

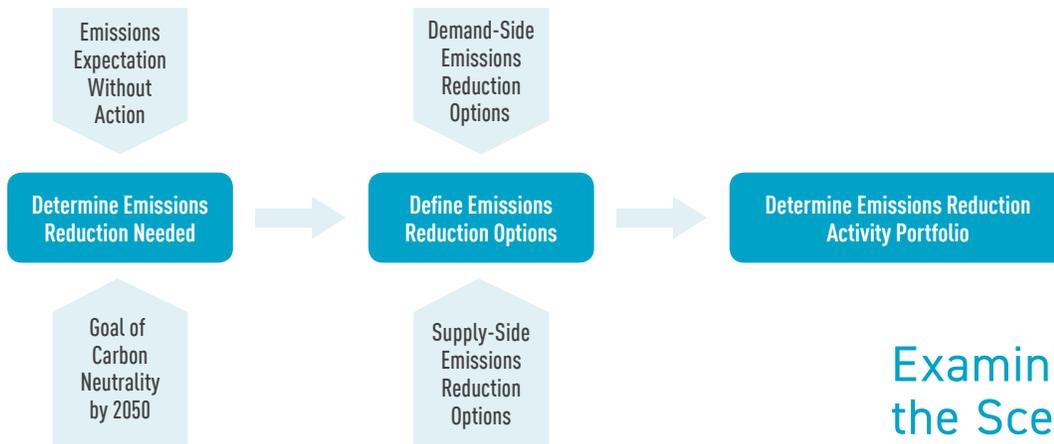
DESTINATION ZERO

Carbon neutrality means having a balance between emitting carbon and absorbing carbon from the atmosphere. To achieve net-zero emissions, all greenhouse gas (GHG) emissions produced must be countered with actions to reduce emissions. While these emissions know no boundaries, the regulations, policies, and markets designed to address them are bounded at every level of government, varying by industry and sector. Efforts to bridge these sectors with policies such as cap and trade, or pricing emissions, have been limited to a few states or regions.

Natural gas utilities such as NW Natural have a unique role in facilitating more holistic approaches to waste reduction and carbon capture that can help society achieve climate goals faster and more effectively.

Modeling Approach: Charting the Paths to 2050

Our approach to developing these models is somewhat like an integrated resource planning exercise. Technical data from third party resources, subject matter experts at NW Natural and industry partners provided forecasts on the various measures, and uncertainties are accounted for through scenario planning.

