TULANE ENVIRONMENTAL LAW JOURNAL

VOLUME 14 SUMMER 2001 ISSUE 2

Emerging Issues in Energy and the Environment Symposium: Introduction

Cleaning, Greening, and Modernizing the Electric Power Sector in the Twenty-First Century

Howard A. Learner*

* President and Executive Director, Environmental Law and Policy Center, Chicago, Illinois. J.D. 1980, Harvard Law School; B.A. 1976, University of Michigan.

I. CLEAN ENERGY DEVELOPMENT TO REDUCE POLLUTION AND MODERNIZE THE ELECTRIC POWER SECTOR

Our nation needs a smart clean energy development strategy that implements targeted policies and practices to capture readily achievable environmental, public health and economic development benefits. Clean energy development will reduce pollution, improve reliability by diversifying the power supply, create new "green" manufacturing and installation jobs, and provide new renewable wind power and biomass energy "cash crops" for farmers. Seizing these sustainable development opportunities makes both good environmental *and* economic sense.

Modern life runs on electricity to power our homes and businesses. From refrigerators to computers to dairies, we depend on reliable electricity. However, at the dawn of the twenty-first century when rapid technological progress is transforming society, much of the nation, and especially the Midwest, is still saddled with polluting and inefficient old equipment generating the energy to drive the "new economy." This overdependence on aging 1950s to 1970s vintage coal plants and 1960s and 1970s vintage nuclear plants, as well as many utilities' underinvestments in modernizing their deteriorating transmission and distribution

systems, are causing both pollution and power reliability problems. Developing clean energy efficiency and renewable energy resources is the smart and sustainable solution to the nation's pollution problems, to power constraints at peak demand times, and to challenges in meeting our overall electricity needs. Clean energy resources are the modern technologies for the twenty-first century energy future.

Technological advances are creating a new economy in which economic growth provides new jobs and creates greater wealth. This rapid technological progress should also result in modern processes that produce less waste and less pollution. While that is true enough in many industrial sectors, the electricity industry lags behind with its aging coal and nuclear plants. It is time for electric utilities and power generators to make the necessary technological advances to give the public what it wants: clean, reliable, and efficient energy at a fair price. That means adopting strategies to aggressively develop clean energy resources to better diversify our nation's energy services system. We can keep the lights on without polluting our air and water and leaving more radioactive nuclear wastes for future generations to clean up.

Environmentalists can and should be technology "hawks" in seeking solutions to the "old economy" coal and nuclear plant pollution and risk problems. There are abundant opportunities to install cost-effective modern energy efficiency technologies ranging from greatly improved residential and commercial lighting, to new industrial motors, and to new appliances that refrigerate, cool the air, and wash clothes just as effectively while using much less energy.

Energy efficiency is the best, fastest, and cheapest solution to power reliability problems. Best, because it avoids social and economic costs from pollution and once new energy efficiency lighting ballasts, for example, are installed, the savings are durable and reliable. Fastest, because energy efficiency measures can be typically implemented within a year, as compared to the several years or more usually needed to site and build a new central power plant. Cheapest, because robust energy efficiency improvements can be implemented for less than 2.5¢/kWh, as shown by the recent *Repowering the Midwest* study described below, and the Five National Laboratories studies recently commissioned by the United States Department of Energy.

The cost of clean renewable energy is also plummeting as wind, biomass and solar power technologies have improved dramatically. Today's large new wind turbines—each producing more than one megawatt of power—are far ahead of even mid-1990s wind equipment in terms of both production efficiencies and cost curves. These high-tech

wind machines are far from the old windmills used for water pumping and other farm activities in rural areas.

Technological advancements in clean small generators—mostly fired by natural gas—and fuel cells may fundamentally change the way electricity services are delivered. Fifteen years ago, few people would have imagined the widespread use and availability of palm-size cell phones, hand-held computing devices and high-power laptop computers that easily slide into a conventional briefcase. Telecommunications services are much less reliant on conventional wires and poles than a decade ago. Today's small laptop computers pack more power than old room-sized mainframe computers that were being built years after many of the coal plants that are still dominating our electricity system today. Many energy analysts believe that businesses and homes will increasingly be powered by distributed on-site small generators and fuel cells; indeed, some early adapters and businesses, such as banks, data processing centers, and medical facilities, that need uninterruptible power supply are already beginning to move in that direction.

Energy policy is at a crossroads in the United States. The movement toward federal electric industry deregulation legislation appears less certain and possibly stalled by the recent California electricity system crisis that follows price spikes in several regions and the summer 1999 meltdown of Commonwealth Edison's distribution system in downtown Chicago and other areas. Electricity deregulation legislation has been enacted in about half of the states, but the other states are largely retaining or tweaking the traditional regulatory system. Mounting scientific evidence on public health and environmental harms from coal plant emissions—NO_X, SO_2, particulates and mercury—is increasing regulatory and public pressure to reduce air pollution. The scientific consensus on the existence of global warming is likewise exerting pressure for precautionary, at least, reductions in CO_2 emissions from coal plants.

This Article on clean energy development policies and the additional articles in this Symposium Issue of the *Tulane Environmental Law Journal* address different energy strategies, but all share the common goal of seeking to reduce pollution by modernizing the electric power sector. Their unifying theme is how can the public achieve cleaner and more reliable electricity services that minimize unacceptable environmental quality and public health harms.

II. INTRODUCTION TO THE ARTICLES OF THE SYMPOSIUM

A. The Future of Wind Energy

Christine Real de Azua's essay *The Future of Wind Energy* describes the rapid technological development and deployment of wind power. As the Communications Coordinator and International Policy Analyst for the American Wind Energy Association, she contends that investments in wind power in areas with significant wind resources can help prevent future shortages of electricity without additional long-term cost, pollution, or delay. The essay advocates a realignment of energy policy priorities from the current overwhelming support of conventional power plant technologies to favor, instead, the development of cleaner and more reliable wind power technologies that are supported by the public.

This policy shift is advocated not only for the pollution reduction benefits from wind power, but also for rural economic development opportunities. Wind energy is truly a "cash crop" for farmers with typical annual lease payments for windy sites in the Midwest now in the range of $2000 to $3000 per turbine. This essay identifies the leaps in wind power technology that can lead to large-scale production of clean megawatts over the next decade.

B. Reducing Emissions from the Electricity Generation Industry: Can We Finally Do It?

George Washington University Law School Associate Professor Shi-Ling Hsu focuses both on reducing pollution from coal plants and spurring renewable energy development in *Reducing Emissions from the Electricity Generation Industry: Can We Finally Do It?* Professor Hsu proposes that implementation of a CO_2 emissions cap-and-trade program be combined with two federal tax credits—a twenty-year production tax credit for renewable energy facilities placed into service by 2012, and a five-year partial investment tax credit for the construction of natural gas plants and renewable energy plants that replace retired old coal plants. After describing the extent of air pollution from coal plants and the perceived effectiveness of the cap-and-trade program for reducing SO_2 emissions, the article explains the difficulty of extending this approach to CO_2 and other pollutants because of the electricity generation industry's political opposition.

Professor Hsu recommends the public subsidies as necessary "sugar pills" to induce the retirement of high-polluting old coal plants and to stimulate the development of clean wind, solar, geothermal and biomass

energy technologies, as well as relatively cleaner new natural gas plants. Both the cap-and-trade program and public subsidies are viewed to be infeasible, standing alone, to achieve cleaner energy production. However, the article argues that combining these two policy instruments could remedy the critical flaws in the individual programs and achieve important pollution reductions in the electricity sector.

