Driven by increasing shares of renewable energy in the electricity generation mix and by the need to update aging grid infrastructure, global investment in “smart grid” technologies rose 7 percent in 2012, totaling $13.9 billion worldwide. A smart grid is an electricity network that uses digital information and communications technologies to improve the efficiency and reliability of electricity transport. The increasing use of highly variable energy resources requires sophisticated control systems to facilitate their integration into the electric grid.

The United States topped other countries in investment in smart grids, spending $4.3 billion in 2012, although that was 19 percent below the 2011 figure of $5.1 billion. China invested $3.2 billion in 2012, an increase of 14 percent over 2011. Smart grid directives in the European Union (EU) drove a 27 percent increase in European spending to $1.4 billion in 2012, up from $1.1 billion in 2011. Latin American investment in smart grid technology remains relatively small, totaling $400 million in 2012. (See Figure 1.) In addition to investments, many countries have formal nationwide development plans and regulatory frameworks for smart grids.

While the United States maintained its position as a leader in smart grids, the decline in U.S. investments in 2012 was due in part to the expiration of federal funding programs initiated under the American Recovery and Reinvestment Act in 2009. Of the $3.4 billion in the federal Smart Grid
Investment Grant program, about $2.3 billion had been spent as of March 31, 2012. These funds have supported 99 smart grid deployment projects across the United States. At the start of 2012, utilities had installed 37 million smart meters, covering 33 percent of American households. Smart meters are just one of the many technologies involved in smart grid infrastructure. These electronic measurement devices gather data on energy usage and provide two-way communication with the utility for efficiency and accurate billing purposes, enabling regulatory mechanisms such as time-of-use pricing to be introduced. The aggregate of utility plans to install smart meters across the country should result in 65 million units installed, covering 57 percent of American households, by 2015. (See Figure 2.)

China’s rising investment in smart grid technologies stems from its nationwide plans to update its poorly designed and inefficient transmission system, and China is poised to surpass the United States in smart grid investment in 2013. The State Grid Corporation of China has a three-phase plan to invest $601 billion in transmission infrastructure, with $101 billion slated for smart grid technology, through 2020. Phase 1 was completed in 2010 and included smart grid planning and pilot projects. Phase 2 is expected to run from 2011 to 2015 and involves full construction and deployment of smart grid infrastructure. In 2011, the value of the smart grid market in China reached $22.3 billion. As of 2012, China had installed 139 million smart meters, enough to cover 35 percent of households.

Other countries in Asia are also investing in smart grid technologies and deployments. South Korea, as of February 2012, had deployed smart meters to fewer than a million households, or roughly 4 percent. But the government plans to install smart meters in half of

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Figure 2. **Current* and Planned Smart Meter Deployments in Select Countries, 2012**

*Current percentages are estimates based on available data. **Sources**: EIA, IEE, Pike Research, European Energy Review, Bloomberg, GSGF.
Korean households by 2016 (10 million units) and in all households by 2020. Japan is already home to one of the most efficient electricity grids in the world, with distribution losses averaging 4.9 percent over the period 2000 to 2010. After the 2011 Fukushima nuclear accident and the subsequent shutdown of most of Japan’s nuclear capacity, the government included smart grid infrastructure in its revised energy plan. The country’s largest power company, TEPCO, plans to put 27 million smart meters in place between 2014 and 2023, with a median 2018 target of 17 million installations. The complete rollout would cover 38.5 percent of Japanese households. Japan’s smart grid market in 2012 was valued at $1 billion.

In the EU, Electricity Directive 2009/752/EC mandates member states to deploy smart metering systems in 80 percent of households by 2020, where cost-benefit analyses of smart meters are positive. Progress varies from country to country, but as of 2011 an average of 10 percent of EU households had smart meters installed. In addition to directives, the European Commission established the European Electricity Grid Initiative, a nine-year, €2 billion research-and-development program for smart grid technology and market innovations.

Some European countries have made considerable efforts to develop smart grid networks. Nearly all Italian households have smart meters installed, for example. Italy’s advanced metering infrastructure rollout began in 2001 with the commencement of the Telegestore project, the main objective of which was to reduce high non-technical losses on the grid. Smart meter installation was mandated in Italy with Regulatory Order No. 292/06 in 2006. In contrast, East European countries have seen little investment or development in smart grid networks due to budget constraints.

The United Kingdom plans to begin nationwide installation of smart meters in 2014. The country plans to install these meters in all households by 2019. But in 2012, installations by individual utilities totaled around 540,000, or less than 2 percent of households.

Smart grid investment in Latin America remains generally low. Brazil is an exception, investing $240 million in stimulus funds in 2010. At the end of 2012, Brazil formalized a regulatory framework for smart grid deployment.

Grid-scale energy storage technologies are another important aspect of evolving grid networks, providing an alternate or complementary solution for the integration of variable renewable energy into the grid, among other benefits. In 2010, the value of the global grid-scale energy storage market was $1.5 billion. Installed storage capacity in 2011 totaled 125.5 gigawatts (GW) worldwide. Pumped hydro storage accounted for 98 percent (123.4 GW) of that total. Other means of storing electricity include thermal energy storage, batteries, and compressed air. (See Figure 3.)

There were 714 grid-scale energy storage projects worldwide in 2012 in varying stages of operation or development. This represents roughly a 19 percent increase in the number of projects from the previous year. Pumped hydro storage accounted for most capacity.

In 2011, pumped hydro storage accounted for 98% of the world’s installed storage capacity.
additions, with 10,359 megawatts installed from 2007 to 2012. However, new technologies, such as advanced batteries, are expected to play a larger role in the energy storage market in the coming years.

Smart grid networks and energy storage technologies are gaining traction in energy sector development plans, with larger-scale projects beginning or planned for the near future. The next few years will see numerous nationwide smart grid deployment projects and advances in energy storage markets, the success of which will surely influence the respective paths of each technology’s development.

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Notes

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