Purchased Carbon Offsets

Carbon offsets are a voluntary method of mitigating greenhouse gas (GHG) emissions. An organization calculates its emissions over a time period - usually a year - and then purchases the equivalent number of offsets in metric tons of carbon dioxide equivalent (MT CO_2e) to balance the GHG impact of those activities. Carbon offsets can come from a variety of project types including forestry, land use (e.g., avoided deforestation, reforestation, avoided grassland conversion, etc.) and waste disposal, among others. Carbon offset projects must follow strict project development, accounting, and verification protocols, and vary in quality and cost. The baseline quality of offsets is set to the Verified Carbon Standard (VCS) while Climate Action Reserve (CAR) and Gold Standard are an even higher level of third-party certification.

While carbon offsets may be used to counteract the climate impacts of any source of GHG emissions, for this information sheet, the need is framed around addressing ODOT's use of natural gas. Because natural gas does not yet have a market-ready, lower-impact substitute that can scale to offset ODOT's total use, carbon offsets are one option to reduce up to 100% of emissions.

Carbon offsets may be purchased from a variety of vendors in the marketplace. Arguably the simplest option in Oregon, from an administrative standpoint, is Northwest Natural Gas Company's (NWN) SmartEnergy program.[1] This program allows for direct, on-bill purchase of offsets equal to the annual quantity of natural gas purchased, from a well-established Oregon provider – The Climate Trust, which develops projects to capture and utilize renewable methane from dairy farms. This program may be used to offset ODOT natural gas purchases from NWN; additional carbon offsets will be needed to offset the agency's natural gas purchases from other utilities. Other reputable vendors include Bonneville Environmental Foundation (BEF), Native Energy, Renewable Choice Energy, and 3Degrees.

Real World Examples

- City of Eugene, Oregon. Carbon offsets are purchased to meet the requirements of the City's Climate Recovery Ordinance requirements.[2]

Other Alternatives (to address fossil natural gas emissions)

- Energy efficiency and conservation is a complement to purchased offsets. Reducing natural gas use will save costs for the fuel itself as well as additional costs for carbon offsets.
- Renewable natural gas (RNG) is an alternative to offsets to address emissions from fossil natural gas. Most methane/natural gas is produced from fossil sources. However, RNG can be utilized for energy when gaseous byproducts of solid waste decomposition, cattle farms and wastewater treatment are collected. RNG is shown to have significantly lower climate impacts compared to fossil gas, particularly when it is collected from dairy operations.[3] RNG from dairies is beneficial as it captures a currently uncontrolled source of methane and utilizes the captured methane to displace fossil energy sources. California Air Resource Board and Oregon Department of Environmental Quality's (ODEQ) Clean Fuels Program have issued carbon intensity values for dairy RNG as less than zero.[4] It is important to note RNG

[1] SmartEnergy details available online at https://www.nwnatural.com/about-us/carbon-offset-program/about-smart-energy
[2] https://www.eugene-or.gov/3210/Climate-Recovery-Ordinance
[3] Dairy operations, depending on manure management, can represent a large direct source of methane emissions.
[4] See ODEQ CFP website for more details https://www.oregon.gov/deq/ghgp/cfp/Pages/Clean-Fuel-Pathways.aspx

cannot fully replace natural gas at current rates of use. At its maximum technical potential, RNG is estimated to replace 10 – 20% of baseline use across Oregon's natural gas system.[5]

