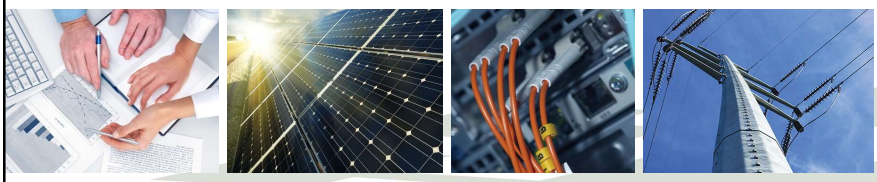

Advanced Meter Reading Infrastructure (AMI)

Opponents and Proponents

Forward-Thinking Professionals
Helping Clients and Colleagues **ACHIEVE** Their **Goals.**

www.powersystem.org

Tom Asp and Kyle Kopczyk
May 2023

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About the Presenter

Tom Asp
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Mr. Asp earned a BS degree in Electrical Engineering from North Dakota State University and an MBA from the University of St. Thomas - St. Paul, MN. He has more than 40 years of experience in communication planning and business development for electric cooperative and public power systems and is recognized as a nationwide expert in evaluating and offering recommendations regarding electric utility broadband communications systems.

Tom has been actively involved with AMI, market research, network feasibility analysis, broadband system design, and the preparation of financial statements and quantitative business plan analysis for electric cooperative, municipal, and public power clients for more 20 years.

He also has extensive experience presenting to utility leadership, conducting needs assessment interviews, and facilitating stakeholder sessions.

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Agenda

1. Review differences between analog meters and AMI meters
2. AMI Summary
3. Review of material and information related to AMI concerns:
   - Health effects of radio frequency (RF) emissions
   - Safety of meters (house fires and other)
   - Privacy violations –meters monitoring and reporting activities in household
   - Electric grid security compromised with AMI (grid shutdowns, terrorist activity, other)
   - Increased costs to consumers by deployment of AMI
4. AMI Use Cases

What is Difference Between an Analog Meter and a Solid-State Meter?

- Analog meters are electro-mechanical meters that were used for decades by electric utilities
  - Analog meters are no longer in production, for example Aclara (GE meters) stopped production in 2005 - it's been around 20 years since Niles last acquired an analog meter
  - Analog meters were left in field for decades (up to a 30-year depreciation), but required regular maintenance and recalibration to maintain accuracy
    - Process was expensive as it required regular exchange of meters
    - If not recalibrated, meter would understate consumption (record slow)
      - Overtime, meter continues to slow down – has an appearance of working but do not meet required accuracy
  - Except for some panel based polyphase meters, analog meters did not have UL approval
  - Analog meters highly suspectable to tampering – for example
    - Magnets slow dial rotation
    - Turn meter upside down, meter runs backwards
    - Jam dial, stops recording

What is Difference Between an Analog Meter and a Solid-State Meter?

- Analog meters replaced with Solid-State meters
  - Solid-state meters do not require recalibration over time
  - Single-phase solid-state meters carry UL approval
  - Solid-state meters typically depreciated over 13 to 15 years
  - In Niles today, approximately over 95 percent of all electric meters are solid-state
- A "Smart-Meter" is a Solid-State meter with a communication module
  - Offers the ability for reporting alarms, not just consumption
    - Outages
    - Blinks
    - Tampering
    - Hot Sockets
    - Other

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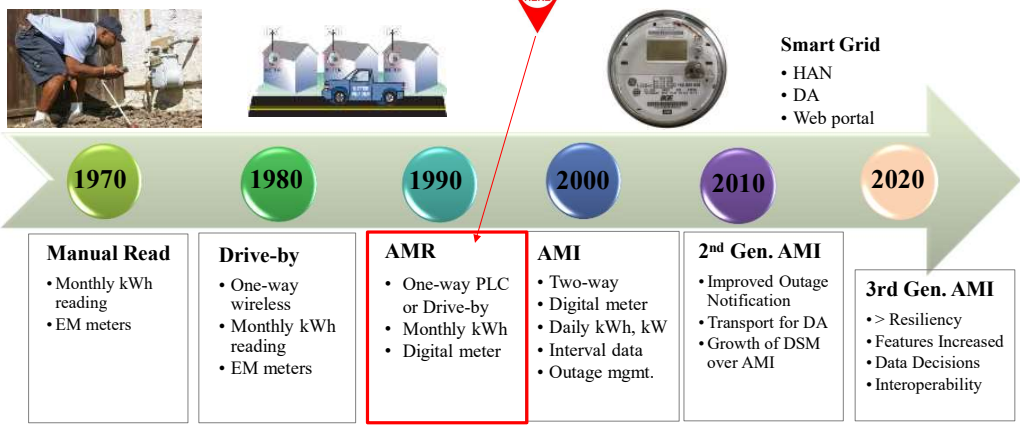
Meter Reading Technology Evolution



EM = Electro-mechanical
AMR = Automated Meter Reading
AMI = Advanced Metering Infrastructure

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What is AMI

- Advanced Metering Infrastructure (AMI): integrated system of electric and water meters, communications networks, and data management systems that enables two-way communication between utilities and consumers.
- Provides functionality not previously possible or had to be performed manually:
  - automatically and remotely measure electricity use
  - connect and disconnect service
  - detect tampering
  - identify and isolate outages
  - monitor voltage

AMI is a growing component of the energy system because it allows an understanding of how energy is generated and transmitted to customers. Utilities can improve parts of the energy system based on their findings using AMI data that they have collected and analyzed.

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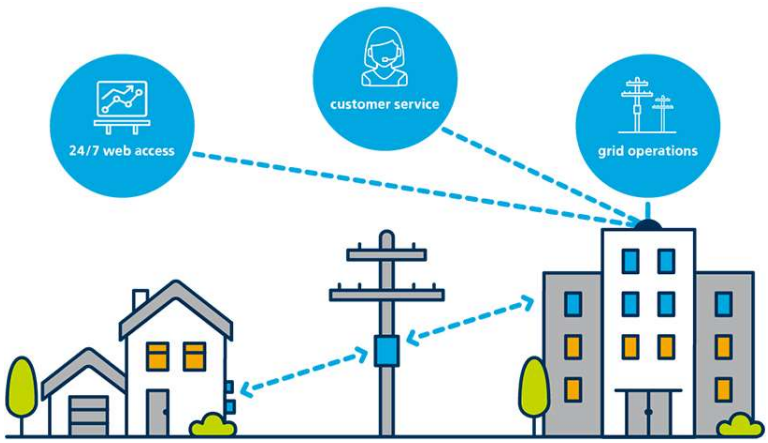
What Data Does AMI Collect?

