

Taking Stock: Where are we on defining, measuring and controlling black carbon?

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5th ICCT Workshop on Marine BC

San Francisco, CA, USA

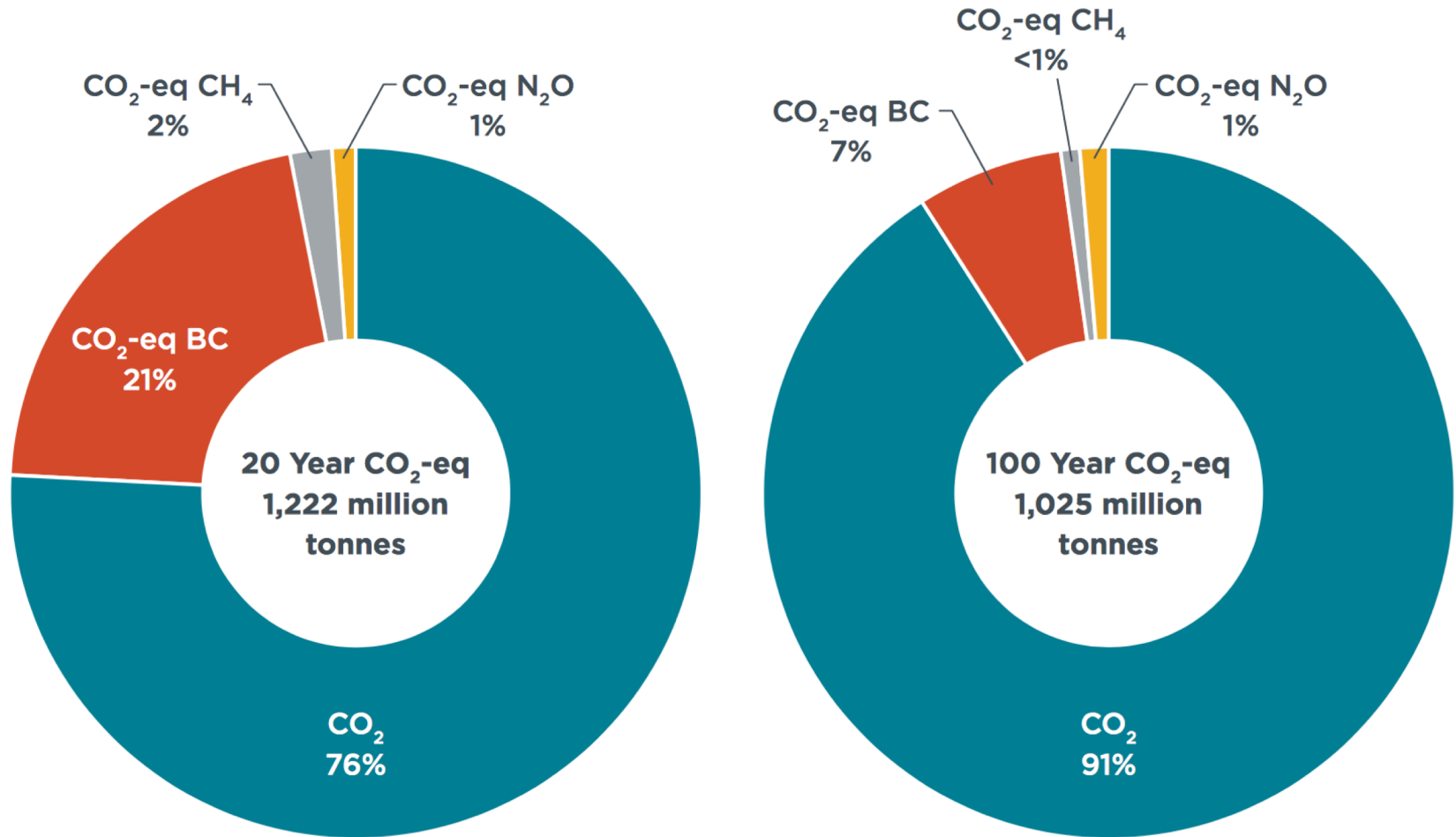
September 2018



Plan

