hold. The only constant is change, whether through natural processes, shifts in human values, human-induced changes to the climate or technological changes that pose new threats to open spaces; such technological changes themselves span from low-speed wind turbines in areas with less wind to new techniques for extracting natural gas from oil shale deposits. Some of the implications of this line of inquiry include the need for the land trust community to:

- Continue to think about how legal instruments can be drafted/used to anticipate and adapt to such changes, such as through the inclusion of specific provisions (floating conservation zones, amendment procedures) and the articulation of criteria (balancing scientific and community values) on which such changes may be made;
- Find ways to incorporate the most recent data on projected changes in temperature, moisture and other climate factors into conservation planning efforts;
- Consider how aesthetics fit into such questions in a changing world, particularly since a powerful part of the land trust business model has been helping donors prevent changes to the lands they love; and
- Challenge itself to lead on the change it would like to see, rather than waiting for condemnation proceedings to sort out the debate site-by-site.

While some participants were of the view that the urgent need to respond to climate change should trump virtually all other public goals, others did not share that perspective. At a minimum, this means that the efforts to find win/win opportunities must intensify. Ways must be found to add "saving land" to the list of popular co-benefits from actions to reduce greenhouse gas emissions – such as saving money (through energy efficiency), creating jobs (through the manufacture and deployment of new, cleaner technologies) and increasing energy security (through reductions in energy demand, as well as the use of more domestic energy sources). The opportunities to reduce emissions from land development and store more carbon in natural areas make this an opportunity well worth exploring further. For example, saving land can save money (as carbon storage in forests/grasslands costs less than many other options), create jobs (in community forestry using woody biomass as a fuel), and increase energy security (through the use of locally grown plants as fuel) while also helping to reduce the flooding expected from extreme storms. It can also allow for the storage of water in areas hit by drought and create opportunities to purify water at a lower cost than more carbon-intensive concrete and steel treatment plants.

*The comparative advantage of land trusts is their ability to say yes across divides.*

Land trusts clearly have the potential to help move the aforementioned efforts forward. Their focus on permanent land conservation in the communities within which they work, along with their local, bipartisan appeal, makes them uniquely credible messengers between relevant stakeholders. This is true both in local communities as well as with representatives in state capitals and Washington, DC.

Land trusts can also help the broader environmental community combine fear with hope – linking the ability to say no (to certain proposals) with the ability to say yes. Many environmental organizations are more comfortable just saying no – you cannot build/dump that here. One of the core strengths of the land trust movement, however, is saying yes – doing deals to acquire rights to land, often in unusual and difficult circumstances.

Marrying the ability to try to stop "bad" clean energy projects with the ability to help move "good" projects along more quickly will be a key component of any effort to bring together the U.S. clean energy and land conservation communities. Obviously, this means that land trusts will need to know what they want to see in "good" projects and be able to say no to "bad" ones – both internally and externally. Nathanael Greene offered three principles on which to build these efforts: (1) minimize the trade-offs that have to be made; (2) make any trade-offs carefully; and (3) make sure to receive what was bargained for when the tradeoff was made.

*New skill sets will be required for land trusts.*

Doing so will require new skill sets for the land trust community at the local, regional, and national levels. While some land trusts have strong public education programs, others do not – such programs will need to be scaled up dramatically. Political action by land trusts often involves targeted contact with decision makers who are supporters of land conservation efforts – will there be a need to go beyond those known supporters to help cultivate new ones? Finding the time and resources to collect, analyze, and disseminate data on the benefits of combining more efficient or cleaner energy efforts with the protection of critical lands will also be a challenge. Since so many energy infrastructure issues arise at a regional level, it may make sense to expand the role of land trust service bureaus to providing support for work on these topics as well.

*And traditional connections will have to be applied in new ways.*

A large number of conservationists have joined the Obama administration, offering an unusual opportunity to push for a balance between protecting critical landscapes and deploying cleaner energy technologies. The Land Trust Alliance should consider keeping an inventory directory of conservationists in the administration, as well as assessing how connections with land trusts can help bring value to their work. One specific initiative is to push for or provide data on inter-agency efforts to create guidelines for assessing and siting new energy facilities that take account of conservation values and community input.

Prior work on tax incentives for conservation has demonstrated the value of the land trust community's grasstops networks in Congress. That network should be brought to bear on clean energy and climate change as well. Efforts should be made to identify senators whose votes are key on climate change or clean energy legislation, then to see which ones are also close to the conservation community and ultimately strive to meet with them. Among the topics that could be covered are: (a) ensuring that public and private protected areas are considered in any federal preemption of the process for siting transmission lines; and (b) providing other incentives for land conservation as part of a climate or clean energy bill.

*Responding to climate change requires the urgent use of many different technologies.*

Moving from these broad themes to more detailed reflections on the discussions regarding specific technologies, one major conclusion was clear – the scale of the change needed to respond to climate change means that no one technology or approach will be enough. Rather, a suite of efforts across a range of technologies and locations will be required. This appears to include an expanded and more connected electricity network as we move from primary reliance on constant/baseload power (coal, nuclear) to more intermittent sources (wind, solar) and decentralized energy production/storage. A related observation is that as we move from more dense fuels (fossil fuel, nuclear) to less dense fuels (wind, solar, biomass), more land may well be required. This means that the competition for land for food, fiber, fuel, shelter and services will only intensify.

Another specific reflection detailed how wide the range of issues discussed spanned different covered technologies. For wind farms and transmission lines, the focus was on criteria and processes for finding and permitting the "best" sites. For oil and gas exploration it was on the implications of technological change in terms of threats to open space, as well as the reputational issues around engagement with energy projects. Issues of severed estates – either subsurface rights or fee ownership – arose in the discussions about fossil fuels and carbon dioxide capture and storage. The human impacts of energy development were starkly illustrated by the discussion of mountaintop removal coal mining in Appalachia. Additionally, the need for new models of locally sourced and delivered heat energy was a central part of the woody biomass discussion.

The next few paragraphs dig a little more deeply into some of these issues. At the same time, the variety of topics covered underscores the need for the land conservation and clean energy communities to continue to learn from each other. Only by doing so can they hope to navigate the tension between conserving critical lands and rapidly deploying cleaner energy technologies.[1]

[1] For an overview of technologies to address climate change, see the GTSP's 2007 report on Global Energy Technology Strategy at http://www.pnl.gov/gtsp/docs/gtsp_2007_final.pdf/.

*Energy efficiency is priority number one.*

All land trusts should push energy efficiency first and as fervently as they can. If demand for energy is reduced, so, too, is the need for new generation and transmission facilities. Land trusts should collaborate with energy efficiency advocates and local programs to promote specific actions in their own operations, by their members, and in their broader communities. Tighter links should also be forged with the smart growth community, given their focus on energy efficiency in buildings and transportation systems.

*New information technologies need to be used to inform siting processes in novel ways.*

Much of our discussion focused on capturing the opportunities that exist to influence the new energy facility siting process. New information technologies offer a means for mapping areas of special interest and engaging a wide range of stakeholders to help define both areas for development and those for protection. Specific efforts in this area might include the following:

- Articulating guidelines for assessing potential energy development sites and building from those that have been developed to date;
- Pushing for a broader, more integrated approach to energy resource planning, particularly in the identification and assessment of options for ways forward;
- Including data on conserved lands, energy resource potential, patterns of existing development and a range of other community values in the assessment of potential sites for energy projects;
- Expanding efforts to hear from more parties earlier in the siting process as part of energy planning efforts at the national, state, regional, and local levels;
- Seeking to engage land trusts more directly in the assessment/planning processes already underway, such as the administration's look at siting on federal lands or that in which NRDC is involved in the U.S. West;
- Advocating for combined "infrastructure corridors," including power lines, major roads, rail systems, pipelines, etc. as a way to minimize the footprint of the different networks;
- Engaging around the topic of cost allocation – not just direct, but externalized costs as well – as a vehicle for justifying mitigation/compensation areas and payments as part of new energy development projects; and

- Using whatever leverage the conservation community has to insert the results of these proactive, regional assessment efforts into the more formal energy siting processes led by governments, regional transmission organizations, and electric utilities.

*Sub-surface rights are a growing area of concern for the conservation community.*

A couple of specific areas of work were identified around sub-surface energy activities, as these appear to be posing new questions for an increasing number of land trusts. Included were the needs to:

- Offer guidance on options for responding to oil and gas leasing on or near conserved lands;
- Consider how that guidance might apply to sub-surface technologies that seem likely to receive more attention in the future, particularly carbon dioxide capture and storage (from the burning of fossil or other biofuels) and deep geothermal projects; and
- Respond to the Secretary of the Interior's request that the land trust community take a position on off-shore drilling, particularly given the historical use of royalties to help fund land conservation.

*Engaging communities and related ethical issues will continue as critical areas for work.*

Underlying many of our discussions were deeper questions about the roles of local communities and the ethical dimensions of land use decisions. On the community side, a variety of concerns were raised about their capacity and right to be heard on, influence, and benefit from the siting of energy projects. Much of the discussion focused on links with local communities, including the historic concentration of land ownership in corporate hands in much of Appalachian coal country, methods for obtaining community input on aesthetics/viewshed issues, and the possibility of recognizing public ownership rights in wind and solar resources. As land trusts become more engaged on these issues, their traditional strengths in enabling decentralized, community-scale action are likely to become an even more valuable part of their efforts.

On the ethics side, a wide range of issues were raised. One of the clean energy representatives raised the question of who should decide how to use what land, expressing some surprise that land trusts, as unelected private actors, felt comfortable making such decisions on their own. More generally: Who should decide what tradeoffs are appropriate using what process with input from whom? Should land trusts profit from fossil fuels? What leadership roles should land trusts and their individual members be taking on climate change/energy options? While a range of views were offered by individual participants on these and related questions, no effort was made to forge a consensus. Rather, these issues remain to be discussed in specific projects, as well as in broader strategy sessions in the future.

## NEXT STEPS

In addition to these broad themes, participants also identified a number of next steps for their organizations, the new administration, and researchers. A sample of these suggestions is provided below.

### Actions by their organizations

*Land conservation/management organizations*

- Be more vocal and engaged on the need to respond to climate change, even ahead of more traditional reasons to conserve land.
- Partner with energy, energy efficiency, climate, and other environmental groups to help capture current policy opportunities.
- Articulate the value of open space/natural areas as part of the solution to climate change (mitigation/adaptation).
- Add energy production to their definition of "working landscapes," including "community/conservation energy" from woody biomass.
- Help promote the development of community scale renewable energy projects (wood, methane, wind, solar, etc.).
- Inventory and disseminate information on new mapping/decision-making tools being developed to enable spatially explicit and participatory planning efforts.
- Better understand and help promote incentives for deploying more renewable energy technologies.
- Engage more closely with the smart growth/transportation-oriented development communities to understand how best to collaborate on specific projects.
- Think more deeply about the impact of traditional approaches to land conservation on standards of living, climate change, and related issues, as well as the implications for future work.
- Help develop site-appropriate rules/guidance for managing conserved forests and range lands to reflect climate considerations.
- Expand the attention paid to energy issues as part of the due diligence for land acquisitions.
- Review model easement language in light of both climate change and energy project developments.
- Think about better ways to communicate the connection between land protection and responses to climate change.

- More actively undertake and promote actions to save energy, including energy audits of offices/homes, along with expanded communications with members and the land trust community as a whole.
- Seek to modify state eminent domain laws to ensure that they reflect conservation organizations' ownership rights and ecosystem values.
- Support wind projects on their lands.
- Build a national database of sites under conservation easements to add to those covering fee-owned conservation land.

*Clean energy organizations*

- Link energy and land use efforts more widely.
- Bring local land trusts into efforts to say yes to "good" clean energy projects.
- Bring people from the land conservation community into the climate/clean energy policy discussions/advocacy at the state and national levels.
- Connect land conservation organizations with the providers of clean energy technologies to explore ways forward

*Research/academic organizations*

- Continue to educate the environmental community on how climate change (as a stock problem) poses fundamentally different issues than traditional pollution (flow problem) and that it needs to be addressed using all available tools as quickly as possible, while still working to raise the general standard of living on the planet (particularly in developing countries).
- Encourage land trusts to engage publicly at the micro (local news, with members) and macro (in DC) levels on the need for action on climate, including siting issues.
- Work with the land trust community to build databases on why certain areas are important so that the scientific community can harvest micro level details on land use from them.
- Develop maps of historical and projected land use change over centuries for use with policymakers, landowners and others.
- Analyze big data sets on energy infrastructure, other infrastructure, and natural systems/infrastructure to see where they overlap or do not and disseminate the results.
- Develop new tools to enable faster modeling of land use choices and broader participation as part of visioning/planning processes.
- Bring land trusts into the work of more academic ecologists on predicting ecological change.

- Understand the land use impacts of the carbon offsets being purchased by the organizations for which they work.

*Ideas for action by the Obama Administration*

- Recognize the climate value from "saving land."
- Ensure that mitigation for new energy projects is adequate to compensate for the full range of their externalized costs.
- Ensure full accounting for carbon from different forms of biomass energy.
- Include consideration of both publicly and privately protected lands in any federal preemption policy for energy facilities.
- Pursue an inter-agency task force on guidelines and processes for assessing possible sites for energy projects.
- Recognize that different energy technologies raise different issues and face different problems and thereby require different policy responses.
- Review the wording of the federal tax code, as well as the model easement under the Forest Legacy and other federal funding programs, to ensure that they adequately reflect climate and clean energy related goals on conserved lands.
- Truly dedicate the funds from energy projects on federal lands to conservation programs.
- Coordinate the spending of federal stimulus dollars with the results of recent climate modeling.

**Topics for further research and development**

- How might the ambiguities in old conservation easements be addressed through presumptions expressed in state law?
- How do cases on rights of way reflect/address protected lands?
- Whether renewable energy resources are or should be covered by the public trust doctrine – i.e., is the government under an obligation to ensure that they are used to promote the public interest in a responsible fashion?
- How do decentralized energy technologies/systems fit into current, more centralized systems, models and decision-making processes for responding to climate change?
- What are the best ways to bring diverse communities to a common level of understanding on clean energy projects? How might new information technologies help support such efforts?
- What does a full, lifecycle accounting show as the carbon budget for different types of biofuels and carbon storage technologies?

