

EE362G Smart Grids: Austin Energy Smart Grids – Part 1

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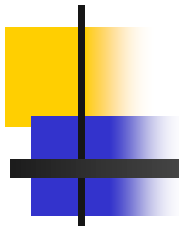
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Spring 2019



Presentation Outline



Note: “Grid Modernization” is the process of implementing “Smart Grid”

- About Austin Energy
- Grid Modernization and Safety
- What is Driving Grid Modernization
- What is Grid Modernization
- Austin Energy’s Power Delivery System
- What is Austin Energy’s Strategy
- What Austin Energy is Doing to Modernize the Grid
- Advanced Metering Infrastructure (AMI)
- History of AMI at Austin Energy
- Grid Automation

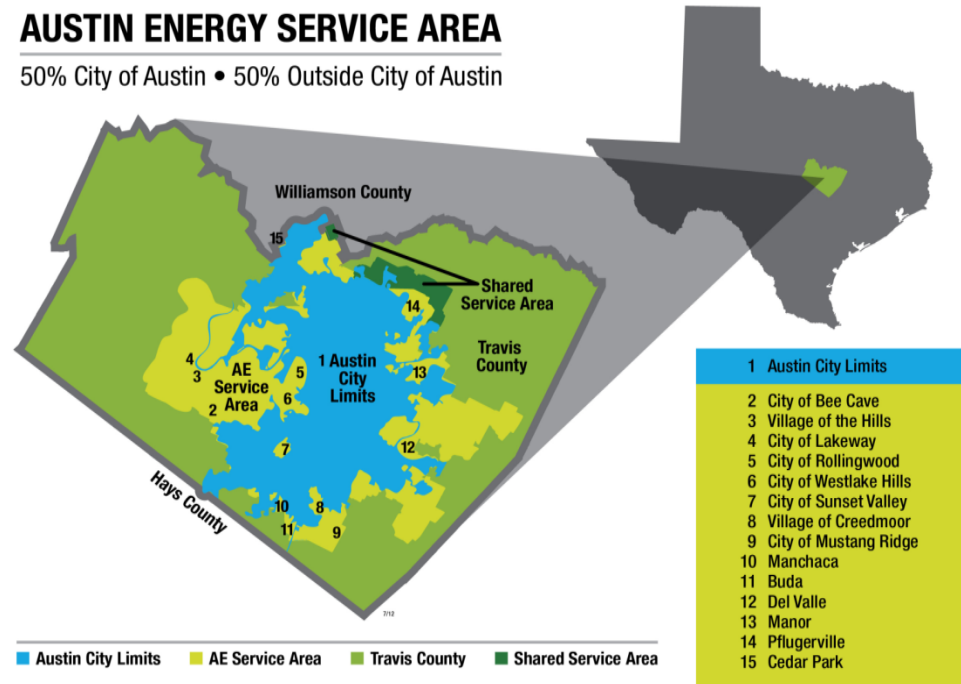
About Austin Energy

- 8th largest community-owned electric utility
- Reports to the City Manager who executes the policy and direction of the City Council
- 437 square miles of service area covering City of Austin and beyond
- Vertically-integrated in a deregulated whole-sale energy only market
- Annual budget \$1.5B
- System peak load
 - 2755 MW (summer)
 - 2377 MW (winter)
- 480,000+ meters (65,000+ C&I)
- 1700+ Employees



AUSTIN ENERGY SERVICE AREA

50% City of Austin • 50% Outside City of Austin



Austin Energy's Mission, Vision, Focus

Mission:

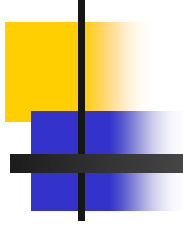
To safely deliver clean, affordable, reliable energy and excellent customer service

Vision:

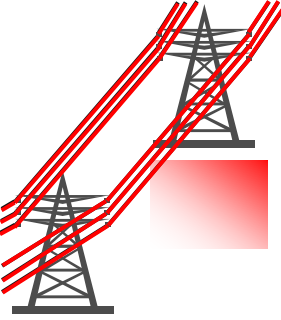
Drive customer value in energy services with innovative technology and environmental leadership

*Customer Driven.
Community Focused.*





How Does Grid Modernization Affect Safety?



Grid Modernization Impacts Safety By ...

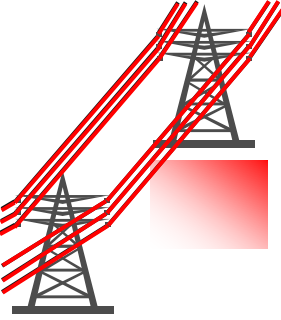


Remote communication and control of T&D assets



Means reduced truck rolls

Reduced exposure

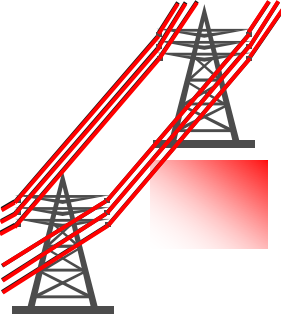


Grid Modernization Impacts Safety By ...



Making Network Vaults Safer for Employees to Work in



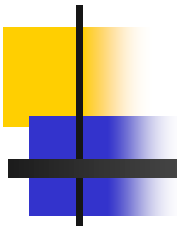
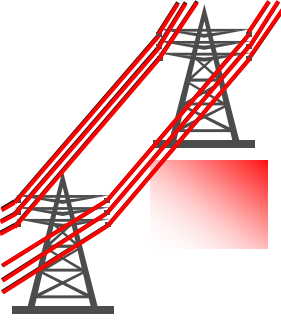


Grid Modernization Impacts Safety By ...

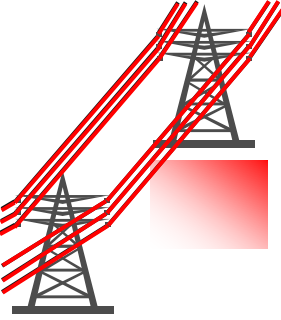


Remotely Inspecting our Infrastructure



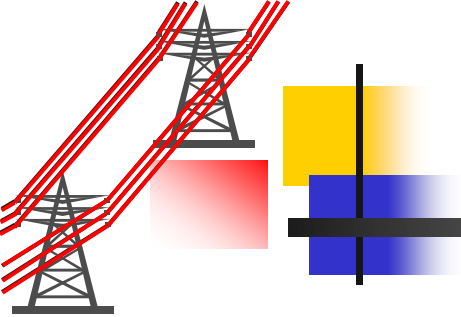


What's Driving Grid Modernization?



