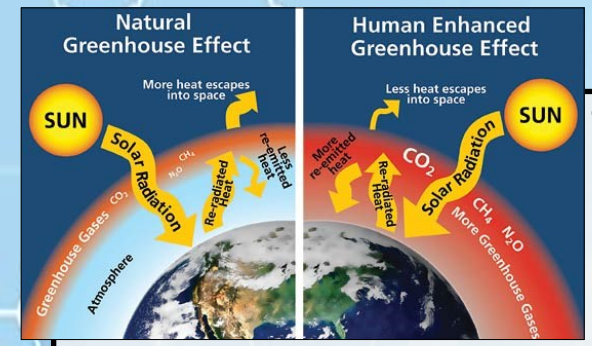
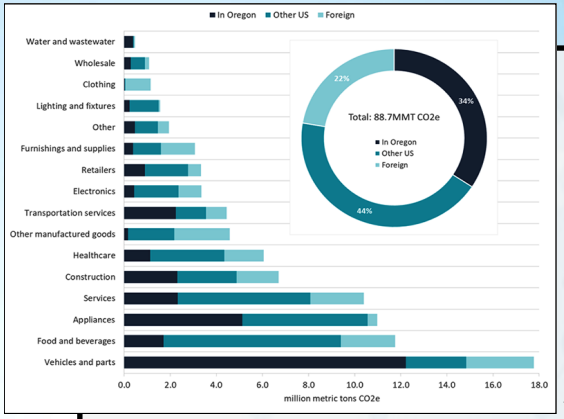
Greenhouse Gases and Carbon Markets



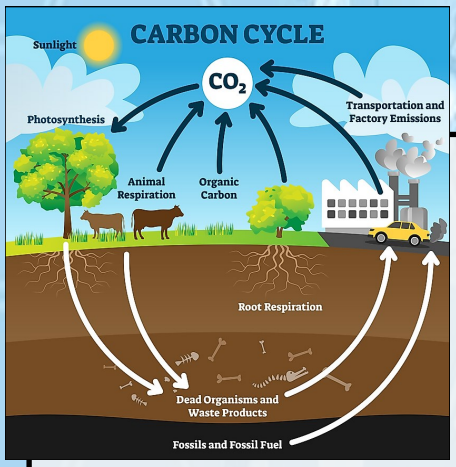
Why is Carbon Important?

Carbon is a naturally occurring atom that is the foundation for life. But too much carbon in the atmosphere is causing Earth's weather patterns to change. The Greenhouse Effect makes life on Earth possible, but it is being intensified by additional carbon and other greenhouse gases in the environment.



GHG Inventories and Carbon Crediting

Efforts are being made to map sources and amounts of carbon emissions. These are called Greenhouse Gas Inventories. These help us understand where we can have the greatest effect for reducing carbon emissions. "Carbon markets" exchange money for reducing carbon emissions through action. It involves polluters paying for carbon capture efforts to offset emissions they create.

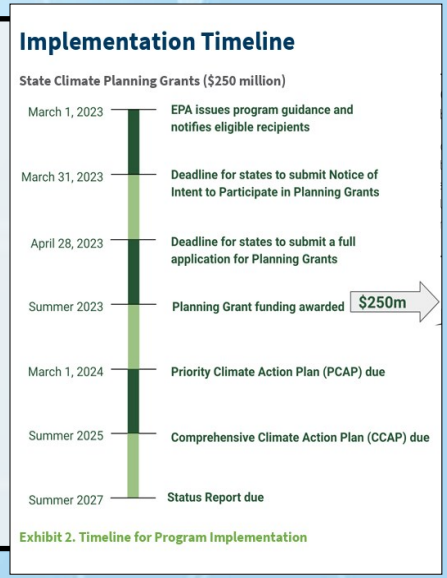


Sources and Sinks of Carbon

Excess carbon comes from many places, but mostly from burning of carbon-based fossil fuels. These have been buried as coal or oil for a long time, but are dug up and burned to provide energy, transportation, and modern living.

What is the CPRG?

The Climate Pollution Reduction Grant has three parts: Planning Grants ($250 million), Implementation Grants ($4.6 billion), and administrative funding ($142.5 million). This listening session is part of securing Implementation funds from this grant. Actions identified here will be eligible for these funds.

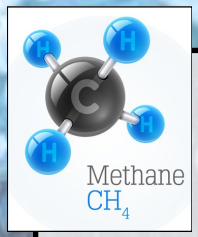


For more information, please contact

ODEQ: Whitney Dorer
Whitney.Dorer@DEQ.Oregon.gov

CTUIR FFPP: Colleen Sanders
ColleenSanders@CTUIR.org

Methane Capture and Anaerobic Digesters



What is Methane?

