# WIND ENERGY AND ITS IMPACT ON FUTURE ENVIRONMENTAL POLICY PLANNING: POWERING RENEWABLE ENERGY IN CANADA AND ABROAD

by

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#### **INTRODUCTION**

Given the tremendous pressure of using finite conventional sources of energy, many countries around the world are turning to renewable sources of energy to cushion against rising costs, while diversifying the means of delivering energy to their citizens. Wind energy is one such example of an innovative strategy to provide energy to citizens in a cleaner, abundant and reliable fashion. As society turns away from conventional sources like coal and natural gas (fossil fuels) due to the rising electricity costs and its deleterious impact on the environment, government-sponsored efforts and technological innovation are pushing wind energy to the forefront of creative environmental policy planning. More specifically, government legislation through financial incentives encourages public and private businesses to participate in pursuing renewable energy sources with more vigor. This paper examines the role of wind energy in Canada and abroad in terms of how its growing emergence is being recognized as one of the best methods of implementing sound environmental regimes that are replacing expensive conventional methods of energy extraction and utilization.

Part I will examine the history and background of wind energy. Here, an overview of wind energy use in various cultures and time periods will be examined. Part II explains the role of wind energy in the context of the Kyoto Protocol. As part of this global initiative, wind energy is reviewed as to how it contributes to a "green" economy. Part III discusses the technology behind wind energy generation. More specifically, the functionality of wind turbines and its role in distributing electricity to surrounding communities is emphasized. Part

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IV focuses on the application of wind energy in the Canadian economy. Here, various wind programs are examined in selected provinces to illustrate modern trends in diversifying the energy sector. Finally, Part V outlines the trend in global application of wind energy projects in various countries around the world. The discussion focuses on several nations actively participating in developing wind energy projects to reduce dependence on conventional fossil fuels, while providing affordable electricity prices for consumption and improving energy output from wind projects. These nations include the United States, Denmark, Germany, Spain, the United Kingdom/Ireland, Australia, China, India, and Japan.

#### I. HISTORY AND BACKGROUND OF WIND ENERGY

The history of wind energy generation traces back to ancient civilizations. It is claimed that over 2000 years ago, Chinese civilizations used the first vertical-axis windmill to pump water and grind grain for agricultural purposes.<sup>1</sup> Around 500-900 A.D., the ancient Persians also used wind energy to pump water on arid lands and grind grain with vertical axis devices known as panemones (Persian wind mill).<sup>2</sup> The island of Crete still has remnants of windmill technology to help irrigate crops and livestock.<sup>3</sup> Pre-industrial Europe saw wind mills evolve with horizontal axis water mills that were used extensively as water pumps during the medieval period. In Holland, the Dutch modified these tower mills around 1390 by designing them to create aerodynamic lift in propelling the windmill sails (the equivalent of today's propeller blades).<sup>4</sup>

The Halladay windmill was introduced in the U.S. in 1854, followed by Aermotor and Dempster designs which still exist today.<sup>5</sup> In the early 19<sup>th</sup> century, the first large-scale wind project was developed in Cleveland, Ohio by Charles F. Brush, creating a low-speed, high-solidity rotor called the Brush machine.<sup>6</sup> In the 1920s, North American farms developed fantype and sail rotor designs for windmills that pumped water and electricity.<sup>7</sup> The modern design of vertical axis windmills with slender, airfoil-section blades developed from the

<sup>5</sup> Id. <sup>6</sup> Id.

<sup>&</sup>lt;sup>1</sup> Illustrated History of Wind Development, *available at* http://telosnet.com/wind/early.html (last visited Feb. 6, 2006).

<sup>&</sup>lt;sup>2</sup> Id.

 $<sup>^{3}</sup>$  Id.

 $<sup>\</sup>frac{4}{5}$  Id.

<sup>&</sup>lt;sup>7</sup> Illustrated History of Wind Development, *available at* http://telosnet.com/wind/20th.html (last visited Feb. 6, 2006).

French Darrieus design in the 1920s.<sup>8</sup> These early historical developments in wind mill technology helped shape modern wind-powering generation methods seen in today's wind turbine engines, which contribute to renewable energy in providing electricity.

Renewable energy is defined as a source of energy that produces usable energy that depletes over time, but which impacts little on the environment.<sup>9</sup> Renewable energy includes water, biomass, wind, solar, and earth energy.<sup>10</sup> In recent times, there is a high demand for renewable energy use, particularly among nations that are implementing major wind power projects to create sustainable resource development. Many of these nations have held environmental conferences with the intention of searching for more viable approaches in providing energy to its citizens. The advent of wind turbine technology that promotes cleaner and more efficient methods of energy delivery is proving beneficial in terms of economic feasibility and reducing the environmental impact. As such, wind energy is one of the fastest growing sources of renewable energy. Wind energy can be used for many purposes, including the generation of electricity, charging batteries for other useful purposes, pumping water, or grinding grain in agricultural processes.<sup>11</sup> While most wind energy is applied in urban or high-density areas, powering wind energy is also practical for generating energy in remote communities and farms.

# II. THE TECHNOLOGY BEHIND WIND ENERGY GENERATION

Perhaps the greatest benefit derived from wind energy technology is its natural availability. Wind is normally produced from differences in temperature gradients in high and low pressure zones created from the land absorbing sunlight and emitting heat that rises to the air.<sup>12</sup> Cooler air then rushes in the spaces left by the rising hot air, generating surface winds.

<sup>8</sup> Id.

<sup>&</sup>lt;sup>9</sup> Natural Resources Canada, Using CANren, *available at* http://www.canren.gc.ca/using/index.asp (last visited Feb. 6, 2006). Natural Resources Canada is a federal agency responsible for promoting environmental initiatives across the nation. In recent times, it has actively participated in educating and funding projects that involve renewable aspects of energy delivery in all provinces and territories [hereinafter Natural Resources Canada]. The agency provides various financial incentives to companies planning to utilize wind energy technology to produce energy by meeting specified conditions.

<sup>&</sup>lt;sup>10</sup> *Id*.

<sup>&</sup>lt;sup>11</sup> U.S. Dept. of Energy, Energy Efficiency and Renewable Energy, available at

http://www.eere.energy.gov/RE/wind.html (last visited Feb. 6, 2006) [hereinafter DOE].

<sup>&</sup>lt;sup>12</sup> Canadian Wind Energy Association (CanWEA), *available at* http://www.canwea.ca/en/HowWindWorks.html (last visited Feb. 6, 2006). CanWEA is a non-profit industry association established in 1984 with more than 230 corporate members representing wind turbine component manufacturers, electric utilities, wind energy project

These surface winds are captured as kinetic energy by wind turbine engines by having the wind turning its blades, which are attached to a horizontal shaft. This shaft is attached to a generator, and as the blades rotate from the winds, it rotates the generator and converts it into electricity.<sup>13</sup> Various factors such as wind speed determine the rate at which turbine propellers turn, which affects the amount of energy produced. Generally, as wind speed increases, the energy output increases from the turbine, producing more electricity generation that is transferred to an electrical grid. Wind speed, in turn, depends on the terrain, the density of air, air temperature, barometric pressure, and altitude.<sup>14</sup> This is why wind turbines are located on tall towers, often in areas of high winds. Such forms of energy comprise the growing wave of "green energy" applications.

Wind energy is thus mainly produced by turbine engines, more specifically by rotors.<sup>15</sup> The rotors of turbine engines consist of propeller blades that capture the wind's energy, and are attached to a generator that creates electricity. The rotor blades are usually made from glass polyester or glass epoxy, sometimes in combination with wood or carbon.<sup>16</sup> The turbine engines are normally situated high-up on steel towers to take advantage of stronger winds, which produce greater "lift" (low pressure winds pulling the blade, causing the rotor to turn), thereby producing greater energy output.<sup>17</sup> Large wind turbines can be subdivided into horizontal axis and vertical axis turbines.<sup>18</sup> Wind turbines can be used by homeowners with single turbine engines or with larger scale operations on *wind farms*.<sup>19</sup> Wind farms are a collection of towers that are equipped with large or small wind turbines.<sup>20</sup> Normally, wires that run down the tower carry electricity to the electricit prover it is stored or used. In this way, the wind turbine engines produce electricity to local utility power grids that supplies electricity to the wider community.

<sup>13</sup> CanWEA, *available at* http://www.canwea.ca/en/faq.html (last visited Feb. 6, 2006).

developers, service providers, and several of Canada's major energy companies. Their objective is to have 10,000 MW of installed wind energy capacity in Canada by 2010 [hereinafter CanWEA].

<sup>&</sup>lt;sup>14</sup> Id.

<sup>&</sup>lt;sup>15</sup> CanWEA, *available at* http://www.canren.gc.ca/tech\_appl/index.asp?CaId=6&PgId=232 (last visited Feb.6, 2006).

<sup>&</sup>lt;sup>16</sup> The European Wind Energy Association, Executive Summary, *available at* http://www.ewea.org/fileadmin/ewea\_documents/documents/publications/WETF/Facts\_Summary.pdf at 3 (last visited Feb. 6, 2006).

<sup>&</sup>lt;sup>17</sup> DOE, *supra* note 11, *available at* http://www.eere.energy.gov/RE/wind\_basics.html (last visited Feb. 6, 2006).

 <sup>&</sup>lt;sup>18</sup> DOE, *supra* note 11, *available at* http://www.eere.energy.gov/RE/wind.html (last visited Feb. 6, 2006).
 <sup>19</sup> Id.

<sup>&</sup>lt;sup>20</sup> Re-energy.ca, Backgrounder Wind Energy, *available at* http://www.re-energy.ca/pdf/bg4.pdf (last visited Feb. 7, 2006) at 2 [hereinafter Re-Energy].

Wind farms typically generate large-scale energy that drive electricity to several designated communities that offer residents the option of purchasing wind energy through various companies at reasonable rates. The average wind turbine lasts 20-25 years, depending on the design and its functionality.<sup>21</sup> With respect to wind energy capacity, it is estimated that a 1 megawatt (MW) turbine engine with a 30 percent capacity produces about 2,600 megawatt-hour (MWh) per year, a process which may power up to 320 homes.<sup>22</sup> However, in order to achieve maximum benefit of wind energy, it is necessary for a wind farm to be highly integrated into an existing electrical transmission and distribution grid network. This is because the technology of wind turbines has changed over time. In the 1970s and 1980s, wind turbines operated under classical control designs to regulate power and speed.<sup>23</sup> However, modern turbines are much larger, mounted on tall towers, and more efficient electricity generators. Given this, modern research seeks to design wind turbines to improve wind capacity generation. Below, Diagram 1 offers a basic illustration of how wind energy production works.

# **Diagram 1: Simple Overview of Wind Energy Application**



<sup>21</sup> CanWEA, *supra* note 12, *available at* http://www.canwea.ca/en/QuickFacts.html (last visited Feb. 6, 2006). <sup>22</sup> *Id.* 

<sup>&</sup>lt;sup>23</sup> Wind Energy Multi-Year Program Plan For 2005-2010 (Nov. 2004), available at

http://www.nrel.gov/wind\_meetings/2003\_imp\_meeting/pdfs/wind\_prog\_mypp\_15Nov2004.pdf (last visited Feb. 8, 2006) [hereinafter Multi-Year Plan].

# III. WIND ENERGY AS "GREEN" AND ITS ROLE UNDER CANADA'S COMMITMENT TO THE KYOTO PROTOCOL

Wind energy is regarded as "green" technology because it has little impact on the environment.<sup>24</sup> This is because the nature of capturing winds in turbine engines produces no air pollutants or greenhouse gases. In this way, wind energy uses no source of fuel, nor does it produce any toxic or radioactive waste.<sup>25</sup> The capture of wind energy also poses little threat to damaging surrounding ecosystems, including wildlife and fauna and flora. Wind farming is popular among farmers because their land can still be used for growing crops and grazing livestock with little interference from wind turbines. Wind energy is also easy to bring online into existing infrastructure plans for developing new suburbs and communities. In terms of land use in Canada, only about 2 percent of land area is needed to install most wind turbines.<sup>26</sup> From a practical view, wind energy may power over 200 homes from 2,000,000 kilowatthours (Kwh) of electricity, as opposed to burning coal, a process that leaves around 900,000 kilograms of coal in the ground (depending on how much energy is extracted), and reducing annual greenhouse emissions by 2,000 tonnes.<sup>27</sup>

In the context of global environmental reforms like the Kyoto Protocol (Protocol),<sup>28</sup> harnessing renewable forms of energy like wind becomes a crucial step in meeting broad objectives of sustainable resource development. The Protocol is a global agreement ratified in 1997 by developed nations in response to the increasing demands of renewable energy usage

<sup>26</sup> Natural Resources Canada, *supra* note 9, *available at* 

 <sup>&</sup>lt;sup>24</sup> DOE, *supra* note 11, *available at* http://www.eere.energy.gov/RE/wind.html (last visited Feb. 6, 2006).
 <sup>25</sup> Natural Resources Canada, *supra* note 9, *available at*

http://www.canren.gc.ca/tech\_appl/index.asp?CaId=6&PgId=232 (last visited Feb. 6, 2006). For more discussion on "green power", see Canadian Wind Energy Association's description at http://www.canwea.ca/en/GreenPower.html (last visited Feb. 6, 2006).

http://www.canren.gc.ca/tech\_appl/index.asp?CaId=6&PgId=232 (last visited Feb. 6, 2006).

<sup>&</sup>lt;sup>27</sup> CanWEA, *supra* note 12, *available at* http://www.canwea.ca/en/faq.html (last visited Feb. 6, 2006).

<sup>&</sup>lt;sup>28</sup> Kyoto Protocol to the United Nations Framework Convention on Climate Change, *available at* http://unfccc.int/resource/docs/convkp/kpeng.html (last visited Feb. 6, 2006). The Kyoto Protocol was a byproduct of a series of negotiations of more than 160 nations, which culminated in developed nations agreeing to limit their emissions of greenhouse gases. This agreement was spawned by the objectives of the 1992 Framework Convention on Climate Change.

and high rates of industrialized pollution.<sup>29</sup> The Protocol is intended to curb greenhouse gas emissions around the world, and contribute to global climate change. Canada is a signatory nation of the Protocol, but it remains somewhat controversial in eyes of many other industrialized countries, including among traditional energy producers. As such, some commentators still debate over the benefits or costs associated with the Protocol, and whether or not there is a dramatic shift in climate change. Despite this, there is no question that searching for renewable energy sources like wind is a high priority for nations that wish to change their methods of extracting and using natural resources, while achieving economic self-sufficiency and price controls on soaring energy costs.

In the last twenty years, extensive research and development on renewable forms of energy like wind has been conducted in universities, private research labs, and utility companies. For instance, the scientific fields of physics and engineering (aerodynamics) are improving technology behind wind turbine operations. This intensive study of wind energy spawns new methods of harnessing electricity by using cutting-edge materials and developing innovative designs of wind turbines to improve the capture of winds, and thus electricity output. This process helps reduce the consumption of electricity in cities, towns, and remote communities such as farms.

Increasingly, the Canadian government is recognizing the importance of renewable energy, and is investing in such projects to find more appropriate means of supplying energy to citizens who are facing rising electricity prices from conventional sources. For instance, it is expected that over \$1.5 billion in capital investments will encourage development of wind turbine projects across Canada in the near future.<sup>30</sup> Other methods of acquiring wind energy are from offshore locations, where energy is generally self-regulated and may or may not be subject to local jurisdictional energy laws of technology and market regulation. As will be seen, offshore wind projects are quickly becoming the latest trend in modern renewable energy development. However, some challenges do remain in acquiring wind energy offshore due to heavy costs, geographical barriers, unfavorable climatic conditions, and negative impacts on wildlife.

<sup>30</sup> Natural Resources Canada, *supra* note 9, *available at* 

<sup>&</sup>lt;sup>29</sup> Energy Information Administration, *available at* http://www.eia.doe.gov/oiaf/kyoto/kyotorpt.html (last visited Feb. 6, 2006) [hereinafter EIA].

http://www.canren.gc.ca/programs/index.asp?CaId=107&PgId=622 (last visited Feb. 6, 2006).

# IV. APPLICATION OF WIND ENERGY TO THE CANADIAN ECONOMY

Wind energy is one of the fastest growing forms of renewable energy in the world. Aside from having little impact on the environment, the application of wind energy technology also has an impact on the economy in terms of setting more reasonable electricity prices for consumption, and creating new forms of employment in the renewable sector. More infrastructure plans in urban and rural settings are directly incorporating wind energy in preparation of future resource development. In recent years, Canada's wind energy capacity is tabled around 682 MW, and has produced over 570 MW.<sup>31</sup> Those using the benefits of wind energy generation are federal and provincial governments, local communities, homes, farms, process industries, and remote communities. In Canada, like many other nations, there are two forms of wind energy applications: (1) large scale and (2) small scale.<sup>32</sup> Large-scale wind generation gives power to local utility grid systems. This is useful in providing energy to a large community of homes and businesses. Small-scale wind generation contributes to energy in smaller, more locally designated sites. With recent advances in wind turbine technology, application of wind energy is contributing to employment in the renewable sector.

To encourage the use of wind energy, current policy options in Canada include:

- Feed-in Tariffs: provide a guaranteed payment for electricity production from wind energy
- **Production Subsidies**: provide a guaranteed payment or tax incentive
- **Investment Subsidies**: support high capital costs of wind energy (grants, loans, favorable tax treatment)
- Investment Incentives: allow easy financing through incentives
- **Renewable Portfolio Standards** (Quota Obligations): require electricity producers and distributors to ensure that a specific percentage of their portfolio derives from renewable energy sources, which are complemented with renewable energy certificates
- **Pollution Taxes:** imposed only on polluting forms of energy, not on renewable energy

<sup>&</sup>lt;sup>31</sup> CanWEA, *supra* note 12, *available at* http://www.canwea.ca/en/WindEnergy.html and http://www.canwea.ca/en/faq.html (last visited Feb. 6, 2006).

<sup>&</sup>lt;sup>32</sup> CanWEA, *supra* note 12, *available at* http://www.canwea.ca/en/HowWindWorks.html (last visited Feb. 6, 2006).