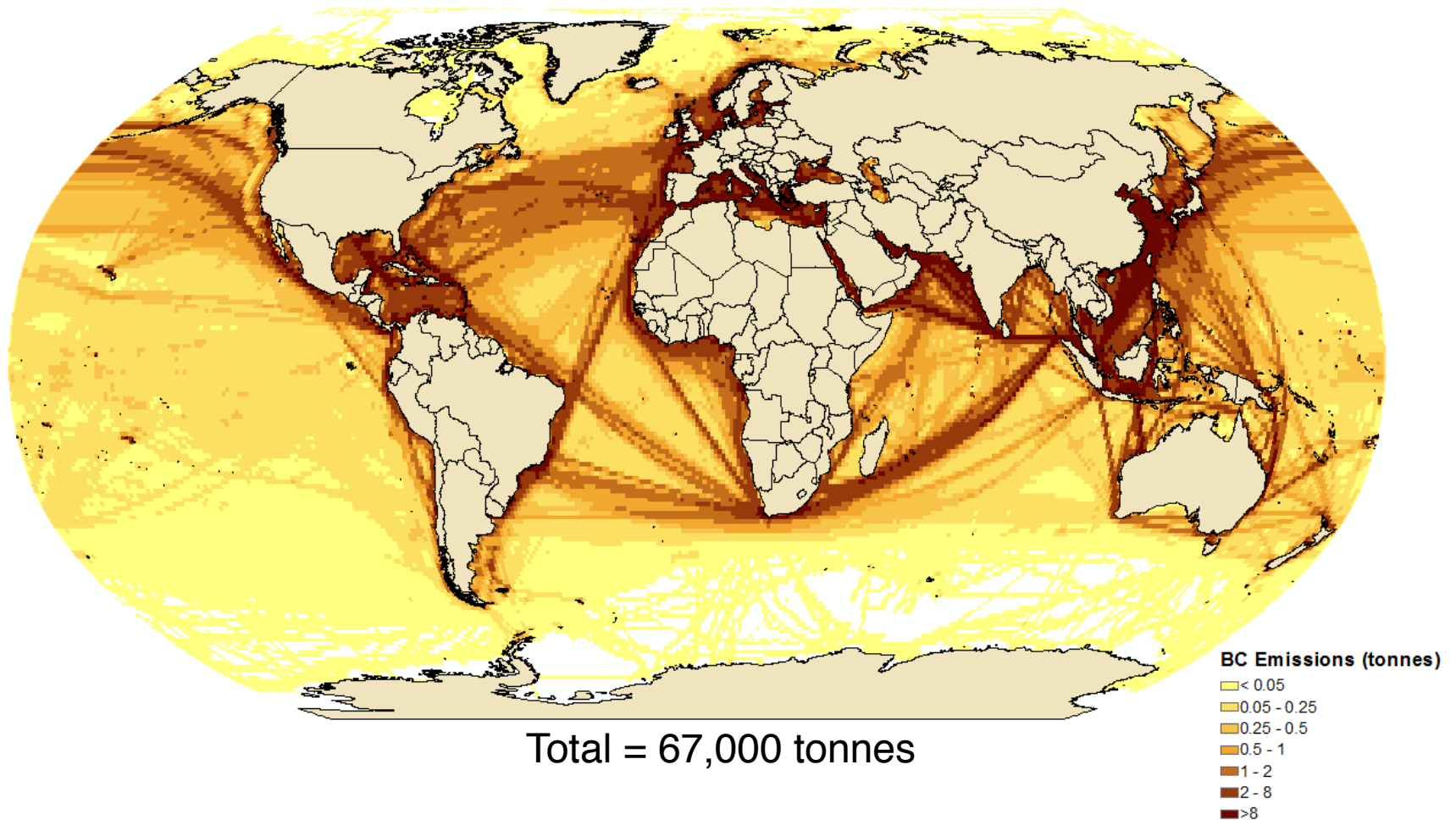
- Explain why we care about BC
- Present you with an overview of progress to date on:
 - Defining BC
 - Measuring BC
 - Controlling BC

BC represents 7% to 21% of shipping's climate impact, due to its strong global warming potential



