



PRESENTED AT
BioCycle REFOR17
57TH ANNUAL CONFERENCE
RENEWABLE ENERGY FROM ORGANICS RECYCLING
October 16-19, 2017 • Portland, OR
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A Biomethane-RNG Roadmap for Washington State

BioCycle REFOR17

Portland, OR, October 17, 2017



Energy Program

WASHINGTON STATE UNIVERSITY

www.energy.wsu.edu

The Natural Gas Debate



Dan Kirschner - Executive director of the Northwest Gas Association



Bill McKibben - Founder of the global climate campaign 350.org

The power of natural gas in the war on carbon emissions

Natural gas makes possible the renewable power we care so deeply about. Natural-gas vehicles and renewable natural gas present our region with terrific opportunities.

Switching from coal to natural gas will not save our planet

Natural gas is not reducing the amount of greenhouse-gas emissions. And worse, it's making it much harder to take the steps that really would matter.

Travel Plan

- Destination
- Current location
- Lay of the land
- Let's get moving
- Obstacles
- Roadside assistance
- Safe arrival

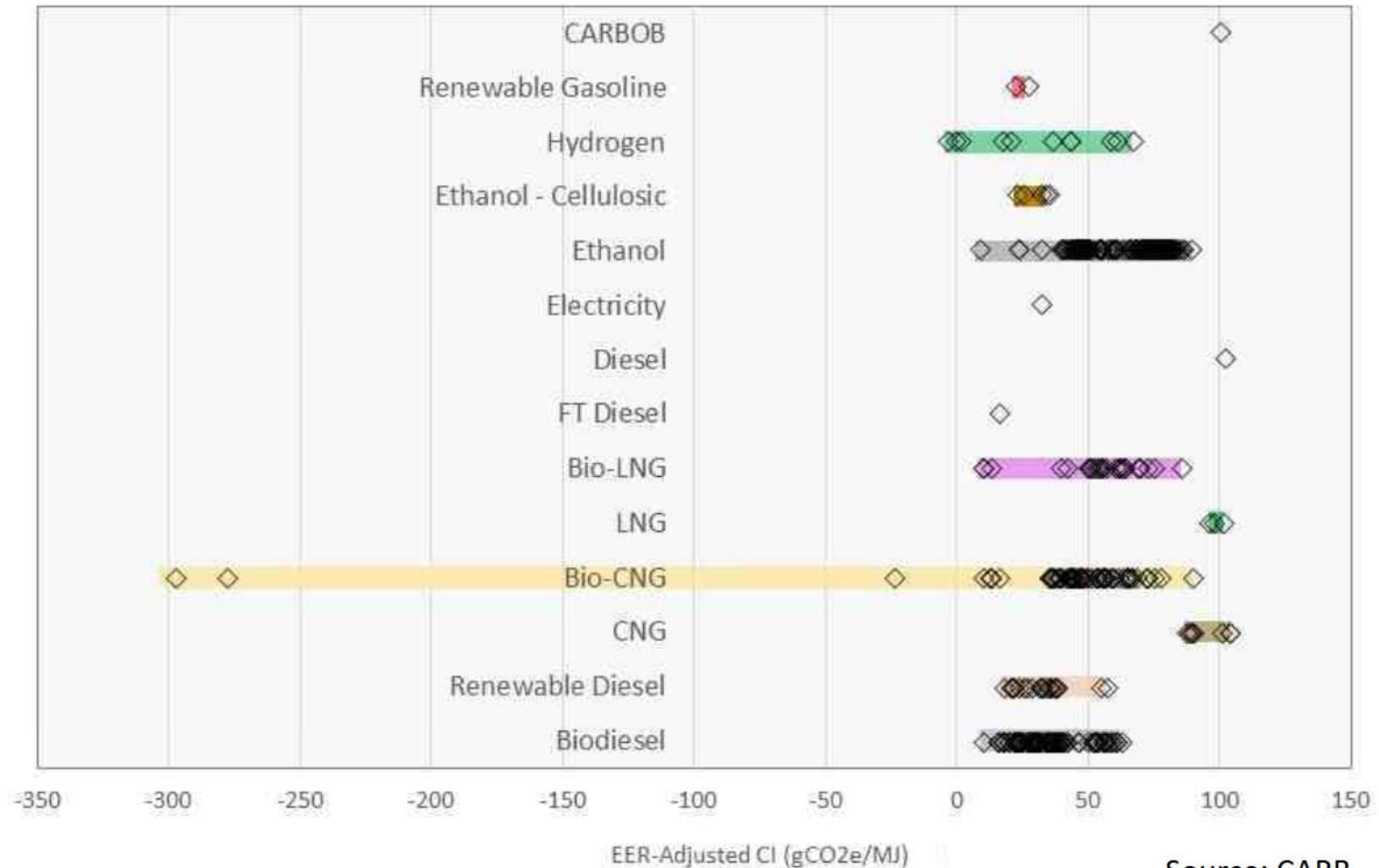


Destination

1. GHG limits set by 2008 Legislature:
 - 2020—reduce to 1990 levels
 - 2035—25% below 1990 levels (40%)
 - 2050—50% below 1990 levels (80%)
2. Gov. Inslee's agenda priorities: building energy efficiency, renewables integration, resiliency, natural gas policy
3. Pacific Coast Collaborative (WA, OR, CA & BC)

GHG Reduction Potential from RNG

Carbon Intensity Values of Current Certified Pathways (2017)



