Electric Vehicle Strategy and Solutions

Are You Ready for the Future?

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NRECA Business & Technology Strategies

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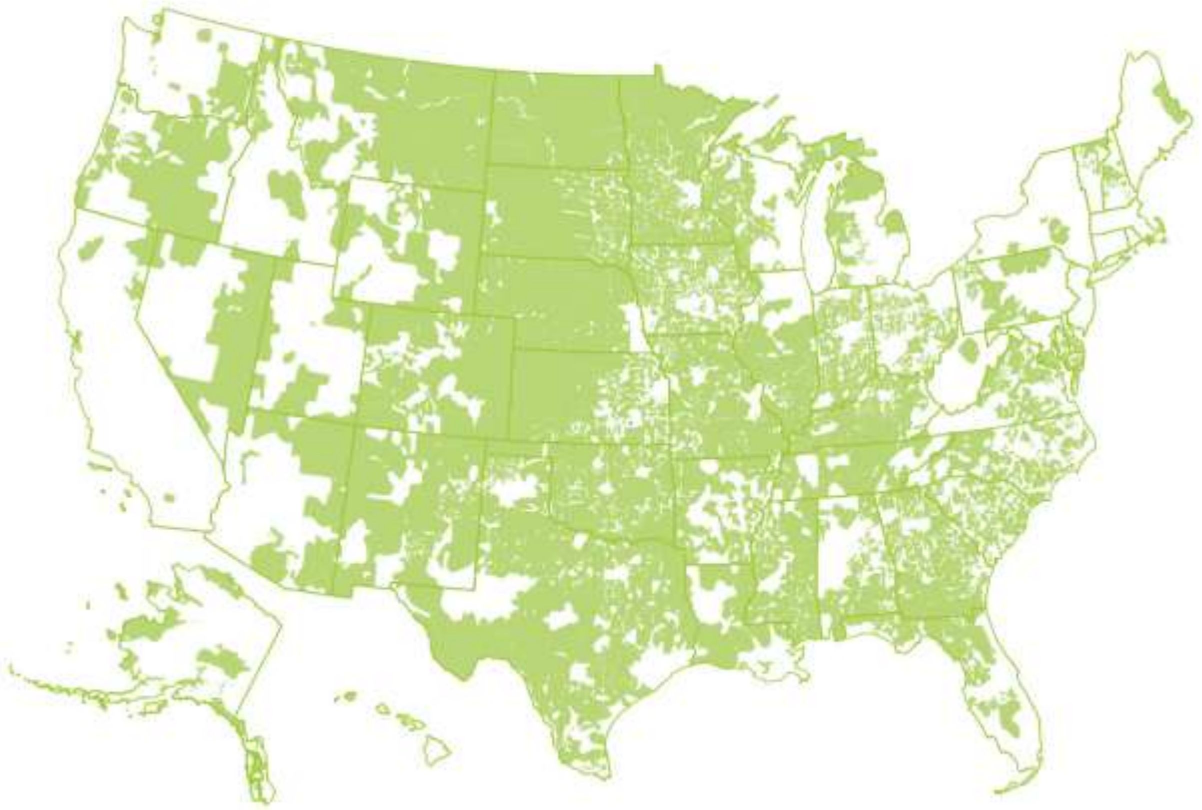
Cooperatives Power 56% of the Nation's Landmass



- 832 distribution cooperatives
  - 42 million people
  - 92% of persistent poverty counties
- 64 G&T cooperatives
  - Wholesale power through their own generation facilities on purchasing on behalf of their distribution members

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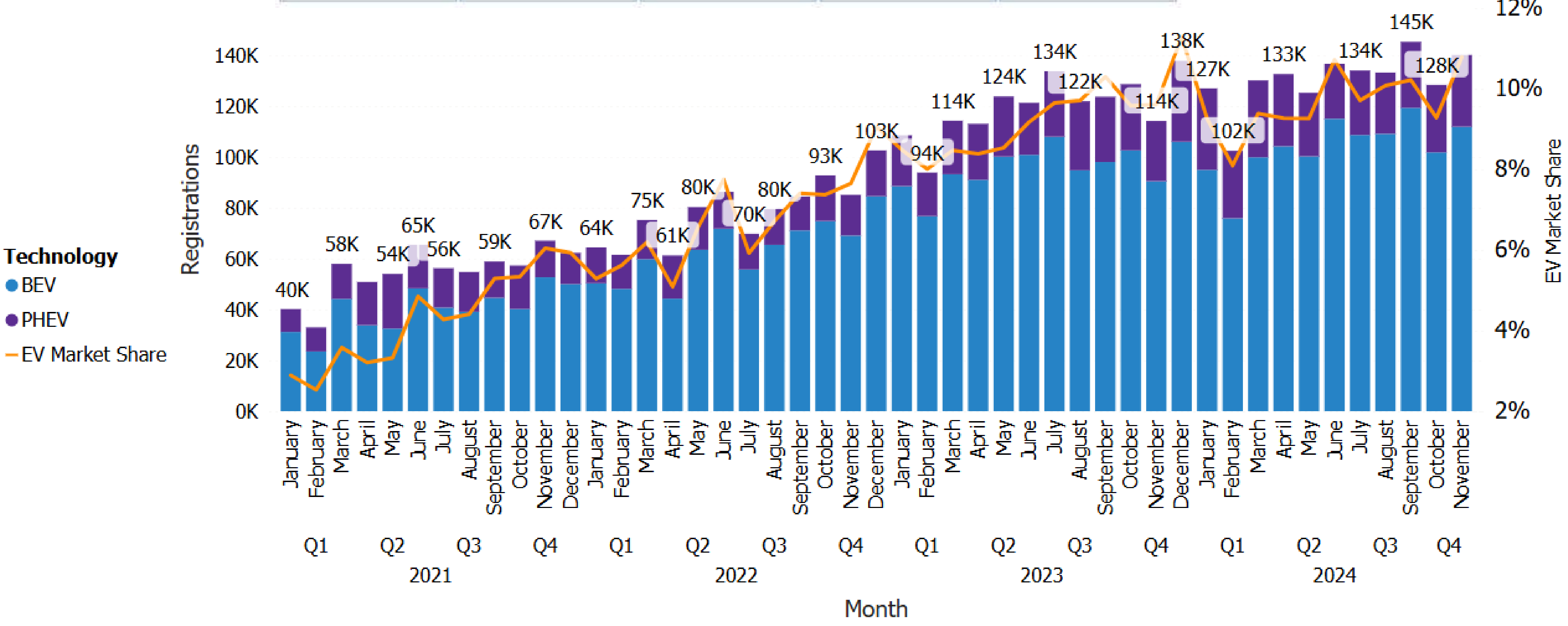
Cooperatives Focused on their Consumer-Members

A Systems Approach – EV's Aren't the Only Issue

- Impact of EV's must be viewed holistically along with everything else
  - Power supply challenges – traditional generation and DERs
    - Plant retirements
    - Renewable capacity versus demand profile
  - Electrification and large loads
    - Data centers, AI, Cryptocurrency
    - Industrial and agricultural conversion to electric energy sources
  - Renewable integration
    - Solar PV, wind
    - Battery Energy Storage Systems (BESS)
    - Demand response programs