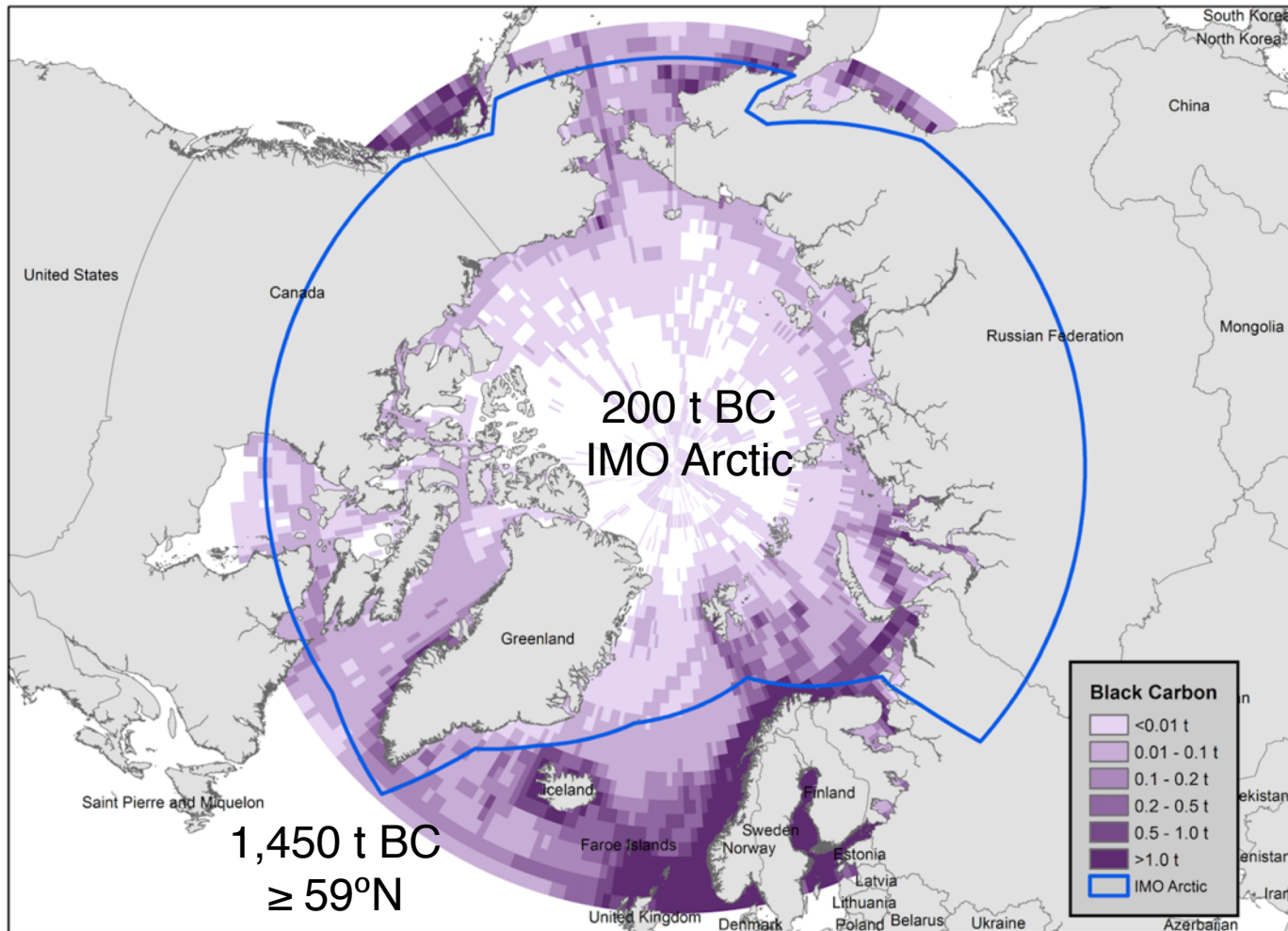
Source: Olmer et al. (2017). *Greenhouse gas emissions from global shipping, 2013-2015*.
Available at: <https://www.theicct.org/publications/GHG-emissions-global-shipping-2013-2015>

Global Ship BC inventory, 2015



Source: Comer et al. (2017). *Black carbon emissions and fuel use in global shipping, 2015*.
Available at: <http://theicct.org/black-carbon-emissions-global-shipping-2015>

Ship Black Carbon Emissions, Arctic Region, 2015



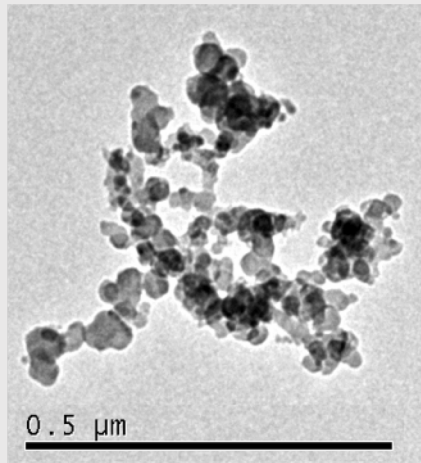
Source: Comer et al. (2017). *Prevalence of heavy fuel oil and black carbon in Arctic shipping, 2015 to 2025*. ICCT. Available at: <https://www.theicct.org/publications/black-carbon-emissions-global-shipping-2015>