Source: CARB

Landfills



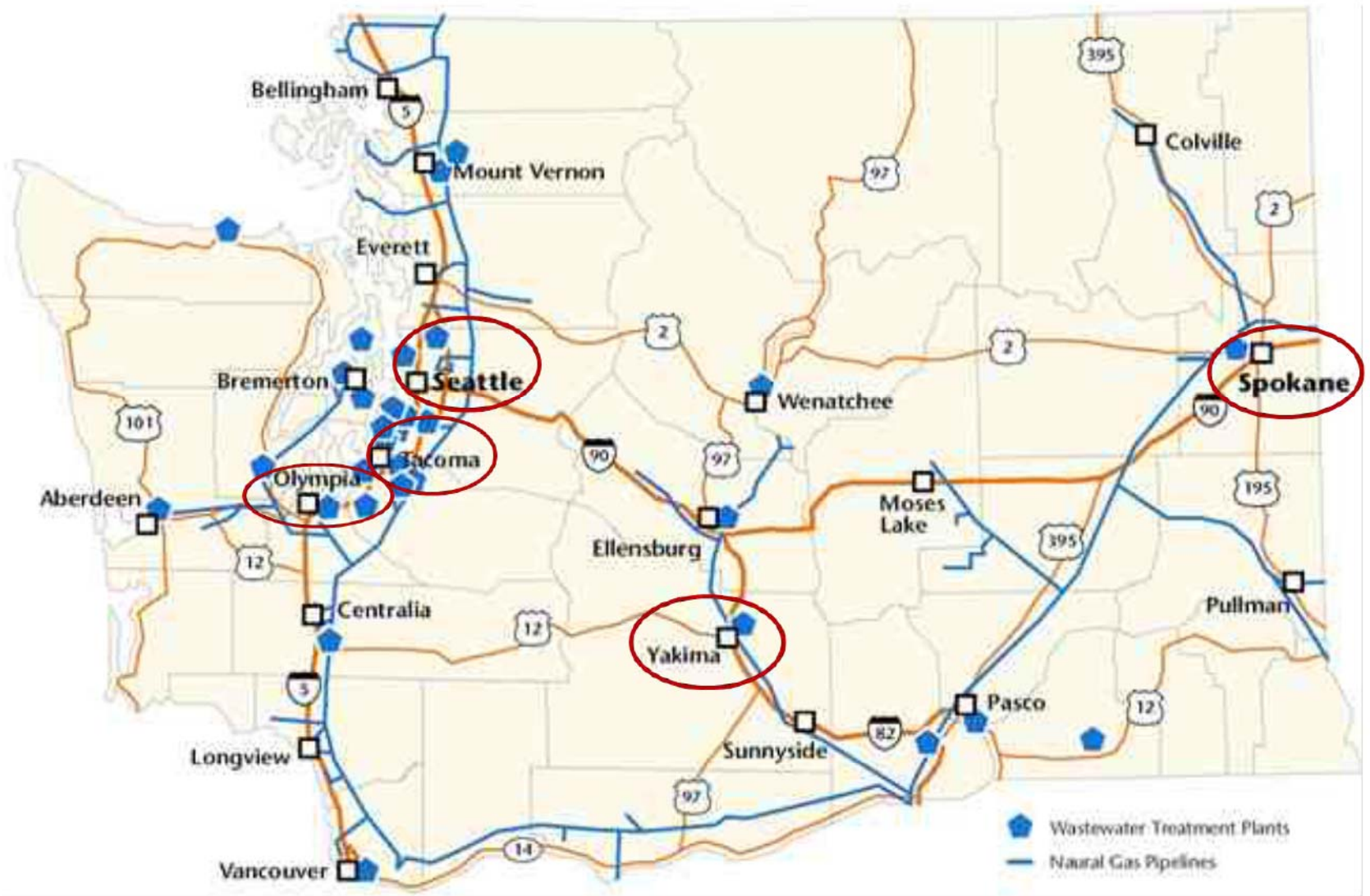
Landfills



