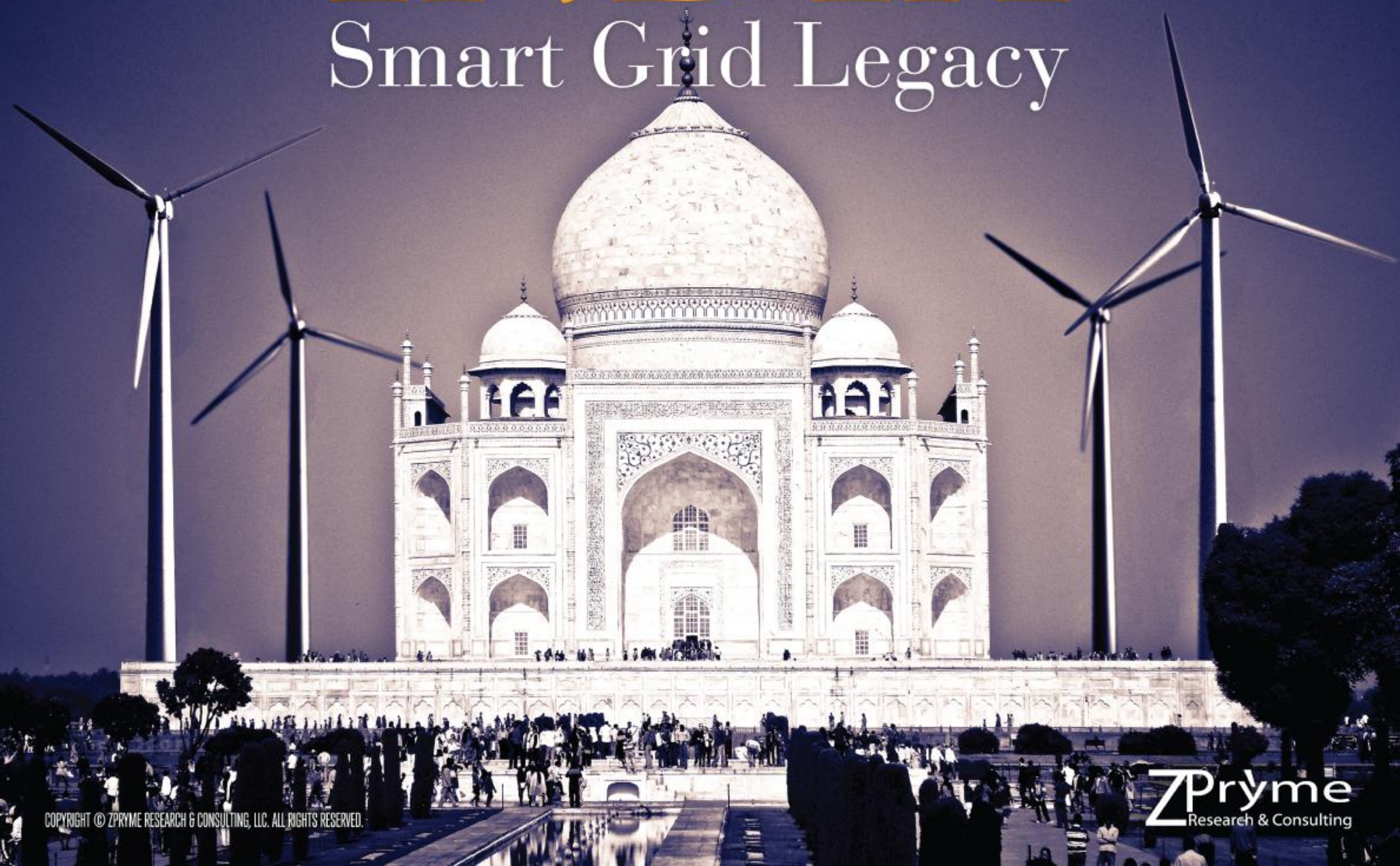


SPECIAL REPORT BY  
ZPRYME'S SMART  
GRID INSIGHTS

SEPTEMBER 2011


# INDIA

## Smart Grid Legacy



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**ZPryme**  
Research & Consulting

The background of the image is a dark, muted purple. In the center, the Indian national flag (Tiranga) is displayed, featuring three horizontal stripes of equal width: saffron at the top, white in the middle, and dark blue at the bottom. The Ashoka Chakra is visible in the white stripe. The flag is attached to a flagpole on the left side. The text is overlaid on the flag and background.

