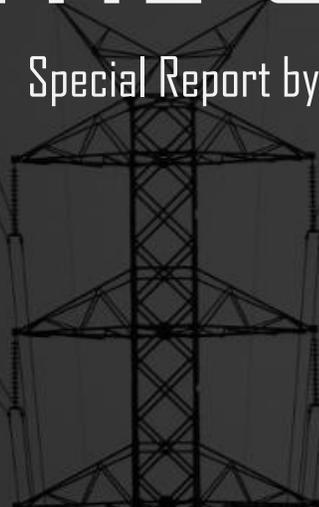


CHINA

RISE OF THE SMART GRID

Special Report by Zpryme's Smart Grid Insights | January, 2011



China: Rise of the Smart Grid

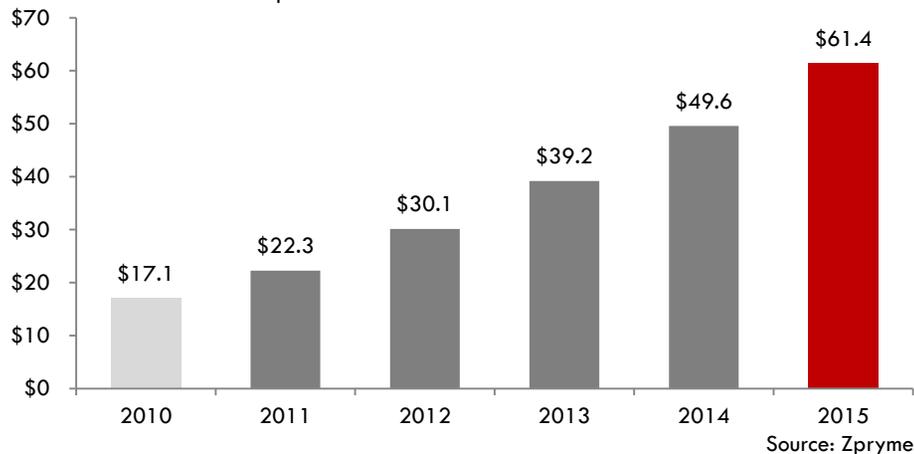
The Smart Grid system is the top priority in China's [Internet of Things] development.

- People's Daily Online¹

The challenge facing China's power sector is no secret. Needing to meet sky rocketing electricity demand fueled by its explosive economic growth, China's power sector faces an undertaking at a scale unlike any other seen before in the world. While it is the largest consumer of energy followed by the United States, the projected growth of China's economy, along with the energy intensity of its industries, underscores the necessity of increasing power generation capacity and improving energy efficiency.² With net electricity generation set to grow at eight and a half percent per annum during the next five years, Zpryme estimates that China must build transmission infrastructure that will be able to effectively deliver just over six trillion kilowatts of electricity to more than a billion customers and energy intensive factories. To meet this challenge, China has outlined major plans and dedicated billions of dollars to research, design and build a nationwide Smart Grid. Zpryme projects the total value of China's Smart Grid market to rise from \$22.3 billion USD in 2011 to \$61.4 billion USD in 2015, an annual growth rate of 29.1 percent over five years.

Projected China Smart Grid Equipment & Technology Market

2010 - 2015 | in U.S. billions
Compound Annual Growth Rate = 29.1%



¹ China's leading national newspaper, December 2010

² www.eia.gov

These plans are part of a massive, nationwide initiative to improve the efficiency of the existing electricity grid, to expand the grid to provide electricity to rural areas, to manage demand to avoid outages and overloads, and to connect power-generating facilities in the western part of the country to the heavily populated east coast by 2020. In 2011, China will move beyond an initial planning phase and begin this massive project. Without any doubt, the challenge ahead is monumental. In the coming decade, China's government, state-owned utilities, and hundreds of international and domestic companies will work to meet this challenge.

