This report identifies Iowa’s renewable energy potential, discusses the benefits of and barriers to developing this potential, and describes seven powerful solutions for switching Iowa to renewable electricity sources in a rapidly changing electricity industry. It is meant to serve as a supplement to Powerful Solutions: Seven Ways to Switch America to Renewable Electricity, which provides extensive detail on renewable energy benefits, potential, market barriers, and solutions, and how those solutions are being implemented in different areas around the nation.

The way electricity is produced and sold in the United States is undergoing an historic change. For a century, electricity has been generated and sold by utilities granted monopolies to supply customers in a given territory. Now, electricity generators are allowed to sell electricity on a wholesale level to any utility anywhere they can transmit their power. In a number of states, electric companies are allowed to compete to sell power to individual retail customers. Whether, how and when to allow or to require competition for electricity customers is being debated in Congress and in every state in the country that has not yet made a decision, including Iowa.

The changes being debated and enacted across the country are primarily intended to lower electricity prices by encouraging competition among power companies and retail providers. That is a laudable
goal, but what are the implications of electricity deregulation for other things we value, such as the environment and public health?

The answer depends on what the rules governing the new electricity market will be. If they ignore threats to the environment and public health, then the overall quality of life in Iowa will be diminished by increased pollution, global warming, and other looming problems. But if new market rules are designed to promote energy efficiency and cleaner, renewable energy sources, then we could see lower electricity bills, more competition and environmental improvement.

Although the state has an abundance of renewable energy sources (see below), Iowa imports 98 percent of its energy in the form of coal, oil, natural gas, nuclear fuel and hydroelectric power. In 1995, two-thirds of Iowa's total energy bill of $6.1 billion left the state to pay for imported fuel. While Iowa added a significant amount of wind power in 1999, the state is still heavily dependent on imported coal and nuclear power to meet nearly all of its electricity needs. In 1998, Iowa generate 86 percent of its electricity from imported coal at a cost of $368 million. This required transporting over 18 million tons of coal hundreds of miles on an estimated 184,000 train cars. Most of the rest of Iowa’s power comes from an aging nuclear plant near Cedar Rapids, built in the early 1970s, and from nuclear plants in Illinois and Nebraska.

To reduce the state’s energy dollar drain, Iowa’s 1990 Comprehensive Energy Plan established the following two goals:

- to meet all future demand for energy by increasing efficiency rather than supply; and
- to increase the use of renewable energy resources from 2 percent of Iowa’s consumption to 5 percent by 2005 and 10 percent by 2015.1

Iowa has started to make some progress in achieving its renewable goal in the electricity sector. In response to Iowa’s Alternate Energy Production (AEP) law, utilities have installed enough wind power to meet the electricity needs of 80,000 homes as well as a number of small biomass energy projects. Even municipal utilities, who are not subject to the law, are taking an interest in wind power. Seven municipal utilities are sharing a small wind farm near Algona. A municipal utility in Waverly also owns two turbines in the large wind farm near Alta. A number of school districts, such as in Nevada, Forest City, Akron and Spirit Lake, are investing in wind power too, as a way to spend less on energy and more on educating children. Iowa has also initiated a demonstration project to co-fire switchgrass (a perennial grass native to Iowa) along with coal in a utility power plant (see box below).

Despite this important progress, non-hydro renewable electricity sources still only provide about 2 percent of Iowa’s electricity. With major changes sweeping through the electricity industry nationwide, many utilities, including those in Iowa, have already cut costs and dropped programs that provide important economic and environmental benefits to consumers in anticipation of competition. If Iowa decides to restructure its electric industry, a package of fair and market-oriented policies will be needed to capture the public benefits of renewables and achieve the state’s renewable energy goal in the electricity sector.

This primer describes the public benefits of renewables, Iowa’s renewable energy potential, the barriers to developing this potential, and seven practical measures to switch Iowa to renewable electricity sources:

1. Renewable portfolio standards
2. Public benefits funding
3. Net metering
4. Fair transmission and distribution rules
5. Fair pollution rules
6. Consumer information
7. Putting green customer demand to work.

**Public Benefits of Renewable Energy**

Renewable energy can supply a significant portion of Iowa’s energy needs, creating many public benefits, including environmental improvement, increased fuel diversity, and economic development. These benefits, however, are often not reflected in the prices paid for energy, placing renewable energy at a severe disadvantage when competing against fossil fuels and nuclear power.
Environmental and Public Health Benefits. Renewable energy provides immediate benefits by avoiding the environmental impacts of fossil fuels. The state’s reliance on coal to make electricity dirties Iowa’s air, consumes and pollutes water, hurts plants and animal life, creates toxic wastes, and causes global warming.

Air pollution is an especially serious problem for which electricity generation bears substantial responsibility. Smog, which is produced from nitrogen oxides and other pollutants, cause an estimated 73,000 asthma attacks and 2,220 hospital emergency room visits in Iowa each year. Another pollutant, fine particulates, which can lodge in the lungs and lead to heart and lung disease, have been linked to an estimated 148 premature deaths in Davenport each year, 137 in Des Moines, and many more throughout the state. This pollutant causes more deaths than the number of people killed in automobile accidents in Iowa each year. Iowa’s coal power plants are also a major source of sulfur dioxide, which produces acid rain, and mercury and toxic metals.

Electricity generation is also a leading source of Iowa’s carbon dioxide emissions, the key heat-trapping gas that is causing global warming. Although scientific uncertainties remain about the timing and size of impacts, there is strong evidence that global warming is occurring and that its effects could be severely damaging to both people and wildlife. The warming that is predicted for the next several decades (without action to reduce carbon emissions) could destroy many coastal wetlands, cause more frequent storms and other extreme weather events, put crop production under great stress in some regions, and disrupt public health and ecosystems. A number of studies have shown that investments in renewable energy and energy efficiency can achieve U.S. greenhouse gas emission reduction goals while providing net benefits to the economy.