C. Nuclear Power in Deregulated Markets: Performance to Date and Prospects for the Future

Robert D. MacDougall and Neil J. Numark contend that nuclear power is becoming more economically competitive in *Nuclear Power in Deregulated Markets: Performance to Date and Prospects for the Future*. The essay describes a combination of factors that have led to recently improved nuclear operating performances including the industry's consolidation in response to state deregulation legislation, favorable "stranded cost" treatment for nuclear plants, and the United States Nuclear Regulatory Commission's increased regulatory flexibility.

The authors argue that better operating performances and current power market constraints support the construction of a new generation of nuclear plants that should be part of the energy future. It is unclear, however, what the type and size of those nuclear plants will be: large-scale advanced light water reactors or smaller, modularized gas-cooled plants that can follow load. The essay is optimistic about the likelihood of new nuclear plants, but recognizes that the keys to their competitiveness will be significant reductions in capital costs and construction times compared to current designs, the absence of major safety problems, tangible progress on nuclear waste disposal including movement of spent nuclear fuel rods away from plants, and continued high or volatile natural gas prices.

D. How Environmental Laws Work: An Analysis of the Utility Sector's Response to Regulation of Nitrogen Oxides and Sulfur Dioxide Under the Clean Air Act

Byron Swift, a Senior Attorney at the Environmental Law Institute, examines the actual performance of environmental regulations and the compliance behavior of electric utilities with the NO_X and SO_2 regulatory standards of the Clean Air Act in his article *How Environmental Laws Work: An Analysis of the Utility Sector's Response to Regulation of Nitrogen Oxides and Sulfur Dioxide Under the Clean Air Act*. The selected 1995 to 1999 time period enables the comparison of two contrasting regulatory approaches to limit coal plant pollution: an

emissions cap-and-trade program for SO_2 and the technology-based emission rate standard to control NO_X pollution.

The study concludes that both the Title IV SO_2 and NO_X standards were too lenient, and that the costs to businesses of reducing pollution are far below the social health and welfare benefits of additional reductions. Accordingly, Swift calls for legislative or regulatory action to lower permissible SO_2 and NO_X levels in order to modernize fossil-fuel generating plants. The article then turns to how best to achieve the pollution reductions and finds dramatic differences in the effectiveness of the regulatory programs for SO_2 (cap-and-trade) and NO_X (technology-forcing). Swift argues that the cap-and-trade approach encourages innovation and creates a continuous driver for pollution reduction. The article recommends moving toward more cap-and-trade programs in order to better align economic and regulatory drivers toward a cleaner environment.

* * *

The remainder of this Introduction is devoted to presenting an aggressive clean energy development strategy for the Midwest that can serve as a national model for reducing pollution through implementing modern new technologies for a more diversified energy portfolio. *Repowering the Midwest—The Clean Energy Development Plan for the Heartland* was produced by the Environmental Law and Policy Center, a public interest environmental advocacy and economic development organization, a Steering Committee of eight environmental organizations, and a team of technical consultants.[1] It is a blueprint for producing economically robust and environmentally sound electricity in the twenty-first century by comparing two possible energy futures for the Midwest—one in which we continue to rely on conventional, or "business-as-usual,"

---

1. Mr. Learner recognizes the active participation of the following colleagues and technical consultants who worked together to produce *Repowering the Midwest—The Clean Energy Development Plan for the Heartland*, which is summarized in this Introduction: Bruce Biewald, Molly Olver, David White, and Tim Woolf of Synapse Energy Economics, who served as the lead technical consultant on the comprehensive study; Una McGeough, along with Hans Detweiler, Peter Morman, and Dan Rosenblum, of the Environmental Law and Policy Center, which led the Project Steering Committee and guided the policy recommendations; Michael Brower of Brower & Associates, Dr. Adam Serchuck and Virinder Singh of the Renewable Energy Policy Project, and Dr. Steven Bernow of the Tellus Institute, all of whom provided focused technical consulting on the study; and the members of the Project Steering Committee, including Bill Grant of the Izaak Walton League of America, Howard Learner and Una McGeough of the Environmental Law & Policy Center, Michael Mullett and Chris Williams of Citizens Action Coalition of Indiana, Michael Noble and Matt Schuerger of Minnesotans for an Energy Efficient Economy, Alan Nogee of the Union of Concerned Scientists, Mark Trechock of the Dakota Resource Center, Michael Vickerman of RENEW Wisconsin, and Ed Woolsey of Iowa RENEW. Steve Clemmer of the Union of Concerned Scientists and William Leighty of the Leighty Foundation also provided helpful comments.

technologies, and a second in which the Midwest unleashes its homegrown clean energy development potential.

III. REPOWERING THE MIDWEST—THE CLEAN ENERGY DEVELOPMENT PLAN FOR THE HEARTLAND

Repowering the Midwest is a clean energy development plan that quantifies the region's untapped energy efficiency and renewable resources and lays out strategies, policies and practices to advance a cleaner electricity future from the industrial Midwest across to the Great Plains. These clean power options are technologically and commercially available today, and they can be obtained with only a modest increase in total electricity costs that is far offset by the environmental and public health improvements and the economic and employment growth for the region. The Midwest is poised to capitalize on clean energy development opportunities.

When it comes to wind power, the flat lands of the Midwest are valuable assets. Wind power is the world's fastest growing energy source, expanding by about 35% in 1998. Tremendous design improvements in wind turbines have led to a huge drop in the per-kilowatt price of installed capacity—less than one-third of the 1981 price and now close to competitive with conventional power sources.

Six of the ten states with the highest wind power potential are in the Midwest, according to the American Wind Energy Association.[2] Iowa and Minnesota are leading the way with more than 500 megawatts of wind power (equivalent to the size of a typical coal plant) coming online since 1998. That includes the world's largest wind farm, which provides enough energy to power 64,000 typical homes in northwestern Iowa.

More clean energy means more green jobs. Not coincidentally, two leading wind power businesses have recently located in the Midwest, providing good-paying manufacturing jobs and capitalizing on current and future market opportunities. Wind developers' lease payments, in the range of $2000 to $3000 per turbine each year, put bread on farmers' tables. That is sustainable development in action for factory workers and farmers. Still, the enormous potential of this growing industry remains largely untapped.

Everyone already knows that Midwest farmlands are ideal for growing the foods that energize our bodies. If the right public policies

---

2. AMERICAN WIND ENERGY ASSOCIATION, WIND ENERGY: AN UNTAPPED RESOURCE, *available at* www.awea.org/pubs/facsheets.html; *see also* D.L. Elliot et al., Pacific Northwest Laboratory, *An Assessment of Available Windy Land Area and Wind Energy Potential in the Contiguous United States* tbl. B1 (1991).

are put into place, Midwestern farmers can be encouraged to grow high-yield "energy crops" that can be mixed with coal to help power our economy. Expanding this biomass power will create new rural jobs and provide new markets for crops while reducing air and water pollution and deterring soil erosion.

Other advanced technologies such as fuel cells and industrial and commercial cogeneration systems, which generate electricity and heat simultaneously, can also diversify our energy supply in the near term. And, even in the often-cloudy skies of the Great Lakes area, solar photovoltaic panels that convert sunlight to electricity can play a growing role, especially on sunny summer days when peak electricity demand is highest and in hard-to-reach remote rural areas where solar power provides a way around costly transmission and distribution line extensions. Natural gas plants are not entirely clean, but are generally less polluting than coal and nuclear power. When properly sited, they can also be an important part of a strategy to improve the overall environmental performance of the Midwest's power sector.

