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Deep Decarbonization in the Northwest is Achievable

Key Findings of a Northwest Deep Decarbonization Pathways Study

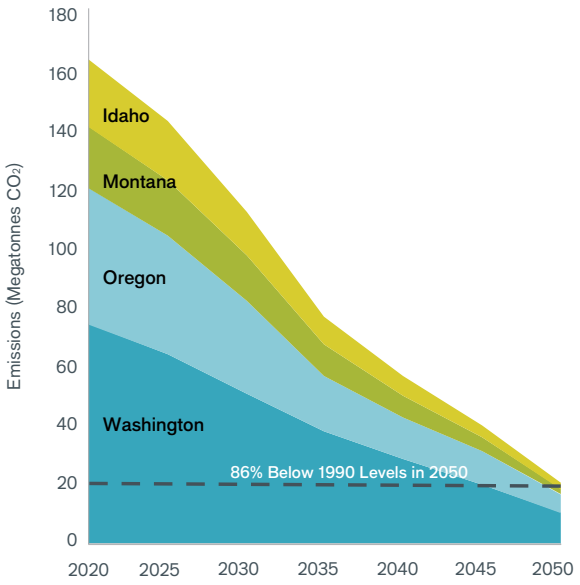
Meeting the Challenge of Our Time: Pathways to a Clean Energy Future for the Northwest **is the first economy-wide analysis to examine decarbonization pathways mapped to the Northwest's economic and institutional realities. The Clean Energy Transition Institute commissioned this study to understand how Idaho, Montana, Oregon, and Washington could technically and economically achieve a low-carbon economy over the next three decades.**

The analysis looks at how the region could meet an energy sector (liquid fuels, pipeline gas, and electricity) emissions reduction target of 86% below 1990 levels by 2050,* a goal consistent with deep decarbonization analyses to date. The study examines eight scenarios, including a Business as Usual Case, reflecting today's policies, and a Central Case, the most efficient pathway for decarbonizing the Northwest.

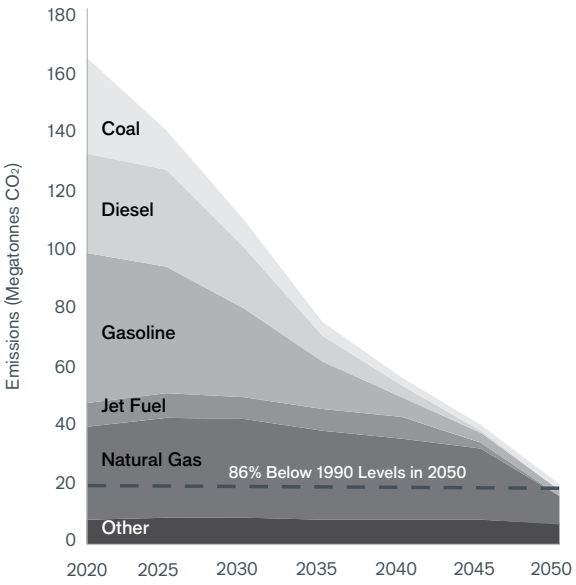
Prior studies answered questions of more limited scope, examining only the electricity grid, one state, one utility service territory, or the role of one fuel in specific economic sectors.

This study is unique in offering a blueprint that broadly frames the opportunities and trade-offs for the region to achieve economy-wide deep decarbonization between today and 2050.

Declining Emissions by State 2020-2050



Declining Emissions by Fossil Fuel Type 2020-2050



* While the overall economy-wide goal is an 80% emissions reduction below 1990 by 2050, the greater difficulty of decarbonizing non-energy sector emissions requires that the energy sector achieve the higher target of 86% below 1990 by 2050.

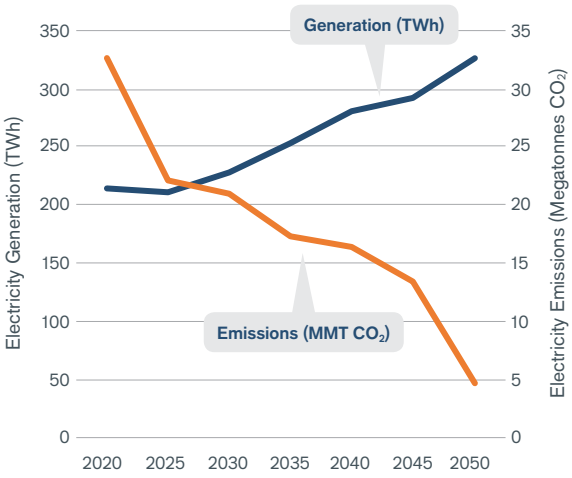
What a Decarbonized Northwest Looks Like in 2050

Clean, efficient electricity is the key to decarbonizing the energy sector in the coming decades.

