

BRAZIL

The Smart Grid Network

October 2011



A dark background featuring a Brazilian flag on a pole and the silhouette of a tree on the left side.

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explode by 2015...**

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Brazil: The Smart Grid Network

“This business will explode by 2015... Governments are coming out with new regulations, forcing utilities to shift to smart metering.¹

- Roberto Vengochea
Manager at GE's Sao Paulo office

The eyes of the world have descended upon Brazil. In 2011, the South American nation has earned its place among the fastest growing economies in the world. As a result of economic reforms and pragmatic governance, the IMF predicts that Brazil will outperform many of the world's most dominating forces. Over the next five years, GDP is expected to grow by 5.9% annually – exceeding the United States, Canada, the European Union, and Russia.^{2 3} To further add to Brazil's attractiveness, the nation will be making substantial investments in its infrastructure as it prepares to host the World Cup in 2014 and the Summer Olympics in 2016.⁴ Simply put, Brazil has some large shoes to fill. Brazil's growth and success rests on the shoulders of its infrastructure, and as the 9th largest energy consumer in the world and the 3rd largest in the Western Hemisphere, behind the US and Canada, it is already feeling the strain. The challenge facing Brazil's power sector is no small undertaking. Brazil's electric power demand has been increasing at a rate above world average.⁵ Between 2007 and 2017, energy

¹ Bloomberg Businessweek. Smart-Grid Sales in Latin America to Reach \$1 Billion, GE Says. Sept. 27 2011.

² www.pnnewswire.com/news-releases/midas-medici-closes-acquisition-of-brazil-based-cimcorp-126854398.html

³ www.kema.com/services/consulting/utility-future/smart-grid/smart-grid-not-limited-to-US.aspx

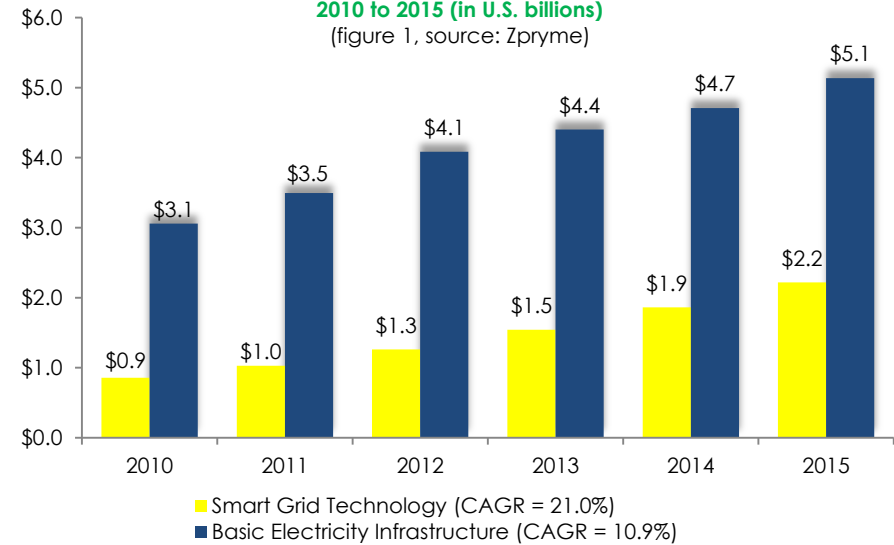
⁴ www.pnnewswire.com/news-releases/midas-medici-closes-acquisition-of-brazil-based-cimcorp-126854398.html

⁵ www.geospafial.blogs.com/geospafial/2011/07/brazil-expected-to-lead-smart-grid-

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

consumption is expected to increase by 60% and as a result production will fall short of total demand.⁶ Research from Zpryme indicates that in 2015 Brazil's smart grid technology market will be \$2.2 billion. Further, Zpryme predicts the country's basic electrical infrastructure needs will grow beyond that, totaling \$5.1 billion in the same year.

Brazil Smart Grid Technology & Basic Electricity Infrastructure & Equipment Manufacturing Market Value Forecast 2010 to 2015 (in U.S. billions)
(figure 1, source: Zpryme)



“Brazil has been drafting legislation over the past two years that requires utilities to install 64 million smart meters during the next decade. At about \$100 each, that would lead to \$6.4 billion in sales through 2021.⁷

- Roberto Falco
VP for Latin America of Ventyx Inc., (a unit of ABB Ltd.)

deployment-in-south-america.html

⁶ www.kema.com/services/consulting/utility-future/smart-grid/smart-grid-not-limited-to-US.aspx

⁷ Bloomberg Businessweek. Smart-Grid Sales in Latin America to Reach \$1 Billion, GE Says. Sept. 27 2011.

