Maryland's Electricity Opportunity:
How to Fix the Power Breakdown and Pave the Way to Innovation, Efficiency, and Competitive Rates

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Introduction

The author argues: modern technology could increase electricity's reliability, enhance consumer choices, and reduce pollution.

Pending rate hikes have focused the attention of Marylanders on electricity. No doubt the increases will burden individuals but they also offer the opportunity for Maryland policymakers to think boldly about the state's energy future. If regulators and lawmakers focus on creating a more diversified electricity system, one based on innovation and efficiency over the long term, these same policymakers can stimulate immense environmental and economic benefits.

Price increases have prompted many to play the blame game. Baltimore Gas & Electric (BGE) officials blame skyrocketing fuel prices, noting that costs for natural gas, which generates about half the region's power, have tripled since 1999, and prices for coal and oil have doubled. With rate caps expiring after six years, Maryland consumers soon will feel the full impact of those multiple-year price increases. Some Maryland legislators disparage deregulation, arguing that it didn't deliver lower costs or competition. Others note that the state's 1999 deregulation law was flawed because it imposed artificially low rates that prevented competitors from entering the market;, moreover, without competition utilities continued to operate their older, less-efficient, and more-polluting power plants.

The substantial pending increases – 38 percent for Pepco's suburban-Maryland residential consumers (or an additional $468 annually for residential customers) and a whopping 72 percent for Baltimore Gas & Electric (or an extra $743 yearly) – are changing market rules and political alignments. Competition may now become a market reality as entrepreneurs and independent generators see an opportunity to undercut utility prices. Just after the rate hikes were announced, for instance, Washington Gas Energy Services began offering rates 10 percent below BGE's.

Political developments are harder to predict. Lawmakers and Governor Robert L. Ehrlich were unable to reach a deal to spread out the sudden pain of higher rates. Most recent discussions in this election year have been partisan, with a Republican governor blaming Democrats for having passed flawed deregulation legislation in 1999 and with leading Democrats blaming the governor for allowing former industry leaders to regulate state utilities. Baltimore Mayor Martin O'Malley, a Democratic candidate for governor, went so far to as state, "Bob Ehrlich has turned a watchdog agency whose sole purpose was the protection of Maryland families into a lapdog for special interests."[1]

Few policymakers are looking beyond the rate increases to consider how Maryland could finally advance innovation and efficiency within its electricity sector. In fact, the opportunities are vast. An array of modern technologies can enhance reliability, increase consumer choices, and reduce pollution, yet such advances are blocked by an array of outmoded policies designed over the last century to promote and protect monopolies. Compared to its neighbors, Maryland has been relatively slow in adopting market rules that spur these modern advances. As a result, it has not attracted energy entrepreneurs and their investments. Rather than simply cast blame about today's higher rates, therefore, the state's leaders need to confront market barriers and create a more workable, effective power system to better serve Marylanders.

The Wonder of Electricity

In 2001, professional engineers were surveyed about the twentieth century's most important technical achievement. Some, noting that it was a rich era technologically, suggested the internal combustion engine that made possible the automobile culture, or the airplane. Others nominated the transistor or computer chip. Yet the vast majority of engineers declared that our greatest accomplishment was to capture and utilize an invisible flow of electrons.

Electricity is a superior energy form. It is clean at the point of use, capable of performing many tasks, and easily controlled. Such attributes have increased electricity's share of total energy use over the past three decades from 25 percent to nearly 40 percent. Electricity powers our high-tech economy, and its precision and flexibility make it critical to future growth.

Electricity is also a huge business. Electric generation and delivery utilities hold assets exceeding $600 billion and have annual sales above $260 billion. They are this nation's largest industry, roughly twice the size of telecommunications and almost 30 percent larger than the U.S.-based manufacturers of automobiles and trucks.

Electricity is critical to our lives. In the 1950s movie entitled *The Day the Earth Stood Still*, the alien, in order to impress upon the U.S. military his seriousness and his clout, decided on the one thing that would stall modern society; he turned off electric power for half an hour.

When power fails, as it did for millions throughout the Northeast and Midwest during the summer-2003 blackout, we can no longer watch television, microwave dinners, obtain cash from ATM machines, pump water through sewage treatment plants, or check emails. Such interruptions force us to reflect on the usual wonder of flipping a switch and brightening a room. They highlight the enormous expense, and vulnerability, of the generators, transformers, transmission lines, and switch boxes needed to tap and deliver electric power.

Our ability to put electricity to work is relatively new. Although we've known about, and have been entertained by, static electricity for more than 2,000 years, we've harnessed this unique form of energy for little more than a hundred years. In that short period, electricity has changed our lives. Electric lights lengthen our days. Electric-power elevators and streetcars heightened and enlarged the cityscapes. Motors transformed industrial societies. Electricity's profound impacts can be traced over only a few generations. For example, my grandparents were born in houses lit by candles and kerosene lamps and heated by wood-burning stoves. Their first "refrigerator" was a leaky chest kept on the back porch "powered" by fifty-pound blocks of ice. Everyday tasks often produced drudgery. Wash days, for instance, demanded boiling water, which required wood to be chopped, stacked, and carried to the house. Starting and regulating the stove proved to be an art form, and the

burning wood produced unbearable temperatures in the summer. Most of this burden fell on women. By the time my father entered high school his family began to enjoy running water warmed by an electric heater. When I became a teenager wall-mounted air conditioners made hot summers more tolerable, and my own teenagers now cannot imagine that I suffered through school without a computer or electronic games. Electric-powered lights and appliances have lessened life's burdens, bringing relief from drudgery.

The Status Quo Can't Survive

As Marylanders think about their electricity's future, the obvious initial question is why we should consider changing the decades-old model of centralized generators controlled by regulated monopolies. After Enron's machinations, California's restructuring debacle, and even Maryland's own pending rate hikes, why shouldn't we revert to the "good old days" of regulated monopolies and status-quo technologies?

Simply, our status quo is rickety, inefficient, and unreliable. Today's average generating plant was built in 1964 using technology from the 1950s. Utilities have not improved their delivered efficiency in some 50 years. With efficiency calculated at 33 percent, they essentially burn three lumps of fuel to generate one lump of electricity. Put another way, two-thirds of the fuel burned to generate electricity is wasted. The predominant configuration of centralized power plants eliminates the possibility of capturing and utilizing that heat. As a result, additional fuels must be burned to heat factories and buildings that are located far from power plants.

The consequences of the electricity system's inefficiencies and stresses are staggering, if little noticed. Unreliable supplies – ranging from milli-second fluctuations that destroy electronic equipment to the summer 2003 blackout that left 50 million without power – annually cost Americans $119 billion.[2] To provide some perspective, this unreliable power adds a 44 percent surcharge to the cost of U.S. electricity. To personalize this cost, one microchip executive stated, "My local utility brags to me that they had only 20 minutes of outages all year. I remind them that these four five-minute episodes interrupted my process, shut down and burnt out some of my controls, idled my workforce. I had to call in my control service firm, call in my computer repair firm, direct my employees to 'test' the system. They cost me eight days and millions of dollars."[3]

Electricity generators, moreover, are this nation's largest polluters, spewing tons of mercury, sulfur dioxide, carbon dioxide, and other contaminants into America's air and waters. Despite significant government attempts to control such pollution, 46 of the nation's top 50 emitters are power plants. In February 2006 the Maryland Nurses Association claimed that emissions from just six state-based generators – Chalk Point and Morgantown in Southern Maryland, and Dickerson in Montgomery County, all owned by Mirant Corp.; Brandon Shores and H.A. Wagner in Anne Arundel County, and C.P. Crane in Baltimore County, all owned by Constellation Energy – caused 100 premature deaths annually in Maryland (and 700 total across the U.S.), as well as 4,000 asthma attacks in the state (and 30,000 region-wide).[4]

Power plants are also the nation's largest consumers of water, taking nearly 100 trillion gallons of water annually from rivers, lakes, oceans, and estuaries. In the process, they trap and kill millions of fish, and they return heated water to lakes and rivers, placing stress on the aquatic life. Some large power plants use almost 2 billion

gallons daily. A single coal-fired plant in Wisconsin reportedly uses more water than the entire state of Illinois.

The traditional model of regulated monopolies and centralized generators offered no options for consumers. Not unlike ATT's ubiquitous black, rotary telephone, a utility's only product was fairly reliable power from a mix of fuels. Customers had no information about the costs of generating electricity at different times of day. They could not pick power produced from a particular fuel, and they could not spend a bit more to obtain more reliable service. In short, consumers lacked choices.