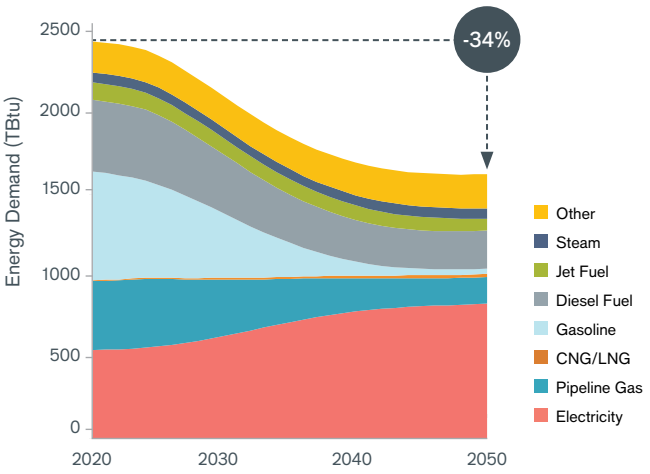
■ In the Central Case, electricity will need to be 96% clean by 2050 and will be used to heat and cool buildings and power vehicles that currently use fossil fuels.

■ Despite a 30% increase in population, total energy demand decreases by 34%, while the share of electricity and electric fuels serving that demand grows from approximately 23% today to 55% from 2020 to 2050.

Electricity Emissions Decline, Electricity Generation Increases



Energy Demand Down 34%, Electricity Share 55% of Total Demand



Low-carbon transport, increased transmission, and emerging technologies are required.

■ Clean electricity decarbonizes some liquid fuels, and those industries that electricity cannot power—such as aviation and long-haul trucking—will use biofuels. As vehicles transition to electricity, liquid fuels **decrease from one-half of today's energy demand to one-fifth** by 2050.

■ Billions of dollars can be saved if the Northwest and California electric grids are expanded and operations are better integrated. Building additional transmission lines between the Northwest and California electricity grids reduces the costs of decarbonization by **an estimated $11.1 billion in net present value** over the 30-year study period (accrued to the combined California and Northwest region).

■ Over time, the region will need to **deploy emerging technologies**, such as **electrolysis to produce synthetic liquid or gaseous fuels** and **electric boilers to produce steam**, which exist today but need investment and development to ensure that they play an increasingly critical role balancing the grid and generating electric fuels.

The five deep decarbonization strategies for the Northwest are:

Energy Efficiency

Aggressive building and appliance efficiency improvements cause per capita energy consumption to decrease by 50%.

This more efficient use of energy means that, despite population increase and economic growth, energy demand will be two-thirds of today's levels in 2050.

Energy efficiency reduces the cost of decarbonization.

Electricity Decarbonization

The region achieves its decarbonization goals with an electricity grid that is 96% clean by 2050.

The average carbon intensity of electricity generation—already relatively low in the Northwest due to hydroelectricity—decreases to near-zero by 2050.

The share of electricity from gas-fired generation is just 3.7% in 2050.

Fuel Decarbonization

The carbon intensity of liquid and gas fuels decreases by 70% in 2050.

Biofuels. Photo credit: Wes Agresta

Electrification

By 2050, all passenger cars on the road and nearly half of all freight trucks need to be electric.

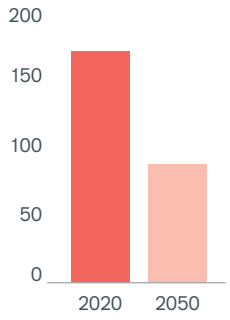
Electricity consumption increases by more than 50% and comprises one-half of all energy demand.

Carbon Capture

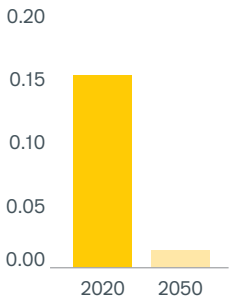
Emerging technologies that deploy hydrogen, carbon capture, and synthetic gas to create low-carbon fuels will play a key role by 2040.

Four million metric tons of CO_2 will need to be captured annually by 2050, with about half of the CO_2 used to produce synthetic fuels and the other half sequestered.