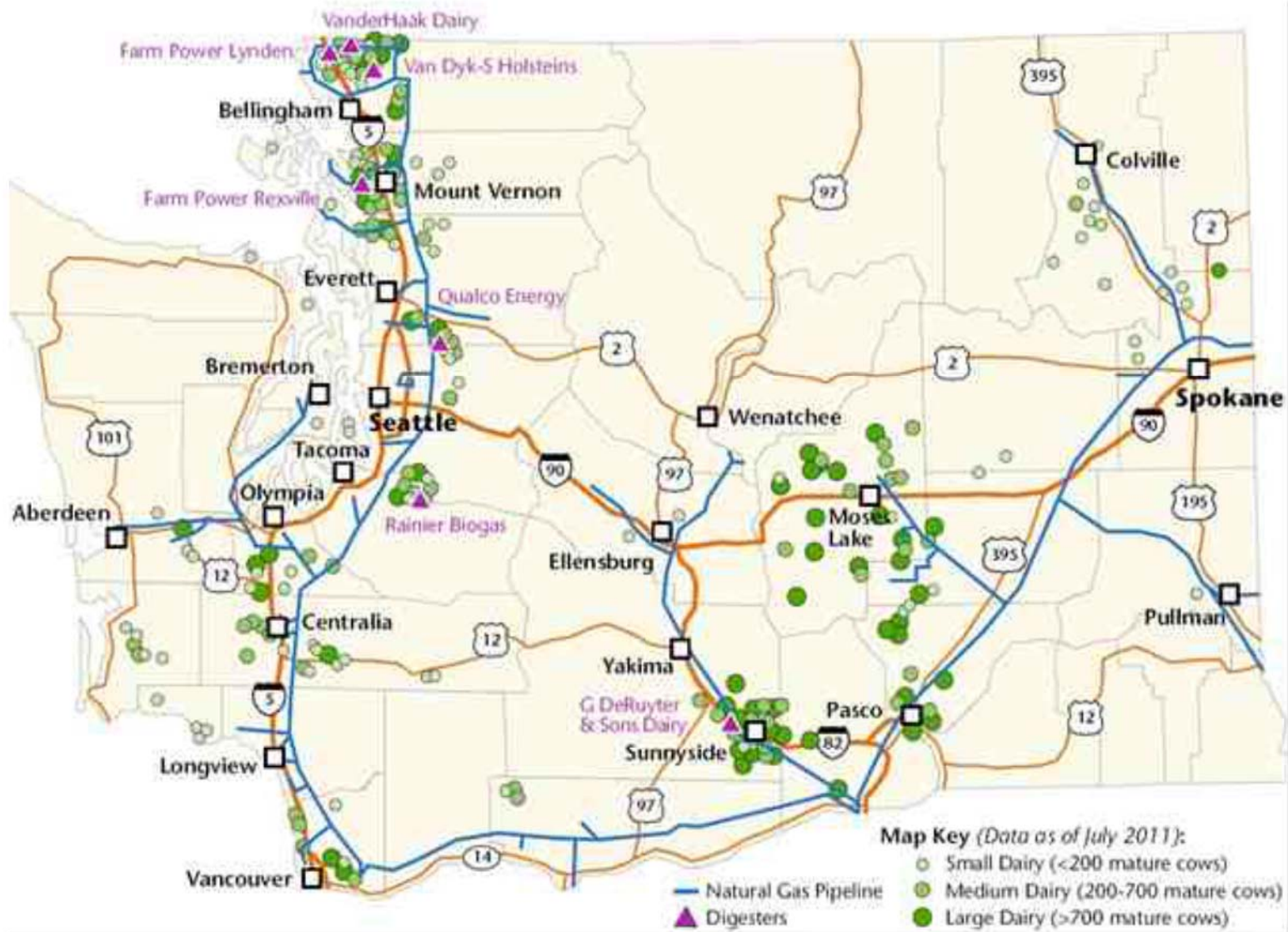
Wastewater Treatment



Wastewater Treatment



Agriculture (Dairy)



