Meeting the Challenge of Our Time

Pathways to a Clean Energy Future for the Northwest

An Economy Wide Deep Decarbonization Pathways Study • 2019

Clean Energy Transition Institute

Clean Energy Transition Institute

Independent, nonpartisan Northwest research and analysis nonprofit organization with a mission to accelerate the transition to a clean energy economy. Provide information and convene stakeholders.

- Identifying deep decarbonization strategies
- Analytics, data, best practices
- Nonpartisan information clearinghouse
- Convenings to facilitate solutions

Why a Northwest Deep Decarbonization Study?

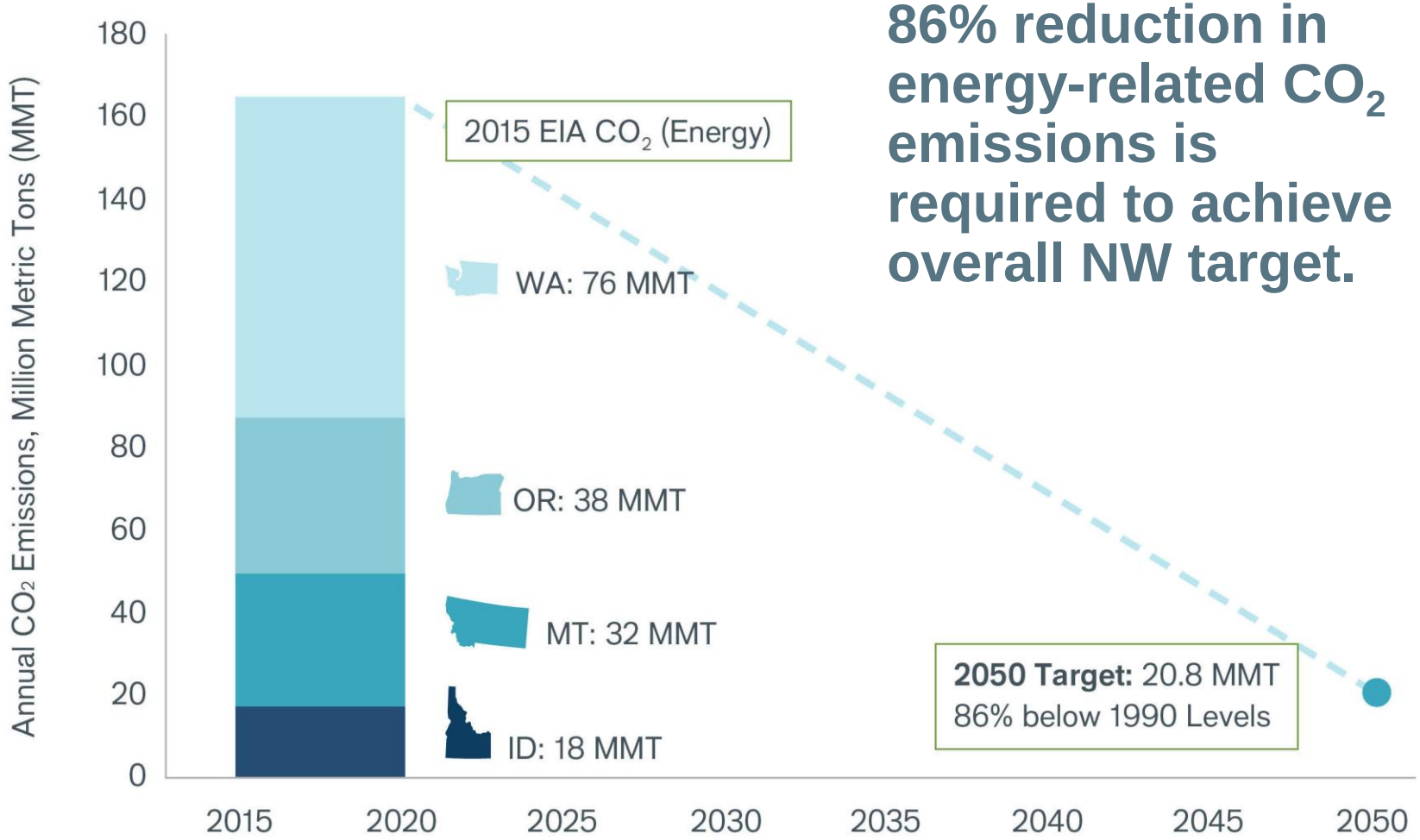
Common set of assumptions to inform decisions about how the clean energy transition could unfold over the coming decades

