

# OUR LOW-CARBON PATHWAY

December, 2017

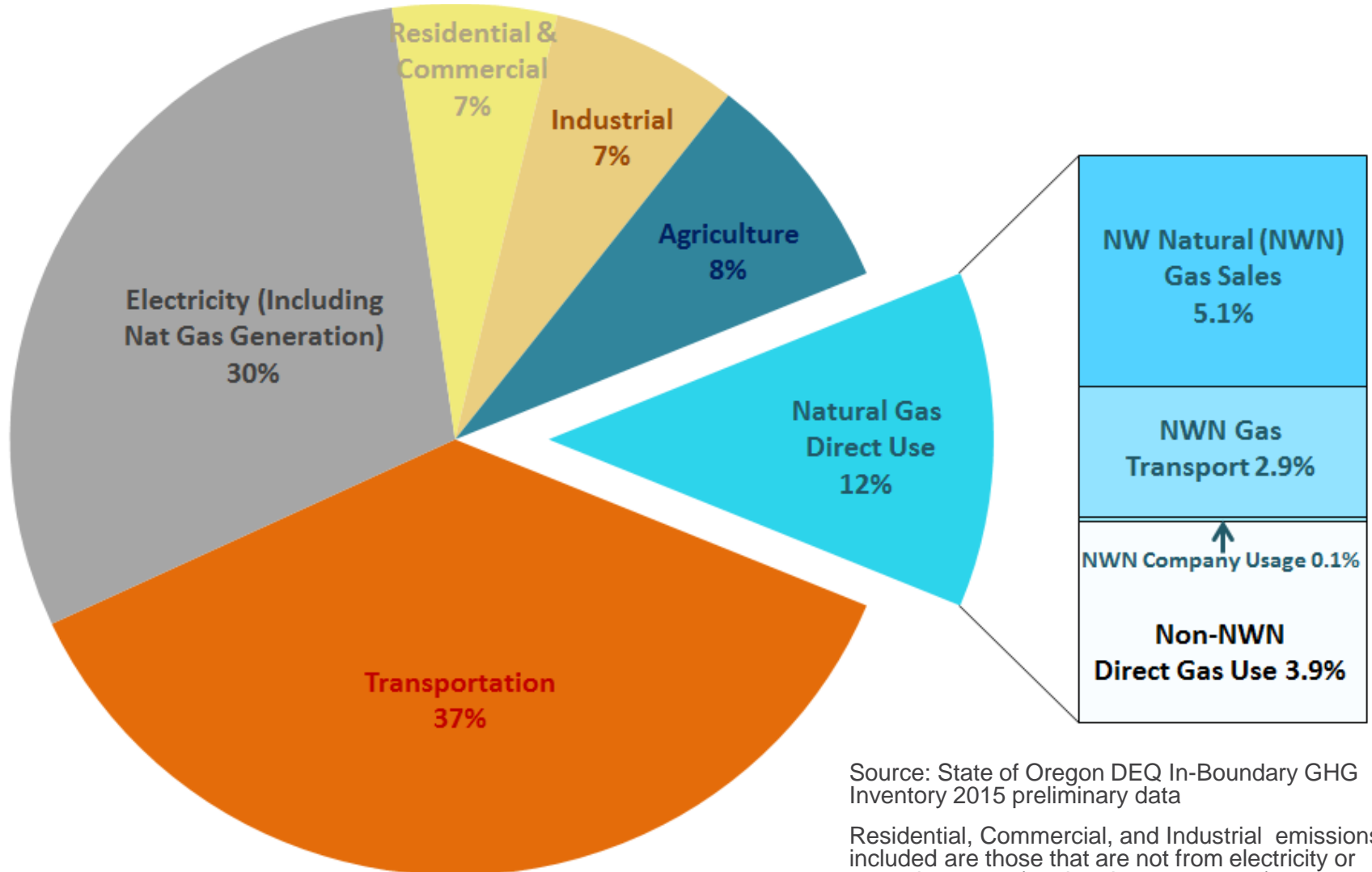


# IS THE DIRECT USE OF NATURAL GAS IMPORTANT?

Modest contributor to state emissions,  
but a critical resource for heating.



