Cover Sheet

Submission on the Issues Paper on Climate Change in Western Australia

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Dear Sir/Madam

Submission on the Issues Paper on Climate Change in Western Australia

1. It is clear from the 2018 Intergovernmental Panel on Climate Change (**IPCC**) Special report on Global Warming of 1.5°C (**Special Report**) that the next ten years are critical and will determine whether the world is able to limit global temperature rise to 1.5°C.[1] In order to limit global warming at any level, we must reach zero CO_2 emissions.

2. <u>If global emissions are to reach zero in thirty years, there is a one-in-two chance of limiting global warming to 1.5°C. To increase this to a two-in-three chance, greenhouse gas (**GHG**) emissions must be reduced to zero in twenty years</u>.

3. Incremental steps are no longer adequate – we need to dramatically increase action. It is incumbent on the Government of Western Australia (**WA Government**), which has the resources and capabilities to accelerate action, to increase the ambition of its carbon target. <u>Therefore, we call upon the WA Government to change its climate target to net zero by 2030.</u>

4. This submission responds to sections 1 and 2 of the Issues Paper on Climate Change in Western Australia (**Issues Paper**): Transforming Energy Generation and Industry Innovation as they relate to recent developments in the maritime sector.

5. Earlier this year, the International Maritime Organization called for urgent concrete action across the entire shipping sector to address GHG emissions within the short, medium and long term (**IMO Initial Strategy**). <u>The short-term strategies require finalization between 2018 and 2023. The medium term measures require finalization between 2023 and 2030</u>. <u>Without a concrete plan in place, Australia will not achieve the targets set by the IMO Initial Strategy.</u>

6. The IMO is the primary international body that addresses international shipping. It is committed to urgent action to address climate change through energy efficient design of new build ships (MEPC 62). However, even with energy efficient ships, GHG emissions from shipping will continue to rise and the reductions needed to keep global temperatures beneath 1.5°C will fail unless measures to introduce

[1] IPCC, 2018: Summary for Policymakers. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press.

vessel speed reductions are introduced and alternative fuel technologies are rapidly developed and deployed. The WA Government has a key role to play in relation to providing infrastructure to supply alternative fuels to ships at WA ports and in setting maximum speed limits within its territorial waters.

7. The need for urgent reform in reducing greenhouse has emissions the maritime sector is evident from recent developments such as the:

   a) International Transport Forum (**ITF**) Report on Decarbonising Maritime Transport: Pathways to Zero-Carbon Shipping by 2035 (2018);

   b) ITF Report on Reducing Shipping Greenhouse Gas Emissions: Lessons from Port Based Incentives (2018);

   c) GEF-UNDP-IMO Global Maritime Energy Efficiency Partnerships (**GloMEEP**) and International Association of Ports and Harbors (**IAPH**) Guide to the Development of Port Emissions Reduction Strategies (2018); and

   d) Third IMO GHG Study (2014).

8. In light of these developments, we make the following recommendations:

Summary of Recommendations

1. **A target of net zero emissions from ships in State territorial waters by 2050, contingent upon the technological development of alternative low or zero carbon fuels.**

2. **Legislation in relation to vessel speed reduction within State territorial waters with the following characteristics:**

   - **The regulated speed should be determined by average speed and dependent on ship type and size.**

   - **The owner of the ship should be the responsible entity, with the ability for liability to pass to the commercial operator or charterer of the ship.**

   - **Speed reduction should apply to all ships over 500GT. In 2006, less than 1.92% of ship emissions were from ships less than 500 GT.**

   - **Speed reduction should be differentiated between vessel types, to reduce distortions between vessel types and to achieve the greatest reductions in GHG reductions.**

   - **Exemptions or relaxed speed restriction should be given to ships with an Energy Efficiency Design Index (EEDI) that is lower than baseline values.**

3. **Assistance to WA ports to install cold ironing facilities. This should be accompanied by increased investment and regulatory policies that incentivise renewable energy projects to support such facilities.**

4. **Incentives to WA ports or shipping companies to engage in pilot projects for alternative low emission or zero emission fuels.**

5. **Regular reviews of emerging clean fuel technologies and opportunities for bunkering facilities to accommodate such technologies with maritime industry stakeholders.**

6. **A target of zero emissions for WA ports by 2040, to match the zero emission target of the Port of Auckland.**

7. **Mandatory emissions inventory and reporting for WA ports with the following characteristics:**

    - **The inventory should include Scope 1, Scope 2 and Scope 3 emissions.**

    - **A comprehensive inventory with detailed port-specific activity information for each emission source category should be required.**

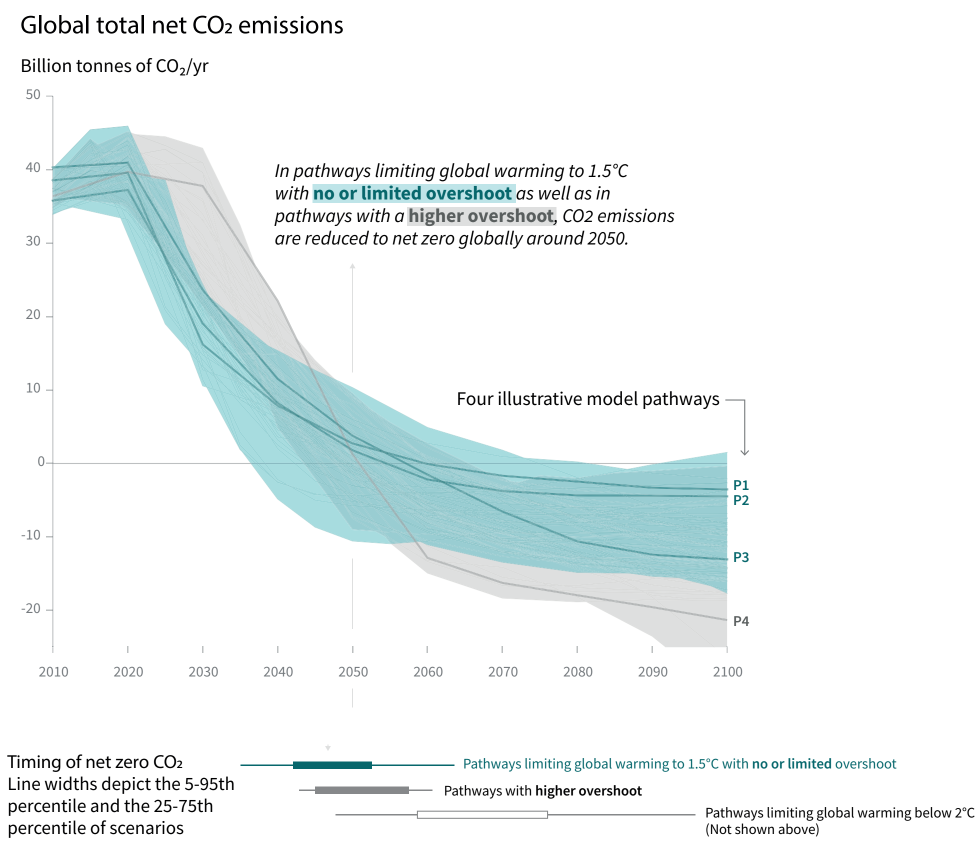
    - **Annual reporting should be required.**