Because they are protected against competition, utilities have had little motivation to innovate, and as a consequence spend significantly less on research and development than most other industries.

Centralized Monopolies

Today's electricity industry, based on centralized generators controlled by regulated monopolies, emerged in the early twentieth century from a mix of new steam turbines, progressive politicians, and industry leaders who wanted state regulation of key businesses.

Prospects for the electricity industry flickered at the dawn of the twentieth century. Manufacturers were reluctant to abandon their steam-powered, belt-driven systems in exchange for unreliable generators, so motors electrified only one factory in 13. Incandescent bulbs illuminated only one lamp in 20, as most homeowners favored the less expensive and more pleasant glow of gas lamps.

Even most power entrepreneurs believed electricity would remain a luxury item for the wealthy. Despite the advance of alternating current and the ability to construct large plants that could transmit electricity over long distances, both General Electric and Westinghouse preferred the immediate profits of selling isolated generators to individual buildings or factories over the uncertainties of marketing electricity from centralized generators.

Samuel Insull developed a different vision. In 1892, Thomas Edison's secretary rejected General Electric's $36,000-per-year job in favor of a $12,000-per-year position managing the Chicago Edison Company, one of 40 struggling electricity-generating firms then in the Windy City. His company had just one power plant and served only a fraction of the present-day Loop in downtown Chicago.

Insull understood that Chicago Edison would grow only if he could take advantage of emerging power-generation technologies, which meant he had to integrate and optimize the demands of disparate electricity consumers. By bribing the streetcar companies to purchase rather than generate their own power, Insull gained a large load during the morning and early evening. By convincing aldermen (often with generous campaign contributions) to shut down the isolated street-lighting generators, he obtained night-time demand. And by marketing special rates to large office buildings and industries, Insull also sold electricity throughout the day.

Selling was Insull's passion. He created a 25-person marketing force and ordered the salesmen to outsell the competition. In an attempt to increase home energy use, he advertised the advantages of refrigerators, cookers, and water heaters, new appliances that devoured electricity. He even published cartoon books for children, whom Insull referred to as future customers, investors, and voters. Admitting to a circus-like hucksterism, Insull stated: "I have always said that Mr. Edison taught me all that I know about electricity, but I owe to one of Mr. Barnum's men all that I know about publicity."[5]

The consistent demand for power enabled Insull to adopt the new steam turbine, which could replace the smaller steam-powered engine. In 1903, he opened the Fisk Street Turbine Station, which was powered by the steam produced from burning coal and boiling water, and it provided a then-remarkable five megawatts of electricity. By 1911, Insull added ten 12-megawatt turbines at the same site. By the mid-1920s, a single turbine was producing 175 megawatts, enough to power a small city.

Insull also embraced new transmission technologies, promoting a rapid transition from a copper wire strung along short wooden poles to compound lines attached to tall steel towers. In 1895, the Niagara Falls line seemed extraordinary with 10,000 volts. By 1908, however, Insull had built a line in Michigan that carried 110,000 volts. By the late 1920s, wires were transmitting a staggering 220,000 volts of electricity.

With his integration of customer demands and his ever-larger centralized generators, Insull could operate regularly, and thus reduce his costs as well as his rates, making more power affordable to more people, and thereby increasing the demand for his electricity. The growing size of generators and lines, moreover, led to a mass of mergers since only large companies could afford the new equipment and satisfy the public's growing appetite for power. At Insull's first board meeting, in fact, the young executive announced plans to purchase the Indiana-based Fort Wayne Electric Company. Within only a few years, Insull served more than four million customers, spanned 32 states, and produced one-eighth of the nation's electricity.

In addition to adopting new technologies, Insull advanced innovative public policies and created a new business model. Tired of municipal politicians squeezing him for money, he became one of the few corporate executives to join Robert LaFollette and other progressive politicians to advance state oversight of business. Insull also preferred to deal with only one state agency rather than hundreds of urban and suburban councils—and the deal ensured that he obtained a monopoly and freedom from pesky competitors.

His model of centralized generators controlled by regulated monopolies endured for almost seven decades. It brought electricity to America, reducing drudgery for millions. For much of that period, it also provided reliable service at ever- decreasing prices. But this model cannot meet the needs of the twenty-first century.

Partial Competition

The opening of utility monopolies to limited competition occurred with little notice. The Public Utility Regulatory Policies Act (PURPA) of 1978 caused considerable concern among utilities because of its proposed rate-making standards and coal-conversion requirements. Yet it was only a three-page provision – identified as Section 210 and buried within 78 provisions and five energy bills-- that allowed "qualified facilities," or "QFs", to avoid Securities and Exchange Commission registration and to take advantage of more-favorable financing. It also enabled these small, independent generators to charge a price equal to a utility's incremental cost of building a new generator. By preventing utility monopolies from using their market control and financial resources to block independents, the law opened the electricity market to limited competition.

When the utilities absorbed the implications of PURPA'S interpretation by the Federal Energy Regulatory Commission, they filed lawsuits, and the Supreme Court finally settled the matter in May 1983, upholding PURPA's provisions and ruling that it was important to "provide a significant incentive to the development of cogeneration and small power production, and that ratepayers and the nation as a whole would benefit from the decreased reliance on scarce fossil fuels and the more efficient use of energy."[6]

Despite its limited nature Section 210 helped spur the deployment of new and more efficient technologies. Combined heat and power units, for instance, rose from 10,500 megawatts in 1979 to 40,700 megawatts in 1992.

When Saddam Hussein's army invaded and attempted to annex Kuwait in August 1990, the United Nations reacted with a trade embargo on Iraq, which caused the United States to lose 10 percent of its oil imports, gasoline prices to rise almost 20 cents per gallon, and American consumers to pay some $21 billion more for petroleum products. It also prompted Congress to approve the Energy Policy Act of 1992, which aimed to reduce U.S. dependence on foreign oil. In the electricity title, the law opened the door to more competition by establishing a new class of "exempt wholesale generators" that could sell power in the wholesale market. Unlike the "qualifying facilities" regulated under PURPA, these merchant generators or independent suppliers could charge market rates, sell their power to non-utilities, and avoid cogeneration and renewable energy requirements. Utilities, however, were not required to buy this independently produced power. The legislation also authorized the Federal Energy Regulatory Commission to order utilities to "wheel," or transmit, a competitor's power across their lines.

Technological developments also played a key role, in forcing the policy reexamination. Equipment manufacturers had profited greatly from airplane-engine advancements that improved a gas turbine's efficiency, which rose above 50 percent in combined-cycle units that ran steam twice through the power plant. These

manufacturers also began to employ mass production techniques that lowered turbine costs significantly.

In April 1996, after several years of debate, the Federal Energy Regulatory Commission announced a set of specific rules, titled Order 888, that outline the conditions by which utilities must provide open, nondiscriminatory access to the nation's transmission system. Suddenly, anyone selling electricity wholesale, including independent generators, government-owned utilities, and industrial producers, could obtain transmission service pursuant to an established uniform tariff at "just and reasonable" rates. By mandating a universal transmission tariff, FERC saved independents from the agency's usual time-consuming review of individual wheeling requests. That order also declared that a transmission owner must charge the same rate for moving an independent's electricity as it would impose on its own power. It even held that a transmission company must expand its capacity if an independent generator is willing to pay its share of the expansion costs. To further streamline the flow of wholesale electricity, in December 1999 FERC issued Order 2000, asking all transmission-owning utilities to consider joining an independent regional transmission organization (see section below on regional electricity coordination). Together, these orders reflected FERC's efforts to eliminate discrimination in the management of the nation's transmission system.

The Energy Policy Act and FERC's subsequent regulations prompted a dramatic change in the ownership of electric generation. For most of the twentieth century, private utilities, regulated monopolies controlling power plants and distribution lines, dominated the industry. Within the past decade, independent suppliers captured 30 percent of the generation market. That amount exceeds the combined ownership of rural coops (4 percent), the federal government (8 percent), and municipal utilities (11 percent), and the share controlled by investor-owned utilities fell to 47 percent. Due to the number of new suppliers in the market and changes resulting from deregulation, wholesale electricity trading also soared, from approximately 100 million kilowatt-hours in 1996 to almost 4,500 million kilowatt-hours in 2000.