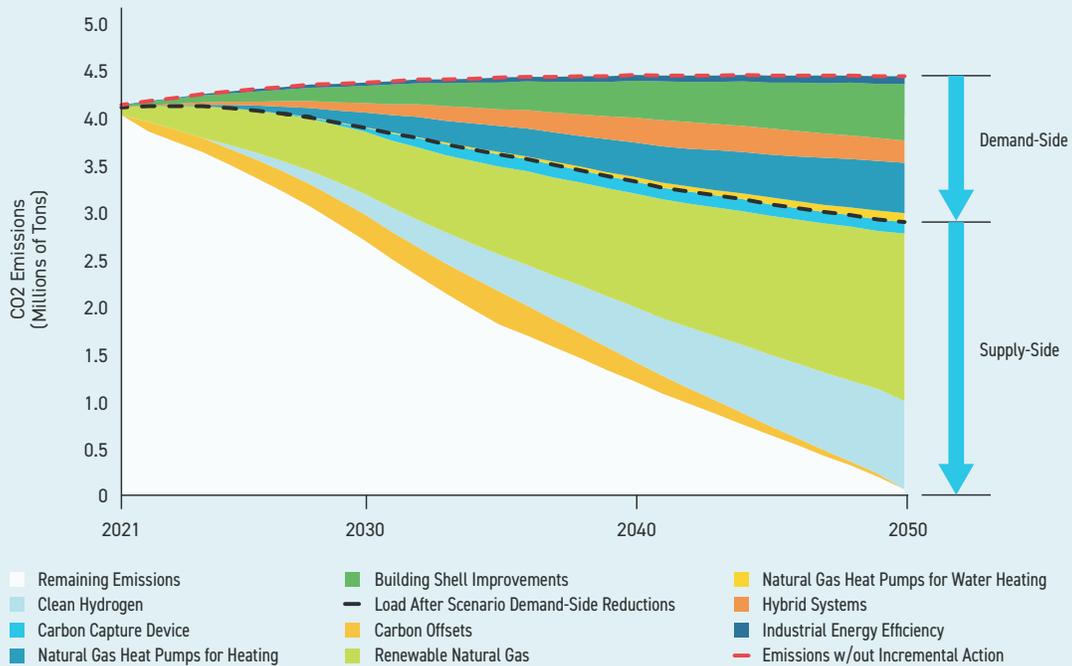


Examining the Scenarios

The following graphs display the breakdown of the emissions reduction activities for the scenarios ►

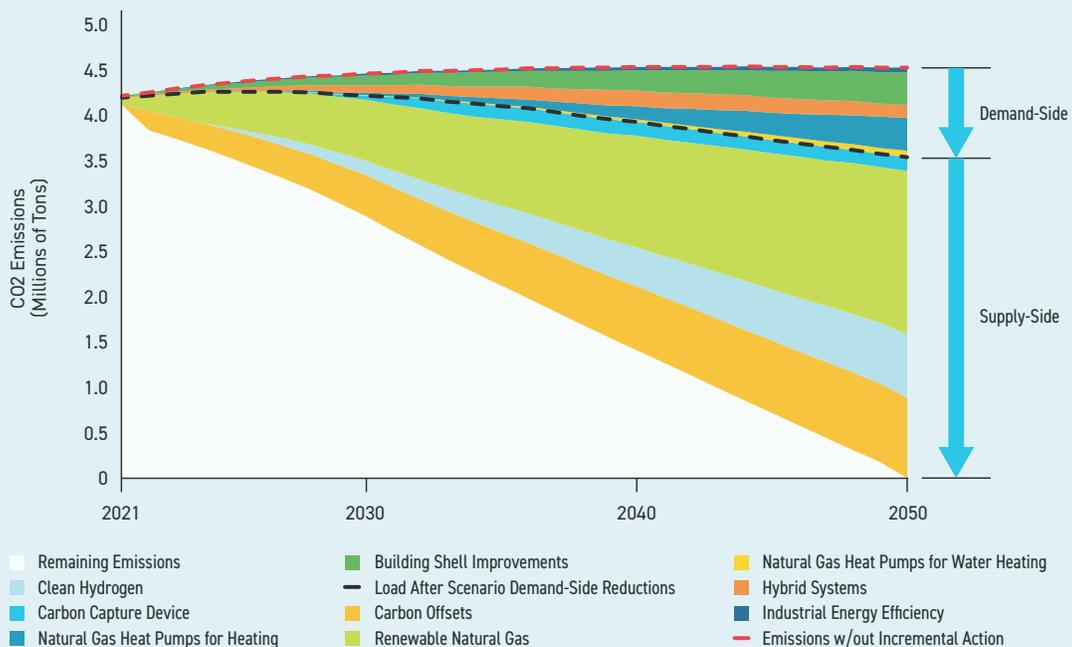
BALANCED APPROACH SCENARIO

The Balanced Approach relies upon a mix of renewable natural gas, clean hydrogen, and energy efficiency measures like natural gas heat pumps, hybrid heating systems, and building shell improvements. This approach achieves carbon neutrality in 2050 without the continued use of carbon offsets.



