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A Race To The Middle In Energy Policy

*by James E. Parker-Flynn**

INTRODUCTION

Climate change is the gravest threat currently facing humanity.[1] To avoid catastrophic climate change over the coming century, global emissions of greenhouse gases ("GHGs") must peak in the very near future and decline steeply thereafter.[2] A significant barrier to reducing GHG emissions domestically is the conflict between and within state energy policies.[3] Some states encourage renewable energies through Renewable Portfolio Standards ("RPSs") and carbon emissions trading schemes, while others promote the production and utilization of fossil fuels; most, however, promote both to some degree.[4]

Internally, states are motivated to utilize available energy resources — both renewable and fossil fuel — for in-state generation of energy, but are simultaneously motivated to develop those resources for exportation.[5] Texas, for example, produces the most natural gas and crude oil of any state, but also has adopted an aggressive RPS and leads the nation in wind energy generation.[6] Texas' use of wind energy in state reduces GHG emissions, but Texas oil and natural gas — whether burned in state or exported — increase GHG emissions. Thus, some states will partake in a "race to the top" in climate policy by reducing net GHG emissions through state energy policies, others will "race to the bottom" by increasing net GHG emissions, while still others will "race to the middle" through state policies that effectively maintain current GHG emissions levels. Whether a state races to the top, bottom, or middle is primarily determined by the energy resources available in any given state, the economic costs and benefits of developing, using, and exporting those resources, along with ancillary environmental and social concerns.

This Article posits that the various "races" will have the practical effect of leaving the nation as a whole, and the states individually, squarely in "the middle." States' prevailing desire to exploit local resources assures that, absent federal regulations, the United States will not contribute to significant reductions in global GHG emissions.[7] The gains from energy policies that encourage renewable energy generation will be offset or overwhelmed by competing or concurrent desires to exploit fossil fuel resources like natural gas, coal, and oil. Moreover, "leakage" and "seepage" of emissions — the former occurs when a state imports fossil fuel-derived energy from out of state while the latter occurs when a state exports fossil fuels[8] — will ensure that GHG emissions will not necessarily decrease, even where the in-state supply of energy is generated from renewable resources; in other words, a state can race against itself. As a result, the United States will not contribute significant reductions in greenhouse gases, climate change will at best be moderately slowed, and the nation will suffer the consequences.

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In order to avoid this race to the middle, I propose that the nation adopt a unified energy policy that not only mandates increased consumption of renewable energy through a national RPS, but that also restricts the extraction and exportation of fossil fuels through Resource Production Limits ("RPLs") to ensure net reductions in greenhouse gas emissions. A federal policy that focuses on all areas of energy production and consumption will prevent a "bottom" state from undermining the contributions of a "top" state, and simultaneously prevent internal state conflicts that lead to stagnant net emissions.

A New Race-to Analysis

Race-to theory presents an analytical framework in which to examine climate change, but a complete analysis must avoid the segmentation that has plagued previous analyses. It is clear that the United States must reduce GHG emissions to help combat climate change. If current domestic energy policies fail to significantly reduce GHG emissions, then the nation must implement more effective solutions. Existing race-to analyses of energy approaches to the climate problem generally focus on whether RPSs represent a race-to-the-top.[9] These analyses, in

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following traditional race-to formulas, fail to account for certain factors that could lead to the middle—stagnant national emissions in spite of reduced emissions locally. Because the middle represents a danger to the United States that is only slightly less worrisome than the bottom, it is imperative to know whether state energy policies are actually racing to the top, bottom, or somewhere in between.

Most commentators have examined the competing races — those to the top and bottom — from a regulatory framework; they have examined whether state governments, in the absence of federal regulation, will craft environmental regulations that will either increase or decrease social welfare.[10] Public welfare is generally measured through an analysis of costs and benefits that quantifies the ecological, economic, and public health implications of environmental regulations,[11] though at times the measure is the mere decrease or increase in environmental regulations.[12] Further, commentators examine how individual states race with others to attract business, and how those races affect the populaces of those states.[13]

This Article diverges from traditional race-to analyses in two critical respects. First, it explores how states' decisions in promoting and using available energy resources will affect net GHG emissions from a results-oriented perspective. A race to the bottom thus leads to increased GHG emissions, while a race to the top leads to decreased GHG emissions. The middle represents stagnant emissions. Public welfare — and associated analyses of costs and benefits — is not specifically addressed because it is assumed that increased or stagnant emissions will be detrimental to the long-term health and economic stability of the country.[14] Likewise, the Article only considers climate change effects, and does not consider other environmental consequences of state policies that lead to greater or lesser emissions.

"Indeed, climate change disparately impacts different geographic areas, but regional effects are not determined or altered by the energy source or the method of energy generation and extraction."

Second, this Article examines how the climate impacts of energy decisions — made across the country and in relation to vastly different energy resources — cumulatively manifest at the national level.[15] Typically, race-to analyses examine the impact of regulations, or the lack thereof, within the participating states.[16] Environmental impacts are thus constrained by both the source of the pollution and the proximate geographic area. For instance, an analysis might look at the effect of air pollution from coal burning power plants on nearby populations, and how relaxed regulations might attract new coal plants but increase the amount of dangerous pollution. Such an analysis is essentially the same wherever the power plant happens to be; decreased regulations might mean more pollution and health consequences, but increased job opportunities. But all of the effects of the regulations are constrained to the populations of the regulating states and proximate areas, and possibly the populations of states that lost out on the new coal plant because of more stringent regulations.

Contrastingly, the national approach proposed herein is more consistent with the premise of the Article because the harms of increased greenhouse gases in the atmosphere manifest both globally and locally,[17] but cannot be constrained to a single geographic area. Indeed, climate change disparately impacts different geographic areas,[18] but regional effects are not determined or altered by the energy source or the method of energy generation and extraction. For example, all GHG emissions from coal-burning power plants contribute to climate change, yet people near a coal-burning power plant in Pennsylvania will experience a different set of climate consequences than people near a coal burning power plant in South Texas.[19] Thus, decreasing GHG emissions from coal plants in Pennsylvania will have different climate consequences on the local population than if the same reductions are made in South Texas. Further, because GHG emissions are "well-mixed" in the atmosphere, increased emissions from a Pennsylvania coal plant will affect distant populations in addition to local and proximate populations. It is thus of no moment whether the emissions of an individual state decrease if the national emissions do not. Accordingly, the Article examines whether state energy policies lead to increased, decreased, or stagnant emissions on the national level. In order to properly examine the climate race from a national perspective, however, it is critical to understand the state energy policies that form the foundation of the national energy policy.

STATE ENERGY POLICIES

Whether state energy policies represent a race to the top, middle, or bottom for climate change depends on the nature of those policies. In analyzing state energy policies, many commentators focus only on the decisions that affect the in-state generation and use of energy resources. A complete energy policy, however, encompasses in-state generation as well as in-state production of energy resources — which include all resources used to generate electricity as well as fuels — regardless of whether those resources are used in-state. Accordingly, this Part first examines energy generation, and then the production of energy resources, in order to fully analyze the effect of state energy policies on GHG emissions.

Energy Generation

States with RPSs

States have increasingly adopted RPSs as part of their energy policies in the past twenty years.[20] An RPS, in simple terms, requires utilities within its jurisdiction to "provide a specified amount or percentage of power from renewable sources as part of their total offering of electricity."[21] Currently, thirty-seven states and the District of Columbia have either a mandatory RPS or a statute outlining voluntary renewable energy goals.[22] RPSs ideally will contribute to reductions in GHG emissions by mandating or promoting the use of energy sources that emit less GHGs than traditional fossil fuel energy sources.[23] Indeed some commentators argue that RPSs, because they involve voluntary and often ambitious state efforts to reduce GHGs despite the lack of a federal mandate, represent races to the top.[24]

Whether RPSs represent a path forward to a more sustainable energy future, or simply political greenwashing,[25] there is an underlying truth about them: RPSs are only segments, and often quite small segments, of state energy policies. In other words, an RPS explicitly describes only part of the energy policy of a state, though it implicitly says much more. For instance, Ohio's RPS requires that all retail electricity providers, except for municipal utilities and electric cooperatives, provide at least twenty-five percent of retail electricity supply from alternative energy sources by 2025.[26] The Ohio RPS, therefore, represents one-quarter of the state energy policy regarding energy generation. The remaining three quarters are presumably represented by an unwritten policy to generate energy in any way that does not violate established laws, even where that generation may lead to greater GHG emissions.[27] This unwritten policy becomes more unnerving when one accounts for potential growth in population and energy demand; indeed, seventy-five percent of Ohio's energy supply in 2025 could, theoretically, account for as much energy as one hundred percent of Ohio's energy use today.[28] In that case, that state's total emissions would not decrease at all. Or, the cost of complying with the RPS could lead Ohio energy producers to replace energy currently derived from nuclear power or natural gas with energy from coal, increasing GHG emissions even as the state gets more energy from renewables.[29]

Similarly worrisome, the Ohio RPS allows the public energy commission to classify *any* new technology as an advanced energy source.[30] This allowance is not limited by any emissions requirements,[31] meaning a new technology to derive energy from coal could be considered an advanced energy source, even if it increases GHG emissions. Many other RPSs have similarly flexible definitions of renewable or alternative energy sources that may encourage GHG-intensive energy generation.[32] Additionally, there are concerns about states including existing hydroelectric power in their RPSs, which could preclude the addition of any new renewable energy.[33] Conversely, some state RPSs do not include local hydroelectric or geothermal power, which forces the state to import less efficient renewable energy from out of state to meet the standard.[34]

Finally, the Ohio RPS — like others — does not account for in-state production of energy sources like coal, gas, and oil.[35] Regulations that apply to production of energy sources are found elsewhere in the Ohio code.[36] These regulations do not set limits on the total amount of the energy source that can be extracted or produced;[37] indeed, every deposit of oil and coal could theoretically be exploited under the current Ohio regulations. More disturbingly, the word "emission" is not found anywhere in any of the regulations regarding oil, gas, and coal production.[38] Exploitation of energy resources is philosophically and practically separated from both energy generation and climate change impacts.[39] Accordingly, states may have RPSs, but none have meaningful RPLs (resource production limits) to prevent or substantially limit the extraction and exportation of fossil fuel resources. The failure to connect generation and production muddies the race-to picture even further.

The Ohio RPS is of course just one example, and is not intended to indicate that all RPSs will inherently lead to stagnant or rising GHG emissions. Many states are far more aggressive with their goals.[40] Additionally, many states have enacted other climate initiatives that may, alongside RPSs, lead to lower GHG emissions.[41] But, the Ohio RPS exemplifies the division between energy generation and production that undermines existing state energy policy measures to address climate change. In short, it demonstrates that even those states that have RPSs may end up racing somewhere other than the top.

