NC STATE UNIVERSITY

SUSTAINABLE FLEET TECHNOLOGY CONFERENCE & EXPO 2021

Session #4: Working with your Utility and Understanding Fleet Charging Costs

September 21, 2021

NC CLEAN ENERGY TECHNOLOGY CENTER

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

SUSTAINABLE FLEET TECHNOLOGY
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Sessions through December 09, 2021

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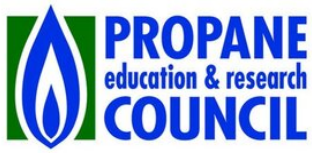
SFT Conference Series Upcoming Sessions

- 09/23: Idle Reduction Simple and Impactful
- 09/30: Innovative Charging Solutions
- 10/05: Total Cost of Ownership--Comparisons of Alternative Fuel Vehicles versus Conventional Fuel Vehicles
- 10/07: Propane Applications and Success Stories
- 10/09: Funding Sources & Creative Financing for Sustainable Fleet Deployment

2021 SFT Conference Series Sponsors



Format

- Q&A at the end
- Submit questions and comments to “Panelists”
- Scheduled for 2:00p-3:30p
- Handout
- Recording

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Working with your Utility and Understanding Fleet Charging Costs
September 21, 2021

2:00-2:10 **Rick Sapienza, NCCETC--**Introduction and Welcome

2:10-2:20 **Lon Huber, Duke Energy**--Electric Vehicle Enablement Vison

2:20-2:35 **Joe Redfield, Redfield Consulting Services**—Utility Tariffs and Fleet Electrification What You Need to Know

2:35-2:50 **Andy Abrams, EVauto**—Efficient EV Fleet Charging

2:50-3:05 **Mike Rowand, eTransEnergy**—EV Fleet Infrastructure & Utility Integration

3:05-3:30 **Q&A**

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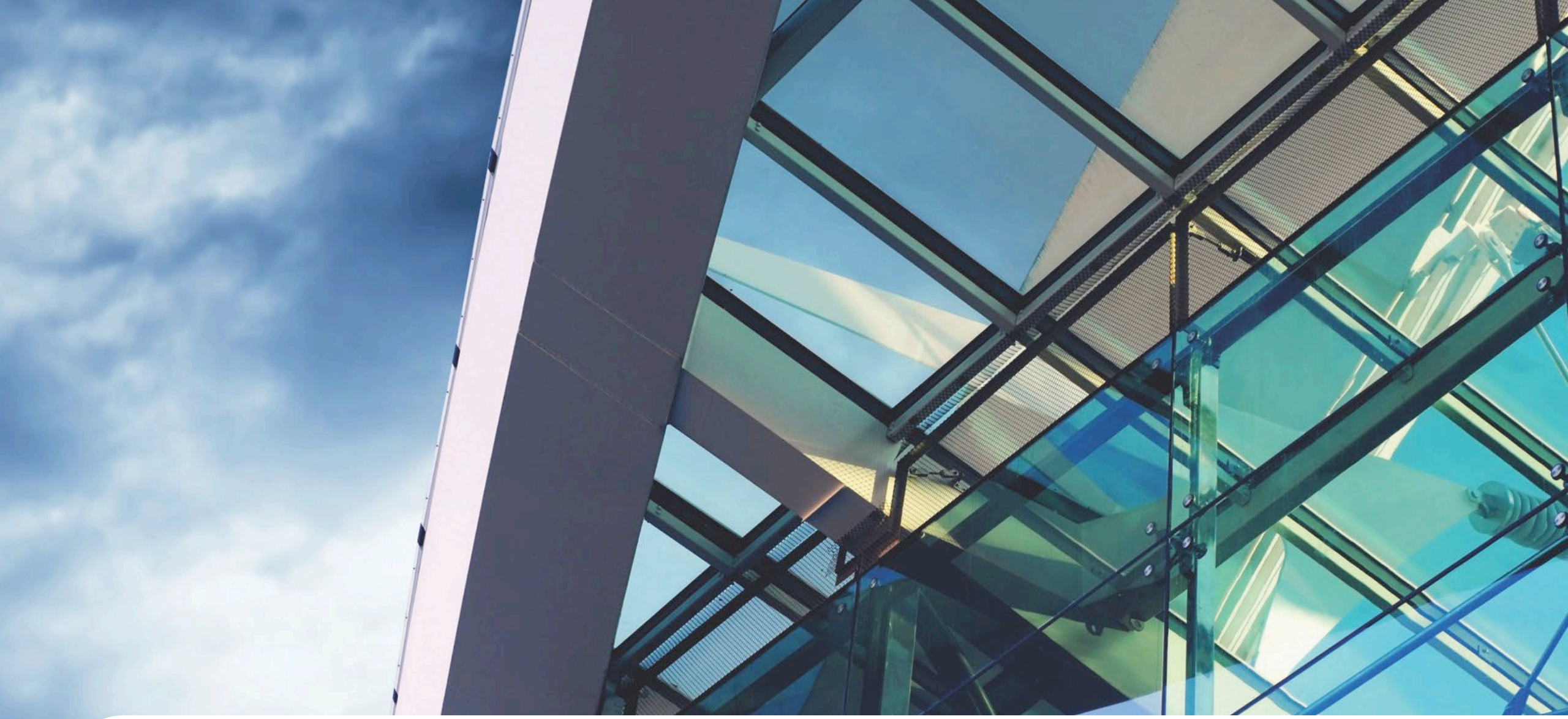
Lon Huber
Lon.Huber@duke-energy.com

- Vice president of rate design and strategic solutions for all Duke Energy's regulated electric utilities
- oversees the development and implementation of innovative structuring & pricing, DSM & customer load analytics, and strategic solutions to meet evolving customer needs
- Numerous awards for his creative solutions to the electricity industry's most pressing issues--Public Utilities Fortnightly, Energy Storage Association and Innovator of the Year by Utility Dive



Electric Vehicle Enablement Vison

Lon Huber

Electric Vehicle (EV) Enablement Ecosystem

Time Varying & Subscription Fueling

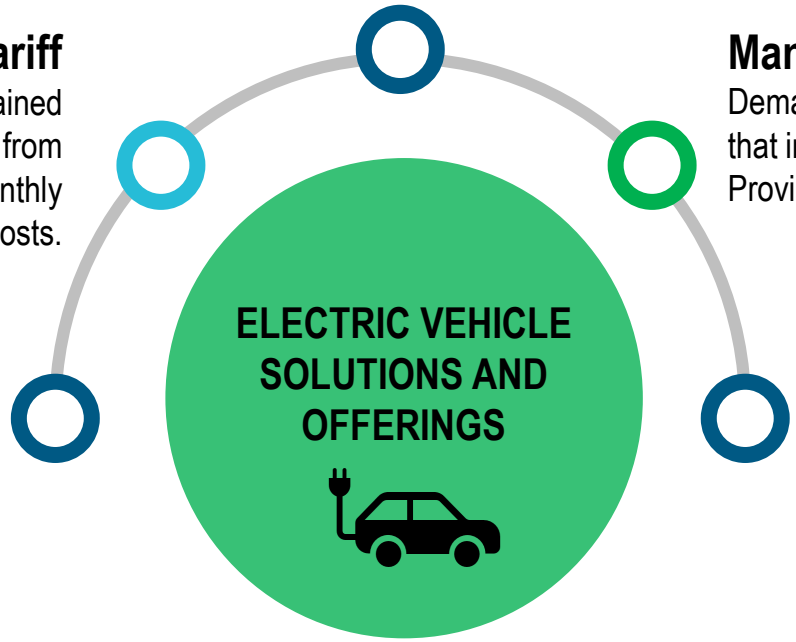
Static TOU, dynamic, and hourly options or fixed-price offerings with fuel-savings certainty for EV customers.

Charging Station (EVSE) Tariff

Suite of Utility-owned and maintained charger options for customers to select from for a cost-based competitive monthly payment, minimizing upfront costs.

Make Ready Credit

Tariff that treats residential and C&I make-ready costs associated with installing an EV charger similar to line-extension investments.