In order to meet skyrocketing demand, the Brazilian National Energy Plan for 2008-2017 calls for the construction of 54 gigawatts of installed capacity.⁸ To this end, massive electric power projects are well underway – however, generation is merely the tip of the iceberg. The Brazilian energy sector must make significant investments in *transmission and distribution* as well.

- Brazil is currently challenged with an overburdened, aging power infrastructure. Further, 98% of Brazil's electricity is transmitted through a single system, the National Interconnected System (SIN), and when something interrupts the power flow, the entire system becomes affected. Localized power cuts in large urban areas are becoming common.⁹ ¹⁰ In 2010, the country suffered 91 massive power outages, up from 48 in 2008.¹¹
- Distribution of power in Brazil results in massive non-technical losses. High rates of illegal connections and theft yield a 17% loss of generated electricity – this is nearly two times higher than the world average. These factors have driven up electric prices and made grid management difficult.¹² Non-technical losses in Brazil total US \$5.1 billion per year.¹³

A complete overhaul of the Brazilian energy sector is

⁸ www.thinkmind.org/download.php?articleid=energy_2011_5_30

⁹ www.geospatial.blogs.com/geospatial/2011/07/brazil-expected-to-lead-smart-grid-deployment-in-south-america.html

¹⁰ www.thinkmind.org/download.php?articleid=energy_2011_5_30

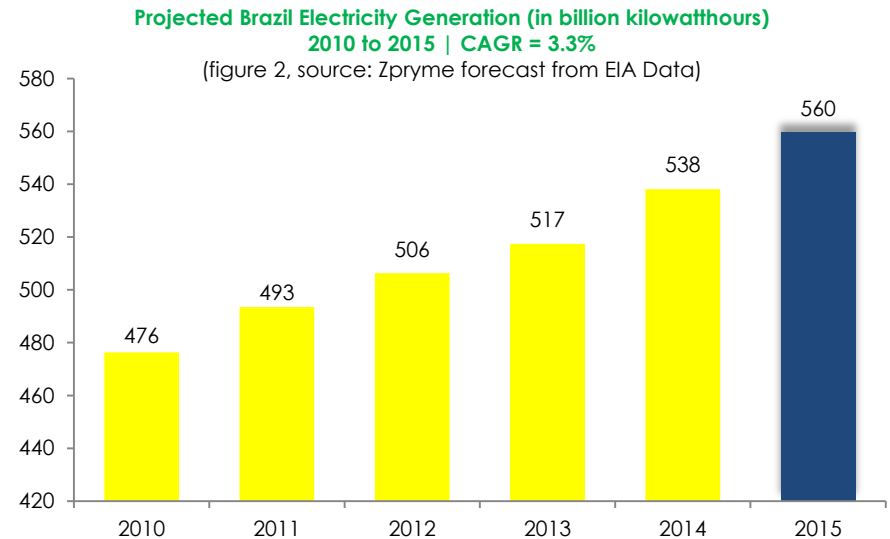
¹¹ Ibid.

¹² Ibid.

¹³ www.smartgridopinions.com/article/brazil-smart-grid-outlook

³ www.zpryme.com | www.smartgridresearch.org

needed in order to sustain the country's explosive growth. To meet the challenge, Brazil is turning to Smart Grid as a means of reducing non-technical losses, improving grid reliability and power quality, and alleviating many of its electrical problems. Implementing Smart Grid will allow utilities to better manage energy distribution and consumers to better manage energy consumption.



Although still in its infancy, Brazil is investing heavily in the modernization of its energy sector and the implementation of Smart Grid. In Latin America, Brazil is leading the way – its efforts are expected to lay the groundwork for deployments in neighboring countries.¹⁴ Brazil is poised to become the largest Smart Grid market in Latin America and one of the most important in the world. The implementation of Smart Grid will ensure Brazil a prominent position in the global economic environment.

