# Overview and Status of DOE's National Transmission Planning Study

April 12, 2023 @ 3:00 PM ET

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| **I.** | Antitrust Guidelines | **Josh Steinhardt**, Operations Director, GridWise Alliance |
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| **II.** | Introduction | **Carl Imhoff**, Manager, Electricity Infrastructure Market Sector, Pacific Northwest National Laboratory |
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| **III.** | Modeling Effort and Interim Results | **Hamody Hindi**, Electrical Engineer, U.S. Department of Energy & Bonneville Power Administration |
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| **IV.** | Stakeholder Engagement Processes and Regulatory Considerations | **Juliet Homer**, Senior Energy Research Engineer, Pacific Northwest National Laboratory |
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| **V.** | Questions and Discussion | **All** |

GRIDWISE ALLIANCE

# GridWise Alliance
# Antitrust Compliance Program Guidelines

It is the policy of the GridWise Alliance to comply fully with the antitrust laws. The Sherman Act and other applicable antitrust laws are intended to promote vigorous and fair competition and to combat various restraints of trade.

Each person who participates in GridWise Alliance activities has a responsibility to his/her employers and to the GridWise Alliance to avoid any improper conduct from an antitrust standpoint. The following guidelines will assist in meeting this responsibility:

1. GridWise Alliance meetings and discussions generally cover topics related to the generation, transmission and distribution of electricity. Should related discussions ever have any potential for competitive impact, all due care shall be taken to avoid such discussion between competitors.

2. In view of antitrust considerations and to avoid any possible restraints on competition, the following legally sensitive subjects must be avoided during any discussion between competitors:

   (a) Future marketing plans of individual competitors should not be discussed between competitors;

   (b) Any complaints or business plans relating to specific customers, specific suppliers, specific geographic markets or specific products, should not be discussed between competitors;

   (c) Purchasing plans or bidding plans of companies in competition should not be discussed (except privately between two parties with a vertical commercial relationship such as supplier and customer); and

   (d) Current and future price information and pricing plans, bidding plans, refund or rebate plans, discount plans, credit plans, specific product costs, profit margin information and terms of sale should not be discussed between competitors. All of the above are elements of competition.

3. Any question regarding the legality of a discussion topic or business practice should be brought to the attention of the GridWise Alliance legal counsel or a company's individual legal counsel for advice.

PNNL-SA-182656

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# National Transmission Planning Study

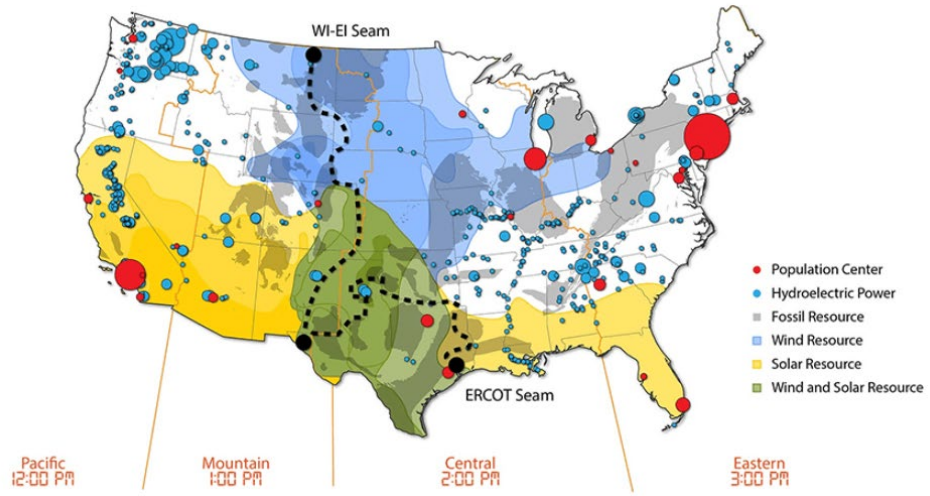
## U.S. Department of Energy

*https://www.energy.gov/gdo/national-transmission-planning-study*

**Summary Overview**
**March 12, 2023**

# Project Team – PNNL, NREL, and DOE

- This study is conducted by a joint National Renewable Energy Laboratory (NREL) and Pacific Northwest National Laboratory (PNNL) project team
- This study builds on past projects and expertise at NREL and PNNL with the support and direction of DOE's Office of Electricity and Grid Deployment Office





NREL Transforming ENERGY

Pacific Northwest NATIONAL LABORATORY

U.S. DEPARTMENT OF ENERGY

Office of Electricity

North American Energy Resilience Model

# Objectives of the Study

Identify interregional and national strategies to accelerate cost-effective decarbonization while maintaining system reliability

Inform regional and interregional transmission planning processes, particularly by engaging stakeholders in dialogue

Results help prioritize future DOE funding for transmission infrastructure support



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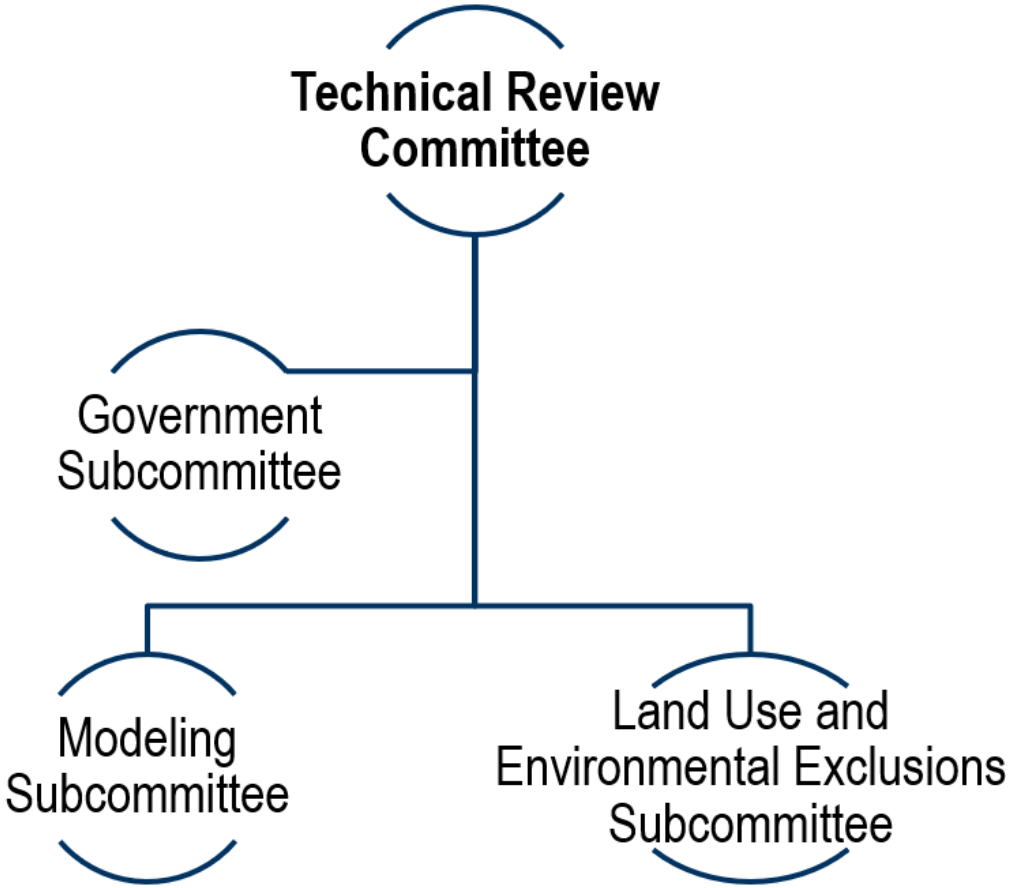
# Technical Review Committee with three subcommittees

