GALVIN ELECTRICITY INITIATIVE
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Issue Brief
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Perfecting Power
for a Secure, Sustainable Energy Future

# Improving the Grid:
## Why Consumers Should Care

Customers should ask themselves:

"What would I rather pay for — an unending stream of wasted money and energy, or the investment required to stop it?"

## Why Push to Modernize the Grid?

There is a growing awareness among consumers that our power grid is in need of an upgrade. Accompanying this awareness has been increasing concern that the costs to do so are prohibitive and will be borne largely by consumers. The untold story is that the hidden costs associated with doing nothing — enduring the outages, wasted energy, antiquated technology and other limitations inherent in our current system — far outweigh the investment needed to make it stable and efficient for the future. These costs are reflected in our utility bills as well as in the costs of goods and services.

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## Consumers Already Pay for Electricity System Waste

The inadequacies of today's electricity system affect all Americans. In addition to leaking energy and fuel, the system risks health and safety, is increasingly vulnerable to attack, and leads to lost productivity.

Here is how today's electricity grid costs Americans trillions of dollars each year:

1. **Inefficiency in generation and transmission:** The plants that generate electricity and the lines that carry power to our cities and towns usually have to move a lot of electricity a long distance to the homes and businesses that use it. These large, centralized power plants were built using decades-old technology that is very inefficient, as they waste almost ⅔ of the fuel they consume.[1,2] In addition, power lines lose up to 10 percent of the power they transport through what is called "line loss." As a result, roughly 75 percent of the resources consumed to supply electricity is wasted.
2. **Unnecessary power outages:** Most power lines in the U.S. are above-ground and frequently fall prey to weather, animals and accidents. When something happens to the line, the power goes out and consumers, businesses and utilities pay for the resulting repairs and economic losses. In extreme cases, electricity outages cause injuries and deaths, but more commonly produce flooded basements, spoiled food and lost work — costing consumers billions each year.[3]

Our electricity system is the top producer of manmade carbon dioxide, sulfur, mercury and other hazardous pollutants.[4]

3. **Underutilized infrastructure:** Utilities spend billions of dollars each year building more power plants, power lines and substations purely to handle periods of extreme cold or heat, when demand for power spikes and exceeds existing capacity. This infrastructure sits idle much of the time.[4]

4. **Potential public health risks from power generation:** Our electricity system is the top producer of manmade carbon dioxide, sulfur, mercury and other hazardous pollutants.[4] When energy is wasted, the carbon dioxide resulting from its generation enters our atmosphere unnecessarily. These inefficiencies also hurt our economy, as health care costs increase due to the effects of pollution.

So we as consumers pay for all of the current waste in the electricity sector. We can continue paying for this waste, or we can pay for improvements that would eliminate it. Think of it as a one-time payment to the plumber to fix the leaky faucet that is driving up your water bill; if you do not pay to have it fixed now, you will be paying in drips until you do.

TABLE 1: ELECTRICITY SYSTEM WASTE

| WASTE | POTENTIAL SAVINGS | ANNUAL SAVINGS, $ |
|---|---|---|
| Wasted fuel, generation and distribution — 70% | 20 quadrillion btus, or about 20% of total U.S. energy consumption[1,2] | **$90 billion** at $4/mmbtu |
| Impact of outages | Injuries and deaths<br>Lost productivity and taxes<br>Damaged goods<br>System repair costs | **$100 billion** at about $1,000 per household[3] |
| Wasted capital — 30% | 300 GW of generation, distribution, and transmission[1] | $40 billion at $4,000/kW for all three financed over 30 years |
| Health and safety | Carbon: 6 billion metric tons<br>Sulfur: 7.5 million tons<br>NOx: 2.4 million tons | $60 billion at $10/ton[5]<br>$1 billion at $120/ton[6]<br>$5 billion at $2,000/ton[6] |
| Fresh water withdrawal | 3.5 trillion gallons annually[4] | $7 billion at $2/1,000 gallons[7] |
| **Total savings** | Total U.S. usage: 3.8 billion MWh[1] | $390 billion or~10cents/kWh |

"Quality is fundamentally about looking at products through the eyes of the customer."

— Jim Buckman, Joseph M. Juran Center for Leadership in Quality

## New Approach Needed for Meaningful Improvement

Power companies have access to some of the greatest minds in the world, to the most innovative approaches and technologies available, and to the latest improvements in quality management methods to maximize the value of their investments.

