APPENDIX C | EMISSIONS PLANNING ASSUMPTIONS

The Plan includes GHG and DPM emissions forecasts for both a no-action (business-as-usual) scenario and an action (emission reduction) scenario, as discussed below.

It is important to note that neither the business-as-usual (BAU) or action scenarios include the short or long-term impacts of COVID-19 on port operations or the maritime industry. The emissions forecasts should be revisited periodically to ensure that they reflect new information about the impacts of COVID-19, as well as changes in port business trajectories and the development of new technologies, policies, and regulations.

Business-as-Usual Forecasts

Each emissions forecast includes an emissions projection under a BAU scenario against which the impact of proposed actions is measured. The Port's consultant team reviewed standard GHG emission inventory protocols and did not find an explicit forecasting methodology for projecting BAU emissions. Analysis of fifteen climate action plans or emissions analyses for port or government entities found variation in data and assumptions used to estimate future changes in activity. For example, city or county community-based emissions forecasts tended to be based on population and/or gross domestic product projections, and port maritime emissions forecasts tended to be based on cargo volume projections or data from business plans. Emission forecasts of government operations (analogous to Port Maritime Administration operations described in this Plan) tended to be based on historical trends and/or planned updates to services. Some, but not all, climate action plans included regulatory changes in the BAU forecast, such as mandated low carbon fuels, engine improvements, or increased use of renewables in the energy portfolio that would occur independent of implementation of the Plan.

Based on this research, the Plan takes a hybrid approach: Maritime Activity sector BAU emissions (ocean-going vessels, cargo-handling equipment, trucks, harbor vessels, and rail) are forecasted based on industry trends; and Port Maritime Administration sector emissions (building and campus energy, fleet vehicles and equipment, employee commuting, and solid waste) are forecasted based on historical trends. The approach assumes that no additional regulatory changes or emission reduction efforts will be made under the BAU scenario. However, the emission reduction projections do account for the impacts of known or expected policy changes, as discussed below under action scenario forecasts.

Port Maritime Administration BAU forecast

For Port Administration sources, the BAU scenario assumes Port operations will grow linearly according to observed historical GHG emissions trends for each of the sectors between the years 2005-2019. The analysis resulted in the following annual growth forecast for Port Administration BAU emissions from 2020-2030:

- Building and Campus Energy: 1.8 percent
- Fleet Vehicles and Equipment: 2.2 percent
- Employee Commuting: 1.0 percent
- Solid Waste: 2.2 percent

The BAU projection does not account for specific future policy changes; it assumes that the Port would continue its historical trajectory without any additional emission reduction efforts. BAU assumptions do, however, incorporate the emission reductions achieved across sectors since the baseline year, such as improvements to buildings, vehicle modernization, policy changes and others. This decision, to project BAU emissions based on historical GHG emission trends, takes a conservative approach to the emissions forecasting and is a methodology consistent with other governments' operational emissions forecasts.

It is also important to note that emissions from Port Administration sources in the Plan are forecasted over a ten-year time horizon from 2020-2030. Over this period, known regulatory changes in state policy, such as the Clean Energy Transformation Act[32], will not yet require reduction in emissions.

Maritime Activity BAU forecast

Most port climate action plans forecast emissions from Port Activity sectors based on cargo throughput projections. Since a cargo throughput metric is not applicable for Port of Seattle's unique emissions portfolio, which includes cruise, grain, commercial fishing and recreational boating, the Plan uses a composite annual growth rate based on research of industry trends in each applicable sector. A composite annual growth rate of 1.9 percent was used for both the GHG and DPM emissions wedge analyses and developed with guidance from the Port's business units. The composite rate was calculated based on industry growth trends for each sector and weighted by the relative contribution of each sector to GHG and DPM emissions.

The following sources were used to forecast industry growth trends:

- BST Associates, *2017 Marine Cargo Forecast and Rail Capacity Analysis Report* (2017) prepared for the Washington Public Ports Association and the Washington State Freight Mobility Strategic Investment Board provides estimated growth for grain exports through Puget Sound ports.
- BST Associates, PCC 45th Semi-Annual Conference: *What lies ahead? Is your marina preparing for the future or just satisfying today's needs?* (2019) provided the outlook for recreational boating.
- McDowell Group, *Modernization of the North Pacific Fishing Fleet – Economic Opportunity Analysis* (2016), prepared for Port of Seattle and the Washington Maritime Federation, provided the outlook for commercial fishing.
- Port Maritime staff provided a cruise forecast that is subject to change.

The Port Activity BAU forecasts assumes GHG emissions will increase proportionate to the rate of business growth. It does not include an explicit assumption about the impact of new technology or emission standards in the future, such as the emission reduction potential from the natural attrition of older equipment and replacement with newer, cleaner models. In this way, it also represents a conservative, 'worst-case' assumption where the main driver for change in emissions under the BAU scenario is projected growth in port-related industries based on research and consultation with Port business units. For example, the cruise forecast included an increase in the number of cruise calls between 2020-2050.

[32] Under the *Clean Energy Transformation Act*, all utilities must supply Washington customers with 100 percent renewable or non-emitting electricity by 2045.

Action Scenario Forecasts

Each emissions forecast also incorporates an action scenario that estimates the emission reduction potential from implementing select strategies identified in the Plan, as discussed below.