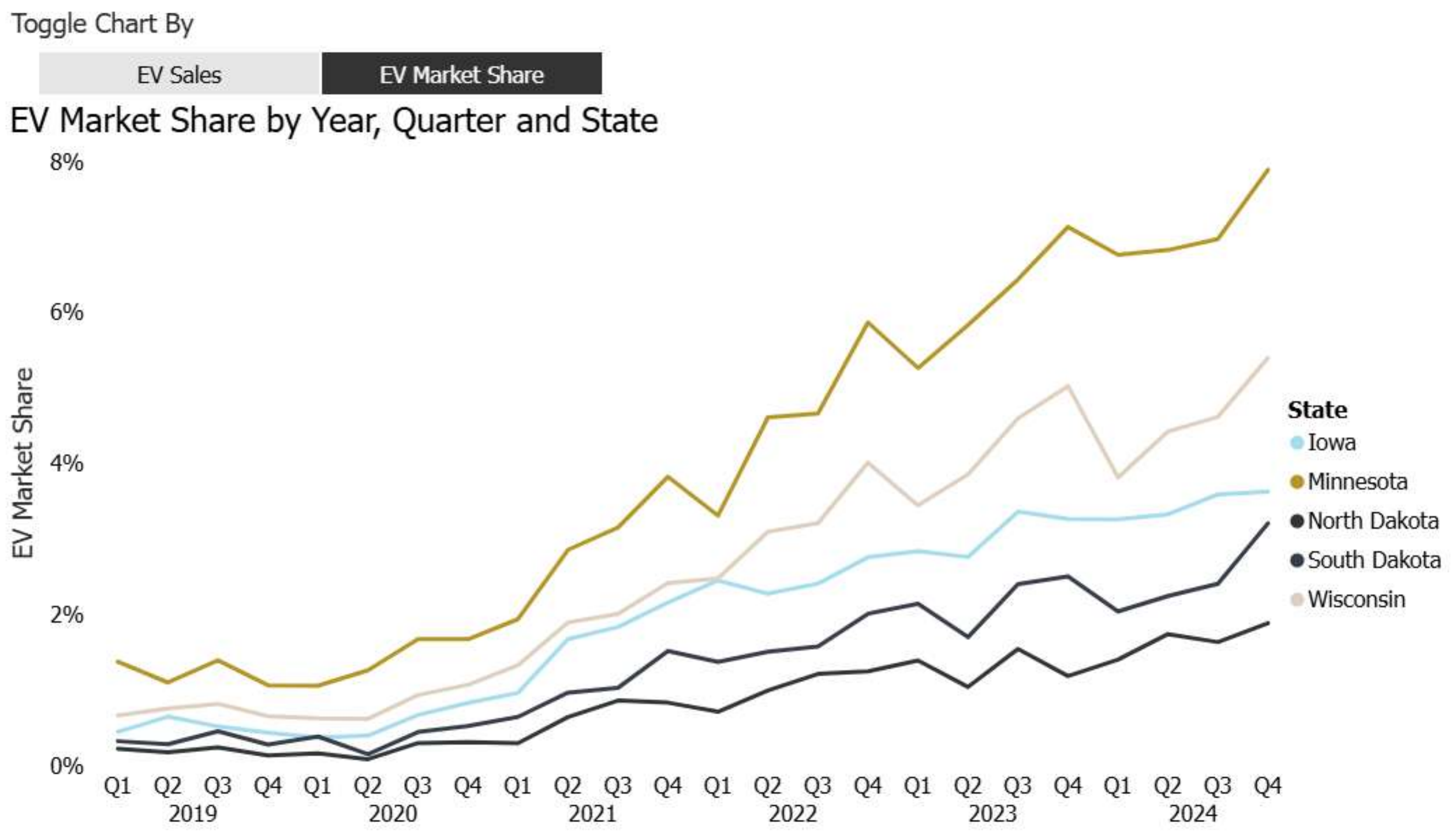
National EV Sales and Market Share

6,224,713	70	239	10.8%	Nov 2024
EV Sales	EV Makes	EV Models	Latest Month EV Market Share	Latest Sales Month



Source: Atlas EV Hub

EV Market Share Trends – North Central US



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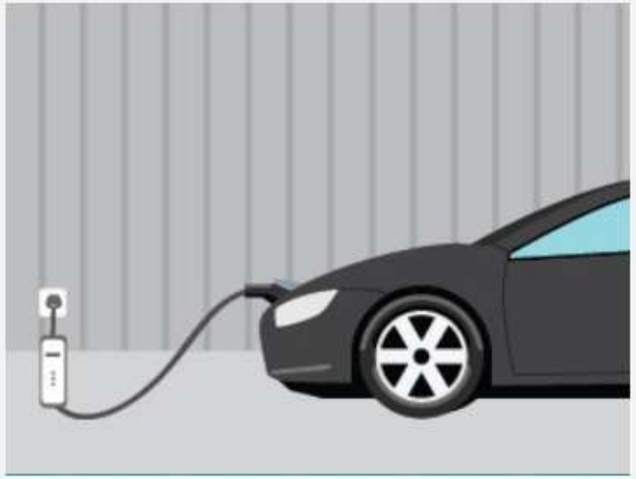
Levels of EV Charging

Level 1



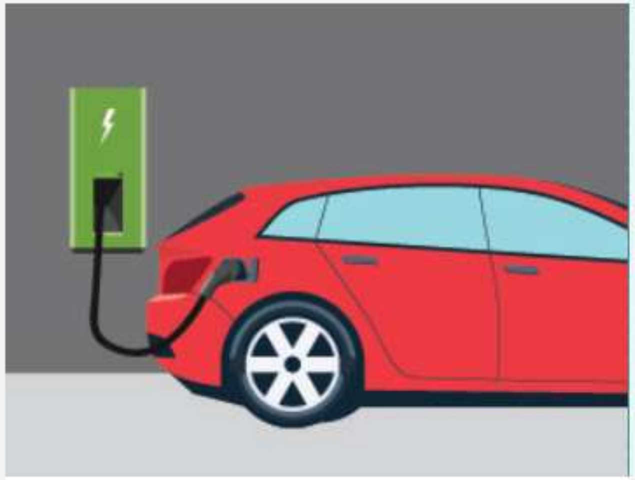
VOLTAGE:
120V 1-Phase AC

AMPS:
12-16 Amps

CHARGING LOAD:
1.4-1.9 kW

CHARGING TIME:
3-5 Miles per Hour

Level 2



VOLTAGE:
208V or 240 V 1-Phase AC

AMPS:
12-80 Amps (Typ. 32 Amps)

CHARGING LOAD:
2.5-19.2 kW (Typ. 6.6 kW)

CHARGING TIME:
12-60 Miles per Hour

DC Fast Charge

VOLTAGE:
208V or 480V 3-Phase AC

AMPS:
>100 Amps

CHARGING LOAD:
50-350 kW

CHARGING TIME:
60-80 Miles in 20 Minutes

EV Charge Acceptance Rate

Factors the influence ROC

Vehicle on board charger

State of charge

Battery temperature

EV model	Driving range	Level 2	DC Fast
Hyundai Ioniq 5	303 miles	11 kW	350 kW
Chevrolet Bolt EUV	247 miles	11 kW	55 kW
Hyundai Kona	258 miles	7.2 kW	77 kW
Nissan LEAF+	226 miles	6.6 kW	100 kW
Nissan Ariya	304 miles	7.4 kW	130 kW
Volkswagen ID.4	275 miles	7.4 kW	125 kW
Tesla Model 3, Std Range	272 miles	11.5 kW	250 kW

Source: Green Energy Consumers Blog: A Buyer's Guide to EV Charging Speeds

Engineering Concerns

Customer loads	Service/Secondary/Transformer
Distribution system	Feeders/laterals/devices/substations
Power supply	Managing peak demand

