

OSU Path to Carbon Neutrality

Introduction

After adopting the American College and University Presidents' Climate Commitment, known as the [Carbon Commitment](#), Oregon State University in 2009 selected a target date of 2025 to achieve carbon neutrality, and undertook immediate actions to reduce greenhouse gas (GHG) emissions throughout the university.

OSU has taken many steps to advance this commitment. Between 2008 and 2019, the university reduced total emissions by 12% (figure 2), and when normalized for enrollment and building growth, the reduction equals 41% per student and per square foot of building space (figure 3). OSU recently implemented an energy policy and a green building policy, and has taken other steps to systemically address carbon emissions. The university has pledged to construct its OSU-Cascades campus in Bend with net zero goals for campus energy, water and waste. Notably, advancing climate science and sustainability are integral to OSU's mission as a land grant university, and Strategic Plan 4.0 includes carbon reduction as an institutional priority.

Actions since signing the Carbon Commitment have included installing 10 acres of solar arrays; the construction of the OSU Energy Center on the OSU Corvallis campus; the adoption of a net zero plan for energy, waste and water for the OSU-Cascades campus; and implementation of updated university construction standards. The university acknowledges further actions and increased investment are necessary to continue and accelerate carbon reduction. This requires careful prioritization and a deliberate plan of action being carried out.

The OSU Path to Carbon Neutrality strengthens OSU's Carbon Commitment and updates the university's [2009 Climate Plan](#) by outlining and prioritizing direct and indirect actions to achieve our goal of carbon neutrality in 2025, or soon thereafter.

Direct Actions to Reduce Emissions

Accounting for constraints like construction timing, space for new renewable energy technologies and non-renewable energy delivered from regional grids, OSU can achieve at least a 34% reduction in direct emissions in the next 10 years or less with a number of direct actions. These actions will require an additional minimum annual investment of approximately \$1.25 million over 10 years. Planned investments include:

- **Deep energy efficiency** in existing buildings via heating and cooling system tune ups (also included in SP 4.0) and upgrades, lighting upgrades, heating and cooling scheduled system refinement, etc.
- **Enhancement funds** to ensure capital construction projects optimize designs to reduce water and energy use, and long-term maintenance.
- **Transportation and land use planning** that aims for a drive-alone rate for commuters to the Corvallis campus of no more than 20%.
- **Strategic investments in solar** equipment at OSU properties across the state.

These investments have numerous and varied benefits in addition to carbon reduction, including reduced operating and maintenance costs, improved student engagement and retention, more comfortable buildings, increased reliability for research activities and positive public relations.

Indirect Actions to Reduce Emissions

Indirect emissions reductions fall into two categories: 1) new renewable energy generation that the university does not own but can benefit from (such as a new wind turbine or a solar farm), and 2) purchases of renewable energy certificates (RECs) or carbon offsets from existing resources that cause incremental change in the carbon marketplace.

New projects can involve partnerships with local utility companies, national energy providers and other parties via long-term contracts. The University Facilities, Infrastructure and Operations (UFIO) Sustainability Office has engaged Pacific Power, NW Natural and others to explore long-term power purchase agreement options (typically over 5 to 10 years) for renewable energy, and potentially aggregating with other Oregon consumers to reduce cost.

While carbon offsets and RECs offer a more immediate solution, they do not address university preference for new renewable energy generation systems coming online as a result of university action.

What Happens in 2025?

By investing in the prioritized list of actions in Table 1, direct emissions can drop 15-20% by 2025 and by 35% or likely more by 2030. Purchase agreements for renewable energy could be in place by 2025, reducing emissions by another 20% or so.

In 2025, the university could choose to purchase carbon offsets to address some or all of its remaining emissions, and over time seek to reduce any reliance on offsets. This portfolio of immediate and longer-term capital investments combined with third-party partnerships and carbon offsets is becoming a common sustainability approach among leading higher education institutions in the United States. One example is American University in Washington, D.C., which [achieved carbon neutrality](#) in 2018 by purchasing green power and carbon offsets. According to its [2020 STARS report](#), American University purchased 30,723 tons of carbon offsets to achieve carbon neutrality. It is projected that OSU would need to purchase 70,000 to 80,000 tons of offsets per year starting in 2025 to achieve carbon neutrality. This would cost approximately \$600,000 per year.

OSU Path to Carbon Neutrality

OSU can reach its carbon neutrality commitment by 2025 by following the direct and indirect actions listed below, while building on policies and systems developed over the past 10 years.