Growing biomass crops to generate electricity can also provide important environmental benefits for Iowa. The Natural Resource Conservation Service estimates that more than three-quarters of all the cropland in Southern Iowa is subject to excessive soil erosion from growing traditional row crops such as corn. Growing biomass crops such as switchgrass on marginal lands or in place of or in rotation with conventional row crops can nearly eliminate erosion, greatly reduce chemical and energy inputs, and sequester atmospheric carbon to the soil. In Wisconsin, researchers found that switchgrass harvested for bioenergy production provided suitable habitat for a number of grassland birds of management concern. Iowa is currently attempting to capture these environmental benefits through the Chariton Valley switchgrass demonstration project, where switchgrass grown in southern Iowa will be co-fired along with coal in the Ottumwa Generating Station (see box below).

Renewables can also help replace nuclear generation and reduce its safety, environmental and economic risks. The Duane Arnold nuclear plant was ranked the 15th least competitive nuclear plant in the country in a 1997 report.

Reducing Pollution Helps the Economy. The pollution and other problems associated with fossil fuels place a burden on the American economy as well as on the environment. The greatest economic impacts take the form of higher health care costs, missed work, and lost lives. According to several studies, such health costs may amount annually to hundreds of billions of dollars in the US. Increasing renewable energy use can help reduce these health costs and also lower the costs to industries and consumers of complying with environmental regulations.

Diversity and Energy Security. By broadening the mix of electricity sources, renewables can make Iowa’s economy less vulnerable to volatile fuel prices and interruptions to the fuel supply. Renewables like wind and solar that do not depend on fuels are not subject to price fluctuations, such as the huge leaps and falls in oil and gas prices seen in the 1970s and 1980s. And since they are locally produced, they are not as vulnerable to supply interruptions from outside the state or country.

Economic Development. Renewable energy technologies can create significant economic development benefits. This is because much of the revenue for manufacturing, installing, fueling, and operating renewable energy technologies can be retained in the state, instead of leaking out to pay for imported fossil fuels. Renewables create high-wage manufacturing and engineering jobs directly in a new, high-tech industry with enormous export potential. Renewables
also create jobs directly in fuel supply, operations and maintenance, as well as indirectly in local support industries. Harvesting wind and biomass power can also create badly needed income for farmers, landowners and rural areas.

A number of studies have demonstrated that renewables can provide net economic benefits for state economies compared to investing in conventional energy sources. For example, a UCS analysis for Wisconsin found that an 800 MW mix of new renewables would create about 22,000 more job-years than new gas and coal plants over a 30-year period or an annual average of 730 full-time jobs. An analysis by the Iowa Department of Natural Resources (DNR) largely confirmed these results. The analysis found that meeting the 1990 Comprehensive Energy Plan’s recommended goal of increasing renewable energy use to 10 percent of the state’s total energy use by 2015—split equally between biomass and wind—would create over 17,000 job-years of employment and over $300 million in disposable income between 1997 and 2015, as shown in the table below. Most of the economic benefits would appear to come from biomass. This is because the analysis assumes that switchgrass will be grown on marginal agricultural lands, which is a labor-intensive activity. Also, the switchgrass is assumed to be cofired along with coal in existing utility boilers, which involves little capital investment to retrofit the plant. While the economic benefits for wind appear modest, the analysis assumed that no new generation would be needed in Iowa for the foreseeable future and therefore new wind plants were assumed to displace low cost existing coal generation.

The capital investment in new wind projects was assumed to increase electricity rates, which offset a large portion of the economic benefits of displacing imported fossil fuels. However, Iowa’s electricity demand is projected to grow at an average rate of around 2 percent during the next 15 years and the region has faced electricity shortages during the past few years. Therefore, it is likely that wind will mostly displace higher cost generation from new natural gas plants as well as some existing coal. Moreover, the analysis did not assume any reduction in the price of wind power over time, despite the fact that the cost of wind is projected to fall to below 3 cents per kilowatt-hour (¢/kWh) by 2010 (see below), making wind power competitive with new natural gas generation. Thus, the economic benefits of wind power are likely to be considerably higher than shown in the DNR’s analysis.

Renewable energy can also provide significant rural economic benefits for Iowa. For example, according to the American Wind Energy Association, the 332 large wind turbines installed near Storm Lake and Clear Lake between July 1998 and June 1999, as a result of the AEP law, created about 200 short-term construction jobs and 40 permanent high wage operation and maintenance jobs. These projects are also generating an estimated:

- $2 million per year in tax payments to counties and school districts
- $640,000 per year in lease payments to local farmers.


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<th>Increased Jobs (job-years)</th>
<th>Increased Disposable Income</th>
<th>CO2 Emissions Avoided</th>
<th>NOx Emissions Avoided</th>
<th>SO2 Emissions Avoided</th>
<th>Particulate Emissions Avoided</th>
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<tr>
<td><strong>Biomass (5 percent of energy use)</strong></td>
<td>16,475</td>
<td>$280 million</td>
<td>27 million tons</td>
<td>90,000 tons</td>
<td>1.02 million tons</td>
<td>118,800 tons</td>
</tr>
<tr>
<td><strong>Wind (5 percent of energy use)</strong></td>
<td>605</td>
<td>$36 million</td>
<td>36 million tons</td>
<td>90,000 tons</td>
<td>1.02 million tons</td>
<td>118,800 tons</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>17,080</td>
<td>$316 million</td>
<td>63 million tons</td>
<td>180,000 tons</td>
<td>2.04 million tons</td>
<td>237,600 tons</td>
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By leasing out a small part of their land to wind developers, farmers can diversify their income and provide insurance against fluctuations in crop prices, with minimal disruption to their operations. Wind farm developers are currently paying Iowa farmers about $2,000 per turbine per year to site the machines on their property, while removing only a quarter acre from agricultural production per turbine. According to data from the Iowa State University Extension Service the average Iowa farm had a net income of just under $6,000 in 1998. While this was an exceptionally bad year, a typical family farm with only three wind turbines would have made more money from wind power in 1998 than from crops.

Other Nontraditional Benefits. Some renewable technologies can be sited on, in or near buildings where electricity is used. This practice, known as distributed generation, can avoid costly expenditures on transmission and distribution equipment. Distributed generation can also improve power quality and system reliability.

