1. **Transportation Sector**
   1. **Vehicle Miles Traveled (VMT) reduction though water transportation**
      1. *GHG Reduction Estimate Method*

This greenhouse gas (GHG) estimate is based on calculations for current active freight barging routes between Port Angeles, WA and destinations in Washington and Oregon. The GHG reduction is produced through the removal of trucks from highways and the corresponding drop in VMT when substituting barging. GHG reduction estimates for the proposed measure are modeled on actual VMT, fuel consumption, and freight volume numbers from 2023. These datasets were compiled on a weekly basis by the Port of Port Angeles and its logistics partners who received freight from Port Angeles. 2023 data reflects outbound (export) barges departing Port Angeles to be received at other ports in Washington and Oregon.

Emissions from long-haul trucking are estimated by calculating the emissions per VMT. Emissions from barging are estimated by adding the emissions per VMT (short-haul trucking) and the emissions from towing vessel fuel consumption (see Calculations Spreadsheet).

* + 1. *Assumptions and Activity Data*

**Implementation Assumptions**

* Year 1:
  + Purchase and installation of spud barge for use in shipping routes
  + Purchase of an inland barge; signed documents leasing the inland barge to a qualified operator
  + Develop management program for scheduling barging route
* Year 2:
  + 1-2 qualified participants selected and enrolled into management program
  + New inland barge begins operating

**GHG Emission Reduction Estimate Assumptions**

* Activity on existing barge routes is assumed to increase as a result of the proposed measure, doubling barge capacity.
* Emissions reductions are assumed to begin in 2026 as project implementation will occur for the first year following funding dispersal. Additional assumptions, uncertainties, and calculations are included in the Calculations Spreadsheet.

**Measure Specific Activity Data**

* Amount of GHG emissions reductions
* Amount of increase in barge traffic route
* Amount of reduction in long-haul trucking VMT
* Amount of reduction in Hazardous Air Pollutants (HAPs) and Criteria Air Pollutants (CAPs)
  + 1. *Reference Case Scenario (GHG emissions or activity level)*

The Reference Case is based on a business-as-usual scenario, the continuation of long-haul trucking. It assumes none of the proposed projects would be built and that the annual average emissions remain constant. See Calculations Spreadsheet for further details and assumptions. Calculations do not take into account the effects of upcoming federal or state incentive programs.

* + 1. *GHG Emissions Reduced*

Table 1 displays emissions reduced. Specific annual GHG emissions reduced are noted in the Calculations Spreadsheet.

Table 1. Estimates of emissions reductions from this measure between 2025-2030 and 2025-2050.

|  |  |  |
| --- | --- | --- |
| ***Measure or Project*** | ***Cumulative Reductions 2025-2030 (MTCO2e)*** | ***Cumulative Reductions 2025-2050 (MTCO2e)*** |
| *Mode switch, reduction in VMT* | *3,626* | *18,130* |

* 1. **Enable decarbonization of rail infrastructure**
     1. *GHG Reduction Estimate Method*

Greenhouse gas (GHG) emissions reductions were calculated by estimating the emissions reduced by the conversion of existing locomotive engines to more fuel efficient, EPA certified Tier 3 and Tier 4 standards. Emissions and fuel consumption information is based on data and calculations done by Cummins and Western Rail, as well as EPA (see Calculations Spreadsheet).

* + 1. *Assumptions and Activity Data*

**Implementation Assumptions**

* Timeline estimated to take at least six to eight months to complete the building design process with an additional six to eight months for the project consultants to draft and finalize a shovel-ready, turn-key building specification plan for the construction of the maintenance and repair shop.
* The actual infrastructure construction of this new facility could take up to 12 to 16 months.
* Following the above estimated 36 month planning and construction phases, engine conversions can begin at a rate of an additional 6 per year on average.

