sia partners

INSIGHT
JULY
2020

Smart Grid Data Analytics

Leveraging Smart Grid Data Analytics for Strategic Business Planning in Energy & Utilities

Current context

The US transition towards smart grids is still in its infancy and projects are starting to emerge all over the country now that smart meters are gradually being rolled out. We will further explore one of the key advantages of smart grids, namely the growing wealth of data that can be accumulated and how to leverage it. With the introduction of IoT on the grid, smart grid benefits grow exponentially – along with completely new challenges that we will address in this article.

Data Analytics in occurrence with IoT is drastically reducing human intervention and could potentially reduce the overall cost for the consumer. But the question is, where are we in the process of enabling this functionality and how will we get there.

What creates the need for data in Energy & Utilities?

The need for data in energy and utilities arises from disaster relief. As stated in a stakeholder meeting for *The Planning an Affordable, Resilient and Sustainable Grid in North Carolina*, that took place in May 2020, in 2018, Hurricane Florence left:

- 1.8 million customers of Duke Energy with outages
- 45+ transmission line fallouts
- 185 miles of distribution lines down
- 10 substations flooded at peak of the storm

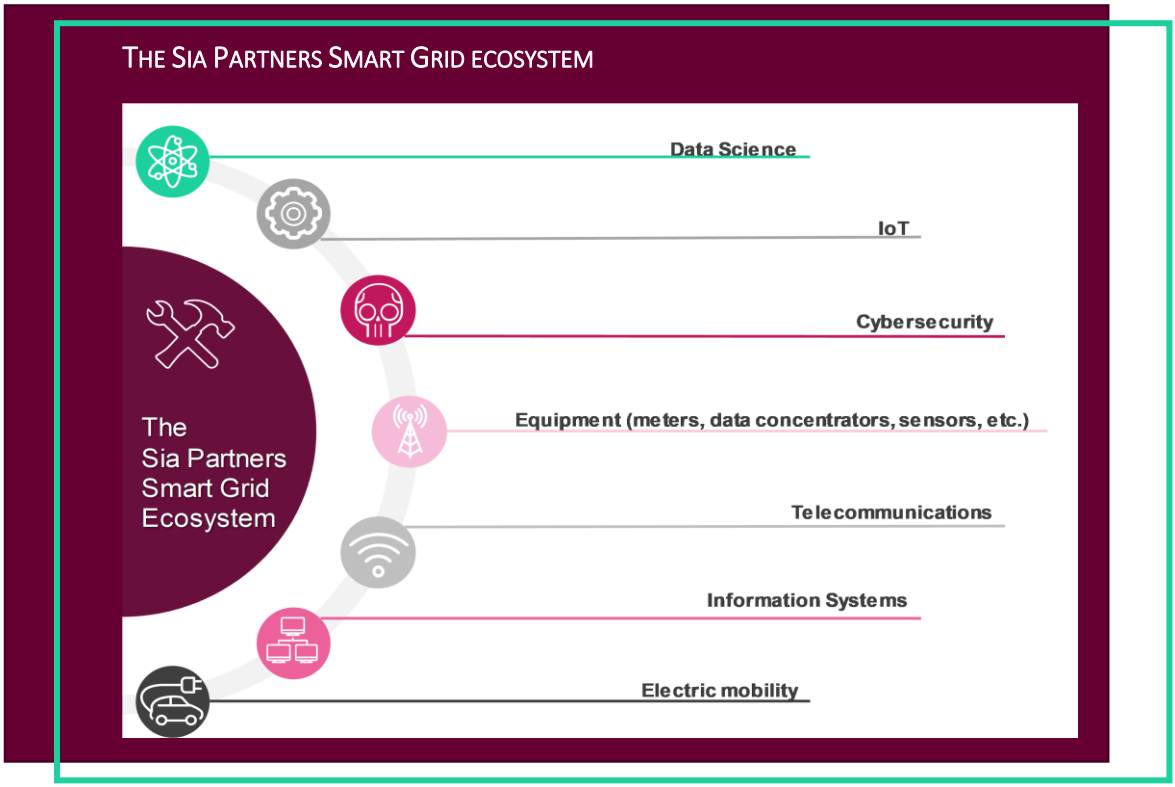
This challenging scenario confirms the fragility of the grid infrastructure. Though a smart grid cannot prevent outages during a natural disaster, its data infrastructure has the potential to bring a new level of service to the customer during major disruptive events (eg. Pre-storm alerts, outage duration estimates, status on repairs, etc.)