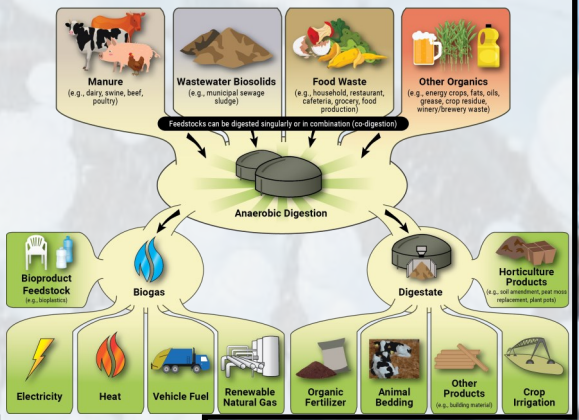
Methane (CH_4) is a greenhouse gas that is created when biological matter decays in an environment without oxygen. When released into the atmosphere, it adds to global heating. Methane has ~30 times the heating potential as carbon dioxide in the short term, and ~85 times the heating over a 20 year period. It causes more heating than carbon dioxide.

Benefits and Risks of Anaerobic Digesters

Benefit: food waste is readily and perpetually available to fuel digester and create localized energy for remote sites.

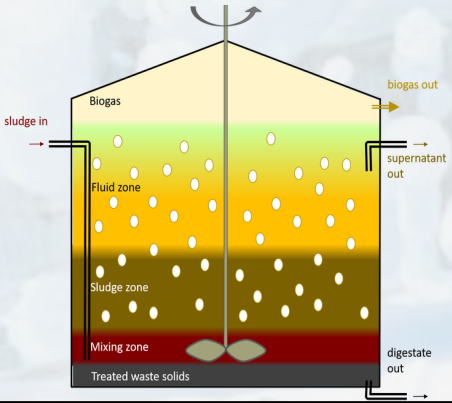
Risk: conversion of methane into carbon dioxide reduces—but doesn't entirely prevent carbon emissions.

Risk: Potential ground-water contamination, and odors nearby.



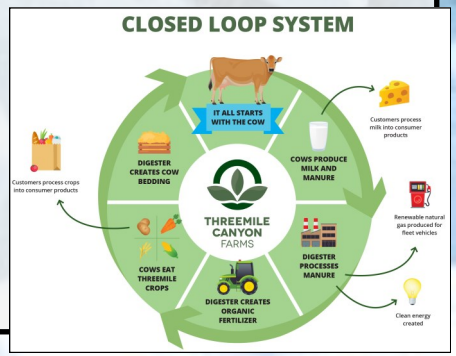
Digesters Harness Methane for Energy

Methane is also a source of carbon-rich energy when burned. Burning methane releases carbon dioxide into the atmosphere, but in a less harmful form. Anaerobic digesters allow for biological material to be taken into a closed tank to create methane, then transmits this gas to a place where it can be burned to create energy.



Case study: Threemile Canyon Farm

One company in our area currently operates an anaerobic digester in Boardman, OR. This large dairy takes waste from dairy cows, creates methane from decomposition, and burns this methane to partially power its farm. It also generates sells carbon offsets from this process to carbon markets in California.



For more information, please contact

ODEQ: Whitney Dorer
Whitney.Dorer@DEQ.Oregon.gov

CTUIR FFPP: Colleen Sanders
ColleenSanders@CTUIR.org

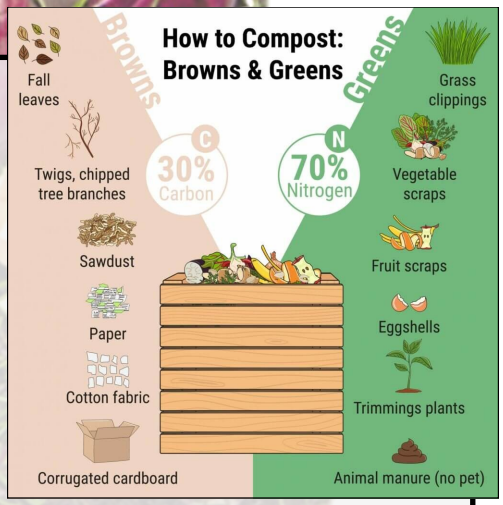
Materials Management: Recycling and Composting

Recycling

Materials used in products are usually extracted from the Earth. By recycling certain things that can be re-used, we can reduce the amount of material that needs to be extracted for use.