**GHG Emission Reduction Estimate Assumptions**

* Full construction of the conversion facility is estimated to take 3 years beginning in 2025, enabling emissions reductions from grant funding to begin in 2028.
* Assuming there are 6 possible conversion types from existing engines to Tier 3 or Tier 4 engines.
* All engine conversions are assumed to take place with equal frequency.
* Additional information, uncertainties, and assumptions may be found in the Calculations Spreadsheet.

**Measure Specific Activity Data**

* Number of locomotives upgraded to Tier 3/4
* Amount of GHG emissions from new hydrogen fuel locomotives
* Improvements in air quality
* Amount of fuel conserved
* Number of direct/indirect jobs created through workforce development program
  + 1. *Reference Case Scenario (GHG emissions or activity level)*

The Reference Case is based on a business-as-usual scenario. It assumes none of the proposed projects would be built and that the annual average engine conversion rate remains the same as estimated into the future. See Calculations Spreadsheet for further details and assumptions. Calculations do not take into account the effects of upcoming federal or state incentive programs.

* + 1. *GHG Emissions Reduced*

Table 2 displays emissions reduced. Specific annual GHG emissions reduced are noted in the Calculations Spreadsheet.

Table 2. Estimates of emissions reductions from this measure between 2025-2030 and 2025-2050.

|  |  |  |
| --- | --- | --- |
| ***Measure or Project*** | ***Cumulative Reductions 2025-2030 (MTCO2e)*** | ***Cumulative Reductions 2025-2050 (MTCO2e)*** |
| ***Convert Engine #1 to Cummins Engine #3*** | *3,858* | *177,456* |

* 1. **Vehicle-to-grid integration for resilience**
     1. *GHG Reduction Estimate Method*

Emissions reduction calculations are composed of the electric vehicle emission reductions portion of this project. The vehicle to grid benefits are not calculated as a small pilot project is planned.

For the electric vehicle emission reduction estimations, the historic annual gasoline/diesel emissions were compared to the projected electricity emissions after the project. Annual gallons of fuel consumed were multiplied by the EPA’s CO2e equivalency factors to obtain the historic emissions from the vehicles to be replaced. For the projected emissions, the mileage for those same vehicles was multiplied by their kWh per mile figures for the electric replacements. The total amount of electricity required to replace that fuel use was then converted to CO2e by multiplying by Avista’s specific grid emission figures. It is expected that approximately 80% of emissions will be demonstrably avoided through the use of zero emission fleet EV (see Calculations Spreadsheet).

* + 1. *Assumptions and Activity Data*

**Implementation Assumptions**

* Implementation will occur over several years, including purchasing, charging stations installation, and data collection for potential grid-related benefits and other renewable energy opportunities.
* Vehicle purchases will occur over a staggered timeline beginning in 2025, with a vehicle conversion rate included in the Calculations Spreadsheet, assuming supply chain issues do not hinder progress.

**GHG Emission Reduction Estimate Assumptions**

* Annual gallons of fuel consumed, and miles driven, will be consistent for future years.
* kWh per mile of target vehicles is weighted-average of all currently available likely replacements.
* All vehicle replacements are converted to electric vehicles, and all future replacements are electric as well.
* EPA factors for CO₂ to CO₂e upscaling is used when only CO₂ per gallon of fuel is known.
* CO₂e calculations are comprised of CO₂, CH₄, and N₂O emissions only.
* Amount of fossil fuels displaced by battery assumes BTU equivalent energy content to calculate reductions.
* Fossil fuel use per unit of time averaged from historic generator data where available to estimate amount of fuel displaced.
* Additional information, uncertainties, and assumptions may be found in the Calculations Spreadsheet.