Industrial Food Waste

- Food processing is the second largest user of electricity in the Northwest.
- Energy generation and fossil fuel use account for vast majority of GHG emissions.
- Successful projects at AgriBeef and JR Simplot provide internal energy offsets.

MSW

Successful Projects

- JC Biomethane
Junction City, OR
- Harvest Power
Vancouver, BC
- (Biofuel Facility)
Surrey, BC

None in Washington

Stalled Projects

- Cedar Grove
Everett, WA
- PacifiClean
Cle Elum, WA
- Columbia Biogas
Portland, OR

Regulations, finance, and
NIMBY opposition

Thermal Gasification

- Competition for woody materials from biojet fuel, biomass CHP for industry, etc.
- We started by quantifying RNG from urban/MSW woody materials.
- In BC analysis, gasification of forestry debris nearly doubled the volume of RNG.

Current Position

| RNG source | Potential Energy (MMBTU/yr) | Electricity (MWh/yr) | Fuel (DGE/yr) |
|---|-----------------------------|----------------------|---------------|
| Landfills | 16,519,219 | 1,191,842 | 119,963,224 |
| Wastewater treatment plants | 1,716,062 | 145,807 | 12,217,767 |
| Private sector biogas: agriculture, food industries | 1,399,410 | 80,000 | 8,000,000 |
| Municipal solid waste | 3,298,890 | 366,543 | 25,182,365 |
| Thermal gasification (fiber) | 8,270,925 | 918,992 | 63,136,834 |

2011, 2013, 2017 state data

DRAFT

Natural Gas & RNG

1,988 trillion BTU
energy consumption (2015)

308 trillion BTU
nat gas consumption (2015)
(308 million cubic feet)
(15.5% of all energy)

20-30 trillion BTU
est RNG production
(6.5-10% of nat gas)