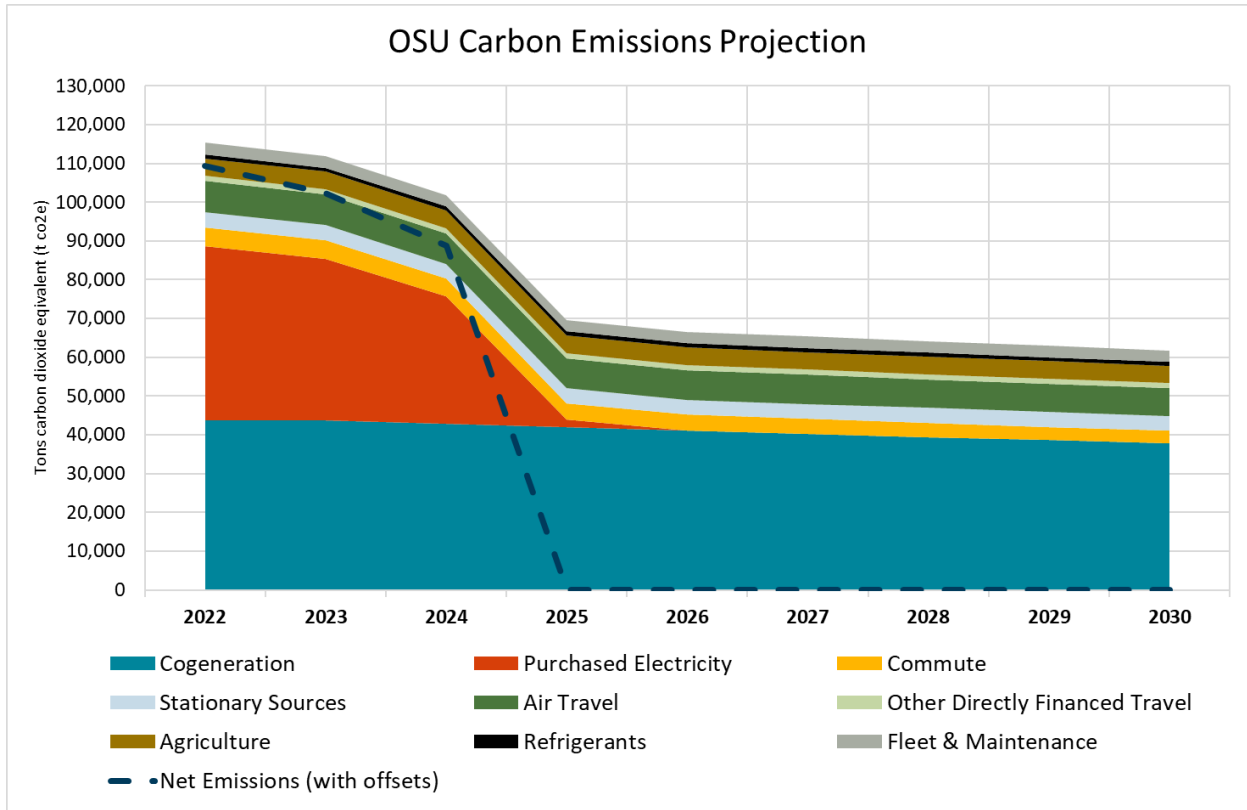


Figure 1: Projected OSU emissions under a 2025 carbon neutrality scenario

Table 1: Carbon Reduction Actions, Estimated Annual Costs and Impacts

Action Priority	Action	Description	% Carbon Reduction	Estimated Marginal Cost	Source of Funds	Funding Status
1	Improve Existing Building Efficiency	Increase building efficiency by implementing heating and cooling system tune ups and calibration, known as retro-commissioning, within at least two existing buildings each year.	16%	\$ 500,000	Utility Savings Reinvestment*	Funded
2	Leverage Capital Improvement and Renewal Projects	Replace and upgrade heating and cooling systems, building controls, lighting and other aging and failing systems to improve energy efficiency in existing buildings.	9%	\$ 500,000	Capital Improvement and Renewal	Funded
3	Expand On-site Renewable Energy	Install solar electrical equipment at two to four university properties each year for 10 years.	6%	\$ 1,000,000	Revenue Bond	Funded
4	Decarbonize Major Capital Projects	Include deep energy efficiency and decarbonization in Major Capital Projects. Prioritize renovation of existing buildings over building new structures, whenever possible. Evaluate hybrid work opportunities to reduce needed building space.	5%	\$ 500,000	Capital Forecast	TBD
5	Purchase Off-site Renewable Energy	By 2025, all of OSU's purchased electricity comes from renewable sources.	17%	\$ 150,000	Operating Funds	TBD
6	Implement Sustainable Transportation Strategy	By 2030, implement OSU's Sustainable Transportation Strategy to reduce commute emissions. Encourage alternatives to university-funded air travel.	5%	\$ 1,100,000	Multiple	Partially Funded
7	Engage University Community	Inspire individual and collective actions that reduce carbon emissions by conducting outreach campaigns that engage the university community.	1%	\$ 5,000	Operating Funds	Funded
8	Decarbonize District Energy Systems	Create a plan and timeline to eliminate fossil fuel use at the OSU Energy Center and in Corvallis campus district energy distribution systems.	TBD	TBD	TBD	TBD
9	Utilize Carbon Offsets	Prioritize direct emissions as much as possible. Evaluate carbon offset potential from university lands. Evaluate third-party-certified, regional carbon offsets to address remaining emissions.	41%	\$ 600,000	Operating Funds	TBD
Total Annual Investment			100%	\$ 3,105,000		
Unfunded Actions				\$ 1,250,000		

* Possible annual scale up to supplement existing \$900,000 Utility Savings Reinvestment (USR)

Action 1

Improve Existing Building Efficiency

Goal: Increase building efficiency by implementing heating and cooling system tune ups and calibration, known as retro-commissioning, within at least two existing buildings each year.

SP 4.0 connection: Evaluate return on investment and develop a plan for increasing the pace of retro-commissioning of existing buildings.

Opportunity

Most OSU buildings have automated control systems to schedule and monitor heating and cooling. Malfunctioning controls can result in simultaneous heating and cooling, comfort issues and other issues that severely impact energy use. Since buildings represent over 75% of OSU's measured carbon emissions, and since heating and cooling needs drive the majority of building energy use, substantial financial and carbon savings — often exceeding 25% — can be achieved by the use of optimized controls. Financial payback is typically within two to six years.