8. **Creation of a WA Port GHG Initiative to provide funding for clean energy projects, technical guidance and a platform for collaboration and collaboration between government and industry.**

Emission pathways consistent with a 1.5⁰C rise in global temperature

9. The IPCC Special Report (Special Report) found that limiting global temperature rise to below 1.5°C will require global net CO2 emissions to reach net zero by 2050 (see Fig 1 below).[2]

Figure 1: Global CO_2 emission pathway characteristics consistent with limiting global warming to1.5⁰C



10. Reducing emissions from the international shipping sector will be critical to the world reaching net zero by 2050. Every year, emissions from shipping alone[3] exceed the annual emissions of large countries such as Australia, Canada, Korea and the United Kingdom.[4]

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[2] IPCC, 2018: Summary for Policymakers. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)].
[3] IMO, *Third IMO Greenhouse Gas Study 2014* (2015).
[4] OECD, *Greenhouse Gas Emissions – OECD Statistics,* <https://stats.oecd.org/Index.aspx?DataSetCode=AIR_GHG>

International shipping emission scenarios

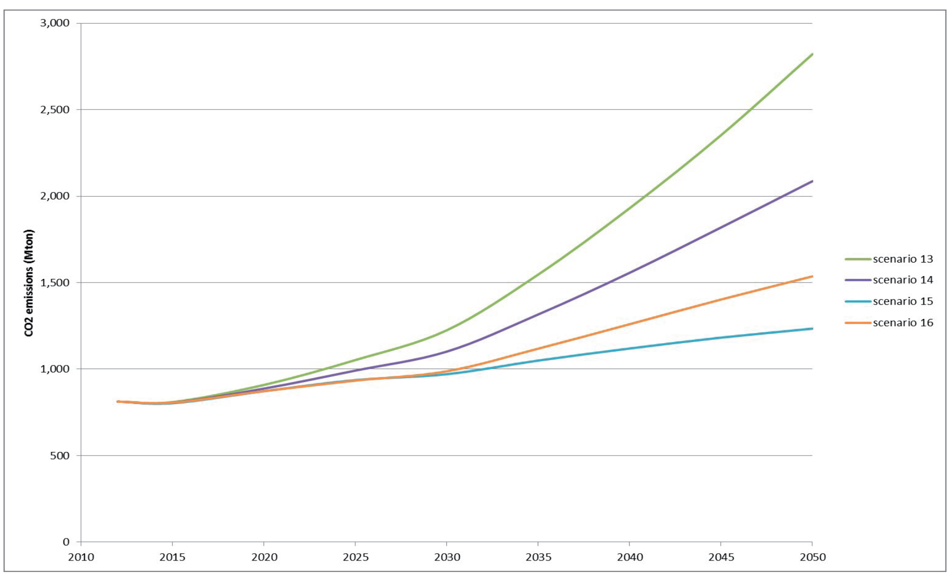
Emission scenario 1: Business as Usual

11. In 2011, the IMO adopted two energy efficiency measures to address emissions from the international shipping sector:

- The Energy Efficiency Design Index (**EEDI**), which sets compulsory energy efficiency standards for new ships built after 2013; and
- The Ship Energy Efficiency Management Plan (**SEEMP),** which requires ships to develop a plan to monitor and potentially improve their energy efficiency.[5]

12. Even with the EEDI and SEEMP, GHG emissions from international shipping are expected to rise between 50-250% by 2050 (Figure 2 below).[6] The EU Parliament has projected that this will lead to shipping emissions accounting to almost one-fifth of global emissions by 2050.[7]

Figure 2: BAU projections of CO_2 emissions from international maritime transport 2012 - 2050[8]



[5] IMO, *Technical and Operational Measures* (2015) < https://www.imo.org/ en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Technical-and- Operational-Measures.aspx.>
[6] IMO, above n 2.
[7] European Union, *Emission Reduction Targets for International Aviation and Shipping* (November 2015) <http://www.europarl.europa.eu/RegData/etudes/STUD/2015/569964/IPOL_STU(2015)569964_EN.pdf> 9.
[8] IMO, above n2, 20.

1. In 2015, the European Parliament concluded that rising emissions from international shipping risk "undermining the efforts that are being made in order to stay on a trajectory that will keep the average global temperature increase below 2°C compared to pre-industrial levels."[9]

Emission scenario 2: Fifty percent reduction of GHGs by 2050

13. The IMO Initial Strategy sets out the following levels of ambition:

- Carbon intensity of ships to decline by implementing of further phases of the EEDI for new ships;

- Carbon intensity of international shipping to decline by reducing intensity by 40% by 2030 and 70% by 2050 compared to 2008; and

- GHG emissions from international shipping to peak and decline through reducing total annual GHG emissions by 50% by 2050 compared to 2008 and working towards completely phasing them out in a manner consistent with the Paris Agreement temperature goals. [10]

14. Achieving these levels of ambition is contingent upon "technological innovation and the global introduction of alternative fuels and/or energy sources."[11]

15. While the IMO has provided lists of potential measures,[12] it has not required specific measures to be implemented. Instead, the IMO Initial Strategy sets the overall level of ambition and milestones to be achieved by certain dates.[13]

16. The targets set by the IMO Initial Strategy, however, fall far short of what is required to limit global temperature rise to 1.5°C.

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[9] EU, above n 4, 17.

[10] Marine Environment Protection Committee, *Initial IMO Strategy on Reduction of GHG Emissions From Ships And Existing IMO Activity Related to Reducing GHG Emissions In the Shipping Sector,* Res MEPC.304(72) (13 April 2018) para 3.1.

