

# October 12, 2023: San Juan County's Climate Action Plan

## Senator Liz Lovelett

- Introduction

## Jay Kimball, San Juan County's Climate and Sustainability Advisory Committee

- San Juan County's plan
- Electric vehicles



## Vince Dauciunas, OPALCO

- Resilient energy systems: power, electrification, "Switch it up" program, solar, experimental tidal energy, transportation

# Response to Climate Change Drives Changes to Energy Systems...

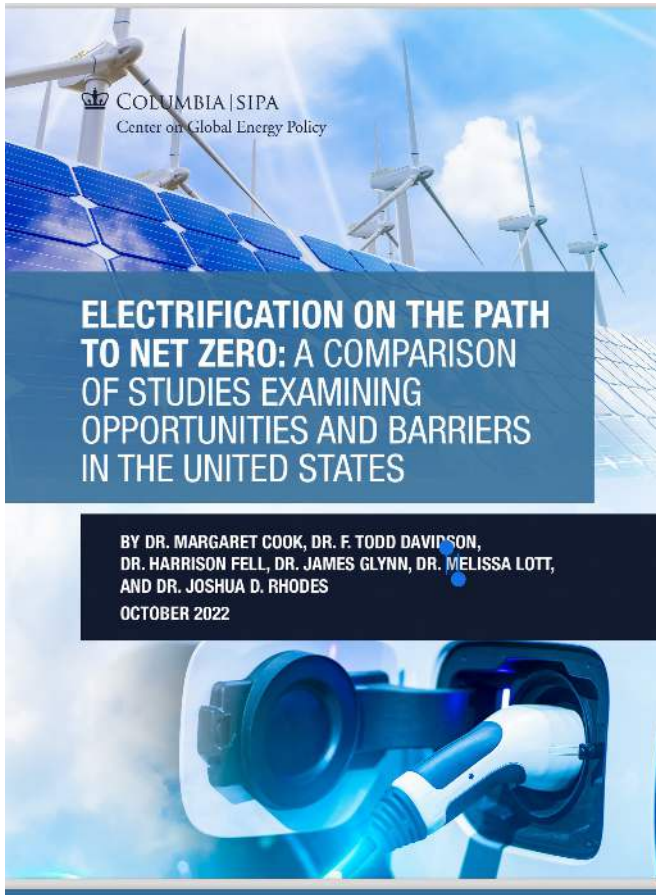
## Washington State Energy Strategy 2021

Avoiding the worst impacts of climate change requires a comprehensive commitment to **decreasing greenhouse gas emissions**. Washington launched initial efforts with legislation to require **clean electricity and efficient buildings**.

**FACT SHEET:** The Biden-Harris Administration Advances Transmission Buildout to Deliver Affordable, Clean Electricity



...the President's goals of **reducing greenhouse gas emissions 50-52% below 2005 levels in 2030 and achieving 100% clean electricity by 2035**.

# Many Studies on How to Do This...Conclusion – Necessary but NOT Easy!



<https://tinyurl.com/2ne7ujb8>

**Table 1:** Studies evaluated in this report

Study name	Abbreviation	Reference
Princeton’s “Net-Zero America” 	Princeton	Larson et al. 2020
“Carbon-Neutral Pathways for the United States”	Williams	Williams et al. 2021
Vibrant Clean Energy’s “Zero by 2050”	VCE	Vibrant Clean Energy 2021
“The Long-Term Strategy of the United States: Pathways to Net-Zero Greenhouse Gas Emissions by 2050”	White House	The White House 2021 (Global Change Assessment Model team)
Electric Power Research Institute’s (EPRI) “Powering Decarbonization: Strategies for Net-Zero CO <sub>2</sub> Emissions”	EPRI	Blanford et al. 2021
Berkeley’s “2035 Electricity” and “2035 Transportation” reports	Berkeley 2035	Phadke et al. 2020; Baldwin et al. 2021
National Renewable Energy Laboratory’s (NREL) “Electrification Futures Study” 	EFS	Jadun et al. 2017; Hale et al. 2018; Mai et al. 2018; Sun et al. 2020; Murphy et al. 2021; Zhou and Mai 2021
NREL’s “Interconnections Seam Study”	Seams	Bloom et al. 2021

## Talks about the Climate, Grids and Energy...are full of:



TLA's – “Three Letter Acronyms”

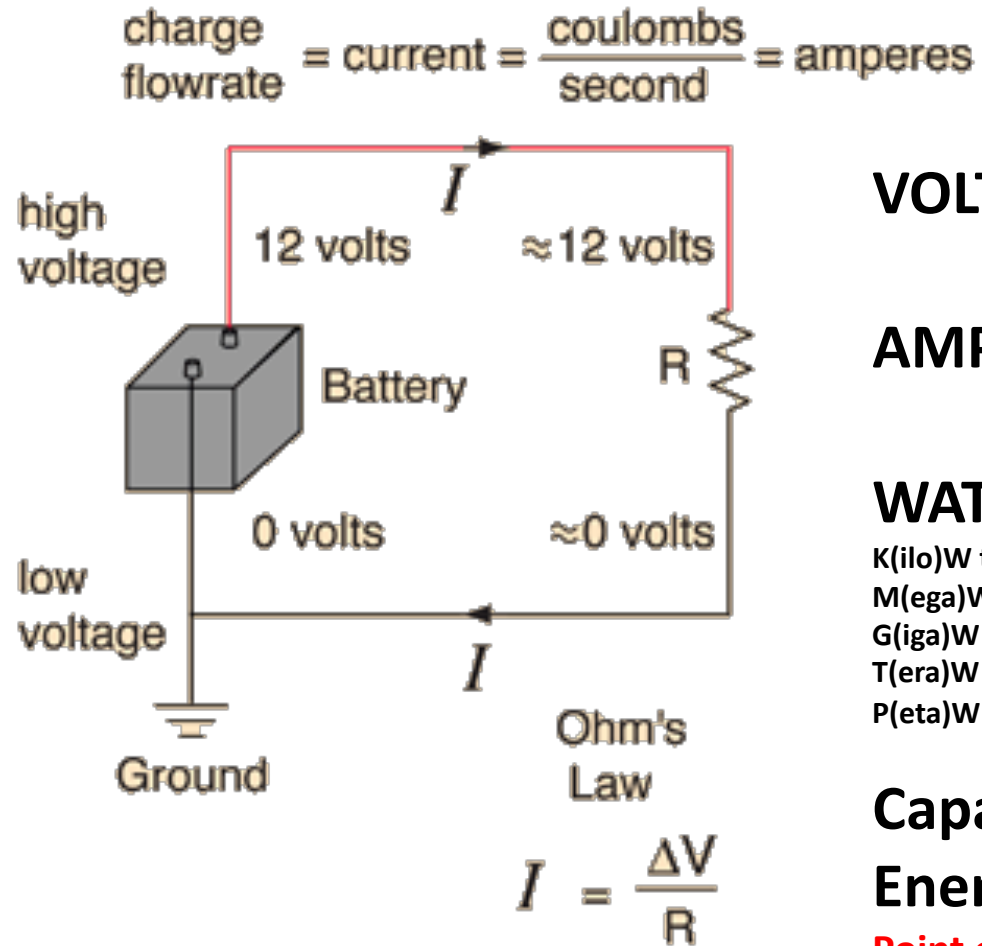
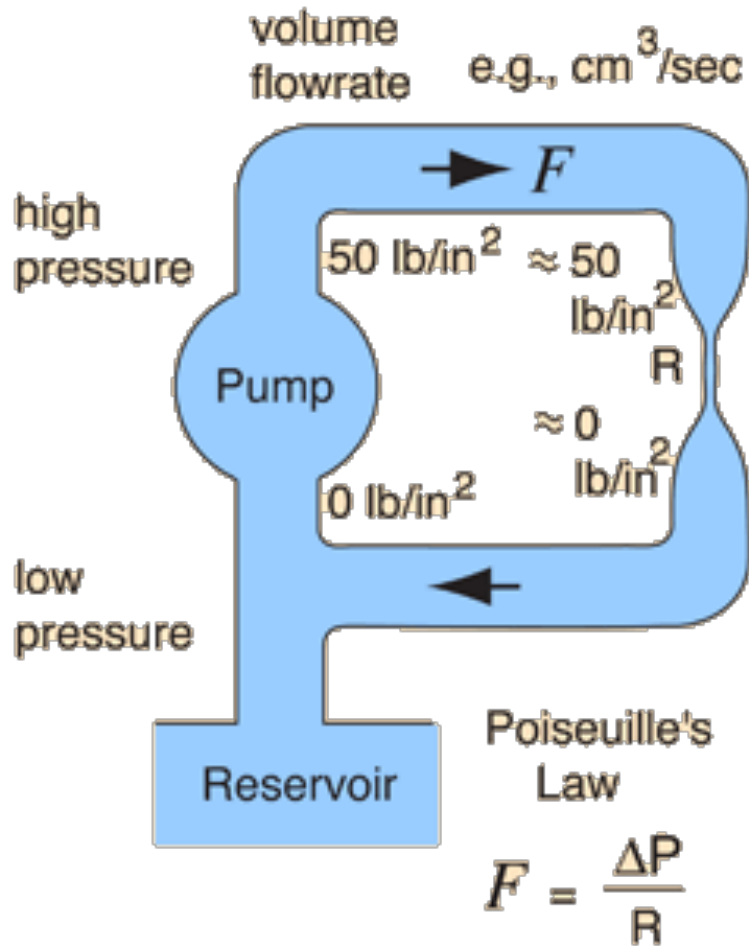
MLA's – “Multi-Letter Acronyms”

Examples:

FERC	CETA	CEIP
NERC	CF	ELCC
LCOE	LACE	EROI
BPA	BA	CVR
NWPCC	PNUCC	VER

...and many many more!

# Energy 001 – Watts Up with this stuff?



**VOLTS**

**AMPS**

**WATTS**

K(ilo)W thousand  
 M(ega)W million  
 G(iga)W billion  
 T(era)W trillion  
 P(eta)W quadrillion

**Capacity = MW's**

**Energy = MWh's**

**Point of confusion!**



We strengthen communities

# Washington 2021 State Energy Strategy

Transitioning to an Equitable Clean Energy Future

DECEMBER 2020

## Major WA State Climate Legislation

- Climate Commitment Act (CCA- SB 5126)

- Clean Energy Transformation Act (CETA -SB 5116)

- HB 1181 - 2023-24

“Improving the state's response to climate change by updating the state's planning framework.”

The 2021 State Energy Strategy is designed to provide a roadmap for meeting the state’s greenhouse gas emission limits.

Enacted in 2020, the CCA commits Washington to limits of:

-45% below 1990 levels by 2030,

-70% below 1990 levels by 2040 and

-95% below 1990 levels  
with net zero emissions by 2050

-140 pages

# Washington State Total gross emissions MMTCO<sub>2</sub>e

<u>Year</u>	<u>Amount</u>	<u>Goal</u>
1990	93.5	2030 51.4
2000	111.0	2040 28.1
2010	95.0	2050 4.7
2015	94.6	
2016	95.1	
1017	95.3	
2018	95.5	
<b>2019</b>	<b>102.1</b>	

*From 2023 to 2030...  
102.1 to 51.4 = -50%*



Washington State Greenhouse Gas  
Emissions Inventory: 1990–2019

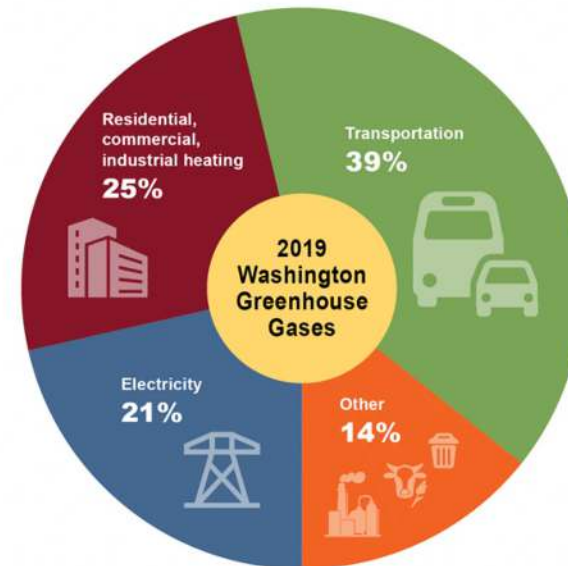
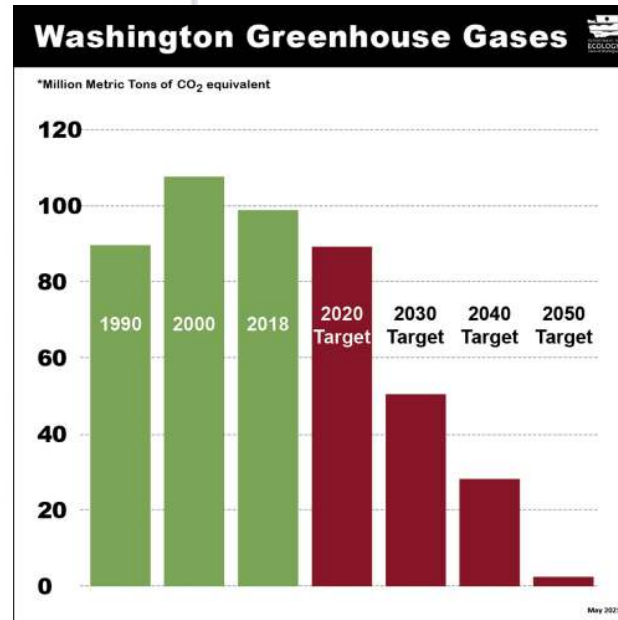
Stacey Waterman-Hoey  
Air Quality Program

Washington State Department of Ecology  
Olympia, Washington

December 2022, Publication 22-02-054



<https://apps.ecology.wa.gov/publications/documents/2202054.pdf>



# CETA Overview

The law requires utilities to **phase out coal-fired electricity** from their state portfolios by 2025.