The estimated marginal cost for this action is \$500,000 and will be funded from the Utility Savings Reinvestment Fund. This action is planned to lead to 16% reduction in carbon emissions.

Current State

University Facilities, Infrastructure and Operations (UFIO) has begun a small scale retro-commissioning program in one building approximately every two years. This work has been limited by existing staffing levels.

Planned and Future Actions

- Planned: Add two additional staff positions in the Facilities Services Building Controls Shop in 2022 to focus on proactive energy efficiency measures.
- Planned: Utilize a newly established reserve fund to capture financial savings from completed projects, and use proceeds for funding future projects and some labor costs.
- Future: Reinvest additional utility savings to expand program as funding allows.

Action Timeline	Project example
Short	Gilbert Addition Retro-commissioning
Complementary Actions	<ul style="list-style-type: none"> • Project cost: \$200,000 • Funding source: Utility Savings Reinvestment Fund • Completion year: 2022 • Carbon reduction: 200 tons/year
Capital Improvements and Renewal Projects (Action 2)	
Lead	
Sustainability Office, Facilities Services	

Action 2

Leverage Capital Improvement and Renewal Projects

Goal: Replace and upgrade heating and cooling systems, building controls, lighting and other aging and failing systems to improve energy efficiency in existing buildings

Opportunity

As building systems age and degrade, performance and energy efficiency suffer. This is particularly true within heating and cooling systems and controls. Additionally, some older buildings lack automation and other features to achieve efficient operation.

The estimated marginal cost for this action is \$500,000 and would be paid from Capital Improvement and Renewal funds. This action is planned to lead to approximately a 9% reduction in total carbon.

Current State

The university's [Facilities Renewal Initiative](#) (FRI) seeks to decrease the backlog of deferred maintenance within aging building systems. The FRI was begun in FY18 and over a decade, is anticipated to replace building systems that are failing or are highly inefficient.

Action Timeline	Project example Energy Center Steam Turbine
Short to Medium	<p>Project cost: \$3 million</p> <ul style="list-style-type: none"> Details: The Energy Center uses a natural gas turbine and a steam turbine to generate steam and electricity for the Corvallis campus. When steam demand fluctuates, some energy is lost due to the existing steam turbine's inability to respond quickly. Upgrading the steam turbine to one that is more responsive will allow it to produce more electricity more effectively. Funding Source: Student Sustainability Revolving Funds and E&G Capital Improvement and Renewal funds (CIR) Completion year: 2022 Carbon reduction: 3,700 tons/year
<p>Complimentary Actions Existing Building Efficiency (Action 1) Off-site Renewable Energy (Action 5)</p>	
<p>Leads Capital Planning and Development, Facilities Services</p>	



Action 3

Expand On-site Renewable Energy

Goal: Install solar electrical equipment at two to four university properties per year over 10 years

Opportunity

Photovoltaic (solar electric) energy represents the best on-site renewable energy resource for most OSU properties. Full buildout of solar systems on suitable building roofs can provide around 5% of the energy needed for a complex, multi-story lab building or as much as 100% of the energy needs for simpler low-rise buildings.