# DIRECT USE NATURAL GAS: 12% OF OREGON'S GHG EMISSIONS

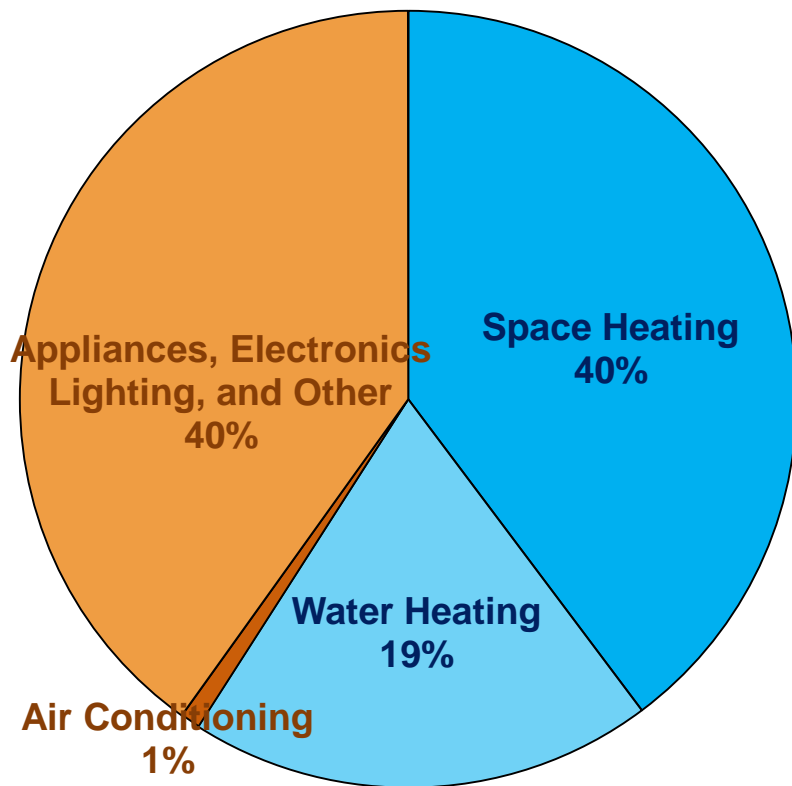


Source: State of Oregon DEQ In-Boundary GHG Inventory 2015 preliminary data

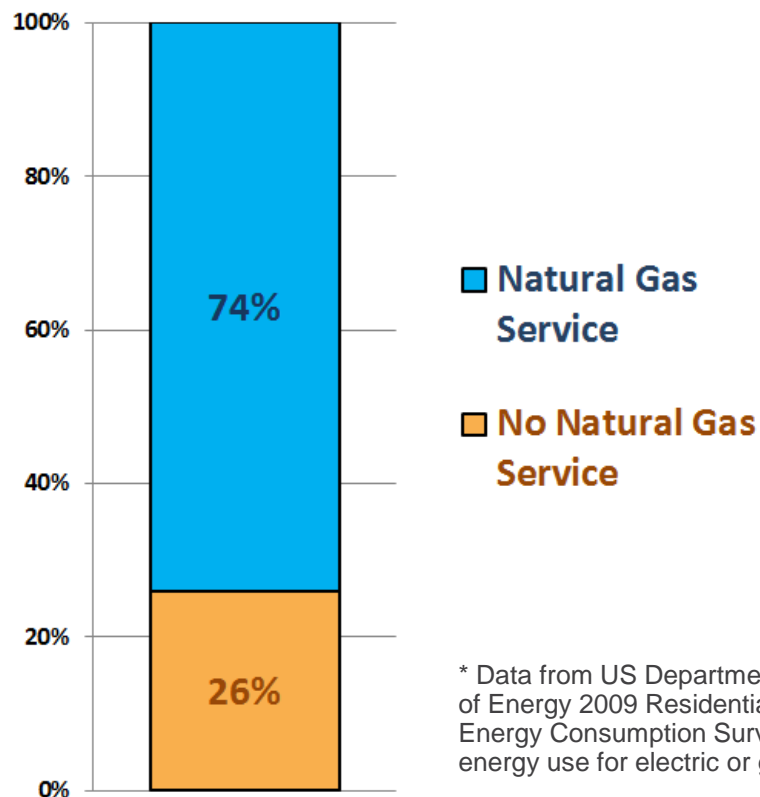
Residential, Commercial, and Industrial emissions included are those that are not from electricity or natural gas use (trash, other waste, etc.).

# RESIDENTIAL ENERGY USE IN THE PORTLAND AREA

Pacific Northwest Residential Annual Energy Use\*



Share of Residential Square Footage in NWN Service Area with Natural Gas Service\*\*