- Continue work to understand and articulate the environmental effects of wind farms.
- What are the implications of various carbon storage techniques for land management choices?
- What would it take to develop a mapping tool that helps landowners see the carbon impacts of different land management choices? Does one already exist?
- Explore ways to bring the values held by affected individuals into the data analysis for siting decisions.

# U.S. POLICY ACTION NECESSARY TO ENSURE ACCURATE ASSESSMENT OF THE AIR EMISSION REDUCTION BENEFITS OF INCREASED USE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY TECHNOLOGIES

Debra Jacobson & Colin High*

## INTRODUCTION

Policies encouraging energy efficiency and renewable energy ("EERE") technologies need to ensure that the air emission reduction benefits of these technologies are calculated accurately. Otherwise, the market will not fully capture their important economic and social benefits.

Federal, state, and local governments and private entities have developed protocols for reporting greenhouse gases ("GHG") and other air emissions.[1] Many of these protocols have been designed to allow emissions from individual sources to be aggregated into total emissions for an entire entity, such as a corporation or a governmental body, while appropriately emphasizing consistency, transparency, and the use of publicly available data. When measuring indirect emissions from electric power generation, these protocols have widely relied on total output emissions rates (the "eGRID system average methodology"[2]), which are based on information in the Emissions & Generation Resource Integrated Database ("eGRID"). The eGRID system average methodology is acceptable for reporting by corporations, governmental bodies, or other entities when they are aggregating emissions from all sources into an inventory.[3]

However, inadequate attention has been focused on methodologies for measuring the air emission reduction benefits of increased use of EERE and other low-emission technologies. This Article, presenting results of original research completed in 2008 and 2009, demonstrates that many individuals have misapplied the most commonly used methodology—the eGRID system average methodology. The eGRID system average methodology undervalues the GHG emission reduction benefits of increased use of EERE technologies in most regions of the country.[4]

This Article demonstrates that the eGRID system average methodology, when compared to the Resource System Group's Time Matched Marginal emissions methodology,[5] understates the carbon dioxide ("$CO_2$") and nitrogen oxide ("$NO_x$") emission reduction benefits of five EERE technologies[6] by approximately 65% to

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1 *See, e.g.*, WORLD RES. INST. & WORLD BUS. COUNCIL FOR SUSTAINABLE DEV., THE GREENHOUSE GAS PROTOCOL: A CORPORATE ACCOUNTING AND REPORTING STANDARD 3 (2004) [hereinafter GREENHOUSE GAS PROTOCOL], *available at* http://pdf.wri.org/ghg_protocol_2004.pdf.

2 As used in this Article, the term "eGRID system average methodology" is not a methodology "of" eGRID, but refers to a methodology that uses eGRID total output emission rates when verified, utility-specific emissions data is not available. *See generally* U.S. Environmental Protection Agency, eGRID Frequently Asked Questions, http://www.epa.gov/cleanenergy/energy-resources/egrid/faq.html (last visited Mar. 25, 2010) [hereinafter eGRID Frequently Asked Questions] (explaining that eGRID as used by EPA is an inventory of air emission data based on information from US electricity-generating plants).

3 *See infra* Part I.A (discussing two types of GHG protocols).

4 *See infra* Part II.

5 *See infra* Part I.B.3.

6 The five technologies studied in this 2008 and 2009 research work are wind energy, solar photovoltaic energy ("PV"), high-efficiency commercial air conditioning, high-efficiency commercial lighting, and LED traffic signal retrofits. *See infra* Part II (introductory text).

165% in the two power markets studied.[7] This Article also concludes that the emission reduction benefits of increased use of EERE technologies calculated with the Environmental Protection Agency's ("EPA") eGRID non-baseload methodology also are significantly higher than those calculated with the eGRID system average methodology.[8] Recent studies across all regions confirm that these findings are not isolated results but are indicative of widespread misapplication of the eGRID system average methodology by many users.[9]

Although the eGRID system average methodology is generally appropriate for estimating indirect emissions from electricity purchases ("scope 2 emissions") for general emission inventory purposes,[10] it does not accurately estimate the year-to-year impacts on GHG levels resulting from increased use of EERE technologies. The Climate Registry,[11] hundreds of local governments, and others have relied on the eGRID system average methodology since 2008 in their protocols for estimating emissions from electricity purchases in their GHG emission inventories.[12] This Article recommends that The Climate Registry consider developing an additional protocol and registry during the 2010 planned revision of its General Reporting Protocol to more accurately reflect the emission reduction benefits from increased use of EERE technologies by states and other entities.

Similarly, EPA should consider developing an additional protocol in its mandatory GHG reporting rule to fully value emission reduction benefits from increased use of EERE technologies. Specifically, regulatory agencies should use a methodology that calculates emission reductions at marginal units.[13] Ideally, these emission reductions should be calculated on an hourly basis.

Finally, this Article recommends addressing these problems in a cost-effective manner. An investment of limited funds by the Department of Energy ("DOE"), EPA, or state agencies to create an enhanced database of marginal electric generating units would enable government agencies and businesses to more accurately evaluate the cost-effectiveness of EERE programs in reducing emissions.

## I. BACKGROUND

### A. Role of EERE in Reducing Air Emissions from Electric Power Generation

The electric power sector is responsible for approximately forty percent of the $CO_2$ emissions in the United States[14] as well as significant direct and indirect emissions of methane and other greenhouse gases.[15] According to leading energy experts, the electric power sector requires a dramatic transformation to meet national targets for GHG emission reductions over the next several decades.[16] Adopting energy efficiency and zero or low-carbon emission technologies, such as renewable energy, is a key part of this transformation.[17] For example, the International Energy Agency has stated that a "global revolution is needed in ways that energy is supplied and used," and it has cited energy efficiency and renewable energy as central to this energy revolution.[18] Building and product efficiency measures, such as high-efficiency lighting and appliances, and dramatic increases in the use of wind and solar energy, are among the high priority technologies cited by the Agency.[19] In addition, many promising strategies for reducing GHG emissions from

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7 The study focused on the PJM Interconnection and the Upstate New York power markets. *See infra* Part II.
8 *See infra* Part I.B.2 and Table 1.
9 *See infra* Part II.
10 THE CLIMATE REGISTRY, THE GENERAL REPORTING PROTOCOL FOR THE VOLUNTARY REPORTING PROGRAM, VERSION 1, at 97 (2008), *available at* http://www.theclimateregistry.org/downloads/GRP.pdf.
11 *Id.* at 8, 99.
12 *See infra* Part III.A.
13 Marginal units are fossil fuel-fired units whose power output varies with the overall level of power demand over time. *See* WORLD RES. INST. & WORLD BUS. COUNCIL FOR SUSTAINABLE DEV., GUIDELINES FOR QUANTIFYING GHG REDUCTIONS FROM GRID-CONNECTED ELECTRICITY PROJECTS 13-14, 54-57 (2007) [hereinafter QUANTIFYING GHG REDUCTIONS], *available at* http://pdf.wri.org/GHGProtocol-Electricity.pdf.
14 ENERGY INFO. ADMIN., ANNUAL ENERGY OUTLOOK 2010, EARLY RELEASE OVERVIEW 11 (2009), *available at* http://www.eia.gov/oiaf/aeo/pdf/overview.pdf.
15 *See* U.S. ENVTL. PROT. AGENCY, eGRID 2007, YEAR 2005 SUMMARY TABLES 1 (2008) [hereinafter EGRID SUMMARY TABLES], *available at* http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2007V1_1_year05_SummaryTables.pdf.
16 *See* INT'L ENERGY AGENCY, LAUNCHING AN ENERGY REVOLUTION IN A TIME OF ECONOMIC CRISIS: THE CASE FOR A LOW-CARBON ENERGY TECHNOLOGY PLATFORM 3 (2009), *available at* http://www.iea.org/G8/docs/Energy_Revolution_g8july09.pdf.
17 *Id.*
*18* INT'L ENERGY AGENCY, ENERGY TECHNOLOGY PERSPECTIVES 2008: SCENARIOS AND STRATEGIES TO 2050 IN SUPPORT OF THE G8 PLAN OF ACTION 1-7 (2008).
19 *Id.*

the transportation sector involve advanced energy technologies, such as plug-in electric hybrid vehicles and electric cars, which reduce petroleum use through electrification.[20]

Implementing these strategies will increase the importance of ensuring the accurate assessment of the effects of EERE technologies on the electric grid, particularly hourly and seasonal differences in GHG emissions. In order to comprehensively report GHG emissions and to measure cost-effectiveness, it is necessary to improve the accuracy and lower the costs of methodologies applied by state and local governments and the private sector to estimate the emission reduction benefits of increased use of EERE technologies.[21]

Other air quality goals, including reducing ozone levels, also can be advanced by increasing use of EERE technologies and practices.[22] Many of these air quality problems are most serious during certain seasons, such as the summer ozone season, and certain hours of the day, such as summer afternoons.[23] Federal, state, and local agencies benefit from accurate and low-cost methodologies to estimate the impact of EERE strategies in the air quality planning process.[24]

In all energy sectors, it is important not only to use improved methods but also to obtain agreement on consistent protocols for quantification and reporting GHG emissions.[25] The need for more accurate methodologies intensified when the EPA adopted the first mandatory GHG reporting rules last year.[26] Moreover, the EPA is now considering options to expand its GHG registry to include indirect emissions from electricity purchases.[27]

There are currently two types of protocols relating to GHG emissions from the use of electric power. Confusion about the appropriate use of these two types of protocols lies at the heart of the issues discussed in this Article.

The first type of protocol is an emissions inventory to provide accounting of GHG emissions for a corporation or other entity.[28] The protocol is designed to facilitate reporting by the owners or operators of individual units, such as business plants and government buildings, so that these emissions can be aggregated for an entire corporation or governmental unit.[29] This protocol typically requires reporting of both indirect emissions and direct emissions.[30] Indirect emissions, also known as Scope 2 emissions, are air emissions that result from activities, such as electricity purchases, of one entity that occur at sources owned or controlled by another entity, such as an electric generating plant.[31] In contrast, direct emissions, also known as Scope 1 emissions, are air emissions from sources owned or operated by the reporting entity, such as GHG emissions from the smokestacks owned by a power generating company.[32]

The *Greenhouse Gas Protocol* of the World Resources Institute and the *General Reporting Protocol* of The Climate Registry are examples of emissions inventories that track both scope 1 and scope 2 emissions.[33] Electricity emission factors from the eGRID system average database are often used under these protocols to represent the amount of GHGs

20 INT'L ENERGY AGENCY, TRANSPORT, ENERGY, AND CO2: MOVING TOWARDS SUSTAINABILITY, EXECUTIVE SUMMARY 32-33 (2009), *available at* http://www.iea.org/Textbase/npsum/transport2009SUM.pdf.

21 *See infra* Part I.B.

22 U.S. ENVTL. PROT. AGENCY, GUIDANCE ON STATE IMPLEMENTATION PLAN (SIP) CREDITS FOR EMISSION REDUCTIONS FROM ELECTRIC-SECTOR ENERGY EFFICIENCY AND RENEWABLE ENERGY MEASURES 1 (2004) [hereinafter GUIDANCE ON STATE IMPLEMENTATION PLAN].

23 DEBRA JACOBSON & COLIN HIGH, ROLE OF ENERGY EFFICIENCY PROGRAMS IN BUILDINGS IN ADDRESSING AIR QUALITY AND GREENHOUSE GAS REDUCTION GOALS 1-3 (2008) [hereinafter ROLE OF ENERGY EFFICIENCY PROGRAMS], *available at* http://apps1.eere.energy.gov/wip/pdfs/tap_webcast_20080717_fact_sheet.pdf.

24 *See infra* Part III.

25 *See generally id*. (discussing technological improvements that would enhance federal and local air quality programs).

26 Mandatory Reporting of Greenhouse Gases, 74 Fed. Reg. 56,260 (Oct. 30, 2009) (to be codified at 40 C.F.R pt. 98); *see also infra* Part III.B.

27 Mandatory Reporting of Greenhouse Gases, 74 Fed. Reg. at 56,288.

28 GREENHOUSE GAS PROTOCOL, *s*upra note 1, at 3.

29 *Id*.

30 *Id.* at 26-27. Under reporting standards developed by the World Resources Institute and the World Business Council for Sustainable Development, operational boundaries have been established with respect to direct emissions and indirect emissions to assist entities in better managing the full spectrum of GHG risks and opportunities for reducing such risks. For many companies, indirect emissions from purchased electricity represent one of the largest sources of GHG emissions and the most significant opportunity to reduce these emissions. *Id.*

31 *Id.* at 25-27.

32 *Id.* at 27.

33 *Id.* at 25; THE CLIMATE REGISTRY*, supra* note 10, at 1. The eGRID system average methodology is typically used in cases where no verified, utility-specific data is available. See *infra* Part I.B.1 for a fuller discussion of the eGRID system average database and calculations.

emitted per unit of electricity consumed.[34] These emission factors are "usually reported in units of pounds of GHGs per kilowatt-hour or megawatt-hour."[35]

A second type of protocol has been developed to quantify reductions in GHG emissions that result from projects that either generate low-carbon electricity or reduce the consumption of electricity transmitted over electric power grids.[36] The most well-known protocol in this area is the *Guidelines for Quantifying GHG Reductions from Grid-Connected Electricity Projects*, developed by the World Resources Institute ("WRI Guidelines").[37] The WRI Guidelines are intended for use by two primary groups: (1) "project developers seeking to quantify GHG reductions outside the context of a particular GHG offset program or regulatory program"; and (2) "designers of initiatives, systems, and programs that incorporate grid-connected GHG projects."[38]

The basic approach set forth by the WRI Guidelines involves the calculation of both an "operating margin" and a "build margin."[39] According to the WRI Guidelines, the operating margin is defined as "electricity generation from existing power plants whose output is reduced in response to a project activity."[40] The WRI Guidelines use EERE technologies as the primary examples of such project activities.[41] The WRI Guidelines state that:

> [Operating margin] emissions are estimated using methods that attempt to approximate the emissions from the specific power plants whose operation is displaced. In theory, this estimation requires identifying which power plants are providing electricity at the margin . . . during the times that the project activity is operating. . . . Generation provided or avoided by the project activity may therefore affect a different marginal resource in each hour. . . . [E]stimating [operating margin] emissions can be a complex and data intensive task, matching a project activity's output to the marginal generating sources in each hour. In practice, a diversity of estimation methods can be used that vary in their complexity and accuracy.[42]

A spectrum of methodologies thus exist that have been used (and misused)[43] to estimate the operating margin. At one end of the spectrum are imprecise tools that estimate the impact of EERE measures on the average mix of emissions in the grid.[44] On the other end of the spectrum are methodologies, such as computer-based "hourly dispatch" models, that "capture a high level of detail on the specific electric generating units displaced by [EERE] projects or programs."[45] These dispatch models can be expensive and "difficult for non-experts to evaluate,"[46] and are therefore too advanced for most state and local governments. In addition, these dispatch models are generally proprietary,[47] which means that the assumptions used in calculating emission reduction benefits are not transparent to third parties.