States Without RPSs

While deficiencies in state RPSs may prevent significant GHG reduction, more worrisome are states that lack any RPS. The states that do not currently have RPSs are Alabama, Alaska, Arkansas, Florida, Georgia, Idaho, Kentucky, Louisiana, Mississippi, Nebraska, South Carolina, Tennessee, and Wyoming.[42] Nevertheless, these states may, and often do, utilize or promote renewable energy sources. For instance, Florida is home to "some of the largest solar power plants nationwide."[43] Although Florida does not have a RPS, it does "encourage renewable electric energy generation" through its Energy Economic Zone Pilot Program.[44] Additionally, Florida actually restricts the amount of natural gas and oil produced from state pools to the "reasonable market demand for oil or gas in this state" — one of the rare state a RPL.[45] In addition to encouraging renewable energy, states without RPSs — like those with — may also feature energy efficiency standards, building requirements, and other demand-side management implements that may indirectly decrease GHGs from energy generation.[46] Additionally, these states may offer tax credits or rebates for clean or renewable energy generation.[47]

While GHG emissions reductions from efficiency standards and tax incentives may obtain, energy generators in states without RPSs are not required to generate energy from renewable sources. Motivation to utilize renewables thus rests on some combination of altruism, economics, reputational incentives, and availability of renewable sources. As noted above, Florida encourages renewable production and generates a fair amount of solar energy, relatively. Florida does not compare to the southwestern states in solar energy potential, but it does have areas that offer more solar potential than other eastern states.[48] The state thus has availability and may also have reputational incentives to utilize solar power; the state motto is, of course, the Sunshine State. Moreover, Florida has over 1,200 miles of coastline and is especially vulnerable to one of climate change's most visible impacts, sea level rise.[49] Rising sea levels not only pose a serious risk to coastal property in the future, they contribute to rising insurance rates for residents, and threaten Florida's drinking water.[50] Nevertheless, Florida still generates over 83% of its energy from fossil fuel resources, 13.5% from nuclear energy, and only .005% from solar energy.[51] Florida, which has numerous incentives to reduce GHG reduce greenhouse gas emissions — available renewable resources, economic and reputational incentives, as possibly the altruistic incentive to protect citizens — still produces more carbon dioxide emissions than all but four states.[52] Without an RPS, consequential reductions in GHG emissions are unlikely.

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Like the states with RPSs, states without do not set meaningful limits on the extraction and production of fossil fuel resources; Florida's RPL, for instance, is a moot instrument, based on in-state consumption and production. Without material limits on either the production of fossil fuel or the GHG emissions from generation, energy generation and production in the fourteen states without RPSs are limited only by other regulations. It is likely, for instance, that Wyoming will continue to mine and burn coal at exceptional rates[53] unless other environmental regulations are established to control air pollution that indirectly or directly decrease GHG emissions.[54] It is unlikely, however, that any independent regulations will slow the extraction of coal. State energy policies that do not feature RPSs are similarly motivated to use available resources, the cost and benefits that result from the exploitation of those resources, and the cost to import outside energy or electricity if necessary. Unlike the states with RPSs, however, those without have no mandate to lower emissions from in-state generation. Consequently, whether these fourteen states race to the top or bottom will depend on which resources they can exploit or import.

Exploitation of Energy Resources

As noted above, state energy policies explicitly or implicitly encourage the exploitation of local energy resources.[55] Because states lack RPLs and at best set standards on what energy sources are used for generation, exploitation of those resources inherently occurs. Accordingly, this section takes a cursory examination of the various energy resources that states exploit, for both generation and exportation, and the climate impacts of those resources.

Fossil Fuels and Natural Gas

Production of natural gas has exploded in recent years due to increased recovery of gas from shale deposits.[56] Proponents of natural gas have touted it as a cleaner source of energy than other fossil fuels (coal and oil primarily); accordingly, advocates argue that it should serve as a "bridge" to a lower carbon society.[57] The heart of the argument is that natural gas produces significantly lower GHG emissions than other fossil fuels when burned — in addition to its other environmental advantages over other fossil fuels[58] — and thus the United States should use natural gas to replace coal in electricity production and gasoline in certain segments of the transportation industry.[59] By doing so, the U.S. could use natural gas as a bridge fuel to a future where the U.S. relies entirely on "efficiency, renewable sources, and low-carbon fossil fuels."[60]

While the idea of natural gas as a bridge fuel is appealing, there is considerable debate in the academic literature about the quantity of GHG emissions reductions, if any, natural gas provides over other fossil fuels.[61] There seems to be no debate that natural gas produces fewer GHGs than other fossil fuels at the electricity generation stage;[62] it is possible, however, that "upstream" GHG contributions — such as methane leakage at the extraction and transmission stages — offset any gains achieved.[63] Whether natural gas produces half as many GHGs as other fossil fuels, or whether it produces the same or more, the fact remains that natural gas is a fossil fuel and will emit some level of GHGs when produced and used.[64] Further, natural gas produces fewer emissions of sulfur dioxide and aerosols than coal, which — in a cruel twist — could reduce the benefits of relying on natural gas to combat climate change.[65]

Because natural gas produces GHG emissions that are significantly higher than those produced by renewable resources like solar and wind, some commentators are concerned that increased reliance on natural gas may leave the U.S. stuck on the proverbial bridge.[66] A full discussion of the reasons why natural gas may not be an ideal bridge to a low carbon future is beyond the scope of this Article. Two basic premises behind the "bridge to nowhere" argument are worth examining briefly, however. First, cheap natural gas will not only replace coal and oil, it may also prevent development of renewable energy.[67] This fear was explored in a study conducted by the International Energy Agency in 2011, which assumed that natural gas use would account for up to twenty-five percent of world energy supply in 2035, but that it would not significantly lower global carbon dioxide emissions.[68] In such a scenario, a long-term and dangerous warming of 3.5ºC (6.3ºF) would still be likely.[69] Second, new infrastructure is needed to fully exploit natural gas, and "a new generation of gas-fired power stations would have a lifetime of at least 25 years, effectively 'locking in' billion of tonnes of carbon emissions a year."[70] If the United States invests heavily in natural gas infrastructure now, new renewable infrastructure is effectively priced out by the sunken cost.

Whether natural gas represents a bridge to nowhere, a bridge to a sustainable energy future, or something in the middle, there is no doubt that natural gas production in the United States has increased over the past 20 years.[71] Large domestic natural gas deposits are distributed throughout the county, and estimates of natural gas deposits seemingly increase every year, largely from the massive gas resources in the Marcellus Shale deposits that span across Pennsylvania, New York, West Virginia, and Ohio.[72] The increased production is largely the result of two technologies — hydraulic fracturing and horizontal drilling — that allow producers to exploit deposits of gas that are locked in shale and other tight-rock formations.[73] Producers can now extract gas more cheaply, and the market price has accordingly dropped. As long as there are no restrictions on the extraction of natural gas based on the eventual emissions that will result, the enormous economic incentives ensure that extraction and consumption of gas will continue to increase globally.[74]

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Coal[75]

Although perhaps not expanding as rapidly as gas, coal production and consumption have increased nationally over the past thirty years.[76] In the years since 2007 and 2008, however, domestic production and consumption have decreased slightly.[77] According to the U.S. Energy Information Administration ("EIA"), the United States has over four billion short tons of demonstrated coal reserves,[78] and over seventeen billion short tons of recoverable coal.[79] Global demand for coal, however, is rising, particularly in Asia.[80] Indeed, China and India, among others, are adding new coal burning facilities at an alarming rate.[81] Accordingly, emissions from coal are rising as well.[82] The United States has more recoverable deposits of coal than any other nation, including China,[83] and exports are rising.

Domestically, sizable coal deposits are found in many states, including Wyoming, West Virginia, Illinois, Kentucky, and North Dakota.[84] Many coal-producing states offer incentives or tax exemptions for the production or consumption of coal.[85] The EIA predicts the price of domestic coal will rise incrementally over the coming years — primarily as a result of increased production costs associated with more costly mines — which will result in the retirement of many coal-fired power plants and subsequent replacement by cheaper natural gas plants.[86] Despite the reduction in plants and increase in cost, however, domestic coal consumption and production is expected to increase in the United States by 2040.[87] States with large coal deposits will still have the economic incentive to exploit those deposits.[88]

Coal is the most carbon intensive of the fossil fuel energy sources.[89] While the debate over the lifecycle GHG emissions from natural gas have cast some doubt on the traditional idea that coal is the dirtiest fossil fuel,[90] there seems to be no debate that coal produces more GHG emissions at the generation phase than from any other fossil fuel.[91] The emissions from burning coal can be mitigated through carbon capture and storage techniques, which produces "clean" coal.[92] Clean coal has its own set of risks, however, one of which is that the captured and stored carbon dioxide will find its way back into the atmosphere.[93] Even if the captured carbon dioxide stays underground, clean coal still produces carbon dioxide emissions and the process of cleaning the coal requires energy, which leads to more emissions.[94] Finally, the cost to remove and store substantial amounts of carbon dioxide from coal emissions is very high,[95] which suggests energy companies will settle for "cleaner" coal, rather than "clean" coal. Without state RPLs to slow coal production, coal will still be economically viable for decades and states with large coal deposits will likely continue to exploit local coal resources.

Oil

The United States is a considerable producer of petroleum, and domestic production is increasing.[96] Forecasts show that the United States will overtake Saudi Arabia as the world's largest producer of oil by 2015.[97] Like natural gas, much of the increased production in oil comes from shale deposits and the increased use of hydraulic fracturing and horizontal drilling.[98] The increased production of domestic oil has been paced in recent years by an increase in exports of U.S. oil.[99]

The largest producers of domestic oil are Texas, North Dakota, Alaska, and California.[100] Texas currently leads the other states by a sizable margin, and production in Texas and North Dakota have increased substantially since 2006.[101] While the increase in Texas's production was larger, the North Dakota increase is perhaps more alarming — the state's production of oil more than tripled over that period.[102] The majority of North Dakota's increase comes from the Bakken formation.[103] In just a few short years, North Dakota has transformed itself from the seventh leading state-producer of domestic oil to the third, and now trails only Texas and California.[104]

Petroleum produces substantial greenhouse gases when burned.[105] The transportation sector is responsible for twenty-seven percent of domestic GHG emissions, and over ninety percent of those emissions are from petroleum products like gasoline and diesel.[106] Additional GHGs, in the form of carbon dioxide and methane, are released during both the extraction of petroleum and the refining process.[107] The use of oil products is, in short, an extreme net contributor to climate change.

Fossil fuels are incredibly abundant in the United States. The nation has large supplies of natural gas, coal, and petroleum, and production of all three is poised to rise in the years ahead. Technologies like hydraulic fracturing have opened up vast new reserves of both natural gas and oil. Increased international reliance on coal also ensures a steady demand for domestic coal. Because of the vast resources and seemingly endless demands, states are poised to exploit their fossil fuel resources for both in-state use and export in the years ahead. Fossil fuels are not the only energy sources available to states, however, and in the coming years renewable energy will also play an important role in state energy policies.