• Green Pricing: system allowing electricity utilities or retailers to give consumers a choice as to the type of power they purchase <sup>33</sup>

These policy options help push forward renewable energy, and require electricity producers and suppliers to reduce carbon emissions from conventional sources such as carbon-intensive power plants (coal and natural gas) and carbon-free energy technologies such as wind, solar, biomass, geothermal, and nuclear energy.<sup>34</sup> As far as wind energy use in the marketplace is concerned, the usual practice is for energy companies to purchase electricity from a land-based generator located on a wind farm or other fixed locations. The energy companies then prescribe to the government how much energy they plan on distributing to consumers, carefully following federal and provincial statutory regulations that set out administrative requirements (such as the granting of licenses) and power development standards (which are percentages of energy derived from renewable sources). Through these policy options, Canada's energy market is experiencing a dramatic shift away from conventional fossil fuels in favor of renewable sources of energy like wind, primarily because of the positive effects on the environment and the economy. As such, wind energy is proving to become a clean, reliable, and cost-effective form of energy that is free from the traditional negative effects of pollution and dependence on expensive rates of conventional fossil fuels.

A. Costs Associated with Wind Energy

The cost of wind energy is determined by: (1) initial cost of wind turbine installation; (2) the interest rate on the money invested; and (3) the amount of energy produced.<sup>35</sup> Initial

<sup>&</sup>lt;sup>33</sup> CanWEA, *supra* note 12, *available at* http://www.canwea.ca/en/faq.html (last visited Feb. 6, 2006). These policy options are applied across Canada in each jurisdiction. However, since electricity is regulated separately under each jurisdiction, providing consistent timeframes and energy output varies from province to province. Thus, efforts are being made by government, industry, and advocacy groups to streamline this process to produce more consistent application of wind energy production. On June 27, 1996, Prime Minister Paul Martin announced the release of a discussion paper that summarized how Canada's Income Tax Act would be amended to introduce favorable tax measures for investors to invest in renewable energy resources. These tax measures would be applied after input from stakeholders in the energy sector in relation to the Canadian Renewable and Conservation Expenses. See generally http://www.fin.gc.ca/news96/96-046\_2e.html for better discussion. The Renewable Portfolio Standard (RPS) is a financial incentive commonly found in other nations to stimulate investment in renewable energy. For instance, as noted *infra*, Japan has introduced the RPS, similar to Canada's policy.

<sup>&</sup>lt;sup>34</sup> EIA, *supra* note 29, *available at* http://www.eia.doe.gov/oiaf/kyoto/electricity.html (last visited Feb. 6, 2006). <sup>35</sup> Natural Resources Canada, *supra* note 9.

costs of starting up wind energy projects include feasibility and resource assessment studies.<sup>36</sup> Other costs include determining the extent, location, and quality of energy resources, negotiation and site-approval costs, site preparation, and service connection to transmit power from the project site (wind farm) to the electric utility grid.<sup>37</sup> Knowing that strong winds contribute to more energy output, windy areas generally produce less expensive electricity than in less windy areas.<sup>38</sup> This is why resource assessment of wind at a potential site becomes crucial in creating wind farms. In Canada, the cost for operating large-scale wind turbines is approximately \$1500 (Cdn) per kilowatt for wind farms, and \$3,000 per kilowatt for smaller-scale wind turbines.<sup>39</sup>

In windy areas, it costs anywhere between 5 and 10 cents per kilowatt hour (kWh),<sup>40</sup> a decrease from 30 cents per kilowatt-hour less than ten years ago. <sup>41</sup> In more remote communities, the cost of producing wind energy from diesel generators costs \$0.25 per kilowatt hour. As can be seen, wind energy costs are declining with time, while prices charged for conventional fossil fuels are continually rising, forcing authorities responsible for energy to find better ways of charging consumers for the cost of using electricity. As part of this plan, government efforts are encouraging the availability of wind energy purchase plans for residents, particularly in newly developed communities. Furthermore, Canadian landowners often receive payment for installing wind turbines on their land for producing wind energy for the wider community.

#### B. Tax Incentives to Encourage Use of Wind Energy

Aside from producing less deleterious effects on the natural environment, the application of wind energy in the marketplace is generally meant to compete against rising costs of energy supplied by conventional fossil fuels like coal or natural gas. To foster more efficient energy pricing regimes, the Canadian government offers tax incentives to businesses or potential investors to create renewable forms of energy that supplement modern

<sup>39</sup> Id.

<sup>&</sup>lt;sup>36</sup> Government of Canada, Tax Incentives for Business Investments in Energy Conservation and Renewable Energy, *available at* http://www.canren.gc.ca/app/filerepository/General-tax\_incentives.pdf at 2 (last visited Feb. 6, 2006) [hereinafter Tax Incentives].

<sup>&</sup>lt;sup>37</sup> *Id.* at 5.

<sup>&</sup>lt;sup>38</sup> Id.

 $<sup>^{40}</sup>$  *Id*.

<sup>&</sup>lt;sup>41</sup> CanWEA, *supra* note 12, *available at* http://www.canwea.ca/en/QuickFacts.html at 2 (last visited Feb. 7, 2006).

environmental policies of sustainable development. In its 1996 federal budget, the Canadian government allowed investors to fully write-off intangible start-up costs by investing in renewable energy projects like wind turbines. In 1998, the Canadian government reiterated how these tax incentives would continue to be applied for companies planning to invest in energy conservation as "green" renewable energy.

For instance, Class 43.1 of Section II of the federal Income Tax Act allows taxpayers a write-off of any machinery or equipment that produces energy in a more efficient way or from alternative renewable sources.<sup>42</sup> Moreover, the Canadian Renewable and Conservation Expenses (CRCE) is a category of fully deductible expenses for the start-up of renewable projects where at least 50 percent of the capital costs of equipment is deductible per year, meaning that investment through renewable technology triggers a capital cost allowance.<sup>43</sup> Under the CRCE, eligible expenditures are 100 percent deductible in the year incurred, and can be later applied indefinitely for deduction in later years.<sup>44</sup> Furthermore, an asset must be acquired after February 21, 1994 to be eligible under Class 43.1.<sup>45</sup> Those that qualify for the Class 43.1 tax write-off incentives include electricity generation systems and thermal energy systems, including wind energy electrical generation systems, geo-thermal systems, and small-scale hydro-electric systems.<sup>46</sup>

Test wind turbines, which are the first turbines installed on a proposed wind farm to test the nature of energy production, are also eligible for tax incentives under Class 43.1, provided that a favorable opinion is given by the Minister of Natural Resources for any installation.<sup>47</sup> Costs which are ineligible for tax write-off are operating costs, spare parts inventory, foundations and structures, and electrical distribution systems.<sup>48</sup> By promoting renewable energy as tax incentives, both the federal and provincial governments in Canada offer *investment tax credits*, particularly for "scientific research and research development".<sup>49</sup> This policy attracts universities, private research labs, and energy companies to develop innovative wind turbine technologies through design reformulation and efficient energy output.

- $^{44}_{45}$  Id. at 2
- $^{45}_{46}$  Id. at 6.
- $^{46}_{47}$  Id. at 3.
- <sup>47</sup> *Id*. at 5. <sup>48</sup> *Id*.
- $^{49}$  *Id.* at 1.
  - *d*. at 1.

<sup>&</sup>lt;sup>42</sup> Tax Incentives, *supra* note 36, at 1.

<sup>&</sup>lt;sup>43</sup> Id.

#### C. The Wind Power Production Incentive (WPPI)

The Canadian Renewable Energy Network (CANren) was created by the Natural Resources Canada federal agency in applying technologies for the advancement of wind energy applications in Canada.<sup>50</sup> Performing similar roles to the U.S. Department of Energy, CANren provides information and support to those who wish to learn and participate in wind energy programs. As part of CANren, the federal Wind Power Production Incentive (WPPI) gives a production incentive of one cent per kilowatt-hour (kWh) to wind power producers, much like the U.S. Wind Program.<sup>51</sup> Introduced in December 2001, WPPI is a federal and provincial project that encourages electric utility companies, independent power producers and other stakeholders in all jurisdictions to actively engage in wind energy initiatives.<sup>52</sup> Here, financial benefits are offered to energy producers to encourage wind energy generation by qualifying specific wind turbines that meet certain standards of operation. Federal spending on promoting wind-generated programs throughout Canada almost quadrupled in the 2005 budget.<sup>53</sup> Under the WPPI, the Canadian government plans on investing \$920 million on wind energy projects in the hopes of establishing a target of 4,000 MW by 2010.<sup>54</sup>

To participate in the WPPI, prospective energy producers must negotiate a contribution agreement with Natural Resources Canada, upon three conditions: (1) the wind farm must be commissioned between April 1, 2002 and March 31, 2007; (2) the wind farm must be independently metered at the point of interconnection with the electricity grid; and (3) the wind farm must have a minimum capacity of 500 kilowatts (kW), while in northern and remote locations it must be 20 kilowatts (kW).<sup>55</sup> The WPPI will provide financial support

<sup>&</sup>lt;sup>50</sup> Natural Resources Canada, *supra* note 9.

<sup>&</sup>lt;sup>51</sup> CanWEA, *supra* note 12.

<sup>&</sup>lt;sup>52</sup> Natural Resources Canada, *supra* note 9, *available at* 

http://www.canren.gc.ca/programs/index.asp?CaId=107&PgId=622 (last visited Feb. 6, 2006).

<sup>&</sup>lt;sup>53</sup> Natural Resources Canada, News Release (May 26, 2005), available at http://www.nrcan-

rncan.gc.ca/media/newsreleases/2005/200536 e.htm (last visited Feb. 17, 2006).

<sup>&</sup>lt;sup>54</sup> Id. <sup>55</sup> Id.

for the installation of 1,000 MW of new capacity until 2007.<sup>56</sup> Promised as an incentive for electricity producers, this type of support covers nearly half the cost of the premium for wind energy production, compared to costs associated with conventional fossil fuel sources. It is expected that by 2010, the WPPI will reduce greenhouse gas emissions by three megatonnes.<sup>57</sup> This form of partnership between government and private industry is echoed in other nations pursuing wind energy programs.

# D. Modern Initiatives to Promote Wind Energy in Canada - The Canadian Wind Energy Association

Since the introduction of the Canadian government's wind program, various provinces and territories have begun to take steps to encourage wind energy projects through financial incentives such as Renewable Portfolio Standards.<sup>58</sup> This is because Canada does not have a comprehensive national electricity grid system.<sup>59</sup> Rather, each province and territory regulates electricity on their own terms with varying emission standards. As such, wind energy resource maps (also known as wind speed maps) are regularly published by Environment Canada in order to assess the potential of wind speeds, thereby helping establish wind turbine projects in various locations.<sup>60</sup> These maps display mean wind speeds and wind energy potential for over 144 sites across Canada, with the best locations for wind turbine projects in Southern Alberta, Saskatchewan, Gaspésie, the Maritimes, and the far North.<sup>61</sup>

The concept of a Renewable Portfolio Standard (RPS) requires electricity producers to purchase a specified percentage of their power from renewable sources of energy.<sup>62</sup> From here, retailers can match this percentage by choosing different types of renewable energy to purchase, thereby encouraging cost-effective renewable energy to residents of a community. This is where *wind energy purchase plans* become a hallmark of consumer interest for renewable energy.<sup>63</sup> These purchase plans include a number of organizations that sell "green

<sup>&</sup>lt;sup>56</sup> CanWEA, *supra* note 12.

<sup>&</sup>lt;sup>57</sup> Natural Resources Canada, *supra* note 9.

<sup>&</sup>lt;sup>58</sup> CanWEA, *supra* note 12.

<sup>&</sup>lt;sup>59</sup> CanWEA, supra note 12, available at http://www.canwea.ca/downloads/en/PDFS/Grid Code -

Press\_Release\_final\_Jan\_16.pdf (last visited Feb. 6, 2006). This is a press release from Jan. 16, 2006. <sup>60</sup> Natural Resources Canada, *supra* note 9, *available at* 

http://www.canren.gc.ca/resou\_asse/index.asp?CaId=56&PgId=451 (last visited Feb. 6, 2006). Environment Canada is a federal agency that provides helpful materials and analysis for Natural Resources Canada.

<sup>&</sup>lt;sup>61</sup> The Gaspésie is a region running along coastal areas of Quebec and the Atlantic provinces.

<sup>&</sup>lt;sup>62</sup> CanWEA, *supra* note 21.

<sup>&</sup>lt;sup>63</sup> Id.

power" for home residents, businesses, and communities. Groups like the Canadian Wind Energy Association support RPS initiatives across Canada to steer energy producers towards the purchase of renewable energy, while providing consumers (particularly new home buyers) with more reasonable energy costs for electricity consumption.

In providing more streamline energy delivery to communities, energy utility operators are developing interconnections between electrical grids on wind farms and surrounding communities. The most recent announcement by the Canadian Wind Energy Association relates to the establishment of the Canadian Wind Interconnection Grid Code (Grid Code) that would connect utility-scale wind farms to provincial electricity transmission grids across Canada.<sup>64</sup> This is a significant step considering that provinces and territories apply their own wind energy interconnection requirements at various times and regulate electricity systems, thereby contributing to uneven rates of renewable plans. The Grid Code plan is expected to involve several Canadian utility and transmission operators and with the North American Electricity Reliability Council (NERC) through a consultation process.<sup>65</sup>

This mobilization effort through the Grid Code signals the degree of harmonization that Canadian wind energy producers wish to provide in developing consistent wind energy standards in all jurisdictions, rather than standards applied in isolation. It is hoped that by 2013, Canada's installed wind energy capacity will increase to 7,000 MW, enough to power 1.8 million homes.<sup>66</sup> Other policy considerations that are incorporated with wind energy programs include crown land issues, transmission and interconnection (between wind farms and utility electrical grids), environmental assessment, land use and zoning rules, and building codes and electrical standards.<sup>67</sup>

<sup>65</sup> *Id.* The North American Electricity Reliability Council (NERC) is a non-profit New Jersey corporation whose members include eight regional reliability councils (Electric Reliability Council of Texas, Florida Reliability Coordinating Council, Midwest Reliability Organization, Northeast Power Coordinating Council, Reliability*First* Corporation, Southeastern Electrical Reliability Council, Southwest Power Pool, Inc., and Western Electricity Coordinating Council). These members come from all segments of the electric industry, including investor-owned utilities, federal power agencies, rural electric cooperatives, state, municipal, and provincial utilities, independent power producers, power marketers, and consumers. NERC's objective is to ensure that the bulk electric system in North America is reliable, adequate and secure. See generally http://www.nerc.com/regional/ for more discussion on NERC.

<sup>&</sup>lt;sup>64</sup> Natural Resources Canada, *supra* note 9, *available at* http://www.canwea.ca/en/NewsReleases.html (last visited Feb. 6, 2006).

<sup>&</sup>lt;sup>66</sup> Id.

<sup>&</sup>lt;sup>67</sup> CanWEA, *supra* note 12.

# V. CURRENT RENEWABLE POLICY INITIATIVES AMONG SOME CANADIAN JURISDICTIONS

The current renewable energy regimes in Canada include a host of federal and provincial projects, some as independent efforts and others as legislative frameworks that cover the application of wind energy technology. Various provinces like Alberta, Quebec, Ontario, and the Yukon Territory are quickly moving towards more renewable-driven efforts to help power essential services such as transportation, agriculture, and household electricity. These four jurisdictions are among Canada's leaders in adopting wind energy as part of their energy infrastructure plans by offering financial incentives to companies pursuing renewable energy. Other provinces with little or no wind energy developments are closely following recent wind-generating projects, and are reasonably likely to introduce similar renewable energy schemes. Modern techniques in applying wind energy technology include both landbased wind farms and, more recently, offshore-based wind farms. Such initiatives require wind turbine technology and improved interconnection of electrical grids between wind farms and cities or remote communities.

#### Alberta

Alberta is the oil and gas capital of Canada, and is thus one of the greatest polluters because of its heavy reliance on conventional fossil fuels. Despite this, Alberta has made tremendous strides in procuring creative wind energy programs, and has become one of Canada's leaders in fostering renewable energy. Historically, Canada's first commercial wind farm was built in southern Alberta, near Cowley Ridge.<sup>68</sup> With respect to Alberta's booming economy and massive influx of people, Alberta is at the forefront of vigorous application of wind technology to produce more efficient energy consumption. One such project is located at Castle River, Alberta, where a wind farm of 60 turbines generates enough electricity (around 39.5 MW) to supply thousands of homes.<sup>69</sup> The first wind turbine was established in November 1997, the Castle River wind farm.

<sup>&</sup>lt;sup>68</sup> Re-Energy, *supra* note 20, at 2.

<sup>&</sup>lt;sup>69</sup> Vision Quest Windelectric Inc., Castle River Wind Farm, available at

http://www.visionquestwind.com/existing.asp?pg=castle&mi=04&bdy=castle1&id=existing (last visited Feb. 16, 2006). The Castle River Wind Farm has 1 Vestas 40-meter tower with 600 kW units and 59 Vestas 50-meter towers with 660 kW units. This wind farm is located west of Pincher Creek, Alberta. Vision Quest Windelectric

Other major projects in Alberta are located at McBride Lake Wind Farm,<sup>70</sup> having a wind-generating capacity of 75 MW, Summerview Wind Turbine,<sup>71</sup> having a windgenerating capacity of 1.8 MW, and Waterton wind turbines, having a wind-generating capacity of 3.6 MW.<sup>72</sup> The McGrath Wind Power Project is another wind program that has 20 turbines having the capacity to generate 30 MW of electricity to power approximately 13,000 homes.<sup>73</sup> This is a \$48 million zero-emissions project introduced in 2004 that will replace 82,000 tonnes of carbon dioxide per year, equivalent to taking away 12,000 vehicles.<sup>74</sup> In the context of federal renewable programs under the Wind Power Production Incentive (WPPI), the McGrath Wind Power Project will receive \$9 million in funding from the Canadian government over the next ten years.<sup>75</sup>

Drawing from these renewable energy developments, municipalities are applying "green" programs to power basic infrastructure services. For instance, in 2001, the city of Calgary, Alberta's largest city boasting a population of over 1 million people, has switched its light-rail transit system to wind-generated electricity. Known as the Ride the Wind Project, the Calgary initiative uses zero-emissions electricity generated from the Castle River Wind Farm in the Pincher Creek area of southern Alberta to power the city's light-rail transit system.<sup>76</sup> It is the first public light-rail transit system in North America that fully operates on

<sup>72</sup> Vision Quest, Waterton Wind Turbines, *available at* 

Inc. is a division of TransAlta Energy Corporation, which is part of TransAlta Corporation, among Canada's largest non-regulated power generation and wholesale marketing companies. It was incorporated in 1996, after a joint venture between The Chinook Project Inc. and Canadian Enhanced Energy Development Limited, two companies historically involved with renewable energy. Vision Quest seeks to produce clean renewable energy to Canadian consumers, focusing primarily on wind generation. It is partnered with Nova Scotia-based Natural Forces Technologies Inc., a company that develops wind projects in the Atlantic provinces.