“Smart grid  
is not a  
luxury [in  
India], **it’s a  
necessity.**”

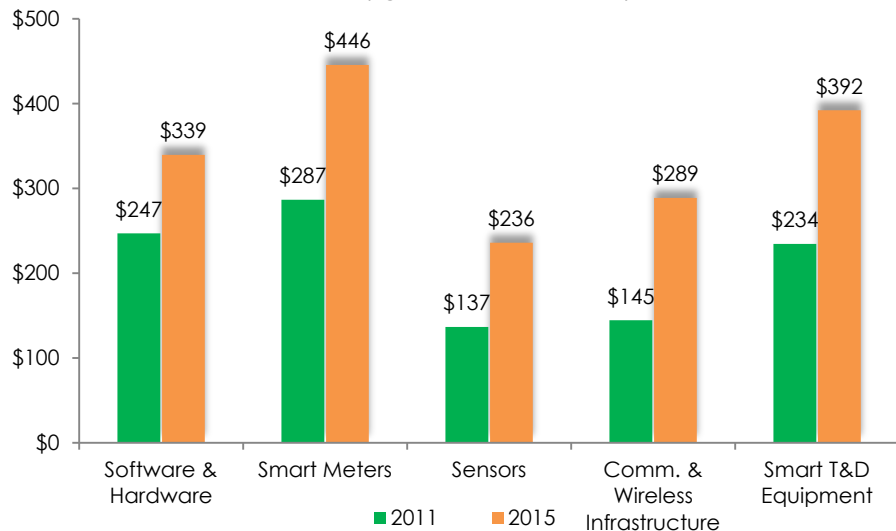
## India: Carving Out Opportunity

Smart grid is not a luxury [in India], **it's a necessity.**<sup>1</sup>

- P. Uma Shankar  
India Secretary of Power

With India recently launching a Smart Grid Task Force and Smart Grid Forum coupled with \$900B in investment planned for generation, transmission, distribution and power quality, this nation is set for massive growth.<sup>2</sup> Conversely, several major hurdles remain before the world's second most populous nation achieves widespread adoption of next generation electrical technology.

India Smart Grid Market Value by Technology Area  
2011 and 2015 (in U.S. millions)  
(figure 1, source: Zpryme )



Research from Zpryme indicates that in 2015 India's smart grid market will be \$1.9 billion. Further, Zpryme predicts the country's basic electrical infrastructure needs will grow beyond that, totaling \$5.9 billion in the same year.

### India Electrical Infrastructure (2015)

**\$5.9**



### India Smart Grid Market (2015)

**\$1.9**



figure 2, source: Zpryme

"Smart grid technologies will help utilities in India optimize efficient energy use in distribution networks," Sanjay Seth,

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<sup>1</sup> Ibid.

<sup>2</sup> GridWeek, Washington, D.C., September 2011

2 www.zpryme.com | www.smartgridresearch.org

Country Manager for Itron India, said to Zpryme this month. "Currently there are pockets in India with surplus power that are unable to sell it to those with deficient energy supply, creating an artificial shortage scenario. Smart grid technologies can enable utilities to employ demand response mechanism, curtailing power at the time of shortages and helping avoid blackouts. Additionally, integration of renewable energy like rooftop solar PVs into the grid will add to generation capacity," he said.

As evidenced by these numbers, the opportunity for growth necessitates a comprehensive, national grid will need be developed before India's smart grid sector rivals the United States, Korea or efforts in Europe.

## India: Energy Challenges

**404 million** people in India currently do not have access to electricity.<sup>3</sup>

- International Energy Agency

A host of issues are confronting India's electrical build out and the modernization of its grid. Greater electrification will play a large part in the country's prolonged economic growth, but rising energy demand is outstripping India's available supply. At peak usage, demand exceeds supply by seven to eleven percent.<sup>4</sup> Electricity generation in June of 2010 was 162 gigawatts, and is predicted to rise seven to ten percent until 2018.<sup>5</sup> By 2032, energy generation is expected to be 800 gigawatts.<sup>6</sup> Zpryme projects demand

growth of 6.0 percent annually from 2010 to 2015, growing from 885 billion kwh to 1,187 billion kwh, respectively.