The World is Changing

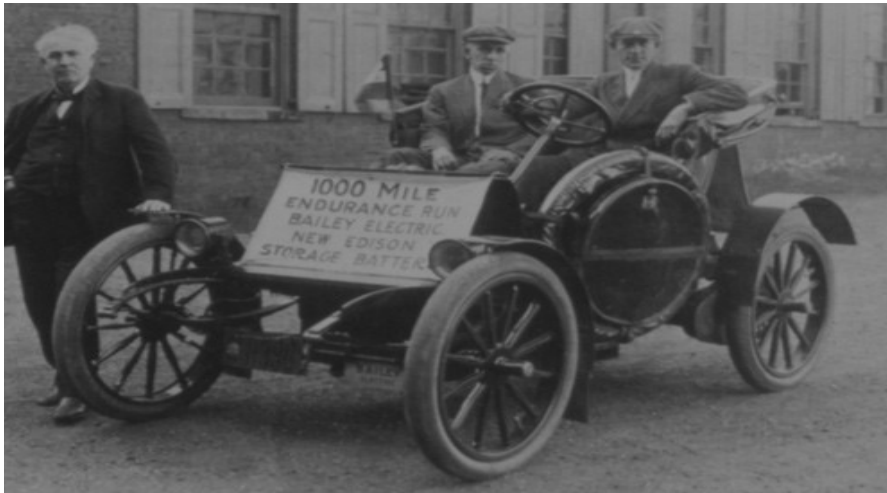




Back to the Future

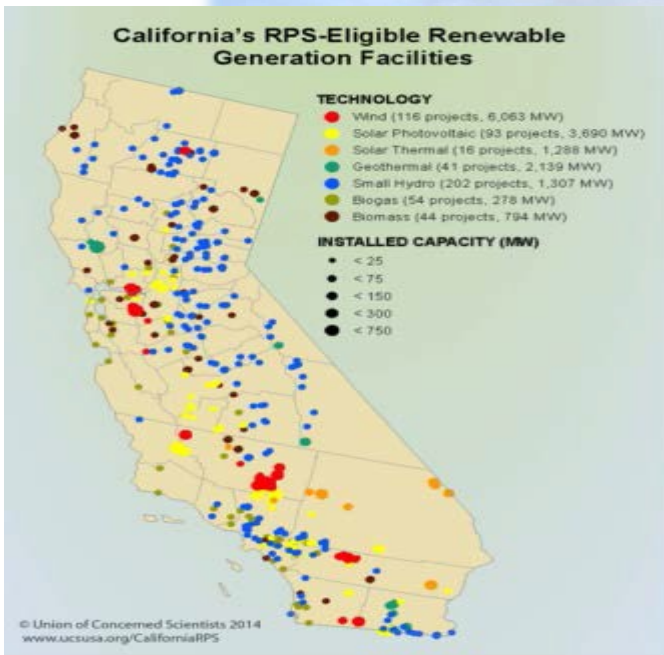
38% of all vehicles are electric vehicles
... in 1917!

*We will not stop until every car on
the road is electric*
- Elon Musk, CEO of Tesla Motors



California and New York

California Governor Brown signs 50% renewable portfolio standard into law



Reforming the Energy Vision **REV**

REV GOALS

- Making energy more affordable for all New Yorkers
- Building a more resilient energy system
- Empowering New Yorkers to make more informed energy choices
- Creating new jobs and business opportunities
- Improving our existing initiatives and infrastructure
- Supporting cleaner transportation
- Cutting greenhouse gas emissions 80% by 2050
- Protecting New York's natural resources
- Helping clean energy innovation grow

REV is a strategy to build a clean, resilient, and affordable energy system for all New Yorkers.

REV is transforming New York State's energy policy and initiatives to make sure energy efficiency and clean, locally produced power are at the core of the State's energy system.

REV is changing the way government and utilities work to make clean energy financially beneficial to everyone. And most importantly, REV is putting customers first by designing new initiatives to impact real people and provide individuals and communities with the opportunity to take an active role in achieving the following State energy goals by 2030.

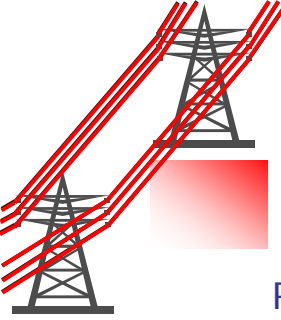
40% Reduction in GHG emissions from 1990 levels
Reducing greenhouse gas (GHG) emissions from the energy sector—power generation, industry, buildings, and transportation—is critical to protecting the health and welfare of New Yorkers and reaching the longer term goal of decreasing total carbon emissions 80% by 2050.

50% Generation of electricity must come from renewable energy sources
Through Governor Cuomo's aggressive Clean Energy Standard commitment, renewable energy sources, including solar, wind, hydropower, and biomass, will play a vital role in reducing electricity price volatility and curbing carbon emissions.

23% Decrease in energy consumption in buildings from 2012 levels
Energy efficiency results in lower energy bills and is the single most cost-effective tool in achieving New York's greenhouse gas reduction objectives. A 23% decrease from 2012 levels is equivalent to 600 trillion British thermal units (Btu) of energy efficiency gains. That's equal to more energy than all New York State homes use in six months.

ny.gov/REV4NY

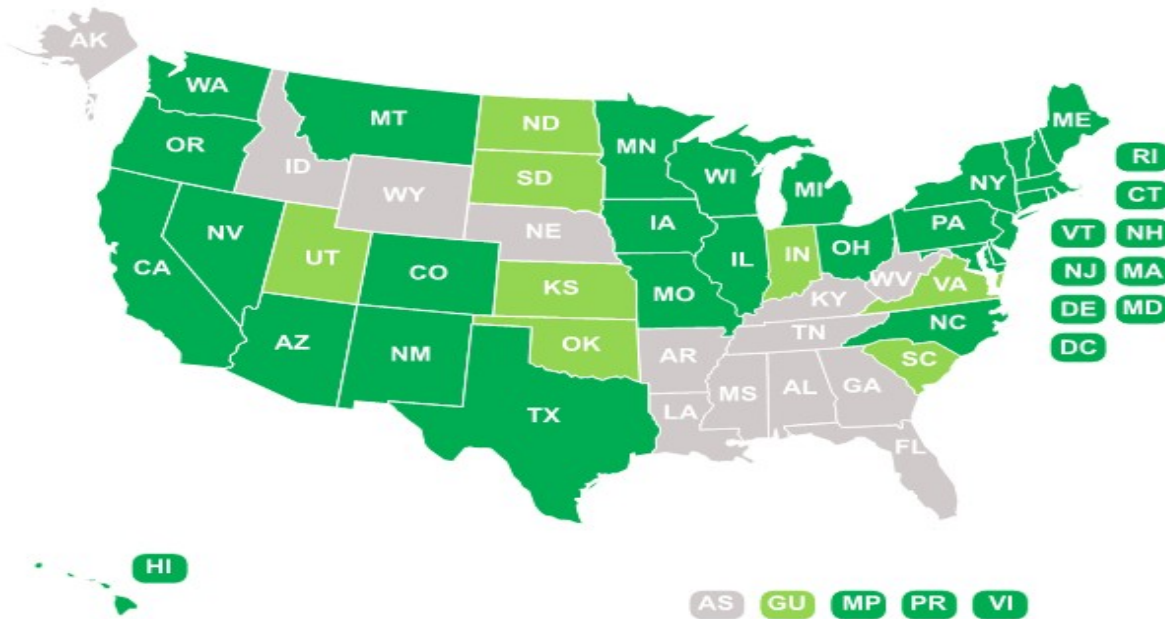
NEW YORK STATE OF OPPORTUNITY Reforming the Energy Vision

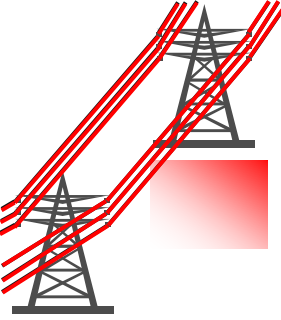


Current Renewable Portfolio Standards (RPS) US Map

RPS is a regulation that requires the increase in production of energy from renewable energy sources.