**Measure Specific Activity Data**

* Number of vehicles converted
* Number of emissions reduced
* Amount of storage capacity deployed
  + 1. *Reference Case Scenario (GHG emissions or activity level)*

The reference case scenario will be developed from historic fuel use in vehicles and generators. This includes information like the annual amount of fuel used in vehicle, the annual mileage of the vehicle, and the average fuel used in energy generation. This baseline annual information is calculated from the most representative annual data, or average of years, to ensure activity data isn’t skewed by things like COVID-restricted time periods. Generator baseline information is comprised of historic uses of generators to offset electricity purchases. Any assumptions about comparisons to the reference baseline case are created from those static figures. the reference case assumes none of the proposed projects would be built and that the annual average fleet and grid emissions remain constant. See Calculations Spreadsheet for further details and assumptions. Calculations do not take into account the effects of upcoming federal or state incentive programs.

* + 1. *GHG Emissions Reduced*

Table 3 displays emissions reduced. Specific annual GHG emissions reduced are noted in the Calculations Spreadsheet.

Table 3. Estimates of emissions reductions from this measure between 2025-2030 and 2025-2050.

|  |  |  |
| --- | --- | --- |
| ***Measure or Project*** | ***Cumulative Reductions 2025-2030 (MTCO2e)*** | ***Cumulative Reductions 2025-2050 (MTCO2e)*** |
| ***Fleet electrification plus vehicle to grid*** | *1,016* | *5,808* |

* 1. **Tribal fleet electrification**
     1. *GHG Reduction Estimate Method*

Greenhouse gas (GHG) emissions reductions were calculated by estimating the emissions reduced by the conversion of existing fleet vehicles to electric vehicles. The historic annual gasoline/diesel emissions were compared to the projected electricity emissions after the project. Annual gallons of fuel consumed were multiplied by the EPA’s CO2e equivalency factors to obtain the historic emissions from the vehicles to be replaced. For the projected emissions, the mileage for those same vehicles was multiplied by their kWh per mile figures for the electric replacements. The total amount of electricity required to replace that fuel use was then converted to CO2e by multiplying by Bonneville Power Administration’s (BPA) specific grid emission figures.

Additionally, emissions reductions from adding 230kW of solar energy by 2027 were estimated using the EPA AVERT tool to determine the GHGs displaced by the addition of solar to the grid (see Calculations Spreadsheet).

* + 1. *Assumptions and Activity Data*

**Implementation Assumptions**

* Fleet Electrification Plan
  + Task 1. Fleet Evaluation - Completed by July 1, 2024.
  + Task 2. Current Use Cases - Completed by July 15, 2024.
  + Task 3. Needs Assessment - Completed by July 15, 2025.
  + Task 4. Electric Vehicle Market Scan - Completed by August 1, 2025.
  + Task 6. Fleet Management Strategy - Completed by 2026.
* Solar Array Installation
  + Task 1. Site Assessment / Energy Analysis - Completed by July 1, 2024.
  + Task 2. Complete System Design - Completed 4 months after site assessment.
  + Task 3. Solar System Permitted - Completed by Q3 of 2025. Permitting is dependent upon city and utility processes.
  + Task 4. System Installation - Completed by Q4 2026. Supply chain interruptions could potentially delay installation.

**GHG Emission Reduction Estimate Assumptions**

* Assume 40 vehicles replaced by electric by 2026 and solar projects implemented by 2027.
* kWh per mile of target vehicles is weighted-average of all currently available likely replacements.
* All vehicle replacements are converted to electric vehicles, and all future replacements are electric as well.
* Additional information, uncertainties, and assumptions may be found in the Calculations Spreadsheet.

**Measure Specific Activity Data**

* Number of vehicles electrified
* Amount of solar arrays installed
* Amount of battery energy storage systems
* Amount of GHG emissions reductions
  + 1. *Reference Case Scenario (GHG emissions or activity level)*

The Reference Case is based on a business-as-usual scenario. It assumes none of the proposed projects would be built and that the annual average fleet and grid emissions remain constant. See Calculations Spreadsheet for further details and assumptions. Calculations do not take into account the effects of upcoming federal or state incentive programs.