When the federal government opened the wholesale power market to competition, about a quarter of the states restructured their utilities. These deregulation efforts varied. The California experience was the most notorious, and epitomizes the costly consequences that can result from good intentions but skewed execution. The Golden State's 2001 electricity disaster, when prices skyrocketed and the state's largest utility declared bankruptcy, resulted largely from political deals made in the mid-1990s that sought to appease virtually every interest group. According to one researcher, "Getting it done fast and in a way that pandered to the many interests involved became more important than getting it right. The end result was the most complicated set of wholesale electricity market institutions ever created on earth and with which there was no real-world experience."[7] The Congressional Budget Office

was even more blunt, concluding, "Deregulation itself (in California) did not fail, it was never achieved."[8]

While California's disastrous restructuring received widespread attention, other states have realigned their power industries, removed barriers to entrepreneurs, and obtained positive results. While admitting that century-old monopolistic practices are painstakingly slow to change, Texas, New York, and Pennsylvania officials profess a positive experience with electric industry restructuring. In Texas, independent suppliers in 2004 offered 60 percent of the electricity used by commercial and industrial customers and 14 percent of the power demanded by residential consumers. Unlike California, Texas allows distribution utilities to purchase power on the spot market or through long-term contracts. That flexibility, as well as the ongoing effort by state officials to resolve conflicts between independents and utilities, have produced a vibrant electricity market and advanced innovative technologies. Unlike Maryland, these other states also did not cap power rates at levels that cut independent generators out of the market. The New York Public Service Commission, while stressing that deregulation's major benefits were improved efficiency, consumer choice, and reduced pollution, found real price benefits for consumers. Its 2006 report stated, "The total real (i.e.,, inflation-adjusted) electric price for a typical residential retail customer in New York, including supply and delivery charges, has dropped by an average of approximately 16 percent between 1996 and 2004. Most commercial and industrial customers have seen decreases in their real energy bills as well."[9] The chairman of the New York commission stated, "Competition places downward pressure on prices … and it empowers customers with greater control over how they can meet their energy needs. … Restructuring has produced customer choice where there was none ten years ago."[10] Pennsylvania officials also calculated that the Commonwealth's pro-competition efforts have saved residential and industrial customers some $8 billion.

Maryland's restructuring effort was relatively tepid, and ineffective for residential customers. Although many large industrial and commercial establishments switched to third-party suppliers, the decision to artificially reduce and cap rates, considered necessary to "sell" deregulation to consumers, made it virtually impossible for competitors to enter most of the Maryland market. With little competition, Maryland lost several years in the race toward innovation, and the state remained reliant on monopolies that could raise rates substantially when the cap limit expired. The deregulation law also did precious little to set market rules that would encourage entrepreneurs to operate in Maryland, missing a golden opportunity to enhance efficiency.

Utilities' reactions to the 1999 law varied. To meet Maryland's mandate to separate generators from wires, Pepco sold its four power plants and became only a distribution company. Constellation kept its generators but moved them to an

unregulated subsidiary, leaving BGE to purchase power from Constellation as well as other producers. Maryland's rural cooperatives and municipal utilities, such as Southern Maryland Electric Cooperative and the Town of Easton, were not forced to restructure.

To appease worried consumers, Maryland's 1999 deregulation imposed rate caps, freezing prices for six years even in the face of soaring costs for the fuels burned to generate electricity. With relatively low rates available from utilities, independent generators were reluctant to enter Maryland's electricity market. As a result, the promised competition for residential customers never materialized.

In short, Maryland's rate caps and natural-gas price increases have made it cheaper for consumers to buy electricity from the incumbent utility than to generate it independently. The legislation imposed a lag between the quick rise in natural gas costs - the result, in part, of hurricanes and increased demand - and of regulated electricity prices. The metric used to measure this differential is called the "spark spread." As rate caps expire, of course, the spark spread will look more advantageous for independent generation from natural gas as well as other fuels, including coal and landfill and digester gas.

Maryland's law was pushed largely by the state's large industrial customers who thought even limited competition would allow them to shop for cheaper electricity. The legislation was lengthy and complex, and, despite substantial vote margins of 99 to 36 in the House and 37 to 9 in the Senate, most members had not even read the complex bill. According to one delegate, "I'm afraid we don't know everything that's in (the bill). We hope and pray and think that they have done what is in the best interests of the people of the state of Maryland."[11]

The legislation also enabled BGE to recover what it described as "stranded costs," the reduced value of its power plants, particularly the nuclear reactor at Calvert Cliffs, as a result of competition. However, without real competition and with increased prices for natural gas and oil, BGE's reactors and coal plants actually increased in value. Several Maryland legislators unsuccessfully advanced legislation to force BGE to return to consumers the $528 million they paid for such "stranded costs."

Maryland utilities argue that such a refund, as well as any meddling with planned rate increases, will put their companies at "substantial financial risk." They argue that if utilities were required to borrow money to make up any difference, their bond rating would falter, their power purchases would be more expensive, and their ability to supply electricity to Maryland consumers would be compromised.[12]

The biggest controversy, of course, is the pending rate increase. Without a phase-in or reduction, rates for BGE's 1.1 million residential customers will rise beginning in

July 2006 an average of $743 a year (a 72 percent increase). Rates for the utility's small commercial customers will climb 40 percent, while medium-sized firms, which use more power, would face a 14 percent increase. The average increase for Pepco's 500,000 residential customers is 38.5 percent, or $468, a year. (BGE's hike is higher largely because its rate caps lasted two years longer and, therefore, the increase reflects higher fuel costs over more years.)

No one likes it when rates are soaring, but BGE customers have enjoyed a relatively sweet deal since 1993, when the utility last imposed a rate increase. The state's 1999 deregulation law, in fact, capped residential rates at 6.5 percent below those 1993 levels. Pepco rates, by comparison, were 26 percent higher than BGE's. In the 13 years since 1993, of course, costs for the fuels burned to generate electricity, natural gas, coal, and oil, rose substantially as a result of rising global demand (particularly in China), disruptions within oil-producing regions, and last year's hurricane damage to rigs in the Gulf of Mexico. Since 1999, in fact, the cost of natural gas soared 127 percent, while coal costs rose 150 percent, heating oil rose 192-percent, and gasoline rose 154 percent for gasoline.[13]

When rates were frozen, BGE and other utilities signed long-term contracts for power supply at prices far below today's market rates; those contracts expire in June, and new supply deals will be far more expensive. Facing protests over the 72-percent increase, in mid-March the Maryland Public Service Commission proposed phasing in the hikes, with rates initially rising 21 percent and then increasing over a 15-month period. BGE subsequently suggested it would phase in about half of the increase over 15 months, imposing a 13 percent increase in the first six months, 15 percent starting in January 2007, and another 15 percent in June 2007.

Such a phase in has caught the attention of Wall Street, which wants to ensure that BGE obtains a steady revenue stream. In fact, in March 2006 the threat of delayed rate increases prompted Moody's Investors Service to put BGE on its credit watch.

Adding to the controversy is the pending $11.5-billion merger of Constellation Energy Group, BGE's parent company, with FPL, formerly Florida Power & Light. Over the past few years, Constellation has become a giant electricity provider, with 107 generators in California, Illinois, and Maryland. Its unregulated side is one of the leading independent power producers, energy service companies (which manage power for large and mid-sized companies), and power brokers (which buy and sell bulk electricity and natural gas). With revenue of $17.5 billion in 2005, Constellation's income nearly doubled in two years. Suggesting that BGE is an attractive merger candidate in part because of the 1999 deal that curtailed competition and increased the value of the utility's coal and nuclear plants, some lawmakers want the state to impose roadblocks or delays to the deal to extract a lower rate increase from BGE. However, according to Dennis Moran, director of the Combined Heat and Power

Applications Center at the University of Maryland, College Park, the state's leverage is limited. "If the conditions become too difficult, the mergers go away," Moran said. "The state doesn't have a lot of power to arm-twist. The fact there is a merger going on does give the regulators a little more leverage, but it isn't carte blanche."[14]

Constellation's possible merger with Florida Power and Light is one of several combinations that have been spurred by the recent repeal of the Public Utility Holding Company Act (PUHCA), legislation approved in the 1930s to prevent the recurrence of the financially-stretched utility empires whose downfalls accelerated the Great Depression. In the past few years, Exelon acquired Public Service Electric & Gas (PSE&G) of New Jersey, Duke merged with Cinergy, and MidAmerican has integrated with PacifiCorp. Several of the affected states used their leverage to obtain some local benefits. New Jersey, for instance, demanded – and obtained – more energy-efficiency programs from Exelon. These multi-state entities also may spur state regulators to pursue cooperative efforts to advance consumer choice, reliability, and efficiency.

