T&DWorld™

EXECUTIVE SUMMARY

The Energy Transition: Gearing Up for Smarter Utility and Industrial Power Grids

Adaptable, Secure, and Resilient Grids: What Do AI and Automation Offer?

Ankush Agarwal, Director of T&D Analytics, Exelon Corporation
Ratanak Heng, Senior Manager of T&D Analytics, Exelon Corporation
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KEY TAKEAWAYS

- Decarbonization, decentralization, and digitalization enable energy transition.
- Digitalization is the key enabler for energy transition.
- Exelon is using analytics and AI to generate actionable insights for their grid.
- Exelon's Analytics Academy accelerates analytics adoption across the organization.

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Adaptable, Secure, and Resilient Grids: What Do AI and Automation Offer?

OVERVIEW

Energy systems are becoming increasingly sustainable, both from an environmental standpoint and from an economic one. As power grids transform to support this sustainability, utilities companies are looking to analytics, automation, and artificial intelligence (AI) to improve the security, stability, and resilience of their grids.

Analytics, automation, and AI aren't just future technologies; companies are using them now to solve current problems. Digitalization is helping companies like Exelon prepare for, respond faster to, and in some cases, prevent, outages.

CONTEXT

Michael Schwan discussed the grid of the future and how decarbonization, decentralization, and especially digitalization enable energy transition. Ankush Agarwal and Ratanak Heng shared how Exelon utilities is taking advantage of digitalization—specifically AI and analytics—to improve their operations today.

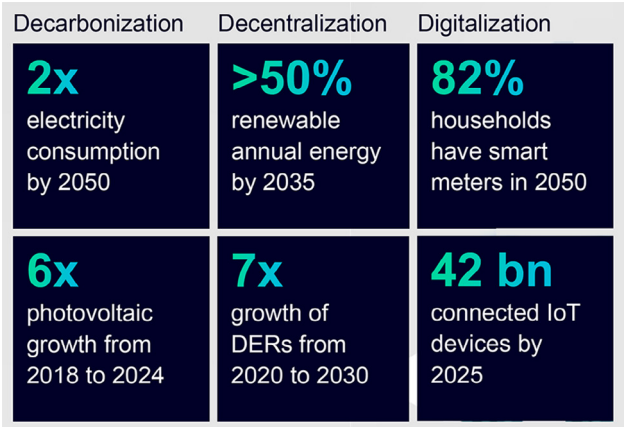
KEY TAKEAWAYS

Decarbonization, decentralization, and digitalization enable energy transition.

The three Ds—decarbonization, decentralization, and digitalization—are enabling the energy transition, transforming power systems so they are more sustainable, both environmentally and economically.

- **Decarbonization** increases the amount of electricity generation based on renewable resources. Electricity consumption will also increase with green electricity driving the electrification of many processes not using electricity today.
- **Decentralization** is pushed, as renewable energy generation is often based on smaller-scale distributed energy resources (DERs), like photovoltaic (PV) panels and wind turbines.
- **Digitalization** includes automation and AI, as well Internet of Things (IOT) devices and smart meters, laying the foundation for a complete revolution in how systems are operated and planned and is essential for managing the ever more complex energy systems.

Figure 1: By the numbers: Decarbonization, decentralization, and digitalization expectations



The green energy generated and provided with the three Ds also provides more economically accessible energy across the world. PVs are already the cheapest way to generate energy, and that economic driver is a key motivator for change in many power systems.

> While climate change might be on the top of the agenda for first-world countries, there are many countries which need to catch up and need any kilowatt hour that can be generated.
>
> *Michael Schwan, Head of Siemens Power Technologies International, Power System Consulting Expert*

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Digitalization is the key enabler for energy transition.

The complexity of energy systems is growing as the number of active players in the space increases, driving power systems to be more flexible to ensure their security, stability, and resilience. The most important aspect of this flexibility is digitalization along the full scope of process: planning, operational, and asset management.

Figure 2: Digitalization across planning, operations, and asset management enables energy transition

Digitalization advancements will be fast-paced, and at the most basic level, require changing analog processes and analog data to digital. Organizations will also want to research and consider how to establish communication across the network and implementation of IOT technologies, like smart metering equipment. AI and analytics are also critical to a successful digitalized approach.

Exelon is using analytics and AI to generate actionable insights for their grid.

Exelon utilities is already investing in the technology necessary to make the grid more flexible, including grid analytics and AI. The utility company, which serves 10 million electric and natural gas customers in five states and Washington, DC, is analyzing data from disparate source systems to generate insights that improve safety, reduce operational costs, increase revenue, and increase customer satisfaction.