- Cumulative kWh usage
- Daily kWh usage
- Peak kW demand
- Last interval demand
- Load profile
- Voltage
- Voltage profile
- Logs of voltage sag and swell events
- Voltage event flags
- Phase information
- Outage counts
- Outage logs
- Tamper notification
- Power factor
- Time-of-Use kWh and Peak kW readings



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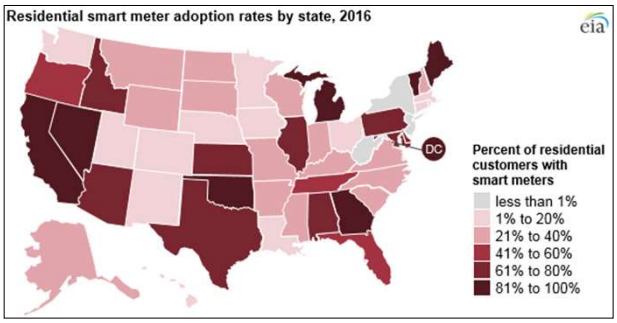
How Many AMI Meters are Installed in the US, and Who Has Them?

- In 2021, U.S. electric utilities had about 111 million AMI installations, equal to about 69% of total electric meters installations.
- Includes meters that measure and record electricity usage at a minimum of hourly intervals and provide data to utility and customer at least once a day.



https://www.eia.gov/todayinenergy/detail.php?id=34012

Number and percentage share of AMI installations by sector, 2021[1]				
Residential	Commercial	Industrial	Transportation	Total
97,708,824 (69%)	12,930,423 (66%)	535,725 (63%)	1,786 (52%)	111,176,758 (69%)

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Opponent and Proponent Research

- Like any technology, health matter, safety, privacy, and other interests, there are multitudes of sites that offer pros and cons of AMI and associated meters
- Healthy skepticism is a good thing, no matter the source
- Anyone can publish anything on the internet. Do a SMART check:
  - Source: Where is this piece of info from? Relevance of the date and context of information.
  - Motive: What is their reason for publishing this? To inform, sell, convince?
  - Authority: Who created this? Check out their background and credentials.
  - Review: What are its main points? Are they all valid and credible?
  - Two-Source Test: How is it similar or different from other sources talking about the same topic? Does the author examine more than one perspective on the issue?

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Common Sites Used by Opponents

- Amy Myers MD - Smart Meter Dangers - Should You Be Concerned? | Amy Myers MD
- SYB - Shield Your Body
  - Smart Meter Dangers: Radiation 160x More Powerful Than Cellphones (shieldyourbody.com)
  - EMF & Nutrition: Which Foods & Supplements Help With EMF Exposure? (shieldyourbody.com)
- Radiation Health Risks - How Dangerous Are Smart Meters? (radiationhealthrisks.com)
- La Maison du 21e siècle, Quebec-based magazine – Smart Meters: Correcting the Gross Misinformation
  - Smart Meters: Correcting the Gross Misinformation - La Maison du 21e siècle - Le Magazine de la Maison Saine
- Physicians for Safe Technology - Physicians for Safe Technology | Smart Meter Radiation Health Effects (mdsafetech.org)
- Smart Meter Radiation - Smart Meter Radiation (wavewallcases.com)
- EMF Safety Networks - http://emfsafetynetwork.org/smart-meters/
- Stop Smart Meters - https://stopsmartmeters.org/why-stop-smart-meters/
- Smart Meter Dangers - http://smartmeterdangers.org
- Healthy Home Economist - https://www.thehealthyhomeeconomist.com/harvard-medical-doctor-warns-against-smart-meters/

Commons Sites Used by Proponents

- World Health Organization "Radiation: Electromagnetic fields": https://www.who.int/news-room/questions-and-answers/item/radiation-electromagnetic-fields
- National Council on Radiation Protection and Measurements (NCRP) - https://ncrponline.org/
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) - https://www.icnirp.org/
- Institute of Electrical and Electronics Engineers - International Committee on Electromagnetic Safety (IEEE-ICES)- https://www.ices-emfsafety.org/
- Public Utility Commission of Texas, Report on Health and RF EMF from Advanced Meters - https://www.house.mi.gov/sessiondocs/2013-2014/testimony/Committee237-12-2-2014-44.pdf
- EPRI Technical Report - Characterization of Radio Emissions from Advanced Metering Infrastructure Revenue Meters (Smart Meters) in CPS Energy Residential Installations (epri.com)
- Whatissmartgrid.org - Myths vs. Facts: The Truth about Smart Meters (whatissmartenergy.org)
- American Cancer Society - https://www.cancer.org/cancer/cancer-causes/radiation-exposure/smart-meters.html
- US Energy Information Administration - https://www.eia.gov/analysis/studies/electricity/
- Federal Communications Commission (FCC), Wireless Devices and Health Concerns - https://www.fcc.gov/sites/default/files/wireless_devices_and_health_concerns.pdf
- EUROPA, European Commission on Public Health - Electromagnetic Fields (europa.eu)
- Forbes: https://www.forbes.com/sites/oshadavidson/2011/02/01/the-truth-about-risks-benefits-of-the-smart-grid/#5748ead37a80

Common AMI Concerns from Opponents

1. Health Concerns from radio frequency transmission
   - Consumers getting bombarded with high intensity EMF (electromagnetic fields)
2. Privacy Violations
   - Utilities or others collecting and selling personal details for profit; arbitrary control of consumers' energy use
3. Security in jeopardy
   - Hackers, terrorists, criminals can see when you are home, on vacation, and at work using homemade devices intercepting signals from meters
   - Terrorists will be able to cause grid outages through consumer meters
4. Safety – meters cause fires and explosions
5. Costs – unfair to poorer communities and disadvantaged populations; job loss and increased costs