¹⁴ www.reepedia.com/archives/1700

Brazil Smart Grid Market Value Forecasts by Technology Type

(figure 3, source: Zpryme – U.S. millions)

| Smart Grid Segment | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | CAGR |
|--------------------------------------|----------------|------------------|------------------|------------------|------------------|------------------|--------------|
| Software & Hardware | \$171.4 | \$216.1 | \$267.2 | \$326.8 | \$363.2 | \$410.4 | 19.1% |
| Smart Meters | \$235.7 | \$288.1 | \$334.0 | \$416.2 | \$512.2 | \$636.7 | 22.0% |
| Sensors | \$109.7 | \$133.8 | \$167.6 | \$215.8 | \$268.2 | \$323.9 | 24.2% |
| Comm. & Wireless Infrastructure | \$124.3 | \$154.3 | \$201.6 | \$238.9 | \$279.4 | \$321.7 | 21.0% |
| Smart T&D Equipment | \$159.4 | \$174.9 | \$208.0 | \$246.6 | \$320.4 | \$377.1 | 18.8% |
| Other | \$56.6 | \$61.7 | \$81.9 | \$97.1 | \$119.2 | \$148.6 | 21.3% |
| Total Smart Grid Market Value | \$856.9 | \$1,028.9 | \$1,260.3 | \$1,541.4 | \$1,862.6 | \$2,218.3 | 21.0% |
| Percent of Total Market | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | |
| Software & Hardware | 20.0% | 21.0% | 21.2% | 21.2% | 19.5% | 18.5% | |
| Smart Meters | 27.5% | 28.0% | 26.5% | 27.0% | 27.5% | 28.7% | |
| Sensors | 12.8% | 13.0% | 13.3% | 14.0% | 14.4% | 14.6% | |
| Comm. & Wireless Infrastructure | 14.5% | 15.0% | 16.0% | 15.5% | 15.0% | 14.5% | |
| Smart T&D Equipment | 18.6% | 17.0% | 16.5% | 16.0% | 17.2% | 17.0% | |
| Other | 6.6% | 6.0% | 6.5% | 6.3% | 6.4% | 6.7% | |
| Total | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | |
| | 100% | 100% | 100% | 100% | 100% | 100% | |

Total Electricity Net Generation

(figure 4, source: Zpryme – in billion kilowatt hours)

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | CAGR |
|----------------|------|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Brazil | 342 | 323 | 340 | 359 | 381 | 397 | 413 | 438 | 455 | 461 | 476 | 493 | 506 | 517 | 538 | 560 | 3.3% |
| Growth (Y-O-Y) | | -5.8% | 5.5% | 5.5% | 6.1% | 4.1% | 4.1% | 6.2% | 3.8% | 1.4% | 3.3% | 3.6% | 2.6% | 2.2% | 4.0% | 4.0% | |

Brazil: Role of Government & ANEEL

Brazil is undergoing tremendous economic growth resulting in the need for both expansion and modernization of the power system.¹⁵ To ensure success, the Brazilian government plans to invest US \$60 billion over the next three years into its energy sector. In particular, investments into Smart Grid technologies have been made a top priority. By the end of the decade, Brazil will deploy 64 million smart meters to residential and commercial energy consumers – with government tax incentives provided for consumers to purchase smart meters. These meters will form the basis for the interconnection of electricity users in Brazil. As part of an eventual interconnected smart grid, Brazil plans to invest almost US \$2.2 billion in the transmission sector through 2017. Under its National Broadband Plan, the Brazilian government is investing around US \$8.5 billion in creating a national fiber-optic network, which will eventually be used for smart grid communications (will bring broadband to 4,600 Brazilian municipalities and provide internet to 75% of Brazilian households).¹⁶

In order to achieve these ambitious goals, the Ministry of Mines and Energy (MME) has established a work group to study and plan the deployment of Smart Grid. Members include representatives from the Energy Research Company (EPE), the Electric Energy Research Center (CEPEL), the Agência Nacional de Energia Elétrica (ANEEL) and the Operator of the National Electric System (ONS).¹⁷ The workgroup primarily focuses on: (i) the consolidation of

Smart Grid programs in Brazil; (ii) the adequacy of regulations and standards for distributors of electricity; (iii) the identification of resources for funding and promoting incentives for the production of equipment in the country; and (iv) the regulation of potential new players in the market, including consumers and distributed generation providers.¹⁸

