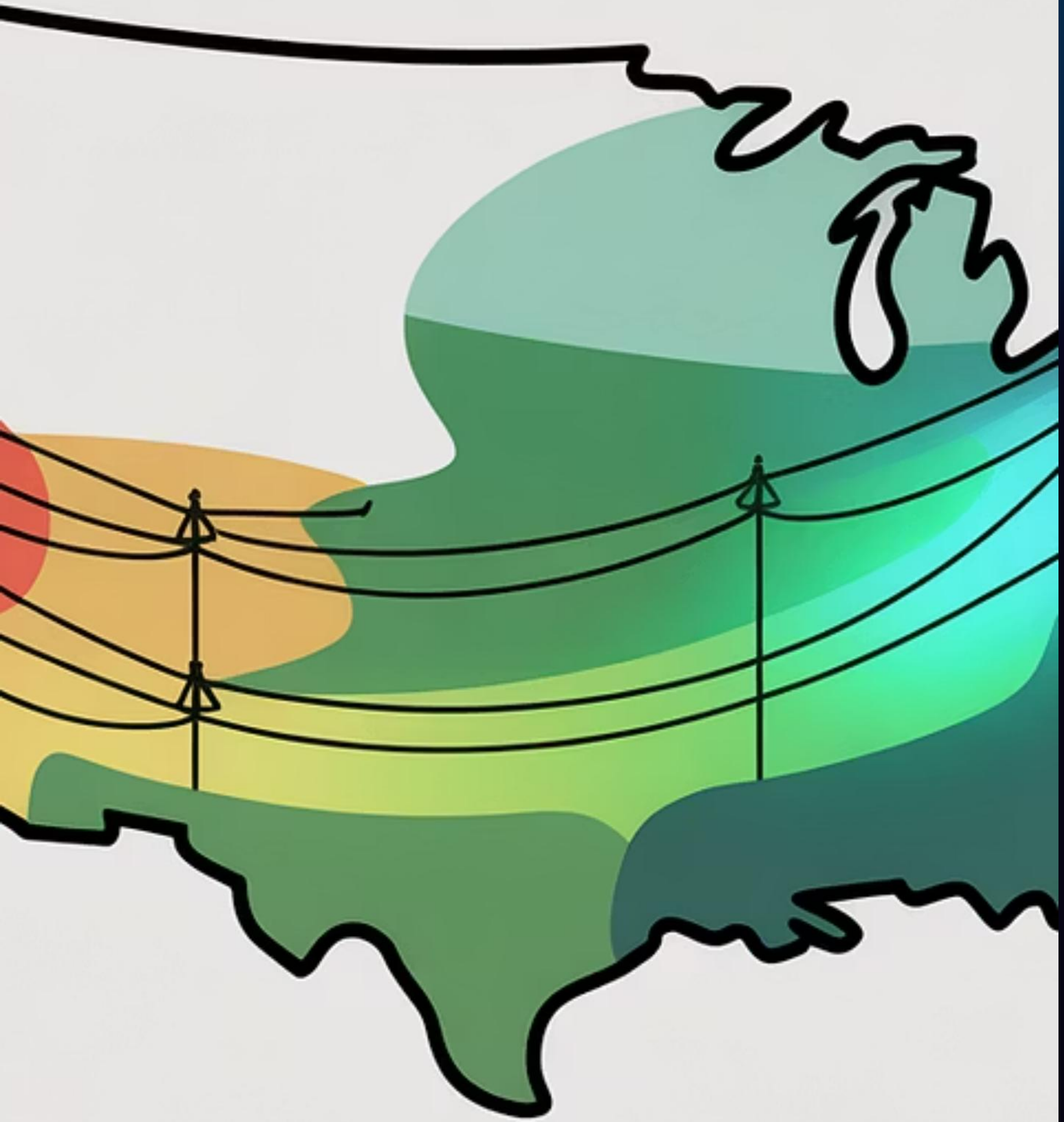

Accrediting Transmission as a Capacity Resource

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Why Are We Talking About This?