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Renewable Energy Resources

States are increasingly utilizing domestic renewable sources in addition to exploiting fossil fuel resources. This section will briefly describe the primary renewable energy resources available to states.

Solar Power

Although fossil fuels and wind would not exist without energy from the sun,[108] solar power traditionally refers to energy directly produced from the sun through photovoltaic ("PV") panels or by concentrating the sun's power to produce thermal energy (concentrated solar power, or "CSP").[109] The United States has immense solar power potential, particularly in the Southwest.[110] Solar power may be harvested at the macro level in large solar plants like the Ivanpah solar thermal plant[111] and the Desert Sunlight PV plant,[112] both located in California's Mojave Desert. Additionally, communities and individual homeowners may harvest solar power at the micro level.[113] Despite massive solar power potential, however, solar power only accounts for a small percentage of total domestic energy, though the actual total is difficult to quantify.[114]

While the majority of domestic solar power potential is in the southwestern United States, solar power resources are ubiquitous; indeed, the states that currently provide the most incentives to exploit solar power include many non-southwestern states.[115] Oregon, for instance, is hardly a bastion of sunshine, yet the state introduced its first solar tax credit over thirty years ago and is still a leader in production of electricity from solar generation sources.[116] Moreover, states like Georgia and Missouri are positioned to greatly benefit from solar energy for a number of reasons beyond pure solar insolation potential, including cost of electricity and cost of installation.[117] Solar power is currently limited, however, by intermittency issues.

Although intermittency places a limit on solar power generation, the cost of solar photovoltaic installation, which has dropped significantly in recent years,[118] is now less of a restraint on the expansion of solar power than it was previously. The drop stems from reductions in the cost of both the solar modules and non-module components of installation.[119] As noted above, however, installation costs vary significantly by state.[120] In a few years, solar energy may actually be as cheap as, or cheaper than, energy from fossil fuels.[121] Solar also provides a fantastic energy resource for states that prioritize dramatically reduced GHG emissions; both CSP and PV solar produce significantly fewer life cycle GHG emissions than fossil fuels.[122] Despite the falling costs and emissions reduction potential, the EIA projects that solar power will continue to supply only a small portion of total domestic energy in the coming decades.[123] States thus have considerable solar resources and incentives to exploit those resources, but it is not clear that solar will significantly reduce reliance on fossil fuels.

Wind Power

While solar power is an underutilized yet increasingly exploited energy resource, wind power is the current king of non-hydro renewable energy resources.[124] The United States has immense wind potential, particularly in the central portion of the country — from Texas up to Canada — and off certain coasts.[125] Installation of utility grade wind power has been increasing steadily in recent years.[126] The EIA, however, expects wind to grow at a slightly slower pace than solar photovoltaic over the next three decades.[127]

Texas is the state that produces the most energy from wind, followed by California, Iowa, Illinois, Oregon, Oklahoma, and Washington.[128] Much of the wind industry boon has been fueled by a federal tax credit that is poised to expire at the end of 2012.[129] Wind power development may slow considerably because of the expiration of the tax credit and the glut of cheap natural gas.[130] Despite cost concerns, wind is an abundant natural resource available to many states, and wind energy produces dramatically less GHG emissions than fossil fuel energy.[131] Like with solar power, economic and environmental incentives, as well as intermittency issues, accompany wind power, but it is unlikely that the incentives are substantial enough to propel wind power ahead of fossil fuel power in state energy policies.

Other Renewable Energy Sources

There are numerous other renewable energy sources available to states. Most prominently is hydroelectric power, which accounts for fifty-two percent of all renewable energy produced in the United States.[132] Hydroelectric power generation has remained fairly steady in the nation over the past two decades.[133] While almost all states utilize hydroelectric power to some extent, the Pacific coast states are the clear leaders in hydroelectric energy generation.[134] Hydroelectric power produces few GHG emissions,[135] and is a cheap source of power.[136] Unfortunately, many of the best hydroelectric resources have already been developed,[137] though there is still potential for future exploitation from existing but non-powered dams.[138] While hydroelectric power is renewable and does not suffer from the intermittency issues of solar and wind, it is dependent on rainfall. Climate change and attendant changes in precipitation could thus alter the amount of hydropower available to many states.

In addition to hydropower, there is energy potential, both realized and untapped, in biomass and biofuels, geothermal sources, and waves and tides.[139] Biomass and biofuels can be generated from a number of sources, including wood, waste, and corn.[140] It is difficult to quantify the exact GHG reduction potential of bioenergy because it can be produced from so many different sources, each with attendant land-use consequences and GHG potential.[141] The IPCC concludes that most bioenergy has some GHG mitigation potential, but notes that the sustainability of bioenergy rests heavily on land-use practices.[142]

Geothermal energy — yet another renewable resource — represents approximately three percent of all renewable energy currently produced in the United States.[143] California produces the most geothermal energy,[144] though there is significant geothermal potential in many of the western states.[145] Although geothermal energy produces very few GHG emissions,[146] energy growth in this sector has been slower than either wind or solar because of siting, cost, and transmission concerns, among other issues.[147]

Finally, wave and tidal power are still in nascent stages.[148] Because of costs and practical difficulties, these two ocean power sources are not expected to meaningfully contribute to domestic power for many years.[149]

While ocean power is still a negligible source of energy, the United States is blessed with many other abundant renewable energy resources, and the nation has substantial fossil fuel resources. State energy policies encourage the exploitation of available resources, particularly when those sources are cheap. Some states explicitly mandate or encourage the use of renewable energy for in-state generation through the use of RPSs, although renewable energy plays some role even in states that do not made its use. Implicitly, however, states segregate energy generation from the extraction and production of energy resources. Because of this philosophical and practical divide between generation and production, no states — including those with aggressive RPSs — have meaningful RPLs. The failure of state energy policies to address production negates efforts to significantly reduce GHG emissions through RPSs, and assures that at best, the United States is racing to the middle in climate change abatement.

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A Race to the Middle

Conflict and Causation: Production and Generation

The United States has enormous and varied energy resources, and competing incentives to produce and use those resources. The crux of the issue is whether those resources and incentives, embedded in state energy policies, will lead to decreased GHG emissions (the "top"), increased GHG emissions (the "bottom"), or somewhere in between (the "middle"). Here, I argue that state energy policies will lead the U.S. to either the middle or the bottom, and consequently, the U.S. should adopt a federal energy policy that prioritizes both renewable energy generation and simultaneously limits the production of fossil fuel resources to facilitate a dramatic decrease in GHG emissions. In other words, the United States should implement a stringent national RPS and RPL.[150]

The primary reason that state energy policies will lead the United States to the middle is conflict: conflict between states, and conflict within states. As to the former, for instance, one state will vigorously promote renewable energy while another will cling to and even expand fossil fuel for in-state generation; the two states effectively cancel the other out. The latter conflict is more concerning and complex, and is exemplified by schizophrenic state energy policies that simultaneously seek to promote renewable energy generation and fossil fuel production. Failure to address the production of fossil fuel resources in state policies ensures that the country races to the middle in battle against climate change.

Conflict Between States

At the core of both conflicts are available energy resources, the cost and feasibility of utilizing those energy resources, and the potential economic benefits of extracting those resources, whether used in state or elsewhere. Greatly simplified, states with abundant fossil fuel resources will maximize those resources as long as economic incentives exist, while states with abundant renewable energy resources will maximize those resources. If a state has insufficient internal resources to power the state, it will either import energy resources for in-state generation, or directly import electricity from other states.[151] Incentives to exploit renewable energy are more complex, as some states may desire to produce or use renewable energy for perceived moral, environmental, or reputational benefits.

Despite complex alternative incentives to exploit renewable resources, available resources and economic considerations are still the primary drivers behind state energy policies, and can lead a state to adopt policies that are either beneficial or detrimental in the climate context. Oregon, for instance, is generally considered an environmentally conscious state; it has a relatively ambitious RPS[152] and zealously promotes solar energy despite a relative dearth of solar resources.[153] It has thus adopted an energy policy that is racing to the top in the climate context. But this policy is still dependent on available resources and economics; in-state generation of electricity comes primarily from hydroelectric power, of which Oregon has substantial and affordable in-state resources.[154] The state also has significant wind resources, but transmission and economic considerations have prevented wind from consistently providing a large portion of Oregon's electricity.[155] Nevertheless, decreasing costs and availability drive the state to further develop wind resources. Only a small portion of Oregon's energy consumption derives from non-biomass, non-hydro renewable resources.[156] Finally, Oregon generates almost thirty percent of its electricity from either natural gas or coal,[157] though it has no domestic fossil fuel resources.[158] The state thus produces over eighty-five percent of its electricity from hydroelectric and fossil fuels — which are cheap and available, and cheap to import, respectively — while wind, which is available and cheaper than before, becomes a bigger part of the state profile. Regardless of the motivations, however, Oregon's remains a sterling example of a state energy policy that heavily promotes renewable energy.

In contrast to Oregon, Wyoming has considerable fossil fuel resources,[159] but no RPS.[160] Almost ninety-three percent of Wyoming electricity generation is from coal and natural gas, with coal accounting for the overwhelming majority.[161] When factoring in transportation, almost ninety-five percent of all energy consumed in Wyoming derives from fossil fuels.[162] In addition to fossil fuel resources, Wyoming has abundant wind resources.[163] Although Wyoming has not yet maximized its wind resources, it appears that the state is beginning to exploit its vast wind potential.[164] Because the state has no RPS, however, there is no mandate for renewable energy generation. As such, the state will only fully maximize local wind resources if economically feasible, or if other factors, like environmental concerns, overwhelm the desire to use cheap, local coal. Regardless, it appears that Wyoming coal production will continue unabated in the immediate future,[165] and that the state's coal exports will continue to increase.[166]

Oregon and Wyoming represent two sides of the energy coin. One has abundant renewable energy resources coupled with strong internal economic and environmental incentives to promote renewable energy, while the other has abundant fossil fuel resources and formidable economic incentives to exploit those resources. The two state energy policies philosophically negate each other[167] and ensure that while one state races to the top with decreased GHG emissions from in-state generation of electricity, the other races to the bottom through production of substantial amounts of GHG-producing fossil fuels for both in-state use and for export elsewhere.

Conflict Within States And The Problems of Leakage and Seepage

In addition to conflict between state energy policies, there is conflict within individual state energy policies that results from the philosophical and practical disconnect between energy generation and production. As noted previously, states may or may not have RPSs, but none currently have meaningful RPLs. This conflict between generation and production can cause a state to race against itself; for instance, a state with a strong RPS may offset the resultant GHG reductions through increased exports of fossil fuels.