China Smart Grid Market by Segment

2010 – 2015 | in U.S. billions

Smart Grid Segment	2010	2011	2012	2013	2014	2015	CAGR ('10-'15)
Software & Hardware	\$4.0	\$5.0	\$6.7	\$8.5	\$10.6	\$13.0	26.4%
Smart Meters	\$1.0	\$1.4	\$1.9	\$2.5	\$3.1	\$3.9	30.2%
Sensors	\$3.9	\$4.5	\$5.5	\$6.4	\$7.4	\$8.5	16.7%
Comm. & Wireless Infrastructure	\$2.5	\$3.6	\$5.1	\$6.9	\$9.3	\$12.5	38.1%
Smart T&D Equipment	\$4.5	\$6.5	\$9.4	\$13.1	\$17.1	\$21.2	36.4%
Other	\$1.1	\$1.3	\$1.5	\$1.8	\$2.0	\$2.3	15.5%
Total Smart Grid Market Value	\$17.1	\$22.3	\$30.1	\$39.2	\$49.6	\$61.4	29.1%

Source: Zpryme

China: Government Initiatives in the Smart Grid

China's current transmission infrastructure is poorly designed and managed. The majority of China's energy resources and power generation capacity is concentrated in areas far away from the densely populated, energy hungry east coast. To combat deprived power distribution and to unify the disparate regional grids, China's government intends to construct three major transmission lines, each expected to reach 20 GW of transmission capacity by 2020. Known as the West-East Electricity Transfer Project, this massive undertaking will provide flexibility and increase system wide generation capacity to mitigate the electricity shortages that have plagued China in the past. This project features the construction of some of the highest voltage, longest transmission lines in the world, including the world's first 1,000-kilovolt alternating current power line that runs for 640 kilometers between Shanxi and Hubei.³

³ www.reuters.com

Beyond helping to meet soaring electricity demand, China's efforts to build a nationwide Smart Grid will play an integral role in helping it achieve two goals over the next 10 years:

1. Increasing renewable energy power generation enough to meet 15 percent of energy demand by 2020.
2. Reducing the carbon intensity of China's economy by 40 to 45 percent by 2020 from a 2005 baseline.

China's push to increase renewable generation capacity is predicated on sending power generated from wind farms, hydroelectric dams, and solar power plants to cities along the east coast. However, approximately 30 percent of wind turbines in China are not currently connected to a transmission network; highlighting the limited reach and poor design of China's electricity grid (it's important to note that according to a report by AMSC on January 11, 2011 China has now installed more wind power capacity than any other nation).⁴ Despite completing the first phase of a 10 GW wind farm located near the city of Jiuquan in November 2010, the wind farm's remote location and China's poor transmission infrastructure has limited actual grid connected generation to 1.15 GW out of 5.16 GW of total installed capacity.⁵ A Smart Grid will not only increase renewable energy capacity but also help manage electricity demand in dense urban centers that are expected to grow with workers continuing to migrate to eastern cities and improving living standards, thus increasing their thirst for electricity. The advantages of Smart Grid technology will help China meet the government's two environmental goals and in turn provide security against swings in global energy prices and help to avoid power shortages and overloads.

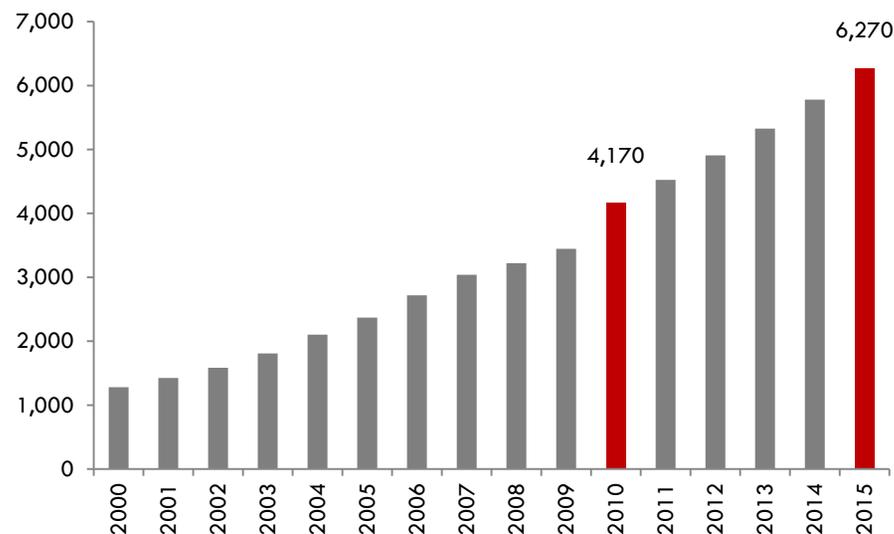
While developing a reliable, countrywide Smart Grid is an enormous challenge, China's size and regulatory system provide inherent advantages that will help it achieve its goals. The massive size of China's nationwide Smart Grid provides an economy of scale that is unmatched anywhere in the world, helping to reduce costs and spark domestic manufacturing of Smart Grid equipment. While utilities in the United States are updating infrastructure and trying to upgrade old equipment, China has the advantage of building Smart Grid technology into transmission infrastructure from the outset. Also, unlike the United States