Managed Charging Programs

Demand side management (DSM) programs that incentivize charging during optimal times. Provide coordinated and planned system value.

Fleet Electrification

Quick deployment of grid assets to transition large fleets to electric. Grid readiness, batteries and smart charging technology.

Utility Tariffs and Fleet Electrification
What you need to know

Presented by

Joe Redfield PE

September 21, 2021

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SUSTAINABLE FLEET TECHNOLOGY
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Joe Redfield PE
j.redfield@ieee.org

- Owner of Redfield Consulting Services
- Works with fleets in developing electrification strategies including conducting charge economic and energy analysis
- Experience in implementing fleet charge control strategies to meet various business objectives
- Previous to RCS, worked for 30 years at Southwest Research Institute developing advanced drivetrain (hybrid and electric) technologies

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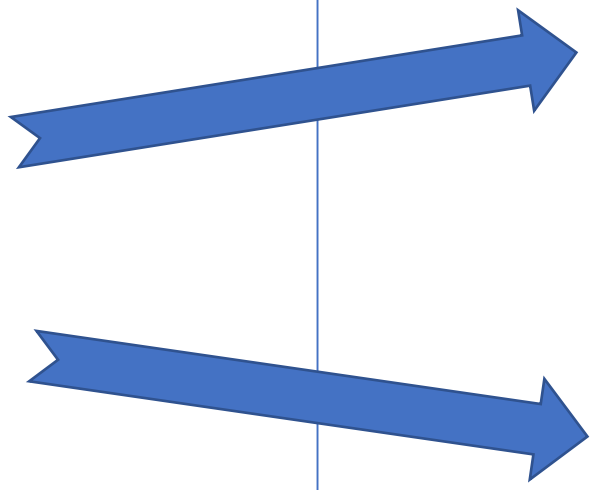
The Basics – What Makes Up My Utility Bill*

- Connection Charge
  (Fixed amount)
- **Energy** Charge
  ($/kWh)
- **Demand** Charge
  ($/kW)
- Distribution Charge
  ($/kWh)
- Power Factor Adjustment



Energy Charge

Charge for energy (kWh) used over billing period

- Flat rate (fixed $/kWh)
- Time-of-Use (**TOU**)
  - Different $/kWh based on time of day
  - Typically 2 or more rates (multi-tier)

Demand Charge

Charge for peek demand (kW) measured over billing period

- Flat rate (fixed $/kW)
- Time based
  - Different $/kW based on time of day
  - Will correspond to TOU period

* Your bill may have different/additional charges

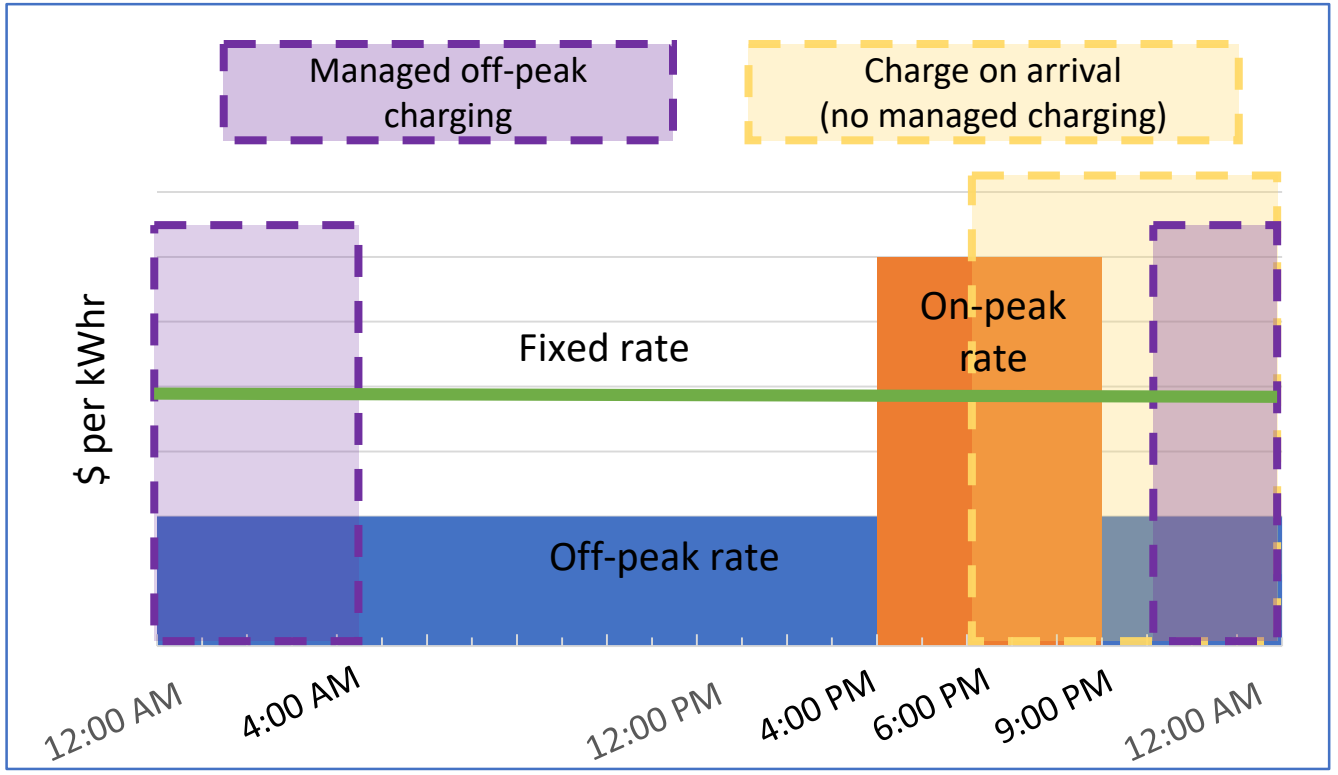
Why is this important – Energy Charge

Example Fleet*

- 10 city delivery vans
- 100 mi/day, 21 days/mo.
- .7 kWh/mi.
- 12 kW charger
- ~ 6 hr charge time
- Depart – 4 AM
- Arrive – 6 PM

Consider three charging scenarios

- Fixed energy rate
- TOU rates
- TOU rates but only charge during off-peak



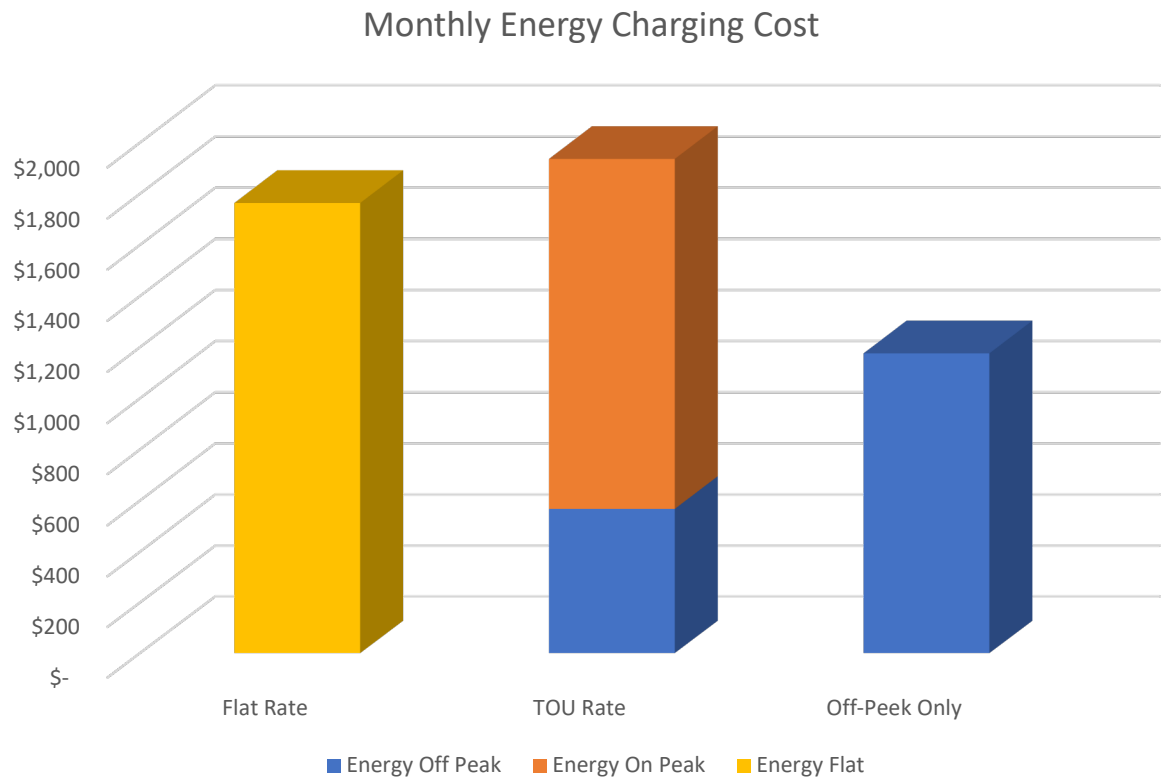
* Scenario simplified for illustration purposes