The segmentation of production and generation is revealed by "leakage" and "seepage," two concepts for which race analyses must account. "Leakage" occurs when strict in-state environmental regulations drive energy generation out-of-state, where regulations are not as strict.[168] Instead of building new renewable power plants, a state may instead import some electricity from existing plants out of state.[169] As a result, a state may achieve its RPS goals without fundamentally altering the amount of greenhouse gas emissions generated by its populace.[170]

Even where the in-state generation policies promote the use of renewable energies or alternative fossil fuels like natural gas, conflicting drivers may also lead to the more insidious form of leakage, which I call "seepage." Seepage occurs when increased in-state utilization of renewable and alternative energy sources leads to greater exports of traditional fossil fuels, and subsequently, stagnant or increased GHG emissions. While state energy policies may promote the domestic use of alternative and renewable energies, there are currently no states that have implemented meaningful RPLs that prevent the production and sale of, for instance, coal.[171] If local (or domestic) demand decreases due to RPSs or other state measures, supply and demand economics suggest that coal producers — if coal is still cheap to produce and profitable to sell — will simply attempt to sell their goods elsewhere; there are still many places, both domestically and internationally, that burn coal, and indeed, coal exports from the U.S. are increasing.[172] This internal conflict to profit from the export of fossil fuels is evident even in states that do not produce fossil fuels. Oregon, for instance, produces no coal and is phasing out existing coal power plants, but the state nevertheless assists in the export of Wyoming coal through Oregon ports.[173] Indeed, Oregon is considering more projects that would allow it to export even more coal.[174]

Thus, powerful economic incentives assure that fossil fuel supply and its consequent GHG emissions will seep or leak abroad and, consequently, net GHG emissions will not decline.[175] It is irrelevant whether or not the increase in exports is a direct result of state energy policies that limit in-state generation of electricity from fossil fuels, or simply the result of greater demand abroad[176]; state-based energy policies that focus only on energy generation cannot lead to decreased global emissions if local production of greenhouse gas intensive fuels are not simultaneously reduced.

> *"While state energy policies may promote the domestic use of alternative and renewable energies, there are currently no states that have implemented meaningful RPLs that prevent the production and sale of, for instance, coal."*

The Cautionary Case of Texas

Perhaps no state better demonstrates the conflict driving the United States to the middle than Texas. Texas has more fossil fuel reserves and more renewable energy potential than any other state.[177] It has a fairly aggressive RPS that calls for at least 10,000 megawatts of renewable energy electricity generation by 2025.[178] Texas already produces more electricity from wind energy than any other state, and will add considerably more in the next decade.[179] Conversely, the state also leads the nation in both oil and natural gas production.[180] In addition to its vast internal oil and gas reserves, Texas is also the nation's largest refiner of oil,[181] much of which is extracted in other states and Canada.[182] Additionally, with port access in the Gulf of Mexico, Texas is one of the leading exporters of oil products to foreign countries.[183] Despite the widespread use of wind energy in the state, Texas leads the nation in GHG emissions.[184]

Texas thus demonstrates the conflicting interests rampant in state energy policies. It has substantial energy resources, both renewable and fossil fuel, and tremendous incentives to exploit all of its resources. Because of its location — in the Southwest with a Gulf Coast border — Texas is at risk of substantial damages from climate change. Its coast is threatened by several feet of sea level rise,[185] its water resources threatened by rising temperatures and faster evaporation rates,[186] its citizens threatened by extreme heat,[187] and its agriculture at risk from drought.[188] The potential devastation that Texas faces from climate change provides the state incredible incentive to transition as quickly as possible to renewable energies that reduce GHG emissions. Conversely, Texas has tremendous economic incentives to exploit its fossil fuel resources regardless of how it generates energy in state. Petroleum accounts for over twenty percent of Texas exports.[189] There are so many fossil fuel reserves in the state that energy companies spend billions of dollars on royalties; indeed, almost a billion dollars in royalties annually goes to Texas itself.[190] Not surprisingly, Texas oil and gas production, far from decreasing, is rising.[191]

Texas is thus racing against Texas. Its energy policy promotes renewable energy use while it simultaneously encourages the production and use of fossil fuel resources. The state is adding in-state energy generation from renewable sources, but also from fossil fuel resources; subsequently, in-state emissions still lead the nation. Texas is also exporting ever-greater amounts of fossil fuels, ensuring that emissions eliminated domestically seep abroad. Because of its schizophrenic energy policy, Texas is at best racing to the middle as an individual state, and at worst is offsetting the gains of states that race to the top.

States, like Texas, have conflicting incentives to exploit both fossil fuels and renewable energy sources. State energy policies at best limit emissions from in-state generation, but universally ignore the production and export of fossil fuels. An analysis that accounts for entire energy policies, including production, sheds new light on the effectiveness of state energy policies to address climate change. Because of conflicts between and among states, including the failure of state energy policies to set meaningful RPLs, state energy policies do not represent a race to the top in climate policy. Some disparate state energy policies race in opposite directions, and effectively cancel each other out, while other state energy policies race internally to a stalemate. Consequently, state energy policies represent a race to the middle at best.

The Argument for a Federal Policy

Because conflicting interests assure that state energy policies will at best lead the nation to the middle — an unacceptable position if the United States is to avoid the substantial, adverse impacts of climate change — the underlying solution is clear: the United States must implement a unified federal energy policy that both promotes the domestic utilization of renewable energy and restricts the domestic extraction and production of fossil fuels. Only through a strong federal floor that includes a stringent RPS *and* RPL — or alternate system of limiting production[192] — can the nation assure meaningfully reduced net GHG emissions. The federal energy policy should proscribe GHG limits from energy generation that steadily and significantly decrease over the next few decades. Similarly, the policy should proscribe a RPL that mandates limits on the extraction and production of fossil fuels. Like the limits on generation, allowable extraction under the national RPL should consistently decline over the years to ensure meaningful reductions in GHG emissions.

Through a unified federal energy policy that limits both the production of energy sources and subsequent generation, the United States can achieve material GHG emissions reductions. In so doing, the nation will send a powerful message to the rest of the world, which in turn may lead to further emissions reductions globally. Moreover, it will eliminate the inefficiencies and conflicts that cause state energy policies to race to the middle in climate policy. Consequently, a unified federal energy policy will give the United States, and the world, a chance to weaken the blow of catastrophic climate change.

> *"The United States must implement a unified federal energy policy that both promotes the domestic utilization of renewable energy and restricts the domestic extraction and production of fossil fuels."*

CONCLUSION

Climate change presents an immense and nearly unimaginable threat to American society. In this century, the effects of climate change will grow more pronounced and dire. While it is likely too late to prevent all of the negative consequences of global warming, the world may still have a chance to avoid catastrophic climate change. In order to avert the worst consequences, global GHG emissions must dramatically decrease in the near future. For a number of reasons, such a dramatic decrease will not become a reality unless the United States significantly abates its GHG emissions. As yet, the federal government has not taken serious steps to address the climate problem; indeed, it has made little effort to reduce GHG emissions from energy.

Domestic energy is dominated by state energy policies. Some of these states policies have measures to reduce GHG emissions, primarily in the form of RPSs. There is an extensive body of legal literature that attempts to answer whether RPSs represent a race to the top in either environmental or climate policy. Existing race-to analyses are incomplete, however, because they only address RPSs, which focus on in-state energy generation and neglect production and exportation. Leakage and seepage of emissions assures that GHG emission cannot be reduced through RPSs alone. A comprehensive analysis of state energy policies must therefore also account for the extraction and production of energy resources in order to fully account for GHG emissions.

This Article instead approaches the race-to analysis from a different perspective. It focuses entirely on net GHG emissions. Decreased emissions indicate a race to the top while increased emissions indicate a race to the bottom. Additionally, the Article examines the results from a national perspective. Finally, the Article accounts for both generation and production, and thus incorporates emissions from both leakage and seepage. From this different perspective, the Article concludes that the inherent conflict between and within state energy policies will lead to emissions that increase or stagnate; state energy policies therefore represent, at best, a race to the middle in climate policy.

Accordingly, the United States should adopt a unified federal energy policy that limits GHG emissions from domestic energy generation and production through a national RPS and RPL. By addressing generation and production, the United States can meaningfully reduce GHG emissions. In the process, the nation will provide both leadership and an emissions-reduction method to the rest of the world that hopefully will result in reduced global GHG emissions. Most importantly, it will give humanity a legitimate opportunity to avoid the worst consequences of climate change.

Endnotes: A Race To The Middle In Energy Policy

1 *See* Alex Renton, Oxfam international, Suffering the Science: Climate Change, People, and Poverty 1 (2009), *available at* http://www.oxfam.ca/sites/default/files/suffering-the-science-climate-change-people-and-poverty.pdf.

2 *See* Climate Change Research Centre, University of New South Wales, The Copenhagen Diagnosis: Updating the World on the Latest Climate Science 7 (2009) [hereinafter Copenhagen Diagnosis] ("Delay in action risks irreversible damage . . . The turning point must come soon."); Intergovernmental Panel on Climate Change, Climate Change 2007: Synthesis Report 66–67 (2007) [hereinafter IPCC Synthesis Report]. There are some in the scientific community who contest it is already too late to avoid dangerous climate change, and that the world would be better off focusing on adaptation than mitigation. *See* Lee Dye, *It May Be Too Late to Stop Global Warming*, ABC News, Oct. 26, 2012, http://abcnews.go.com/Technology/late-stop-global-warming/story?id=17557814#.UIwkgoXfjxQ ("At present, governments' attempts to limit greenhouse-gas emissions through carbon cap-and-trade schemes and to promote renewable and sustainable energy sources are probably too late to arrest the inevitable trend of global warming.") (quoting Jasper Knight & Stephan Harrison, *The Impacts of Climate Change on Terrestrial Earth Surface Systems*, 3 Nature Climate Change 24, 27 (2012)).

3 *See* discussion *infra* Conflict and Causation: Production and Generation.

4 *See* discussion, *infra* State Energy Policies.

5 *See id.*

6 *See Texas: State Energy Profile Analysis*, Energy Info. Admin., http://www.eia.gov/state/analysis.cfm?sid=tx (last updated Nov. 20, 2014); *Texas: Incentives/Policies for Renewables & Efficiency*, Database of State Incentives for Renewables and Efficiency, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=TX03R&re=0&ee=0 (last updated Oct. 28, 2014).

7 *See* discussion, *infra* Conflict and Causation: Production and Generation.

8 Defined and discussed further, *infra*, Conflict Within States And The Problems of Leakage and Seepage.

9 Lincoln L. Davies, *State Renewable Portfolio Standards: Is There a "Race" and Is It "To the Top"?*, 3 San Diego J. Climate & Energy L. 3, 30–32 (2012);Lesley K. McAllister, *Regional Climate Regulation: From State Competition to State Collaboration*, 1 San Diego J. Climate & Energy L. 81, 86 (2009); Barry G. Rabe, Pew Ctr. Global Climate Change, Race To The Top: The Expanding Role of U.S. State Renewable Portfolio Standards 1 (2006), *available at* http://www.c2es.org/docUploads/RPSReportFinal.pdf.

