Advanced Grid Research
OFFICE OF ELECTRICITY
US DEPARTMENT OF ENERGY

Smart Electric Power Alliance

NREL
Transforming ENERGY

Virtual Discussion: Grid Infrastructure Investment Requirements for Electrification

July 29, 2021

Participating in a Virtual Discussion

- This discussion will be recorded.
- Please mute yourself and turn off your camera unless you would like to speak.
- **Your knowledge and experience are key.** Two ways to participate:
  - Use the chat box to add your comments and questions
  - Raise your virtual hand and the moderator will call on you
  - Turn on your camera and microphone so the moderator can call on you
- Please mute yourself unless you're making a comment or asking a question.
- Slides will be shared after the workshop.

Voices of Experience

- Started in 2011 following the Recovery Act Smart Grid Program
- Provide a forum to exchange ideas and learn from colleagues
- Capture high-level insights and advice
- Preserve the voice of the participants
- Focus on areas that pose challenges or are critical transformation
- Create a valuable resource for utilities
- Provide an educational foundation and neutral perspective for other industry stakeholders (e.g., commissions, legislatures, consumer advocates, etc.)
- **New in 2021… Electrification**

Why Did We Choose Electrification?

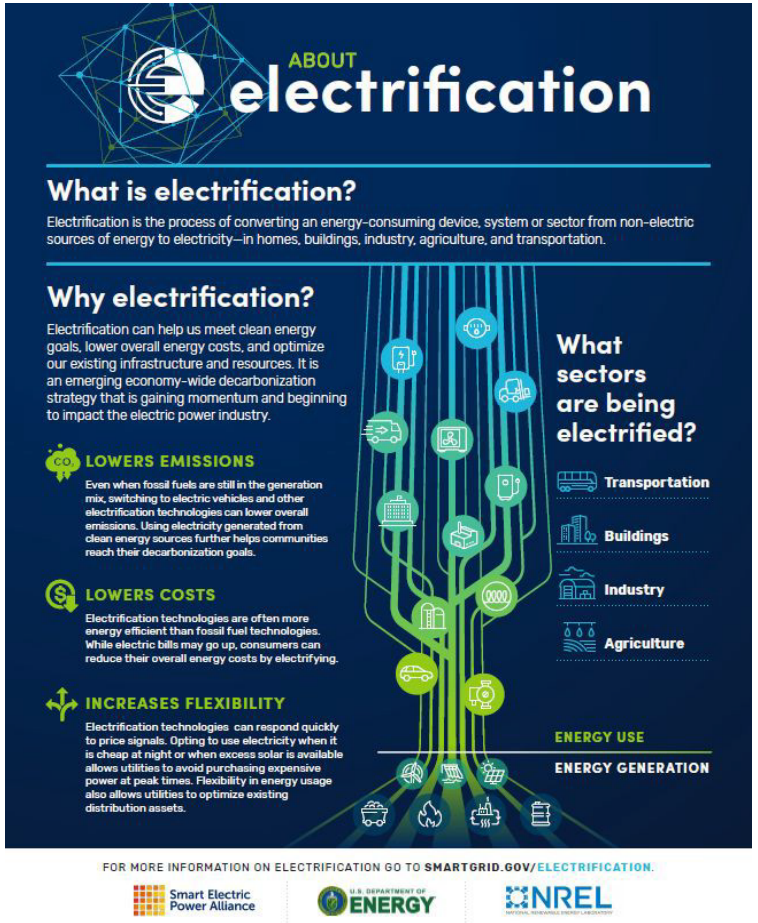
What is electrification?

Electrification is the process of converting an energy-consuming device system or sector from non-electric sources of energy to electricity-in homes, buildings, industry, agriculture, and transportation.

Electrification can help us meet clean energy goals, lower overall energy costs, and optimize our existing infrastructure and resources. It is an emerging economy-wide decarbonization strategy that is gaining momentum and beginning to impact the electric power industry.

Why electrification?

