

Keeping the Lights On: Challenges of Cybersecurity Training and Awareness for the Smart Grid

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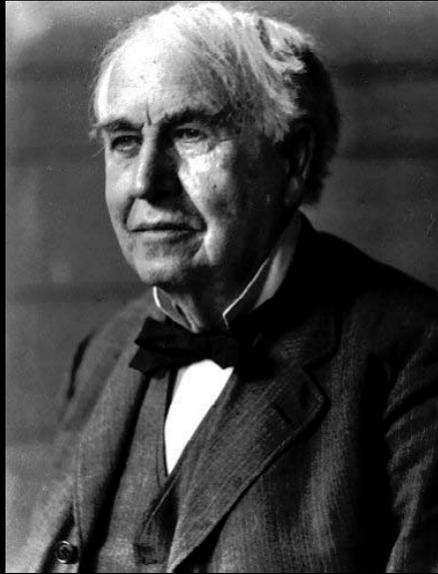


U.S. DEPARTMENT OF
ENERGY



What is the Grid?
Why is the Grid like it is?

The War of the Currents

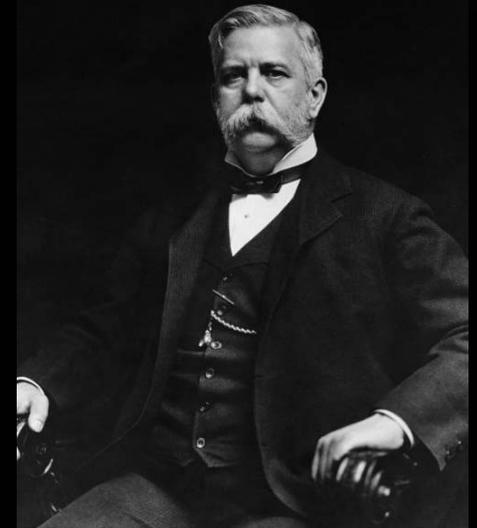


Thomas Edison



Nikola Tesla

George Westinghouse



Electricity Evolution?



Emerging technology in
1893 . . .
Still influencing the grid
today

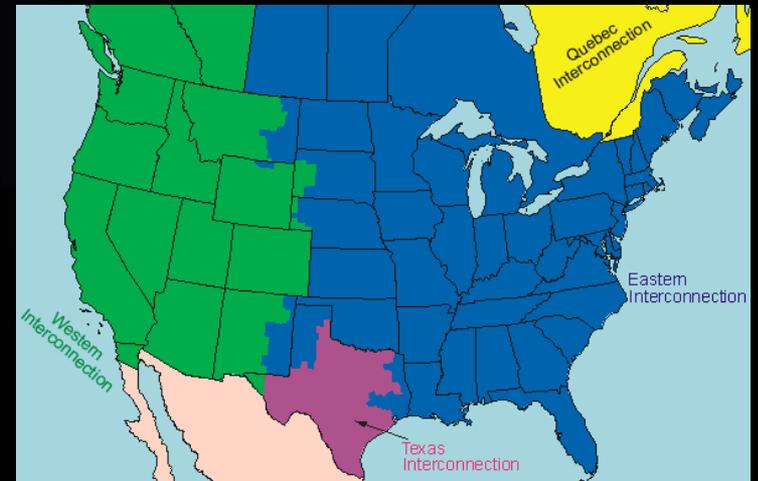


In the 1940s, connected local
generation and transmission
systems created
an “electric grid.”



Today's Electric Grid

- Three major linked regional power grids in the lower 48 states
 - More than 3,000 utilities
 - About 10,000 power plants
 - Several hundred private and public transmission grid owners
 - Approximately 130 balancing authorities
 - Millions of power consumers
- More than **4,000 million megawatt-hours consumed annually.**



How dependable electricity reaches you

Most of us take reliable electric power for granted. But do you know how far that power has to travel before it gets to you?

Power Plant

At a generating plant, water is heated to steam using fuels such as natural gas, coal and oil; the steam turns turbines that turn generators to produce electric energy. In some areas, nuclear power or water flowing through hydroelectric dams powers the turbines.

Step-Up Substation

Transformers at the generating plant increase the voltage up to 345,000 volts, so it can travel long distances over high-voltage transmission lines.

High-Voltage Transmission Lines

These lines carry the electric energy over long distances. Insulators on the towers prevent the power from flowing to the towers or the ground.

Transmission Substation

Transformers reduce the electric energy up to 69,000 volts, making it suitable for high-volume delivery over short distances.

Large Industrial User

Most industries need 2,400 to 4,160 volts to run heavy machinery. They usually have their own substation at the facility.