**Technical Review Committee** (TRC) – constructively scrutinize and review the overall project and, where needed, will provide a forum for integrating input from all three subcommittees.

- **Government Subcommittee –** provide feedback on reflecting federal and state policy and regulatory issues in the analysis.
- **Modeling Subcommittee** – provide technical feedback on assumptions, modeling, and data.
- **Land Use and Environmental Exclusions Subcommittee** – provide feedback on generalized issues related to constraints on locating new transmission and generation.

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# Four Aspects to Public Engagement

- Public Input
- Existing Convenor Groups
- Technical Review Committee
- Tribal Outreach

# We are actively seeking input on modeling inputs and results from the Technical Review Committee and public

## Engagements

- Regularly conducting regional meetings (Northeast, Southeast, West, Southwest) with TRC members to review inputs and modeling results
- Solicited feedback from state public utility commissions and state energy offices on state-level demand and policy assumptions used in modeling
- Working through regional organizations to solicit feedback
- Holding public meetings and encouraging feedback through a public comment form

## Adjusting our approach based on feedback

- We modified assumptions about energy storage deployments with new generation
- We modified our approach to stress scenarios and climate change impacts
- We are modifying our assumptions about LCC and VSC HVDC technologies
- We are developing a companion paper on Regulatory Pathways to address practical institutional and regulatory barriers to interregional transmission development
- Others

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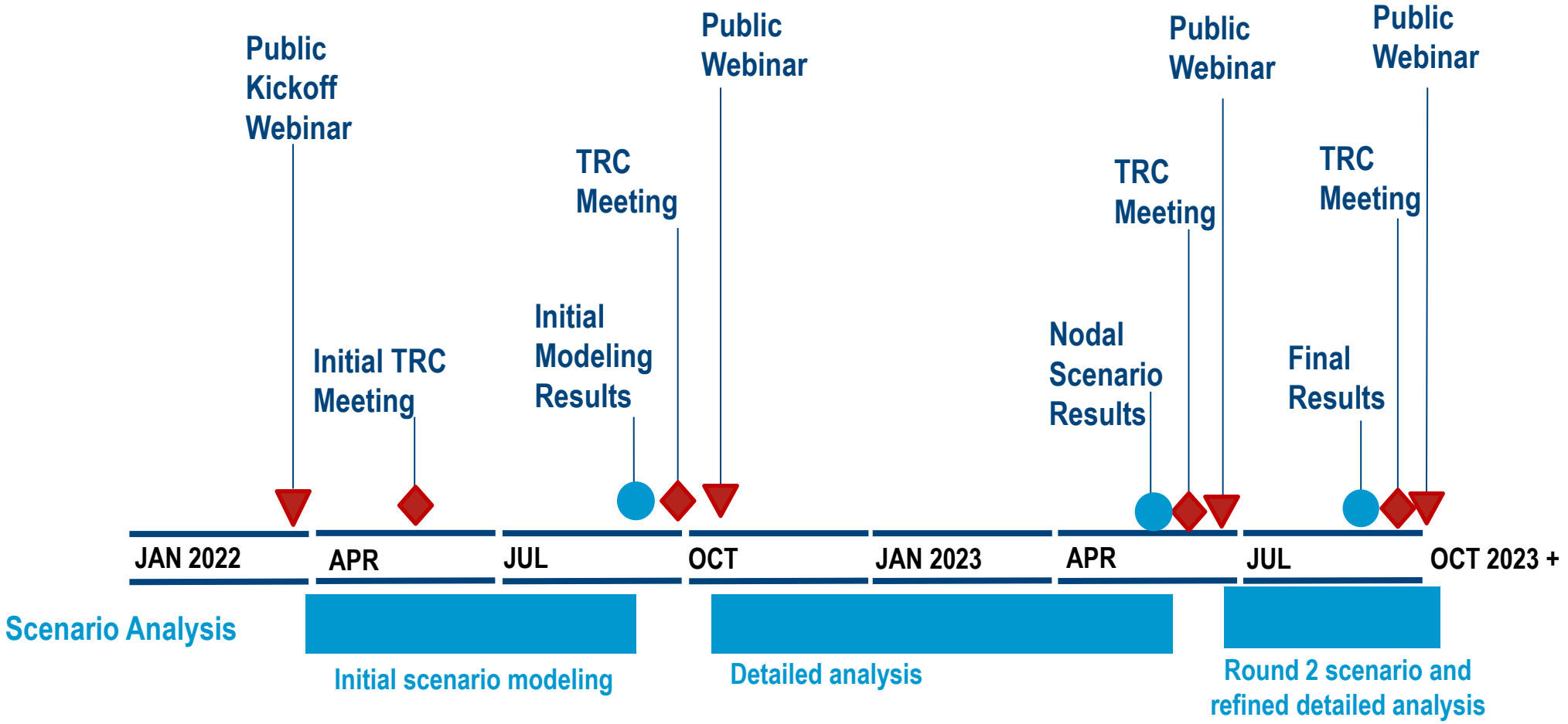
# Study will wrap up in the fall of 2023