The estimated marginal cost for this action is \$1 million and would be paid from revenue bonds, leading to a 6% reduction in total carbon.

Current State

OSU receives approximately 3% of its electricity from on-site solar systems – predominantly from [five ground mounted systems](#) owned by Tesla. With only one large rooftop system located at the Student Experience Center, there are many opportunities for additional solar facilities at OSU sites across the state. A 2020 solar assessment has informed OSU's Solar Development Plan, and indicates that at least six megawatts of additional solar-generated power is feasible in fewer than 10 years – enough to power around 600 homes.

Planned and Future Actions

- Planned: In 2022, utilize a power purchase agreement to access federal tax incentives and install at least one new solar electric system.
- Future: Utilize a power purchase agreement model to complete two to four solar power projects per year, including within some Major Capital Projects.

Action Timeline	Project example
Short to Medium	Campus Operation Center Solar
Complimentary Actions	<ul style="list-style-type: none"> • Project cost: \$600,000 • Portion of building electricity from solar: 100% • Funding source: OSU revenue bonds • Carbon reduction: 380 tons/year
Major Capital Projects (Action 4) Off-site Renewable Energy (Action 5)	
Lead	
Sustainability Office	



Action 4

Decarbonize Major Capital Projects

Goal: Include deep energy efficiency and decarbonization in Major Capital Projects. Prioritize renovation of existing buildings over building new structures, whenever feasible. Evaluate hybrid work opportunities to reduce needed building space.

Opportunity

Adding premium efficiency equipment, renewable energy systems and electrification measures during the construction of new buildings and the renovation of existing buildings is the most effective way to achieve extensive energy efficiency and leverage existing funding sources. Retrofitting equipment and systems can be more costly and less effective; by enhancing funding for decarbonization projects in the 10-Year Capital Forecast, efficiencies can be both more extensive and less costly. This is particularly true for major renovations, which represent the vast majority of work in OSU's Ten-Year Capital Forecast. Additionally, since buildings represent over 75% of OSU's measured carbon emissions, improved space management and more hybrid work programs – including employees working within a mix of onsite and remote work – could help reduce emissions by “right sizing” OSU's space needs. This may delay or eliminate the need to add square footage within OSU campuses and facilities statewide.

The estimated marginal cost for this action is \$500,000 from a funding source to be determined. This action is planned to lead to at least 5% reduction in total carbon.

Current State

The Corvallis Campus Vision prioritizes renovation over constructing new buildings, whenever feasible. Capital projects increase energy efficiency but often cannot reach ultra-low or no carbon status. Adding measures to decarbonize buildings will increase initial project costs but reduce operating costs over the life of a building. We estimate a 4% to 5% cost premium to reach minimum decarbonization goals in OSU's *Requirements for Sustainable Development*. Further energy savings and carbon reduction will be evaluated.

For more information, please see the [Ten-Year Capital Forecast](#).

<p>Action Timeline Medium to Long</p> <p>Complimentary Actions On-site Renewable Energy (Action 3) University Community Engagement (Action 7)</p> <p>Lead Capital Planning and Development</p>	<p>Project examples</p> <p>LaSells Stewart Center roof & heating/cooling upgrade</p> <ul style="list-style-type: none"> • Project cost: \$6 million • Funding source: State and E&G Capital Improvement and Renewal funds (CIR) • Completion year: 2022 • Decarbonization features: energy use 20% below building code • Carbon reduction: 100 tons/year <p>Arts & Education Complex</p> <ul style="list-style-type: none"> • Project cost: \$500,000 • Funding source: OSU revenue bonds designated for Carbon Neutrality Projects in the Capital Forecast • Completion year: 2024 • Decarbonization features: rooftop solar array, energy use 29% below building code, designed for full electrification (no natural gas) in the future via high efficiency heat pumps and other measures
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Action 5

Purchase Off-site Renewable Energy

Goal: By 2025, all of OSU's purchased electricity will come from renewable sources

SP 4.0 connection: Develop funding and contracting pathways that increase proportion of university energy use that is renewable

Opportunity

By combining OSU's purchasing power with that of other large electrical consumers in Oregon — and by entering into multi-year power purchasing contracts — the university can cost effectively increase its acquisition of electricity from renewable sources. Models like [Portland General Electric's Green Future Impact](#) have paved the way for this type of purchasing program.