Resource adequacy is under pressure from multiple directions simultaneously — and the traditional options are limited.

Surging Demand

AI data centers, electrification, and advanced manufacturing are driving load growth at a pace not seen in decades.

Supply Constraints

Firm gas CTs face siting and permitting barriers. Storage capacity value is saturating. Interconnection queues stretch years.

Underutilized Option

Interregional transmission — both existing and future — remains largely unaccredited as a capacity resource
a significant gap in the current RA framework.

Informed by Recent Studies

The proposed framework for transmission accreditation build upon critical insights from recent industry reports and ongoing analyses.

1

NERC

Interregional Transfer Capability Study

2

ESIG

Wide Area Adequacy Assessments

3

GridLab

Eastern Interconnection Resource Adequacy Study

4

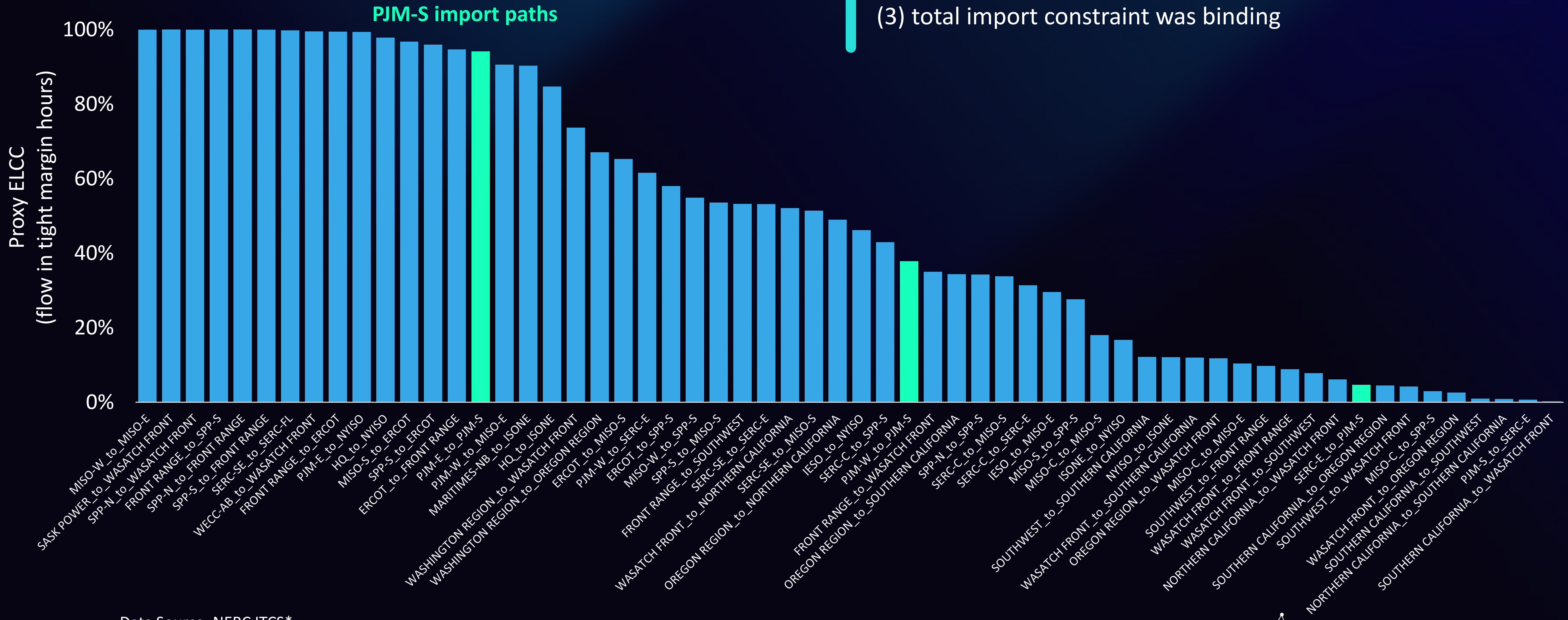
PNNL

Transmission Planning for Long-Term Reliability

Leveraging RA assessments for transfers during high-risk hours

"Proxy ELCC" measures the average flow during tight margin hours on the receiving end (<10% margin)