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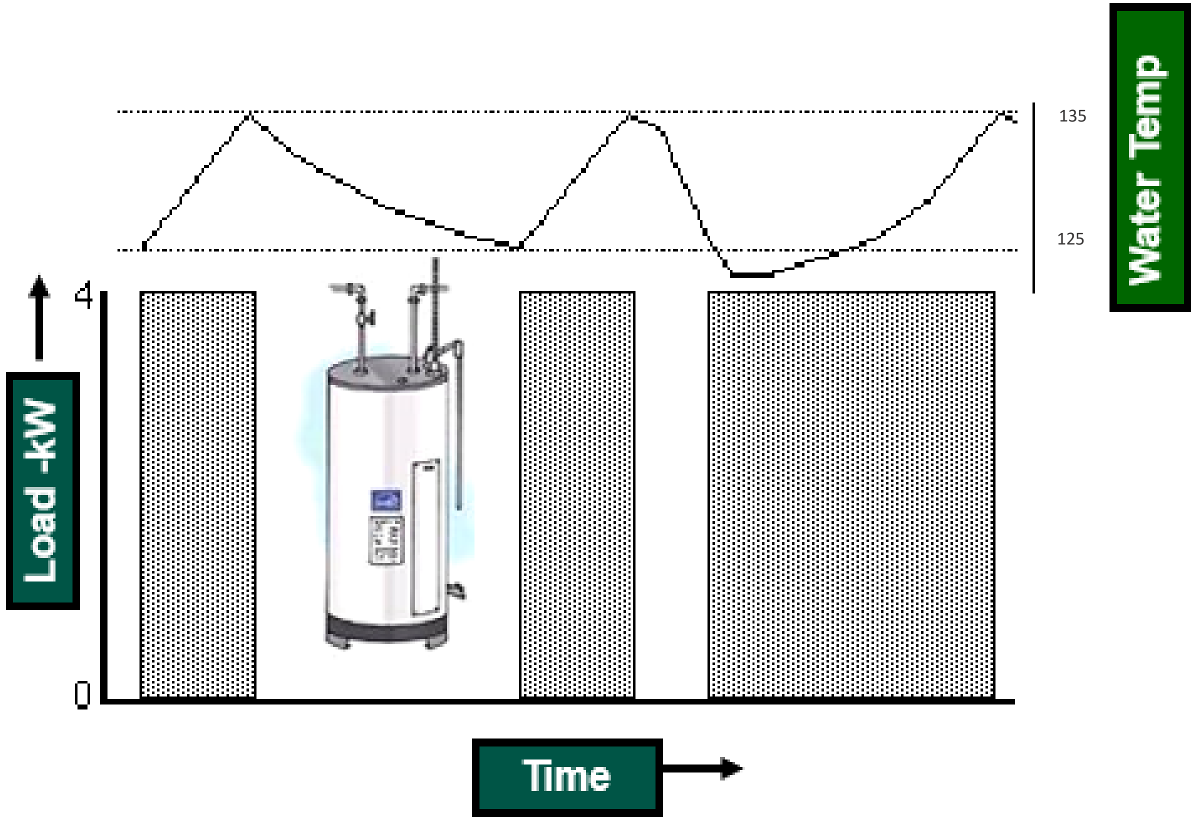
Load Diversity

- A water heater cycles on and off to maintain set point temp
- As the need for hot water increases, the unit comes on more often and/or stays on longer, depending on settings
- No two homes have the same water heater cycle, but there are occasions where two water heaters might be "on" at the same time



Willis, H. L.; "Spatial Electric Load Forecasting, 2nd edition"

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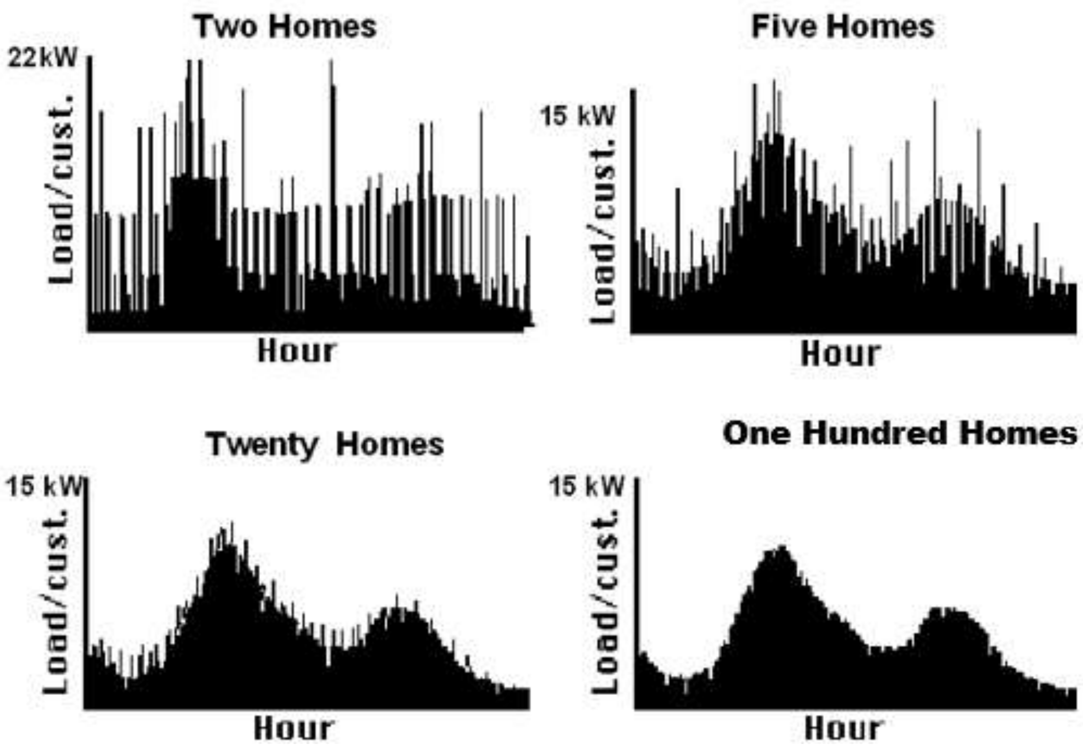
Load Diversity



Willis, H. L.; “Spatial Electric Load Forecasting, 2nd edition”

- Each home is made up of switched devices that are either on or off, controlled by a manual switch, thermostat, or timer
- As more homes are included in the sample, a pattern (“load shape”) begins to appear
- Note the average peak per customer decreases as more homes are included