10 *See, e.g.*, Richard L.Revesz, *Rehabilitating Interstate Competition: Rethinking the "Race to the Bottom" Rationale for Federal Environmental Regulation*, 67 N.Y.U. L. Rev. 1210, 1233–43; Peter P. Swire, *The Race to Laxity and the Race to Undesirability: Explaining Failures in Competition Among Jurisdictions in Environmental Law*, 14 Yale L. &Pol'y Rev. 67, 70 (1996); Kristen H. Engel, *State Environmental Standard Setting: Is There a "Race" and Is It "To the Bottom"?*, 48 Hastings L.J. 271, 274 (1997); Davies, *supra* note 9, at 30–32.

11 *See, e.g.*, Revesz, *supra* note 10, at 1220 (noting "social welfare" defined as traditionally understood by economists); *See* Swire, *supra* note 10, at 97 (noting race-to articles typically assume a "neutral and costless cost/benefit analysis" in analyzing social welfare).

12 *See* Engel, *supra* note 10, at 283.

13 *Id.* at 274 (finding that the term "race-to-the-bottom" refers to "progressive relaxation of state environmental standards, spurred by interstate competition to attract industry, that also occasions a reduction in social welfare below the levels that would exist in the absence of such competition").

14 A two-degree Celsius temperature rise is often cited as the threshold to dangerous, or catastrophic climate change. *See Climate Change Explained*, U.K. Env't Agency, http://www.environment-agency.gov.uk/homeandleisure/climatechange/31802.aspx (last visited Dec. 22, 2014). The world cannot avoid such a temperature rise without drastic cuts in GHG emissions globally, beginning in the very near future. *See also* Intergovernmental Panel on Climate Change, Summary for Policymakers, Climate Change 2007: Impacts, Adaptation and Vulnerability, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf.

15 For a thorough analysis of potential impacts of climate change within the United States, *see generally* U.S. Global Change Research Program, Global Climate Change Impacts in the United States 12 (Thomas R. Karl et al. eds., 2009) [hereinafter U.S. Climate Change Impacts].

16 *See* Davies, *supra* note 9, at 33–36. The general assumption is that every state will begin racing, which consequently would lead to nationwide effects. Nevertheless, as discussed *id*. at 33–36, the effects, both positive and negative, are actually limited to those states that participate in the race.

17 *See generally* Intergovernmental Panel on Climate Change, Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change ch. 3, 237–39 (2007) (noting both global and more localized effects of climate change).

18 *See* U.S. Climate Change Impacts, *supra* note 15, at 107–52 (noting different effects of climate change in different regions of the country).

19 *Id.* at 107–52 (describing the different regional effects of climate change).

20 *See* Davies, *supra* note 9, at 5–6.

21 Rabe, *supra* note 9, at 1–2. For a thorough discussion of RPSs, *see* Davies, *supra* note 9, at 10–23.

22 *RPS Data*, Database of State Incentives for Renewables and Efficiency, http://www.dsireusa.org/rpsdata/index.cfm (last visited Dec. 22, 2014) (click on "DSIRE RPS Data Spreadsheet"); *see also* Davies, *supra* note 9, at 6.

23 Rabe, *supra* note 9, at 1.

24 *Id.* at 7–8.

25 *Greenwashing*, Sourcewatch, http://www.sourcewatch.org/index.php/Greenwashing (last visited Dec. 22, 2014) ("Greenwashing is the unjustified appropriation of environmental virtue by a company, an industry, a government, a politician or even a non-government organization to create a pro-environmental image, sell a product or a policy, or to try and rehabilitate their standing with the public and decision makers after being embroiled in controversy.").

26 *Ohio Alternative Energy Portfolio Standards*, Database of State Incentives for Renewables and Efficiency, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=OH14R&re=1&ee=1 (last visited July 24, 2014). Alternative energy sources include both renewable and "advanced energy" resources. *Id.* The statute only requires the qualified utilities to provide 12.5% of the energy supply from renewable energy sources, with the other 12.5% allotted to advanced energy resources. *Id.* Advanced energy resources include clean coal, generation III nuclear power, and efficiency, among other things. *Id.*

27 State energy policies certainly have other components that may help protect against the negative environmental and health consequences of energy generation. For instance, many states have energy efficiency standards apart from RPSs. Additionally, many states must consider environmental impacts before granting siting approval for new power plants and transmissions lines.

28 It is unlikely that Ohio's energy demand will increase enough to make that hypothetical a reality. *See* Public Utilities Commission of Ohio, Ohio Long Term Forecast of Energy Requirements 2011-2030 29 (2012), *available at* http://www.puco.ohio.gov/emplibrary/files/util/UtilitiesDeptReports/OhioLTFEnergyReq2011-2030.pdf (predicting an Ohio energy demand increase of approximately 10% by 2025). Nevertheless, the rising demand will ensure that, all other factors remaining the same, emissions from Ohio in-state energy generation are not monumentally lower than today.

29 *See* Jim Rossi, *The Limits of National Renewable Portfolio Standard*, 42 Conn. L. Rev. 1425, 1437 (2010) (noting that the cost of coal "may lead to substitution away from more expensive forms of producing electric power and toward the . . . least expensive options").

30 Ohio Rev. Code Ann. § 4928.64(A)(2) (West 2012).

31 *Id.* § 4928.64.

32 *See, e.g.*, Brent J. Hartman, *Defining "Biomass": An Examination of State Renewable Energy Standards*, 19 Tex. Wesleyan L. Rev. 1, 8–15 (2012) (discussing the varied definitions of biomass in state RPSs). *See also* Benjamin K. Sovacool & Christopher Cooper, *The Hidden Costs of State Renewable Portfolio Standards (RPS)*, 15 Buff. Envtl. L.J. 1, 11-13 (2007) (noting different definitions of "renewable" in state RPSs).

33 *See Renewable Portfolio Standard*, Hydropower Reform Coalition, http://www.hydroreform.org/policy/rps (last visited Dec. 22, 2014).

34 *See* Sovacool & Cooper, *supra* note 32, at 10–14.

35 Ohio Rev. Code Ann. §§ 4928.64 et seq. (West 2012).

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36 For regulations relating to oil and gas production, *see* Ohio Rev. Code Ann. §§ 1509.01–99 (West 2012). For regulations relating to coal production, *see* Ohio Rev. Code Ann. §§ 1513.01–99 (West 2012).

37 *See* Ohio Rev. Code Ann. §§ 1509.01–99, 1513.01–99 (West 2012).

38 *See id.*

39 This analysis has not even considered state regulation of energy efficiency and transportation, which may or may not be found in the same places as renewable portfolio standards or energy production standards. In sum, most state energy policies are chaotic and fragmented, at best.

40 Rabe, *supra* note 9, at 7 ("More recent RPS enactment has tended toward more ambitious levels, consistently in double-digits and as high as 33 percent by 2020 in California and 25 percent by 2013 in New York.")

41 *See* McAllister, *supra* note 9, at 86–87 (discussing various state initiatives to lower greenhouse gas emissions); *see generally* Arnold W. Reitze Jr. & Marie Bradshaw Durrant, *State and Regional Control of Geological Carbon Sequestration (Part I)*, 41 Envtl. L. Rep. News & Analysis 10348 (2011) (discussing state and regional carbon capture and storage initiatives).

42 *See Most States Have Renewable Portfolio Standards*, U.S. Energy Info. Admin. (Feb. 3, 2012), http://www.eia.gov/todayinenergy/detail.cfm?id=4850.

43 Uma Outka, *The Renewable Energy Footprint*, 30 Stan. Envtl. L.J. 241, 248 (2011).

44 Fla. Stat. Ann. § 377.809(1) (West 2012).

45 *Id.* § 377.30(1). This restriction on the amount of oil and gas produced is, for all intents and purposes, completely irrelevant based on the amount of oil and gas that the state consumes. *Compare Natural Gas Annual Supply and Disposition – Dry Production*, U.S. Energy Info. Admin., http://www.eia.gov/dnav/ng/ng_sum_snd_a_EPG0_VC0_Mmcf_a.htm (last updated Nov. 28, 2014), *with Natural Gas Annual Supply and Disposition – Consumption*, U.S. Energy Info. Admin., http://www.eia.gov/dnav/ng/ng_sum_snd_a_EPG0_VC0_Mmcf_a.htm (last updated Nov. 28, 2014).

46 *See, e.g.*, Energy Efficiency and Sustainable Construction Act of 2008, Ga. Code Ann. § 50-8-18 (2012).

47 *See, e.g.*, *Georgia: Incentives/Policies for Renewables & Efficiency*, Database of State Incentives for Renewables and Efficiency, http://www.dsireusa.org/incentives/index.cfm?re=0&ee=0&spv=0&st=0&srp=1&state=GA (last visited Dec. 22, 2014).

48 *See Photovoltaic Solar Resource of the United States Map*, Nat'l Renewable Energy Lab., http://www.nrel.gov/gis/images/eere_pv/national_photovoltaic_2012-01.jpg (last visited Dec. 22, 2014).

49 The Fla. Oceans and Coastal Council, Climate Change and Sea Level Rise in Florida: An Update on the Effects of Climate Change on Florida's Ocean and Coastal Resources 1 (2010), *available at* http://www.floridaoceanscouncil.org/reports/Climate_Change_and_Sea_Level_Rise.pdf.

50 *See generally id.* at 49.

51 *Florida*, Inst. for Energy Research, http://www.instituteforenergyresearch.org/states/florida/ (last visited Dec. 22, 2014).

52 *See* Envtl. Protection Agency, State CO2 Emissions from Fossil Fuel Combustion, 1990-2010, *available at* http://www.epa.gov/statelocalclimate/documents/pdf/CO2FFC_2010.pdf (2010). The only states that produce more carbon dioxide from fossil fuel combustion are Texas, California, Ohio, and Pennsylvania. *Id.*

53 *See Wyoming, State Profile and Energy Estimates*, Energy Info. Admin., http://www.eia.gov/beta/state/analysis.cfm?sid=WY (last updated Aug. 21, 2014) (noting that coal-fired power plants account for 8 out of every 9 kilowatt hours of net electricity generation).

54 Federal regulation of air pollution under the Clean Air Act, for instance, may lead to decreased use of coal in the state. Additionally, the Clean Air Act might be used to limit GHG emissions from power plants, beginning with new power plants. *See* Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units, 79 Fed. Reg. 1429 (Jan. 8, 2014) (to be codified at 40 C.F.R. Parts 60, 70, 71, and 98) [hereinafter New EGU Performance Standards].

55 This Article does not explicitly address nuclear energy resources and extraction, though many of the same principles discussed herein apply.