Hours when a region would have imported more, but there was either:
(1) insufficient transfer capability,
(2) insufficient resources on the sending end, and/or
(3) total import constraint was binding



Data Source: NERC ITCS*
*NERC is not proposing nor endorsing proxy ELCC for transmission

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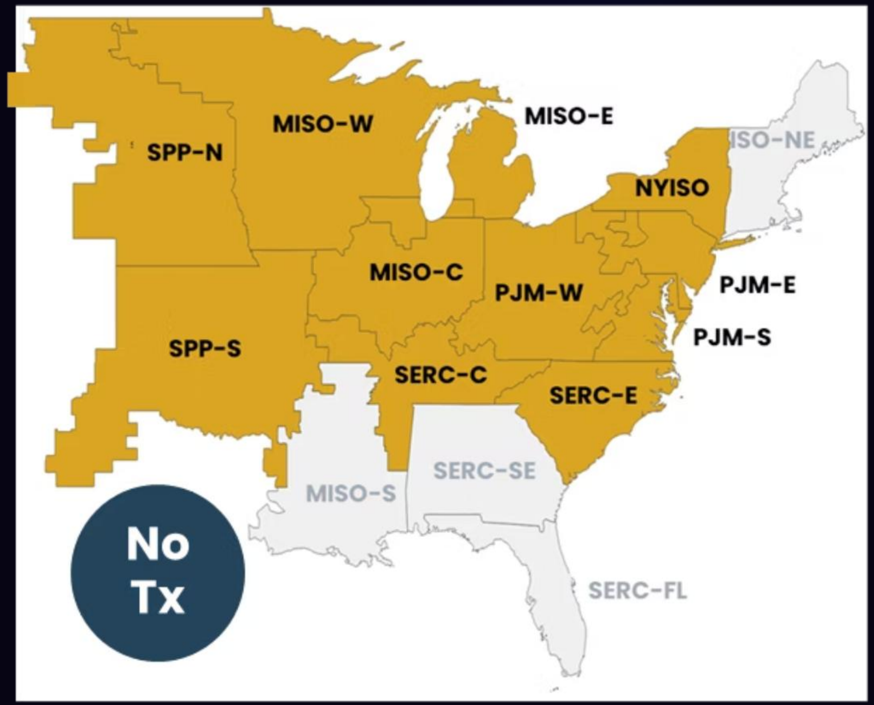
Eastern Interconnect RA Study

Existing interreigonal, non-firm transmission already provides resource adequacy value to the grid, but it is not always quantified or used to reduce capacity obligations.

Limited mechanisms to monetize *new* transmisison resources.

