Environmental Implications of Restructuring

Overview

Competitive restructuring is expected to change the manner in which electric generating units are planned, constructed, and operated. Like several other states, Maryland has restructured its electric utility industry based on the belief that competitive forces will promote efficiency and, at least eventually, lower the cost of electric service. Another important issue is whether restructuring, on balance, will improve or harm the environment over time. There has been considerable disagreement over this question as part of the larger debate over restructuring. Ultimately, the answer may depend upon how restructuring is implemented, both at the state and federal levels.

It should be noted that Maryland's Electric Customer Choice and Competition Act includes several provisions intended to address the protection of the environment. One of the Act's five stated purposes is to "ensure compliance with federal and state environmental standards." The Act further states that "it is the intent of the General Assembly to minimize the effects of electric restructuring on the environment." As discussed in Section 2, the Act retains the CPCN framework, which provides for a comprehensive review of new generation and transmission facilities sited in Maryland. Other important provisions of the Act, which directly or indirectly concern the environmental consequences of restructuring, include the following:

- *The PSC must ensure that restructuring does not adversely impact energy efficiency programs. The PSC must consider impact on the environment as one of four principal criteria in evaluating programs for funding and implementation.*
- *The Act requires periodic disclosure to consumers of each supplier's fuel mix and air emissions. This will assist consumers who wish to use the environmental attributes (perhaps along with price and other factors) as a basis for choosing a supplier.*
- *The PSC must consult with the Maryland Department of the Environment (MDE) to adopt "appropriate measures" to maintain environmental standards.*
- *The PSC is required to investigate and report on the feasibility of implementing a renewables portfolio standard (RPS; see discussion on page 32).*
- *As an additional precaution, the Act requires that Maryland electric companies conduct a study to track the changes in generation and emissions resulting from restructuring. If the results of the study are adverse, then the Act requires that the PSC and MDE evaluate the feasibility of remedial measures.*

Since competitive restructuring of retail electric service is only in its infancy, there has not been sufficient experience to determine whether it will adversely impact the environment, improve environmental quality, or have virtually no effect at all. One certainly could argue that restructuring is likely to have little

Section Highlights

Restructuring may have consequences that affect the environment to some degree. The Restructuring Act in Maryland included several provisions designed to inform consumers of the environmental impacts from electricity generation, and to protect the State's natural resources.

or no effect on the environment. Restructuring by itself — and Maryland's decision to restructure — does not alter in any manner existing state or federal environmental standards or regulations. For example, the applicability of the provisions of the Clean Air Act Amendments to Maryland's generating units is not changed in any way by the decision to deregulate those units. Further, industry restructuring to date does not seem to be changing the types of generating units being built or the power plant technologies being relied upon. Maryland utilities in the 1990s constructed (or proposed) mostly gas-fired combustion turbines and combined cycle plants. These are the same type of plants being constructed today as non-utility merchant plants. Again, whether the new plants are to be regulated utility or non-regulated merchant has no effect on the environmental control regulations to which the plants must comply. Moreover, Maryland has retained substantially the same CPCN environmental review process as existed prior to deregulation.

Some analysts have suggested that restructuring could provide net environmental benefits. With customer choice, some electric customers may decide to select "green power" — power supplies from relatively clean generation resources (see page 30). This market response, which is absent under regulation, would provide an incentive for competitive suppliers to construct clean power technologies (such as those using renewable fuels) or to control existing power plants beyond the minimum regulatory standards. It is further argued that competition promotes efficiency, as compared to monopoly regulation, leading to accelerated retirements of older, uneconomic power plants. The older plants typically have higher emissions rates than new plants. Finally, some of the states that have deregulated generation have required that customer choice be accompanied by mandatory funding of conservation programs and support for renewable resources.

On the other side of the debate, there is a concern that restructuring, if not accompanied by certain protections, could result in adverse environmental impacts. On a nationwide basis, competition and transmission open access could change the regional pattern of generation. Many of the coal-fired generating units in the Midwest and South are both underutilized and grandfathered from emissions control standards as stringent as those in the Northeast and mid-Atlantic regions. Deregulation creates an opportunity for greater utilization of those high emitting plants, leading to a net increase in pollutants. With the long range air transport of emissions, this could adversely affect air quality and increase nitrate deposition in Maryland and in other states in this region.