- Unbiased, analytical baseline for the region
- Variety of pathways to lower carbon emissions
- Surface trade-offs, challenges, and practical implications of achieving mid-century targets
- Broaden conversations about actions needed

Key Study Questions Posed

- **How does the energy sector need to transform** in the most technologically and economically efficient way?
- **How does electricity generation need to be decarbonized** to achieve economy-wide carbon reduction goals?
- **What if we can't** achieve high electrification rates?
- **What is the most cost-effective use** for biomass? What if biomass estimates are wrong?
- **What would increased electricity grid transmission** between the NW and CA yield?

Northwest Deep Decarbonization Target

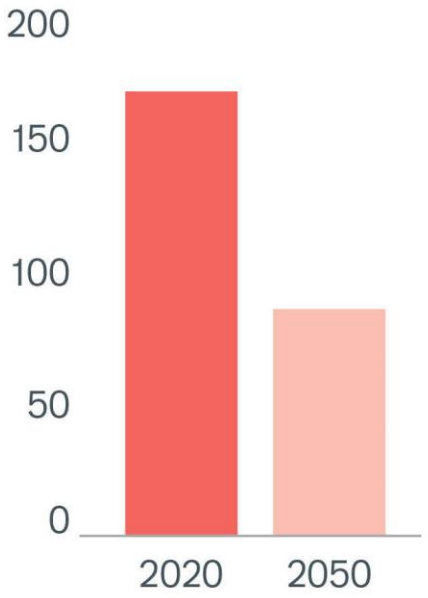


86% reduction in energy-related CO_2 emissions is required to achieve overall NW target.