A key factor of successful Smart Grid implementation is establishing a regulatory framework and setting industry standards. ANEEL, the agency responsible for regulating generation, transmission and distribution of power in Brazil is in the process of finalizing regulations that should lead to widespread smart meter deployment.¹⁹ Brazil will be the first country in the region to approve a regulatory framework for the implementation of remote management.²⁰ Further, ANEEL will invest in efforts to complement the smart meter program with the establishment of regulations that permit time differentiated rates. Time-of-use rates will enable consumers to effectively manage their energy consumption simply by responding to price signals.^{21 22} ANEEL recognizes the importance of a demand response program to the successful implementation of Smart Grid – after all, a key component of a Smart Grid is a smart consumer.²³ In many areas, Brazil has pioneered methods of power sector modernization and has been setting the standard for Smart Grid deployment – demand side management is

¹⁸ Ibid.

¹⁹ www.analysis.smartgridupdate.com/industry-insight/brazil-unique-market-drivers-speed-meter-deployment

²⁰ www.cospp.com/articles/pei/2011/07/interest-in-smart-metering-on-the-rise-in-latin-america.html

²¹ www.geospatial.blogs.com/geospatial/2011/07/brazil-expected-to-lead-smart-grid-deployment-in-south-america.html

²² www.thinkmind.org/download.php?articleid=energy_2011_5_30

²³ www.aneel.gov.br/arquivos/PDF/Luiz%20Maurer_Jun09_AneelSeminar_eng.pptx.pdf

¹⁵ www.thinkmind.org/download.php?articleid=energy_2011_5_30

¹⁶ www.smartgridopinions.com/article/brazil-smart-grid-outlook

¹⁷ www.thinkmind.org/download.php?articleid=energy_2011_5_30

⁵ www.zpryme.com | www.smartgridresearch.org

another instrument to add to the arsenal and ANEEL has a significant role to play in establishing these programs.²⁴

Brazil: Key Industry Players

The rapid growth of Brazil's Smart Grid market has attracted global attention from energy suppliers, manufacturers, IT and engineering consultants and Smart Grid integrators.

International Smart Grid companies are moving into Brazil to gain a foothold in the promising market. When asked about the Smart Grid opportunity in Brazil, CPFL director Rubens Bruncek Ferreira said, “[Smart Grid] is a market requirement, especially here in Brazil where power consumption and population are expected to increase over the coming years”.²⁵

Suppliers

In 2010, nearly every Brazilian electric utility began studying Smart Grid to prepare for the modernization of the electric system.²⁶ Utilities are moving forward to modernize their distribution networks to reduce losses through the incorporation of Smart Grid systems and technologies: electronic and smart meters and Automated Meter Reading technology; substation automation; SCADA; GIS AM/FM; and Outage Management Systems.²⁷ In 2011, several pilot projects are well underway: Companhia

Energetica de Minas Gerais (CEMIG) has initiated a pilot project in Sete Lagoas City with 95,000 meters, Eletrobrás in Parintins City with 15,000 meters, and Ampla in Buzios City with 10,300 meters.²⁸ COPEL has worked to implement electrical vehicles and contributed to transform Curitiba into a digital city. And CELESC has been investing in new R&D projects involving demand response.²⁹ State owned Eletrobrás plans to invest around US \$700 million in operational and commercial process automation at the group's six distributors.

Manufacturers

Smart Grid technology manufacturers are also competing for market share as major players such as Itron, GE, and ABB are launching investments in the Brazil Smart Grid market. Recently, Landis+Gyr received the green light to begin installing the first of what will eventually be 200,000 smart meters. Landis+Gyr plans to install its SGP+M System, which will provide a two-way communication between customer meters and utility back-end systems.³⁰

Most recently Alstom Grid opened a new ultra-high voltage power transformer test laboratory at its facility in Canoas, Brazil, with an investment of EUR24m. The Canoas factory will now be able to design, manufacture and test alternating current and high voltage direct current (HVDC) transformers up to 800kV. The company said first tests will support the production of converter transformers for the Rio Madeira HVDC transmission line project in Brazil.³¹

²⁴ www.aneel.gov.br/arquivos/PDF/Luiz%20Maurer_Jun09_AneelSeminar_eng.pptx.pdf

²⁵ www.smartplanet.com/blog/smart-takes/ibm-signs-smart-grid-deals-in-brazil-korea/17377

²⁶ www.thinkmind.org/download.php?articleid=energy_2011_5_30

²⁷ www.geospatial.blogs.com/geospatial/2011/07/brazil-expected-to-lead-smart-grid-deployment-in-south-america.html

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

²⁸ www.iea.org/Platform/workshops/Mexico/1_Grudtner.pdf

²⁹ www.thinkmind.org/download.php?articleid=energy_2011_5_30

³⁰ www.smartgridnews.com/artman/publish/news/Brazil_Opens_Doors_to_Smart_Meters-649.html

³¹ EBR Staff Writer. Energy Business Review, Alstom Grid opens Power transformers test laboratory in Brazil. Oct. 7, 2011.