where improving electricity grids is initiated on a regional level, China's enormous state-owned transmission companies and streamlined regulatory processes facilitate rapid construction without barriers that are characteristic in more developed countries. These factors have made China the largest, most important market for Smart Grid development in the world.

China: Electric Utility Initiatives

Regulations were recently passed that will require Chinese utilities to reduce energy sales volume by 0.3 percent a year through efficiency gains. China's largest transmission company, State Grid Corporation of China (SGCC), is the driving force behind China's efforts to build a nationwide Smart Grid. As the world's largest transmission company that covers 88 percent of China and serves over 1 billion customers, SGCC has enormous influence over not only the development of Smart Grid infrastructure, design, and management in China but also throughout the world. China's other major transmission company; China Southern Power Grid Company (CSG) has taken a secondary role in developing Smart Grid technologies, waiting for SGCC to complete its planning and research phases before developing plans to upgrade its own grid.

China's Projected Net Electricity Generation
2000 - 2015 | in billion kilowatt hours



Source: U.S. EIA & The China Electricity Council

⁴ www.atimes.com

⁵ www.windtech-international.com

In accordance with the Chinese government’s plans, SGCC has divided the development of a Smart Grid into three phases, planning to invest a total of \$601 billion USD into a nationwide transmission network with \$101 billion USD of these funds to be dedicated to developing Smart Grid technology.

The first phase, which ended in 2010, focused on planning Smart Grid construction by outlining technical standards, developing technology and equipment, and implementing pilot projects. The total investment of this phase was \$77.8 billion USD including a \$9.2 billion USD investment into Smart Grid technology. The second phase will last until 2015 and will see the construction of a reliable nationwide transmission grid, including operational Smart Grid management systems, wide spread deployment of smart meters, and enough EV charging stations to accommodate the use of EVs. This phase will invest \$282.9 billion USD with \$45.8 billion USD of these funds dedicated to Smart Grid technology. The final phase will last from 2016 to 2020 and complete China’s nationwide grid by connecting all planned coal, hydroelectric, nuclear and wind power generation facilities to areas of high demand in a reliable, intelligently managed transmission network. The last phase will invest \$240.5 billion USD into building this transmission grid with \$45.8 billion USD of these funds dedicated to Smart Grid technology.⁶

SGCC Strengthened Smart Grid Plan
2010 – 2020 | in U.S. billions

Phase	Time Period	Total Investment Amount	UHV Investment	Smart Grid Investment
1	2009 - 2010	77.8	12.1	9.2
2	2011 - 2015	282.9	43.8	45.8
3	2016 - 2020	240.5	36.5	45.8
Total (2009 - 2020)		601.1	92.4	100.8

Source: SGCC Strengthened Smart Grid Plan (released on May 21, 2009)

During the first phase, SGCC implemented 228 Smart Grid pilot projects to solve technical issues, test designs, and develop management systems.⁷ These projects covered the entire gamut of Smart Grid implementation, ranging from connecting wind power plants to automating distribution networks to metering households. The projects were implemented across different regions of China, including a highly publicized Smart Grid

demonstration project at the Shanghai World Expo. Using the experience gained from these projects, SGCC released a set of industry rules, standards, and favored technologies for 22 criteria of Smart Grid technology in June 2010.⁸ For both domestic and international manufacturers of Smart Grid equipment, these standards and favored technologies have enormous impact on the products offered by their businesses. The standardization of components for such a massive project yields an economy of scale that at least initially dwarfs any other source of demand for Smart Grid equipment. Chinese manufacturers, who already make the bulk of Smart Grid equipment for the world, will shift their focus to equipment that meets SGCC’s standardization, making it cheaper and more readily available than other Smart Grid equipment.