<sup>&</sup>lt;sup>70</sup> Vision Quest, McBride Lake Wind Farm, *available at* 

http://www.visionquestwind.com/existing.asp?pg=mcbride&mi=04&bdy=mcbride&id=existing (last visited Feb. 16, 2006). The McBride Lake Wind Farm was established in September 2003, 8 kilometers south of Fort McLeod, Alberta. The wind farm has 114 Vestas 50-meter towers generating around 660 kW units.

<sup>&</sup>lt;sup>71</sup> Vision Quest, Summerview Wind Turbine, *available at* 

http://www.visionguestwind.com/existing.asp?pg=summer&mi=04&bdy=summer&id=existing (last visited Feb. 16, 2006). The Summerview Wind Turbine is a 1 Vestas 1800 kW unit 67-meter tower, and is located northeast of Pincher Creek, Alberta. It was commissioned on January 2002.

http://www.visionquestwind.com/existing.asp?pg=waterton&mi=04&bdy=waterton&id=existing (last visited Feb. 16, 2006). The Waterton Wind Turbines are a collection of six individual turbines located at strategic points south and west of Hillspring, Alberta.

<sup>&</sup>lt;sup>73</sup> Suncor Energy, *available at* http://www.suncor.com/links\_popup.aspx?ID=2408 (last visited Feb. 17, 2006). The McGrath Wind Power Project is an equal partnership between Suncor Energy Inc., EHN Wind Power Canada Inc., and Enbridge Inc. Enbridge has purchased one-third of the facility's electricity for its pipeline operations, while EHN operates the facility.  $^{74}$  Id.  $^{75}$  Id.

<sup>&</sup>lt;sup>76</sup> Ride the Wind!, available at http://www.re-energy.ca/ridethewind/about.shtml (last visited Feb. 17, 2006). This project was approved by Calgary City Council on Feb.12, 2001. The history of the project saw Vision Quest

wind-generated electricity. This transfer of electricity generation from conventional sources of energy to wind energy is powered by Vision Quest Windelectric Inc., a subsidiary of TransAlta Utilities.<sup>77</sup> The Ride the Wind project serves as an example of interconnecting wind farms in mainly rural communities with urban electrical grids to power municipal services like the light-rail transit.

#### Québec

Traditionally dependent upon hydroelectricity power, Québec is becoming one of the most active provinces in pursuing renewable wind energy programs. In 2004, the Québec government announced that a \$1.5 billion (Canadian) windmill power project has the potential of doubling Canada's wind energy capacity.<sup>78</sup> Hydro Québec (HQ), the province's largest energy company, hosted bids from two private companies, Cartier Wind Energy and Northland Power Inc./Northland Power Income Fund, to build and operate eight wind turbine farms in eastern Québec that would produce 1,000 MW of power by 2012.<sup>79</sup> More specifically, Cartier Wind Energy has contracted with HQ for 740 MW worth of wind power projects located in the Gaspesie-Iles-de-la-Madeleine region and the regional county municipality of Matane.<sup>80</sup>

This program is expected to cost an average of 6.5 cents per kilowatt-hour (kWh).<sup>81</sup> Under this program, Québec will install 660 wind turbines in eight projects throughout the province between 2006 and 2012, with the assistance of General Electric (GE), totaling 990

<sup>78</sup> MSNBC, *available at* http://msnbc.msn.com/id/6182383/ (last visited Feb. 16, 2006) [hereinafter MSNBC].

<sup>79</sup> *Id.* Hydro Québec (HQ) is a body of the Québec provincial government, with the government as its sole shareholder. HQ is responsible for operation and development of generation facilities in Québec. The production division of HQ buys and sells electricity on wholesale markets. See generally

Windelectric Inc. entering into contract with Enmax, then having Enmax signing an agreement with Calgary City Transit to deliver wind power to the light-rail transit system. Enmax transferred its Emission Reduction Credits to City Transit. Here, ten wind turbines are constructed, owned, and operated by Vision Quest, all of which were fully operational by Aug.31, 2001. In 2001, Calgary Transit was awarded by the Federation of Canadian Municipalities with a CH2M HILL Sustainable Community Award for promoting renewable energy. Calgary Transit was also awarded with the 2001 Pollution Prevention Award by the Canadian Council of Ministers of the Environment. See http://www.calgarytransit.com/environment/ride\_d\_wind.html (last visited Feb. 17, 2006). <sup>77</sup> Id.

http://www.candu.org/hydroquebec.html for a general overview of HQ's services. Cartier Wind Energy is a consortium of Innergex, TransCanada Energy, and Renewable Systems Energy USA (RES). Northland Inc. is a major Canadian developer of independent power projects.

<sup>&</sup>lt;sup>80</sup> TransCanada News Release (Feb. 25, 2005), available at

http://www.transcanada.com/news/2005\_news/2005\_02\_25.htm (last visited Feb. 18, 2006). <sup>81</sup> MSNBC, *supra* note 77.

MW in wind capacity.<sup>82</sup> This development is a result of Hydro Quebec's 2003 request for proposal to supply 1,000 MW for new wind power capacity by 2012, supporting the Quebec government's Decrees 352 and 353, both of which request this wind capacity amount.<sup>83</sup> A second project announced in 2004 involves a \$300 million project by Skypower Corporation to develop a wind farm in Riviere-du-Loup, Quebec.<sup>84</sup> This project is slated as being Canada's largest private wind energy production in the nation's wind producing history, with both Skypower and Hydro-Quebec signing an agreement for Skypower to build a 200 MW "SuperPark".<sup>85</sup> The superpark will supply around 625 million kilowatt-hours (kWh) of electricity, enough to power 70,000 homes, and produce 20 permanent jobs.<sup>86</sup>

A third wind project in Quebec includes the creation of two wind farms in Murdochville, Quebec with the help of \$36.5 million of federal funding under the auspices of Canada's Wind Power Production Incentive (WPPI).<sup>87</sup> Here, sixty wind turbines on Mount Miller and Mount Copper will provide 108 MW of wind capacity, enough to power 150,000 homes in Quebec.<sup>88</sup> The Murdochville project is estimated to cost \$1.1 billion (Canadian) and the construction of the wind farms is currently underway in 2006.

# Ontario

Meeting the growing demands of electricity consumption and reducing dependence on coal-generated energy inspired the government of Ontario to pass the *Electricity* 

<sup>&</sup>lt;sup>82</sup> General Electric, Press Release (Oct.4, 2004), available at

http://www.gepower.com/about/press/en/2004\_press/100504.htm (last visited Feb. 18, 2006). <sup>83</sup> *Id.* 

<sup>&</sup>lt;sup>84</sup> Skypower News Release (Nov. 25, 2004), available at

http://www.skypowercorp.com/docs/SPC\_Inf\_PR\_Press%20release\_RDL\_%20New%20english\_Nov24.pdf (last visited Feb. 18, 206). Skypower Corp. is a private wind energy development company based in Toronto, Ontario, that provides expertise in developing wind farms across Canada, having wind projects in over 8 provinces. It is actively involved in wind projects from the exploration phase to the construction phase, and into commercial marketing. For further discussion, see http://www.skypowercorp.com/html/aboutus.html (last visited Feb. 18, 2006).

<sup>&</sup>lt;sup>85</sup> Skypower, News Release, *available at* 

http://www.skypowercorp.com/docs/SPC\_Inf\_PR\_Press%20release\_RDL\_%20New%20english\_Nov24.pdf (last visited Feb. 18, 2006).

<sup>&</sup>lt;sup>86</sup> Id.

<sup>&</sup>lt;sup>87</sup> Natural Resources Canada, News Release (March 16, 2005), *available at* http://www.nrcan-rncan.gc.ca/media/newsreleases/2005/200512\_e.htm (last visited Feb. 18, 2006). The Murdochville project will be funded under the WPPI regime for the next ten years, starting from March 2005.
<sup>88</sup> Id.

*Restructuring Act* (ERA) in 2004.<sup>89</sup> This Act amended the 1998 *Ontario Energy Board Act* and the 1998 *Electricity Act*, thus restructuring the province's electricity sector.<sup>90</sup> The main objective of the ERA is to expand alternative and renewable sources of electricity consumption, helping reduce the rising costs of conventional fossil fuel energy, and promoting energy conservation. In applying this statute, the Ontario Energy Board seeks to provide affordable electricity prices for consumers who have not signed contracts with electricity retailers. The Act also establishes a *Regulated Price Plan* that offers the true cost of electricity and stabilizes pricing.

The government of Ontario enacted the *Electricity Conservation Responsibility Act* (Bill 21) on November 3, 2005 as a means to promote energy efficiency strategy in the province.<sup>91</sup> Schedule B of Bill 21 creates a "smart metering entity", which is an administrative body with powers to gather energy use information from individual households and businesses. Smart meters are devices that calculate the time of use of energy, allowing local electricity distributors to track how much energy is used and what time of day it is used.<sup>92</sup> This contrasts with traditional energy meters which sum up the total energy used in a given period. The policy of Ontario's government is to install over 800,000 smart meters across the province by December2007, and for all Ontario consumers by 2010.<sup>93</sup>

As part of this initiative, the government of Ontario is partnered with six local electricity distribution companies in a project known as *powerWISE*.<sup>94</sup> PowerWISE is a multi-year initiative to encourage energy conservation to consumers. Under this scheme, the provincial government and the electricity distribution companies are launching a consumer education campaign in order to raise awareness about rising energy costs and when to reduce energy consumption during periods of high prices. The smart meter campaign offers

<sup>&</sup>lt;sup>89</sup> Ontario Energy Board, available at http://www.oeb.gov.on.ca/html/en/consumerinformation/leg\_bill100.htm (last visited Feb. 7, 2006).

<sup>&</sup>lt;sup>90</sup> Id.

<sup>&</sup>lt;sup>91</sup> Mark S. Winfield, Submission to the Standing Committee on Justice Regarding Bill 21: The Electricity Conservation Responsibility Act, 2005 (Feb.3, 2006), available at

http://www.pembina.org/pdf/publications/Sub\_Bill21\_ElecConsRA\_05\_Feb06.pdf (last visited Feb. 7, 2006). The Pembina Institute promotes sustainable energy solutions through education, research, and advocacy. <sup>92</sup> powerWISE, Smart Meters, *available at* http://www.powerwise.ca/gov\_meters.html (last visited Feb. 7, 2006). PowerWISE comprises six of Ontario's largest local electricity distribution companies, including Enersource Hydro Mississauga, Hamilton Utilities Corporation, Hydro Ottawa Limited, PowerStream Inc., Toronto Hydro-Electric Systems Limited, and Veridian Connections. This project is estimated to combine around \$70 million (Canadian).

<sup>&</sup>lt;sup>93</sup> Id.

<sup>&</sup>lt;sup>94</sup> powerWISE, available at http://www.powerwise.ca/about\_whatis.html (last visited Feb. 7, 2006).

affordable prices for consumer during on-peak (periods of highest electricity consumption), mid-peak, and off-peak (periods of lowest electricity consumption).<sup>95</sup>

The new trend in global wind energy applications is by installing wind farms offshore, particularly in smaller countries. For instance, Toronto Hydro Energy Services Inc., along with Windshare, is installing a wind turbine offshore on Lake Ontario.<sup>96</sup> This offshore turbine will generate 1,400 megawatt-hours of power per year, giving energy to approximately 250 homes.<sup>97</sup> At 94 meters high, the 750 kilowatt-hour wind turbine cost \$1.3 million (Canadian dollars).<sup>98</sup> The wind turbine also produces very little noise, at around 43 decibels.<sup>99</sup> Another off-shore wind project is located on Lake Huron, known as the *Huron Wind Farm*, Ontario's first commercial wind farm.<sup>100</sup>

Located in the municipality of Kincardine, the Huron Wind Farm is a partnership between Ontario Power Generation (the province's largest "green energy" supplier) and British Energy Canada (the UK's largest electricity generating company).<sup>101</sup> The Huron Wind Farm is a collection of 1.8 MW turbines that supply approximately 2,000 to 3,000 homes on an annual basis.<sup>102</sup> The Huron Wind Farm underwent extensive administrative compliance procedures, whereby environmental assessments were conducted to determine the potential for wind energy development.<sup>103</sup> Such assessments required This wind farm markets and distributes electricity to consumers and businesses throughout Ontario. It also encourages compliance with Ontario's environmental legislation.

<sup>&</sup>lt;sup>95</sup> powerWISE, *supra* note 91.

<sup>&</sup>lt;sup>96</sup> Re-Energy, *supra* note 20, at 3.

<sup>&</sup>lt;sup>97</sup> Toronto Hydro, *available at* 

http://www.torontohydro.com/corporate/initiatives/green\_power/wind\_turbine/index.cfm <sup>98</sup> Id.

<sup>&</sup>lt;sup>99</sup> Id.

<sup>&</sup>lt;sup>100</sup> Realty Times, *available at* http://realtytimes.com/rtcpages/20021203\_caenergy.htm (last visited Feb. 16, 2006). Also see Huron Wind, *available at* http://www.huronwind.com/huronwind/ (last visited Feb. 16, 2006). The Huron Wind Farm is located on the shore of Lake Huron in Bruce County, Ontario. It was designated with 100 acres as industrial development land. There are five 1.8 MW wind turbines approximately 117 meters tall. The Huron Wind Farm was assessed under Ontario's Environmental Assessment Act, and thereafter underwent an environmental screening process. Considering that most of this parcel of land was used for agricultural purposes, after the environmental assessment, it was realized that 95 percent would still be retained for farming after the wind farm is built. This program is a result of Canada's Wind Power Production Incentive (WPPI), whereby Huron Wind was required to submit environmental assessment data to Natural Resources Canada. See Huron Wind Fact File, *available at* http://www.huronwind.com/huronwind/hw\_pdfs/35.pdf (last visited Feb. 16, 2006). The Huron Wind project was announced on March 20, 2001, and began operation on December 1, 2002. See generally http://www.huronwind.com/huronwind/project.asp (last visited Feb. 16, 2006).

<sup>&</sup>lt;sup>101</sup> Sunsets.com, available at http://www.sunsets.com/huronwindfarm.htm (last visited Feb. 16, 2006). <sup>102</sup> Id.

<sup>&</sup>lt;sup>103</sup> Huron Wind Fact File, *available at* http://www.huronwind.com/huronwind/hw\_pdfs/35.pdf (last visited Feb. 16, 2006) at 1.

#### Yukon

The Yukon Territory is also active in Canada's push towards wind energy production. During the early 1980s, two Yukon government efforts, the Yukon Conservation Strategy and the Yukon Economic Strategy, considered how Yukon may incorporate renewable energy into the territory's existing infrastructure regime, replacing imported diesel (a trend similarly found in China's rapidly-growing cities).<sup>104</sup> Wind turbine generation is now an established part of Yukon's energy sector with the creation of two major wind farms on Haeckel Hill near the capital of Whitehorse.<sup>105</sup> Located high up at 4,700 feet (1,430 meters), this project is enough to supply electricity up to 150 homes.<sup>106</sup> The location is deliberate in that high altitudes (as mentioned) produce higher winds that contribute to more electricity generation from wind turbines. The Haeckel Hill wind project serves as an alternative energy source, considering that much of Yukon's electricity supply comes from diesel generators.<sup>107</sup> Although two major hydro-electric plants provide some energy, most of the diesel plants are not connected to the hydro-electric plants.

The first wind turbine in the Yukon was manufactured in December 1992 by the Danish company Bonus Energy A/S, known as Bonus 150.<sup>108</sup> The wind turbine is a 150 kW

<sup>&</sup>lt;sup>104</sup> Yukon Energy and Yukon Dev. Corp., The Winds of Change : The Story of Wind Generation in the Yukon, available at http://www.yukonenergy.ca/downloads/db/74 winds of change.pdf (last visited Feb. 18, 2006) at 1. Yukon Energy is a publicly-owned electrical utility company that was established in 1987. It is the main generator and transmitter of electrical energy in the Yukon, working closely with its parent company Yukon Development Corporation. Yukon Energy employs around 66 workers. Yukon Energy is regulated by three territorial statutes, the Business Corporations Act, the Public Utilities Act, and the Yukon Water Act.

<sup>&</sup>lt;sup>105</sup> Yukon Energy, available at http://www.yukonenergy.ca/services/renewable/wind/ (last visited Feb. 18, 2006). Yukon is the northern territory of Canada bordering Alaska on its eastern edge. Yukon's population is approximately 33,000, two-thirds of which live in the capital city Whitehorse. Haeckel Hill is a wind monitoring station located on a shoulder of Mount Sumanik, west of Whitehorse. Originally, two local citizens (Jack Cable and Dr. Doug Craig) investigated Environment Canada's upper air data and found that wind speeds reach high levels on Mount Sumanik, around 6.6 meter per second (m/s) at 4,000 feet, 6.9 m/s at 5,000 feet, and 7.3 m/s at 6,000 feet. This led to the establishment of the Haeckel Hill wind monitoring station. The Haeckel Hill provides electricity to the Whitehorse/Aishihik/Faro grid. <sup>106</sup> *Id.* 

<sup>&</sup>lt;sup>107</sup> John F. Maissan, Wind Power Development in Sub-Arctic Conditions with Severe Rime Icing, available at http://www.yukonenergy.ca/downloads/db/45 final wind paper.pdf (last visited Feb. 18, 2006). Daily temperatures in Whitehorse during January are typically -25 Celsius, reaching lows of -40 Celsius. Rime icing is any build-up of ice on solid objects from moist, supersaturated air at sub-zero temperatures.