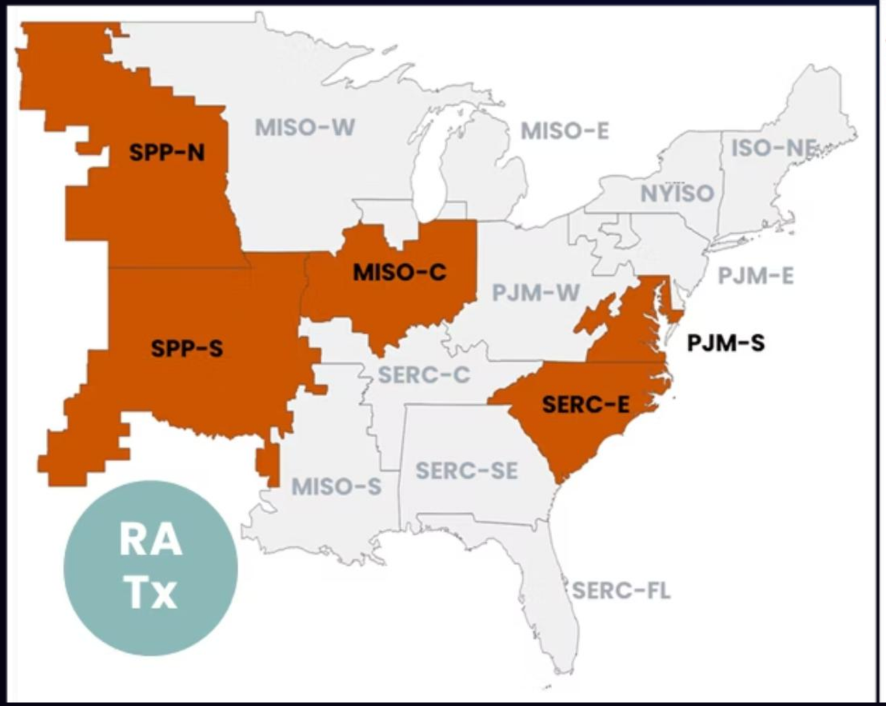
Moderate Risk

Greater than 0.1 days/year LOLE, but only without interregional transfers



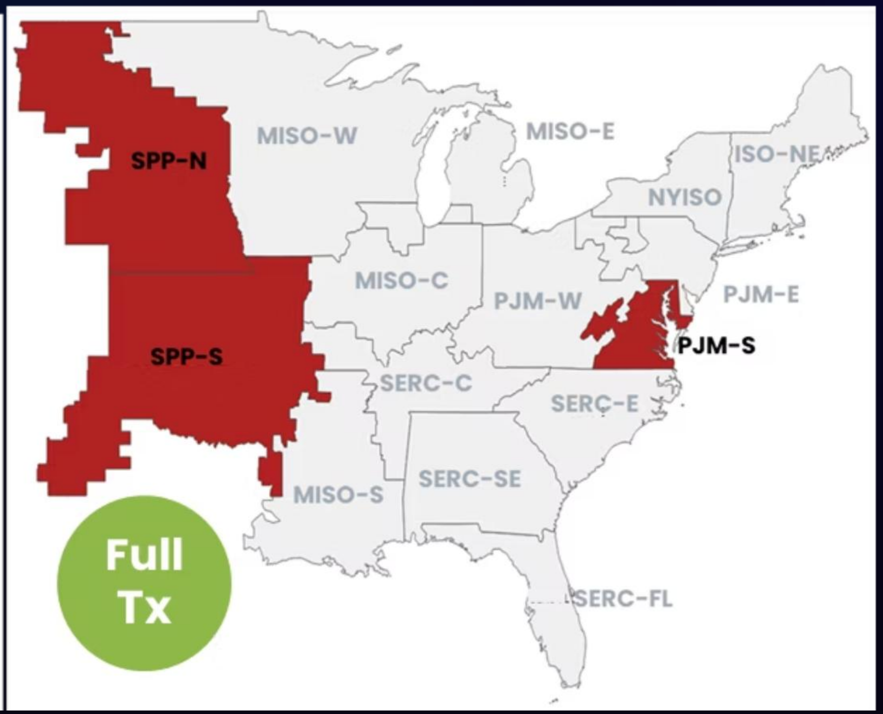
Elevated Risk

Greater than 0.1 days/year LOLE when using a region's RA import levels



High Risk

Greater than 0.1 days/year LOLE in all scenarios, even with full transfer capability



Source: GridLab, Analysis of Resource Adequacy across the Eastern Interconnection, https://gridlab.org/gridpath_ei/