As for the demand side of the equation, many clean energy efficiency improvements are smart, economical and waiting to be tapped. Inefficient energy use continues to waste money and cause unnecessary pollution. That should be changed by deploying new, more energy efficient heating and cooling systems, lighting, appliances, and building designs and materials. Seizing these opportunities will save money, relieve electricity demand pressures, and improve our quality of life. That is especially true in the Midwest where most utilities have historically underinvested in efficiency programs that save customers' energy and money. Here, too, clean energy means more green jobs because Midwestern companies such as Andersen Windows, Honeywell, Johnson Controls, and Maytag manufacture many of the new energy efficient products.

Unfortunately, the electric utilities have failed to keep pace with these improvements and opportunities. Even though new technologies can generate power cleanly and more efficiently, a staggering 95% of the Midwest's electricity is produced by coal and nuclear plants—the two fuel sources with the worst environmental and public health impacts. These old power plants produce pollution that causes smog, acid rain and global warming, and they generate radioactive nuclear wastes and other toxic pollutants. Depending so heavily on business-as-usual coal and nuclear power locks in a high pollution future and misses the opportunity to improve reliability by diversifying our power resources. Bypassing more energy efficient processes and technological advances not only increases businesses' costs, but misses the job creation opportunities in the growing clean energy sector.

The Midwest's clean energy resources are here and ready to be developed. The region is blessed with abundant wind resources, untapped biomass production potential and relatively high levels of solar availability. Likewise, new energy efficient lighting and appliances operate at low costs while avoiding pollution, but have yet to capture a firm foothold within the industry or the marketplace.

As engineering improvements continue to be made, many of the modern clean energy technologies await sensible policy shifts to reverse the incentives that prop up the polluting technologies of the past. It is no longer a question of engineering know-how, but, instead, a challenge of political will. It is time to leave the 1950s behind and realize the promises of homegrown clean energy in the Midwest to provide a healthier environment and a truly new economy. Now is the time to repower the Midwest for a clean energy development future.

A. Summary of the Midwest Clean Energy Development Plan and Its Benefits[3]

The *Clean Energy Development Plan* achieves large environmental, public health and economic development benefits with only very modest increases in cost. Moreover, investing in clean modern energy efficiency and renewable energy technologies will diversify the region's electricity portfolio and thereby improve reliability. The *Plan* will:

1. Aggressively implement modern cost-effective energy efficiency technologies, including the newest as well as the "tried and true" approaches.
2. Develop and implement new clean renewable energy technologies, including wind power, biomass and solar photovoltaics.
3. Develop and implement efficient natural gas uses in appropriate locations, especially combined heat and power, district energy systems and fuel cells.
4. Retire selected older, less-efficient and highly polluting coal plants.
5. Apply sustainable development strategies to aggressively link these environmental improvement policies to economic development. Clean energy development means more green energy jobs for the Midwest.

---

3. The full report, *Repowering the Midwest—The Clean Energy Development Plan for the Heartland*, which includes the comprehensive technical analysis and policy recommendations that are summarized in this Introduction, is available at www.repowermidwest.org. Single copies can be obtained from the Environmental Law and Policy Center upon request by calling (312) 673-6500.

Taking these actions to implement the *Clean Energy Development Plan* will produce the following benefits:

1. Dramatic improvements in environmental quality by 2020, compared to business-as-usual policies and practices, by reducing: sulfur dioxide (SO_2) pollution, which causes acid rain, by 56%; nitrogen oxide (NO_X) pollution, which causes smog, by 71%; and carbon dioxide (CO_2) pollution, which causes global warming, by 51%.
2. Energy efficiency improvements for Midwestern consumers that save 17% of electricity use by 2010 and 28% by 2020. The average investment of 2.3¢ per kilowatt-hour (kWh) to achieve these energy savings is much less than the cost of generating, transmitting and distributing electricity from a coal plant or most other sources.
3. Renewable energy development that provides 8% of the region's electricity generation by 2010 and 22% by 2020.
4. Improved electricity reliability as a result of a more robust and diversified mix of Midwestern power resources compared to the region's historic almost-total reliance on coal and nuclear plants.
5. Economic development and job growth through new wind power and biomass energy "cash crops" for farmers, increased business for manufacturers of energy efficiency and renewable energy equipment and new skilled jobs for the installation and maintenance of this equipment throughout the Midwest.

These benefits can be achieved with only slightly increased electricity costs across the Midwest: 1.5% in 2010 and 3.4% in 2020.

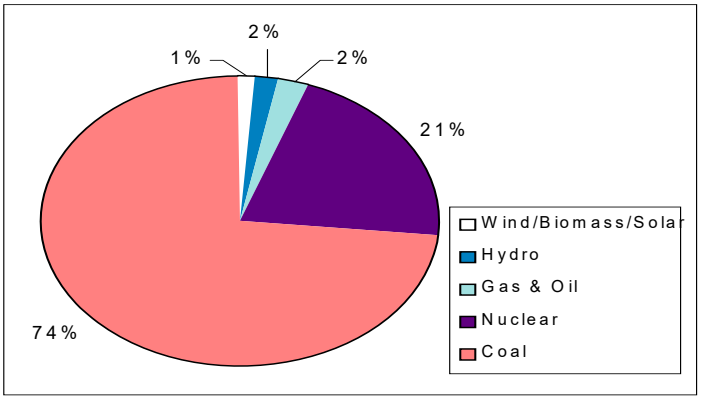
B. The Midwest Electricity Portfolio Under the Business-As-Usual Scenario

The Midwest relies almost exclusively upon coal and nuclear power for electricity supply, as shown in Figure 1. Coal plants produce 74% of the Midwest's electricity, and nuclear plants generate 21% more, while natural gas and oil plants provide 2%. Renewable energy resources supply only 3%, mostly from hydropower dams, with relatively small contributions, thus far, from wind, biomass and solar photovoltaic power. Modern energy efficiency technologies and tried and true efficiency measures are significantly underutilized.

Most Midwestern coal plants were built between 1940 and 1970, and many have not been fully upgraded with modern pollution control technologies. Compared to other regions, the Midwest relies more heavily on these older, inefficient coal plants and thus produces a

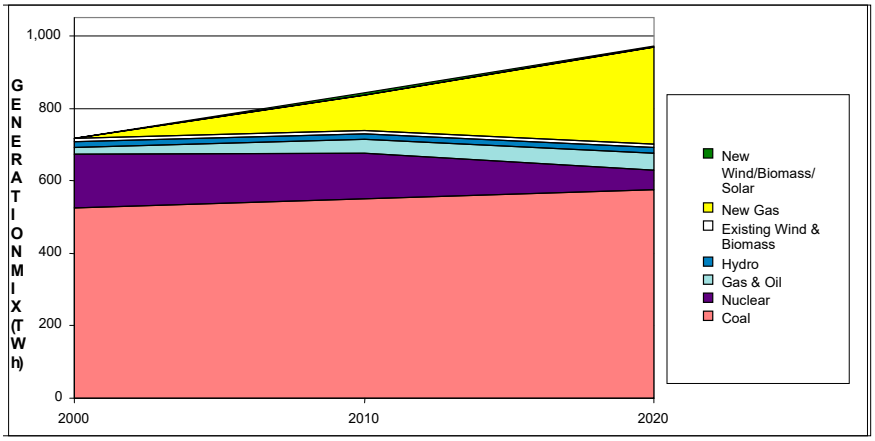
disproportionate amount of air pollution causing health and environmental problems. The Midwest generates 21% of the nation's electricity, but produces 31% of the SO_2 pollution, 32% of the NO_X pollution, and 26% of the CO_2 pollution from the nation's electric industry sector.