Health Concerns from Exposure to RF Emissions of AMI Meters

- Radio Frequency (RF) radiation is low-energy radiation; not enough energy to remove electrons from an atom or molecule (ionize), so called non-ionizing radiation.
  - Non-ionizing radiation has enough energy to move atoms in a molecule around or cause them to vibrate, which can lead to heat, but it can't damage DNA directly[2].
  - ~25,000 articles published over past 30 years on biological effects and medical applications of non-ionizing radiation. Despite feeling of some that more research is needed, scientific knowledge in this area is now more extensive than for most chemicals[3].
  - Scientists are investigating effects below threshold level for body heating as a result of long-term exposure. To date, no adverse health effects from low level, long-term exposure to radiofrequency or power frequency fields have been confirmed (scientists are actively continuing to research this area).
- AMI meters do not continuously transmit. Utilities typically read meters once every 15 minutes and time to transmit data is less than 1 second or ~ .011%[4] of the day. *(Even if transmits once every 15 seconds, would only be 6.7% of the day.)*
- The system Niles would install would transmit only once every 4 hours.

Not new in consumer market – debate continues with Wi-Fi and other wireless deployments

Health Concerns from Exposure to RF Emissions of AMI Meters

- Federal Communications Commission (FCC) adopted radio frequency (RF) exposure limits for public and workers
  - Actual RF emissions from AMI meters are a fraction of limit allowed.
  - AMI transmits at lower radio frequency power than baby monitor, cell phone, or garage door opener.
  - Radio frequency emissions from an AMI meter has been shown to be 125 to 1,250 times below that of a cell phone.
- Non-government research and standards agencies such as American National Standards Institute (ANSI), Institute of Electrical and Electronics Engineers, Inc. (IEEE), and National Council on Radiation Protection and Measurements (NCRP), compiled research associated with human exposure of RF energy and created guidelines that FCC and federal Occupational Safety and Health Administration (OSHA) have adopted[5].

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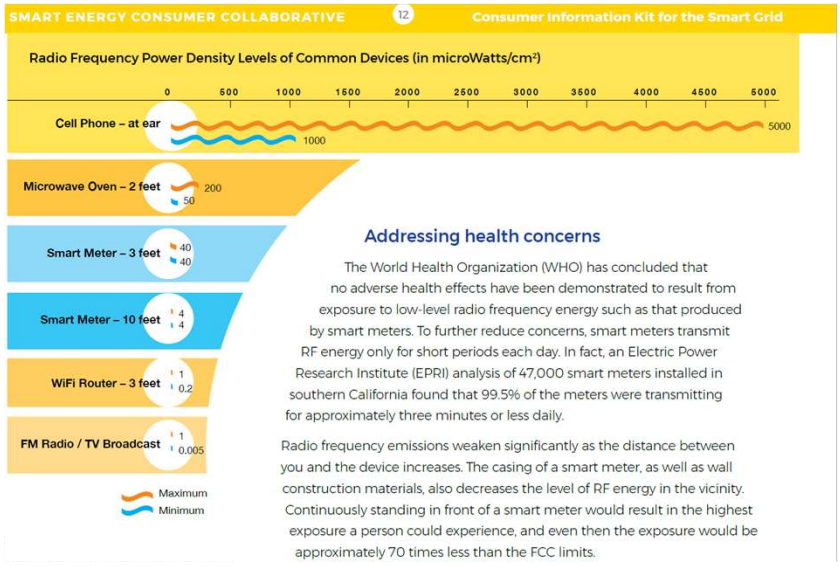
RF Power Density Levels of Common Devices



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RF Exposure

- Electric Power Research Institute (EPRI) undertook several substantial investigations of AMI meter RF EMF and found that they comply with FCC maximum permissible exposure (MPE) requirements.
- Further, found that in-residence exposure to emissions greatly mitigated by several factors:
  - intensity of RF EMF reduced exponentially with greater distance from emitting device
  - shielding provided by the meter enclosure
  - home's building materials further weaken field strength
  - meter antenna orientation inhibits inward direction of field pattern

Several entities such as City of Naperville, IL, Vermont Department of Health, Victorian State Government of Australia, and City of Richmond in British Columbia, Canada have performed their own tests on RF EMF from meters and corroborated results of EPRI's investigations.

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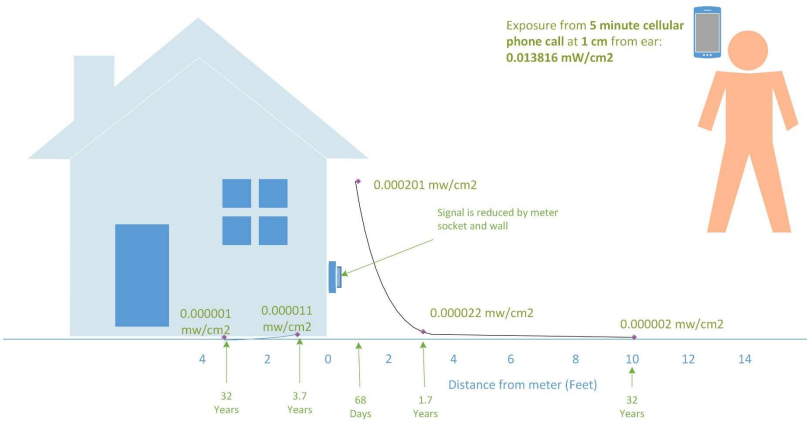
RF Exposure

How long does it take to receive the same time-averaged RF exposure from the advanced metering system that you would receive from one cellular phone call?



Adapted from the 2015 City of Fort Collins/ FCU Customer Education presentation

1. RF power density values are calculated for a duty cycle of 0.1% (86 seconds per day) for the meter operating at 250 mW
2. Transmit power of the cellular phone used for calculation is 50 mW based on FCC data on the HTC Thunderbolt smart phone.

