

# Washington State Energy Strategy Technical Consulting



# Agenda-March 31, 2020 Advisory Committee Meeting

- Introduction Clean Energy Transition Institute Team
- Deep Decarbonization Pathways Modeling Framework
- Meta-Analysis Scope and Purpose
- Technical Analysis Framework
- Key Issues for Energy Strategy
- Feedback/Input from Advisory Committee



# Clean Energy Transition Institute (CETI)

**Independent, nonpartisan  
Northwest research and analysis  
nonprofit organization with a  
mission to accelerate the transition  
to a clean energy economy**

- Identify deep decarbonization strategies
- Provide analytics, data, best practices
- Offer information clearinghouse
- Convene stakeholders to facilitate solutions



# CETI Washington State Energy Strategy Team

- Stockholm Environment Institute-US
- Evolved Energy Research
- Hammerschlag, LLC
- Inclusive Economics
- FTI Consulting
- 2050 Institute
- One Visual Mind



# Framing for State Energy Strategy

- Align the energy strategy with the state's long-term greenhouse gas reduction goals
  - 45% below 1990 levels by 2030
  - 70% below 1990 levels by 2040
  - Net zero by 2050
- Enable an affordable and equitable transition to a carbon-free future while ensuring a vibrant sustainable economy and good jobs for communities throughout Washington
- Balance the need to maintain competitive energy prices and a competitive economy in Washington while achieving these targets equitably

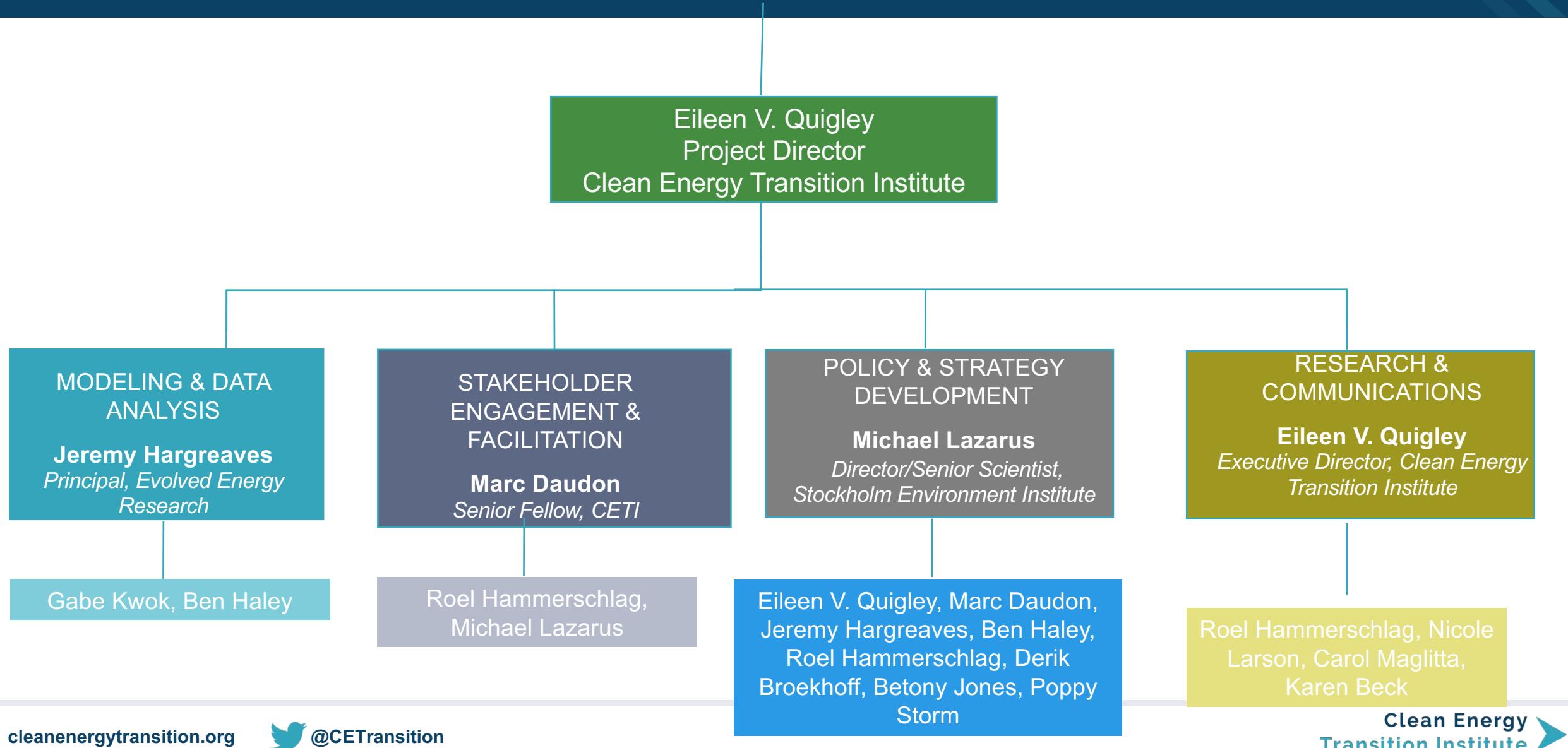


# Scope of Technical Analysis Work-State Energy Strategy

- Meta-analysis of existing energy studies and strategies; inventory of existing Washington policies, programs, regulations, investments, and tools
- Decarbonization modeling and analysis, building on existing efforts, guided by the technical advisory process and Advisory Committee deliberations
- Technical advisory process to inform the Advisory Committee's advice and recommendations
- Communication materials: design and preparation of a final report and supporting documents to launch the final 2021 State Energy Strategy



# Department of Commerce



# Workplan for Technical Analysis

Washington State Energy Strategy Project Plan												
Deliverables/Tasks	Start	End	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
ADVISORY COMMITTEE MEETING			3/31			6/30		8/21	9/15	10/15, 31	11/20	
Task 1. PROJECT MANAGEMENT	March	October										
Task 2. CONDUCT META-ANALYSIS	April	August										
Task 3. DEEP DECARBONIZATION PATHWAYS MODELING	April	September										
Task 4. FACILITATION OF TECHNICAL ADVISORY PROCESS	April	December										
Task 5. EQUITY IMPLICATIONS ASSESSMENT	June	October										
Task 6. ECONOMIC IMPACTS MODELING	June	October										
Task 7. POLICY AND STRATEGY DEVELOPMENT	April	October										
Task 8. COMMUNICATIONS MATERIALS	March	December										

A wide-angle photograph of a wooden boardwalk stretching into the distance through a wetland. The boardwalk is flanked by wooden railings and leads towards a range of mountains in the background. The sky is filled with dramatic, low-hanging clouds.

# Deep Decarbonization Modeling Framework: Jeremy Hargreaves

# Meeting 2050 Energy and Climate Goals in Washington

- Challenge: Transforming Washington's energy system
- AC Engagement: Your experience/expertise to identify promising pathways, challenges to overcome, and risks to frame the analysis
- Northwest DDP: A useful foundation
- Three key questions:
  - Where are we now?
  - Where are we going?
  - How do we get there?
    - Affordably, reliably, competitively, equitably



# Transforming Washington's Energy System

- Transformational rather than incremental change
- Aggressive action needed across all energy sectors
- Many options to get there
  - Process designed to find the best path forward for Washington State's priorities
    - Equity, affordability, reliability, competitiveness
- Building on a foundation of past studies and efforts in other states

Emissions targets for State Energy Strategy:

**2020: 1990 levels**  
**2030: 45% below 1990**  
**2040: 70% below 1990**  
**2050: Net zero**

# Advisory Committee Input – Teeing up for Afternoon

- *What do you see as important components of a strategy to get to net zero?*
- *What might prevent Washington state from achieving net zero?*
- *What do you consider the most important near-term energy policy priorities?*

# Northwest Deep Decarbonization Study (NWDDP) June 2019: A Useful Foundation

# Why a NWDDP 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



# NWDDP Scope: Northwest Regional Energy Sector

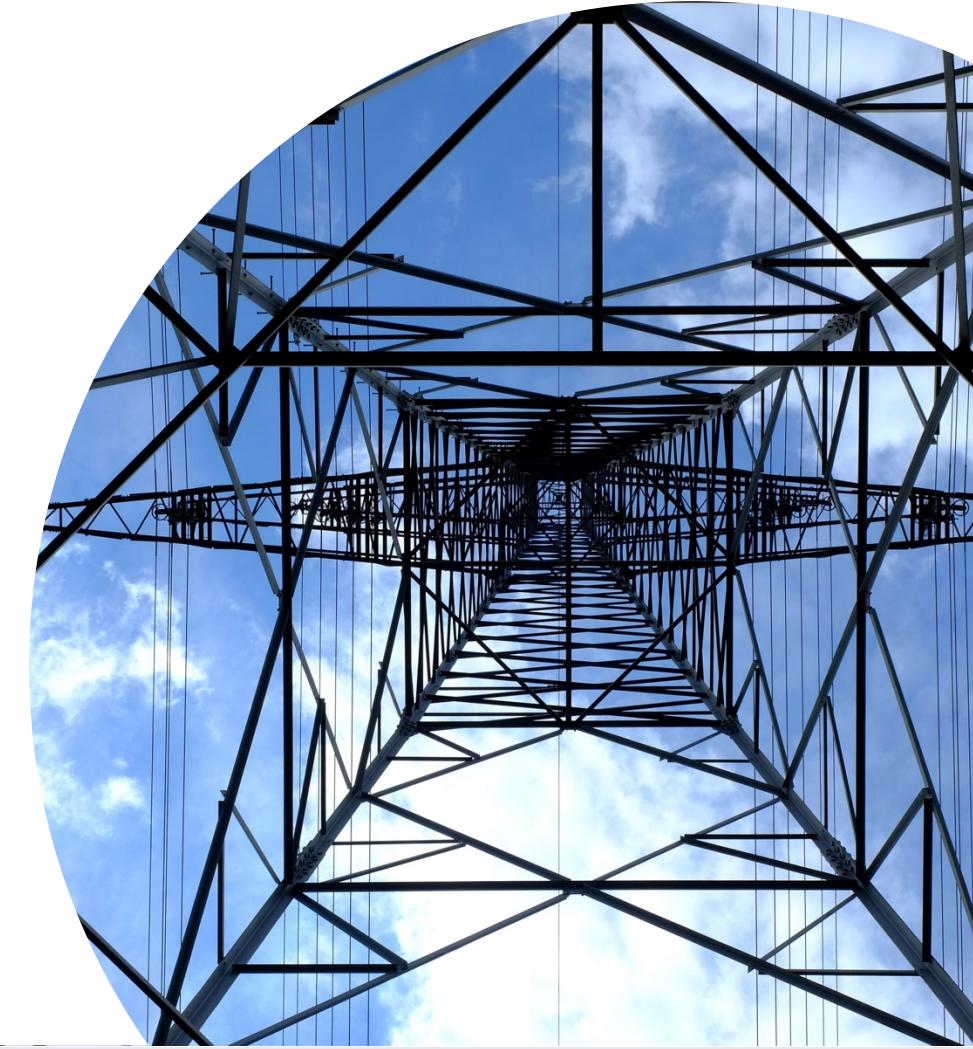
- **Scope:** WA, OR, ID, MT
- **All Energy Sectors Represented:**
  - Residential and commercial buildings
  - Industry
  - Transportation
  - Electricity generation