These supply gaps exacerbate the lack of consistent, comprehensive electric service to citizens as just under half of India's rural population is not connected to the grid.<sup>7</sup> Technical issues also plague India's grid, and line losses are averaging 26 percent with some states as high as 62 percent. When the country's widespread electrical theft is factored in, transmission line losses average 50 percent. Remarkably, this theft continues despite years of effort by the Indian Government. Thermal efficiency in Indian coal plants also lags at 27 percent compared to 37 percent in the West. Furthermore, the infrastructure is not consistent across the five regional power grids in India. Four of the regional grids operate as one synchronous grid and the southern region utilizes a High Voltage Direct Current (HVDC) link.

Transmission and transportation issues are problematic for moving electricity and fuel needed for power generation due to the geography of hydroelectric and coal resources. As a result of these various institutional fractures, each region has developed its own protocols, and a patchwork of generation and transmission solutions. Electrical monitoring across the country is very imprecise, making efficient solutions all the more difficult to apply. This all results in frequent power outages, heavy line losses, and an increase in overall grid instability.

<sup>3</sup> IEA, World Energy Outlook 2010

<sup>4</sup> Power India 2010. [www.indiacore.com/power.html](http://www.indiacore.com/power.html)

<sup>5</sup> Balijepalli, S.A., Khaparde, R.P., and Gupta, Y.P.K. "Smart Grid Initiatives and Power Market in India." IEEE PES General Meeting, Minneapolis, MN, USA, 2010.

<sup>6</sup> KPMG. "The Indian Power Sector: Rising Up the Curve." September 24, 2010.

<sup>3</sup> [www.zpryme.com](http://www.zpryme.com) | [www.smartgridresearch.org](http://www.smartgridresearch.org)

[www.kpmg.com](http://www.kpmg.com)

<sup>7</sup> Reddy, B.S. and Nathan, H.S.K. "Energy Infrastructure for a High Humane and Low Carbon Future." Indira Gandhi Institute of Development Research, Mumbai, June 2010.

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## India: Government Solutions

We get to build a **Smart Grid from scratch**.<sup>8</sup>

- Vimal Mahendru  
President of IEEMA

The good news for firms looking to invest in India's electrical and Smart Grid sector is that the government has developed a plan to meet these challenges, and has a huge population and growing expertise in the IT industry to propel it forward. By uniting the complex bureaucracy of the Indian central government with the various states and private expertise, India has laid out an ambitious effort to modernize their grid over the next 10 years. India's Secretary Uma Shankar said that there are six guiding principles for the Smart Grid in India:<sup>9</sup>

1. That it is based on an Indian model and developed indigenously
2. Focuses on power shortage problems
3. Addresses theft prevention and loss reduction
4. Provides power in rural areas
5. Development of alternative sources of power
6. It is affordable and enables sustainable production of power

The Ministry of Power (MoP) is the umbrella under which an array of agencies operate, each in charge of a separate policy area (such as planning, funding and power trading). Most of the generation companies are also state owned. Additionally, recent rules have opened up

competition to private companies and foreign firms to provided advanced products and services to India's electrical sector.

- **R-APDRP:** The Restructured-Accelerated Power Development and Reform Program (R-APDRP) of 2008 intends to implement distribution reform and strengthen IT innovation in India. The program is often characterized as a proto-smart grid plan. Split into two phases, the first concentrates on information and communications technology (ICT) and investments of power infrastructure to first measure and mitigate inefficiencies and theft. The second phase will focus on implementing changes based upon that data and power transfer systems with the broader goal of modernizing the electrical system as it is built. According to IEEE, the program is specifically designed “to bring Aggregate Technical & Commercial (AT&C) losses below 15 percent in five years in urban and in high-density areas.”<sup>10</sup> The Indian government will spend an estimated \$10.86 billion on these efforts.<sup>11</sup> Hence, companies that can help India meet their R-APDRP goals and are “empanelled” have a good avenue to break into the market.
- **DRUM:** Established just after the APDRP, the goal of the Distribution Reform, Upgrades and Management (DRUM) program is to work in tandem with the R-APDRP to create three “Centers of Excellence” that will serve as guides to improving the electrification of the rest of India. These efforts include developing a

<sup>8</sup> Ibid.