IT Consultants & Smart Grid Integrators

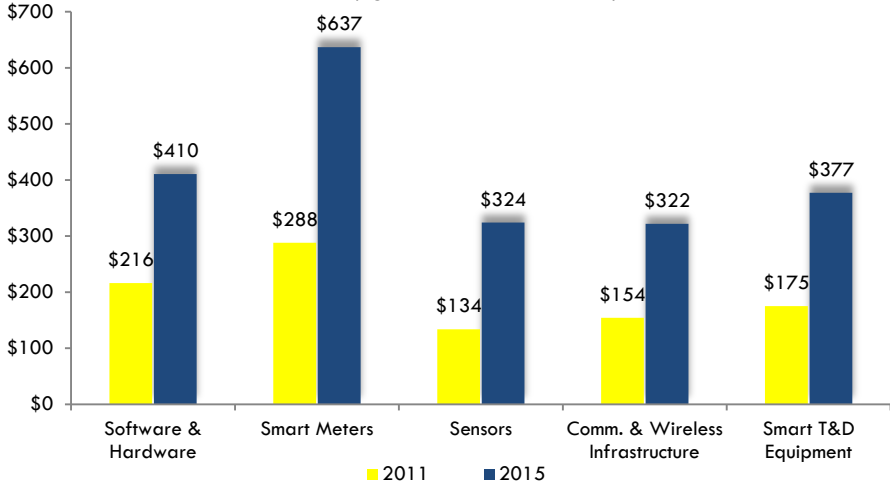
IT vendors and Smart Grid integrators are key players that are making moves in the Smart Grid market. On June 29th, IBM signed a deal with utility company CPFL Energia to help plan for eventual deployments of Smart Grid technology. IBM is consulting on three Smart Grid projects pertaining to automated data collection and management for smart meters and communications network optimization.³² Through the Brazilian distributor Coelce, Enel and Endesa are piloting a smart meter project in Brazil with the objective of exporting their remote management model to the country. The rolling out of smart meters by the Italian and Spanish companies is based on a model already implemented in Spain. The objective is to allow all operations on the power distribution grid to be carried out remotely, marking the first step towards the creation of a Smart Grid.³³ By the end of 2015, the company will have installed over 13 million new devices, which will be managed from the operations center in Seville.³⁴

Brazil: Trends & Drivers

When it comes to modernizing the electric system – Brazil is open for business. The Brazilian Development Bank (BNDES) projects that investments in the energy sector will increase by 7.4% annually until 2013. In this time, Brazil will invest US \$60 billion into its electric system.³⁵ Overall, the

Smart Grid market in South America will reach over US \$25 billion by 2020 led by Brazil and followed by Argentina and Chile.³⁶ The Brazil Smart Grid market is a great opportunity for business development for investors in both the energy sector and Smart Grid.³⁷ Initially, investments in the basic electricity infrastructure – transmission and distribution segments – will offer major opportunities for growth. Although Brazil is aggressively pursuing Smart Grid technology investments, about 77% of their power sector investments in 2011 will be on basic electricity infrastructure. Investments are projected to reach US \$3.5 billion in 2011 while the Smart Grid technology market is projected to reach US \$1.0 billion in the same year. By 2015, basic infrastructure investments will value US \$5.1 billion – this is more than two times the value of the Smart Grid market – projected to reach US \$2.2 billion.