Iowa’s Renewable Energy Potential
Technically speaking, Iowa has enough renewable energy sources to supply all of its electricity needs. A 1993 UCS report called Powering the Midwest showed that renewables could economically supply a large portion of Iowa’s electricity. The cost of renewable energy technologies has declined by as much as 80-90 percent over the past two decades and further decreases are projected in the future. While wind and biomass energy appear to be the most economically viable resources on a large scale, solar power could also make an important contribution.

Wind Energy. Iowa has the 10th largest wind energy potential in the country, according to a federal study. Iowa is also home to the largest single wind farm in the world and currently ranks third in total U.S. wind production after California and Minnesota. New high-tech wind turbines, each as tall as a 20 story building and providing enough power for 380 typical homes, are beginning to sprout up in Iowa and across the country. Advances in wind turbine technology over the past twenty years have steadily increased the efficiency and lowered the cost of wind power. These advances, combined with growing concern over the environmental impacts of fossil fuels and nuclear power, have made wind power the fastest growing technology in the world, with an average growth rate of about 40 percent per year during the past five years.

In Powering the Midwest, UCS found that wind power could supply almost 3 times as much power as the state now produces for under 5 ¢/kWh, as shown in the figure below, although transmission capacity would constrain development far below that level. Prices have continued to decline since Powering the Midwest was released in 1993. Recent wind power projects in Iowa cost about 3.5 ¢/kWh on average over a 30-year period and in the higher wind areas of Minnesota and Texas as little as 3 ¢/kWh. These prices include the federal production tax credit, which is worth 1.5 ¢/kWh (in 1992 dollars, adjusted for inflation) for 10 years and is available until December 31, 2001. A recent report by the Electric Power Research Institute and the US Department of Energy projects the cost of wind power to fall even further--to below 3 ¢/kWh by 2010 in wind regimes similar to Iowa, not including the tax credit. These prices make wind among the least expensive new sources of electricity in some locations, yet wind produces no emissions, avoids all risk of fuel price spikes and supply interruptions, and requires no imports of out-of-state fuels.
The Iowa Wind Energy Institute has been monitoring the wind resource in Iowa since 1994 at 14 geographically dispersed sites around the state. The data shows that the Northwest Buffalo Ridge area of Iowa and the north-central part of the state have the best wind resources.16

**Biomass Energy.** The soil and climatic conditions that have made Iowa an agricultural leader are capable of producing a large amount of biomass energy. Using advanced biomass gasification technology, UCS estimated in *Powering the Midwest* that biomass could theoretically provide about twice as much electricity as the state current uses for under 6 ¢/kWh, as shown in the figure. At 5 ¢/kWh, the potential is closer to 15 percent of current state demand. The main source of biomass energy in the state appears to be switchgrass, a fast-growing native prairie grass, grown as an “energy crop” on marginal farmland. A significant amount of crop residues, such as corn stover, could be used for energy production as well, while maintaining residue cover and providing enough nutrients for the soil.

Burning biomass along with coal in existing utility boilers would provide a less expensive short-term option than gasification. It would also help establish a market and infrastructure for growing energy crops, as cleaner conversion technologies such as gasification become fully commercialized. As discussed above, utilities in Iowa are currently demonstrating the feasibility of cofiring biomass with coal in existing boilers through the Chariton Valley switchgrass demonstration project (see box).17 Capturing the methane produced from the decay of organic biomass wastes at landfills, wastewater treatment plants, and farms can also be an economically viable method for producing electricity. The Iowa Energy Center has established the Biomass Energy Conversion Center in Nevada to research and demonstrate innovative applications for converting biomass into fuels, power and chemicals.

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**Chariton Valley Switchgrass Project**

Chariton Valley is continuing its research on developing switchgrass, a native perennial, into an energy producing feedstock. The U.S. Department of Energy (DOE) has identified switchgrass as one of the most promising energy crops. Switchgrass is a hardy perennial native to Iowa and is among the species recommended for land withheld from production under the Conservation Reserve Program.

**Chariton Valley**

The Chariton Valley Resource Conservation Development (RC&D) agency is developing a proposed switchgrass-to-energy initiative. Chariton Valley received research funding from the National Renewable Energy Laboratory for a feasibility study to evaluate both feedstock and conversion aspects of using dedicated energy crops. This project is still in the early stages. Phase I includes:

- Research and development on soil-specific production costs and methods on increasing yield
- Refinement of methodologies and costs for establishment, harvest and transport
- Assessment of using switchgrass in both gasification and cofiring situations using conventional turbines and fuel cells
- Designs for on-site switchgrass handling and feeding systems compatible with both gasification and cofiring facilities
- Plans for commercialization

**Land Available**

The DOE predicts that there are 200 million acres of land in this country that could be used to grow hardy perennials, such as switchgrass. The DOE also calculates that, by the year 2005, an agricultural industry producing energy feedstocks could harvest $4 billion annually.

Two factors have slowed down the development of Iowa's biomass energy potential: the lack of a production system and infrastructure to ensure a reliable and cost competitive biomass fuel supply; and the lack of efficient conversion systems to compensate for the lower energy value of biomass feedstocks relative to fossil fuels.

**Huge Potential**

According to the 1994 Iowa Biomass Energy Plan, Iowa has the potential to grow enough switchgrass to provide electricity to 1.9 million homes. It also has the potential to produce 900 million gallons of ethanol.

--Iowa Energy Bureau, Department of Natural Resources, Renewable Energy Case Study #7, online at [www.state.ia.us/dnr/energy/pubs/ren/rcase/rcase07.htm](http://www.state.ia.us/dnr/energy/pubs/ren/rcase/rcase07.htm)
Solar Energy. Solar energy can also provide some of Iowa’s electricity, but its economic potential is considerably lower than biomass or wind. However, since electricity demand is typically the highest on the warmest days of the year to run air conditioners, solar power can have a higher economic value than other renewables in reducing peak loads and displacing high cost electricity. The applications with the greatest potential in Iowa include installing solar panels or photovoltaics, which convert sunlight directly into electricity, on rooftops or in remote areas away from power lines; solar water and space heating; and daylighting. Based on a grant from the Iowa Energy Center, researchers at the Iowa Photovoltaics Test Facility at ISU are measuring Iowa’s solar resource and examining the performance of various types of solar modules. Solar data is also being collected at four of the wind monitoring sites to gain a statewide perspective of the solar resource.