Five Decarbonization Strategies Deployed

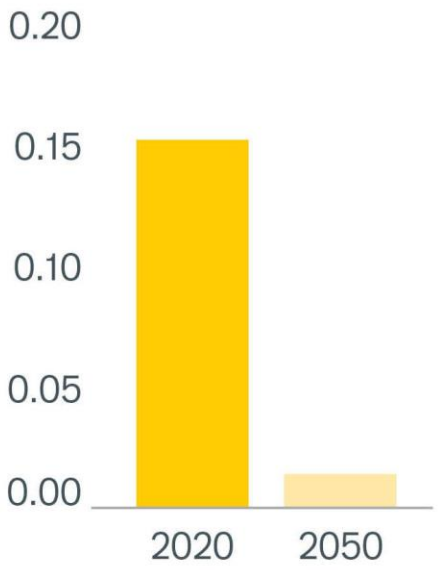
Efficiency

Per capita decreases 50%



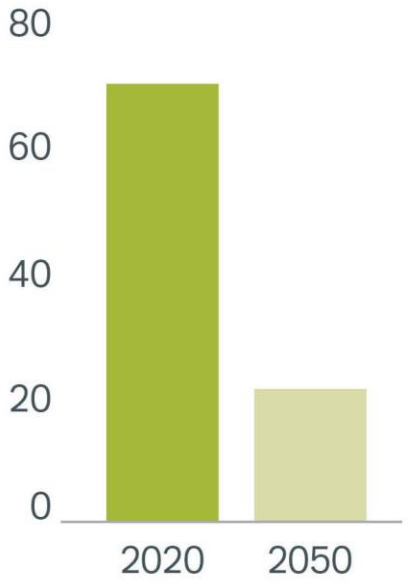
Clean Electricity

96% Clean by 2050



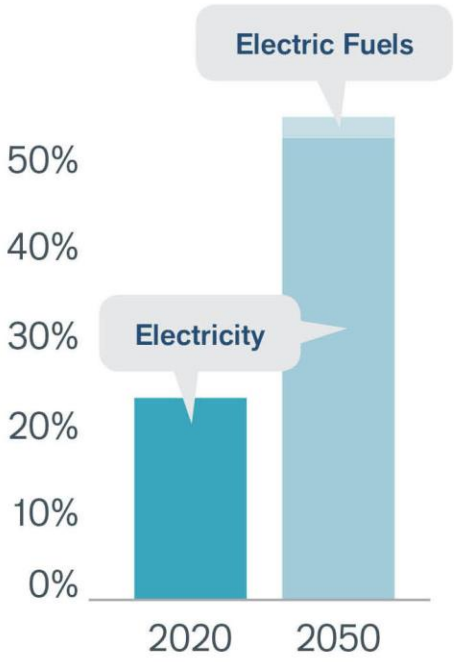
Low Carbon Fuels

70% decrease



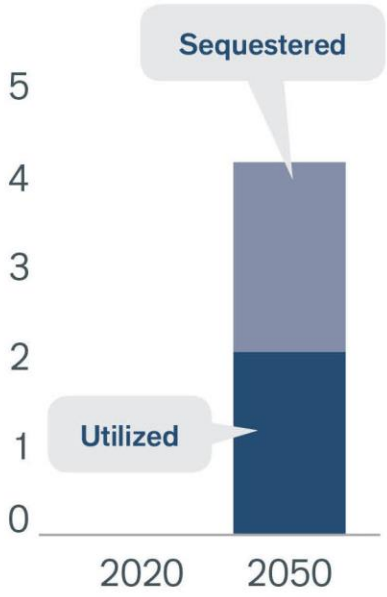
Electrification

Doubles from 23% to 55%



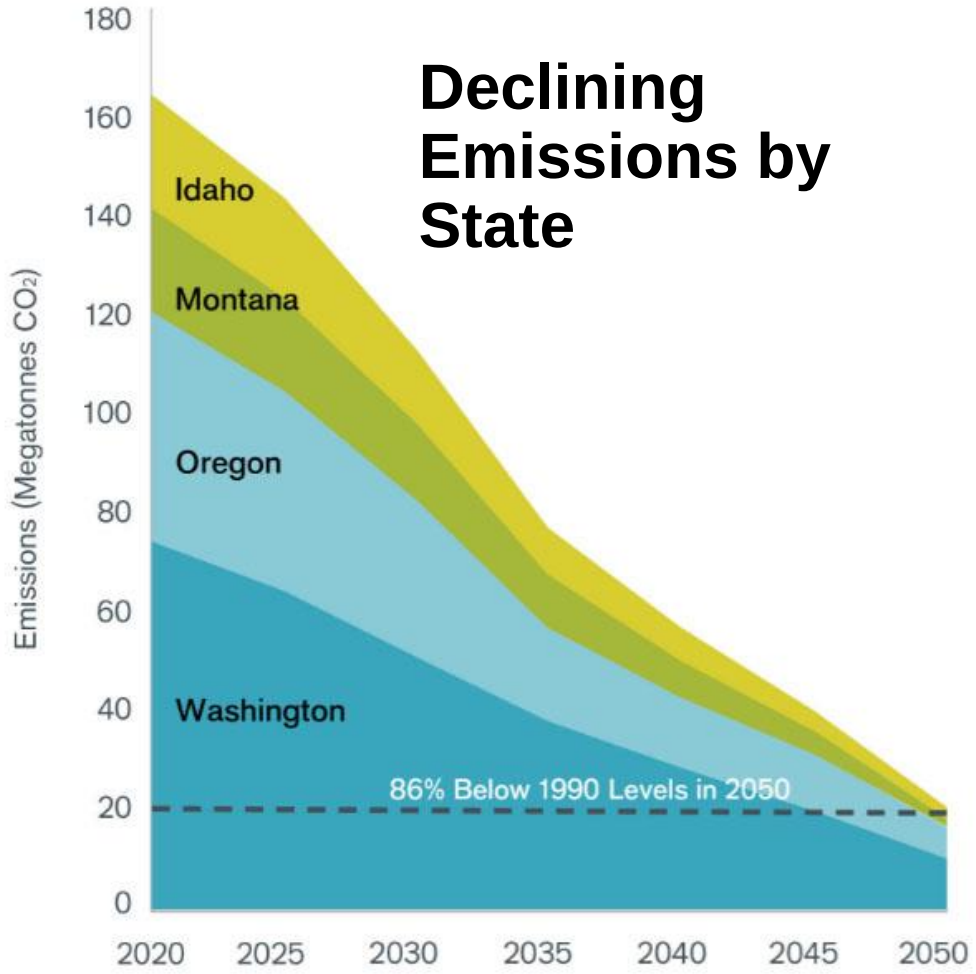
Carbon Capture

1/2 fuel; 1/2 sequestered