Composting

Composting living material, rather than throwing it away, helps us reduce our carbon emissions, and creates a wonderful garden fertilizer. Balancing "brown" carbon-rich materials with "green" nitrogen-rich ones helps build a healthy compost for us to incorporate into gardens!



Food Waste Collection

Food in landfills creates methane, a greenhouse gas. By keeping food scraps and other living material out of landfills, we can reduce methane emissions, and create a healthy soil fertilizer!

Case Study: Pendleton Sanitary Service Inc.

One waste management service currently conducting food waste collection is PSSI in Pendleton, OR. PSSI currently collects 4-5 tons of food waste per week from three locations around Umatilla County.

Food waste is composted at PSSI's waste management facility, and becomes compost. This collection does not include meat and dairy, which have different composting requirements.

For more information, please contact

ODEQ: Whitney Dorer
Whitney.Dorer@DEQ.Oregon.gov

CTUIR FFPP: Colleen Sanders
ColleenSanders@CTUIR.org

Soils

key to **unlocking** the **potential** of **mitigating** and **adapting** to a **changing climate**

SUSTAINABLE DEVELOPMENT GOALS

SDG 13 | CLIMATE ACTION | ADAPT / MITIGATE TO CLIMATE CHANGE

Global warming

Temperature increase

Emissions

CO_2

Unsustainable soil management

leads to soil degradation and CO_2 emission into the atmosphere

- Intensive tillage
- Overuse of agro-chemicals
- Removal of vegetation cover
- Wetland / peatland drainage
- Urbanization / soil sealing
- Monocropping
- Loss of soil structure
- Reduction of organic matter inputs
- Soil compaction
- Soil erosion /disturbance

Soil Organic Carbon

Plant photosynthesis

CO_2

C

- Crop/plant residues = Soil Organic Matter
- Litter fall = Soil Organic Matter
- Secretions = Soil Organic Matter
- Soil Organic Matter

Soil Organic Carbon

Soil Organic Carbon

750 Pg C* in the **ATMOSPHERE**

560 Pg C* in **VEGETATION**

1417 Pg C* in the 1st meter of **SOIL**

2500 Pg C* at 2 meters SOIL depth

Sustainable soil management

fosters CO_2 sequestration to boost soil health and contribute to achieving SDGs

- Conserving /increasing soil biodiversity
- Implementation of the VGSSM*
- Increasing soil organic matter inputs
- Crop rotation / diversification
- Better soil surface coverage
- Reduced tillage
- Preserving wetlands /peatlands
- Monitoring soil organic carbon stocks
- Reduce soil contamination

* Voluntary Guidelines for Sustainable Soil Management

There is more Organic Carbon in our Soil than in vegetation and the atmosphere combined

* Pg C = Petagram of Carbon - 1Pg = 10^{15}g = 1 Gigatons

Food and Agriculture Organization of the United Nations

For more information, please contact

ODEQ: Whitney Dorer
Whitney.Dorer@DEQ.Oregon.gov

CTUIR FFPP: Colleen Sanders
ColleenSanders@CTUIR.org

with the support of

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

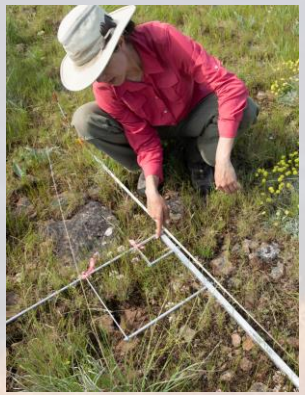
Federal Department of Economic Affairs, Education and Research EAER
Federal Office for Agriculture FOAG

GLOBAL SOIL PARTNERSHIP

Working Lands and Natural Climate Solutions

How? Increase carbon sequestration and storage
Avoid/Decrease greenhouse gas emissions