The estimated marginal cost for this action is \$150,000 from a funding source to be determined. This action is planned to lead to 17% reduction in total carbon.

Current State

OSU purchases from Pacific Power approximately 60% of the electricity needed for the Corvallis campus. The balance comes from the OSU Energy Center. Over 55% of Pacific Power's electricity comes from burning coal, which emits twice as much carbon dioxide as natural gas. Pacific Power's long-range plans reduce the amount of coal in their grid mix, but OSU is currently in discussions with the firm about accelerating its transition to clean power production, similar to PGE's Green Future Impact program.

Planned and Future Actions

- In 2022 and beyond, continue conversations with Pacific Power and other firms, as necessary, to establish by 2025 a renewable energy purchasing contract that provides new, regional renewable resources.

<p>Action Timeline Medium to Long</p>	<p>Lead Sustainability Office</p>
<p>Complimentary Actions On-site Renewable Energy (Action 3) District Energy De-carbonization (Action 8)</p>	<p>Project Cost Approximately \$150,000</p>
	<p>Funding Source Operating funds from Energy Operations</p>

Action 6

Implement Sustainable Transportation Strategy

Goal: By 2030, implement OSU's Sustainable Transportation Strategy to reduce commute emissions. Encourage alternatives to university-funded air travel.

Opportunity

Within the 2030 Sustainable Transportation Strategy (STS), the university commits to reduce by 33% drive-alone commute trips to the Corvallis campus from 30% to 20%. The STS includes bold actions that, when implemented together, will reduce OSU's total carbon emissions by approximately 2%. The actions will increase the ease of commuters engaging in more sustainable methods of commuting and will decrease total commuter-related greenhouse gas emissions, foster positive relationships with the community, and preserve land for open space and university education and research operations that otherwise would be utilized for parking lots. Regarding air travel, the COVID-19 pandemic has taught us new ways to engage with others nationally and internationally without flying. Prioritizing digital engagement and encouraging careful and selective use of air travel, will be critical in reaching OSU's emissions goals.

The estimated marginal cost for this action is approximately \$1.1 million with partial funding from established E&G resources and from other sources being explored. Action 6 is planned to lead to 5% reduction in total carbon.

Current State

Emissions from Corvallis campus commuters' current 30% drive-alone commute rate account for approximately 6% of the university's total emissions. Historically, air travel funded by the university contributes to around 11% of OSU's total carbon emissions.

Planned and Future Actions

Please see the [Sustainable Transportation Strategy](#) for a full list of projects and more details.



Action Timeline

Short to Medium

Complimentary Actions

Existing Building Efficiency (Action 1)
University Community Engagement (Action 7)

Lead

Transportation Services

Project example

Campus Mobility Hub

- **Project cost:** \$400,000
- **Funding source:** State grant funding (external)
- **Completion year:** 2023
- **Decarbonization features:** improved connection between multiple transit systems and bike/pedestrian amenities

Action 7

Engage University Community

Goal: Inspire individual and collective actions to reduce carbon emissions by conducting outreach campaigns that engage the university community.

SP 4.0 connection: Conduct annual outreach and action campaigns to engage the university community in individual and collective actions that reduce carbon emissions.

Opportunity

Each member of the university community has a role to play in reducing carbon emissions. Through a combination of collective action and centralized investments, significant carbon savings can be reached, and more resources may be leveraged for further work.

The estimated marginal cost for this action is \$5,000 annually and will be funded by operating funds. This action is planned to lead to 1% reduction in total carbon.

Current State

In collaboration with the Faculty Senate Carbon Commitment Committee (C3), the Sustainability Office plans to hold or support at least one university-wide forum or campaign each academic year. In 2021, the Provost's Office, C3 and the Sustainability Office co-hosted "Carbon Neutral OSU: What You Can Do" to engage the university community in advancing OSU's Carbon Commitment. On the Corvallis campus, a residence hall [Eco-Reps program](#) hosts an annual energy competition between residence halls. The Sustainability Office's [Green Certification programs](#) offer numerous ways to measure and advance sustainability efforts at the unit level throughout OSU, including within the affiliated Greek community. Student organizations, including the Associated Students of OSU, are also engaged in promoting campaigns and efforts.