<sup>&</sup>lt;sup>108</sup> *Id.* at 3. The cost of the 150 kW Mark III wind turbine was \$1 million (Cdn), and it was erected on Haeckel Hill in July 1993. The wind turbine is approximately 30 meters high. Bird strikes have been problematic on some Yukon wind farms, a concern expressed on virtually every wind farm around the world. Such problems have an impact on environmental assessments conducted by relevant authorities in determining the potential for creating and maintaining wind farms. Five years of bird studies consider the Haeckel Hill facility relatively safe. See generally http://www.yukonenergy.ca/downloads/db/74 winds of change.pdf at 6 (last visited Feb. 18, 2006).

Mark III, three-blade, conventional horizontal axis machine. The sub-arctic climate of the Yukon provides insight into the preservation of wind turbines in severely cold temperatures, a climatic condition which may interfere in the operation of the equipment. For instance, the effect of rime icing (buildup of ice on solid objects) is detrimental to a normal-functioning wind turbine. The accumulation of rime ice on the leading edges of a propeller blade slows the rate of rotation of the blades, a process that slows down electrical generation. To counteract this effect, wind operators are forced to install blade heaters that minimize some accumulation of ice build-up, but not entirely.

Without using these blade heaters, the wind blades will stop altogether. This is why Bonus Energy A/S and Yukon Energy worked together to make necessary technical modifications to the Bonus 150 wind turbine prior to installing it on Haeckel Hill.<sup>109</sup> Such modifications included low-temperature tolerant steels, synthetic lubricants, six-inch heating strips for leading edges on blades, heating systems in the generator, and a 30 meter-high base to capture high winds.<sup>110</sup> Other Yukon-made solutions include the burying of power lines that eliminates power outages, widening the heating strips used on blade edges to increase efficiency, and applying a black-colored fluorourethane coating to encourage ice shedding.<sup>111</sup> A second wind turbine was installed in 2000 by the Danish company Vestas Wind Systems A/S, also on Haeckel Hill.<sup>112</sup> Known as the Vestas V47-660 kW, this wind turbine generates 660 kW, has a tubular tower 37 meters high, with three fiberglass blades, and is conditioned to face low temperatures of -30 °C.<sup>113</sup> This project is modeled after the Bonus 150 wind turbine, but utilizes modern specifications and technology to power at least 130 homes.<sup>114</sup>

The wind projects in Yukon are remarkable in that northern climates are incorporating wind turbine technology in supplying electricity to regions which are mostly remote and extremely cold. Taking advantage of naturally-occurring high winds during the winter months, Yukon is certainly on its way in developing greater wind-generating capacity in the near future. This certainly raises the possibility of developing wind projects in northern regions around the world. Current events in Yukon's wind energy sector have seen the May

<sup>&</sup>lt;sup>109</sup> *Id.* at 7.

 $<sup>^{110}</sup>$  Id. at 7.

 $<sup>^{111}</sup>$  *Id.* at 8.

<sup>&</sup>lt;sup>112</sup> *Id.* at 10. Vestas Wind Systems A/S works closely with Yukon Energy in applying its software program that monitors Yukon-specific weather conditions on Haeckel Hill. The fine-tuning of computer software provides more efficient capture of wind energy by increasing wind capacity. The Vestas V47-660 kW will produce enough electricity, equivalent to 350,000 litres of diesel fuel.

 $<sup>^{113}</sup>$  Id.  $^{114}$  Id. at 13.

2003 international conference that saw over 100 delegates attending the Yukon International Wind Energy Conference in Whitehorse.<sup>115</sup> The Yukon government has established a *Community Wind Resource Assessment Program* as a means to provide financial incentives and technical assistance to companies testing wind energy as an alternative to diesel fuel.<sup>116</sup> The Yukon experience demonstrates how surveying wind monitoring data and a firm commitment to move away from conventional sources of energy such as diesel help foster new attitudes towards sustainable resource development, even in the most remote locations.

#### VI. GLOBAL APPLICATIONS OF WIND ENERGY

The global wind energy industry is growing at a rapid pace. From a purely economic perspective, the significance of producing wind energy helps reduce high costs of electricity consumption. Fossil fuels represent the traditional means of producing energy, but given the finiteness of this resource, the high levels of pollution it produces, and the rapid rise in consumption costs from fossil fuels such as coal and natural gas, the advent of cheaper and more efficient wind energy tools like wind turbines is certainly proving to be a more attractive alternative in helping various nations coordinate their environmental policies.

While some forms of wind energy are more costly to apply than conventional means (such as with offshore wind projects), the high demand for electricity consumption is causing conventional energy costs to rise at a rapid rate. In contrast, wind energy costs are declining due to the improved technological advancements in producing more efficient wind energy production from wind turbine engines. Governments, industry, and consumers are beginning to realize the potential benefits associated with renewable energy extraction and application. From an environmental perspective, the use of wind energy greatly reduces the adverse effects of land and air pollution, while conserving local habitats by lessening the impact on wildlife. It is thus useful to examine some global approaches in applying wind energy as an important renewable alternative.

# United States: Department of Energy's Wind Program, the National Wind Technology Center and Other Initiatives

 $<sup>^{115}</sup>$  Id.

<sup>&</sup>lt;sup>116</sup> *Id.* at 14.

Since 1972, the United States has researched wind generation under the National Science Foundation, primarily in response to the oil crisis.<sup>117</sup> With respect to modern wind energy, the U.S. Department of Energy's Wind Program (DOE Wind Program) is a comprehensive strategy designed to promote wind power generation in the United States.<sup>118</sup> This program is instrumental in tripling the wind energy capacity in the U.S. from 1,600 MW in 1994 to over 6,700 MW by the end of 2004.<sup>119</sup> In guiding this trend, the U.S. approach includes a federal production tax credit, which is an inflation-adjusted credit of 1.9 cents per kilowatt-hour (kWh) for technologies for the first ten years of production.<sup>120</sup> Recent efforts has seen the DOE Wind Program implement two projects, one known as the Next Generation Wind Turbine (1994-2003), and the other being WindPACT (1999-2004).<sup>121</sup> These two projects helped innovate designing larger turbines that would produce more wind energy, and significantly reduce costs For instance, the cost of operating utility-driven turbines has been reduced from \$0.80 per kilowatt-hour (kWh) to under \$0.04 per kilowatt-hour.<sup>122</sup>

The *DOE Wind Program* involves a partnership between the DOE's Wind Powering Team and industry representatives by providing state support and utility plans.<sup>123</sup> This partnership helps create large-scale and small-scale projects in various communities across the nation. The main objective of DOE Wind Program is to apply an average of 100 MW wind capacity in over thirty states by 2010.<sup>124</sup> Other more ambitious projects under the Wind Energy Multiyear Program Plan set targets of 100 gigawatts (GW) of wind energy capacity to be installed around the U.S. by 2020.<sup>125</sup> Working in conjunction with the DOE is the

<sup>117</sup> Multi-Year Plan, *supra* note 23. The oil crisis began in 1973, mainly in response to political tensions in the Middle East. These events prompted Arab nations as members of the Organization of Petroleum Exporting Countries (OPEC) to no longer ship petroleum to the United States and most of Western Europe. This shortage of petroleum supply triggered high oil prices, resulting in sudden shifts in economic dependence on foreign oil supplies. See generally http://en.wikipedia.org/wiki/1973 energy crisis (last visited Feb. 17, 2006).

<sup>&</sup>lt;sup>118</sup> U.S. Dept. of Energy (DOE), Wind Power Today: Fed. Wind Program Highlights, available at http://www.nrel.gov/wind/pdfs/37147.pdf (last visited Feb. 6, 2006) at 3. The Wind Program is administered by the Office of Energy Efficiency and Renewable Energy within the DOE. The DOE Wind Program is carried out by a national team under the Wind Powering America initiative. This project has staffed 36 exhibits in several states, including Alaska, Arizona, California, Colorado, Connecticut, Idaho, Illinois, Louisiana, Minnesota, Montana, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Washington, Wisconsin, and Wyoming. Approximately 43,000 copies of the Wind Powering America program was distributed at these exhibits nation-wide [hereinafter Wind Power Today].

<sup>&</sup>lt;sup>119</sup> *Id*.

<sup>&</sup>lt;sup>120</sup> *Id.* at 9.  $^{121}$  *Id*.

 $<sup>^{122}</sup>_{123}$  *Id.* at 4.  $^{123}_{123}$  *Id.* 

 $<sup>^{124}</sup>$  *Id.*  $^{125}$  *Id.* at 5.

*National Wind Technology Center* (Wind Technology Center), managed by the National Renewable Energy Laboratory.<sup>126</sup>

This center helps develop better wind energy technologies to be applied in the wind energy industry. The Wind Technology Center is involved in the Turbine Research Project, which seeks to improve existing wind turbine design and equipment functionality to promote cost-effective electricity. More specifically, the Turbine Research Project aims at reducing energy costs produced by large wind systems from 3 cents per kilowatt-hour in Class 6 winds from 2004 (average wind speeds of 6.7 meters per second at a 10-meter height) to 3 cents per kilowatt-hour in Class 4 winds by 2010 (average wind speeds of 5.8 meters per second at a 10-meter height).<sup>127</sup>

This is precisely why generating wind speed maps is so critical in producing more efficient means of wind energy production. Here, the Wind Technology Center seeks competitive solicitations from industry partners that, when selected, share in the costs of the wind turbine project.<sup>128</sup> This collaboration between the federal government and industry partners is part of the DOE Wind Program's emphasis on cost-sharing turbine projects that improve efficiency standards, a process that began in 1997.<sup>129</sup> For instance, there is a push in the industry towards developing stronger and lighter propeller blades with carbon fiber and carbon-glass hybrids. This lighter composite design of the propeller blade allows the turbine to last longer in turbulent winds (which, over time, breaks down the surface materials of the blade), and rotate faster to provide more energy.<sup>130</sup>

Considering that the rotor and blades comprise about 25 percent of the capital cost of the wind turbine (while capturing 100 percent of energy), it makes sense to research and modify the overall design and compositional materials of the turbine. Thus, a healthy partnership exists between government-sponsored scientific research and market-based energy producers. With this cooperation in place, a major goal of the Wind Technology

<sup>&</sup>lt;sup>126</sup> Natl. Wind Tech. Ctr., *available at* http://www.nrel.gov/wind/ (last visited Feb. 6, 2006). This center is a world-class facility located near Boulder, Colorado. The center also works closely with another major research facility located in Albuquerque, New Mexico, Sandia National Laboratories, to help create innovative and cutting-edge wind energy technologies. This initiative is partnered with private industry and university research. Particularly, the National Wind Technology Center consults industry on design and review analysis, component development, systems, controls, and structural analysis, certification, utility integration, and resource assessment [hereinafter Tech. Ctr.].

<sup>&</sup>lt;sup>127</sup> Id, at http://www.nrel.gov/wind/working.html (last visited Feb. 6, 2006).

 $<sup>^{128}</sup>$  *Id.* 

<sup>&</sup>lt;sup>129</sup> Tech. Ctr., *supra* note 124, *available at* http://www.nrel.gov/wind/working\_achievements.html (last visited Feb. 6, 2006).

<sup>&</sup>lt;sup>130</sup> Wind Power Today, *supra* note 117, at 9.

Center is to meet 5 percent of the nation's energy needs, and to double the number of states participating in wind energy programs.<sup>131</sup>

These developments allow the Wind Technology Center to create better wind turbine technology in order to integrate wind power with electrical grids in various communities. Integration is achieved in four ways: (1) Wind Farm Monitoring; (2) Wind Farm Model Development; (3) Planning Models and Operations; and (4) Market Assessment.<sup>132</sup> Wind farm monitoring involves gathering data on power output and searching for power output diversity. Wind farm model development involves studying the behavior of power systems under varying conditions to identify grid stability, since different wind farms are connected to different types of utility electrical grids.

This process eventually produces uneven electrical output levels, which forces wind planners to seriously consider the interconnectivity of grid systems when planning wind projects. Planning models and operations includes the study of how multiple wind power plants or generators streamline each other's output under different windy environments. Market assessment determines how competitiveness can be introduced in the domestic and international economy by reducing the costs of wind energy from the effects of rising fossil fuel production. In light of the increasing consumer demand, market assessment helps the wind industry appreciate economic factors in fine-tuning future projects, rather than focusing only on science of wind generation.

Despite these efforts, some barriers to wind development include transmission constraints, utility grid integration, and site operations. Since the enactment of the *Energy Policy Act* in 1992, issues of open access to transmission lines have been presented to the Federal Energy Regulatory Commission (FERC).<sup>133</sup> Here open access tariffs filed by transmission providers to FERC are limiting services available to wind producers, maintaining high transmission costs, and imposing penalties. This has inspired FERC to develop a standard set of rules for developing interconnections between generators on wind farms and utility grid transmission lines.<sup>134</sup> Utility grid integration connects the wind farms to the electrical grids that supply surrounding communities. This is significant considering that conventional energy sources generally do not incorporate the modern renewable wind

<sup>&</sup>lt;sup>131</sup> Tech. Ctr., *supra* note 124, *available at* http://www.nrel.gov/wind/working\_wpa.html (last visited Feb. 6, 2006).

 $<sup>^{132}</sup>$  Id.

<sup>&</sup>lt;sup>133</sup> Wind Power Today, *supra* note 117, at 12.

<sup>&</sup>lt;sup>134</sup> *Id.* at 13.

technology and new design schemes of wind turbines on wind farms that supply energy to these grids.

Addressing such problems, FERC hosted a conference entitled 'State of Wind Energy in Wholesale Electric Markets', to ensure that wind technology does not receive discriminatory treatment in electricity policy planning.<sup>135</sup> In response to this conference, and with the help of the American Wind Energy Association, FERC issued a *Notice of Proposed Rulemaking*, in which the Commission proposed standards that would streamline the interconnection of grid systems and the economies of scale for large wind generating plants.<sup>136</sup> Along these lines, other issues to be taken into consideration for wind site development include land use, noise pollution, and environmental impacts on wildlife.

In the U.S., key jurisdictions participating in wind energy technologies are California, Texas, and Minnesota.<sup>137</sup> However, it is expected that most other states will gradually incorporate wind energy programs, given the increasing recognition of wind energy's feasible application in resource management. For example, the Wind Turbine Company (WTC) of Washington has partnered with the DOE in developing utility-scale wind turbines that will produce cost-effective prices, keeping in line with government and industry cost-sharing plans.<sup>138</sup> In 2004, the WTC was awarded \$800,000 from the DOE's National Renewable Energy Laboratory to work on developing prototype wind turbines, including a 750 kilowatt wind turbine.<sup>139</sup> The WTC is currently developing a two-blade, downwind wind turbine, a project closely affiliated with the Wind Technology Center.<sup>140</sup> Its first prototype model turbine (250 kilowatt) was tested at the Wind Technology Center in May 2000, while its second model (500 kilowatt) was installed in December 2001 in Los Angeles County in California.<sup>141</sup>

<sup>&</sup>lt;sup>135</sup> *Id.* at 13. The conference 'State of Wind Energy in Wholesale Electric Markets' was held in December 2004 in Denver, Colorado.

<sup>&</sup>lt;sup>136</sup> *Id*.

<sup>&</sup>lt;sup>137</sup> EIA, *supra* note 29.

<sup>&</sup>lt;sup>138</sup> Tech. Ctr., *supra* note 124. The Wind Turbine Company (WTC) is a company founded in 1989 in Bellevue, Washington, that designs, manufactures, and sells wind turbines to wind farms capable of competing in the energy markets. The WTC's main goal is to produce energy-efficient wind turbines without relying upon subsidies from the government in order to develop wind turbine technology.

<sup>&</sup>lt;sup>139</sup> Tech. Ctr., *supra* note 124, *available at* http://www.windturbinecompany.com/milestones/index.html (last visited Feb. 6, 2006).

<sup>&</sup>lt;sup>140</sup> The Wind Turbine Co., *available at* http://www.windturbinecompany.com/index.html (last visited Feb. 6, 2006).

<sup>&</sup>lt;sup>141</sup> Technology Ctr., *supra* note 124, *available at* http://www.windturbinecompany.com/index.html (last visited Feb. 6, 2006).

Wind energy is also improving energy distribution in rural communities, while also creating unforeseen economic benefits. In states like Colorado, the 162 MW Colorado Green Wind Farm is now the fifth-largest wind project in the United States.<sup>142</sup> Aside from providing renewable energy, the wind farm has provided the local county of Prowers with an increase of 33 percent (or \$33 million) in its tax base revenue.<sup>143</sup> The county credits the wind project for providing more job opportunities for local citizens in the renewable sector. Such projects are a part of state-based initiatives that include landowner and community meetings, workshops, state wind working groups, state wind resource maps, and wind consumer guides.<sup>144</sup>

Other state departments like the U.S. Department of Agriculture (USDA) also offer funding support. In April 2003, the USDA announced a \$23 million package of loans, loan guarantees, and grants to help farmers, ranchers, and rural businesses purchase renewable energy systems.<sup>145</sup> This form of assistance derives from Section 9006 of the 2002 Farm Bill, which offers funds for developing energy from wind, solar, biomass, geothermal, and hydrogen sources.<sup>146</sup> Thus, the rural community is very much a part of the *DOE Wind* Program, and state energy offices often work in collaboration with USDA officials, the Farm Bureau, the Farmer's Union, agricultural schools, and the financial community.<sup>147</sup> Even DOE programs like Tribal Energy Program are administered under the Native American Wind Interest Group (NAWIG), which provide outreach materials and technical assistance to over 700 Native American tribes.<sup>148</sup>

#### **European Union**

Europe is the world's leader in harnessing wind energy potential in applying renewable energy projects.<sup>149</sup> As part of the European Union's effort to enhance wind energy

<sup>&</sup>lt;sup>142</sup> Wind Power Today, *supra* note 117, at 14. The Colorado Green Wind Farm went online in December 2003 near Lamar, Colorado. County commissioner John Stulp commented that "The Colorado Green wind farm is a win-win project for our community....It has been a significant shot in the arm for the economy during construction, and it's providing some good permanent jobs."

 $<sup>^{143}</sup>_{144}$  *Id.* at 15.

 $<sup>^{145}</sup>$  *Id.* at 17.

<sup>&</sup>lt;sup>146</sup> *Id*. <sup>147</sup> Id.