<sup>9</sup> <http://www.metering.com/node/19875>

<sup>4</sup> [www.zpryme.com](http://www.zpryme.com) | [www.smartgridresearch.org](http://www.smartgridresearch.org)

<sup>10</sup> <http://smartgrid.ieee.org/public-policy/india>

<sup>11</sup> “IT Firms Set to Ride \$2-Bln Reform” Ketan Bondre and Bharghavi Nagaraju. Reuter. <http://in.reuters.com/article/2009/10/20/idINIndia-43287520091020?pageNumber=1>

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pre-payment system, power factor improvement, and communications upgrades to enhance preventative maintenance.

- **Smart Grid Task Force & Forum:** The Smart Grid Task Force and Smart Grid Forum were created in 2010 to coordinate smart grid activities in India. The Forum brings together public and private stakeholders under seven working groups to accelerate the development of smart grid technologies. The Task Force consists of interdepartmental entities focused on a roadmap to reduce load through shifting peak use, thus creating cheaper, more reliable power.
- **Bureau of Indian Standards (BIS):** The Indian government is cognizant of the “leapfrog” potential that would enable it to build infrastructure that would meet basic capabilities while still providing a flexible platform for future smart grid applications. Such modular abilities would rely upon standards adopted across the country. The BIS has taken the lead in adopting international standards (particularly IEC 62056 and IEC 61850) common in the global smart grid community. More substantial efforts will kick in as the nation becomes more integrated and more able to transfer power across their regional grids.

## India: Smart Grid Projects Underway

The **demand for power in India is far outstripping supply** and a significant percentage of power generated is lost during transmission due to which power generation & distribution companies are focusing on adopting

efficiency enhancement solutions.<sup>12</sup>

- Cui Liangjun  
ZTE India CEO

Large, multi-national blue chips are already placing long-term bets on the eventual build out of the Indian electric grid. However, there is a fairly open market for additional companies of varying size and nationalities. The Ministry of Power (MoP) has allocated \$44.3 million for smart grid pilot projects across the country.<sup>13</sup>

- One of the higher profile partnerships brings together USAID, MoP, the Central Power Research Institute (CPRI) and Bangalore Electricity Supply Company (BESCOM) for a pilot project in Electronic City to cover around 17,500 domestic and business users.<sup>14</sup>
- The Smart Grid Task Force is currently coordinating eight pilot projects across the country’s national electricity grid. For the next 18 months these projects will provide an indication of what the overall framework for a detailed national plan will be.<sup>15</sup>
- A smart micro-grid designed for renewable energy sources has also been commissioned at The Energy

<sup>12</sup> ZTE India has launched a range of end-to-end solutions which will address the need for creation of Smart Grids in the country, the company said in a statement. The company is also in advanced talks with Power Grid Corporation of India Ltd (PGCIL) to offer its range of end-to-end Smart Grid solutions

<sup>13</sup> <http://smartgridopinions.com/article/india-smart-grid-outlook>

<sup>14</sup> Ibid.

<sup>15</sup> <http://www.technologyreview.in/blog/post.aspx?bid=371&bpid=27019>

Research Institute's (TERI) Gurgaon campus with the Ministry of New and Renewable Energy.<sup>16</sup>

- The Bureau of Energy Efficiency is partnering with IBM on a project that would conduct a cost-benefit analysis on various smart grid initiatives and the deployment capabilities for smart grid technology.<sup>17</sup>
- In India, managing peak load will be key driver as peak power plants will add an untenable margin to the cost of electricity in a developing nation. The Mangalore Electricity Supply Company (MESCOM) smart grid project will seek to scale back demand rather than cut it off entirely, allowing customers to meet critical demand needs while giving critical institutions un-interrupted supply.<sup>18</sup>
- North Delhi Power Ltd, itself a consortium between the government and Tata Power, partnered with GE for various smart grid solutions. The US Trade and Development Agency awarded NDPL a \$686,447 grant for a smart grid project in North-West Delhi intended to reduce blackouts and increase reliability. NDPL is considered a smart grid technology leader in India rolling out smart metering infrastructure and automated meter reading.<sup>19</sup>

<sup>16</sup>ibid.