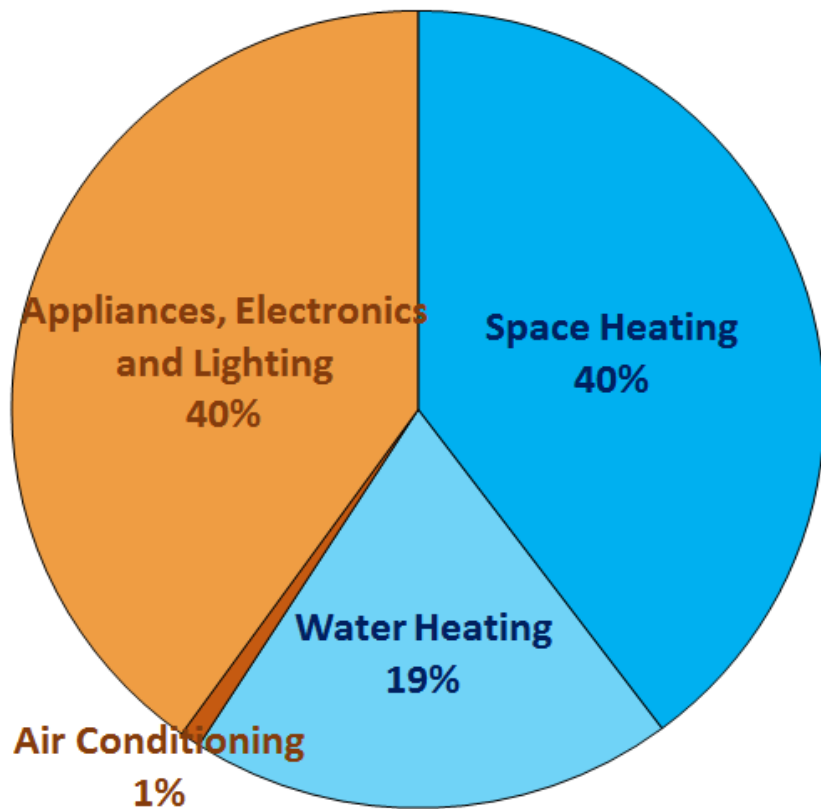
\* Data from US Department of Energy 2009 Residential Energy Consumption Survey; energy use for electric or gas.

\*\*Data from 2014 Residential Sites Database; Residences on or near NW Natural main service

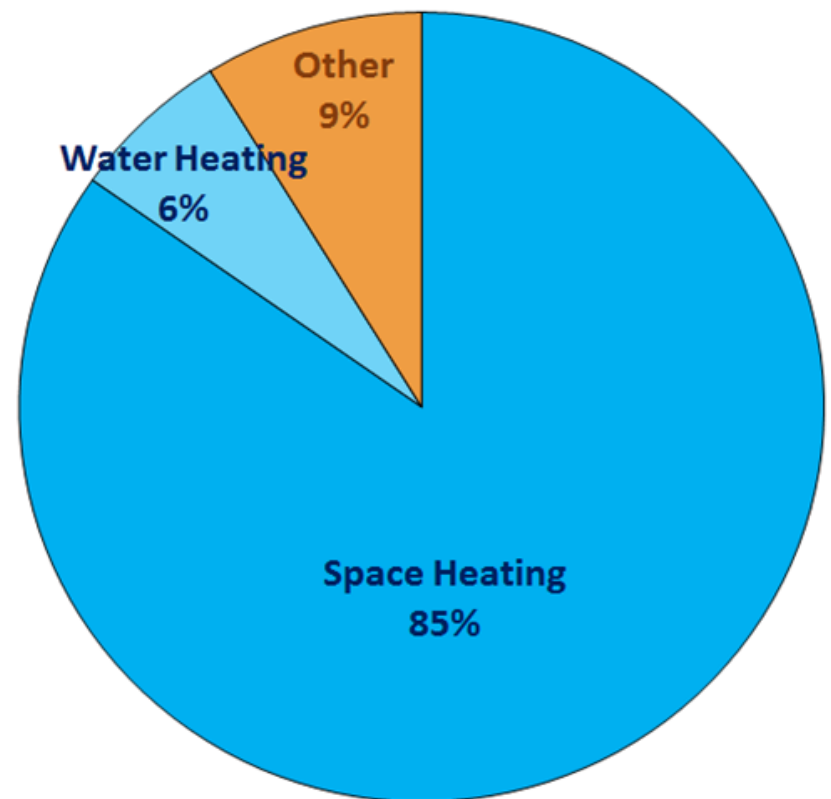
# PORTLAND ENERGY USE: DRIVEN BY SPACE AND WATER HEATING

PNW Household Usage: Annual vs. Peak Hour

Annual Usage



Winter Peak Hour Usage\*\*



\*\*Based on kWh usage of a home with a 9.0 HSPF heat pump and standard electric water heater for the 7am hour in the winter with a temperature of 7°F.

# DIRECT USE TAKEAWAYS

NW Natural's system is a highly efficient way to serve winter peak energy needs.

