

## **ATTACHMENT 3: Carbon Wedge Analysis Summary**

### **OVERVIEW**

In 2017, the Thurston Regional Planning Council (TRPC) hired a team of Seattle-based consultants to assess Thurston County’s carbon footprint and potential “wedge” pathways to hitting regional emissions-reduction targets.

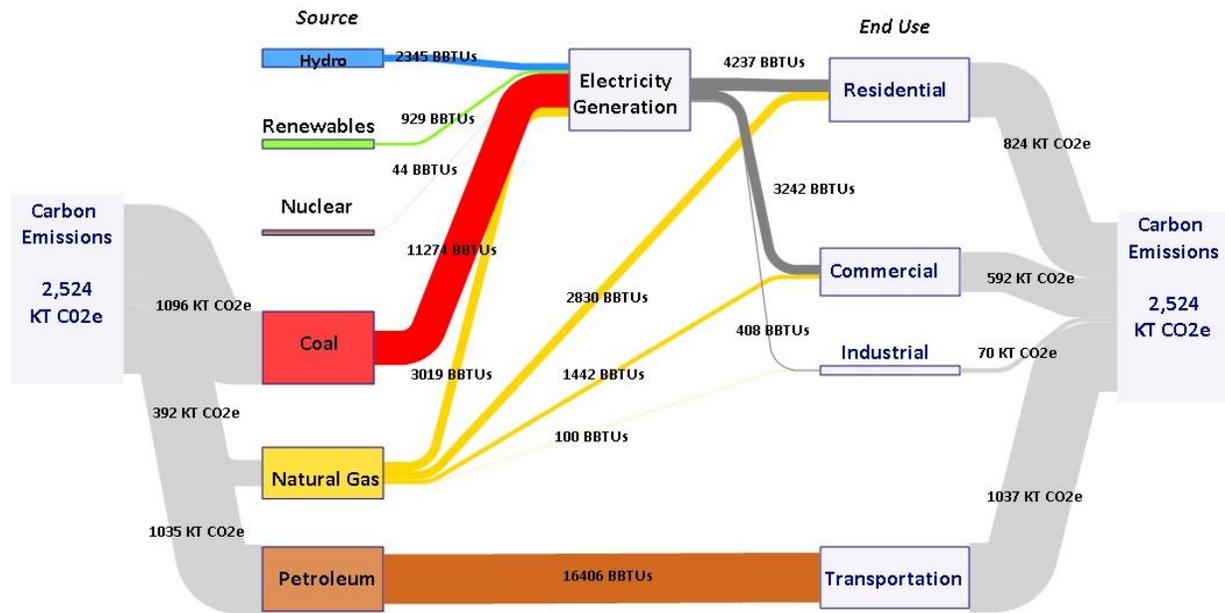
The consultants — Clean Energy Transition and the Stockholm Environment Institute — developed an “energy map” that shows the greenhouse gas emissions associated with Thurston County’s 2015 electricity generation sources (coal, natural gas, etc.) and end uses (buildings, vehicles, etc.). The consultants also developed a “carbon wedge” analysis — a series of graphs [*enclosed*] that show Thurston County’s actual 1990 and 2015 emissions and the 2020, 2035, and 2050 emissions-reduction targets that TRPC adopted in its Sustainable Thurston plan.

Initial wedges in the graphs show the emissions-reduction impacts of existing state and federal policies (e.g., the Washington State Energy Code); additional wedges show the impact of potential climate mitigation actions, including reducing vehicle miles traveled and fossil-fuel power generation. Read the analysis here: <http://www.trpc.org/869/Greenhouse-Gas-Emissions-Analysis>

## DETAILED ANALYSIS

### Energy and Carbon Footprints

Energy and Carbon footprints map out the sources and end use of carbon emissions. The energy and carbon footprint for Thurston County for 2015 identifies six energy sources: hydro, renewables, nuclear, coal, natural gas, and petroleum [Figure 1]. Of these, the first five are used by Puget Sound Energy to generate electricity for residential, commercial, and industrial uses. Natural gas is also used directly for commercial and industrial uses. Petroleum, and a small amount of electricity, is used for the transportation sector.