Ratanak Heng shared several examples of how Exelon utilities is using AI and analytics today to help their grid be more resilient. He discussed storm readiness, vegetation management, critical asset maintenance, and fault location.

> Resilience is not just about hardening the system; it's also about how do utilities quickly respond and mitigate outages that do occur.
>
> *Ratanak Heng, Senior Manager of T&D Analytics, Exelon Corporation*

Three Examples of Digitization with Siemens

Siemens is involved in researching and implementing flexible digitalization solutions to support the security, stability, and resilience of power systems. The three examples shared were:

1. **Dynamic Grid Control Center.** This research project provides real-time AI-based insights as well as advice on the system's dynamic performance into control centers, supporting secure and stable system operation with high shares of volatile generation from renewable energy sources.
2. **Siemens Network Model Management.** Automated and digitized data management from multiple disparate sources are used to collect information across the power system, significantly decreasing the amount of time engineers spend managing the data.
3. **Power Quality Analytics.** Siemens is developing a new methodology that uses new technology, including pattern recognition and machine learning, to discern normal operations from abnormal events. This can help predict certain types of equipment failures so they can be addressed before they occur.

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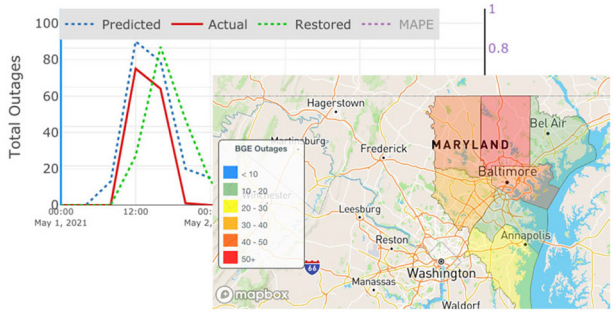
Figure 3: Exelon utilities analyzes data from multiple source systems to provide actionable insights

Storm Readiness

Weather has a significant impact on the resilience of the electric grid. Exelon develops machine learning models to help predict and prepare for extreme, unpredictable weather events, such as hurricanes, tornadoes, and derechos. This has the potential to reduce the duration of storm restoration, increasing customer satisfaction, and reducing annual storm expenditures.

Figure 4: Storm Readiness: Improving response to weather events through machine learning



- Outage Prediction
- Estimated Time of Restoration (ETR)
- Staffing Level Recommendations
- Storm Analogue

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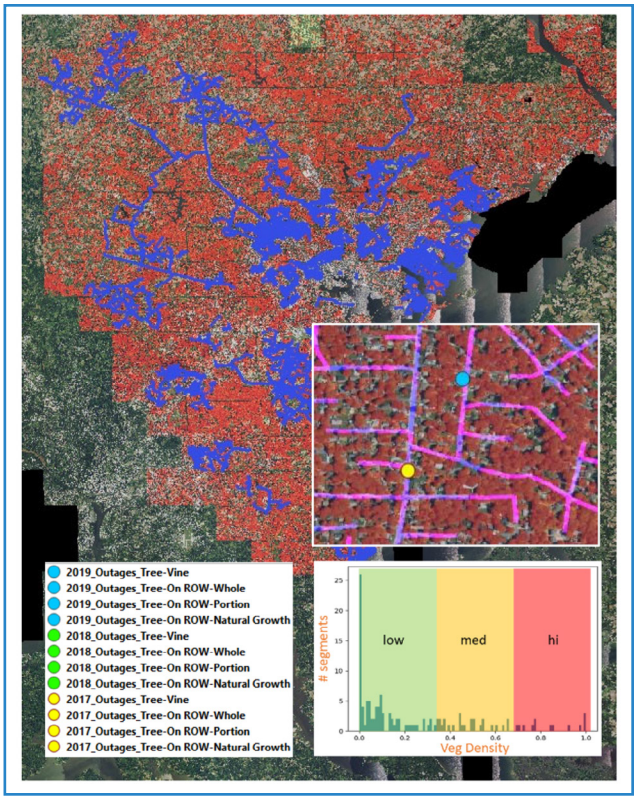
Vegetation Management

Vegetation-caused outages, including those that occur due to weather, are the single largest outage cause at Exelon utilities, accounting for 24% of all outages annually. Exelon utilities implemented image detection and an analytics solution that enabled a data-driven approach to reduce vegetation risks.