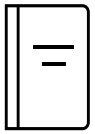



TRC = Technical Review Committee

# Building a Better Grid Initiative

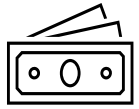
## Engagement and collaboration

- States
- Tribal nations
- Stakeholders
- Federal Agencies
- ISO/RTOs
- EROs



## Enhanced transmission planning

- Transmission Needs Study
- National Transmission Planning Study
- Atlantic Offshore Wind Transmission Study



## Federal financing tools ($20+B)

- Transmission Facilitation Program ($2.5B)
- Smart Grid Investment Matching Grant Program ($3B)
- Grid resilience grants for states, Tribes, and utilities ($10+B)
- Loan guarantee programs
- Transmission Facility Financing ($2B)
- Siting of interstate Electricity Transmission Lines ($760M)

## Transmission permitting process

- Streamline permitting with federal agencies
- Public private partnerships
- Designation of National Corridors

## Transmission-related R&D

- "Next generation" electricity delivery technologies
- Supporting activities



One Stop Shop: the DOE Grid and Transmission Programs Conductor

# What the Study is and is not doing

## What the study will do

- Link several long-term and short-term power system models to test a number of transmission buildout scenarios
- Inform existing planning processes
- Test transmission options that lie outside current planning
- Provide a wide range of economic, reliability, and resilience indicators for each transmission scenario

## What the study will not do

- Replace existing regional and utility planning processes
- Site individual transmission line routes
- Address the detailed environmental impacts of potential future transmission lines
- Provide results that are as granular as planning done by utilities
- Develop detailed plans of service

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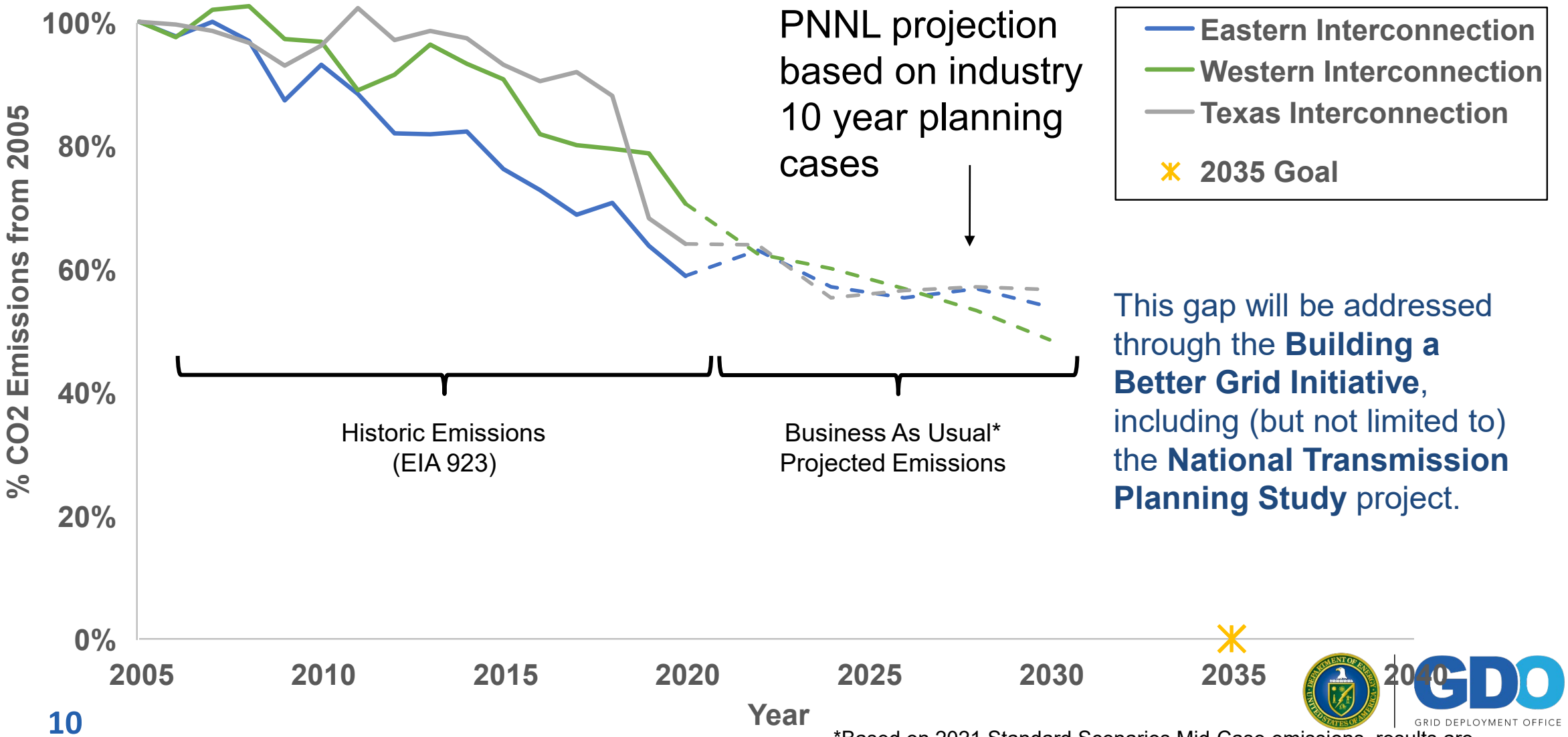
# Achieving Complete Grid Decarbonization by 2035 will be a Daunting Challenge




This gap will be addressed through the **Building a Better Grid Initiative**, including (but not limited to) the **National Transmission Planning Study** project.

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EIA 923 Emissions (https://www.eia.gov/electricity/data.php#elecenv)

*Based on 2021 Standard Scenarios Mid-Case emissions, results are consistent with Basecase 2030 production cost modeling results