[11] Ibid para 8.

[12] Ibid para 4.7-4.9.

[13] Ibid para 6.2-7.1.

Emission scenario 3: Almost complete decarbonisation by 2050

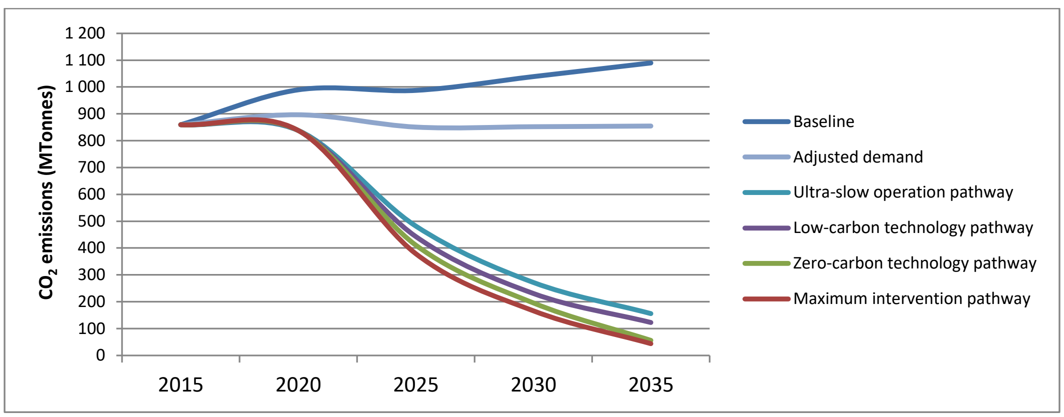
17. In 2018, the International Transport Forum (**ITF**), an intergovernmental think tank on transport policy within the Organisation for Economic Co-operation and Development (**OECD**), released a report examining different pathways to zero emissions for international shipping (**ITF Report**).[14]

18. The report modeled different combinations of emission reduction measures and found that almost complete decarbonisation of the shipping industry by 2035 was possible via four pathways (see Table 1 and Figure 3 below). <u>These pathways are projected to reduce total annual GHG emissions from international shipping by 82% ("ultra-slow operation") to 95% ("maximum intervention") by 2050.</u>[15]

Table 1: Four potential decarbonisation paths and their components[16]

Pathway	Operational measures	Technical measures	Carbon factor reduction due to alternative fuels	Electric ship penetration
"Maximum intervention"	Maximum	Maximum	80%	10%
"Zero-carbon technology"	Moderate	Maximum	80%	10%
"Ultra-slow operation"	Maximum	Maximum	50%	-
"Low-carbon technology"	Moderate	Maximum	75%	-

Figure 3: Four potential decarbonisation pathways for shipping[17]



19. The four pathways incorporated the following technical measures:

    a. Maximum ship design specifications to lead to the highest reduction in ship carbon intensity;

    b. Uptake of electric ships mostly to serve short-distance shipments. The penetration rate of electric ships is assumed to increase to 10% in 2035; and

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[14] OECD/ITF, *Decarbonising Maritime Transport: Pathways to zero-carbon shipping by 2035* (2018) <https://www.itf-oecd.org/sites/default/files/docs/decarbonising-maritime-transport.pdf>.
[15] Ibid 49.
[16] Ibid 45.
[17] Ibid 49.

c. Expansion of Onshore Power Supply (OPS) facilities due to regulation, for example in the EU where it will become mandatory for core ports by 2025.[18]

20. All of the pathways rely upon two major measures to deliver deep cuts in emissions: speed reduction and use of alternative low or zero carbon fuels. The difference between the pathways lies in the degree of speed reduction implemented and the extent of uptake of alternative fuels.

21. Given that Emission Scenarios 1 and 2 will not deliver cuts to GHG emissions that will limit global temperature rise to 1.5^{o}C, it is submitted that the WA Government should adopt a policy that is consistent with Emission Scenario 3.

Recommendation 1: A target of net zero emissions from ships in State territorial waters by 2050, contingent upon the technological development of alternative low or zero carbon fuels.

Which measures are most effective?

22. The IMO Initial Strategy emphasized the need for evidence-based decision making balanced by the precautionary approach as set out in MEPC.67(37).[19] Given that the window to keep global temperature rise at safe levels is rapidly closing, it is critical for the WA Government to choose the most effective measures in the short, medium and long term.

23. The following table sets out the findings of the ITF Report in relation to the efficacy of various measures in reducing emissions:

Table 2: CO_2 emissions reduction potential of main technological measures[20]

Measures	Potential fuel savings
Light materials	0-10%
Slender design	10-15%
Propulsion improvement devices	1-25%
Bulbous bow	2-7%
Air lubrication and hull surface	2-9%
Heat recovery	0-4%

Note: Emission reduction potentials are assessed individually. Ranges roughly indicate possible fuel savings depending on varying conditions such as vessel size, segment, operational profile, route, etc., hence limiting the possibilities for comparison. Numbers cannot be cumulated without considering potential interactions between the measures.
Sources: Bouman et al. (2017); Gilbert et al. (2014); IMarEST (2011); Lindstad (2015b); Rehmatulla et al. (2017b); Royal Academy of Engineering (2013); Smith et al. (2016); Tillig et al. (2015); Van Kluijven et al. (2013).

[18] Ibid 44.
[19] IMO, above n9, para 3.2.4.
[20] OECD/ITF, above n13, 26.

Table 3 CO_2 emission reduction potential of main operational measures[21]

Measures	CO_2 emissions reduction potential
Speed	0-60%
Ship size	0-30%
Ship-port interface	1%
Onshore power	0-3%

Note: Emission reduction potentials concern the entire ship fleet. Numbers cannot be cumulated without considering potential interactions between the measures.
Sources: Faber et al. (2012, 2017a); Gollas et al. (2009); Kiani et al. (2006) Lindstad et al. (2011, 2012, 2013); Psaraftis and Kontovas (2014); Smith et al. (2014).

Table 4 CO_2 emission reduction potential of alternative fuels[22]

Measures	CO_2 emission reductions
Advanced biofuels	25-100%
LNG	0-20%
Hydrogen	0-100%
Ammonia	0-100%
Fuel cells	2-20%
Electricity	0-100%
Wind	1-32%
Solar	0-12%
Nuclear	0-100%

Note: Emission reduction potentials are assessed individually. Ranges roughly indicate possible fuel savings depending on varying conditions such as vessel size, segment, operational profile, route, etc., hence limiting the possibilities for comparison. Numbers cannot be cumulated without considering potential interactions between the measures. Considering upstream emissions of synthetic fuels and electricity, an almost 100% emission reduction can occur only if produced by renewable energy sources.
Sources: See sections below.

