DERS AS GRID ASSETS

EMERGING ISSUES AND VALUE PROP

LUMINARY
STRATEGIES

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ABOUT

LUMINARY
STRATEGIES

- Large Load Flexibility
  - AI for Energy Access Market Design, Utility Policy
  - Energy Use/LoadFlex Software in Data Center Design
  - Congressional & State Legislative Engagement
  - Data Center Campus Development - COD Reg Strategy
- Small Load Flexibility (DER) Integration on Distribution Grids
- Competitive Markets VPP
- Regulated Markets VPP
- Private Equity & Growth Stage Investing in US Companies

TESLA ENERGY IN TEXAS (2020-2024)

- Aggregated DER – Tesla Electric
  - Integration of EVs and Powerwall
- Megapack Wholesale Storage
  - Large-scale energy storage solutions
- Megapack Microgrid Islanding
  - Independent energy systems for isolated areas
- Retail and Wholesale Markets Integration
  - Business Formation & Launch
  - Retail Customer Acquisition & Retention
- Retail Offer Design
- BESS A/S Policy

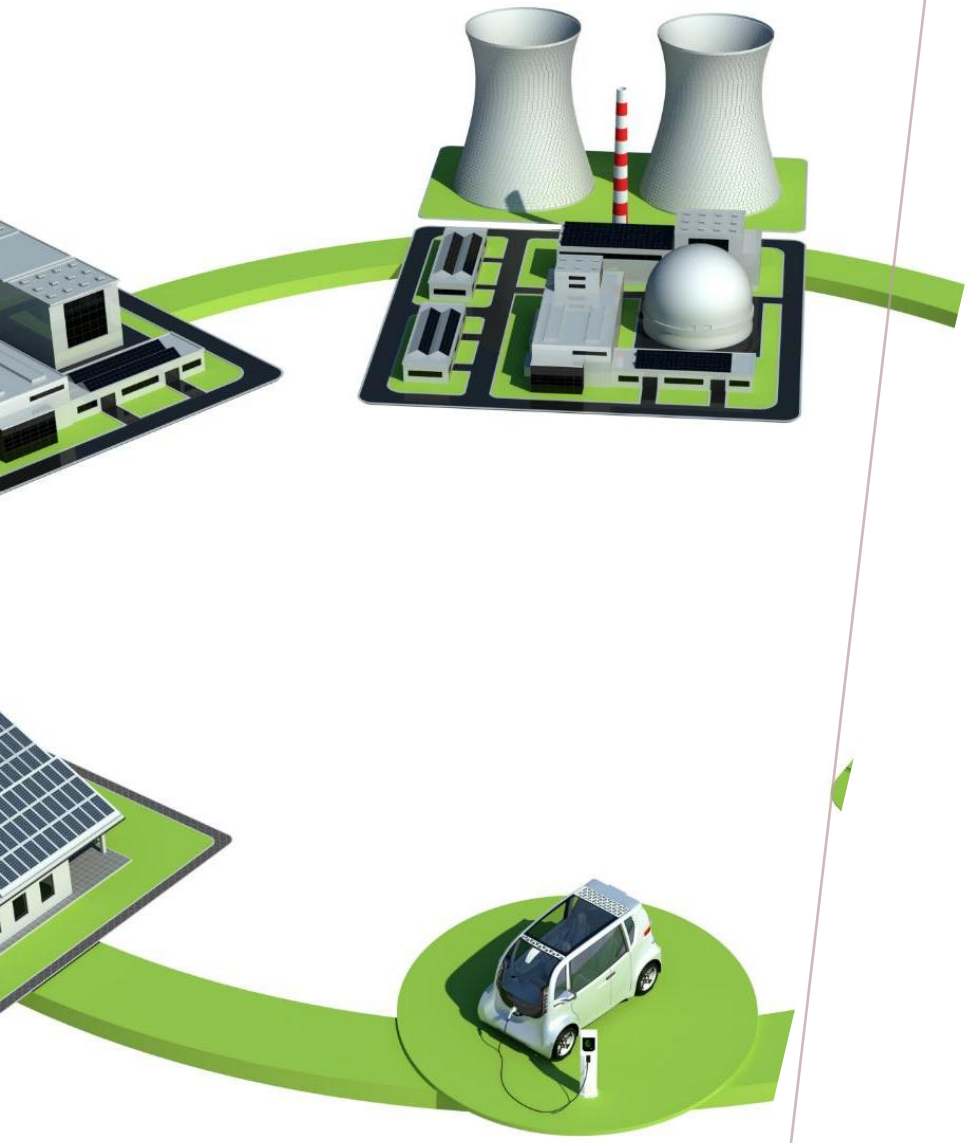
U.S. Department of Energy (DOE)
236K followers
7mo •

When Winter Storm Uri hit Texas two years ago, more than 2 in 3 people lost power. Last week, Secretary Jennifer Granholm met with Austin Mayor Kirk Watson and Texas' ADER Pilot Task Force to discuss scaling up Virtual Power Plants—an alternative to increase grid flexibility & reduce fossil fuel use.