Increased air emissions also could occur from the demand side of the market. Restructuring is expected to result over time in a lower cost for electric service. However, the cost reduction may stimulate additional electricity usage by consumers, which means greater power plant emissions. This demand response might be even greater if restructuring is accompanied by reduced investment in energy conservation programs, which has occurred in Maryland during the past few years.

As mentioned above, the environmental impact of restructuring may depend in part on whether it accelerates the retirement of older power plants. It is argued that, under monopoly regulation, utilities had little incentive to replace their relatively inefficient power plants with clean, new plants. So far, however, there is little evidence that deregulation and competition have prompted plant retirements of older fossil units to any significant extent. In part, this is because market prices of generation (and shrinking reserve margins) have been high enough to justify keeping older, less efficient plants in operation. As is the case with fossil plants, so far deregulation does not appear to have motivated the retirement of nuclear power plants.

Given this uncertainty, PPRP has been sponsoring research to increase its understanding of the possible air emissions consequences of restructuring. A preliminary study conducted by PPRP projected that restructuring could increase NO_x emissions nationwide (compared to a baseline of only very limited restructuring) by up to 4 percent and increase CO_2 emissions by 1 to 3 percent. The expected emissions increases in the Southeast and portions of the Midwest are substantially greater than those national averages. Research in this area is continuing as more is learned about restructuring.

There is a final area of concern that is specific to PPRP's experience with power plant licensing. As stated above, deregulation of generation does not by itself alter environmental laws or standards. However, the environmental licensing of power plants is more than merely ensuring compliance with specific requirements. Based on PPRP's experience, it is clear that there are many judgmental and discretionary decisions associated with power plant projects which have implications for environmental and local community impacts. Historically, many aspects of power plant licensing were worked out on a voluntary basis with utilities going beyond the minimum requirements under the law. This voluntary compliance and willingness to go beyond minimum standards to protect the environment has been facilitated by the "cost plus" nature of monopoly regulation. Under that structure, utilities were not at risk for the recovery of environmental expenditures from their customers, particularly when those measures were negotiated with State agencies and approved by the PSC in CPCN proceedings.

The question is whether this cooperative behavior will continue in a restructured industry. With the implementation of deregulation, incremental expenditures for environmental protection may be perceived by the developer as reducing profits or in some cases even threatening the financial viability of the project. The developer will have a stronger financial incentive to minimize environmental expenditure and not to exceed minimum standards of compliance, compared to regulated utility developers in the past.

Emissions Disclosure

Under the Maryland Electric Customer Choice and Competition Act of 1999, electric companies in Maryland are required to provide each customer with accurate information about the environmental characteristics of the energy that the customer is purchasing. Experience in states where deregulation took place in advance of Maryland's Restructuring Act, such as California and Pennsylvania, suggests that electricity customers, especially residential customers, consider carefully environmental aspects of the electricity they are purchasing. There is anecdotal information that indicates that a percentage of the population will choose a "clean" source of electricity over a "dirty" source, even if the cleaner source is somewhat more expensive.

Section Highlights

To allow customers to compare the electricity supply offers made by different companies, the law requires companies to report standard information regarding what fuels are used to generate their electricity, and what air emissions are produced from that generation.

To help customers in Maryland make informed decisions about their electricity suppliers, the regulations implementing customer choice require electric companies to disclose information about emissions. Specifically, all electricity suppliers and service providers in Maryland are now required to provide two types of information about the electricity they are selling to customers in Maryland:

- *Fuel mix — Electric companies must indicate what types of fuels were used by the company to generate electricity, and what percentage of the total electricity generated was contributed by each fuel type; and*

- *Air emissions — Electric companies must provide information on emissions of sulfur dioxide (SO_2), oxides of nitrogen (NO_x), and carbon dioxide (CO_2) associated with generation of electricity being sold in Maryland. The PSC, in consultation with MDE and DNR, may at a later date require electric companies to disclose emissions information on additional pollutants, such as fine particulate matter or mercury.*

There are a number of ways to characterize air emissions (and even fuel mix/generation technology) from power plants. To ensure that customers can easily compare the reported information, electric companies must disclose required fuel and emissions information in common units of measure:

- ***Fuel mix information** is presented in terms of percentage in the fuel mix of coal, gas, nuclear, and oil; and of renewables, which includes captured methane gas, hydroelectric, solar, wind, municipal solid waste, and biomass.*

