From Sail to Satellite: Delivering Solutions for Tomorrow's Marine Transportation Systems

Environmental Performance of Ports – Use of an Emissions Footprint of a Shipping Container as a Metric

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June 21, 2016

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- EDF creates solutions that let nature and people prosper
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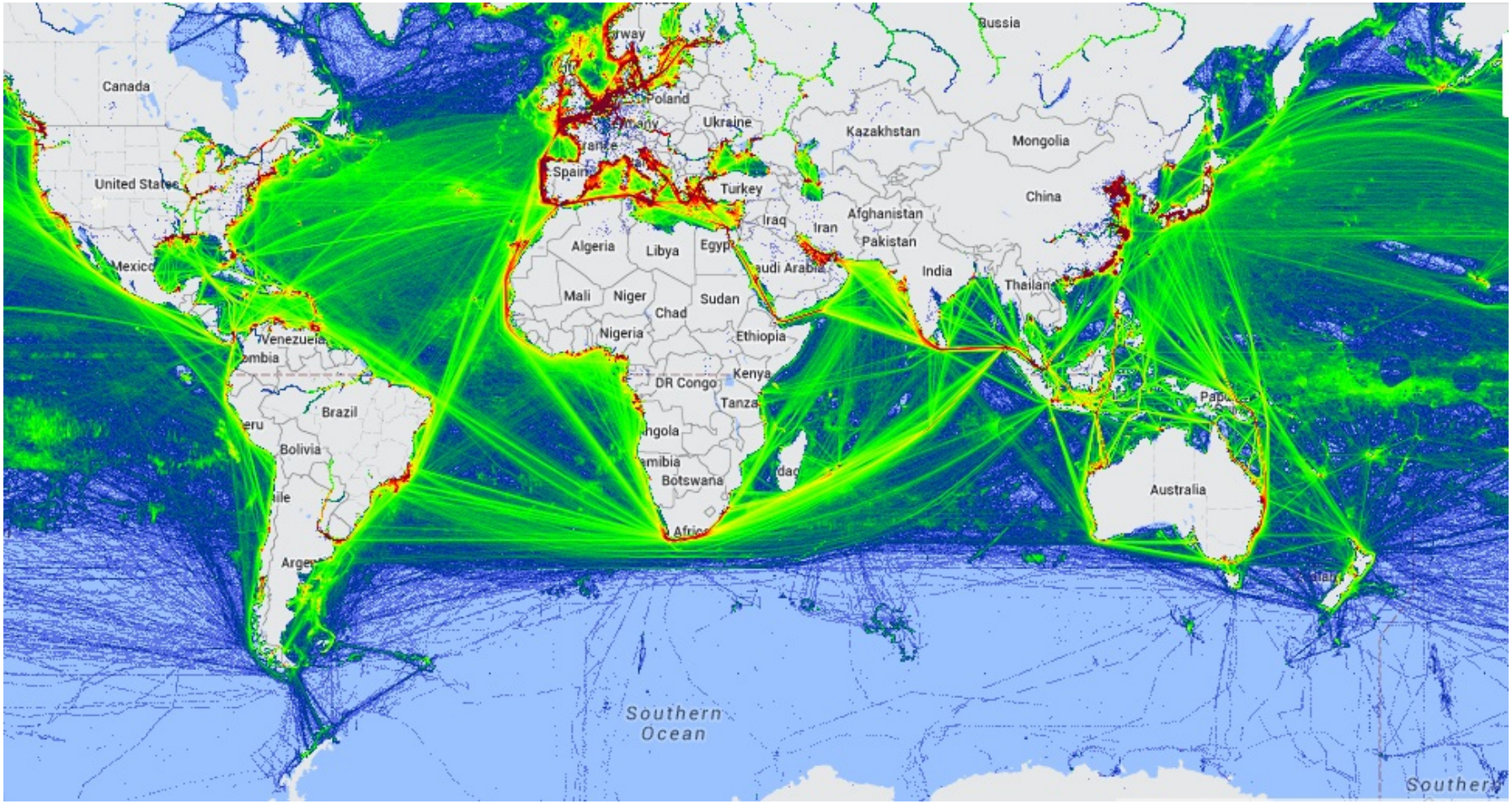
- 530 scientists, economists, and other professional staff
- > 1 million members