Apart from severe weather, some non-climate stressors that are affecting the energy industry are:

- Clean energy transition
- Population growth
- Socioeconomic disparity
- Cybersecurity
- Rural-urban divide
- Pandemics

To fully enable the transition to universal clean energy, the energy and utilities industry must become a data-driven business. Sensors, intelligent devices, advanced equipment and distributed systems are integrated onto the grid enabling utility companies to get various forms of data in unmanageable volumes.

This sudden overflow of data will require data analytics to become a focal point of energy and utility businesses due to an overwhelming need to understand real-time situations on the grid, benchmark them against historical data, define the most efficient ways to meet customer needs, run a business, and improve both system design and performance.



Big Data strategy

Clearly, the amount of data in the smart grid system requires a very specific approach, namely a Big Data Approach.

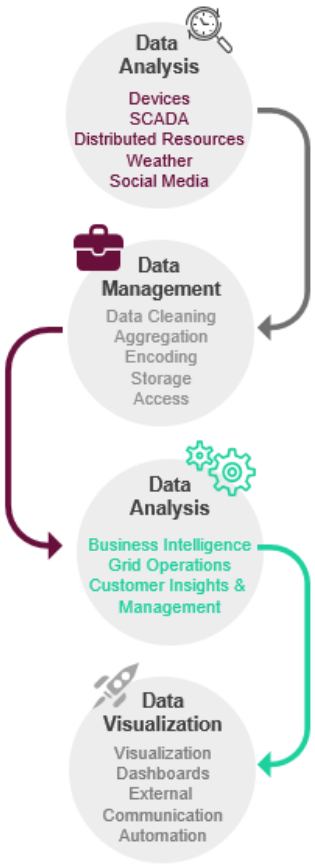
In the context of Smart Grids, joining these volumes of data means looking beyond legacy information sources and focusing on:

- Smart meters
- Digital sensors and control devices
- Market data
- Weather data
- Social media
- Smart devices
- Third party data providers
- Etc.

Smart meter data has been the easiest to collect and manage. The more substantial value of this data, however, is by infusing data from across the enterprise and third-party sources to use it for its analytical and predictive strength.

Steps to building effective data models for Smart Grids

Before we can even do a deep dive into complex and insightful analysis, there are a few steps to take:



1. Data Collection: Identifying all sources that can generate useful data for decision making
2. Data Management:
   - Data quality (reconciling bad values, duplicate data, data formatting)
   - Data aggregation - aggregating data from different sources in an effective way with a unified view
   - Data Storage, Data security, privacy settings and access management
3. Data Analysis: Data fusion, network analysis, cluster analysis, time-series analysis, etc.
4. Data Visualization: In order to have any value, data needs to be presented in a functional manner that inspires actions and outcomes

Overcoming challenges

Building a sustainable foundation in order to get benefits from the smart grid requires bringing the best minds together. This means bringing together talent highly specialized in energy and utilities, customer journeys and experience, big data management and data science. It is going to require strong, visionary leadership to create cohesive teams by helping each participant understand their mission and values.

Management plays a key role in determining the successful outcome of projects.