- **Heats 74%** of residential square footage in the areas we serve
- **Provides 90%** of peak day energy needs for our residential space and water heat customers
- **Serves 60%** of total peak hour energy use of buildings in the areas we serve
- **NW Natural's emissions account for 8%** of state's total carbon emissions

**For perspective; to serve the current gas peak load with electricity, the Northwest's winter peak electric load would roughly double (increase by ~25GW).**

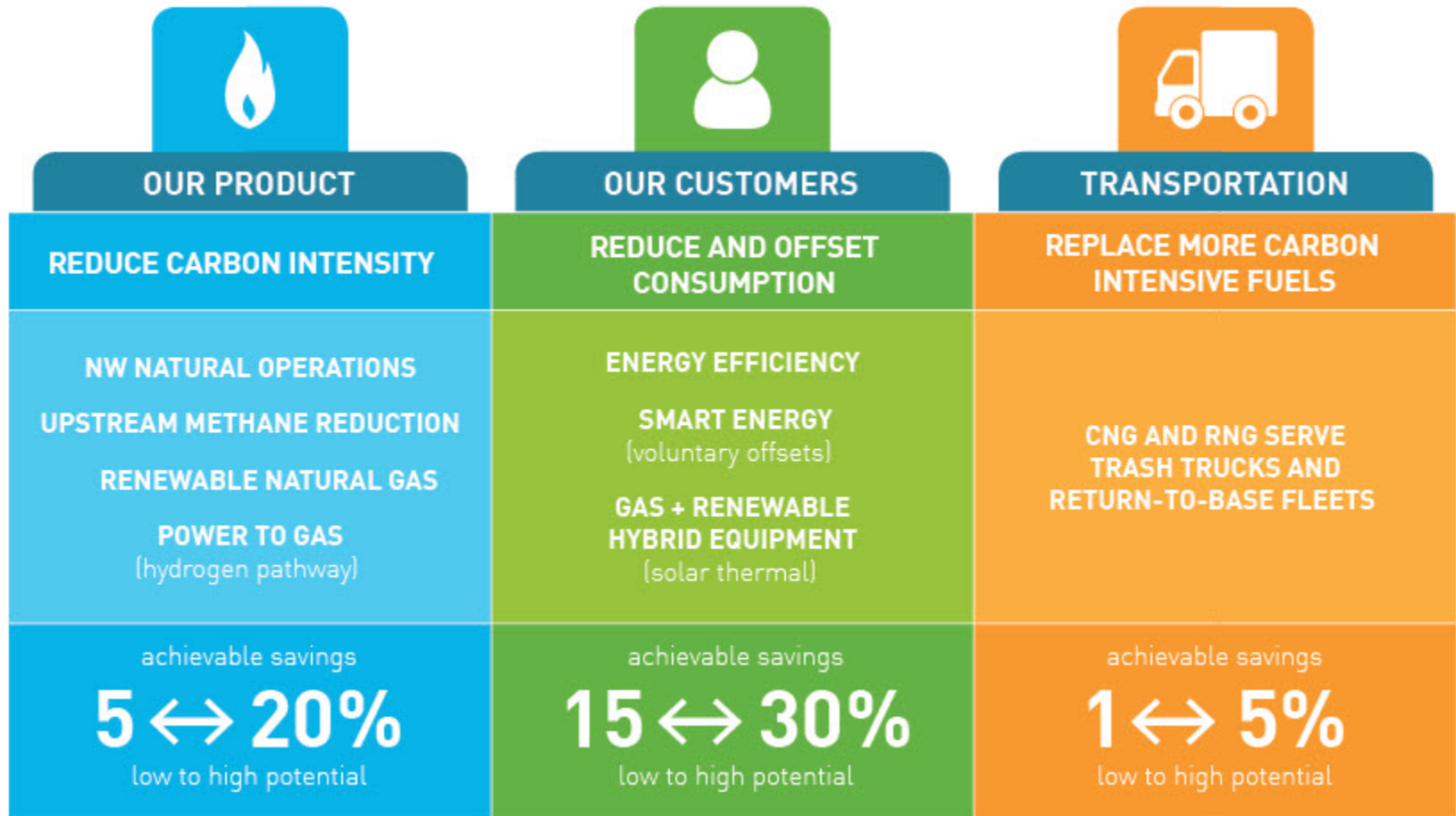
- Assumes comprehensive adoption of high efficiency heat pumps for space and water heating.
- Assuming adoption of today's commonly purchased heat pumps, the electric winter peak load would roughly triple (increase by ~50GW).

# WHERE ARE THE OPPORTUNITIES?

Substantial savings can be realized when we look at the entire natural gas value chain.