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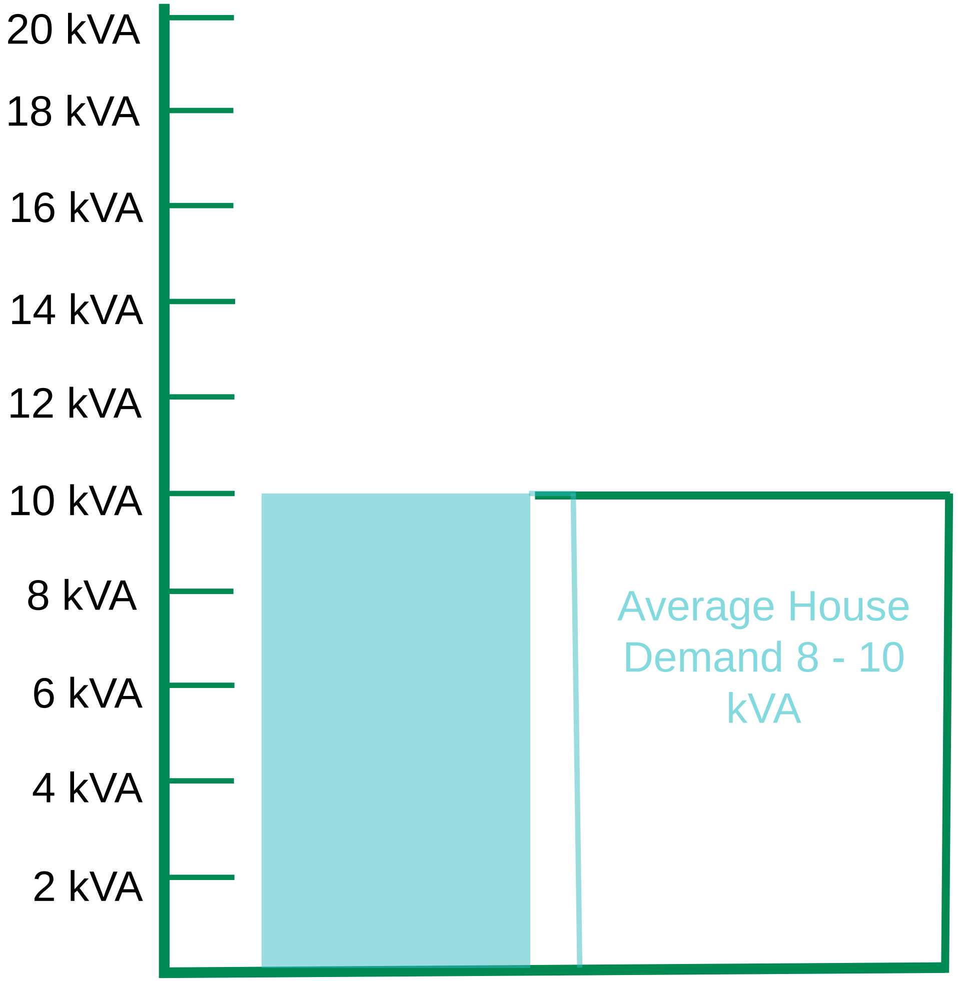
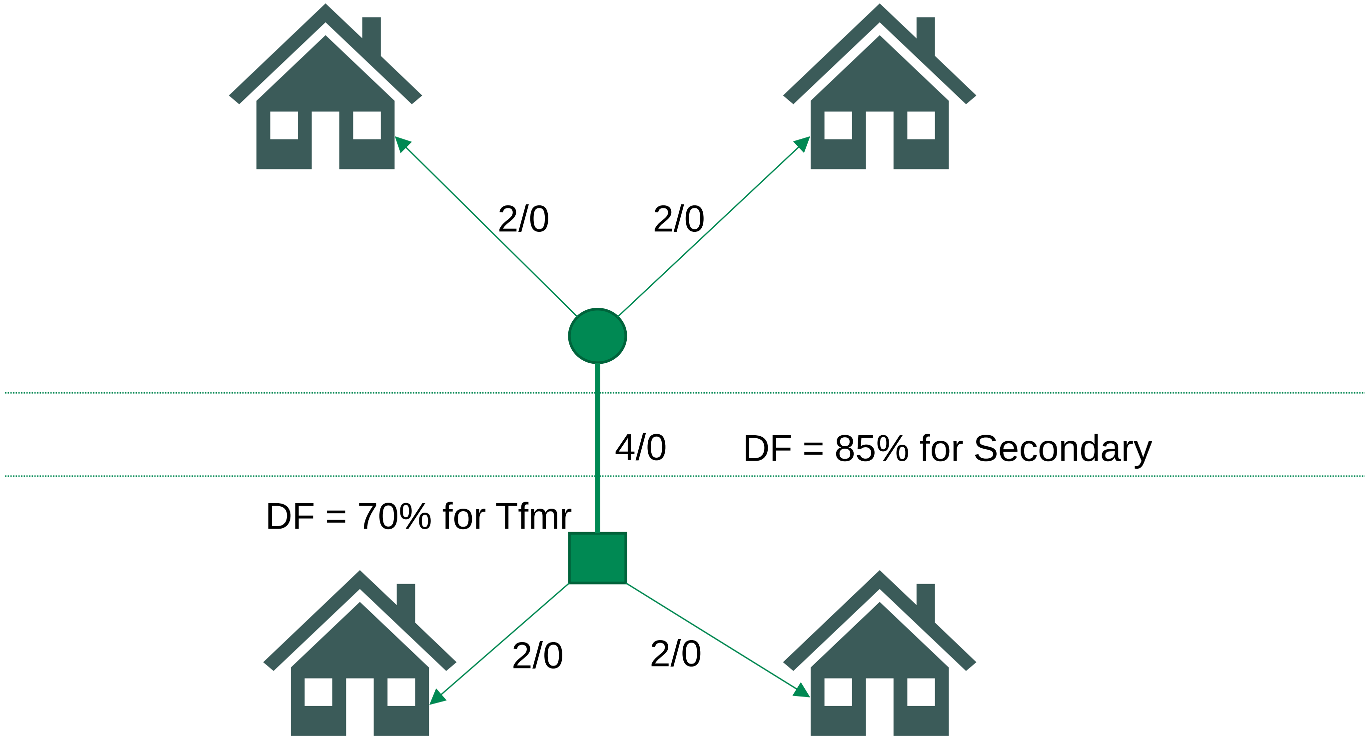
Diversity Factors for Multiple Homes

Number Units	Diversity Factors Percentage of Unit Demand
1	100%
2	85%
3	75%
4	70%
5	60%
6	55%
8	50%
10	45%
20+	40%