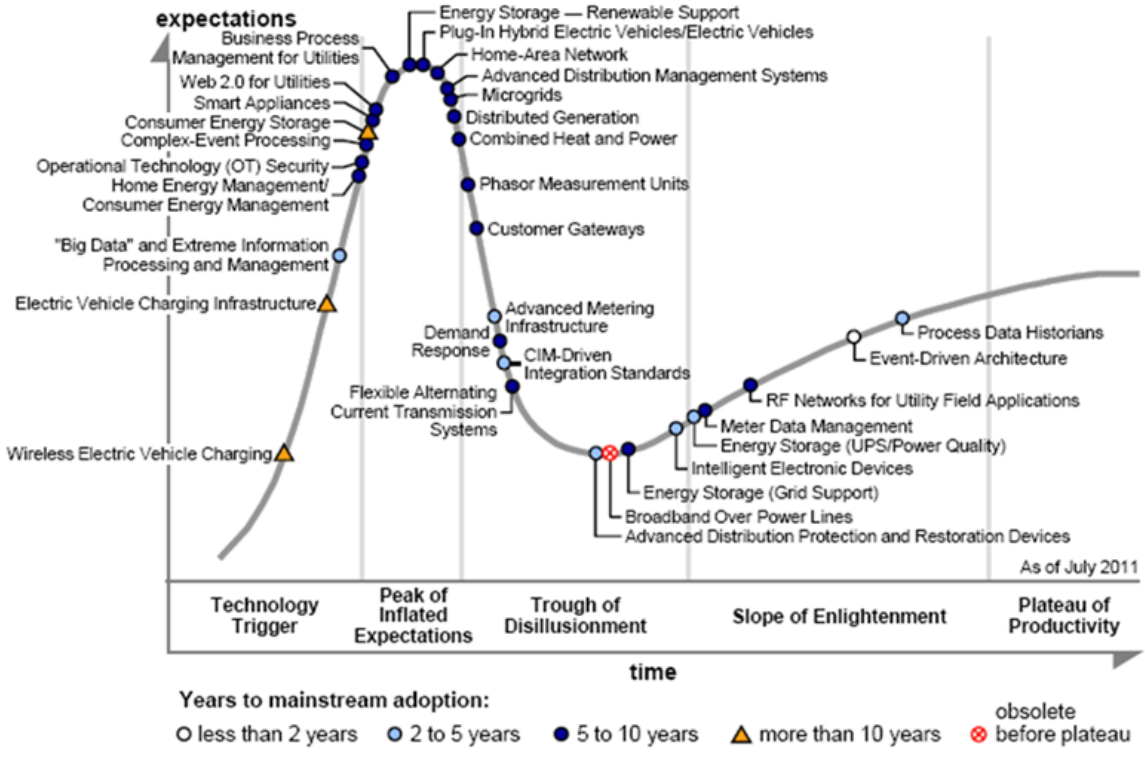
Therefore, stakeholders need to:

- Implement logical and sustainable data architecture that is flexible and scalable. This means that first and foremost, existing and future business needs have to be identified which will define the types of data that will be managed.
- Start from the beginning. Don't force the data to give you answers you want to hear, let data speak the truth. Many industries make a mistake of forcing questions on data to get the answers they need by applying numerous filters and limiting data sources joined to get the answers. This prevents the stakeholders from uncovering the unknown.
- Deploy and develop analytical software and models that fit the business model and strategic interests. Don't just copy/paste what others do.
- Invest in talented Data Visualization professionals. The art of visualizing information requires many skills beyond the pure analytical and statistical. This will require individuals who can think conceptually and creatively; resources equipped with data analysis skills and the

ability to tell a story. Resources of this kind are hard to find but essential to make the big data effort a success. These resources are supposed to communicate information both internally as well as to consumers in a very consumer-centric way

- Changing the mindset from treating the customer as a 'meter points' to treating the consumer as a person for who they are, building analytics using a human-centric approach
- Breaking down department silos to bring the right conversations into the room. This will define the direction of data analytics so that you can spend money and resources wisely by resolving the problems that will have the largest impact on the ROI
- Finally, implement measurable KPIs to start generating results for the company

Gartner Hype Cycle-Smart Grid



Source: Gartner (July 2011)

As per Gartner, the smart grid is a vision of a future energy delivery infrastructure. It would be a stepping stone in the utility sector which would enhance network resilience & empower customers. The smart grid data analytics market is expected to grow at CAGR (Compound annual growth rate) of 25%, during the 2019 to 2024 forecast period. With an escalation of Internet of Things (IoT) and big data analytics coupled with rapidly growing ICT (Information & Communication Technology), modernization has led to the emergence of smart grid analytics.