By 2030, their portfolios must be **greenhouse gas emissions neutral**, which means they may use limited amounts of electricity generated from natural gas if it is offset by other actions.

By 2045, utilities must supply Washington customers with electricity that is **100% renewable or non-emitting** with no provision for offsets.



2025  
NO COAL  
STANDARD



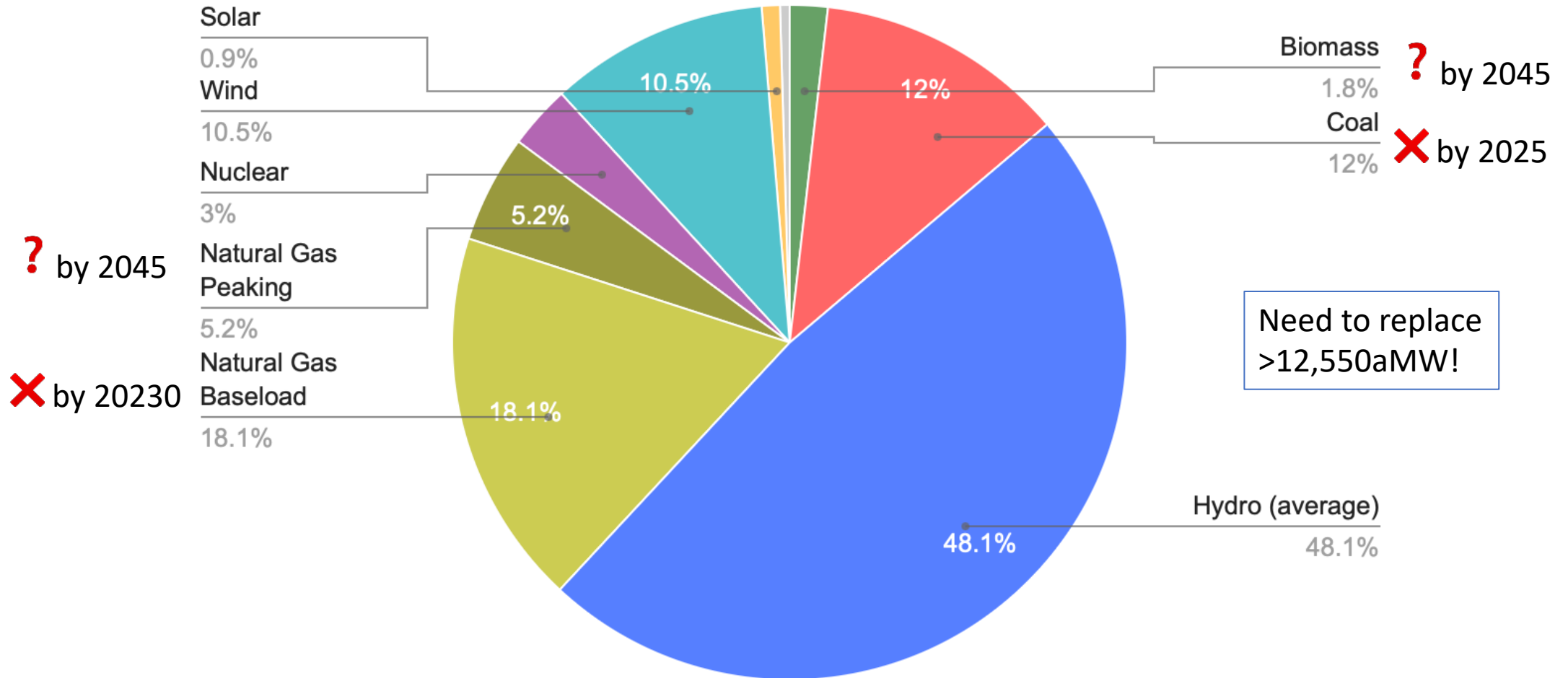
2030  
GHG NEUTRAL  
STANDARD



2045  
100% CLEAN  
STANDARD



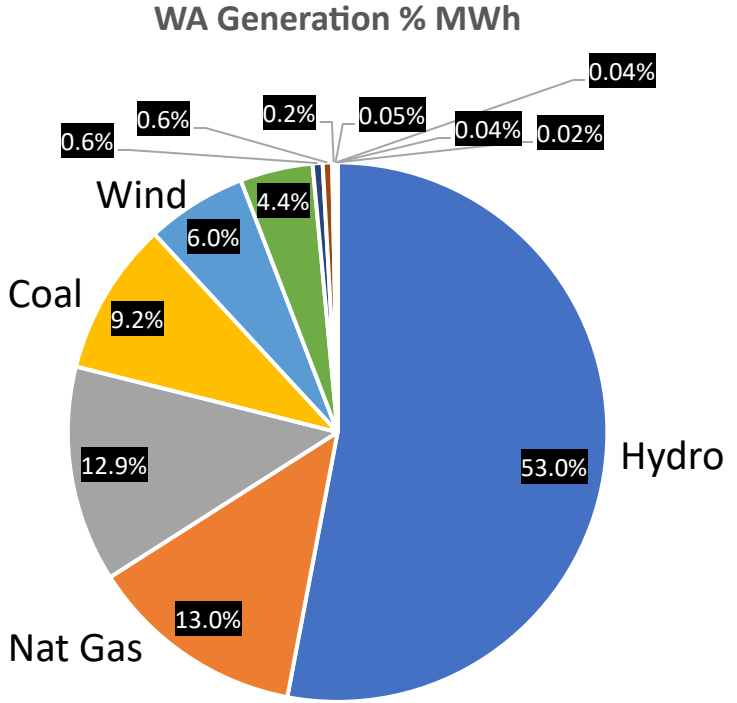
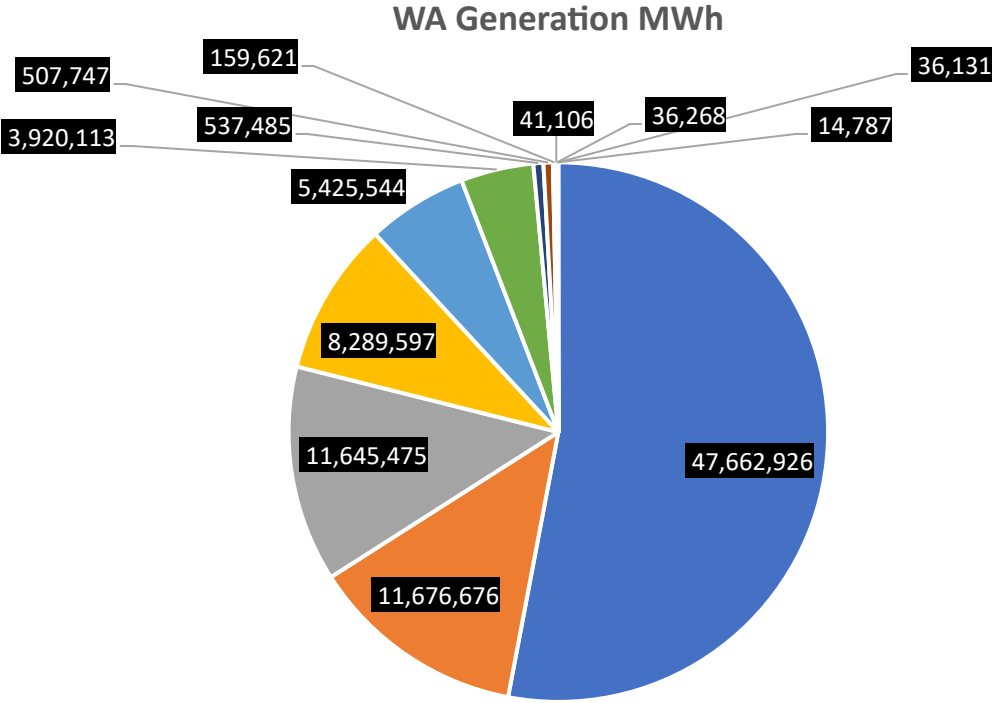
## Pacific Northwest Generating Capability: 33,828 MWa\*



**Capability** is the maximum amount of energy the plants are capable of producing over the course of an average year. Download chart as PNG