# OUR LOW-CARBON PATHWAY

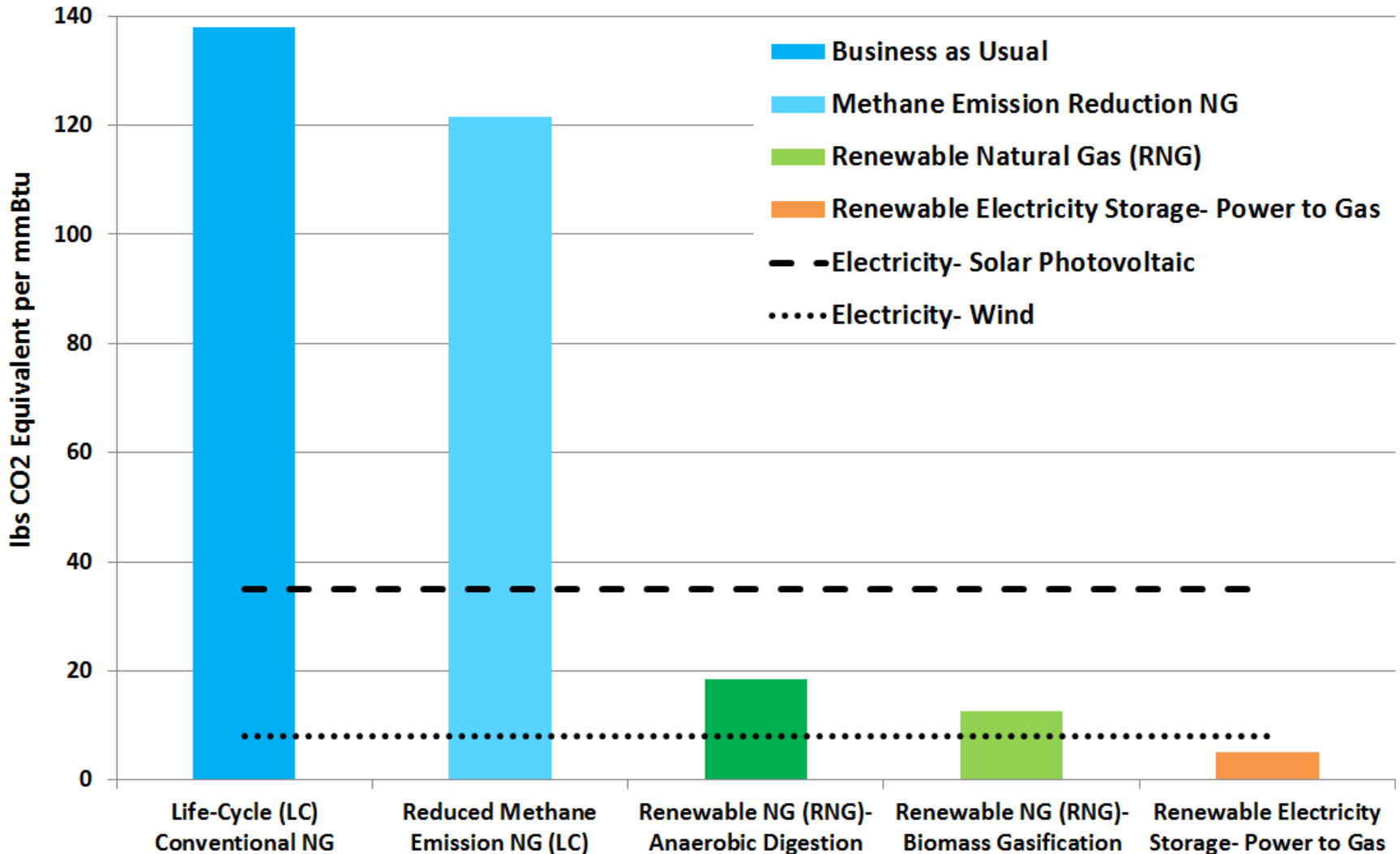




# LOWER EMITTING GAS



Relative Life-Cycle (LC) Natural Gas Carbon Intensities



# OREGON RENEWABLE NATURAL GAS POTENTIAL



ESTIMATED ANNUAL TECHNICAL POTENTIAL

**15 -17 Bcf** = Up to **25%** of Sales Throughput

Our Goal: **10%**



## ANAEROBIC DIGESTION

(wet process)

Anaerobic digestion of organic materials

FOOD WASTE  
WASTE WATER  
ANIMAL WASTE  
LANDFILLS



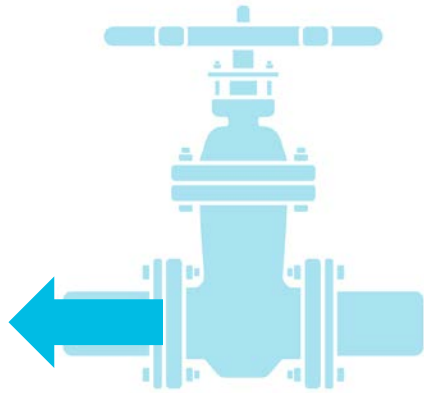
## BIOMASS GASIFICATION

(dry process)