Why is this important – Energy Charge

Monthly charging energy* costs vary dramatically between different tariff/charging scenarios

Monthly Energy Charging Cost

Charging Scenario	Energy
Flat Rate	$ 1,764
TOU Rate	$ 1,936
Off-Peak Only	$ 1,176



Difference in charging cost for the same amount of kWh

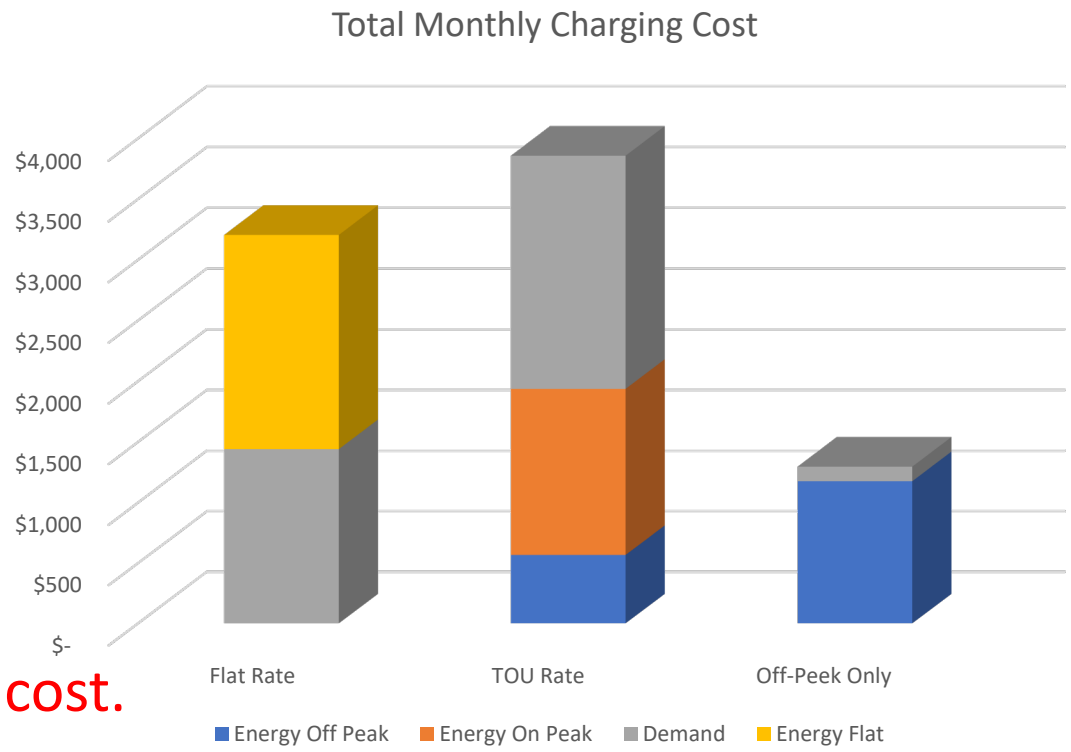
* Charge Energy = 14,700 kwh/month

What about demand charge

- Demand charges are additional fees for delivering energy to the customer. They are based on peak usage during billing period and are priced at $/peak kW.
- For most electric fleets, charging demand will be <u>in addition</u> to the existing facility demand.
- Like energy, demand charge pricing can vary dramatically by tariff.
- Considering demand charges in our example:

Total Monthly Charging Cost

Charging Scenario	Energy	Demand	Total Costs
Flat Rate	$ 1,764	$ 1,440	$ 3,204
TOU Rate	$ 1,936	$ 1,920	$ 3,856
Off-Peak Only	$ 1,176	$ 120	$ 1,296



Demand can be 50% or more of the total charging cost.

Now about Utility Tariffs

- Utility tariffs vary greatly across the country
- The commercial tariffs are generally divided into
  - Small or medium user
  - Large user (large is typically > $1,000 kW demand)
- Depending on the fleet size and charging infrastructure installation, your facility may need to move to a large user tariff.
- Review available tariffs for both for rate and demand charge comparisons
  - Fixed rates
  - TOU rates (on/off-peak/semi-peak)
    - Single or multi-tier timing
  - Seasonal rate adjustment
  - Demand charge minimum billing

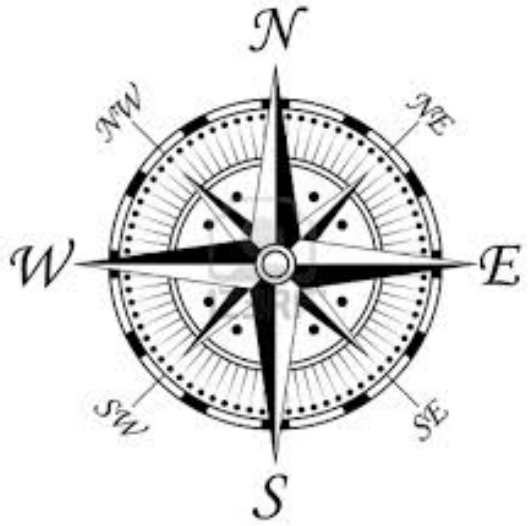
What about EV Tariffs

- Utilities are experimenting with special tariffs for fleet EV charging.
- Expect more tariff variations to be available for fleets.

	General Service	Electric Vehicle Charging
Metering	One service One meter	Require dedicated EV service Separately metered
Rate	TOU • Single or multi-tiered • Seasonal adjustment	Flat fee/kWh (no demand) TOU • Single or multi-tiered • No Seasonal Adjustment • Different $/kWh rate
Demand	• Billed at period peak • Either fixed or TOU based • May be multi-tiered	• NO demand (w/flat fee/kWh) • Purchase fixed demand blocks (ex. Purchase 50 KW increments) • No TOU or multi-tiered

Fleet Electrification and Utility Tariffs

Moving forward to manage charging costs



- Engage with your facility energy manager
- Educate yourself on available tariffs
- Plan for charge management
- Engage with your utility
- Be flexible in your solution to adjust your strategy to changing tariffs and/or changing fleet operation

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Andy Abrams
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- Founder of Evauto
- More than 30 years of experience in commercial engineering, design, and control systems development and operations
- Guides the development, refinement, and testing of the EVauto platform, with focus on constant improvement and expansion of features and capabilities