### B. Methodologies for Calculating Emission Reductions from EERE Technologies

Grid-connected EERE technologies, such as wind power, have zero direct air emissions[48] and displace emissions from fossil fuel-fired electric power generation.[49] These emission reductions occur because

34 GREENHOUSE GAS PROTOCOL, *supra* note 1, at 99.
35 *Id.*
36 *See* QUANTIFYING GHG REDUCTIONS, *supra* note 13, at 4.
37 *Id.*
38 *Id.* at 6.
39 *Id.* at 11-16.
40 *Id.* at 13.
41 *Id.* at 11.

42 *Id.*
43 *See infra* Part I.B.
44 STEVEN R. SCHILLER, NATIONAL ACTION PLAN FOR ENERGY EFFICIENCY MODEL ENERGY EFFICIENCY PROGRAM IMPACT EVALUATION GUIDE 6-5 (2007), *available at* http://www.epa.gov/cleanenergy/documents/evaluation_guide.pdf.
45 *Id.* at 6-7.
46 *Id.*
47 *Id.*
48 DEBRA JACOBSON & COLIN HIGH, U.S. DEP'T OF ENERGY OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY, COMPARISON OF ALTERNATIVE AVOIDED EMISSIONS METHODOLOGIES APPLIED TO SELECTED NORTHEAST POWER MARKETS 4, *available at* http://www.mwcog.org/uploads/committee-documents/bf5dwFtb20081216140014.pdf.
49 QUANTIFYING GHG REDUCTIONS, *supra* note 13, at 11-12. In our Article, EERE is generally used to refer to energy efficiency and zero-emission renewable electric power generation, including solar energy, wind energy, geothermal energy, and tidal energy. Other renewable energy technologies, such as biomass, waste-to-energy, and landfill gas, do have some direct GHG emissions from combustion and other processes.

of the way the electric power system works. EERE technologies have zero fuel costs and very low incremental operating costs. In other words, when renewable generation produces power, electricity supplies from other sources generally will be reduced or not brought on-line.[50] For example, "a wind-generated kilowatthour displaces a kilowatthour that would have been generated by another source—usually one that burns a fossil fuel. . . The wind-generated kilowatthour therefore avoids the fuel consumption and emissions associated with that fossil-fuel kilowatthour."[51] When available, EERE technologies generally will displace generation at facilities with higher operating costs and varying output over time.[52]

The specific mix of coal, oil and gas-fired power units that will be displaced by EERE technologies varies significantly among states and regions of the country.[53] Some states, such as West Virginia and Pennsylvania, rely on coal plants for a majority of their generation, and in those States, coal units are displaced by EERE technologies during some seasons and times of day.[54] In comparison, natural gas units are more typically displaced in other states and regions, such as California and New England.[55]

EERE technologies "almost never displace nuclear power on the electric grid. Nuclear power plants are normally operated as baseload generators that run at full capacity (unless there is a planned or unplanned outage) because of low operating costs."[56]

In addition, EERE technologies generally do "not reduce hydroelectric power on the grid because of its low operating costs and flow constraints."[57] Although the operators of hydroelectric plants may shift the timing of their generation as a result of renewable energy use or energy savings, the "[t]otal generation at such hydroelectric plants is generally not reduced on average."[58]

Finally, the total amount of emission reductions resulting from EERE technologies also varies by time of day and season.[59] For example, emission reductions are highest in the middle of the day because energy efficiency savings, particularly from high-efficiency commercial air conditioners, "are greatest at the hours of the day with the highest temperatures and the highest electricity demand in offices and other commercial buildings."[60] Similarly, the energy savings and air emission reduction benefits of high-efficiency air conditioners are "concentrated in the summer months" whereas "high-efficiency refrigerators and dishwashers provide year-round energy savings."[61]

In this Article, we review three common methodologies used for quantifying emission reductions from increased use of EERE technologies, along with specific examples to illustrate the range of results. The three methodologies produce data with the following parameters: eGRID system average emission rates, eGRID non-baseload emission rates, and Time Matched Marginal ("TMM") emission rates.

Proprietary electric grid system dispatch models also have been used as a basis for calculating marginal emission rates from EERE technologies.[62] These models are not reviewed because they are proprietary, and as a result, the costs are often prohibitive. They also are not sufficiently transparent or replicable to be suitable for use in public accounting of air emissions.

### 1. EPA eGRID System Average Methodology

The eGRID database is maintained by the EPA and is "a comprehensive inventory of environmental attributes of electric power systems" in the United States.[63] According to EPA, eGRID is "[t]he

50 *Id.* at 11.
51 Michael Milligan et al., *Wind Power Myths Debunked,* IEEE POWER & ENERGY MAG., Nov.-Dec. 2009, at 89, 94.
52 DEBRA JACOBSON & COLIN HIGH, NAT'L RENEWABLE ENERGY LAB. SUBCONTRACTOR REPORT #SR-500-42616, WIND ENERGY AND AIR EMISSION BENEFITS: A PRIMER 9-10 (2008), *available at* http://www.windpoweringamerica.gov/pdfs/policy/wind_air_emissions.pdf. For more information on the complexities of analyzing avoided emissions under cap-and-trade programs, *see id.* at 12-17.
53 *Id.* at 10.
54 *Id.*
55 *Id.*
56 *Id.*
57 *Id.*
58 *Id.* The operating schedule of hydroelectric plants also may be limited by environmental constraints. *Id.*
59 ROLE OF ENERGY EFFICIENCY PROGRAMS, *supra* note 23, at 1-4. *See also* Press Release, PJM Interconnection, PJM Reports New Carbon Dioxide Emissions Data (Mar. 25, 2010) [hereinafter PJM Press Release], *available at* http://www.pjm.com/~/media/about-pjm/newsroom/2010-releases/20100325-pjm-reports-new-carbon-dioxide-emissions-data.ashx (attached graphic and tables comparing $CO_2$ emission rates of marginal generating units compared to $CO_2$ emission rates of system average generating units for 2005 to 2009).
60 *Id.* at 3.
61 *Id.* at 1.
62 *See supra* text accompanying note 45-47.
63 eGRID Frequently Asked Questions, *supra* note 2.

preeminent source of air emissions data for the electric power sector. . . .”[64] The eGRID database is derived from:

> [A]vailable plant-specific data for all U.S. electricity generating plants that provide power to the electric grid and report data to the U.S. government. eGRID integrates many different federal data sources on power plants and power companies, from three different federal agencies: EPA, the Energy Information Administration (EIA), and the Federal Energy Regulatory Commission (FERC).[65]

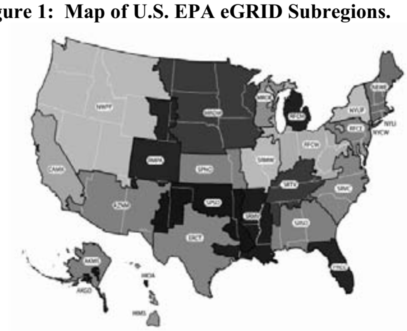
This database contains air emissions data for several GHGs, including $CO_2$, methane (“$CH_4$”) and nitrous oxide (“$N_2O$”).[66] It also provides data for the following criteria and hazardous air pollutants: $NO_x$, sulfur dioxide (“$SO_2$”), and mercury (“Hg”).[67]

The eGRID database is provided in a web-based application, eGRIDweb, as well as in Microsoft Excel format.[68] The database is publicly accessible on the EPA’s web site.[69] The EPA funds a contractor[70] to compile various types of data, including aggregated emissions data by state, electric generating company, parent company, power control area, eGRID subregion, North American Electric Reliability Corporation (“NERC”) region, and total U.S. levels.[71] “Total emissions and emission rates, and total generation and resource mix are displayed for each of these levels.”[72] The two most important eGRID output emission rates are the system average emission rates (also called “total output emission rates”) and the non-baseload emission rates.[73]

The system average emissions rate is calculated by dividing the total annual emissions of a particular pollutant[74] from all units in a region or power system (i.e., within the relevant grid boundary) by the total energy output of those units over the year.[75] This system, or grid average, includes all units that report data to the government, including nuclear power plants, hydroelectric plants, and other zero-emission sources as well as fossil fuel-fired generation units.[76] The system average emission rates rely on information from electric generation companies required to provide emissions data to both the EPA, including data from Continuous Emissions Monitors (“CEMs”), and to the Energy Information Administration.[77]

The EPA reports the system average emission rates for the NERC regions and eGRID subregions shown in Figure 1.[78] The twenty-six eGRID subregions are subsets of the NERC regions.[79]

**Figure 1: Map of U.S. EPA eGRID Subregions.**



The most recent eGRID database available includes emissions data for calendar year 2005.[80] The eGRID system average emission rates for each eGRID subregion vary considerably depending on the amount

64 *Id.*
65 *Id.*
66 *Id.*
67 *Id.*
68 SUSY ROTHSCHILD & ART DIEM ET AL., THE VALUE OF EGRID AND EGRIDWEB TO GHG INVENTORIES 1 (2009).
69 *See* U.S. Environmental Protection Agency, eGRID, http://www.epa.gov/egrid (last visited Mar. 25, 2010) [hereinafter eGRID].
70 *See* E.H. PECHAN & ASSOC., INC., EGRID EMISSIONS AND GENERATION RESOURCE INTEGRATED DATABASE VERSION 1.0 USER’S MANUAL (2009).
71 eGRID, *supra* note 69.
72 *Id.*
73 *See* ROTHSCHILD & DIEM ET AL., *supra* note 68, at 5-7.
74 Measurements are typically in pounds. *See* SCHILLER, *supra* note 44, at 6-5.
75 *See id*. Total energy output of units over a year is typically measured in Megawatt-hours or MWh.
76 *See* E.H. PECHAN & ASSOC., INC., THE EMISSIONS & GENERATION RESOURCE INTEGRATED DATABASE FOR 2007 TECHNICAL SUPPORT DOCUMENT (2008), *available at* http://www.epa.gov/RDEE/documents/egridzips/eGRID2007TechnicalSupportDocument.pdf.
77 *See id.* at 4.
78 EGRID SUMMARY TABLES, *supra* note 15, at 6, 10.
79 eGRID Frequently Asked Questions, *supra* note 2; *see* ROTHSCHILD & DIEM ET AL., *supra* note 68, at 1.
80 *See* eGRID, *supra* note 69.

of zero emission sources, such as nuclear and hydroelectric power, in the subregion.[81] Analyses conducted by Resource Systems Group, Inc. ("RSG") reveal that the system average emission rates are the lowest of the three methods discussed here in most eGRID subregions.[82]

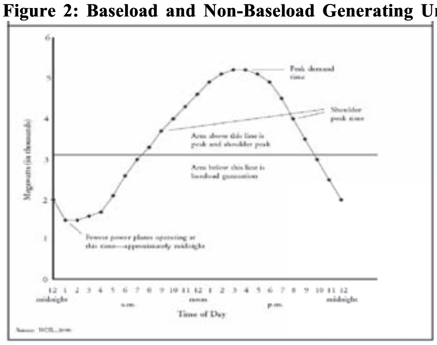
The methodology for calculating indirect emissions from electricity purchases, as adopted by The Climate Registry, relies on system average emission rates (when verified, utility-specific data is not available).[83] As a result, this methodology implicitly values emission reduction benefits of EERE technologies at the same emissions rate as the system average rate. Under the system average methodology, year-to-year changes in electric power purchases resulting from increased use of EERE technologies are accounted for by calculating the difference between the indirect emissions from electricity purchases in successive years based on the eGRID system average emission rates.[84]

However, according to the WRI Guidelines, "because calculating a simple average is significantly less precise than other methods," the system average approach "should only be used where other methods are not practicable [for calculating the operating margin for EERE projects]."[85] As discussed below, the eGRID system average methodology has been found to significantly understate the emission reduction benefits of increased use of EERE technologies in most regions.[86]

2. eGRID Non-Baseload Average Methodology

The eGRID non-baseload methodology is based on an understanding of the way in which increased EERE technology use displaces fossil fuel-fired electric generation.[87] This type of methodology focuses on electric generating units whose output varies according to the overall level of power demand (the "load" level) in the regional power market.[88] These load-following generating units are generally fossil fuel-fired, and include generating units usually classified as intermediate (shoulder) load and peak load plants.[89] These units are also called "marginal units" because they provide electricity "at the margin," and their output varies depending on the load.[90] Baseload units are generally excluded but may function as marginal units during certain hours and seasons of the year.[91] For example, some coal plants operate as intermediate plants in the PJM[92] Interconnection power market during certain times of the year.[93] Figure 2 highlights the distinction between baseload and non-baseload (shoulder/intermediate and peak load) generating units.[94]

**Figure 2: Baseload and Non-Baseload Generating Units**




Source: National Conference on State Legislatures, 2005.[95]

81 The EPA eGRID summary tables provide information on the generation resource mix (percent of generation from coal, oil, natural gas, other fossil fuels, biomass, hydro, nuclear, wind, solar, geothermal, and other) in each of the eGRID subregion. These summary tables also provide information on the eGRID emissions rates in each of these regions. A comparison of these tables demonstrates that the eGRID system average emission rates are lower when a subregion or region has a high percentage of nuclear and hydro resources in the generation mix. *See* EGRID SUMMARY TABLES, *supra* note 15, at 6, 10.
82 *See infra* Part II.
83 THE CLIMATE REGISTRY, *supra* note 10, at 99.
84 *See id.* at 99-100.
85 QUANTIFYING GHG REDUCTIONS, *supra* note 13, at 55.
86 *See* discussion *infra* Part II. *See also* PJM Press Release, *supra* note 59 (attached graphic and tables comparing $CO_2$ emission rates of marginal generating units compared to $CO_2$ emission rates of system average generating units for 2005 to 2009).