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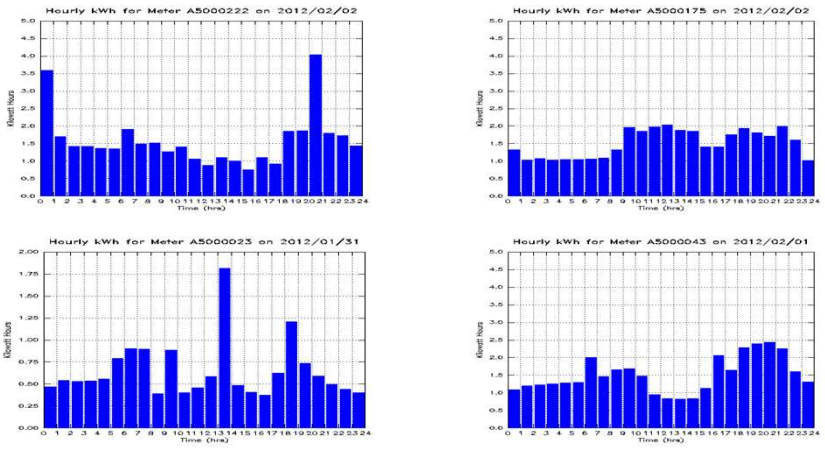
Privacy

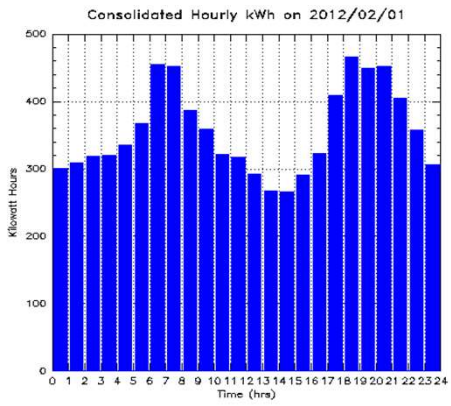
- Just as cable TV is now digital instead of an antenna, and cell phones require no land line, electric and water meters work digitally to transmit information to the utility over securely encrypted networks.
- Meters and communication modules track consumption similarly to older analog meters, but report data back to utility digitally using a secure code associated with customer's account.
  - Meters measure how much energy you use, based on time of day, not how you use that energy. Unless you install a home energy management system, meters cannot tell whether the energy used is from your oven, air conditioner, or hairdryer.
  - Meters do not store or transmit personal information such as your name, address, or bank details.

Name that Load Profile



Source: Dan Harms, La Plata Electric Association. Durango, Colorado.

300 Meters Combined



Source: Dan Harms, La Plata Electric Association. Durango, Colorado.

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Security

- While any electronic communications system is theoretically subject to hacking, AMI architecture has inherent security features built in to keep information private and secure.
  - Any data sent over the AMI network uses industry-proven encryption combined with a proprietary protocol.
  - The meters and communication modules are password protected and have a "key" that is refreshed on a regular basis.
  - The AMI architecture contains intelligence technology to alert a highly secure data center of any suspicious activity.
- AMI meters do not use the internet, and they have their own closed, dedicated communications system.
- Optical ports on meters do not provide a tunnel into the utility network or provide the ability to communicate to other meters.

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Safety

- AMI meters must meet safety requirements and standards spelled out in the National Electric Safety Code (NESC).
- Residential AMI meters have UL approval (unlike old analog meters).
- Public service commissions require independent certification proving that AMI meters are safe and show resistance to heat, fire, voltages, surges, and self-heating.
- Companies that manufacture AMI meters produce certifiably safe and reliable equipment. Nevertheless, AMI meters should be installed and uninstalled only by trained professionals exercising standard safety precautions.

Several investigations by PUCs (in MD, PA, TX, others), vendors, and others about meters causing fires resulted in clear findings. Fires were not caused by the meter, but the lugs. Installation crews placed meters in bad sockets, a risk with an electromechanical meter or a solid-state meter. If lugs are bad, it's a fire waiting to happen, regardless of meter.

Costs

- AMI does not raise utility costs. The benefits of AMI exceeds the cost of AMI.
  - Some customers, however, may see increased bills as older, worn out, and less accurate electro-mechanical meters are replaced with newer and more accurate meters.
- Charging for actual consumption reduces expenses that are levelized to all customers for unaccounted electricity from less accurate mechanical meters.
- Green-energy initiatives (consumer solar to electric vehicles) increases the need for AMI in order to manage and stabilize the grid.

Opt-Out Program

- Some consumers will object to having AMI meter; consider an opt-out program
  - Typically, one time charge to cover cost to remove and replace meter
  - Ongoing charge per reading to cover added cost of manual meter read
- Customers opting-out may see diminished service offerings
  - Outage and restoration verification may be delayed – causing repeat visits
  - Longer lead time to investigate service issues (low or high voltage, high bill, etc.)

Examples of Opt-Out Programs
Cowlitz PUD, Longview, WA
AMI meter replacement with analog - $135; Monthly fee - $25
Electrical District Number 3, Maricopa, AZ
Enrollment fee - $75; Monthly fee - $30
Sacramento Municipal Utility District (SMUD)
Set up fee - $127; Monthly fee - $14
Duke Energy Progress, NC
Enrollment Fee $170; Monthly fee - $14.75
Rochester, Minnesota
Initial setup fee $200; Monthly fee for Electric $80, Water $55

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Example Use Cases

- Historical Outage & Restoration
  - Data refresh year-over-year
  - Heat maps for quick identification
- System Line Loss Analysis
  - System vs. Substation vs. Feeder
- Rate Impacts
  - Are members in the right or best rate class?
  - Coincident Peak Billing
- High Bill
  - Preemptive trending and potential high bills
- Load Management
  - Measurement and Verification
  - Rebates vs. participation
- Estimates vs. As-Builts
  - Project cost tracking
  - Are estimates within range?
- Voltage
  - High and low voltage detection
  - End of line vs. mid-line

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Presenting Data

- We have found reporting to be difficult and not as straightforward as needed
- Improvements may be realized through existing reporting tools
  - Tableau & PowerBI can provide decent visualizations
    - Board reporting
    - Internal financial impact, year-over-year tracking, etc.
  - Exploring options in reporting may unlock unrealized potential

Asset Management

- We are getting better at using data sources to prevent outages
  - Predictive failures/risk assessments
  - Number of operations
  - Temperature
  - Demand
  - Timed Inspections
  - Better maintenance records and supply chain management
  - Ordering the right equipment, we need when we need it