EVauto
fleet charging control system

Efficient EV Fleet Charging

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September 21, 2021

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Andy Abrams

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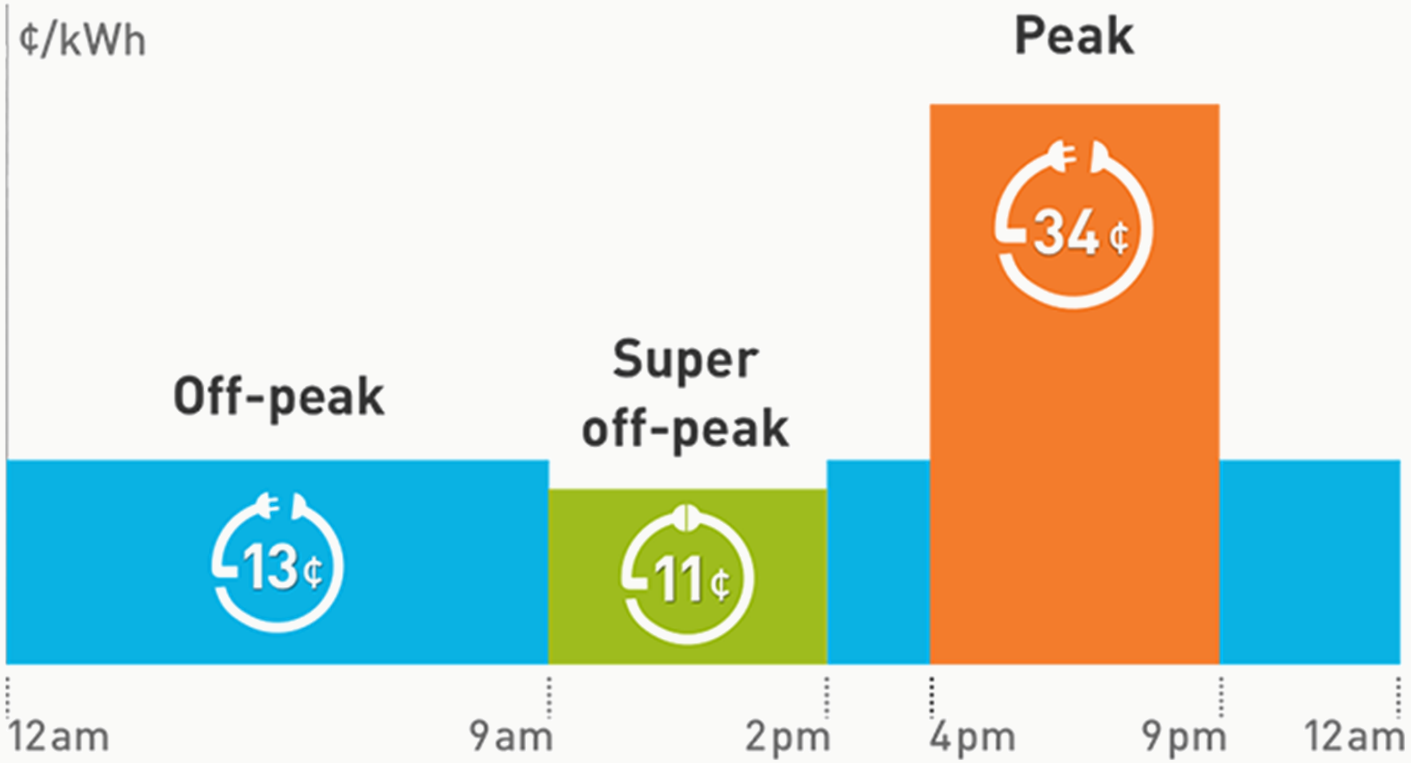
Example Utility Tariff

PGE BEV2



Utility $ = Peak kWh x $ / kWh
+ Mid kWh x $ / kWh
+ Off kWh x $ / kWh
+ Peak kW x $ / kW

Energy rates can vary by utility, season and time of day. Most tariffs include demand charges that vary based on peak power usage.

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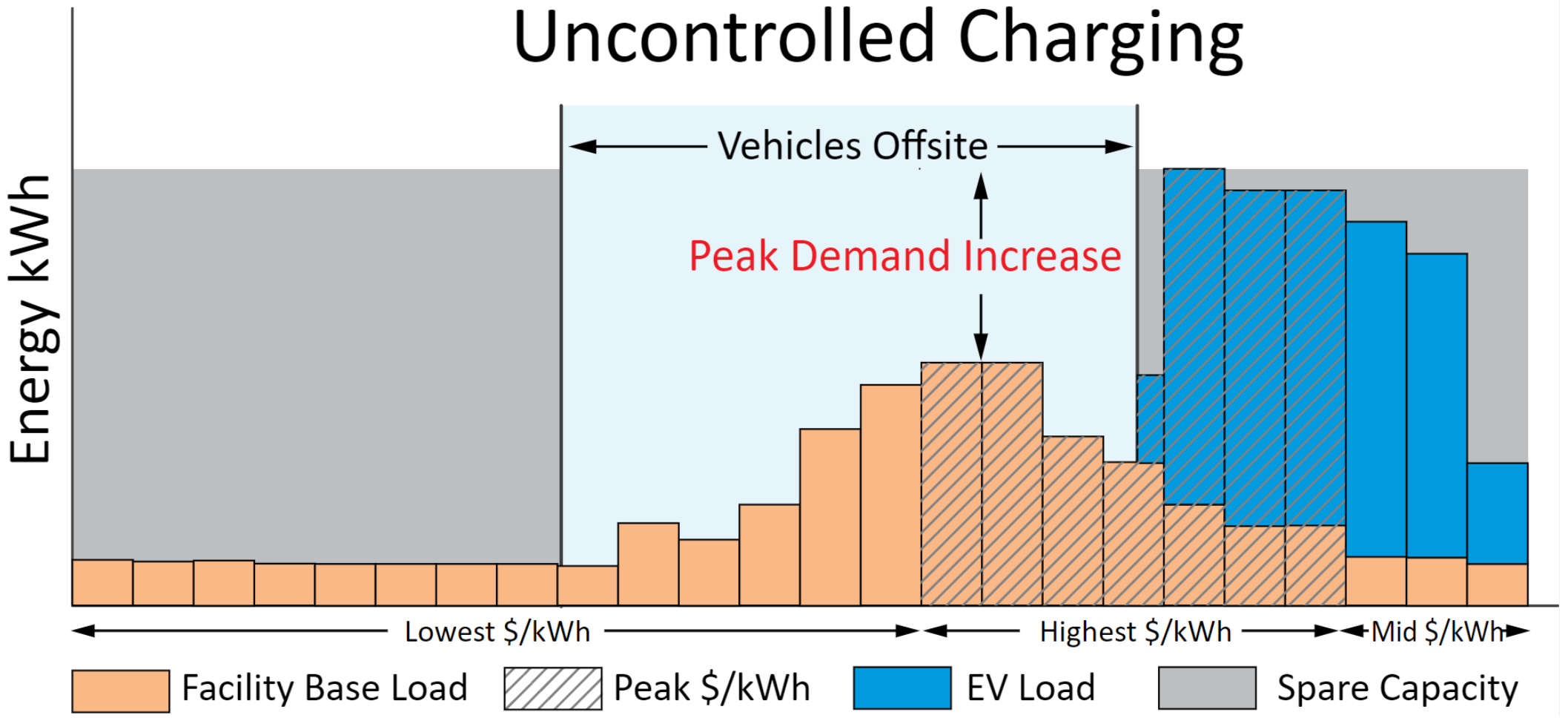