The Smart Grid will also play a key role in China’s efforts to build infrastructure to support electric vehicles (EVs). In June 2010, SGCC announced plans to fully develop an electric vehicle charging network, intending to establish 75 public charging stations, 6,209 AC charging spots, and a handful of battery replacement stations in Shanghai, Beijing, Tianjin and other cities that will serve as pilot projects.⁹ This announcement follows a string of projects launched by SGCC aimed at introducing EVs to China. Since 2006 the SGCC has procured 101 electric vehicles, constructed 30 pilot charging stations and collaborated with Beijing’s municipal government to design 7 electric bus lines for 58 electric buses.¹⁰ In 2008, SGCC built the infrastructure to charge 55 electric buses and over 400 electric vehicles to move athletes and staff during Beijing’s Olympic Games.¹¹ China’s other large transmission company, CSG, is also facilitating the spread of EVs by establishing charging stations in Shenzhen, Nanning and Guilin. CSG recently signed an agreement with BYD Co. to build an energy storage station with 3 megawatts of capacity in Shenzhen.¹²

China: Industry Players Making Moves

The size of China’s Smart Grid market has brought attention from infrastructure companies, IT and networking solutions providers, and Smart Grid equipment manufacturers from across the globe. When asked about the Smart Grid opportunity in China Fulei Yang of Alcatel Lucent expressed to Zpryme, “State Grid Company of China (SGCC) is

⁶ State Grid Corporation of China

⁷ www.nist.gov

⁸ www.nist.gov

⁹ www.sgcc.com.cn

¹⁰ www.sgcc.com.cn

¹¹ www.huliq.com

¹² www.bloomberg.com

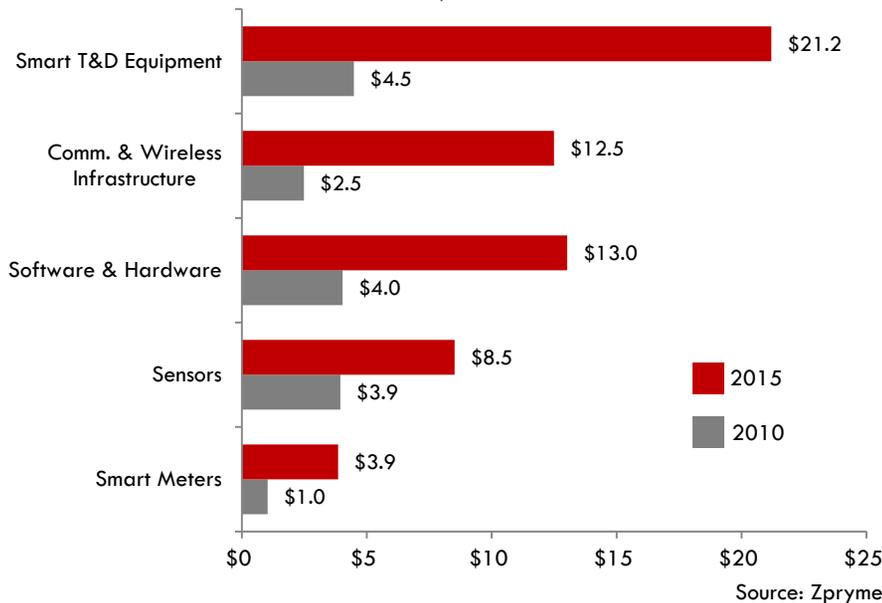
putting huge investment into ‘Smart Grid’, specially focusing on distribution networks -- in an attempt to prevent it from splitting from the transmission network. In the meantime, SGCC is building a strong supply chain internally, making their own specifications and standards, manufacturing equipment, and integrating them into their own grid. Southern Grid of China (SGC) is acting differently -- wait and see the policy from central government.”

