EPRI

THE CLEAN ENERGY TRANSITION

Balancing the Pace of a Clean Energy Transition... Affordably, Reliably, and Responsibly For All

Rob Chapman

Sr. Vice-President, EPRI

EPRI *Born in a Blackout*

Independent, non-profit, center for public interest research

New York City:
The Great Northeast Blackout, 1965

Mission

Advancing safe, reliable, affordable, and clean energy for society through global collaboration, science and technology innovation, and applied research.

Vision

Together…Shaping the Future of Clean Energy

Power of Collaboration

Leveraging Research Funds (~500M/year), industry expertise, Academia and National Labs, DOE/CEC/NYSERDA/EU Horizon 2020 etc.

Global Presence

Over 40 countries participate in EPRI overall research, development, and demonstration activities.

- International members > 25% of EPRI research (50% for nuclear)

CLEAN ENERGY TRANSITION = OPPORTUNITY!

2-3x

GROWTH IN ELECTRICITY SALES

20-30%

IMPROVEMENT IN ENERGY AFFORDABILITY

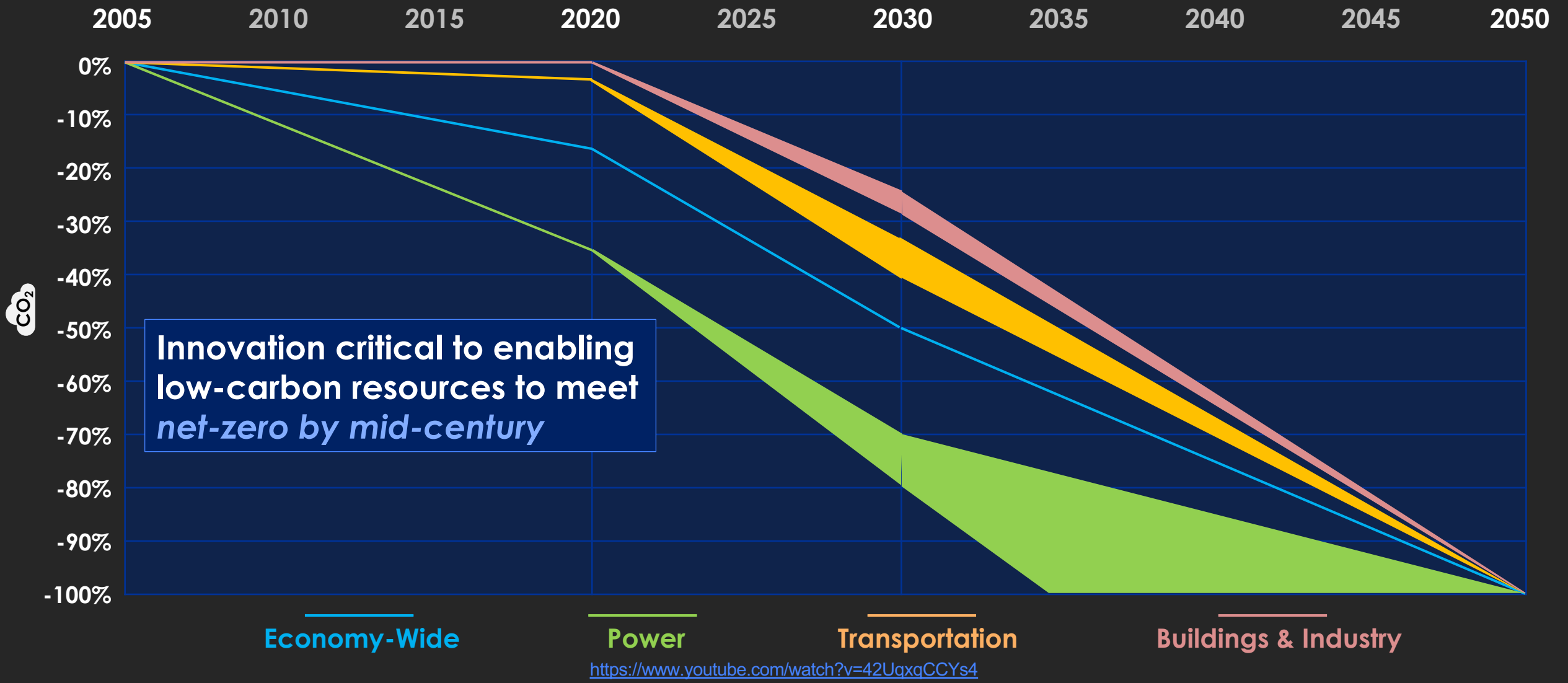
Choice

CUSTOMER OPTIONS

DONE RIGHT…CLEAN ENERGY TRANSITION SHOULD BE AFFORDABLE TO ALL

PROGRESS…

YET LIFT GETS MORE CHALLENGING



https://www.youtube.com/watch?v=42UqxqCCYs4

2030 STRATEGIC IMPERATIVES

NEW THINKING, NEW APPROACHES

Accelerate Energy Supply Innovation