24. It is clear from the above tables that the greatest reductions in CO_2 emissions will come from speed reduction (0-60%) and advanced zero carbon fuels (25-100% from advanced biofuels and 0-100% from hydrogen, 0-100% from ammonia and 0-100% from electricity from renewable sources).

Vessel speed reduction to reduce GHG emissions

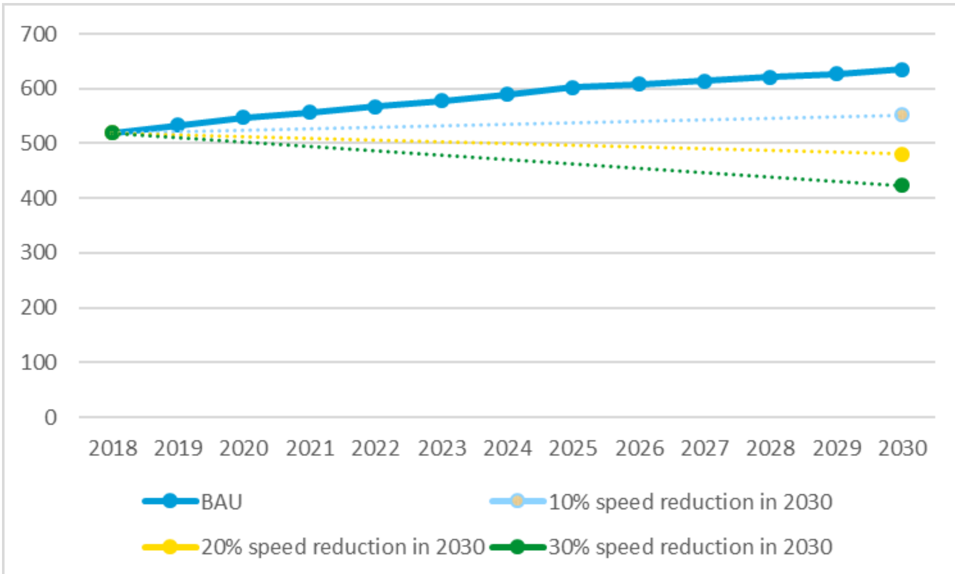
25. Vessel speed reduction is one of the candidate short-term measures identified in the IMO Initial Strategy.[23]

26. In all but the most extreme cases, reduced speed decreases ship energy use and fuel consumption. Fleet-wide fuel consumption and emissions are reduced even if additional ships are used to maintain transport supply.[24]

27. The CO_2 emission reduction potential of three alternatives speed regimes (10%, 20% and 30%) in absolute terms is set out in Figure 2 below.

[21] OECD/ITF, above n13, 28.
[22] OECD/ITF, above n13, 32.
[23] MEPC, above n12, s 4.7.1.
[24] Bryan Comer, Ph.D., Chen Chen and Dan Rutherford, *Relating short-term measures to IMO's minimum 2050 emissions reduction target*, (Working Paper, ICCT, 2018) IMO MEPC 73/INF.27.

Figure 4: CO_2 emissions of three ship types in a BAU scenario and under three alternative speed regimes[25]



28. The potential for GHG emission reductions from speed reductions will vary depending on the type of ship. These are set out in Table 5 below.

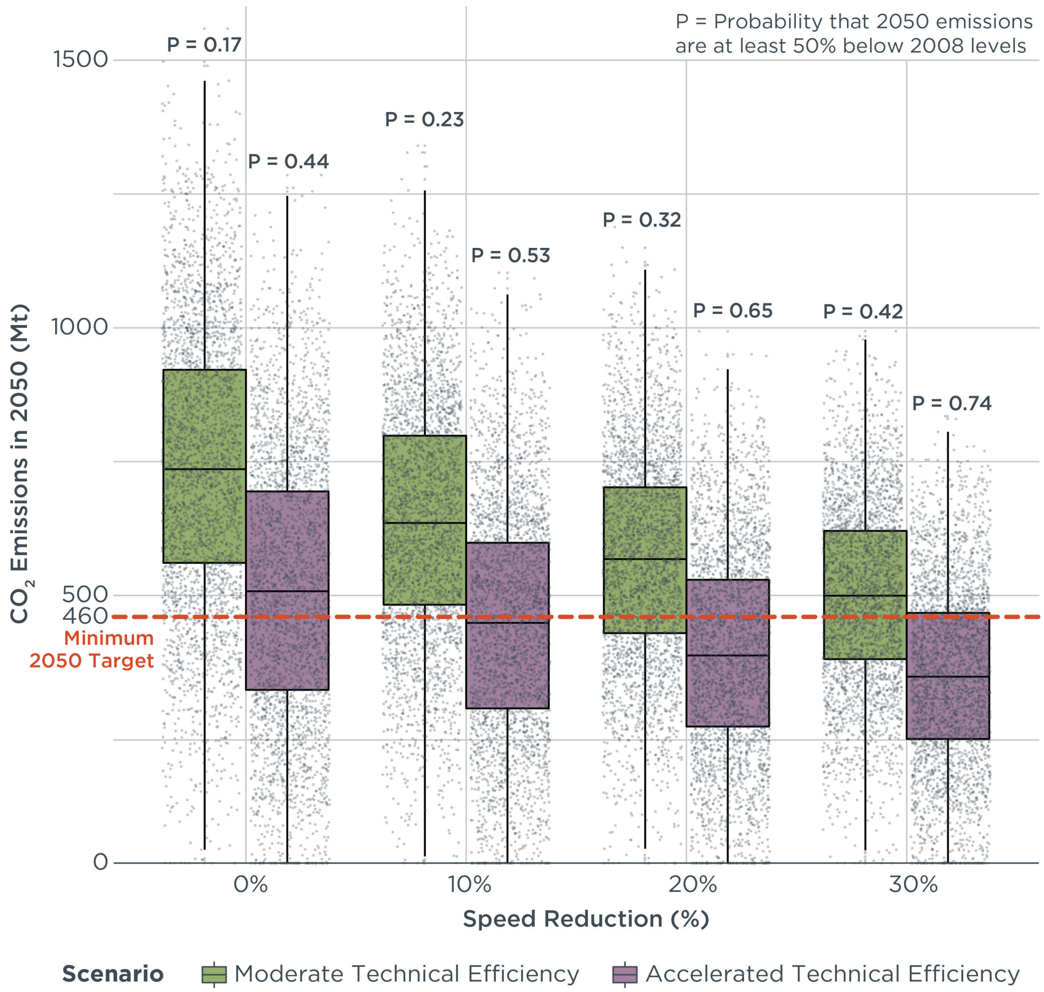
Table 4 Relative CO_2 emission reduction potential for alternative speed regimes[26]