56 Christopher L. Weber & Christopher Clavin, *Life Cycle Carbon Footprint of Shale Gas: Review of Evidence and Implications,* 46 Envtl. Sci. Tech. 5688, 5688 (2012) (noting a forty-eight percent increase in shale gas production between 2006 and 2010).

57 *See* Howarth et al., *Venting and Leaking of Methane from Shale Gas Development: Response to Cathles et al.*, 113 Climatic Change 537, 537 (2012); John D. Podesta &Timothy Wirth, Center for American Progress, Natural Gas: A Bridge Fuel for The 21st Century 1 (2009), *available at* https://www.americanprogress.org/issues/green/report/2009/08/10/6513/natural-gas-a-bridge-fuel-for-the-21st-century/.

58 *See* Cathles et al., *A Commentary on "The Greenhouse-gas Footprint of Natural Gas in Shale Formations" by R.W. Howarth, R. Santoro, and Anthony Ingraffea*, 113 Climatic Change 525, 526 (2012) (noting that natural gas is cleaner than other fuels because it "does not produce detrimental by-products such as sulfur, mercury, ash and particulates and because it provides twice the energy per unit of weight with half the carbon footprint during combustion"). Production of natural gas, however, does create environmental problems, particularly when that gas is derived from fracking. For a thorough discussion of the environmental challenges posed by fracking, *see generally* Hannah Wiseman, *Untested Waters: The Rise of Hydraulic Fracturing in Oil and Gas Production and the Need to Revisit Regulation*, 20 Fordham Envtl. L. Rev. 115, 127–42 (2009).

59 Podesta & Wirth, *supra* note 57, at 1-2.

60 *Id.* at 1.

61 *Compare, e.g.*, Howarth et al., *supra* note 57, at 537 ("[u]sing all available information and the latest climate science, we conclude that for most uses, the GHG footprint of shale gas is greater than that of other fossil fuels on time scales of up to 100 years. When used to generate electricity, the shale-gas footprint is still significantly greater than that of coal at decadal time scales but is less at the century scale."), *with* Cathles et al., *supra* note 58, at 525 ("shale gas has a GHG footprint that is half and perhaps a third that of coal."). While both of the articles focus primarily on shale gas, they include analyses of conventional natural gas as well. *See* Howarth, *supra* note 57, at 538-40; Cathles, *supra* note 58, at 526. A 2012 study concludes that shale gas produces life-cycle emissions that are six percent lower than traditional natural gas, twenty-three percent lower than gasoline, and thirty-three percent lower than coal. *See* Andrew Burnham et al., *Life-Cycle Greenhouse Gas Emissions of Shale Gas, Natural Gas, Coal, and Petroleum*, 46 Envtl. Sci. Tech. 619, 619 (2011).

62 Cathles, *supra* note 58, at 526.

63 Ramon A. Alvarez et al., *Greater Focus Needed on Methane Leakage from Natural Gas Infrastructure*, 109 Proc. of the Nat'l Acad. of Scis. 6435, 6435 ("CH4 leakage from the production, transportation and use of natural gas can offset benefits from fuel-switching."). For more on fracking-related methane leakage, *see* Adam R. Brandt et al., *Methane Leaks from North American Natural Gas Systems*, 343 Scis. 733, 733 (2014); David T. Allen et al., *Measurements of Methane Emissions at Natural Gas Production Sites in the United States*, 110 Proc. of the Nat'l Acad. of Sci. 17768 (2013).

64 *See* discussion, *infra*, accompanying notes 67–73.

65 *See* Tom M. L. Wigley, *Coal to Gas: The Influence of Methane Leakage*, 108 Climatic Change 601, 601 (2011) (noting that methane leakage, changes to radiative forcing from aerosols and sulfur dioxide, and "differences in the efficiency of electricity production between coal- and gas-fired power generation . . . more than offset the reduction in warming due to reduced CO2 emissions"). Sulfur dioxide, through production of sulfate aerosols, can lead to a cooling of the atmosphere. *See* Tom M. L. Wigley, *Could Reducing Fossil-Fuel Emissions Cause Global Warming?*, 349 Nature 503, 503 (1991).

66 *See* Thomas Friedman, Op-Ed, *Get It Right On Gas*, N.Y. Times, Aug. 4, 2012, http://www.nytimes.com/2012/08/05/opinion/sunday/friedman-get-it-right-on-gas.html ("[a] sustained gas glut could undermine new investments in wind, solar, nuclear and energy efficiency systems — which have zero emissions — and thus keep us addicted to fossil fuels for decades.").

67 Fiona Harvey, *Natural Gas Is No Climate Change "Panacea," Warns IEA*, The Guardian, June 6, 2011, http://www.guardian.co.uk/environment/2011/jun/06/natural-gas-climate-change-no-panacea (quoting Nobuo Tanaka, the executive director of the International Energy Agency, as saying natural gas "could muscle out low-carbon fuels such as renewables and nuclear").

68 *See* Int'l Energy Agency, Are We Entering a Golden Age of Gas 8–9 (2011), *available at* http://www.worldenergyoutlook.org/media/weowebsite/2011/WEO2011_GoldenAgeofGasReport.pdf.

69 *See id.*

70 Harvey, *supra* note 67.

71 *See U.S. Natural Gas Gross Withdrawals*, U.S. Energy Info. Admin., http://www.eia.gov/dnav/ng/hist/n9010us2A.htm (last visited Dec. 22, 2014).
72 *See* Michael Krancer & Patrick Hendersen, *Superstar of Natural Gas: With the Marcellus Shale, Pa. is Becoming a Responsible Energy Capital*, Pittsburgh Post Gazette, Oct. 29, 2012, http://www.post-gazette.com/opinion/Op-Ed/2012/10/29/Superstar-of-natural-gas-With-the-Marcellus-Shale-Pa-is-becoming-a-responsible-energy-capital/stories/201210290227 (noting that "[p]roduction from Marcellus wells is exceeding expectations").
73 *Technology Drives Natural Gas Production Growth from Shale Gas Formations*, Energy Info. Admin. (July 12, 2011), http://www.eia.gov/todayinenergy/detail.cfm?id=2170.
74 *See* U.S. Energy Info. Admin., AEO 2013 Overview 1 (2012), *available at* http://www.eia.gov/forecasts/aeo/er/pdf/0383er(2013).pdf [hereinafter AEO 2013 Overview] (noting that low natural gas prices will lead to increased use in both the industrial and energy sectors).
75 Unless otherwise noted, all references to coal include anthracite, bituminous, subbituminous, lignite, and any other form of coal that may be used to produce energy. Additionally, unless otherwise noted, coal will refer to coal that is "clean."
76 *See Coal Overview*, 1949–2011, U.S. Energy Info. Admin. (Sept. 27, 2012), http://www.eia.gov/totalenergy/data/annual/showtext.cfm?t=ptb0701.
77 *See id.*
78 *See Coal Demonstrated Reserve Base, January 1, 2011*, U.S. Energy Info. Admin. (Sept. 27, 2012), http://www.eia.gov/totalenergy/data/annual/showtext.cfm?t=ptb0408.
79 *See* U.S. Energy Info. Admin., Recoverable Coal Reserves and Average Recovery Percentage At Producing Mines By State, 2010, 2009 (2012), *available at* http://www.eia.gov/coal/annual/pdf/table14.pdf (last visited Dec. 22, 2014) [hereinafter Coal Reserves].
80 *See International Energy Statistics*, U.S. Energy Info. Admin., http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=1&pid=1&aid=2 (last visited Dec. 22, 2014) (showing global coal consumption increased by over one billion short tons between 2007 and 2011); Richard K. Morse, *Cleaning Up Coal: From Climate Culprit to Solution*, 91 Foreign Aff. 102, 102 (2012) (noting "China and India alone will drive 75 percent of the growth in coal demand before 2035").
81 *See* Lisa Friedman, *India Has Big Plans for Burning Coal*, Sci. Am. (Sept. 17, 2012), http://www.scientificamerican.com/article.cfm?id=india-has-big-plans-for-burning-coal (finding that India and China are poised to add approximately 550 new coal burning power plants).
82 *See International Energy Statistics*, *supra* note 80 (showing international emissions from coal consumption increased by over two billion metric tons between 2006 and 2010).
83 *See id.*
84 Coal Reserves, *supra* note 79.
85 *See* Appalachian Regional Commission, National and State Energy Policy Trends 18 (2006), *available at* http://www.arc.gov/assets/research_reports/SummaryofNationalandStateEnergyPolicyTrends.pdf (noting Alabama and Virginia have production tax incentives for coal); Wyo. Stat. Ann. § 39-14-105 (West 2012) (tax exemption for coal used in production of coal prior to sale).
86 *See* AEO 2013 Overview, *supra* note 74, at 5, 8–9.
87 *Id.* at 8–9, 11.
88 As noted, *supra*, the EPA has proposed regulations for new power plants that would limit coal-fired power plants to 1,100 pounds of carbon dioxide per megawatt hour. *See* New EGU Performance Standards, *supra* note 54, at 1433. Clearly, these proposed regulations would increase the post-extraction cost of coal, and would likely limit the construction of new coal-fired power plants domestically. But, the regulations do not necessarily affect the cost of coal extracted for international export.
89 *See U.S. Energy-Related CO2 Emissions in Early 2012 Lowest Since 1992*, U.S. Energy Info. Admin. (Aug. 1, 2012), http://www.eia.gov/todayinenergy/detail.cfm?id=7350(noting that coal "has the highest carbon intensity among major fossil fuels, resulting in coal-fired plants having the highest output rate of CO2 per kilowatthour").
90 *See* discussion, *supra* Exploitation of Energy Resources.
91 *See* Rossi, *supra* note 29, at 1438; *see also* Andrew Burnham et al., *supra* note 61, at 623 (noting in Figure 2 the emissions from each stage of the life-cycle of fossil fuels); Cathles et al., *supra* note 58, at 526.
92 James B. Meigs, *The Myth of Clean Coal*, Popular Mechanics (July 14, 2011), http://www.popularmechanics.com/science/energy/coal-oil-gas/4339171.
93 *Id.*
94 Xiaoye Liang et al., *Up-to-date Life Cycle Assessment and Comparison Study of Clean Coal Power Generation Technologies in China*, 39 J. of Cleaner Production 24, 30–31 (2012).
95 Morse, *supra* note 80, at 110 (noting the cost of carbon capture and storage is now "roughly $50 to $100 for every ton of carbon dioxide stored").
96 Jim Landers, *Will the U.S. Lead the World in Oil Production*, Dallas Morning News, Oct. 31, 2012, http://www.dallasnews.com/business/columnists/jim-landers/20121030-will-the-u.s.-lead-the-world-in-oil-production.ece.
97 Grant Smith, *U.S. to be Top Oil Producer by 2015 on Shale, IEA Says*, Bloomberg (Nov. 12, 2013), http://www.bloomberg.com/news/2013-11-12/u-s-nears-energy-independence-by-2035-on-shale-boom-iea-says.html. The United States Energy Information Administration reports that the United States may have surpassed Russia as the leading producer of both petroleum and natural gas in 2013. *Today in Energy*, Energy Info. Admin. (Oct. 4, 2013), http://www.eia.gov/todayinenergy/detail.cfm?id=13251.
98 *See* Benoit Faucon et al., *U.S. Oil Boom Divides OPEC*, Yahoo Finance (May 28, 2013, 7:45 AM), http://finance.yahoo.com/news/u-oil-boom-divides-opec-114544799.html.
99 *See Market Implications of Increased Domestic Production of Light Sweet Crude Oil*, Energy Info. Admin. (Nov. 28, 2012), http://www.eia.gov/oog/info/twip/twip.asp.
100 *See Crude Oil Production–Annual*, Energy Info. Admin., http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm (last visited Dec. 22, 2014). Federal offshore production trails only Texas. *Id.*
101 *See id.* Texas crude oil production increased by over 330,000,000 barrels per year from 2006 to 2012. *Texas Field Production of Crude Oil*, Energy Info. Admin., http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRFPTX1&f=A (click on Download Data (XLS File)) (last visited Dec. 22, 2014). North Dakota production increased by over 200,000,000 barrels per year over the same period. *North Dakota Field Production of Crude Oil*, Energy Info. Admin., http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRFPND1&f=A (click on Download Data (XLS File)) (last visited Dec. 22, 2014).
102 *Id.*
103 *North Dakota Crude Oil Production Continues to Rise*, Energy Info. Admin. (Aug. 15, 2012), http://www.eia.gov/todayinenergy/detail.cfm?id=7550.
104 *Crude Oil Production – Annual*, *supra* note 100.
105 *See* Burnham et al., *supra* note 61, at 622–24.
106 *Sources of Greenhouse Gas Emissions*, Envtl. Protection Agency, http://www.epa.gov/climatechange/ghgemissions/sources.html (last visited Dec. 22, 2014).
107 *See* Burnham et al., *supra* note 61, at 622–24.
108 *See Chapter 15: Solar Energy*, The Energy Story, http://www.energyquest.ca.gov/story/chapter15.html (last visited Dec. 22, 2014) (noting that all energy on earth derives originally from the sun or other stars).
109 Intergovernmental Panel on Climate Change, Renewable Energy Sources and Climate Change Mitigation: Special Report 8 (2012) [hereinafter IPCC Special Report], *available at* http://srren.ipcc-wg3.de/report. Passive solar refers to the use of the sun to heat or cool without conversion into electricity. *See Passive Solar Home Design*, Dep't of Energy (June 24, 2013, 7:18 PM), http://energy.gov/energysaver/articles/passive-solar-home-design. For purposes of this Article, I will focus on solar photovoltaic and solar thermal energy.
110 *See Photovoltaic Solar Resource of the United States Map*, *supra* note 48; *Concentrating Solar Resource of the United States*, Nat'l Renewable Energy Lab., http://www.nrel.gov/gis/images/eere_csp/national_concentrating_solar_2012-01.jpg (last visited Dec. 22, 2014).
111 *See Ivanpah*, Bright Source Energy, http://www.brightsourceenergy.com/ivanpah-solar-project (last visited Dec. 22, 2014). Invanpah began generating power in February 2014. Michael R. Blood & Brian Skoloff, *Huge Invanpah Solar Power Plant, Owned by Google and Oakland Company, Opens as Industry Booms*, San Jose Mercury News, Feb. 13, 2014, http://www.mercurynews.com/business/ci_25134528/huge-ivanpah-solar-power-plant-opens-industry-booms.
112 *See DOE Closes on Four Major Solar Projects*, Renewable Energy World (Sept. 30, 2011), http://www.renewableenergyworld.com/rea/news/article/2011/09/doe-closes-on-three-major-solar-projects?cmpid=SolarNL-Tuesday-October4-2011. Desert Sunlight is expected to begin producing electricity in February 2014. *More Enormous Solar Plants Come Online in California*, SustainableBusiness.com (Feb. 4, 2014), https://www.sustainablebusiness.com/index.cfm/go/news.display/id/25494.