Advance Load Forecasting, System Operations; Integrated Planning

Reimagine Shared Customer Resource

MANAGING INTERMITTENCY

Emerging Low-Carbon Dispatchable Technologies will be Required

Wind & Solar

Carbon Capture, Usage & Storage

Advanced Nuclear

Hydrogen

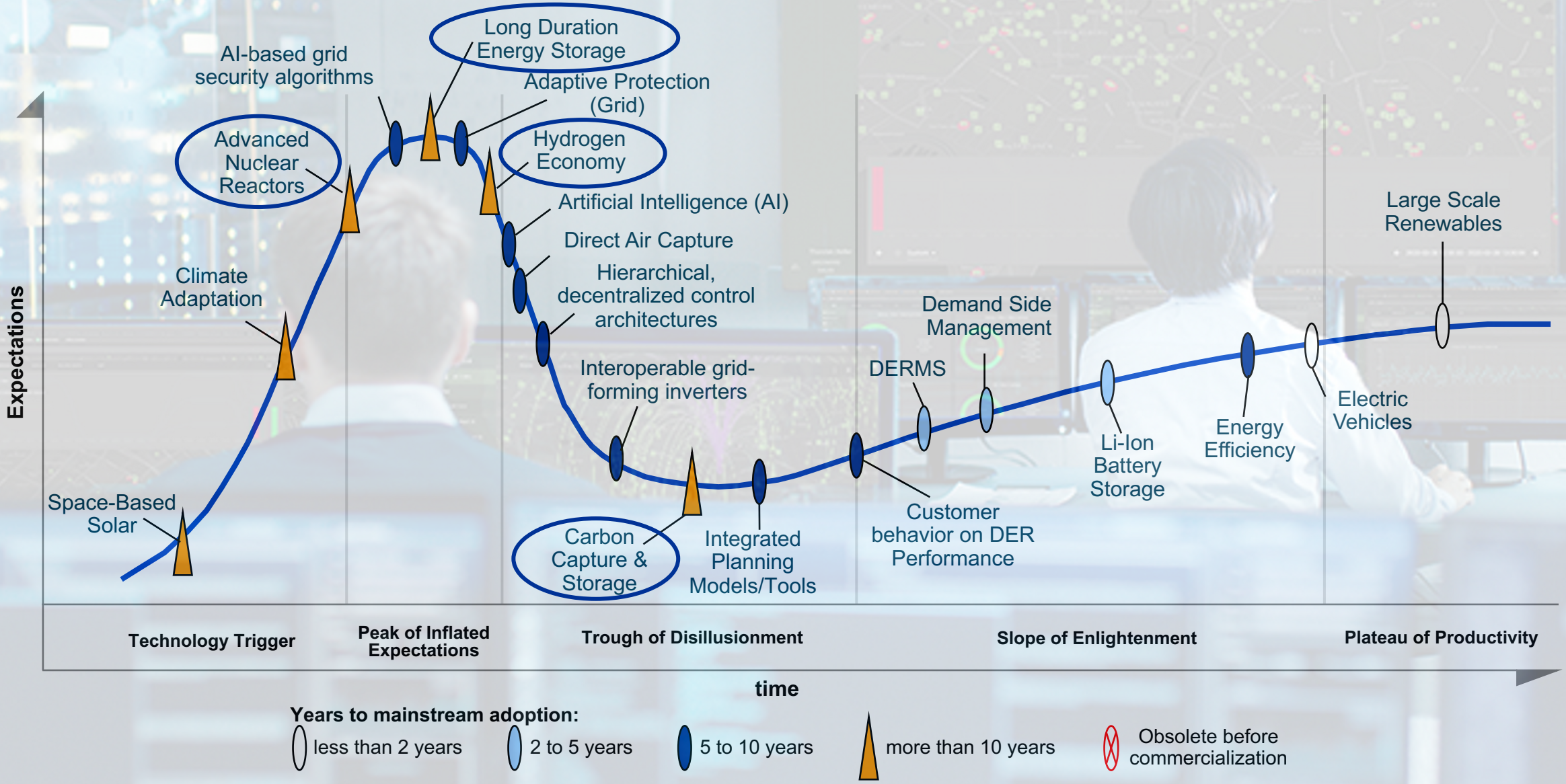
Long Duration Battery Storage

Virtual Powerplant

PACE of CHANGE IMPACTS AFFORDABILITY, RELIABILITY and RESILIENCY

Energy System Decarbonization Technologies

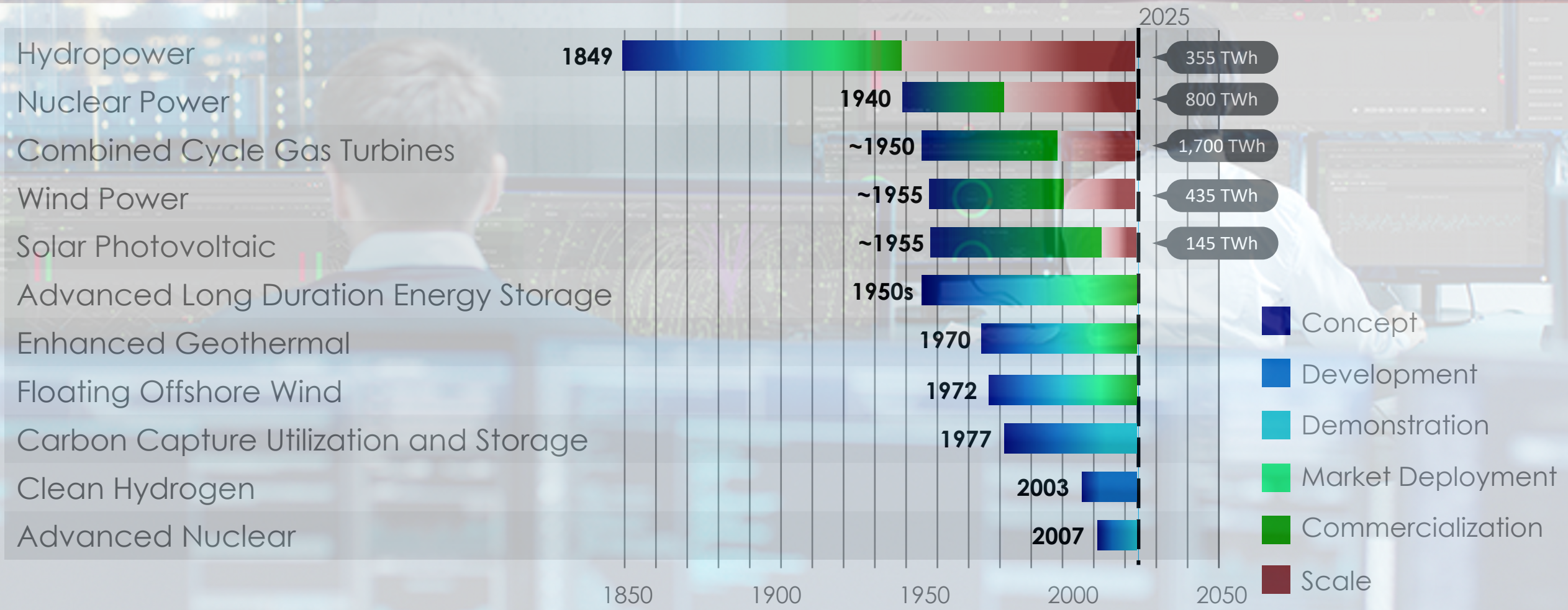
Hype Cycle



TRANSITION TIMING

Nascent Technologies demand Deliberate Deployment

History has shown technology development and scale requires decades of effort.