Based on the initial assessments by the American Council for an Energy Efficient Economy predict the use of Information & Communication Technology (ICT) and smart appliances would save about $80 billion in America's annual electricity bill.

This would be feasible if big data analytics, machine learning and artificial intelligence are performed on the data gathered by smart grid. By the combination of these techniques, it would be possible to predict the load demand, generation volume and system disturbances.

Different types of Analytics currently explored in the Energy and Utilities' space:

- Disaggregation Analytics
- Dynamic-Pricing Analytics
- Resiliency Analytics
- Sentiment Analysis
- Big Data Cybersecurity Analytics – Proactive Approaches

Benefits of well-structured Data Analytics in Energy and Utilities:

Technical benefits

- Quick Fault detection
- Predictive maintenance/condition-based maintenance - A successful Distribution Activity has the capability to localize and isolate the faults in the distribution system with a reduced restoration time and improved customer satisfaction.

Organizational Benefits

- Load disaggregation - non-intrusive load monitoring of household appliances, helps utility companies develop a more energy-efficient strategy for their consumers
- Load profiling - typical behavior of electric consumption

Consumer benefits

- Power quality monitoring - allows users to use energy when it is cheaper
- Electric device health monitoring - so that consumers can be notified when parts need replacement or if they are using more electricity than what they are expected to use

How can Data Analytics help during emergency situations such as pandemics and severe weather?

Allocate energy where it is needed:

The impact of severe weather and the resulting power outages are especially critical for buildings such as hospitals. The aggregation of several interfering events may increase the need to have accurate predictions on the resolution time for power outages as emergency generators may fail or wear out. Weather and power quality analytics can help actively predict the possibility of interruption of service to proactively isolate the microgrid and provide seamless, uninterrupted power to the hospitals.

Preventative measures:

The same data models can be applied to areas affected by severe weather. Predictive models can help alert people when it is time to evacuate and what routes are best for evacuation.

Data can also point out the specific outages and in combination with historical data we can identify the weak points of the grid that will need immediate attention after the storm. Moreover, those baseline data points can help to predict the approximate time to fix the infrastructure and thus provide customers with more accurate estimates.

For the outages that need human intervention, data would be able to show the exact point of failure, and in that way reduce the number of staff members that need to be deployed to locate and then fix the issue.

Cybersecurity:

In situations like COVID-19, where most people are forced to work remotely, cybersecurity becomes a big issue when a lot of employees need to log into confidential systems remotely. Data models can identify abnormal behaviors and create alerts when a potential cybersecurity attack is performed.

Conclusion

The value data will provide is dependent on the quality of the collected data, effective data processing and the ability to find the correct algorithms in a short amount of time.

The need for real-time response to detect patterns is becoming greater, with the growing complexity of the smart grid ecosystem. Big data analytics is fundamentally changing the way Energy and Utility companies operate and interact with their customers. Rethinking and updating fundamental business models will enable companies to stay engaged and relevant. That new model can only be built on the power of data analytics and changing the way that business gets done.

How Sia Partners can help

- Sia Partners has got a unique blend of digital technology, design creativity & business transformation capabilities. We take advantage of our innovative skills & agile methodologies to identify business use cases and research on how data could be leveraged.