GE Distribution Transformer Manual

EV Demand Growth Challenge





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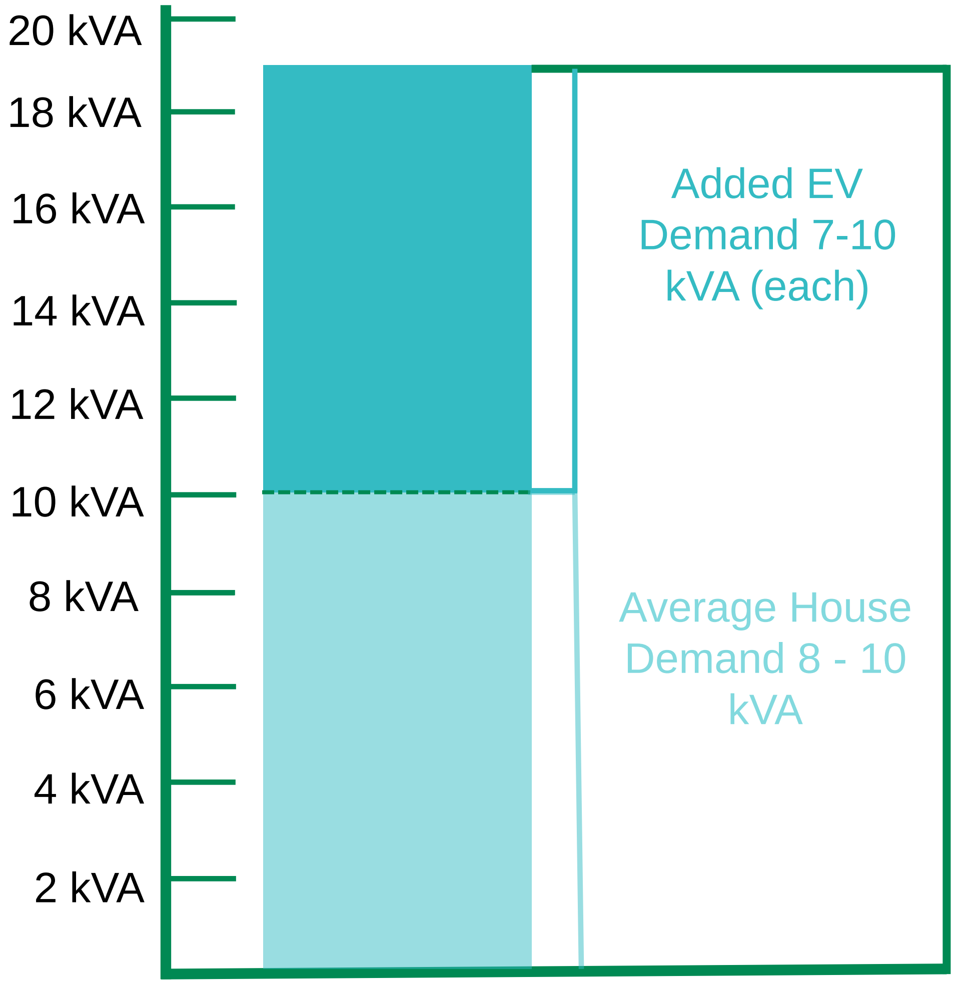
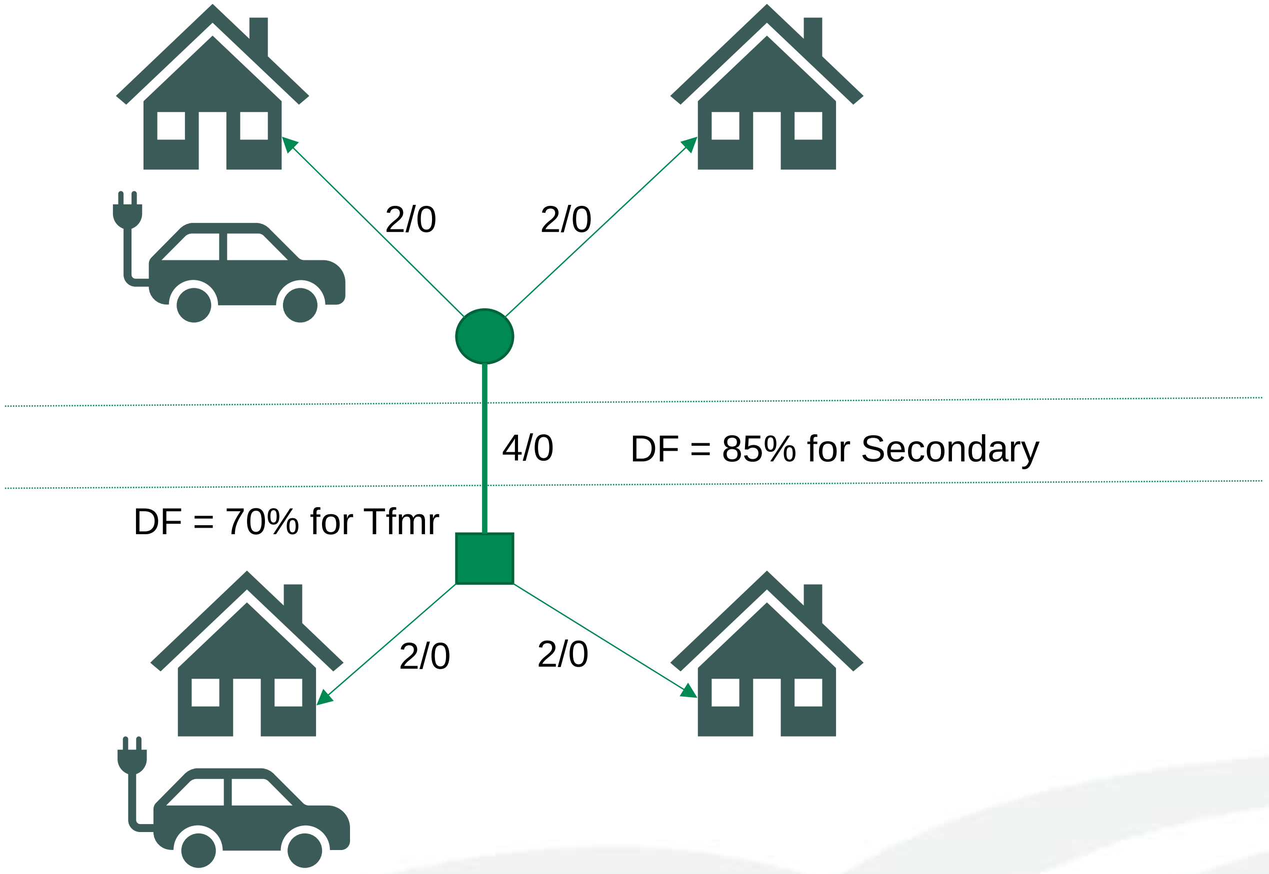
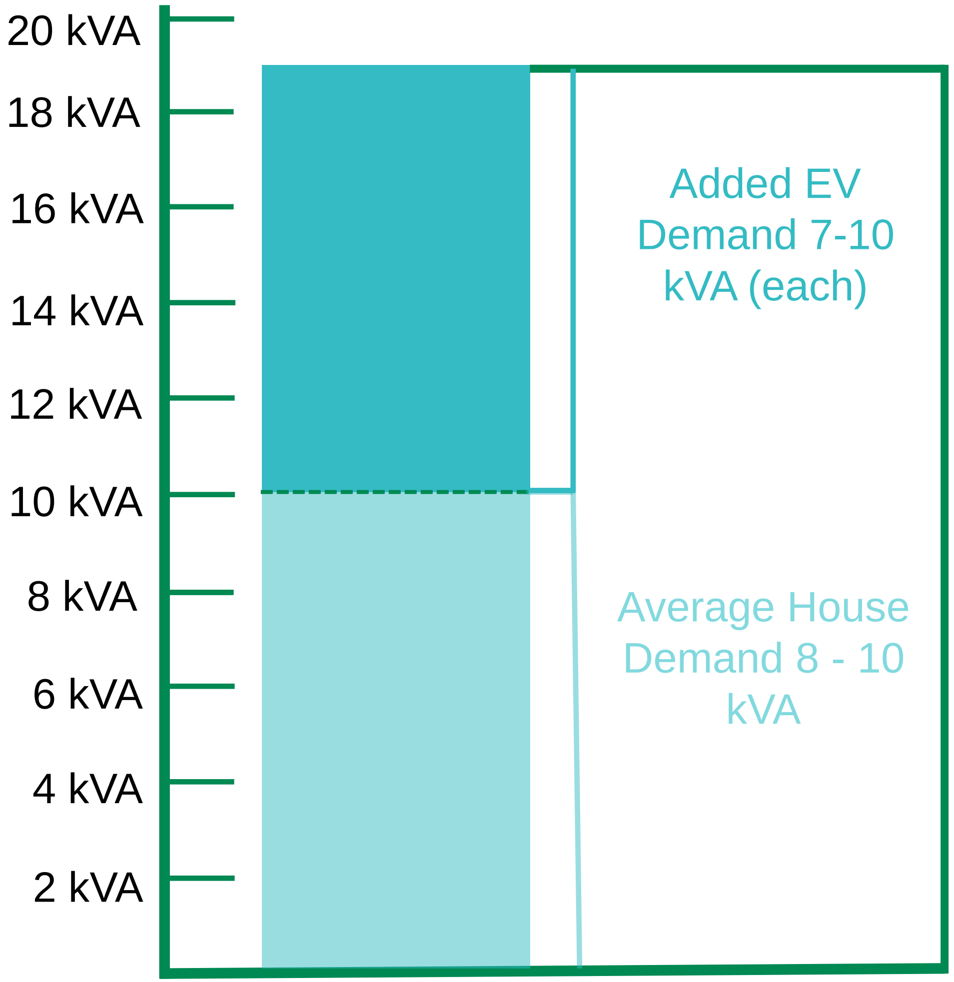
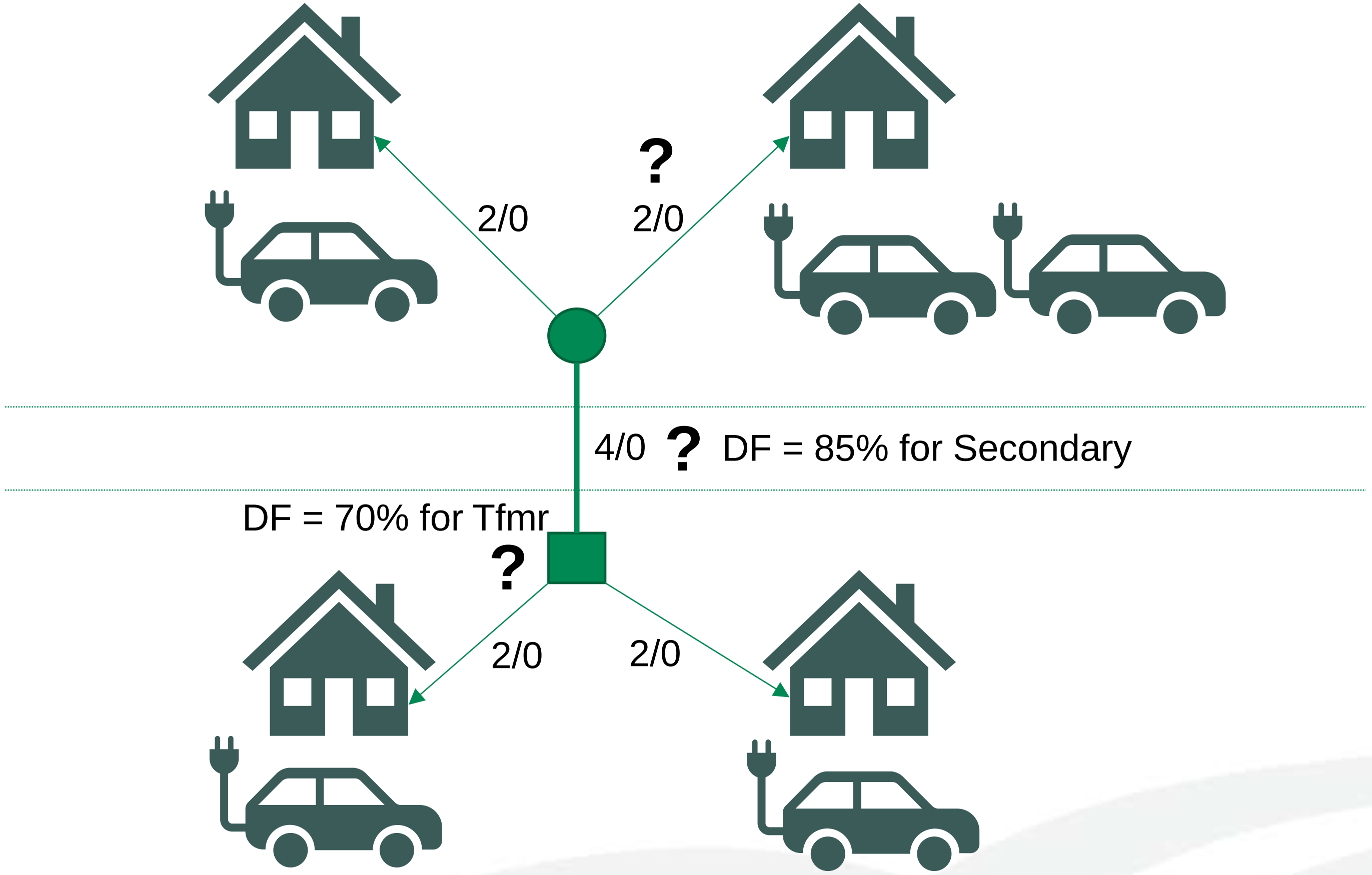
EV Demand Growth Challenge