- Lowers emissions and meets clean energy goals
- Lowers costs and improves efficiency
- Increases grid flexibility



Industry Steering Committee

- Maria Bocanegra, Commissioner, Illinois Commerce Commission
- Christopher J. Budzynski, Director, Utility Policy, Exelon Utilities
- Allen Dennis, P199 Electrification Program Manager, EPRI
- Keith Dennis, Vice President, NRECA
- David Farnsworth, Principal, Regulatory Assistance Project
- Garrett Fitzgerald, Principal of Electrification, Smart Electric Power Association
- Diane Huis, SVP, Innovation and Business Development, North Carolina Electric Cooperative
- Mike Judge, Director, Electric Power Division, MA-DPU
- Greggory Kresge, Manager of Electrification of Transportation, Hawaiian Electric
- David Logsdon, Director, Electrification & Strategic Technology, Seattle City Light
- Michael Luhrs, Vice President, Retail Programs, Duke Energy
- Mackay Miller, Director, US Strategy, National Grid
- Richard Oberg, Manager of Product Delivery, SMUD
- Jason Stanek, Chairman, MD PSC
- Sharon L. Tomkins, VP, Sustainability, Sempra Energy
- David Treichler, Director, Strategy and Technology, Oncor
- Rob Wozny, Senior Product Manager, Electrification, Alliant Energy

Topics that Emerged

1. Enabling Technology for Electrification – June 17, 2021
2. Customer Engagement for Electrification –June 24, 2021
3. Benefits Beyond Decarbonization – July 8, 2021
4. Energy Equity and Electrification – July 15, 2021
5. Electrification and Resiliency – July 22, 2021
6. Grid Infrastructure Investments and Electrification – July 29, 2021
7. Impacts of Electrification on the Natural Gas Industry – August 5, 2021