285 million BTU estimated
per capita consumption

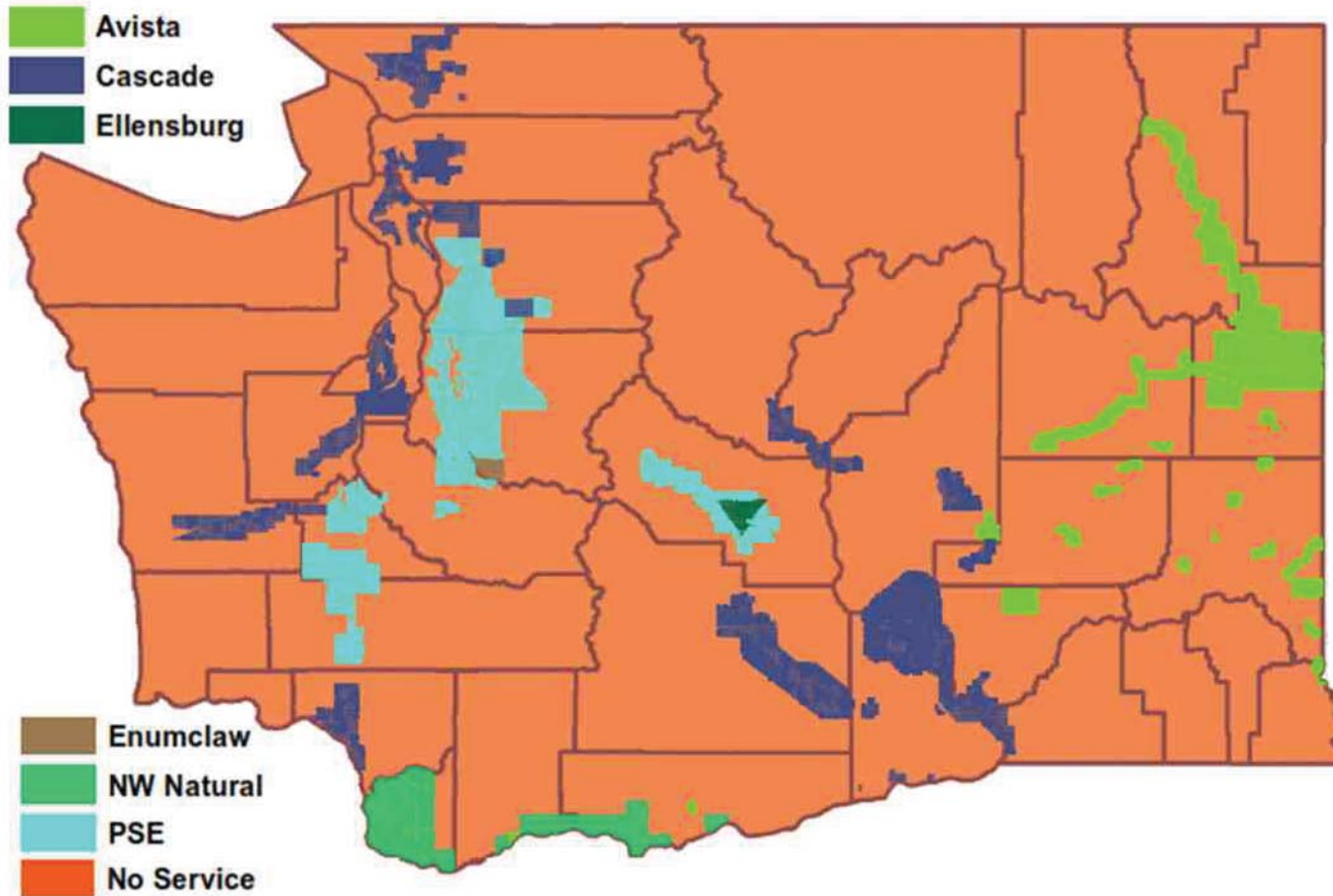
\$21,798 million = Total
energy expenditures (2014)

\$3,653 = Total energy
expenditures per capita
(2014)

265 million cubic feet, or
265 trillion BTU (2011 est.)

Lay of the Land

(Natural Gas Market in Washington)



Western Gas Pipeline Grid



Williams (Northwest)

Pipeline supplies natural gas from Canada, from the Rocky Mountain region, and from the San Juan Basin in the U.S. Southwest.

Gas Transmission Northwest Pipeline enters the state from Idaho, bringing natural gas, primarily from Canada.