Planned and Future Action Examples

- Planned: Continue annual Eco-Rep energy reduction competition, which is known as the Kilowatt Crackdown.
- Planned: Support Faculty Senate Carbon Commitment Committee periodic campaigns and initiatives that engage the university community in direct action.
- Future: More widely market Green Certifications and similar programs throughout the university community, adding participation or achievement incentives.

Action Timeline

Short to Medium

Complimentary Actions

Sustainable Transportation Strategy (Action 6)

Lead

Faculty Senate Carbon Commitment Committee (C3),
Sustainability Office



Action 8

Decarbonize Corvallis Campus District Energy Systems

Goal: Create a plan and timeline to eliminate fossil fuel use at the OSU Energy Center and in Corvallis campus district energy distribution systems.

Opportunity

Centralized or “district” energy distribution systems offer significant potential efficiencies and flexibility for large organizations like university campuses. In recent years, some universities, including Stanford and Texas A&M, have shifted away from steam systems like that used on the Corvallis campus, in favor of chilled and heated water distribution. Water distribution systems are more flexible and efficient, and offer both heat recovery and injection opportunities not possible with steam energy.

The estimated marginal cost, funding and carbon reduction for this action on the Corvallis campus is to be determined.

Current State

The North District Utility Plant on the Corvallis campus was completed in 2021 and offers the first of what could be several interlinked district systems that share heated and/or chilled water. Several smaller “loops” exist in other parts of the Corvallis campus, presenting intriguing opportunities. For example, renovation and re-development of the north campus triangle and engineering district is planned to be served from a large and expandable chiller plant located within Kelley Engineering Center. This “mini” district already serves Kelley and Johnson Hall with piping and valves ready to expand to other buildings.

Future Actions

- Planned: Renovated and new buildings planned in the 10-Year Capital Forecast will have systems that can be integrated with energy efficient, reliable and cost-effective district energy systems.
- Planned: Begin long range planning over 15-20 years to determine future energy distribution systems.
- Future: As more “mini districts” are established on the Corvallis campus, add major infrastructure (such as piping and conduits under roadways) that allow future flexibility to tie in larger districts.

Action Timeline

Study: short; Implementation: long

Complimentary Actions

Major Capital Projects (Action 4)

Lead

Capital Planning and Development

Action 9

Utilize Carbon Offsets

Goal: Prioritize direct emissions as much as possible. Evaluate carbon offset potential from university lands. Evaluate third-party-certified, regional carbon offsets to address remaining emissions.

Opportunity

Carbon offsets offer an immediate, but indirect solution to reducing OSU greenhouse gas emissions. University lands may offer significant potential to produce verified carbon offsets that contribute to eliminating OSU's carbon footprint. If needed, purchasing local offset products supports actions in the Pacific Northwest and elsewhere that reduce global warming. For emissions not practical to eliminate in the short term, such as significantly reducing the consumption of natural gas within the Energy Center or reducing employee air travel, offsets – whether sourced internally from OSU land holdings, or purchased from external sources – offer a “bridge” solution that can be implemented quickly, are flexible in scale, and can be reduced over time.

The estimated marginal cost for this action is \$600,000 from operating funds. This action is planned to lead to up to 41% reduction in total carbon.

Current State

OSU annually purchases small amounts of carbon offsets and renewable energy certificates (RECs) to offset travel-related emissions through an [opt-in program](#) for business travelers, and to offset electricity use in selected buildings. Renewable energy purchases are typically specific to buildings seeking green building certification, or at the direction of students.

Planned and Future Actions

- Planned: Continue promoting opt-in programs for travel offsets and targeted REC purchases.
- Planned: Evaluate carbon offset potential from university lands.
- Planned: Monitor carbon offset and REC regional and national pricing, evaluating the appropriate volume of purchases on a year-by-year basis.