<sup>17</sup> <http://www.eetimes.com/electronics-news/4216126/India-launches-first-smart-grid-project>

<sup>18</sup> <http://www.business-standard.com/india/news/rahul-tongiasmart-solution-to-power-shortage/441468/>

<sup>19</sup> <http://smartgrid-for-india.blogspot.com/2011/08/ndpl-receives-06-million-grant-from.html>

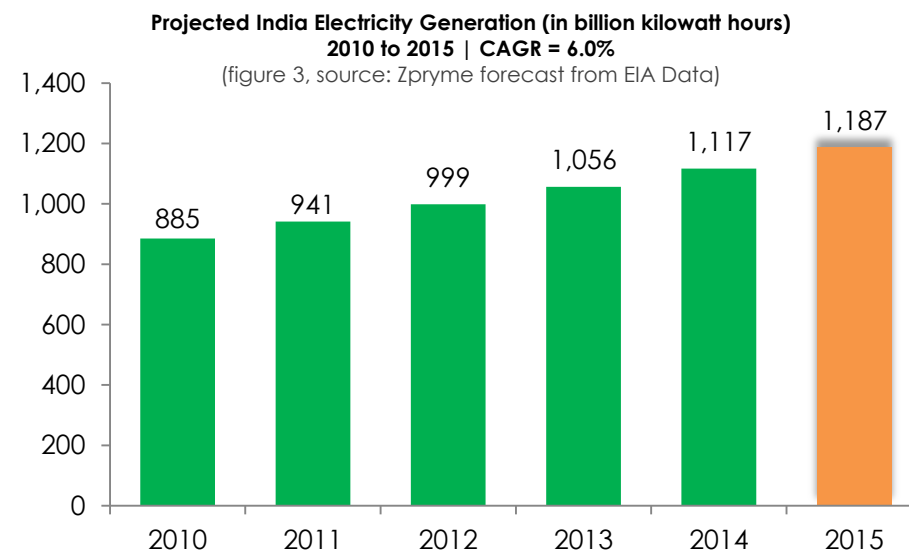
6 www.zpryme.com | www.smartgridresearch.org

## India: Market Opportunities

India has long been involved in smart grid activities and long before these became known as smart grid, but were known as automation.<sup>20</sup>

- Murugesan Navaneethakrishnan  
Director General of the Central Power Research Institute (CPRI)

Zpryme forecasts that the Indian government will spend \$26.2 billion in electricity infrastructure between 2011 and 2015. When it comes to Smart Grid technology, Zpryme estimates the market value in 2011 at \$1.1 billion and CAGR of 16.3% between 2010 and 2015.



According to Rahul Tongia, a principal research scientist at the Center for Study of Science, Technology, and Policy

<sup>20</sup> International Conference on Roadmap for Smart Grid, August 2011

(CSTEP), a Bangalore-based not-for-profit research center, “the really useful technologies will be those that help constrain peak demand and peak load growth at reasonable cost while cutting losses.”<sup>21</sup>

The fastest growing market segment is Communications and Wireless with a CAGR of 24.9%, the 2011 value of that sector is \$144.5 million. Smart T&D will total \$234.5 million in 2011. Smart meters currently constitute \$286.6 million in 2011 and are projected to reach \$445.5 million in 2015. In 2011, sensors were \$136.5 million while software and hardware is estimated at \$146.9 million.

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<sup>21</sup><http://smartgrid.ieee.org/news-smart-grid-newsletter/5324-what-the-smart-grid-means-and-doesnt-mean-for-india>