States and territories with Renewable Portfolio Standards	States and territories with a voluntary renewable energy standard or target	States and territories with no standard or target
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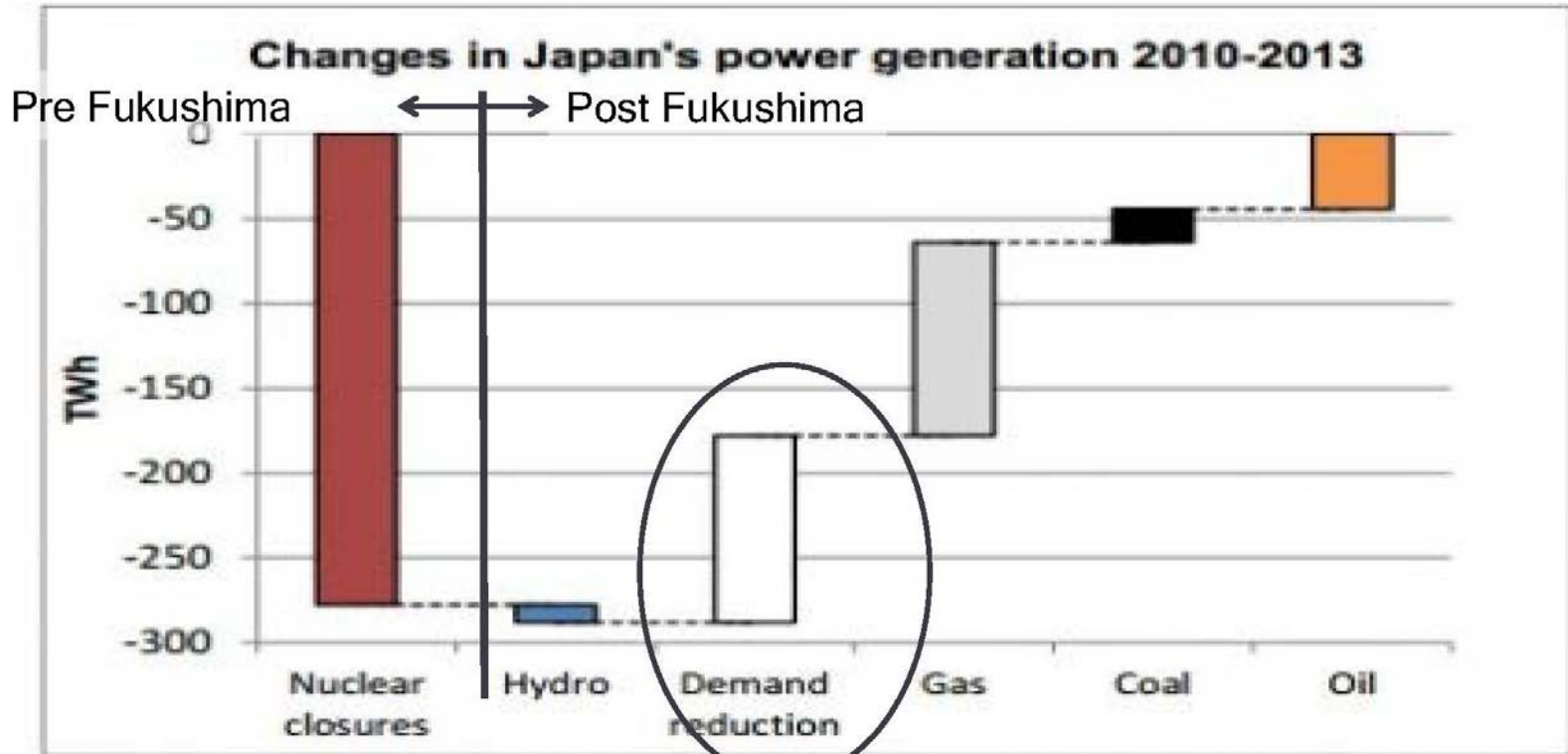




Do You Recognize This Picture?



Silver Lining of a Post Fukushima Grid

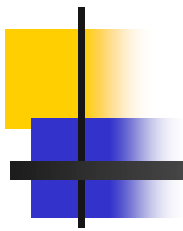


Source: calculated from Japan's official monthly power generation statistics².

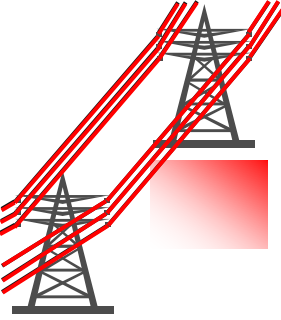


What About Us?





What Exactly Is Grid Modernization?