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

# NWDDP Approach to Decarbonizing Energy Supply

- Uses **conservative** assumptions about existing technology from public sources
- **Explores** how four NW states can achieve deep decarbonization in all energy sectors
- **Modeling determines optimal investment** in resources with least-cost
- **Decarbonizing energy supply**—electricity, pipeline gas, liquid fuels
- Accounts for **California systems** impact on the region

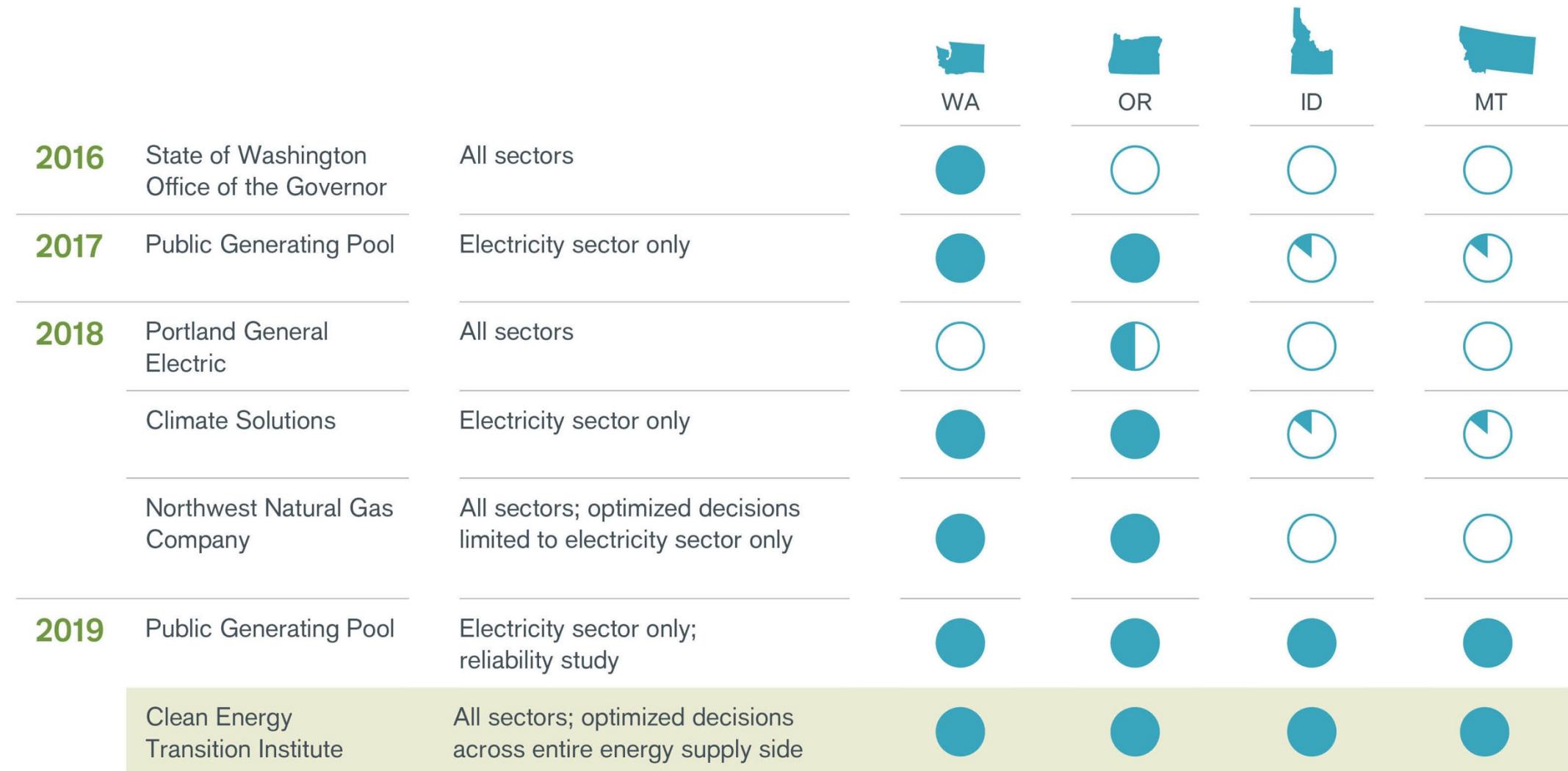


# NWDDP Study Questions Posed

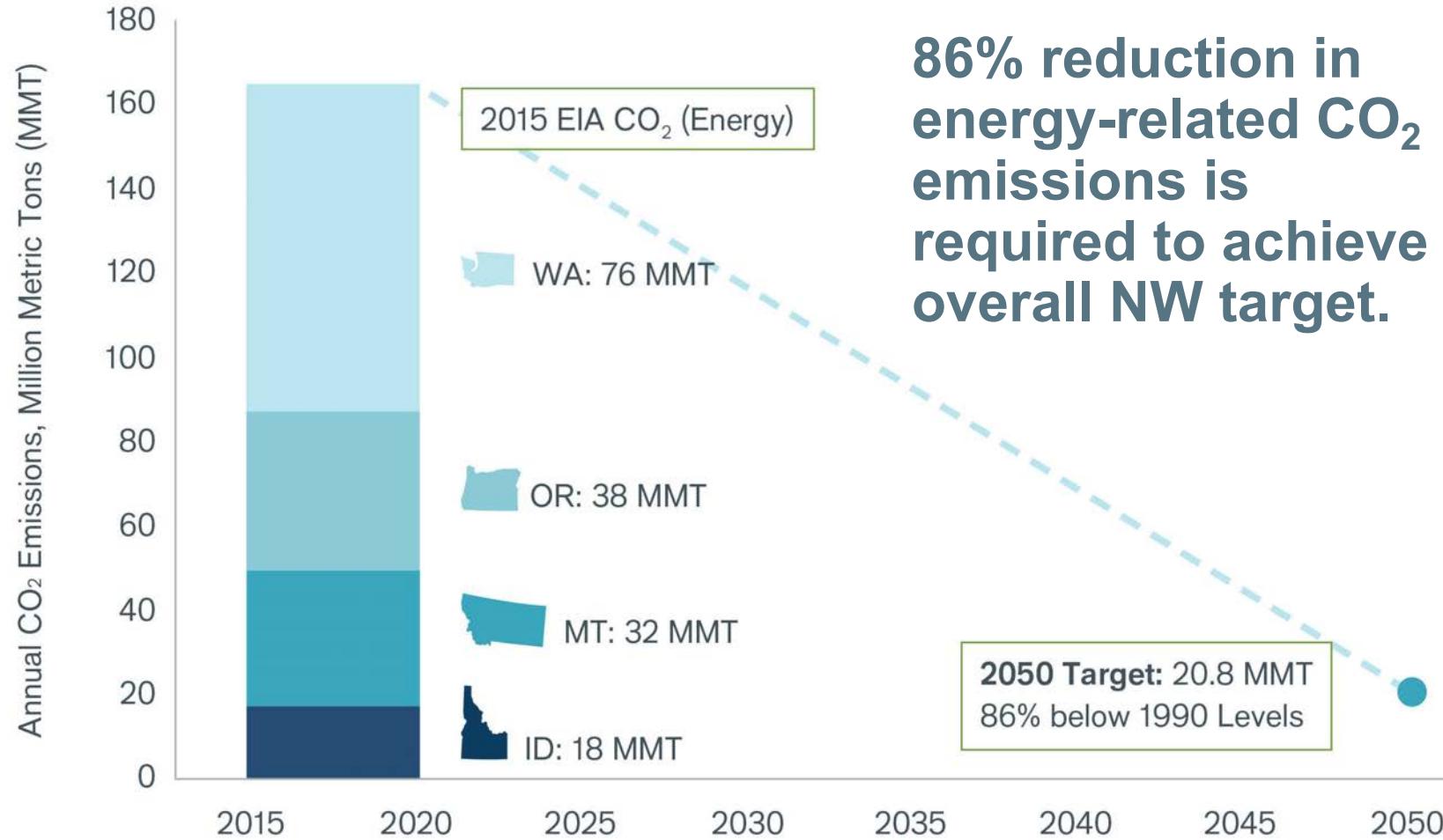
- **How does the energy sector need to transform** in the most technologically and economically efficient way?
- **How does electricity generation need to be decarbonized** to achieve economy-wide carbon reduction goals?
- **What if we can't achieve high electrification rates?**
- **What is the most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