Trade globalization

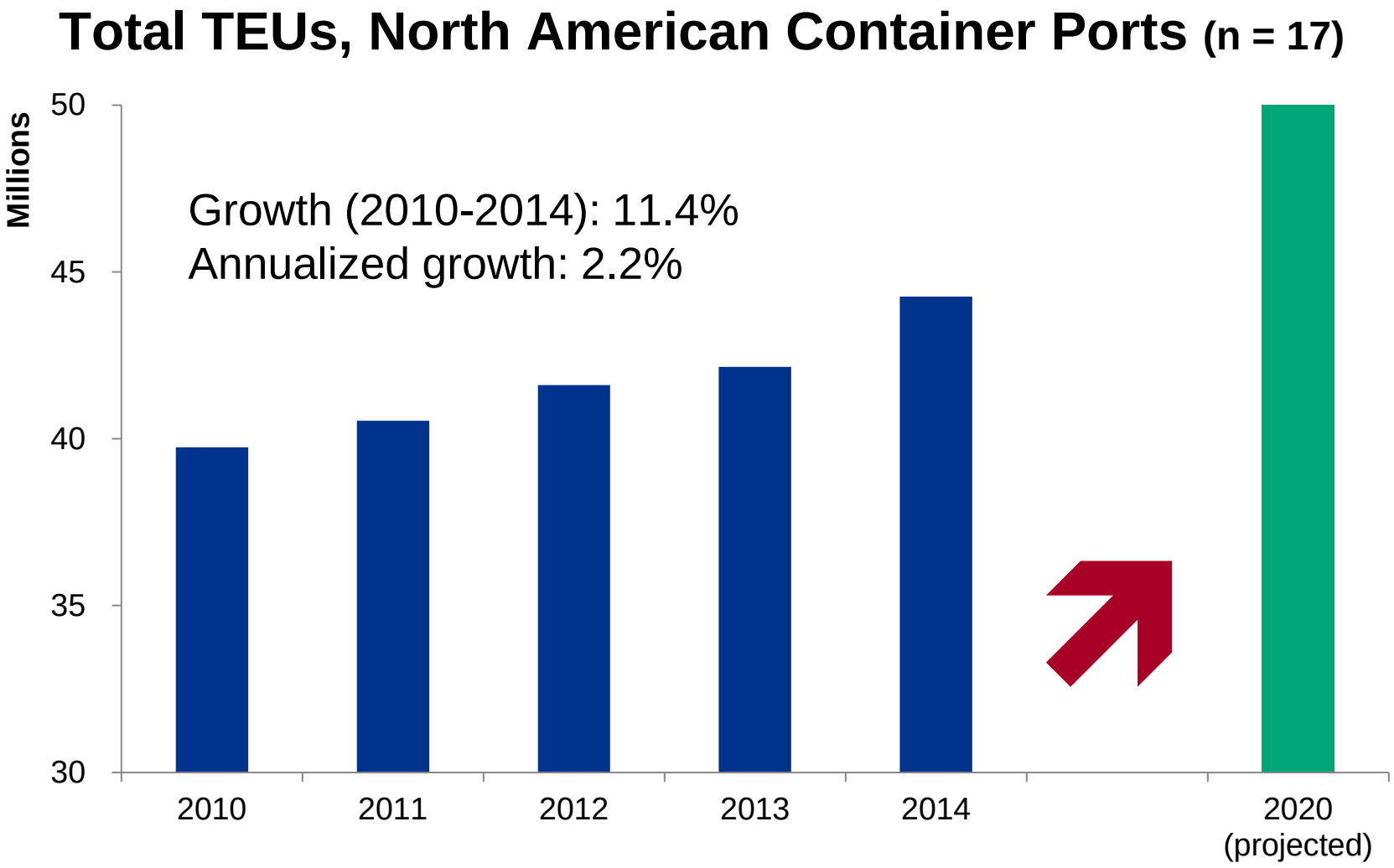


2014 Vessel Density, AIS.
Source: www.marinetraffic.com

Innovation → trade revolution

Photo credit: Captain Albert Theberge, NOAA

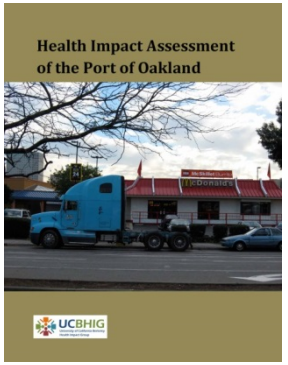
Trends in containerized cargo

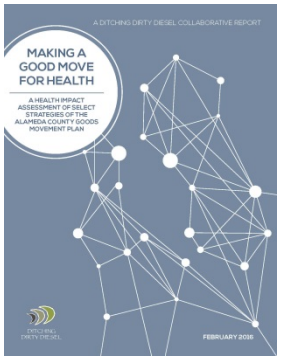


Source: EDF, unpublished data, 2016.