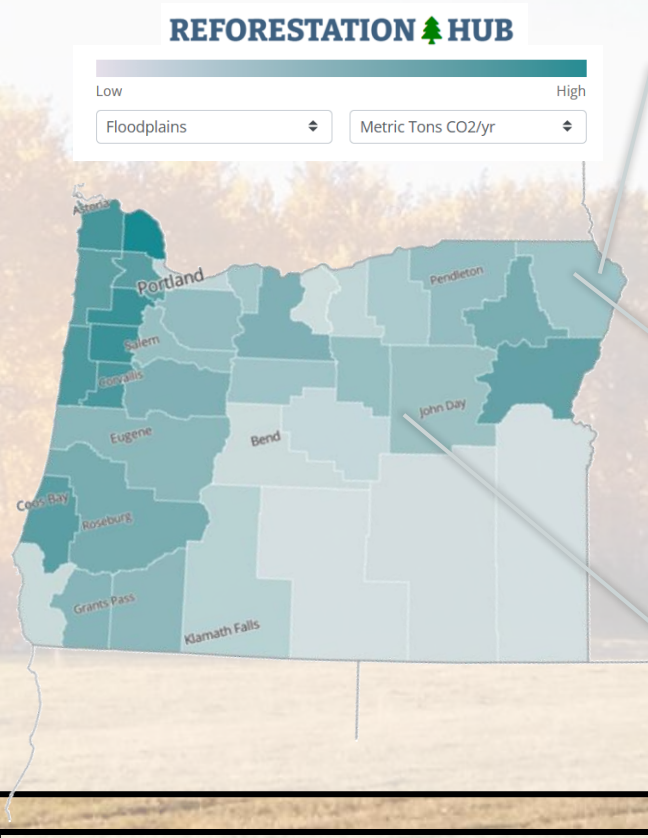
CHANGE
practices on working lands



RESTORE
ecosystems and processes

PROTECT
intact ecosystems and processes

Where? Riparian, grasslands, sagebrush-steppe



What Can We Do?

- Defer timber harvest and replant after wildfires
- Avoid conversion of forests and grasslands
- Restore and reforest riparian areas
- Protect and restore sagebrush-steppe

***AND** research and evaluate tools to guide restoration and support accounting of carbon storage outcomes*

Local Co-Benefits

- Improved habitat and water quality
- Protection of biodiversity
- Improved soil quality and productivity

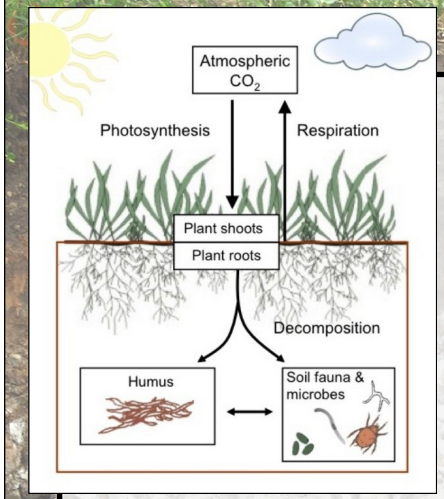
For more information, please contact

ODEQ: Whitney Dorer
Whitney.Dorer@DEQ.Oregon.gov

CTUIR FFPP: Colleen Sanders
ColleenSanders@CTUIR.org

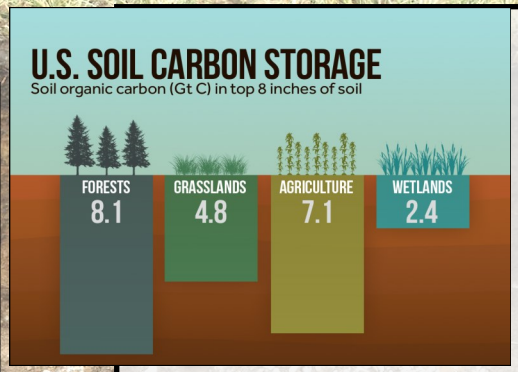
The Nature Conservancy

Soil Carbon in Agricultural Systems



Why is Carbon Important for Soil?

Carbon is part of "soil organic matter," or "humus." High carbon soils absorb water, support microorganisms, retain nutrients, and create strong plants! Improving soil organic matter removes carbon from the air and makes it part of healthy soils.

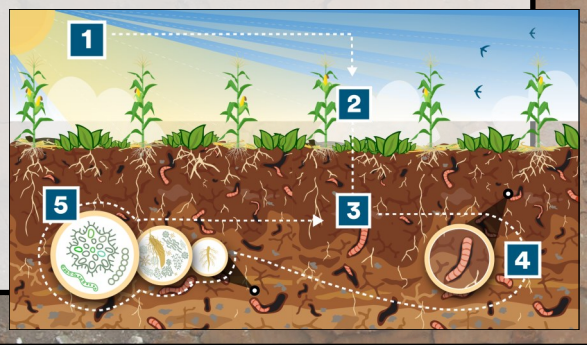


Practices for Soil Carbon

Activities that increase soil carbon include: reduced tillage or no-tillage planting, leaving plant growth standing in place after harvest, and planting cover crops, among others. Disturbance of soils, like tillage, releases carbon back into the atmosphere. Thus, reducing or eliminating disturbance increases carbon. In our area's lowlands, long term grasslands have been shown to store the most carbon.