Discussion Leaders

Moderator

Keith Dennis

Presenters

David Treichler

&

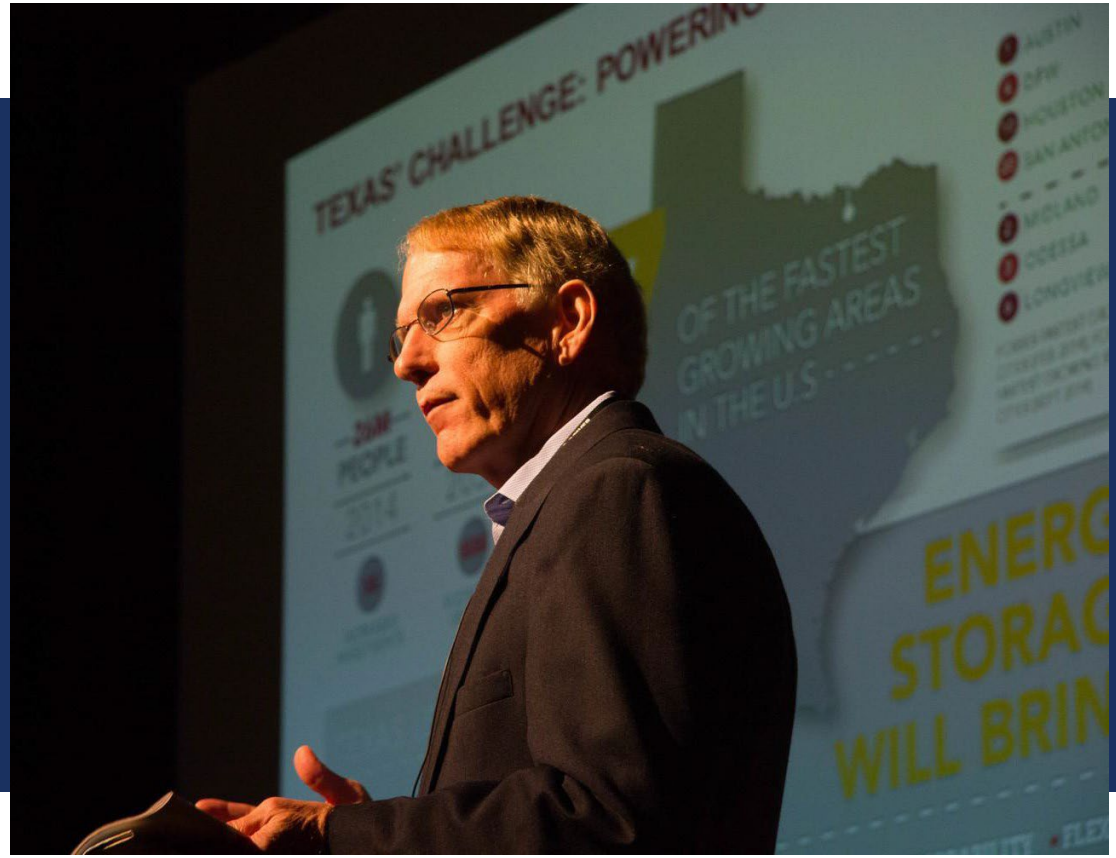
Christina Alston

Keith Dennis, PE

Vice President | National Rural Electric Cooperative Association

David Treichler

Director Strategy and Technology | Oncor Electric Delivery



Infrastructure Investments Needed for Electrification.

David Treichler | Director Strategy and Technology

Department of Energy – Voices of Experience Discussions

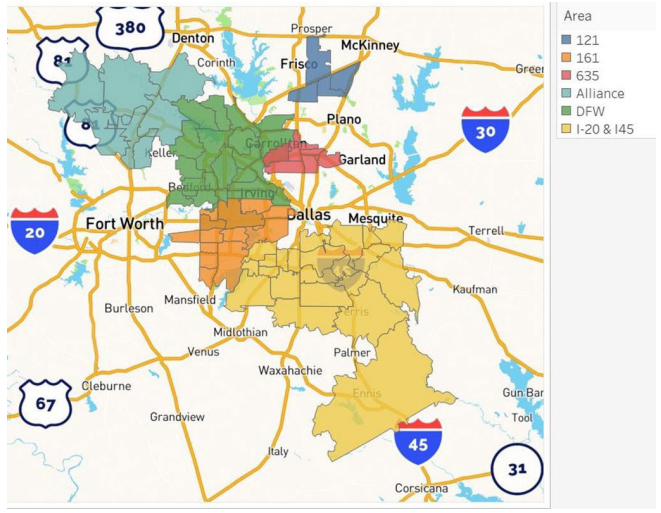
July 29, 2021

Investment Categories

1. Transportation Electrification
   - Fleets
   - Personal vehicles
   - Air mobility
   - Locomotives
2. Premise Electrification
   - Commercial / Industrial / Governmental
     - Resiliency Needs
     - High Reliability
   - Residential
     - Hybrid Premise

Fleet Electrification

Oncor Service Area: Approximately 24,000 fleets.



Charging loads as high as 40MW for single premise

Distribution centers – new loads ranging from 2.5 to 6.5MW

Current loads at distribution centers generally <150 kW

Issues for Fleet Electrification

Relationships with customers

Customer internal working teams (electric vs fleet)