Port-related health impacts

Location	Study
US: Port of Charleston	Svendsen et al., 2014
US: Ports of Los Angeles/Long Beach	Houston et al., 2014 Hricko et al., 2014
Belgium	De Meyer et al., 2008
China: Hong Kong	Yau et al., 2013
China: Shanghai	Zhao et al., 2013
China: Taiwan (Kaohsiung)	Berechman and Tseng, 2012
Spain: Tenerife (Canary Islands)	González et al., 2011
Norway: Bergen	McArthur and Osland, 2013
Greece: Thessaloniki	Tolis et al., 2014
Greece: Athens (Pireaus Port)	Chatzinikolaou et al., 2015
Italy: Venice	Contini et al., 2011
Ireland: Cork	Hellebust et al., 2010
The Netherlands: Rotterdam (Rijmond)	Keuken et al., 2005
US: Oakland	Kuwayama et al., 2013
Europe	Viana et al., 2014

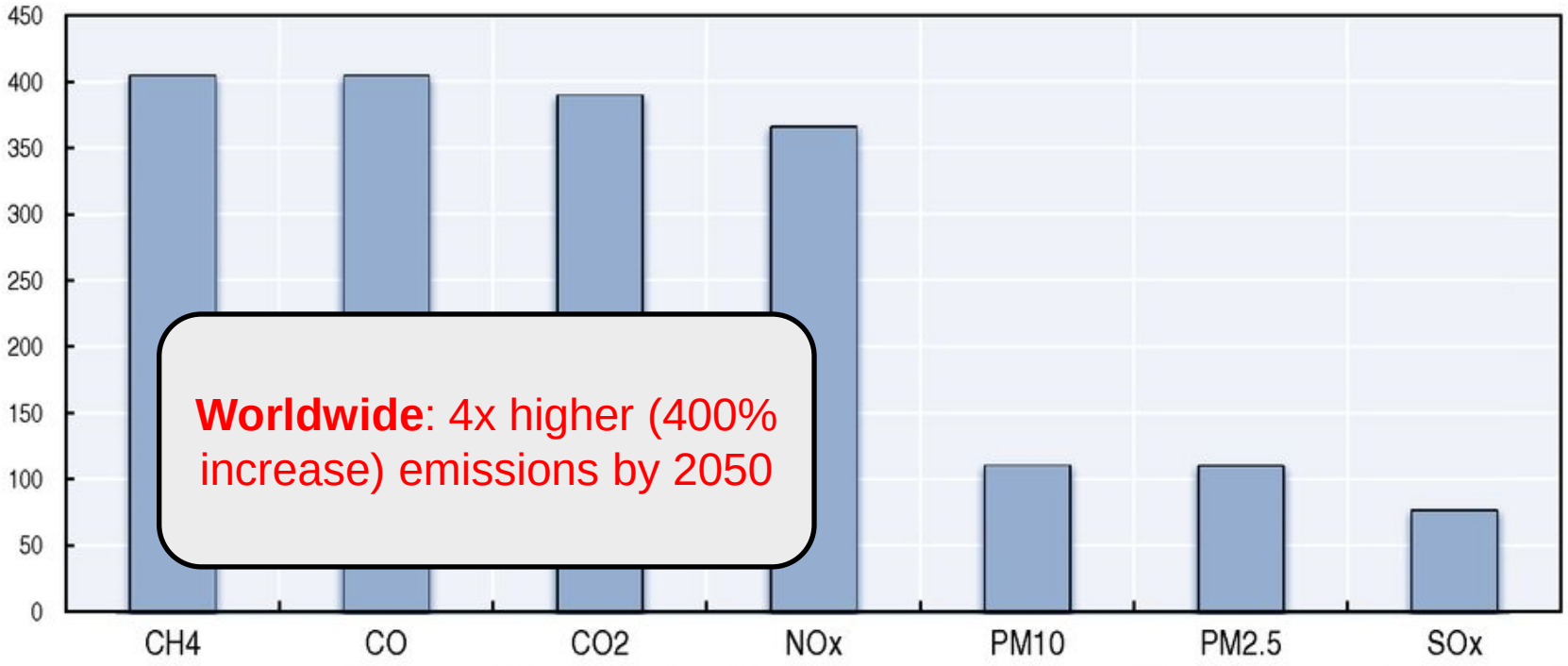




Port-related health impacts - 2050

Figure 3.8. **Growth in shipping emissions in ports, 2050**

2010 = 100

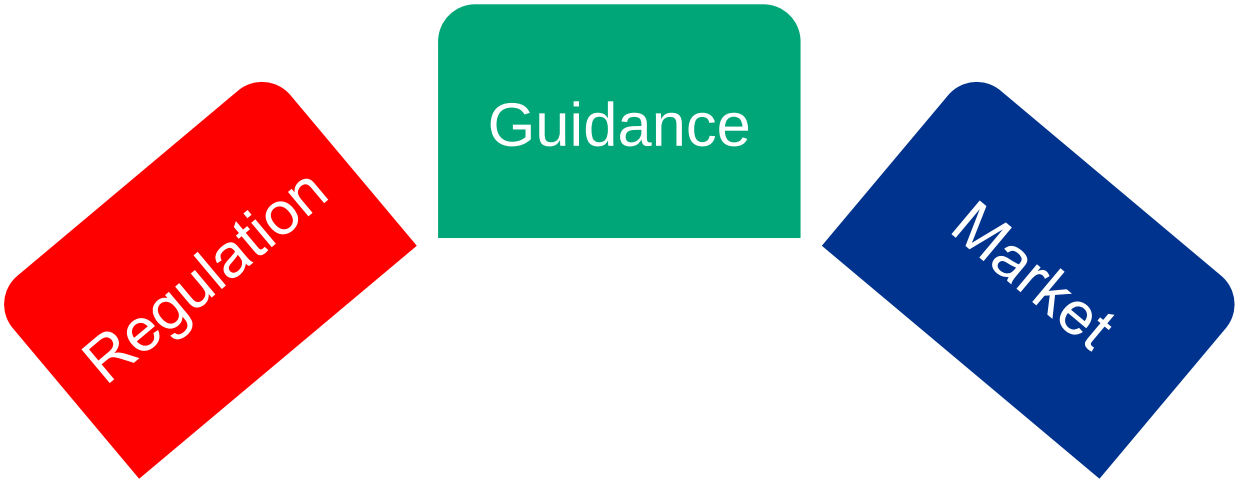