- ***Emissions information** on SO_2, NO_x, and CO_2 must be presented in terms of pounds of pollutant per megawatt-hour (lb MWh) on an average basis. To ensure that customers can compare emissions information readily, the regulations require electric companies to present the emissions information in a uniform label, and relative to the "Maryland benchmark."*

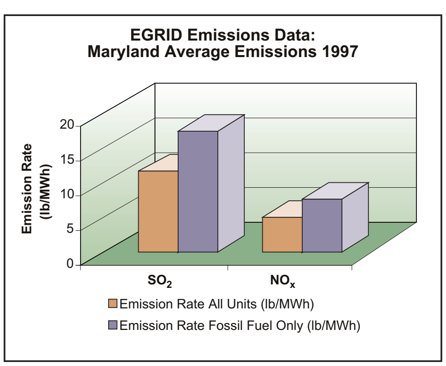
The benchmark represents a common reference point against which customers can compare reported emissions information. The PSC selected as the Maryland benchmark the average regional emission rates of the three pollutants, as reported in the U.S. Environmental Protection Agency's (EPA) Emissions and Generation Resource Integrated Database (EGRID). EGRID is an amalgamation of emissions and operating information from both utility and some non-utility power plants that report this information to the U.S. EPA, the Energy Information Administration, or FERC. The most recent year of EGRID information is for calendar year 1997.

The Maryland benchmarks for SO_2, NO_x, and CO_2 are based on the average emission rates from all reporting generating units in EGRID in the PJM region (or, for customers in Allegheny Power's service territory, the AP region). For this first year of emissions disclosure under customer choice, the Maryland benchmark emissions are as follows, in pounds per megawatt-hour (lb/MWh):

The **Emissions & Generation Resource Integrated Database (EGRID)** captures a range of available information on environmental attributes of electric power systems in the United States. The data base includes plant-specific data for electricity generating plants that provide this type of data to the U.S. government under various programs. Data in EGRID include:

- Generation in megawatt hours (MWh),
- Capacity in megawatts (MW),
- Resource mix for renewables and non-renewables,
- Heat input in million Btu (MMBtu),
- Emissions of NO_x, SO_2, and CO_2 in tons per year, and
- Emission rates for NO_x, SO_2, and CO_2 in pounds per megawatt-hour (lbs/MWh) and in pounds per million Btu (lbs/MMBtu).

EGRID presents this information at various "levels of aggregation" such as by boiler, power plant, generating company, state, NERC region, and across the U.S.



	PJM	Allegheny Power
SO_2	10.0	15.0
NO_x	3.3	5.4
CO_2	1301.3	2066

For electricity generation that companies have been offering for some period of time, the fuel mix and emissions information disclosed on labels will eventually be based on historical information on actual operations over the previous 12 months. For new energy products offered by existing electric companies, or for new entrants into the Maryland market, electric companies can disclose environmental information prospectively for a limited period of time (six months). After the initial six-month period, the electric company must document that it met the fuel mix and emissions claims it made prospectively (with a margin of error) and begin using historical information on the emissions disclosure labels.

Electric companies are scheduled to begin disclosing fuel mix and emissions information in April 2001. In certain circumstances, electric companies will be allowed to report benchmark fuel mix or emissions information, instead of actual, historical information for a limited period of time. Figure 3-1 is an example of an "emissions disclosure" label with benchmark regional PJM fuel mix and emissions information. Eventually, electric companies will present actual emissions information relative to the benchmark data so that customers can make informed comparisons on electric providers.

Figure 3-1
Fuel Mix and Air Emissions Uniform Label

Environmental Information for Standard Offer Service

The following environmental information is for standard offer service which commenced on July 1, 2000. These data are regional averages. [Company Name] specific emissions and energy source (fuel mix) data may vary from these averages.

Electricity can be generated in a number of ways with different impacts on the environment. The standardized environmental information shown below allows you to compare this electricity product with electricity products offered by other electricity suppliers.

Energy Source (Fuel Mix)

Regional values are shown which represent 1997 averages for this region.