Barriers to Renewable Energy
Yet despite the large potential, and many economic and environmental benefits, renewables have been slow to develop in Iowa. Four problems are mainly responsible:

- Commercialization barriers. Like all emerging technologies, renewables must compete at a disadvantage against the entrenched industries. They lack the infrastructure and economies of scale that are necessary to accelerate development and lower costs.

- Distortions in tax and spending policy. Studies have established that federal and state tax and spending policies tend to favor fossil-fuel technologies over renewables.

- Little value is placed on the public benefits of renewables. Many of the benefits of renewables, such as reduced pollution and greater energy diversity, are not reflected in market prices, thus eliminating much of the incentive for consumers to switch to these technologies.

- Other market barriers. Lack of information by customers, institutional barriers, high initial costs, the small size and high transaction costs of many renewables, high financing costs, split incentives among those who make energy decisions and those who bear the costs, and high transmission costs can also be barriers to renewables development.

Green market limits. Surveys show that many customers are willing to pay more for renewables. But given the barriers to renewables competing fairly in the marketplace, “green markets” are likely to develop slowly. Many people believe that the cost of renewables should be shared by everyone, since everyone benefits from clean air. A recent Texas Utilities deliberative poll found that 79 percent feel that the cost of renewables should be shared at least in part by everyone, since everyone benefits from clean air, while only 12 percent preferred to rely only on green-pricing. Most existing green power programs have achieved a market share of less than 1 percent of all customers, with the most successful program achieving 5 percent. Moreover, nearly all of the customers who have signed up for renewable products are from the residential sector. Very few businesses—which represent about two-thirds of total US electricity use—have purchased green products. Thus, while green markets are very important new opportunities, they are not sufficient to fully capture the benefits of renewables.

Seven Ways to Switch Iowa to Renewable Electricity
Iowa has made an important start in building a renewables industry infrastructure. In addition to the AEP law, the state wind monitoring program, the Alternative Energy Revolving Loan Program, and the Chariton Valley switchgrass demonstration project are all helping to facilitate the commercialization of renewable energy technologies. However, as electricity generation becomes increasingly competitive, a package of fair and market-oriented policies will be needed to capture the public benefits of renewables and overcome the market barriers to their development in Iowa.

We identify seven effective ways to encourage the wider use of renewable energy in Iowa:

1. Renewables Portfolio Standard. The renewables portfolio standard (RPS) would use market mechanisms to ensure that a growing percentage of Iowa’s electricity is produced from renewable
sources. The RPS creates a minimum commitment to a sustainable energy future. It would build on and enhance the investment Iowa has already made in sustainable energy. And it would ensure that electricity markets recognize that clean renewable electricity is worth more than polluting fossil fuel and nuclear electricity.

Further, these goals can be accomplished using a market approach that provides the greatest amount of clean power for the lowest price and an ongoing incentive to drive down costs. By establishing tradable “renewable energy credits,” the RPS would function much like the Clean Air Act emissions allowance trading system. Electricity providers could generate the power themselves, purchase renewables directly from suppliers or buy credits from other companies who have extras to sell, whichever is cheaper. This would give providers tremendous flexibility in complying with the requirement.

An RPS can ensure steady, predictable growth of Iowa’s renewable energy industry. That would enable the industry to obtain lower-cost financing and achieve economies of scale and production that would make the technologies more competitive. The RPS would ensure that the lowest cost renewables are developed by creating competition among renewable developers. The RPS would have low administrative costs, since the market would decide what kinds of renewable energy would be produced.

Iowa’s citizens already benefit from similar standards in other sectors of the economy, such as recycling standards and minimum energy-efficiency standards for buildings and appliances. From airlines to cars to drugs, standards ensure public safety, economic health, and environmental protection. Such standards help societies achieve goals or meet needs that markets do not fully recognize.

As of January 2000, eight states (Connecticut, Maine, Massachusetts, New Jersey, Nevada, Pennsylvania, Texas and Wisconsin) have enacted RPS’s during restructuring. These state RPS laws will lead to an estimated 3,800 megawatts of new renewables capacity by 2010 and provide support to an estimated 3,600 megawatts of existing renewables. The state renewables targets range from 1 percent of total electricity sales in Nevada (with half coming from solar) to 30 percent in Maine. Connecticut has the fastest growing state target, requiring that 6 percent of its electricity supply come from new non-hydro renewables by 2009. The Texas RPS will create the largest market for new renewables, providing 2000 megawatts by 2009.

In October 1999, Wisconsin became the first state to adopt an RPS and public benefits fund (see below) without moving to retail competition, as part of the Reliability 2000 legislation. Wisconsin’s RPS requires the state’s electric utilities to provide 2.2 percent of their electricity sales from renewables by 2011, which could lead to the development of an estimated 280 MW of new renewables. The RPS builds on the Wisconsin Reliability Act of 1997 (Act 204)—which included a requirement that 50 MW of new capacity come from renewables.

Two other neighboring states have enacted laws or are considering proposals with RPSs or similar minimum renewable requirements. A 1994 Minnesota law is requiring Northern States Power (NSP) to build or purchase 425 MW of wind and 125 MW of biomass by 2002, and an additional 400 MW of wind by 2012, in exchange for allowing NSP to temporarily store nuclear waste at its Prairie Island nuclear power plant. Under this minimum requirement, renewables would provide nearly 5 percent of Minnesota’s electricity by 2012. Minnesota is also considering including an RPS as part of electricity restructuring legislation that will be introduced in the 2001 legislative session. A bill proposed in the Nebraska legislature includes an RPS of 10 percent by 2012.