High heat and pressure process used to extract gas

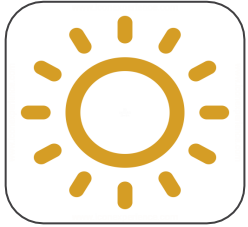
WOODY PLANTS  
PINE NEEDLES  
LEAVES  
TREE LIMBS

# REDUCE UPSTREAM METHANE



- Nationally 1.4% of methane is emitted from the full natural gas value chain - wellhead to burner tip.
- Distribution systems estimated at 0.1%.
- To reduce emissions from conventional gas, the largest opportunity is in the production sector.
- NW Natural partnered with NRDC to identify best practices that can reduce methane during production by up to 30%.
- We are working on a pilot project for stakeholder consideration to implement these practices.

# POWER TO GAS (P2G)



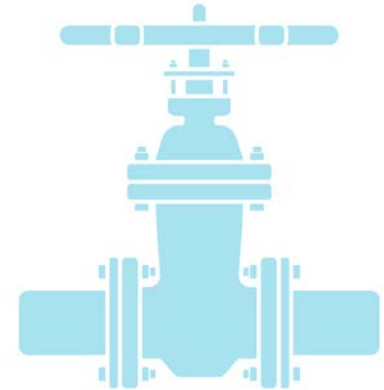
EXCESS  
RENEWABLE  
GENERATION



ELECTROLYSIS



H<sub>2</sub>



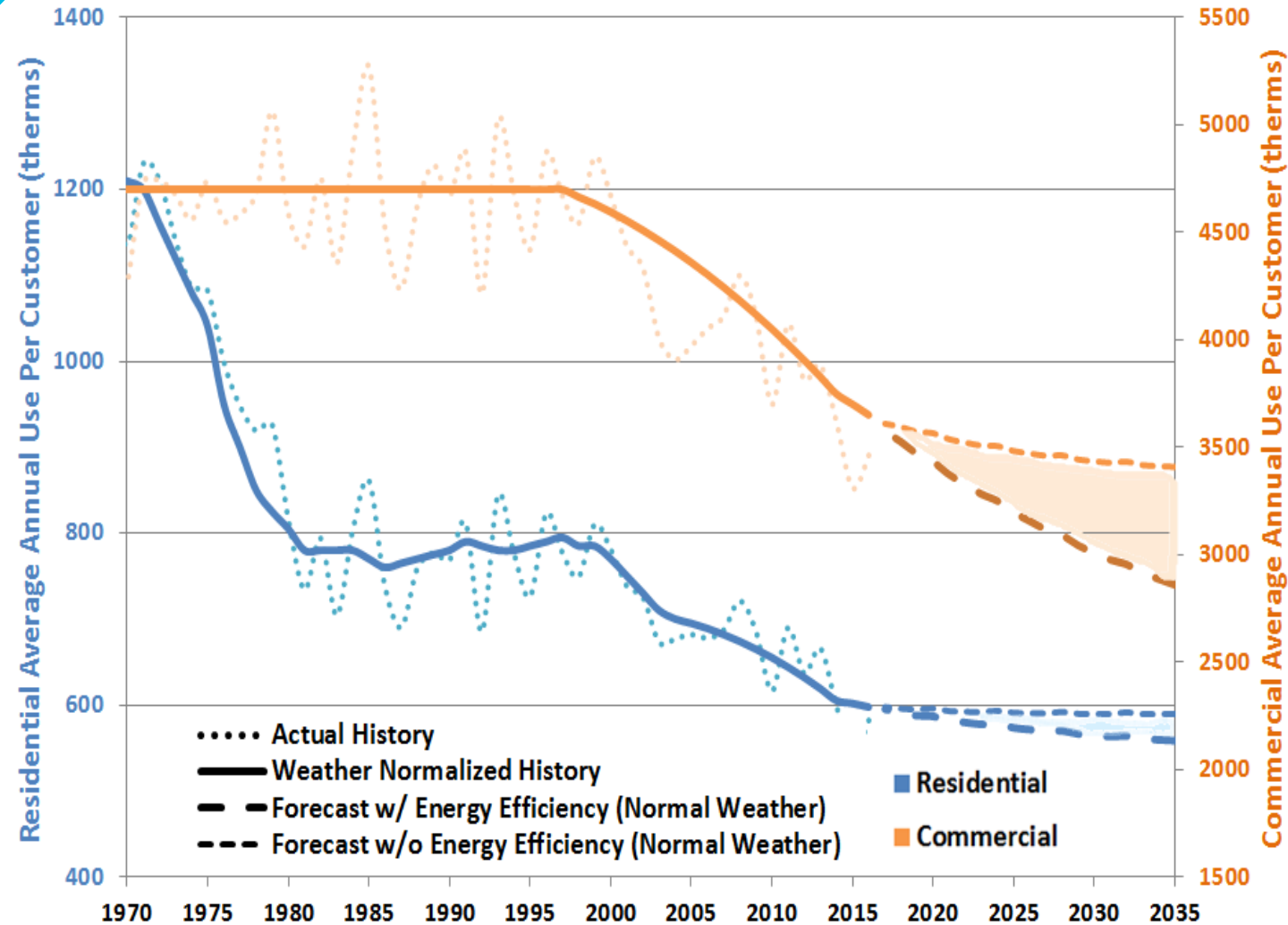
RENEWABLE  
STORAGE ON  
DISTRIBUTION  
SYSTEM



## Viable Seasonal Renewable Storage Solution

- Create hydrogen and blend up to 15% into the natural gas pipeline system without any impacts on end-use equipment, as we work toward 100% hydrogen utilization.