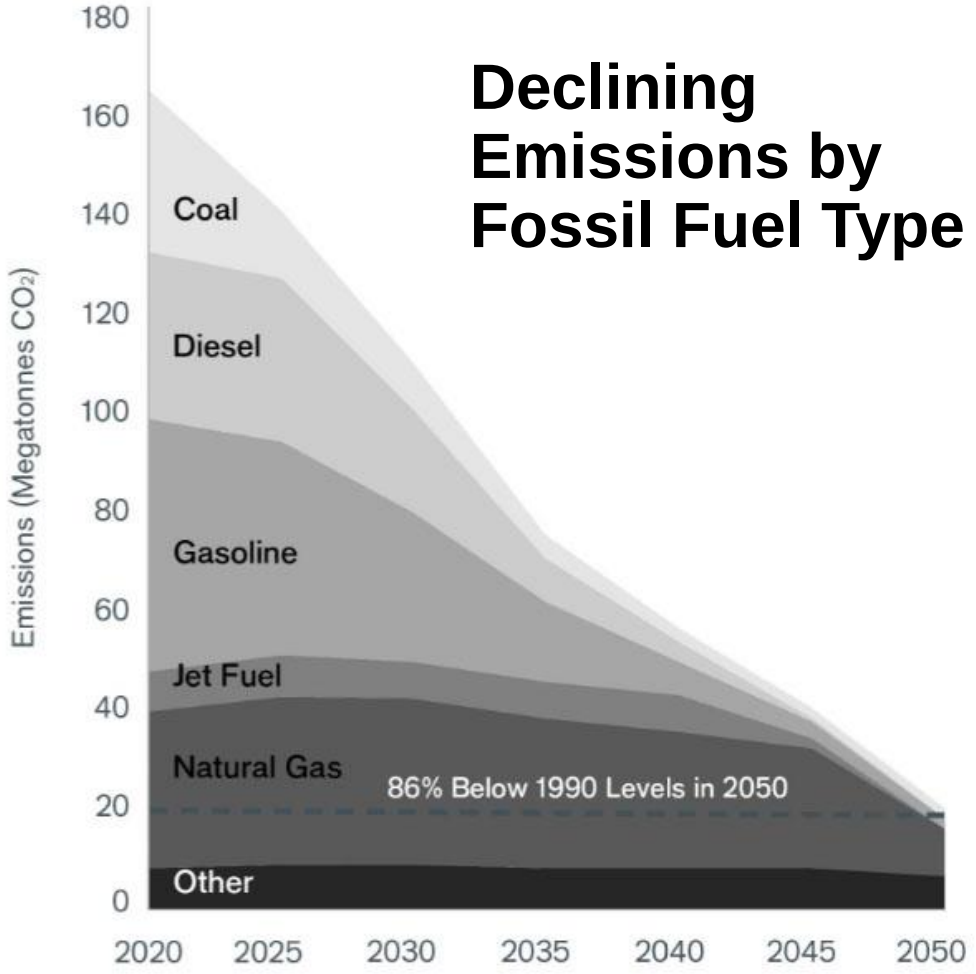


CO_2 Emissions Decrease by State & Fossil Fuel Type

Declining Emissions by State

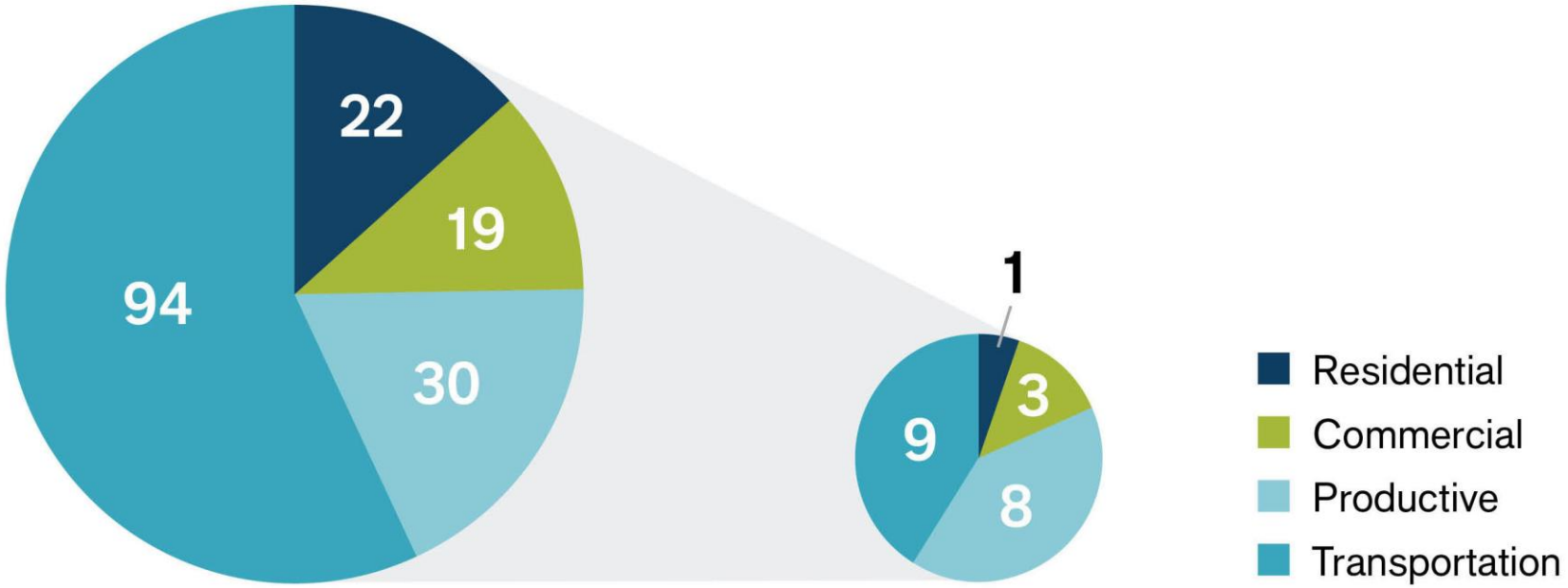


Declining Emissions by Fossil Fuel Type



NW CO_2 Emissions Decrease by Sector

All sectors contribute to reduction in Northwest CO2 emissions, with decreases ranging from 95 to 73%.



2020: 165 MMT CO_2

2050: 21 MMT CO_2

Key Findings: Deep Decarbonization Achievable

- **Electricity** generation must be **~96% clean**
- **A highly efficient built environment** powered by clean electricity
- **Aggressive vehicle electrification** powered largely by clean electricity
- **Thermal generation (natural gas) important for reliability** but operates at low capacity factor in 2050
- **Significant cost savings** if the Northwest and California **grids are better integrated**
- **Biomass** allocated to replace jet and diesel fuel
- **Electric fuels** play an important role