<sup>&</sup>lt;sup>148</sup> Id. The DOE Tribal Energy Program provides this technical assistance to all Native American tribes located on approximately 38.8 million hectares of land, which comes to 96 million acres. This includes Native Alaskan villages and communities. Like other rural programs, workshops and symposia are offered to local groups. <sup>149</sup> Global Wind Energy Council, available at http://www.gwec.net/fileadmin/documents/GWEC Brochure.pdf

<sup>(</sup>last visited Feb. 7, 2006) at 7. The Global Wind Energy Council is an international organization comprised of

technology, the European Wind Energy Association (EWEA) is instrumental in working with the European Commission (the European Union's administrative body) to develop innovative strategies in tackling the rising costs of energy production from fossil fuels.<sup>150</sup> For wind turbine manufacturing, the European world market share represents over 85 percent, while installed capacity represents over 75 percent.<sup>151</sup> Today, over 35 million European citizens enjoy the benefits of wind energy generation.<sup>152</sup> On average, it is estimated that a 10 megawatt wind farm can be constructed in two months, and produce enough energy for approximately 4,000 homes.<sup>153</sup>

In realizing such benefits, European nations assess wind resources throughout the continent by utilizing national and regional data gathered from weather stations and specialized computer software, which eventually produce wind speed maps, or 'wind atlases'.<sup>154</sup> Such efforts reveal that the overall wind capacity in Europe is estimated at 600 terawatt-hours (TWh) for land-based wind farms and 3,000 TWh for offshore wind parks.<sup>155</sup> One of the reasons why European nations are producing much more wind energy is their utilizing more cutting-edge wind turbine technology. For instance, in 1980 the average rotor diameter of wind turbines were only 15 meters that produced 50 kilowatts, while in 2003 the

over 1,500 companies that host global forums for the wind energy sector, bringing the wind industry and its representative associations. For a complete overview of this council, see

http://www.gwec.net/fileadmin/documents/GWEC Brochure.pdf (last visited Feb. 7, 2006) [hereinafter Wind Council].

<sup>&</sup>lt;sup>150</sup> The European Wind Energy Assn, available at http://www.ewea.org/index.php?id=4 (last visited Feb. 6, 2006). The European Commission is the main legislative body of the European Union, consisting of 20 members nominated from various member states who are obliged to act in the best interests of European member states, apart from their national status. The European Commission consists of 36 directorates, which have a general and specialized nature. More specifically, the European Commission's Directorate General for Transport and Energy assists the European Wind Energy Association in developing wind energy projects.

<sup>&</sup>lt;sup>151</sup> The European Wind Energy Assn., Executive Summary, Wind Energy – The Facts, An Analysis of Wind Energy in the EU-25, available at

http://www.ewea.org/fileadmin/ewea documents/documents/publications/WETF/Facts\_Summary.pdf (last visited Feb. 6, 2006) at 1.

 $<sup>^{152}</sup>$  *Id.*  $^{153}$  *Id.* at 4.

 $<sup>^{154}</sup>$  *Id.* at 2.

<sup>&</sup>lt;sup>155</sup> Id. Beginning Feb. 27, 2006 until Mar.2, 2006, the European Wind Energy Conference (EWEC) will be held in Athens, Greece. Here, the leading experts in wind technology, companies, and policymakers from the European Union and around the world will gather to discuss wind energy issues and the latest advancements in applying wind energy in various nations. The range of issues includes resource assessment, innovations in wind turbine design, and market and policy measures. Senior politicians and representatives from international institutions and governments are all invited. For further discussion, see http://www.ewec.info/ (last visited Feb. 6, 2006).

average rotor diameter of wind turbines were 124 meters producing 5,000 kilowatts of energy.<sup>156</sup>

The latest trend in global wind energy is the development of large-scale offshore wind turbines. These offshore wind farms are fully operating off the coasts of Denmark, Sweden, Ireland, the Netherlands, and the United Kingdom.<sup>157</sup> The significance of offshore wind turbine projects is the higher mean wind speeds, low turbulence (meaning longer wind turbine life), and less geographical barriers. Thus, offshore wind energy becomes an attractive option, considering some of the potential problems associated with onshore wind energy such as population density, land ownership, positioning of wind turbines in relation to roads and overhead power lines, uninhabited or used buildings, and avoidance of specially-protected environmental zones.<sup>158</sup>

In terms of wind energy installation capacity, the most successful European nations are Germany (at 16,629 MW in 2004), Spain (at 8,263 MW), and Denmark (at 3,117 MW), with penetration levels in the marketplace at 7 percent, 6.5 percent, and 20 percent, respectively. <sup>159</sup> These percentages reflecting penetration in the marketplace refer to the degree by which wind energy is utilized as part of powering electricity generation to consumers. The European Union's *Renewables Energy Directive* (Directive) seeks to provide electricity from renewable sources to increase from 14 percent in 1997 to 21 percent in 2010, with half of this increase to be delivered by wind power.<sup>160</sup> Under the Directive, Member States shall provide a *guarantee of origin* of electricity produced from renewable sources, carefully specifying the energy source from which the electricity was produced, and pertinent data of location of wind projects and electricity distribution criteria.<sup>161</sup> The Directive also

<sup>&</sup>lt;sup>156</sup> *Id.* at 3.

<sup>&</sup>lt;sup>157</sup> Id.

<sup>&</sup>lt;sup>158</sup> Id.

<sup>&</sup>lt;sup>159</sup> Wind Council, *supra* note 147, at 7.

<sup>&</sup>lt;sup>160</sup> *Id.* The European Union (EU) Renewables Directive has been in place since 2001. In 1997, the EU Commission published a White paper entitled 'Energy for the future: Renewable Sources of Energy'. After four years of negotiation, the EU adopted the Directive on the Promotion of Electricity produced from Renewable Energy Sources, or Renewables Directive. Under Article 2(a) the Renewables Directive's definition of "renewable energy sources" includes wind, solar, geothermal, wave, tidal, hydro-power, biomass, landfill gas, sewage treatment plant gas, and biogases. Generally, the Renewables Directive helps comply with the EU's commitment to the Kyoto Protocol.

<sup>&</sup>lt;sup>161</sup> Directive 2001/77/EC of the European Parliament and of the Council of 27 Sept. 2001, Art. 5(3). See generally http://europa.eu.int/eur-lex/pri/en/oj/dat/2001/l\_283/l\_28320011027en00330040.pdf (last visited Feb. 17, 2001).

addresses grid system issues of interconnecting wind farms with electrical grids that supply energy to communities.<sup>162</sup>

Where appropriate, Member States may require transmission system operators and distribution system operators to bear all the costs of installing a grid system network.<sup>163</sup> After every five years, a detailed summary report by Member States must outline *national indicative targets* for future consumption of electricity.<sup>164</sup> This summary report shall be submitted to the Commission, which will present findings of progress related to electricity consumption from renewable and non-renewable sources. The Directive also follows the global trend of streamlining administrative procedures related to reducing barriers to electricity supply from renewable sources. In particular, under Article 6, the Directive indicates that there should be no discrimination in the charging of transmission and distribution fees for renewable-generated electricity, especially in peripheral regions, island regions, and regions of low population density.<sup>165</sup> Thus, a careful monitoring of specific activities of wind projects is conducted by very detailed legislative frameworks.

#### Denmark

Denmark is one of the European Union's leaders in wind energy production. Enormous progress in the development and implementation of wind energy programs can be seen in Denmark. Already established as one of the most innovative renewable energy markets in the world, Denmark has spurned other nations to develop new strategies for renewable energy application, particularly for wind energy projects. In particular, the Danish model of wind energy capacity has attained 20 percent penetration into the electricity sector.<sup>166</sup> It is hoped that by 2025, the renewable energy sector will harness over 30 percent from wind programs.<sup>167</sup> The Danish Wind Industry Association (DWIA) is instrumental in creating and maintaining the latest technology in wind farm operations.<sup>168</sup>

<sup>&</sup>lt;sup>162</sup> Id. at Art. 7(1). Here, Member States must provide smooth transmission of electricity from renewable sources, and must provide a legal framework or transmission system guidelines to bear the costs of technical modifications such as grid connections and grid reinforcements.

<sup>&</sup>lt;sup>163</sup> *Id.* at Art. 7(3). <sup>164</sup> *Id.* at Art. 3(1)-(2). Further to the national indicative targets, under Art. 3(3), Member States must also publish a report every two years describing the degree of success in meeting national indicative targets, especially with regard to climatic conditions affecting such targets.

 $I_{165}^{165}$  *Id.* at Art. 6(3).  $I_{166}^{166}$  *Id.* at 2.

<sup>&</sup>lt;sup>167</sup> Annual Rept. of the Danish Wind Industry Assn. (March 2005)., available at

http://www.windpower.org/media(775,1033)/annual report 2004.pdf (last visited Feb. 16, 2004) at 8. In this

The DWIA has established a wind program known as 'Wind 50', where input is provided for the federal government's long-term energy strategy towards 2025.<sup>169</sup> The Wind 50 initiative is a response to Denmark's commitment in reducing carbon emissions under the Kyoto Protocol. With respect to electricity pricing, the DWIA estimates that wind energy projects will lower costs of consumption to 0.16 DKK (Danish Krones) per kilowatt-hour (kWh).<sup>170</sup> Facing administrative and logistical challenges (as in many other nations), the DWIA recommends that regional planning be encouraged to focus on technological potential (scientific research) of wind turbines in various wind regions as a precursor to future wind projects.

In March 2005, the Danish Parliament signed an energy agreement among all political parties to permit 750 MW of wind energy to be installed in Denmark over the next five years.<sup>171</sup> This agreement calls for the development of 400 MW in offshore wind farms, and 350 MW onshore.<sup>172</sup> More specifically, one offshore wind farm will be located at Horns Rev in the North Sea, while the other will be located at Rodsand.<sup>173</sup> The Danish Energy Authority has appointed contractors to manage these wind farms. It is estimated that by 2009, 25 percent of Denmark's energy sector will draw electricity from these wind parks.<sup>174</sup> A conference entitled the "Copenhagen Strategy" was held in October 2005, where over 80 European Union officials called for offshore wind plants to be developed throughout Europe.<sup>175</sup> Worldrenowned Danish companies like Vestas Wind Systems A/S are partnered with Siemens Wind Power in providing more than 90 percent of Denmark's wind capacity. These Danish

annual report, Bjarne Lundager Jensen, its managing director, stated: "Our vision is to strengthen the Danish leadership in the field of wind power, thus enabling the wind industry to continue to create growth and jobs in Denmark," at 3-4. The organization recommends: (1) more focused business policy framework to maintain hightech, knowledge-intensive wind turbine production and employment; (2) aggressive investments in public research and education to generate skills from single turbines to wind farms; and (3) an energy strategy to stabilize Denmark's energy supply and carbon dioxide reduction. [hereinafter Annual Report].

<sup>&</sup>lt;sup>168</sup> Danish Wind Industry Assn., available at http://www.windpower.org/en/core.htm (last visited Feb. 17, 2006). The Danish Wind Industry Association was founded in 1981, and is a non-profit organization comprised of over 80 members whose purpose is to promote wind energy in Denmark and abroad. The organization is a member of the European Wind Energy Association (EWEA). It publishes annual report, in both electronic and conventional forms, related to wind technology developments and market evaluations of energy pricing. It also engages in substantial media relations to promote wind energy on radio, television, and internet programming. <sup>169</sup> Annual Rept, supra note 165, at 9. <sup>170</sup> Id.

<sup>&</sup>lt;sup>171</sup> Annual Rept, *supra* note 165, at 3.

<sup>&</sup>lt;sup>172</sup> *Id.* at 6.

<sup>&</sup>lt;sup>173</sup> *Id*.

<sup>&</sup>lt;sup>174</sup> *Id*.

<sup>&</sup>lt;sup>175</sup> Danish Wind Industry Assn News Release, *available at* http://www.windpower.org/composite-962.htm (last visited Feb. 17, 2006).

companies are very active in manufacturing and supplying wind-related products to overseas markets.

An interesting trend is developing in Denmark as far as employment in the wind energy sector is concerned. Due to globalization and the high demand for European-made wind products, many Danish wind companies have moved to developing nations like India and China. However, some wind companies among these developing nations are moving to Denmark as well. For instance, the Indian wind turbine company Suzlon has invested in Denmark, recognizing Denmark's highly-skilled work force in the wind energy sector.<sup>176</sup> Although Suzlon does not plan on manufacturing wind turbines within Denmark, it does expect to focus on global sales and marketing using expertise among Denmark's wind energy professionals. Other companies like Siemens Wind Power are also investing in Denmark. In response to Denmark offering financial incentives through its *Bonus Energy Point* program, Siemens Wind Power is expected to employ many Danish workers in its development, production, and sales departments.<sup>177</sup>

#### Germany

As a signatory nation to the Kyoto Protocol, Germany is fully committed to using renewable wind energy to develop their energy market. Today, wind energy powers approximately 6 percent of the German electricity consumption at around 16,650 MW, making Germany the highest producer of wind-generated electricity in the world.<sup>178</sup> With almost 17,000 wind turbines in operation, the German wind industry employs over 60,000 people (over-taking its coal-mining industry), and is successful in exporting wind-related products and technology to other nations.<sup>179</sup> The evolution of wind energy in Germany has seen remarkable change in wind turbine installation capacity. For instance, in 1991, wind

<sup>&</sup>lt;sup>176</sup> Suzlon Energy Ltd. is an Indian wind turbine manufacturer, ranked 10<sup>th</sup> in the world among wind turbine manufacturers, that will create 25 jobs in Denmark. Suzlon has chosen Denmark to be its headquarters in the hopes of expanding internationally. Suzlon is active in many other nations, including in Germany for technology development, in the Netherlands for research and development of rotor blades (developing the latest technology in Resin Fusion Moulding on blade designs), in Chicago, Illinois to cater to the North American market, in China for marketing and sales of wind products, and in Melbourne, Australia for the same purpose. For a complete overview of this company, see http://www.suzlon.com/# (last visited Feb. 17, 2006).

<sup>&</sup>lt;sup>177</sup> Annual Rept., *supra* note 165, at 11.

<sup>&</sup>lt;sup>178</sup> *Id.* at 15.

<sup>&</sup>lt;sup>179</sup> German Wind Energy Assn, A Clean Issue – Wind Energy in Germany, *available at* http://www.wind-energie.de/index.php?id=593 (last visited Feb. 18, 2006).

turbines accounted for 100 MW of total power, whereas in 1997, wind turbines provided 2,000 MW.<sup>180</sup> However, by 2004 there was a remarkable increase in wind energy output, accounting for a total of 17,000 MW.<sup>181</sup>

Legislative efforts to promote renewable energy have been instrumental in pushing Germany towards higher standards of increased wind energy capacity and the implementation of energy-driven efficiency standards. For instance, the *Electricity Feed Act* of 1990 and the Renewable Energy Sources Act (RESA) of 2000 are two pieces of legislation that have spurned the development of wind energy in Germany.<sup>182</sup> Generally, the *Electricity Feed Act* (often referred to as Electricity Feed Law) required utility companies to purchase electricity from renewable sources, and to pay for 90 percent of the electricity to a producer on a wind farm.<sup>183</sup> That is, if a consumer paid 10 cents euro (€)per kilowatt-hour (kWh) in 1993, a farmer operating a wind farm may receive 9 cents euro (€) for every kWh fed into the grid in 1995.<sup>184</sup> Thus, the Act introduced a feed-in tariff system that establishes a minimum guaranteed price per kilowatt-hour (kWh) that a utility company has to pay to an independent producer of renewable power fed into the grid.<sup>185</sup>

Feed-in tariffs may be set at uniform levels, but are normally differentiated based on the type of energy used to power electricity, whether from wind, solar, biomass, photovoltaic, landfill gas, or geothermal sources.<sup>186</sup> This system of feed-in-tariffs is commonly used in European countries to foster renewable electricity, particularly in Germany, Denmark, and Spain. Replacing the Electricity Feed Law is the *Renewable Energy Sources Act*, which is

<sup>&</sup>lt;sup>180</sup> German Wind Energy Assn., Wind Energy and the Energy Economy, available at http://www.windenergie.de/index.php?id=595 (last visited Feb. 18, 2006).

<sup>&</sup>lt;sup>181</sup> Id.

 $<sup>^{182}</sup>$  Id. For complete overview of the Renewable Energy Sources Act (RESA), see

http://www.eurosolar.org/politics/EEG englisch.html (last visited Feb. 18, 2006). The Renewable Energy Sources Act is also referred to as the Act on Granting Priority to Renewable Energy Sources. Section 1 of the Renewable Energy Sources Act describes the Act's purpose in providing "sustainable development of energy supply in the interest of managing global warming and protecting the environment and to achieve a substantial increase in the percentage contribution made by renewable energy sources to power supply in order at least to double the share of renewable energy sources in total energy consumption by the year 2010..." [hereinafter Renewable Sources Act].

<sup>&</sup>lt;sup>183</sup> Caspar Institute, Electricity Feed Law in Germany, *available at http://solarnet.org/juice/Wind/feedlawDE.htm* (last visited Feb. 18, 2006). § 2 of Electricity Feed Law. The Electricity Feed Law is also known as Stromeinspeisungsgesetz, and came into effect on Jan. 1, 1991. The 90 percent requirement refers to revenue generated per kilowatt-hour (kWh) from the delivery of electricity to consumers.