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The Core Insight

Batteries shift energy across *time*

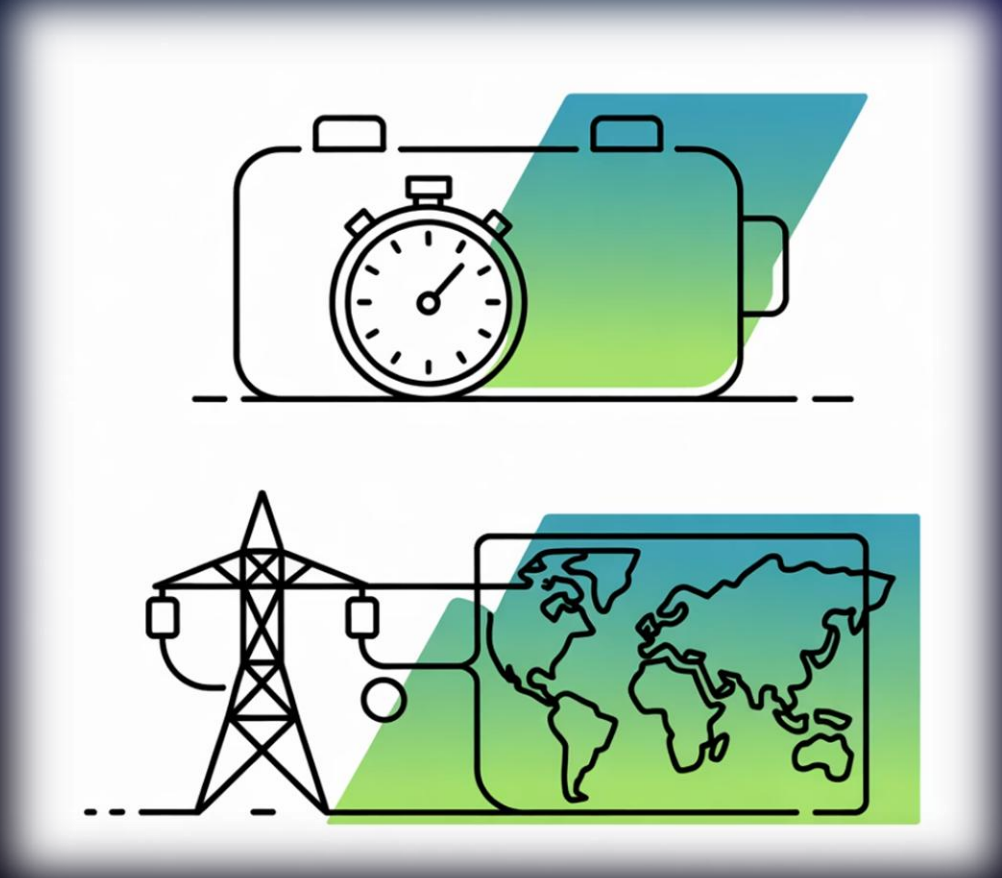
Storing and dispatching energy to meet load <u>when</u> it is needed most.

Transmission shifts energy across *space*

Moving power to <u>where</u> it is needed most.
Geographic diversity evaluated as a reliability asset.

HVDC looks like any inverter-based resource

At the point of interconnection, it delivers controllable MWs during risk periods — just like wind, solar, or storage.



If we accredit wind, solar, batteries, and even thermal using ELCC — we can do the same for transmission.

How Regions Handle Transmission's RA Benefits Today

Most ISOs and utilities account for some non-firm "external assistance" in resource adequacy and reserve margin studies — but the treatment is inconsistent and opaque.