Iowa’s Alternative Energy Production (AEP) law also established a minimum renewable energy requirement for each electric utility in the state. The law required utilities to build or purchase 105 “average” MW of electric generating capacity, which resulted in the construction of nearly 250 MW of “nameplate” wind power capacity in 1999 and a number of small biomass projects. The capacity requirement was distributed equally to each of the state’s utilities based on their share of total electricity sales. Utilities are allowed to recover any above market costs over time through rates. However, if Iowa decides to open up its electricity system to retail competition, this requirement would no longer be competitively neutral since it would apply to certain electricity providers and not others. By requiring all
retail providers to purchase a minimum amount of electricity from renewables—and allowing them to meet the requirement through credit trading—an RPS would provide Iowa with a flexible, competitively neutral mechanism to build on its historic commitment to renewables under the AEP law.

A number of RPS proposals have been introduced as part of electricity restructuring legislation in Iowa. The Iowa Department of Natural Resources (DNR) introduced an amendment to electricity restructuring legislation proposed last year (House File 740) that would steadily increase renewable electricity to 4 percent of Iowa’s total electricity sales by 2005, 7.5 percent by 2010, and 10 percent by 2015. On February 23, 2000, Governor Vilsack announced a proposal to create an RPS of 5 percent by 2006 and 8 percent by 2011. A proposal by the Responsible Electric Deregulation for Iowa (REDI) coalition calls for an RPS of 12.5 percent by 2010.

All of the proposals would allow new and existing wind, biomass (including organic wastes), landfill methane, solar, and geothermal projects to be eligible to meet the RPS requirement. Some recent proposals would also allow generation from certain hydro and municipal solid waste (MSW) incinerators to be eligible. One potential problem with allowing existing renewable generation, and particularly existing hydro and MSW, to be eligible without restrictions is that resources from outside the state could potentially “swamp” the RPS. This would restrict the development of new renewables projects in Iowa and greatly reduce the public benefits that these projects would bring. This is a problem with the Maine RPS, which allows existing generation to be eligible without many restrictions and does not have a specific requirement for new renewables. Data from the Energy Information Administration (EIA) shows that enough existing renewable generation is potentially available in the Mid-Continent Area Power Pool (MAPP)—the electricity reliability region including Iowa, Minnesota, North Dakota, South Dakota, Nebraska, and part of Wisconsin—to provide 44 percent of the Iowa’s electricity use in 2000, with hydro alone providing up to 34 percent.

There are a number of possible solutions to this problem. One solution would be to exclude existing hydro and MSW facilities from the RPS. In addition to restricting imported hydro and MSW from taking over the RPS, we believe they should be excluded because they are mature technologies that do not necessarily need the support and are likely to continue operating without an RPS. We also believe that MSW incineration and certain hydro projects have more significant environmental impacts than other renewables. Furthermore, we believe that MSW should not be classified as a renewable resource because it includes metals and other materials that produce toxic emissions and ash when burned.

A second possible solution would be to restrict the amount of existing renewable generation that is eligible to meet the RPS. This can be done by adopting specific percentage targets for new and existing renewables. Many states that have adopted RPSs have used this approach. Massachusetts, Connecticut, New Jersey, Wisconsin and Nevada all have adopted variations of a two-tier RPS that have a fixed target for existing generation based on its current share of the state’s total electricity sales and a separate target for new renewables built after a certain date that starts at zero and steadily increases over time. Texas also has a specific requirement for new renewables, but allows a limited amount existing generation, built after a certain date, to be eligible for the RPS.

Some proposals in Iowa have included a restriction on the amount of existing generation that can be eligible for the RPS, which should help address the problem. However, if additional restrictions are not placed on the type of existing renewable generation that’s eligible, it’s possible that imports could be used to meet the existing target instead of existing renewable generation in Iowa.

Other possible solutions that states have implemented along with the two solutions suggested above include:

- Require verification that eligible renewable generation be physically sold to Iowa consumers. This will limit the amount of imported generation because of transmission constraints and the additional costs of transmitting power over long distances.
- Restrict projects that are subject to cost recovery in consumer electricity rates or that are being
used to meet an RPS or similar requirement in other states from being eligible.

UCS calculated the costs and benefits of DNR’s proposed RPS of 10 percent by 2015, using a model of the U.S. electricity system that we developed to analyze federal RPS proposals. The model is patterned off the National Energy Modeling System (NEMS), which was developed by EIA. The main function of both models is to determine what power plants are likely to be built in 13 regions of the country (the North American Electric Reliability Council, or NERC, regions, minus Alaska and Hawaii). Because our model is based on data for specific reliability regions, we only have the capability to model RPS proposals for an entire region, such as MAPP. However, Iowa’s wind and biomass resources are relatively comparable in quality and quantity to other states in the region. Therefore, a regional RPS analysis that allocates a portion of the costs, benefits and renewables development to Iowa based on its share of the region’s generation can serve as a reasonable proxy for estimating the potential impacts of meeting an Iowa-specific RPS.

We modeled the DNR’s proposed RPS as a region-wide requirement in MAPP. We assumed that the RPS targets would start at the current market share of non-hydro renewable generation (about 2 percent) and increase linearly as a percentage of total electricity sales to 4% in 2005, 7.5% in 2010, and 10% in 2015 and thereafter. We also assumed that hydro and MSW were not eligible to meet the RPS, but other existing renewable generation was eligible.

Our analysis shows that the implementing the DNR’s proposed RPS targets is feasible and affordable. We estimate that the proposed RPS would cost a typical (500 kWh/month non-electric heating) household only 68 cents more per month in 2015 than without an RPS. According to national polls, most households would be willing to pay more than $2 extra per month for renewables, and thus would appear willing to support a higher target. A number of studies have also shown than in displacing some of the projected growth in natural gas use for electricity generation, an RPS can help restrain the growth in natural gas prices for all gas consumers and provide net savings on combined electric and gas bills.

Furthermore, our analysis does not include the federal production tax credit (PTC) for wind and biomass, which is scheduled to expire December 31, 2001. If the PTC is extended or some equivalent mechanism is in place, such as credits for reducing carbon emissions, the costs of the RPS would be considerably lower. For example, an analysis recently completed for Iowa by the American Wind Energy Association found that if all the projects under the RPS were eligible to receive the PTC, the RPS would save Iowa over $300 million over a 25-year period. This is equivalent to an average savings of 29 cents per month on a typical household’s electric bill. In a scenario that assumed the federal PTC for wind was not extended beyond 2001, the study found that meeting an RPS of 10 percent by 2015 entirely with wind power would cost 57 cents more per month on a typical household’s monthly electric bill.