87 *See supra* Part I.B.1.
88 QUANTIFYING GHG REDUCTIONS, *supra* note 13, at Annex A.1.
89 Matthew Brown et al., NAT'L CONFERENCE OF STATE LEGISLATURES, ENERGY AND AIR QUALITY: THE POWER INDUSTRY AND AIR QUALITY 6-7 (2005).
90 QUANTIFYING GHG REDUCTIONS, *supra* note 13, at 55.
91 JACOBSON & HIGH, *supra* note 52, at 10.
92 PJM is a regional transmission organization supplying Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia. *See* PJM: Who We Are, http://www.pjm.com/about-pjm/who-we-are.aspx (last visited Mar. 25, 2010).
93 JACOBSON & HIGH, *supra* note 52, at 10.
94 Brown et al., *supra* note 89, at 6.
95 *Id.*

The major difference between the eGRID system average methodology and the eGRID non-baseload methodology is the group of generating units that is considered in calculating the avoided emissions rate. Whereas the eGRID system average methodology considers the emissions of *all* generating units operating on the regional or subregional power grid, the non-baseload calculation excludes all generation from resources that are not fossil fuel-fired.[96] Thus, "[p]lants with 100% hydro, nuclear, wind, solar, and/or geothermal generation are removed from the non-baseload calculation."[97] In addition, "[no] generation at plants with high capacity factors (0.8 and greater) is considered in the calculation of the non-baseload emissions rate."[98] Thus, the non-baseload average emission rates do not include consideration of emissions from baseload units[99] such as nuclear power plants, hydroelectric power plants, and many coal-fired plants.[100]

As highlighted by a sample of subregional power markets in the 2005 eGRID Subregion Emission Rates table, the eGRID non-baseload emission rate is significantly higher than the system average rate in most regions[101] because it excludes zero-emission nuclear and hydropower units and renewable energy generation.[102]

**Table 1: Comparison of eGRID Non-Baseload Methodology and eGRID System Average Methodology for Selected eGRID Subregions**[103]

| Subregional Power Market | Non-Baseload Methodology (lb. $CO_2$ /MWh) | System Average Methodology (lb. $CO_2$/MWh) |
|---|---|---|
| Midwest (MROW) | 2,158.79 | 1,821.84 |
| Midwest (SRMW) | 2,101.16 | 1,830.51 |
| Mid-Atlantic (RFCE) | 1,790.50 | 1,139.07 |
| California (CAMX) | 1,083.02 | 724.12 |
| Southwest (AZNM) | 1,201.44 | 1,311.05 |

Comparison of the eGRID database reveals that the eGRID non-baseload emissions rate is higher than the eGRID system average rate in twenty out of the twenty-six eGRID subregions.[104] Experts involved in the 2005 eGRID database confirmed this conclusion in a recently published paper, stating that "in general, with few exceptions, the non-baseload values are larger than the total output emission rates."[105]

The eGRID non-baseload average emission rates for eGRID subregions are also provided by the EPA on its website and in its summary reports.[106] The EPA's Green Power Partnership appropriately relies on the eGRID non-baseload average methodology in calculating emission reductions resulting from the use of renewable energy generation.[107] This EPA program has developed a calculator tool that incorporates the eGRID non-baseload methodology.[108]

96 *See* E.H. PECHAN & ASSOC., INC., *supra* note 76, at 15.
97 *Id.*
98 *Id.* According to the technical document, the non-baseload average is calculated from a percentage of each plants emissions and generation (depending upon capacity factor) that combusts fuel and has a capacity factor of less than 0.8. *Id.* at 15.
99 *Id.*
100 *Id*. Nuclear, hydroelectric, and coal plants are considered baseload plants because their capacity factor is greater than 0.8. *Id.*
101 *See* EGRID SUMMARY TABLES, *supra* note 15, at 6.
102 E.H. PECHAN & ASSOC., INC., *supra* note 76, at 15.

103 EGRID SUMMARY TABLES, *supra* note 15, at 6.
104 EGRID SUMMARY TABLES, *supra* note 15, at 6.
105 ROTHSCHILD & DIEM ET AL., *supra* note 68, at 7.
106 *Id.*
107 *See* U.S. Environmental Protection Agency, Green Power Partnership, http://www.epa.gov/greenpower/index.htm (last visited Mar. 5, 2010) [hereinafter Green Power Partnership]. The Green Power Partnership is a voluntary EPA program that supports the organizational procurement of green power by offering expert advice, technical support, tools and resources. For purposes of this program, green power is defined as electricity produced from a subset of renewable resources, such as solar, wind, geothermal, biomass, and low-impact hydro. *See id.*
108 *See* U.S. Environmental Protection Agency, Green Power Equivalency Calculator,

3. Time-Matched Marginal Emissions Methodology ("TMM")

Over the course of several years, Resource Systems Group ("RSG") has developed a methodology for estimating air emissions avoided by the increased use of EERE technologies. This TMM emissions methodology differs from the eGRID system average approach in several fundamental ways.

First, the TMM methodology is based on emissions monitoring data for each of the 8,760 hours of the year for generating units that submit hourly data to EPA. In comparison, the eGRID database focuses on *annual* averages of emissions for grid-connected electric generators.[109] The significance of this difference is underscored by the National Action Plan for Energy Efficiency, a coalition of the DOE, EPA, and more than fifty other agencies and organizations.[110] The National Action Plan's *Model Energy Efficiency Program Evaluation Guide*, released in November 2007, emphasizes that the eGRID system average approach to estimating avoided emissions has several major limitations.[111] The first major limitation is summarized as follows:

> [One] shortcoming of this approach is that energy efficiency savings tend to vary over time, such as savings from an office lighting retrofit that only occurs during the workday. Using an annual average emission factor that lumps daytime, nighttime, weekday, and weekend values together can skew the actual emissions benefits calculation.[112]

The second difference between the TMM methodology and the eGRID system average methodology is that the TMM methodology focuses on the actual generating units expected to be displaced when renewable energy generation or energy savings take place. Nuclear units and hydropower units are thus generally not considered by the TMM methodology when calculating avoided emissions.

In comparison, the eGRID system average methodology considers nuclear and hydroelectric units in calculating avoided emissions, even though such units are rarely displaced by increased use of EERE technologies.[113] The National Action Plan's *Program Evaluation Guide* views the inclusion of nuclear and hydroelectric units as a shortcoming of the methodology:

> A shortcoming of this [system average] approach is that it does not account for the complexity of regional power systems. . . . In many regions, the marginal units displaced by energy efficiency programs can have very different emissions characteristics from the base load units [such as nuclear and hydropower] that dominate the average emissions rate.[114]

The eGRID non-baseload methodology also shares the first limitation of the eGRID system average methodology because it is based on the annual average avoided emissions,[115] instead of a more accurate hourly measure. However, it differs from the system average methodology and shares a benefit of the TMM methodology because it focuses on the non-baseload units that are actually displaced when EERE technology comes online.[116]

Thus, RSG's TMM methodology provides a marginal rather than a system average emission rate. In addition, it uses a time-matching approach that is specific to the EERE technology under consideration. The TMM methodology is based on the following steps:

1. Estimating the hourly electric power generation for each fossil fuel-fired unit in a specific power market area;
2. Identifying the marginal fossil fuel-fired units at each hour by using the hourly generation to identify units that follow the total load at each hour. Based on this information, RSG's TMM method estimates average emission rates of the marginal units based on their incremental contribution to the load;
3. Using data to compile a profile of the energy savings or energy generation on an hourly basis over

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http://www.epa.gov/greenpower/pubs/calculator.htm (last visited Mar. 5, 2010). This tool is only available to Partnership members.

109 *See supra* Part I.B.1.

110 SCHILLER, *supra* note 44.

111 *Id.* at 6-5.

112 *Id.*

113 *See* Part I.B.

114 SCHILLER, *supra* note 44, at 6-5.

115 E.H. PECHAN & ASSOC., INC., *supra* note 76, at 15.

116 *Id.*

the 8760 hours of the year. This profile is prepared for a particular technology, such as wind power or high-efficiency commercial air conditioning, and for a particular region;[117]

4. The "time-matching" occurs when the load profile is matched for a specific technology on an hourly basis against the marginal emissions profile for the same hours;

5. The avoided emission rates can be used to produce, in Microsoft Excel format, a calculator that provides total avoided emissions from annual generation or savings, using either project-specific profiles or default regional profiles. This calculator also can be used to estimate avoided emissions on a monthly or seasonal basis.

Although RSG pioneered the TMM methodology, at least one other prominent energy consulting firm has used a conceptually similar approach. In July 2008, Synapse Energy Economics published a report for the EPA using an hourly approach to estimate avoided emissions based on hourly EPA CEM data from intermediate and peak load generating units.[118] This report, entitled *Analysis of Indirect Emissions Benefits of Wind, Landfill Gas, and Municipal Solid Waste Generation*, calculates avoided emissions for the three selected renewable energy technologies in each of the EPA's twenty-two eGRID subregions in the continental U.S.[119] The regional, hourly power profiles for each of the three renewable resources are combined with the hourly indirect emissions factors to yield annual indirect emissions benefits for each type of resource for each eGRID subregion.[120]

Researchers at the Laboratory for Energy and the Environment at the Massachusetts Institute of Technology ("MIT") also have studied the emission reductions from another renewable energy technology, solar photovoltaics ("PV"), using a methodology similar to the TMM method.[121] The MIT study relies on "matching up PV generation with associated changes in unit generation on an hourly basis."[122] It focuses on the fossil fuel units offset by PV generation in each region and each hour of the day.[123]

Moreover, the MIT study expresses serious concerns about the system average approach.[124] The researchers stressed that "[t]his report also challenges the simple averages approach on the ground that there is no evidence that average . . . emission rates occurring when PV is generating are representative of the fossil units that respond to changes in load, to be met by dispatchable generation."[125]

Finally, the DOE's Loan Guarantee Program Office ("LGPO") has adopted the RSG TMM methodology as a component in its review of loan guarantee applications for EERE projects.[126] The LGPO is applying the methodology in its evaluation of comparative GHG and air emission reduction benefits of projects competing for loan guarantees.[127]

## II. Findings From Comparison of Three Avoided Emissions Methodologies

In 2008, RSG conducted an analysis of results from the three different methodologies that measure the emissions impact of increased use of EERE technologies. The analysis focused on five EERE technologies: high-efficiency commercial lighting, high-efficiency commercial air conditioning, LED traffic lights, solar PV, and wind energy. In each case, RSG compared the avoided emissions from a specific technology using its TMM methodology, the eGRID system average methodology, and the eGRID non-baseload methodology. RSG analyzed both the PJM

117 The recommendations in Part IV*, infra*, highlight the need for additional work to refine these load profiles and to make them publicly available.

118 *See* Bruce Biewald et al., U.S. Envtl. Prot. Agency, Office of Research and Dev., Analysis of Indirect Emissions Benefits of Wind, Landfill Gas, and Municipal Solid Waste Generation i (2008), *available at* http://www.synapse-energy.com/Downloads/SynapseReport.2008-07.EPA.EPA-Indirect-Emissions-Benefits.06-087.pdf.

119 *Id.*

120 *Id.*

121 *See* The Analysis Group for Reg'l Energy Alternatives, Emissions Reductions from Solar Photovoltaic (PV) Systems 1-4 (2004), *available at* http://web.mit.edu/agrea/docs/MIT-LFEE_2004-003a_ES.pdf.

122 *Id.* at 1-2.

123 *Id.* at ES-1.

124 *Id*. at 1-4.

125 *Id*.

126 The LGPO subcontracted with RSG to conduct the analysis of GHG and air emission reduction benefits on the electric grid resulting from alternative technologies competing for loan guarantees, and RSG is applying its TMM methodology in this process. *See generally* RSG, Inc., Avoided CO2 Emissions, http://www.rsginc.com/avoided-co2-emissions-2/ (last visited Mar. 25, 2010). The DOE required applicants to set forth the hourly load profiles for electric generation or savings under their technologies as part of the loan guarantee application process. See Loan Guarantee Program Office, U.S. Dep't of Energy, Electrical Profiles—Generation, Purchases, Savings and Transfers Worksheet (2008), *available at* http://www.lgprogram.energy.gov/lew.xls.

127 *Id.*

Interconnection power market and the Upstate New York power market.

The findings of this analysis are as follows:

1. Avoided air emission benefits for the five EERE technologies for $CO_2$ and $NO_x$ are from 65% to 165% or more higher using the TMM methodology when compared to the eGRID system average method;

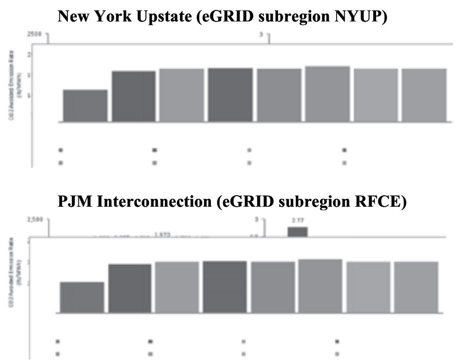
2. Avoided air emissions benefits for the five EERE technologies for $CO_2$ are from approximately fifteen percent higher using the TMM methodology when compared to the eGRID non-baseload methodology;

3. Within the two power market areas studied, the emission reduction benefits associated with the five different EERE technologies varied by only up to three percent. The variability is mainly associated with the degree of seasonal variation in electricity savings or additional renewable energy generation.

4. In all cases, the results for $NO_x$ are more complicated and more variable than the results for $CO_2$. This complexity is related to the highly variable emission rates for $NO_x$ resulting from large differences in the efficiency of pollution control technologies for this pollutant. In comparison, there are no pollution controls for $CO_2$ on the units studied.