**Figure 1:** Thurston County 2015 Energy and Carbon footprint.

### Greenhouse Gas Emission Targets

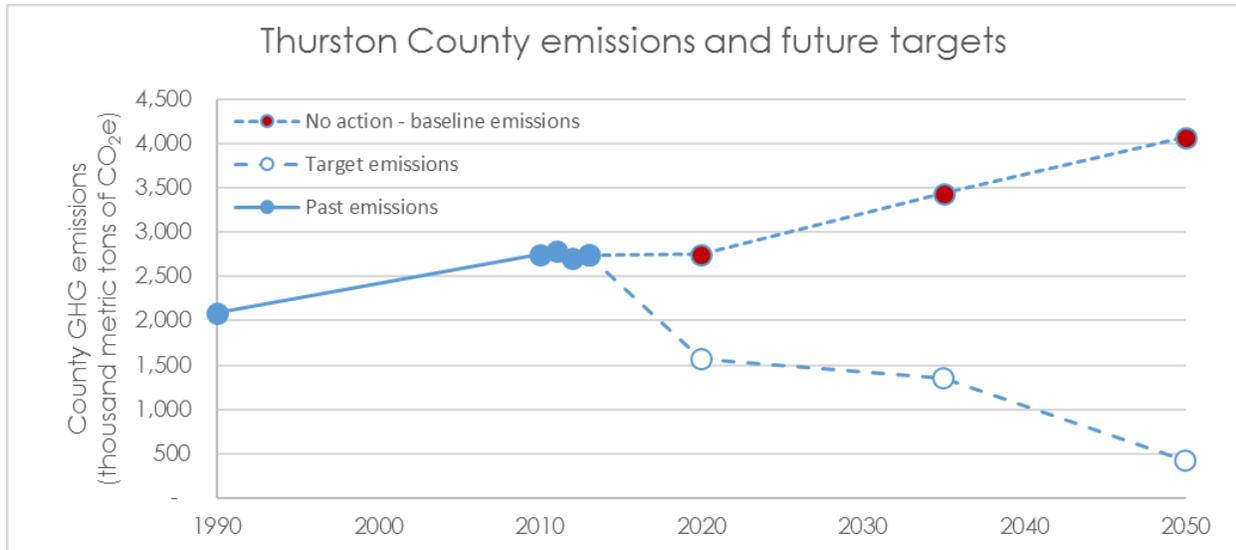
In TRPC's Sustainable Thurston planning process, regional policymakers adopted the following targets for greenhouse gas emissions:

- Achieve 25 percent reduction of 1990 levels by 2020
- Achieve 45 percent reduction of 1990 levels by 2035
- Achieve 80 percent reduction of 1990 levels by 2050

The Thurston Climate Action Team (TCAT) has developed estimates of county-wide GHG emissions for recent years, as well as projected back to estimate levels for 1990. Using these estimates as the baseline, the consulting team projected emissions to 2050, assuming the following 'no action – baseline' conditions:

- No change in the fuel mix for electricity generation
- Building sector energy grows with population
- Vehicle Miles Traveled (VMT) grows with population
- No change in vehicle fleet mix
- No change in vehicle fuel efficiency

Based on the projections, under ‘no action – baseline’ conditions, the region will fall short of meeting its goals [Figure 2].