The RPS would also help clean-up and diversify Iowa’s electricity. Our analysis shows that the RPS would reduce Iowa’s carbon dioxide emissions by an estimated 2.3 million metric tons in 2015 or 6% below projected business-as-usual levels in the electricity sector. Carbon emissions are reduced as new generation from wind farms and biomass cofiring in existing coal plants displace new natural gas generation and some existing coal generation. We estimate that over 1,030 MW of wind capacity and nearly 200 MW of biomass and landfill gas capacity could potentially be built in Iowa by 2015 to meet the 10 percent requirement.

As of January 2000, the 106th Congress had introduced five electricity restructuring bills containing RPS provisions with minimum renewables targets ranging from 3 percent of electricity sales in 2005 to 20 percent in 2020. A 1999 UCS study of federal RPS proposals found that to help meet a national standard of 10 percent (nonhydro) renewables generation by 2010 and 20 percent by 2020, the high plains states would generate about half of their electricity from wind and biomass. Under the proposal, renewable developers in these states would receive tradable renewable energy credits for each unit of electricity they generate. Any credits they possess in excess of their 20 percent requirement would be sold to electricity providers in other states to help meet the national requirement at the lowest cost. The income
received from these credit sales would support the development of a renewable energy industry in Iowa, providing jobs and income for state businesses, farmers and rural economies, diversifying the state’s energy mix, and capturing environmental benefits.

2. Public Benefits Funding. Another way of encouraging a switch to renewable sources is to fund renewable energy development with a small charge on all electricity sold. Such a charge could fund specific activities to overcome market barriers and help commercialize new technologies. These charges are sometimes referred to as “system benefit charges” and are analogous to funding mechanisms created during both long-distance telephone and airline deregulation. A fee on long-distance calls, for example, helps to preserve universal telephone service. A surcharge on all airline tickets helps support airport maintenance and air traffic control. The United Kingdom created a Non-Fossil Fuel Obligation (NFFO) levy to fund renewables when electricity was deregulated there in 1990. Public benefits funding has been proposed to cover not only renewable energy, but energy efficiency programs, research and development, universal service, and other low-income protections and services.

Such a direct funding mechanism has some unique advantages for preserving the public benefits of renewables. First, funds can be allocated where they are likely to be most effective. For example, they can be directed toward technologies that have great long-run potential, like solar photovoltaics, but that will not be immediately competitive even with other renewables. These technologies will have a difficult time competing for market share even with a Renewables Portfolio Standard. Second, public benefits funding allows the level of the support for renewables to be precisely defined. Unlike tax credits, which may never be used if not structured appropriately, public benefits funding can assure a minimum level of market activity and renewables development. At the same time, the total cost of the program is limited by the funding levels provided.

As of January 2000, twelve states had adopted renewables funds that will collect a total of about $1.7 billion by 2010. This funding could help underwrite the development of an estimated 1,000 MW of new renewables. More than half of this development would occur in California, which also has the highest level of total funding at $540 million over four years. Connecticut has the highest funding per customer at 0.3 $/kWh for energy efficiency, plus 0.05 $/kWh for renewables initially, and increasing to 0.10 $/kWh. Massachusetts has implemented a charge of about 0.35 $/kWh for all public benefits funding, with almost 0.10 $/kWh for renewables for five years, and 0.05 $/kWh thereafter.

A number of neighboring states have adopted public benefits funds for renewables. Illinois included a renewables public benefits fund of $50 million over 10 years in its restructuring legislation, as well as a separate $250 million clean energy trust fund through a settlement with one its utilities. Wisconsin enacted a public benefits fund of about $80 million per year for energy efficiency, renewable energy and environmental research. Minnesota law requires Northern States Power to contribute $500,000 per year for each cask storing nuclear waste at its Prairie Island nuclear power plant beyond 1998 into a fund to support new renewable energy projects above and beyond those already required by law, with a preference for in-state projects. The fund will provide $4.5 million for projects in 1998, rising up to a maximum of $8.5 million per year in the future.

Support for energy efficiency and renewables in Iowa is in jeopardy. In 1996, the Iowa legislature removed the requirement that investor-owned utilities spend 2 percent of their electric revenues and 1.5 percent of their natural gas revenues on energy efficiency. Funding levels are now determined annually by the Iowa Utility Board, making them less certain. Also, federal oil overcharge funds, which have funded a wide range of clean energy programs in Iowa for over a decade, are nearly exhausted.

State and utility programs in Iowa are currently spending about $82 million per year on energy efficiency. A proposal by the Iowa DNR would create a public benefits fund of $56 million per year for 15 years for energy efficiency and renewables. This is equivalent to a charge of about 0.15 $/kWh in 2000 falling to 0.11 $/kWh in 2015, assuming the charge is collected from all electricity consumers and demand is growing at 2 percent per year on average. This places Iowa in the middle of the funding levels adopted by other states in restructuring, but is less
than one-third the level adopted in Connecticut and Massachusetts. A proposal by the Responsible Electric Deregulation for Iowa (REDI) coalition to provide $100 million for energy efficiency and renewable energy is equivalent to a charge of about 0.27 ¢/kWh in 2000 falling to 0.20 ¢/kWh in 2015. This is still considerably below the commitments made by Connecticut and Massachusetts, but is higher than most of the other states.

While most parties in Iowa agree that restructuring legislation should support the development of renewable electricity, there has been considerable discussion about how to do it and at what level. Recently, some parties have suggested using only financial incentives from the public benefits fund to meet renewable energy goals rather than using an RPS that places an obligation on retail providers and allows them to meet their requirement through credit trading. Under the incentives-only approach, the state would award money and long-term contracts to renewable projects through a competitive bidding process. Proponents of this approach claim that establishing long-term contracts will provide more certainty for renewable developers and help lower financing costs.