Land acquisition for new substations and ROW

Lead times to build out requirements

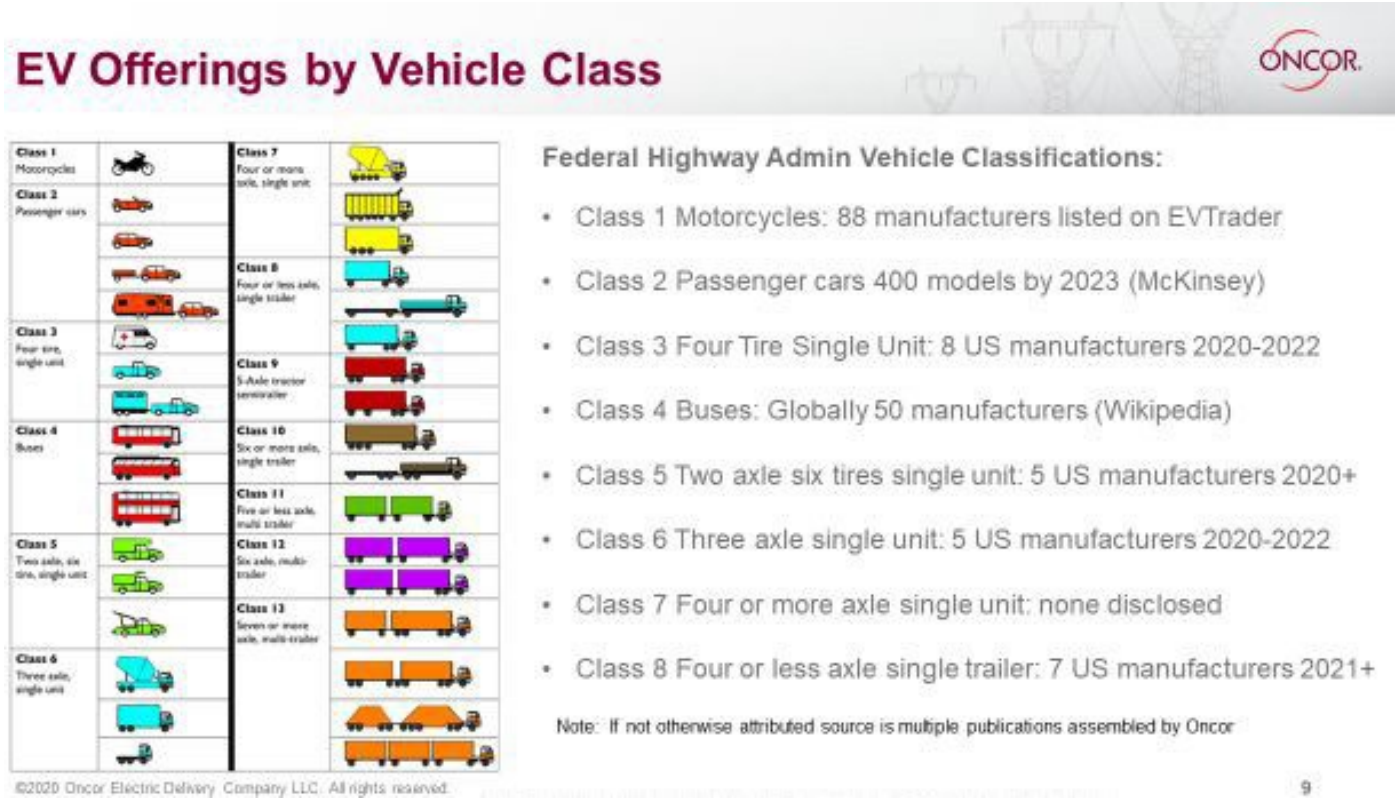
Needs for reliability and resiliency

Managed charging to address demand charges

Integration of DERs into charging infrastructure

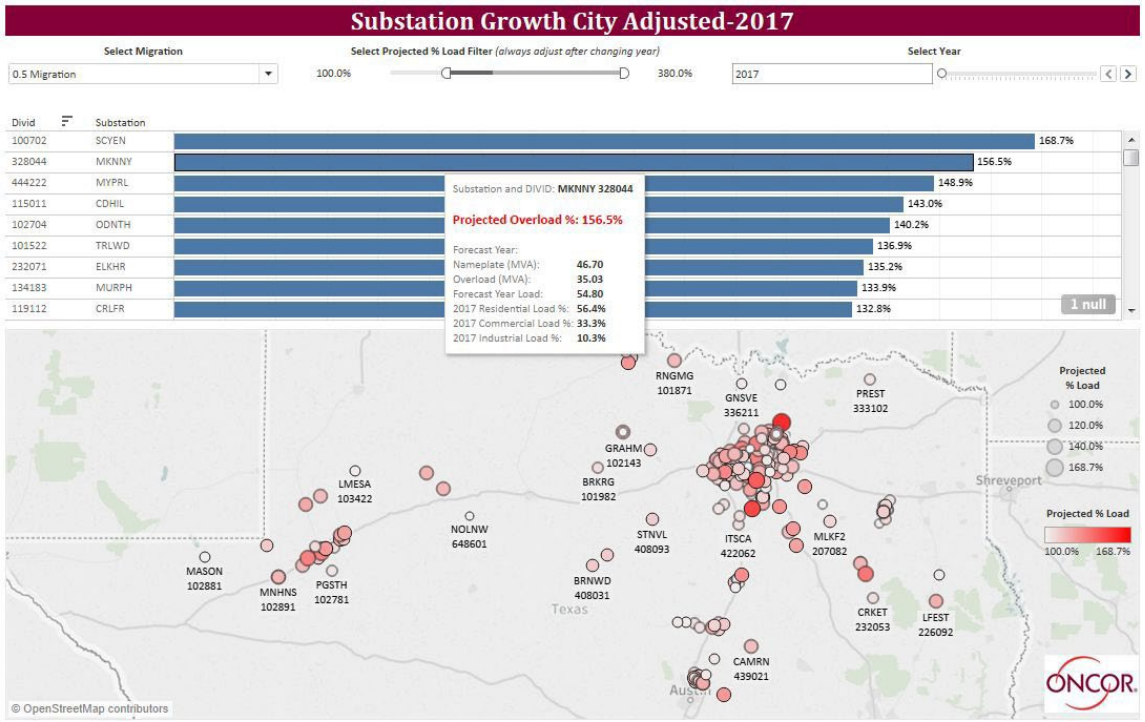
Changing business needs

- OEM upgrades to vehicles
- Slow vs fast charging
- Operating tempo
- Migration of charging loads



Supporting Fleet Electrification: the Oncor EV Fleet Planning Tool

- Process for EV charging analysis and make ready build out defined by New Construction Management
- Tools are existing distribution system planning tools and the Green Fleets tool. It is used for outreach educational efforts with fleet owners and operators throughout the Oncor service area.



- **A challenge that Oncor must address** is how to ensure high reliability and resiliency for electrified fleets. If a fleet cannot charge at the appropriate times, the trucks don't roll, which is operationally unacceptable.
- One possible solution is an energy storage integrated charging infrastructure as it can both reduce demand charges and also ensure a period of time during an outage where the fleet can still charge, expecting outages to last no more than 4 hours with the exception of major storms.

Personal Vehicles

The problem of load forecasting for ISOs

Distributed load across system – lack visibility – data

Expect point upgrades where clusters of vehicles

Internal analysis – 25% penetration on feeder

Issues:

- V2H opportunity of Ford F-150 Lightning