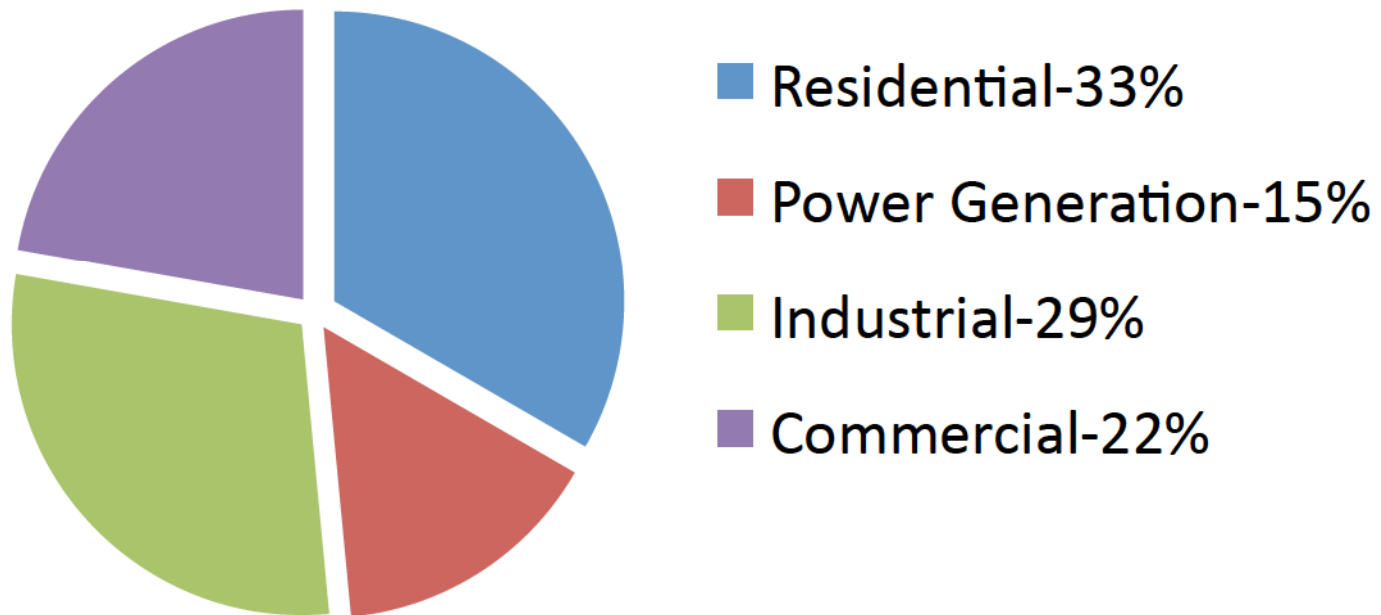
Washington Gas Pipeline Grid



Natural Gas Utilities

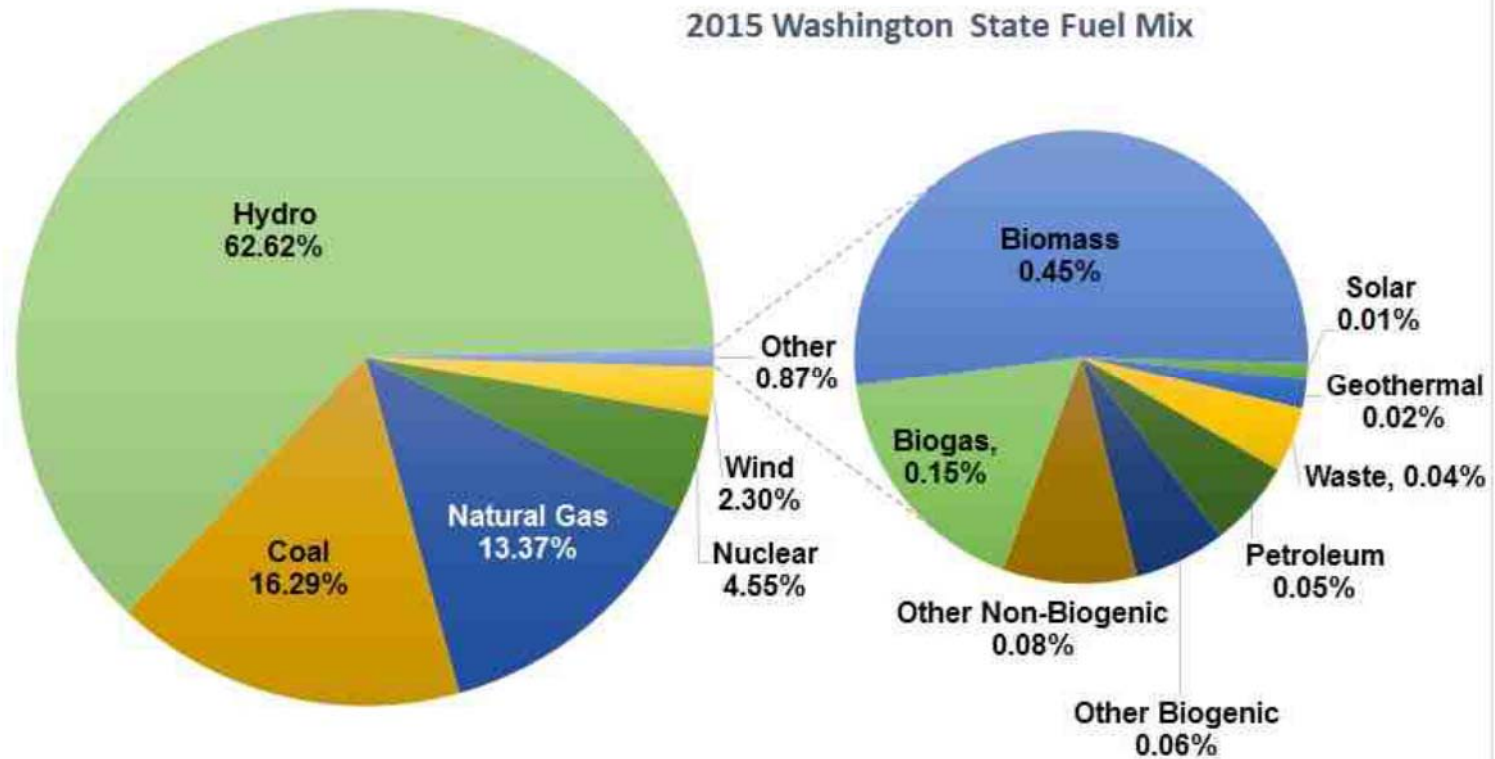
| Utility | Gas Customers | Territory |
|---|---------------|--|
| Puget Sound Energy Bellevue, WA | 790,000 | Central Puget Sound region |
| Avista Corp. Spokane, WA | 300,000 | Eastern Washington and northern Idaho |
| Cascade Natural Gas Kennewick, WA | 282,000 | Scattered among NW, central and southern Washington counties |
| Northwest Natural Gas Co. Portland, OR | 650,000 | Western Oregon and southwest Washington |