The main disadvantages of an incentives-only approach are:

- State government or some independent agent decides which projects win and lose, rather than the market.
- There is no guarantee that the winning projects will actually be built, making it difficult to achieve goals, whereas an RPS would require retail suppliers to have a certain number of credits each year or face penalties.
- It could involve considerably more government oversight and administration costs to evaluate and award bids and monitor performance, whereas much of this will be done by the market under an RPS.
- If renewable developers are awarded long-term contracts with the price determined up-front, future savings are impossible without renegotiating contracts. Under an RPS, developers must constantly compete for credits in the market, providing downward pressure on prices.
- The level of funding may not be sufficient to achieve renewable energy targets, thereby reducing the potential to capture public benefits and remove market barriers.

The incentive-only approach has been used in California and the UK with mixed success. A number of relatively low cost renewable energy projects have received winning bids, and the costs have generally fallen through successive auctions. However, without a requirement that projects be built by a certain date or penalties for failing to deliver, it appears that many winning bidders “lowballed” their bids and are waiting for renewable costs to fall to a certain level to make their projects more profitable. Consequently, many of the projects have not been built or are behind schedule. Recently, the UK decided to abandon the incentives-only approach in favor of an RPS.

One way to minimize the problems of an incentives-only approach is to design the public benefits fund to be complementary to the RPS. An RPS with credit trading is designed to create competition between renewable developers and retail electricity providers to meet the standard at the lowest cost. Thus, the technologies that are closest to becoming competitive with conventional technologies, such as large wind power projects, are likely to meet most of the requirement, as demonstrated by the recent projects installed to meet the AEP law and as shown in the analyses above. Therefore, a renewables fund can be used to encourage resource diversity by supporting emerging technologies that are more currently more expensive, but have the potential to provide significant long-term economic and environmental benefits. This could include energy crops, methane digestors, solar photovoltaics, and small distributed wind turbines. A renewable fund can also be designed to help remove particular market barriers, develop infrastructure, lower financing costs and educate consumers that could help create long-lasting demand for renewables.

3. **Net Metering.** Net metering is an important way to eliminate penalties for electricity consumers that elect to generate their own power from renewable sources (with, for instance, small wind turbines or
rooftop solar systems). It allows customers who produce more electricity than they are using at a given moment to feed the surplus back into the electricity system and only pay for net electricity used over an entire billing period or year. Customers that produce more power than they use over a designated period usually must sell the surplus power back to the electricity provider at wholesale prices. This provides an incentive for the customer to size the system to meet their electricity needs.

As of January 2000, 29 states, including Iowa, required net metering, with utilities in two other states also using net metering. In the last few years, a handful of states have either adopted or reaffirmed net metering as part of electricity restructuring.

Iowa's net metering law has been relatively successful in encouraging the development of customer-owned renewable energy systems compared to other states. Except for Ohio, Iowa is the only other state that does not have a size restriction for eligible systems. Because larger renewable energy systems are typically more economically viable than smaller systems, fairly large wind turbines have been installed at a number of schools, farms and businesses. However, since any electricity that's generated in excess of the customer's use can only receive the utilities wholesale electricity price, systems are typically sized to meet the customers electricity needs.

Iowa's net metering rule is currently in jeopardy. In August 1999, the Polk County District Court ruled in favor of a challenge by MidAmerican Energy Co. that the IUB net metering rule violated federal law. However, the decision is currently being appealed by the IUB, the Iowa Office of Consumer Advocate, and a coalition of environmental and renewable advocacy groups. Another challenge to Iowa's net metering rule by MidAmerican Energy Co. is pending before the Federal Energy Regulatory Commission (FERC). The utility argued that net metering constitutes a forced purchase of electricity at a set price, a practice FERC has previously prohibited. Environmental and renewable energy advocacy groups have intervened to defend net metering as sound policy falling squarely within state, rather than federal jurisdiction.

The Iowa DNR has proposed to reaffirm the state's net metering policy as part of electricity restructuring legislation. Proposals are also being discussed to provide incentives for electricity providers to encourage net metering by allowing them to receive credit toward the proposed RPS requirement of up to 150 percent of the total capacity of the renewable energy system. The proposal may make it easier for the provider to meet its RPS requirement, help offset potential revenue losses and encourage some development of small customer-owned systems.


Some renewables can be sited in or around customer buildings where they can not only replace conventional generation, but help avoid transmission and distribution costs. An important issue is whether these technologies are credited for these savings. In some cases, distributed renewables generation can become cost-effective when these transmission and distribution savings are counted.

New regulations or incentives are needed to encourage distributed generation where it is economic. Options include integrated resource planning for distribution systems and performance-based ratemaking. Massachusetts and Connecticut have required consideration of distributed technologies.

Renewable energy producers, like other generators, need access to the transmission grid and the ability to sell power whenever it is available. New federal rules and regional independent system operators (ISOs) could increase access to customers for renewable generators, and reduce transmission costs for remote facilities. Some proposals for transmission service pricing, however, could unfairly penalize intermittent renewables like wind and solar, by requiring generators to specify sales a day or more in advance and pay penalties for deviating from the amount purchased. Other transmission pricing issues could also affect renewables adversely. An analysis by the Lawrence Berkeley Laboratory shows that charging only for energy transmitted by renewables will produce the least-cost electricity system.

5. Fair Pollution Rules.

Under the Clean Air Act, older power plants are allowed to emit more pollutants than newer plants and, therefore, do not have to spend as much money on pollution controls. For example, one of the units at the Muscatine coal plant has acid rain emissions three times higher than the statewide average and NOx emissions more than
A study for the National Association of State Regulatory Utility Commissioners found that on average, these rules save older plants in the High Plains states 0.7 cents per kilowatt-hour or $578 million per year, giving them an unfair competitive advantage over new plants.