- Maintenance of public charging infrastructure
- Educating the ecosystem

Other Transportation

Air e-mobility
Regional Passenger e-Jets
Electric Locomotives

Issues:

- Air-e-mobility –
  - Fast charge loads between flights
  - Capacity to top of building landing sites
- Regional Passenger e-jets
  - Fast charge loads at airport gates
  - System protection challenges
- Electric Locomotives:
  - Currently 2.5MWh battery
  - Project 16MWh battery systems

Premise Electrification

Commercial/Industrial/Governmental

- Service entrance levels
- Conductor upgrades/feeder augmentation
- Substation upgrades and additions
- Transmission capacity
- Customer focus on energy efficiency updates
- Local generation / backup / microgrids / fleets

Residential

- Service entrance upgrades (100-200 amp)
- Energy efficiency investments
- Hybrid – home and office
  - reliability updates
  - resiliency updates
- Predictive maintenance / system modeling

The Challenge for Utilities

The right skill sets to develop new tools, methods and practices – ability to test before deployment

Analytical tools that help predict where new large loads may occur and develop long range plans to serve

Early investments in land and ROW to serve the large new loads that are expected.

Educating all stakeholders of the process utilities must follow to deliver capacity where and when needed.

Flexibility from commissions and ISOs in how utilities will plan for and execute the advanced preparations and adjustments that mobile loads will require.