Pre-paid Metering Examples

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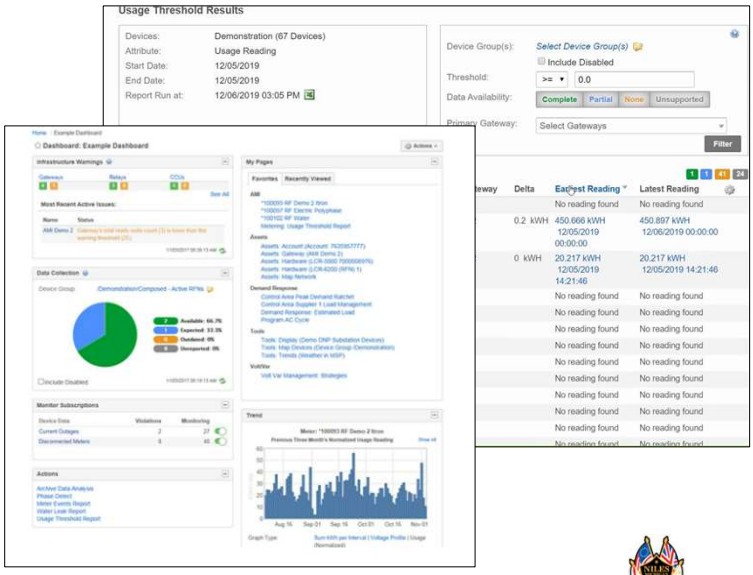
Alarms, Events, and Monitoring

- Setup alarms and events
  - High demand
  - Voltage issues
  - Outage and restore
  - Tamper detect
  - Water leak detect
- Alerts and events sent to email lists



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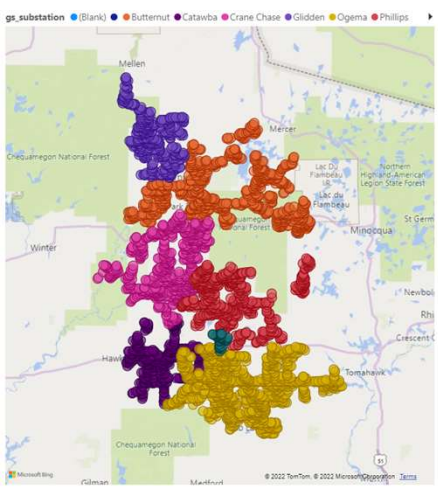
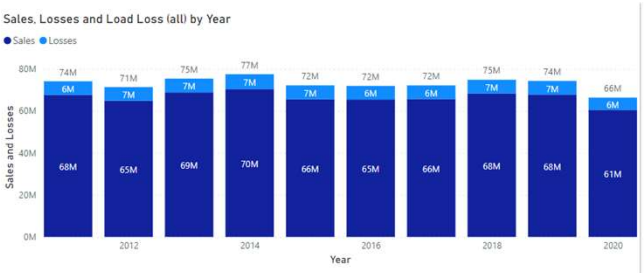
Line Loss Historical Progression

Presenting Data – System Loss (Direct Utility Costs)

Transformer Load Loss / No Load Loss



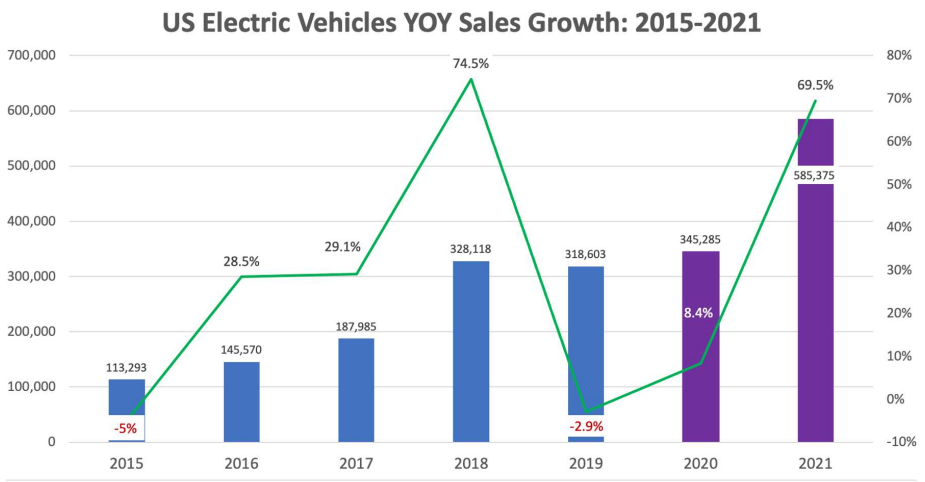
gs_substation	OBJECTID
Butternut	2177
	1343
2	696
4	138
Ogema	1792
	1267
2	353
3	92
1	80
Crane Chase	1559
	640
4	487
2	255
3	177
Phillips	1364
	979
3	252
1	132
2	1
Glidden	699
	357
1	331
3	11
Catawba	475
	244
2	168
4	63
Prentice	47
	12
	9
1	2
4	1
Total	8127



gs_substation	NL Loss (kW) Core Losses Total	NL Loss (kWh_annual)
	0.95	8,278.20
	0.09	788.40
Butternut	132.67	1,162,171.68
Catawba	23.69	207,498.12
Crane Chase	80.07	701,395.68
Glidden	38.09	333,642.12
Ogema	97.80	856,763.04
Phillips	72.98	639,304.80
Total	453.30	3,970,864.20

Year	Sales	Purchased	Load Loss (all)
			100.00%
2011	67,711,980	74,133,379	8.66%
2012	64,860,934	71,373,572	9.12%
2013	68,834,474	75,397,955	8.71%
2014	70,489,344	77,491,531	9.04%
2015	65,595,040	72,190,395	9.14%
2016	65,426,224	71,918,888	9.03%
2017	65,681,678	72,172,598	8.99%
2018	68,349,272	74,849,413	8.68%
2019	67,791,964	74,305,403	8.77%
2020	60,542,559	66,366,055	8.77%
Total	665,283,469	730,199,188	8.89%

2021 US EV Sales to Increase 70% Over 2020



Data: GoodCarBadCar.net, InsideEVs, Auto Manufacturers Alliance/IHS Markit, Automotive News|
Chart & Forecasts: Loren McDonald / EVAdoption.com