	10% speed reduction	20% speed reduction	30% speed reduction
Container fleet	13%	23%	32%
Dry bulk fleet	15%	28%	38%
Crude & product tanker fleet	10%	18%	24%
Total	13%	24%	33%

29. It is highly unlikely that the world will be able to achieve IMO's target of reducing GHG emissions from shipping by 50% by 2050 without vessel speed reduction policies. A report by the International Council on Clean Transportation (**ICCT Report**), found that with moderate technological efficiency, the probability of meeting the IMO target is 23% with a 10% speed reduction, 32% with a 20% speed reduction and 42% with a 30% speed reduction.[27]

[25] Jasper Faber, Thomas Huigen and Dagmar Nelissen, 'Regulating Speed: A short-term measure to reduce maritime GHG emissions', (Report, CE Delft, 18 October 2017) 9.
[26] Ibid 10.
[27] Comer, Chen and Rutherford, above n24, 4.

Figure 4: 2050 International shipping CO2 emissions (million tonnes, Mt) and associated probability (P) of meeting IMO's minimum 2050 emissions target by improving technical efficiency and implementing speed reduction[28]



[28] Ibid.

Proposed Vessel Speed Reduction Policies

30. Research by CE Delft, the ICCT and Professor Mike Tsimplis, a professor of the School of Law and Ocean Sciences at the University of Southampton, analysed policy options for vessel speed reduction (**CE Delft Report**). Based on the findings of the CE Delft Report, we make the following policy recommendations:

Recommendation 2: The WA Government should introduce legislation in relation to vessel speed reduction within State territorial waters. It should have the following characteristics:

- **The regulated speed should be determined by average speed and dependent on ship type and size.**
- **The owner of the ship should be the responsible entity, with the ability for liability to pass to the commercial operator or charterer of the ship.**
- **Speed reduction should apply to all ships over 500GT. In 2006, less than 1.92% of ship emissions were from ships less than 500 GT.**
- **Speed reduction should be differentiated between vessel types, to reduce distortions between vessel types and to achieve the greatest reductions in GHG reductions**
- **Exemptions or relaxed speed restriction should be given to ships with an EEDI that is lower than baseline values.**

“Cold ironing” to reduce GHG emissions

What is cold ironing?

31. “Cold ironing” or shore power is one of the candidate short-term measures identified in the IMO Initial Strategy.[29] Cold ironing facilities allow ships to turn off their engines and connect to the electricity grid to power ships. Such facilities emit zero CO_2, provided that electricity is generated carbon-free.[30]

Figure 5: Cold ironing facilities at the Port of Los Angeles[31]

Global context of cold ironing facilities

32. Cold ironing been implemented or are scheduled for implementation in major ports around the world such as:

a. Amsterdam;
b. Antwerp;
c. Genoa;
d. Guangzhou;
e. Halifax;
f. Hamburg;
g. Incheon;

[29] MEPC, above n12, s 4.7.1.
[30] OECD/ITF, above n16, 31.
[31] Wendy Laursen, ‘Is Cold Ironing Redundant Now?’, *The Maritime Executive* (online), 23 May 2015 < https://www.maritime-executive.com/features/is-cold-ironing-redundant-now>.

h. Kiel;
i. Killini;
j. Lianyungang;
k. Los Angeles;
l. New York Brooklyn;
m. Ningbo-Zhoushan
n. Oakland;
o. Palma;
p. Rostock;
q. Rotterdam;
r. San Diego;
s. San Francisco;
t. Seattle;
u. Shenzhen Yantian; and
v. Vancouver.

33. In December 2018, new regulations by the Chinese government are requiring the following types of Chinese vessels to be equipped with shore power capabilities:

a. public service vessels;

b. inland river vessels (with exception of liquid cargo vessel);

c. river-coastal vessels;

d. domestic coastal container ships;

e. cruise ships;

f. ro-ro passenger ships;

g. passenger ships with a gross tonnage at least 3,000 tons; and

h. dry bulk cargo ships with a gross tonnage at least 50,000 tons.[32]

34. The world, including WA's major trading partners, is shifting to cold ironing. It is submitted that the WA government should invest in cold ironing facilities both for its environmental benefits and to remain on the cutting edge of discovery, innovation and future investment.

[32] 'New regulations to apply in Chinese ECAs from January 2019', *Safety4Sea* (online), 17 December 2018 <https://safety4sea.com/uk-club-issues-reminder-on-new-fuel-requirements-in-chinese-waters/>; 'Germany promotes shore-generated power to cut emissions in ports', *Safety4Sea* (online), 17 October 2019 <https://safety4sea.com/germany-promotes-shore-generated-power-to-cut-emissions-in-ports/>.

Is cold ironing effective at reducing GHG emissions from ships?

35. A recent study conducted by the University of Sydney, Imperial College London and the Technical University of Denmark of found that cold ironing was highly effective at reducing GHG emissions. In particular, the study concluded:

> "Provision of Alternative Marine Power (AMP) for all berthing vessels can lead to reductions of in-port emissions of 48- 70%, 3-60%, 40-60%, and 57-70% for CO_2, SO_2, NO_x and BC respectively. These benefits rely on suitable equipment being carried by vessels, with large benefits associated with larger vessels."[33]

Figure 6: Cold Ironing Facilities in the Port of San Diego[34]

36. Significant reductions in GHG emissions from cold ironing at ports include:

    a. Vancouver – In 2018, cold ironing facilities were installed at DP World's Centerm container terminal. This has resulted in the elimination of 95 tonnes of air pollutants and GHG emissions, for each large ship at berth for 60 hours. This is the equivalent to taking 20 cars off the road for one year.[35]

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[33] Zis, T., North, R. J., Angeloudis, P., Ochieng, W. Y., & Bell, M. G. H. (2014). Evaluation of cold ironing and speed reduction policies to reduce ship emissions near and at ports. Maritime Economics & Logistics, 16(4), 371-398, 30.