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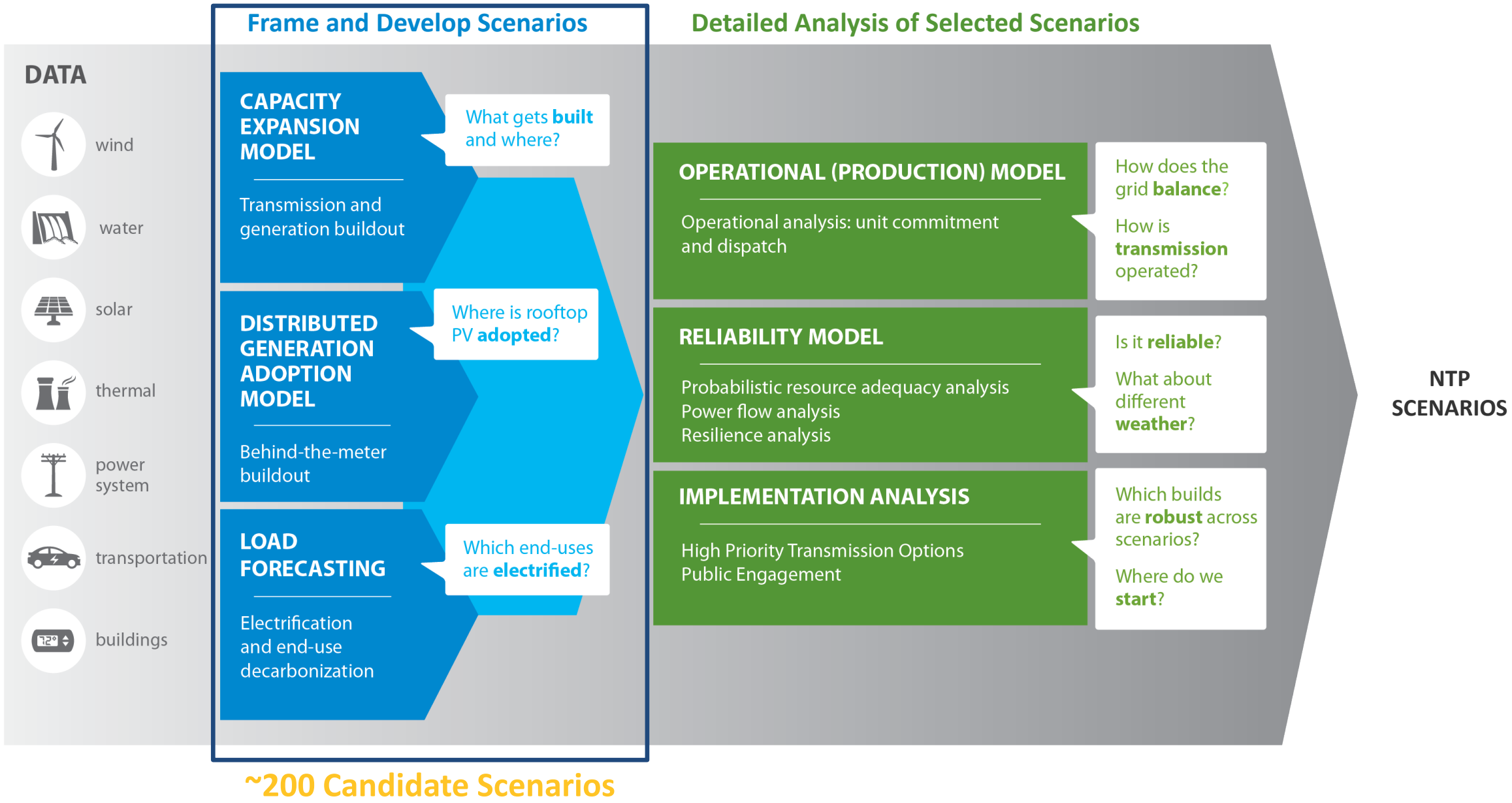
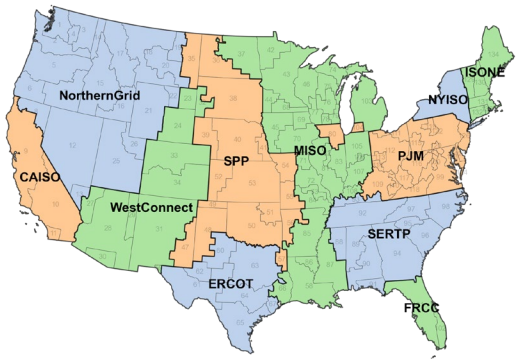
# NTP Scenario Analysis Relies on Multiple Linked Modeling Exercises

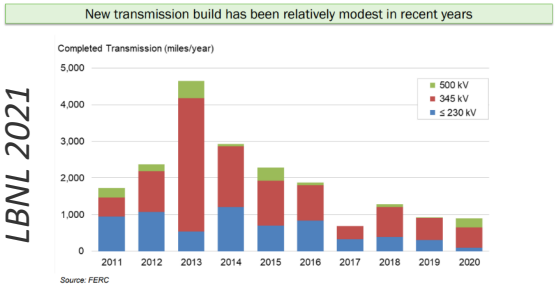


# Transmission Paradigms

## Limited

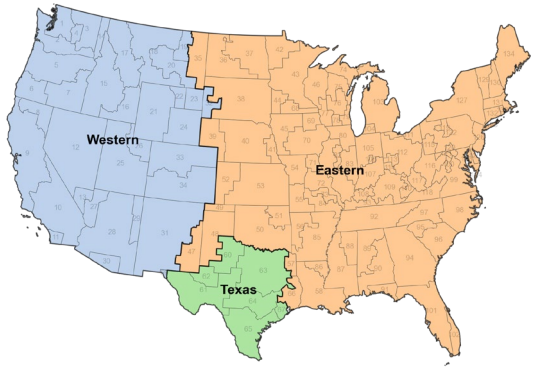



- **Intra-regional** transmission expansion within planning regions only
- Cap annual transmission builds based on recent (since 2009) average of ~1.4 TW-miles/yr.



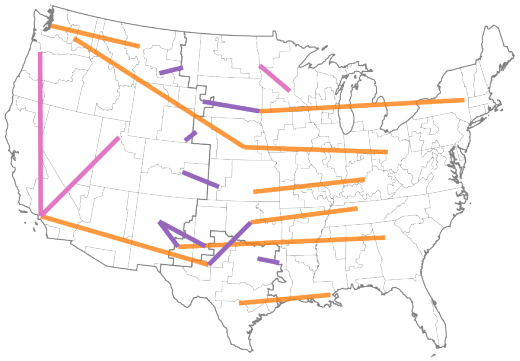

*LBNL 2021*

## AC



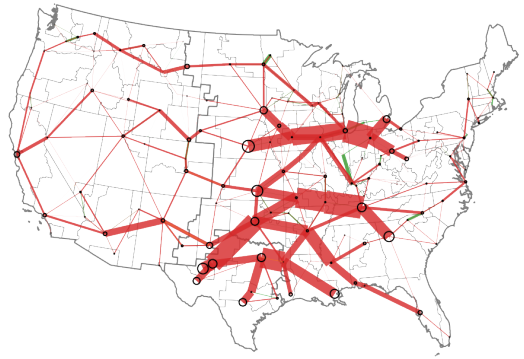

- **Intra-interconnection** transmission expansion between 134 zones (no new back-back DC ties across seams)
- Transmission cost and losses based on AC transmission (500 kV).