Figure 3 highlights these results, and the actual data relating to these summary findings is set forth in the Appendix.

**Figure 3: Comparison of RSG TMM Avoided Emissions Rates for $NO_x$ and $CO_2$ with eGRID Emission Rates for the Upstate New York and PJM Interconnection Power Markets**




The wide variation in the results poses significant challenges to state and local governments in preparing GHG inventories and conducting other GHG accounting.[128] The following hypothetical example highlights the differences among the three methodologies. (It should, however, be noted that the eGRID system average methodology is not recommended for this type of estimation even though it is often inappropriately used for calculating emission reductions resulting from increased use of EERE technologies).[129]

This hypothetical involves a municipality in western New York that is tracking its GHG emissions and reporting under The Climate Registry protocols—using system average emission rates for its purchase of electricity. Assume that the municipality decided to reduce its GHG emissions to meet a target in its Climate Action Plan and decided to install a municipal wind farm to power its own facilities and generate 10,000 MWh per year. The reported avoided emissions from the three alternative emissions assessment methodologies are shown in Table 2.

**Table 2: Avoided $CO_2$ Emissions from 10,000 MWh of Wind Energy Generation in Upstate New York. Based on 2005 Data.**

| Avoided Emissions Methodology | Avoided $CO_2$ Emissions (Tons per Year) | Organization Using Methodology |
|---|---|---|
| eGRID System Average | 3,600 | Climate Registry[130] |
| eGRID Non-Baseload Average | 7,571 | EPA Green Power Partnership |
| Time-Matched Marginal (TMM) | 9,160 | DOE Loan Guarantee Program, Metro Washington COG |

128 In this example (and for simplicity), we only have considered avoided emissions from operational changes in generation in the near-term. We have not considered the added complexity that additional generation may have on reducing the need to build new electric generating capacity in the future.

129 *See generally* Part III (discussing the widespread use of the eGRID system average methodology).

130 *See infra* Part III.A.

Under this example, the municipality's own wind power project would result in a decrease in reported $CO_2$ emissions to The Climate Registry of approximately 3,600 tons per year.[131] On the other hand, the municipality might be a member of EPA's Green Power Partnership and calculate the air emission benefits from its new wind farm using the eGRID non-baseload methodology. Under this methodology, the emission reduction benefits claimed would be 7,571 tons of $CO_2$.[132] The amount of avoided $CO_2$ emissions reported under this non-baseload methodology would thus differ substantially from the amount of avoided $CO_2$ emissions calculated under the eGRID system average methodology. Moreover, using an hourly marginal emissions analysis, such as the TMM method, a more accurate estimate of the avoided emissions benefits of a municipal purchase of 10,000 MWh of wind power would be about 9,160 tons of $CO_2$.

If the municipality wanted to quantify its progress toward a GHG reduction target, the TMM methodology would be most accurate in the near-term. This hypothetical illustrates the need for greater consistency and accuracy in calculating and reporting $CO_2$ reduction benefits.

The analysis described above is based on only two of the twenty-six NERC subregions. However, subsequent to the completion of the research included in this Article, RSG analyzed the emission reduction benefits of a wide range of EERE projects across all of the NERC regions and virtually all of the NERC subregions. RSG's analysis confirms that the use of the TMM methodology results in significantly higher emission reduction benefits than using the eGRID system average methodology in most regions of the country. The comparison with the non-baseload average is more complex, making it difficult to draw clear conclusions.

Thus, this recent work further confirms that the eGRID system average methodology is an inappropriate approach for assessing the avoided emissions benefits of specific EERE programs and projects, which is implicit in how state and national registries and accounting programs currently estimate indirect emissions from electricity purchases.[133] This conclusion was supported by EPA eGRID experts at the recent Energy and Environmental Conference 2010 (commonly called the EUEC 2010) in Phoenix.[134] According to a paper presented by the eGRID experts, the eGRID non-baseload emission rates, rather than the eGRID total output emission rates (system average rates), are recommended for use in estimating "the emissions benefits of reductions in grid supplied electricity use, especially those that are somewhat coincident with peak demand."[135] The experts specifically recommended the eGRID non-baseload methodology to calculate emission reductions from using high-efficiency air conditioning.[136]

## III. Improved Methodologies Would Benefit Federal and State Climate and Air Quality Programs

### A. The Climate Registry's Reliance on the eGRID System Average Methodology

It is very important to promptly address the inappropriate use of the eGRID system average methodology for calculating changes in $CO_2$ emissions resulting from increased use of EERE technologies. Unfortunately, a large majority of states and hundreds of local governments and private entities using GHG emission protocols are misapplying the system average avoided emissions methodology in these circumstances.[137] Reliance on the eGRID system average methodology has significant ramifications because of the possibility that other government entities and the authors of national climate legislation will follow this precedent.

Most importantly, the General Reporting Protocol of The Climate Registry—a non-profit organization

131 The Climate Registry's General Protocol does suggest the reporting of supplemental information about green power purchases in its entity-wide report on indirect emissions from electricity purchases. THE CLIMATE REGISTRY, *supra* note 10, at 101. However, the indirect emissions that are reported as scope 2 emissions from electricity purchases would only be reduced by 3,600 tons.

132 U.S. Environmental Protection Agency, eGRID2007 Version 1.1 Year 2005 GHG Annual Output Emission Rates, http://cfpub.epa.gov/egridweb/ghg (last visited Mar. 23, 2010) (listing the "[a]nnual non-baseload output emissions rates" for Upstate New York (NYUP) as 1511.14 lb CO2/KWH); U.S. Environmental Protection Agency, Green Power Partnership, Green Power Equivalency Calculator, http://www.epa.gov/greenpower/pubs/calculator.htm (last visited Mar. 23, 2010).

133 *See infra* Part III.C.

134 *See* ROTHSCHILD & DIEM ET AL., supra note 68, at 6.

135 *Id.*

136 *See id.*

137 *See infra* notes 171-73 and accompanying text.

comprised of forty states and the District of Columbia—recommends the use of system average emissions rates to calculate indirect GHG emissions from electricity purchases if utility-specific emissions information is not available.[138] The Climate Registry's General Reporting Protocol incorporates a table that contains specific emission factors to apply in such cases—the eGRID system average.[139]

The General Reporting Protocol does suggest the reporting of supplemental information regarding green power purchases in its entity-wide report on indirect emissions from electricity purchases.[140] However, this Protocol does not require any reductions in the level of indirect emissions from electricity purchases (scope 2 emissions) reported as a result of the increased use of renewable energy technologies and does not require an additional inventory to reflect emission reductions that result from increased use of renewable energy technologies.[141] The General Reporting Protocol, moreover, does not discuss any adjustments to account for reductions in energy use from major energy efficiency projects undertaken by an entity.[142]

In comparison to the TMM methodology, the General Reporting Protocol methodology does not involve marginal emissions rates, nor does it require time-varying profiles of specific EERE technologies.[143] A companion Protocol developed by the Local Governments for Sustainability ("ICLEI") in partnership with The Climate Registry, the California Climate Action Registry, and the California Air Resources Board, uses a similar approach.[144] In addition, as discussed below, Climate Registry protocols have been referenced in several major pieces of national climate legislation.[145]

It should be noted that The Climate Registry's General Reporting Protocol "recognizes the need to develop a specific accounting framework for green power purchases in order to encourage and incentivize emission reduction efforts."[146] The General Reporting Protocol, however, asserts that "[t]here is not yet consensus on how to accurately and credibly track green power purchases in an accounting framework, beyond allowing Reporters to provide supplementary information about their green power purchases in annual emission reports."[147]

In its General Reporting Protocol, The Climate Registry committed to "incorporating a framework for accounting for contractual purchases of electricity, such as green power," as it "develop[ed] an industry specific protocol for the power and utility sector. . . ."[148] Unfortunately, The Climate Registry did not resolve this issue when it issued its voluntary reporting protocol for the electric power sector in June 2009.[149]

The Climate Registry's Protocols raise particular concerns about the disconnect between year-to-year changes in $CO_2$ emissions reported to The Climate Registry, as compared to energy efficiency savings, and related GHG emission reductions reported by state energy agencies and electric utilities. For example, if the State of Maryland—a member of The Climate Registry—reports its $CO_2$ inventory under the General Reporting Protocol, it is likely to underestimate the benefits of energy savings from high-efficiency heating equipment in the State for a variety of reasons, including the fact that the eGRID system average methodology does not reflect seasonal changes in avoided emissions.[150]

This issue of seasonal variation is significant because the avoided $CO_2$ emissions from energy efficiency technologies in Maryland are greater in the

138 *See* THE CLIMATE REGISTRY, *supra* note 10, at 99. The Climate Registry is a non-profit organization that supports public reporting of greenhouse gas emissions throughout North America in a single unified registry. The Protocol indicates that generator-specific emission factors are preferred instead of eGRID data but allows the use of eGRID data when such generator-specific emission factors are not available. Even with respect to the generator-specific data, the Protocol does not require the use of marginal emissions data. *See id.* at 99.

139 *See id.* at 99, 104.

140 *See id.* at 101.

141 *See id.*

142 *See id.* at 97-108.

143 *Compare id.*, *with supra* Part I.B.3 (discussing TMM methodology).

144 LOCAL GOV'TS FOR SUSTAINABILITY ET AL., LOCAL GOVERNMENT OPERATIONS PROTOCOL, VERSION 1.0, at 169, 175-76 (2008), *available at* http://www.icleiusa.org/action-center/tools/lgo-protocol-1 (using system average data in Tables providing default electricity emissions factors).

145 *See infra* notes 160-67 and accompanying text.

146 THE CLIMATE REGISTRY, *supra* note 10, at 101.

147 *Id.*

148 *Id.*

149 THE CLIMATE REGISTRY, ELECTRIC POWER SECTOR PROTOCOL FOR THE VOLUNTARY REPORTING PROGRAM, ANNEX 1 TO THE GENERAL REPORTING PROTOCOL, VERSION 1.0, at 54, 64-67, 76-77 (2009), *available at* http://www.theclimateregistry.org/downloads/2009/05/Electric-Power-Sector-Protocol_v1.0.pdf.

150 *See* NAT'L ACTION PLAN FOR ENERGY EFFICIENCY, MODEL ENERGY EFFICIENCY PROGRAM IMPACT GUIDE 6-5 (2007), *available at* http://www.epa.gov/cleanenergy/energy-programs/napee/resources/guides.html#guide5.

winter months.[151] The fossil fuel-fired units displaced in the regional power market are more often coal-fired units with high $CO_2$ emissions.[152] As Maryland implements its new EmPOWER Maryland efficiency initiative,[153] The Climate Registry methodology is thus unlikely to reflect the full benefits of the new initiative.

The eGRID system average methodology also will not provide an accurate comparison of the cost-effectiveness of alternative GHG reduction strategies that rely on EERE technologies, particularly comparisons of actions in different regions and power markets. For example, the MIT study emphasized that the degree of reliance on higher emitting fossil fuel-fired electricity in a particular power grid will be a greater determinant of the level of avoided emissions from solar photovoltaic energy than the amount of sunshine in a particular region.[154] This fact may heighten the $CO_2$ reduction value of solar energy in certain regions, such as the Northern Plains and the Tennessee Valley, which generally are not viewed as promising solar generation areas.[155] Furthermore, the adoption of time-of-use pricing in electricity markets[156] will require increased emphasis on time-of-use avoided emissions analysis if the cost-effectiveness of energy efficiency programs is to be properly evaluated.

The misapplication of the eGRID system average is likely to have sweeping impacts because the broad geographic membership of The Climate Registry has spurred partnerships with other important organizations. For example, in December 2008, ICLEI announced a partnership with The Climate Registry to encourage local governments to report their emissions as members of The Climate Registry.[157] Previously, ICLEI had worked with The Climate Registry to develop the Local Government Operations Protocol to facilitate reporting of GHGs by local governments.[158] More than 600 local governments in the United States are members of the ICLEI organization.[159]

Several pieces of national climate legislation also have referenced The Climate Registry's protocol. For example, H.R. 2454, the American Clean Energy and Security Act of 2009, approved by the House of Representatives in June 2009, references The Climate Registry in its provisions establishing a greenhouse gas registry.[160] Section 713(b)(1) requires the EPA Administrator to issue regulations establishing a federal greenhouse gas registry, and subsection (b)(1)(E) requires the Administrator to: "[T]ake into account the best practices from the most recent federal, state, tribal and international protocols for the measurement, accounting, reporting, and verification of greenhouse gas emissions, *including protocols from The Climate Registry* and other mandatory state or multistate authorized programs."[161]

Moreover, H.R. 2454 requires the EPA Administrator to explain any major differences in the approach between the registry established under the new regulations and The Climate Registry and other mandatory state and multistate programs.[162] The Climate Registry is defined in the legislation as "the greenhouse gas emissions registry jointly established and managed by more than 40 States and Indian tribes

151 Information is based on RSG Inc. TMM emissions methodology discussed *supra* Part I.B.3.

152 *Id*.

153 *See* Maryland Energy Administration, Energy Facts and Programs, http://www.energy.maryland.gov/facts/empower/index.asp (last visited Mar. 25, 2010). Under Maryland's "EmPOWER Maryland" initiative, the state is working with its utilities to require actions to reduce energy consumption by fifteen percent by the year 2015. *Id*.

154 STEPHEN CONNORS ET AL., LAB. FOR ENERGY & THE ENV'T, EMISSIONS REDUCTIONS FROM SOLAR PHOTOVOLTAIC SYSTEMS ES-2, at 8-1 (2005), *available at* http://solar.gwu.edu/index_files/Resources_files/MIT_Solar%20PV%20Report2004.pdf.

155 *Id.* at 6-7.

156 Time-of-use rates provide electric consumers with rates that vary over time to reflect the "value and cost of electricity in different time periods." The purpose of this approach is to encourage consumers "to use less electricity at times when electricity prices are high." U.S. DEP'T OF ENERGY, BENEFITS OF DEMAND RESPONSE IN ELECTRICITY MARKETS AND RECOMMENDATIONS FOR ACHIEVING THEM: A REPORT TO THE U.S. CONGRESS PURSUANT TO SECTION 1252 OF THE ENERGY POLICY ACT OF 2005, at v, xi (2006), *available at* http://www.oe.energy.gov/DocumentsandMedia/congress_1252d.pdf.