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EV Charging Stations by State (Excluding California & Vermont)

per 100,000 residents

Stations | Outlets | Level 1 Chargers | Level 2 Chargers | DC Fast Chargers

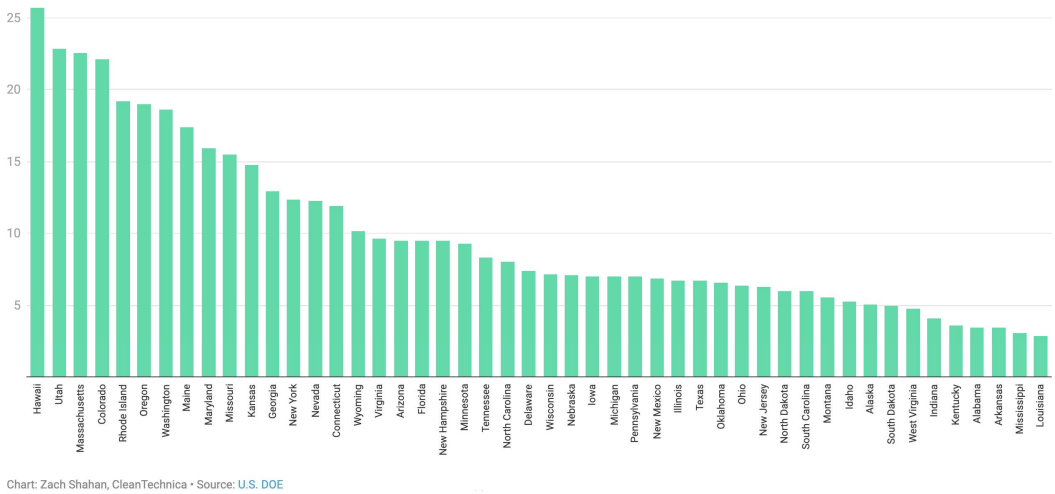

Chart: Zach Shahan, CleanTechnica • Source: U.S. DOE

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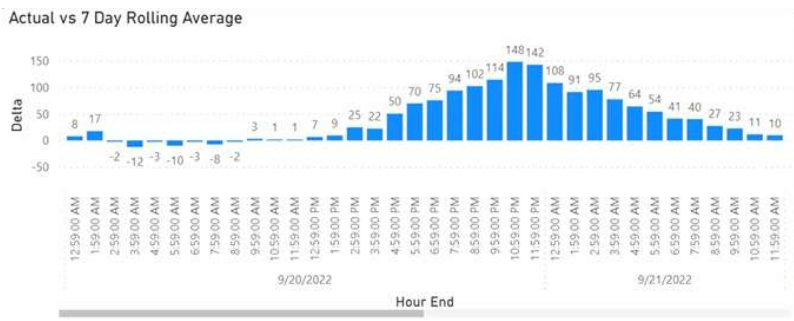
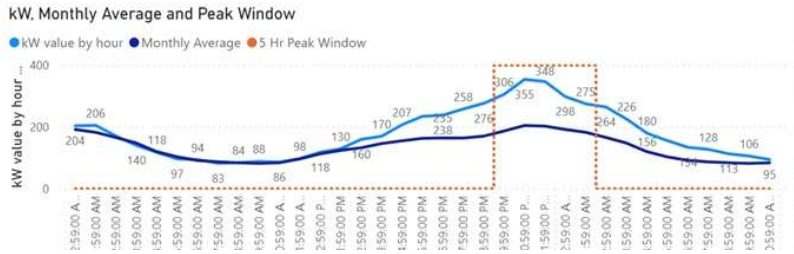
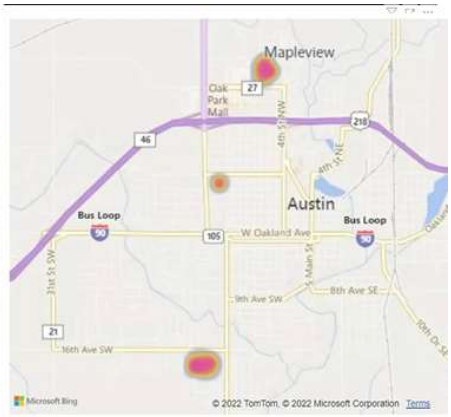
Peak Day - System Load Analysis







Date	Hour End	kW value by hour	kW demand 7 day rolling average	Delta
9/20/2022	12:59:00 AM	203.72	196.00	8
9/20/2022	1:59:00 AM	205.56	188.19	17
9/20/2022	2:59:00 AM	170.64	173.09	-2

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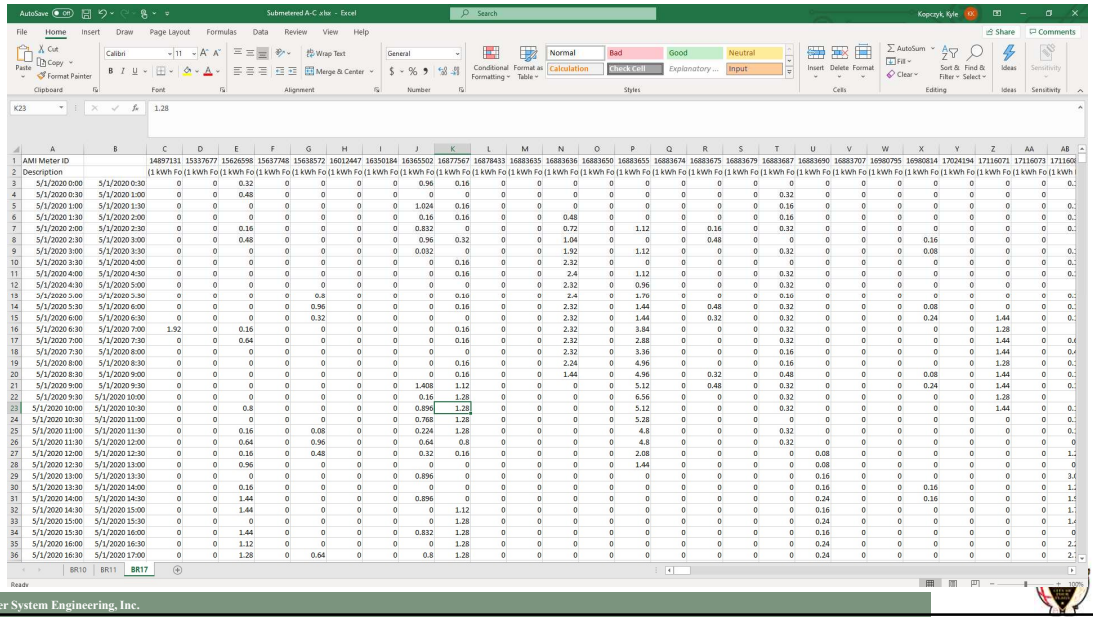
Raw Data