# NWDDP Study Comparison to Prior Decarbonization Studies



# NWDDP Study CO<sub>2</sub>e Reduction Target: 80% Overall



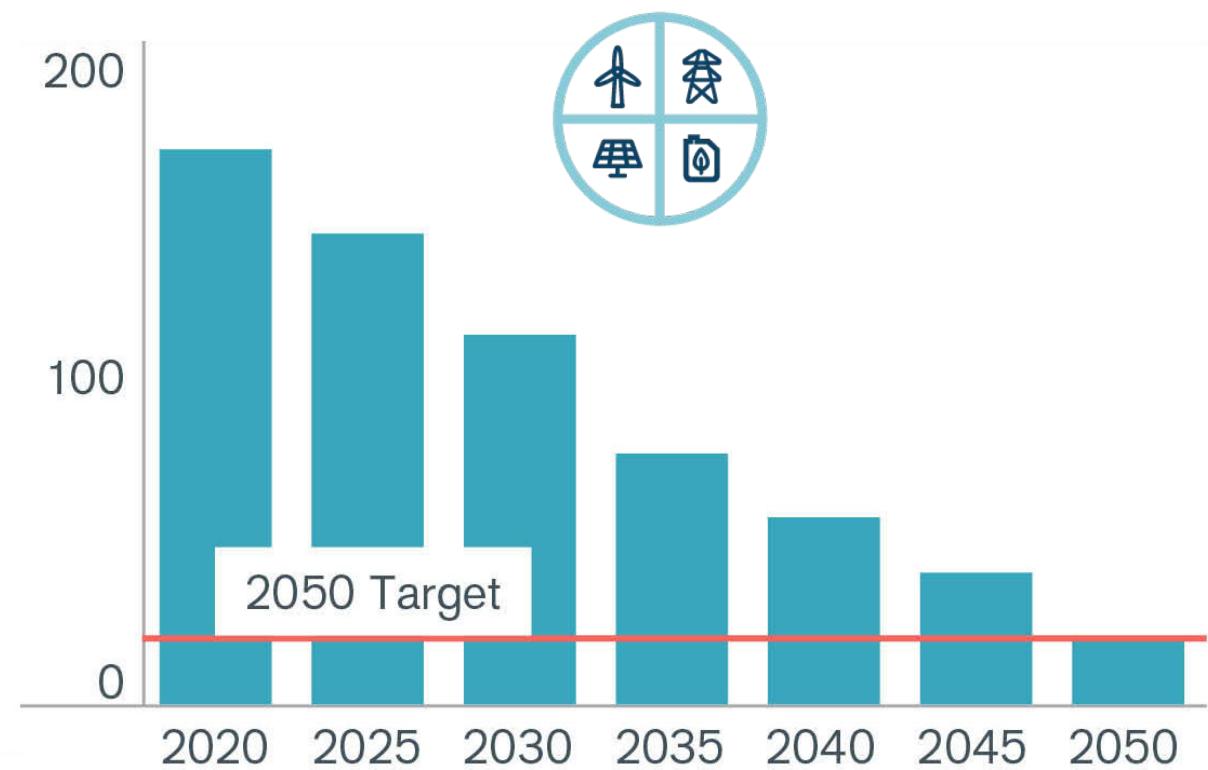
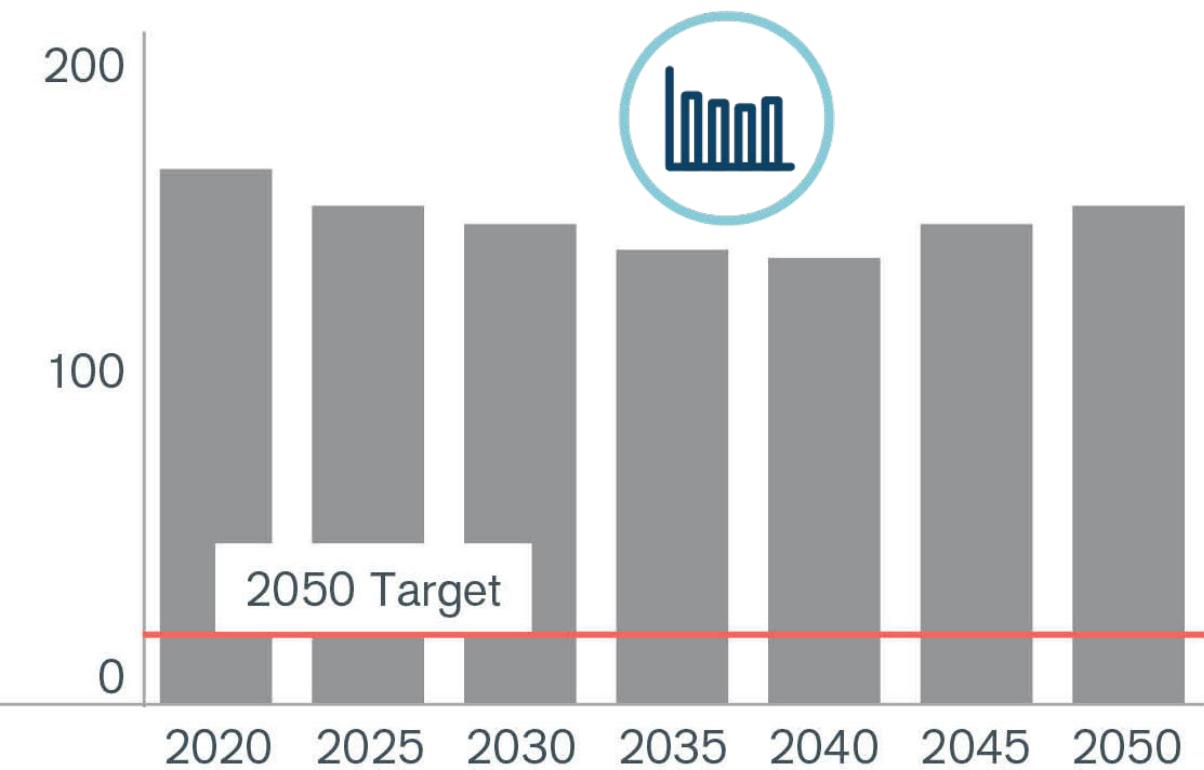
**86% reduction in energy-related CO<sub>2</sub> emissions is required to achieve overall NW target.**

Less stringent than new Ecology emissions targets being adopted for the State Energy Strategy:

2020: 1990 levels  
2030: 45% below 1990  
2040: 70% below 1990  
2050: Net zero

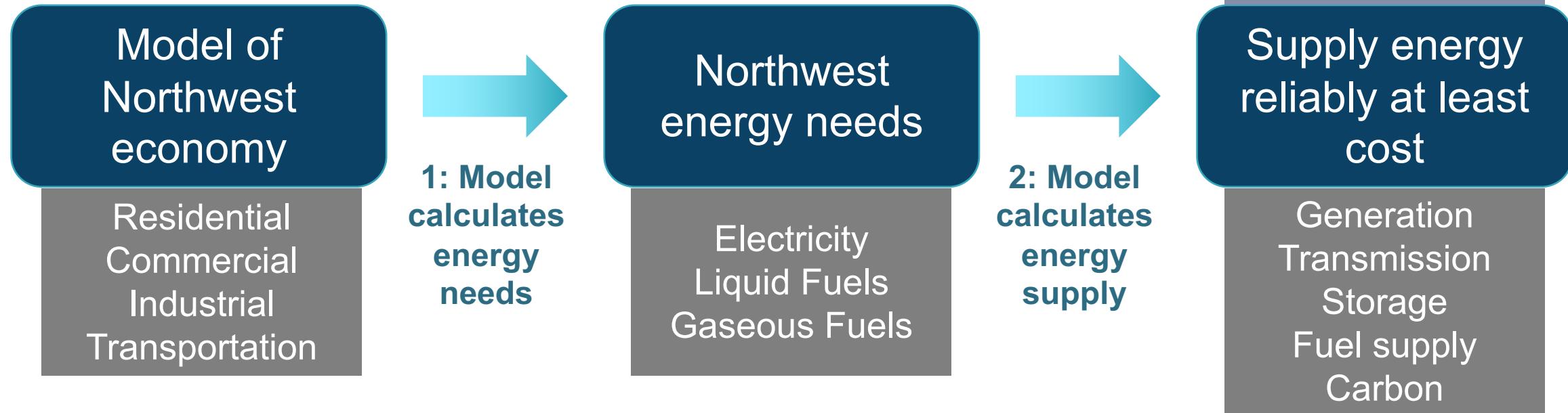
# NWDDP Study: Business as Usual vs. Central Case

In the Business as Usual Case emissions trajectory falls far short of the 2050 reduction goal, while the Central Case meets the mid-century energy CO<sub>2</sub> emission target of 86% below 1990 levels.



# High-Level Description of Modeling Approach

- Model calculates the energy needed to power the Northwest economy, and the least-cost way to provide that energy under clean energy goals