[113] For a thorough discussion of community-level solar power, *see generally* Nat'l Renewable Energy Lab., U.S. Dep't of Energy, A Guide to Community Shared Solar: Utility, Private, and Non-Profit Project Development (2012), *available at* www.nrel.gov/docs/fy12osti/54570.pdf.

[114] *See* Michael Mendelsohn, *Where Did All the Solar Go: Calculating Total U.S. Solar Energy Production*, Nat'l Renewable Energy Lab. (June 11, 2012, 8:00 AM), https://financere.nrel.gov/finance/content/calculating-total-us-solar-energy-production-behind-the-meter-utility-scale

[115] *See* Carol Gulyas, *Top Ten States for Solar Power*, Clean Technica (Mar. 16, 2008), http://cleantechnica.com/2008/03/16/top-ten-states-for-solar-power/.

[116] *Id.*

[117] *See* Matt Croucher, *Top States for Solar Power: Best 11 for Solar Energy Deployment According to OSDI*, Huffington Post, May 25, 2011, http://www.huffingtonpost.com/2010/12/02/solar-deployment-top-10-s_n_789886.html#s194385&title=1.
(discussing the Optimal Deployment of Solar Index developed by Matt Croucher at Arizona State University).

[118] *See* Galen Barbos et al., Lawrence Berkley Nat'l Lab., U.S. Dep't of Energy, Tracking the Sun V: An Historical Summary of the Installed Price of Photovoltaics in the United States from 1998 to 2011, 12 (2012), *available at* http://emp.lbl.gov/publications/tracking-sun-v-historical-summary-installed-price-photovoltaics-united-states-1998-2011.

[119] *Id.* at 1–2.

[120] *Id.* at 2 (showing, for example, an installed cost of $4.9 per watt in New Hampshire compared to $7.6 per watt in Washington D.C.).

[121] *See* Brian Wingfield, *GE Sees Solar Cheaper Than Fossil Power in Five Years*, Bloomberg (May 26, 2011), http://www.bloomberg.com/news/2011-05-26/solar-may-be-cheaper-than-fossil-power-in-five-years-ge-says.html. In comparing costs, it should be noted that the negative externalities from fossil fuel energy generation are generally not considered.

[122] *See* Garvin A. Heath & John J. Burkhardt III, Nat'l Renewable Energy Lab., Meta-Analysis Estimates of Life Cycle Greenhouse Gas Emissions from Concentrating Solar Power 7 (2011), *available at* http://www.nrel.gov/docs/fy11osti/52191.pdf; Hyung Chul Kim et al., *Life Cycle Greenhouse Gas Emissions of Thin-Film Photovoltaic Electricity Generation: Systematic Review and Harmonization*, 16 J. of Indus. Ecology S110, S119 (2012). The sources here demonstrate the life cycle GHG emissions from CSP and PV. For a comparison to coal life cycle GHGs, *see* Stacey L. Dolan & Garvin A. Heath, *Life Cycle Greenhouse Gas Emissions of Utility-Scale Wind Power: Systematic Review and Harmonization*, 16 J. of Indus. Ecology S136, S145 (2012) (discussing final coal GHG estimates).

[123] *See* U.S. Energy Info. Admin. AEO2013 Early Release Overview 8–9 (2013), *available at* http://www.eia.gov/forecasts/aeo/er/pdf/0383er%282013%29.pdf (noting solar PV will account for only 17% of energy produced from renewables, which collectively will only account for 11% of total domestic energy, by 2040). *But see* John Farrell, Inst. for Local Self-Reliance, Commercial Rooftop Revolution 19 (2012), *available at* http://www.ilsr.org/wp-content/uploads/2012/12/commercial-solar-grid-parity-report-ILSR-2012.pdf (noting that "rooftop" solar has the potential to power 10% of the United States' energy needs by 2012).

[124] *See Net Generation from Renewable Sources: Total (All Sectors), 2003-November 2013*, Energy Info. Admin., http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_1_1_a (last updated Nov. 25, 2014) (showing wind produces more electricity than any renewable energy source other than hydroelectric).

[125] *See Utility-Scale Land-Based 80-Meter Wind Maps*, Wind Powering America, http://www.windpoweringamerica.gov/wind_maps.asp (last visited Dec. 22, 2014); *Offshore 90-Meter Wind Maps and Wind Resource Potential*, Wind Powering America, http://www.windpoweringamerica.gov/windmaps/offshore.asp (last visited Dec. 22, 2014).

[126] *See Net Generation from Renewable Sources: Total (All Sectors), 2003-November 2013*, *supra* note 124 (showing dramatic growth in electricity generation from wind).

[127] *See* U.S. Energy Info. Admin, *supra* note 123, at 9.

[128] *See Installed Wind Capacity*, Wind Powering America, http://www.windpoweringamerica.gov/wind_installed_capacity.asp (last visited Dec. 22, 2014). Illinois's ascension as a leading wind producer has been quite dramatic, as the state went from no wind capacity in 2002, to being one of the top producers of wind power in 2012. *See id.* (view the animated map).

[129] Diane Cardwell, *Tax Credit in Doubt, Wind Power Industry is Withering*, N.Y. Times, Sep. 20, 2012, http://www.nytimes.com/2012/09/21/business/energy-environment/as-a-tax-credit-wanes-jobs-vanish-in-wind-power-industry.html?pagewanted=all&_r=0. A similar solar tax credit is set to expire at the end of 2016. *See* Richard W. Caperton, *Small Tweaks to the Tax Code Can Mean Big Improvements In Renewable Energy Development*, Think Progress (Dec. 14, 2012), http://thinkprogress.org/climate/2012/12/14/1334061/small-tweaks-to-the-tax-code-can-mean-big-improvements-in-renewable-energy-deployment/.

[130] *Id.*

[131] *See* Dolan & Heath, *supra* note 122, at S145 (noting wind energy produces 1.2 to 7.9% of the lifecycle greenhouse gas emissions as coal).

[132] *See How Much of Our Electricity is Generated from Renewable Energy?*, Energy Info. Admin., http://www.eia.gov/energy_in_brief/article/renewable_electricity.cfm (last updated Apr. 14, 2014). Wind accounts for approximately 28% of renewable energy, while solar only provides less than one percent. *Id.*

[133] *Id.*

[134] *See Renewable & Alternative Fuels*, Energy Info. Admin., http://www.eia.gov/renewable/data.cfm#hydro (last visited Dec. 22, 2014).

[135] *Hydropower Results: Life Cycle Assessment Review*, Nat'l Renewable Energy Lab., http://www.nrel.gov/analysis/sustain_lca_hydro.html (last visited Dec. 22, 2014). Total life cycle greenhouse gas emissions from hydropower may be greater than estimated due to net emissions from land use changes. *See id.*

[136] *See Hydropower*, National Geographic, http://environment.nationalgeographic.com/environment/global-warming/hydropower-profile/ (last visited Dec. 23, 2014).