Figure 1. Current Sources of Electricity Generation in the Midwest (2000)



Substantial changes in public policies and business planning are necessary to achieve the benefits of implementing the largely untapped energy efficiency and renewable energy technology opportunities. Otherwise, the current portfolio of old, highly polluting coal and nuclear plants will remain overwhelmingly dominant in the Midwest for decades. Figure 2 projects the likely sources of generation for the next 20 years if business-as-usual policies and practices continue. Although nuclear generation is expected to decline as some plants reach the end of their operating licenses, coal plant generation would steadily increase. New natural gas plants will meet most of the growing demand for electricity, but might not replace much generation from old coal plants.

Figure 2. Portfolio of Electricity Generation
Sources: Business-As-Usual Practices



This combination of business-as-usual factors casts a pollution cloud over the Midwest. The harmful health impacts from air pollution impose social and economic costs on the public. The social costs are increased asthma and respiratory ailments (and deaths) especially for children, senior citizens, and other at risk groups. In addition, there are economic costs for the region and the nation from increased health care and insurance costs and lower productivity due to missed work. Business-as-usual practices also lead to a risk of significant costs to comply with future environmental regulations.

The harmful environmental quality impacts of the Midwest's coal plants extend nationally and globally as air pollution drifts downwind to the Northeast and Canada. They cause smog, acid rain, and global warming, and impose associated public health, environmental quality, and economic burdens. Moreover, running these coal plants on a business-as-usual basis will lead to a 30% increase in CO_2 pollution between 2000 and 2020.

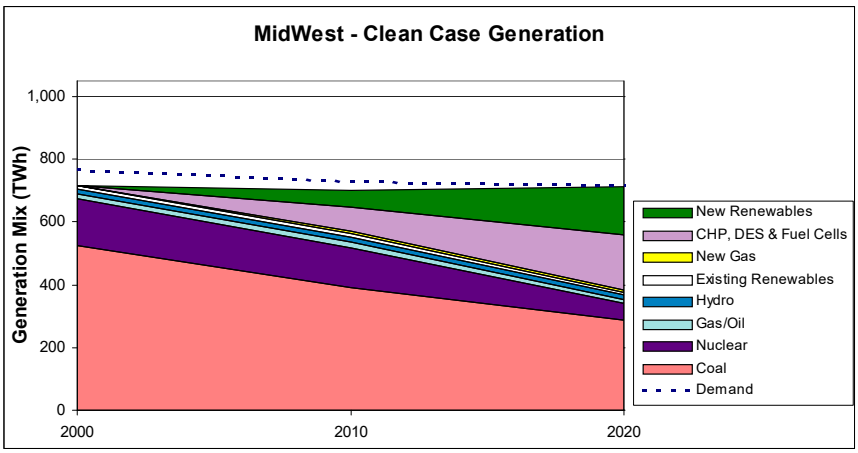
C. The Midwest Clean Energy Development Plan—Principal Findings

There are better courses for the Midwestern electricity sector than to continue along this shortsighted and damaging path. The *Clean Energy Development Plan* proposes developing underutilized energy efficiency measures and largely untapped homegrown renewable energy resources to form a cleaner, more reliable and more diverse electricity portfolio for the Midwest that can spur job creation in this emerging economic sector.

Figure 3 describes this preferable Midwestern electricity portfolio by 2020 under the *Clean Energy Development Plan*:

1. Energy efficiency measures reduce electricity generation from power plants because demand remains essentially constant over time, instead of growing steadily each year.
2. Renewable energy resources—wind, biomass and solar—supply roughly 8% of generation by 2010 and 22% by 2020.
3. Coal generation declines significantly as renewable energy resources with increasingly lower operating costs generate more power in the Midwest.
4. New efficient natural gas generation provides 10% of generation in 2010 and 25% of generation in 2020.
5. Fewer new conventional natural gas plants are needed than under the business-as-usual scenario because less capacity is needed to meet demand due to energy efficiency.
6. Nuclear generation declines to the same extent as under the business-as-usual scenario, as the nuclear plants in the Midwest retire, on average, at their scheduled license termination dates. Some nuclear plants may operate longer by obtaining license extensions, while others may shut down earlier.

Figure 3. Portfolio of Electricity Generation Sources: *Clean Energy Development Plan*



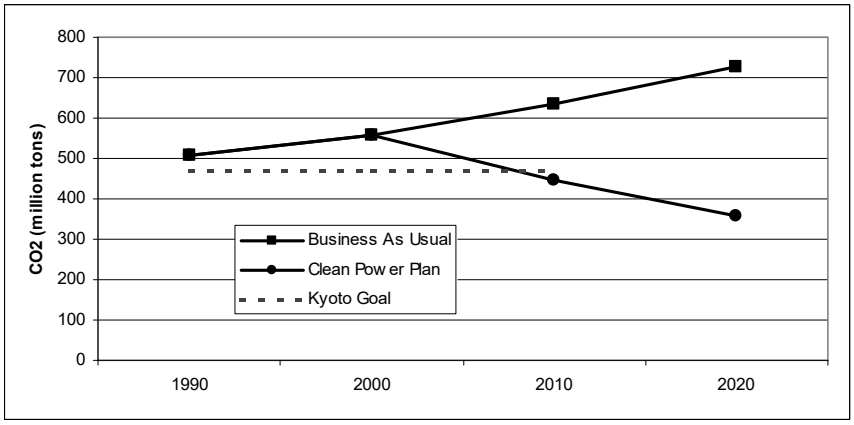
1. Findings: Environmental Improvements

The *Clean Energy Development Plan* reduces acid rain and smog by decreasing SO_2 and NO_X pollution. By 2020, SO_2 emissions are projected to be 56% lower and NO_X emissions are 71% lower than under

business-as-usual policies and practices, and 51% lower and 83% lower than in 2000, respectively. This will reduce acid rain falling in the Great Lakes and inland lakes and forests of the Upper Midwest and Canada, and it will reduce smog that harms public health. Because SO_2 emissions are subject to a "cap-and-trade" system under the Clean Air Act, as discussed in Professor Hsu's and Byron Swift's articles in this Symposium, and NO_X emissions may also be governed by a trading regime under the United States Environmental Protection Agency's rules, the precise pollution percentage reductions in the Midwest may vary. However, it is clear that citizens in the Midwest states will benefit from improved environmental quality and public health due to decreased SO_2 and NO_X emissions under the *Clean Energy Development Plan*.

The *Clean Energy Development Plan* helps mitigate global warming by reducing SO_2 pollution. By 2020, CO_2 emissions are 51% lower than under business-as-usual policies and practices, and 36% lower than in 2000. In 1997, the United States and other developed nations agreed to the Kyoto Protocol, which requires the United States to reduce CO_2 emissions to 7% below 1990 levels over the period of 2008 to 2012. As indicated in Figure 4, the Clean Energy Development Plan puts the Midwest on target to meet the Kyoto Protocol goals by 2010, and it would continue to significantly reduce CO_2 emissions over the following years.

Figure 4. CO_2 Pollution Reductions from the *Clean Energy Development Plan*



2. Findings: Regional Economic Development Benefits

The *Clean Energy Development Plan* will promote job growth and economic development in the Midwest. Wind and biomass power are

"cash crops" for farmers in the Heartland, supplementing their income from agricultural land. At the same time, manufacturing, assembling, installing and maintaining wind power and solar equipment are creating new jobs as well. For example, NEG Micon's wind turbine assembly plant in Champaign, Illinois, is the second largest in the country, and LM Glasfiber has created 400 new jobs manufacturing wind turbine blades in Grand Forks, North Dakota. Likewise, Spire Solar is creating eighty new jobs manufacturing solar photovoltaic panels on a former "brownfield" site on Chicago's West Side.