\* Other (yellow segment) includes geothermal, petroleum, and solar

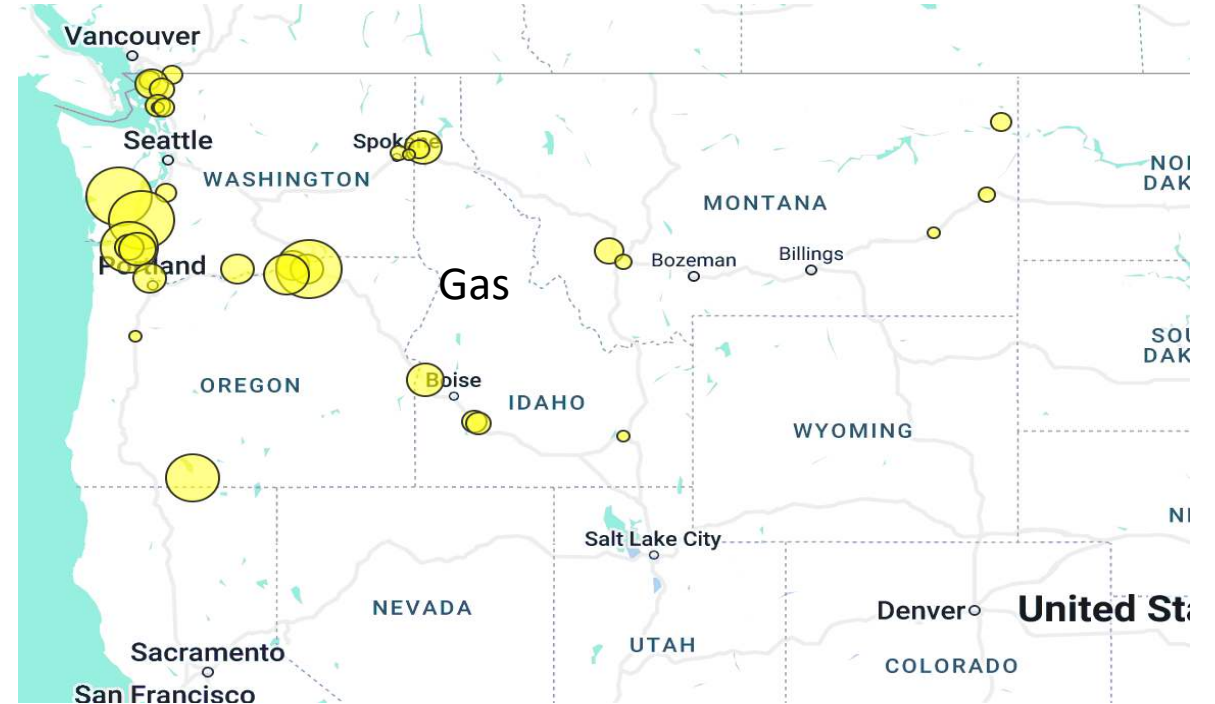
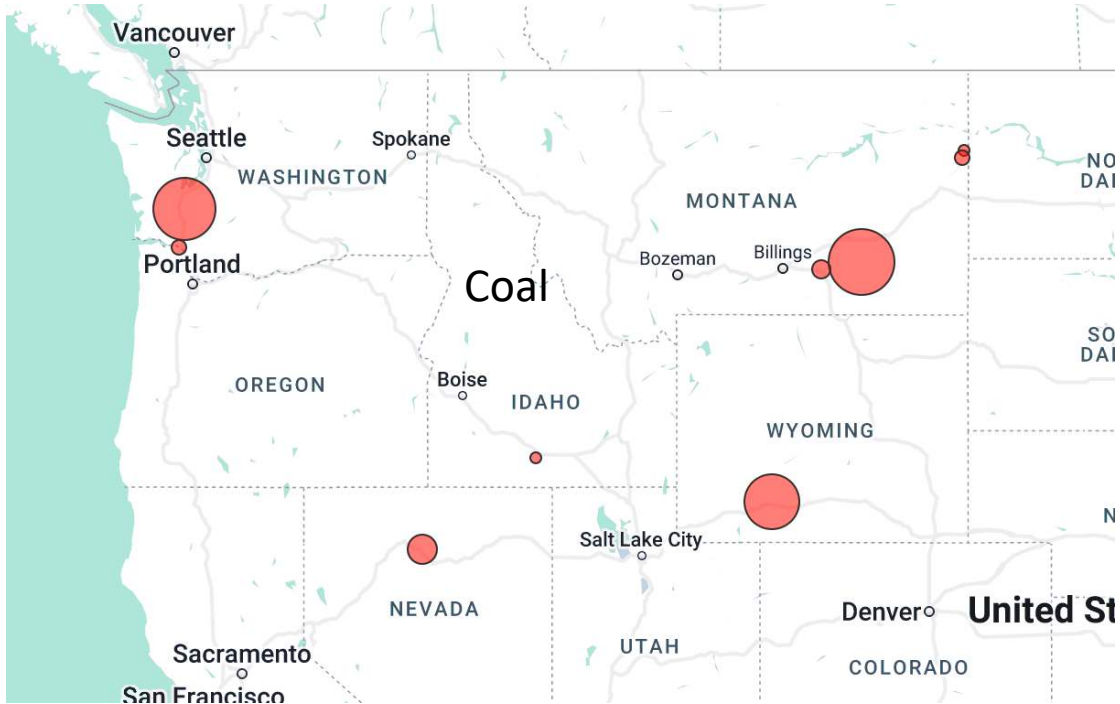
# WA State Aggregate Fuel Mix for Utilities 2021



- hydro
- natural gas
- unspecified
- coal
- wind
- nuclear
- biomass
- solar
- biogas
- waste
- other biogenic
- geothermal
- petroleum

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- natural gas
- unspecified
- coal
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# PNW Coal and Natural Gas Plants

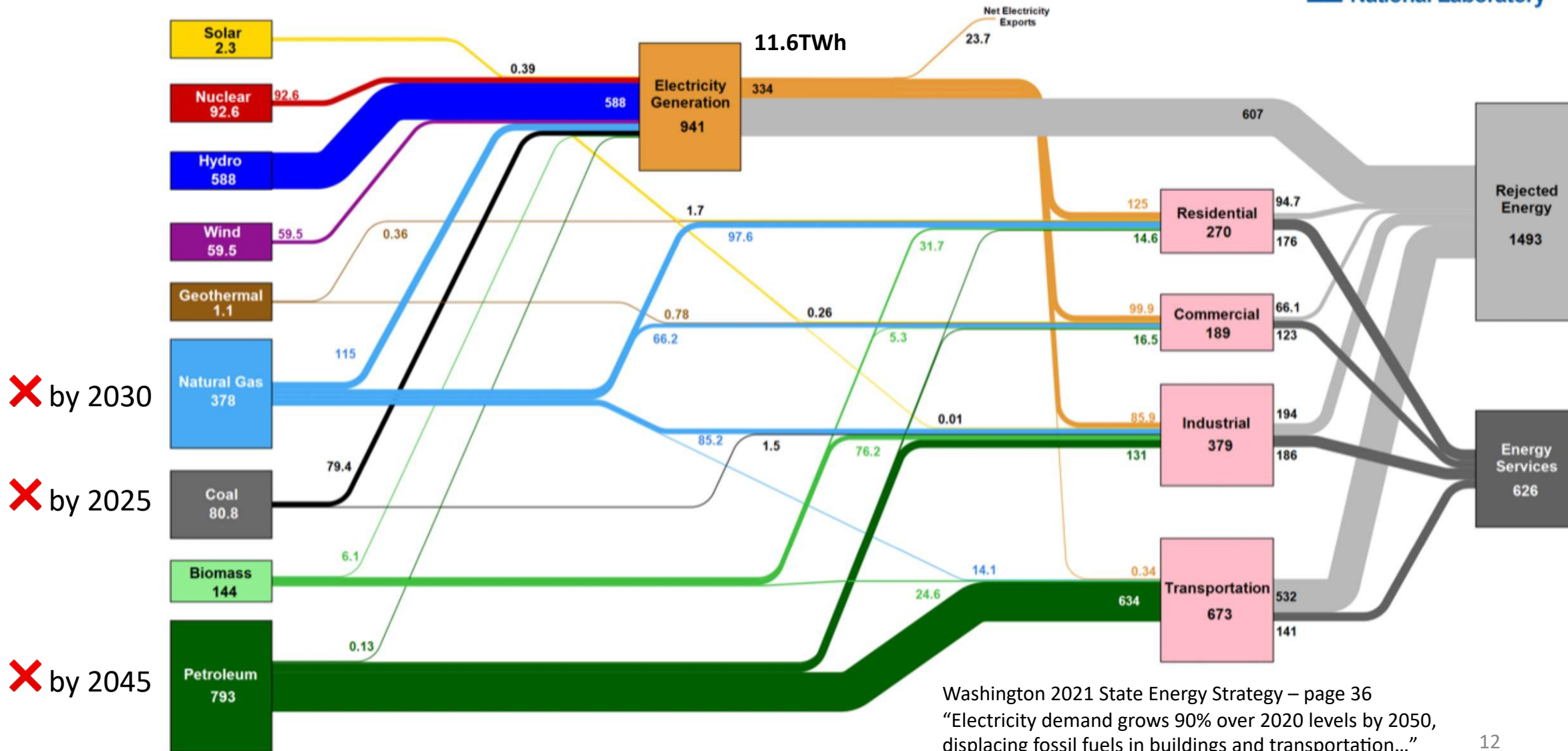


<https://www.nwcouncil.org/energy/energy-topics/power-supply/map-of-power-generation-in-the-northwest/>

# WA State "Sankey" Diagram

## GHG Reduction Goals imply ~2x Clean Electricity

Washington Energy Consumption in 2019: 2143 Trillion BTU



# BONNEVILLE POWER ADMINISTRATION

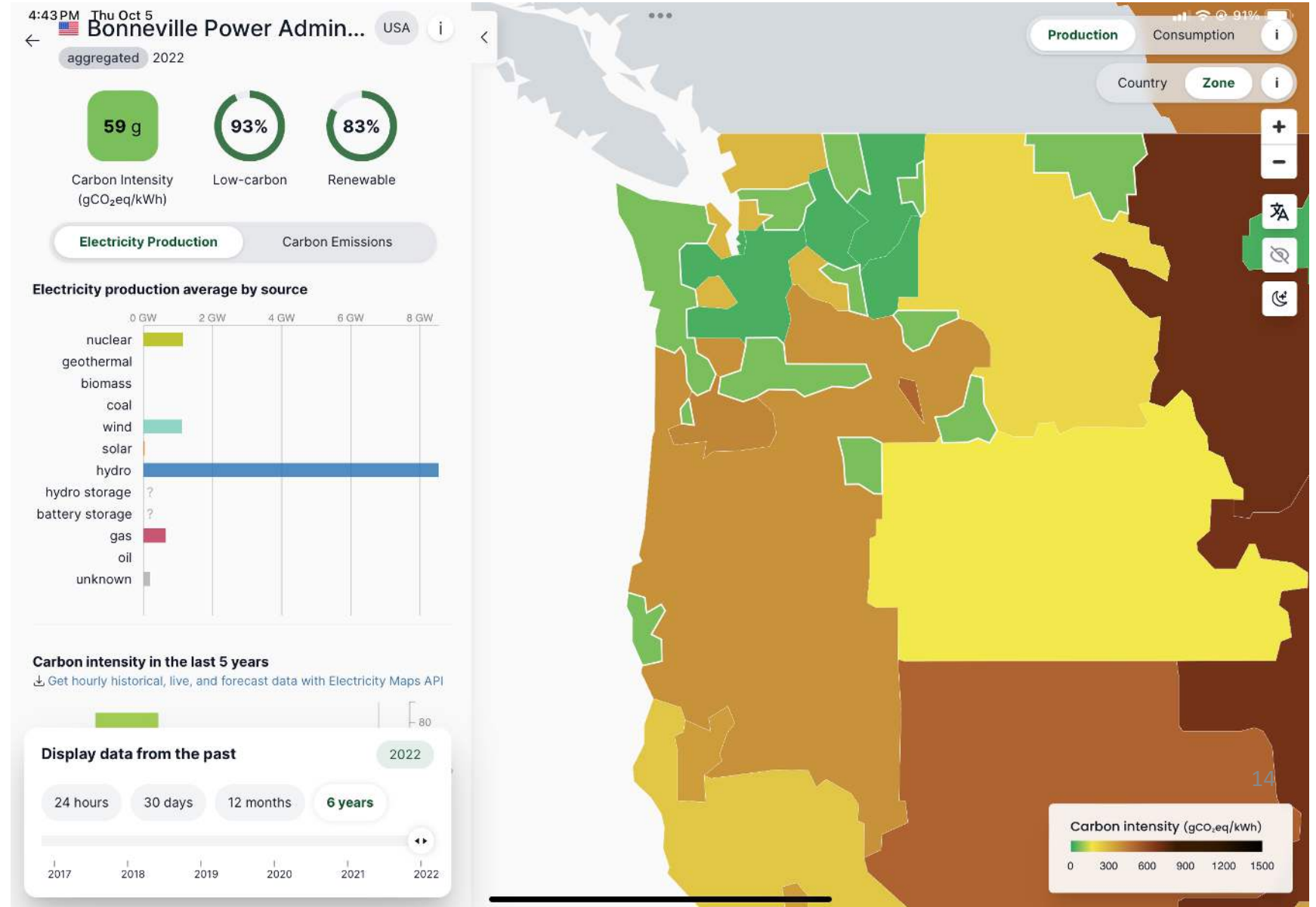
## BPA Fuel Mix Percent Summary. Calendar Year 2022. 96% Renewable

Type	CY 2021	CY 2022	Percent Change
Biomass and Waste	0.0%	0.0%	0%
Geothermal	0.0%	0.0%	0%
Small Hydroelectric	0.9%	0.7%	0%
Solar	0.0%	0.0%	0%
Wind with RECs	0.0%	0.0%	0%
Coal	0.0%	0.0%	0%
Large Hydroelectric	83.7%	84.0%	0.4%
Natural Gas	0.0%	0.0%	0%
Nuclear	10.9%	11.0%	0%
Non Specified purchases <sup>1</sup>	4.0%	3.4%	-0.6%
EIM purchases <sup>2</sup>	0.0%	0.6%	1%
Wind without RECs <sup>3</sup>	0.6%	0.4%	0%
<b>Total</b>	<b>100%</b>	<b>100%</b>	

## Carbon Intensity

BPA ~130lbsCO<sub>2</sub>e/MWh  
Hydro ~42lbsCO<sub>2</sub>e/MWh  
Gas ~1,000lbsCO<sub>2</sub>e/MWh  
Coal ~2,000lbsCO<sub>2</sub>e/MWh