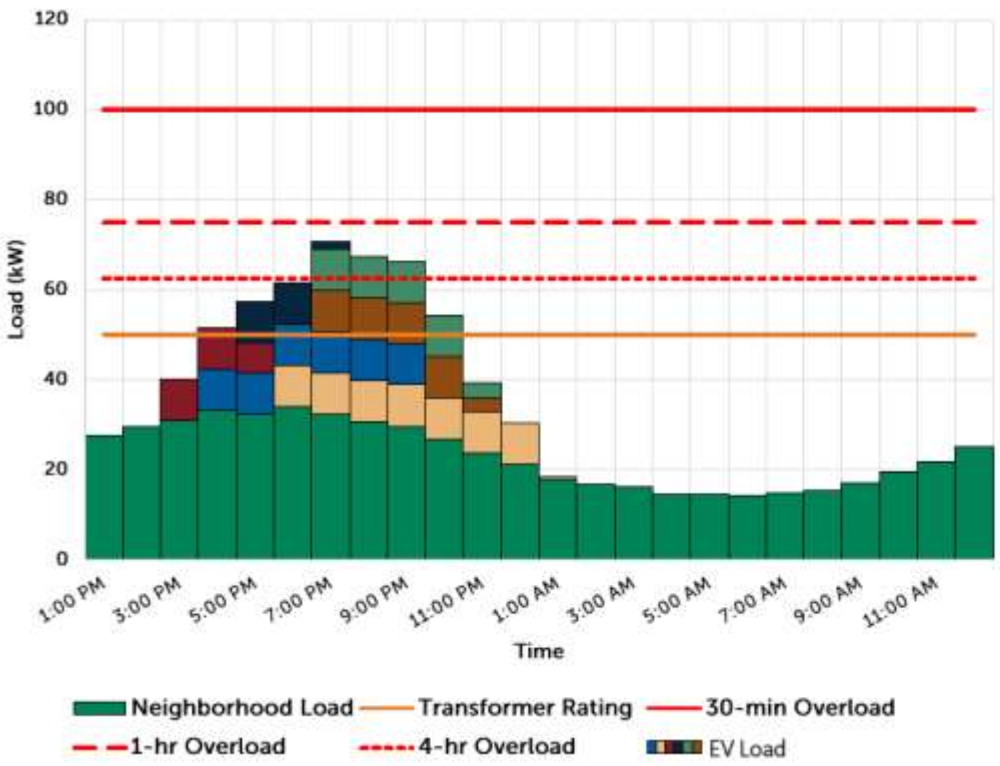


EV Demand Growth Challenge





Residential High EV Adoption - Unmanaged



Assumptions

- 6 EV chargers added
- Each charger is 9.6 kW
- No charger management employed

Impact

- Transformer overload ratings violated for several hours
- Charging occurs during high-cost evening peak

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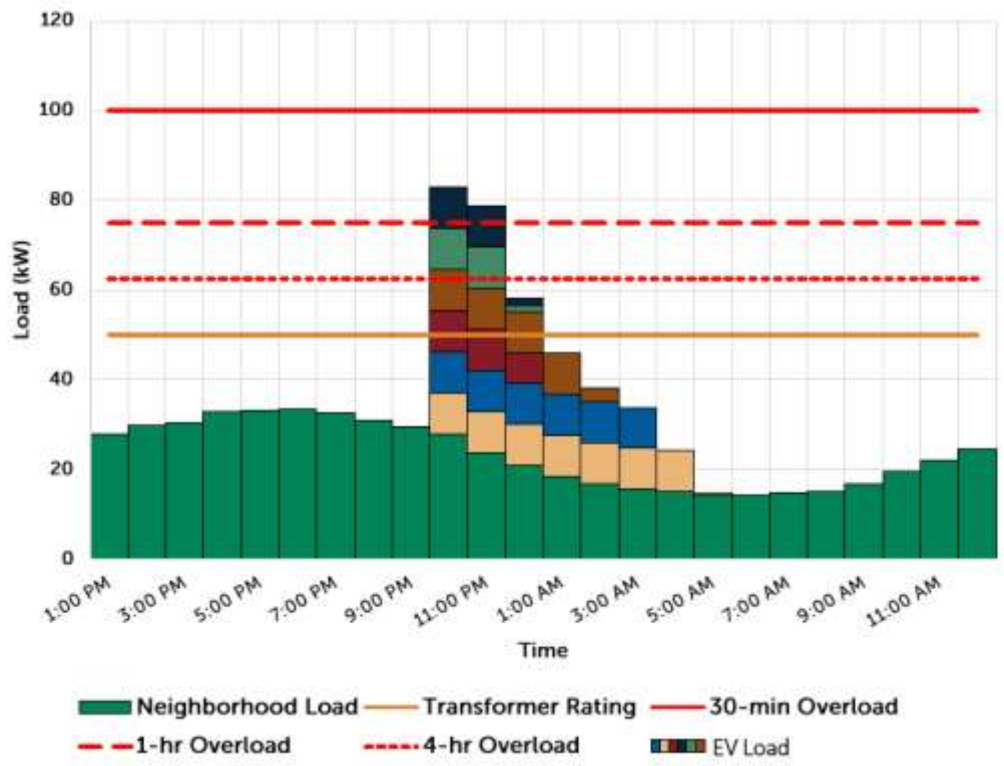
High EV Adoption – Residential TOU Rate