Natural Gas Use



Source: EIA, 2011

Natural Gas for Power



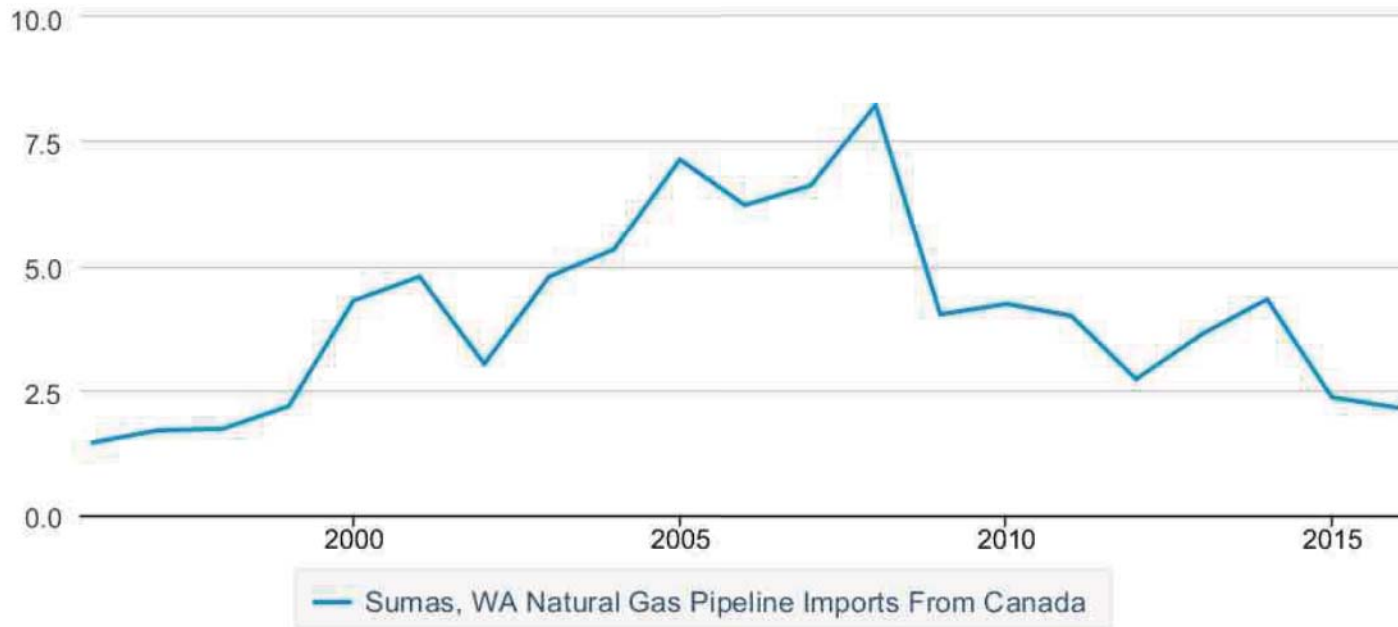
Source: Dept of Commerce Fuel Mix Disclosure, 2015.