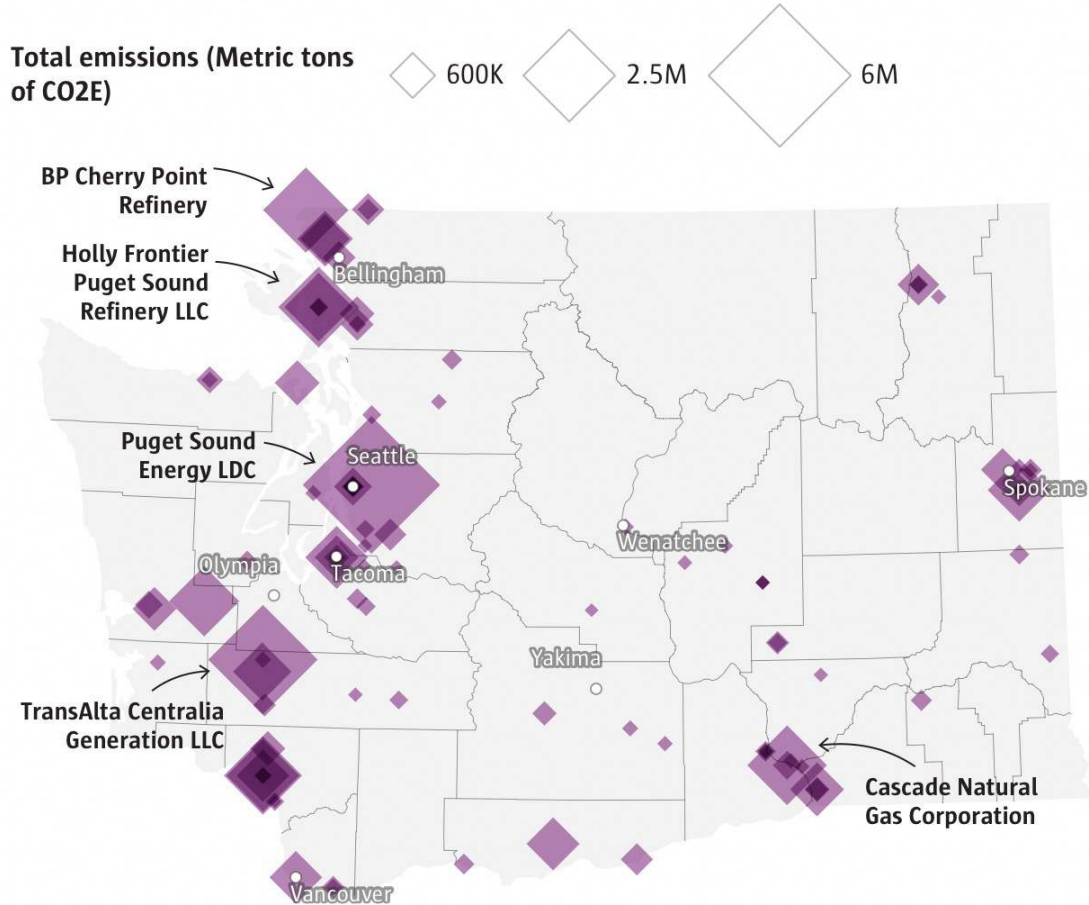
NWPP ~635lbsCO<sub>2</sub>e/MWh  
<https://www.epa.gov/egrid/summary-data>



<https://app.electricitymaps.com/zone/US-NW-BPAT?lang=en>

## Top carbon emitters in Washington state

This map shows the top emitters in 2021, with one key omission: fuel suppliers, which account for all the gas sold in the state and burned on the road. The state recently removed fuel suppliers from its data; new data will be available in the fall.



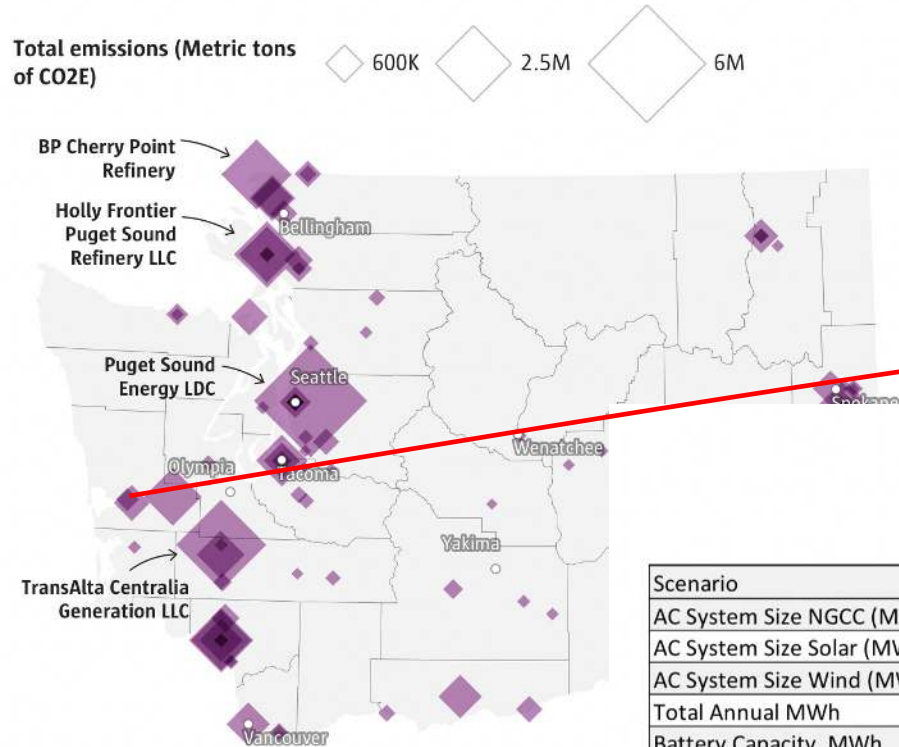
Map: Frank Mina / The Seattle Times • Source: Washington state Department of Ecology

## Top Emitters 22% of WA State total

Reporter	Industry	Parent company	Total emissions (Metric tons of CO2E)
Puget Sound Energy LDC	Natural gas supplier	Puget Holdings LLC	5,603,773
TransAlta Centralia Generation LLC	<b>Power Generation</b> Coal plants <b>730MW</b>	TransAlta	3,484,305
BP Cherry Point Refinery - Blaine	Petroleum refineries	BP	2,066,338
HollyFrontier Puget Sound Refinery LLC - Anacortes	Petroleum refineries	Shell Petroleum	1,837,958
Cascade Natural Gas Corporation	Natural gas supplier	MDU Resources Group	1,787,939
Nippon Dynawave - Longview	Kraft mills		1,721,330
WestRock LLC - Longview	Kraft mills	Kapstone Paper & Packaging	1,475,085
Grays Harbor Energy Center - Elma	<b>Power Generation</b> Natural gas turbine plants <b>650MW</b>		1,367,817
Marathon Anacortes Refinery	Petroleum refineries	Marathon Petroleum	1,296,106
Avista	Natural gas supplier	Avista	1,085,641

## Top carbon emitters in Washington state

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Map: Frank Mina / The Seattle Times • Source: Washington state Department of Ecology



## Replacement of Gray's Harbor Energy Center 650MW Gas Turbine Generating Plant with Wind and Storage (a "wicked" problem) CapEx: \$5.8B      Area: 22,000 acres ( 34 sq. mi.)

[-Gray's Harbor Energy center is located on a 20-acre site within the Satsop Redevelopment Park in Grays Harbor County  
-Lopez+Shaw islands area: 37 sq.mi.]

	NGCC	NGCC with Carbon Tax	Solar and NGCC	Solar and Storage	Wind and Storage	Solar, Wind and Storage
Scenario	1	1	2	3	4	5
AC System Size NGCC (MW)	650	650	650	-	-	-
AC System Size Solar (MW)	-	-	650	2,958	-	845
AC System Size Wind (MW)	-	-	-	-	2,625	2,065
Total Annual MWh	4,839,900	4,839,900	4,839,900	6,738,381	12,392,152	11,671,720
Battery Capacity, MWh	-	-	-	10,250	6,550	2,410
Acreage	30	30	5,460	24,843	22,053	24,443
<b>Wholesale Rate, \$/MWh</b>	<b>\$47.1</b>	<b>\$88.4</b>	<b>\$88.4</b>	<b>\$181.0</b>	<b>\$135.9</b>	<b>\$99.0</b>
Carbon Tax (\$/MWh)	N/A	\$41.3	\$41.3	\$133.9	\$88.7	\$51.9
Carbon Tax (\$/ton)	N/A	\$75.0	\$75.0	\$389.6	\$258.2	\$151.0
Capital Expenditure	\$702,000,000	\$702,000,000	\$1,630,200,000	\$7,720,641,000	\$5,811,379,774	\$5,075,501,108
Annual O&M + Fuel Cost	\$110,627,806	\$110,627,806	\$116,087,806	\$101,718,000	\$363,743,664	\$272,621,604
Debt	\$280,800,000	\$280,800,000	\$652,080,000	\$3,088,256,400	\$2,324,551,909	\$2,030,200,443
Equity	\$421,200,000	\$421,200,000	\$978,120,000	\$4,632,384,600	\$3,486,827,864	\$3,045,300,665
ROE	10.50%	13.24%	10.50%	10.50%	10.50%	10.51%

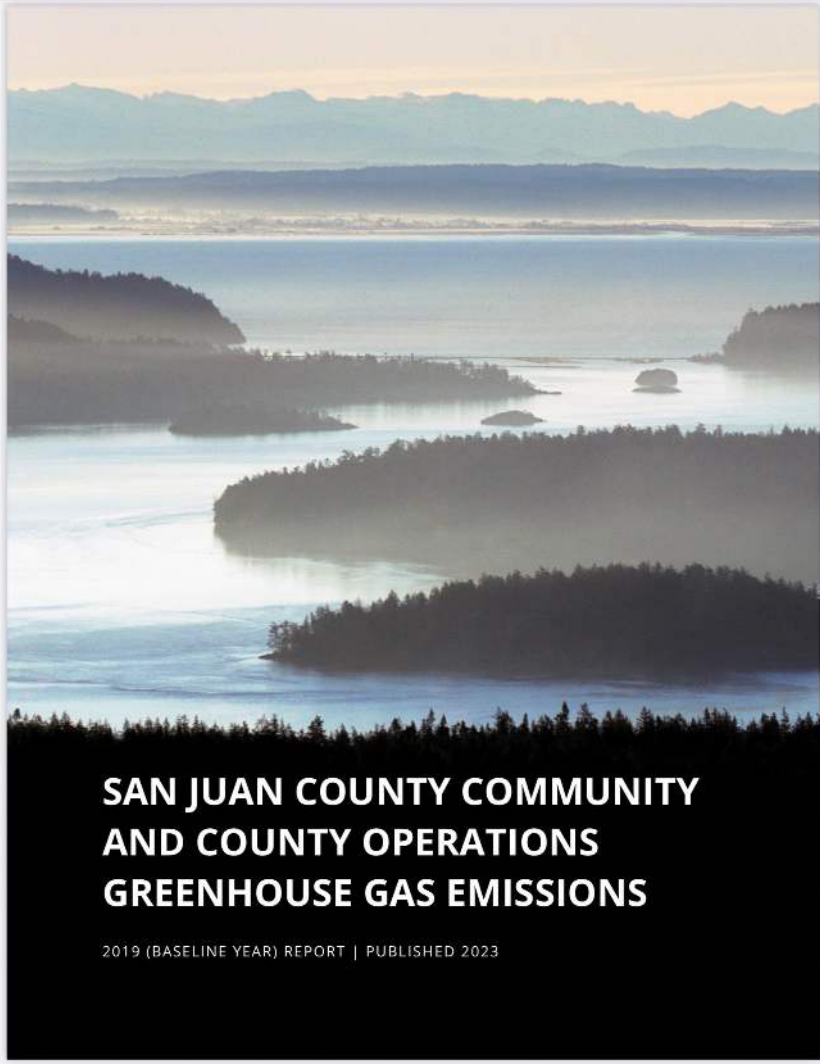
Table 1: Summary Table

"MEASURING RENEWABLE ENERGY AS BASELOAD POWER"