# ENERGY EFFICIENCY



By 2035, if the goal is achieved, Energy Trust gas efficiency programs are projected to save enough energy to heat 230,000 homes annually, which is about the same number of new homes Oregon expects to add over the next decade.

# TRANSPORTATION



Near Zero Emission (NZE) Natural Gas Vehicles (NGVs):  
Cleanest available technology for heavy duty applications.

- Transportation is the largest contributor to emissions and growing.
- In Oregon, nearly 50% of NOx emissions (air pollution) in the transportation sector come from heavy duty vehicles.
- Heavy duty vehicles account for the bulk of transportation emissions and air quality impacts.
- There are limited electric alternatives for heavy-duty use.
- New NGVs emit 90% less smog-forming pollutants than the cleanest diesel.
- NGV's deliver about a 20% reduction in carbon emissions
- Allows for drop-in renewable natural gas - provides for 80% or more reduction in GHGs.

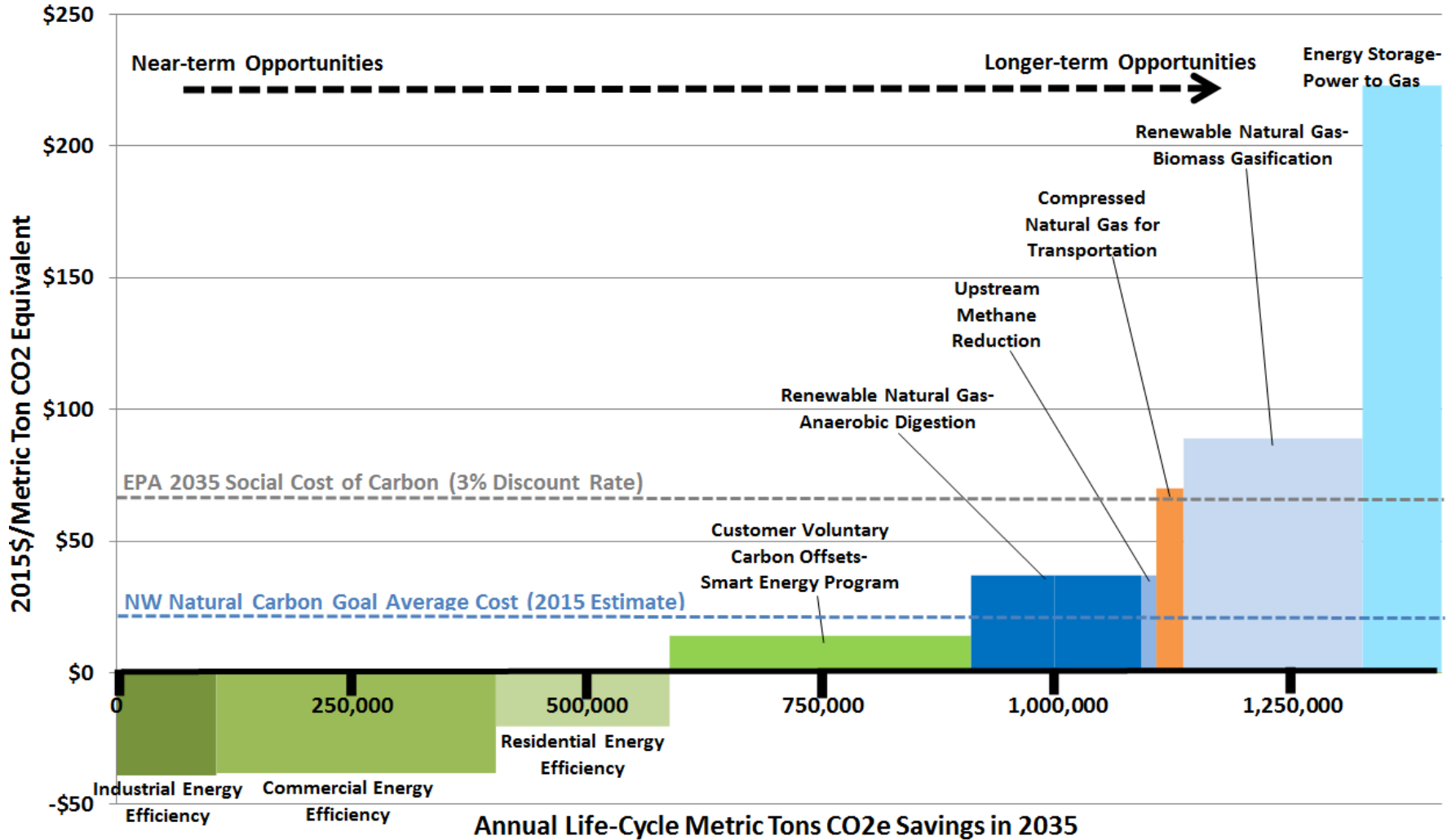
# WHAT ARE THE POTENTIAL COST IMPLICATIONS?