Structure of the Grid



Generation – Power Plant



Substation



Transmission System

Distribution System



Customer

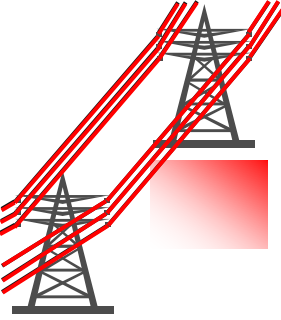


AE's Power Delivery System Today

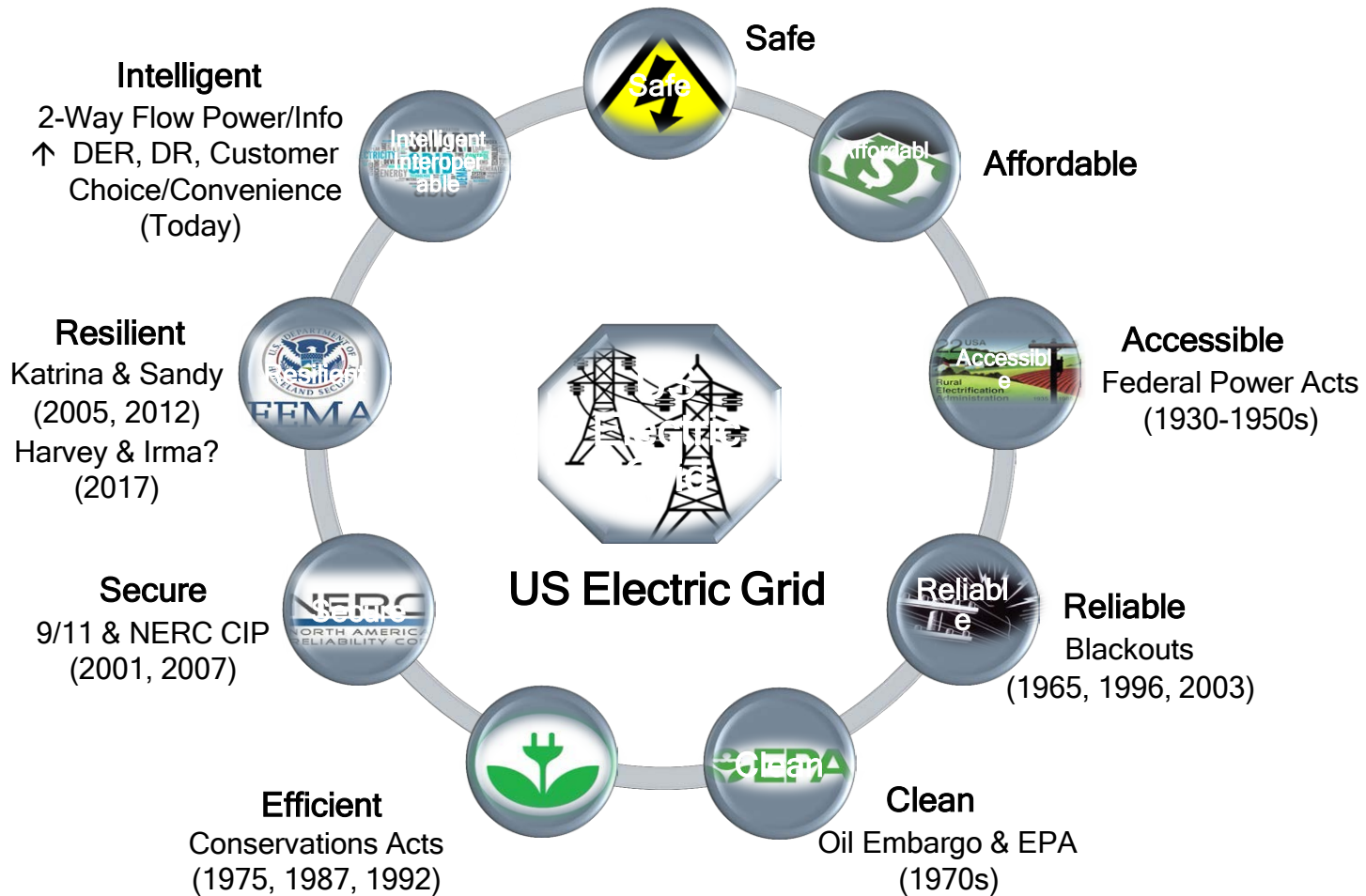
POWER DELIVERY SYSTEM

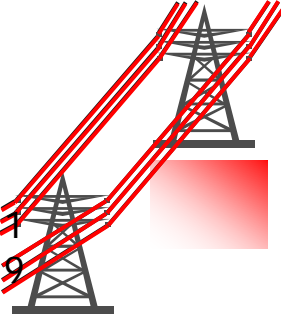


- ERCOT Market
- ~ 72,000 MWs generation
 - 4,834 MWs Austin Energy owned and contracted generation
- 623 miles of Transmission Lines
- 75 Substations
- 4,938 miles Overhead Distribution Lines
- 6,652 miles Underground Distribution Lines
- 80,000 Distribution Transformers
- 180,000 Distribution Poles
- 2 Community Solar Farms
- 2 Energy Storage Systems (Shines Project)
- 30 MW Local Solar
- 480,000 Customers
- 10,000 Solar Generating Customers
 - 380,122 homes
 - 926,426 people
 - 596 schools, hospitals
 - 23 police, fire stations
 - 56,879 of businesses



Grid Modernization Evolution





AE Grid Modernization Strategic Goal



STRATEGIC GOALS

FINANCIAL HEALTH

Long-term financial resiliency that ensures cost recovery, provides market competitiveness, delivers operational excellence and creates value for customers and the Austin community.

CUSTOMER COLLABORATION

New heights in customer satisfaction through increased collaboration, varied and high-quality services, programs, and delivery methods and competitive pricing that strengthen customer loyalty.

GRID MODERNIZATION

Innovative two-way grid utilizing customer and company infrastructure to deliver superior reliability and customer experience at the lowest reasonable cost.

EMPLOYEE ENGAGEMENT

Employees are safe, healthy and engaged and equipped with tools and training to effectively perform their work.

BUSINESS EXCELLENCE

Best Managed Utility culture where customer needs are thoroughly and efficiently achieved through optimal use of resources.

ENVIRONMENT

Minimized environmental footprint throughout Austin Energy's value chain.

VISION: Drive customer value in energy services with innovative technology and environmental leadership.

Goal: Innovative **two-way grid** utilizing customer and company infrastructure to deliver **superior reliability** and **customer experience** at the **lowest reasonable cost**.

Measure: Achieve top decile T & D reliability indices (SATLPI, SAIDI, SAIFI, CAIDI) and above average JD Power customer satisfaction index for residential and commercial customers

Current State: Top quartile reliability indices; Bottom quartile customer satisfaction index

Opportunities/Challenges: Resources (personnel/knowledge/funding), Analytics, Solution Selection



AE Grid Modernization Strategy



Austin Energy Strategic Goals



Grid Modernization



Advanced Metering Infrastructure



Grid Automation



Distributed Energy Resource Integration



Asset Management

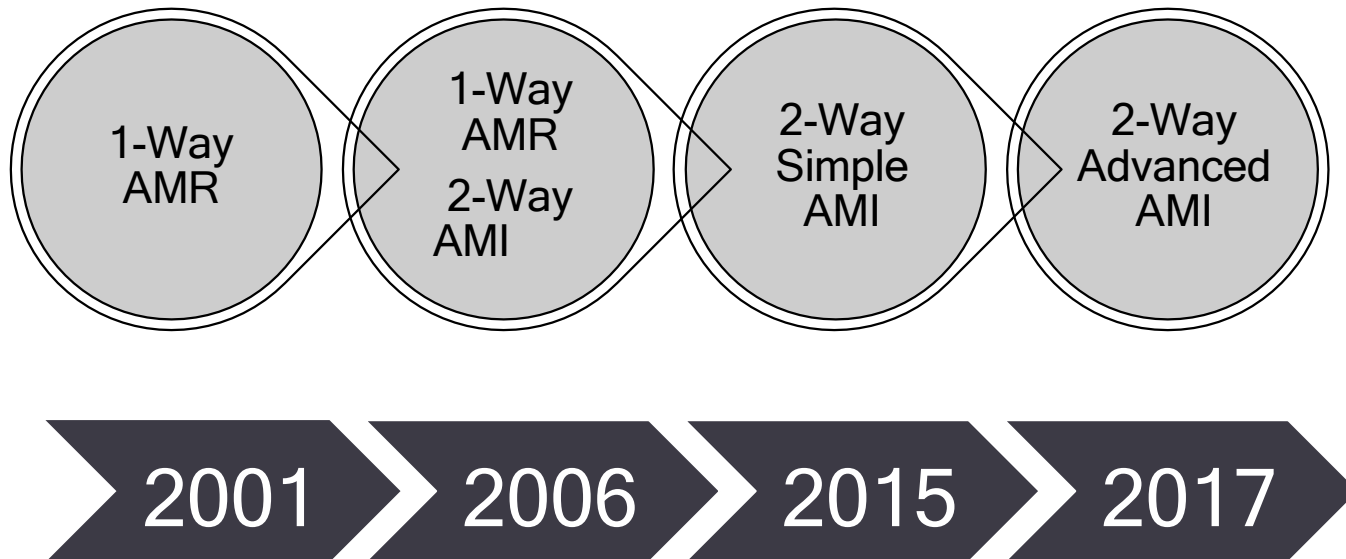


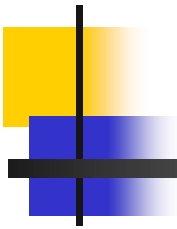
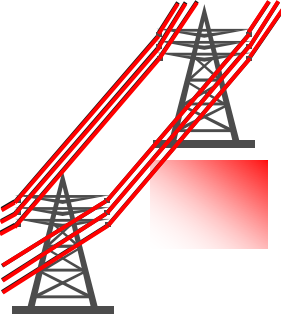
Advanced Metering Infrastructure (AMI)



History of AMI at Austin Energy

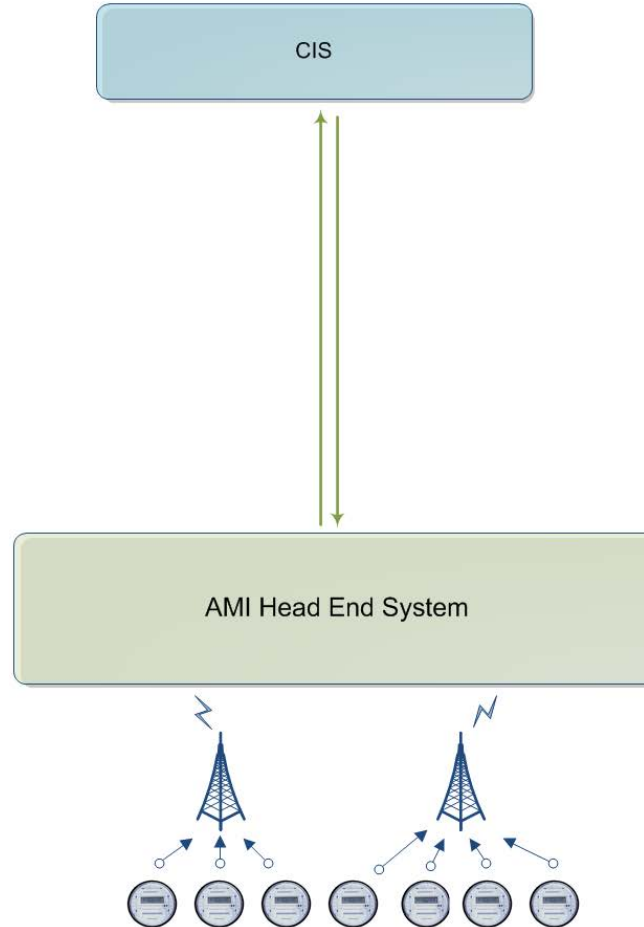
AMR (Automatic Meter Reading) definition: an older technology (emerged in 80's and 90's) to collect basic meter reading data