**Figure 2:** Comparison of ‘no action – baseline’ alternative to regional GHG emission reduction targets.

### Carbon Wedge Analysis

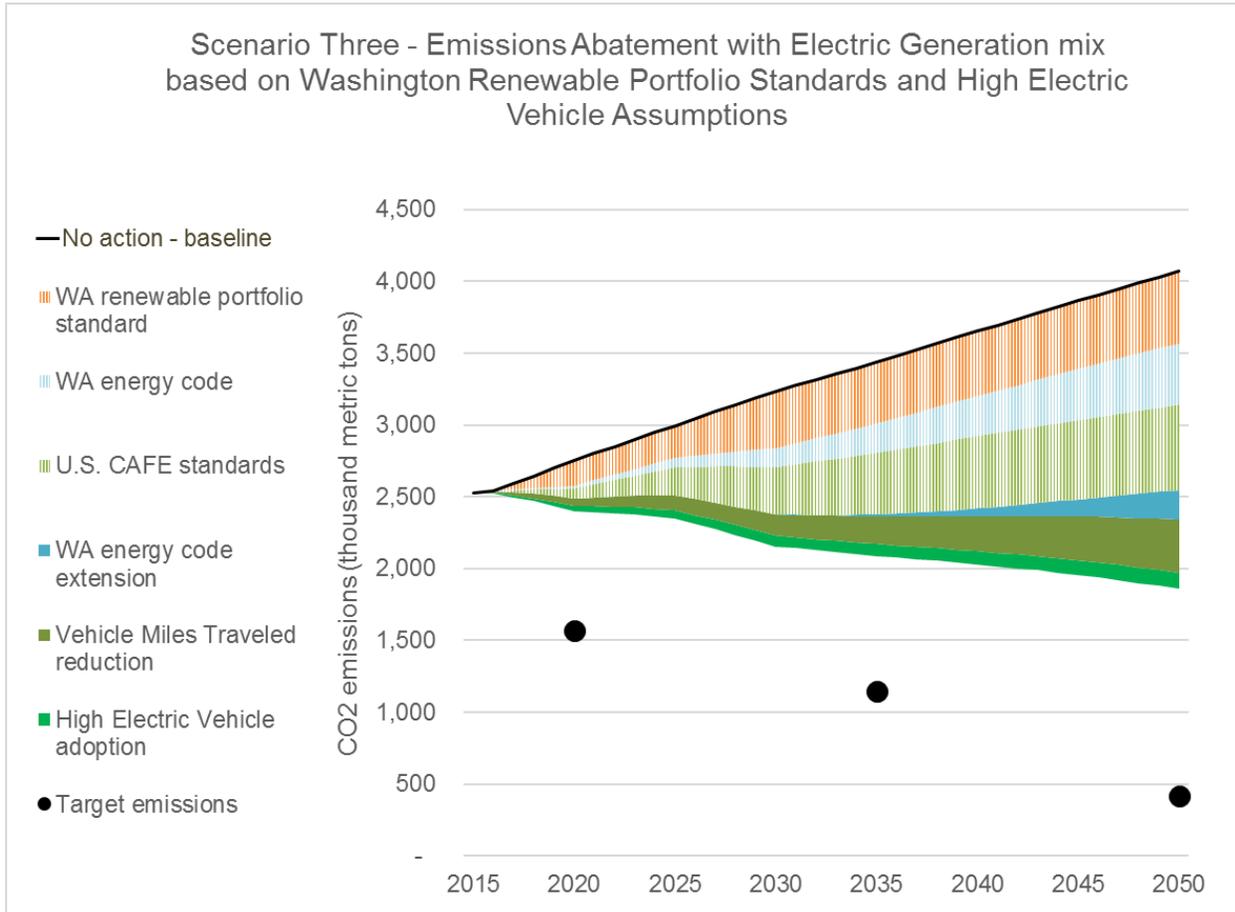
The carbon wedge analysis is a way of presenting the effects various policy actions have toward meeting the regional greenhouse gas emission targets. Essentially, different policy actions help fill the ‘wedge’ between the ‘no action – baseline’ trajectory, and the targets. Each slice of the wedge represents the emissions saved by taking a specific policy action.

Some policy actions are fairly discrete, such as the updated Washington State Energy Code. Others are more broadly defined. For example, the study examined a “deep decarbonization pathway” for Washington’s electricity sector that could result from a range of state, regional, and/or national policy actions. It also examined the effects of increased adoption of electric vehicles (EVs), which could be achieved through a similarly broad set of local, state, and national policies and incentives. More details on each action and the analysis can be found in the assumptions documentation on TRPC’s website:

<http://www.trpc.org/869/Greenhouse-Gas-Emissions-Analysis>

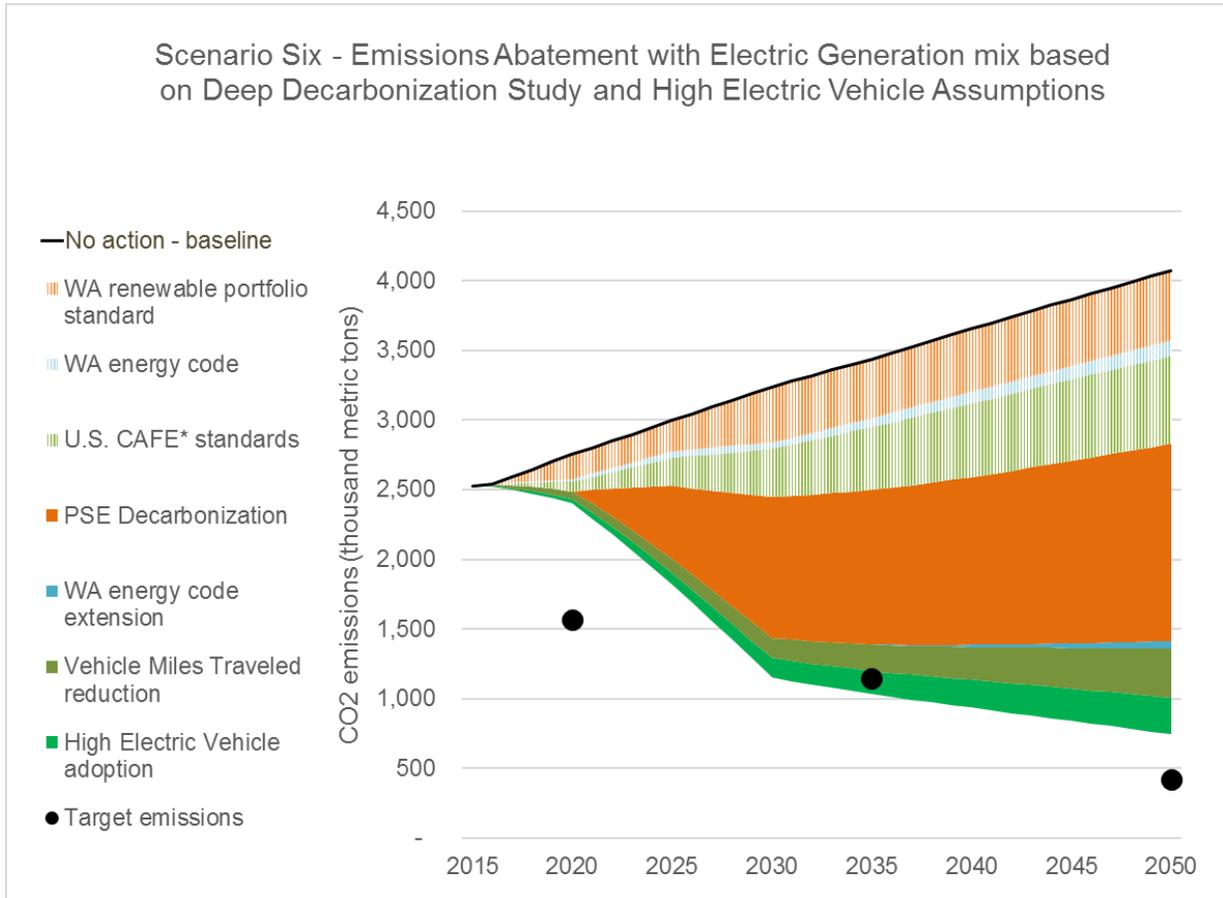
The consultant team ran a few different scenarios of policy actions, including two alternatives for the mix of sources for electricity generation, and three scenarios for electric vehicle (EV) adoption. The following figures (3A and 3B) compare two energy generation alternatives.

**3A: Thurston County Wedge Analysis: emissions abatement with electricity generation mix based on the Washington renewable portfolio standard**



**Figure 3A:** The Thurston County Wedge Analysis shows the emission-abatement potential of various policy actions. The policies are cumulative, and in many cases interdependent. For instance, reductions related to high electric vehicle (EV) adoption are only effective if the electrical grid is decarbonized, as illustrated in the differences in the High EV Adoption slice of the wedge in figures 3A and 3B.

**3B: Thurston County Wedge Analysis: emissions abatement with electricity generation mix based on the Deep Decarbonization Pathways study**



### Explanation of Actions shown in the Wedge Analysis

*Washington Renewable Portfolio Standard:* The Washington State Renewable Portfolio Standard mandates that for the state's largest utilities, including Puget Sound Energy, 15% of the electricity grid must be met with new (non-hydroelectric power) renewable resources and all cost-effective conservation by 2020. The consultants modeled this 15% through 2050. Other sources of energy were based on Puget Sound Energy's 2015 Integrated Resource Plan.

*Washington Energy Code:* By state law, new residential and commercial buildings must achieve a 70% reduction in annual net energy consumption below 2006 levels by 2031. This law is being implemented.