Modern Technologies

The nation's electricity system is at the beginning of a major technological revolution. The traditional model of centralized, steam-power generators is challenged by a combination of modern devices, innovation-based policies, and creative entrepreneurs. This assortment of innovations is changing the electric industry's basic structure. Modern generators, motors, and computers have many advantages over the large centralized power plants owned by regulated monopolies. Although these new devices offer increased efficiency and reduced pollution, numerous policy barriers, built up over decades to protect utility monopolies, discourage innovative technologies and entrepreneurs. We need a policy revolution to match the technological change.

The move away from large, centralized generators began almost 40 years ago, and went virtually unnoticed. From the 1890s to the 1960s, electrical engineers had developed larger and larger boilers that could withstand enormous and increasing amounts of heat and pressure. Supercritical steam, or extremely high pressure steam, could reach temperatures exceeding 1,050 degrees and pressures above 3,206 pounds per square inch, turning water into dry, unsaturated steam. The power companies had employed an array of new alloys to protect a power plant's metal from corrosion and fatigue. They also met rising power demands with larger turbines, and demanded from their equipment manufacturers bigger and bigger units, often without taking the time to test and learn from each incremental increase.

Progress stalled in the mid-1960s, when utility managers slowly began to realize that their larger systems were not performing well. Turbine blades twisted frequently, furnaces couldn't maintain high temperatures, metallurgical problems became apparent in boilers and turbines, and a slew of other defects retarded reliability and performance. Large plants also required expensive construction techniques since many components had to be custom built on site rather than prefabricated in a factory. A General Electric manager later admitted that the rapid growth in the size of generators and boilers caused "major failures leading to the need for costly redesigns, costly rebuilds in the fields, and the additional costs involved for purchased power."[15]

Power company executives slowly became skeptical of giant generators, and the era of centralization waned. "Central thermal power plants stopped getting more efficient in the 1960s, bigger in the 1970s, cheaper in the '80s, and bought in the '90s," stated the Rocky Mountain Institute. Reflecting centralization's efficiency limit, "smaller units offered greater economies from mass production than big ones could gain through unit size."[16] In the 1990s, California commissioned several hundred small generators whose combined capacity exceeded the output of its four existing nuclear reactors.

Compared with the generators protected by tradition-bound utility monopolies, an array of modern equipment offers opportunities for new and innovative players to

enter the electricity market. If not blocked by outmoded policy, the entry into the market of new players purveying new technologies could vastly expand consumer options, increase productivity, and reduce pollution.

Most discussions of alternative energy focus on wind turbines, fuel cells, and photovoltaics, but numerous less glamorous generators are challenging centralization and providing increased efficiency and decreased pollution. One of the hottest items is the cogenerator. This ingenious machine, a primitive model of which Thomas Edison employed at his Pearl Street power plant in New York City, produces both heat and electricity and can create huge savings for consumers that might otherwise vent most of their energy to the great outdoors. A cogenerator captures the usually wasted heat to warm buildings, power chillers, dry paints and materials, and run an array of industrial processes. The benefit of cogeneration, sometimes called "combined heat and power," is efficiency. The hybrid machines more than double the deployment of useful energy. A typical power plant producing only electricity is approximately 32-percent efficient, while a cogenerator using the same amount of fuel but producing both electricity and heat can be 80 percent efficient. Despite the economic downturn between 1998 and 2002, some 31,000 megawatts of cogeneration capacity were added in the United States, and the identified potential exceeds 200,000 megawatts.

Maryland is home to some 827 megawatts of cogeneration, roughly the equivalent output of a large coal-fired power plant. The sizes and fuels range from a 75-kilowatt, natural gas-powered installation at the University of Maryland's Chesapeake Laboratory Administration Building to the 152-megawatt, waste-powered unit at the Bethlehem Steel Corporation at Sparrows Point to the 180-megawatt, coal-fired facility at the Warrior Run chemical facility in Cumberland.[17] A cogeneration unit managed by Trigen provides 2.1 megawatts of electricity as well as steam, hot water, and chilled water for 250 commercial, government, institutional and hospitality customers in downtown Baltimore and Inner Harbor East. A separate facility at the University of Maryland in College Park provides 26 megawatts as well as heating and cooling for campus buildings; the school expects to save $120 million over the life of the 20-year contract.

Another technology is recycling energy. Primary Energy, for instance, operates several turbines that provide an electrical output equivalent to that of a large nuclear reactor as well as process steam by tapping the gas once glared from giant blast furnaces at steel smelters along the southern shore of Lake Michigan. At Ispat Island's steel-making operation in East Chicago, 16 heat recovery boilers capture and utilize the waste heat from that steel company's metallurgical coke-making facility, and a desulfurization process and fabric-filter system make Ispat the steel industry's environmental standard. Recycled heat, which requires no additional fuel and produces no additional pollution, is every bit as environmentally friendly as any renewable resource, yet is it virtually ignored by policymakers and environmentalists.

Recycled heat could generate a substantial 45,000 megawatts of electricity and reduce carbon dioxide pollution by 320 million tons.[18] Primary Energy benefited from an enlightened local utility, NiSource, which realized that an independent operation capturing energy at the smelters would enable the utility to sell its own power more profitably to other customers. Most utilities, including those in Maryland, tend to view entrepreneurs as competitors rather than partners.

Also little noticed but productive are back-pressure steam turbines that capture the energy at the points where industries or institutions reduce pressures in their steam pipes and convert it to electricity. Many universities, hospitals, and industrial buildings, including several in Baltimore, employ district heating systems that distribute hot water or steam through pipes to buildings throughout their complexes. Few of these institutions capture the pressure reduction when valves cut the high-pressure steam coming from the generator to the low-pressure steam that can be handled by individual buildings. Lumber, pulp-and-paper, food, refining, and chemical firms also could employ similar back-pressure steam turbines to extract the energy released when they reduce steam pressure in order to run different industrial processes or when they release pressurized flue gas. Similarly designed expansion turbines take advantage of the pressure drop when natural gas in high-pressure pipelines is decompressed for local networks. These small expansion turbines are relatively inexpensive, the "fuel" is recycled and free, and their U.S. potential exceeds 6,500 megawatts, the output of 13 large coal-fired power plants.

Huge energy savings can result from the widespread adoption of other seemingly simple technologies that increase energy efficiency. Modern compressors and heat exchanges, for instance, can reduce dramatically the operating costs of refrigerators, buildings can make better use of natural lighting and ventilation, and electronic devices can cut the standby consumption of computers and other equipment. Numerous energy management firms install sophisticated monitors and controls that trim costs and pollution, and scores of companies are devising more efficient and cleaner ways to produce paper, aluminum, steel, and chemicals.

Such efficient technologies already have reduced the nation's energy intensity, This measure of energy used per unit of economic activity fell by 42 percent from 1973 to 2000. In essence, the United States produced more with less power. The government's national laboratories calculate an even larger energy savings potential – almost 50 percent for lighting and space heating and cooling, and about 33 percent for refrigeration, water heating, and iron and steel production.[19] Energy efficiency, moreover, is relatively cheap. Conservation programs in New England are "producing" power at 1.9-2.4 cents per kilowatt-hour, far below Maryland's average electricity rate of 8.6 cents per kilowatt-hour. More efficiency would mean less need for electricity generation and transmission and their accompanying economic and environmental costs.

Another modern technology is the combined-cycle gas turbine, made possible by advances in jet airplane engines that resulted from cash-strapped airlines demanding lower fuel costs and the military requiring better efficiency. These innovative turbines capture waste heat from the combustion turbine and use it to power a steam turbine. Put another way, the heat from burning natural gas or some other fuel is cycled twice through turbines to generate more electricity. (Unlike cogenerators, however, the remaining heat is vented) Because their relatively low emissions don't spark lengthy state environmental reviews, a power-only unit can be licensed and constructed in less than 18 months. Combined-cycle units, while still substantial in size, can be mass produced to meet near-term demands for power.

Improvements in truck turbo-chargers and hybrid electric vehicles also have spurred a slew of micoturbines, which feature a shaft that spins at up to 100,000 rpm and drives a high-speed generator. Because microturbines use recuperators to transfer heat energy from the exhaust steam back into the incoming air stream, they are far more efficient than other small combustion turbines. The recuperators also lower the exhaust temperature to the point where little nitrogen-oxide pollution is formed. Mass production should soon lower costs to only $250 per kilowatt, making them attractive to the residential market. Microturbines range in size from 24 kilowatts (enough to power a home) to 500 kilowatts (enough to power a fast-food restaurant), and their operating costs are about a third of a comparable diesel generator's. Maintenance costs also are relatively low because microturbines have only one moving part, the high-speed shaft spinning on air bearings.