157 Press Release, The Climate Registry and Local Gov'ts for Sustainability, ICLEI and the Climate Registry Partner to Track Rigorous GHG Emissions Accounting for Local Governments (Dec. 2, 2008).

158 *See* Open Letter from Rachel Tornek, Senior Policy Manager, Cal. Climate Action Registry & Garrett Fitzgerald, Dir. Of Programs, ICLEI — Local Govt's for Sustainability, Local Government Protocol Invitation (Mar. 2, 2008), *available at* http://www.icleiusa.org/programs/climate/protocol-invitation-letter/?searchterm=LocalGovernmentOperationsProtocol.

159 ICLEI — Local Governments for Sustainability, About ICLEI, http://www.icleiusa.org/about-iclei (last visited Mar. 5, 2010).

160 *See* American Clean Energy and Security Act of 2009, H.R. 2454, 111th Cong. § 713 (2009).

161 H.R. 2454 §§ 713(b)(1), (b)(1)(E) (emphasis added).

162 H.R. 2454 § 713.

in 2007 to collect high-quality greenhouse gas emission data from facilities, corporations, and other organizations to support various greenhouse gas emission reporting and reduction policies for the member States and Indian tribes."[163]

Similarly, the provisions of the Senate version of climate legislation establishing a GHG registry also reference The Climate Registry protocols.[164] Section 713(b)(1)(E) of the Clean Energy Jobs and American Power Act states that the regulations issued by the EPA Administrator to establish a GHG registry shall "take into account the best practices from the most recent Federal, State, tribal and international protocols for the measurement, accounting, reporting, and verification of greenhouse gas emissions, *including protocols from The Climate Registry* and other mandatory State or multistate authorized programs."[165]

In summary, The Climate Registry is in a key position to develop additional protocols that more accurately reflect the emission reduction benefits of increased use of EERE technologies. The leadership of the Climate Registry has emphasized that corrections and clarifications to its General Reporting Protocol will be necessary as the program evolves.[166] The organization has announced plans to release a new version of its General Protocol in 2010,[167] and the Authors have sought to facilitate necessary clarifications by sharing the results of the methodology issues raised in this Article with the Climate Registry staff.

B. Mandatory GHG Reporting Rules

On October 30, 2009, the EPA published a final rule requiring the first-ever national mandatory reporting system for GHGs in the United States.[168] Although the October 2009 rule only focused on direct emissions and did not require reporting of indirect emissions from electricity purchases,[169] the preamble to the final rule indicated that reporting of indirect emissions was likely to be considered in the future.[170] Any methodology ultimately adopted by the EPA in a future rulemaking for mandatory reporting of GHG emissions will be extremely important in establishing a precedent for the treatment of indirect emissions from electricity purchases.

According to the preamble, the EPA stated:

> While EPA is not collecting data on electricity purchases in this rule, we understand that acquiring such data may be important in the future. Therefore, we are exploring options for possible future data collection on electricity purchases and indirect emissions, and the uses of such data. Such a future data collection on indirect emissions would complement EPA's interest in spurring investment in energy efficiency and renewable energy.[171]

To date, the EPA has not addressed the option of developing two separate inventories for indirect emissions—one to help aggregate reports of GHG emissions from individual entities and a second to account for changes in GHG emissions resulting from increased use of EERE technologies.[172] However, since the EPA views the encouragement of EERE technologies as an important goal, it is essential for the EPA to use the appropriate methodology to accomplish its objective.

Consistent with the WRI Guidelines, the EPA should use a marginal emissions methodology in any emissions inventory intended to measure reductions in GHGs resulting from increased use of EERE.[173] Businesses and policymakers seeking a level playing field for EERE technologies should closely follow EPA's future rulemaking activities in this area.

Moreover, EERE technologies are not the only technologies affected by this methodological problem. The evaluation of air emissions reductions from other electric technologies, such as fuel cells, grid-connected batteries, compressed air and pumped storage and plug-

163 H.R. 2454 § 713(a)(1).
164 Clean Energy Jobs and American Power Act, S. 1733, 111th Cong. § 713(b)(1)(E) (2009).
165 S. 1733 § 713(b)(1)(E) (emphasis added).
166 THE CLIMATE REGISTRY, GENERAL REPORTING PROTOCOL 1.1 CLARIFICATIONS AND CORRECTIONS 1 (2008), *available at http://www.theclimateregistry.org/downloads/08.11.24_GRP_Clarifications_and_Corrections.pdf*.
167 *Id.*
168 Mandatory Reporting of Greenhouse Gases, 74 Fed. Reg. 56,260 (Oct. 30, 2009) (to be codified at 40 C.F.R. pt. 98).
169 *Id.* at 56,289.
170 *Id.*
171 *Id.*
172 *See id.*
173 *See infra* Part IV (providing a more extensive elaboration of this recommendation); *see supra* Part I.B.2.-3 (providing a description of the non-baseload and TMM methodologies).

developed with support from the DOE Clean Energy/Air Quality Integration Initiative, could fulfill this essential need. It has already been employed by the Metropolitan Washington Council of Governments (MWCOG), the Commonwealth of Virginia, the State of Maryland, and the District of Columbia.[188]

The MWCOG calculator, which is based on the RSG TMM methodology, allows the user to use standard load profiles for a specific renewable energy or energy savings technology, or project-specific load profiles, and to enter these profiles into an Excel-based spreadsheet.[189] In developing its air quality plan to meet the eight-hour ozone standard, the MWCOG staff used the calculator to compute the annual or monthly avoided emission estimates for $NO_X$ using the hourly TMM emission rates that were embedded in the calculator.[190]

An hourly marginal emissions methodology is also ideally suited to assess the benefits of EERE measures on high electric demand days. Energy savings measures that reduce summer electric use "during the days and hours with the highest electrical demand, such as high-efficiency air conditioning and commercial lighting, are particularly valuable in reducing emissions of $NO_X$—a precursor to ground-level ozone that causes adverse respiratory effects in adults and children."[191] "Ozone is formed on hot summer days, and the hottest summer days also are typically the days of highest electrical demand—the so-called 'high electric demand days.'"[192]

Research has demonstrated that daily $NO_X$ emissions on high electric demand days from fossil fuel-fired electric generating units in certain regions of the country, such as the Northeast and the Mid-Atlantic regions, substantially exceed emissions on more typical summer days.[193] "This result occurs because the peak load generating units used on these limited number of days each year (generally fewer than a dozen days) are typically older units with limited pollution controls."[194]

There is a major opportunity to provide access to the TMM method and calculator to state and local governments. States have time to develop and distribute the database and calculator prior to the submission of the SIPs in 2013 and to train state employees to use this tool.

## IV. Recommendations

Based on the findings presented above, this Article offers five recommendations. Adopting these recommendations would substantially advance efforts to measure the full air emission reduction benefits of EERE technologies.

First, DOE, EPA, and state air, climate, and energy agencies, including the Board of The Climate Registry, should fund an enhancement of the eGRID database to provide a profile of hourly marginal emissions for each of the 8,760 hours of the year in each of the eGRID subregions. This enhanced eGRID database should cover all power markets as well as all regions and subregions of the North American Electric Reliability Corporation.

The enhanced eGRID database would include additional information based on the TMM methodology or a similar methodology (initially using data from

188 The following document issued by the Metropolitan Washington Council of Governments ("MWCOG") relies on the analysis from the TMM calculator in its chapter on voluntary control measures (Chapter 6) and in Appendix H. Metro. Wash. Council of Gov'ts, Plan to Improve Air Quality in the Metropolitan Washington, DC-MD-VA Region: State Implementation Plan for 8-Hour Ozone Standard 6-61 to 6-82, Appendix H (2007), *available at* http://www.mwcog.org/environment/air/downloads/SIP_APP/default.asp.
The calculator tools are set forth in Appendix H of the MWCOG document for LED traffic lights, wind energy and the DC RPS. The methodology underlying the calculator tools is set forth in the following document contained in Appendix H of the MWCOG document. *See* Colin High & Kevin Hathaway, Res. Systems Group, Avoided Air Emissions from Energy Efficiency and Renewable Energy Power Generation in the PJM Interconnection Power Market Area (2007), *available at* http://www.mwcog.org/environment/air/downloads/SIP_APP/App_H_-_RSG_Avoided_Emissions_Rept_5-23-07_Draft_Final.pdf.

189 Metro. Wash. Council of Gov'ts, *supra* note 188, at 6-61.

190 *Id.* The calculator tool that was initially developed in 2007 has been refined in 2008 and 2009 under a grant issued by the DOE's Office of Energy Efficiency and Renewable Energy (EERE). The grant was issued to the Virginia Department of Mines, Minerals and Energy under the EERE's state Energy Program to support a project titled "Promoting Air Quality with Clean Energy in the Metropolitan Washington Region." The methodology has been further refined under work performed for the DOE's Loan Guarantee Project Office to encompass GHGs and other pollutants. In view of the NOx emissions trading regime in effect in Maryland, the District of Columbia, and Virginia, the air agencies in these jurisdictions committed to retire NOx allowances in an amount commensurate with the amount of calculated emissions. *See id.* at Appendix H.

191 Role of Energy Efficiency Programs, *supra* note 23, at 2.

192 *Id.*

193 *See* Ne. States for Coordinated Air Use Mgmt., Final White Paper: High Electric Demand Day and Air Quality in the Northeast (2006).

194 Role of Energy Efficiency Programs, *supra* note 23, at 2.

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191 ROLE OF ENERGY EFFICIENCY PROGRAMS, *supra* note 23, at 2.

192 *Id.*

193 *See* NE. STATES FOR COORDINATED AIR USE MGMT., FINAL WHITE PAPER: HIGH ELECTRIC DEMAND DAY AND AIR QUALITY IN THE NORTHEAST (2006).

194 ROLE OF ENERGY EFFICIENCY PROGRAMS, *supra* note 23, at 2.

Continuous Emission Monitors and other data reported to the EPA). As a result, it should be possible to compile this database for a relatively modest amount of funding relative to the potential benefits. Since the enhanced eGRID database would be extremely useful in obtaining air quality, climate, and energy goals by federal, state, and local agencies, some type of cost-sharing arrangement among these agencies appears reasonable.

Alternatively, it seems appropriate to fund such a database on a longer-term basis with funds from allowance auction revenues generated under regional or national climate change legislation. This funding can be justified on the grounds that the data will directly facilitate the development of more accurate GHG reduction estimates.

Second, as an interim measure pending the completion of the eGRID enhancement set forth in our first recommendation, the federal government and states should utilize the eGRID non-baseload emissions methodology for calculating the emission reduction benefits of increased use of EERE technologies. This non-baseload methodology is far more representative than the eGRID system average methodology and has already been developed by the EPA. Moreover, the eGRID non-baseload methodology is recommended for estimating emissions reductions from EERE,[195] and this methodology has been adopted by the EPA Green Power Partnership to calculate the GHG emission reduction benefits of renewable power.[196]

The eGRID non-baseload methodology could therefore serve as a valuable interim approach. During the interim period before the development of an enhanced eGRID database, appropriate agencies should consider allowing state and local governments, such as the MWCOG, and private entities to submit marginal emissions calculations from other verified sources, such as the RSG TMM, instead of using the EPA non-baseload emissions estimates.[197]

195 ROTHSCHILD & DIEM ET AL., *supra* note 68, at 6.

196 *See* Green Power Partnership, *supra* note 107.

197 For example, shortly before the publication of this Article, the PJM Interconnection announced the availability of $CO_2$ emissions data for marginal generating units from January 2005 to December 2009. The related press release stated that this data "can be used to estimate carbon dioxide reductions from demand response, energy efficiency measures and increases in emissions-free generation." PJM Press Release, *supra* note 59 (attached graphic and tables comparing $CO_2$ emission rates of marginal generating units compared to $CO_2$ emission rates of system average generating units for 2005 to 2009).

As noted above, recent research by RSG has determined that the difference between the eGRID non-baseload methodology and the TMM methodology can be quite significant for certain regions and technologies. Therefore, reliance on this eGRID non-baseload approach should be only an interim step.

Third, DOE, the EPA, and other interested agencies and parties should consider continuing their support of the Northeast Energy Efficiency Partnerships ("NEEP") Evaluation, Measurement, and Verification ("EMV") Forum,[198] and other similar efforts to develop hourly load profiles for specific EE technologies. The EMV Forum was initiated in 2008 with funding from a number of entities, including DOE and the EPA. There remains strong synergy between the proposed work of the EMV Forum to compile hourly load profiles of various energy efficiency measures with the proposed compilation of hourly marginal emission rates under the TMM and the eGRID non-baseload methodologies.

As stated in Part I.B.3, *supra*, the "time-matching" aspect of the TMM methodology involves matching the load profile for a specific technology against the emissions profile of the marginal units.[199] The recommendation for the eGRID enhancement would provide information to generate the hourly emissions data on the marginal units, but the NEEP process and other similar efforts will provide the second piece of the puzzle for energy efficiency resources—the load profile for specific energy efficiency technologies, such as high-efficiency commercial air conditioning and high-efficiency residential lighting.[200]

198 *See* SUSAN COAKLEY ET AL., NE. ENERGY EFFICIENCY P'SHIP, NORTHEAST EVALUATION MEASUREMENT AND VERIFICATION FORUM: THREE-YEAR PLAN 3 (2008), *available at* http://neep.org/uploads/EMV%20Forum/EMV_forum_plan_4.08.pdf.

199 *See supra* Part I.B.3.