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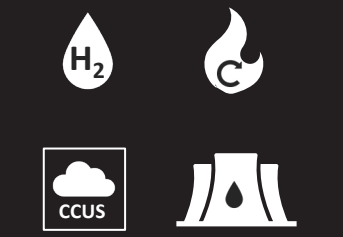
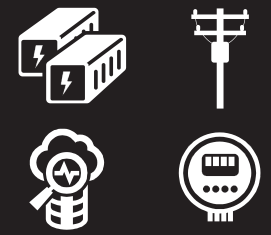


Accelerate Energy Supply Innovation



Advance Load Forecasting, System Operations; Integrated Planning

Reimagine Shared Customer Resource

BALANCING SUPPLY AND DEMAND REQUIRES ADVANCES IN…

Load Forecasting

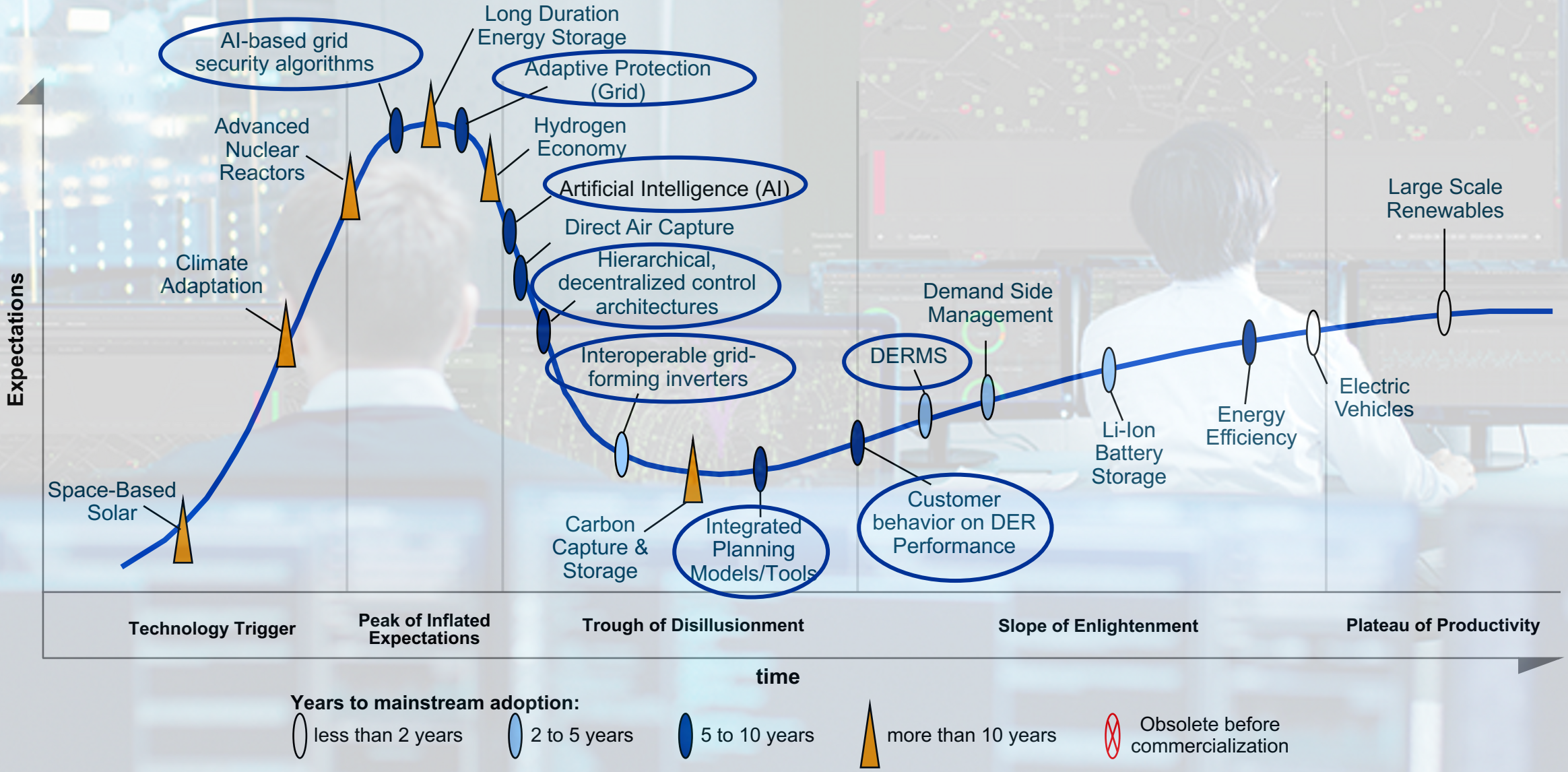