MODERATE OFFSETS SCENARIO

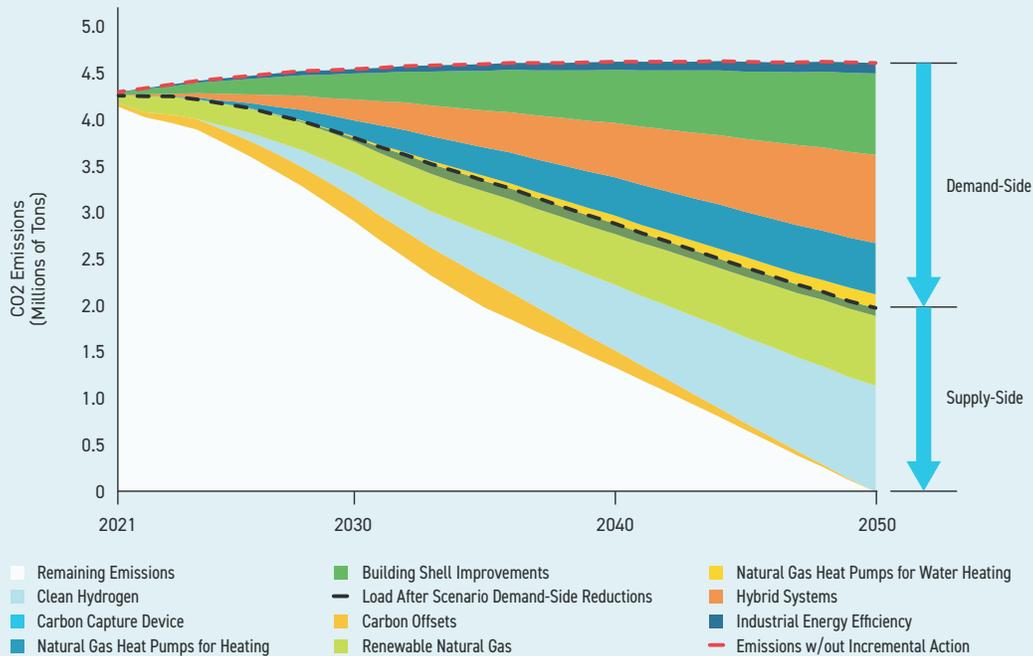
The Moderate Offsets scenario relies less upon the demand side emissions reduction activities than is used in the Balanced scenario, and utilizes a moderate amount of carbon offsets to achieve carbon neutrality in 2050.



RNG CONSTRAINED SCENARIO

A growing body of data shows there is vast potential for renewable natural gas across North America—with innovations increasing RNG supply in real time. But to be conservative, we developed a third scenario that imposes artificial limits on the amount of renewable natural gas that can be procured, capping volumes at around 14 million dekatherms annually, compared to 34 million dekatherms acquired in the Balanced Approach and Moderate Offsets scenarios.

Some of this energy is replaced with clean hydrogen, but this pathway places a greater reliance on demand side measures in 2050 than any other and does not rely upon offsets by midcentury.