With over \$600 billion USD expected to be invested into electricity infrastructure and Smart Grid technology over the next 10 years, firms within the Smart Grid space cannot afford to ignore China’s booming market. However, China’s insular business community and favoritism for domestic firms pose major obstacles for companies seeking to profit from China’s Smart Grid investment. In response, foreign companies have sought to establish alliances and partnerships with Chinese companies, leveraging their superior knowledge and experience to gain access to contracts and pilot projects in hopes of expanding business once large-scale investment and construction begins.

solutions to automate distribution and manage electricity demand is the best way for foreign firms to capitalize on China’s booming Smart Grid industry. Zpryme projects that the software and hardware segment of China’s Smart Grid market will grow from \$4.0 billion USD in 2010 to \$13.0 billion USD in 2015, an annual growth rate of 26.4 percent. Ignacio Gonzalez, CEO of Telvent told Zpryme, “While China is a top consumer of energy, it is also placing immense importance on building a smart grid infrastructure to ensure that energy is procured, managed, and delivered efficiently. As part of this effort, Telvent is proud to be working with the State Grid through our projects with Shanxi Electric Power Company and the Southern Grid with Guizhou Electric Power. We hope to continue our partnership with China, offering the technology and solutions it needs to build a smart grid for the 21st century.” Large industry players such as Telvent have already made inroads in both these market segments and others:

Foreign companies getting involved:

Projected China Smart Grid Market by Technology
2010 and 2015 | in U.S. billions



The largest portion of China’s market is in Smart Grid T&D, which. Zpryme projects will grow from \$4.5 billion USD last year (’10) to \$21.2 billion USD by 2015, an annual growth rate of 36.4 percent. Because of China’s limited technological capabilities, providing IT and networking

- In January 2011 The State Grid Corp. of China, Chinese Academy of Science and GE are going to collaborate in standardizing Smart Grid technology (from the State-owned Assets Supervision and Administration Commission of China). The three parties have signed a memorandum of understanding on strategic cooperation to cover electricity charging and discharging technology for EVs, large-capacity storage systems and network technology and other related Smart Grid technology.
- In January 2011 Telvent announced that it has expanded its partnership with China South Grid Guizhou Electric Power Company. Based on a previous pilot project, Telvent will now provide its Distribution Management System to Guizhou Power’s entire service territory.
- In January 2011 SGCC selected Landis+Gyr to supply industrial and commercial AMI for deployment in six provinces. The first phase of the project involves the installation of 10,000 meters (SGCC has noted that a country-wide deployment is also likely).
- In January 2010, GE partnered with Yangzhou Beichen Electric Equipment Company, a subsidiary of SGCC, to build Smart Grid equipment and set up a Smart Grid demonstration center in the

Yangzhou New Economy and Development Zone. Over a span of four years, this demonstration center will implement wireless smart meters, residential demand management systems, smart thermostats and appliances, automated outage identification and restoration systems, field-force automation, grid network management software, and even systems to manage plug-in hybrid cars. In November of 2010, GE announced further collaboration with subsidiaries of SGCC. GE and Wuhan Nari agreed to work together in improving the efficiency and reliability of the electricity grid, and GE and Electric Power of Shanghai agreed to jointly acquire a controlling stake of Tianling Switchgear to develop smart power distribution equipment.

- IBM has actively sought to establish partnerships with local municipalities and energy companies to provide technological solutions primarily aimed at intelligent management systems. In September 2009, IBM partnered with the industrial city of Shenyang to improve city management systems and to establish a research institute to advance eco-city technology. In November 2009, IBM partnered with diversified Chinese energy company ENN Group providing a capital investment by IBM into ENN's energy services business, agreeing to jointly develop "Intelligent Energy" solutions, and jointly building industry expertise and skills to serve China's booming energy market. In March 2010, IBM established an Energy & Utilities Solutions Lab in Beijing to research ways for utility companies to improve energy delivery and optimize performance through network automation and improved efficiency. In November 2010, IBM released a new grid management technology that will be piloted in collaboration with Shanghai Power to manage power outages more effectively while improving grid efficiency.
- In 2010 Hewlett-Packard acquired network equipment manufacturer 3Com for \$2.7 billion in order to gain a foothold in providing China's Smart Grid with networking solutions.
- In March 2010, Accenture launched the Accenture Intelligent Network Data Enterprise, a platform to help utilities manage, integrate and analyze real-time data generated by millions of disparate sources throughout a utility's Smart Grid network. Accenture has formed an alliance with East China Grid Co and is participating in 10 pilot projects in China.