Understanding "Sequestration"

Plants capture carbon dioxide from the air (1&2) and grow roots deep into the soil, and move carbon into the soil (3). Worms and other small soil creatures eat these roots, and pass them as castings (4). Microorganisms in the soil break this down into minerals (5).



Case Study: CBARC Long Term Study Plots

The Columbia Basin Agricultural Research Center (CBARC) is located near Pendleton, OR. This Center hosts one of the longest running soil carbon study plots in the country, started in the 1930's. These plots have highly relevant information about agricultural management for soil carbon in our Columbia River Plateau region.

For more information, please contact

ODEQ: Whitney Dorer
Whitney.Dorer@DEQ.Oregon.gov

CTUIR FFPP: Colleen Sanders
ColleenSanders@CTUIR.org

ENERGY EFFICIENCY AND RENEWABLE ENERGIES

MANY ENERGY SOURCES EMIT CARBON

Reducing energy use through efficiency, and moving to non-fossil fuel sources reduces carbon emissions

Efficiency is the second-largest electricity resource in Oregon (behind hydropower). Maximizing energy efficiency and smart-grid technologies in our homes, schools, offices, farms, and industries can lower energy use and costs while reducing greenhouse gas emissions.

Save Energy

Reliability & Resilience

Oregon is working to build an energy system that includes distributed energy generation, renewables, microgrids, batteries and other storage to strengthen the system's resilience to the effects of climate change and natural disasters.

Clean Up Transportation Fuels

Supporting infrastructure for using clean fuels (including electricity renewable natural gas and hydrogen) and alternative transportation modes (including walking biking, carpooling, and public transportation) leads to more choices for consumers.

Accelerating to adoption of low- or zero-emission vehicles also encourages use of locally produced fuel (Oregon imports nearly all its transportation fuels).

Decarbonize & Diversify Energy Mix

Transitioning to locally generated, low-carbon resources (like wind, solar, hydro renewable natural gas, and geothermal, would diversify our energy mix and reduce our reliance on volatile global energy markets.

PROGRAMS THAT CAN HELP

Before you decide on which energy-saving actions make the most sense for you, here are a few things to keep in mind:

- Which utilities do you have at your home?
- Do you rent or own your home?
- Do you have a central heating and cooling system?

For more information:

HOMEOWNER* | RENTER* | A BUILDER* | SOLAR

Energy Trust of Oregon
energytrust.org/residential

State Heating Oil Weatherization
oregon.gov/ohcs/energy-weatherization/Pages/show

Umatilla Electric Cooperative
umatillaelectric.com/energy-efficiency

Oregon Department of Energy
oregon.gov/energy/Incentives

CAPECO
capeco-works.org/weatherization

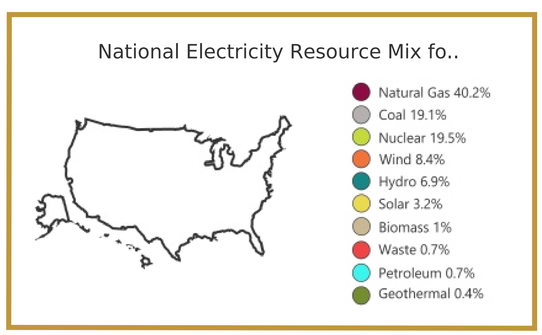
CTUIR Housing
ctuir.org/departments/housing

*Includes resources for manufactured homes

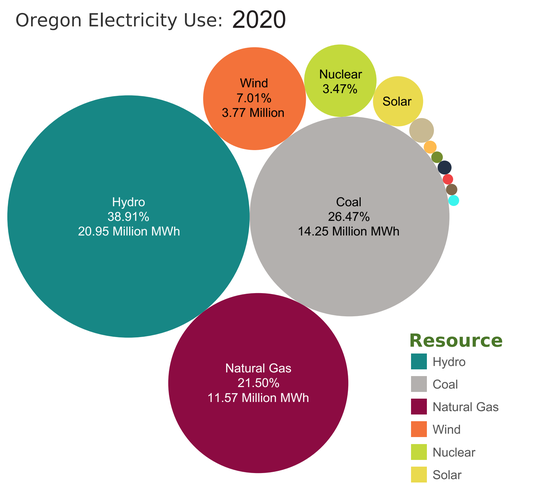
RENEWABLE ENERGY OPPORTUNITIES

Oregon Electricity Use: Resource Mix

This illustration shows the state level resource mix for investor and consumer-owned electric utilities serving Oregon from 2012 to 2020. The mix of resources generating electricity used in Oregon included in-state and out-of-state electricity generation. Most of the mix came from hydropower, coal, and natural gas. A smaller percentage of power in the region was provided from non-hydroelectric renewable resources, such as wind, biomass, and solar. See the *Data Info* button for more information. In 2020, Oregon used 53.7 million MWh of electricity.