Learn more about VPPs: https://lnkd.in/gcqNhVSa

AGENDA

- Introduction
- Recent Learnings
- Exemplar DER Programs
- Growing Programs with Potential
- Learnings from Regulators and Utility Execs
- If You Know More, You Can Do More
- Beneficial AI: Dynamic Ops Future



DERS AS GRID TOOLS

- DER's as a Grid Tool
  - Evidence of reliable operations needed
  - Ease of integration required
- Challenges in Integration
  - Avoid mismatched and hodgepodge of DERMS middleware
  - Minimize new IEEE standards and confusing webs of interoperability agreements by focusing on simplest integrations – biggest bang for buck in managing DERs

DISTRIBUTION VS TRANSMISSION ECONOMICS

- Differences in Economics
  - Distribution economics differ significantly from transmission system economics
- Operational Overhead
  - DSPs have substantial operational overhead even when efficient
- Peak Shaving
  - Distribution peak shaving is similar to grid-scale BESS responding to price signals
  - Supply versus demand-driven peak shaving is not a unique differentiator

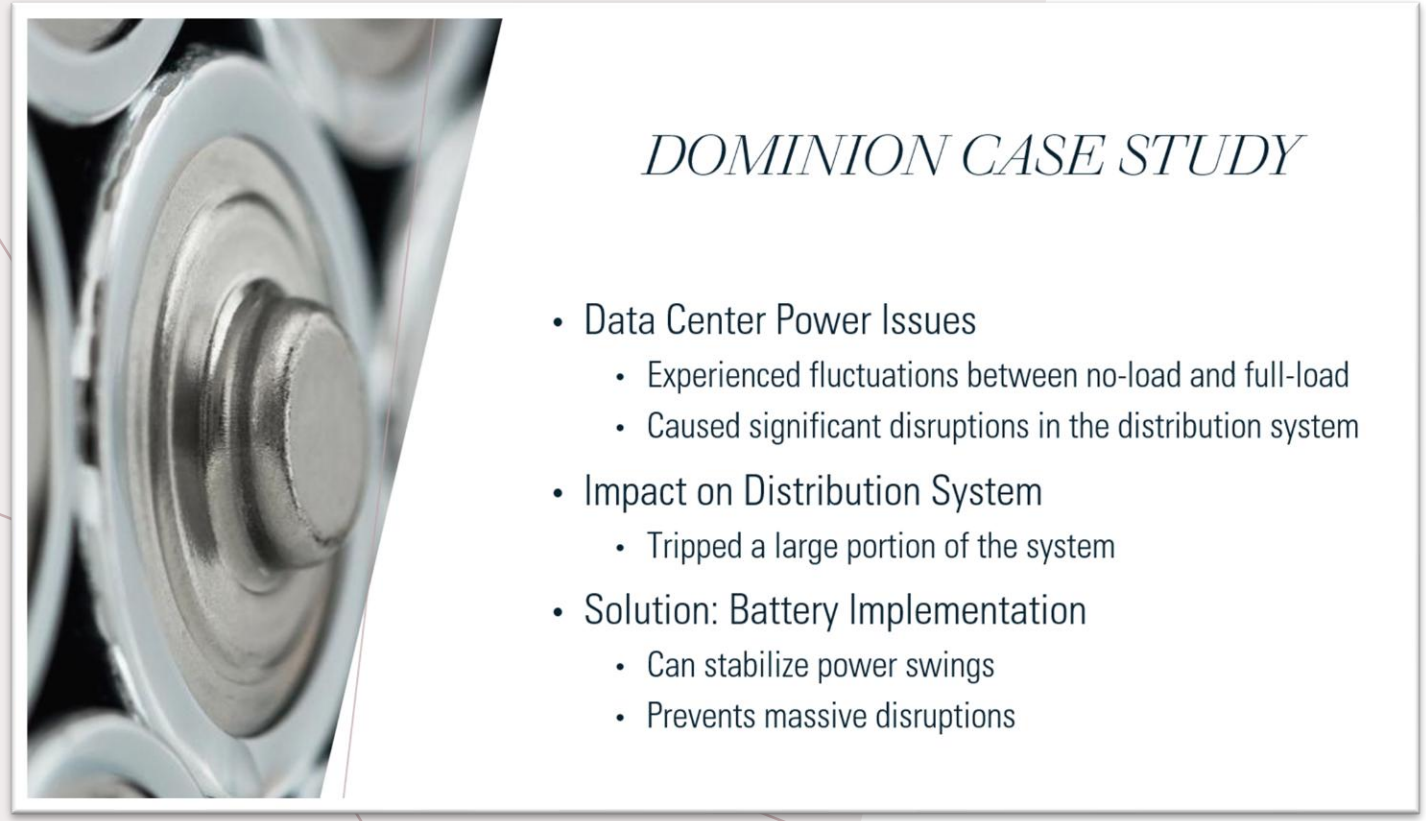
DER VALUE STACK

Recent Learnings

- Multiplicative Value of Distributed Resources
  - Provide behind-the-meter value (resilience, security, VOLL)
  - Full Cost of DERS doesn't need to be shifted to the rate-base – happy substitute for utilities under rate hike pressures
- Benefits of batteries
  - Quick solution for substation capacity expansion deferral
  - Quick solution for avoiding distribution line upgrades

UTILITIES AND BATTERIES