* + 1. *GHG Emissions Reduced*

Table 4 displays emissions reduced. Specific annual GHG emissions reduced are noted in the Calculations Spreadsheet.

Table 4. Estimates of emissions reductions from this measure between 2025-2030 and 2025-2050.

|  |  |  |
| --- | --- | --- |
| ***Measure or Project*** | ***Cumulative Reductions 2025-2030 (MTCO2e)*** | ***Cumulative Reductions 2025-2050 (MTCO2e)*** |
| ***Fleet electrification plus solar*** | *2,267* | *12,132* |

1. **Electric Power Sector**
   1. **Tribal clean energy grants program**
      1. *GHG Reduction Estimate Method*

To estimate the GHG impacts over time, the Washington State Department of Commerce (Commerce) used an estimate based on the amount of solar provided to tribes by similar programs implemented in the past. GHG reductions were calculated using the EPA AVERT tool to determine the GHGs displaced by the addition of solar to the grid (see Calculations Spreadsheet).

* + 1. *Assumptions and Activity Data*

**Implementation Assumptions**

* The state-funded Tribal Clean Energy grant program timeline runs from February 15, 2024 into the fall of 2024.
* Implementation timelines and schedules would likely mirror those of the state-funded program, and could follow a similar timeline, with an estimated 1 year roll out an implementation period following the distribution of funds in late 2024.

**GHG Emission Reduction Estimate Assumptions**

* GHG reductions are based on the results of past projects of this kind funded and implemented by the [Department of Commerce.](https://www.commerce.wa.gov/contracting-with-commerce/tribal-clean-energy-grants-applications-now-open-for-tribes-and-tribes-contracted-service-providers-for-clean-energy-projects/)
* Assuming project costs and GHG reductions are similar to past projects, a $16 million grant should be able to fund around 14 projects.
* Emissions reductions are assumed to begin in 2026 as project implementation will occur for the first year following funding dispersal. Additional assumptions, uncertainties, and calculations are included in the Calculations Spreadsheet.

**Measure Specific Activity Data**

* Number of tribal projects funded
* Amount of renewable energy capacity constructed
* Amount of storage capacity constructed
* Amount of GHG emissions reduced
* Health disparities impact on tribal lands
  + 1. *Reference Case Scenario (GHG emissions or activity level)*

The Reference Case is based on a business-as-usual scenario, the continuation of current utility usage for all Tribes. It assumes none of the proposed projects would be built and that the annual average emissions remain constant. See Calculations Spreadsheet for further details and assumptions. Calculations do not take into account the effects of upcoming federal or state incentive programs.

* + 1. *GHG Emissions Reduced*

Table 5 displays emissions reduced. Specific annual GHG emissions reduced are noted in the Calculations Spreadsheet.

Table 5. Estimates of emissions reductions from this measure between 2025-2030 and 2025-2050.

|  |  |  |
| --- | --- | --- |
| ***Measure or Project*** | ***Cumulative Reductions 2025-2030 (MTCO2e)*** | ***Cumulative Reductions 2025-2050 (MTCO2e)*** |
| ***Tribal Sovereignty*** | *13,930* | *69,651* |

1. **Building Sector**
   1. **Decarbonize campus energy systems: Seattle Central College (SCC)**
      1. *GHG Reduction Estimate Method*

This all-electric measure uses the [Washington Department of Enterprise Service’s (DES) Energy Savings Performance Contracting program model](https://des.wa.gov/services/facilities-and-leasing-management/energy-program/energy-savings-performance-contracting-espc). SCC contracted through DES with a DES-approved energy services company (ESCO), McKinstry, to analyze all the available technologies and come back with a design, modeled performance and estimated GHG reduction based on published emission data from SCC’s utility providers and Centrio, the college’s current steam provider. The SCC approach to this measure includes two phases. SCC would replace its use of fossil-fueled steam heating with an all-electric, heat pump based, low carbon impact heating and cooling system. Emissions factors used are the factor set published by the [City of Seattle](https://www.seattle.gov/documents/Departments/OSE/Building%20Energy/BEPS-GHGI-Targets.pdf) for the Centrio steam plant, Seattle City Light electricity, and natural gas.