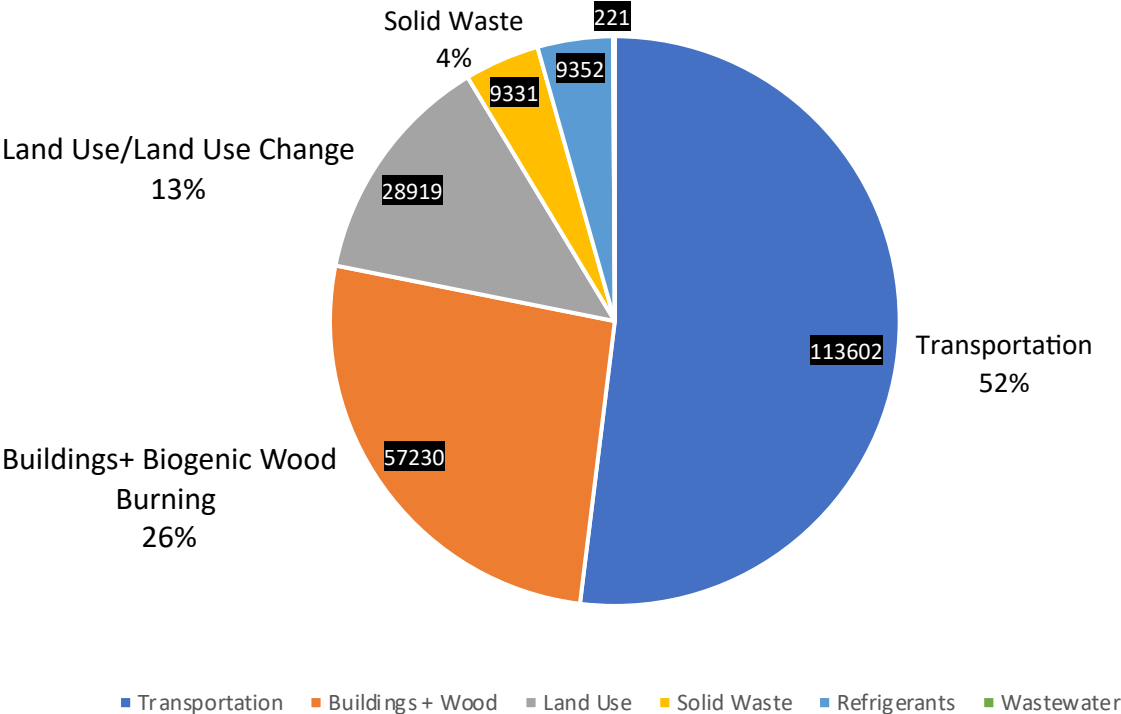
UNC Kenan-Flagler Business School – Page 12



# SJC GHG Inventory – 2019 Base Year



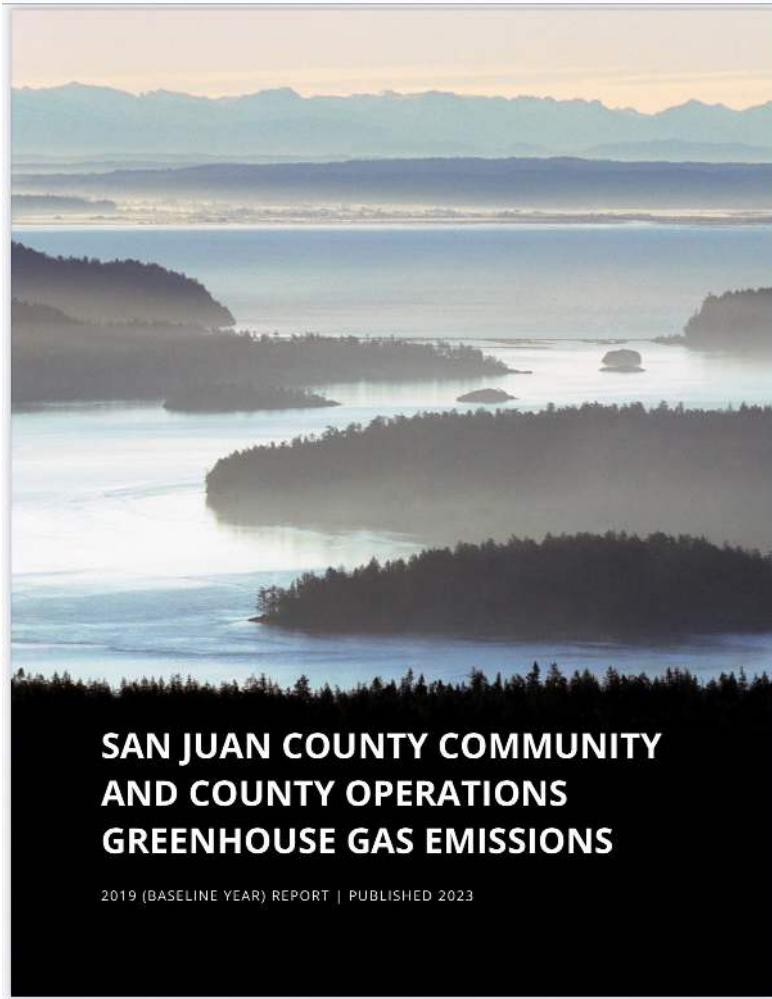
### San Juan County GHG Emissions 2019 (218,665 MTCO<sub>2</sub>e)



Looking Ahead...now what?



218,655 MTCO<sub>2e</sub>



Category	MTCO <sub>2e</sub>	% Category	% Total
<b>Overall Emissions w/ WSF + Biogenic Wood</b>	<b>218,655</b>	<b>100%</b>	<b>100%</b>
<b>Transportation</b>	<b>113,602</b>	<b>100%</b>	<b>52.0%</b>
Maritime	68,914	39%	31.5%
<i>WA State Ferries</i>	37,141	54%	17.0%
<i>Recreational Boating</i>	31,773	46%	14.5%
On-road	32,806	18%	15.0%
<i>Passenger Cars</i>	20,012	61%	9.2%
<i>Light Trucks</i>	11,154	34%	5.1%
<i>Heavy Trucks</i>	1,640	5%	0.8%
Off-Road	11,507	7%	5.3%
<i>Construction</i>	4,258	37%	1.9%
<i>Lawn &amp; Garden Eqpt</i>	3,567	31%	1.6%
<i>Other</i>	3,682	32%	1.7%
Aviation	375	0.2%	0.2%
<b>Building Energy Emissions</b>	<b>16,403</b>	<b>100%</b>	<b>7.5%</b>
Wood	503	3%	0.2%
Propane	10,611	65%	4.9%
Electricity	2,809	17%	1.3%
<i>Residential</i>	2,022	72%	0.9%
<i>Commercial/Industrial</i>	787	28%	0.4%
Fuel Oil	2,481	15%	1.1%
<i>Residential</i>	1,625	66%	0.7%
<i>Commercial/Industrial</i>	856	34%	0.4%
<b>Biogenic Wood burning</b>	<b>40,827</b>	<b>100%</b>	<b>18.7%</b>
<b>Land Use</b>	<b>28,919</b>	<b>100%</b>	<b>13.2%</b>
Tree Loss	22,783	79%	10.4%
Livestock	5,701	20%	2.6%
<i>Beef</i>	4,903	86%	2.2%
<i>Chickens, Sheep</i>	798	14%	0.4%
Soil Management	436	2%	0.2%
<b>Solid Waste</b>	<b>9,331</b>	<b>100%</b>	<b>4.3%</b>
Fugitive	5,833	63%	2.7%
Waste Transportation	3,498	37%	1.6%
<b>Refrigerants</b>	<b>9,352</b>	<b>100%</b>	<b>4.3%</b>
<b>Wastewater</b>	<b>221</b>	<b>100%</b>	<b>0.1%</b>

- 2
- 4
- 3
- 6
- 7
- 1
- 5

Top 5  
76% of total

WA Goal: -50%  
in 7 years!

**BY THE NUMBERS  
SNAPSHOT**

# 2021 Numbers

**238,640,807**

kilowatt hours (kWh)  
purchased

**\$32,131,904**

annual electric sales

**\$1,100,000**

Capital Credits Paid to  
Members

**15,569**

meters connected

**11,645**

Members

**1,259**

miles of power lines  
(87% underground)

**25**

submarine cables

**20+**

islands served



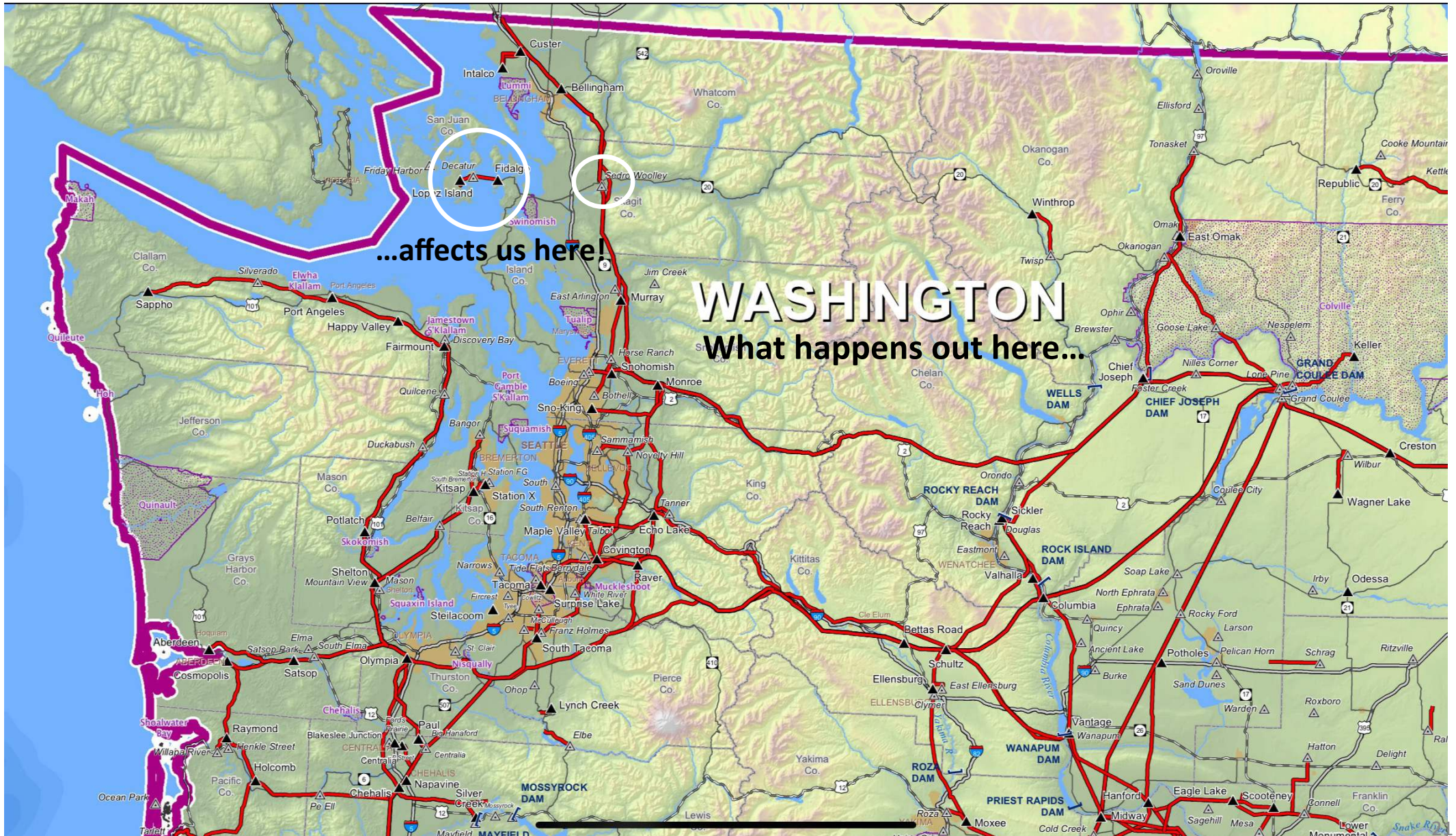
**OPALCO**

Co-op Run. Community Powered.

