The Evolution of Data Analytics at Oncor

Adding the “Smart” to the Smart Grid

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WE DELIVER.

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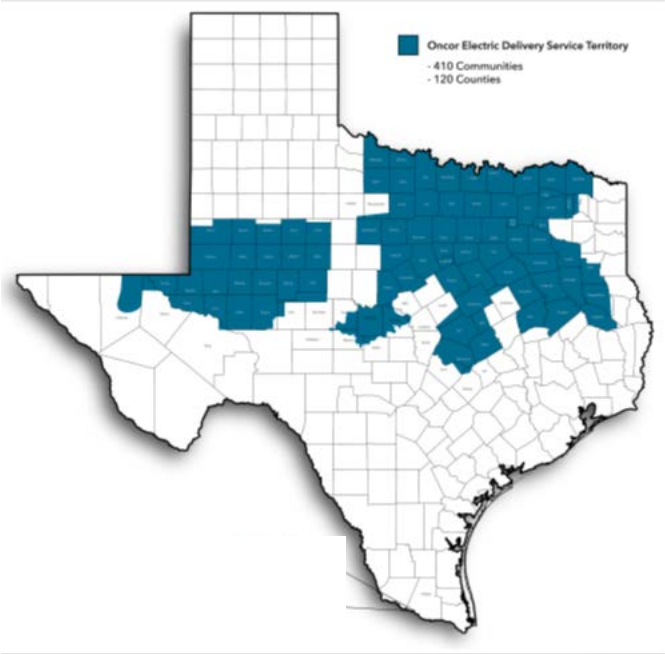
Oncor - By the Numbers

- **Transmission and Distribution services only (no commodity exposure)**
- **Open energy delivery platform as market enabler**
- **Enabling competitive retail, generation, and in-home services**
- **Agnostic to generation technologies or locations**
- **Focus on grid reliability and information services**
- **In 2019 ERCOT enabled 31 GW of competitive renewable generation**



3.6M
AMS Meters

137k
Circuit Line Miles

500k
Switch Points

250K
SCADA Points

50M
SCADA x-actions /day

300M
AMS data x-actions /day

4 PByte
Analytics Data Store

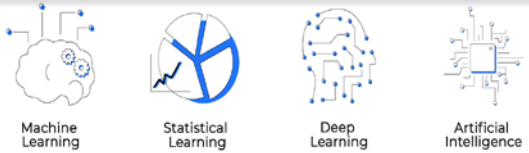
How ONCOR Puts the “Smart” into the “Smart”Grid

Oncor’s Investments in Grid Technology:

- **Advanced Metering**
- **Distribution Automation**
- **Communications Infrastructure**

Data & Information “Assets”

+ Application of Advanced Data Analytics:



GRID-FOCUSED DECISION ENHANCEMENTS

Process Efficiency
Resource Productivity
Asset Utilization
Strategic Investment Options

CUSTOMER EMPOWERMENT

Customer Decision Support
Added-Value Services
Market Defense
Market Enablement

Enhanced Operational Decisions to Improve Reliability

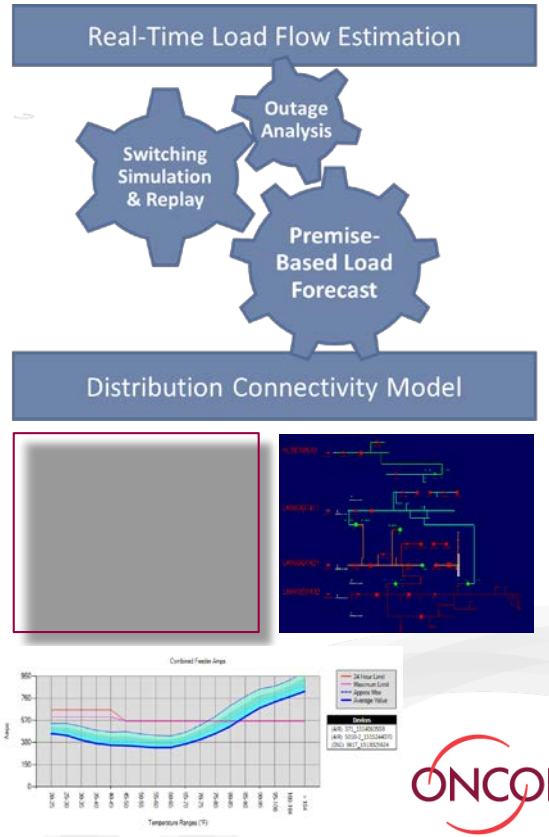
Distribution State Estimator / Load Forecast

Neural-network based Distribution real-time and predictive **load flow simulation and fault location estimates** are critical for switching decision during service restoration and for the avoidance of critical over load conditions.

Reliability Improvement: 3 – 5 minutes

Distribution **“connectivity errors”** compromise operational decision quality and cause “mis-routed” customer notifications.

Customer satisfaction for Oncor Alert users is 97%, the highest of any type of transaction for Oncor.