Alternative Pathway Results

100% Clean Electricity Grid

Limited Electrification & Efficiency

No New Gas Plants for Electricity

Limited Biomass for Liquid Fuels

Increased NW-CA Transmission

- Easier with economy-wide approach; electric fuels achieves additional 4%
- Enormous supply/cost implications; scale of facilities prohibitive; imports likely
- More energy storage & renewables for reliability; approximately double the cost
- Similar energy system impacts to the No New Gas, though not as costly
- Saves $11.1B; avoid development of low-quality renewables in CA & in NW

Equity and Implementation Implications

- Deep Decarbonization Implementation Challenges:
  - Implementing widespread transportation electrification
  - Limiting natural gas in buildings, transport, and the grid
  - Achieving deep energy efficiency
  - Grid storage, grid readiness
  - Improving/expanding Northwest-California grid integration
  - Assessing actual biomass in the Northwest
  - Determining the role power-to-X, electrolysis, direct air capture in the Northwest
- Equity implications must be examined and addressed

Institute Next Steps

- **Develop Policy, Innovation, Investment& Equity Frameworks** to Accelerate Deep Decarbonization
  - Role of Natural Gas in Buildings, Transport, Grid
  - Transportation Electrification
  - Northwest-California Grid Integration
- **Additional Runs** of the Model
  - Run model with updated cost & technology data
  - Assumptions about hydroelectricity, nuclear availability, coal plant retirements, natural gas pricing and carbon intensity.
- **Project:** Building Decarbonization with an Equity Focus

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CLEAN ENERGY TRANSITION INSTITUTE

partisan Northwest research and analysis nonprofit organization dedicated to **accelerating the clean energy transition in the Northwest.**

The Clean Energy Transition Institute's Role is to:

- Conduct Research and Analysis
- Serve as an Information Clearinghouse
- Provide Stakeholder Convening

FEATURED REPORT

Meeting the Challenge of Our Time: Pathways to a Clean Energy Future for the Northwest is the first economy-wide analysis to examine decarbonization pathways mapped to the Northwest's economic and institutional realities.

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Thank you

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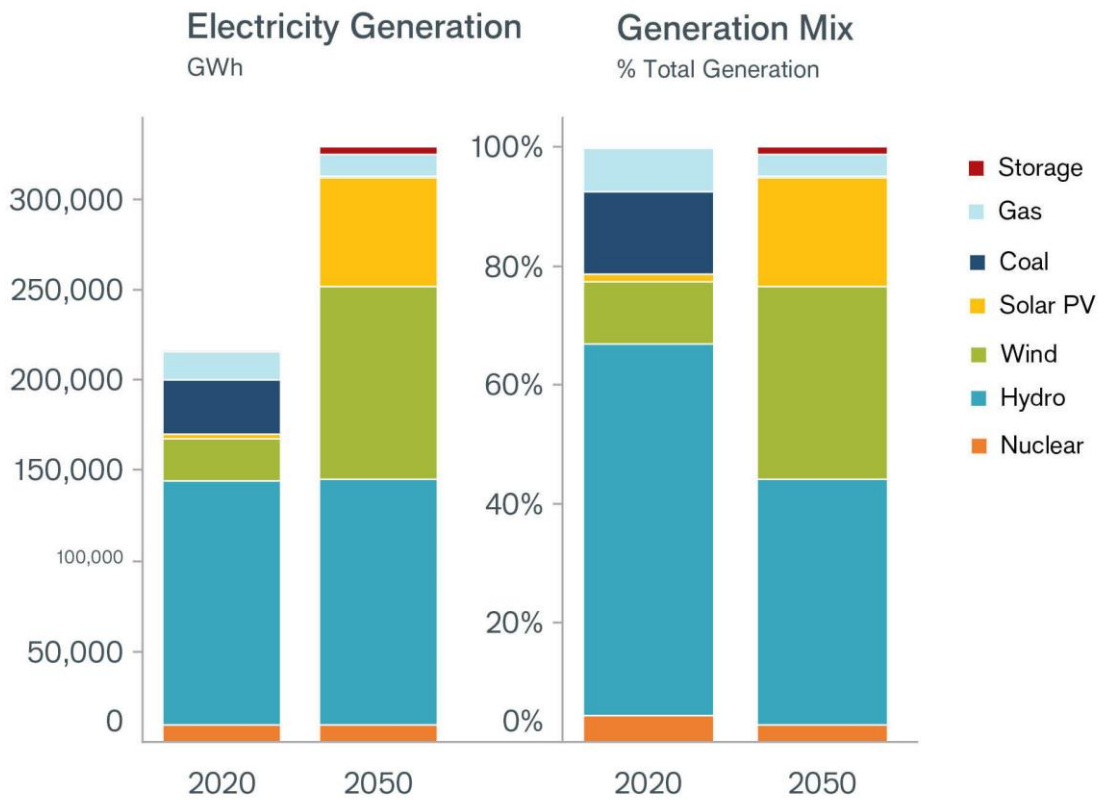
Study Emissions Target