<p>Action Timeline Medium to Long</p>	<p>Project example Winston Creek Project</p>
<p>Complimentary Actions All</p>	<ul style="list-style-type: none"> • Achieves greenhouse gas reduction by extending the rotation age of forest stands. • Price per offset ton: \$10-\$12
<p>Lead Sustainability Office</p>	

Supporting Documentation

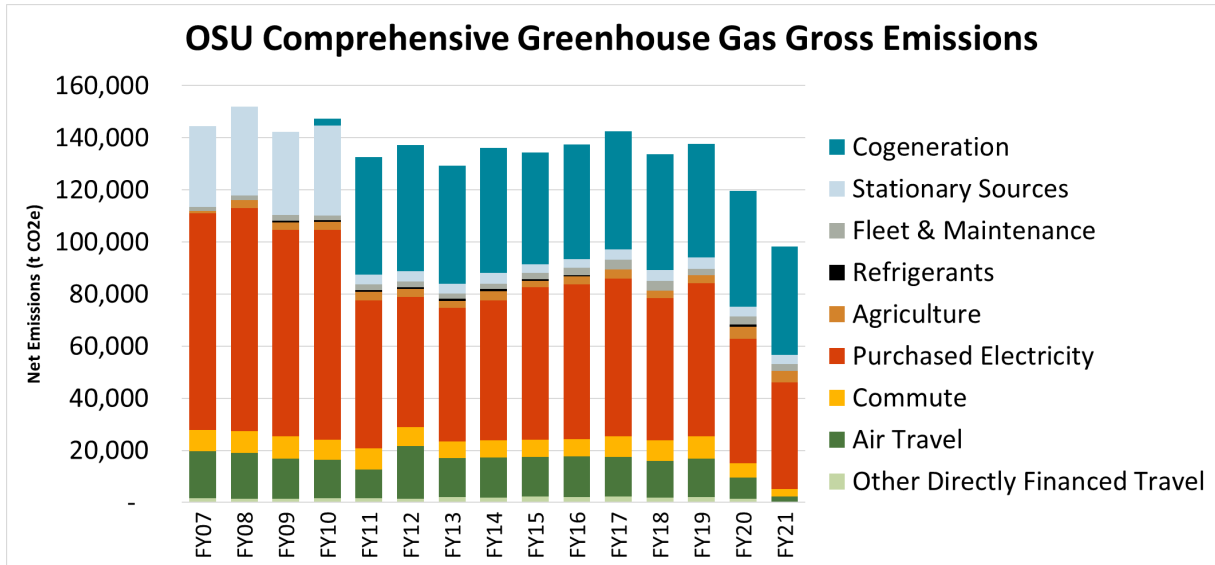


Figure 2: Oregon State University greenhouse gas emissions trend

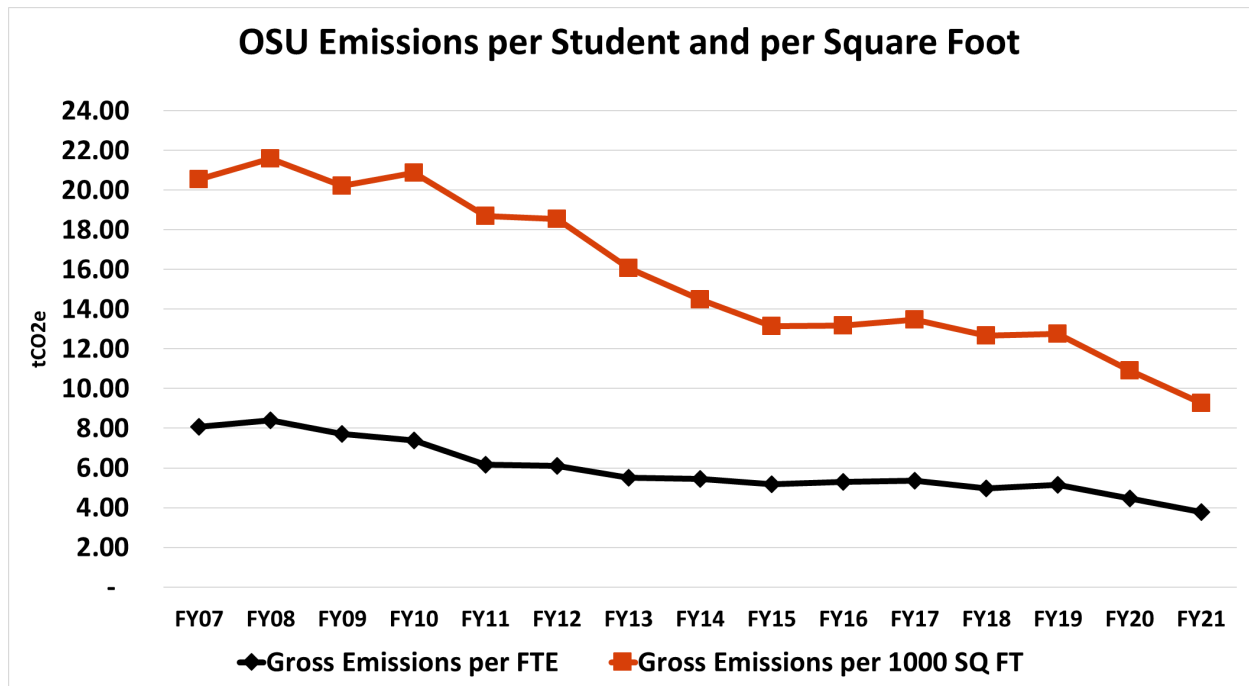


Figure 3: Normalized emissions per FTE student and per square foot of building space