## HVDC Point-to-Point



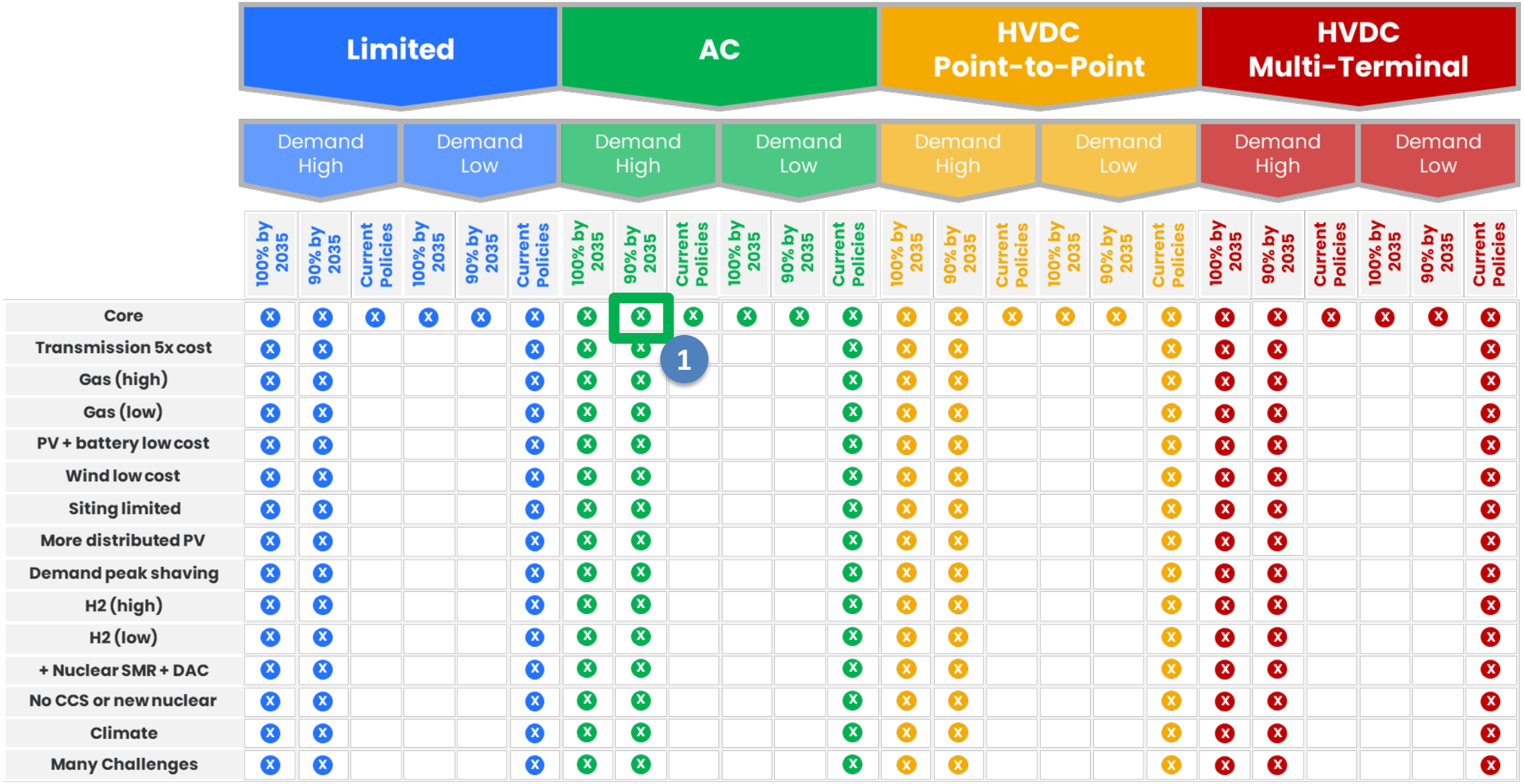
- **Inter-interconnection** transmission expansion (new back-back DC ties allowed)
- HVDC (point-to-point line-commutated converter) expansion allowed
- Available LCC connections identified based on preliminary scenarios.

## HVDC Multiterminal



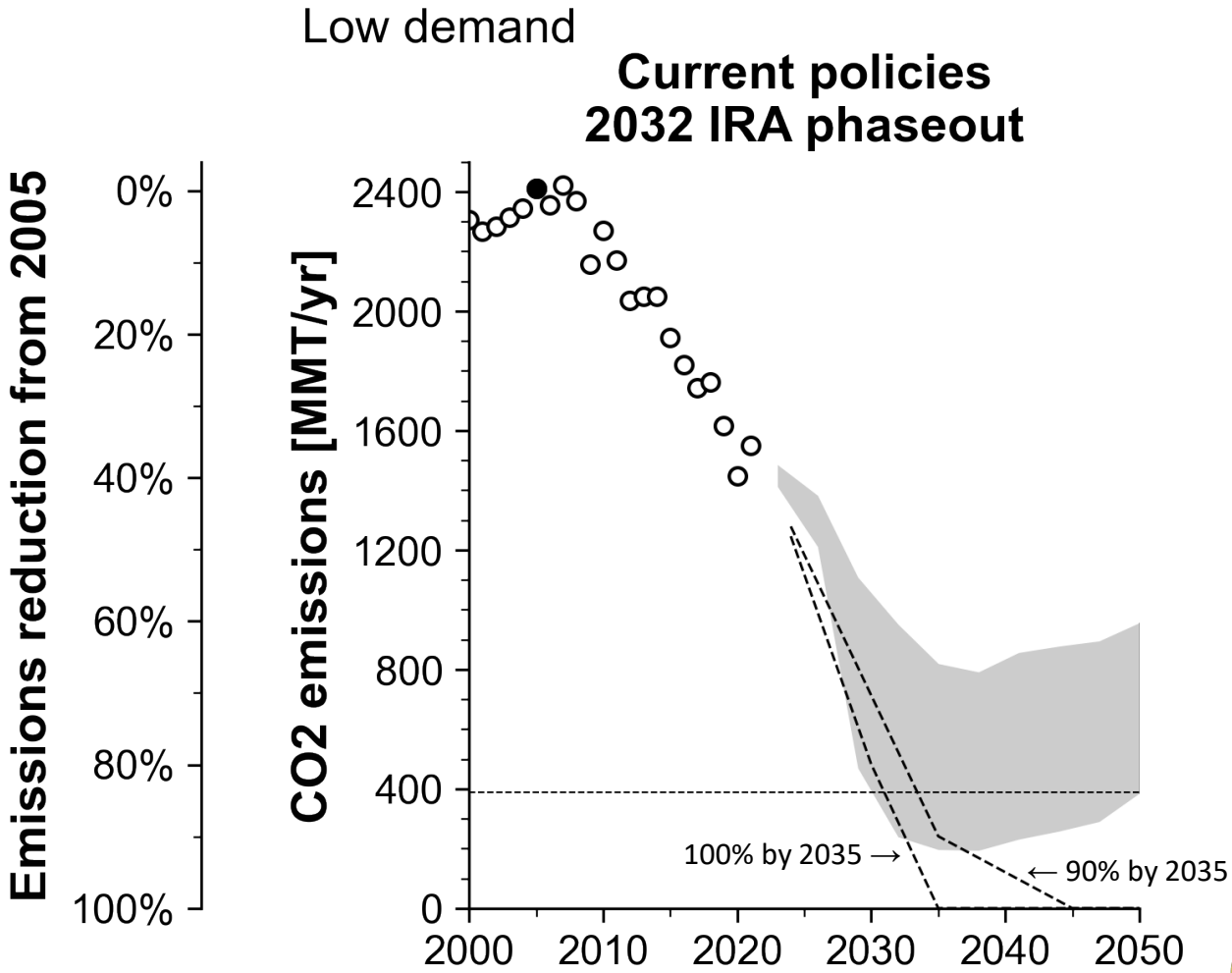
- **Macrogrid** multiterminal HVDC network designed by the model and specific to the scenario
- Transmission lines and voltage-source-converter capacities are decided separately
- VSC builds are not allowed until 2032.