Most of these modern innovations allow for on-site electricity production. In addition to avoiding transmission and distribution losses, such decentralized generation offers consumers the opportunity to optimize their power systems, increase efficiency, lower costs, and enhance productivity. Most also reduce emissions, although environmentalists have expressed concerns about unregulated diesel generators. Today's dominant utility approach -- centralized power plants for electricity and separate units for thermal energy to heat or cool buildings -- might have made sense with the generation and distribution technologies of the 1950s, but smaller and dispersed electricity systems now provide economic and environmental advantages.

Numerous other technology advances are possible for Maryland. Much discussion – but until recently little action – has focused on capturing the energy within poultry litter, which is overwhelming Eastern Shore farmers and causing substantial pollution of the Chesapeake Bay. Poultry packers do capture most of their packaging wastes, and Perdue is selling some pellets of processed poultry manure as a soil additive for golf courses. Yet there's also potential to either obtain gas from the litter or to burn it, although incineration has major environmental impacts. Modified sludge burners on the market could fire such wastes, and the resulting high-pressure steam could be used to generate electricity. Maryland's pending rate increases – if accompanied by

barrier-busting policies – may finally convince firms to invest in such gasifiers and clean burners.

A variety of new technologies, in fact, are improving the production and processing of biomass, which includes farm and forestry wastes, wood, municipal garbage, and crops grown for energy use. Biomass-powered electricity generation doubled in the United States from 1987 to 1999.[20] Sweden has planted willow tree plantations for power production, and it intends to obtain 40 percent of its energy from biomass by 2020.

Wind energy development has been slow in Maryland. Compared to the 129 megawatts installed in Pennsylvania and the 66 in West Virginia, Maryland sports no current wind developments. Three projects are proposed in the state, but only one – a 40 megawatt effort in Allegany and Garrett counties – has been permitted.[21] With renewal of federal tax credits, wind turbines represent the world's fastest-growing energy source, expanding some 30 percent annually. Wind turbine performance has improved dramatically as a result of better rotor blades and controls. Wind technologies can be deployed in centralized wind farms as well as on a smaller scale.

Maryland could be on the forefront, however, of solar energy with the largest photovoltaic production facility (BP Solar) in Frederick and the largest solar financing company (SunEdison) in Baltimore. PV cells, which convert sunlight into electricity, have enjoyed fourfold cost reductions in the past 15 years, and further cuts seem likely because of advances in the manufacture of silicon wafers. At current prices, approximately $0.25 per kilowatt-hour, photovoltaics can compete in niche markets, such as in rural areas where it is costly to extend transmission and distribution lines, yet they remain about three times the cost of conventional electricity. Not factored into these costs, however, are solar's external values, including grid support and environmental protection.

Maryland has adopted a renewable energy standard that requires 1 percent of the power sold within the state in 2006 (and 7 percent by 2018) to come from renewable sources, including solar, wind, and biomass. Still, other states are more aggressively advancing photovoltaics, for example, New Jersey has installed more than 1,000 solar systems since 2003 and the state is ahead of its target to meet 0.4 percent of its electricity needs with solar energy in 2008. Pennsylvania has a solar-specific carve-out within its renewable energy standard. With $3 billion of state support, California anticipates a substantial 3,000 megawatts of solar electricity by 2020.

Among the more promising, but not yet widely commercialized, developments are fuel cells that produce an electric current and heat from chemical reactions rather than from combustion. They work by combining hydrogen with oxygen from the air, and their waste products are simply water and carbon dioxide. Although similar to a battery, fuel cells are recharged by the addition of hydrogen. Despite relatively high

costs, fuel cells are attractive in niche applications because they emit negligible pollution, have very high electric efficiency, employ few moving parts, require low maintenance, and are quiet. Of the several types of fuel cells, perhaps the most attractive is the proton-exchange membrane (PEM), which uses a special polymer "filter" that looks like an ordinary sheet of plastic wrap. DaimlerChrysler and Toyota already are using PEM units in cars, while General Motors and Dow Chemical have installed a large-scale PEM fuel cell (up to 35 megawatts) at Dow's giant chlorine-production plan in Freeport, Texas.

In addition to powering fuel cells, hydrogen can store and carry energy directly. One advocate says, "Hydrogen as a widely used energy carrier is essential and inevitable,"[22] yet other researchers argue that using electricity directly remains more efficient than making hydrogen to transport power.[23] A transition to a hydrogen economy, although promising, would take time and money. According to the National Academy of Sciences, it would require "a comprehensive, long-range program of innovative, high-risk/high-payoff basic research in catalysis, nanomaterials, membranes, and separation."[24] That report calls for expanded research into distributed hydrogen production and storage systems.

Advocates of centralized power point to new nuclear designs, such as the pebble-bed modular reactor (PBMR) that would employ "pebbles" filled with uranium oxide granules. Compared to reactors from the 1970s, the smaller PBMRs are promoted as safer, quicker to construct, and less expensive. Although PBMRs would emit no air pollution, they will produce long-term radioactive wastes, and, despite substantial taxpayer subsidies in the 2005 energy policy act, most investors (as well as the general public) remain skeptical of nuclear technologies after past accidents and cost overruns.

To continue burning the nation's substantial supply of coal, other engineers advance modern processes that convert coal into a gas. When subjected to heat and pressure, coal breaks down into a relatively clean-burning "syngas" of hydrogen and carbon monoxide, which then can be piped to turbines and burned. Without using the scrubbers that usually clean pollutants, four coal-gasification pilots – including a 250-megawatt station in West Terre Haute, Indiana – are releasing significantly less sulfur, nitrogen oxides, and mercury than conventional coal-powered generators. The gasification technology, however, remains a bit expensive, and risk-sensitive power companies have been reluctant to invest, although the climate may change if stricter air pollution regulations are enforced.

All of these innovations, of course, need to be compared to mature technologies that now dominate the electricity industry. Today's centralized coal plants account for approximately 60 percent of Maryland's power (slightly above the national average of 56 percent) and have not improved their delivered efficiency in almost five decades.

Moving Toward Decentralization

The interplay of advanced technologies and innovation-based polices has prompted numerous regional experiments. The Dutch, for instance, are advancing distributed generation. Iceland is moving toward a hydrogen-based economy. Northeastern states are considering a trading program for carbon-dioxide emissions, while Texas is becoming the nation's wind-energy capital. Maryland has the opportunity to be known for its electricity innovation.

Most of today's technological innovations suggest a shift toward dispersed generation, with a more efficient grid linking turbines, cogenerators, energy recyclers, fuel cells, or renewable technologies. No doubt there's a need for transmission infrastructure improvements and some utility executives want to continue building big coal-fired and nuclear facilities, but the trend is toward smaller units that can be sized more readily and economically to meet a particular need.

Localized power can avoid or reduce distribution bottlenecks and curtail the need for massive investments in high-voltage (and unpopular) transmission lines. No doubt some line upgrades will be needed in the near term, particularly to address reliability needs in the Baltimore-Washington region, modern technologies offer alternatives to the traditional transmission approach. Some 10 percent of electricity is sacrificed during the typical long-distance transmission process as a result of heat and resistance. During peak hours, the number rises to 20 percent, meaning that congestion-related losses require the construction of extra generators and lines.[25] Such costs would shrink if electricity producers were close to power consumers. In addition, the combined heat and power units could capture thermal energy that is normally wasted, using it to heat buildings or run industrial processes, reduce pollutants per unit of useful energy output.

Today's centralized power system offers numerous backup redundancies, yet harsh weather, terrorist attacks, and simple accidents have highlighted the vulnerability of large power plants and far-flung transmission wires. Smaller, dispersed units, in contrast, could enhance security and resiliency; a destroyed microgenerator has a smaller impact than would damage to a nuclear reactor or high-voltage line.

Distributed generators can help provide the highly reliable and high-quality power increasingly demanded by the array of businesses that cannot afford energy disruptions. On-site units also can avoid most power outages and surges that result from problems with the grid, for example, Kodak's factory continued to operate during the massive blackout in summer 2003 that left 50 million people without power in the Northeast and Midwest.

Perhaps decentralization's key benefits are financial. Smaller modules are less risky economically because they take less time to devise and construct, obtain greater efficiencies, are portable, and are less vulnerable to fuel shortages and price volatility.

Small generators, which can be built in increments that match a changing electricity demand, allow for more reliable planning. Large units, in contrast, take a dozen years to complete, during which time forecasts can alter dramatically, perhaps eliminating or reducing the need for the investment. Big plants also invariably "overshoot" because they add huge supplies that remain idle until the expected demand "catches up."