The Midwest is also home to a large share of the nation's energy efficiency manufacturing industry. Osram Sylvania in Lake Zurich, Illinois, and GE Lighting in Cleveland, Ohio, manufacture energy-efficient lighting. Honeywell Home and Building Control makes thermostatic controls in Golden Valley, Minnesota, and Johnson Controls in Milwaukee, Wisconsin, makes energy-efficient motors. Andersen Corporation in Bayport, Minnesota, and Pella Corporation in Pella, Iowa, both make energy-efficient windows. Maytag manufactures energy-efficient refrigerators in Galesburg, Illinois, and Trane Company manufactures high-efficiency air conditioning systems in La Crosse, Wisconsin. Implementing these modern energy efficiency technologies saves money for businesses to reinvest in their Midwestern operations. It saves money for residential consumers, which can then be spent for goods and services on the main streets of Midwestern towns. The Midwest regional economy benefits in all of these respects.

3. Findings: Cost Impacts

The environmental and economic development benefits of a cleaner energy future can be achieved for the Midwest with only a modest increase in overall electricity costs. Many energy efficiency measures, such as commercial lighting improvements, are highly cost-effective and are significantly less expensive than conventional power sources. The energy efficiency savings thus offset much of the cost of renewable energy resources, which are generally more expensive than running "cheap and dirty" coal plants.

The *Clean Energy Development Plan* is expected to increase total electricity costs across the Midwest by 1.5% in 2010 ($765 million) and 3.4% in 2020 ($1780 million). On the other hand, the public will receive offsetting benefits in the form of lower health care costs and fewer health-related productivity losses.

4. Findings: Enhanced Reliability

The *Clean Energy Development Plan* will improve electricity reliability by diversifying the Midwest's energy portfolio. Today, the Midwest relies almost entirely on older coal and nuclear plants to supply electric power needs. The *Clean Energy Development Plan* deploys a more robust mix of energy efficiency, renewable energy, and natural gas resources, along with the coal and nuclear plants. Energy efficiency reduces demand for power and improves reliability by saving generation and alleviating strained transmission and distribution systems. Adding substantial wind, biomass, and solar resources, along with natural gas plants, to the Midwest's energy portfolio enhances diversity and makes the region less vulnerable to swings in coal prices and to nuclear plant risks.

D. Reaping Energy Efficiency Benefits

An array of modern energy efficiency technologies—ranging from smart thermostats to new lighting ballasts to new motors—and tried and true measures, such as high R-value insulation and "Energy Star" appliances, are highly cost-effective, but greatly underutilized in the Midwest. Many energy efficiency opportunities can be employed by business, residential and public agency consumers at less than the cost of electricity, thus saving them money and avoiding wasteful energy use. Businesses will free up dollars for investment and become more profitable. Residential consumers will have more disposable income to spend or save. Public agencies can use budget savings to meet other responsibilities and hold down taxes. The public gains environmental and health benefits because implementing energy efficiency reduces pollution from coal and nuclear plants.

1. The Most Significant Energy Efficiency Opportunities in the Midwest by Sector

Residential Sector—The greatest potential is more efficient lighting (20% of potential residential savings) and water heating (9%). For example, compact fluorescent lamps (CFL) produce the same amount of light as conventional incandescent light bulbs, but use only one-quarter as much electricity and last twelve times longer. Replacing one incandescent bulb in a high-use area with a CFL will save a Chicago-area residential consumer about $50 in electricity costs over the life of the CFL.

Commercial Sector—The greatest potential is efficient lighting technologies (50% of potential commercial savings) and space cooling

(15%). For example, installing modern energy-efficient lighting ballasts in new commercial buildings, or through retrofits of existing buildings, produces rapid paybacks and operating cost savings in almost all settings.

Industrial Sector—The greatest opportunities for efficiency are found in the metals fabrication (28% of potential industrial electricity savings), rubber and plastics (13%), primary metals (12%), and agricultural (11%) industry sectors by employing more efficient industrial motors and drives; more advanced heating, ventilating and cooling techniques; and better lighting technologies.

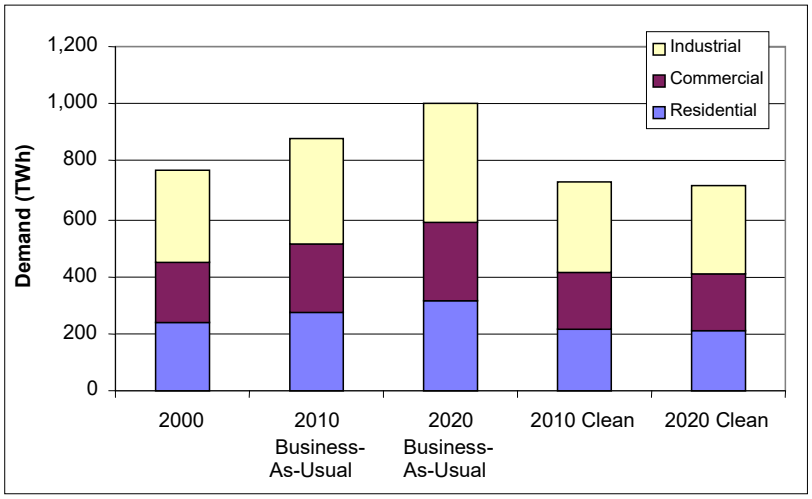
The major population centers and industrialized areas of the Midwest are the largest electricity load centers and provide the greatest opportunities to reap energy efficiency savings. Of the total efficiency savings in the Clean Energy Development Plan, about 24% are available in Ohio, 20% in Illinois, 16% in Michigan, and 14% in Indiana.

2. Findings: Energy Efficiency

The *Clean Energy Development Plan* enables Midwestern consumers to save up to 17% of electricity use through energy efficiency improvements by 2010, and 28% by 2020, as shown in Figure 5. Electricity demand will decline slightly each year, rather than increase by more than 1% per year under the business-as-usual scenario. By 2020, these energy efficiency savings will avoid the need for 290 billion kWh (TWh) of generation—roughly equivalent to the output of 100 coal plants at 500 MW each.

Implementing these energy efficiency measures is highly cost-effective. On average, reaping the energy efficiency opportunities in the *Clean Energy Development Plan* requires a 2.3¢ per kWh investment. That is significantly less than the cost of generating, transmitting, and distributing electricity to consumers. By 2020, the proposed energy efficiency measures will save $12.1 billion in power plant and distribution system costs in return for a $6.6 billion investment. The result is $5.5 billion in net benefits or, put another way, savings of $1.80 for every $1.00 invested in energy efficiency. That, of course, does not include the economic and social value of the environmental and public health benefits.

Figure 5. Midwest Electricity Demand Reductions
Due to Efficiency Gains



E. Developing Renewable Energy Resources

The Midwest possesses abundant renewable energy resources. The Great Plains states have the most large-scale wind power potential in the nation, and there are also significant distributed wind power opportunities throughout the Midwest.[4] Biomass potential is large in the agricultural belt of the Heartland, and there are focused, though smaller, solar power development opportunities, especially to meet costly summer peak power demand, throughout the region. Dramatic technological improvements in wind turbines and solar photovoltaic panels have enhanced generating efficiencies and lowered power production costs over the past twenty years. Developing these clean renewable energy technologies avoids pollution from coal and nuclear plants and increases generation reliability by diversifying the region's energy portfolio and using local resources. Because renewable resources can also be deployed on a distributed basis—as relatively small generators located near customer demand—power delivery reliability is enhanced and new transmission and distribution upgrades and extensions can sometimes be avoided. Capital costs vary widely among types of renewable energy resources; however, even when their capital costs are high, the fuel and operating costs are typically very low.

4. *See supra* note 2.