# Team will down-select from ~200 capacity expansion scenarios to 5-7 for translation to nodal



# Preliminary Finding #1

Emissions fall significantly with **current policies** and new interregional transmission, but not to zero. There is a large range of uncertainty in the magnitude of potential emissions reductions (gray-shaded area)




Interim results
Do not cite

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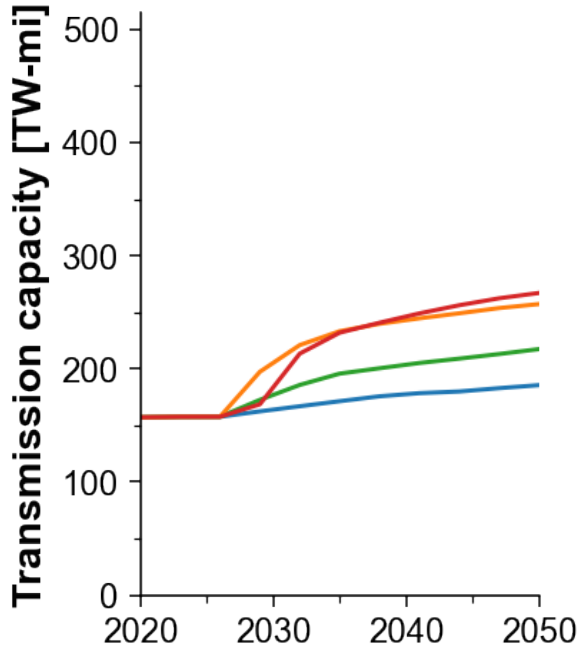
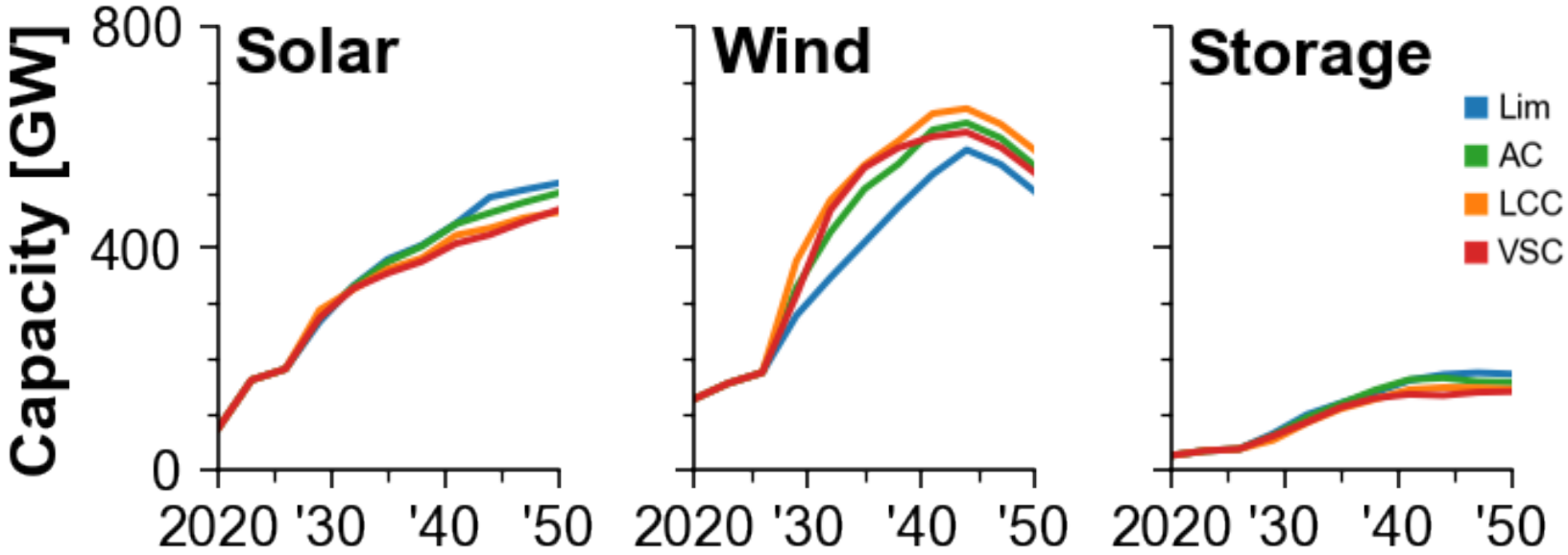
# Preliminary Finding #2

There is notable growth in RE, storage, and transmission capacity even under the **current policies with low demand** scenarios, but fossil w/o CCS remains.