Local Distribution Substation

Local electric co-ops operate several of these substations to reduce electricity to 7,200-14,400 volts for distribution to their members.

Distribution Lines

Lines belonging to local electric co-ops carry electricity to transformers that reduce power levels to 120/240 or 120/208 volts for use in schools, farms, small businesses and homes.

Schools

Farms

Small Businesses

Homes



What is the Smart Grid?
How is it different?

Big in Value



... Little in Cost

The difference
is like...



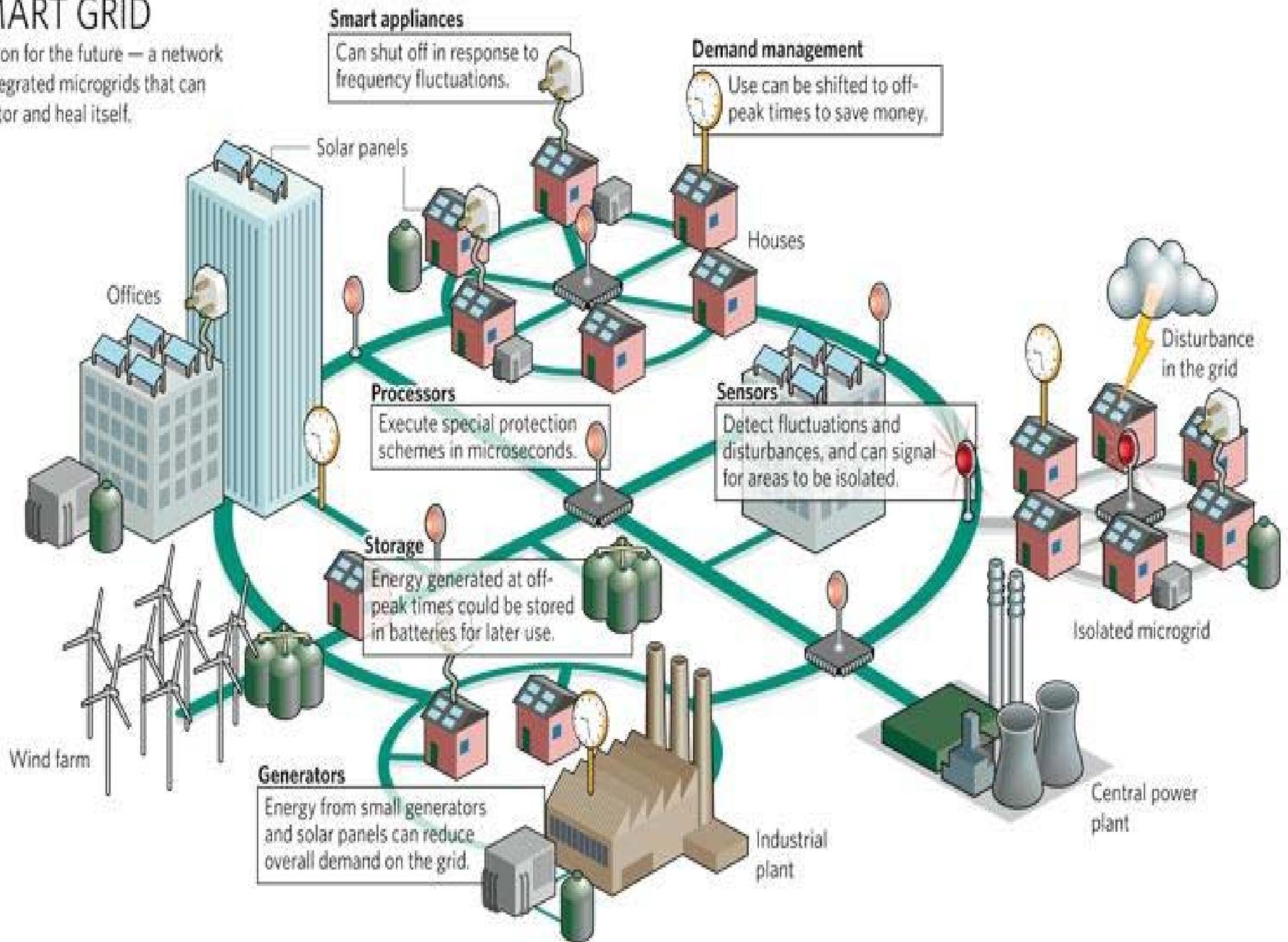
The Smarter Grid can. . .

- Heal itself
- Motivate consumer participation
- Resist attack
- Provide higher quality power
- Save money
- Accommodate generation and storage options
- Enable electricity markets to flourish
- Run more efficiently
- Increase use intermittent power generation sources



SMART GRID

A vision for the future — a network of integrated microgrids that can monitor and heal itself.