Source	
Coal	46%
Gas	2.5%
Nuclear	35.0%
Oil	1.8%
Unspecified Fossil	11.6%
Renewable Energy:	
Captured Methane Gas	0.0%
Geothermal	0.0%
Hydroelectric	1.2%
Solar	0.0%
Solid Waste	0.0%
Wind	0.0%
Wood or Other Biomass	0.0%
Unspecified Renewable	1.6%
Total	**100.0%**

Renewable energy sources subtotal: 2.8%

Air Emissions

The amount of air pollution associated with the generation of the electricity production for this region is shown in the table at right.

	Pounds emitted per Megawatt Hour of Electricity Generated
Sulfur Dioxide (SO_2)	10.0
Nitrogen Oxides (NO_x)	3.3
Carbon Dioxide (CO_2)	1,301.3

CO_2 is a "greenhouse" gas, which may contribute to global climate change. SO_2 and NO_x released into the atmosphere react to form acid rain. NO_x also react to form ground level ozone, an unhealthful component of "smog."

SECTION HIGHLIGHTS

Some customers are willing to pay slightly more for electricity from sources perceived to be more environmentally friendly than fossil fuel or nuclear power plants. While they have important benefits, even renewable energy sources, such as solar and wind power, have some environmental impacts.

Green Power

Definition

The implementation of customer choice presents an opportunity for consumers of electric power to choose the sources from which the power that they purchase is generated. Specifically, consumers can opt to purchase some or all of their power requirements from suppliers offering generation from renewable, or environmentally preferred, resources. Power generated from these resources is generally referred to as "green power."

There remains some disagreement as to which resources should be classified as "green." Maryland's Restructuring Act identifies the following as renewable energy resources: solar, wind, tidal, geothermal, biomass (including waste-to-energy and landfill gas recovery), hydroelectric, digester gas from wastewater treatment plants, and waste-to-energy systems. No electric generation technology, however, is completely free of environmental impacts. For example, wind generation entails land use impacts, can result in the deaths of migrating birds and raptors, and can have visual impacts on adjacent communities. Solar photovoltaic technology, which converts sunlight directly into electricity, has, in addition to land use impacts, some adverse environmental impacts that emerge from the manufacture of photovoltaic panels. Table 3-1 summarizes the set of generation technologies generally represented as being renewable or "green," including the potential for development in Maryland and the mid-Atlantic region, the cost relative to conventional (e.g., fossil fuel) technologies, and a brief description of the environmental impacts associated with each technology.

Substantial controversy surrounds the inclusion of hydroelectric facilities in the set of green power technologies. Hydropower relies on the movement of water to spin turbines and generate electricity. Large hydroelectric facilities typically require a dam to create a reservoir from which water is released and forced through the turbines to produce electric power. Hydroelectric facilities, therefore, affect stream flows and can adversely affect existing ecosystems. In particular, dams can prevent certain species of fish, such as American shad, from migrating upstream to spawn. While small hydroelectric facilities, generally defined as those facilities with a generating capacity of 30 MW or less, can exhibit lower levels of environmental impacts, some of the same adverse environmental consequences associated with the operation of large facilities characterize the operation of small-scale hydropower. (More discussion of hydroelectric facilities and their environmental characteristics is included in Section 4.)

Costs and Availability

Currently, green power technologies tend to be more costly than conventional generation technologies. Furthermore, the additional costs associated with renewables is not uniform among the various "green" technology types. For example, solar photovoltaic generation is currently estimated to cost in excess of $0.25 per kWh compared to a cost of under $0.05 per kWh for a new combined cycle plant using natural gas as a fuel. Certain green power technologies entail costs only slightly higher than, or competitive with, electricity generated from fossil fuels (natural gas, oil, and coal). For example, geothermal power, which is generated from naturally occurring steam trapped in underground pockets, is competitive with conventional technologies, although not readily available in the mid-Atlantic region. Certain biomass technologies can also approach competitiveness with conventional technologies, depending on the quality and quantity of biomass fuel available for combustion. (Biomass generation refers to reliance on agricultural waste as fuel or crops grown specifically for use as fuel.)