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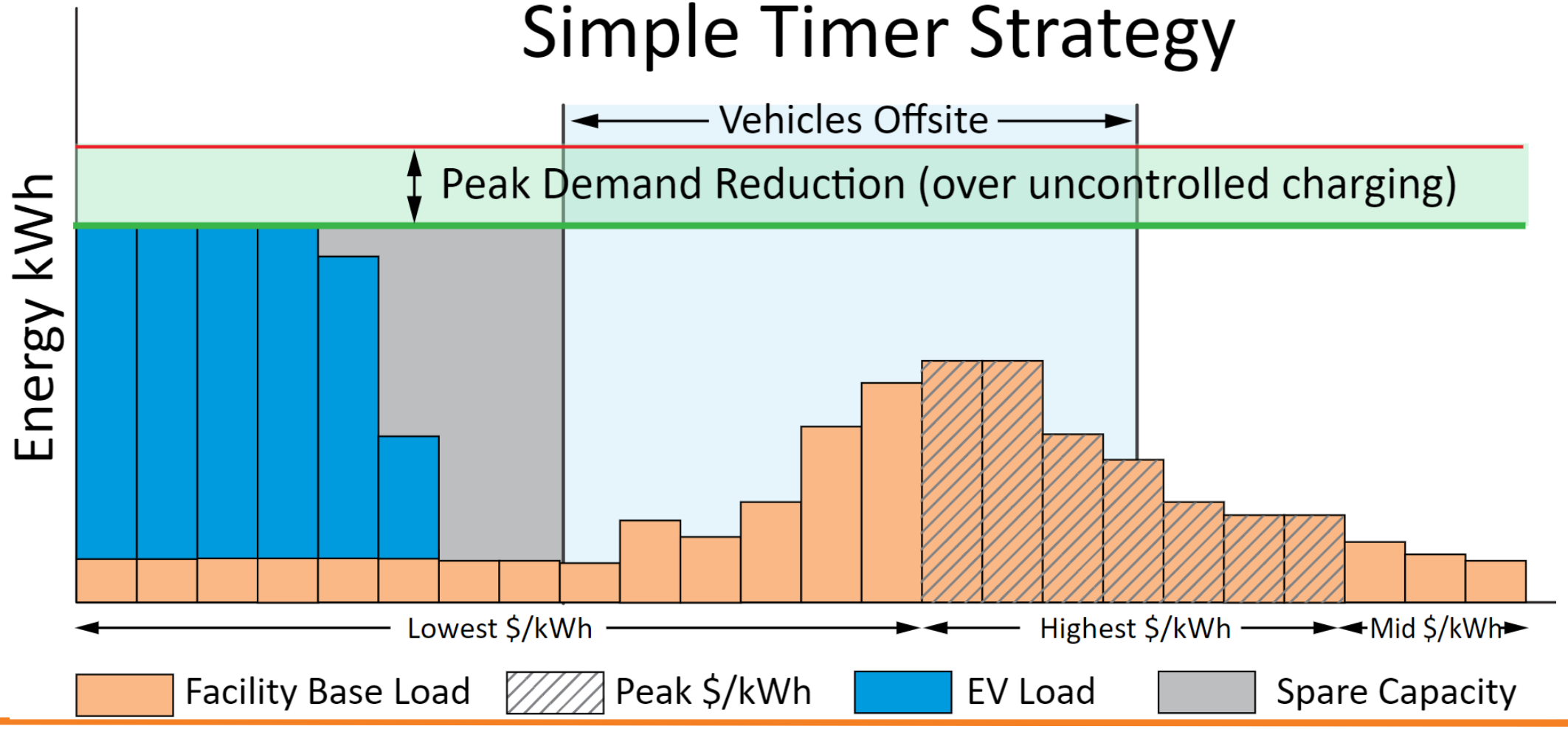
Simple Timer Strategy



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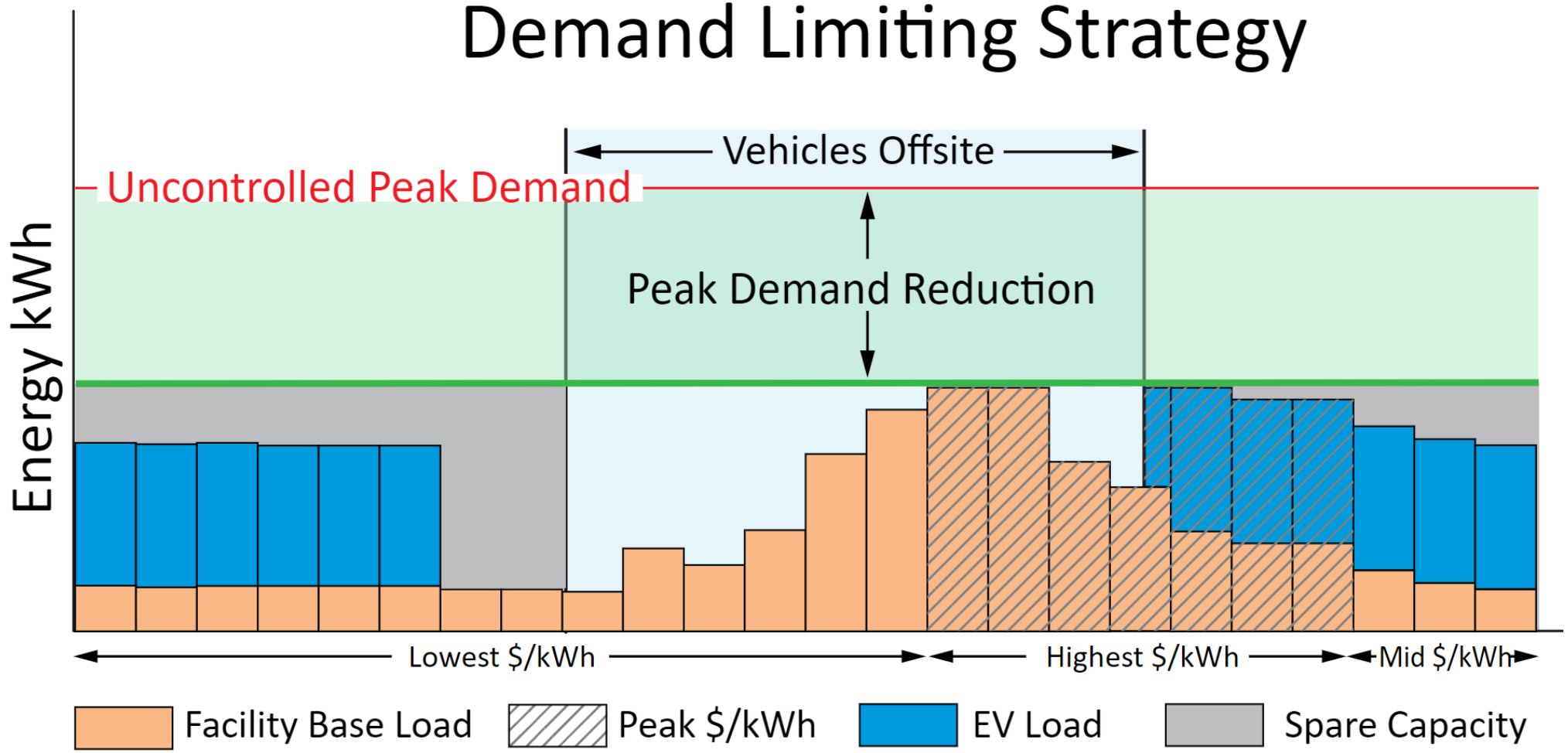
Demand Limiting Strategy