Better Investment Decision to Avoid Outages

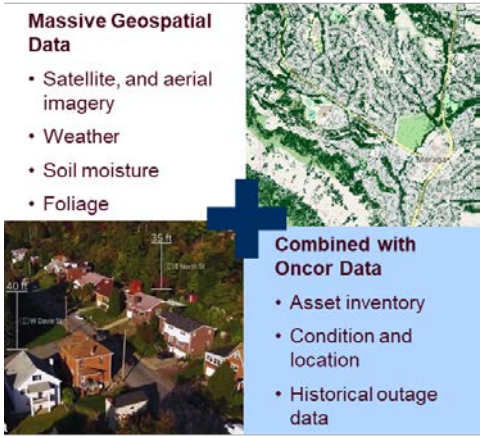
Equipment Failure Prediction:

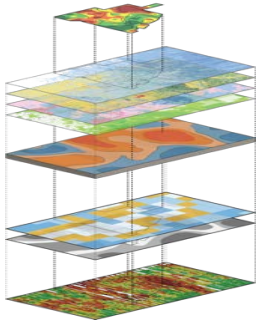
- Using meter data, in 2019, almost 2,000 power quality issues were detected before causing an outage. This avoided over 1,500 unplanned truck rolls per year.
- Using advanced regression algorithms and machine learning supported failure models, in 2019 the maintenance strategy team proactively identified 250 overloaded transformers and 349 transformers that had damaged coils (5,000 avoided outages).
- Using advanced statistical regression modeling, the maintenance strategy team has been able to accurately predict the failure probability of specific underground cable segments. This resulted in a 40% cable-related SAIDI improvement at unchanged CapEx funding levels.

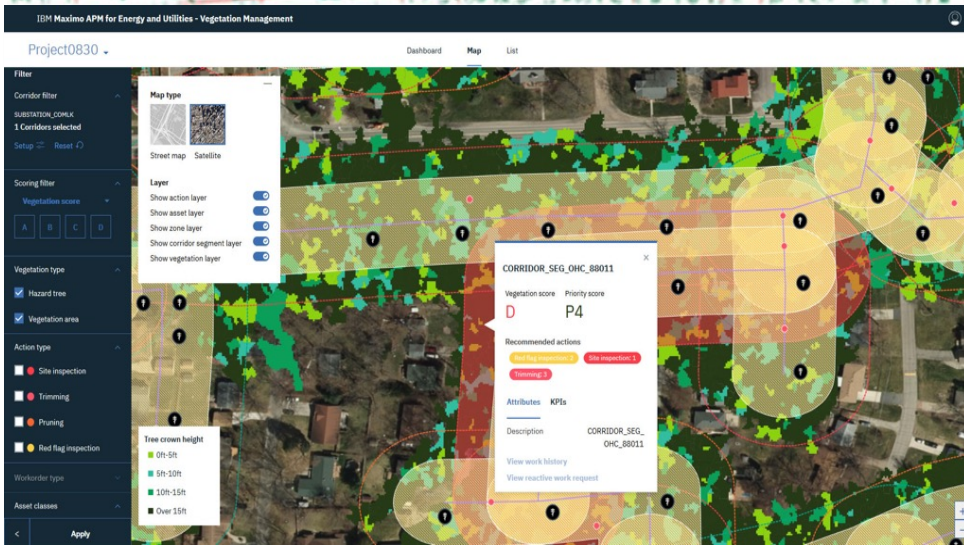
Key Benefits:

- Safety
- Avoided customer outages (SAIDI)
- Increased capital efficiency

Targeted Vegetation Management at Scale







- Depict current state of vegetation across all of Oncor's territory (137k miles) including tree heights and growth
- Identify critical priority zones due to proximity of vegetation to equipment
- Assess, prioritize, sort and filter by asset class, districts equipment types etc

How Does Oncor Build its Capacity to Be “SMART”

… but by investing in capabilities that *promote synergies*, *compounding effects* and *strategic options*

… focus on data management and self-service data availability at scale

… develop motivated grass-roots analytics communities

KEY ANALYTICS CAPABILITIES

PEOPLE

Cross-functional expertise is critical

Functional Ownership/Alignment

Data Science Training

SYSTEMS

Invest in central data management capabilities (Standardize data models)

Self-Service Analytics Platform

Focus on Open Source Technology & Synergies to Production Systems

PROCESS

Broad adoption of Agile and Design Thinking Methodologies

Expand data governance and data quality capabilities

Move from one-off use cases to standardized process approach

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Challenges, Obstacles & Research Opportunities

- Assessment of common AI algorithms and models for suitable application in the utility sector
- Remote-sensing data analytics and cross-technology tool sets (i.e. images, LIDAR, Infrared, SAR)
- Remote sensing data delivery process and “speed to action/decision”
- Data harmonization across various equipment types and vendors (i.e. time synchronization, scan rates, event responses)
- End-to-end data quality management (i.e. chattering RTUs, failed replication/transformation processes…)
- Library of failure mode signatures (i.e. connectivity errors, faults, equipment failures)
- Data ingestion approaches and utilization of GPUs (large scale data processing)
- Resource prioritization and sharing (within and across utilities)
- Lack of utility-specific, open-source code sharing communities and education

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QUESTIONS?