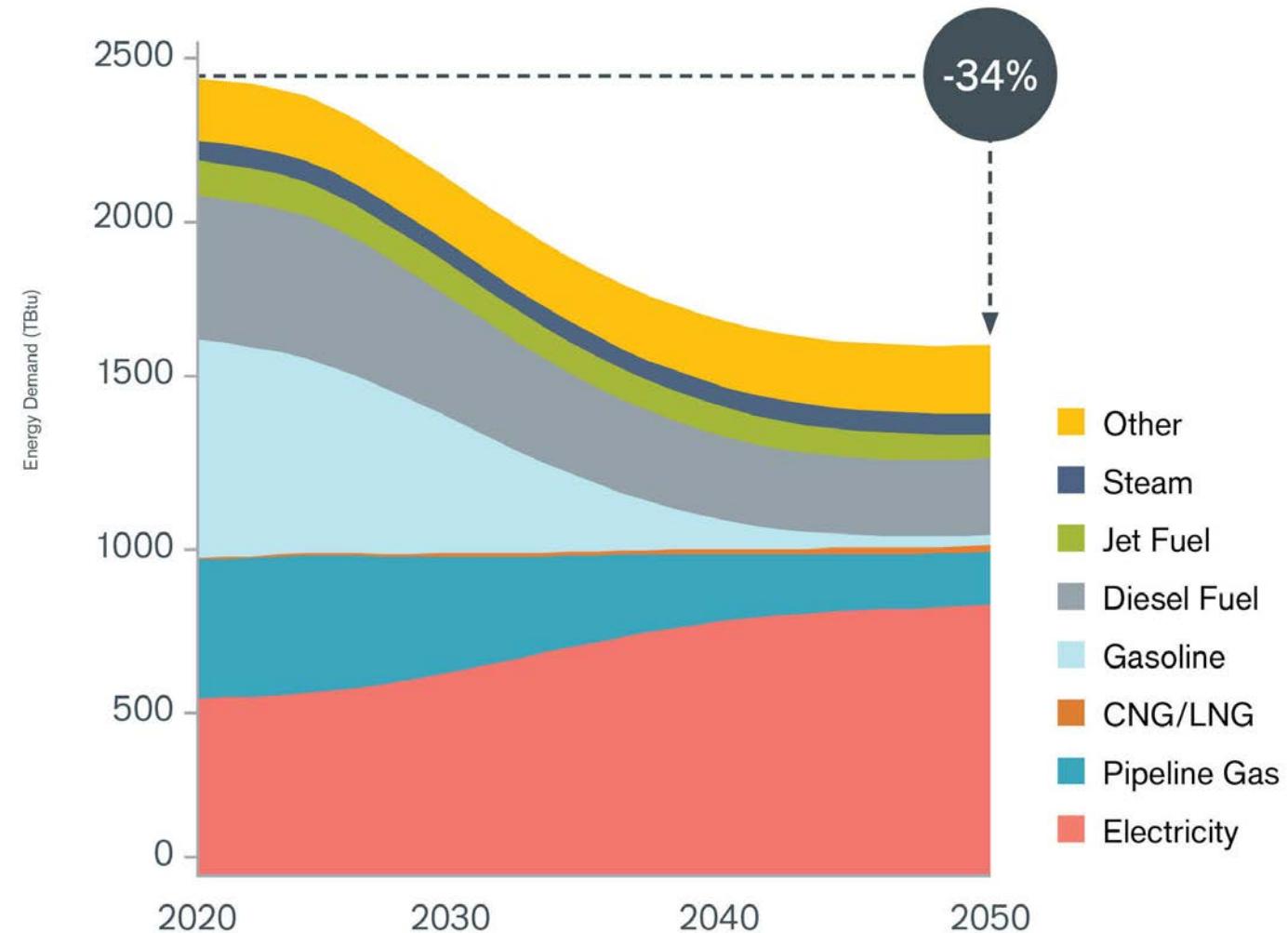


# NWDDP Study Central Case Results



# Final Energy Demand Declines, Even as Region Grows

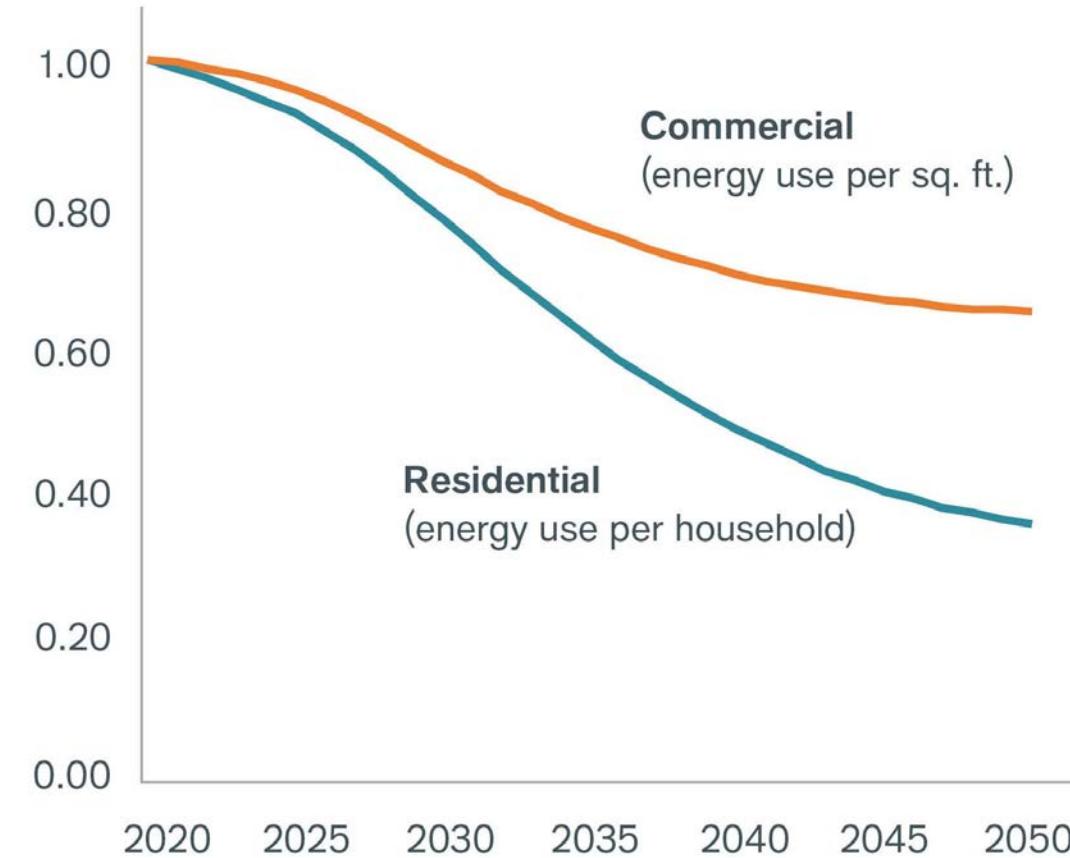
- In the Central Case energy demand is down 34% and electricity consumption is up more than 50% in 2050
- Even as population increases from 14.7 million people in 2020 to 19 million in 2050 and economy grows



# Buildings: Deep Efficiency & Electrification

- Building energy intensity declines by 30% for commercial and 60% for residential sector from 2020 to 2050

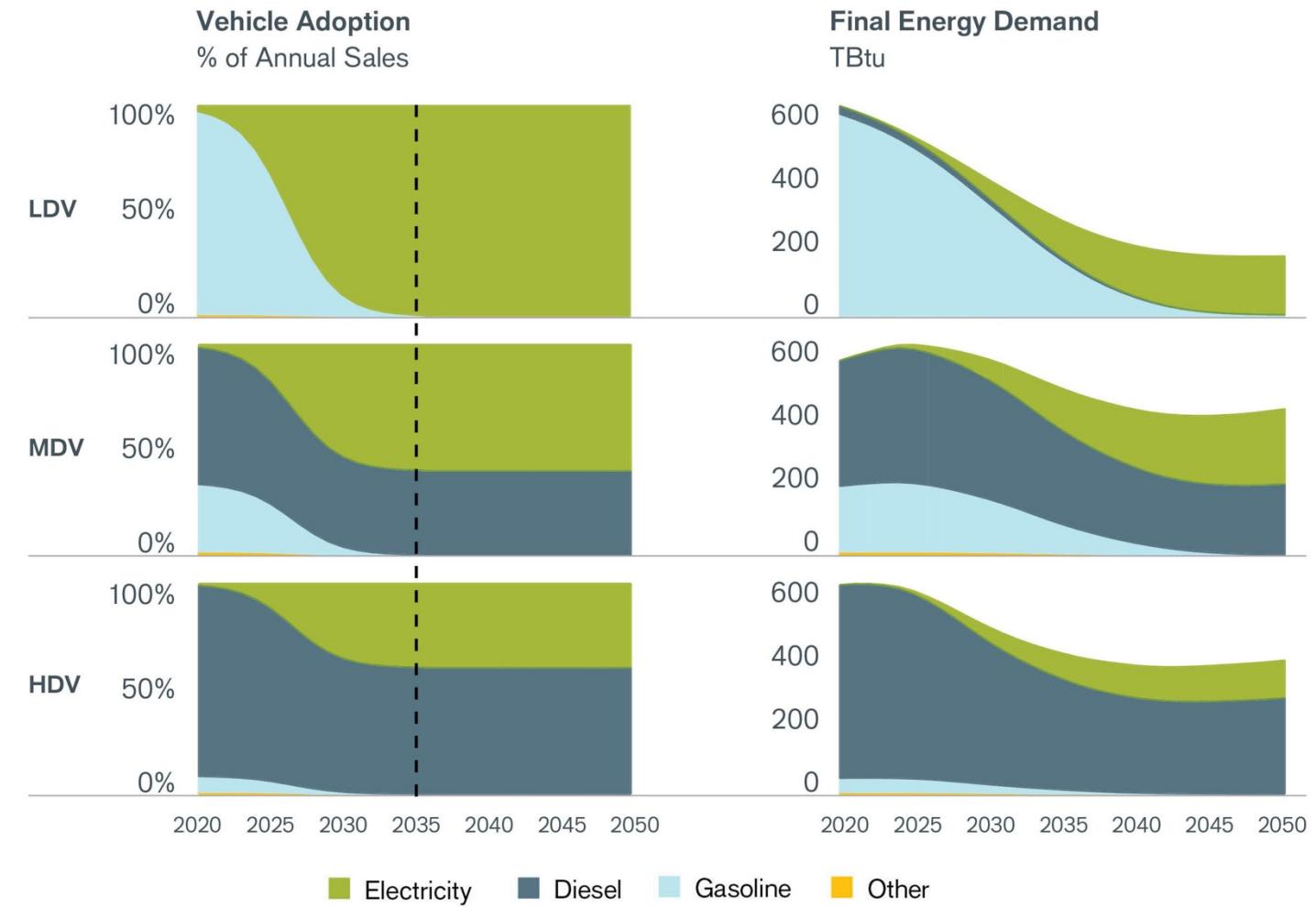
Building Energy Intensity (2020=1.0)



# Transportation: Massive Shift to Electric Vehicles

By 2050:

- Cars, SUVs, and light trucks fully electrified
- Medium and heavy-duty trucks partially electrified
- Results in a 60% reduction in final transportation sector energy demand from light, medium, and heavy-duty vehicles