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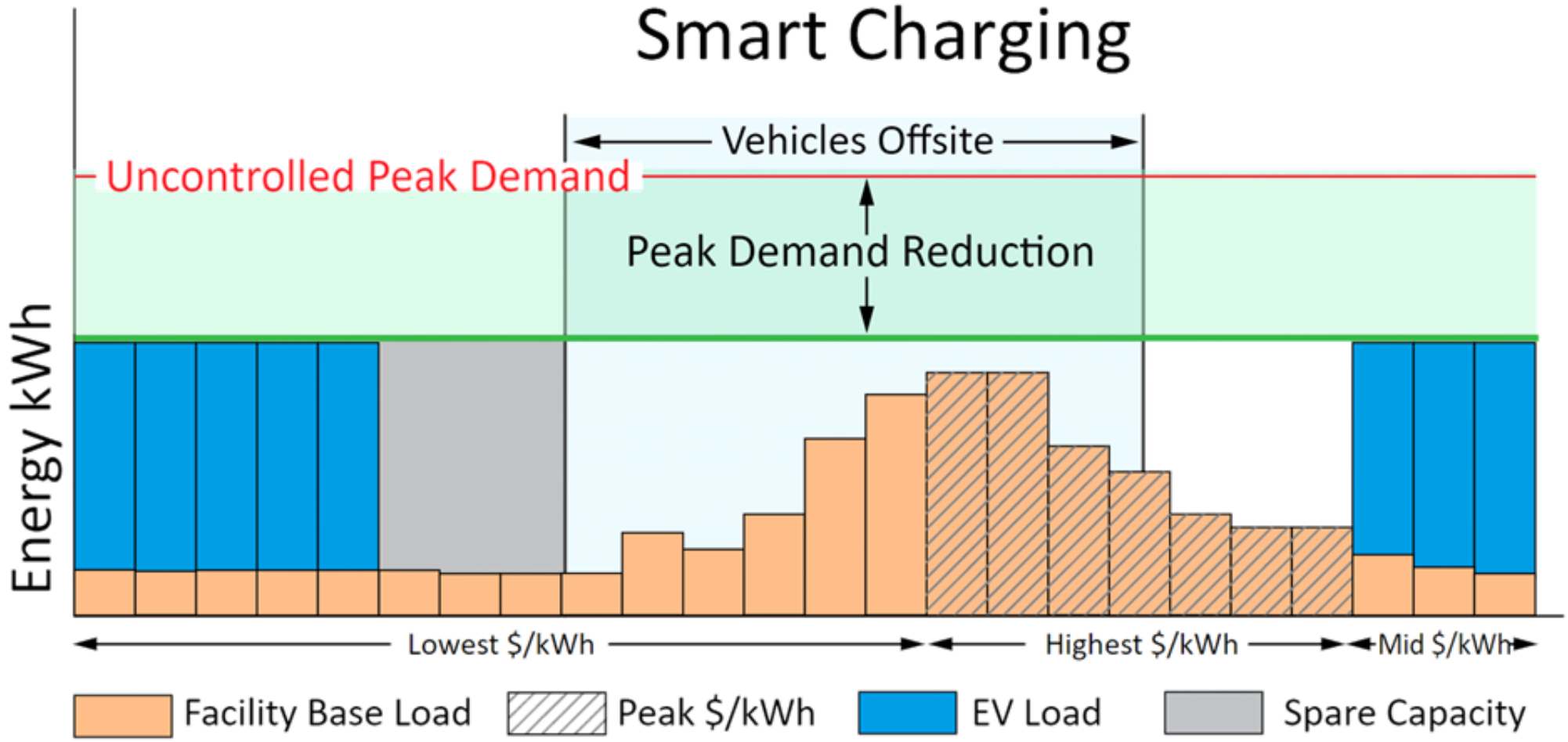

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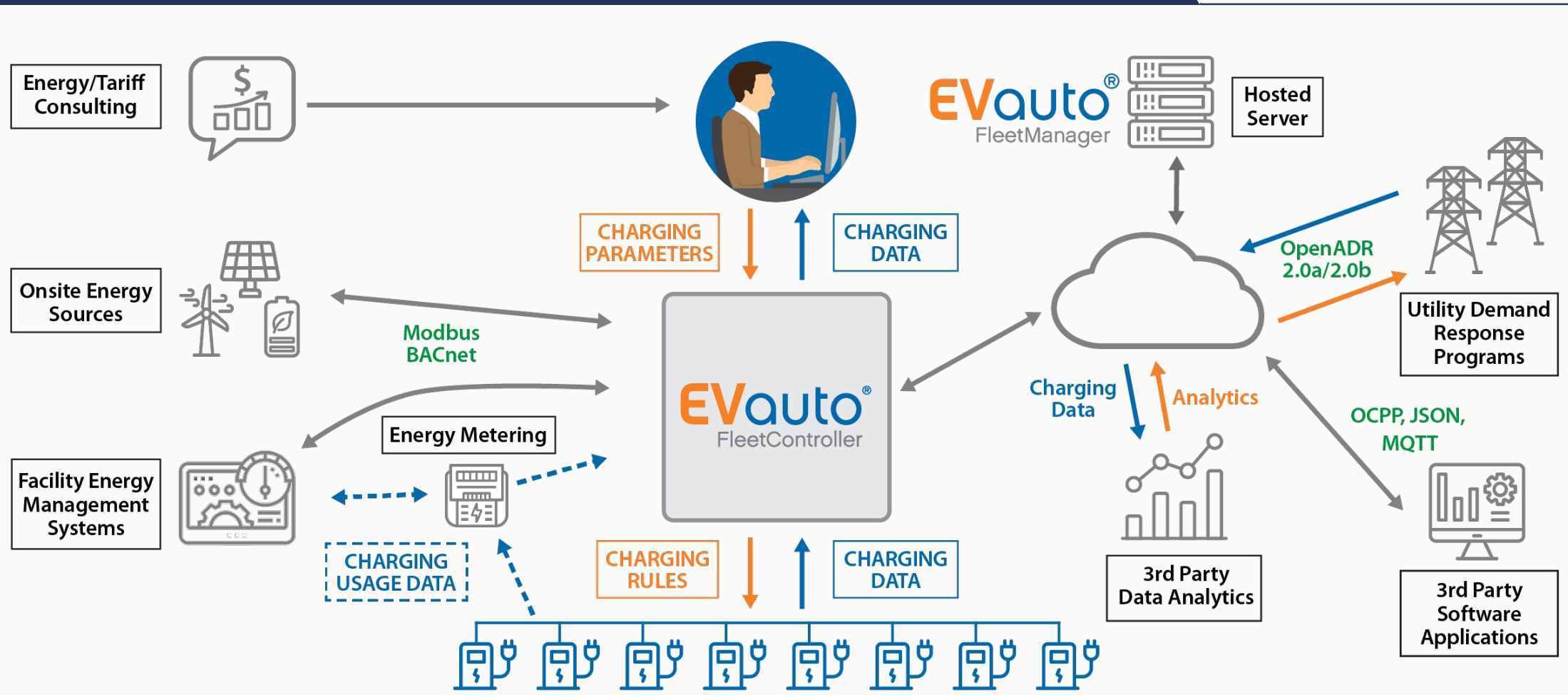

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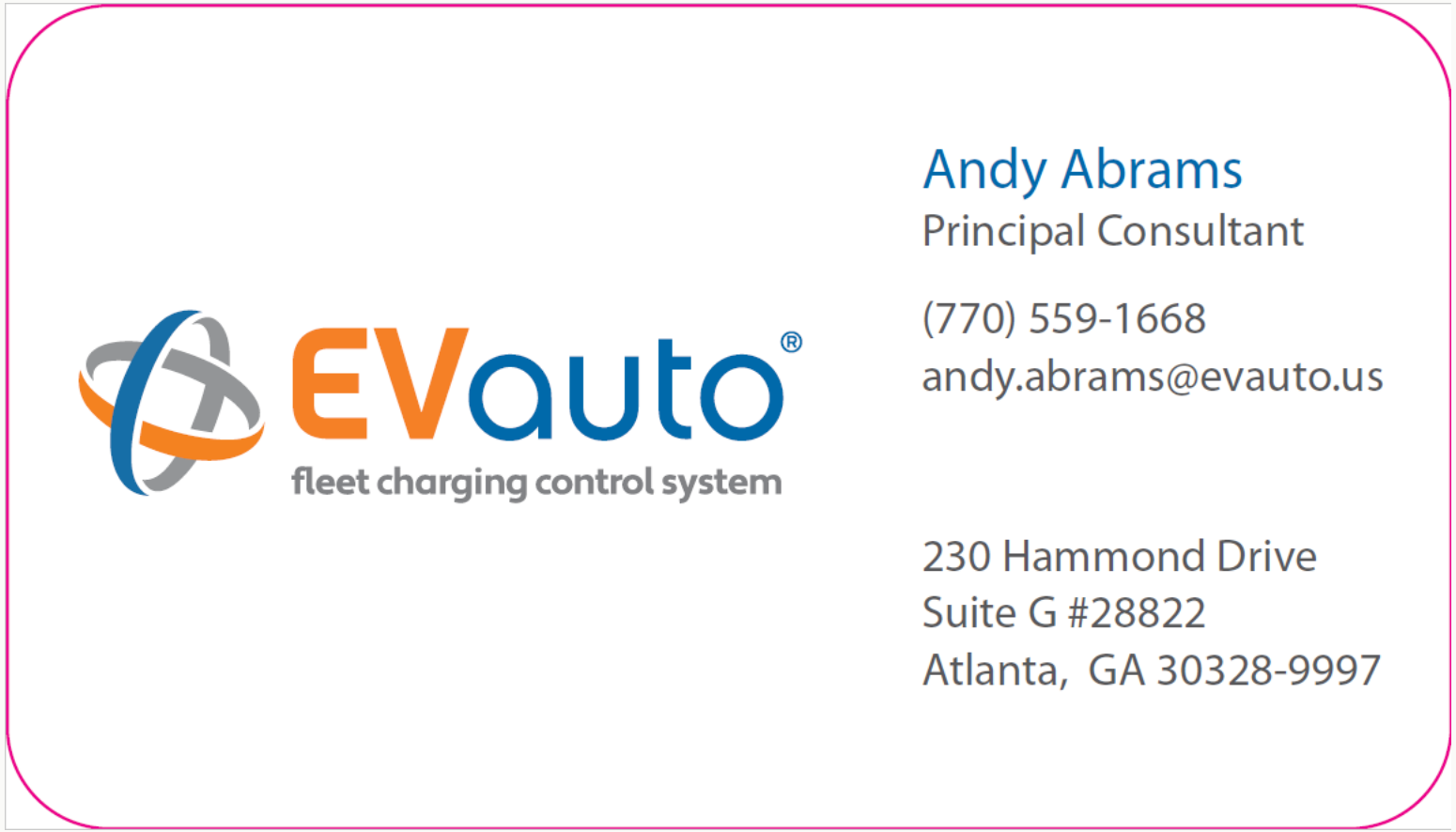