200 With respect to renewable energy resources, many of the load shape profiles are already readily available. For example, the National Renewable Energy Laboratory has developed the PVWatts™ calculator to allow researchers to easily determine the energy production of grid-connected "PV" energy systems in different regions of the U.S. and the world. National Renewable Energy Laboratory, Renewable Resource Data Center, PVWatts, http://www.nrel.gov/rredc/pvwatts (last visited Mar. 5, 2010). The PVWatts calculator works by creating hour-by-hour performance simulations that provide estimated monthly and annual energy production in kilowatts and energy value. Users can select a location and choose to use default values or their own system parameters for size, electric cost, array type, tilt angle, and azimuth angle. In addition, the PVWatts calculator can provide hourly performance data for the selected location. *See id.*

Fourth, DOE, the EPA, and other agencies and entities should initiate additional research to refine the time-matched marginal emissions methodology. Although both marginal emissions methodologies are far more accurate than the system average methodology in estimating avoided emissions from EERE technologies, these marginal methodologies require additional research to overcome certain limitations discussed below.[201] Federal and state agencies should consider funding this research to increase the value of the marginal methodologies measurement approach.

The most valuable improvement in both the eGRID non-baseload and TMM methodologies would be an expansion of the methodologies to include the impact of significant grid changes in the mid-term and long-term. This refinement would capture changes in emissions caused by the construction of new power generation units and by the retirement of old units.

The two eGRID methodologies and the initial TMM methodology (used for the analysis of the two power markets discussed in this Article) only capture the displacement of *existing* fossil fuel-fired units on the grid by EERE technologies because they are based on the analysis of historic data. These analyses thus reflect the so-called operating margin[202] that dominates near-term changes in emissions.

However, leading experts on GHG emission analysis emphasize that the analysis of avoided emissions from grid-connected electric generation over several decades also must consider the impact of new units that may be built on the grid—the so-called build margin.[203] Further work is needed to develop cost-effective and transparent methods to capture this "build margin."[204]

In addition, electric generation modeling experts suggest that it would be useful to compare the results of at least one leading proprietary dispatch model with the results of the TMM methodology.[205] This comparison would be useful to further validate the methodology and to identify any areas of necessary improvement.

Finally, we recommend that federal and state regulatory agencies, as well as electric utilities and their trade associations, consider the GHG emission profiles of electric generation in evaluating charging strategies for electric and plug-in hybrid vehicles as well as energy storage technologies. The GHG emissions profile of electric generation varies by region, season, and hour of the day. Unless governmental agencies consider the specific emissions profile of each region, they may fail to develop the optimal strategy for reducing GHG emissions from new technologies for energy storage and advanced electric vehicles.

## CONCLUSION

Federal and state agencies involved in climate, air pollution, and energy matters should act promptly to ensure that accurate methodologies are used in calculating reductions in emissions of GHGs and other air pollutants resulting from increased use of EERE technologies on the electric power grid. In particular, the forty states involved in The Climate Registry should consider developing an additional protocol and registry during their planned revisions of the General Reporting Protocol in 2010. The proposed supplementary protocol should incorporate a more accurate methodology based on marginal emissions to account for the increased use of EERE technologies on the electric power grid. Such an approach also should be incorporated into EPA's Mandatory Greenhouse Gas Reporting Rule and in requirements of climate legislation relating to GHG inventories.

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201 *See infra* Part I.B.3.
202 *See* QUANTIFYING GHG REDUCTIONS, *supra* note 13, at 13.
203 *See Id.*
204 RSG has undertaken initial work related to three NERC subregions to expand its TMM methodology to include projections of the construction of new electric generating capacity based on construction in progress, planned additions, and projections of future plant additions (reflecting alternative public policy scenarios).
205 Telephone Interview with Chris James, Senior Assoc., Synapse Energy Econ., & Jeremy Fisher, Scientist, Synapse Energy Econ. (Winter, 2009).

## APPENDIX

**Comparison of RSG TMM Avoided Emissions Rates for NOx and CO2 with eGRID Emission Rates for Two NERC Subregions**

**New York Upstate (NERC subregion NYUP)**

| | **CO2** Avoided Emission Rate *(lb/MWh)* | **CO2** Difference from eGRID System *(Average %)* | | **NOx** Avoided Emission Rate *(lb/MWh)* | **NOx** Difference from eGRID System *(Average %)* |
|---|---|---|---|---|---|
| **Avoided Emissions Methodology** | | | | | |
| eGRID Output System Average | 721 | 0% | | 0.83 | 0% |
| eGRID Non-Baseload Average | 1,706 | 137% | | 1.82 | 119% |
| RSG Average TMM Rate | 1,813 | 151% | | 2.14 | 158% |
| TMM-Wind | 1,832 | 154% | | 2.01 | 142% |
| TMM-PV | 1,805 | 150% | | 2.12 | 155% |
| TMM-AC | 1,798 | 149% | | 2.20 | 165% |
| TMM-Lighting | 1,808 | 151% | | 2.18 | 163% |
| TMM-LED Traffic Signals | 1,822 | 153% | | 2.17 | 161% |

For the New York Upstate data, 8760 hour generation or savings profile was simulated based on comparable profiles for the TMM-Wind, TMM-PV, TMM-AC, TMM-Lighting, and TMM-LED Traffic Signals.

Note: The results are based on 2005 eGRID data and 2005 Continuous Emission Monitors (CEM) and other 2005 emissions data reported to the EPA. The year 2005 is the most recent for which comprehensive verified emissions data is available from the EPA.

**PJM Interconnection — (NERC subregion RFCE)**

| | **CO2** Avoided Emission Rate *(lb/MWh)* | **CO2** Difference from eGRID System *(Average %)* | | **NOx** Avoided Emission Rate *(lb/MWh)* | **NOx** Difference from eGRID System *(Average %)* |
|---|---|---|---|---|---|
| **Avoided Emissions Methodology** | | | | | |
| eGRID Output System Average | 1,139 | 0% | | 1.63 | 0% |
| eGRID Non-Baseload Average | 1,790 | 57% | | 2.77 | 70% |
| RSG Average TMM Rate | 1,888 | 66% | | 2.14 | 31% |
| TMM-Wind | 1,905 | 67% | | 2.01 | 23% |
| TMM-PV | 1,892 | 66% | | 2.12 | 30% |
| TMM-AC | 1,870 | 73% | | 2.2 | 35% |
| TMM-Lighting | 1,894 | 66% | | 2.18 | 34% |
| TMM-LED Traffic Signals | 1,881 | 65% | | 2.17 | 33% |

For the PJM Interconnection data, 8760 hour generation or savings profile was simulated based on comparable profiles for the TMM-Wind data. 8760 hour generation or savings profile was based on actual profiles for the region for the TMM-PV, TMM-AC, TMM-Lighting, and TMM-LED Traffic Signals.

Note: The results are based on 2005 eGRID data and 2005 EPA Continuous Emission Monitors (CEM) and other 2005 emissions data reported to the EPA. The year 2005 is the most recent for which comprehensive verified emissions data is available from the EPA.

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# INTRODUCTION

## Copenhagen Climate Conference— Success or Failure?

RICHARD L. OTTINGER[*]

The Copenhagen Climate Conference and its Copenhagen Accord have generally been regarded by the press as a failure.[1] I think this is a very unfortunate mischaracterization. The conference was a failure only in not achieving binding

[*] Richard L. Ottinger came to the Pace University School of Law when he retired from Congress in 1984. As a professor, he taught in the environmental law program and as co-director of the Center for Environmental Legal Studies, he started the Pace Energy Project (renamed the Pace Energy and Climate Center), which raises $900,000 per year, advocating utility investment in conservation and renewable energy resources. In his sixteen years as a member of the United States House of Representatives, Dean Ottinger authored a substantial body of energy and environmental laws. He was one of the earliest environmentalists in Congress in 1965. As chairman of the Energy Conservation and Power Subcommittee, Energy & Commerce Committee, he was instrumental in adopting key energy and environmental legislation. Dean Ottinger was also a founding staff member of the Peace Corps, serving it during 1961-1964. He was appointed Dean of Pace Law School in December 1994, retired as Dean in July 1999, and currently serves as Dean *Emeritus*. Dean Ottinger attended COP15 from December 7-19, 2009 as one of the International Union for Conservation of Nature (IUCN) delegates to the environmental summit. For a list of Dean Ottinger's blog posts, *see* Pace Law School, IUCN Delegate Richard Ottinger's Copenhagen Blog, http://www.pace.edu/page.cfm? doc_id=35304 (last visited Jan. 20, 2010). This article is an expansion of a previous blog post. *See* Copenhagen Climate Conference: Success or Failure?, http://www.facebook.com/ note.php?note_id =228485486503 (Dec. 31, 2009, 10:28 EST).

1. *See* Darren Samuelsohn, *Obama Negotiates 'Copenhagen Accord' With Senate Climate Fight in Mind*, N.Y. TIMES, Dec. 21, 2009; Juliet Eilperin & Anthony Faiola, *Climate Deal Falls Short of Key Goals*, WASH. POST, Dec. 19, 2009, at A01; Joss Garman, *Copenhagen—Historic Failure That Will Live in Infamy*, THE INDEP., Dec. 20, 2009.

commitments[2] to reduce global greenhouse gas emission levels sufficient to meet the requirements identified by the some 3,000 leading global scientists of the United Nations Intergovernmental Panel on Climate Change (IPCC) to avoid disastrous consequences such as sea level rise leading to massive population displacement, food disruption, water shortages, tropical disease migration, and destruction of biodiversity.[3] The conference organizers could not have foreseen that their summit would occur in the midst of a global recession that would cause countries to focus their energies on preventing economic collapse instead of on mitigating climate change and curtailing greenhouse gas emissions. Even against such a tumultuous backdrop, a great deal was accomplished at the conference, and leading emitters have established a good foundation for a future agreement.[4] The years of hard work by many international, national, municipal, industrial, and academic experts resulted in some very significant results.

First, the fact that 193 nations sent delegations to Copenhagen to address the global climate challenge was truly unprecedented.[5] The participation by the key emerging countries of China, India, Brazil and South Africa who, along with the United States (U.S.), negotiated the final Accord and the agreement by Mexico to host the next climate conference were very important. This is because of particular importance as these countries had earlier declined to make greenhouse gas emission reduction commitments for the Kyoto Protocol.[6] The near universal recognition of the seriousness of the climate change

2. Frank E. Loy & Michael A. Levi, *The Road From Copenhagen*, N.Y. TIMES, Dec. 24, 2009.

3. *See generally* IAN ALLISON ET AL., THE UNIV. OF NEW S. WALES CLIMATE CHANGE RESEARCH CTR., THE COPENHAGEN DIAGNOSIS (2009), http://www.ccrc.unsw.edu.au/Copenhagen/Copenhagen_Diagnosis_LOW.pdf.

4. *See* Andrew C. Revkin & John M. Broder, *A Grudging Accord in Climate Talks*, N.Y. TIMES, Dec. 20, 2009, at A1.

5. *See* Loy & Levi, *supra* note 2. *See also* John M. Broder, *Many Goals Remain Unmet in Five Nations' Climate Deal*, N.Y. TIMES, Dec. 19. 2009, at A1; David A. Fahrenthold, *Copenhagen Climate Talks, by the Numbers*, WASH. POST, Dec. 19, 2009, at A06.

6. Patrick Kampert, *U.S. Takes Heat; Why is Bush's Stand on Global-warming Treaty Upsetting Nations Around the World*, CHICAGO TRIBUNE, Apr. 17, 2001, at C3.

challenge for the future of the world[7] and support for a binding international agreement to address it[8] were vitally important. Indeed, there would have been a clearly binding agreement to lock in the commitments made at the conference if the Danish Prime Minister had not taken over the chairmanship from the very able Danish Climate & Energy Minister, Connie Hedegaard.[9] The Prime Minister misinterpreted the need for adoption of the Accord by "consensus" as a requirement for unanimity.[10] Therefore, the objections of just five countries—Bolivia, Cuba, Nicaragua, Sudan and Venezuela—were allowed to derail the desires expressed in speech after speech by virtually all other countries in support of such an agreement, including the U.S. and China.[11] There is even an active debate among legal scholars[12] about whether the Accord can be considered "soft law"[13] for which countries making emission reduction and financial commitments can be held accountable.

The fact that 119 heads of state both attended the conference and overwhelmingly voiced strong support for an international climate commitment[14] was also unprecedented and clearly demonstrates the importance the world attaches to addressing this issue. In addition, the civil society generated an incredible outpouring of support for a strong agreement. Concerned citizens

7. *See generally* Revkin & Broder, *supra* note 4.

8. *Id.*

9. John M. Broder, *Poor and Emerging States Stall Climate Negotiations*, N.Y. TIMES, Dec. 17, 2009, at A16.

10. *See generally* Robert Stavins, *Another Copenhagen Outcome: Serious Questions about the Best Institutional Path Forward*, BELFER CTR. FOR SCI. & INT'L AFFAIRS, Jan. 5, 2010, http://belfercenter.ksg.harvard.edu/analysis/stavins/?p=496# (last visited Jan. 23, 2010).

11. Alden Myer, Director of Strategy & Policy, Union of Concerned Scientists, Statement: The Copenhagen Accord: Not Everything We Wanted, But Something to Build On (Dec. 23, 2009), *available at* http://www.ucsusa.org/global_warming/solutions/big_picture_solutions/the-copenhagen-accord.html. *See* Loy & Levi, *supra* note 2; *see also* Louise Gray, *Copenhagen Accord: Questions and Answers*, TELEGRAPH, Dec. 19, 2009, *available at* http://www.telegraph.co.uk/earth/copenhagen-climate-change-confe/6846033/Copenhagen-Accord-Questions-and-Answers.html.

12. *See* Posting of James Harrison, to International Law Observer, http://internationallawobserver.eu/2009/12/22/after-copenhagen/ (Dec. 22. 2009).

13. *See* Alan E. Boyle, *Some Reflections on the Relationship of Treaties and Soft Law*, 48 INT'L & COMP. L.Q. 901 (1999).

14. *See* Fahrenthold, *supra* note 5.

and many non-governmental organizations (NGOs) from around the world comprised the 45,000 conference attendees, and maintained enthusiastic support even though the Center could accommodate only 15,000 of them.[15] The NGOs, governments, international and scientific organizations, industrial groups, and others held approximately 1,000 "side events" and conducted panels on every aspect of climate change and its solutions.[16] The United Nations Foundation, Climate Action Network, Environmental Grantmakers' Association and others held public briefings with many of the top experts and negotiators on climate issues and the status of the conference.[17] All of this reflected an incomparable energy and enthusiasm.