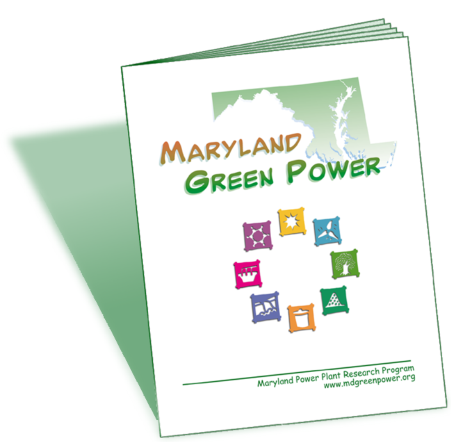
The costs associated with green power depend significantly on local geographical conditions. Maryland's location on the mid-Atlantic seaboard makes the state less well suited to accommodate certain types of renewable generation than other states. For example, the solar characteristics of Maryland are not as favorable as those of the southwestern United States. Wind conditions in the state are less favorable than those in the upper Midwest, though Western Maryland does have several locations that are favorable to wind resource development. There is no evidence of geothermal activity in the state (or elsewhere in the mid-Atlantic region), and there presently appears to be no potential for development of tidal power resources.

Maryland does, however, have significant potential for biomass development from several sources, including agriculture, the timber industry, and the poultry industry. (Poultry litter, a combination of poultry waste and sawdust or wood shavings used to cover the floors of poultry houses, has a heat content only slightly lower than wood.) Several generating stations in Europe are fueled by poultry litter and there is increasing interest in developing this potential resource in Maryland given the large and concentrated poultry industry located on the Eastern Shore.

State Procurement

With the restructuring of Maryland's electric industry, the State government, like other consumers of electric power, will have a choice as to the source of its power supply. State government purchases of electricity total approximately $80 million per year. This figure includes power supply costs for the University of Maryland system, Baltimore-Washington International Airport, the Port of Baltimore, and the Maryland Stadium Authority (which oversees Oriole Park at Camden Yards and the adjacent PSINet football stadium).

The State's goal is to purchase 6 percent of the State government energy requirement from green resources, which for purposes of the State's competitive solicitation of electric power is defined as solar, wind, biomass, landfill gas, and



To educate consumers, PPRP is producing a booklet and Web site (www.mdgreenpower.org) describing green power technologies and their environmental characteristics. The booklet describes the extent to which each type of electric generation contributes to such environmental issues as climate change, nitrogen loadings to the Chesapeake Bay, and water use. The importance of energy efficiency and conservation are also discussed. Consumers can use the descriptive information in the booklet when considering a purchase of green power.

Table 3-1 Summary of Renewable Technology Characteristics

Technology	Potential for Development in Maryland	Cost	Environmental Impacts
Solar	Fair/good	Significantly higher than system average	Photovoltaic (PV) systems do not produce any air emissions or water pollution. Large PV systems have significant land impacts and toxic materials are used to construct PV panels.
Wind	Good (Western Maryland)	Slightly to moderately higher than system average	No air emissions or water pollution. Wind turbines can entail major aesthetic impacts and cause migratory bird mortality as birds collide with the turbine blades. Also, wind power entails substantial land use impacts.
Biomass	Good/excellent	Slightly to moderately higher than system average	Different types of biomass fuel entail different air emissions. In general, biomass combustion contributes moderately to acid rain, smog, nutrient loadings to the Chesapeake Bay, and releases of toxic substances. Using biomass for energy recovery reduces solid waste impacts.
Municipal Solid Waste	Excellent	Moderately higher than the system average	Contributes moderately to climate change, acid rain, smog, and nutrient loadings to the Chesapeake Bay. These plants have positive land use impacts since material that would otherwise be deposited in a landfill is used to generate electricity.
Landfill Gas Recovery	Excellent	Slightly higher than system average	Contributes moderately to acid rain, smog, and nutrient loadings to the Bay. Landfill gas recovery affects climate change in a positive way, since methane generated from the landfill is burned and converted to CO_2, a much weaker greenhouse gas.
Hydroelectric	Poor	Slightly to moderately higher than system average	No air pollution results from hydroelectric operations. Hydroelectric operations significantly affect stream flows and aquatic ecosystems.

municipal solid waste. The fundamental reasons underlying the State's green power goal are to demonstrate a commitment to supporting the development of green resources and to provide market signals to developers indicating that a substantial market exists for green power.

Another approach to including environmentally preferable generation profiles in State procurement is under development, in conjunction with the Pennsylvania government. This approach focuses on quantifying the emissions profile of electric power producers. This profile can be compared to a market benchmark, e.g., the PJM average system mix, allowing the inclusion of conservation programs and efficiency improvements in determining an energy product's "environmental preferability."