Several proposals have been made to reduce the disparity in emissions allowed at different plants. Connecticut and Massachusetts directed their environmental regulators to develop emission performance standards for retail supplier portfolios. Another approach is to develop an overall emission cap in the area affected by a specific pollutant, and to allow trading among companies to meet the cap. The US Environmental Protection Agency has proposed a nitrogen oxides trading scheme for Eastern states. Several federal proposals would create caps for multiple pollutants. Under both approaches, renewable generators should receive credit for displacing emissions that would have otherwise been produced from fossil fuels and reducing the cost of compliance for existing conventional generators. This can be accomplished by setting-aside a portion of the total emissions allowances in a given state for renewables and energy efficiency projects. The Iowa DNR has proposed that any revenue that is received from the sale of emissions credits resulting from investments in renewables and energy efficiency projects that receive incentives under the public benefits fund be returned to the fund to support additional projects. This will ensure that the total value of these programs is returned to Iowa citizens through continued reprogramming.

A third approach would be to tax emissions, a policy that has gained some favor in other countries. The revenues could be used to support investments in renewables and energy efficiency or to lower other taxes such as personal income and property. Initiatives like this have been proposed in Minnesota and Vermont.

6. Customer Information. To exercise their preference for clean energy sources, customers need reliable information about products they are offered. To address this issue, electricity suppliers can be required to label their products. These disclosure labels would be analogous to nutrition labels on food. A number of states have required electricity providers to disclose the fuel mix and emissions from their electricity products, and others are considering it. In addition, education programs about environmental impacts and choices available in the marketplace, as well as certification of renewable electricity services by an independent organization, can provide important information.

7. Putting Green Customer Demand to Work. Many surveys have shown that customers are willing to pay more for electricity from clean renewable sources. As of January 2000, competitive suppliers or green marketers were actively offering renewable energy products to consumers in a few states with retail competition, with Pennsylvania and California being the most active markets. In addition, about 50 regulated utilities across the US are offering customers renewable energy choices. Results from initial pilot and marketing experiments are mixed, with low initial participation rates but some signs of long-term promise.

Supportive market rules are important for allowing effective customer choice. Electricity customers who switch suppliers need to receive a shopping credit that includes avoided retail overhead costs. Aggregation of small customers can reduce overhead and marketing costs, and facilitate choice of green products. Municipal aggregation, authorized by Massachusetts law, where a city or town votes to purchase electricity for all its residents and businesses, may be especially promising. Government purchases of renewable electricity is another approach to stimulate development.

Conclusion
Electricity restructuring presents both risks and opportunities for renewable energy. The main risk is that renewables will be at a competitive disadvantage against fossil fuels, if the public benefits of renewables are not reflected in electricity prices. If this occurs, the result could be even less use of renewable electricity than we see today, with corresponding higher levels of pollution, greenhouse gases, and other problems.

No matter what industry structures Iowa chooses to adopt, markets can be structured to be fair to clean energy resources, or to discriminate against them. Under any market structure, there are potential...
opportunities for renewables if appropriate policy steps are taken.

This report has described seven practical measures that would greatly increase the contribution of renewable sources to the Iowa’s electricity supply. These measures are complementary and can be enacted together to capture the public benefits of renewables and place Iowa on course towards a sustainable energy future. Policymakers should consider them as an integral part of increasing competition in the electricity industry.

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4 For example, see A Small Price to Pay: US Action to Curb Global Warming is Feasible and Affordable, Union of Concerned Scientists and Tellus Institute, July 1998.


8 Michael Brower, Michael Tennis, Eric Denzler and Mark Kaplan, Powering the Midwest: Renewable Electricity for the Economy and the Environment, Union of Concerned Scientists, 1993. The study assumed 400 MW of wind, 110 MW conventional biomass, and 300 MW advanced biomass.


10 See American Wind Energy Association publications on wind power in Iowa online at www.iowawind.org.


14 This is the estimated annual average or levelized cost over the estimated 30-year life of the projects.

16 A map of the state’s wind energy resources that incorporates this wind monitoring data is available from the Iowa Energy Center, online at www.energy.iastate.edu.

17 In gasification, the biomass is heated under pressure until it gives off volatile gases. The gases are captured and burned in a high-efficiency gas turbine. This is cleaner and more efficient than simple combustion. For more information, see the Appendix of Powerful Solutions.


20 Nameplate capacity refers to the maximum capacity a particular facility is capable of producing while average capacity refers to the actual average output from that facility.


23 This effect was demonstrated in analyses of federal RPS proposals conducted by the Energy Information Administration, including the runs completed for Annual Energy Outlook—2000; and in Steve Clemmer, Alan Nogee and Michael C. Brower, A Powerful Opportunity: Making Renewable Electricity the Standard, Union of Concerned Scientists, 1999. This effect was not modeled in RPS analysis for Iowa.


26 Regulatory Assistance Project, Making Room for Renewables, Issues letter, July 1996, online at www.rapmaine.org/room.html. A Non-Fossil Fuel Obligation (NFFO) levy of up to one percent of revenues goes into a pool, which the system administrator distributes to the winning bids, using a request-for-proposals (RFP) process. The administrator establishes the amount of power to be acquired and the RFP criteria. The NFFO levy was designed to enable new renewables to be developed to supply 3 percent of system capacity by the year 2000, as well as to preserve at least 20 percent of generation from all non-fossil fuel sources, including nuclear.


28 MidAmerican Energy Co. vs. IUB, Case Nos. AA3172/3195/3196.

29 MidAmerican Energy Co., Docket No. EL 99-3-000. Filings available online at rimsweb1.ferc.fed.us/rims/


31 The emission rate is the pounds of sulfur dioxide or nitrogen oxide emitted per million BTU of fuel used. This allows for comparison of plants with different levels of output. Source: US EPA, Emissions Scorecard 1996, online at www.epa.gov/acidrain/score96/es1996.htm.

Appendix A
The following detailed assessment of Iowa’s renewable electricity resources and potential is taken from the 1993 UCS report *Powering the Midwest* (see reference 8). The assessment provides key energy statistics, renewable energy resource maps, cost-supply curves, and summary tables. However, since the report was published, wind technology has steadily improved and the cost has steadily fallen. The cost of wind power is projected to fall below 3 cents per kilowatt-hour by 2010 in wind regimes similar to Iowa, as discussed above. Thus, the wind energy cost-supply curves for Iowa should be viewed as conservative.