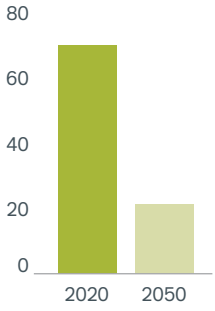
Energy Consumption Per Person (MMBtu)



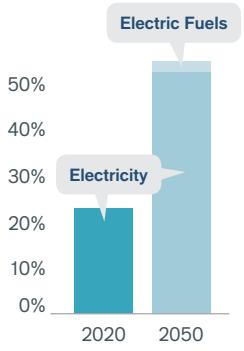
Electricity Carbon Intensity (tonnes CO_2 per MWh)



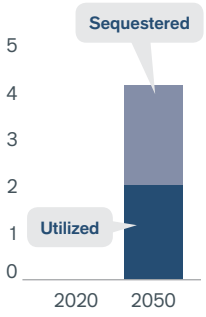
Fuels Carbon Intensity (kg CO_2 per MMBtu)



Electricity Share of Total Energy (percentage)



Carbon Capture (Megatonnes CO_2)



Costs

Over the period 2020 to 2050, the cumulative costs of decarbonizing the energy system in the Central Case are 9.5% higher than the capital and operating expenses of the Business as Usual energy system. This represents roughly 1% of the region's GDP. The annual costs of the Central Case peak at 16.1% above the Business as Usual Case in 2038 and decline to 8.3% higher by 2050, by which time the Central Case has an avoided carbon cost of $48/tonne and declining. The net costs of a decarbonized system are largely due to the additional cost of producing biofuels, investing in electrification and efficiency, and building renewable electricity infrastructure, offset by reduced spending on fossil fuels, largely gasoline, diesel, and jet fuel.

Net annual costs peak at approximately 1% of the region's GDP, and are offset by reduced spending on fossil fuels.

Solar installer. Photo credit: Chris Chesneau, Pixabay

How Energy Demand and Supply Would Change from 2020 to 2050

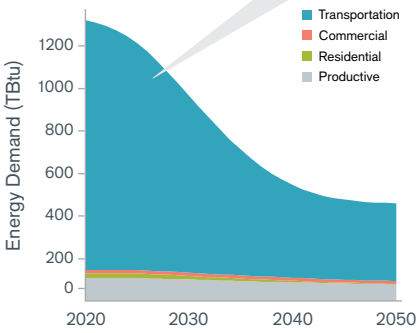
Overall demand and supply for clean electricity would increase significantly as electrification decreases liquid fuel and gas demand for the transport, building, and industrial sectors. Biofuels and synthetic liquids produced with clean electricity would significantly reduce the carbon intensity of liquid fuels, while synthetic gas would decarbonize pipeline gas. Coal retirement and new renewable energy would decarbonize the electricity supply.

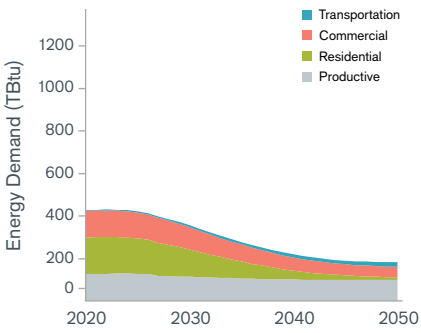
Liquid Fuels emissions reductions achieved with electrification and biofuels

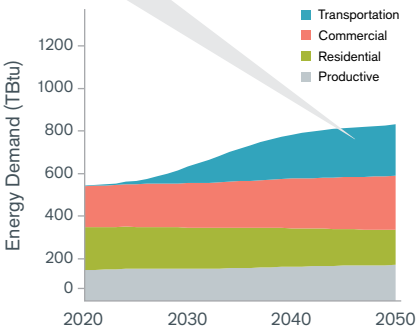
Pipeline Gas emissions reductions achieved through electrification and electric fuels

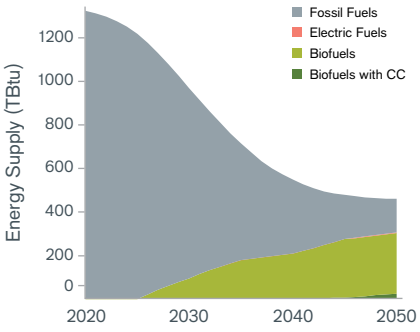
Electricity emissions reductions achieved through coal retirement and deployment of renewables

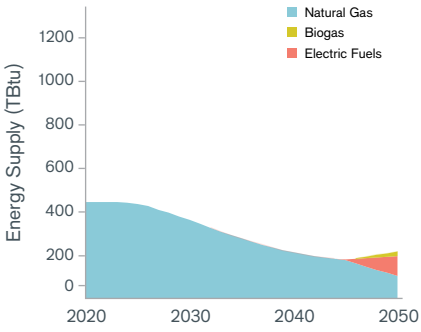
Liquid fuels for transportation largely replaced by efficient electricity and some biofuels

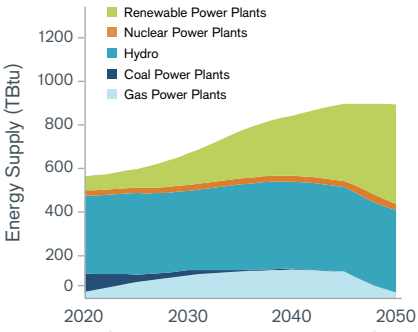












Electricity goes from 79% clean to 96% clean