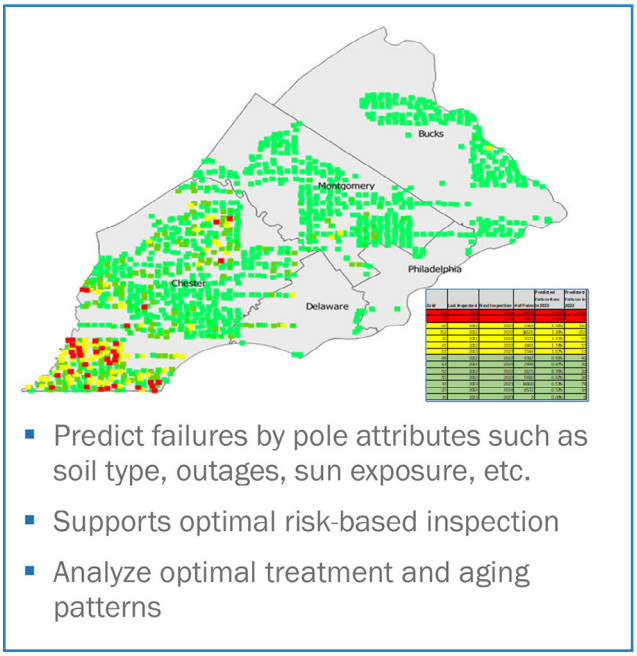
Figure 5: Exelon utilities visualizes the data to improve vegetation management



Critical Asset Maintenance

Ensuring critical assets are properly maintained also helps improve system performance, especially during storms. Exelon utilities applied AI to optimize maintenance programs for one of its largest asset groups: wood poles. Using AI, they were able to improve predictions of pole rot based on soil type, outages, sun exposure, and other factors.

Figure 6: Applying AI to optimize wood pole rot prediction and maintenance programs



- Predict failures by pole attributes such as soil type, outages, sun exposure, etc.
- Supports optimal risk-based inspection
- Analyze optimal treatment and aging patterns

Fault Location

Information on where outages occur is not always available, making it difficult to predict future outages. Rather than relying on field crews to log where they are working and the work they did, especially in an outage situation, Exelon utilities is working to apply geospatial analytics, which allows them to better identify where crews spent time and where to harden the system.

Figure 7: Using geospatial analytics to better identify where to harden the system

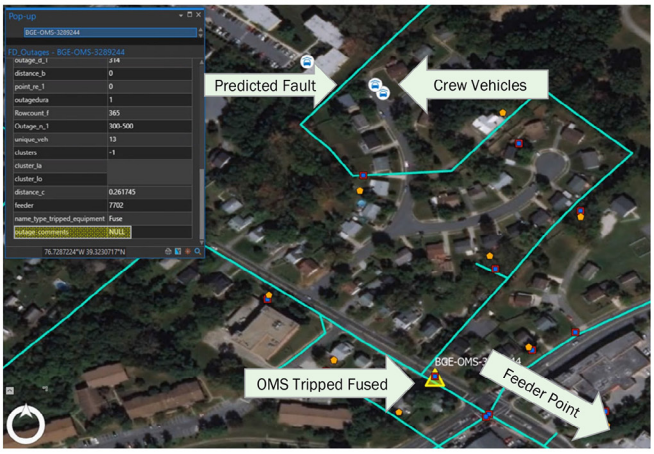


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Figure 7: continued

Three vehicle clusters were identified for this outage job using analytics.

Relevant vehicles were ranked based on several factors, including time spent on job and proximity to tripped equipment

Rank 1 Vehicle

arrival_time	3/2/2018 2:36:00 PM
departure_time	3/2/2018 3:54:00 PM
vin_duration_at_outage	78.45
vin_rank_by_duration	1
No_records_Eachvin_afterclustering	44
XCoord	
YCoord	

Rank 2 Vehicle

arrival_time	3/2/2018 2:36:00 PM
departure_time	3/2/2018 3:42:00 PM
vin_duration_at_outage	66.25
vin_rank_by_duration	2
No_records_Eachvin_afterclustering	4
XCoord	
YCoord	