Brazil Smart Grid Market Value by Technology Area 2011 and 2015 (in U.S. millions) (figure 5, source: Zpryme)



³² www.smartplanet.com/blog/smart-takes/ibm-signs-smart-grid-deals-in-brazil-korea/17377
³³ www.cospp.com/articles/pei/2011/07/interest-in-smart-metering-on-the-rise-in-latin-america.html
³⁴ Ibid.
³⁵ www.thinkmind.org/download.php?articleid=energy_2011_5_30
⁷ www.zpryme.com | www.smartgridresearch.org

³⁶ www.geospatial.blogs.com/geospatial/2011/07/brazil-expected-to-lead-smart-grid-deployment-in-south-america.html
³⁷ www.thinkmind.org/download.php?articleid=energy_2011_5_30
Zpryme Smart Grid Insights | October 2011

However, the market for Smart Grid technology will grow almost two times as fast as the market for basic electricity infrastructure products over the next five years. Between 2011 - 2015 the Smart Grid market is projected to grow at a rate of 21.0 % annually.

The fastest growing Smart grid segment is sensors with a CAGR of 24.2% and a 2011 sector value of \$133.8 million. Smart meter spending will reach \$288.1 million in 2011 and climb to \$636.7 million in 2015. By 2015, the software and hardware, communications and wireless infrastructure, and smart T&D equipment segments will reach \$410.4 million, \$321.7 million, and \$377.1 million, respectively.

The focus for now remains on smart meters. Over the next ten years, Brazil will host the largest AMI market in the world with 63 million smart meters. With time, the smart meter market will drive investments in other smart solutions. Smart markets are expected to emerge on the national landscape with very positive forecasts for distributed generation, communication infrastructure and IT applications.³⁸ New consuming elements – such as electric vehicles and smart appliances – will be incorporated into the grid.³⁹ The introduction of electrical micro-generation to the grid – particularly solar and wind energy – is on the horizon and will be formalized under Brazil's new electricity business model, allowing anyone to produce, sell and buy these resources.⁴⁰

Although Brazil has traditionally, and for the most part currently, been a country that prefers to buy-national, the implementation of Smart Grid has made it necessary for

Brazil to look to the expertise and experience of international companies. In spite of the steep tariffs and import duties, international Smart Grid vendors dominate the market in Brazil. Now in 2011, international firms serve 73% of the Smart Grid market while Brazilian firms serve only 27%. This trend is expected to continue as the Smart Grid market evolves in Brazil and eventually branches out into neighboring countries. South America presents unparalleled opportunity for international investors. Still, when entering the market, Smart Grid vendors are encouraged to entrench themselves within the country either by building local factories as Itron and Landis+Gyr have done, incorporating and opening an office as Silver Spring Network did in Sao Paulo, or partnering with locally established manufacturers and/or distributors, as Echelon did with ELO Sistemas Electronicos.

At a glance, what can potential investors expect to see in the upcoming decade?

- In Brazil, aging infrastructure and rapidly growing energy demand will require grid expansion and modernization. As a result, the Brazilian government will invest over US \$60 billion into its energy sector – more specifically Smart Grid. A successful overhaul will be contingent upon a sound regulatory framework. ANEEL will pave the way with a revised tariff structure and industry standards.
- Plans will be set into action – the transformation will begin with investments in basic infrastructure and grid expansion. Potential investors should initially focus on these segments. Several generation projects are well underway, such as the construction

³⁸ www.thinkmind.org/download.php?articleid=energy_2011_5_30

³⁹ www.blog.telecomfuturecentre.it/2011/04/16/brazilian-smart-grid-is-arriving-in-2012/

⁴⁰ Ibid.

of the Belo Monte Dam in the state of Pará.⁴¹ The transmission and distribution segments offer major opportunities for growth as well – actively building new generation capacity will require high voltage transmission lines and new substations.

- With a reliable backbone in place, Brazil will then invest heavily in grid modernization and Smart Grid. Initially, investments should focus on smart meters – in time, the smart meter market will drive investments in other smart solutions – more specifically distributed generation and renewables, communication infrastructure and IT applications.
- Potential international investors should consider that Brazil has steep tariffs and import duties. When entering the market, Smart Grid vendors are encouraged to entrench themselves within the local economy either by building regional factories, incorporating and opening regional offices, or partnering with locally established manufacturers and/or distributors.
- Following implementation in Brazil, Smart Grid deployment will expand into other South American markets. Neighboring countries exhibit similar attractive market conditions for Smart Grid implementation – energy consumption and non-technical loss rates are high and there is tremendous potential for distributed generation.⁴² Following Brazil, investors can expect to see markets develop in Argentina and Chile as well.

⁴¹ www.geospatial.blogs.com/geospatial/2011/07/brazil-expected-to-lead-smart-grid-deployment-in-south-america.html

⁴² www.reepedia.com/archives/1700

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