<sup>&</sup>lt;sup>184</sup> J.P.M. Sijm, The Performance of Feed-In Tariffs to Promote Renewable Electricity in European Countries, available at http://www.ecn.nl/docs/library/report/2002/c02083.pdf (last visited Feb. 18, 2006) at 7.  $^{185}$  *Id.* at 6.  $^{186}$  *Id.* 

responsible for laying out fixed remuneration standards for wind operators.<sup>187</sup> More specifically, RESA compensates wind operators for electricity feeds per kilowatt-hour in the amount of 5.5 to 8.7 cents euro ()for electricity from wind energy.<sup>188</sup>

In effect, this system provides a financial incentive for those purchasing electricity from renewable sources, much like other nations promoting wind energy. Grid costs associated with connecting installations must be paid by the installation operator, including any upgrades to the grid.<sup>189</sup> The basic framework under RESA includes a transmission system operator who contracts with a distribution system operator and a supplier.<sup>190</sup> The distribution system operator and supplier both contract with consumers who wish to purchase electricity (similar to purchase plans in North America). The Act also contributes to substantially reducing electricity costs – the German Wind Energy Association estimates that the average power bill for a three-person household is around 52 euros (€) per month, with only one euro deriving from green electricity.<sup>191</sup>

Recent developments in Germany's wind industry include the setting of a timetable to install an 850 kilometers-long high-voltage grid by 2015 to necessitate future wind energy projects throughout the country.<sup>192</sup> However, perhaps the greatest challenge for Germany's wind industry is developing offshore wind farms. This is partly due to administrative challenges, whereby wind companies must obtain approval from twelve different authorities prior to creating offshore wind parks.<sup>193</sup> Moreover, not all wind energy can be successfully harnessed offshore due to geographical barriers and unpredictable climatic conditions. Despite

<sup>&</sup>lt;sup>187</sup> Wuppertal Institute for Climate, Environment, and Energy. The German Renewable Energy Act – Success and Ongoing Challenges, Dr. Manfred Fischedick (Jan. 2004), *available at* 

http://www.wupperinst.org/download/renewables/ICORE.pdf (last visited Feb. 18, 2006). The German Renewable Energy Act came into force in April 2001. Section 7 of the Renewable Energy Sources Act, entitled Compensation to be paid for Electricity Generated from Wind Energy, is the main provision dealing with <sup>188</sup> *Id.* at 17.

<sup>&</sup>lt;sup>189</sup> Renewable Sources Act, *supra* note 180, § 10.

<sup>&</sup>lt;sup>190</sup> Id. at 18.

<sup>&</sup>lt;sup>191</sup> Id. The German Wind Energy Assn is also known as Bundesverband WindEnergie (BWE). The BWE promotes wind energy and other forms of renewable energy sources, energy-efficient technologies, and energy-saving measures. Like the British Wind Energy Assn, the BWE actively promotes a public relations campaign. The BWE has over 17,000 members, making it one of the world's largest wind energy organizations.
<sup>192</sup> German Wind Energy Assn, *available at* http://www.wind-

energie.de/index.php?id=402&tx\_ttnews[tt\_news]=85&tx\_ttnews[backPid]=166&cHash=9794bb0e0a (last visited Feb. 18, 2006). German legislators now require the four dominant regional power companies, Eon, RWE, Vattenfall, and EnBW, to use their substantial income from grid fees to expand the national power grid. See generally http://www.wind-energie.de/index.php?id=595 (last visited Feb. 18, 2006) under the caption *Secure Power Grids through Wind Energy*.

<sup>&</sup>lt;sup>193</sup> German Wind Energy Assn., Wind Power Goes Offshore, available at http://www.windenergie.de/index.php?id=596 (last visited Feb. 18, 2006).

this, Germany is still determined to plan for future offshore wind parks. Adding these offshore wind parks will only enhance Germany's wind sector as the leading renewable market in the world.

# Spain

Spain boasts the second largest wind market in the European Union. In 1997, Spain enacted its first renewable energy legislation in its *Electricity Act*.<sup>194</sup> The Electricity Act creates a Special Regime to encourage investment in renewable sources, supplying a guaranteed access to a grid and premium payments for power generation.<sup>195</sup> Under this regime, the government of Spain has ambitious plans to increase wind capacity levels from 6.5 percent in 2004 to 15 percent by 2011.<sup>196</sup> Strong partnerships between transmission operators, utilities, and regional governments are encouraging more than 500 companies to employ 30,000 people in the wind industry.<sup>197</sup> As of 2004, Spain's total wind capacity was at 8,263 MW.<sup>198</sup> So aggressive is the Spanish approach to wind energy that it has set higher targets than Germany in seeking a wind capacity of over 20,000 MW by 2011.<sup>199</sup>

In 2004, Spain enacted *Royal Decree 436/2004*, which created financial incentives by keeping fixed prices on the market, while encouraging wind producers to make offers to the spot market.<sup>200</sup> Here, fixed tariffs, premium payments, and other market incentives are legally defined as a percentage of the Average Electricity Tariff (AET).<sup>201</sup> The AET is published annually by the government of Spain to illustrate the relationship between costs to support electricity suppliers and wind forecast demands from consumers. The *Royal Decree 436/2004* improved payment schemes by guaranteeing new tariffs for the entire lifespan of electrical plant activity, and providing more transparent methods of calculating premium payments. In

<sup>&</sup>lt;sup>194</sup> Crispin Aubrey, Focus on Spain, available at

http://www.ewea.org/fileadmin/ewea\_documents/documents/publications/WD/WD24v\_Sp.pdf (last visited Feb. 8, 2006) [hereinafter Focus on Spain].

<sup>&</sup>lt;sup>195</sup> *Id.* at 16.

<sup>&</sup>lt;sup>196</sup> Corin Millais, The Story of Wind Power in Spain: Global Leader, Global Teachere, Wind Directions, *available at* 

http://www.ewea.org/fileadmin/ewea\_documents/documents/publications/WD/WD24v\_Viewpoint.pdf (last visited Feb. 8, 2006).

<sup>&</sup>lt;sup>197</sup> Id.

<sup>&</sup>lt;sup>198</sup> Focus on Spain, *supra* note 192, at 20.

<sup>&</sup>lt;sup>199</sup> *Id* at 16.

 $<sup>\</sup>frac{200}{201}$  *Id.* at 17.

<sup>&</sup>lt;sup>201</sup> *Id.* at 21.

2005, the AET was around 7.33 € cents/kWh.<sup>202</sup> To achieve modern goals of efficient wind capacity and stable electricity prices, the Spanish wind power industry seeks to improve grid management and forecasting. Here, a study conducted by a network grid operator Red Electrica de Espana (REE) and the Spanish Wind Business Association demonstrates how to integrate all wind capacity on the Iberian peninsula, including Portuguese wind farms.<sup>203</sup> This study takes into consideration the Iberian grid system's capacity and wind forecasting demands until 2011.

Most of Spain's wind turbines are manufactured within the country, and are fully operational in various regions such as Andalucia, Galicia, Aragon, Castilla-La Mancha, and Castilla y Leon.<sup>204</sup> Several companies in Spain are strong global competitors in the wind energy market. For instance, the largest wind park developer in the world is Spain's EHN, a subsidiary of the Acciona Group.<sup>205</sup> The EHN company has installed over 2,535 MW of wind energy in six countries, comparable to 5 percent of installed capacity around the world.<sup>206</sup> Two notable companies in Spain, Gamesa and Ecotecnia, are among the world's top manufacturers in 2004, comprising about 20 percent of the world market.<sup>207</sup> Iberdrola is Spain's second largest power utility company, and is the largest owner of wind farms in the world.<sup>208</sup> Owning approximately 3,300 MW of wind capacity, Iberdrola has current wind projects in several nations such as Greece, France, Portugal, the United Kingdom, Italy, Mexico, and Brazil.<sup>209</sup> Given this, Spain's future in developing wind energy as part of its commitment to renewable energy is certainly bright.

# **United Kingdom and Ireland**

<sup>&</sup>lt;sup>202</sup> *Id.* at 22.

 $<sup>^{203}</sup>$  *Id.* at 25.

<sup>&</sup>lt;sup>204</sup> Id.

 $<sup>^{205}</sup>$  *Id.* at 30.

<sup>&</sup>lt;sup>206</sup> *Id.* The EHN company produces about 25 percent of Spain's wind capacity, and plans to invest over  $\notin$  2 billion in the next four years.

<sup>&</sup>lt;sup>207</sup> *Id.* at 17. Gamesa is a large Spanish company with over 7,000 employees worldwide. It is a major manufacturer and supplier of advanced products and services in both aeronautics and renewable energy sectors. Ecotecnica is a Spanish company with over 625 employees, installing 789 turbines, with a turnover of  $\in$  183 million in 2004. Ecotecnica's Managing Director, Antoni Martinez, commented that 790 MW of wind turbines is due to be installed in 2005 and 2006, with a further 300 MW in 2007. The company has sold wind turbines to countries such as India, Cuba, France, Portugal, and Japan.

<sup>&</sup>lt;sup>208</sup> *Id.* at 37. Iberdrola has over 22,602 MW of installed wind capacity in Spain. Its renewable energy output increased by 42 percent from 2003 to 2004.

<sup>&</sup>lt;sup>209</sup> *Id.* Patricia Hewitt, Secretary of State, UK Dept of Trade and Industry, notes that another 2 percent of electricity can be created from renewable sources.

The UK approach to wind energy is taking on new advances. At present, the UK utilizes under 3 percent of electricity from renewable sources.<sup>210</sup> However, the UK government is planning to target electricity generation from renewable sources at 15 percent by 2015.<sup>211</sup> Given its geography, it is expected that the UK will install 33 offshore wind turbines to supply enough electricity to seven million homes.<sup>212</sup> In 2005, the UK wind industry experienced tremendous advances by becoming only the eighth country in the world to surpass the 1 gigawatt (GW) installed capacity level.<sup>213</sup> This is not surprising considering that installed capacity increased from 241 MW in 2004 to 446 MW in 2005.<sup>214</sup> Recently, the British Wind Energy Association (BWEA) has encouraged the creation of roof-top wind turbines to promote wind power use throughout the United Kingdom.<sup>215</sup> This project will establish 19 Windsave wind turbines (of 1 kW each) on its corporate building, generating a capacity of 44,000 kWh per year.<sup>216</sup> The roof-top turbine concept is significant because approximately one-third of the UK's carbon dioxide emissions come from buildings.<sup>217</sup> Like other nations, the BWEA created a *Wind Energy Database*, which illustrates relevant data such as wind speed maps, graphs, climatic conditions, regional potential for wind, and updates on current projects.<sup>218</sup>

In September 2004, the BWEA launched the *Embrace the Revolution* media campaign (Campaign) as a major effort to bring wind energy and renewable resources to the forefront.<sup>219</sup> Using advertising techniques ranging from street posters to appearances by celebrities, the Campaign educates the general public about the benefits of renewable sources of energy in the modern economy. Future events will see the BWEA host its 5<sup>th</sup> annual

<sup>&</sup>lt;sup>210</sup> Id. at 33.

<sup>&</sup>lt;sup>211</sup> Elsam, Kentish Flats Offshore Wind Farms Brochure, available at

http://www.kentishflats.co.uk/multimedia/Kentish\_Flats\_brochure\_GB.pdf (last visited Feb. 17, 2006).

<sup>&</sup>lt;sup>212</sup> Annual Rept., *supra* note 165, at 14.

 $<sup>^{213}</sup>$  *Id.* at 5.

<sup>&</sup>lt;sup>214</sup> *Id*.

<sup>&</sup>lt;sup>215</sup> The British Wind Energy Assn. (BWEA) is the trade and professional body for the United Kingdom renewable industries. It was formed in 1978 and consists of over 310 members. Its main objective is to promote wind power in both onshore and offshore locations. In 2004, the organization expanded its operations to include wave and tidal energy. The BWEA publishes a newsletter, *Real Power*, to describe the latest developments in the wind industry around the world. From these newsletters, current members of the BWEA and potential members advertise their companies' skills and services.

<sup>&</sup>lt;sup>216</sup> BWEA News, *available at* http://www.bwea.com/media/news/060213\_coop.html (last visited Feb. 17, 2006).

 $<sup>^{217}</sup>$  Id.

<sup>&</sup>lt;sup>218</sup> BWEA, UKWED, available at http://www.bwea.com/ukwed/index.asp (last visited Feb. 17, 2006).

<sup>&</sup>lt;sup>219</sup> BWEA News, *supra* note 214, at 38.

offshore wind conference to address plans in adding more wind farms around the UK.<sup>220</sup> Such initiatives are proving so successful that future national policy plans in Wales are being encouraged under the Technical Advice Note (TAN 8) to encourage renewable energy strategies in developing wind farms for this region.<sup>221</sup>

Offshore wind projects are proving to be the wave of the future for tapping into strong wind potential sites in harnessing wind energy. Over 7 GW of wind capacity has been submitted to the UK government for future prospects of offshore wind development.<sup>222</sup> Evidencing its commitment to offshore wind projects, the UK now boasts one of the largest offshore wind farms in the world at Kentish Flats in the Thames.<sup>223</sup> Here, there are thirty wind Vestas turbines capable of producing 3 MW each, for a total of 90 MW worth of electricity.<sup>224</sup> The Kentish Flats project is located about 8.5 kilometers north of Whitstable outside of the Thames shipping lanes on a shallow plateau. It is estimated that this project will offset approximately 223,000 tonnes of carbon dioxide emissions, and supply energy to 100,000 homes located in Whitstable, Canterbury, and Herne Bay.<sup>225</sup> The grid system consists of underground power lines buried beneath the ocean floor and land that connect the offshore wind park to onshore electricity grids that supply electricity to the cities. As part of the offshore wind park development, environmental assessments are carried out to determine the impact of such projects on local wildlife such as birds, seals, and fish.<sup>226</sup>

Ireland is also developing innovative offshore wind energy programs, as with its wind project located in Arklow Bank Wind Park in the Irish Sea, around 10 kilometers off the east coast of Ireland.<sup>227</sup> As Ireland's first offshore wind project, this massive project uses seven

<sup>&</sup>lt;sup>220</sup> BWEA Annual Rept. 2005, *available at* http://www.bwea.com/pdf/bwea-annual-review-2005.pdf (last visited Feb. 17, 2006) at 2 [hereinafter BWEA Report].

<sup>&</sup>lt;sup>221</sup> *Id.* at 14.

 $<sup>^{222}</sup>$  *Id.* at 33.

 $<sup>^{223}</sup>$  *Id.* at 16.

<sup>&</sup>lt;sup>224</sup> Elsam, Kentish Flats Offshore Wind Farms, *available at* http://www.kentishflats.co.uk/page.dsp?area=1391 (last visited Feb. 17, 2006). The Kentish Flats project was originally developed by GREP, a subsidiary of the Danish wind turbine manufacturer NEG Micon, now called Vestas. In November 2003, the project was sold to another Danish power company, Elsam. The Kentish Flats was fully consented in March 2003, and is now fully operational as a response to the British government's commitment to the Kyoto Protocol. The electrical grid consists of three buried cables each with 33 kV near Hampton Pier in Herne Bay. The wind farm is constructed for 20 years of service. The total cost of the project is around £105 million (GBP). For further discussion, please see http://www.kentishflats.co.uk/page.dsp?area=1379 (last visited Feb. 17, 2006).

<sup>&</sup>lt;sup>225</sup> *Id.* See also http://www.kentishflats.co.uk/multimedia/Kentish\_Flats\_brochure\_GB.pdf (last visited Feb. 17, 2006).

<sup>&</sup>lt;sup>226</sup> Elsam, Kentish Flats Offshore Wind Farms Brochure, available at

http://www.kentishflats.co.uk/multimedia/Kentish\_Flats\_brochure\_GB.pdf at 2 (last visited Feb. 17, 2006). <sup>227</sup> Airtricity, Background Arklow Bank, *available at* 

http://www.airtricity.com/opencontent/default.asp?itemid=399&section=WIND+FARMS (last visited Feb. 17,

General Electric 3.6 MW wind turbines, which is supplied by Airtricity.<sup>228</sup> The Arklow Bank Wind Park is particularly successful because of the generous offshore wind resources that produce high winds, thus generating high electricity output from wind turbines.<sup>229</sup> This achieves the economies of scale that helps reduce electricity costs during energy consumption. Generous support from the federal government through financial incentives, and with administrative bodies like the Sustainable Development Commission fully endorsing the UK's wind energy programs at the BWEA's fourth annual offshore wind conference, are key indicators of the UK's persistence in using wind energy for future energy projects.<sup>230</sup>

#### Australia

Most of Australia's electricity is generated from about 84 percent of coal fired power stations.<sup>231</sup> Renewable sources supply approximately 5 percent of Australia's energy sector.<sup>232</sup> But, its market potential for developing wind technology is enormous. Recent efforts signify a genuine intent on the part of the Australian government and wind industry officials to encourage renewable energy. For instance, in 2004 wind capacity installation doubled to reach 380 MW, with 1,350 MW of wind energy projects slated for approval.<sup>233</sup> A recent opening of an assembling plant by the Danish turbine manufacturer Vestas also illustrates Australia's commitment to renewable energy production.<sup>234</sup> A major federal wind law, known as Mandatory Renewable Energy Target (MRET), places a legal obligation on

<sup>2006).</sup> Airtricity is one of Europe's largest renewable energy companies, focusing on 3 areas: (1) Wind farm development; (2) Finance and ownership of wind farms; and (3) Green electricity supply. The founders of Airtricity formed the Future Wind Partnership in 1997 as a vehicle to explore innovations in the renewable energy sector. In 1999, the Future Wind Partnership partnered with NTR plc (Ireland's leading private sector developer, financier, and operator of public infrastructure) to form Airtricity. In partnership with companies like General Electric, Airtricity helped construct the Arklaw Bank Wind Park. Airtricity is helping develop wind farms in Ireland, Northern Ireland, and Scotland [hereinafter Arklow Bank].

<sup>&</sup>lt;sup>228</sup> Wind Power Today, *supra* note 117, at 4.

<sup>&</sup>lt;sup>229</sup> Arklow Bank, *supra* note 225.

<sup>&</sup>lt;sup>230</sup> BWEA Report, *supra* note 218, at 8. The BWEA's fourth annual offshore wind conference was held in London in April 2005. Sponsored by Marine Projects International, the conference was attended by over 400 senior officials from the UK wind energy sector. In November 2005, the BWEA hosted a two-day seminar known as the Offshore Contracting Seminar where members discussed ways to improve offshore wind projects, and how electricity costs can be reduced for the benefit of consumers. Here, the seminar brought together working groups from all sectors of the wind industry.

<sup>&</sup>lt;sup>231</sup> Wind Council, *supra* note 147, at 10.

<sup>&</sup>lt;sup>232</sup> Govt of Australia, Energy in Australia – Why is Energy Important?, *available at* 

http://www.dpmc.gov.au/publications/energy\_future/docs/energy\_chapter\_1.pdf (last visited Feb. 7, 2006) at 37. <sup>233</sup> *Id.* <sup>234</sup> *Id.* 

purchasers of electricity to participate in renewable energy production.<sup>235</sup> The MRET aims at encouraging innovation among emerging renewable electricity generation methods.