This goal can be achieved affordably using existing infrastructure.



# CARBON GOAL POTENTIAL COSTS

2035 Estimated Carbon Goal Emissions Savings and Costs





# KEY TAKEAWAYS

## Why is the direct use of natural gas so important?

- Critical to serve region's heating needs, especially on coldest days.

## What is the value of setting a carbon savings goal?

- Creates focus and engagement on opportunities for reductions in the gas sector proactively.

## What is our goal?

- 30% carbon emissions savings by 2035 from 2015 baseline.
- Provides net reductions despite substantial regional growth.

## What are the reduction areas to target?

- Our Product, Customer Use, Heavy-Duty Transportation

## What are the cost implications?

- Can be done affordably using existing, modern pipeline infrastructure.
- Low natural gas prices create opportunity to make reductions more affordably.

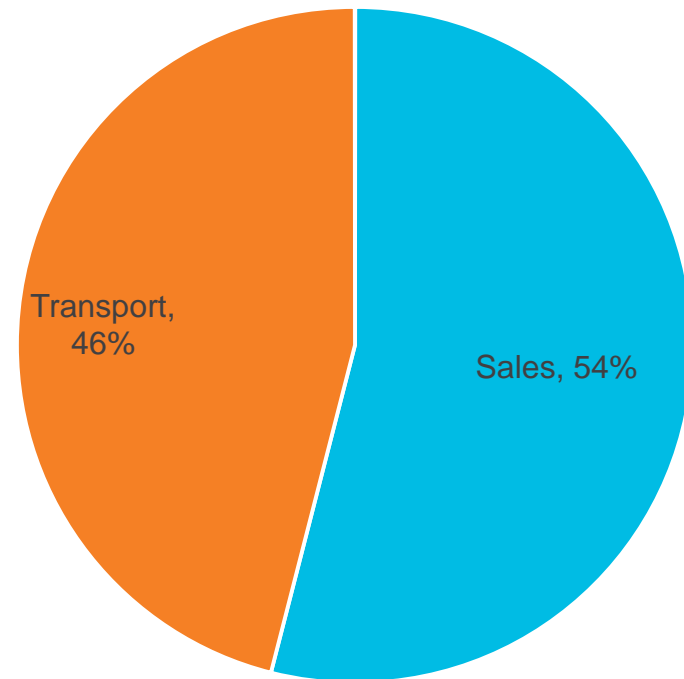
# Climate Legislation



# Oregon – Climate Legislation Issues

- **Point of Regulation:**  
The compliance obligation for the emissions associated with the direct use of natural gas **should be** placed on the party that is in the best position to impact the reduction of those emissions.

2015 Direct use Natural Gas Deliveries in Oregon



# Oregon – Climate Legislation Continued

- Allowances:
  - Distributed directly and free-of-charge to electric companies and natural gas utilities;
  - Distributed directly and free-of-charge to some sources, including emissions-intensive, trade-exposed industries to address leakage and as determined necessary by EQC
- Sources subject to the cap must submit compliance instruments to DEQ every three years equal to their compliance obligation. A penalty for noncompliance is assessed at the rate of four allowances for every one allowance that a source fails to submit.

# Oregon – Climate Legislation Continued

- Offsets may make up no more than 8 percent of a covered source's compliance obligation in each compliance period.
- Proceeds from the auction of allowances distributed directly and free-of-charge to utilities:
  - Must be consigned to state and cannot be used to meet utility's compliance obligation
  - Used for Low income bill assistance
  - Used for bill assistance for energy intensive industries not receiving free allowances
  - Used for weatherization & energy efficiency programs

**THANK YOU**