Resource Adequacy

System Operations

Integrated Planning

Energy System Decarbonization Technologies

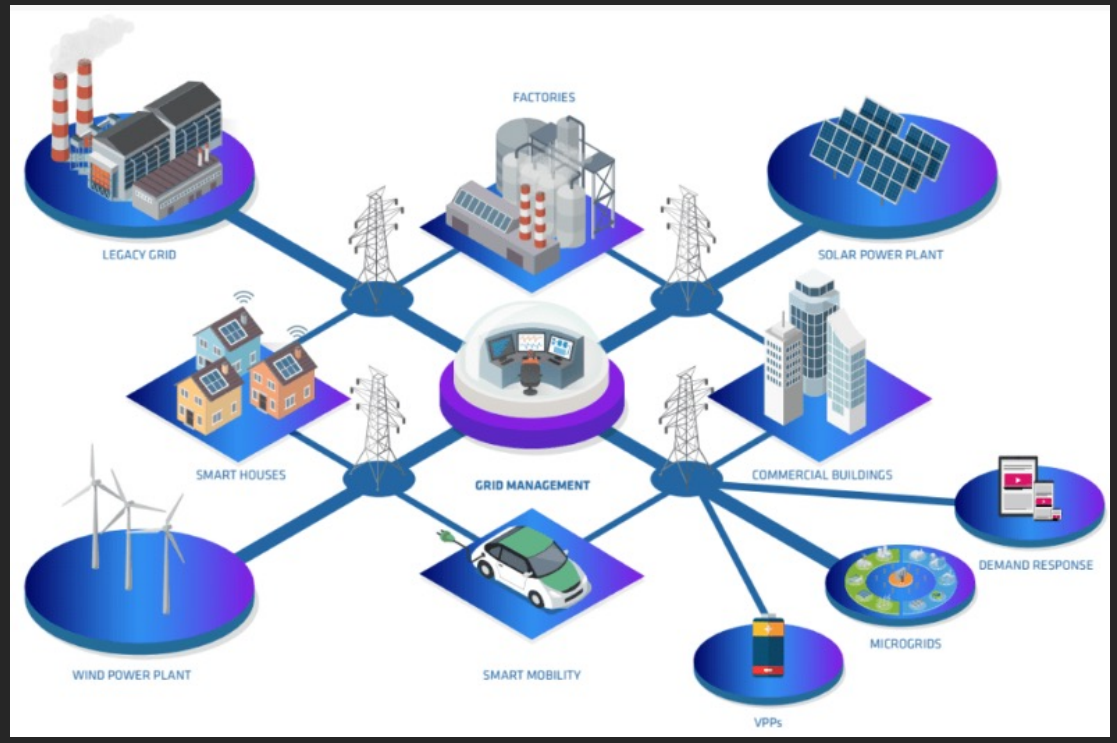
Hype Cycle



DER DEPENDENT GRID…

Mission Critical Assets Enabling Affordable, Reliable and Resilient Grid Operations

- DER Visibility
- Utility/Aggregator Interface
- Grid Modernization
- Market Transformation