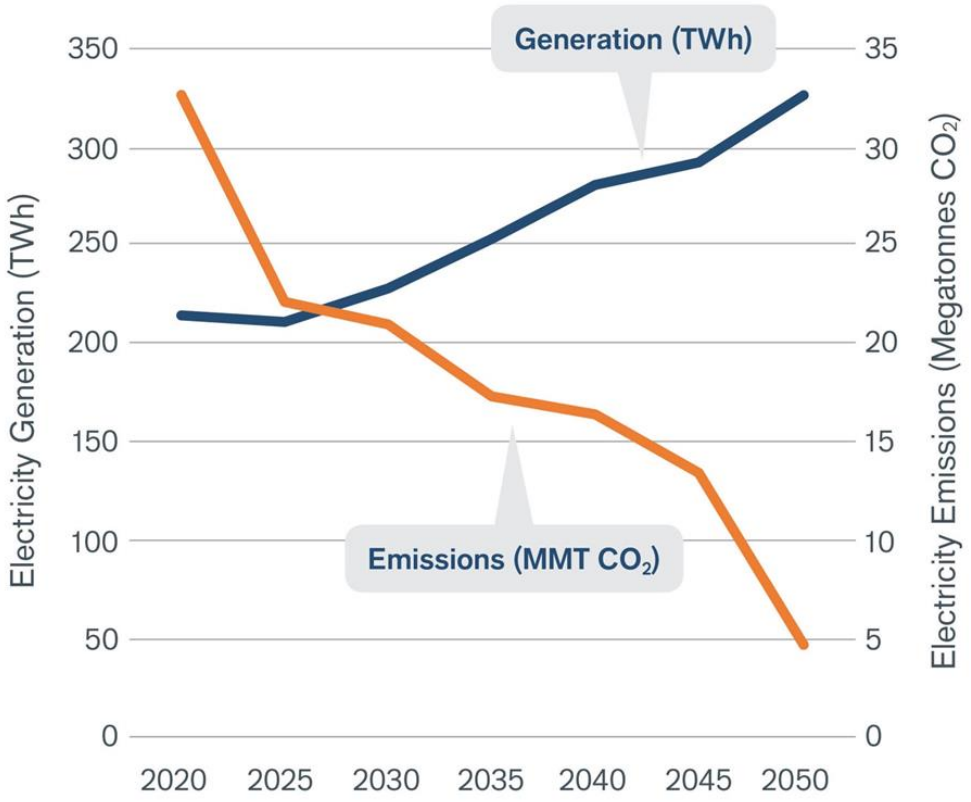
86% reduction in energy-related CO_2 below 1990 levels by 2050

- Applied to each Northwest state independently
- Consistent with economy-wide reduction of 80% below 1990 levels by 2050
- Allows for reductions below 80% for non-energy CO_2 and non-CO_2 GHG emissions, where mitigation feasibility is less understood relative to energy