Information from State of Oregon



EnergyTrust of Oregon

WORKING WITH CTUIR

MAJOR COMMERCIAL PROJECTS

Ti'mine Way Multifamily
- New construction
- (3) two-story buildings, 28 units

Participated in the New Buildings Market Solutions Offering for Multifamily (see attached flyer) Ductless heat pumps for heating and cooling Low flow plumbing fixtures and other efficiency features
- Solar system is 175.68 kW DC with an estimated annual production of 259,183 kWh to offset tenant power use
- Blue Sky grant from Pacific Power
- Energy Trust solar incentive

Nixyáawii Education Center

Efficiency obtained through passive and active building design

Project received incentives and support
- Early design / Technical assistance PTNZ
- Installation incentives
- Commissioning

Estimated annual energy savings
- 330,620 kWh
- 1,485.80 therms

Building performance 44.7% more efficient

Renewable generation planned

Yellowhawk Health Center

Efficiency obtained through passive and active building design

Project received incentives and support
- High-performance envelope
- Efficient heating and cooling energy recovery
- Solar panels on covered parking areas
- LED lighting
- Low-flow water fixtures

Estimated annual energy savings
- 646,000 kWh = $58,000 energy costs
- Building performance 60% more efficient
- Renewable generation planned, not installed

Wildhorse Resort and Casino Expansion Phase B

Efficiency measures:
- Lighting, interior & exterior
- Energy star gas fryers
- Tankless water heaters

Incentives received to date $47,657

Estimated annual energy savings:
- 198,000 kWh
- 5,200 therms

MAJOR RESIDENTIAL PROJECTS

Tillicum Grange Housing Project
- 4 separate duplex units, including 1 duplex unit providing 2 separate single-level senior housing units
- Participation in Energy Performance Score

Lucky 7 Manufactured Homes
- 18 new units, NEEM+ energy efficiency standards
- Increased insulation, air sealing, high performance windows, HVAC, water heating, LED lighting
- Ten 3- bedroom units, 1,400sf
- Eight 2-beroom units, 1,100sf
- 50-100% median household income

Funding 2020 State Emergency Board, Meyer Memorial Trust, Energy Trust Manufactured Home Replacement Pilot

Nixyáawii Neighborhood
- Working to provide EE and RE learning opportunities

STRATEGIC ENERGY MANAGEMENT PARTICIPATION

Wildhorse Resort and Casino
- 3 of years in SEM, 20 of projects identified
- $11,297.10 incentives received
- Total kwh saved 165,878

Cayuse Technologies
- 3 of years in SEM, 36 of projects identified
- $ 19,317.16 incentives received
- Total kwh saved 132,758

For more information, please contact

ODEQ: Whitney Dorer
Whitney.Dorer@ODEQ.Oregon.gov

CTUIR FFPP: Colleen Sanders
ColleenSanders@CTUIR.org

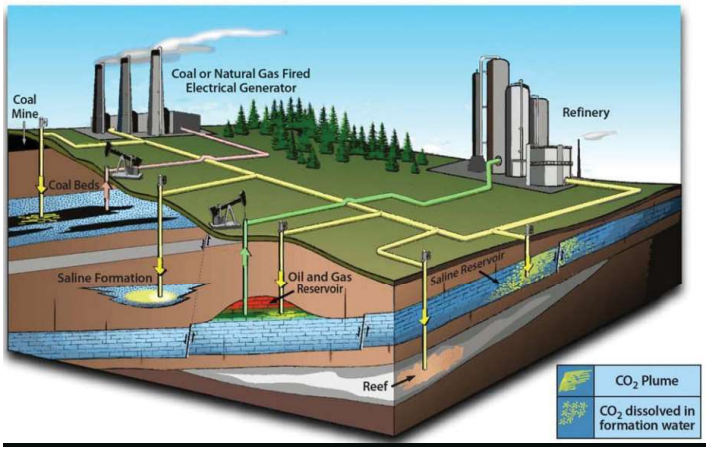
Oregon Department of Geology and Mineral Industries

Geologic Carbon Sequestration in Oregon

Contact Us:
Jason D. McClaughry, RG
Geological Survey & Services Program Manager
(541) 519-3419
jason.mcclaughry@dogami.oregon.gov
https://www.oregon.gov/dogami