MOVING BEYOND A "DER AWARE" GRID REQUIRES ADDRESSING THESE GAPS

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FAST FORWARD TO 2030

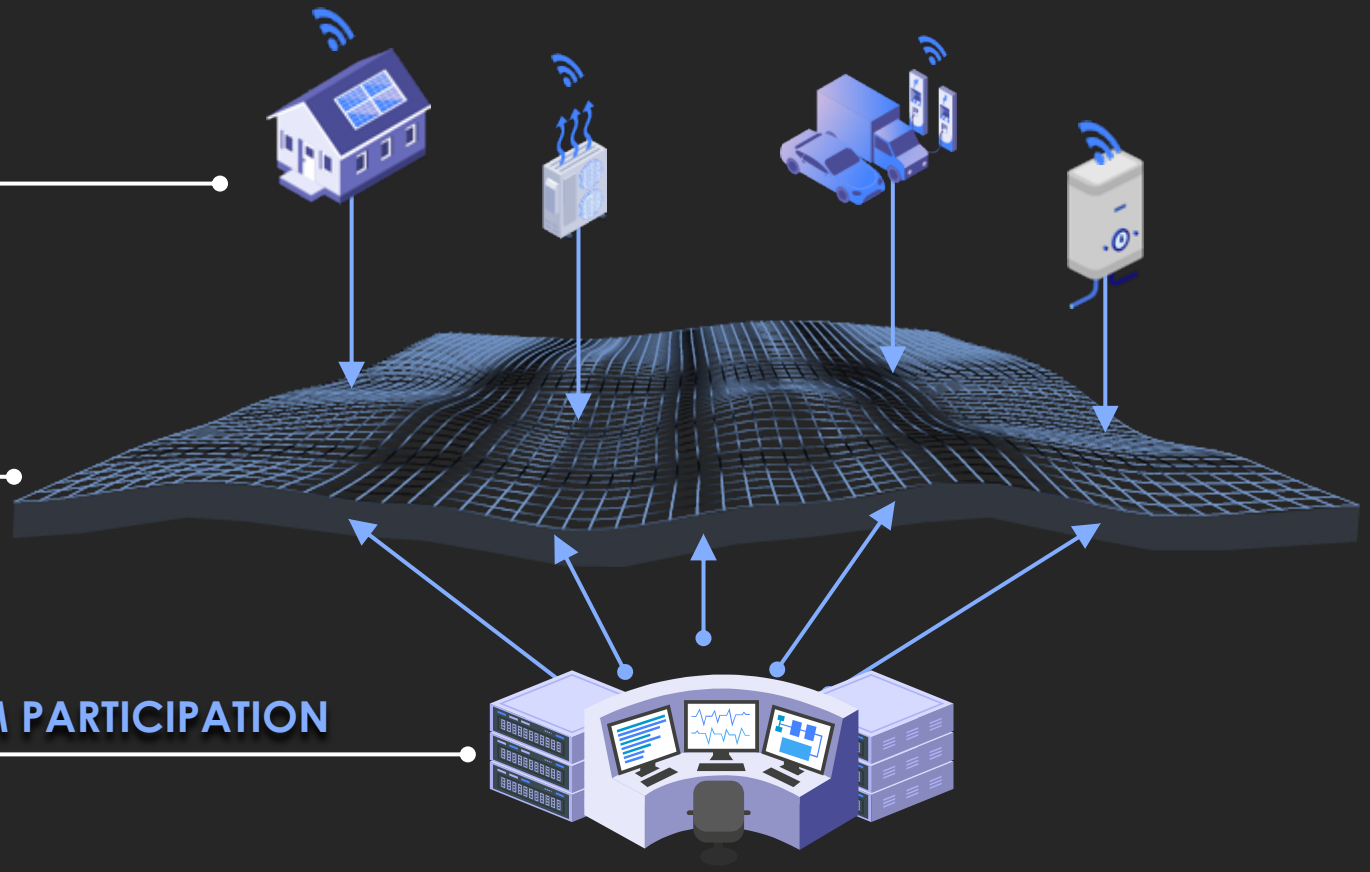
WHAT IF…

In this future, each customer brings

2-11 kW

of controllable load.

- CUSTOMER-OWNED APPLIANCES ARRIVE GRID-CONNECTED
- EV CHARGERS ARE CONTROLLABLE FROM DAY ONE
- EVERY NEW WATER HEATER AND A/C INCENTIVIZES DEMAND-RESPONSE PROGRAM PARTICIPATION