Smart house

Features digital meter, smart thermostat and other devices to allow customers to adjust their energy consumption according to preference and rates.

Solar panels: Excess power generated can be sent back to the grid.

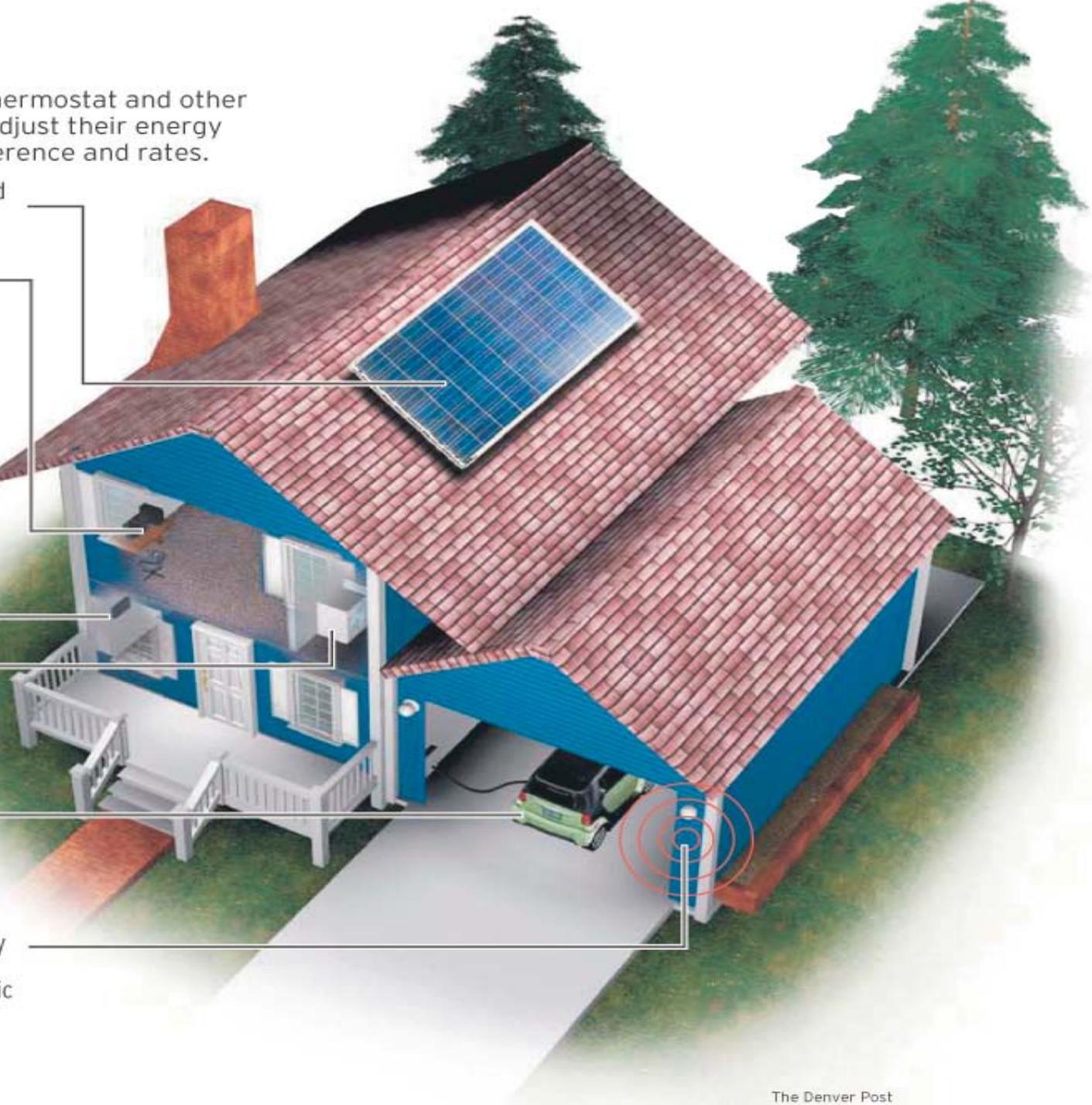
Computer: Customers can go online to a Web portal to view real-time information about their power consumption or change their home energy settings.

Thermostat: Can automatically adjust home temperature setting based on communication with power grid. Can also display how much customers are currently paying for power per kilowatt hour.

Smart appliances: Washers and dryers with on-board computer chips that can sense grid conditions and turn off or on as needed.

Electric plug-in vehicle: Can act as a backup generator for homes and supplement the grid during peak hours, and charge in off-peak hours at lower cost.

Smart digital meter: Allows two-way communication between customer's home and the utility and gives automatic energy usage readings, eliminating the need for meter readers.