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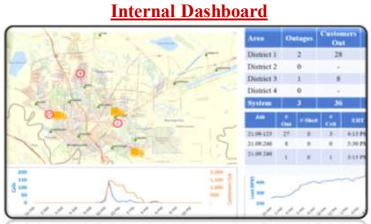
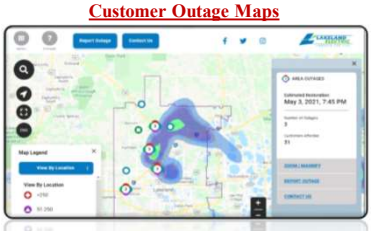
OMS Template Dashboards & Reports

Examples of a framework of best-practice reports

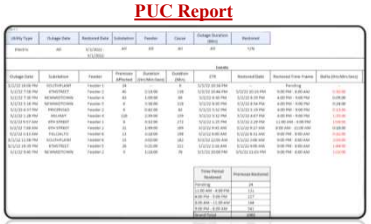
Internal Dashboard



Customer Outage Maps



PUC Report



(Key) Customer Analysis

Extent & Time

Cause & Area Reliability

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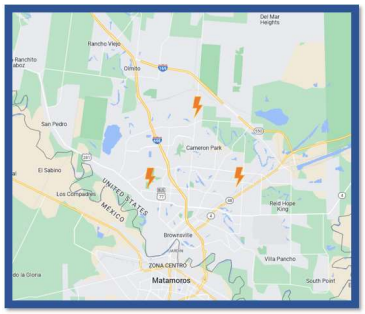
Presenting Data – Outage Management



Current Premises Affected	Premises Restored Last 24 Hours
24	1063

Planned Outages	Unplanned Outages	Forced Outages
0	3	0

Events

Outage Start Date	Substation	Feeder	Premises Affected	Cause	Restored Date	Restored Time Frame	Duration (Hrs:Min:Sec)	Outage Type	Restored?
################	SOUTHPLANT	Feeder 1	24	Wind	--	Pending	--	Unplanned	N
5/2/22 7:58 PM	6THSTREET	Feeder 2	45	Tree	5/2/22 10:16 PM	9:00 PM - 8:00 AM	2:18:00	Unplanned	Y
5/2/22 7:30 PM	NEWMIDTOWN	Feeder 4	43	Animal	5/2/22 8:39 PM	4:00 PM - 9:00 PM	1:09:00	Unplanned	Y
5/2/22 5:16 PM	NEWMIDTOWN	Feeder 5	6	Animal	5/2/22 8:54 PM	4:00 PM - 9:00 PM	3:38:00	Unplanned	Y
5/2/22 4:37 PM	PRICEROAD	Feeder 2	6	Motor Vehicle Accident	5/2/22 5:19 PM	4:00 PM - 9:00 PM	0:42:00	Unplanned	Y
5/2/22 1:28 PM	MILHWY	Feeder 4	126	Accident	5/2/22 4:07 PM	4:00 PM - 9:00 PM	2:39:00	Unplanned	Y

Key Accounts

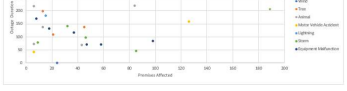
Outage Start Date	Substation	Feeder	Account Name	Account Type	Outage Duration	ETR	Restored Time	Cause	Restored?
################	SOUTHPLANT	Feeder 1	Department Store	Commercial	--	5/2/22 10:30 PM	--	Wind	N
################	SOUTHPLANT	Feeder 2	Residential Home #1	Residential	--	5/2/22 10:30 PM	--	Wind	N
################	SOUTHPLANT	Feeder 4	Restaurant #1	Commercial	--	5/2/22 10:30 PM	--	Wind	N
################	SOUTHPLANT	Feeder 5	Restaurant #2	Commercial	--	5/2/22 10:30 PM	--	Wind	N
################	SOUTHPLANT	Feeder 2	Gas Station	Commercial	--	5/2/22 10:30 PM	--	Wind	N
################	SOUTHPLANT	Feeder 4	Bank	Commercial	--	5/2/22 10:30 PM	--	Wind	N

Outage Metrics by Substation

	CAIDI	SAIDI	Total Outage Min	Major Events
SOUTHPLANT	2.91	3.93	466	1
6THSTREET	0.83	11.93	1351	1
NEWMIDTOWN	2.94	6.76	672	0
PRICEROAD	7.72	6.86	595	0
MILHWY	1.44	2.66	425	0
PALOALTO	16.23	4.24	188	0

% of Outages by Cause

Substation	Winter Storm	Animal	Motor Vehicle Accident	Equipment Malfunction	Planned	Forced	Tree	Total
SOUTHPLANT	36%	36%	9%	9%	0%	0%	9%	100%
6THSTREET	9%	9%	7%	36%	0%	0%	7%	100%
NEWMIDTOWN	7%	21%	14%	21%	7%	0%	14%	100%
PRICEROAD	14%	29%	14%	43%	0%	0%	0%	100%
MILHWY	14%	14%	7%	29%	0%	0%	14%	100%
PALOALTO	7%	14%	7%	14%	0%	0%	0%	100%