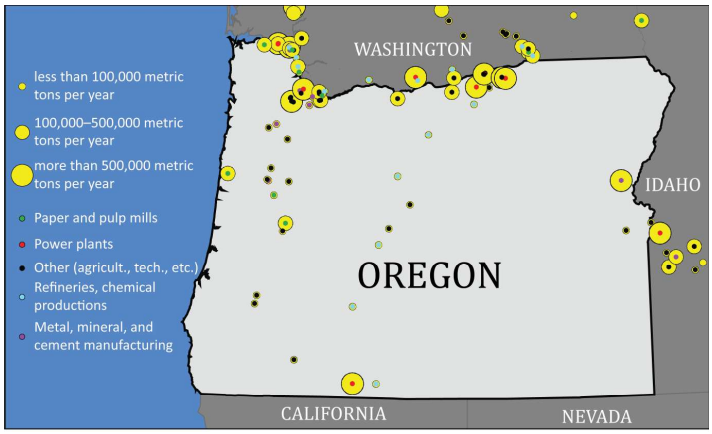
What is Carbon Sequestration ?

Carbon Sequestration refers to natural or artificial processes, where carbon dioxide (CO_2) is removed from the atmosphere and captured, secured, and stored. CO_2 is a greenhouse gas that comes from both natural and human activities. The build-up of CO_2 and other greenhouse gases in Earth's atmosphere can trap heat and contribute to climate change. The capture and long-term storage of CO_2 in solid and dissolved forms is now recognized as a key part of a comprehensive climate change mitigation strategy to limit the amount of human-made CO_2 contributed to the atmosphere.



Idealized carbon capture and storage (DOE/NETL publication Geologic Storage Formation Classifications).

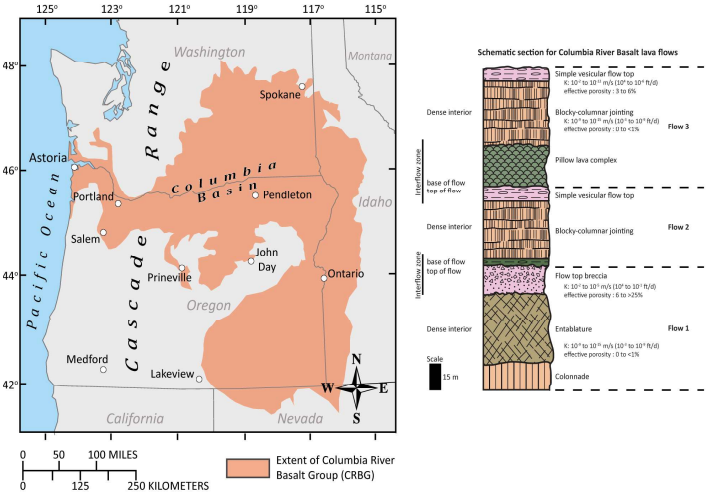
Carbon Dioxide Emissions in Oregon



Map of CO_2 point sources in Oregon as of 2021 (Data from EPA).

Geologic Carbon Sequestration Possibilities

Thick and deep, stacked lava flow sequences of the 17 to 6 million-year-old Columbia River Basalt Group (CRBG), a continental flood-basalt province, serve as potential reservoirs for CO_2 storage and mineralization in the Columbia Basin of eastern Oregon and Washington.



Extent of CRBG in Oregon, Washington, and Idaho and a schematic section of typical CRBG lava flows. Targets for CO_2 storage would be porous tops of lava flows (J.D. McClaughry, DOGAMI).

Target reservoirs in the CRBG reside within the Grande Ronde Basalt, below the potable water zone in the Columbia Basin. The Grande Ronde Basalt is composed of ~100 individual, laterally extensive lava flows, with a thickness up to 14,760 feet. These lava flows encompass an area of nearly ~65,599 square miles. Grande Ronde lava flows consist of highly fractured, weathered, brecciated, and/or vesicular flow tops and bases with dense, crystalline colonnade and/or entablature interiors. Lava flow tops and bottoms have an estimated porosity of 14 to 39%, while most flow interiors are estimated to have a porosity around 1 to 2%. Estimates of CO_2 storage potential in the CRBG range from 10 metric gigatons (Gt) to 100 Gt.

