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Smart Grid Costs Are Massive, but Benefits Will Be Larger, Industry Study Says

By PETER BEHR of

Deployment of smart grid technology from U.S. utility control centers and power networks to consumers' homes could cost between $338 billion and $476 billion over the next 20 years, but will deliver $1.3 trillion to $2 trillion in benefits over that period. The benefits will include greater grid reliability, integration of solar rooftop generation and plug-in vehicles, reductions in electricity demand, and stronger cybersecurity, according to a new study by the Electric Power Research Institute (EPRI).

The projected costs of deploying digital controls and applications on the grid, averaging $17 billion to $24 billion a year, will fall most heavily on utility distribution systems that deliver power to retail customers, EPRI concluded. About 70 percent of the total investment in the higher-cost estimate would be required to upgrade substations, lines, poles, meters, billing and communication systems on the retail side to enable smart grid technologies and replace aging equipment, the study says.

EPRI assumes that by 2030, 10 million plug-in vehicles will be on the road, and smart grid technologies will permit plug-in vehicles not only to take recharging power from the grid, but to feed power back in from their batteries to help meet sudden changes in electricity demand.

About 20 percent of investments in the high-cost scenario would go into upgrading the high-voltage transmission grid, including installation of sensors to alert operators to potential failures of transformers on the system, and purchases of equipment to protect the grid and make it more efficient, EPRI said.

The smart grid components going directly into the home would add about 10 percent to overall smart grid investment in the high-cost scenario. The average household monthly electricity bill rise by $9 to $12 for smart grid products and services. E that consumer acceptance and adoption of smart grid applications would increa

About 10 percent of residential customers would have advanced energy manage

by 2030, the study assumed. (EPRI does not include the costs of a new generation of efficient, programmable refrigerators and other appliances as part of the household's smart grid costs.)

'Ultimately ... the consumer pays'

Clark Gellings, an EPRI senior fellow and lead author of the new study, said that the division of investments among the distribution, transmission and costumer segments should not obscure the fundamental reality: "Ultimately, at some point, the consumer pays for everything."

One of the many unknowns the authors encountered was where consumers would get their smart grid appliances and devices. The study reports "a growing belief" that these services will be delivered to customers as part of a package of services from new competitors in the telecommunications and information technology industries, rather than traditional electric utilities.

Utility executives and smart grid advocates agree that apart from the smart grid projects funded by $4 billion in federal stimulus grants, most current smart grid investment is going into improving the efficiency, reliability and profitability of power supply, rather than reaching consumers directly. Recent studies conclude that while some tech-savvy consumers will line up for smart grid applications for the home, most residential customers are not eager to manage their daily energy use, particularly with electricity prices at relatively low levels.

Given the right financial incentives, though, many households may accept smart grid strategies that let utilities reduce power consumption in homes at peak periods of demand, when wholesale electricity prices are highest, some analysts conclude.

"Many of the experts who are studying the Smart Grid are increasingly adopting the view that a truly Smart Grid should require as little consumer participation as possible. The Smart Grid does not require consumer participation to succeed," the EPRI study says.

EPRI's study updates a 2004 report that estimated total smart grid investments of $165 billion, one-third below the current study's top figure.

Gellings said this increase in the smart grid's cost is based on the expanded capabilities of the new technologies. "They reflect a newer, more advanced version of a smart grid," he said.

As the grid gets 'smarter,' electricity use slows

A major consumer benefit, according to the study, could be a reduction in electricity consumption. EPRI noted that the Energy Department's 2010 energy outlook forecasts a 1

percent annual growth rate in electricity consumption over the 2008-2035 period. Demand response and efficiency gains enabled by smart grid technologies would reduce annual electricity growth to less than 0.7 percent, EPRI predicted. The growth rate in peak energy demand would be even lower.

Lower power consumption lowers greenhouse gas emissions, EPRI said. Another EPRI study concluded that smart grid technologies would enable a transition to cleaner generation and reduced consumption that could reduce overall carbon emissions in 2030 by 58 percent compared to 2005 levels.

The barriers to smart grid deployment include agreement on technical standards for smart grid technologies and wariness among state utility commissions about passing on higher costs for smart grid systems until their value is clearly established, EPRI said.

Another issue is that utilities and their regulators are accustomed to buying power equipment that lasts 40 years or more. The new digital equipment being installed on the grid may last as little as a decade or two before being replaced by better devices, EPRI said.

The study notes a recent comment from the Illinois Commerce Commission that controversy and lawsuits accompany some smart grid deployments. "Disagreements exist about whether recovery of a utility's smart grid costs should be restricted to the 'traditional' rate-base method, or whether a 'non-traditional' method ... should be used. Some stakeholders are concerned that utility proposals for cost recovery of smart grid investments would lead to significantly higher monthly bills and a shift in the risk of investment from utilities to ratepayers. Others believe that non-traditional cost recovery would be essential to accelerate deployment of smart grid technologies."

A major uncertainty the study authors confronted was assessing the costs of protecting the U.S. grid against the threat of solar storms that send geomagnetic pulses slamming into vulnerable transformers and other critical grid equipment.

A once-in-a-century storm could cripple large parts of the power delivery system, with potentially catastrophic consequences, federal experts warn. EPRI is working on protective devices to safeguard power substations from pulse effects. "It is feasible, but it hasn't been developed yet," Gellings said. "The real question is, what is the potential impact of geomagnetic storms? They could be much more severe than we've estimated."

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