- 'Heka' is one of our artificial intelligence platforms which is currently hosting 30 client platforms as well as 60 bots. These bots are ready to use solutions and can be used based on the client's specific use cases. Some examples of business applications would be - social listening, fraud detection, weather sensitivity, dynamic pricing, etc.

- Our accelerators simulate ideation & accelerate our AI projects based on competitive analysis, image recognition, impact & risk modeling, failure prediction, infrastructure implementation optimization, etc.

- We are technical experts with a deep understanding of asset management, markets and trading, smart meter program management, modelling and regulation. We also have deep expertise in renewable energy consulting, oil and gas, water markets and regulation and infrastructure development.

- We assist with strategy development, economic and regulatory analysis and program management. Our consultants work across the globe to assist utilities and regulators with complex challenges.

- We also work with utilities, assisting in the transformation to "the utility of the future". A process where we assist with managing the impact of new regulation, develop a vision for the future particularly around consumer services and product development, including the transformation to digital services and products

References:

- https://www.smart-energy.com/industry-sectors/smart-meters/covid-19-slows-smart-meter-market-accelerates-software-spend-in-future/

- https://www.smart-energy.com/industry-sectors/storage/global-energy-storage-market-to-rebound-in-2021-despite-covid-19/

- https://www.researchandmarkets.com/reports/5024115/covid-19-impact-on-smart-grid-market-by-component?utm_source=dynamic&utm_medium=BW&utm_code=nxpcfd&utm_campaign=1388934+-+Impact+of+COVID-19+on+the+Smart+Grid+Market+by+Component+and+Region+-+Global+Forecast+to+2021&utm_exec=joca220bwd

- https://energyinformatics.springeropen.com/articles/10.1186/s42162-018-0007-5

- Stimmel, Carol L. *Big Data Analytics Strategies for the Smart Grid. Boca Raton: CRC Press, 2015. Digital*

- https://www.gartner.com/en/documents/3774766/hype-cycle-for-smart-grid-technologies-2017

- https://www.smartgrid.gov/files/documents/Achieving_Smart_Grid_Interoperability_through_Collaboration_200806.pdf

- https://www.businesswire.com/news/home/20191223005319/en/Smart-Grid-Data-Analytics-Market-2024-Increase

- https://smartgrid.ieee.org/images/files/pdf/big_data_analytics_white_paper.pdf

- https://epic.uncc.edu/sites/epic.uncc.edu/files/media/PARSG%20Stakeholder%20Meeting%201%20%20-%202020.05.19.pdf

YOUR CONTACTS

Davina Demelenne
Manager
+1 (704) 430-1525
davina.demelenne@sia-partners.com

Marija Zutic
Supervising Senior Consultant
+1 (646) 639-0838
marija.zutic@sia-partners.com

Ryan Hudgin
Consultant
+1 (774) 276-6161
ryan.hudgin@sia-partners.com

Sunidhi Gupta
Data Science Consultant
+ 1 (704) 712-6841
sunidhi.gupta@sia-partners.com

ABOUT SIA PARTNERS

Sia Partners is a next generation consulting firm focused on delivering superior value and tangible results to its clients as they navigate the digital revolution. With over 1,400 consultants in 16 countries, we will generate an annual turnover of USD 280 million for the current fiscal year. Our global footprint and our expertise in more than 30 sectors and services allow us to enhance our clients' businesses worldwide. We guide their projects and initiatives in strategy, business transformation, IT & digital strategy, and Data Science. As the pioneer of Consulting 4.0, we develop consulting bots and integrate AI in our solutions.

Abu Dhabi | Amsterdam | Baltimore l Brussels | Casablanca | Charlotte | Chicago l Denver | Doha | Dubai | Frankfurt | Hamburg | Hong Kong | Houston | London | Luxembourg | Lyon | Milan | Montreal | New York l Paris l Riyadh | Rome | Seattle | Singapore | Tokyo | Toronto |

For more information, visit **www.sia-partners.com**

Follow us on **LinkedIn** and **Twitter @SiaPartners**