*U.S. CAFE Standards:* The Corporate Average Fuel Economy (CAFE) standards put in place by the Obama Administration call for fuel economy to increase to 54.5 miles per gallon for cars and light-duty trucks by model year 2025. The U.S. Energy Information Administration predicts that the U.S. vehicle fleet will achieve an average vehicle fuel efficiency of 27.3 miles per gallon in 2030 under current CAFE standards. President Trump has called for a roll back to these regulations, which will take approximately two years to work their way through the courts and the regulatory process. Hence, we modeled the current laws at this time.

*Decarbonization:* The consultants developed a scenario based on a general suite of policies that would drive deep decarbonization in Washington's electricity sector, in line with the outcomes modeled in Washington's Deep Decarbonization Pathways study. Washington State Deep Decarbonization Pathways Analysis by Evolved Energy Research, April 2017

<http://www.governor.wa.gov/sites/default/files/DeepDecarbonizationPathwaysAnalysisforWashingtonSt.pdf>

*Washington Energy Code Extension:* The consultants extended the Washington state energy code to achieve net-zero energy for new buildings by 2050.

*VMT Reduction:* The consulting team modeled a vehicle miles traveled (VMT) reduction consistent with the targets in TRPC's Regional Transportation Plan. They are:

Decrease annual per capita vehicle miles traveled in the Thurston Region to:

- 1990 levels by 2020
- 30 percent below 1990 by 2035
- 50 percent below 1990 by 2050

*High EV Adoption:* The consultants modeled three scenarios for electric vehicle infiltration. The High EV policy scenario is shown in the wedge diagram. The three scenarios are:

- Current policy - Low: Energy Information Agency Annual Energy Outlook electric vehicle projections; 6% of light-duty vehicle VMT from electric vehicles in 2050
- Medium EV policy case: 20% light-duty vehicle VMT from EVs in 2050
- High EV policy case: 60% light-duty vehicle VMT from electric vehicles in 2050, based on Bloomberg New Energy Finance's Long-Term Electric Vehicle Outlook

*Low Carbon Fuel Standard:* The consultants modeled a 10% reduction in transport fuel carbon intensity over 10 years (2018 to 2028), which is what the Washington State Clean Fuel Standard (CFS) would likely have achieved had it been enacted. They assumed that the CFS can be met through a combination of reduction in gasoline and diesel emission intensity and increasing use of electric vehicles.

Under the High EV use policy scenario, the requirements of the CFS are completely met through electric vehicle use. Thus, there is no additional emissions reduction from the CFS shown in Figure 3.

## Findings

The Carbon Wedge Analysis indicates that the Thurston County region will only be able to meet its emissions-reduction targets if its electricity is generated from a greater proportion of renewable sources, along the lines of the State's Deep Decarbonization Pathways targets. For this reason, we must work with our energy provider, Puget Sound Energy, in addition to state lawmakers and the Utilities and Transportation Commission to look for ways to make our electricity generation less dependent on fossil fuels.

Even with that aggressive action, our region will need to identify additional actions to meet the region's 2050 targets. The consulting team identified several areas where opportunities may exist, including:

- Heavy-duty vehicles: Emission reduction potential exists for heavy duty vehicles since reductions for them were excluded in this analysis.
- Buildings: Natural gas fuel-switching and further energy efficiency are possible.
- Technologies: New technologies that are not deployed today but likely will be before 2035 will help achieve targets.
- Vehicle Miles Traveled: It is possible that additional VMT reductions could help Thurston County achieve its goal, but we have not done the analysis to ascertain whether additional VMT reduction is realistic.

## Next Steps at TRPC

TRPC staff have identified the following next steps for the agency:

- Continue to explore emerging transportation technologies.
- Analyze potential actions to achieve vehicle miles traveled targets. Potential actions include: increased transit (such as bus-rapid transit), increased telework; investments in multimodal facilities such as bicycle lanes and trails, increased parking costs in city centers and for government employees; changes in land use; and high-occupancy vehicle lanes on Interstate 5. Such analysis is underway and expected to be completed during winter 2018.
- Work with jurisdictional partners on a regional climate mitigation plan.

On a related note, in early 2018, TPRC adopted the **Thurston Climate Adaptation Plan**, which recommends 91 adaptation actions to help Lacey and other Thurston County stakeholders prepare for and cope with climate impacts including more frequent and intense storms, floods, droughts, and wildfires. To read the plan, please visit [www.trpc.org/climate](http://www.trpc.org/climate).