1. Wind Power

As Christine Real de Azua's essay in this Symposium explains, large-scale wind energy generation has improved tremendously, both in cost and reliability, since the first wind energy boom in the early 1980s. Wind power is now the fastest growing energy resource in the world in large part due to substantial technological improvements. Modern wind turbines generate electricity at an average cost that is close to competitive with new coal and combined-cycle natural gas plants. The Midwest has been the nation's leader in wind power growth as Iowa, Minnesota, and Wisconsin have installed a total of 600 megawatts (MW) of new wind capacity over the past few years, and they are on their way to 1000 MW of capacity. For example, about 400 MW of wind power is being developed in the Buffalo Ridge area of Southwestern Minnesota (as part of utility commitments for 825 MW), a 112 MW wind power "farm" is operating in Alta, Iowa, and a new 30 MW wind power project is planned in Iowa County, Wisconsin.

The Midwest is blessed with such an abundance of windy terrain, especially in the Great Plains states of North and South Dakota, Iowa, Minnesota, and Nebraska, that it is sometimes referred to as the "Saudi Arabia of wind energy." There are also other windy areas scattered through Illinois, Indiana, Michigan, Ohio, and Wisconsin that offer strong opportunities for distributed wind power development.

Large wind energy machines have the most potential to replace coal plants, but small wind turbines designed for local residential and commercial use are a growing market niche in the Midwest. Although their costs per kWh are usually higher than the larger wind turbines, they can still displace some higher-cost energy sources and also function well in lower winds.

Wind power costs have declined significantly over the past twenty years and continue to do so. In 2000, wind power is being produced at a range of 3¢ to 6¢ per kWh (depending on wind speeds), but by 2020, wind power generating costs are projected to fall to 3¢ to 4¢ per kWh.

Wind power provides substantial environmental and public health benefits because it creates no air pollution, greenhouse gases, or radioactive and other dangerous wastes. By applying responsible siting practices, wind projects can have minimal impacts on wildlife and natural resources. Wind is an intermittent power resource, fluctuating with daily and hourly wind patterns and velocities. Its energy supply can be made more consistent and balanced, if desired, by managing wind resources and gas plants together as is now being done with Northern Alternative Energy's major new 350 MW project in Minnesota, which

combines 50 MW of wind power with 300 MW of natural gas generation.

Wind power development also provides a new cash crop, mostly for farmers, in the communities where it is located. In agricultural areas, farmers can often increase their incomes by 50% or more by leasing a portion of their land for wind turbines and access roads; farming operations on the rest of their land are unaffected. The opportunity to promote rural economic development and the support of farming communities has been critical to the recent expansion of windpower in Iowa and Minnesota. Likewise, the creation of new wind power manufacturing jobs by LN Glasfiber in Grand Forks, North Dakota and by NEG Micon in Champaign, Illinois has spurred interest and support.

2. Biomass Energy

The Midwest has enormous untapped biomass energy potential from both crop residues (left over from farming) and energy crops (grown expressly for energy). The Midwest also has many coal plants that could be converted to use biomass for part of the fuel supply. The *Clean Energy Development Plan* focuses on two leading near-term options to increase biomass energy production: (1) Co-firing with biomass in existing coal plants and (2) Installing efficient combined heat and power (CHP) systems at large industrial facilities, especially pulp and paper mills. Co-firing with biomass directly reduces some of the coal use and the associated SO_2, NO_X, CO_2, and other pollution. CHP is much more efficient than separately generating electricity and heat. Virtually all sizable pulp and paper mills in the Midwest already use their mill residues for energy, but most use inefficient steam- or heat-only boilers. Modern CHP equipment can convert biomass to steam, heat and electric power with close to 90% efficiency. In the future, biomass gasification may also become increasingly practical.

Increasing biomass energy will produce substantial economic and environmental benefits in the Midwest. Employment impact studies demonstrate that biomass is likely to create many more jobs than it would displace in other sectors because money flowing into agriculture creates a large number of jobs. Because biomass fuels are rarely shipped long distances, the money spent on this energy development tends to remain in rural communities.

Sustainably produced biomass provides significant environmental advantages because it generates no net CO_2. The *Clean Energy Development Plan* relies only on biomass fuel sources that minimize environmental damages and assumes that biomass energy plants meet the

same strict pollution limits as newer coal plants. It does not call for any increased logging for biomass feedstocks, but rather seizes the opportunities for use of energy crops such as switchgrass and crop residues. Biomass co-firing and CHP are the most cost-effective forms of renewable energy generation at roughly 2¢ to 3¢ per kWh.

3. Solar Power (Photovoltaics)

Solar photovoltaic panels convert sunlight directly into electricity using semiconductor materials. They can be built in various sizes and placed in arrays ranging from watts to megawatts. Their remarkable simplicity and flexibility makes them suitable for a wide variety of applications, including central-station power plants, substation power plants for distribution support, grid-connected systems for home or business use, and off-grid systems for remote power use.

The amount of sunlight available to generate electricity varies by season, time of day, and location. The wide-open spaces of Nebraska and the Dakotas have solar power resources comparable to parts of northern California and east Texas. Shading from buildings and trees, natural obstacles, and other variables affect local energy-producing potential. Although the Midwest is not usually considered an especially sunny region, solar power can provide economically valuable electricity because of the strong coincidence between its greatest availability on sunny summer days and the timing of peak power demands for air conditioning.

The cost of solar photovoltaics is now significantly higher than most other electricity generation, but rapid technological improvements and increased production leading to lower per-unit costs are likely to make solar more cost-competitive in the future. At present, there are three markets in which solar photovoltaics are becoming economically viable. First, as mentioned above, the recent history of soaring summer peak energy price spikes makes solar a potentially attractive energy source during high-energy use times on sunny days. Second, solar photovoltaics are cost-effective generation for particular off-grid uses, such as remote residences in rural areas that are far from power lines and hard-to-reach cellular relay towers. Third, solar photovoltaics may be useful and cost-effective distributed resources in specific locations that need grid support or would otherwise require costly upgrades to the existing transmission and distribution system. Moreover, solar photovoltaics may be a desired energy source for those businesses and residences preferring to buy "green power."

Solar power development provides substantial environmental and public health benefits because it creates no air pollution, greenhouse gases, or radioactive and other dangerous wastes. In addition, there are significant economic development opportunities for Midwest solar companies that manufacture both for domestic use and exports to developing countries. Chicago, in particular, is seizing these solar development opportunities by supporting Spire Solar's new solar panel manufacturing plant on a former "brownfield" site, installing solar panels on the rooftops of nine major museums, and planning to build the largest single photovoltaic assembly (2.5 MW) in the country to provide cleaner and greener power for public use.

F. Deploying Efficient Generation Technologies

Natural gas is a cleaner fuel than coal and will likely gain an increasing share of the electric generating market. However, the market share will depend on the long-term price of natural gas, which has tended to fluctuate significantly, and fuel availability. Although natural gas plants produce less SO_2, NO_X, particulates, and mercury pollution than do coal plants, the gas plants do produce considerable CO_2 emissions that exacerbate climate change. Moreover, it is important that community environmental values be respected in determining where to site these large power plants. Natural gas should be viewed as a transitional fuel from our current energy path to a more sustainable energy future, rather than as a long-term solution.

Fuel cells combine hydrogen (from the fuel source) and oxygen (from the air) in the presence of a catalyst to generate electricity, heat, and water. They have great promise as an efficient, modular, combustion-free power technology. Over the next two decades, fuel cells can be used for central power plants or as on-site generators providing reliable distributed generation. Fuel cells are an especially strong option for high-quality power users, such as hospitals, financial institutions, data processing and other computer centers, museums, police and fire stations, and research labs that have little tolerance for utility outages and interruptions. The superb reliability of fuel cells compensates for the added expense because outages can cause severe economic costs for those consumers and, in some cases, catastrophes. For this reason, the First National Bank in Omaha, Nebraska, recently installed four 200-kilowatt fuel cells to run its computer system, which processes $6 million each hour in transactions. This high-reliability system is down less than four seconds per year. In the longer term, fuel cells are a key component in a transition to a renewable energy economy.

