Ports in Asia have grown rapidly and competition is intense

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Most large port cities in Asia have large population and face air pollution problems.
Air pollution from shipping causes adverse health impacts

Premature deaths per year attributable to East Asian Shipping Emissions

Port cities collaborate on clean air efforts: Improve air quality while maintaining competitiveness

- Ships using clean fuels, advanced technologies and practices in regulated regions could readily meet stricter standards.

- Uniform regulations can minimize cargo diversion to the least regulated ports.

- Incentive programs for promoting green shipping and ports become more attractive if adopted by a larger network of ports.

- Ports could leapfrog to adopt cost-effective, green port technologies / practices.

Shore power | Electric- or LNG-fueled port equipment | LNG-fueled vessels
Thank you!
NOx pollution in Asia is BAD (2014)…
...so is PM$_{2.5}$ pollution (2000-2010)

Sources: Aaron van Donkelaar et al. “Use of satellite observations for long-term exposure assessment of global concentrations of fine particulate matter”, http://dx.doi.org/10.1289/ehp.1408646
Ships are a major source of air pollution in port cities

<table>
<thead>
<tr>
<th>Pollution from ships</th>
<th>SO$_x$</th>
<th>NO$_x$</th>
<th>PM$_{2.5}$</th>
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<tr>
<td>Hong Kong$^+$</td>
<td>44%</td>
<td>33%</td>
<td>42%</td>
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<td>Shenzhen$^§$</td>
<td>59%</td>
<td>16%</td>
<td>5%</td>
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<td>Shanghai$^{++}$</td>
<td>22%</td>
<td>17%</td>
<td>4%</td>
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$^+: 2014$ data, Includes emissions from all vessels

$^§: 2014$ data, Includes emissions from oceangoing vessels; account for share of SO$_2$, not SO$_x$

$^{++}: 2013$ data, Includes emissions from all vessels
Controlling shipping pollution is late-coming in Hong Kong

PM$_{2.5}$

1997
- Marine: 17%
- Road Transport: 43%
- Electricity Generation: 9%

2014
- Marine: 42%
- Road Transport: 17%
- Electricity Generation: 10%

SO$_2$

1997
- Marine: 23%
- Road Transport: 4%
- Electricity Generation: 66%

2014
- Marine: 44%
- Road Transport: 0%
- Electricity Generation: 53%
Regions that regulate marine fuel sulfur content

IMO North America ECAs (0.1%)

IMO North Sea & Baltic Sea SEC As (0.1%)

California OGV Fuel Rule (0.1%)

Hong Kong OGV Fuel Switch At Berth Regulation (0.5%)

China Domestic Emission Control Areas (DECAs) (0.5%)