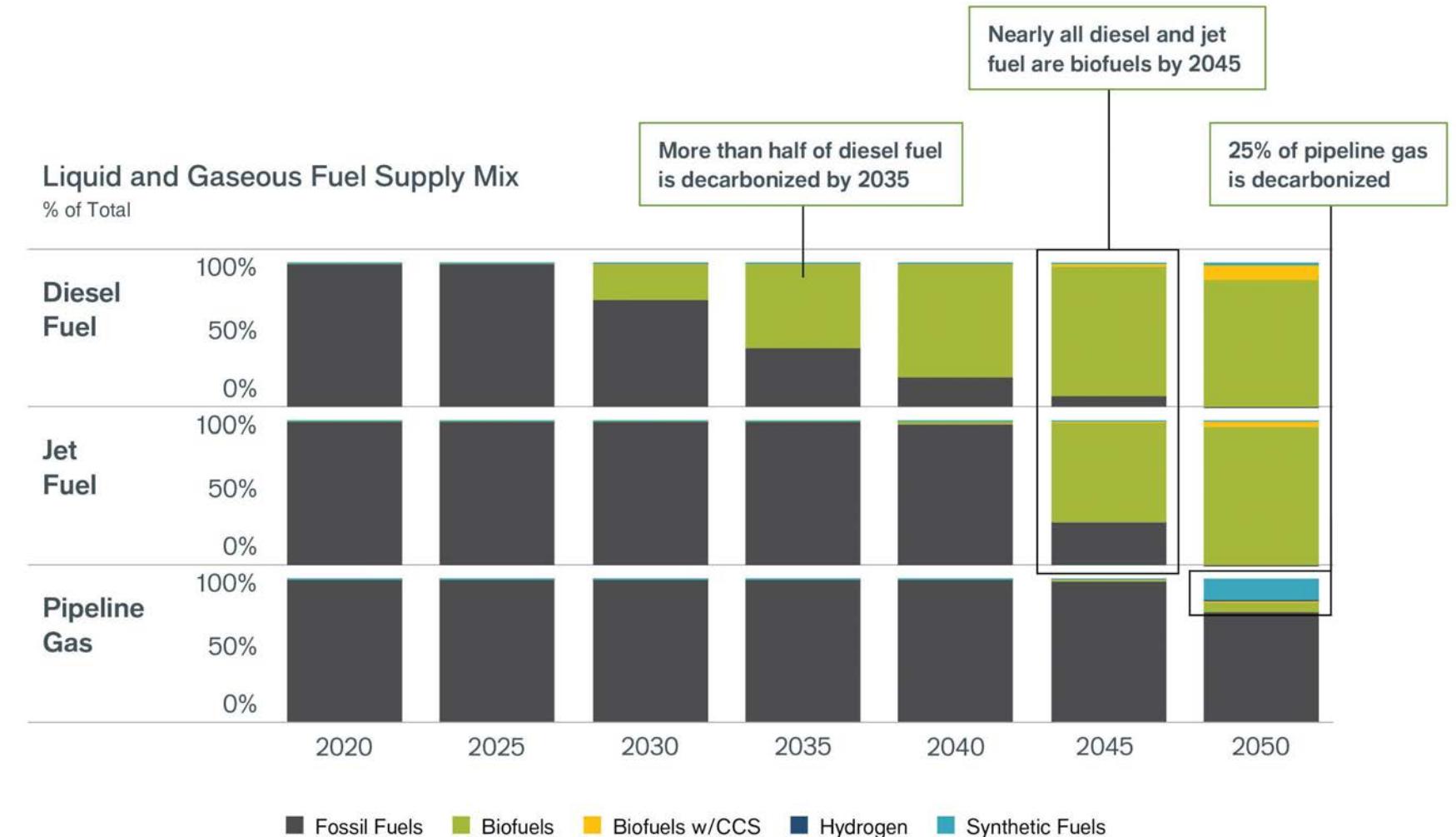


# NWDDP

## Fuels: Decarbonized Diesel, Jet, and Pipeline Gas

By 2050:

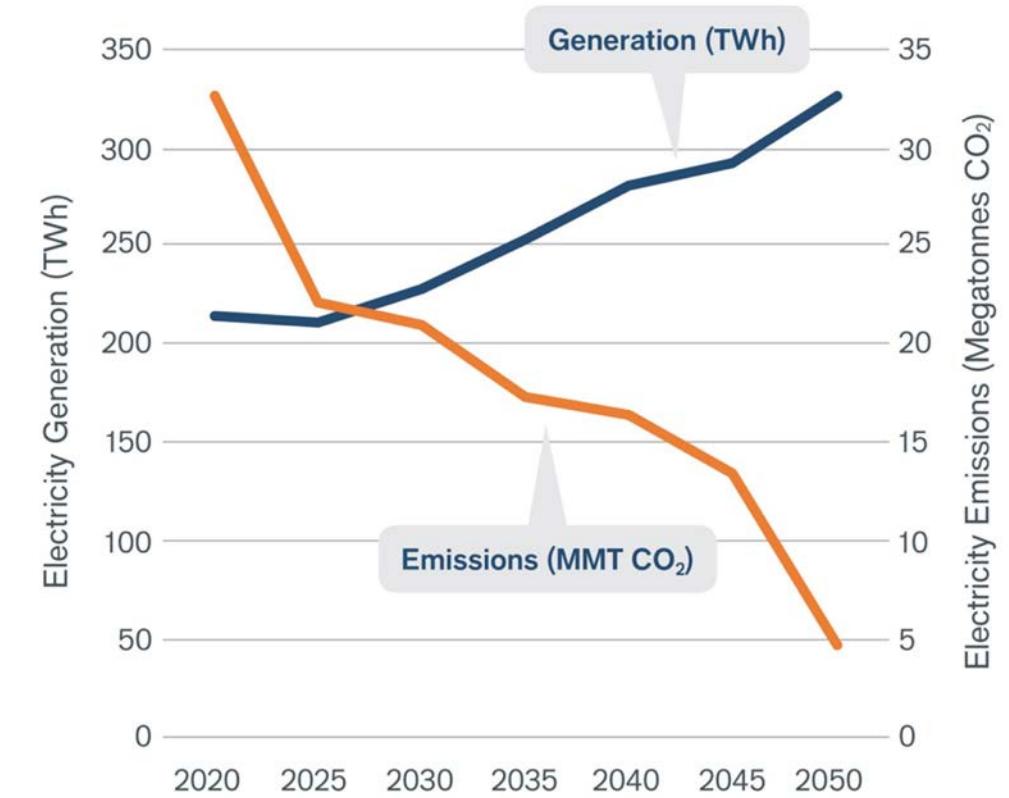
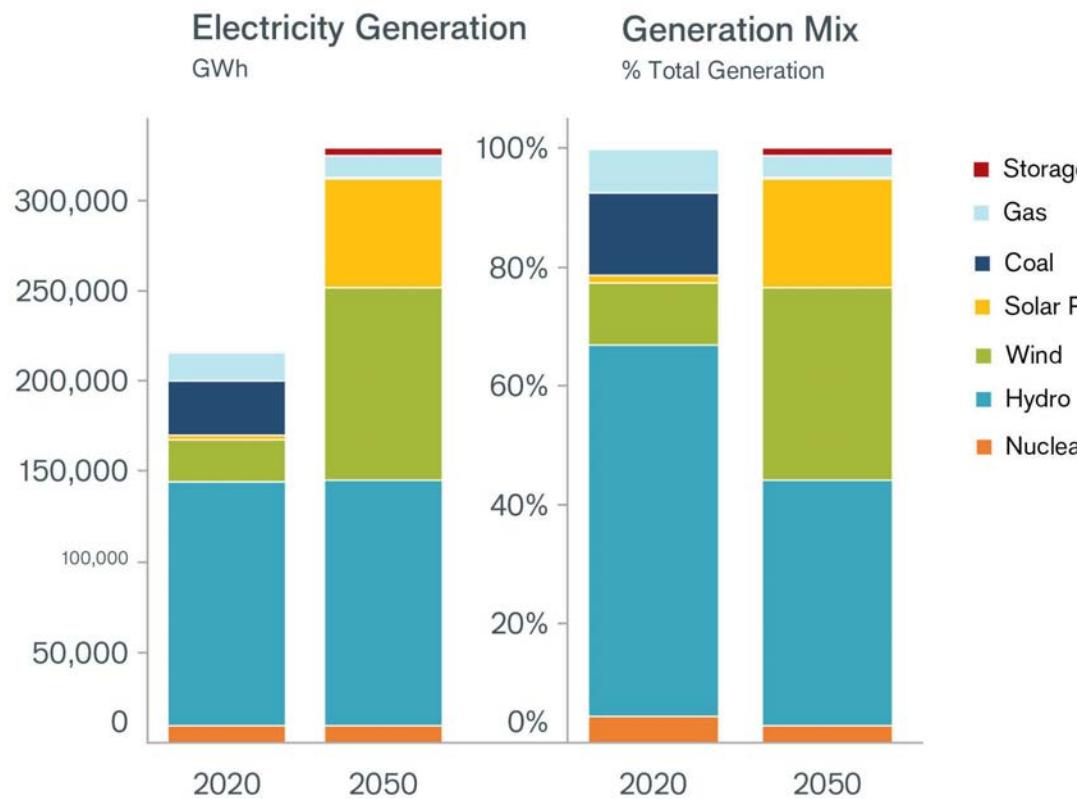
- Diesel and jet fuel fully decarbonized, primarily using biofuels
- 25% of pipeline gas decarbonized
- Synthetic fuels play a key role