**657 member generators**

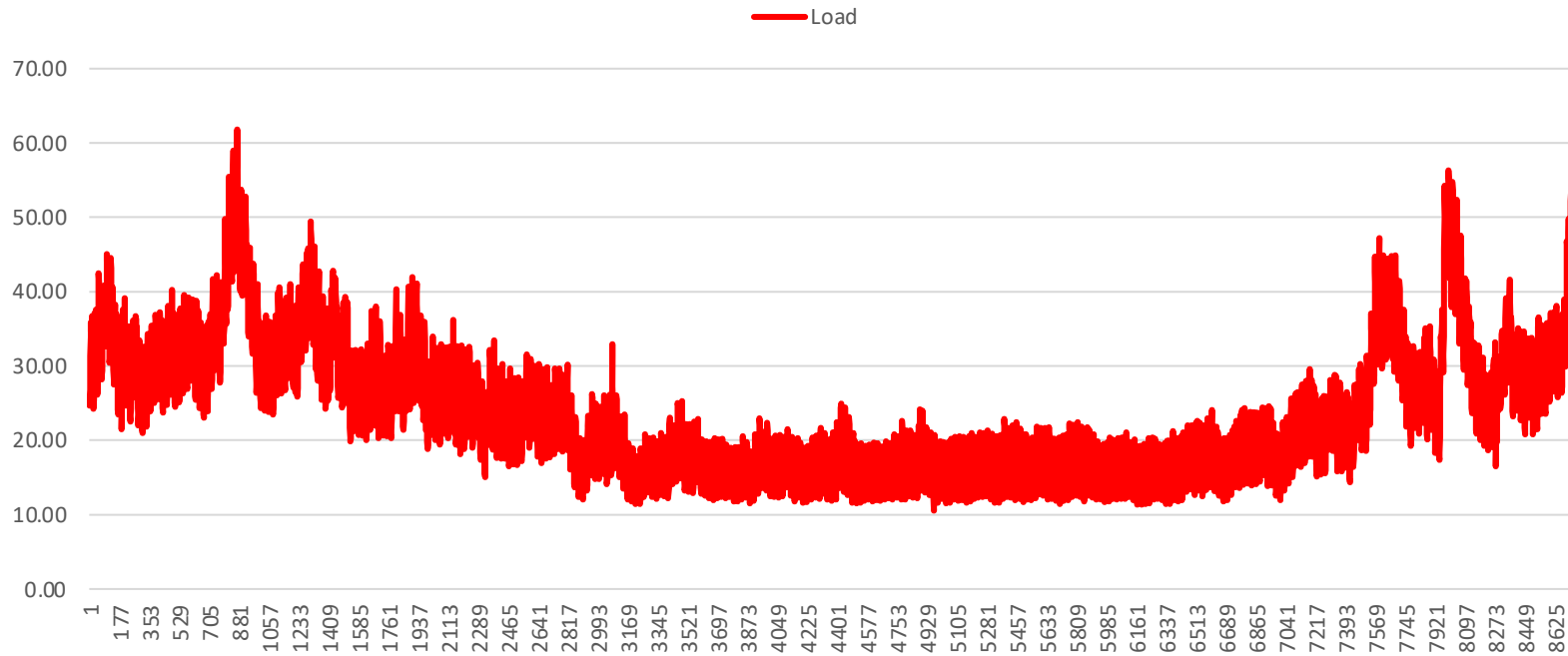
(1.5% local generation)

# BPA PNW Transmission Lines



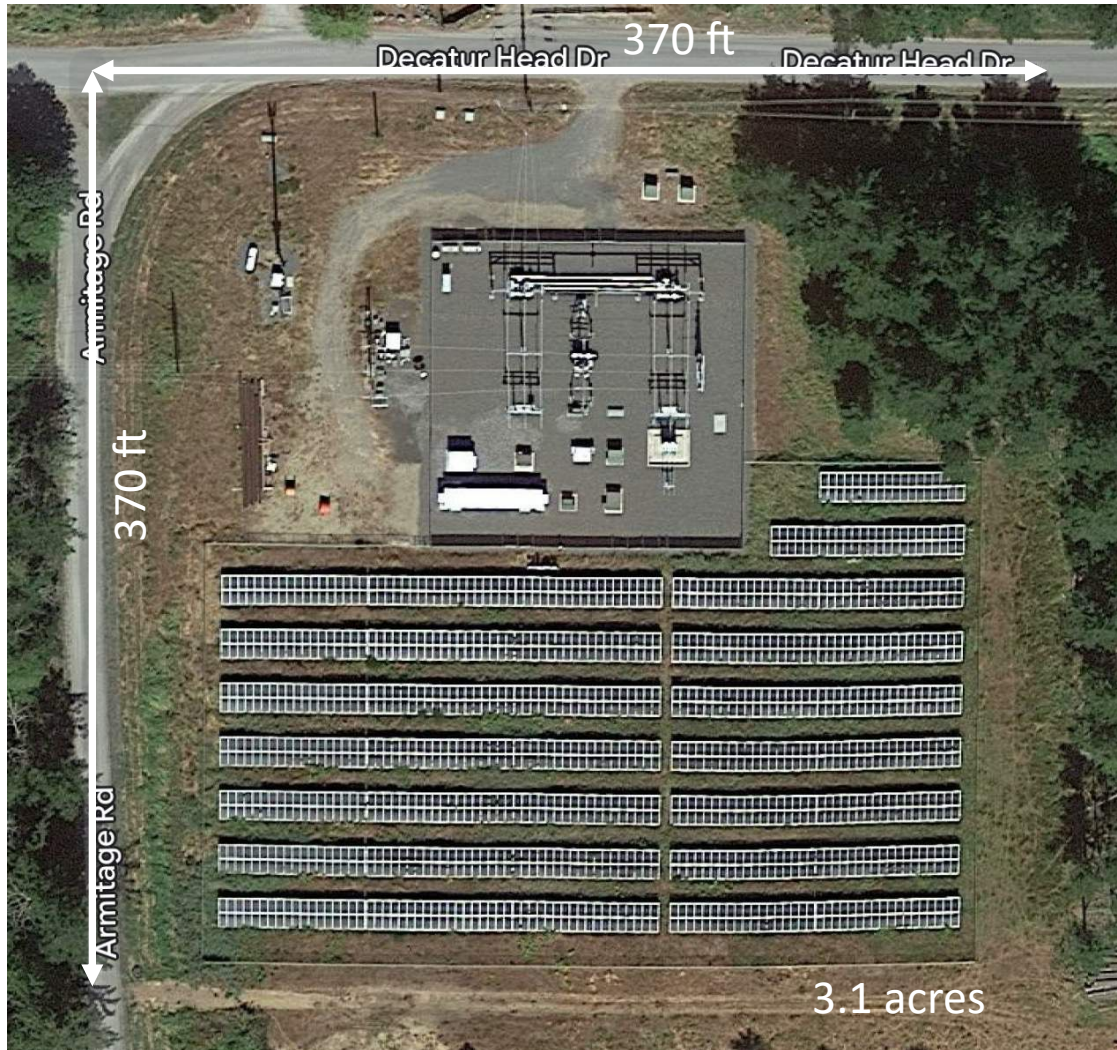
# Example: OPALCO 2014 Load MW by Hour

2022 peak 83MW

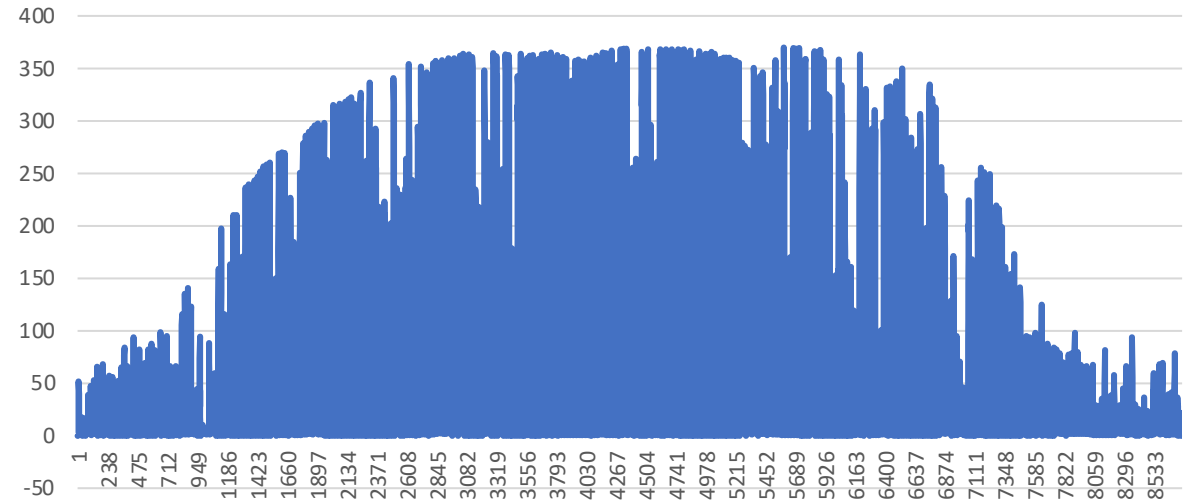


## 2014 Load Characteristics:

Hours/yr: 8,760  
Total: 206,873MWh  
Maximum: 61.8MW (2/6/14 8:00am)  
Minimum: 10.6MW  
Average: 23.6MW



## Decatur Community Solar Array

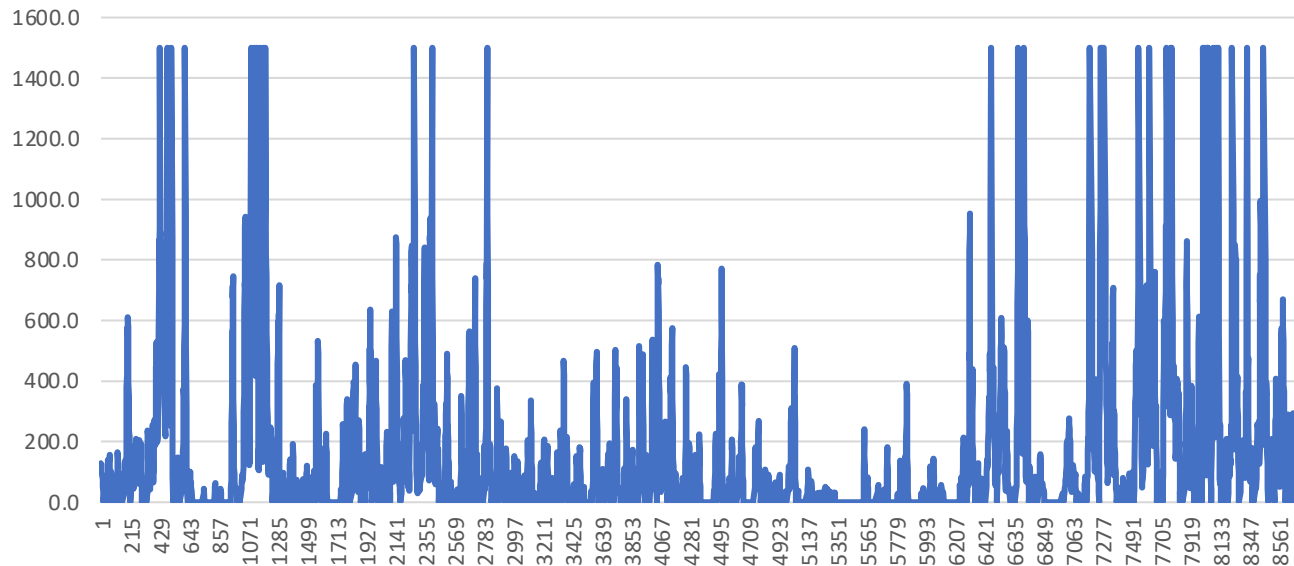


### Solar Generation Characteristics:

Hours/yr:	8,760
Total:	506,614kWh
Maximum:	370kW
Minimum:	0kW
Average:	58kW
Summer:Winter	6:1
Hours/year zero output:	3,954
Hours/yr > zero output:	4,806
kWh/kW :	1,013