Combined Heat and Power (CHP) brings together a conventional heat-producing industrial boiler or furnace with a turbine to cogenerate electricity. This dual-production process harnesses waste heat and can generate electricity at efficiencies as high as 80%. Ongoing technological advances give CHP great potential for energy savings and economic benefits in industrial and community energy systems. For example, the McCormick Place Convention Center in Chicago uses a CHP system operated by Trigen Energy to achieve an 81% fuel efficiency rate, while reducing NO_X, SO_2, and CO_2 pollution.

District Energy Systems provide thermal energy through steam or hot water pipes to multiple customers within a specific geographic area for space heating, water heating, cooling, and industrial processes. They often cogenerate electric power along with thermal energy and, thereby, create a highly efficient source of electricity generation. District energy systems also provide an excellent opportunity for biomass-fired CHP. For example, District Energy St. Paul supplies the downtown business district with electricity, heating and cooling. It recently announced plans to upgrade its system by replacing the coal and natural gas boilers with a 98 MW wood chip-fired CHP plant that combines thermal and electricity production.

Findings: Renewable Energy and Modern Efficient Generation Technologies

Both renewable energy resources and modern efficient generation technologies can provide substantial clean power for the Midwest. Figure 6 presents the generation resources that are included in the *Clean Energy Development Plan*. Wind turbines account for the greatest new renewable capacity. Combined heat and power, using natural gas or biomass, provides the second largest source of new clean power potential. Solar photovoltaics, biomass gasification, and fuel cells play a smaller role because of their relatively high costs, but as these technologies rapidly improve, they are expected to be more cost-effective toward 2020.

Renewable energy technologies will generally be deployed in those areas with the best combination of resource potential, public policy support, and business opportunities. The wind power potential is largest in the Great Plains states, while Illinois, Indiana, Michigan, and Ohio will use more CHP because of their greater concentration of industrial facilities. Biomass potential is largest in Illinois, Indiana, and Ohio because of the opportunities for co-firing in their large number of existing coal plants and their agricultural lands.

Figure 6. New Clean Generation Capacity
Included in *Clean Energy Development Plan*

	2010			2020		
Generator Type	Installed Capacity (MW)	Generation (GWh)	Generation (% of total)	Installed Capacity (MW)	Generation (GWh)	Generation (% of total)
Wind Turbines	6,698	21,283	3.0	24,510	80,795	11.3
CHP - Biomass	2,949	23,881	3.4	6,003	48,527	6.8
Biomass - Co-Firing	1,850	9,778	1.4	4,807	22,113	3.1
Photo-voltaics	161	196	0.0	482	571	0.1
Biomass Gasification	75	536	0.1	575	4,049	0.6
Subtotal Renewables	11,733	55,674	8.0	36,377	156,055	21.9
CHP – Natural Gas	5,650	45,422	6.5	12,230	98,286	13.8
District Energy Systems	3,223	25,309	3.6	6,446	50,470	7.1
Fuel Cells	282	2,267	0.3	3,257	25,925	3.6
Subtotal Efficient Natural Gas	9,155	72,998	10.4	21,933	174,681	24.5
Total	**20,888**	**128,672**	**18.3**	**58,310**	**330,736**	**46.4**

This includes all renewables added after 2000.
The totals may not add up precisely due to rounding.

G. Policy Recommendations: Implementing the Clean Energy Development Plan

These clean energy resources are now technologically achievable and economically realistic. They will not, however, reach their full potential without significant public policy support. Coal plants and nuclear energy currently receive enormous financial subsidies and policy benefits. Implementing the *Clean Energy Development Plan* will require thoughtful and aggressive action beyond business-as-usual practices and regulatory policies. Energy efficiency and renewable energy resources are also hindered by a variety of market barriers that prevent them from competing fairly against coal and nuclear plants on a level playing field. Public policies to overcome these market barriers are needed to obtain

the benefits of more energy efficiency and wind, biomass, and solar power in order to achieve a more diversified electricity portfolio in the Midwest.

Several Midwestern states have recently taken important steps to promote clean energy, but much more remains to be done. The key policies and actions necessary to achieve the fundamental energy policy shifts and to reach the goals of the *Clean Energy Development Plan* are presented below.

1. Energy Efficiency

- Each Midwestern state should establish an Energy Efficiency Investment Fund, or an equivalent mechanism, supported by a non-bypassable charge of 0.3¢ per kWh (less than one-third of 1¢) to support the robust energy efficiency initiatives of the *Clean Energy Development Plan*. All electricity customers should invest in the Fund just as various decommissioning charges, franchise fees, utility taxes, and other utility charges already apply to all customers on their electric utility distribution bills. All customers will benefit from the cleaner air and improved health resulting from developing energy efficiency opportunities. The Energy Efficiency Investment Fund should be implemented as soon as possible and maintained at this level until at least 2010. At that time, the impacts of energy efficiency investments should be evaluated, and public officials and stakeholders should assess whether to modify the funding levels in order to achieve the *Clean Energy Development Plan*'s energy efficiency target for 2020. Finally, Congress should enact legislation to provide substantial matching energy efficiency investment funds that can be used by states to supplement or partially offset their investment funds.
- The Energy Efficiency Investment Fund should be managed by an independent and highly capable third-party administrator—a not-for-profit organization or foundation or an appropriate public agency. The Energy Efficiency Administrator should be overseen by a board including environmental and consumer organization representatives, state energy officials, and energy efficiency industry representatives. The overall mission of the Administrator should be to transform the markets for energy efficiency products and services, and to maximize the long-term economic and societal benefits available from energy efficiency. The new $225 million Illinois Clean Energy Community Foundation, with its mission to improve energy efficiency and

develop renewable energy resources, among other things, is one model of an Energy Efficiency Administrator.

- More stringent energy efficiency standards and building codes should be applied throughout the Midwest. Commercial lighting improvements, more energy efficient windows, daylighting, and heating, venting, and air conditioning efficiency are some of the most cost-effective opportunities for better environmental performance in the Midwest. Each of the Midwestern states should: (1) evaluate its current efficiency standards and building codes, (2) upgrade outdated codes and standards, and (3) establish monitoring and enforcement practices to ensure that revised standards and codes are implemented. States should coordinate their efforts to provide regional consistency.

2. Renewable Energy Resources

- Each Midwestern state should promptly establish a Renewables Portfolio Standard (RPS) that requires all retail electricity suppliers to include a specified percentage of renewable resources in their generation mix. The RPS percentage requirement should increase steadily each year to reach 8% by 2010, and then reach 20% by 2020. The RPS should require new renewable energy generation to meet the specified percentage target, not just a repackaging of already existing resources. In states that have adopted electric industry restructuring legislation, the RPS should apply to all customers, including "standard offer" or "default" customers served by electric distribution companies. The RPS can also include a renewable credit trading system, consistent with assuring improvements to local air quality through renewables development in all states, by which qualifying renewable energy generators in the Midwest would produce credits that could be sold to retail electricity suppliers in the region. Ideally, a national RPS would be enacted, in addition to a regional RPS policy for the Midwest as a whole.
- Each Midwestern state should establish a Renewable Energy Investment Fund, or an equivalent mechanism, supported by a non-bypassable charge of 0.1¢ per kWh (one-tenth of 1¢) to support the robust development of wind, biomass and solar power. All electricity customers should invest in this Fund, just as with the Energy Efficiency Investment Fund, because all customers will benefit from the cleaner air and improved health resulting from developing renewable energy resources. The Renewable Energy Investment Fund complements the Renewables Portfolio Standard, which largely supports technologies that are already close to

commercial viability. The Investment Fund will advance technologies that are still in the developmental stages. The Renewable Energy Investment Fund should be implemented as soon as possible and maintained at this level until at least 2010. At that time, the impacts of the renewables investments should be evaluated, and public officials and stakeholders should assess whether to modify the funding levels in order to achieve the *Clean Energy Development Plan*'s renewable energy resources target for 2020. Finally, Congress should enact legislation to provide substantial matching renewable energy investment funds that can be used by the states to supplement or partially offset their investment funds.