# India Smart Grid Market Value Forecasts by Technology Type

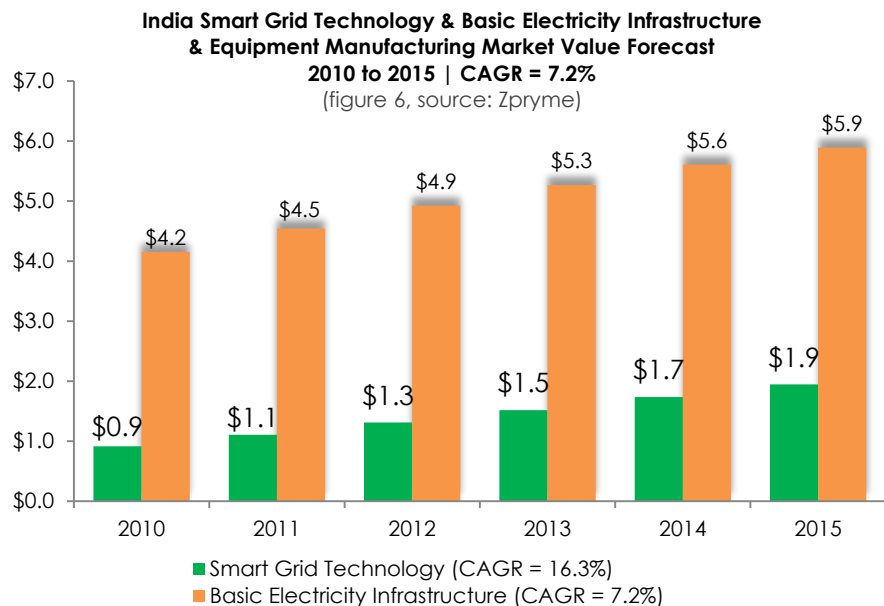
(figure 4, source: Zpryme - in U.S. millions)

Smart Grid Segment	2010	2011	2012	2013	2014	2015	CAGR
Software & Hardware	\$197.9	\$246.9	\$269.0	\$292.6	\$317.7	\$339.4	11.4%
Smart Meters	\$178.3	\$286.6	\$333.3	\$372.3	\$412.1	\$445.5	20.1%
Sensors	\$150.5	\$136.5	\$166.5	\$191.5	\$216.4	\$235.9	9.4%
Comm. & Wireless Infrastructure	\$94.8	\$144.5	\$183.6	\$220.3	\$257.7	\$288.6	24.9%
Smart T&D Equipment	\$189.3	\$234.5	\$274.3	\$315.5	\$356.5	\$392.1	15.7%
Other	\$102.8	\$56.9	\$83.7	\$125.3	\$175.4	\$243.8	18.9%
<b>Total Smart Grid Market Value</b>	<b>\$913.7</b>	<b>\$1,105.9</b>	<b>\$1,310.4</b>	<b>\$1,517.5</b>	<b>\$1,735.7</b>	<b>\$1,945.4</b>	<b>16.3%</b>
Percent of Total Market	2010	2011	2012	2013	2014	2015	
Software & Hardware	15.0%	18.3%	17.6%	17.4%	17.3%	17.3%	
Smart Meters	12.0%	8.3%	8.7%	8.9%	8.9%	9.1%	
Sensors	23.1%	17.0%	17.4%	17.3%	17.2%	17.0%	
Comm. & Wireless Infrastructure	14.5%	18.0%	19.2%	19.9%	20.5%	20.9%	
Smart T&D Equipment	29.0%	29.2%	28.6%	28.5%	28.4%	28.3%	
Other	6.4%	9.2%	8.5%	8.0%	7.6%	7.4%	
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

## India Total Electricity Net Generation

(figure 5, source U.S. EIA, Zpryme - in billion kilowatt hours)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	CAGR
<b>India</b>	529	550	565	601	631	662	712	759	786	835	885	941	999	1,056	1,117	1,187	6.0%
Growth (Y-O-Y)		3.9%	2.8%	6.2%	5.1%	4.9%	7.5%	6.7%	3.4%	6.3%	6.0%	6.3%	6.1%	5.8%	5.7%	6.3%	



companies should look to provide solutions like energy audits, remote metering and automatic meter reading that can bridge the gap between basic electric infrastructure and the smart grid.

In terms of the utility value chain, the major opportunities for firms looking to tap the India market are in the areas of generation, transmission and distribution and in basic power infrastructure. Regarding specific technology areas, the major opportunities are in the areas of metering equipment, advanced metering infrastructure, reducing losses in the network, IDL, IT infrastructure and demand side management. IT and engineering consultants and integrators will see larger opportunities in the next 5-10 years as more advanced components of the grid will be needed once AMI and smart meters are deployed in the various regions in India.

Companies that build sensors which enable utilities to better detect and prevent theft and provide integrated solutions that lower line loss or enable distributed generation will have readily available opportunities. The

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