The MRET program is in response to Australia enacting the *Renewable Energy (Electricity) Act of 2000*, which required the generation of 9,500 gigawatt-hours (GWh) of extra renewable electricity per year by 2010.<sup>236</sup> MRET effectively carries the obligations imposed by the 2000 Act on all states and territories, and applies only to electricity grid-based power applications over 100 kW of installed capacity.<sup>237</sup> These grids connect generators that produce electricity from wind farms to surrounding communities. Companies operating under MRET are proportionately liable for meeting their share of the renewable obligations.<sup>238</sup> For example, if a party purchases 10 percent of electricity in Australia, it will need to meet 10 percent of the target level for that year.<sup>239</sup>

From here, renewable power percentages determine the number of renewable energy certificates to discharge liability, thus avoiding exposure to penalties imposed by MRET. These renewable energy certificates must be surrendered annually to the Office of Renewable Energy Regulator.<sup>240</sup> This office has a renewable energy certificate electronic registry system to keep track of ownership and energy activities of companies operating in such endeavors. The role of renewable energy certificates, as found in most wind-producing nations, allows companies to trade energy-generation assets in financial markets in order to demonstrate compliance with federal renewable regulating laws, helping these companies meet efficient wind market standards.<sup>241</sup>

Another legislative scheme to promote wind energy is the Australia government's creation of the *Australian Energy Market Commission* and the *Australian Energy Regulator* in

 $^{240}$  Id.

<sup>&</sup>lt;sup>235</sup> *Id.* The Mandatory Renewable Energy Target (MRET) commenced on April 1, 2001. However, this measure was significantly reviewed by the Australian government to re-think its strategy in dealing with renewable energy technologies given the high demand of energy consumption, rising energy costs, and Australia's trade links with other wind-powering nations. Overall, this initiative aims at improving the operational and administrative efficiency renewable energy of all forms in Australia. The penalty for non-compliance with MRET is \$40/MWh. However, penalties can be redeemable if the shortfall is made up within 3 years. MRET is administered by the Office of the Renewable Energy Regulator, which accredits renewable energy generators, issues renewable energy certificates, and maintains lists of existing grid networks.

<sup>&</sup>lt;sup>236</sup> Govt of Australia, Dept. of the Environment and Heritage, Australian Greenhouse Office, *available at* http://www.greenhouse.gov.au/markets/mret/ (last visited Feb. 7, 2006).

 <sup>&</sup>lt;sup>237</sup> Govt of Australia, Office of the Renewable Energy Regulator, Overview of the Mandatory Renewable Energy Target, *available at* http://www.orer.gov.au/about/overview.html (last visited Feb. 7, 2006).
 <sup>238</sup> Id

 $<sup>^{239}</sup>$  *Id*.

<sup>&</sup>lt;sup>241</sup> *Id. available at* http://www.orer.gov.au/publications/certificates.html (last visited Feb. 7, 2006). This website provides details as to the role of renewable energy certificates in Australia. These renewable certificates must be surrendered to the Office of Renewable Energy Regulator on Feb. 14 of every year.

2004, both of which are responsible for rule-making/market development and daily market regulation, respectively.<sup>242</sup> As for wind energy, both of these administrative bodies must closely monitor the wholesale, network, and retail elements of the energy market, where most attention will be focused on electricity transmission regulation. Additionally, the federal government will set aside \$34 million (Australian) towards research and development of wind forecasting and electricity storage technologies.<sup>243</sup> Such efforts have enabled the establishment of wind farms in various regions of Australia.

The greatest concentration of wind farms in Australia is located in the state of South Australia, in and around the capital city of Adelaide.<sup>244</sup> It is here that Australia is showing the greatest potential for developing wind turbine technology for energy efficient consumption. As Auswind's CEO states, "Approximately half of Australia's wind energy capacity is currently located in South Australia, where almost 10 percent of the state's energy supply comes from wind alone."<sup>245</sup> The South Australia wind plan is indicative of how wind energy projects throughout the world concentrate only in specific regions, thus creating responsibility on the part of regional authorities to plan and administer renewable programs. This is why regional planning is so important, and despite federal support to bolster wind energy programs, local governments play a crucial role in encouraging investment opportunities and implementing strategies for renewable technology development to supplement a growing energy sector.

Along these regional efforts, the Australian government, in its white paper *Securing Australia's Energy Future*, has committed \$14 million to wind forecasting.<sup>246</sup> This funding would assist in creating more wind farms, while providing competitive electricity pricing for consumers. Moreover, \$20 million will be earmarked for developing advance storage systems for electricity in improving interconnections between wind farms and grids supplying

<sup>&</sup>lt;sup>242</sup> Govt of Australia, Energy Markets – Delivering Australia's Electricity and Gas Needs, *available at* http://www.dpmc.gov.au/publications/energy\_future/docs/energy\_chapter\_3.pdf at 65 (last visited Feb. 7, 2006).
Both the Australian Energy Market Commission and the Australian Energy Regulator was established by legislation on July 1, 2004.

<sup>&</sup>lt;sup>243</sup> Id.

<sup>&</sup>lt;sup>244</sup> Global Wind Energy Council 2005 Press Release, available at

http://www.auswea.com.au/global06/media/051031global-wind-international.pdf (last visited Feb. 7, 2006). <sup>245</sup> *Id.* Auswind is a name given for the annual wind conferences held in Australia. The Australian Wind Energy Association held a conference in August 2005 in Sydney, Australia.

<sup>&</sup>lt;sup>246</sup> Govt of Australia, Australian Greenhouse Office, Govt Response to Mandatory Renewable Energy Target Review Recommendations, *available at* http://www.greenhouse.gov.au/markets/mret/pubs/mret-response.pdf (last visited Feb. 7, 2006).

electricity to consumers.<sup>247</sup> Given Australia's long coastlines, offshore development of wind parks also has great potential, such as with the North West Shelf.<sup>248</sup> Although it is more costly to operate offshore wind parks, the costs are generally offset by higher electricity output generated by high winds from the ocean, creating more efficiency in wind capacity. These offshore wind projects are self-regulatory in that they are not subject to the MRET plan, unless companies purchase energy in a wholesale fashion.

The Australian Wind Energy Association, like its counterparts in other wind energy nations, is cognizant of how international trade impacts future wind projects. In light of recent trade agreements between Australia, the U.S., and other Asian nations,<sup>249</sup> future wind conferences will be partnered with Global WindPower 2006 <sup>250</sup> in the hopes of initiating global networking and information exchange. Because Australia has not ratified the Kyoto Protocol, the Global Wind Energy Council has encouraged the Australian government to boost spending on wind energy projects under the Asia-Pacific Partnership on Clean Development and Climate, to which Australia is committed.<sup>251</sup> This is an international agreement committing various nations to reduce greenhouse gas emissions by their own standards, apart from the Kyoto Protocol which imposes mandatory standards of reduction. The Council claims that the global wind energy market will double to \$25 billion by 2010.<sup>252</sup>

#### China

As one of the fastest growing economies in the world, China is also active in pursuing renewable energy by wind power. Given the high rates of urbanization and a rising middle

<sup>&</sup>lt;sup>247</sup> Id.

 $<sup>^{248}</sup>$  Id.

<sup>&</sup>lt;sup>249</sup> Auswind, Open Letter from Auswind's CEO Dominique La Fontaine, *available at* http://www.auswea.com.au/auswind/index.html (last visited Feb. 7, 2006).

<sup>&</sup>lt;sup>250</sup> Global WindPower 2006 is a global wind energy event which provides a forum for speakers to share information For a complete overview of Global WindPower 2006, see

http://www.auswea.com.au/global06/index.html (last visited Feb. 7, 2006).

<sup>&</sup>lt;sup>251</sup> The Asia-Pacific Partnership on Clean Development and Climate is a non-treaty international agreement announced on July 28, 2005 at the Association of South East Asian Nations (ASEAN) regional forum. The partnership includes Australia, India, Japan, China, South Korea, and the United States. For more discussion on this partnership, see http://www.pm.gov.au/news/media\_releases/media\_Release1482.html (last visited Feb. 7, 2006). The Global Wind Energy Council (GWEC) was established in early 2005 that provides an international forum for the wind energy sector. GWEC aims to promote wind energy through: (1) Policy Development (creation of policy frameworks); (2) Business leadership (engaging stakeholders); (3) Global Outreach (work with emerging markets); and (4) Information and Education. See generally http://www.gwec.net/index.php?id=17 (last visited Feb. 7, 2006).

<sup>&</sup>lt;sup>252</sup> *Id., available at* http://www.auswea.com.au/auswea/downloads/Mediareleases/050817GWEC\_MR.pdf (last visited Feb. 7, 2006).

class of consumers demanding more energy consumption, China is facing a major challenge in providing renewable energy in a cost-effective manner. Early projects such as the Chengfeng Program have seen the installation of 110 MW of wind turbines throughout China until 1998.<sup>253</sup> By the end of 2003, China's total grid-connected installed wind capacity was 567 MW.<sup>254</sup> In remote communities, non-grid wind systems see over 170,000 small windturbines (with capacity of 25 MW) In 2005, the Beijing International Renewable Energy Conference was held, which produced a report by the Chinese Renewable Energy Industries Association (CREIA) showing that China has the potential of becoming one of world's leaders in developing wind technology and application.<sup>255</sup>

With its large consumer base, China's current wind energy plan is to reach 30 gigawatts (GW) by 2020 with ambitious plans of creating 20,000 wind turbines in regions of high potential for winds.<sup>256</sup> With regard to offshore wind projects, China has vast potential along its coastline located mainly the south-east and nearby islands.<sup>257</sup> The National Development and Reform Commission is planning to create 20 wind farms of 100 MW capacity before 2010.<sup>258</sup> Like other wind-powering nations, China's new approach requires power grid companies to purchase electricity generated by renewable energy sources.

<sup>&</sup>lt;sup>253</sup> Id.

<sup>&</sup>lt;sup>254</sup> Chinese Renewable Energy Industries Assn, available at

http://www.creia.net/cms\_eng/\_code/english/industry/detail\_info.php?column\_id=67&item\_id=129 (last visited Feb. 18, 2006).

<sup>&</sup>lt;sup>255</sup> Wind Council, *supra* note 147 at

http://www.gwec.net/index.php?id=30&no\_cache=1&tx\_ttnews[tt\_news]=14&tx\_ttnews[backPid]=4&cHash=7f a2e7b60d (last visited Feb. 7, 2006). The Beijing International Renewable Energy Conference brought together 1,300 representatives from over 100 countries. It was hosted by the Chinese government, and sponsored by the German government. The forum included CEO's from the world's leading wind energy manufacturers and developers. The Chinese Renewable Energy Industries Association (CREIA) was created in 2000 under the Project of Capacity Building for Rapid Commercialization of Renewable Energy in China. As an independent organization (with formal recognition from the Ministry of Civil Affairs), the CREIA has brought together national and international wind project developers and investors, and served as an intermediate between government and industry representatives. The CREIA has over 260 members, with 100 corporate members and 160 individual members from a range of renewable energy companies. For further discussion, see http://www.creia.net/cms\_eng/\_code/english/about/about.php (last visited Feb. 18, 2006).

http://www.gwec.net/index.php?id=30&no\_cache=1&tx\_ttnews[tt\_news]=16&tx\_ttnews[backPid]=4&cHash=a 790e066c4 (last visited Feb. 7, 2006). The executive director of the European Wind Energy Association, Corin Millais, commented that China's overall wind capacity is enormous at around 500,000 to 600,000 MW, but requires further development of renewable energy policies and a legal framework. See generally Energy Bulletin, *Change in the Chinese Wind*, available at http://www.energybulletin.net/2452.html (last visited Feb. 18, 2006). Moreover, the managing director of Colorado's Rocky Mountain Institute, Kyle Datta, indicated that China is supporting wind programs because it is as cheap as purchasing coal, and that consumers, particularly in urban centers, would prefer wind-generated energy over diesel generators which contributes heavily to pollution.

<sup>&</sup>lt;sup>258</sup> Id.

As a means to stimulate renewable energy investment, the Chinese government is providing financial incentives through low-interest loans and tax incentives for New and Renewable Energy (NRE) projects.<sup>259</sup> These incentives cover wind turbine manufacturing and market development of wind energy, and the Chinese government has permitted financial institutions to grant preferential loan treatment to companies listed on a national renewable guidance catalog.<sup>260</sup> Considering the sheer size of China's population, the Chinese government is also emphasizing self-reliant mechanisms to apply wind energy projects in local communities.

Three federal state agencies, the Ministry of Science and Technology (MOST), the State Development and Planning Commission (SDPC), and the State Economic and Trade Commission, have all joined to firmly establish a national renewable program entitled *Program on New and Renewable Energy Development in China* that covers the period between 1996 and 2010.<sup>261</sup> This program includes all renewable sources of energy, but for wind energy it specifically targets 1,000 to 1,100 kWh of wind capacity to be generated for electricity consumption.<sup>262</sup>

In 2005, the World Bank approved a loan of \$87 million (U.S.) to China in order to help develop renewable energy.<sup>263</sup> Other projects link China with major wind-producer from Europe. For example, the Spanish company EHN has a joint venture with the Chinese state-owned company CASC. This joint venture will see the manufacturing of wind turbines with the latest Ingetur technology (owned by EHN) in a plant being built in Nantong, on the east coast of China. It is expected that the wind capacity of the Nantong plant will generate the equivalent of 400 turbines. In January 2006, China enacted the *Renewable Energy Promotion* 

<sup>&</sup>lt;sup>259</sup> China New Energy, *available at* http://www.newenergy.org.cn/english/policy/index.htm (last visited Feb. 18, 2006).

<sup>&</sup>lt;sup>260</sup> The Renewable Energy Law, People's Republic of China, *available at* 

http://www.renewableenergyaccess.com/assets/download/China\_RE\_Law\_05.doc (last visited Feb. 18, 2006) § 25, c.6. Article 29, c.7, of this Law imposes penalties on power grid companies that fail to purchase renewable energy in full and contribute to economic loss of the renewable power generation enterprise. Such penalties include compensation for the economic loss of the entire project, and, if not complying with instructions to modify the power grid system, compensation less than the economic loss of the project. Under Article 10, c. 3, the authorities in the State Council must prepare development guidance catalogs for renewable energy industries. <sup>261</sup> Wind Power Asia, *available at* http://www.newenergy.org.cn/english/policy/index.htm (last visited Feb. 18, 2006).

 $<sup>\</sup>frac{1}{262}$  *Id*.

<sup>&</sup>lt;sup>263</sup> InWind Chronicle, *available at* http://www.inwindchronicle.com/ (last visited Feb. 8, 2006). InWind is an international magazine with quarterly publications based in India that focuses of developments in the wind industry.

*Law (REPL)* to provide a modern framework to apply renewable energy projects.<sup>264</sup> The new law aims at reducing pollutions levels, safeguarding the environment and human health, contribute to climate change, and provide power to non-grid rural areas.

Under REPL, Article 24 indicates that the Chinese government may fund renewable energy plans that involve: (1) scientific research and development; (2) application in rural and pasturing areas; (3) application in remote communities and island regions; (4) surveys, assessment, and creation of information systems; and (5) localized production of equipment that uses renewable energy.<sup>265</sup> Here, administrative permits are granted to companies constructing power generating projects with grid connections.<sup>266</sup> Thus, ample opportunity exists for utility companies or investors to participate in China's renewable energy program.

Upcoming events for China's wind industry include the 3<sup>rd</sup> Asian Wind Power Exhibition and Conference will be held in Beijing in June 2006.<sup>267</sup> The focus of this conference will be on large wind turbines, grid connections, the latest equipment, and technological consulting. Other future events include the Renewable Energy Finance Forum, sponsored by the CREIA and Euromoney.<sup>268</sup> This forum will include input from forty international and Chinese renewable energy and investment experts, and explore the opportunities to help China reach its current renewable energy target of 130 gigawatts (GW) by 2020.<sup>269</sup> The forum will also focus on the evolution of Chinese renewable policies, including market entry requirements, funding strategies, risks in the Chinese investment environment, and developing renewable technologies. This partnership between the CREIA and Euromoney is a byproduct of China's willingness to consult both Germany and Denmark in helping develop its Renewable Energy Promotion Law.

http://www.renewableenergyaccess.com/assets/download/China\_RE\_Law\_05.doc (last visited Feb. 18, 2006). The Renewable Energy Law in China came into effect on Jan. 1, 2006. Under Art. 18 of the Renewable Energy Law, the Chinese government clearly indicates its commitment in promoting renewable energy in rural areas, particularly with small-scale wind farms for wind energy projects [hereinafter Renewable Law].

<sup>&</sup>lt;sup>264</sup> The Renewable Energy Law, People's Republic of China, available at

<sup>&</sup>lt;sup>266</sup> *Id.* § 13.

 <sup>&</sup>lt;sup>267</sup> Wind Power Asia, *available at* http://www.windpowerasia.com/wpanews1.htm (last visited Feb. 18, 2006).
 <sup>268</sup> Chinese Renewable Energy Industries Assn, *available at*

http://www.creia.net/cms\_eng/\_code/english/news/new\_detail.php?column\_id=20&item\_id=386 (last visited Feb. 18, 2006). Euromoney is the world's leading organizer of conferences promoting international investment and capital markets, and providing information for potential investors, financial institutions, and governments. For more insight into Euromoney, see http://www.euromoneyconferences.com/ (last visited Feb. 18, 2006). The Renewable Energy Finance Forum will be held March 30-31, 2006 at the Kerry Center in the capital city of Beijing.

<sup>&</sup>lt;sup>269</sup> Renewable Energy Finance Forum, *available at* 

http://www.creia.net/cms\_eng/upload\_file/news/19e4771eb0e2dad028433c73bb3570e7.pdf (last visited Feb. 18, 2006).

#### India

India is quickly emerging as South Asia's major driving force behind wind energy development. As the world's fifth largest wind producer, India has a current total wind capacity installation level of over 3,000 MW.<sup>270</sup> Since the early 1980s, wind power programs were created under the Sixth Plan with a market-oriented strategy.<sup>271</sup> This strategy stimulated wind resource assessment, research and development, and infrastructure capability, all of which contributed to the development of wind farms. Administered by the Ministry of Non-Conventional Energy Sources (MNES), the Indian government, like other nations who have pioneered wind technology, is offering financial incentives to companies participating in wind energy distribution.