[137] *Id.*

[138] *See U.S. Hydropower Potential From Existing Non-Powered Dams*, Dep't of Energy, http://energy.gov/maps/us-hydropower-potential-existing-non-powered-dams (last visited Dec. 22, 2014).

[139] *See How Much of Our Electricity is Generated from Renewable Energy?*, *supra* note 132.

[140] IPCC Special Report, *supra* note 109, at 216–20.

[141] *Id.* at 257–68.

[142] *Id.* at 18–19.

[143] *See How Much of Our Electricity is Generated from Renewable Energy?*, *supra* note 132.

[144] *See California, State Energy Profile Analysis*, Energy Info. Admin., http://www.eia.gov/beta/state/analysis.cfm?sid=CA (last updated June 19, 2014).

[145] *See U.S. Has Large Geothermal Resources, But Recent Growth is Slower Than Wind Or Solar*, Energy Info. Admin. (Nov. 18, 2011), http://www.eia.gov/todayinenergy/detail.cfm?id=3970.

[146] *See* Martin Pehnt, *Dynamic Life Cycle Assessment (LCA) of Renewable Energy Technologies*, 31 Renewable Energy 55, 59 (2005).

[147] *See U.S. Has Large Geothermal Resources, But Recent Growth is Slower Than Wind Or Solar*, *supra* note 145.

[148] *See Regulators Approve First Commercial Hydrokinetic Projects in the United States*, Energy Info. Admin. (Oct. 2, 2012), http://www.eia.gov/todayinenergy/detail.cfm?id=8210&src=email (noting that "[h]ydrokinetic energy is still in its infancy in the United States").

[149] *Id.*

[150] In a forthcoming companion article, I will discuss the practical and constitutional implications of and impediments to implementing a national RPL. Those implications will no doubt cause many readers to wince. Yet it seems short sighted, at best, to discount the possibility of "upstream" regulations that limit the extraction of fossil fuels from the ground simply because it is an uncomfortable remedy.

[151] California, for example, is a leading producer of oil, hydroelectric power, solar power, and wind power, yet still imports more electricity than any other state. *See California, State Energy Profile Analysis*, *supra* note 144.

[152] *See Oregon Renewable Portfolio Standard*, Database of State Incentives for Renewables and Efficiency, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=OR22R&re=0&ee=0 (last updated Aug. 25, 2015).

[153] *See Top Ten States for Solar Power*, *supra* note 115..

[154] *See Oregon: State Profile and Energy Estimates*, Energy Info. Admin., http://www.eia.gov/beta/state/?sid=OR#tabs-4 (last visited Dec. 22, 2014) (showing hydroelectric power accounts for over 58% of Oregon electricity generation).

[155] *See* Ted Sickinger, *Wind Power Surpasses Hydro for the First Time Ever in Northwest Region*, The Oregonian, Oct. 23, 2012, http://www.oregonlive.com/environment/index.ssf/2012/10/wind_power_surpasses_hydro_for.html.

[156] *See Oregon: State Profile and Energy Estimates*, *supra* note 155, at Tab 1. There are also other, more complex reasons why in-state consumption of renewable resources is not higher, including transmission issues.
[157] *See id.* (Oregon Net Electricity Generation by Source, Aug. 2012).
[158] *See* Inst. for Energy Research, Oregon Energy Facts 1 (2009), *available at* www.instituteforenergyresearch.org/state-regs/pdf/Oregon.pdf.
[159] *See Wyoming: State Profile and Energy Estimates*, Energy Info. Admin, http://www.eia.gov/beta/state/?sid=WY#tabs-3 (last visited Dec. 22, 2014).
[160] *See Most States Have Renewable Portfolio Standards*, *supra* note 42.
[161] *See Wyoming: State Profile and Energy Estimates*, *supra* note 160.
[162] *Id.*
[163] *See Utility-Scale Land-Based 80-Meter Wind Maps*, *supra* note 125.
[164] *See* Susan Kraemer, *Obama Administration Fast-Tracks 2,500 MW Wind Project in Wyoming*, Clean Technica (Jan 11, 2012), http://cleantechnica.com/2012/01/11/obama-administration-fast-tracks-2500-mw-wind-project-in-wyoming/.
[165] The Wyoming legislature is proposing to make coal mining even cheaper. See Dylan Scott, *Changes to Wyoming Coal Mining Taxes Could Cost State Millions*, Governing (Oct. 24, 2011), http://www.governing.com/news/state/Changes-To-Wyo-Coal-Mining-Taxes-Could-Cost-State-Millions.html.
[166] *See* Irina Zhoroz, *Coal Exports Going Abroad Increasing*, Wyoming Public Media (Dec. 7, 2012), http://www.wyomingpublicmedia.org/post/coal-exports-going-abroad-increasing.
[167] Clearly, the scale of local populations, energy consumption, and resource production will determine the quantitative effects of these state energy policies on net GHG emissions.
[168] Lincoln L. Davies, *Power Forward: The Argument for A National RPS*, 42 Conn. L. Rev. 1339, 1368–69 (2010). *See also* Rossi, *supra* note 29, at 1431; J.R. DeShazo & Jody Freeman, *Timing and Form of Federal Regulation: The Case of Climate Change*, 155 U. Pa. L. Rev. 1499, 1532 (2007)..
[169] Davies, *supra* note 169, at 1368–69.
[170] *Id.* at 1369.
[171] *See* discussion of RPSs, *supra* States with RPSs. Many states have regulations, such as oil allowable rates, which limit production. *See, e.g.*, 16 Tex. Admin. Code § 3.45 (2013). These regulations, however, are intended to efficiently maximize production, prevent waste, or ensure equitable distribution of minerals, not to set a cap on the total amount that can be produced. *See* Tex. Nat. Res. Code Ann. § 85.054 (West 2005). Indeed, these types of regulations are designed to ensure the maximum possible extraction of fossil fuels over decades. On the other hand, New York has implemented a moratorium on production of shale gas through hydraulic fracking. *See* Freeman Klopott, *New York Decision on Fracking Regulations Delayed*, Bloomberg (Jan. 29, 2014), http://www.bloomberg.com/news/2014-01-29/new-york-decision-on-fracking-regulations-delayed.html (noting that Governor Cuomo's administration is unlikely to issue fracking regulations, and thus end the multi-year moratorium, until at least 2015). Similarly, three Colorado cities have banned the use of fracking. *See* Michael Wines, *Colorado Cities' Rejection of Fracking Poses Political Test for Natural Gas Industry*, N.Y. Times, Nov. 7, 2013, http://www.nytimes.com/2013/11/08/us/colorado-cities-rejection-of-fracking-poses-political-test-for-natural-gas-industry.html?_r=0. These moratoriums should not be confused, however, with a policy to prevent the production of gas generally — for example, extraction by other methods — or one that prevents extraction of gas due to future emissions that would result.
[172] *U.S. Coal Exports On Record Pace in 2012, Fueled By Steam Coal Growth*, U.S. Energy Info. Admin. (Oct. 23, 2012), http://www.eia.gov/todayinenergy/detail.cfm?id=8490&src=email#.
[173] *See* William Yardley, *Oregon Town Weighs a Future with An Old Energy Source: Coal*, N.Y. Times, Apr. 18, 2012, http://www.nytimes.com/2012/04/19/us/boardman-ore-considers-a-future-in-coal.html?pagewanted=all&_r=0
[174] *Id.*
[175] While seepage is primarily the result of conflict within an individual state energy policy, it is important that it is not double counted in a national race-to analysis. For example, State X generated 100% of its electricity at coal-fired power plants that ran on coal mined in the state. The state later implemented an aggressive RPS, and within five years, twenty percent of the State X electricity is generated from in-state renewable resources. Because there is no RPL, State X coal exports to State Y increase significantly. The emissions from this State X coal will be counted in State Y's energy policy, and should not also be attributed to State X's energy policy. It is important that emissions not be ignored simply because they leave the state, but equally important that they not be double counted to mask any net gains in emissions reduction. From a national race-to perspective, the seepage of emissions is primarily important when the energy resource leaves the country. The problem of double counting is similarly present with leakage.
[176] Asian demand for coal is expected to increase significantly in the coming years. *See generally* Daniel Cusick and Climate Wire, *Asian Demand Forecasts Boom for Coal*, Scientific Am. (May 14, 2012), http://www.scientificamerican.com/article.cfm?id=asian-demand-forecasts-boom-for-coal.
[177] *See Texas: State Energy Profile Analysis*, *supra* note 6.
[178] *See Texas: Incentives/Policies for Renewables & Efficiency*, *supra* note 6.
[179] *See Texas, State Energy Profile Analysis*, *supra* note 6.
[180] *Id.*
[181] *See* Number and Capacity of Operable Petroleum Refineries by PAD District and State as of January 1, 2013, Energy Info. Admin., *available at* http://www.eia.gov/petroleum/refinerycapacity/table1.pdf.
[182] *See* Jordan Weissman, *Why Texas Is America's Export King*, The Atlantic. Sep. 29, 2012, http://www.theatlantic.com/business/archive/2012/09/why-texas-is-americas-export-king/263021/#.
[183] *Id.*
[184] Matthew Tresaugue, *Texas Leads U.S. in Greenhouse Gas Emissions*, Hous. Chron., Jan. 11, 2012, http://www.chron.com/news/houston-texas/article/Texas-leads-U-S-in-greenhouse-gas-emissions-2476015.php.
[185] *See* U.S. Climate Change Impacts, *supra* note 15, at 57.
[186] *See id.* at 124.
[187] *See id.* at 90 (noting that some parts of Texas may annually experience over 100 days of 100-degree heat by 2100).
[188] *See id.* at 124. For an example of the damage drought can cause to Texas agriculture, *see Texas Agricultural Drought Losses Reach Record $5.2 Billion*, AgriLife Today (Aug. 17, 2011), http://today.agrilife.org/2011/08/17/texas-agricultural-drought-losses-reach-record-5-2-billion/.
[189] *See* Jordan Weissman, *supra* note 183.
[190] *See* Dave Fehling, *Why Texans are Chasing Millions in Oil and Gas Royalties*, NPR State Impact (March 26, 2012, 7:00 AM), http://stateimpact.npr.org/texas/2012/03/26/how-texans-are-chasing-millions-in-oil-gas-royalties/.
[191] *See Crude Oil Production – Annual*, *supra* note 100; *Texas Natural Gas Gross Withdrawals and Production*, Energy Info. Admin., http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_stx_a.htm (last visited Dec. 22, 2012) (select Texas and annual).
[192] A carbon tax, for instance, might limit the production of coal, particularly if the tax is implemented "upstream." But, as long as someone is willing to pay more, a tax cannot guarantee that fossil fuels stay in the ground.