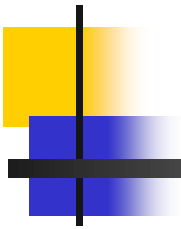
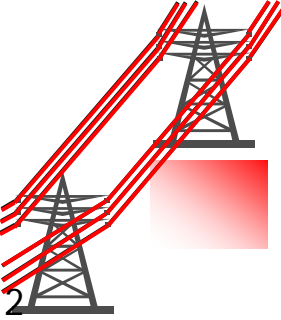


AMI in 2013

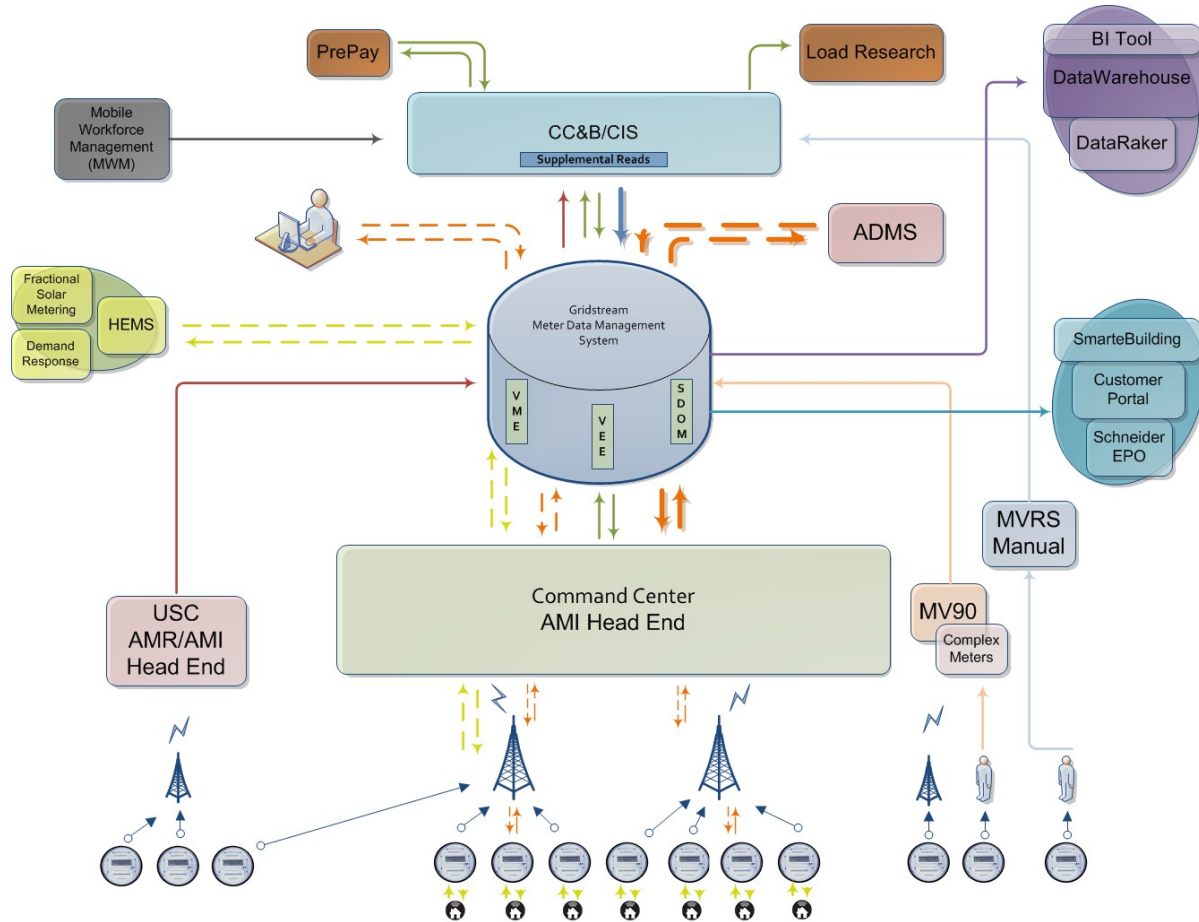
A **Head End System** is hardware and software that receives the stream of meter data brought back to the utility through the AMI. Head End Systems may perform a limited amount of data validation before either making the data available for other systems to request or pushing the data out to other systems.

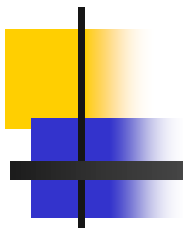


AMI in 2018



6





AMI Data Flood



2013

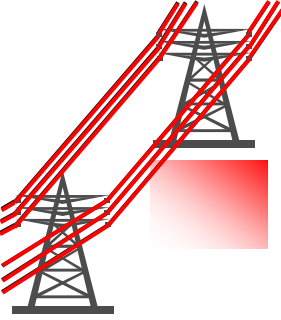


Daily Reads = 1/day
Alarms/Events/Flags = 4

2018



Daily Reads = 1/day Interval
Reads = 96/Day
Alarms/Events/Flags = 137 - 600



Commercial & Residential Meter Upgrades



Commercial Meter Replacement Project

- 48,000 GE and Elster meters to be exchanged
- Planned completion FY 2019
- 30% complete
- Installation contractor

Residential Meter Replacement Project

- 245,000 residential meters to be exchanged
- Planned completion FY 2022
- 10% complete
- Revenue Measurement and Control



Head End System Upgrade

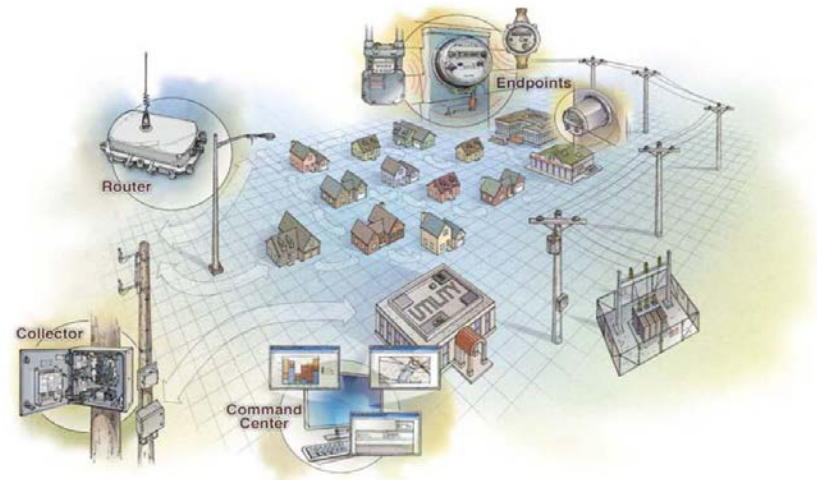
Remote Connect/Disconnect

ADMS Integrations

- Instantaneous voltage underway
- Automated outage/restoration events to MDMS>ADMS
- On Demand voltage requests from ADMS

Other Initiatives

- Thermostat and Home Energy Management System (HEMS) ZigBee integration proof of concept
- Proposed pilot of IP based metering communication protocol



