Shipping emission controls in China
—Drivers and Benefits

Huan Liu, Ph.D, Assoc. Prof.
Tsinghua University, liu_env@tsinghua.edu.cn
Background: air pollution in China

Global PM2.5 concentrations
Challenges in China: unbalanced development vs. emission controls

Some rural area in China’s west

Services

Buildings

Transportation

Education

Some urban area in China’s southeast
Challenges in China:
Controlling power plants vs. all emission sources

Decline trend of emissions from Power plants
Increment of emissions from other sources

Source: MEIC by Tsinghua
Demands on shipping emissions control in coastal cities

Thousand ton
- >400000
- 300000-400000
- 200000-300000
- 100000-200000
- 10000-100000
- <10000

Throughput of coastal ports

PM$_{2.5}$ source apportionment
- Vehicle 43%
- Power plant 8%
- Ocean 5%
- Biomass combustion 3%
- Vessel 12%
- Dust 13%
- Industry 16%
The gaps from science to policy

Policy:
1. unified method and comparable results;
2. fixed domain under administration;
3. all ports located in target zone;

Science:
1. multiple methods;
2. domain with interests or upon availability;
3. large ports with interests;
Health and climate impacts of ocean-going vessels in East Asia

Huan Liu, et al. Vol 6 (NO 11), 2016, 6, 1037-1041.
Health and climate impacts of ocean-going vessels in East Asia

Top 3 local registration region with CO2 emissions in East Asia: Japan, China, Hong Kong

CO2 emission from vessels with different ship flags and affecting regions:
- 65% CO2 emissions from vessels registered out of East Asia
- Both local and foreign vessels should be under control!
Our recommendation: To upgrade DECA

Emission levels comparison

<table>
<thead>
<tr>
<th>Emission limits of IMO (Tier 2)</th>
<th>Emission limit of MEP (Phase 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx (g/kWh)</td>
<td>Power (kW)</td>
</tr>
<tr>
<td>8.18-9.75</td>
<td>[2.5L≤SV &lt; 5L]</td>
</tr>
<tr>
<td>8.98-9.75</td>
<td>[5L≤SV &lt; 15L]</td>
</tr>
<tr>
<td>8.98-9.75</td>
<td>[15L≤SV &lt; 20L]</td>
</tr>
<tr>
<td>8.98-9.75</td>
<td>[20L≤SV &lt; 25L]</td>
</tr>
<tr>
<td>10.1-11.1</td>
<td>[25L≤SV &lt; 30L]</td>
</tr>
</tbody>
</table>
Our recommendation: To upgrade DECA

The ships are encouraged to use fuel with sulfur content less than 0.5% m/m when at berth in DECA.

The ships at berth in DECA core ports must use fuel with sulfur content less than 0.5% m/m.

The ships at berth in all DECA ports use fuel with sulfur content less than 0.5% m/m.

The ships use fuel with sulfur content less than 0.5% m/m in the scope of DECA.

Evaluate whether to use fuel with sulfur less than 0.1% m/m in DECA.

---

2016/1/1

2017/1/1

2018/1/1

2019/1/1

2019/12/31
Our recommendation: To upgrade DECA
DECA Upgrade

- The DECA region?
- Environmental impacts?
- Business impacts?

Requirements for ECA Application of MARPOL Annex VI

1. Region of ECA
2. Pollutant species under control in ECA region
3. Information of population and environment affected by vessel emissions
4. Atmosphere and environment impacts of vessel emissions
5. Weather and geography situation surrounding the ECA region
6. Traffic volume of vessels in ECA region
7. Situation of controlling the air pollution source from land
8. Potential economic impact of ECA
DECA Upgrade (1): Vessel emissions in China — national, regional and port levels

DECA Upgrade (2): Emission forecasts & different scenarios in three key regions

Under current DECA control policy:
- 57.4-74.8% reduction of PM
- 64.3-81.4% reduction of SO2

With bigger area and lower sulfur content:
- Over 86% reduction of PM
- 96% reduction of SO2

Liu, H.*, et al. (2017) Shipping emission forecasts and cost-benefit analysis of China ports and key regions’ control. Environmental Pollution.
DECA Upgrade (3): extend out of three key regions

For PRD: Expanding DECA region along the coastline may be better than expanding away from the coastline.

Next Step: Mitigation strategies

Proposal to Designate an IMO Emission Control Area

Sponsor: ENERGY FOUNDATION

Advisors: NORDIC ENVIRONMENTAL FUND, WAPENAMUREN
Long-term hard working for the blue sky!
THANKS

Huan Liu
Liu_env@tsinghua.edu.cn