Recent Learnings



- Batteries ensures connected Load isn't stranded from DSP's perspective and “behaves” in compliance with grid expectations
- “Unpredictable Bursts from Industrial Load”
  - Batteries prevent wear and tear between load and interconnect

AGGREGATED DER – TEXAS

Exemplar DER Programs

- Aggregated DER – Texas
  - Recognition of dispatchable DERs < 1 MW agg. to min. 100kW as ADER-CLR in SCED
  - New variations for small DER participation coming in ERCOT Governing Document Updates – 2025
  - Review 53911 Project at PUC Texas for Challenges & Opportunities Deep Dive

UTILITY VPP

Exemplar DER Programs

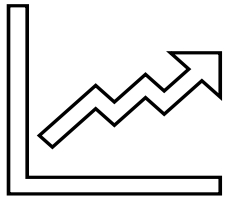
- SMUD's My Energy Optimizer Partner+ Program
  - Model for vertically integrated utilities – multiple value streams, several pilots work cohesively together with varied levels of DER control via SMUD
- Green Mountain Power in Vermont
  - Started as ATRR, LFC, Capacity
  - Has become model for vertically integrated-third party partner-supported VPP

NEW DER PROGRAMS AND OPPORTUNITIES

Growing Programs with Potential

- Together New Orleans Proposal for Entergy New Orleans
  - Grow compliance with utility DR mandate
  - Support residential and commercial value streams with dispatchable BESS
- Hero Hub, Louisiana
  - Matched federal and state dollars for resilience hubs throughout Louisiana
- Texas Coops in ADER
- Vermont Electric Cooperative
  - Remarkable progress towards rural electric coop DERMs\
- Mass. CEC Location-Specific Distribution Grid Services Study