What if utilities were to take a systems approach to grid improvement? Inherently a systems approach is designed to find leverage — small changes that produce significant improvements. It helps to create new thinking and innovation. One example is the Village of Naperville, Ill.[8] Fifteen years ago, this municipal utility was faced with a takeover bid by the large investor-owned utility serving the Chicago area. Municipal utility leaders leveraged continuous improvement methods to achieve dramatic improvements in reliability without raising costs.

In 2005, former Motorola CEO Robert W. Galvin formed the Galvin Electricity Initiative to design and promote a power system that cannot fail the end user. It leverages Six Sigma quality principles to enhance the efficiency, reliability and security of a dynamic power system. The Initiative intends to demonstrate that it is both economically plausible and practical to deliver "Perfect Power" to the consumer. The ultimate goal is to meet the needs of the end-user — perfectly.

The Initiative has applied systems thinking and approaches to improving the electricity system for two separate sites with similar results.[5] The path to Perfect Power begins with defining the customer's needs along with a comprehensive set of performance metrics that provides evidence that the system has improved.

## Smart Microgrids: A Model for Reducing Electricity System Waste

The Galvin Electricity Initiative demonstrates the feasibility of a new approach to electricity generation and distribution that minimizes waste and better addresses consumers' needs: smart microgrids. These community-based systems use consumer choice and competition among power providers as a strategic lever for innovation — a significant shift from the current practices of electricity producers, regulators and others in a position to change the grid.

In these community-based systems, consumers can choose more efficient, more environmentally friendly power. Entrepreneurs are inventing new technologies and solutions, such as efficient and renewable local power generation, that would replace our reliance on inefficient and distant coal-fueled plants. These local generating facilities can be fueled by the sun, bio-fuels, natural gas and other low-carbon

sources, and can be hidden from view in buildings that look no different from others in the area. Line loss is greatly reduced, and even the heat that is normally lost in the generation process can be captured and used for other purposes.

By incorporating smart technology and new configurations in addition to on-site generation, smart microgrids are much more reliable than the centralized grid. These systems also can be networked together so that they back each other up. When something happens to a power line, smart switches re-route power around problem areas and help technicians pinpoint the location of the fault instantly. And when the power stays on, consumers pay less for repairs.

On the community level, smart microgrid development is most often coordinated with local governments, and thus can coincide with other major capital projects such as roads, sewer and water. For instance, when other infrastructure projects are under way, above-ground power lines can be buried underground where they are less vulnerable to the elements.

In sum, smart microgrids can reduce the costs of waste so that consumers truly pay only for the power they use.

The Galvin Electricity Initiative, launched by former Motorola CEO Robert W. Galvin, has brought together many of the nation's leading electricity experts to reinvent our electric power system into one that is fundamentally more affordable, reliable, clean and energy-efficient. The Initiative has created innovative business and technology blueprints for the ultimate smart grid — the Perfect Power System. The system is a smart microgrid that meets the needs of 21st century consumers and provides reliable, secure electricity regardless of nature's wrath or security threats. To pave the way for Perfect Power and system transformation as a whole, the Initiative is advocating for new policies that reflect a set of guiding Principles — the electricity consumer's bill of rights — in Illinois and other key states. For more information on the Electricity Consumer Principles, the policy framework or the Perfect Power System, visit ***www.galvinpower.org***.

[1] Energy Information Association. *Annual Energy Outlook 2009*, Tables A1-A20.

[2] Livermore, L. Energy, Carbon, and Water Flow Charts, National Labs *https://publicaffairs.llnl.gov/news/energy/archive.html#energy_archive*

[3] Berkeley, L. *Understanding the Cost of Power Interruptions to U.S. Electricity Consumers*, National Labs, September 2004.

[4] *2008 State of the Market Report for PJM*, Figure 2-4 *http://www.pjm.com//media/documents/reports/state-of-market/2008/2008-som-pjm-volume2-sec2.ashx*

[5] Galvin Electricity Initiative Perfect Power prototype design reports for the Illinois Institute of Technology and Mesa del Sol development, *http://galvinpower.org/projects/perfect-power-illinois-institute-technology*

[6] *http://tonto.eia.doe.gov/oog/info/ngw/ngupdate.asp*

[7] Consumptive Water User for U.S. Power Production, NREL/TP-550-33905, P. Torcellini, N. Long, and R. Judkoff, December 2003.

[8] Galvin Electricity Initiative Naperville Case Study, *http://galvinpower.org/media/news/initiative-conducts-naperville-case-study*

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