# NWDDP Decarbonized Electricity

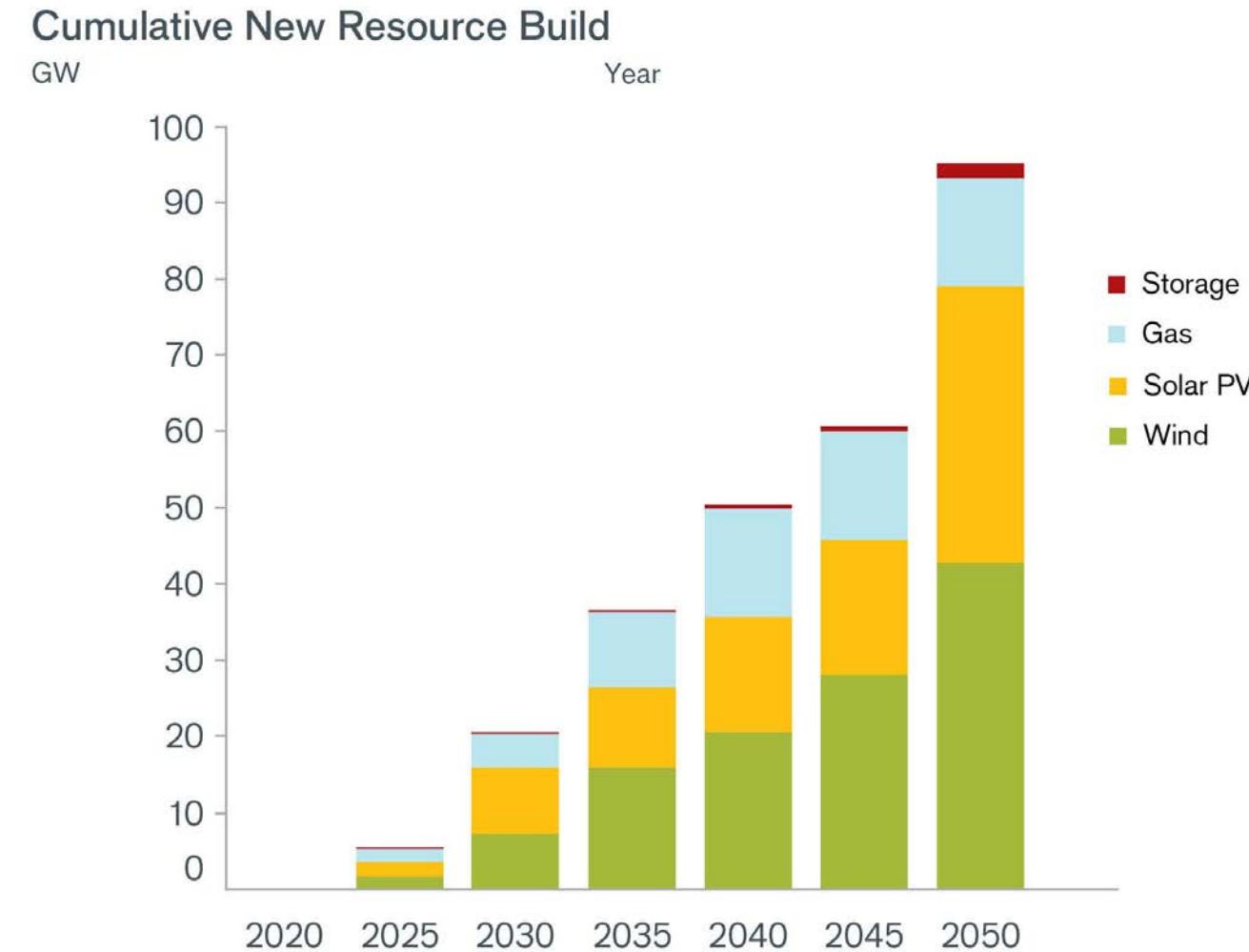
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Generation increases 53%, with fossil fuel use at 4%, emissions decline by 86%.



# NWDDP Electricity: Expands to Serve 55% of Energy Demand

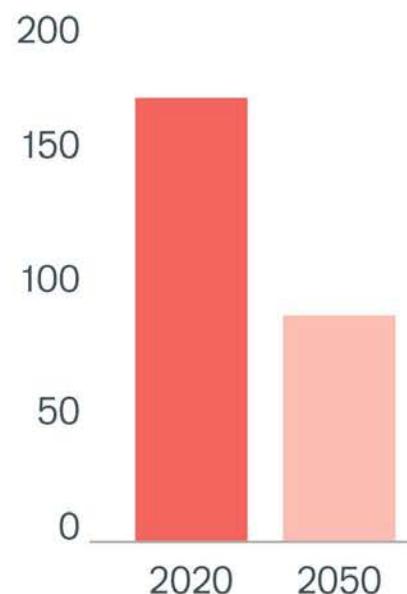
- By 2050, 95 GW of generation capacity added
- 44 GW wind, 35 GW solar
- 14 GW gas, primarily for reliability, capacity value in times of low hydro, wind, solar combined with high demand
- 2 GW storage



# Five Decarbonization Strategies Deployed

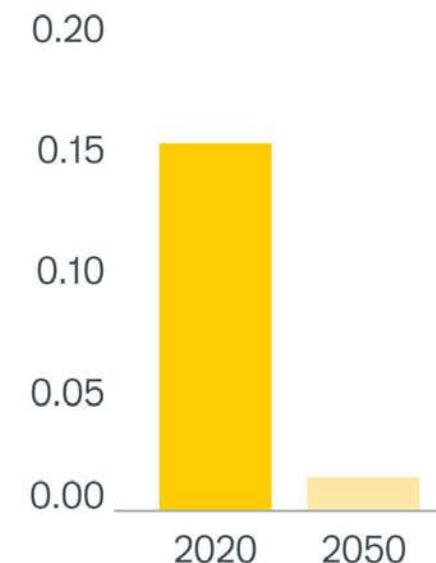
## Efficiency

Per capita decreases 50%



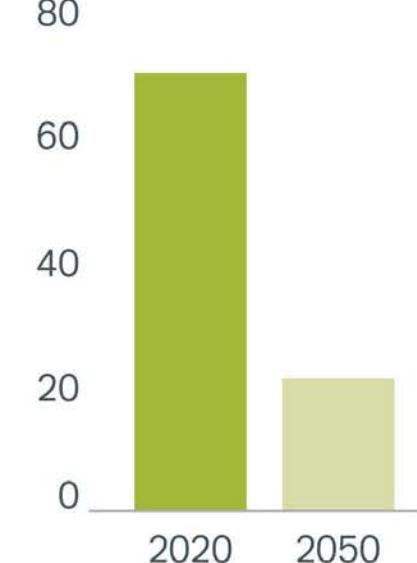
## Clean Electricity

96% Clean by 2050



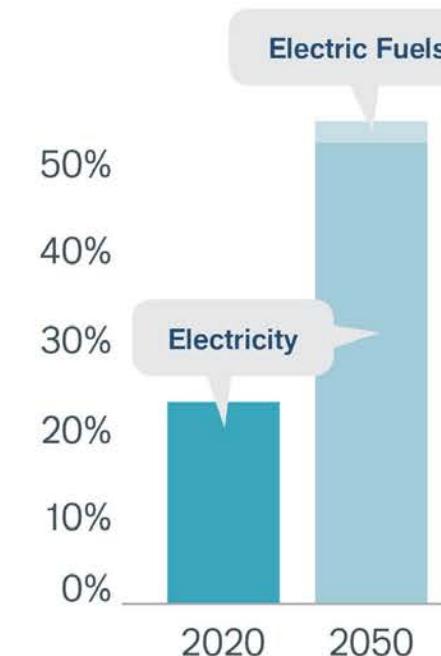
## Clean Fuels

70% decrease in carbon intensity



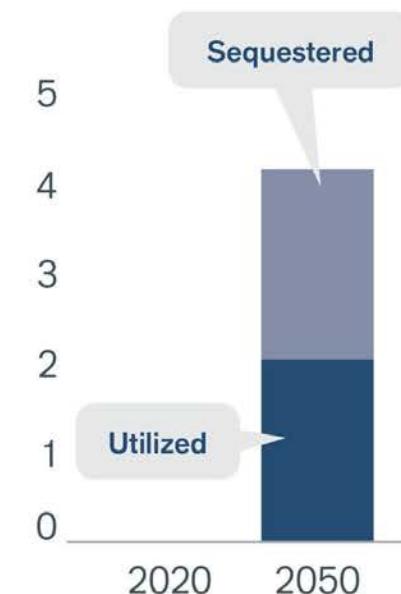
## Electrification

Doubles from 23% to 55%



## Carbon Capture

1/2 fuel; 1/2 sequestered



# Alternative Pathways and Key Findings

# NWDDP 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**

# NWDDP Key Findings: Deep Decarbonization Achievable

- **Electricity generation least cost at ~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



A photograph of a long wooden boardwalk stretching into the distance through a wetland area. The boardwalk is flanked by wooden railings and leads towards a range of mountains in the background. The sky is filled with dramatic, low-hanging clouds.

# How Decarbonization Modeling will Inform Washington Energy Strategy

# Tailored Analytical Approach for Washington State

- Least-cost energy system planning and policy/action design complement one another
  - Process to determine Washington State's best path forward
- The best path is a balance of different, often competing objectives
  - Not all objectives can be quantified in economic terms
  - Analysis provides more information to allow decisionmakers to weigh one option against another
- Advisory Committee input essential to help us define the options

# Three Framing Questions

- Where are we now?
  - *What is the current state of Washington's energy system?*
- Where do we want to go?
  - *What are Washington's most desirable pathways to meeting emissions goals?*
- How should we get there?
  - *What policies and actions get us to where we want to go?*

# Where Are We Now?

## Washington and WECC current energy resources and infrastructure

- **Stock** of all energy producing and consuming technologies
- **Patterns** of energy consumption
- **Final energy demand of fuels and electricity** across the economy
- **WA and WECC electricity system**
- **Transmission between Washington, neighboring states, and beyond**
- **Fuel prices and sources**

## Existing Washington policies and targets through 2030 and 2050

- **Electricity fuel mix disclosure**
- **Biennial energy report**
- **Utility resource plans**
- **Energy code strategy**
- **Bioenergy coordination**
- **Energy Independence Act**
- **Appliance standards**
- **Power plant emission standards**
- **Clean Energy Transformation Act**

# Where Do We Want to Go?

- What is the best future we can envision for the state?
  - Balance of different, often competing objectives
    - Equity, affordability, reliability, competitiveness
  - Alternative least cost pathways examining different priorities
- Understanding the tradeoffs
  - How much does one pathway cost versus another?
    - Counterpoint for policymakers and stakeholders
  - Provides a target for near-term policy and action design to hit
- Understanding the uncertainties
  - How does an uncertain future impact our decisions?