The Smart Meter



225,000,000 Internet access points





**Cybersecurity training,
education, and outreach
leverages human capital
assets for protection of the
Electric Grid.**

Electric Grid Cybersecurity TEA Goals



- Increase Consumer Awareness of cyber-related security on the Electric Grid
- Promote Electric Sector Cybersecurity Training, Education, and Awareness
- Recruit and Retain a Workforce Skilled in Cybersecurity

Consumer Awareness



- Why?
 - New technologies
 - Changing security and privacy impacts
 - Resistance to change
- What?
 - Understanding their role
 - Accepting their responsibilities
- How?
 - Media targeted to each consumer segment
 - Increased attention to cybersecurity in K-12 curriculum





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Your Life. Plugged In.™

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Smart Grid | Energy Saving Programs | Renewable Energy | Protecting Our Environment | Reliability

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Smart Meters



Pepco is installing smart meters in homes and businesses across the District of Columbia. These smart meters will allow us to provide you detailed energy information that will help you better understand your electric use and help all of us meet our energy reduction goals.



Smart meters are equipped with technology that allows two-way communications between your home or business and Pepco. The meter records your daily energy use, and in the future you will have access to the data to monitor your own energy use.

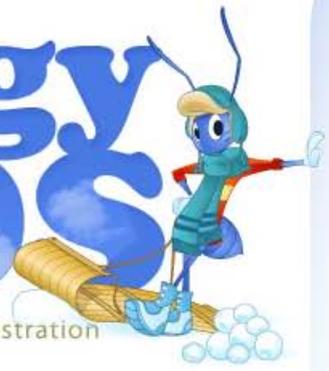
Energy information from your smart meter will help you make decisions about your energy use and help you target ways to save. You also can learn through our online energy-audit tool [My Account](#) about ways to lower energy bills.

Crews will begin installing the smart meters in October 2010 and will continue with the installation process through December 2011 until all District customers receive a new meter.

ENTER KEYWORDS

energy KIDS

U.S. Energy Information Administration



HEY TEACHERS!
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A framed portrait of a man with a white beard, likely a historical figure related to energy or science.

What is Energy?

Energy Sources

Using & Saving Energy

History of Energy

Games & Activities

FOR TEACHERS

[ENERGY CALCULATORS »](#)

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Training, Education, and Awareness



■ Why?

- Assure reliable power
- Support National security
- Protect the Grid
- Adapt to the increased use of information technology
- Meld cybersecurity practices into all aspects of business operations



Effective information security governance requires senior management commitment and an overall culture conducive to information security at the executive and operational levels. Too often, management determine that it is **easier to buy a solution than to change a culture. . .**

Education and training in the operation of information security processes are often overlooked as well. However, management should consider that even **the most secure system, if operated by ill-informed, untrained, careless or indifferent personnel, will not achieve a significant degree of security.**



Training, Education, and Awareness

- What?
 - Adapt to a changing workforce
 - Adapt to changing technology
 - Cultivate a cyber-aware work environment
 - Establish baselines for cybersecurity competency and proficiency
 - Change the way cybersecurity is perceived



Training, Education, and Awareness

- How
 - Communicate with all employees
 - Assess existing skill levels
 - Develop role-based cybersecurity training and education programs
 - Incorporate cybersecurity concepts in occupational training programs
 - Leverage training resources and best practices



Cybersecurity Workforce

- Implications of skilled workforce shortage
 - The number and quality of qualified professionals is low.
 - Recruitment is extremely competitive.
- Recruitment of new staff
- Retention and development of staff in practice
- National focus on qualifications for staff in significant cybersecurity functional roles
- Training and education opportunities



Cybersecurity Workforce

- Currently an estimated 2.28 million information security professionals worldwide
- Nearly 4.2 million by 2015

RESULTS:

1. Career opportunities for those with the right skills
2. Increased competition for skilled staff



Every occupation in the Electric Sector needs cybersecurity knowledge, skills, and abilities that match the evolving technology they use in their jobs.



New thinking about the workforce and workplace and new human resources strategies are need for critical mission-based disciplines.

Electric Sector Workforce

- Impending volume of retirements
- Smaller hiring pool
- Undefined requirements for new skills
- Career stereotypes
- No standards, competency models, or career ladders
- Few mechanisms for knowledge transfer
- Cyber-related roles and responsibilities not well-defined
- Too few industry-defined, portable credentials
- Insufficient occupational training programs



Changes are coming. . .

- Human capital assets are critical to the protection of the Electric Grid.
- The public needs to understand how it will be impacted.
- The Electric Sector workforce must be ready and able to move forward.
- The industry must attract and retain skilled individuals for its workforce.
- Training and awareness must be comprehensive, timely, and continuous.





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