Wind 1.5MW  
GE XLE1.5

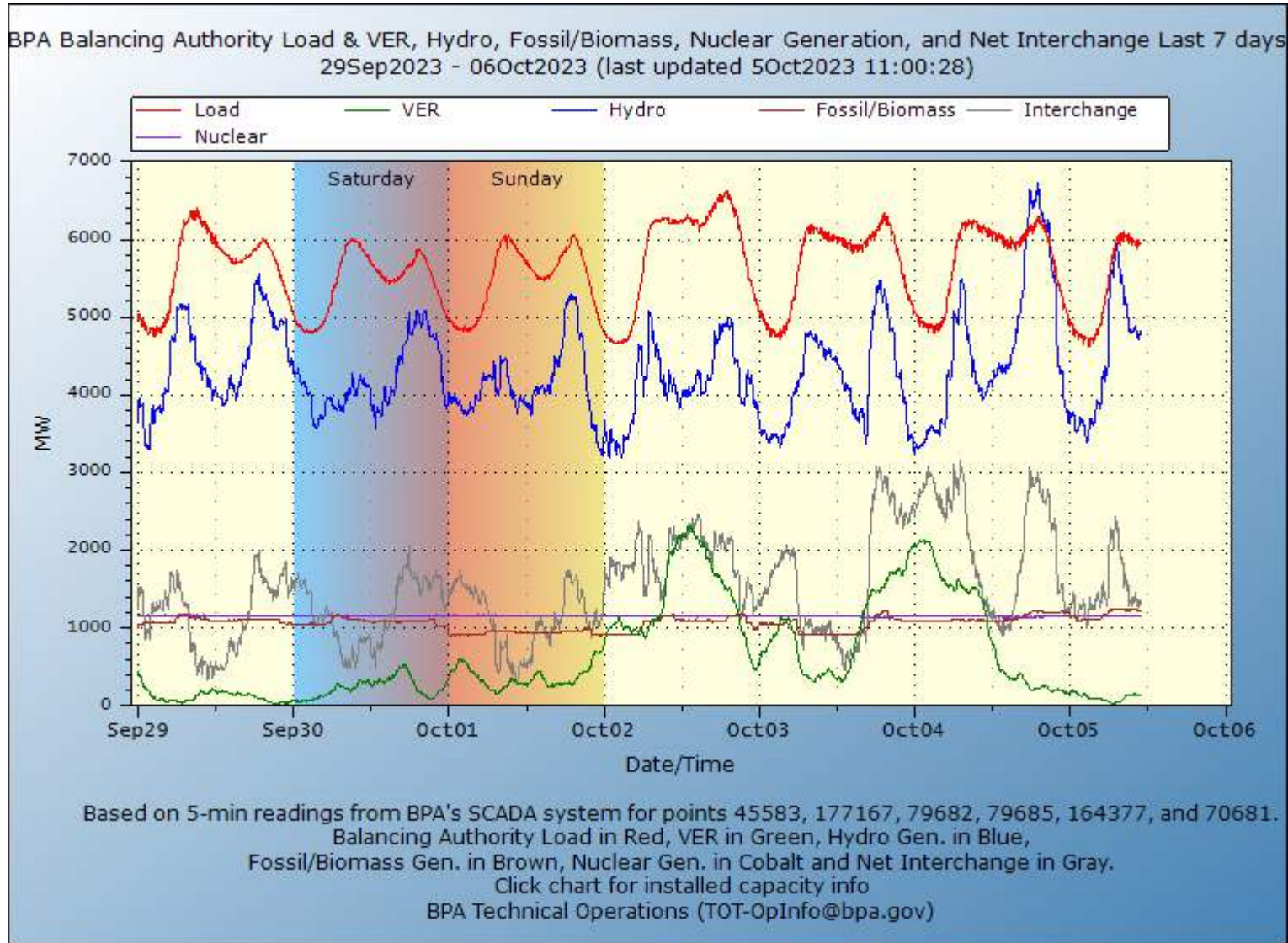


### Wind Generation Characteristics:

Hours/yr:	8,760
Total:	1,449,145kWh
Maximum:	1,500kW
Minimum:	0kW
Average:	166kW
Hours/year zero output:	3,505
Hours/yr > zero output:	5,255
Hours/yr < Average output:	3,133
kWh/kW :	966
Capacity Factor:	11%



## BPA Balancing Authority Load and Total VER, Hydro, Fossil/Biomass, Nuclear Generation, and Net Interchange, Near-Real-Time



In the renewable energy sector, a **dunkelflaute** (German: ['dʊŋkəlˌflaʊtə], lit. 'dark doldrums' or 'dark wind lull', plural dunkelflauten) is a period of time in which little or no energy can be generated with wind and solar power, because there is neither wind nor sunlight.

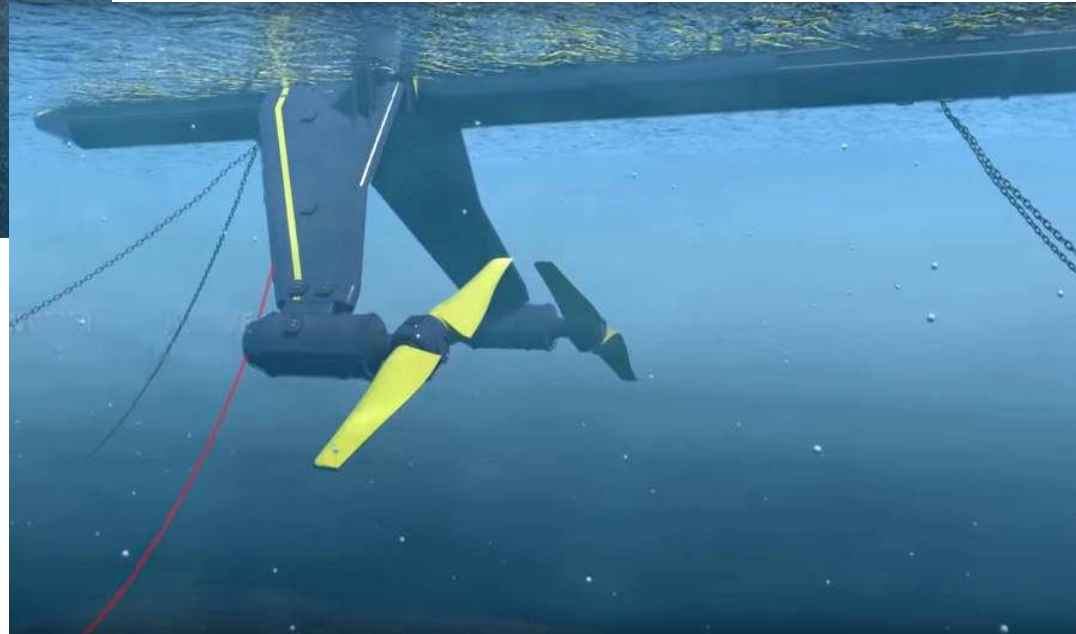
“Wind ZERO”

11/14/09-11/27/09	13 days
1/12/17-1/18/17	6 days
1/1/18-1/9/18	8 days
10/30/19-11/09/19	10 days

# Orbital Marine Power O2 floating Tidal Turbine



- 242- foot hull with suspended rotors
- Floating approximately 5 feet above the waterline and 7.5 feet below
- 2 MW unit maximum output @ 2.5m/s current
- Estimated annual production is anticipated to be 2.5GWh
- ~4x less short-term BESS required for firming vs solar
- NO long-term BESS required for cross seasonal firming



<https://www.orbitalmarine.com>

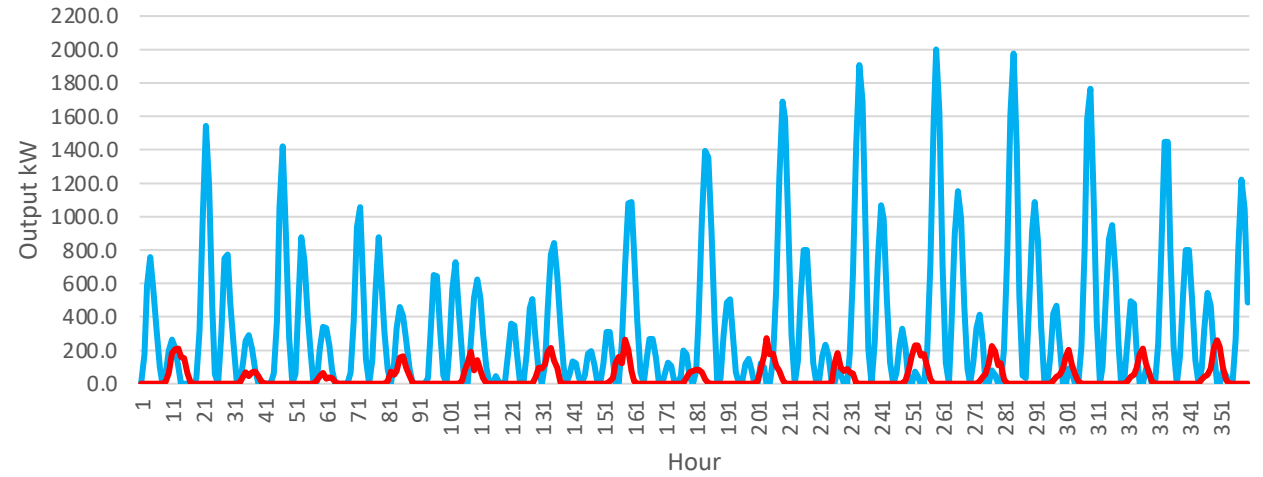
“PNNL is investigating the unique benefits of marine energy and quantifying its potential value to the grid.

As part of that project, the research team found that including marine energy in an energy portfolio can **decrease the need for solar and wind up to 50% all while requiring less battery storage.**”

[https://www.pnnl.gov/main/publications/external/technical\\_reports/pnnl-31123.pdf](https://www.pnnl.gov/main/publications/external/technical_reports/pnnl-31123.pdf)