These financial incentives include capital subsidies, long-term leases on land, permission to sell power to third parties, zero sales tax and excise duties, exemption from energy-generation taxes, and free import of wind components.<sup>272</sup> The Indian Wind Turbine Manufacturer's Association is a key organization that represents efforts to foster wind energy development in India.<sup>273</sup> This association reveals that the operation and maintenance costs of wind farms are low, with zero input fuel costs, and tax holidays for newer power projects are provided by the government for five years.<sup>274</sup> The association intends to gradually move towards self-sufficiency in producing wind technology and electrical grid networks, rather than relying upon imported European-made wind products.

In recent times, India has been extremely active in developing modern wind programs. In 2001, the Indian parliament enacted the *Energy Conservation Act*.<sup>275</sup> This Act promotes energy efficiency and conservation through legal frameworks and regulatory mechanisms at both federal and state levels of government. Energy conservation is headed by the Bureau of

<sup>275</sup> Energy Conservation (India), *available at* 

<sup>&</sup>lt;sup>270</sup> *Id.* at 11.

<sup>&</sup>lt;sup>271</sup> Indian Wind Energy Assn, *available at* http://www.inwea.org/windenergy.html (last visited Feb. 8, 2006). The Indian economy is based on 'five-year' plans, administered by India's Planning Commission. The Sixth Plan is a federal initiative from 1978 to 1983 known as the "Janta Government Sixth Five Year Plan", with an emphasis on increasing employment in the rural economy, and focusing on natural mobilization of resources. See generally http://en.wikipedia.org/wiki/Five-Year\_Plans\_of\_India for an overview of India's five year plans. <sup>272</sup> Id.

<sup>&</sup>lt;sup>273</sup> *Id.* The Indian Wind Turbine Manufacturer's Assn was established in 2000, and represents the major manufacturers of wind turbines in India, who are approved by the Indian Ministry of Non-Conventional Energy Sources.

<sup>&</sup>lt;sup>274</sup> Indian Wind Turbine Manufacturers' Assn., Financial Benefits, available at

http://www.indianwindpower.com/fin\_benefit.html (last visited Feb. 8, 2006).

http://powermin.nic.in/acts notification/energy conservation act/introduction.htm (last visited Feb. 7, 2006).

Energy Efficiency, a body of around twenty members, whose function is to provide a policy framework for energy conservation.<sup>276</sup> Under section 16 of the Act, a state government administers the State Energy Conservation Fund in order to provide grants and loans to implement energy conservation measures, including the training of personnel and specialists in renewable technologies.<sup>277</sup>

Any violation of the Act results in a fine of not more than 10,000 Indian rupees.<sup>278</sup> Here, an adjudicating officer appointed by the central government is responsible for conducting hearings on statutory violations.<sup>279</sup> When the adjudicating officer has power to determine any potential wrongdoing by any party, a civil court has no jurisdiction to hear the same matter, and thus has no authority to grant injunctions, unless otherwise specified. However, the affected party may appeal through the Appellate Tribunal for Energy Conservation against the orders of the adjudicating officer.<sup>280</sup>

In 2003, India enacted the *Electricity Act* (EA), which covers the generation, transmission, distribution, and trading of electricity in a competitive fashion.<sup>281</sup> The EA is a broad statute that encourages investment in wind energy projects through competition, licensing distribution schemes, and lays the framework for power development throughout India. Generally, the Act grants state authorities to provide an *Electricity Supply Code* in order to deal with issues like the recovery of electrical charges, billing of electricity, and restoration and maintenance of damaged electrical plants or grids.<sup>282</sup> The Act also focuses on preventing theft of electricity (a common problem in developing nations using electrical

<sup>&</sup>lt;sup>276</sup> Bureau of Energy Efficiency, Chapter 2, available at

http://powermin.nic.in/acts\_notification/energy\_conservation\_act/chapter2.htm (last visited Feb. 8, 2006) at § 4. The Bureau of Energy Efficiency consists of a Governing Council, which comprise of government ministers from various energy departments such as coal, natural gas, atomic energy, mining, and consumer affairs. See also http://www.vigyanprasar.com/comcom/develop70.htm (last visited Feb. 19, 2006).

<sup>&</sup>lt;sup>277</sup> Energy Conservation Act, Power of State Govt to Facilitate and Enforce Efficient Use of Energy and its Conservation, *available at* http://powermin.nic.in/acts\_notification/energy\_conservation\_act/chapter6.htm (last visited Feb. 8, 2006) § 15(f).

<sup>&</sup>lt;sup>278</sup> Energy Conservation Act, Penalties and Adjudication, *available at* 

http://powermin.nic.in/acts\_notification/energy\_conservation\_act/chapter8.htm (last visited Feb. 8, 2006). <sup>279</sup> *Id.* § 27.

<sup>&</sup>lt;sup>280</sup> Energy Conservation Act, Appellate Tribunal for Energy Conservation, available at

http://powermin.nic.in/acts\_notification/energy\_conservation\_act/chapter9.htm (last visited Feb. 8, 2006) § 30. <sup>281</sup> Electricity Act 2003, *available at* 

http://powermin.nic.in/acts\_notification/electricity\_act2003/preliminary.htm (last visited Feb. 8, 2006). On a purely administrative level, the EA requires state governments to restructure local electricity boards. <sup>282</sup> Electricity Act 2003, Distribution of Electricity, *available at* 

http://powermin.nic.in/acts\_notification/electricity\_act2003/distribution\_electricity.htm (last visited Feb. 8, 2006) § 50.

grids), while recovering revenue from unauthorized use of electricity.<sup>283</sup> Here, the EA grants statutory authority to any state commission to revoke distribution licenses where the authority feels that a licensee's activities are in breach of the public interest.<sup>284</sup>

The protection of consumers is highlighted in section 42 of the EA, where a licensee must provide a forum for 'redressal of grievances' from consumers, who may submit their concerns to an Ombudsman.<sup>285</sup> Moreover, the EA, like the Energy Conservation Act, provides expeditious proceedings in a court known as the *Special Court*.<sup>286</sup> The Special Court may hear grievances related to theft of electricity, including theft of electrical lines and materials, interference with electrical meters or the works of a licensee, and negligently wasting electricity. Attached to such forms of wrongdoing are penalties such as imprisonment of not more than 3 years, or equivalent fines.<sup>287</sup>

Given this legislative framework, India has begun hosting more wind energy events. In December 2005, the Center for Wind Energy Technology (C-WET) installed a new wind monitoring station at Khodal, Rajasthan.<sup>288</sup> The Indian Wind Power Association is hosting a one-day training program on February 18, 2006 for wind farms technicians and operators at Kanyakumari.<sup>289</sup> States like Gujarat, Andhra Pradesh, Karnataka, Madhy Pradesh, Tamil Nadu, and Maharashtra also display tremendous potential for wind capacity generation.<sup>290</sup> For instance, there are about 84 wind stations established in the state of Maharashtra, with 62 in Andhra Pradesh, 60 in Tamil Nadu, and 58 in Gujarat.<sup>291</sup> Several state governments have agreed to purchase power generated on wind farms in the private sector.<sup>292</sup> Moreover, the

<sup>283</sup> Id.

<sup>&</sup>lt;sup>284</sup> *Id.* § 19.

<sup>&</sup>lt;sup>285</sup> Electricity Act 2003, available at

http://powermin.nic.in/acts\_notification/electricity\_act2003/distribution\_electricity.htm (last visited Feb. 8, 2006) § 42(5)-(6).

<sup>&</sup>lt;sup>286</sup> Electricity Act 2003, Special Courts, available at

http://powermin.nic.in/acts\_notification/electricity\_act2003/special\_courts.htm (last visited Feb. 8, 2006) § 158. <sup>287</sup> Electricity Act 2003, Offences and Penalties, *available at* 

http://powermin.nic.in/acts\_notification/electricity\_act2003/offences\_%20penalties.htm (last visited Feb. 8, 2006) § 137.

<sup>&</sup>lt;sup>288</sup> Wind Power India, *available at* http://www.windpowerindia.com/newsdetailer.html#bkmark2 (last visited Feb. 7, 2006).

<sup>&</sup>lt;sup>289</sup> Id.

<sup>&</sup>lt;sup>290</sup> *Id.* at http://www.windpowerindia.com/statest.html (last visited Feb. 7, 2007).

<sup>&</sup>lt;sup>291</sup> Id. at http://www.windpowerindia.com/statwind.html (last visited Feb. 7, 2006).

<sup>&</sup>lt;sup>292</sup> Indian Renewable Energy Development Agency Ltd (IREDA), Wind Power in India, *available at* http://solstice.crest.org/renewables/ireda/wind.html (last visited Feb. 7, 2006). IREDA was incorporated in March 1987 under the Ministry of Non-Conventional Energy Sources (MNES), Govt of India. IREDA intends to promote sustainable resource development and investment in renewable technologies for efficient consumption of energy. See generally http://solstice.crest.org/renewables/ireda/index.html (last visited Feb. 7, 2006).

states of Gujarat and Madhya Pradesh have introduced tax incentive schemes to attract companies towards renewable energy. Given India's rapid rate of economic growth and rising demands for energy consumption from over a billion people, the opportunities for investment and operating in wind projects remain prosperous.

### Japan

Japan is making steady advances in wind energy generation. Early projects administered by the Ministry of Economy, Trade, and Industry have included the 100 kilowatt wind class generation plant on Miyake island from 1981 to 1986, and the development of small island wind projects.<sup>293</sup> In June 2001, the New Energy Division of the Advisory Committee for Natural Resources and Energy recommended expansion of renewable energy programs in Japan.<sup>294</sup> More recent projects have seen GE Wind Energy supply ten wind turbines for a 15 MW wind farm located on the coast of Hibikinada, Japan in 2003.<sup>295</sup> These turbines supply power to the local Kyushu Electric Power Company, which provide energy to approximately 10,000 homes.<sup>296</sup> The Hibikinada Wind Farm was partially funded by the Japanese government in displaying their commitment to renewable energy production. In 2005, two new wind turbines (at a rated power of 1.5 MW each) were installed in the city of Akita, while seventeen other wind turbines will be set up in 2006 on the coastal city of Hachiryu, both located north-west of Honshu island.<sup>297</sup>

Following Canada's approach, the Japanese government introduced a Renewable Portfolio Standard (RPS) in April 2003 in the hopes of providing 1.35 percent of electricity

<sup>&</sup>lt;sup>293</sup> Agency for Natural Resources and Energy, Govt of Japan, available at

http://www.enecho.meti.go.jp/english/energy/new\_energy/wind.html (last visited Feb. 7, 2006) [hereinafter Govt of Japan].

 <sup>&</sup>lt;sup>294</sup> 382<sup>nd</sup> Regular Researcher's Meeting, Discussion Points in Japan's Renewable Energy Promotion Policy, (June 24, 2003), *available at* http://eneken.ieej.or.jp/en/data/pdf/205.pdf (last visited Feb 19, 2006).
 <sup>295</sup> GE 2003 Press Release, *available at* http://www.gepower.com/about/press/en/2003\_press/040903.htm (last

<sup>&</sup>lt;sup>295</sup> GE 2003 Press Release, *available at* http://www.gepower.com/about/press/en/2003\_press/040903.htm (last visited Feb. 7, 2006). GE Wind Energy is a subsidiary of GE Power Systems, which is one of the world's leading suppliers of power generation technology, energy services, and management systems located in Atlanta, Georgia. The Hibikinada Wind Farm began operation in March 2003. The project is specifically located in the bay area about 10 miles NW of Kokura City, Japan. For more discussion, see http://www.power-technology.com/projects/hibikinada/ (last visited Feb. 7, 2006).

<sup>&</sup>lt;sup>296</sup> Id.

<sup>&</sup>lt;sup>297</sup> InWind Chronicle, *available at* http://www.inwindchronicle.com/ (last visited Feb. 8, 2006) at 12. Hikaru Matsumiya, a representative of Japanese Wind Energy and the Japanese Wind Power Association, stated, "Japan plans to attain the wind power target of 3,000 MW by the year 2010 after the Kyoto Protocol. We have installed about 936 MW to date which is 20 times in comparison to five years ago and one-third of the national target." See generally Environment News Services, Wind Power Goes Global (Mar. 10, 2005), *available at* http://www.ens-newswire.com/ens/mar2005/2005-03-10-05.asp (last visited Feb. 19, 2006).

distribution from renewable sources by 2010.<sup>298</sup> Related to these financial incentives, the Japanese Wind Power Association promotes wind energy by fostering conservational policies and creating employment with the renewable sector.<sup>299</sup> Despite these efforts, Japan's goal of reaching renewable energy targets faces challenges. These challenges include geographical concerns over population density and terrain issues that prevent adequate construction of wind farms, as well as low wind potential due to disturbances in the atmosphere.<sup>300</sup> This has led to the pursuit of offshore wind parks as a credible alternative to supplying renewable energy for Japanese citizens. However, as some commentators have noted, offshore wind energy is difficult to harness because current wind turbine technology restricts wind generation to shallow waters.<sup>301</sup> Despite this, given the natural capacity of ocean-bearing winds and recent advances in turbine technology, offshore wind parks are quickly becoming the alternative to this problem, and many new projects are being considered by the Japanese wind authorities.

#### CONCLUSION

The growing emergence of renewable energy highlights the importance of searching for cheaper, cleaner, and more reliable methods of utilizing the world's natural resources. This response is reasonable given the volatility of electricity prices in the market from using conventional fossil fuels, such as coal and natural gas. Whether or not wind energy can replace these conventional sources remains to be seen. However, more nations are discovering its untapped potential, and are targeting energy capacity goals by using wind energy technology given its natural availability. Thus, harnessing this potential depends upon the level of commitment by government, industry, and citizens that can help establish a meaningful partnership in advancing sensible environmental policy frameworks.

<sup>&</sup>lt;sup>298</sup> Wind Council, *supra* note 147, at 13. The Japanese Wind Power Association was established in 2001, and consists of over 110 members of the wind industry. The group also provides educational campaigns and workshops. The Japanese RPS is also known as the *Special Measures Law Concerning the Use of New Energy by Electric Utilities*, which came into effect in April 2003, and generally promotes renewable energy in Japan. The definition of the Japanese RPS is: legislation that sets a minimum percentage of electricity generated by renewable energies in terms of electricity sold, and presents target achievement options such as figure trade among electric utilities. See generally http://eneken.ieej.or.jp/en/data/pdf/205.pdf (last visited Feb. 19, 2006).

<sup>&</sup>lt;sup>300</sup> Govt of Japan, *supra* note 290.

<sup>&</sup>lt;sup>301</sup> Marc Fioravanti, *Wind Power Versus Plutonium: An Examination of Wind Energy Potential and a Comparison of Offshore Wind Energy to Plutonium Use in Japan*, Institute for Energy and Environmental Research, *available at* http://www.ieer.org/reports/wind/summrec.html (last visited Feb. 19, 2006).

As described earlier, federal and state/provincial governments play an active role in promoting the use of renewable energy by providing financial incentives to companies by way of tax incentives, favorable loan treatment, and renewable energy credits or certificates, the latter which complies with legislative energy mandates. Furthermore, companies are given financial incentives through funding mechanisms by purchasing electricity directly from renewable energy sources. Wind-generated electricity is certainly becoming prosperous given the high urbanization rates and an increasing pressure on local authorities to provide affordable electricity to consumers. Numerous authorities are attempting to cushion against fluctuating energy market prices that stem from conventional fossil fuel sources. It is no wonder why renewable energy is being sought to guide future environmental policy planning. Aside from economic considerations, a determined commitment has been made by several nations in promoting wind energy that minimizes the impact on local environments.

Perhaps the greatest contribution of the wind energy sector is its ability to diversify markets that were once highly dependent on conventional fossil fuels. The legislative framework adopted by many jurisdictions in advancing renewable energy is carefully being re-orchestrated to meet the rising demands of electricity consumption, coupled with searching for cost-effective and efficient energy use. In a world of burgeoning resource utilization, wind energy is gathering momentum to the extent that policymakers and industry are stressing the need for improved research and development of wind turbines, design and planning of wind farms both on land and offshore, utility integration that connects wind farms with surrounding communities, and market impact strategies for reducing electricity costs for consumers.

However, the drive towards wind energy and other renewables is not without its challenges. First, companies producing energy from conventional fossil fuels are still active in contributing electricity to consumers. These sources of electricity will not be entirely replaced by renewable sources like wind energy given that current infrastructure plans still rely upon contribution from this sector. Second, environmental assessments may reveal some limitations in that wind projects may impact the surrounding environment by encroaching upon existing wildlife habitat. Third, the natural availability of winds may not exist in certain regions to deliver enough wind energy. Surveying wind maps and other relevant data may reveal that certain locations or climates may not be suitable for creating wind farms. This is where scientific research in improving wind turbine technology serves its purpose. Finally, the degree of political support and societal recognition may not be strong enough to help launch

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future wind energy projects. Here, some regional governments are throwing their political support behind wind energy projects by promoting investment opportunities in the renewable sector, or by fostering media campaigns to raise awareness of greener technologies.

Arguably, this push towards wind energy generation has forced a change in attitude towards environmental policy planning by changing infrastructure models into "green" systems that produce little pollution and harmful effects to the surrounding environment, while creating new forms of employment within the energy sector. International commitments to improving pollution levels and climate change by way of the Kyoto Protocol are just one aspect of the drive towards clean and reliable renewable energy. Other equally influential factors such as the growing demand of finite conventional fossil fuels, legislative reforms in responding to market pricing of electricity to benefit consumers, increasing governmentfunded research and development of renewable energy, and the emergence of "green" companies are contributing to the rise of wind energy. The wind energy issue reveals how the merging of scientific research and committed policy-making can influence changes in the economy, by creating employment, tax incentives, and diversification in energy distribution. What makes wind energy particularly useful for future environmental policy planning is that much of the world has vast and untapped areas of a naturally-occurring resource that only needs to be harnessed in sensible and efficient ways.



**Diagram 2: Cross-section of a Wind Turbine Engine** 

Photo courtesy of: http://windeis.anl.gov/guide/basics/turbine.html