Even fervent distributed-generation advocates do not envision the total abandonment of today's centralized generators or long-distance transmission lines. More likely is a more equal hybrid of central power and distributed energy. Compared to the present system's virtually total reliance on large plants and long lines, a mixed approach would provide substantial economic, environmental, and security benefits. The American Gas Association forecasts that by 2020 small distributed generators will account for 20 percent of the nation's new electric capacity.

Although the U.S. market for distributed generation is substantial, perhaps the potential is greatest for the world's three-billion poor people who have no reliable access to electricity. On-site generators can save the $1,500 per kilowatt that developing countries would be required to spend on transmission lines. They could allow those nations to eliminate the need to build an expensive system based on giant generators and high-voltage wires, much as some countries are using cell phone technology to leapfrog the need to string expensive telephone landlines. If electricity consumption in developing countries continues to rise rapidly, dispersed technologies – such as gas turbines, recycled energy, wind turbines, and fuel cells – may be the way to minimize carbon dioxide emissions and limit demand for oil and natural gas from the world's volatile regions.

Potential innovation, goes well beyond increased efficiency and improved generators. At a late 2005 conference in Philadelphia, information-technology (IT) executives from outside the power industry argued that utilities have taken little advantage of computing and telecommunications advances. One speaker complained about the slow progress in moving toward using electric wires for telecommunications, downloading movies, or integrating home management and security systems. Another noted that the technology exists to allow a real estate developer who owns buildings around the country or a major manufacturer who has plants in various states to use an electricity web site equivalent to the LendingTree on the Internet and obtain immediate and multiple quotes for power to all those buildings and plants at certain times and levels of reliability.

Consider the changes that resulted from the breakup of the AT&T monopoly and allowed us to transcend the ubiquitous black, rotary telephone for a cornucopia of cell phones, cable TV, and video teleconferencing. Largely because of innovations spurred by competition, messages now can travel by airwaves, cable, fiber optics, microwave, as well as traditional copper wires, and the cost of sending a unit of data has plummeted more than 90 percent. These innovations, many of which were unknown when competition was brought to the telecommunications industry, have expanded consumer options substantially. Likewise, innovations that could be sparked by true electricity competition are vast.

New Policy Paradigms

Modern electricity technologies clearly enable new business structures within the electricity enterprise. They also prompt debate about what combination of public policies, regulation, monitoring/policing, and assistance would provide more reliability, consumer options, and efficiency. For the past several decades, unfortunately, policymakers have been limited by, two major debates. The first pitted public monopolies against private monopolies. For much of the last century, some regulators and lawmakers argued that electricity is too valuable to be controlled by profit-seeking industry, while others maintained that government control is a recipe for bureaucratic inaction. No doubt the public-versus-private debate remains; the federal government still is this nation's largest electricity supplier and politicians from the subsidized regions in the Pacific Northwest and Tennessee Valley make up a majority of the Senate Energy Committee, and go out of their way to protect their subsidies, thus blocking efforts to advance electricity coordination throughout the country.

Still, a more significant struggle has emerged between competitors and monopolists: entrepreneurs promoting an open market face stiff opposition from both public and private utilities. Today's debate should be about what balance of competition and regulation will deliver more consumer choices, reasonable costs, environmental sustainability, and reliable electrical service.

The other outmoded debate has focused on subsidies and mandates for specific energy resources. Some policymakers are fierce advocates of nuclear power. Others favor solar energy. The latest craze for some is to gasify coal and burn it more cleanly.

Others think much of the Midwest should become the Saudi Arabia of wind turbines. Politicians of all stripes swear they would never pick winners and losers. Yet the latest energy policy act approved by Congress as well as the president's State of the Union Address reflect that very thinking, and they provide an array of taxpayer subsidies to the energy resources with the most powerful lobbyists. Environmentalists, who also tend to believe they know what's best for the market, favor substantial tax credits for wind turbines and requirements that utilities generate a certain percentage of their power from renewable fuels. Yet an energy policy based on taxpayer subsidies usually leads to waste, both of government dollars and of energy. Consider the short-lived but expensive campaigns for synfuels, then for "clean coal," as well as the costly subsidies that forced nuclear power upon a reluctant market. Similarly, mandates that order utilities to adopt someone's favorite technologies usually meet resistance, fail to attack the underlying source of that resistance, and ignore the power of supply and demand.

An alternative approach is to develop market rules that enable an array of technologies to compete fairly. Market rules that enable entrepreneurs to compete against monopolists, and rules that favor innovation rather than stagnation, will lead to more efficiency and less pollution.

One benefit Maryland enjoys is its participation in PJM Interconection the nation's most advanced regional coordination system for electricity and the most sophisticated independent board that creates rules and markets for open power exchanges. PJM Interconnection, created in 1927 to help mid-Atlantic utilities finance and integrate a fairly large hydroelectric plant, operates a vast wholesale electricity market stretching from New Jersey to North Carolina and west to northern Illinois. It is the world's largest centralized electricity dispatcher, coordinating the output of 800 power plants and 25,000 miles of transmission lines that serve about 35 million people. Some 300 sellers and buyers of electricity participate in PJM's markets, which had led to increased efficiency, reliability, consumer savings, and investments in the transmission grid.

PJM operates the grid as well as day-ahead and spot markets for electricity, enabling generators and consumers to participate in a real-time electricity market. That market, made possible by tools with awkward-sounding names such as "marginal pricing by location," "day-ahead" "real-time bidding, and "security-constrained dispatch", is competitive and nondiscriminatory, and it balances demand and generation to maintain the 60-Hertz frequency required by sensitive motors and computers. According to Phillip Harris, PJM's president, "We don't care if the needed balance is achieved by reducing demand or by increasing supply. Our job is to ensure that generators and consumers have accurate and timely pricing information so they can make informed decisions for themselves."[26]

No doubt independent system operators like PJM can be better platforms for wholesale competition, in part by having the authority to require the construction of new transmission lines in order to maintain reliability, and they are necessary for fair and transparent trading. Although centralized, such transmission systems enable distributed generators to link to a grid and buy and sell power. Without such unbiased institutions, a dominant utility would control the transmission lines.

The Federal Energy Regulatory Commission has been trying to duplicate the PJM model across the country, but faces opposition from southern and northwest lawmakers who want to maintain their control of federally subsidized electricity from the Tennessee Valley Authority and the Bonneville Power Administration. Those politicians, who include the majority leader of the United States Senate and most members of the Senate Energy Committee, try to block power coordination reforms that would benefit Maryland and the entire nation. To ensure an open and fair wholesale power market, therefore, Maryland lawmakers need to participate in the federal debate to encourage coordination reform so as to protect their regional transmission system from such attacks by the subsidized.

Another benefit Maryland enjoys is its participation in the Mid-Atlantic Distributed Resources Initiative (MADRI), an effort by the region's utility regulators, federal

officials, and PJM Interconnection to overcome the retail barriers to distributed generation, demand response, and energy efficiency. MADRI believes distributed resources should compete with traditional forms of generation and transmission to ensure that the grid is reliable and the wholesale electricity market functions. As noted by Richard Morgan, a commissioner with the District of Columbia's Public Service Commission, "There are formidable barriers that stand in the way of deployment of (distributed resources), such as the jurisdictional split between retail and wholesale markets, traditional trade designs that blend costs and dampen price signals, (and) a ratemaking formula that rewards maximization of through-put."[27]

In addition to addressing the barriers to innovation outlined below, MADRI has focused on the lack of advanced metering tools that could provide real-time information to consumers. With "smart meters," customers would cut back on their consumption during peak hours, when electricity was expensive to generate, allowing the consumer to save money and the power company to cancel its plans to build more generators. MADRI also has sought to encourage net metering, whereby self-generators can sell their excess power to the grid at a reasonable rate. MADRI wants to replace traditional rate designs with dynamic pricing and to tweak the ratemaking formula with a revenue stability mechanism to remove a utility's incentive to maximize sales.

Barriers to Innovation

The shift to innovation will take time, and establishing market rules will require a good bit of trial and error. Power markets don't occur naturally, they are developed. For example with natural gas deregulation, the Federal Energy Regulatory Commission went through numerous revisions over seven-years before effectively opening access to alternative natural gas suppliers.

Bringing innovation to the power industry requires a shift in thinking. More than four generations of Americans have come to accept the notion that electricity is best produced by monopolies at centralized generators. Most take for granted the traditional system, in which distant power plants throw away much of their heat, while more fuel is burned elsewhere to produce the same thermal energy for homes, office buildings, and factories. Utilities, moreover, have been protected from market discipline for some 90 years, but few challenge the inaccurate assumption that the United States already has achieved maximum efficiency.