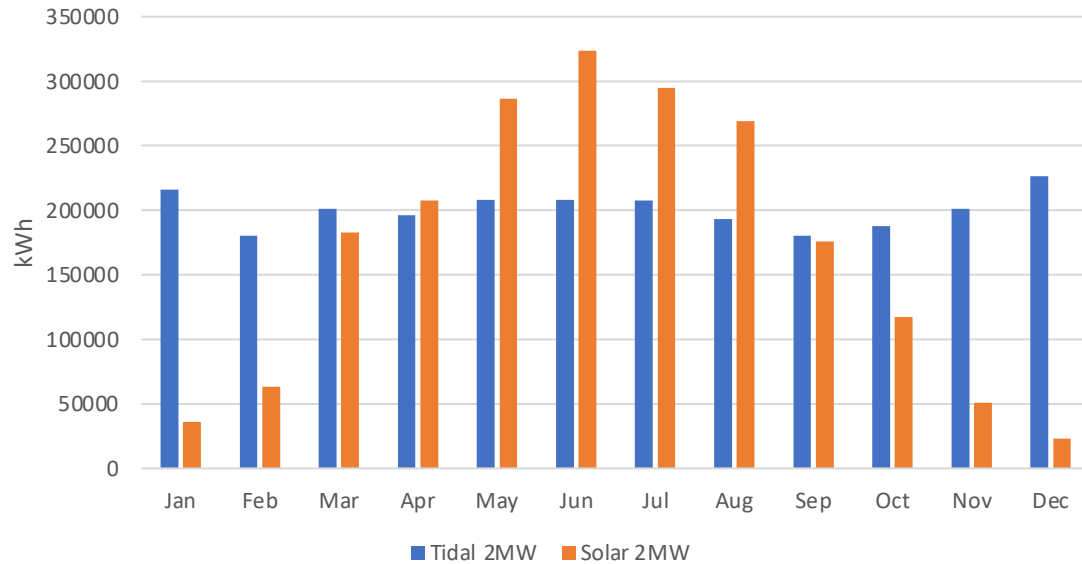


Tidal & Solar Output - kW Jan 1-15

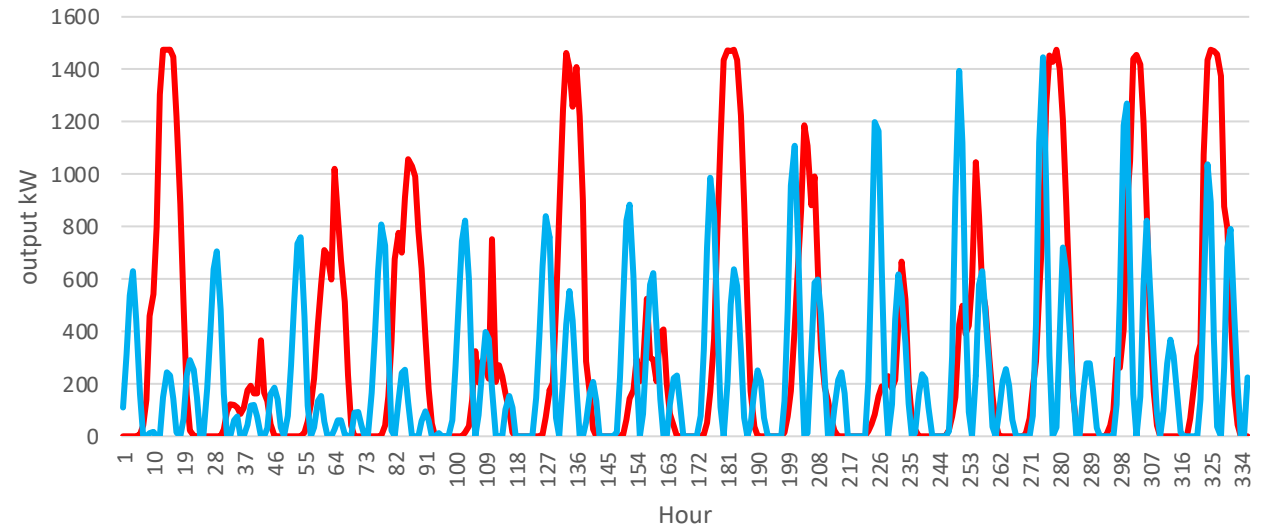


Tidal Solar

## 2MW Tidal vs 2MW Solar Monthly kWh output



Tidal & Solar Output - kW Jul 1- 15



Solar Tidal

# Decarbonizing Buildings - Heating

## San Juan County WA Residential Heating by Fuel Source

San Juan County, WA

Table B25117 American Community Survey 2020

5-year

	Lopez	Orcas.	San Juan.	Total	
<b>Renewable</b>					
Electricity	787	1643	2566	4996	
Solar	15	0	22	37	
<b>Total</b>	<b>802</b>	<b>1643</b>	<b>2588</b>	<b>5033</b>	<b>59.5%</b>
<b>Fossil</b>					
Utility gas	34	76	111	221	
Bottled, tank, or LP gas	257	492	705	1454	
Fuel oil, kerosene, etc.	154	65	72	291	
Coal or coke	0	0	0	0	
Wood	392	511	501	1404	
<b>Total</b>	<b>837</b>	<b>1144</b>	<b>1389</b>	<b>3370</b>	<b>39.8%</b>
<b>Other fuel</b>					
No fuel used	4	2	12	18	
<b>Total</b>	<b>16</b>	<b>16</b>	<b>24</b>	<b>56</b>	<b>0.7%</b>

~54,000 TCO<sub>2</sub>eq

## Ready to Switch It Up?

“Switch It Up is OPALCO’s on-bill financing program. Members can choose from a variety of efficiency projects to improve their home or business and finance the project on their OPALCO bill. Five or ten year terms are available with a 2% amortized interest rate (for projects under \$100,000).”

Project	2019	2020	2021	2022	2023	Grand Total
Appliance					12,132	\$ 12,132
Energy Storage				39,510		\$ 39,510
Ductless Heat Pump	648,252	611,617	641,765	1,553,247	989,390	\$ 4,444,272
Fiber		30,725	48,681	29,301	30,038	\$ 138,745
Ducted Heat Pump	8,119	30,000	15,000	18,127	546,682	\$ 617,928
Heat Pump Water Heater	13,985	9,805		5,012		\$ 28,802
Insulation				256,935	7,799	\$ 264,735
Other	14,543			90,649	2,245	\$ 107,437
Solar + Storage				302,520	138,161	\$ 440,681
Solar				1,541,688	1,302,235	\$ 2,843,923
Windows				563,557	62,272	\$ 625,829
<b>Grand Total</b>	<b>\$ 684,900</b>	<b>\$ 682,146</b>	<b>\$ 705,446</b>	<b>\$ 4,400,546</b>	<b>\$ 3,090,954</b>	<b>\$ 9,563,993</b>

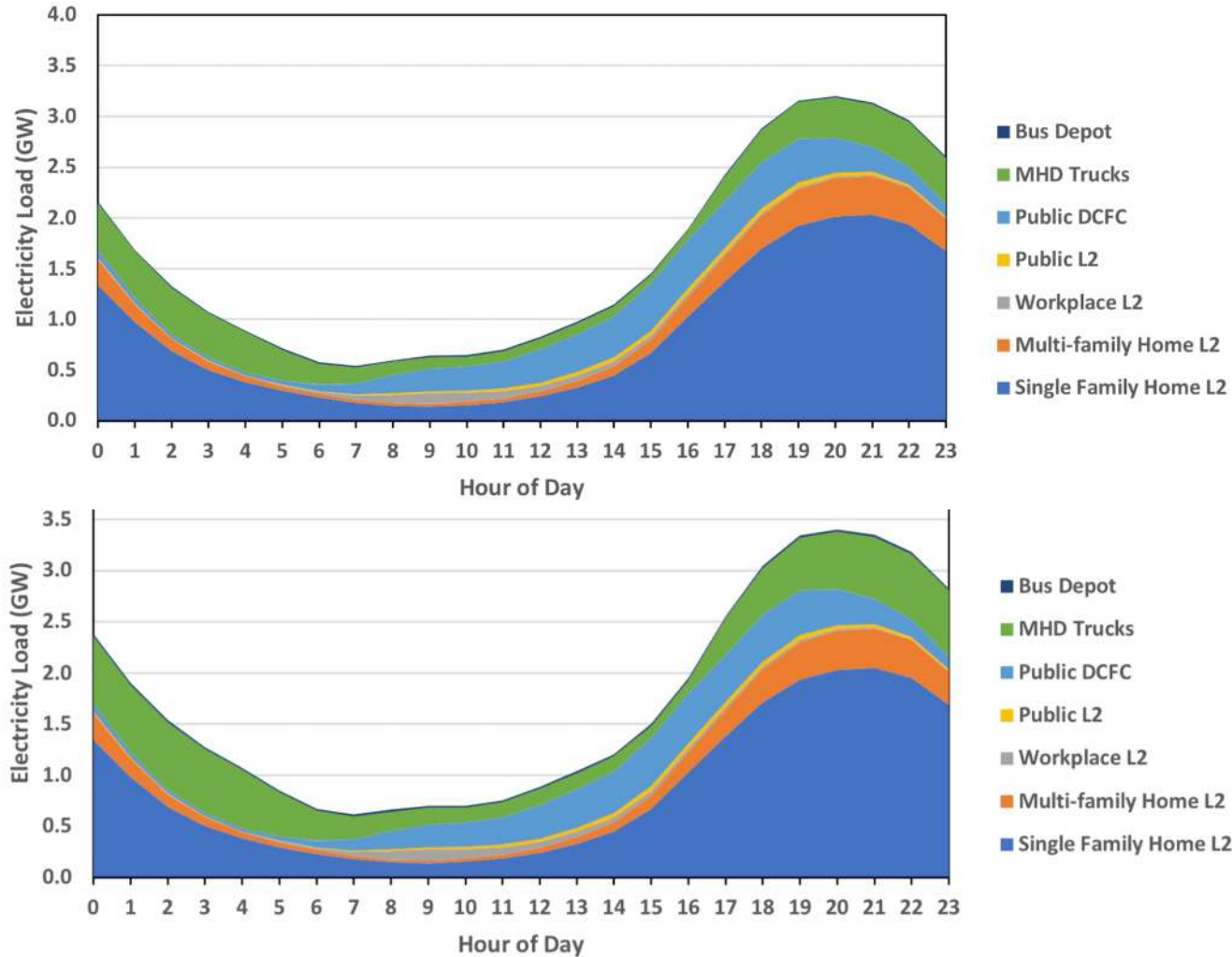
# What could Drive Future **Local** Load Increase? Decarbonization of Transportation and Buildings!

“Unofficial – Back of the spreadsheet estimate – YMMV!”

2021 Load		~238,000,000kWh
EV Charging	SJC Total Vehicles	22,000
	If 25% are EV's by 2032	5,500
	Additional load	<b>+6,875,000kWh</b>
“Switch It Up”	50% of 3,370 houses	<b>+25,200,000kWh</b>
WSF Ferry Electrification		<b>+79,000,000kWh</b>
Population Growth 0.5%/yr	+600 houses	<b>+7,200,000kWh</b>
Total Load Increase		<b>+118,275,000kWh</b> <b>+50%</b>

# Draft Washington State Transportation Electrification Report

FIGURE 31. STATEWIDE EV LOAD, 2035 BASELINE (TOP) AND STRONG ELECTRIFICATION POLICY (BOTTOM) SCENARIOS



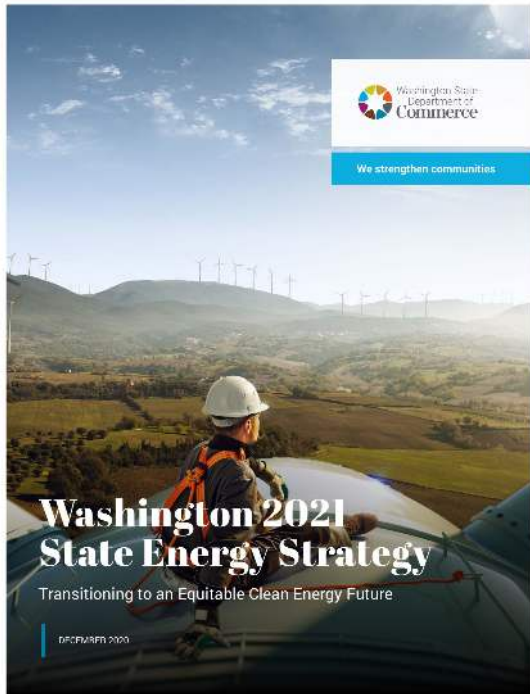
2021 WA State  
Nameplate Capacity  
30,609MW  
Net Generation 110TWh

Peak Additional 2035  
Load for EV Charging:

+3,500MW peak  
+15TWh annual load

+11% peak  
+14% annual load

# Big Picture – What needs to happen to meet GHG goals?



- 1) Transition Electric Grid to Low to Zero Carbon
  - a) Acquire large amount of new renewable generation
  - b) Find land to put it on
  - c) Build new Transmission Lines to move the power
  - d) Acquire large amount of ESS (Energy Storage Systems)
  - e) Improve siting and permitting process!
  - f) Integrate large amounts of DER's (Distributed Energy Systems)
  - g) Create an RTO (Regional Transmission Organization) in the PNW to coordinate energy production, transmission, and markets
  
- 2) Electrification of Transportation (39% GHG)
  - a) Transportation Electrification Strategy  
<https://www.commerce.wa.gov/growing-the-economy/energy/clean-transportation/ev-coordinating-council/transportation-electrification-strategy>
  
- 3) Electrification of Buildings (25% GHG)
  - a) <https://www.commerce.wa.gov/growing-the-economy/energy/clean-energy-fund/building-electrification-grant/#:~:text=The%20Building%20Electrification%20Program%20provides,the%20path%20to%20zero%2Denergy.>





Eastsound, Washington

2020 – 2040

Integrated Resource Plan

OPALCO's Vision for the Next 20 Years

## Executive Summary

- Continue to meet the energy needs of the members
- Support San Juan County's GHG reduction and Climate resiliency goals
- Achieve SJC Comprehensive Plan objectives
  - Incentivize conservation and efficiency
  - Increase local renewable generation for resiliency, and as a buffer to market volatility!
  - Improve grid for reliability, and to integrate increasing amounts of VER's
  - adopt new technology and operating procedures when appropriate

<https://www.opalco.com/wp-content/uploads/2019/11/OPALCO-2020-2040-IRP-R16.pdf>

<https://www.opalco.com/?s=quick+facts>

## What else is there?

“I have made this ~~letter~~ longer than usual because I have not had time to make it shorter.”  
presentation

17th century French mathematician and philosopher Blaise Pascal

- Technology advancements
  - battery chemistry
  - other long term storage technologies
- PNW Geothermal potential
- Widespread adoption of residential demand response
- Cybersecurity
- AI, Software (SMOP!)
- PNW and WECC market structure
- Funding??
- Sociopolitical implications

Thank You...“many hands make light work”

- To all the people at OPALCO!
- FHL and The Madrona Institute
- Senator Lovelett
- WA State Dept's of Commerce, Transportation, Ecology, and DNR
- SJC Council, Commissions and Committees
- the Citizens of San Juan County

Questions... 