[34] 'Pictures from San Diego Shore Power Hook-up', *Cruise Industry News* (online), 13 December 2010 <https://www.cruiseindustrynews.com/images/pictures/2010/sdshore/sd_shorepower1.jpg>.

[35] 'Canada Shore Power Complete' *GreenPort* (online), 5 December 2018 <https://www.greenport.com/news101/americas/canada-shore-power-project-complete>.

b. Brooklyn – In 2016, cold ironing facilities were installed at the Brooklyn Cruise Terminal, New York. This has resulted in the elimination of 1,500 tons of carbon dioxide, 95 tons of nitrous oxide, and 6.5 tons of particulate matter annually.[36]

c. San Diego – In 2014, cold ironing facilities were installed at the Tenth Avenue Marine Terminal. This has resulted in a reduction of GHG emissions of more than 50% (more than 2,000 metric tons) per year. This is the equivalent to the GHG emission from about 1,500 cars per year.[37]

37. We note that, in order to be effective in reducing GHG emissions, provision of shore power facilities in WA ports must be accompanied by increased investment into renewable energy generation and renewable energy targets.

Recommendation 3: The WA Government should provide assistance to WA ports to install cold ironing facilities. This should be accompanied by increased investment and regulatory policies that incentivise renewable energy projects to support such facilities.

Incentives for demonstration projects using low or zero carbon fuels

38. Research and development into alternative low-carbon and zero-carbon fuels is critical to accelerate the commercial feasibility of such fuels and, as such, has been identified as a candidate short-term measure by the IMO Initial Strategy.[38]

39. Current initiatives at the port and industry level include:

a. Port of Rotterdam – In January 2019, the Port of Rotterdam launched a EUR 5 million fund for maritime projects involving low-carbon and zero-carbon demonstration projects.[39]

b. Port of Valencia – In February 2019, Valencia Terminal Europa and MSC Terminal Valencia began a demonstration project testing the use of hydrogen-powered machinery. These included a reach stacker for loading/unloading and transporting containers; a terminal tractor for ro-ro operations, powered by hydrogen fuel cells; and a mobile hydrogen refuelling station.[40]

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[36] Nikhita Venugopal, 'Emission-Reducing Shore Power Ready for Ships at Brooklyn Cruise Terminal', *DNA Info* (online), 11 November 2016 < https://www.dnainfo.com/new-york/20171101/red-hook/ups-distribution-sites-lease-amazon>.
[37] 'Port of San Diego Celebrates Shore Power Installation', *Safety4Seas* (online), 26 February 2014 <https://safety4sea.com/port-of-san-diego-celebrates-shore-power-installation-2/>.
[38] MEPC, above n12, s 4.7.9.
[39] 'Port of Rotterdam launches EUR 5 million low-carbon fuel initiative', *Bioenergy International* (online), 25 January 2019 <https://bioenergyinternational.com/storage-logistics/26426>.
[40] Fuel Cells and Hydrogen Joint Undertaking, *The H2Port kicks of in Valencia*, (5 February 2019) <https://www.fch.europa.eu/news/h2ports-project-kicks-valencia>.

c. Port of London – In June 2019, the Port of London received its first hybrid pilot boat. The hybrid system is expected to result in fuel reductions from 86,000 litres of fuel to around 7,000 litres of fuel a year.[41]

Figure 7: PLA's hybrid ORC 136 "Leader"

'Leader' is emission-free while operating in electric mode. Credit: Rebecca Jeffrey

40. In addition to testing pilot projects, ports will play a vital role in providing supporting infrastructure for alternative fuels if ambitious GHG targets are to be met by the shipping industry.

Recommendation 4: The WA Government should provide incentives to WA ports or shipping companies to engage in pilot projects for alternative low emission or zero emission fuels.

Recommendation 5: The WA Government should conduct regular reviews of emerging clean fuel technologies and opportunities for bunkering facilities to accommodate such technologies with maritime industry stakeholders.

[41] Port of London Authority, *Air quality strategy launch & first hybrid boat order* (12 June 2019) <https://pla.co.uk/PORT-OF-LONDON-AUTHORITY-AIR-QUALITY-STRATEGY-LAUNCH-FIRST-HYBRID-BOAT-ORDER>; 'Goodchild hybrid boat to lower PLA emissions', *Maritime Journal* (online), 13 June 2019 <https://www.maritimejournal.com/news101/seawork/goodchild-hybrid-boat-to-lower-pla-emissions>.

Context: WA Port emissions

41. Western Australia has five port authorities, which are responsible for nine ports. The ports are key infrastructure for the export of commodities such as iron ore, gold and wheat. The main export destinations from Western Australia are the nations of China (46%), Japan (14.2%) and Korea (5.5%).[42]

Figure 8: Map of ports in Western Australia[43]

Port Type	Port Status	Total
(red)	*Port Authority Act 1999* ports	9
(blue)	*Shipping and Pilotage Act 1967* proclaimed ports currently overseen by DoT. Notes: 1. Yampi Sound comprises of Cockatoo and Koolan Islands 2. Carnarvon comprises of Cape Cuvier and Useless Loop 3. Onslow comprises of Onslow, Airlie and Thevenard Islands	9 declared ports (13 port facilities)
(green)	Proposed ports (Anketell, James Price Point, Balla Balla, Oakajee and Cape Preston East)	5
		23 potential ports in total

[42] https://dfat.gov.au/trade/resources/Documents/wa.pdf
[43] https://www.transport.wa.gov.au/Freight-Ports/port-authorities.asp

42. WA ports are some of the largest in the world. Table 5 below shows relative capacities of WA ports compared to other ports in the world.