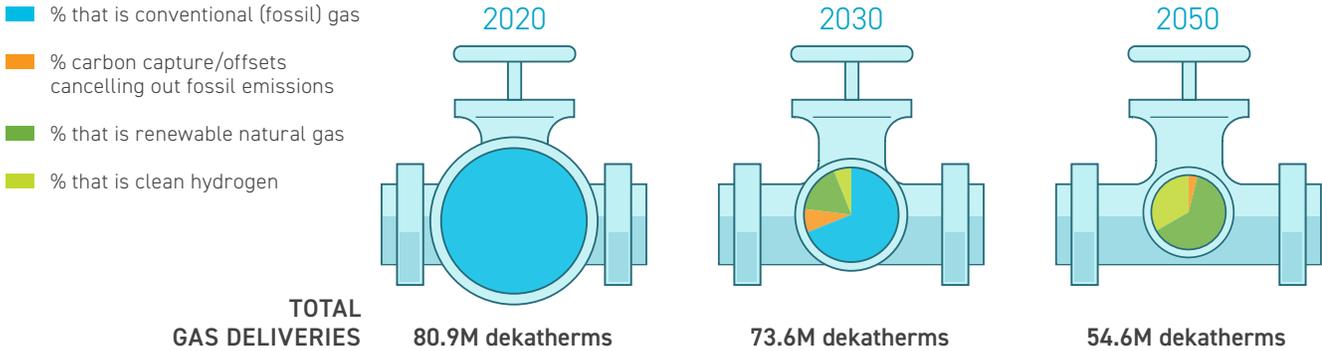
Our Customers Use Less Over Time

Customers are expected to use less natural gas to meet individual energy needs in both the business-as-usual case and all Vision 2050 scenarios. This reflects ongoing trends in customer usage, which have declined by half since 1970 for residential customers, thanks to improvements in efficiency programs, building codes and appliance standards.

The use declines more substantially in our scenarios due to acceleration of advanced heating equipment, like gas heat pumps or hybrid systems, not yet supported by existing energy efficiency programs, as well as building retrofits and exterior shell improvements, which also reduce heating needs.

Summary of Supply Mix by Scenario

BALANCED APPROACH SCENARIO



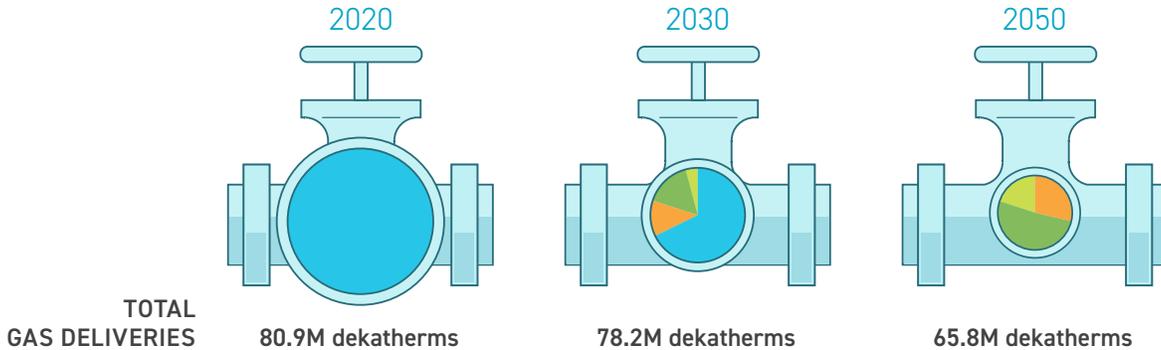
2020: 100% conventional (fossil) gas

2030: 69% conventional (fossil) gas, 8% carbon capture/offsets cancelling out fossil emissions, 17% renewable natural gas, 6% clean hydrogen

2050: 0% conventional (fossil) gas, 4% carbon capture/offsets cancelling out fossil emissions, 62% renewable natural gas, 33% clean hydrogen*

* Carbon capture in 2050 begins to sequester biogenic CO₂ emissions from renewables, meaning that the scenario has shifted to a carbon-negative system.

MODERATE OFFSETS SCENARIO



2020: 100% conventional (fossil) gas

2030: 68% conventional (fossil) gas, 12% carbon capture/offsets cancelling out fossil emissions, 16% renewable natural gas, 4% clean hydrogen

2050: 0% conventional (fossil) gas, 29% carbon capture/offsets cancelling out fossil emissions, 52% renewable natural gas, 20% clean hydrogen*

* Carbon capture in 2050 begins to sequester biogenic CO₂ emissions from renewables, meaning that the scenario has shifted to a carbon-negative system.

RNG CONSTRAINED SCENARIO



2020: 100% conventional (fossil) gas

2030: 76% conventional (fossil) gas, 8% carbon capture/offsets cancelling out fossil emissions, 9% renewable natural gas, 7% clean hydrogen

2050: 0% conventional (fossil) gas, 4% carbon capture/offsets cancelling out fossil emissions, 38% renewable natural gas, 58% clean hydrogen*

* Carbon capture in 2050 begins to sequester biogenic CO₂ emissions from renewables, meaning that the scenario has shifted to a carbon-negative system.