* + 1. *Assumptions and Activity Data*

**Implementation Assumptions**

* Phase 1 is sized to serve the 404,000 square feet (sf) Broadway/Edison building, the 83,000 sf Science and Math Building, and the 41,000 sf Broadway Performance Hall.
* Future phases would expand the work to other buildings on campus.
  + Piping to distribute the hot and chilled water is sized for future expansion to include the Mitchell Athletic Center, a remodeled Student Union Building, planned student housing, and a planned North Plaza instructional building.
* SCC estimates an eighteen-month construction to commissioning timeline. The start date for this work is contingent on funding and other statewide rulemaking related to contracting with an ESCO.

**GHG Emission Reduction Estimate Assumptions**

* Projected utility use under the EcoDistrict equipment scheme was estimated based on average energy usage over the preceding few years.
* Emissions reductions are assumed to begin 6 months into 2026 as project implementation will occur for the first year and a half following funding dispersal. Additional assumptions, uncertainties, and calculations are included in the Calculations Spreadsheet.
* 33.5% of the total project cost will be funded from the CPRG, therefore the emissions reductions below are scaled by that amount.

**Measure Specific Activity Data**

* Natural gas (therms) reduced
* Electricity (kWh) consumed
* Emissions reduced
  + 1. *Reference Case Scenario (GHG emissions or activity level)*

The Reference Case is based on a business-as-usual scenario, the continuation of current utility usage for all buildings. It assumes none of the proposed projects would be built and that the annual average emissions remain constant. See Calculations Spreadsheet for further details and assumptions. Calculations do not take into account the effects of upcoming federal or state incentive programs.

* + 1. *GHG Emissions Reduced*

Table 6 displays emissions reduced. Specific annual GHG emissions reduced are noted in the Calculations Spreadsheet.

Table 6. Estimates of emissions reductions from this measure between 2025-2030 and 2025-2050.

|  |  |  |
| --- | --- | --- |
| ***Measure or Project*** | ***Cumulative Reductions 2025-2030 (MTCO2e)*** | ***Cumulative Reductions 2025-2050 (MTCO2e)*** |
| ***SCC EcoDistrict*** | *2,916* | *15,878* |

* 1. **Decarbonize campus energy systems: Western Washington University (WWU)**
     1. *GHG Reduction Estimate Method*

For WWU’s component of this application, GHG emissions reduction estimates were calculated by creating a virtual computer model for each of the subject buildings. The computer model included the exterior envelope and the internal operating equipment and schedules. The model was then calibrated to closely match historical building energy consumption. From this baseline, alternative Energy Efficiency Measures (EEM’s) were also modeled enabling the energy performance to be compared as the difference in kWh for electricity, and Therms for heating energy. Once these energy values were known, the corresponding GHG reduction was determined with standard conversion formulas (see Calculations Spreadsheet).

* + 1. *Assumptions and Activity Data*

**Implementation Assumptions**

* All measures were assumed to be fully implemented at the start of by 2027.
* The Exhaust Heat Recovery EEM’s were conceptually designed and sized for the buildings including piping, pumps, and heat transfer coils.
* The specific equipment and performance characteristics were added to the virtual computer model to simulate the energy savings.
* The HVAC Controls Recommissioning and Upgrade EEM’s also utilized the specific building computer simulation models to calculate savings.