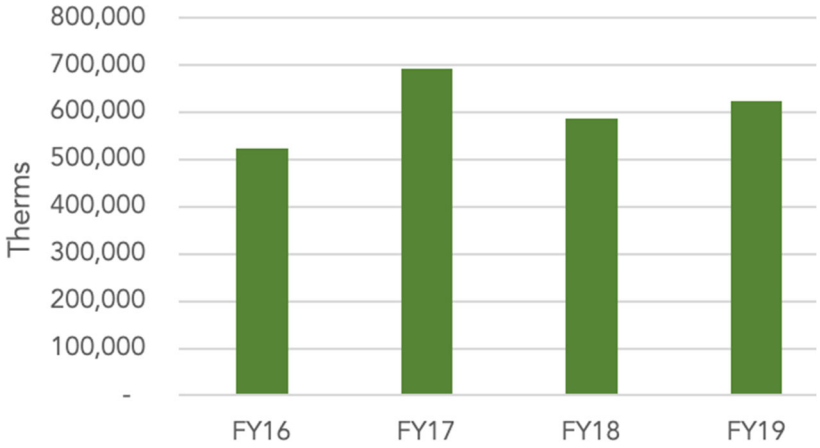
- Renewable hydrogen also offers an alternative to offsets for gas when produced using renewable electricity to split water molecules (electrolysis). Hydrogen produced from natural gas is most common, but provides much less (if any) climate benefit compared to green hydrogen. This technology is in the early phases and has yet to achieve large-scale production. Based on recent modeling done for Oregon Clean Fuels Program, hydrogen is anticipated to enter the Oregon fuel mix in 2030.[6]
- Building electrification (trading gas furnaces for electric heat pumps) also provides an alternative to purchasing offsets for natural gas. However, electrification is not an option for all building types, sizes and configurations. American Council for an Energy Efficient Economy (ACEE) released a report in 2020 detailing the greatest opportunities in the commercial building space.[7]

Current Conditions

During Fiscal Years (FY) 2016- 2019, ODOT purchased an average of 600,000 therms of natural gas to heat office spaces and maintenance district crew rooms, thaw maintenance trucks during inclement weather, and maintain specific temperatures in material laboratories. This represents an average of 3,200 MT CO_2e per year. Natural gas is purchased from three natural gas utilities in Oregon: Avista, Cascade, and NWN. The only utility to currently offer the purchase of carbon offsets directly is NWN and they also plan to offer the ability to purchase 4% of gas from renewable sources beginning in 2022.

Figure 1, below, shows ODOT natural gas purchases have remained relatively consistent between FY 2016 – 2019. The year-to-year variations are primarily driven by changing cold weather temperatures and increased heating fuel demand, generator use and road maintenance (thawing more snow and ice of equipment) during inclement weather.

Figure 1 - ODOT Natural Gas Use



[5] See Oregon Department of Energy report for more details https://www.oregon.gov/energy/Data-and-Reports/Documents/2018-RNG-Inventory-Report.pdf
[6] For details see Scenario C https://www.oregon.gov/deq/rulemaking/Documents/cfp2021icf.pdf
[7] See ACEEE's report for details https://www.aceee.org/research-report/b2004

Market Study

Availability and Access

As mentioned above, NWN provides offsets as part of a monthly bill. The offset projects are managed by The Climate Trust, located in Portland, and focus on dairy-farm methane capture projects for use as RNG. One-year contracts are a minimum with longer terms available for bulk pricing. Other vendors (BEF, Native Energy, Renewable Choice Energy, and 3Degrees) offer a variety of project types. Offsets may be purchased annually, but longer-term contracts are also available (up to 25 years) and typically come at a reduced cost. See the next section for additional details by vendor on project offerings and costs.

Costs

Project types differ in cost widely from under $2 per MT (for low-cost voluntary market)[8] to upward of $21 per MT (NWN SmartEnergy Program and California's compliance market).[9] Project pricing varies and is impacted by quality, market supply and demand as described below:

- Supply: Certain types of projects and technologies are not as widely available. Landfill gas projects are abundant, whereas dairy projects in the U.S. are less available.
- Vintage: The age of offsets vary by project. Some projects are attributed to the current year whereas others are related to projects generated within the last few years. There are also credits for projects yet to be built. Generally, older projects will be less expensive, while current or future projects will cost more.
- Regulatory quality: Offsets that are required for certain compliance markets, or follow compliance market protocols, are typically priced higher.
- Co-benefits and cultural alignment: A key difference between offsets is the proximity to the operational and supply chain emissions sources. Generally, offsets that are more closely aligned (i.e., within the same state or region of emissions source) will cost more, particularly projects originating in the exact region of interest. Projects that offer significant additional co-benefits, a more compelling story, or tie into core operations or customer-shared value generally draw a higher price point.