Christina L. Alston

Transmission Development Manager | Georgia Transmission Corporation

Beneficial Electrification

Georgia Transmission

GTC Statistics

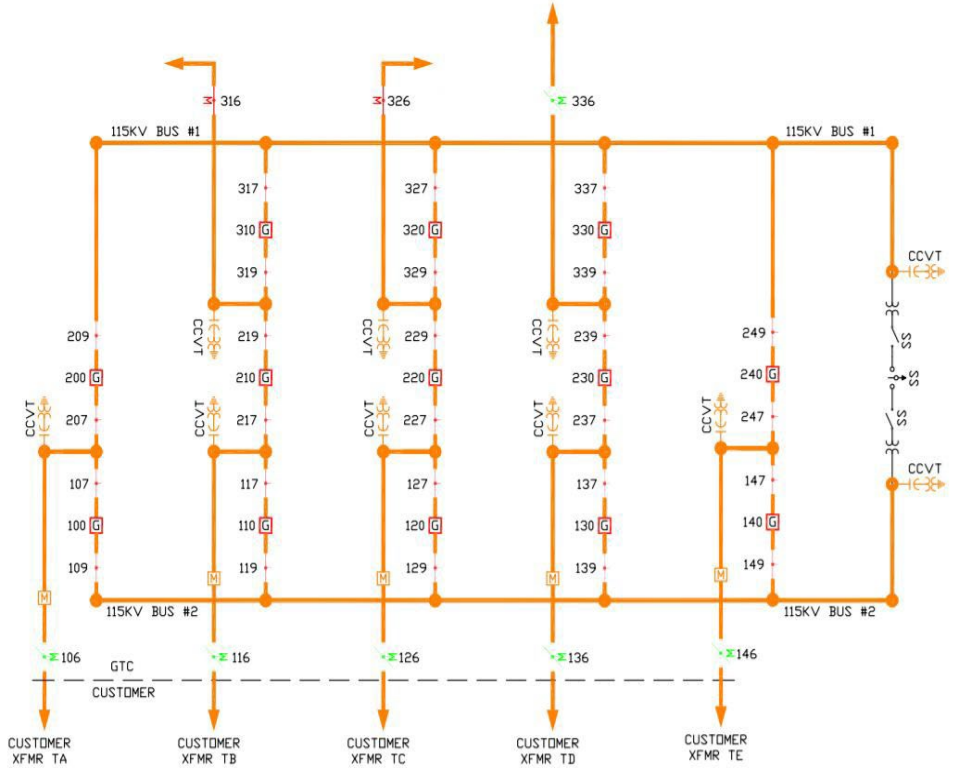
- Over 3,400 miles of T/L
  - 46 kV: 247 miles
  - 115 kV: 1,376 miles
  - 230 kV: 1,301 miles
  - 500 kV: 535 miles
- 742 transmission and distribution substations
- $3B in total assets
- ~9800 MW of Load

Electrification Impacts to the Grid

- Building Electrification
- Electric Fleet Conversion
  - Class 8 Vehicles
  - Last Mile Delivery
  - Residential Charging
- Indoor Agriculture

Building Electrification – Data Centers

- 1-million square foot data center ~ 200MW at Build Out
- New 115 kV, 13 breaker and a half dedicated customer substation
- Lead time to RFS 12 months