Electricity: 96% Carbon Free

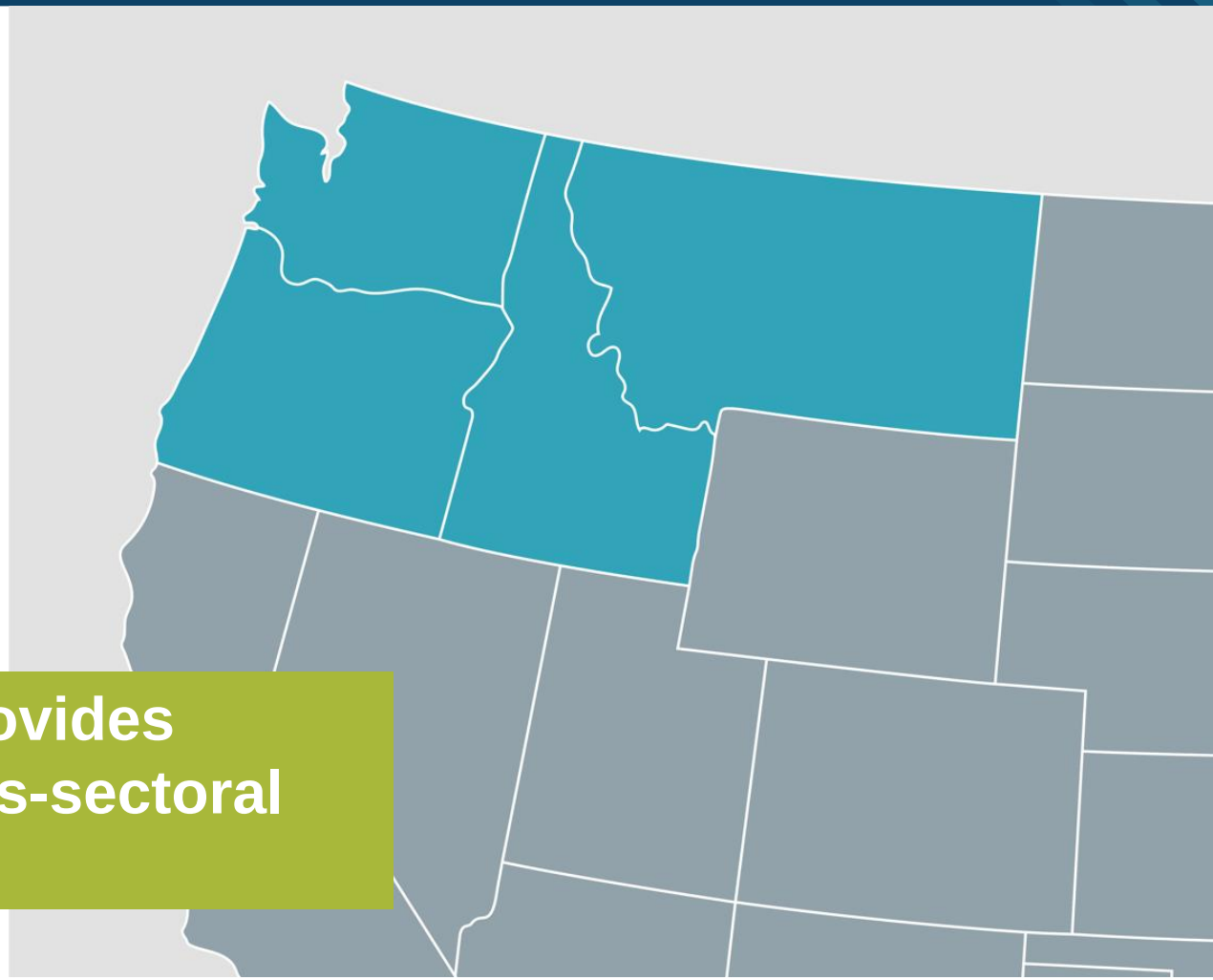
Generation increases 53%, with fossil fuel use at 4%, emissions decline by 86%.





Scope: Northwest Regional Energy Sector

- **Scope:** WA, OR, ID, MT
- **All Energy Sectors Represented:**
  - Residential and commercial buildings
  - Industry
  - Transportation
  - Electricity generation



Evaluating holistically provides an understanding of cross-sectoral impacts and trade-offs