[8] Ecosystem Marketplace – State of the Voluntary Carbon Markets 2020. Report online at https://app.hubspot.com/documents/3298623/view/101893633?accessId=bf5d12

[9] CA Carbon Allowance Prices (2021). Report online at https://ww2.arb.ca.gov/sites/default/files/classic/cc/capandtrade/carbonallowanceprices.pdf

Table 1 - Overview of Carbon Offset Projects

Company	Description and Costs (price per 1 MT CO2e)
NWN - SmartEnergy Program	• Dairy farm biodigesters in PNW ($20 with 1-year contract) • Dairy farm biodigesters in PNW ($12–16 with 3-year contract)
NativeEnergy	• Landfill gas in U.S. ($2-5) • Forestry / land use projects ($5) • Clean water or cookstove projects in Haiti ($6-12) • Avoided deforestation in Tanzania ($11) • Avoided grassland conversion ($12-14) • Dairy composting project ($16)
The Climate Trust	• Landfill gas to energy ($2-$3) • Forestry and grasslands ($6-$8). • Dairy biodigester (The Climate Trust manages NWN's SmartEnergy program)
Bonneville Environmental Foundation (BEF)	• Landfill gas-to-energy in North Carolina ($2) • Landfill gas-to-energy in Utah ($6) • Waste heat recovery in Montana ($7) • Clean energy career training program for PNW Students ($8) • Organic waste composting in Washington ($7-9) • Avoided grassland conversion in Oregon ($12) • Dairy biodigester in Idaho ($12) • Forestry project in Washington ($12) • Forestry project in California ($13) • Prairie conservation in South Dakota ($15)

Cost Impacts

Table 2, on the following page, provides program costs in two groupings: 1) Northwest Natural (NWN), and 2) all others (Avista and Cascade). To offset remaining gas purchased from other natural gas utilities in Oregon (Avista, Cascade), prices from BEF are used because they sell offsets produced within the NW region for a variety of relevant project types and costs.

Table 2 - Carbon Offset Costs

Carbon Offset Vendor	Project Type	Average Annual Use (therms)	Average Annual Cost ($)	Annual GHG Reductions (MT CO2e)	Price per MT of Reduction
Northwest Natural – SmartEnergy (1-year contract)	Dairy biodigester in PNW	323,000 (NWN use only)	$35,460	1,718 (scaled for Northwest Natural only)	$20.66
Northwest Natural – SmartEnergy (3-year contract)	Dairy biodigester in PNW	323,000 (NWN use only)	$20,600 - $27,500	1,718 (scaled for Northwest Natural only)	$12 - $16
BEF	Dairy biodigester in Idaho	277,000 (Avista and Cascade use)	$17,000	1,482 (scaled for Avista/Cascade gas only)	$11.50
BEF	Tree planting on west coast	277,000 (Avista and Cascade use)	$11,900	1,482 (scaled for Avista/Cascade gas only)	$8
BEF	Grassland restoration in Oregon	277,000 (Avista and Cascade use)	$17,800	1,482 (scaled for Avista/Cascade gas only)	$12
BEF	Landfill gas to energy in North Carolina	277,000 (Avista and Cascade use)	$3,000	1,482 (scaled for Avista/Cascade gas only)	$2
BEF	Landfill gas to energy in North Carolina	277,000 (Avista and Cascade use)	$6,400	3,200 (scaled for total (all utility) gas)	$2

Combining costs for NWN's SmartEnergy program (3-year contract) for dairy biodigesters with BEF offsets from tree planting would cost ODOT approximately $35,000 annually to offset 100% of natural gas emissions (3,200 MT CO_2e). These costs could be dramatically reduced if ODOT were to purchase BEF offsets for landfill gas to energy in North Carolina - annual costs for these offsets would total $6,400.

Recommendations

- Participate in Oregon natural gas programs (as they become available) that substitute RNG for fossil natural gas. Again, NWN anticipates having a product offering for RNG available in 2022.
- Purchase carbon offsets from BEF at the lowest cost to offset 100% of ODOT's natural gas emissions. Research found BEF to be a regional service provider with a range of project types and costs.
- In conjunction or as an alternative to the recommendations above, participate in NWN's SmartEnergy program. SmartEnergy carbon offsets cost significantly more than other options, however, they offer significant co-benefits including regionally-based projects focused on developing RNG-production capacity.