Interim results
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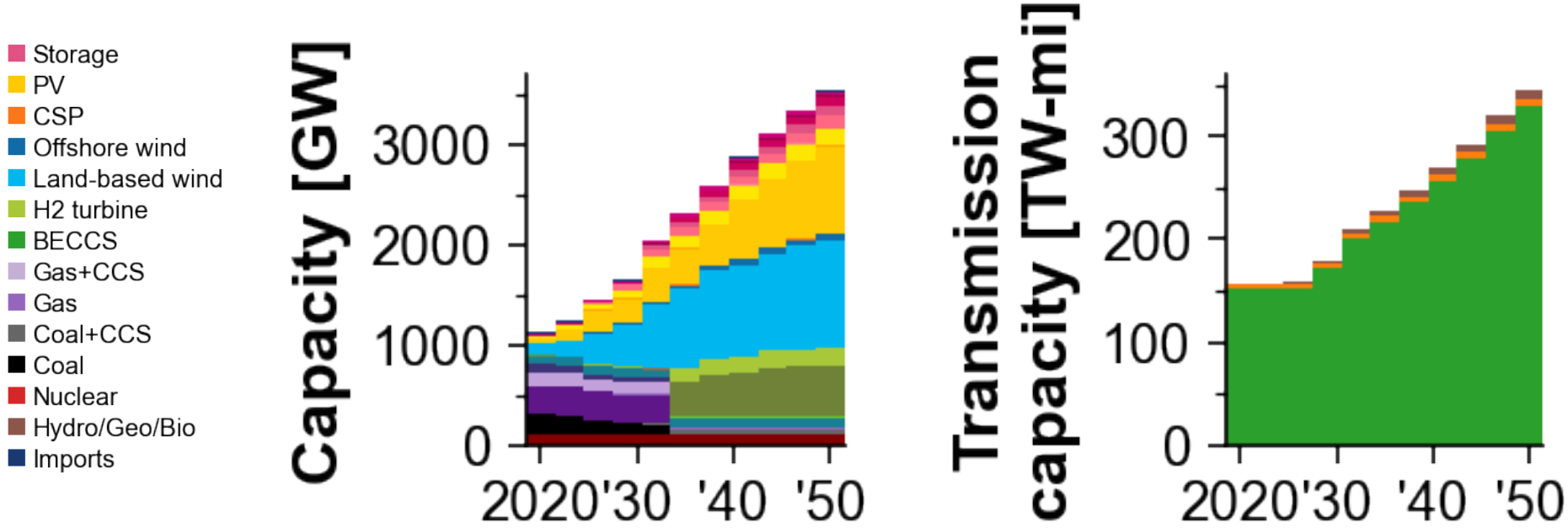
# Preliminary Finding #3




The combination of **high demand growth and 90% or 100% emissions reduction** leads to RE, storage, and transmission capacities many times larger than today.

Interim results
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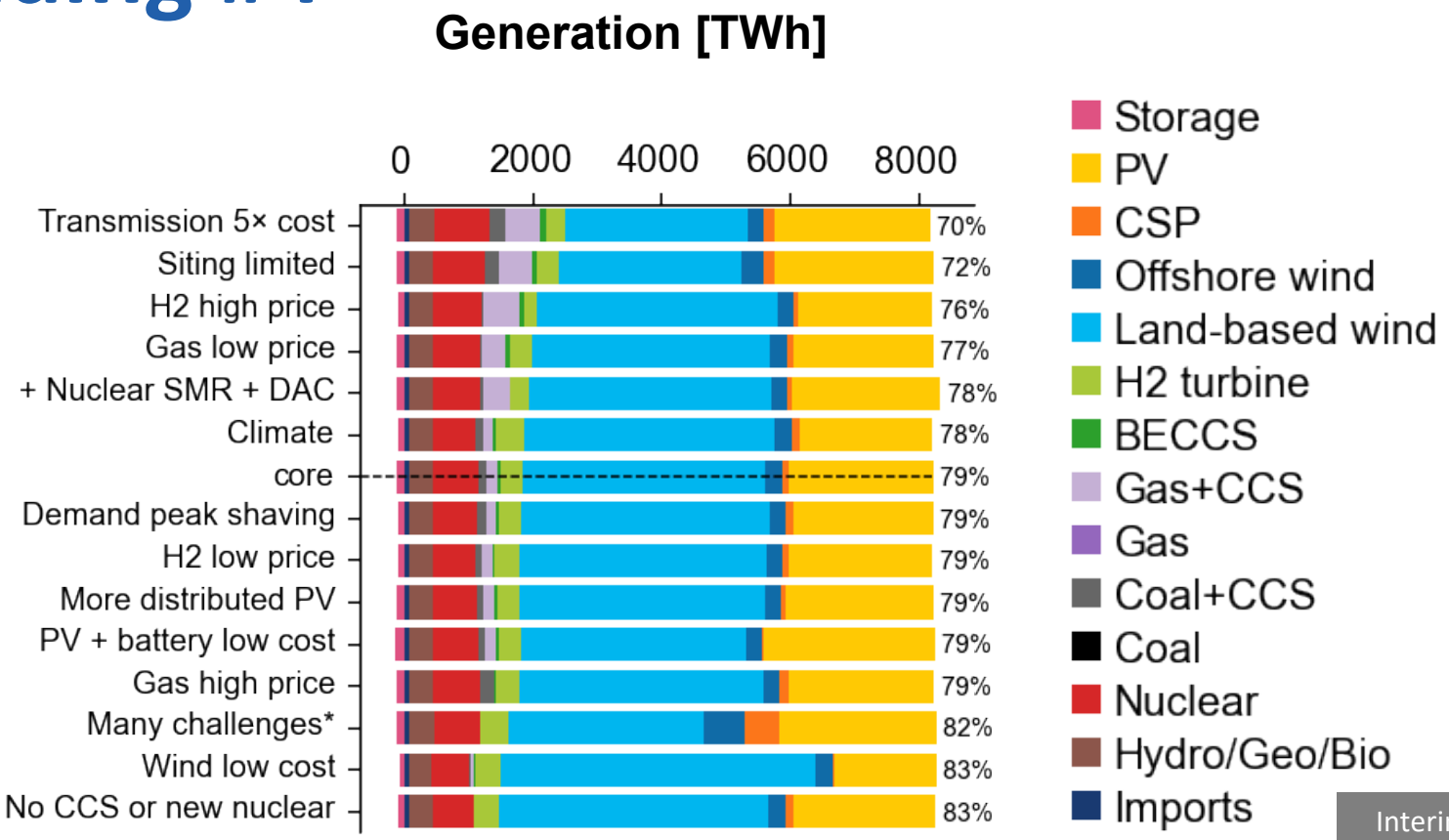
# Preliminary Finding #4

100% by 2035, High demand, AC

The majority of decarbonization is delivered by wind and solar, along with coordinated deployment of storage and transmission.