RA Assessments

Existing Transfer Capability Study

↓

LOLE Study (RA)

↓

Capacity Benefits of Ties Study

↓

Reserve Margin Study

Resource Procurement

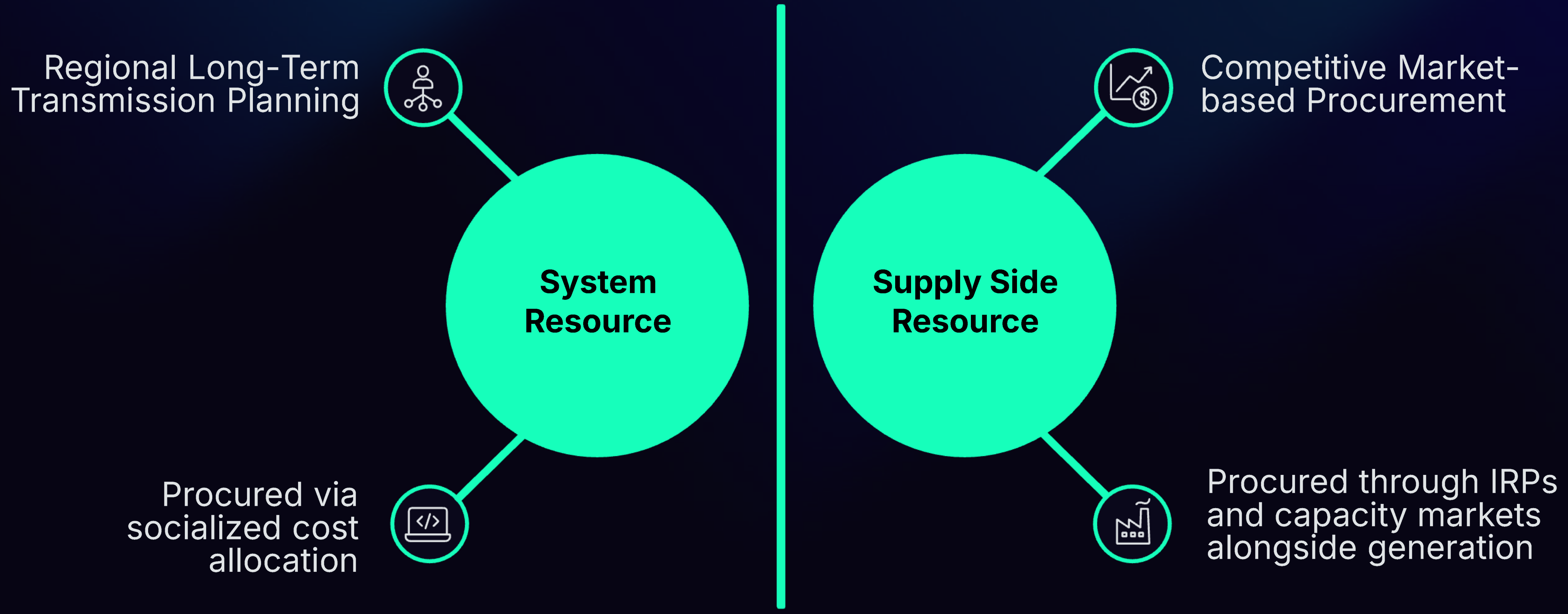
Capacity Market Req. or IRP Procurement

- **CAISO:** External RA limited by RA import capability. 0 MW non-firm imports, requires RA showing for external contracts
- **SPP:** Firm contracts only. Currently exploring non-firm RA contributions.
- **MISO:** Includes an external region proxy modeled as a probabilistic distribution between 6500 (S), 9200 MW (W)
- **PJM:** Capacity benefit of ties capped at ~2200 MW
- **NYISO:** Full modeling of NPCC, 1500-3500 MW non-firm market assistance to reduce IRM requirement.
- **ISO-NE:** Full modeling of NPCC, "Tie Benefits" study determines interface limits, no single wide system cap.
- **UK (precedent):** National ESO explicitly assigns capacity value to HVDC interties — offered into the capacity market.

Source: Pacific Northwest National Laboratory,
Transmission Planning for Long-Term Reliability (forthcoming)

Alternative Participation Models

Transmission developers can pursue one of two primary avenues for integrating their projects into the grid, each with distinct benefits and accreditation requirements.