Table 5: Comparative annual tonnage of WA ports compared to large global ports

	Port	Year	Tonnes
1.	Fremantle (including Outer Harbour in Kwinana)	2018-2019	34,500,000 [44]
2.	Broome	2018-2019	357,329 [45]
3.	Geraldton	2018-2019	15,905,000[46]
4.	Ashburton	2018-2019	10,966,000[47]
5.	Dampier	2018-2019	172,900,000[48]
6.	Port Hedland	2018-2019	513,300,000[49]
7.	Albany, Bunbury and Esperance	2018-2019	30,465,203[50]
8.	Rotterdam	2018	469,000,000[51]
9.	Los Angeles	2018	194,500,000[52]
10.	New York and New Jersey	2018	84,962,000[53]
11.	Vancouver	2019	72,498,360[54]

[44] https://www.fremantleports.com.au/trade-business/annual-trade-overview
[45] https://www.kimberleyports.wa.gov.au/News-and-Media/Reports-(1)/ANNUAL-REPORT-2018-2019
[46] https://www.midwestports.com.au/annual-reports.aspx
[47] https://www.pilbaraports.com.au/Port-of-Ashburton
[48] https://www.pilbaraports.com.au/Home/About-PPA/News-and-Publications/Latest-news/End-of-year-shipping-results
[49] https://www.pilbaraports.com.au/Home/About-PPA/News-and-Publications/Latest-news/End-of-year-shipping-results
[50] https://www.southernports.com.au/trade-data
[51] https://www.portofrotterdam.com/en/our-port/facts-figures-about-the-port
[52] https://www.portoflosangeles.org/business/statistics/tonnage-statistics
[53] https://www.panynj.gov/port/pdf/trade-statistics-2018.pdf
[54] https://www.portvancouver.com/wp-content/uploads/2019/08/Overall-cargo-–-YTD-June-2019.pdf

43. GHG emissions from ports are a significant problem globally (see Table 6 below). For example, in 2017 Port of Rotterdam emitted 33.1 million tonnes of CO_2e, which was approximately 17.4% of the Netherland's national emissions (189.5 billion tonnes of CO_2e)[55]. The Port of Rotterdam is the largest port in Europe, but still handles less cargo than Port Hedland in WA. In 2016, the Port of New York and New Jersey's (**PANYNJ**) annual emissions was 5.9 million tonnes of CO_2e.[56] PANYNJ's annual throughput is less than half Port Dampier's throughput.

44. In 2017, WA's total emissions were 88.5 million tonnes of CO_2e a year. Given the energy intensity of port operations, the amount of throughput cargo handled by WA ports and the GHG emissions from ports of similar scale globally, it is likely that WA ports are a significant source of GHG emissions, with operations resulting in at least ten million tonnes of CO_2e annually.

45. Despite the urgency of the climate crisis, no ports in WA have published GHG inventories or have emission reduction plans. Without intervention, WA port GHG emissions are likely to rise with growing trade under a business as usual (**BAU**) scenario.

    Recommendation 6: A target of zero emissions for WA ports by 2040, to match the zero emission target of the Port of Auckland.

Mandatory GHG emissions inventory and reporting for WA Ports

46. WA ports must conduct emission inventories as a necessary first step in reducing emissions. In 2018, GloMEEP and the IAPH published the Port Emissions Toolkit Guide No 01: Assessment of Port Emissions (GloMEEP Toolkit 1), which is a technical guide for ports to assess their GHG emissions.

47. GloMEEP Toolkit 1 states that an emissions inventory assessment should comprise of the following 3 parts:

    a. Emissions inventories – These catalogue various port-related emissions sources and their activities, translate those activities into energy consumption levels and then translate energy consumption into emissions. They provide insight on activities and related emissions of the various source categories, within defined geographical, operational and temporal domains.

    b. Equipment, activity and emissions metrics – These provide context to the inventory through inter-related data on equipment, activities, energy

[55] 'Slight drop in greenhouse gas emissions', *CBS* (online), 9 May 2019 <https://www.cbs.nl/en-gb/news/2019/19/slight-drop-in-greenhouse-gas-emissions>.
[56] 'Greenhouse gas and criteria air pollutant emissions inventory for the Port of New York and New Jersey Calendar Year 2016', (Final Report, Port of New York and New Jersey, September 2018) <https://www.panynj.gov/about/pdf/EY2016-Report-Final.pdf > 8.

consumption, emissions sources, cargo throughput, as well as other indicators to create standards against which the design and performance of efforts to reduce emissions can be accomplished. For example, an emissions metric, such as emissions-per-tonne of cargo, can be tracked over time and used to determine whether the ratio improves or worsens. In the case of the latter, the identification of inefficiencies can help inform corrective measures that would decrease the emissions intensity of the activity.

c. Emissions forecasts are future projections of emissions – These are based on estimates of cargo throughput increases and changes in equipment and operations over time. Forecasts are used to: evaluate emissions reduction scenarios; estimate benefits from regulation of port-related sources; identify the potential emissions reduction magnitudes when developing future emissions reduction targets; and energy efficiency planning.[57]

48. The emissions inventory should include Scope 1, Scope 2 and Scope 3 emissions. These are illustrated in Figure 9 below. They are defined in the GloMEEP Toolkit 1 as follows:

a. Scope 1 – Port direct sources.

These sources are directly under the control and operation of the port administration entity and include port-owned fleet vehicles, port administration owned or leased vehicles, boilers and furnaces in buildings, port-owned and operated cargo handling equipment and any other emissions sources that are owned and operated by the port administrative authority.

b. Scope 2 – Port indirect sources.

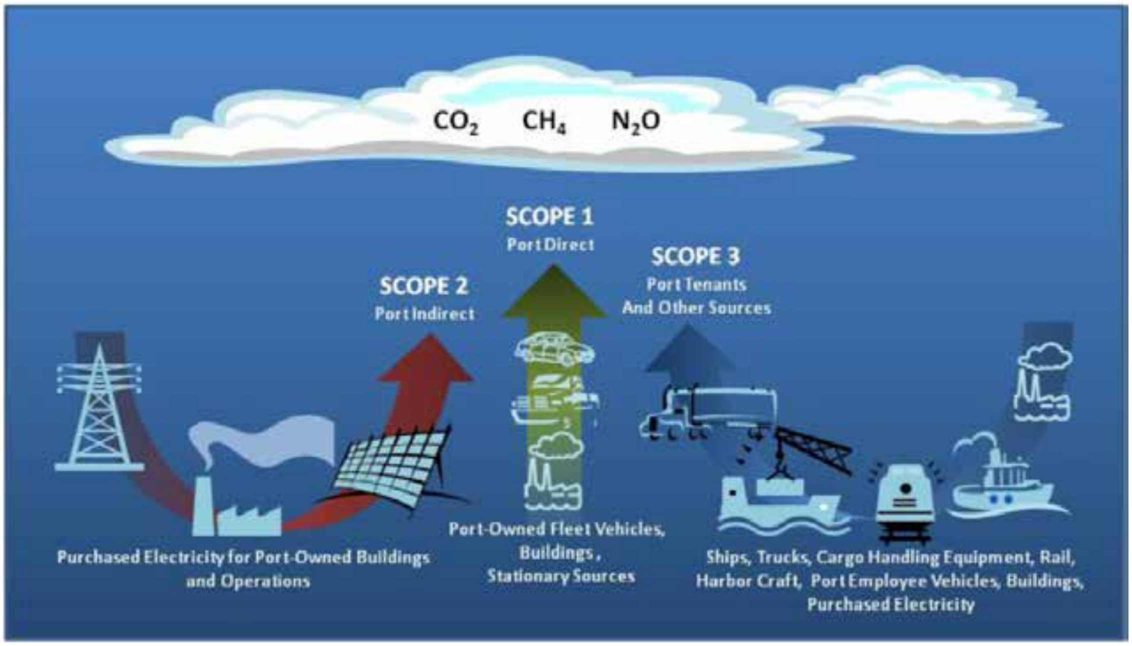
These sources include purchased electricity for port administration owned buildings and operations. Tenant power and energy purchases are not included in this scope.