IMO BC work plan

- MEPC 62 (2011) agreed to a work plan to consider the impact on the Arctic of BC emissions from international shipping and instructed BLG (now PPR) to:
 - Develop a definition of BC
 - Identify the most appropriate method(s) to measure marine BC
 - Investigate appropriate control measures

IMO Progress on Black Carbon Work Plan since 2011

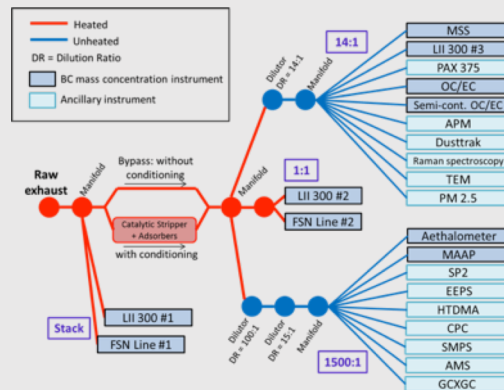
Step 1: Definition



2015: Definition

Bond et al.

Step 2: Measurement Methods

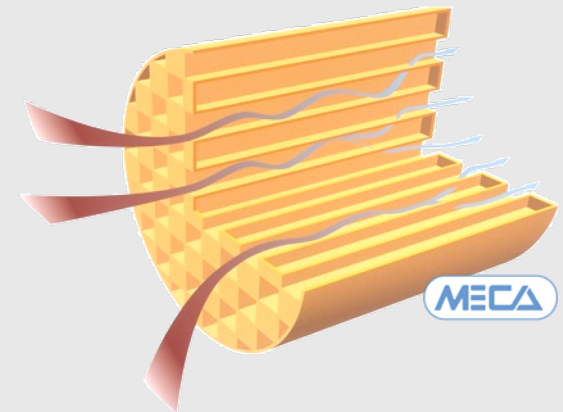


2018: Measurement Methods

FSN, PAS, LII

Step 3: Control Measures

?



2019: Control Measures?

There are many potential control measures, but our job is to identify “appropriate” control measures

Exhaust Treatment	Fuels/ Propulsion	Operations/ Design	Policies
<p>Existing: DPFs Scrubbers SCR</p> <p>Potential: ESP</p>	<p>Existing: MDO/MGO LNG Nuclear</p> <p>Potential: Biofuels Methanol Ammonia Batteries Fuel cells Wind-assist Etc.</p>	<p>Existing: Slow steaming Hull coating/cleaning Shorepower Weather routing Propeller- optimization Hydrodynamics Aerodynamics</p> <p>Potential: Hull air lubrication</p>	<p>Existing: EEDI ECAs 2020 0.5% S rule IMO GHG Strategy</p> <p>Potential: Arctic HFO ban Stronger EEDI New ECAs Revised GHG Strategy R&D scheme Carbon Price</p>

Defining terms: control measures vs. control policies

- For the group to consider, we propose:
 - **Control measure** means a technology or operational practice that reduces black carbon from the source.
 - Examples include use of distillate fuel, aftertreatment technologies like scrubbers or DPFs, and slow steaming.
 - This is the proposed scope of this workshop.
 - **Control policy** means a government regulation or policy that requires or promotes a control measure.
 - Examples include Emission Control Areas, the Energy Efficiency Design Index, or carbon pricing.
 - We propose not trying to identify appropriate control policies at this workshop.

Conclusions

- BC is an important pollutant that should be addressed
- We've defined BC
- We've agreed on appropriate measurement methods
- We've identified many ways to control BC
- Now we need to identify “appropriate” BC control measures

Thank you!