***Both* participation models remain available,** either through conventional regional transmission planning process (FERC Order 1920) or through capacity procurements.

Two Participation Models

Model 1 — System Resource (Socialized)

Quantify the RA benefit of transmission and reflect it in the planning reserve margin — reducing the total capacity the system must procure. Aligned with FERC Order 1920 and regional planning processes. Cost and benefit are socialized across load.

Best fit for: AC or DC network upgrades and broad system-level benefits

Model 2 — Supply-Side Resource (Market-Based)

Accredit HVDC transmission with a probabilistic ELCC value and allow it to bid into capacity markets or all-source procurements alongside generation and storage. **Developer chooses: traditional rate recovery *or* merchant/investor-backed bidding.**

Best fit for: HVDC interties with controllable, measurable MW flows

Why HVDC for Model 1 or 2? HVDC is dispatchable — known MW injections and withdrawals at the point of interconnection. It behaves like a generator operationally. AC benefits are real but diffuse, making Model 1 the better fit.

Model Comparison: Tradeoffs at a Glance

Dimension	Model 1: System Resource	Model 2: Supply-Side / Market
Benefit allocation	Socialized — lower PRM, lower total procurement cost	Privatized — Direct accreditation to developer via ELCC
Procurement signal	Top-down planning; no direct developer incentive	Clear revenue signal; competitive procurement
Performance risk	Ratepayers bear risk if line underperforms	Pay-for-performance; developer bears risk and can hedge accordingly
Applicability	AC or HVDC; full network benefits	HVDC only; controllable and measurable MW flows preferred
Regulatory complexity	Lower; builds on existing planning processes	Higher; blurs transmission/generation regulation

Analytical Requirements for Accreditation

01

Wide-Area RA Modeling

Model multiple regions simultaneously — capturing geographic diversity in weather, load shapes, and correlated outages. Single-region models with fixed import assumptions miss the core diversity value.

02

Probabilistic ELCC of Transmission

Add the candidate HVDC line to a calibrated multi-region reliability model. Measure LOLE reduction. Express as equivalent perfect capacity (MW) — calculated in *both* directions.

03

Consistent All-Resource Frameworks

Transmission must be evaluated with the same probabilistic rigor as generation, storage, and DR — enabling fair head-to-head competition in procurements.

Key Challenges for Transmission Accreditation

Multi-Regional Complexity

ELCC must be evaluated in a multi-zonal framework. Requires coordination and data sharing across entities.

Calibration to 0.1 LOLE

Do you bring each region to 0.1 days/year criterion at the same time - or evaluate separately?

ELCC Process

When comparing against firm capacity or load additions, are resources added in both regions simultaneously or separately?

Large Resource Size Effects

HVDC lines (1,000–2,000+ MW) are far larger than a typical marginal resource. ELCC per MW may decline with size — diminishing returns shouldbe modeled.

Double-Counting

If both interconnected regions accredit the same line, the same MWs risk being counted twice and must-offer rules are an issue.

Next Steps: What the Industry Can Do

Analytical Priorities

- Invest in wide-area reliability studies that quantify geographic diversity across broad footprints
- Develop and standardize transmission ELCC methodologies
- Continue pilot studies on candidate HVDC interties to demonstrate methodology and quantify real capacity values

Industry Coordination

- Cross-regional collaboration between ISOs, utilities, and planning entities to align modeling and accreditation standards
- Learn from the UK capacity market's treatment of HVDC interties as a working international precedent

Market & Policy Reforms

→ Create participation pathways for HVDC in capacity markets and all-source procurements

→ Establish consistent accreditation frameworks across **all** resource types

→ Address double-counting through coordinated multi-regional market rules or bilateral agreements

→ Develop pay-for-performance mechanisms that align capacity obligations with reliability outcomes

Questions?

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