Assumptions

- TOU rate enters “super off-peak at 10:00 PM
- Vehicles automatically update charge schedule to match TOU rate

Impact

- Secondary peak induced at beginning of TOU period
- Higher overload ratings at transformer level
- Power supply solution exacerbates the problem at local infrastructure level

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Let's Cover

- Importance of DERs and EVs
- Existing Policies
- Policy Gaps & Challenges
- Lessons Learned
- Integrated Distribution System Planning

Importance of DERs and New Loads

DERs

- Solar PV
- Battery Energy Storage
- Demand Response (DR)

Electrification

- Electric Vehicles
- Buildings
- Data Centers

Potential Benefits -- if Done the Right Way

Benefits

- Cost Savings for Members and Fleets
- Increased Revenue, Avoided Costs and Load Flexibility
- Community Engagement and Member Choice
- Economic Development
- Environmental

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Actions

Infrastructure Upgrades

- Increased Demand from Electrification
- Smart Grid Technologies

Grid Integration & Management

- Managing the variability of solar energy generation alongside the fluctuating demand from EVs
- Advance Grid Management
- Demand Response Programs
- Real-time Monitoring

Data Integration

- Cooperatives must effectively integrate data from various sources to optimize operations and enhance forecasting capabilities.
- Centralized Data Platform
- Predictive Learning

Regulatory & Policy Uncertainty

- Navigating regulatory landscape to ensure compliance with policies related to renewable energy and EV integration
- Stay Informed
- Advocate for Supportive Policies

Member Engagement

- Educating about EV benefits and solar options
- Encouraging participation in demand response programs
- Participation Incentives

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Are your policies sufficient to meet the evolving trends?

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Policy Gaps and Challenges

- Technical challenges in managing new loads.
- Financial implications of infrastructure upgrades.
- Governance challenges in policy implementation.
- Importance of stakeholder engagement in policy development.
- Need for comprehensive data integration strategies.
- Regulatory uncertainties impacting cooperatives.
- Strategies for overcoming consumer engagement barriers.
- Importance of scenario planning for future developments.

Practical Next Steps for Planning

DER / EV Scenario Planning

1. Importance of integrating distribution system planning with scenario planning.
2. Steps for comprehensive system assessment.
3. Impact estimation of DERs on grid performance.
4. Financial and regulatory assessments for planning.
5. Policy development based on scenario analysis.
6. Importance of long-term forecasting for grid investments.
7. Strategies for enhancing member education and engagement.
8. Recommendations for infrastructure investments.
9. Importance of collaboration with external stakeholders.
10. Continuous evaluation of planning processes.

Proactive DER Planning Process Summary

Step	Name	Description
1	Load and DER Adoption Forecast	Develop load forecast, assess technical/economic/achievable potential for DER deployment and estimate customer adoption, and determine net load profile.
2	T&D Grid Impacts	Run dynamic distribution system model to identify and quantify all grid impacts from load/DER growth.
3	Bulk Power Impacts	Run full model of bulk power system (generation and transmission), including impacts from distribution level.
4	Finance, Rates and Regulation	Quantify locational costs and benefits of DERs, determine if/how DERs can defer or avoid traditional utility distribution investments, calculate financial and rate impacts of DER deployment, and develop appropriate policies (e.g., incentives, tariffs, standard contracts, competitive solicitations) to encourage DERs at the right place and right time.
5	Strategy and Operations	Decide on utility's overall DER strategy and any related changes to the business model, as well as modifications to utility operations to support effective DER integration.

The five-step process to planning for DERs

SEPA — B&V white paper

Lessons Learned & Considerations

Resource Planning & Procurement

- Integrated Distribution System Planning
  - Balance renewables and EVSE integration
- Data Management
  - Validated feeder models
  - Real-time DER data
- Long-term forecasting
  - Future scenarios analysis
  - Anticipate demand and plan for grid investments
  - Ensure alignment with state policies and customer needs

Regulatory Framework & Incentives

- Regulatory Frameworks
  - State policies that align incentives with environmental goals
  - Encourage adoption of DERs and EVs
- Financial Incentives
  - Rebates, tax credits, grants and other programs designed to lower upfront costs for consumers adopting DERs and EVs

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Lessons Learned & Considerations

Interconnection & Net Metering

- Interconnection Standards
  - Streamlined processes to reduce delays and interconnection costs
- Net Metering Policies
  - How are customers credited for excess generation?

Customer Rates & Data Access

- Dynamic Pricing Models
  - More reflective of actual utility power supply costs
  - Enhance member engagement
  - Comprehensive AMI data collection with detailed member energy usage patterns
  - Confirm demand response (DR) participation and effectiveness
- Data Access
  - DER monitoring
  - Grid performance metrics to identify stress points
  - Engagement metrics and regulatory compliance

Lessons Learned & Considerations

Maximizing Grid Investment

- DER Integration
  - Focus on integrating DERs into planning and operations to enhance grid flexibility and resilience
  - DERMS to optimize the use of local resources
- Non-Wires Alternatives
  - Explore alternatives to traditional infrastructure investments such as demand response (DR) and energy storage
  - Can provide cost effective solutions to meet grid demands without expensive upgrades
- Stakeholder Collaboration
  - Engage with consumers, regulators, and 3rd party providers is crucial
  - Develop effective policies that maximize the benefits of DERs and EVs while ensuring grid reliability

Integrated Distributed System Planning (IDSP)

Necessary for planning and operating the evolving grid

An opportunity for closer collaboration across the electricity value chain

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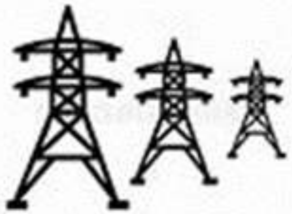
Reliability & Resiliency Challenges



Bulk Power Systems
(Generation & Transmission)

Fuel Availability

'Disorderly' retirement

Supply Chain

Weather

Cyber/Physical security

Permitting

Operational reliability

Sufficient capacity

Resiliency

Distribution Grid
(Distribution & Consumption)

Electrification

Consumer expectations

Cyber/Physical security

Third-parties

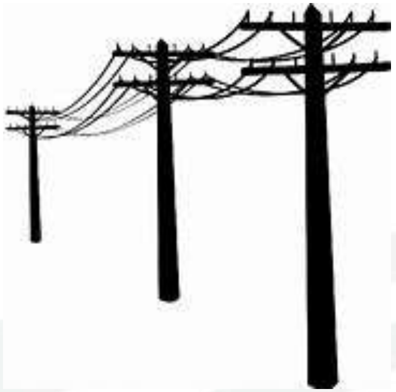
Weather

Distributed Energy Resources

Demand Management

Business Models (DSO, Transactive Energy)