EV Fleets

How it Started

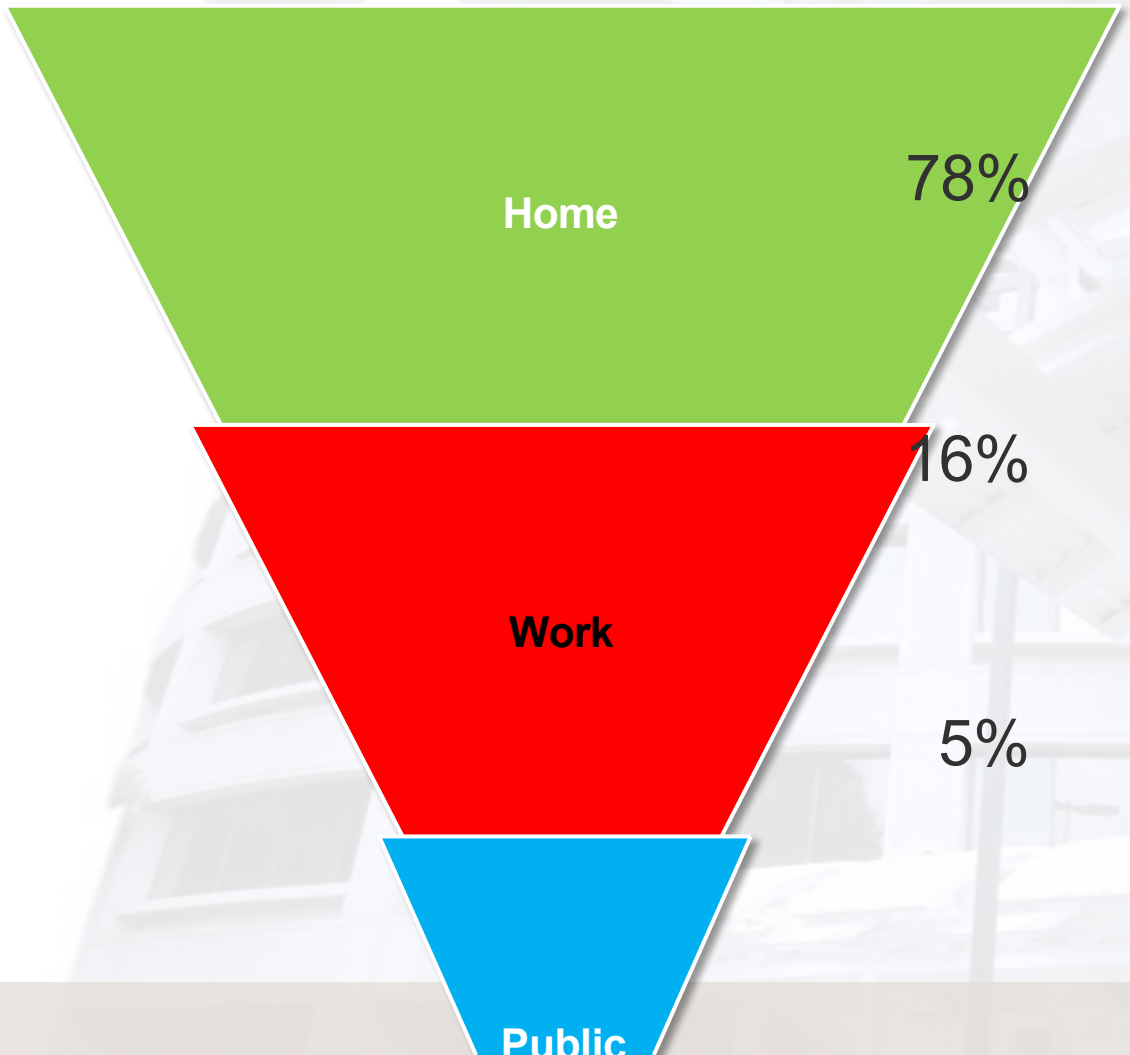
UPS Electric Fleet 1936

How its Going

UPS Electric Fleet 2020

Residential Electric Vehicles – Charging

- **Focus on the home**
- Potential for energy sales growth
- Must manage charging to limit demand growth



Indoor Agriculture – Commercial Revitalization

180,000 sq. feet ~ 900 acres of arable land

DOA, DOT & EPA

- Reduced carbon emissions from interstate trucking
- Significant reduction of water requirements
- Increased availability of land for renewable initiatives
- Provides food security for underserved areas
- Utility benefits
  - Increased revenue
  - Demand side management
  - Area revitalization
  - Carbon bank participation

Managing The Risk -

Risk

- Transmission System Overload
- Increased Demand Charges
- Lack of Lead Time
- Outdated PGP's
- Lack of Associate Knowledge
- Increased Staffing Requirements

Opportunities

- Identify Potential Locational Hotspots
- Manage Customer Demand Profiles
- Review Construction Lead Times
- Consider Supply Chain Blankets
- Create or Update Policies
- Review Rates
- Create Appropriate Customer Touchpoints

Join the Next Discussion

Impacts of Electrification on the Natural Gas Industry
August 5, 2021

Thursday from 1:00 - 2:30 Central Time!

Register on

SmartGrid.gov