c. Scope 3 – Other indirect sources.

These sources are associated with tenant operations and include ships, trucks, cargo handling equipment, rail locomotives, harbour craft, tenant buildings, tenant purchased electricity and port employee vehicles. For a port with a large number of tenants, this will likely be the largest source of GHG emissions.

[57] GEF-UNDP-IMO GloMEEP Project and IAPH, 2018: Port Emissions Toolkit, Guide No.1, Assessment of port emissions, 1.

Figure 9: Port Emissions by Source[58]



49. The level of detail required for the GHG emissions inventory should be at a level considered "best practice". Port emissions inventories can vary according to the level and type of data used to calculate emissions. The three main options for the level of detail required for port emission inventories are as follows:

    a. Scaled inventories - These use approximations to obtain an order-of-magnitude estimate of a port's emissions.

    b. Screened inventories - These use more port-specific activity data, although still with a simplified emissions quantification method and incomplete level of detail, to get a better order-of-magnitude result than scaled inventories.

    c. Comprehensive inventories - These are considered "best practice" as they are based on detailed port-specific activity information for each emission source category. They are based on detailed and sophisticated estimation methods.

Recommendation 7: Mandatory emissions inventory and reporting for WA ports with the following characteristics:

- **The inventory should include Scope 1, Scope 2 and Scope 3 emissions.**
- **A comprehensive inventory with detailed port-specific activity information for each emission source category should be required.**
- **Annual reporting should be required.**

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[58] Ibid 5.

A WA Port Initiative to reduce GHG emissions

50. The US Environment Protection Agency (**US EPA**) is a multi-tiered initiative to support efforts to make ports more sustainable. It works with industry stakeholders to provide funding for clean technologies and technical resources to identify the best clean air investments. It also provides a platform for collaboration and cooperation between the government and stakeholders.

51. As part of the Initiative, the the US Environment Protection Agency published the National Port Strategy Assessment: Reducing Air Pollution and Greenhouse Gases at U.S. Ports (**US Port GHG Strategy**).[59] The US Port GHG Strategy:

    a. examines current and future emissions from various diesel sources at ports;

    b. explore the effectiveness of a range of emission reduction strategies; and

    c. informs EPA's Ports Initiative and voluntary port-related efforts.

52. The US Port GHG Strategy forms the basis for ports to take concrete technological and operational actions to reduce their GHG emissions. For example, Table 6 below shows the US EPA's assessment of the most effective technologies to reduce drayage truck emissions. Table 7 below shows the US EPA's assessment of operational strategies to reduce drayage truck emissions.

Table 6: Most promising drayage truck technological strategies[60]

Strategy	Per Truck Reduction			Cost Per Truck	Years Effective
	NOx (lbs)	$PM_{2.5}$ (lbs)	CO_2 (tons)		
Replace MY1998-2003 with MY2010+	840	19.9	0.0	$110,000 (new); $55,000 (4 yrs used)	2020
Replace MY2004-2006 with MY2010+	398	19.9	0.0	$110,000 (new); $55,000 (4 yrs used)	2020
Replace MY 2010+ Diesel with Battery Electric	44	1.8	12.1	$220,000 (new, est.)	2030

[59] 'National Port Strategy Assessment: Reducing Air Pollution and Greenhouse Gases at US Ports', (Final Report, United States Environmental Protection Agency, September 2016) < https://www.epa.gov/ports-initiative/national-port-strategy-assessment-reducing-air-pollution-and-greenhouse-gases-us>.
[60] Ibid 46.

Table 7: Approximate annual typical port emission impacts for truck operational strategies, 2020[61]

Strategy	NOx		$PM_{2.5}$		CO_2	
	Tons	Percent	Tons	Percent	Tons	Percent
Reduce Inbound Gate Queues						
50% Reduction (from 20 to 10 min)	-5.3	-0.5%	-1.54	-2.0%	-6,933	-2.0%
25% Reduction (from 20 to 15 min)	-2.6	-0.2%	-0.77	-1.0%	-3,466	-1.0%
Automated Gates						
100% of Gate Transactions	-10.8	-1.0%	-3.10	-4.0%	-13,918	-4.1%
50% of Gate Transactions	-5.4	-0.5%	-1.55	-2.0%	-6,959	-2.1%
25% of Gate Transactions	-2.7	-0.2%	-0.78	-1.0%	-3,479	-1.0%
Container Information System						
75% of TEUs Covered	-3.1	-0.3%	-0.21	-0.3%	-708	-0.2%
50% of TEUs Covered	-2.1	-0.2%	-0.14	-0.2%	-472	-0.1%
Extended Gate Hours						
50% of traffic off-peak	-7.7	-0.7%	-1.71	-2.2%	-7,480	-2.2%
30% of traffic off-peak	-4.6	-0.4%	-1.02	-1.3%	-4,488	-1.3%
10% of traffic off-peak	-1.5	-0.1%	-0.34	-0.4%	-1,496	-0.4%
Minutes per Transaction						
20% reduction (from 30 min to 24)	-17.0	-1.5%	-1.00	-1.3%	-3,831	-1.1%

53. We support a collaborative approach between government and industry similar to the approach taken by the US EPA.

    Recommendation 8: Creation of a WA Port GHG Initiative to provide funding for clean energy projects, technical guidance and a platform for collaboration and collaboration between government and industry.

[61] Ibid 47.