Rather than subsidize or mandate the technologies promoted by the politically powerful, innovation-enhancing markets will require the elimination of regulatory and environmental obstacles. Numerous power-market rules were designed over the last century to support and protect today's dominant structure – centralized, steam-powered generators controlled by regulated monopolies. Thus, today's rules are skewed against alternatives and innovation. Instead, we need, a barrier-busting strategy.

For instance, because dominant power companies can block entrepreneurs from connecting to the distribution grid, we need clear and fair interconnection standards.[28] Although Maryland's interconnection-approval process has improved slightly in recent years, it still takes nine months to two years, a delay that few small projects can afford.

Today's utility monopolies, moreover, enjoy the sole right to string wires. A manufacturer can construct natural-gas pipelines, or build telephone lines, steam tunnels, and internet extensions to my neighboring buildings-- but if she were to run an electric wire across a street she could be sent to jail because today's rules continue to provide a monopolistic advantage to electric utilities. If the rules were changed, few businesses would construct their own electric lines, just as there are few independent gas pipelines, but the availability of competitive wires would transform the power industry and end the monopolies' ability to block entrepreneurs from generating their own electricity.

To protect their monopolies, many utilities also impose exorbitant rates for the backup power most electricity entrepreneurs need when their units are not available because of maintenance or some other reason. Distribution monopolists typically assume that every single independent generator will be out of service at the same

time, so that independent generators would demand backup power when it is most rare and expensive. Such high backup rates are comparable to a home insurance company's setting its annual premium at a house's full replacement price.

Even environmental laws discourage energy efficiency. The U.S. currently measures air emissions based on fuel inputs, usually stated as pounds of pollutants per unit of fuel. Unfortunately, this input-based approach rewards power plants that burn a lot of fuel, regardless of their efficiency. In contrast, output-based regulations would calculate emissions based on the amount of electricity generated, thereby rewarding those innovative generators that supply more electricity but less pollutants. As noted below, Massachusetts, Texas, and several other states have adopted output-based environmental regulations.

The basic utility ratemaking structure, moreover, encourages throughput, or huge amounts of energy moved through the wires, and waste, since not all the energy can be used. Because regulated monopolies have obtained a profit on their investments, they see investment potential in building new large and expensive power plants. This regulatory approach also offers little incentive for utilities to retire those power generators, even when new technologies are more economical, efficient, and environmentally sound.

That ratemaking structure, which averages electricity charges throughout the month, also does not send accurate pricing signals to consumers. Rates are set to compensate the utility for all its costs, including the energy that is lost to inefficiencies in production and transmission. Regulators, by allowing utilities to pass through all fuel costs to consumers, also provide no incentive for power companies to improve efficiency or install distributed generation.

Recommendations

To obtain the benefits of innovation and efficiency, Maryland needs a new, bolder approach to electricity. Below are several suggested actions.

Plan: As with most enterprises, planning is essential. The city of Baltimore has done an impressive job with its various land-use master plans, but could do more on the energy front. Following New York City's example, the Baltimore mayor should organize an Energy Policy Task Force to create a five-year plan that would have the city lead by example. Task Force membership should be limited to 15 to 20 individuals so that the panel can operate effectively, but must include representatives from diverse stakeholders, including the local utility, business associations, community organizations, environmental-justice advocates, real estate developers, and construction contractors. Within six months of its forming, the task force should issue a document that outlines what the city will do – through building codes, bulk purchases, land-use plans, and other tactics – to enhance electricity reliability and efficiency. In addition to setting a clear agenda of near- and long-term actions, the task force will create alliances among key constituencies to stimulate future cooperation, rather than confrontation. Of course, Maryland's governor should launch a similar Energy Policy Task Force for the state.

Break Down the Barriers: To obtain the benefits of innovation and efficiency, Maryland first must remove systematically the barriers to entrepreneurs and modern technologies. The state must modernize its rules if it is to develop a modern electricity system for the 21st century.

1. Regulators should allow the stringing of independent wires across any public street, enabling independent generators to send power to their customers. As they can with telephone lines, steam tunnels, and Internet connections, developers should be able to run their own wires and not rely on the utility competitor.
2. Regulators must establish clear and fair interconnection rules, enabling independent generators to connect with the distribution system. Unlike most of its neighboring states, Maryland has rejected such rules and, thereby, burdened entrepreneurs. The standards must address safety since uncontrolled electricity endangers power-line workers and the general public. Fortunately the Institute of Electrical and Electronics Engineers (IEEE) has issued a national consensus technical interconnection standard that establishes criteria and requirements for linking distributed resources with electric power systems. In May 2005, the Federal Energy Regulatory Commission (FERC) issued interconnection procedures for generators no larger than 20 megawatts, but the rule applies only to interstate facilities subject to FERC's jurisdiction. New York issued its own standardized interconnection procedures in 1999, and California followed with its Rule 21 in December 2000. Maryland must step up and offer its own clear and fair rules for interconnections.

3. Regulators must set reasonable backup rates for entrepreneurs who occasionally need to purchase power from the grid. A possible model would be the standby rates adopted by the New York Public Service Commission, which sought to enable customers to produce some of their own electricity and face fair rates from utilities.
4. Maryland's net-metering provisions should be strengthened to provide more opportunity for independent generators to sell their excess power to the grid. Unlike Pennsylvania and New Jersey, which set standards for generators up to 2 megawatts, Maryland's effort is limited to only 0.8 megawatts. The state should increase its level to 10 megawatts.
5. Maryland should spur the adoption of advanced meters that would enable consumers to obtain real-time prices for their power and use electricity more efficiently and when it is less costly. The state now requires any consumers using more than 600 kilowatts (mostly industrial and large commercial customers) to install smart meters, and that requirement will be lowered to 500 kilowatts in June 2008. If more aggressive, however, the state would prompt utilities to develop the billing system and other back-room infrastructure that would make it relatively easy to bring such meters to the mass market. While the costs are not insubstantial, the additional information from advanced meters would help utilities prevent power theft and better control their distribution systems.
6. Legislators should adopt output-based environmental regulations that calculate emissions on the amount of electricity generated, thereby rewarding generators that supply more electricity and less pollutants. Maryland has adopted limited allowances for energy efficiency and renewable energy in its cap-and-trade program to reduce nitrogen-oxides emissions, yet other states have been more aggressive. For instance, in 2001, Texas issued a standard permit with output-based emission limits for all small electric generators. In Massachusetts, the allocations within its nitrogen-oxide program consider a generator's total useful output, including the thermal contribution from cogenerators.

Provide Consumer Information: The 1999 deregulation law eliminated most utility programs that encouraged energy efficiency and offered information and energy audits. Such programs would be valuable as Maryland residents now seek alternatives to the utilities' higher-priced power. The Public Service Commission (or some other state agency), therefore, should provide a repository of independent analysis and calculations for judging energy alternatives. Maryland should join the numerous other states that offer unbiased information on how homeowners can weatherize and insulate their homes. Also useful would be consumer-protection monitoring as well as a clearinghouse of objective information on contractors able to provide energy services to Maryland consumers. Some states impose a small charge on all consumed electricity to finance such outreach and campaigns to advance efficiency. Many years ago New York state imposed a one-cent charge per kilowatt-hour to support the New York State Energy Research and Development Authority,

which provides energy information and helps to research and commercialize promising technologies. In a related matter, Maryland lawmakers must continue to beat back the efforts by southern and Pacific Northwest politicians who want to hamstring PJM and other regional transmission organizations that provide the information and markets for wholesale electricity exchanges.

Protect the Environment: Over the past several years, while northeastern states and California have worked to ensure that the price of power better reflects the costs of its pollution, Maryland and most other mid-Atlantic states have sat on the sidelines. That stance is beginning to change. In April 2006, Governor Ehrlich reversed course and signed the Healthy Air Act which requires power companies to spend approximately $355 million on pollution-filtration systems by 2010 to cut their mercury emissions by 80 percent by 2010, nitrogen oxide emissions by 69 percent, and sulfur dioxide emissions by some 78 percent. The law also requires Maryland to join seven other northeastern states in an effort to have power plants cut carbon-dioxide emissions by 10 percent by 2018. The law represents a long-delayed move to rein in Maryland polluters and to have the price of electricity include more of the costs associated with power production. It will both improve public health and encourage entrepreneurs to embrace less-polluting technologies. As noted above, Maryland should also adopt output-based environmental regulations which reward efficiency.