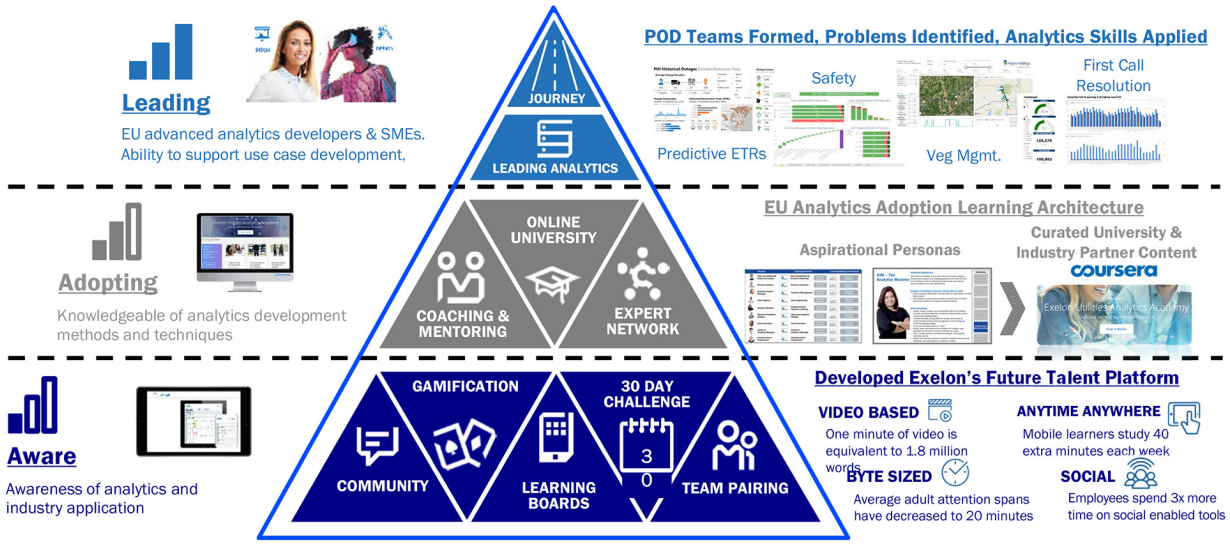
Exelon's Analytics Academy accelerates analytics adoption across the organization.

Exelon is looking to its existing employees, and not just its data scientists, to analyze and act upon the information from its AI and analytics programs. Analytics Academy, which Exelon developed with partners Accenture and Coursera, trains engineers and other employees to build data analytics skills, increasing awareness and adoption of analytics and its applications in the industry.

> The Analytics Academy has helped create an ecosystem of analytic enthusiasts who can identify and solve complex business problems.
>
> *Ankush Agarwal, Director of T&D Analytics, Exelon Corporation*

To date, the Analytics Academy has graduated more than 200 employees who have delivered over 20 complex analytic solutions that are helping Exelon improve its business.

Figure 8: Exelon's Analytics Academy accelerates the maturity and adoption of analytics across the organization



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BIOGRAPHIES

Ankush Agarwal

Director of T&D Analytics, Exelon Corporation

Ankush Agarwal is the Director of Advanced Analytics at Exelon utilities where he is responsible for collaborating with business leaders and experts across the Exelon family of six utility companies to develop and deliver a robust Grid Transmission and Distribution analytics capability and program. Ankush is passionate about enabling awareness and adoption of analytics across organizations to help accelerate development of an analytics-driven culture and co-founded Exelon utilities' premiere Analytics Academy program. He's spent 10 years at Exelon in various Analytics leadership roles and was previously responsible for shaping the strategy and execution of Exelon's Audit & Controls' data analytics and IT Audit function.

Ankush leads Utility Analytic Institute's Safety Analytics Community initiative, serves on Association of Edison Illuminating Companies' (AEIC) Analytics Council, GridForward's Advisory Council, and previously co-chaired the joint Data Analytics Committee for Edison Electric Institute and American Gas Association (EEI-AGA). He has two young daughters and is passionate about increasing engagement of girls in STEM programs and technology careers.

Ratanak Heng

Senior Manager of T&D Analytics, Exelon Corporation

Ratanak Heng currently serves as the Senior Manager of Advanced Analytics for Exelon utilities (EU). Ratanak leads the Grid Analytics organization at Exelon utilities to drive sustained value by improving reliability and customer satisfaction, decreasing operational cost, and capturing new revenue opportunities. In his role, Ratanak collaborates with business leaders and experts across the Exelon family of utility companies to further develop EU's analytics strategy, lead innovative projects, and grow EU's grid analytics portfolio. Ratanak has over 12 years of utility experience in operations, planning, and engineering & standards with Baltimore Gas & Electric, a subsidiary of Exelon. Ratanak earned a bachelor's degree in Electrical Engineering and a master's degree in Business Administration from University of Maryland, College Park.

Michael Schwan

Head of Siemens Power Technologies International, Power System Consulting Expert

Michael is an expert in power system planning and analysis with more than 20 years of experience. Today, he is the head of the Siemens Power Technologies International (PTI), managing the world-wide business on power system advisory and consulting with more than 1,000 projects every year, executed by a dedicated team of more than 150 specialists and consultants.

Before joining Siemens PTI in 2005 as Senior Consultant, he was with the Research Association for Electrical Equipment and Power Economics (FGH e.V.) as department director for system studies. He completed his doctoral degree in power engineering at Saarland University in 2003, where he was working as a research associate from 1998 following his diploma certification.