- The Renewable Energy Investment Fund should be managed by an independent and highly capable third-party administrator—a not-for-profit organization or foundation or an appropriate public agency—that should be overseen by a board including environmental and consumer organization representatives, state energy officials, and renewable energy industry representatives. Competitive bidding processes, such as reverse auctions, should be emphasized in deploying these investment funds.
- Transmission pricing policies and power pooling practices should treat renewable energy resources fairly. They must account for the intermittent nature of wind and solar power operations, and their generally smaller scale and remote locations. The regional transmission Independent System Operators and Regional Transmission Organizations should have governance structures that reasonably include representation of both environmental organizations and renewable energy generators. "Pancaked" multiple transmission rates should be eliminated, and single "postage stamp" rates should be encouraged. Real-time balancing markets should allow generators to buy or sell firm transmission capacity that deviates from the amount reserved in advance. Spot-market bidding systems should not penalize renewable energy generators that have intermittent generating patterns. Net metering and fairer interconnection policies should be adopted as explained below.

3. Clean Distributed Generation

Distributed generation resources are small power plants that can be deployed at many locations throughout an electric distribution area. They can enhance generation reliability by providing power when and where most needed, as well as provide power in remote locations where it is costly and difficult to run power lines. They can also enhance

distribution reliability by providing grid support to relieve stress on aging electricity delivery systems especially in urban and older suburban areas, such as Chicago, that have recently been plagued by recurring power outages. In some cases, distributed resources may avoid the need for transmission line extensions as sprawl pushes development beyond existing suburban areas. Policies should be designed to support clean distributed generation technologies, including small turbines, solar photovoltaic panels, and fuel cells.

- Net metering should be enacted and implemented in all Midwestern states. Net metering should apply to all of the clean distributed generation technologies listed above. Net metering customers should be paid the retail rate for surplus generation that is provided back to the utility and the grid. Federal legislation to adopt net metering nationally is appropriate as well.
- Uniform safety and power quality standards should be developed throughout the Midwest in order to facilitate the process for customers and developers to reasonably, economically, and safely interconnect to the electricity distribution system.
- Utilities and state utility regulatory commissions across the Midwest should work cooperatively to establish standard business and interconnection terms and conditions that will help to overcome existing institutional barriers to clean distributed generation technologies. Utilities should waive their interconnection charges for small wind power, solar photovoltaic panels, and fuel cell installations because of the reliability and environmental benefits provided by these clean technologies. State utility regulatory commissions should require these steps if not undertaken voluntarily by the utilities.
- Federal and state environmental officials should apply clean air standards to small distributed generation sources so that clean power technologies are promoted and highly polluting diesel generators are not. Congress should eliminate the exemption from federal Clean Air Act standards for small generation sources. In today's circumstances, this exemption undermines the national air quality improvement goals, and it provides inefficient diesel generators with an unfair competitive advantage. Diesel generators, for example, produce up to thirty times as much NO_X and particulate pollution as new combined-cycle natural gas plants and microturbines, but these old generators are often the first choice of some customers for standby and peak power. In addition to truly clean wind turbines, solar photovoltaic panels, and fuel cells, there are also new relatively

clean microturbines and other small generator technologies on the market that can achieve the benefits of distributed power resources without sacrificing environmental quality and public health.

4. CO_2 Reduction Policies

Legislators, regulators and public stakeholders seeking to reduce CO_2 pollution from coal and natural gas plants should also look beyond these clean energy proposals. Aggressive energy efficiency and renewable energy resources development can, indeed, play an important role in offsetting increased CO_2 pollution. However, coal plants produce the largest share of the Midwest's air pollution and achieving significant CO_2 reductions will require reducing pollution from these plants. State and federal policymakers should consider three basic approaches to achieve CO_2 reductions:

Multipollutant regulation: Environmental regulations have traditionally treated each pollutant separately. Pollution regulations for SO_2, NO_X, CO_2, particulates, and mercury should be integrated in order to allow power plant owners to pursue efficient compliance strategies, including repowering with natural gas or retirement of older coal plants.

CO_2 pollution cap-and-trade mechanisms: CO_2 pollution from fossil-fuel power plants could be subject to a cap-and-trade system similar to that currently used for SO_2, for the reasons generally explained in Byron Swift's article in this Symposium.

Early retirement of older highly polluting coal plants: Legislatures, regulators, and public stakeholders should establish policies to encourage or require the retirement of older, less-efficient coal plants. Retirements can be achieved through voluntary negotiations, explicit requirements or other mechanisms. Professor Hsu suggests a pragmatic approach combining a CO_2 cap-and-trade program with targeted federal tax credits in his article in this Symposium.

* * *

The Midwest cannot do it alone. Air and water pollution cross state and regional lines. There is also an important federal role and responsibility to ensure that all regions contribute to solving pollution problems and obtaining the environmental, public health, reliability, and economic benefits from clean energy development. Federal legislation should be enacted soon to provide a national renewables portfolio standard, matching energy efficiency and renewable energy resources investment funds as described above, sensible pollution reduction policies, net metering, and targeted tax credits for clean energy

technologies. These forward-thinking actions will provide significant benefits for the Midwest and the nation.

IV. CONCLUSION

The *Midwest Clean Energy Development Plan* is visionary, and it is practical and achievable. It will require a dedicated and concerted effort by governors, legislators, regulators, the electric power industry, consumers, and citizens to replace current, outdated power plants and practices with modern clean energy technologies and policy innovations. It will require specific steps to adopt and aggressively implement the recommended new strategies, policies, and practices. The public is ready to seize the opportunities to robustly develop clean energy efficiency and renewable energy resources that will lead to better environmental quality and public health, improved electric system reliability, and regional economic development gains.

One or two states alone cannot achieve the full benefits of the *Midwest Clean Energy Development Plan*. The electricity services market is regional and successful energy strategies and policies for the Midwest require regional solutions and cooperation across state lines. The *Clean Energy Development Plan* is a smart policy and technical strategy for the Midwest that can also serve as a model for the rest of the nation. As federal legislators consider more aggressive clean energy development policies and practices to secure national environmental benefits, more balanced fuel portfolios and economic growth, the nation's Heartland can and should lead the way.

This Symposium issue of the *Tulane Environmental Law Journal* comes at a time when America's energy future has become a first-tier public issue. Energy concerns are at the center of political activity and media attention in light of the current California electricity reliability crisis, accompanied by electricity price spikes and recurring power outages in several regions, rising public awareness of environmental damage and health harms due to pollution from coal plants, and soaring natural gas prices over the past winter heating season.

In chaos, there are often new opportunities to adopt creative policy innovations and implement advanced technologies to help solve today's problems and forge better futures. The articles in this Symposium describe key opportunities to deploy new wind power and other clean renewable and energy efficiency technologies and policies that the public consistently says it wants, discuss a potential next generation of nuclear plants, and design better regulatory policies to overcome past difficulties

in reducing pollution from coal plants. Sound new ideas are needed, and the timing for reasoned consideration could not be better.