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Appendix

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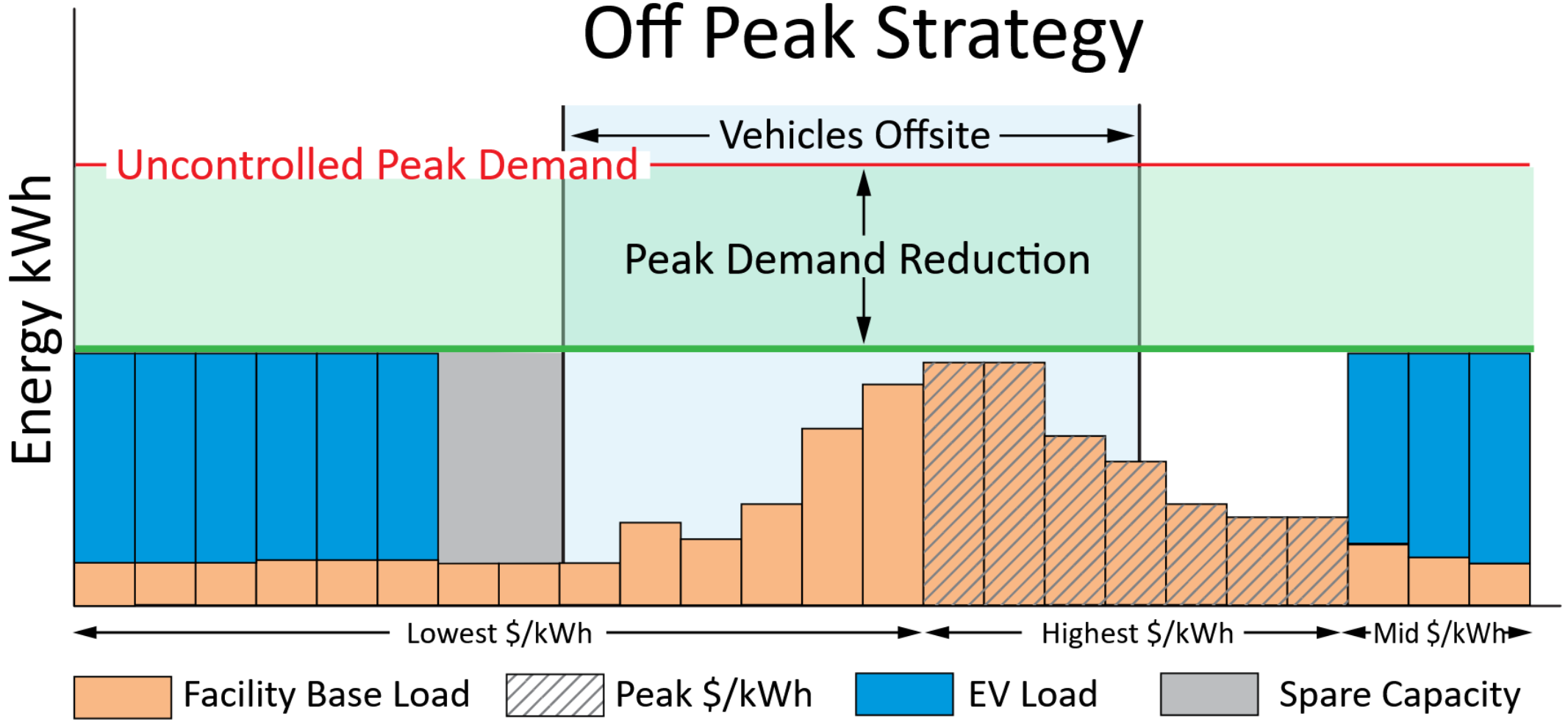
Off Peak Strategy



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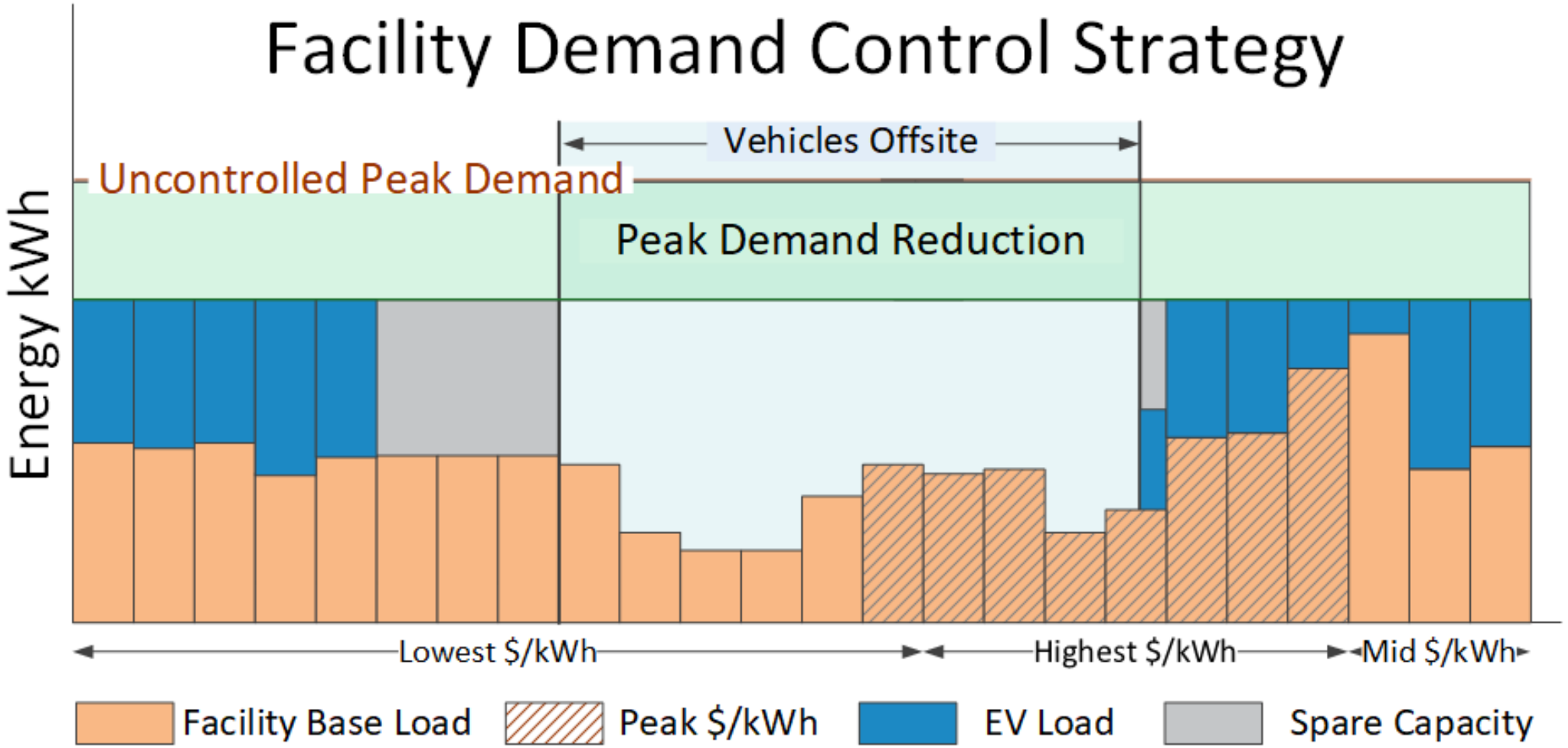
Facility Demand Control Strategy