Supply Chain



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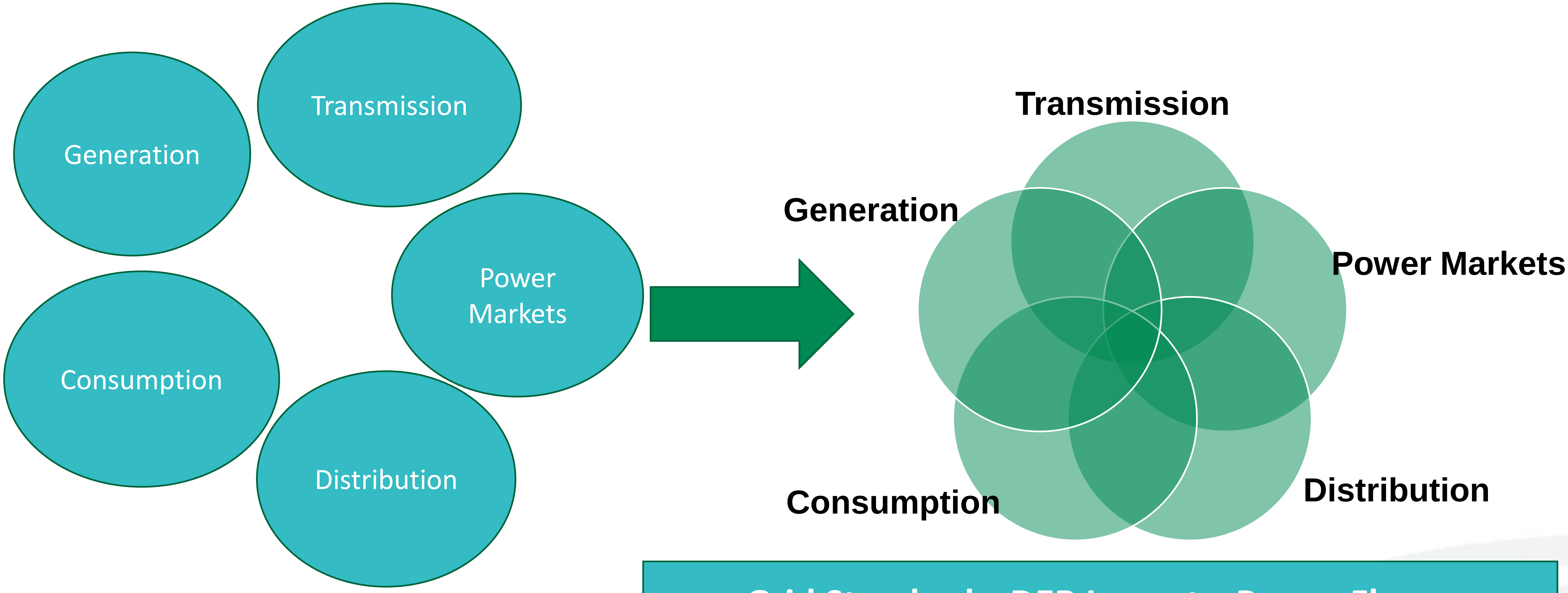
Increasing interdependencies



Grid Standards, DER Impacts, Power Flows, Equipment Loading, System Protection, Price Signals

System Plan -- Integrated View of the Grid

- Determining optimal infrastructure investments and to plan for reliable grid operations
- Development process based on objectives, regional characteristics, and other factors such as regulatory compliance
- Developing IDSP enables utilities to explore the following:
  - How will changes in consumer actions, grid and technologies evolution, and other factors impact grid planning and operations?
  - How to determine optimal set of capital investments for the future?
  - What are the set of “no-regrets” investment decisions that will be cost-effective while preparing grid to accommodate future changes?
  - What are the risk factors that will impact those investment decisions?

Potential Impacts

Technical perspective

- Bidirectional power flow and information (data)
- Advanced power grid components & measures (sensors, relays, AMI, ..etc)
- Advanced control & communication capabilities

Investment perspective

- Expansion plans at the substation level and upstream
- Cost-benefit analysis for integrating new technologies and programs

Regulatory perspective

- Who is controlling DER ? and who is purchasing the power from consumers ?
- Example: regulated co-ops in MN & SC consider DER impact in planning stages

Considerations in developing an IDSP framework

- Flexible but rigorous process
- Try to minimize complexity
- Focus on collaboration opportunities across the energy value chain on joint planning/operations, information/data sharing, aggregate optimization
- Optimize utilization of all grid and consumer assets to meet grid needs
- Identify opportunities for grid performance, reliability, resiliency and security enhancements

Integrated Distributed System Planning - Key Steps

Inputs:
- Utility Objectives
- DER adoption
- Member-owners choice
- Regulatory Requirements
- Current Assets status
- Generation/Demand profiles

Assessments:
- Reliability analysis
- Multi-scenario DER and load forecasting

Results:
- Projected System Needs
  - Infrastructure, Power, Energy, Communications, Processes, Analytics

Integration:
- Bulk Power Supply (G&T) Planning and Operations

Risk Analysis:
- Alternative solutions evaluation

IDSP:
- Set of resource and infrastructure needs
- Operational processes
- **Coordination across the energy spectrum**
- Workforce needs
- Investment profile – capital and operations

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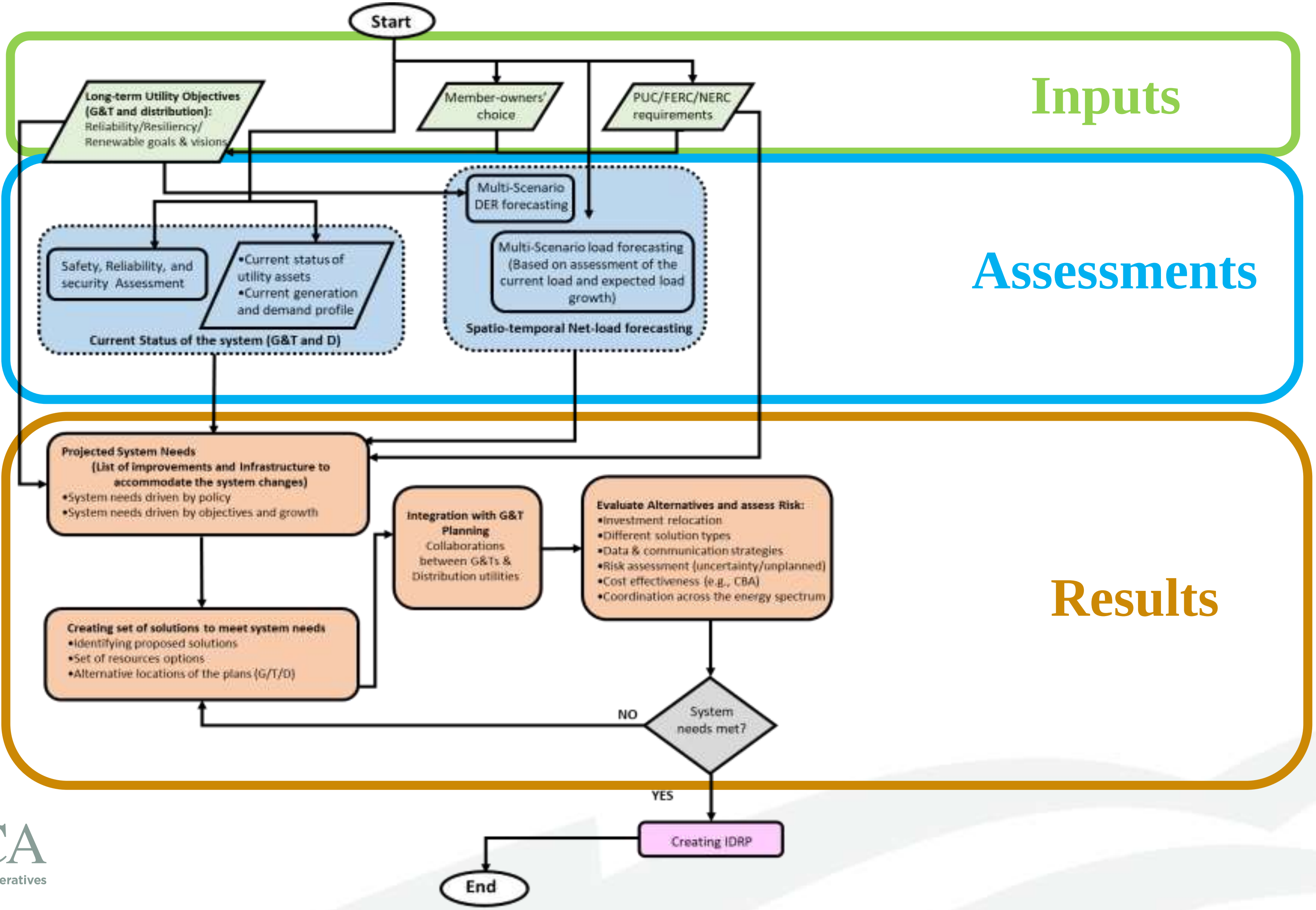
Enterprise Risk Management Framework

Draft IDSP Framework



Questions & Answers

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