**GHG Emission Reduction Estimate Assumptions**

* The central steam plant heating system was determined in a TRANE study to be overall 60% efficient on an annual basis.
  + The 40% losses breakdown basically to 20% due to boilers at the plant operating at 80% efficiency and the remaining 20% due to pipe and trap losses in the distribution network.
  + The distribution pipes are heated to a constant 355F no matter the season and losses will not reduce based on incremental conservation efforts at the buildings.
  + The 80% boiler efficiency losses affect every Therm produced, so that multiplier effect on the Natural Gas CO2 reductions from the buildings has been included.
* Additional assumptions, uncertainties, and calculations are included in the Calculations Spreadsheet.

**Measure Specific Activity Data**

* Natural Gas Therms reduced
* Electricity (kWh) reduced
* Amount of GHG emissions reductions
  + 1. *Reference Case Scenario (GHG emissions or activity level)*

The specific energy consumption computer modeling software used for the study is TRANE’s proprietary Trace 700 which has been in use over 20 years and modeled energy savings for thousands of buildings. The big benefit of the simulation model is it allows the existing building and its historical energy use to become its own reference case scenario. By tuning the model to match the historical trends, you prove the baseline is accurate. The history of thousands of implemented project’s measured outcomes compared back to the model instills confidence the estimating methods are accurate.

The reference case assumes none of the proposed projects would be built and that the annual average emissions remain constant. See Calculations Spreadsheet for further details and assumptions. Calculations do not take into account the effects of upcoming federal or state incentive programs

* + 1. *GHG Emissions Reduced*

Table 7 displays emissions reduced. Specific annual GHG emissions reduced are noted in the Calculations Spreadsheet.

Table 7. Estimates of emissions reductions from this measure between 2025-2030 and 2025-2050.

|  |  |  |
| --- | --- | --- |
| ***Measure or Project*** | ***Cumulative Reductions 2025-2030 (MTCO2e)*** | ***Cumulative Reductions 2025-2050 (MTCO2e)*** |
| ***WWU District Energy Decarbonization*** | *5,170* | *31,021* |

1. **Agriculture Sector**
   1. **Community anaerobic digesters**
      1. *GHG Reduction Estimate Method*

GHG emissions reductions were determined by calculating the difference between baseline emissions resulting from landfilling food waste and net project emissions reductions from two anaerobic digester installation projects of varying sizes. This GHG estimate is based on calculations done using EPA emissions factors and the [EPA Warm Model](https://www.epa.gov/warm) (see Calculations Spreadsheet).

* + 1. *Assumptions and Activity Data*

**Implementation Assumptions**

* 2 anaerobic digester projects are expected to begin operation 6 months in to 2025
  + One AD185, one AD500 (referring to food waste capacity in tons)

**GHG Emission Reduction Estimate Assumptions**

* Emissions reductions are expected to begin in 2025 after a 6-month installation period.
* Projects are expected to operate at anaerobic digester capacity for the entire duration of the project period.
* All food waste digested is assumed to be landfill bound if not for this project.
* Additional assumptions and uncertainties are included in the Calculations Spreadsheet.

**Measure Specific Activity Data**

* Number of digester projects completed
* Tons of waste diverted from landfill
* MTCO2e avoided
* Communities engaged
* Local jobs created
  + 1. *Reference Case Scenario (GHG emissions or activity level)*

The Reference Case is based on a business-as-usual scenario, the continuation of landfilling food waste. It assumes none of the proposed projects would be built and that the annual average emissions remain constant. See Calculations Spreadsheet for further details and assumptions. Calculations do not take into account the effects of upcoming federal or state incentive programs.

* + 1. *GHG Emissions Reduced*

Table 8 displays emissions reduced. Specific annual GHG emissions reduced are noted in the Calculations Spreadsheet.

Table 8. Estimates of emissions reductions from this measure between 2025-2030 and 2025-2050.

|  |  |  |
| --- | --- | --- |
| ***Measure or Project*** | ***Cumulative Reductions 2025-2030 (MTCO2e)*** | ***Cumulative Reductions 2025-2050 (MTCO2e)*** |
| ***Anaerobic Digesters*** | *2,190* | *10,155* |