RPS Requirement

The implementation of electric industry restructuring has led several states to consider and implement a Renewables Portfolio Standard (RPS) applicable to sellers of electric power for use in the respective state. An RPS requires that electric power sold include a minimum percentage of power generated from renewable energy sources. Such renewable resources are typically defined to include solar, wind, geothermal, and biomass, but may also include hydroelectric, municipal solid waste, fuel cells, or other resources that an individual state would like to promote and encourage.

The fundamental reasons underlying the implementation of an RPS relate to perceived market barriers and imperfections that can serve to hamper the development of renewable generation projects. These market barriers and imperfections include, but are not limited to: the present inability of renewables projects to benefit from scale economies, which would serve to lower the total cost of production of energy from renewables; inadequate information regarding the benefits of increased reliance on renewable technologies including environmental benefits, diversity of the fuel supply, and reduced reliance on fossil fuels; and high initial capital funding requirements. An RPS is seen as a means to overcome the market barriers and imperfections to allow generation from renewable resources to ultimately be competitive with generation from conventional sources.

Because generation from renewable resources is generally more expensive than generation from conventional generating facilities, the imposition of an RPS will entail increased costs for power purchased by consumers compared to the costs that consumers would face absent an RPS. The degree to which costs would increase under an RPS is highly dependent upon how the RPS is structured. For example, an RPS that entails a five-percent renewables requirement would be more expensive to implement than one that specifies only a three-percent requirement. Similarly, an RPS that excludes generation from combustion of municipal solid waste (MSW) from the set of renewable energy sources will be more expensive for consumers than one that includes MSW. (Generation from combustion of MSW is less expensive than solar or wind generation, for instance.)

RPS provisions have been enacted in nine states. Two other states have implemented RPS requirements applicable only to the investor-owned utilities operating in the state. Several other states, including Maryland, are considering adoption of an RPS. Table 3-2 summarizes the key aspects of the RPSs currently in place and indicates a wide range of characteristics that have been incorporated into the RPSs that have been established to date. Significant differences among the various RPSs include the percentage requirements, the qualifying resources, the duration of the programs, and whether tradable renewables credits can be used. (The maximum percentage requirements for renewable energy are generally below seven percent. Maine is a notable exception with a 30 percent RPS requirement. The Maine requirement, however, includes existing hydroelectric resources, which provided more than 30 percent of Maine’s electricity prior to restructuring.)

It is important to note than an RPS is but one of several methods that could be used to facilitate the market for electric power generated from renewable resources. Other methods discussed earlier in this report — such as State purchases of renewable energy, tax incentives, and emissions disclosure — could be used in lieu of, or in conjunction with, an RPS to support the development of renewables generation.

Table 3-2 Summary of State Renewables Portfolio Standards

Included Technologies	AZ	CT	IA**	MA	ME	MN**	NJ	NV	PA*	TX	WI
Biomass	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Cogeneration					✔				✔		
Fuel Cells		✔		✔	✔		✔		✔		✔
Geothermal					✔		✔	✔	✔	✔	✔
Hydro		✔	✔		✔		✔			✔	✔
Landfill Gas	✔	✔	✔	✔			✔		✔	✔	✔
MSW		✔	✔		✔		✔		✔	✔	
Solar	✔	✔	✔	✔	✔		✔	✔	✔	✔	✔
Tidal					✔		✔		✔	✔	✔
Wind	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Program Duration (Years)	12	10	N/A	10	N/A	14	12	5	N/A	10	10
Initial Year Requirement	0.2%	5.5%	105MW	1%	30%	550MW	2.5%	0.2%	2%	1280MW	0.5%
Maximum Requirement	1.1%	7%	105MW	4%	30%	950 MW	6.5%	1%	2%	2880MW	2.2%
In-State Siting Requirement	✔							✔		✔	
Credits Trading	✔	✔					✔	✔		✔	✔

* Applies to "Competitive Default Provider" only. Only applicable in PECO, West Penn Power, and PP&L service areas. A similar requirement is in place for the GPU service area, but the requirement is for 0.2% rather than 2% renewables.

** Specific set-aside of capacity by investor-owned utilities for renewable technologies.

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