Key Fact! – ***Basaltic rocks are highly reactive with metals needed to permanently immobilize CO_2 by forming carbonate minerals. Where fractured and porous, basaltic rocks provide storage space for the mineralized CO_2.***

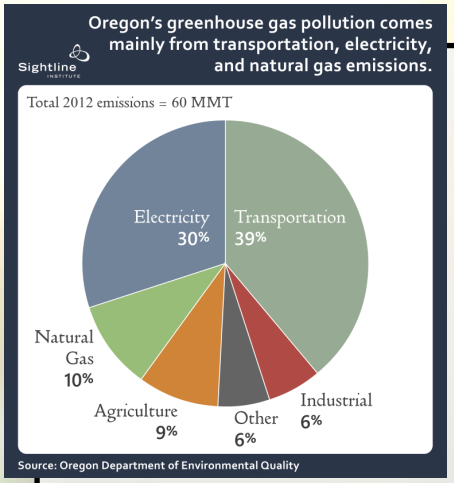
The Oregon Department of Geology and Mineral Industries provides earth science information and regulation to make Oregon safe and prosperous.

For more information, please contact

ODEQ: Whitney Dorer
Whitney.Dorer@DEQ.Oregon.gov

CTUIR FFPP: Colleen Sanders
ColleenSanders@CTUIR.org

Oregon Community Climate Investments (CCI)

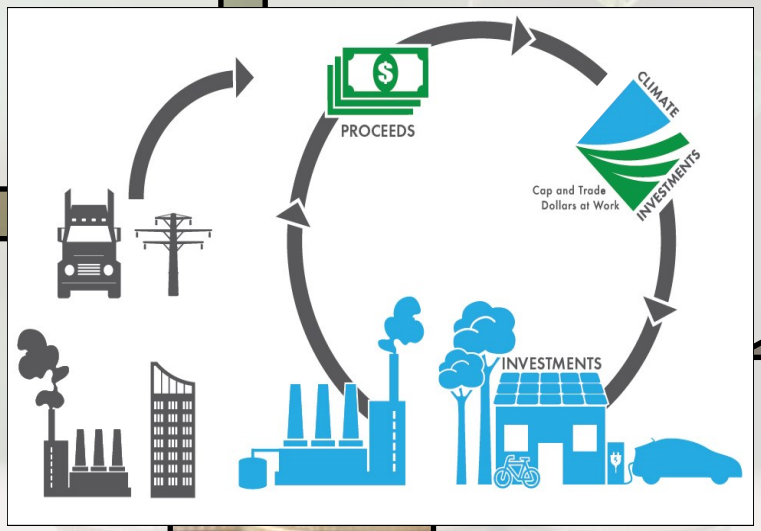


Transportation Fuel Suppliers Pay Up

As part of the Climate Protection Program, fuel suppliers can contributing a limited amount of funds to DEQ-approved CCI entities. Those CCI entities then invest those funds in projects that reduce greenhouse gas emissions in Oregon's environmental justice communities.

CCI Project Priorities:

1. Reducing greenhouse gas emissions on average at least one ton per CCI credit
2. Reducing emissions of other air contaminants, particularly in or near environmental justice communities
3. Promoting public health, environmental, and economic benefits for environmental justice communities
4. Accelerating the transition to clean energy, particularly in or near environmental justice communities



Funding for Community Projects

Every year, the program lowers those limits with a goal of reducing statewide fossil fuel emissions 50% by 2035 and 90% by 2050. One of the ways fossil fuel companies can reduce their greenhouse gas emissions is through the Community Climate Investment program.

The current contribution amount is $123 effective March 1, 2023, through Feb. 29, 2024.

How are Funds Distributed?

DEQ and Community Climate Investment Equity Advisory Committee selected Seeding Justice to be a Community Climate Investment Entity to implement the funding.

Seeding Justice estimates the fund would generate $150 million each year for climate action across the state.

seeding justice

For more information, please contact

ODEQ: Whitney Dorer
Whitney.Dorer@DEQ.Oregon.gov

CTUIR FFPP: Colleen Sanders
ColleenSanders@CTUIR.org

Columbia River Gorge National Scenic Area

Climate Change Action Plan Priorities
2023-2030

OVERALL PRIORITIES

Inclusive Climate Action
Engaging with diverse communities and partners across the Gorge

High Climate Resilience Areas
Identifying and conserving areas expected to support species in a changing climate

ADAPTATION

Cold Water Refuge Streams
Protecting water temperature and flow for fish

Wetlands
Improving wetland habitat for associated plants and wildlife

Tribal Treaty Rights
Supporting Tribes to ensure ecosystems and land use promote accessible, thriving First Foods

Oak Woodlands
Improving oak woodland habitat and corridors

MITIGATION

Regional Transportation
Reducing single-passenger vehicle travel and promoting regional transit

Electric Vehicle Infrastructure
Increasing charging stations and collaborative electrification planning

Carbon Sequestration
Enhancing land-based carbon sequestration

Fire Risk
Supporting resilient forests and fire-adapted communities

www.gorgecommission.org/initatives/climate-change