## Investigating policies



**100% Clean Electricity Grid**



**No New Gas Plants for Electricity**

## Evaluating uncertainties



**Limited Electrification & Efficiency**



**Limited Biomass for Liquid Fuels**

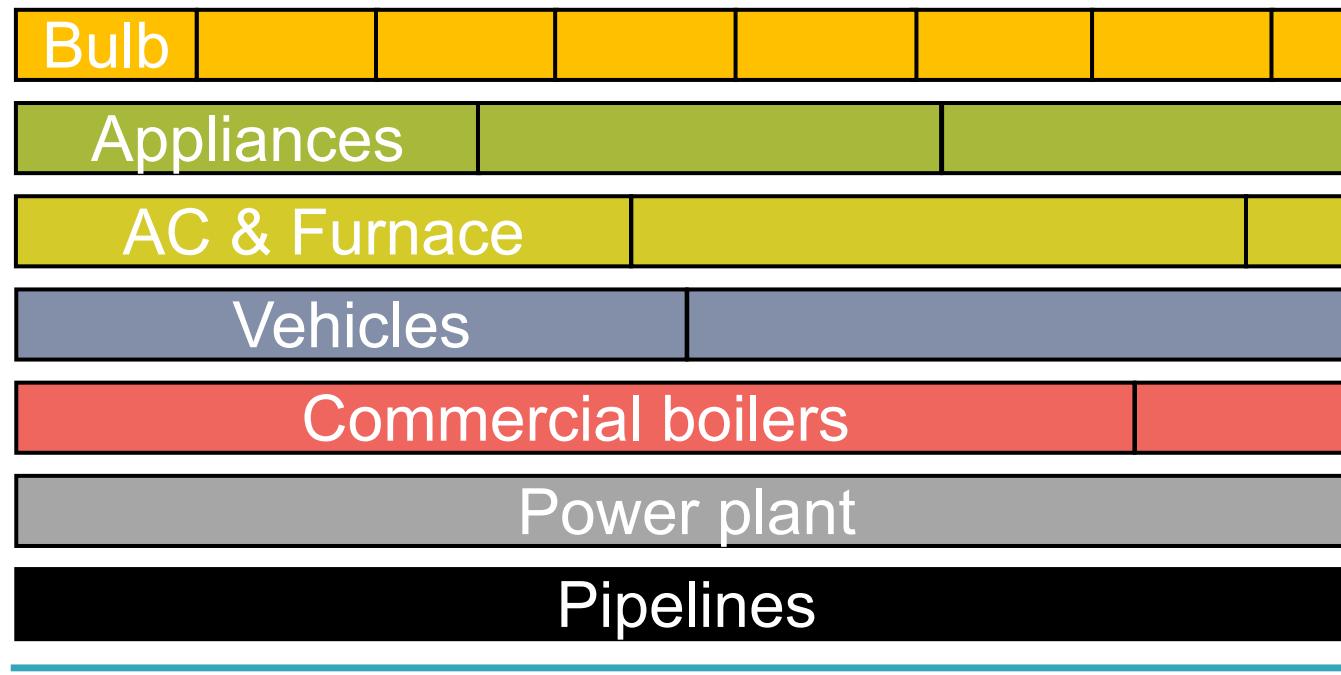
# How Should We Get There?

- By targeting favorable future pathways we can ***develop and prioritize near-term policies and actions***
- Targets are not prescriptive, but provide the best guidance given current information and uncertainties
  - Common elements deployed 2020-2030: “no regrets”
  - Replace or avoid long-lived resources
  - Early action on long lead-time or hard to achieve energy transformations
- Policy development that favors Washington’s goals
  - Equity, affordability, reliability, competitiveness

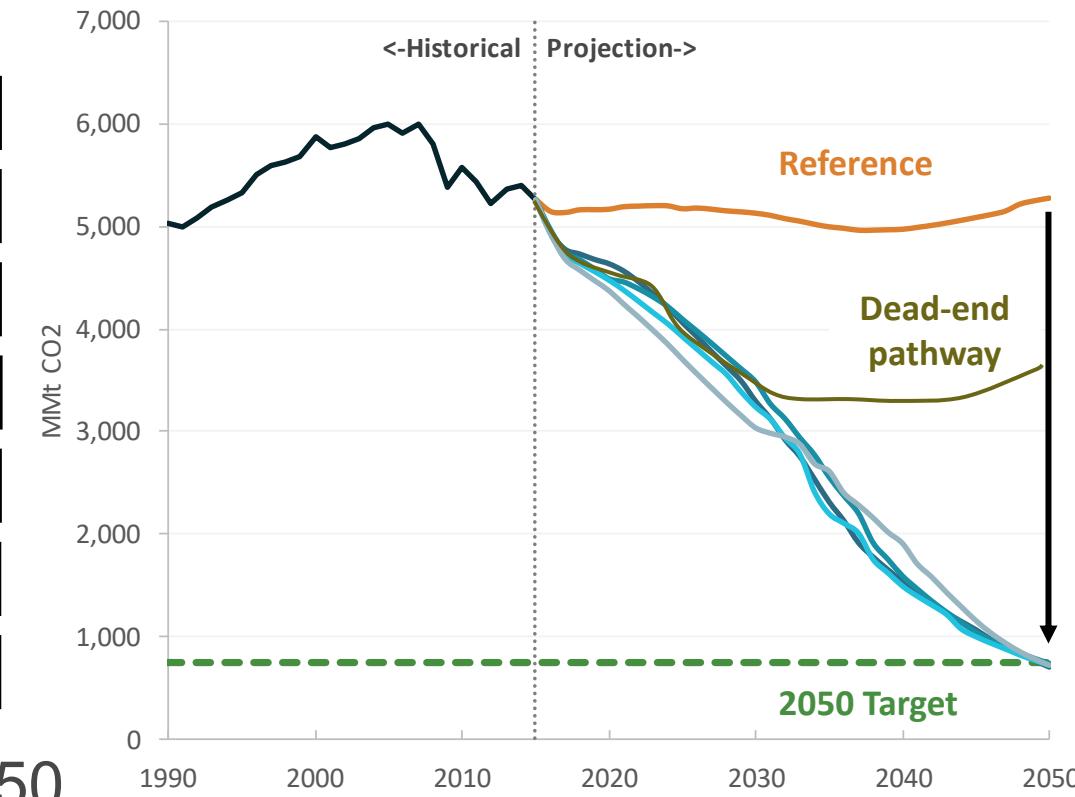
# Near-Term Focus on Long-Lived Assets

Long-lived infrastructure should be an early focus to avoid carbon lock-in or stranded assets

Stock replacement count before mid-century



## U.S. Energy-related CO<sub>2</sub> Emissions



A wide-angle photograph of a wooden boardwalk stretching into the distance through a wetland. The boardwalk is flanked by tall grasses and reeds. In the background, there are rolling hills and mountains under a dramatic sky with scattered clouds. On the hills, several wind turbines are visible. The overall scene is a mix of natural beauty and sustainable energy infrastructure.

# Meta-Analysis Framework: Roel Hammerschlag

# Meta-Analysis Components

- Lessons learned from other states
- Inventory of WA clean energy policies since 2008
- Decarbonization studies context



# Lessons Learned from Other States

- Review other state energy plans:  
MN, VT, CO, CA, OR, CT, MA, NJ
- Synthesize analysis by national entities:
  - NASEO
  - Regulatory Assistance Project
  - ACEEE
  - many more!
- Compile suite of best practices applicable to Washington



# Inventory of Washington Clean Energy Policies

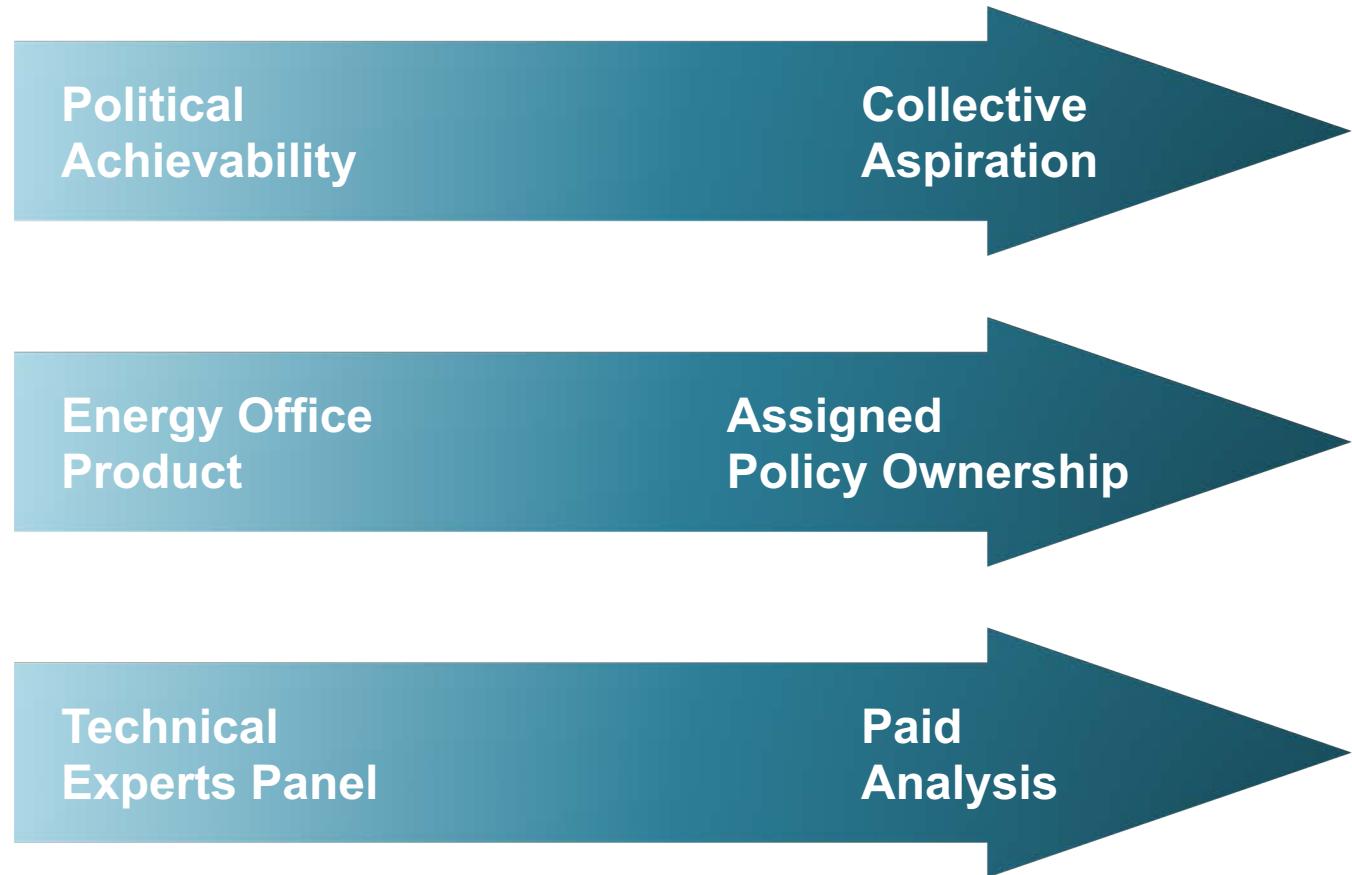
- 2008-present
- Full accounting of:
  - legislation
  - rulemakings
  - executive orders & directives
- 5-10 oral histories to supplement:
  - agency programs, investments, tools
  - qualitative evaluations of success & failure
  - wish-lists



# Decarbonization Studies Context

			WA	OR	ID	MT
<b>2016</b>	State of Washington Office of the Governor	All sectors				
<b>2017</b>	Public Generating Pool	Electricity sector only				
<b>2018</b>	Portland General Electric	All sectors				
	Climate Solutions	Electricity sector only				
	Northwest Natural Gas Company	All sectors; optimized decisions limited to electricity sector only				
<b>2019</b>	Public Generating Pool	Electricity sector only; reliability study				
	Clean Energy Transition Institute	All sectors; optimized decisions across entire energy supply side				

# Going Beyond the 2012 State Energy Strategy



# Going Beyond the 2012 State Energy Strategy

- What will make the 2021 State Energy Strategy most successful?