Another of the conference's very important accomplishments was the uniting of the Alliance of Small Island States (AOSIS) and the Group of Least Developed Countries (LDCs) organization.[18] Pace Law School and the Yale School of Forestry and Environmental Studies, under the leadership of Professors Roy Lee and Robert Van Lierop, had collaborated with these organizations in devising a strategy to use their leverage to strengthen the agreement and to assure that their members' dire need for climate change adaptation help were met, which was largely ignored at the prior climate conferences. While drastic, their acts of shutting down the plenary for more than a week and at one point in walking out of the conference with the African countries was very effective in making negotiators address these needs.[19] As one member nation after another pointed out, the island states and many of those most vulnerable stand to lose their countries, homes and livelihoods if greenhouse gas emissions are not effectively and sufficiently limited.[20] AOSIS

15. Elisabeth Rosenthal & Tom Zeller Jr., *Left Out in the Cold at the Climate Talks*, N.Y. TIMES, Dec. 15, 2009, at A17.

16. *See* U.N. Framework Convention on Climate Change, Side Events List, http://regserver.unfccc.int/seors/reports/events_list.html?session_id=COP15 (last visited Jan. 23, 2010).

17. *Id.*

18. *See* AOSIS: Alliance of Small Island States, http://www.sidsnet.org/aosis/ (last visited Jan. 23, 2010).

19. *See* Broder, *supra* note 9.

20. The statement is based on the author's own observations during the Copenhagen Climate Conference. For additional support, *see generally* Elisabeth Rosenthal, *In a Busy Conference Center, an Alphabet Soup of Causes and Clauses*, N.Y. TIMES, Dec. 19, 2009, at A10; *see also* Broder, *supra* note 9.

and the LDCs, therefore, had little choice but to take these drastic actions, and they succeeded in obtaining an agreement to immediately establish a $10 billion short-term adaptation fund.[21] This fund will grow to $30 billion in 2010-2012, for which full funding was committed.[22] Additionally, $100 billion a year by 2020 was committed;[23] though the donors to the $100 billion fund were not identified, Secretary Clinton did commit the U.S. to paying its fair share.[24] They also obtained a commitment in the Accord requiring consideration of establishing emission reductions to limit temperature increases to 1.5˚C (350 ppm) in the first reviewing period in 2015.[25]

The conference adopted the goal set by the IPCC scientists for holding temperature increases to 2˚C (450 ppm),[26] which would require a 10-40% global emission reduction below 1990 levels by 2020.[27] The press paid little attention to the quite substantial greenhouse gas (GHG) emission reductions commitments designed to reach this goal. The European Union (E.U.) and Japan made the largest commitments—20%[28] and 25%[29] respectively below 1990 levels. Negotiators for the twenty-seven, member bloc were very aggravated over the fact that other large emitters made much smaller reduction commitments and

21. Broder, *supra* note 9.

22. U.N. Framework Convention on Climate Change, Conference of Parties, Fifteenth Session, Dec. 7-18, 2009, *Copenhagen Accord*, ¶ 8, U.N. Doc. FCCC/CP/2009/L.7 (Dec. 18, 2009) [hereinafter *Copenhagen Accord*].

23. *See* John M. Broder & Elisabeth Rosenthal, *Obama Has Goal to Wrest a Deal in Climate Talks*, N.Y. TIMES, Dec. 18, 2009, at A1; Juliet Eilperin & Anthony Faiola, *U.S. Pledges Aid, Urges Developing Nations to Cut Emissions*, WASH. POST, Dec. 18, 2009, at A01.

24. Broder & Rosenthal, *supra* note 23; Eilperin & Faiola, *supra* note 23.

25. *Copenhagen Accord*, *supra* note 22, ¶ 12.

26. *Id.* ¶ 2.

27. IPCC FOURTH ASSESSMENT REPORT (AR4): CONTRIBUTION OF WORKING GROUP III TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 748 (B. Metz et al. eds., 2007).

28. European Union, Climate Action, http://ec.europa.eu/environment/climat/climate_action.htm (last visited Jan. 23, 2010).

29. Embassy of Japan in Germany, *Note Verbale*, U.N. Doc. JB 15/2010 (Jan. 26, 2010), *available at* http://unfccc.int/files/meetings/application/pdf/japancphaccord_app1.pdf.

that no binding agreement was reached.[30] The E.U. industry is also very concerned that the cost requirements of meeting their much higher emission reduction goals will cause job losses and put them at a competitive disadvantage.[31] The U.S. committed to a 17% emissions reduction, but only below 2005 levels,[32] which equates to just 3% below 1990 levels. President Barack Obama was under great constraint because he did not want to undermine the passage of a climate bill if he agreed to more stringent reductions than those contained in the pending Senate legislation; this dilemma was generally recognized by the international community, and the U.S. did make a very substantial $3.6 billion commitment towards the short term developing country adaptation fund.[33] Furthermore, China and India made emission reduction commitments for the first time of 40-45% and 20-25% below 2005 levels, respectively.[34] However, these reductions are only of emissions intensity, not emission levels.[35] Brazil committed to reductions of 36.1 to 38.9% by 2020,[36] Mexico to 50% below 2002 levels,[37] South Africa to 34%

30. *See* Paul Taylor, *Snubbed in Copenhagen, EU Weighs Climate Options*, REUTERS, Jan. 13, 2010, *available at* http://www.reuters.com/article/idUSTRE60C3HB20100113.

31. The statement is based on the author's own observations during the Copenhagen Climate Conference. For additional support, *see* Jonathan Stearns, *EU Nations Spar Over Climate Policy After UN Summit Deadlock*, BLOOMBERG, Jan. 17, 2010, *available at* http://www.businessweek.com/news/2010-01-17/eu-nations-spar-over-climate-policy-after-un-summit-deadlock.html.

32. John M. Broder, *Obama to Go to Copenhagen With Emissions Target*, N.Y. TIMES, Nov. 26, 2009, at A1.

33. Selina Williams & Alessandro Torello, *Proposed Climate Deal: US Pledges $3.6 Billion Climate Finance 2010-12*, DOW JONES NEWSWIRES, Dec. 18, 2009, *available at* http://www.nasdaq.com/aspx/stock-market-news-story.aspx?storyid=200912181816dowjonesdjonline000666&title=proposed-climate-dealus-pledges-36-billion-climate-finance-2010-12.

34. Jonathan Watts, *China Sets First Targets to Curb World's Largest Carbon Footprint*, THE GUARDIAN, Nov. 26, 2009, *available at* http://www.guardian.co.uk/environment/2009/nov/26/china-targets-cut-carbon-footprint; *see also* Nitin Sethi, *India Vows 20-25% Carbon Intensity Cuts*, TIMES OF INDIA, Dec. 4, 2009, http://timesofindia.indiatimes.com/india/India-vows-20-25-carbon-intensity-cuts/articleshow/5298030.cms.

35. Watts, *supra* note 34; Sethi, *supra* note 34.

36. *See Brazil's Lula Signs Law Cutting CO2 Emissions*, AGENCE FRANCE-PRESSE, Dec. 29, 2009, *available at* http://www.google.com/hostednews/afp/article/ALeqM5iez9sn2BkTTmjkMO-JxaGawmSrdw.

37. *See* David Adam, *Mexico Leads the Way with Carbon Reduction Pledge*, THE GUARDIAN, Dec. 11, 2008, *available at* http://www.guardian.co.uk/ environ

reduction by 2020 and 42% by 2025,[38] South Korea to 4% below 2005 levels, and a 30% reduction by 2020.[39] Agreement for these commitments was incorporated into an Appendix to the Accord along with a provision for the inclusion of greater and additional commitments by January 31, 2010.[40] Very significantly, the International Institute for Applied Systems Analysis (IIASA) found that these commitments would reduce 2020 emissions by 11 to 22% and that the costs of achieving these goals would be only 0.15% of gross domestic product.[41]

One of the most important accomplishments of the conference was an agreement on the architecture and funding for the Reducing Emissions from Deforestation and Degradation, or REDD program (short for), which included measures for monitoring, reporting and verification.[42] In addition, developed countries agreed to pay a total of $30 billion to initiate quickly the forest preservation process.[43]

The Accord contained verification formulae agreed upon by both the U.S. and China,[44] commitments for technology development and transfer to developing countries,[45] a black carbon reduction program to be undertaken by the U.S.,[46] the

ment/2008/dec/11/poznan-climate-change-mexico-carbon-pledge; *see Mexico to Pledge Halving Emissions by 2050*, AGENCE FRANCE-PRESSE, Dec. 1, 2009, *available at* http://www.energy-daily.com/reports/Mexico_to_pledge_halving _emissions_by_2050_999.html.

38. Simon Mundy, *SA Surprises with Pledge of 42% Emissions Slowdown*, BUSINESS DAY, Dec. 8, 2009, http://www.businessday.co.za/Articles/ Content .aspx?id=88994; Posting of Christian Teriete to WWF Climate Blog, *Good Move: South Africa Surprises Copenhagen with Peak Pledge*, http://blogs.panda. org/climate/2009/12/07/good-move-south-africa-surprises-copenhagen-with-peak-pledge/ (Dec. 7, 2009).

39. Christian Oliver et al., *South Korea Pledges Emissions Cut*, FIN. TIMES, Nov. 17, 2009, *available at* http://www.ft.com/cms/s/0/49e3bc1a-d3a7-11de-8caf-00144feabdc0.html?ftcamp=rss.

40. *See Copenhagen Accord*, *supra* note 22, ¶¶ 4-5.

41. Jeff Tollefson, *World Looks Ahead Post-Copenhagen: A Weak International Climate Agreement Leaves Room for Science to Shape the Next Round of Negotiations*, 462 NATURE 966, 967 (2009).

42. *See Copenhagen Accord*, *supra* note 22, ¶¶ 6, 8, 10.

43. *Id.* ¶ 8.

44. *Id.* ¶ 5.

45. *Id.* ¶¶ 3, 8, 10-11.

46. Press Release, U.S. Dep't of State, Bureau of Oceans & Int'l Envtl. & Scientific Affairs, Strategy to Reduce Black Carbon Emissions Affecting the Arctic (Dec. 17, 2009), *available at* http://cop15.state.gov/pressroom/133771.htm.

continuation of the negotiations by the IPCC Long Term Cooperative Action Working Group and Kyoto Protocol Working Group,[47] and guidance on reforming the Clean Development Mechanism (CDM) and Joint Implementation (JI) programs.[48] There was no agreement to include carbon capture and storage as a CDM measure, and the Accord instead called for more research on leakage and permanence of sequestration.[49] The International Union for the Conservation of Nature (IUCN) also made important contributions to the Accord, which included the consideration of gender, the needs of indigenous peoples, the role of marine issues, and the need for environmentally based adaptation measures.[50]

Finally, President Obama and Premier Wen Jiabao of China emerged as the key leaders in saving the Accord.[51] Although there were some very unfortunate conflicts between the U.S. and China along the way, both countries eventually agreed on the urgency of a strong climate agreement.[52] President Obama perfectly underscored both the successes of the Copenhagen Conference and the need for more action when he stated:

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47. *See Copenhagen Accord*, *supra* note 22, at pmbl.

48. *See* U.N. Framework Convention on Climate Change, Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol, Dec. 7-18, 2009, *Further Guidance Relating to the Clean Development Mechanism*, U.N. Doc. FCCC/KP/CMP/2009/L.10 (Dec. 18, 2009); *see also* U.N. Framework Convention on Climate Change, Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol, Dec. 7-18, 2009, *Guidance on the Implementation of Article 6 of the Kyoto Protocol* (Dec. 18, 2009).

49. *See generally Copenhagen Accord*, *supra* note 22.

50. *See* Lorena Aguilar, *At Last a Turning Point for Women and Climate Change?*, INT'L UNION FOR CONSERVATION OF NATURE, Nov. 30, 2009, http://cms.iucn.org/unfccc/events/copenhagen/?uNewsID=4256; Annelie Fincke & Gonzalo Oviedo, *Indigenous Women: Most Vulnerable to Climate Change but Key Agents of Change*, IUCN NEWS, June 22, 2009, http://cms.iucn.org/about/work/programmes/social_policy/news/?uNewsID=3403; Press Release, Int'l Union for Conservation of Nature, Copenhagen Climate Summit: Copenhagen Accord a Step in Right Direction, but Insufficient (Dec. 19, 2009), http://cms.iucn.org/media/materials/releases/?4417/Copenhagen-Climate-Summit-Copenhagen-Accord-a-step-in-right-direction-but-insufficient.

51. *See* Revkin & Broder, *supra* note 4.

52. *Id.*

> For the first time in history all major economies have come together to accept their responsibility to take action to confront the threat of climate change . . . we're going to have to build on the momentum that we've established here in Copenhagen to ensure that international action to significantly reduce emissions is sustained and sufficient over time. We've come a long way, but we have much further to go.[53]

As President Obama described, sustained international action on emissions reduction will be a key part of any agreement in Mexico City. Furthermore, as the threats and damage associated with sea level rise and changing weather patterns grow stronger, there will have to be a greater focus in each country on climate change adaptation and mitigation.

Thus, while the conference did not achieve a clearly binding agreement or emission reductions satisfying the IPCC requirements to avoid catastrophic global temperature increases, it will serve as the foundation for such an agreement during the November 2010 Conference of the Parties meeting in Mexico City.[54] There is little point to being depressed about the outcome of Copenhagen because, as Chair Connie Hedegaard stated, "what we need to do is to secure the step that we took and turn it into a result."[55]

53. Press Release, The White House, Office of the Press Sec'y, Remarks by the President During Press Availability in Copenhagen (Dec. 18, 2009), http://www.whitehouse.gov/the-press-office/remarks-president-during-press-availability-copenhagen.

54. Lisa Friedman, *Path from Climate Summit Unclear for Many*, N.Y. TIMES, Jan. 4, 2010, *available at* http://www.nytimes.com/cwire/2010/01/04/04climatewire-path-from-climate-summit-unclear-for-many-3832.html

55. Justyna Pawlak, *EU Calls for More U.S. Involvement in Climate Works*, REUTERS, Dec. 22, 2009, *available at* http://www.reuters.com/article/idUSTRE5BL21F20091 222.