Ten Year Carbon Emissions Reduction by Emissions Category

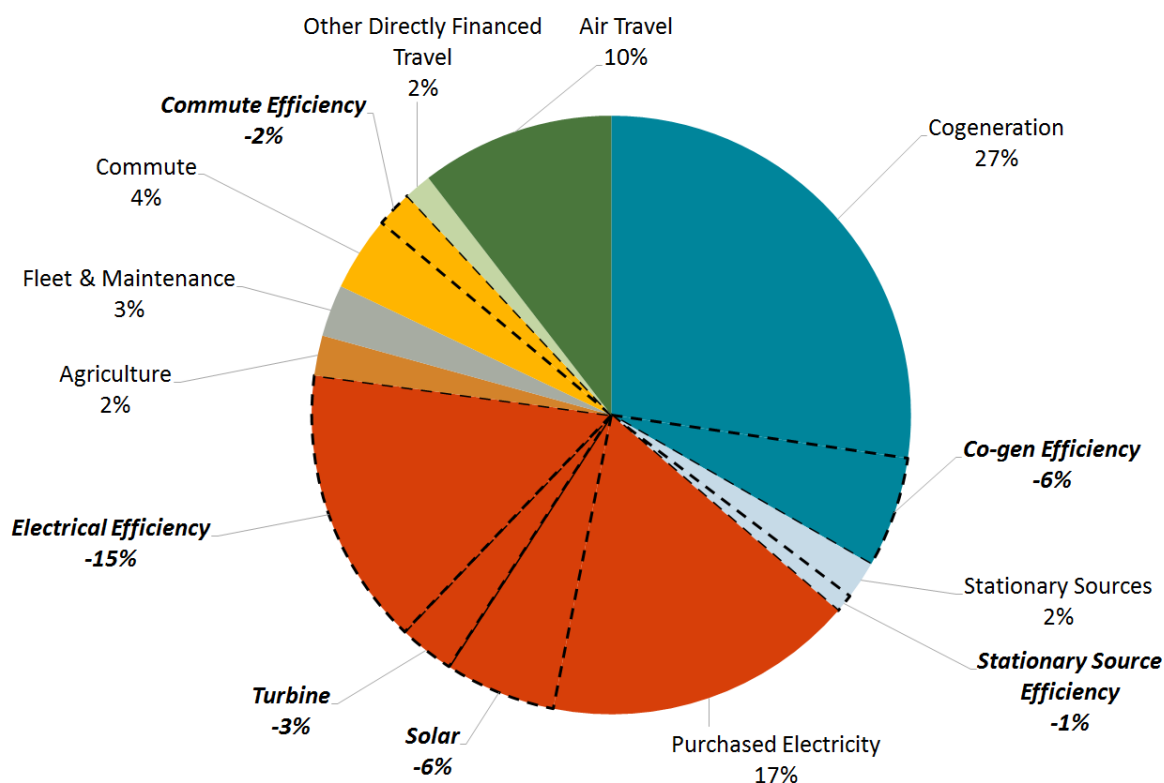


Figure 4: Direct emissions reductions (shown bolded) with enhanced investment of ~\$1.5M/year

External Influences

- OSU's reliance on non-renewable natural gas is significant. Although highly efficient, the OSU Energy Center runs on a fuel for which there are few sufficient renewable sources. Renewable fuels markets are tapped presently. University Facilities, Infrastructure and Operations is prioritizing a gas-free future by including options for several major capital projects, such as the Arts and Education Complex, to be heated only with electricity in the future.
- Energy efficiency programs and use of solar power reduce the impact and uncertainty of energy cost escalation within the context of state or federal carbon pricing. These same measures improve disaster resilience and help the institution adapt to a changing climate.
- Pacific Power, which serves as the university's main source of outside electricity, currently generates over 55% of its power from coal. According to [PacifiCorp's 2019 Integrated Resource Plan](#), a substantial shift to lower carbon electricity sources will take more than 10 years to achieve.