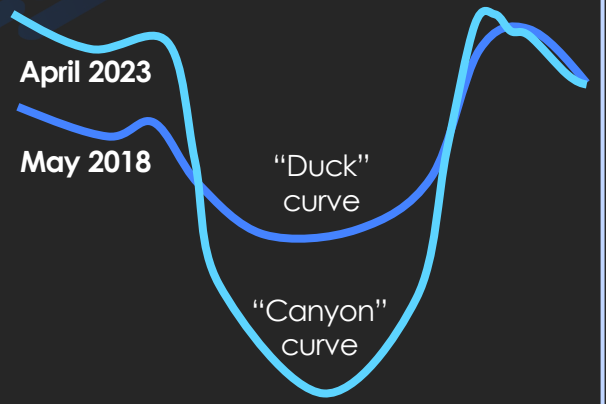


REALIZING THIS VISION BY 2030 REQUIRES A COMPREHENSIVE STRATEGY NOW

Flexible Load…Clean, Affordable, Resilient Energy

The Challenge:

Energy Transition that Improves Energy Affordability for All



▼1% Reduction in Peak hours

▼10% Reduction in Infrastructure Investment

VPPs reduce peak load and ramps, improve asset utilization and enable cost savings and increased resilience

The Opportunity:

Leverage Customer Flexible Resources to Manage Peaks & Ramps

Building Envelope

+

Heat Pump **3.5kW**

HPWH **0.5 kW**

+

Level 2 EV Charger: **7kW**

1 M Homes =

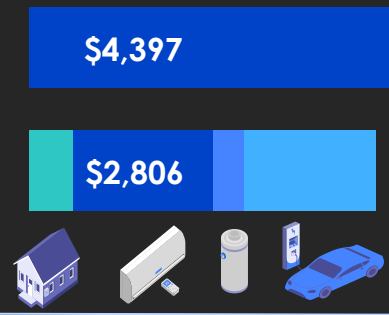
11 GW Flexible Load

Technical Potential

Win-Win for Customers and Grid:

Customers $$$ ▼36%*

These technologies lower energy costs & enable grid flexibility



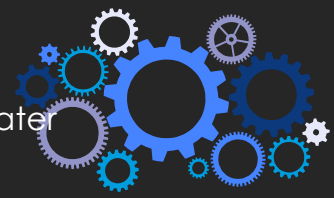
W.Va. Example* energy cost reduction with all upgrades- excludes equipment capital cost

Lack of Capital Puts LMI Community At Risk

44% of US households are low or middle income (LMI)

80% have a vehicle with transportation costs top expense after housing

15% energy & transport burden; 3X greater than non-LMI households



DONE RIGHT…THE ENERGY TRANSITION SHOULD IMPROVE ENERGY AFFORDABILITY

ENABLING A SHARED ENERGY ECONOMY

Innovation Needs

Regulatory
Investments in shared customer resources benefit all

Customer Engagement
Greater choice, comfort, convenience, control

Affinity Partnership
From tech companies to the environmental justice community

Grid Operations & Planning
Integrated, system-level approach

Integrated Grid
Ubiquitous communication and DERMS integration

MARKET TRANSFORMATION CHALLENGES

DESIGN, PLANNING AND OPERATIONS

Key Gaps under Market Transformation

Retail/Grid Alignment

Aligning the needs of the grid and society with the rates and programs for retail customers

- **Vision of Success**: Greater share of customers reacting to transmission and distribution grid needs to enhance reliability
- **Research Gap**: Barriers to participation or to changes to retail/wholesale to enable participation; Challenges to efficacy and equity
- **Need for accelerated solution**: Understanding the implications of innovative retail structures

Wholesale Market Reform

Designing wholesale markets that can continue to support reliability and resilience under supply resources with zero fuel costs

- **Vision of Success**: Incentives leading to investments, short-term decisions, and innovation contributing to power system reliability and resilience under clean energy scenarios
- **Research Gap**: If there is necessary market reform, need to explore and adjust
- **Need for accelerated solution**: To determine efficient markets, we need tools/data/analysis to understand the outcomes of possible under existing and alternative market designs

Efficient Decarbonization

Instituting policies and markets to meet decarbonization and electrification goals efficiently

- **Vision of Success:** Policies and incentives leading to efficient and innovative clean energy investment
- **Research Gap**: Policy gaps and prescriptive technology solutions
- **Need for accelerated solution**: Exploration of alternative policies and solutions

Set of policies, regulations, and market structures supporting an economically sustainable framework to achieve decarbonization and reliability goals

A PERFECT STORM

This Decade Represents a Perfect Storm of Challenges and Opportunities.