Mike Rowand
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- Director, Engineering & Technical Services for eTransEnergy
- eTransEnergy provides single point solutions for Fleets to enable a cost-effective and successful transition to electric vehicles
- More than 35 years Duke Energy in various aspects of the utility industry including Emerging Technology, Transmission and Distribution Engineering, Customer Service, Rates and Regulatory processes, and Marketing
- Graduate of the University of Florida with a degree in Mechanical Engineering, licensed Professional Engineer in North Carolina and South Carolina, and a Certified Energy Manager

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EV Fleet Infrastructure & Utility Integration

Mike Rowand
eTransEnergy

9/21/2021

- EV Charging Equipment (EVSE)
- Facility Electrical Infrastructure
- Utility Service Infrastructure
- Distributed Energy Resources

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EV Charging Equipment (EVSE)

Level 1 120V AC	1.4 kW		Hairdryer
Level 2 240V AC	3 – 19 kW		Dryer, Water Heater
DCFC	50 kW – 350 kW +		Small Office Bldg
Megawatt Charging System (MCS)	1 MW +	TBD	High Rise Office, Retail Mega-Center

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EV Charging Equipment (EVSE)

Design Considerations

- Vehicle parameters (battery size, AC/DC capability)
- Dwell time for charging
- EVSE : Vehicle ratio
- Charge Management
- Physical configuration
  - Indoor/outdoor, pedestal/overhead
- Future optionality

Operational Flexibility can improve or restrict design options ($$)

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Facility Infrastructure

Design Considerations

- Existing equipment capacity (amps, branch circuit availability, etc.)
- Thresholds for capacity upgrades
- Voltage requirements for charging
- Separate delivery for EV charging
- Utility rate tariff implications
- Building/Charge management options

Cost: Can be nominal or multiples higher than EVSE Cost

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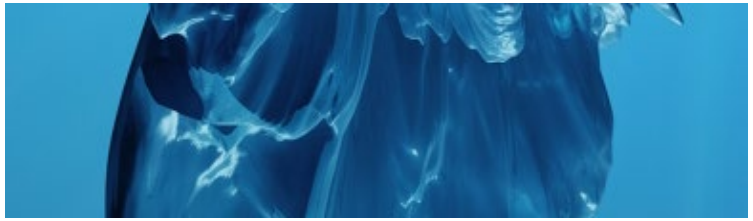

Utility Service Infrastructure

Considerations

- Existing utility capacity and thresholds
- Timeline for potential upgrades
  - On-site
  - Off-site
- Existing vs. new delivery
- Delivery voltage
- Rate Tariff options
- Potential for "CIAC"

Optional Utility Services ($)

- Alternate Feeder
- Dedicated Feeder
- Redundant Transformers

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Distributed Resources

Considerations

- Resiliency
- Sustainability
- Energy Cost
- Infrastructure Cost

Potential Solutions

- On-Site “spinning” generation (or portable)
- Solar (on-site / off-site)
- Energy Storage

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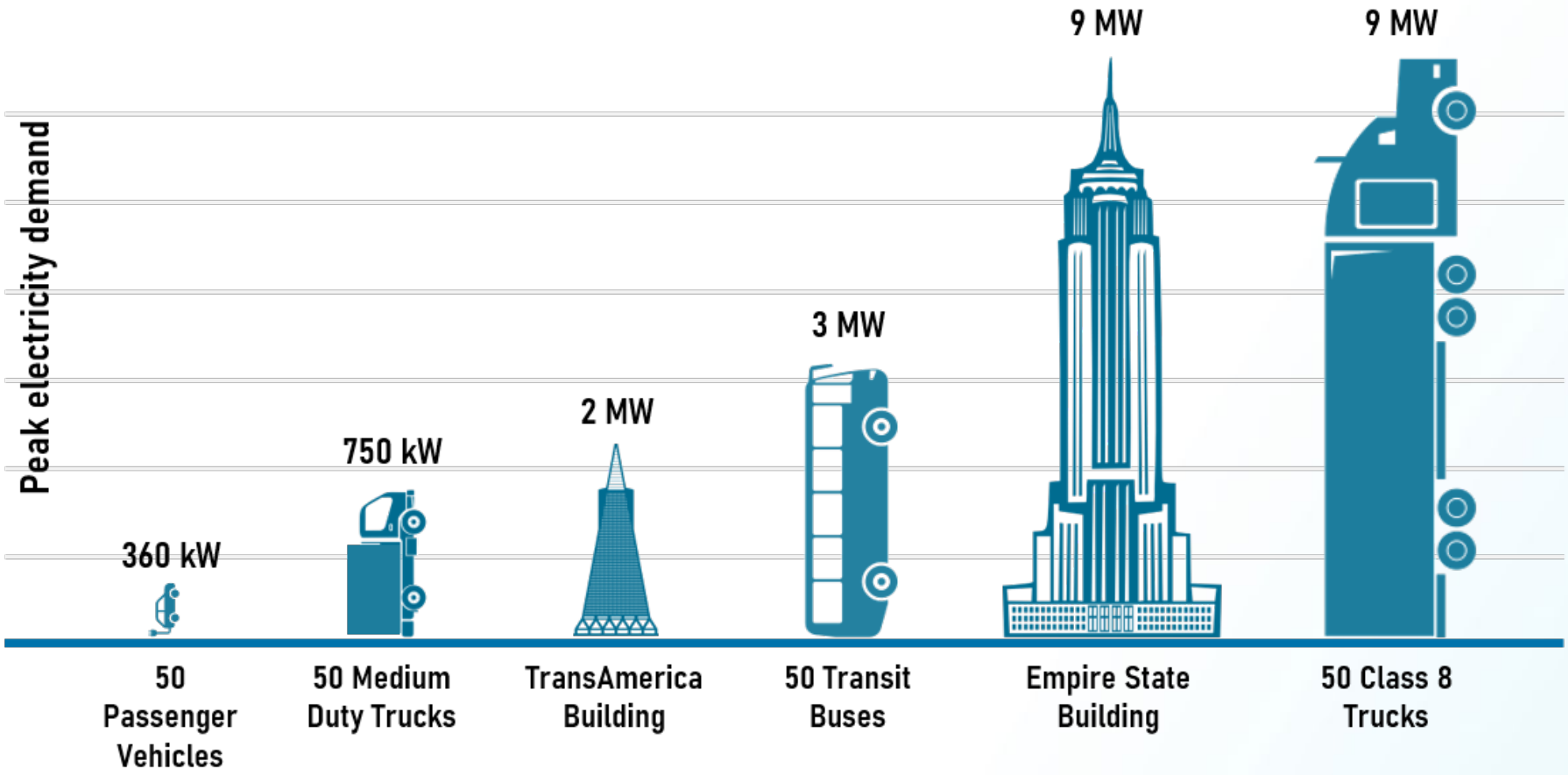
Large EV Fleet Requirements in Perspective



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Thank You

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