Outage Date	Substation	Feeder	Premises Affected	Duration (Hrs:Min:Secs)	Duration (Min)	ETR	Restored Date	Restored Time Frame	Delta (Hrs:Min:Secs)	Cause	Restored?
5/2/22 10:08 PM	SOUTHPLANT	Feeder 1	24	--	0	5/2/22 10:36 PM		Pending		Wind	N
5/2/22 7:58 PM	6THSTREET	Feeder 2	45	2:18:00	138	5/2/22 10:46 PM	5/2/22 10:16 PM	9:00 PM - 8:00 AM	0:30:00	Tree	Y
5/2/22 7:30 PM	NEWMIDTOWN	Feeder 4	43	1:09:00	69	5/2/22 8:30 PM	5/2/22 8:39 PM	4:00 PM - 9:00 PM	0:09:00	Animal	Y
5/2/22 5:16 PM	NEWMIDTOWN	Feeder 5	6	3:38:00	218	5/2/22 8:30 PM	5/2/22 8:54 PM	4:00 PM - 9:00 PM	0:24:00	Animal	Y
5/2/22 4:37 PM	PRICEROAD	Feeder 2	6	0:42:00	42	5/2/22 5:32 PM	5/2/22 5:19 PM	4:00 PM - 9:00 PM	0:13:00	Motor Vehicle Accident	Y
5/2/22 1:28 PM	MILHWY	Feeder 4	126	2:39:00	159	5/2/22 5:32 PM	5/2/22 4:07 PM	4:00 PM - 9:00 PM	1:25:00	Motor Vehicle Accident	Y
5/2/22 9:57 AM	6TH STREET	Feeder 1	8	4:32:00	272	5/2/22 1:25 PM	5/2/22 2:29 PM	11:00 AM - 4:00 PM	1:04:00	Animal	Y
5/2/22 7:38 AM	6TH STREET	Feeder 2	21	1:49:00	109	5/2/22 9:45 AM	5/2/22 9:27 AM	8:00 AM - 11:00 AM	0:18:00	Tree	Y
5/2/22 3:53 AM	PALOALTO	Feeder 8	13	5:18:00	198	5/2/22 8:31 AM	5/2/22 8:31 AM	5:00 PM - 8:00 AM	0:31:00	Tree	Y
5/1/22 11:58 PM	SOUTHPLANT	Feeder 8	15	3:02:00	182	5/2/22 12:05 AM	5/2/22 3:00 AM	5:00 PM - 8:00 AM	2:55:00	Lightning	Y
5/1/22 10:39 PM	6THSTREET	Feeder 5	26	5:21:00	321	5/2/22 2:16 AM	5/2/22 4:00 AM	5:00 PM - 8:00 AM	1:44:00	Lightning	Y
5/1/22 9:45 PM	NEWMIDTOWN	Feeder 2	9	1:18:00	78	5/1/22 10:00 PM	5/1/22 11:03 PM	9:00 PM - 8:00 AM	1:03:00	Storm	Y

Time Period Restored	Premises Restored
Pending	24
11:00 AM - 4:00 PM	131
4:00 PM - 9:00 PM	227
8:00 AM - 11:00 AM	184
5:00 PM - 8:00 AM	541
Grand Total	1063

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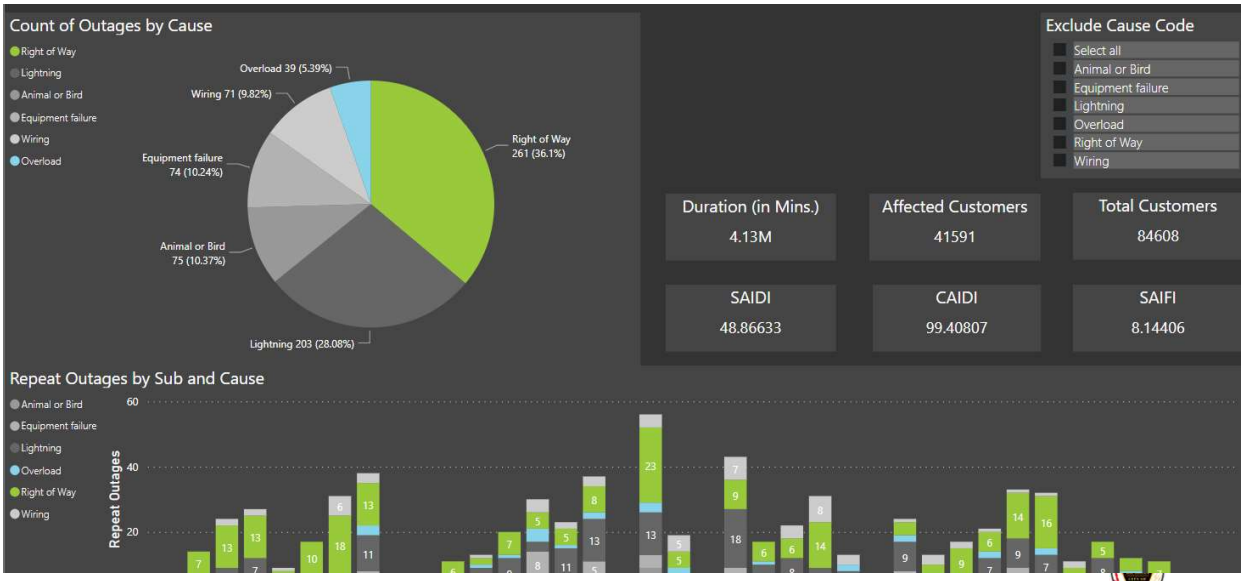
Outage Summary



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The consumer is arguably playing a greater role than ever before in the energy sector, and the need for accurate consumer research on today's energy issues is more crucial now than ever.

Mark Brown, Senior Customer Programs Officer, Fayetteville Public Works Commission, and Chairman of the Board of Directors at the Smart Energy Consumer Collaborative (https://smartenergycc.org/)

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References & Resources

References (from footnotes)

1. Number and percentage share of AMI installations by sector 2021 (table). https://www.eia.gov/tools/faqs/faq.php?id=108&t=3
2. American Cancer Society, "Smart Meters": https://www.cancer.org/cancer/risk-prevention/radiation-exposure/smart-meters.html
3. World Health Organization "Radiation: Electromagnetic fields": https://www.who.int/news-room/questions-and-answers/item/radiation-electromagnetic-fields
4. Daily exposure percentage = [(4 seconds/hour)/(24 hours/day*60 minutes/hour*60 seconds/minute)]* 100 (Source: Utilities Telecom Council, "No Health Threat from Smart Meters": UTC Journal, 4th Quarter) 2010
5. http://transition.fcc.gov/oet/rfsafety/background.html

Other Resources

- International and National Expert Group Evaluations: Biological/Health Effects of Radiofrequency Fields: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4199025/
- Health and RF EMF from Advanced Meters: An Overview of Recent Investigations and Analyses. - https://www.house.mi.gov/sessiondocs/2013-2014/testimony/Committee237-12-2-2014-44.pdf

Thank You

We look forward to helping you achieve your goals.

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