Lead by Example: Maryland's state and municipal governments own hundreds of buildings that annually consume millions of dollars of electricity. Although some University of Maryland campuses employ combined-heat-and-power units, few government structures have embraced modern technologies. As a result, Maryland's public sector has missed numerous opportunities to save money as well as advance an industry that could bring jobs, creativity, and economic development to the state. The energy plans to be developed by Maryland's governor and Baltimore's mayor should include specific recommendations for how government buildings can lead the demand for electricity innovation and efficiency.

Attract Innovators: To become a leader in energy innovation, Maryland must go out of its way to attract entrepreneurs. It already is home to one of the largest photovoltaic manufacturers, and the University of Maryland hosts a combined-heat-and-power research center. Still, the state could learn from Pennsylvania, which recently convinced Gamsea Corp, a Spanish firm that is the world's second largest wind turbine maker, to place its U.S. headquarters in the Commonwealth, providing 1,000 high-paying manufacturing jobs. Although states typically use subsidies to lure businesses, Maryland could achieve substantial gains with simple outreach and the public declaration that the state wants to break down market barriers and attract electricity entrepreneurs. Such efforts would be enhanced if Maryland also expanded its university research efforts on innovative energy technologies.

Aggregate: A few analysts say today's higher rates demonstrate that electricity is too vital a commodity to be controlled by profit-seeking companies, and they argue for Baltimore and other communities to take over their electric systems. Such an approach would be costly and produce no guarantee of increased reliability, affordability, or efficiency. Instead, communities should encourage or participate in power-buying cooperatives. For instance, several trade associations created the Mid-Atlantic Aggregation Group Independent Consortium shortly after the 1999 deregulation law to purchase power in bulk for some 7,000 Maryland businesses, including clothing stores, nursing homes, and pharmacies. That group claims to have obtained savings of 3 to 8 percent for its members. The Columbia Association – representing approximately 97,000 Howard County residents – has been prompted by the recent increases to explore the creation of a similar cooperative.

Aggregation is particularly important for residential customers. Unlike industrialists, they do not buy large quantities of power and therefore cannot bargain for lower prices. By pooling their demand, coalitions of homeowners and renters could shop for better deals.

Such buying coops differ from the rural electric cooperatives, which were established in the 1930s to bring power to underserved areas, largely because they do not own distribution lines or generators. The Southern Maryland Electric Cooperative, one of the nation's largest rural coops, purchases power from a variety of utilities and delivers it through its own distribution lines to customers in St. Mary's, Charles, and Calvert counties.

At present, Maryland forbids city and county governments from creating buying coops on behalf of their residents due to opposition from traditional utilities. Ohio, in contrast, adopted "opt-out municipal aggregation," allowing cities to buy power at substantial bulk discounts for their interested residents. Maryland lawmakers should explore that option for its communities.

Assist Low-Income Residents: The pending rate increases will have a disproportionate impact on the poor, who often face the unfair choice of food or fuel. Maryland lawmakers can continue to advocate for the Low Income Home Energy Assistance Program (LIHEAP), but that initiative serves only a small proportion of eligible households. Also needed is advocacy for initiatives, such as Weatherization, that help low-income residents make their homes more energy efficient, thus cutting their power demand and costs. Maryland should also provide aggregation services and reach out to low-income residents with energy efficiency information and resources.

Conclusion

No doubt restructuring the nation's largest industry is difficult, the obstacles to change are formidable, and many utility monopolies are working aggressively to remain protected from entrepreneurs. Yet the U.S. electricity system must change to meet the demands of the twenty-first century. Innovation's environmental benefits alone are critical. Businesses and individuals also increasingly need more reliable power than the current arrangement provides.

Maintaining this status quo is no longer an option. Instead, we must envision and advance a more perfect power system. Maryland can and should become a hub for such electricity innovation. Modern technologies are available, and the region is home to coordinated wholesale-power exchanges. What's needed to take advantage of this opportunity is political leadership that will eliminate the numerous regulatory and legal barriers that protect monopolies and discourage innovative entrepreneurs. If Maryland policymakers can look beyond the current rate hikes and restructure the electricity industry based on the principles of technology modernization, market efficiency, and consumer choice, they will bring about immense benefits for the state's economy and environment.

Footnotes

[1] Andrew A. Green, "Former industry leaders regulating state utilities," *Baltimore Sun*, March 14, 2006.
[2] Electric Power Research Institute Consortium for Electric Infrastructure to Support a Digital Society, *The Cost of Power Disturbances to Industrial & Digital Economy Companies* (Palo Alto, CA: EPRI, June 2001).
[3] Scott Sklar, "New Dawn for Distributed Energy," *Cogeneration and On-Site Power Production*, July-August 2004.
[4] "Nurses' Study Blames Six Maryland Plants for 100 Annual State Deaths," Associated Press via Dow Jones Newswires, February 15, 2006.
[5] Burton Berry, "Mr. Samuel Insull," Insull Collection at Loyola University Chicago (unpublished but copyrighted in 1962 by Samuel Insull, Jr.)
[6] *American Paper Institute, Inc., Petitioner, v. American Electric Power Service Corporation, et al.; Federal Energy Regulatory Commission, Petitioner, v. American Electric Power Service Corporation, et al.*, Nos. 82-34, 82-226, 103 S. Ct. 1921 (1983)
[7] Paul L. Joskow, "California's Electricity Crisis," Working Paper 8442, National Bureau of Economic Research, August 2001.
[8] Congressional Budget Office, "Causes and Lessons of the California Electricity Crisis," September 2001. http://www.cbo.gov/showdoc.cfm?index=3062&sequence=0#pt5
[9] "NYPSC: Competition Works in New York," Electricity Daily, March 6, 2006.
[10] "NY PSC Chairman Rebuffs Customer Choice Critics," *New Power Executive*, March 31, 2006.
[11] Quote by Dr. Joseph F. Vallario, Jr, as quoted in Dan Rodricks, "Where were they when the lights got expensive?" *Baltimore Sun*, March 12, 2006.
[12] Ann E. Marimow and Matthew Mosk, "Power Industry Holds Firm on Rate Jumps," *Washington Post*, March 15, 2006.
[13] From a Public Service Commission press release as noted in Paul Adams, "BGE bill to increase $743," *Baltimore Sun*, March 8, 2006
[14] Thomas Dennison, "Lawmakers ponder ways to cushion increases in electric rates," *Maryland Gazette*, March 14, 2006.
[15] J.T. Peters, "That Vital Commodity, Quality," *Public Utilities Fortnightly*, May 10, 1973.
[16] Amory Lovins, *Small Is Profitable* (Snowmass, CO: Rocky Mountain Institute, 2002).
[17] "Combined Heat and Power Units Located in Maryland," data base prepared by Energy and Environmental Analysis, Inc. and the U.S. Department of Energy. http://www.eea-inc.com/chpdata/index.html
[18] Thomas R. Casten, chairman of Primary Energy, interview with author, May 11, 2004.
[19] Interlaboratory Working Group, 1997, *Scenarios of U.S. Carbon Reductions: Potential Impacts of Energy Technologies by 2010 and Beyond*, Oak Ridge, TN: Oak Ridge National Laboratory; and Berkeley, CA: Lawrence Berkeley National Laboratory.
[20] W. Short, "Renewable Energy Technologies: Progress, Markets, and Industries." Presentation at the 2nd Renewable Energy Analysis Forum, National Renewable Energy Laboratory, Golden, CO, May 29, 2002.
[21] American Wind Energy Association's "Wind Project Data Base." http://www.awea.org/projects/Maryland.html
[22] "Leapfrogging the Power Grid," *Nature*, February 19, 2004.
[23] Institute for Lifecycle Environmental Assessment, *Carrying the Energy Future: Comparing Hydrogen and Electricity for Transmission, Storage, and Transportation* (2004) at http://www.ilea.org
[24] National Academies of Sciences, *The Hydrogen Economy: Opportunities, Costs, Barriers, and R&D Needs* (Washington, D.C.: National Academies of Sciences, February 2004).
[25] U.S. Department of Energy, "National Transmission Grid Study," May 2002.
[26] Philip Harris, interview with author, May 24, 2004.
[27] Testimony of Richard Morgan at FERC Demand Response and Advanced Metering Conference (Federal Energy Regulatory Commission Docket No. AD06-02-000). January 25, 2006.
[28] U.S. Department of Energy, "Making Connections – Case Study of Interconnection Barriers and their Impacts on Distributed Power Projects," NREL/SR-200-28053. July 2000.