A photograph of a long wooden boardwalk extending from the foreground into a wetland area. The boardwalk is flanked by wooden railings. In the background, there are green fields, a small town, and a range of hills with wind turbines on top under a cloudy sky.

# Technical Analysis & Facilitation: Marc Daudon & Michael Lazarus

# State Energy Strategy-Technical Analysis and Facilitation

- Purpose and Focus
- Strategy and Technical Work - Scope & Framing
- Technical Advisory Process



# State Energy Strategy Purpose and Focus

- **Achieve legislatively mandated GHG reduction targets (2030 – 45%; 2050 – 95%/net zero) and 100% clean electricity target, while**
  - Maintaining fair and reasonable energy prices; supporting economic success
  - Promoting a competitive clean energy economy & workforce development
  - Meeting needs of low-income and vulnerable populations; urban and rural communities
- **Roadmap:** sectoral and cross-cutting actions; barriers to overcome; infrastructure investments; innovations
- **Encompass** legislative, agency, & government action; private sector, community, regional, federal; address transition issues, including diverse communities & rural concerns
- **Venue** for creativity, positive focus, working together to craft solutions to achieve goal

# Strategy Scope and Parameters

- **2021-2030 timeframe:**
  - 2021-24: Immediate/near-term policies and actions; address Covid-19 recovery
  - 2025-30: Mid/longer term policies and actions; achieve 2030 GHG targets
  - Enable/ensure infrastructure, other decisions put us on best path for long term
- **A strategy for the conventional energy system:**
  - Energy supply, transformation, and demand in the WA economy
  - Including fossil fuels, electricity, renewables, efficiency, nuclear, geothermal (RCW43.21)
- **Focus on the key issues, options, and leverage points that can accelerate transformational change needed to achieve goals**
- Nature-based solutions (lands) and non-energy emissions reduction (approach TBD)

# Potential Focus Areas

Electricity

Transport

Buildings

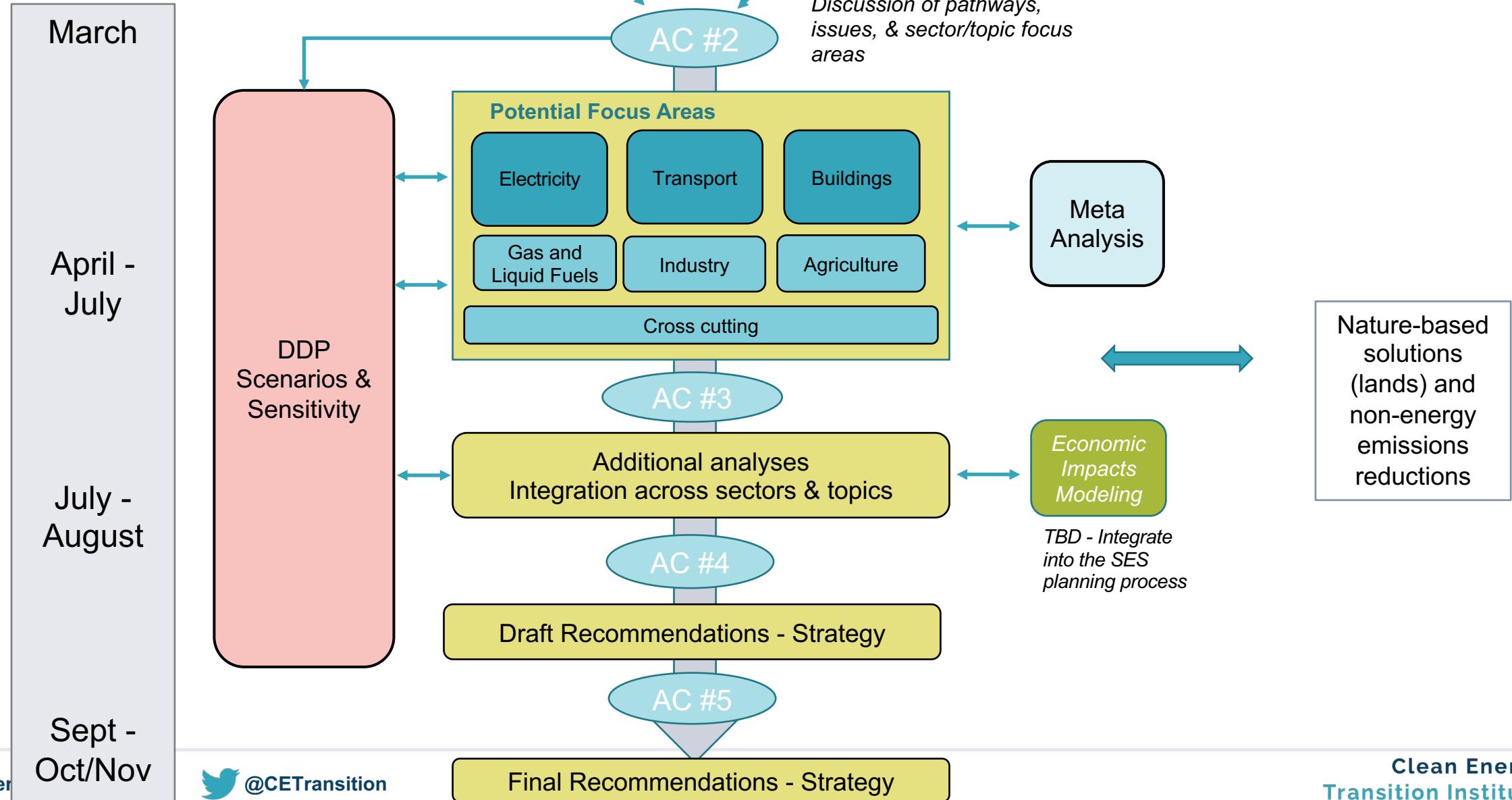
Gas and Liquid  
Fuels

Industry

Agriculture

*Cross cutting – Equity, Workforce, Urban & Rural Community Concerns,  
Economy-wide*

# SES: Technical Analysis & Facilitation Process Flow



# Examples of Issues and Options (Illustrative)

## ➤ Electricity

- Issues: Meeting electrification needs; getting to 100% clean; managing variable resources; reliability; siting; role of gas...
- Options: Support for grid and distributed resources; demand response; storage solutions; regional grid integration...

## ➤ Transport

- Issues: Vehicle electrification; fuels for freight, shipping and aviation; land use, transit and mobility....
- Options: Purchase incentives and mandates; charging infrastructure investment; land use planning; alternative fuel policies; VMT reduction....

## ➤ Buildings

- Issues: Electrification; efficiency; role of gas....
- Options: Codes and standards; electrification incentives; low-income weatherization support....

# Examples of Options and Issues (Illustrative)

## ➤ Gas and Liquid Fuels

- Issues: Availability of biofuel and renewable gas supply; potential for hydrogen and synthetic gas; need for new gas infrastructure
- Options: Clean fuels standard; biofuel and renewable gas incentives; hydrogen infrastructure investment

## ➤ Cross-cutting

- Issues: Needs of low-income and vulnerable populations; workforce development; reaching and responding to rural and urban communities; economy-wide measures
- Options: Community energy planning; R&D support; workforce training and transition programs; pricing; infrastructure investment

# Technical Advisory Process – Next Steps

- **Technical team compiles strategy issues and options by focus area (April)**
  - Informed by meta-analysis, AC input, agency guidance
  - DDP scenario analysis provides indicative goalposts (e.g., for efficiency, low-carbon fuels, infrastructure)
- **Identify & engage technical experts for consultations (April)**
- **Consultations with AC members and technical experts (April-June)**
  - Assist identify policies and actions to consider
  - Advise on benefits, risks, barriers and how to overcome, opportunities to address equity, workforce development, fair prices, reliable supply, and needs of urban and rural communities
  - Assess whether policies and actions are ambitious and comprehensive enough to achieve goals
- **Preliminary findings for Advisory Committee review (July)**
- **Additional analysis and consultation (July-Aug)**
- **Draft and final strategy recommendations (Sept-Nov)**

# Topics and Issues to Address (Initial List)

## Achieving emission reduction targets

- Reduce & manage demand
  - Energy efficiency and conservation
  - Fuel switching (e.g. transportation & building electrification)
  - Behavior change (e.g. telework)
- Decarbonize supply
  - Clean electricity (achieving 100%)
  - Clean liquid and gas fuels
- Carbon sequestration
  - Direct air capture
  - *Lands management*

## While promoting competitiveness, affordability, and equity

- Maintaining reliability & affordability (fair & reasonable prices)
- Enhancing economic competitiveness
  - Clean energy economy
  - Industrial and agricultural sectors
  - Workforce & business development
  - Innovation
- Benefiting all Washingtonians – achieving equity goals, addressing rural and urban needs
- Accounting for uncertainty



# Thank you!