Port Maritime Administration action forecast

For Port Maritime Administration sectors, the Plan includes estimated potential emission reductions on a strategy-by-strategy basis. Reductions were calculated using Port-specific knowledge and data, as well as publicly available literature. The analyses include factors such as activity levels, energy usage, and timing of strategy implementation. When a strategy required substituting one energy source for another, the estimate reflects the net decrease in in emissions. The following assumptions were used in estimating emission reductions from 2019-2030 for each sector:

Building and Campus Energy sector

- Number and timing of energy projects are based on capital plan or typical equipment lifespan
- Eliminating natural gas includes 12 percent energy equivalent replacement with electricity
- 2019 emissions factor for electricity is assumed to remain constant to 2030

Fleet Vehicles and Equipment

- Number and timing of vehicles and equipment upgrades to lower-emission models is based on the Port's fleet replacement schedule
- Biogenic-based portion of renewable fuels is treated as zero-emission per GHG inventory protocols

Employee Commuting

- Progressive increase in telework days and drive-alone trips resulting from strategies identified in the Port's Commute Trip Reduction Plan

Solid Waste

- Progressive reduction in solid waste being landfilled resulting from strategies identified in the Port's Maritime Solid Waste Management Plan

Maritime Activity action forecast

For Maritime Activity sectors, the Plan includes potential emission reductions based on Port-specific knowledge and data, as well as publicly available literature. In addition, the action scenario includes the impact of vessel efficiency improvements resulting from regulatory mandates that are in force or being developed by the IMO. For other Maritime sectors, the analysis assumed a theoretical straight-line reduction to zero emission by 2050 that is needed to meet the goal set in the 2020 Strategy. The following assumptions were used in estimating emission reductions from 2019 – 2050 for each sector:

Ocean-going vessel sector

- GHG and DPM emission reductions for shore power are based on operational data provided by cruise lines, and emissions data from the Puget Sound Maritime Air Emissions Inventory

- Assumes 100 percent of homeport vessels are shore power-equipped with a 100 percent shore power connection rate by 2030
- The current IMO mandate for new ships to be 30 percent more energy efficient will not be fully realized until 2050, due to long operational life of ocean-going vessels
- An additional IMO strategy to reduce GHG emissions from shipping by 50 percent (this includes the 30 percent efficiency mandate above) by 2050 is expected to begin taking effect by 2030, ramping up by 2050

All other Maritime Activity sectors

- Analysis assumes a theoretical straight-line reduction to zero emissions by 2050 needed to phase out emissions (pathways still be determined)

Strategy Ease and Effectiveness Comparison

Figure 26 in the Plan displays the relative ease and effectiveness of implementing select strategies. (Only strategies with quantified GHG emission reduction potential were included.) The strategies were assigned scores based on their annual emission reduction potential in 2030. They were also assigned scores according to the relative implementation difficulty, which incorporates cost, technology readiness, and the Port's level of control over the emissions. The following strategy evaluation rubric was used to assign ease and effectiveness scores to each strategy.

Annual Emission Reduction Impact by 2030 (-6 is low impact, +6 is high impact)	Value
>10,000 MT GHG reduction and DPM reduction	+6
>10,000 MT GHG reduction with no DPM reduction	+5
5,000 – 9,999 MT GHG reduction and DPM reduction	+4
5,000 – 9,999 MT GHG reduction with no DPM reduction	+3
1,000 – 4,999 MT GHG reduction and DPM reduction	+2
1,000 – 4,999 MT GHG reduction with no DPM reduction	+1
500 – 999 MT GHG reduction and DPM reduction	0
500 – 999 MT GHG reduction with no DPM reduction	-1
300 – 499 MT GHG reduction and DPM reduction	-1.5
300 – 499 MT GHG reduction with no DPM reduction	-2
200 – 299 MT GHG reduction and DPM reduction	-2.5
200 – 299 MT GHG reduction with no DPM reduction	-3
100 – 199 MT GHG reduction and DPM reduction	-3.5
100 – 199 MT GHG reduction with no DPM reduction	-4
50 – 99 MT GHG reduction and DPM reduction	-4.5
50 – 99 MT GHG reduction with no DPM reduction	-5
0 – 49 MT GHG reduction and DPM reduction	-5.5
0 – 49 MT GHG reduction with no DPM reduction	-6

Implementation Difficulty (-4 is low difficulty, +4 is high difficulty)	
Technology readiness	**Value**
No technology impact	-3
Technology commercially available & can be used in existing equipment or infrastructure	-2
Technology commercially available with modification to existing equipment/infrastructure	-1
Preferred technology pathway identified and will be market-ready within 2 years	0
Technology pathways in demonstration	+1
Technology pathways in early demonstration	+2
Technology pathways still being researched	+3
Level of investment needed	**Value**
Strategy will save over $100,000/year	-4
Strategy offers cost savings of up to $100K/year	-3
Strategy is cost-neutral	-2
Strategy cost-competitive w/conventional alternatives	-1
Strategy requires 5-year cost < $1M	0
Strategy requires 5-year cost of $1M – $4.9M	+1
Strategy requires 5-year cost of $ 5M – $9.9M	+2
Strategy requires 5-year cost of $ 10M – $14.9M	+3
Strategy requires 5-year cost of $15M or more	+4
Level of control over emissions	**Value**
Port Maritime Administration, Scope 1 source	-3
Port Maritime Administration, Scope 2 source	-2
Port Maritime Administration, mix of Scope 1, 2, 3 sources	-1
Port Maritime Administration, Scope 3 source	0
Maritime Activity Scope 3, Port owns infrastructure/equipment	+1
Maritime Activity Scope 3, tenants or industry own infrastructure/equipment	+2
Maritime Activity Scope 3, no business relationship with emission source	+3