Interim results
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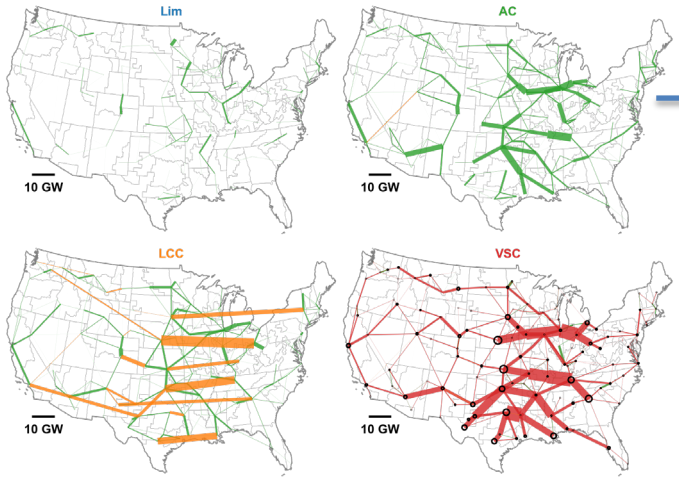
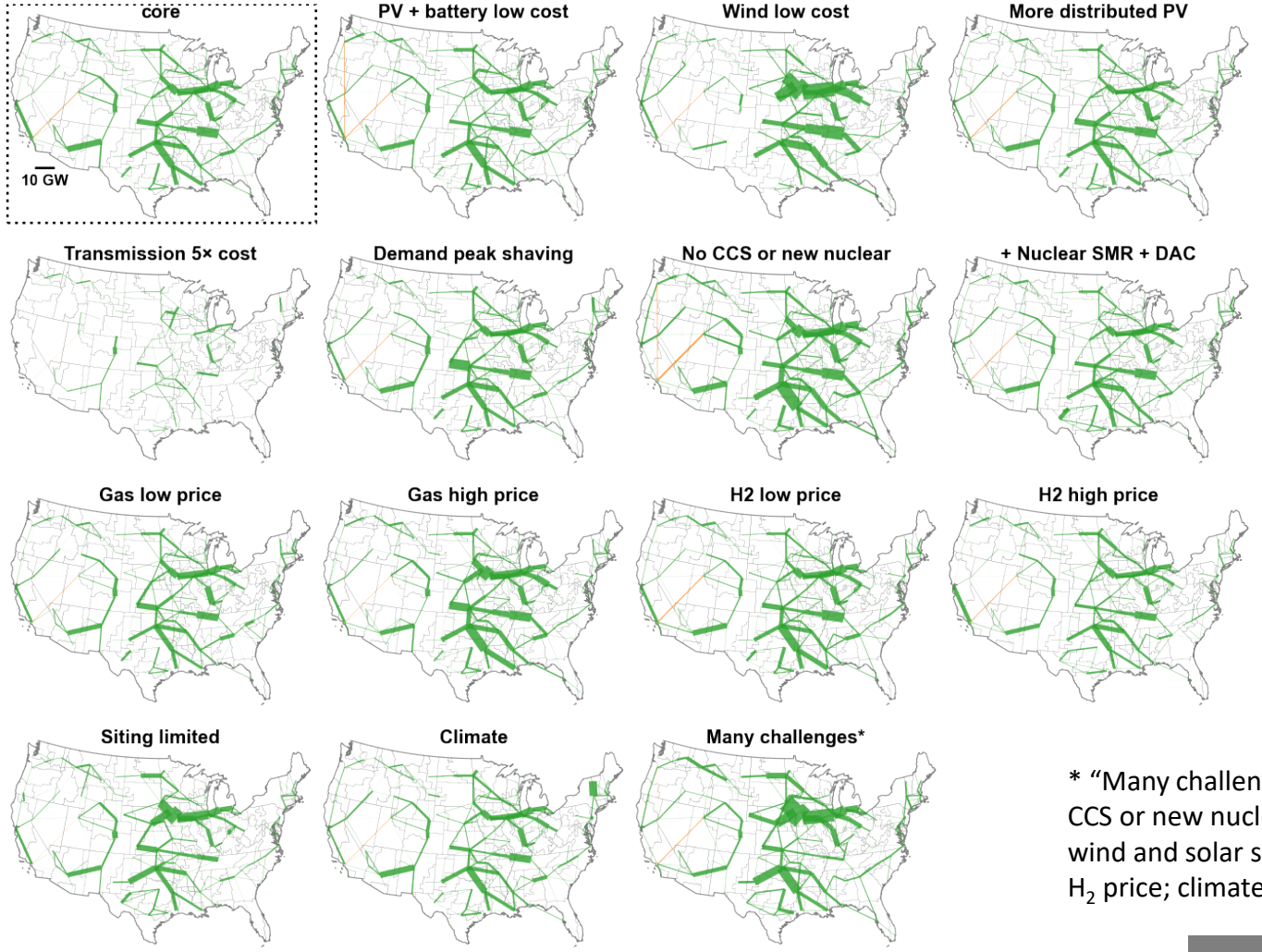
# Preliminary Finding #5

100% by 2035, High demand




The **geographic distribution** of transmission additions is **robust** across many sensitivities, although the total capacity (TW-miles) can vary.

The highest density of transmission additions occurs **between the wind belt and eastern interconnection demand centers**, but increased transmission occurs in all regions of the country.

* "Many challenges" = No CCS or new nuclear; limited wind and solar siting; high $H_2$ price; climate

# Next Steps

- Identify *initial draft* of **high priority transmission options** based on the full suite of Candidate Scenarios
- **Down-select scenarios** for more detailed analysis
  - Production Cost Modeling and Resource Adequacy analysis (zonal)
  - Production Cost Modeling and power flow analysis (nodal)
  - Economic Analysis (Tx value by region, multi-value approach, range of outcomes)
  - Resilience Analysis (heat waves, cold waves, and drought)
- **Refined capacity expansion modeling** for Candidate Scenarios v2
  - Climate change-informed input data
  - Demand updates
  - Other updates…



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# THANK YOU

- Overview of NTP Study goals and objectives
- Project news and milestone results
- Webinar presentations
- NTP Study mailing list
- TRC meeting schedules and presentation materials
- Public comment form


www.energy.gov/gdo/national-transmission-planning-study



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