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Acknowledgements:

Workshop Participants

Climate and Clean Air Coalition

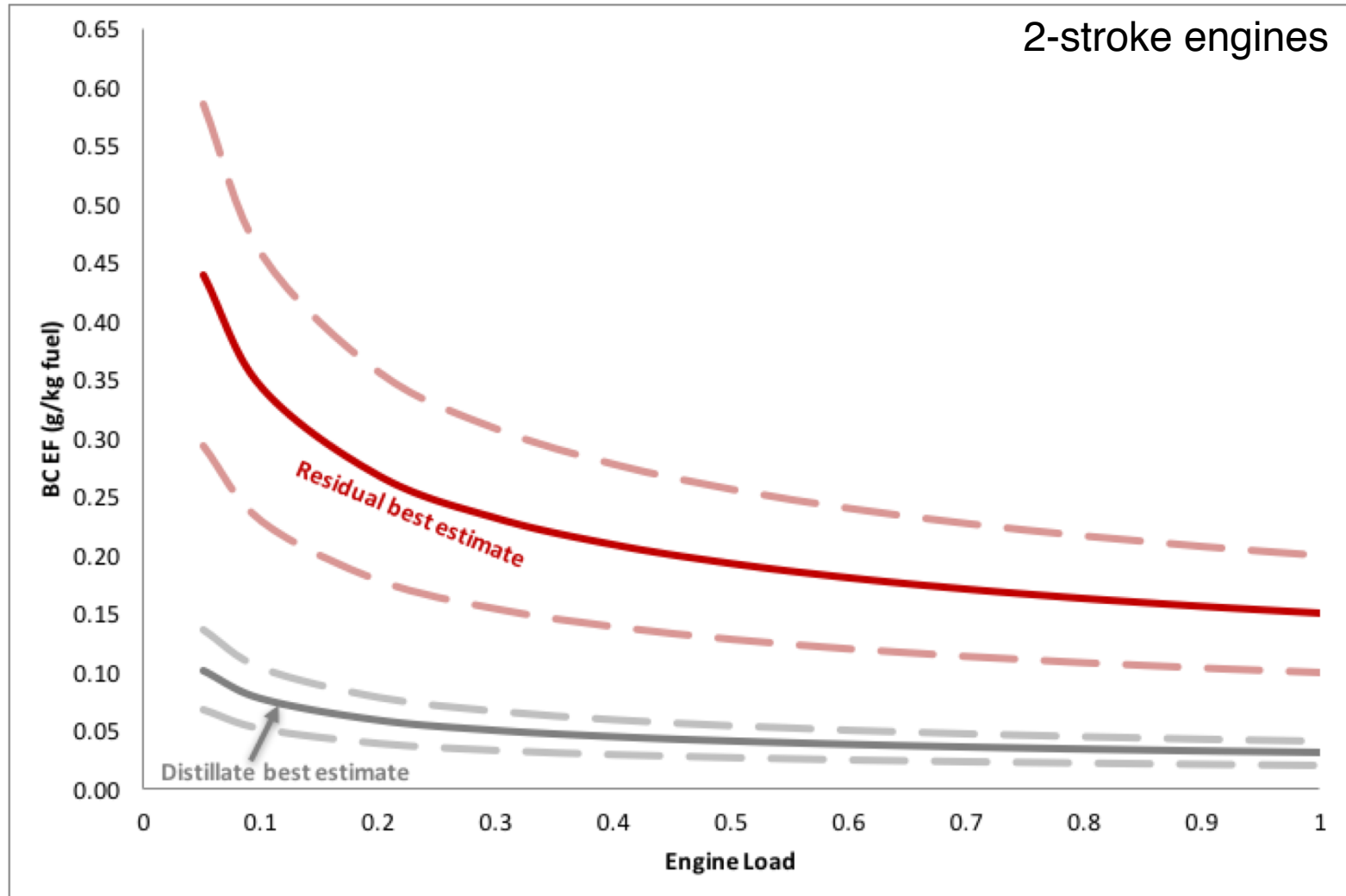
Pisces Foundation

ClimateWorks Foundation

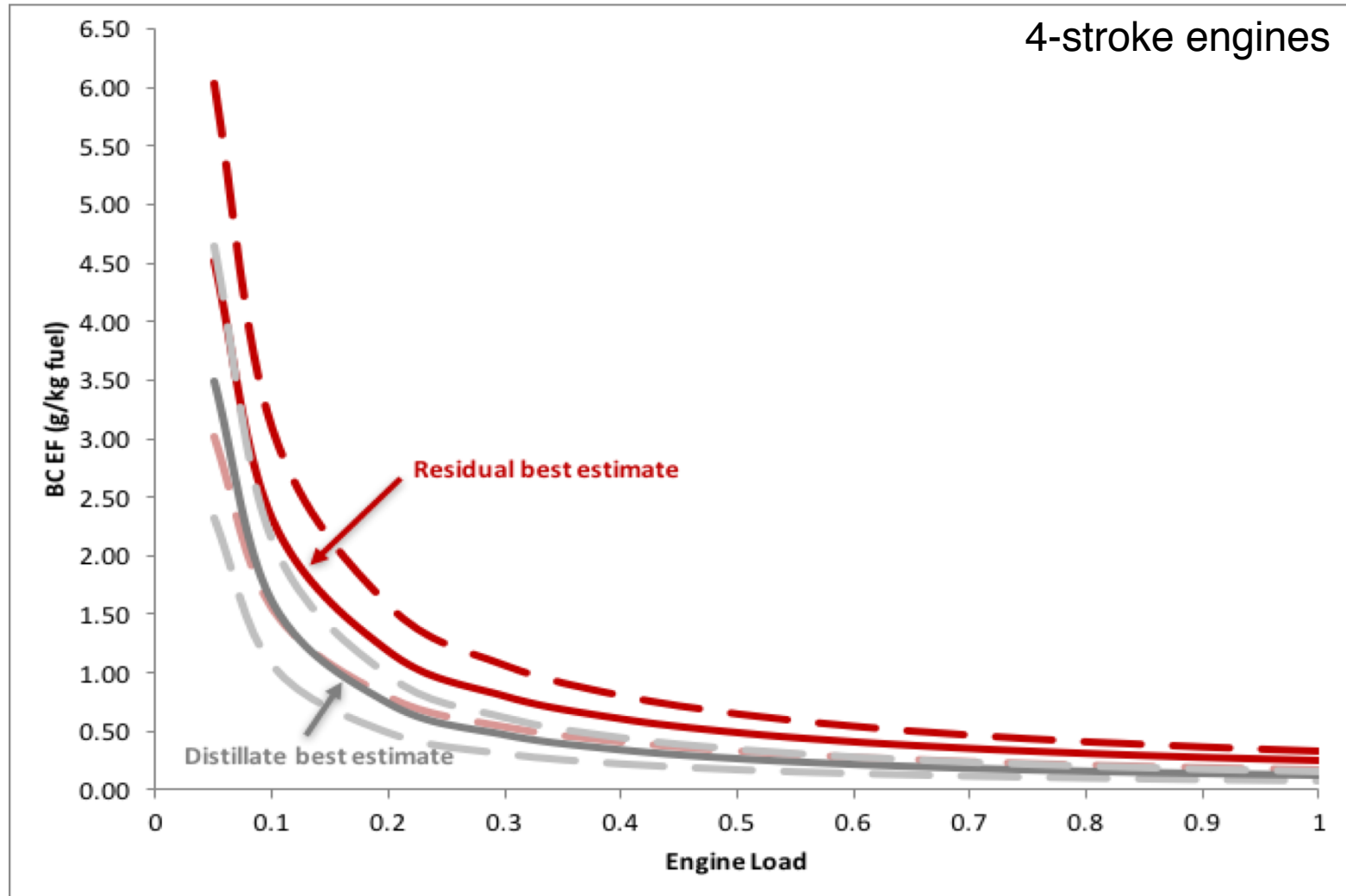
ICCT Colleagues

Extra Slides

Global BC inventory uses BC EFs based on recent testing data and can be updated over time



4-stroke engine BC EFs (note the order of magnitude increase on the y-axis)



Progress on the IMO BC work plan

Year	Meeting	Outcomes
2015	MEPC 68	<ul style="list-style-type: none">• Adopted Bond et al. (2013) definition of BC, as agreed to at 1st BC technical workshop (Ottawa)
2016	PPR 3	<ul style="list-style-type: none">• PPR endorsed EUROMOT measurement reporting protocol refined at the 2nd BC technical workshop (Utrecht) and field tested in subsequent research
2017	PPR 4	<ul style="list-style-type: none">• Canada and the Netherlands submitted a summary of 3rd BC technical workshop (Vancouver) on BC measurement and control• Agreed to identify the most appropriate method for measuring marine BC at PPR 5• Agreed to to finalize appropriate control measures for BC at PPR 6

Upcoming IMO actions on BC

Year	Meeting	Outcomes
2018	PPR 5	<ul style="list-style-type: none">Finalized BC measurement reporting protocolIdentified the most appropriate methods for measuring BC: FSN, PAS, LII
2019	PPR 6	<ul style="list-style-type: none">Identify appropriate control measures for consideration by MEPC
2019	MEPC 74	<ul style="list-style-type: none">Debate on BC control measures and policies could begin