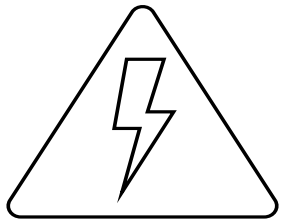
DER VALUE DIFFERENTIATORS



Deregulated Markets

Different challenges for DER investment

Opportunities for innovation and competition



Regulated Markets

Distinct challenges for DER investment

Limited competition in 'poles and wires' business

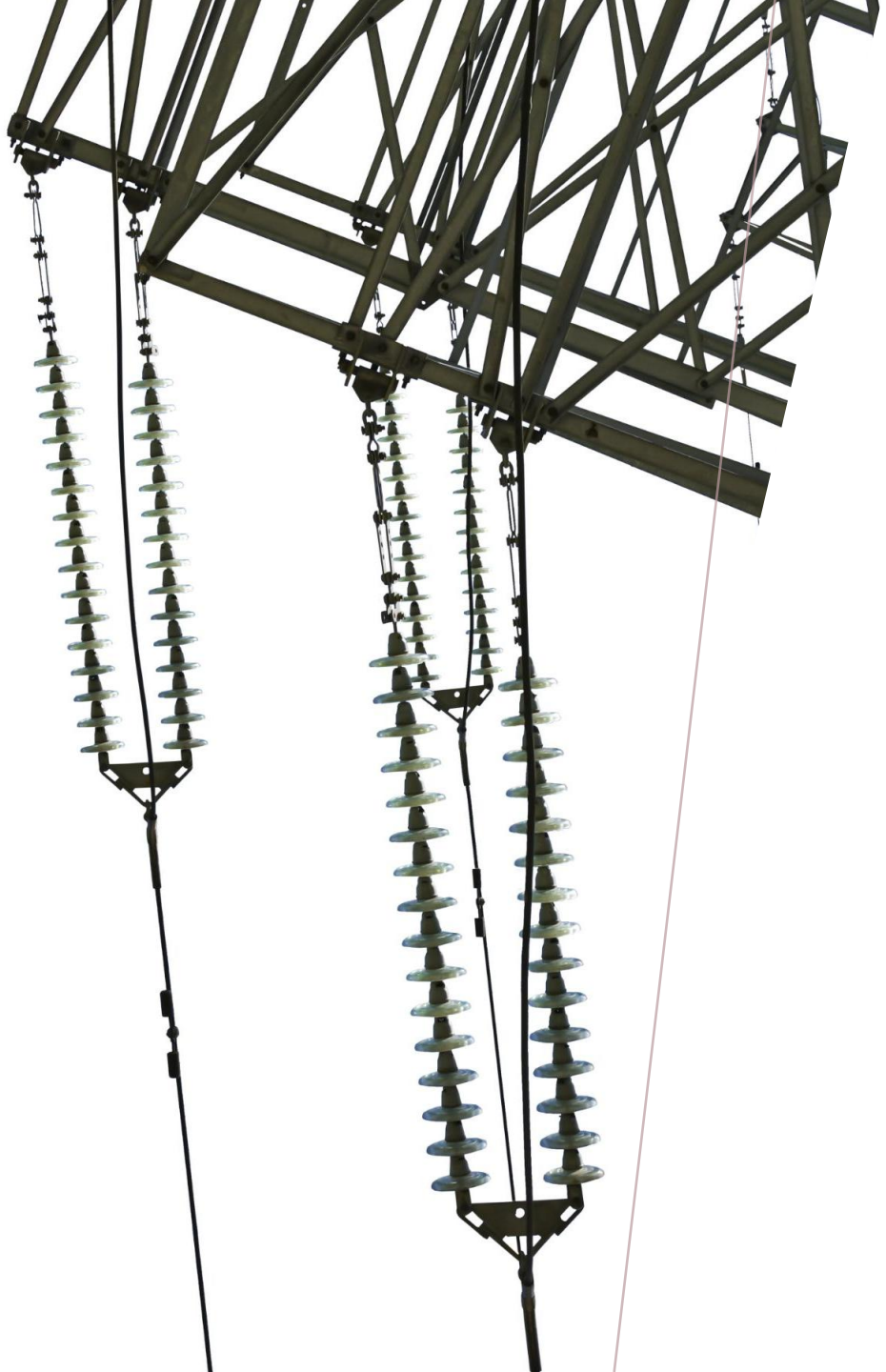
Distribution Systems vs Bulk Transmission Systems

Distribution systems have 10,000x more electrical busses

Higher maintenance and operational expenses (opex)

SIZE MATTERS

- Smaller Utilities Adopting Sensor-Based Approaches
  - Faster implementation of low voltage grid awareness
  - Monitoring through sensors instead of AMI + Third Party DERMS support
- Large IOUs Facing Cyclical Pressure
  - Ratings agencies downgrades
  - Increased cost of capital
  - Higher rates for customers due to capital investment
  - Investments have higher opportunity cost = leverage DERs with existing grid
- Distribution System Challenges
  - “Static models from my engineering school days”



UNEXPECTED GRID ISSUES

- Unexpected Grid Issues
  - Utilities may experience abnormal voltage swings
  - Transformer overloading can occur
  - Power quality problems might arise
  - Immediate causes are often unknown

MISMATCHES BETWEEN MODELS AND REALITY

- Historical Snapshots in Grid Models
  - Based on past engineering data
  - Do not reflect real-time conditions
- Changing Loads from Electric Vehicles (EVs)
  - Impact on grid not accounted for
- Distributed Energy Resources (DERs)
  - Fluctuating contributions to the grid
- New Loads & Hosting Capacity
  - Sudden DER IX Request Increases
  - Curtailment, Feeder Management
  - New Homes Developers v. Individuals buying Trucks – Right Sizing the Distribution Grid

GRID-EDGE TROUBLESHOOTING

- Grid Anomalies in Low-Load Periods
  - Not predicted by static models
  - Unexpected voltage issues
  - Transformer overloads
  - Reverse power flows from solar
- Immediate causes of system anomalies in distribution grid are often unknown
- Truck rolls for line-of-sight visibility, issue identification and remediation are costly and raise opex + emissions

UNSEEN PROBLEMS

- Unseen Problems Detection
  - Real-time data helps in identifying issues before they escalate – what devices and behavioral trends are growing on the system, how are users being incentivized?
  - Examples
    - Detecting a transformer running hotter than usual
    - Power fluctuations in meters indicating a failing line

ROLE OF BENEFICIAL AI

- Role of Beneficial AI in Decision Making
  - AI assists in parsing data quickly
  - Enables human decision-making
- Future Utility Control Center
  - Transition from static to dynamic operations
  - Focus on distribution system operations future:

  Will your local utility be a service provider or a grid operator in 10 years?