- Cisco has been slower to enter into China's market, but has recently restructured its East Asia business to create a Greater China division that will aim to gain access to China's Smart Grid market.
- Over the past 4 years, Swiss-Swedish infrastructure giant ABB has received a number of substantial contracts to supply transistors, power lines, and other transmission equipment to SGCC and CSG. Most recently, ABB won a contract to design, supply and install transformers for a substation in the Jilin province in northeastern China. ABB also supplied equipment for China's largest EV charging station in Shenzhen.
- In June 2010, Siemens completed the Yunnan-Guangdong transmission line that is operated by CSG. It is the first HVDC link in the world. In November 2010, Siemens announced that it would sign an agreement to build EV charging infrastructure.
- In August 2010 Duke Energy partnered with China Huaneng Group, China's biggest utility, to explore a variety of clean-energy technologies.

Chinese domestic companies getting involved:

- In January 2011 China Singyes Solar Technologies has completed and switched on a Smart Grid project that combines wind, solar and diesel fuel power generation with energy storage on Dong'ao Island in Zhuhai, Southern China. The project will boost the share of green energy in the island's energy mix to 70 percent from 30 percent.
- Two Shenzhen-based manufacturers have benefitted most from China's push to install smart meters. In 2009, Shenzhen-based Clou Electronics won approximately \$27 million USD worth of orders from SGCC. Waison Group has won tenders from several utilities throughout China and is collaborating with California-based Cogo Group to expand business.
- China's large state-owned companies have made acquisitions to benefit from the coming Smart Grid boom. SGCC acquired

electrical-equipment makers Pinggao Electric and XJ Electric in the beginning of 2010. China Aerospace Science & Industry Corporation, the country's space and defense manufacturer, acquired two-meter makers, Shenzhen Techrise Electronics and Liangli Instrument in August 2009.

- In May 2010 Siemens signed an agreement with Wasion Group to conduct feasibility studies in an effort to launch new Smart Grid pilot projects in the Middle Kingdom.
- Since 2009 Huawei Technologies, China's foremost network service provider, has taken steps to enter into the Smart Grid solutions market.

China: What to Look for in 2011

An olympic leap forward has been taken by China in the past 12 months. Where around the globe and more specifically the U.S. is at a snail's crawl injecting grants and loans for Smart Grid programs and pilots, China is well ahead. The leading Asian economic power has proven to have more government gusto to fuel Smart Grid infrastructure and development. In the near future the Smart Grid sector coupled with clean energy industries such as solar and wind generation have the power to determine an economy's energy consumption fate – well ahead of the curve China is already in preparation mode by: building strategic global relationships, aggressively building electric infrastructure, and more importantly making the Smart Grid initiative a national policy. Other insights to consider from the report:

- More blue chip global companies such as GE, Siemens and IBM and Smart Grid centric companies such as Landis+Gyr and Telvent will continue to position themselves to capitalize on the China Smart Grid market without significant competition in 2011 (as compared to the U.S.). Such moves will come in the form of joint-ventures, domestic firm partnerships, pilot projects, and full-blown China operations.
- China will become one step closer to clearly establishing itself as the world leader for Smart Grid technology.

- Private investment (venture capital) will continue to pour into China firms that can serve the electricity infrastructure and Smart Grid market.
- China will seek to become the leader across the entire EV value chain. Meaning that EV manufacturers, telematic, EV charging, and EV component companies should set their strategic business dial to China in 2011.
- Chinese domestic firms serving the Smart Grid market will expand their footprint beyond their nation's borders as their technologies and services will become increasingly competitive with their foreign counterparts.
- The Chinese government totally supports the efforts of domestic and foreign Smart Grid and clean energy manufacturers through subsidies, R&D funding, and major lines of credit (domestic).
- While utilities in the U.S. are updating infrastructure, China has the advantage of building Smart Grid technology into transmission infrastructure from the outset – essentially a clean slate.
- China's state-owned transmission companies and streamlined regulatory processes facilitate rapid construction without barriers that are characteristic in more developed nations such as the U.S. and U.K.

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