Meter Data Management System Upgrade

Phase II Upgrade

- Upgrade to Version 4.0
- Planned completion Q1 FY 2020

Integration testing and reporting

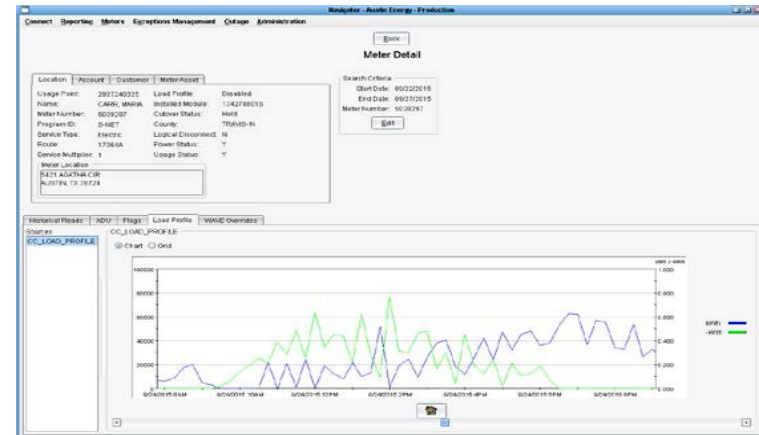
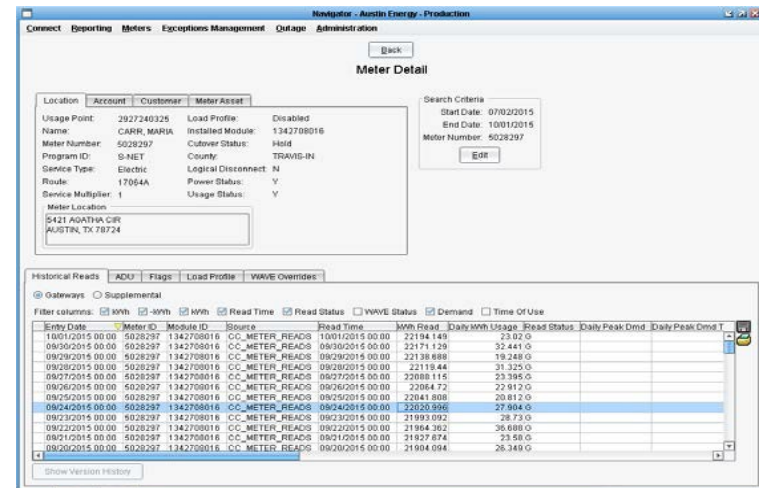
- All business unit needs (metering, rates, billing, field operations, CC&B vendor transition)

ADMS Integrations

- Automated outage/restoration events to ADMS
- On Demand Voltage requests from ADMS
- Monthly and Annual load profile data for all AMI reporting meters to support load flow estimates in ADMS

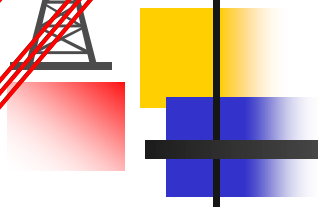
Totalized and Fractional Metering

- Using MDMS Virtual Metering Engine

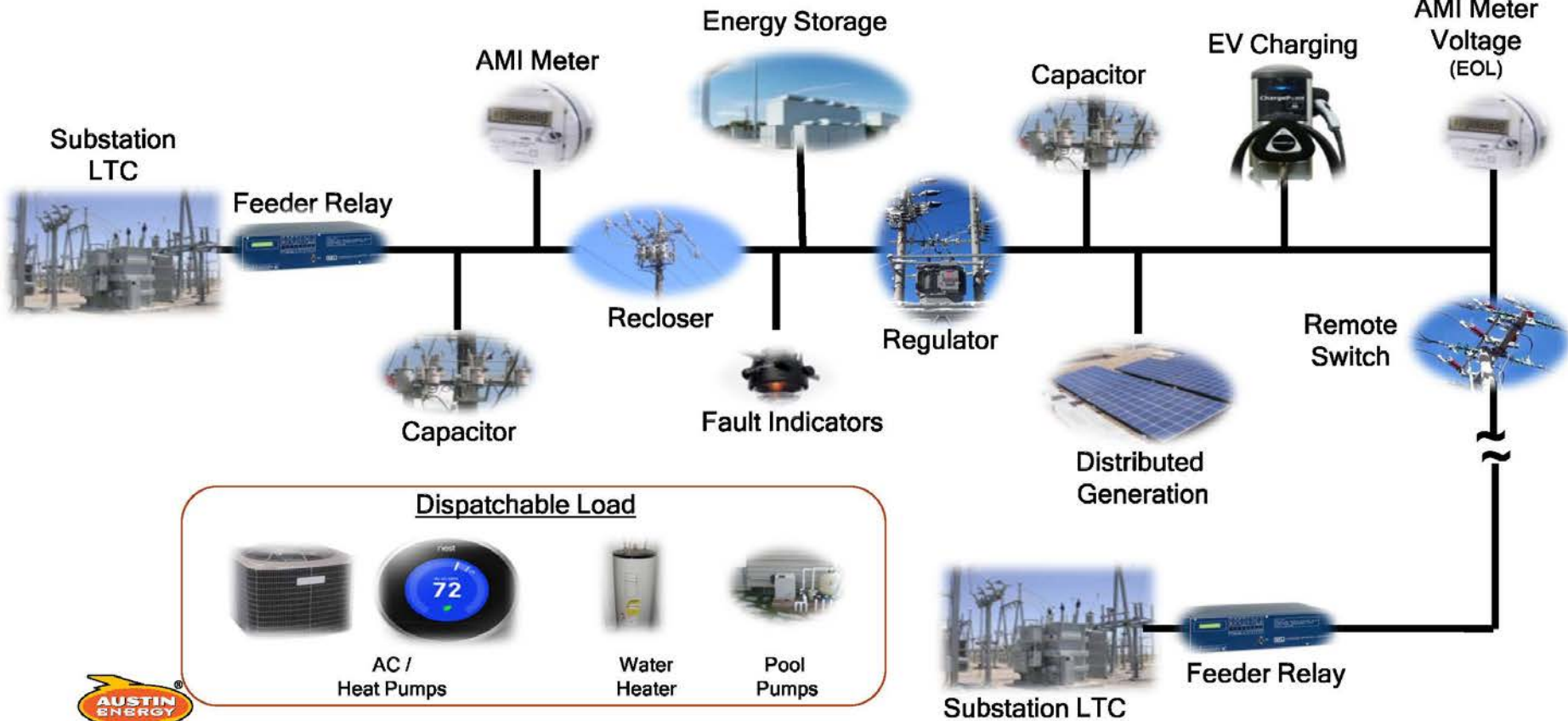
The screenshot shows the 'Meter Detail' window for meter number 5028297, displaying a table of 'Historical Reads'. The table has columns for Entry Date, Meter ID, Module ID, Source, Read Time, Read Status, Demand, Time of Use, Read Status, Daily MWh Usage, Read Status, Daily Peak Dmd, and Daily Peak Dmd T. The table contains multiple rows of data representing meter readings over time.

Entry Date	Meter ID	Module ID	Source	Read Time	Read Status	Demand	Time of Use	Read Status	Daily MWh Usage	Read Status	Daily Peak Dmd	Daily Peak Dmd T
10/01/2015 00:00	5028297	1342708016	CC_METER_READS	10/01/2015 00:00		22194.149			23.02 G			
09/30/2015 00:00	5028297	1342708016	CC_METER_READS	09/30/2015 00:00		22171.129			32.441 G			
09/29/2015 00:00	5028297	1342708016	CC_METER_READS	09/29/2015 00:00		22139.888			19.248 G			
09/28/2015 00:00	5028297	1342708016	CC_METER_READS	09/28/2015 00:00		22119.44			31.325 G			
09/27/2015 00:00	5028297	1342708016	CC_METER_READS	09/27/2015 00:00		22088.115			23.345 G			
09/26/2015 00:00	5028297	1342708016	CC_METER_READS	09/26/2015 00:00		22064.172			22.912 G			
09/25/2015 00:00	5028297	1342708016	CC_METER_READS	09/25/2015 00:00		22041.808			20.812 G			
09/24/2015 00:00	5028297	1342708016	CC_METER_READS	09/24/2015 00:00		22020.996			27.904 G			
09/23/2015 00:00	5028297	1342708016	CC_METER_READS	09/23/2015 00:00		21993.092			28.73 G			
09/22/2015 00:00	5028297	1342708016	CC_METER_READS	09/22/2015 00:00		21964.362			36.688 G			
09/21/2015 00:00	5028297	1342708016	CC_METER_READS	09/21/2015 00:00		21937.874			23.58 G			
09/20/2015 00:00	5028297	1342708016	CC_METER_READS	09/20/2015 00:00		21904.094			26.349 G			