Additional sources: Energy Information Administration, State Energy Data System

Natural gas price trends

Sumas, WA Natural Gas Pipeline Imports From Canada

Dollars per Thousand Cubic Feet



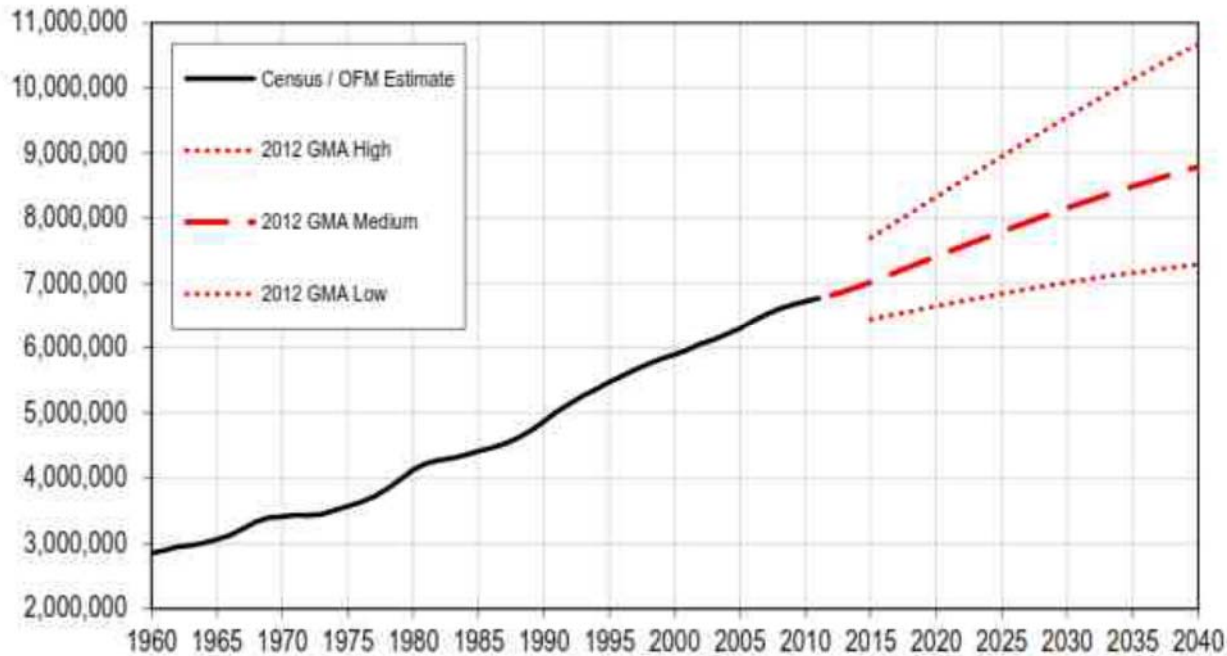
Residential: \$10.26 /1000 cf (2017) -- City Gate: NA /1000 cf (2017)

Residential: \$13.02 /1000 cf (2013) -- City Gate: \$5.86 /1000 cf (2013)

Source: Energy Information Administration, State Energy Data System

Projected population growth

Washington State



Washington State population (OFM, April 2016) = **7,183,700**
Population growth curves shown in the table below.

Source: Office of Financial Management, 2012. *County Growth Management Population Projections by Age and Sex: 2010-2040* http://www.ofm.wa.gov/pop/gma/projections12/GMA_2012_county_pop_projections.pdf

Where are the Keys?

- Location, location, location
- Interstate interconnection
- Monetize environmental benefits (transportation & California links)
- Co-products
- Private finance
- State and local support



We're on the Move



Landfills



WWTPs



Private



MSW

Road Hazards



1. Limited pipeline infrastructure
2. RNG quality standards for pipeline gas
3. Scattered RNG sources
4. Price trends
5. Insufficient incentives

Roadside Assistance



Federal



State



Local



Research

State Policy Options

- Carbon pricing on GHG emissions
- RNG portfolio standard for gas utilities
- Clean fuel standard
- Utility regulation (interconnection standards, net metering, standard offers)
- Environmental and waste regulations
- Streamline permitting for new facilities
- Purchasing contracts and preferences, including state highways and fleets
- Financial assistance/incentives (Clean Energy Fund, property tax deferral, sales tax exemptions, etc.)

Coordinated Efforts

POLICY – state and local governments

BENEFITS – economic, environmental, social

FINANCE – public and private



Thank You

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