Grid Automation

Grid Modernization – Today's Distribution System



LTC: Load Tap Changer

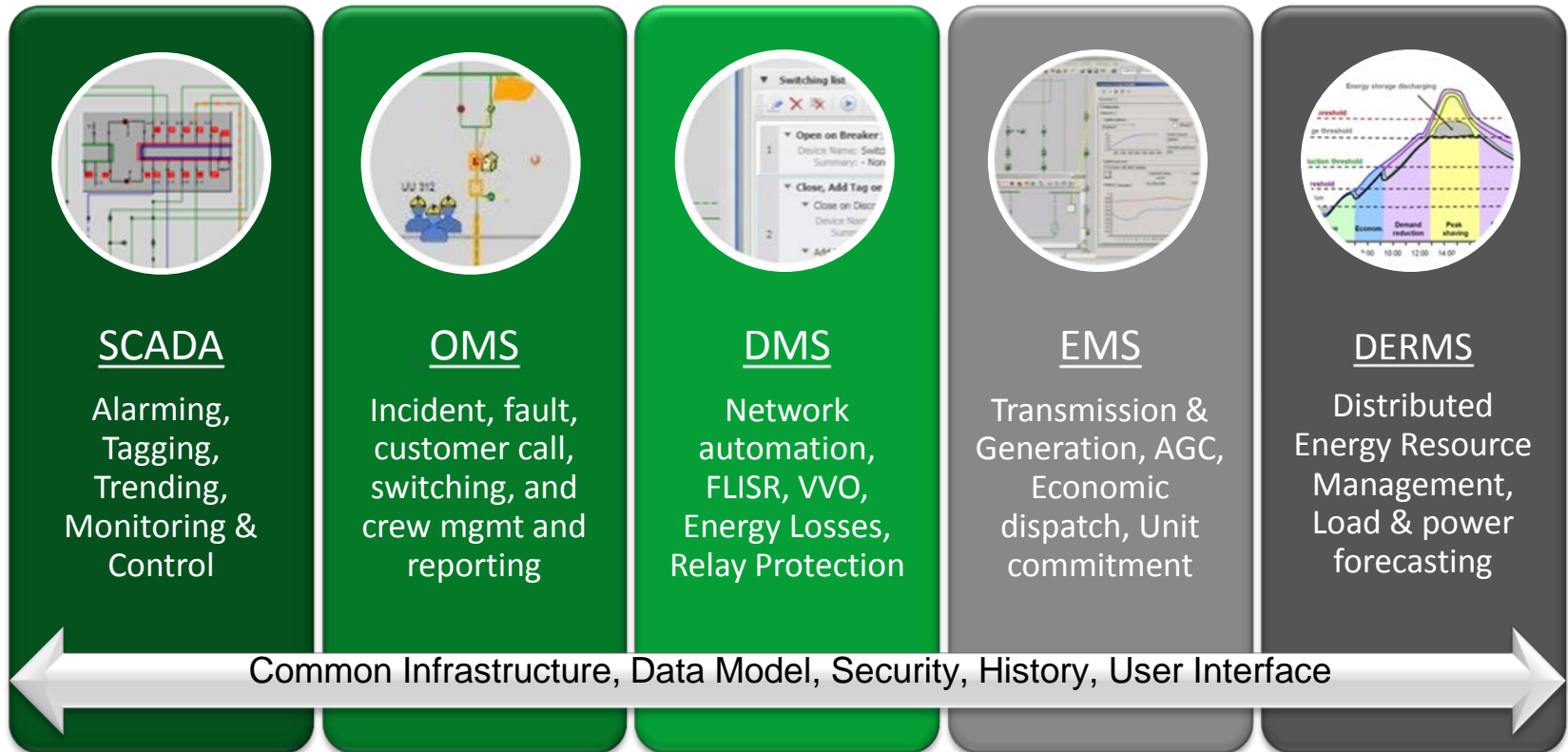
EOL: End-of-line

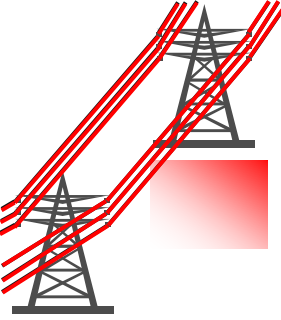
Recloser: Automatic circuit recloser

Advanced Distribution Management System (ADMS) Platform

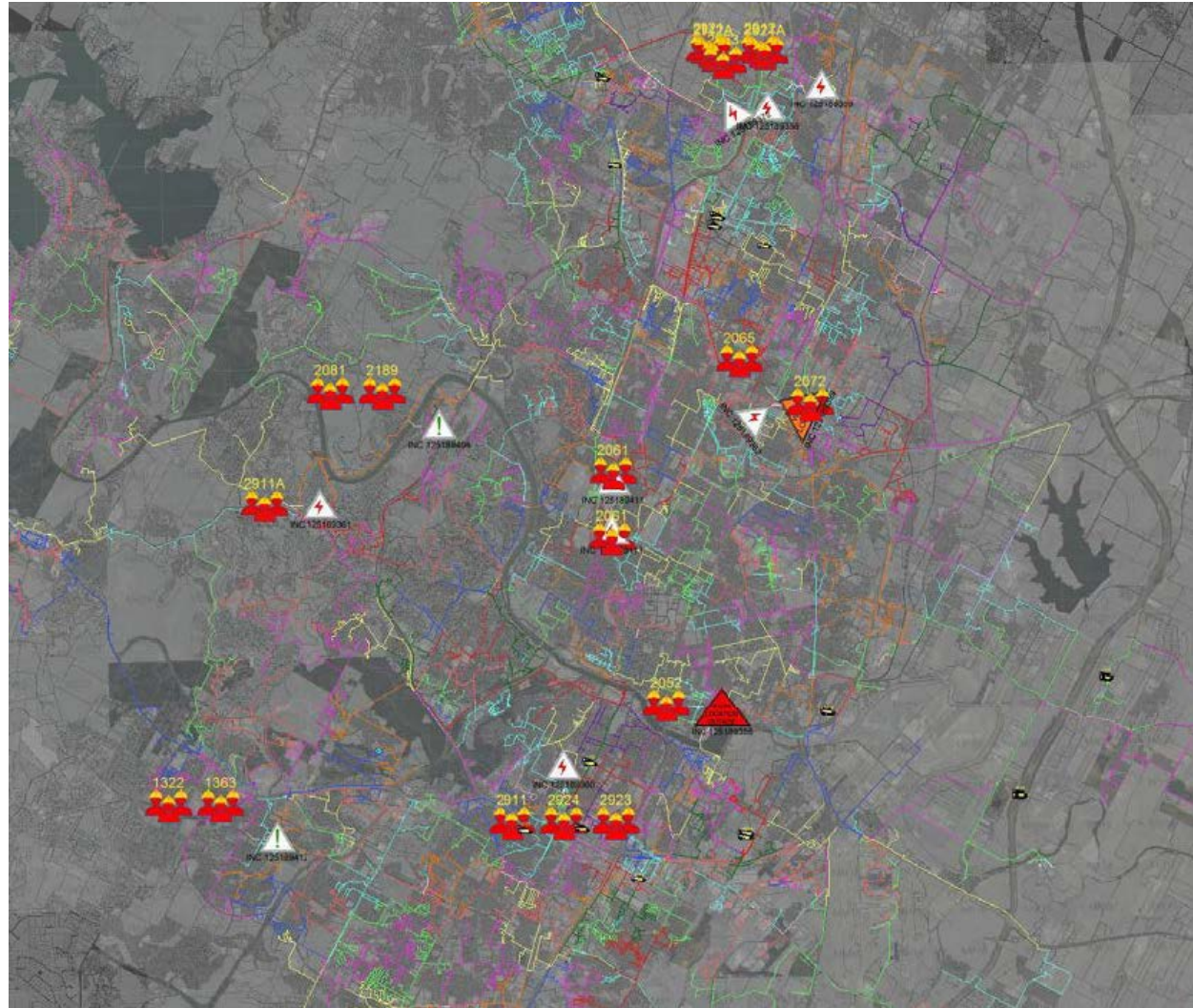


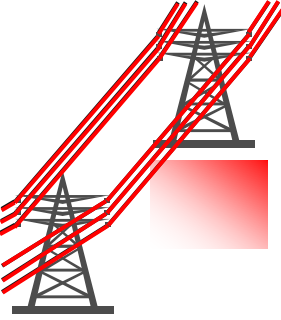
ADMS is a *comprehensive network management solution* with monitoring, analysis, control, optimization, planning and training tools sharing a common infrastructure, data model, and user experience





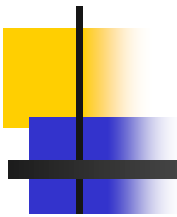
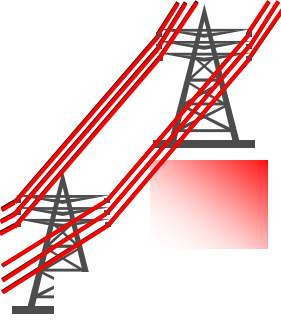
Grid Automation- ADMS



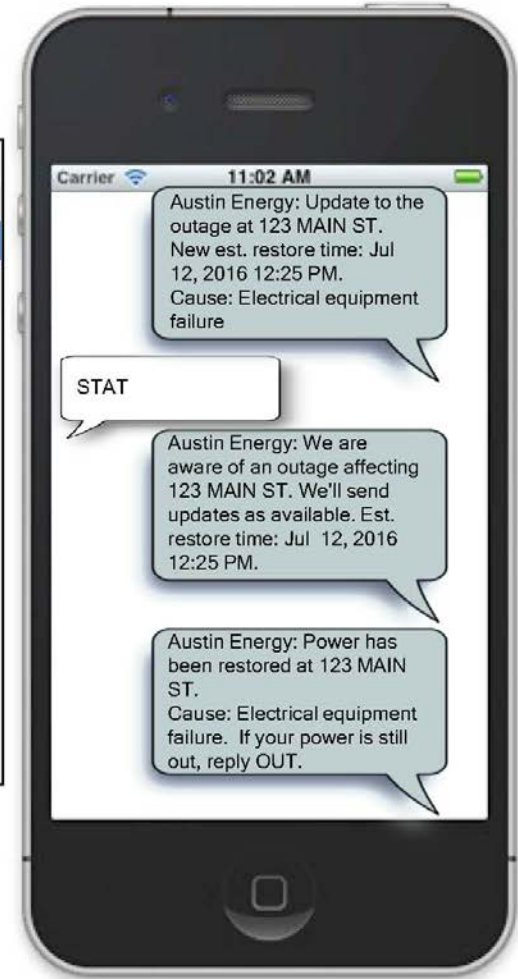
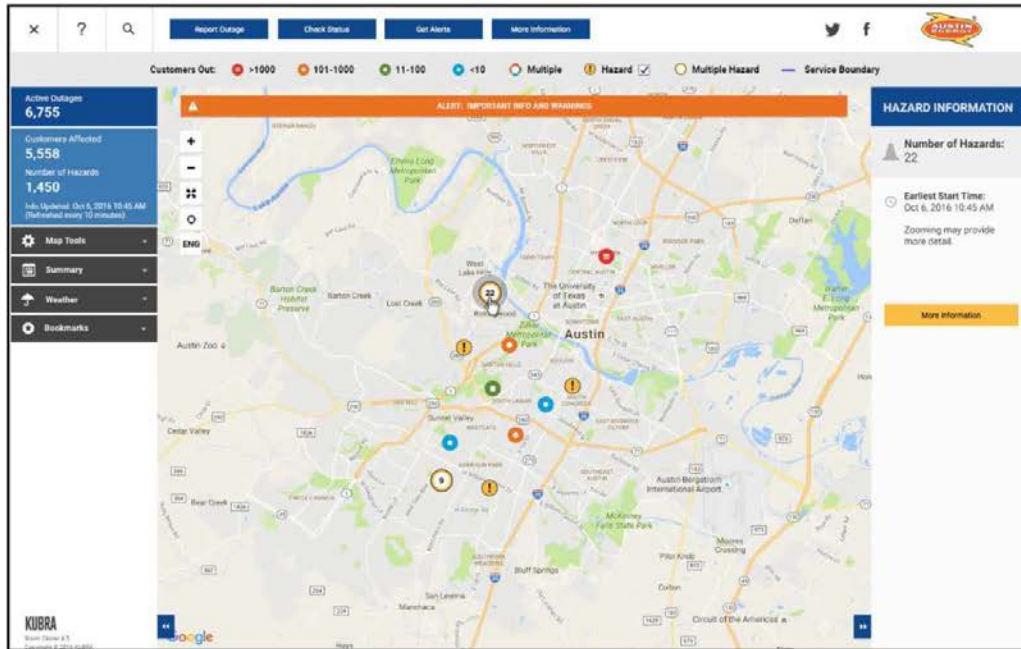


Grid Automation Roadmap





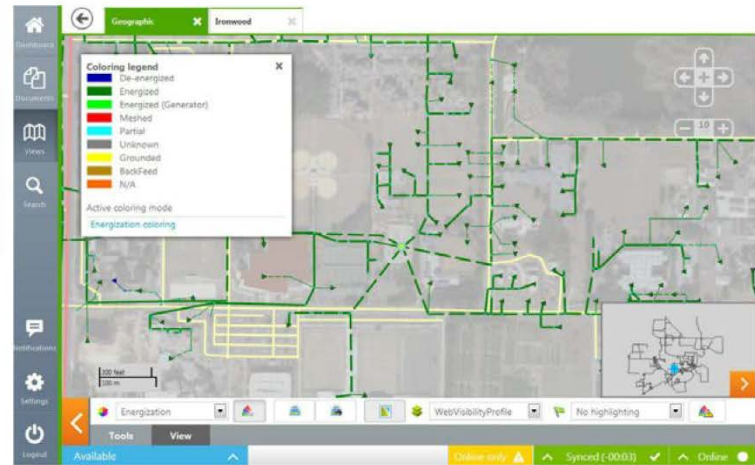
Customer Outage Communication

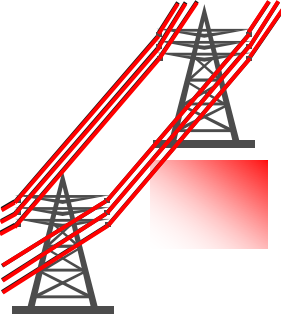


Mobile Workforce Accessibility



Taking the ADMS, OMS, and Work Order Management to the Field





Homework – Due March 7



1. What is the difference between Smart Grid and Grid Modernization? Hint: Use the Department of Energy's websites material to describe the difference.
2. What are the drivers for Austin Energy's Grid Modernization?
3. What is an ADMS?
4. What are the most important characteristics of Smart Grid?
5. Considering the increase in the AMI data flow from 2013 to 2018 at Austin Energy, calculate the percent increase in the needed communication bandwidth. Assume 4 bytes for reading number and 1 bit for Alarm/Event/Flag.
6. Do you have any suggestions for Austin Energy for Smart Grid implementation?