Note: CH_4 – Methane, CO – Carbon monoxide, CO_2 – Carbon dioxide, NO_x – Mono-nitrogen oxides, PM_{10} – Particulate matter with diameter inferior to 10 micrometre, $PM_{2.5}$ – Particulate matter with diameter inferior to 2.5 micrometre, SO_x – Sulfur oxides.

StatLink http://dx.doi.org/10.1787/888933168807

Source: OECD/ITF, 2015. ITF Transport Outlook 2015.

Big problems – many solutions



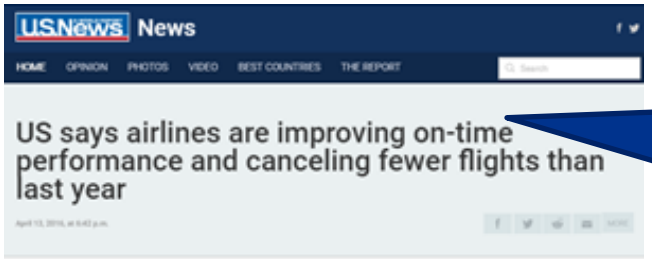
Port operations are complicated…

…but Ports often function like businesses…

…simple to understand *metric* to drive improvement?

Industry benchmarks - examples

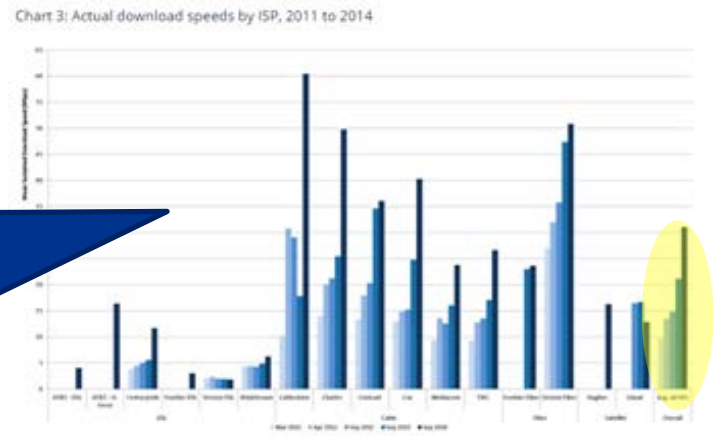
- Transportation
  - Airline on-time performance



"The Department of Transportation said Wednesday that 83.6 percent of flights on the leading airlines arrived on time in February. That's up from 81.3 percent in January and 72.8 percent the previous February."

- Communications
  - Data speed

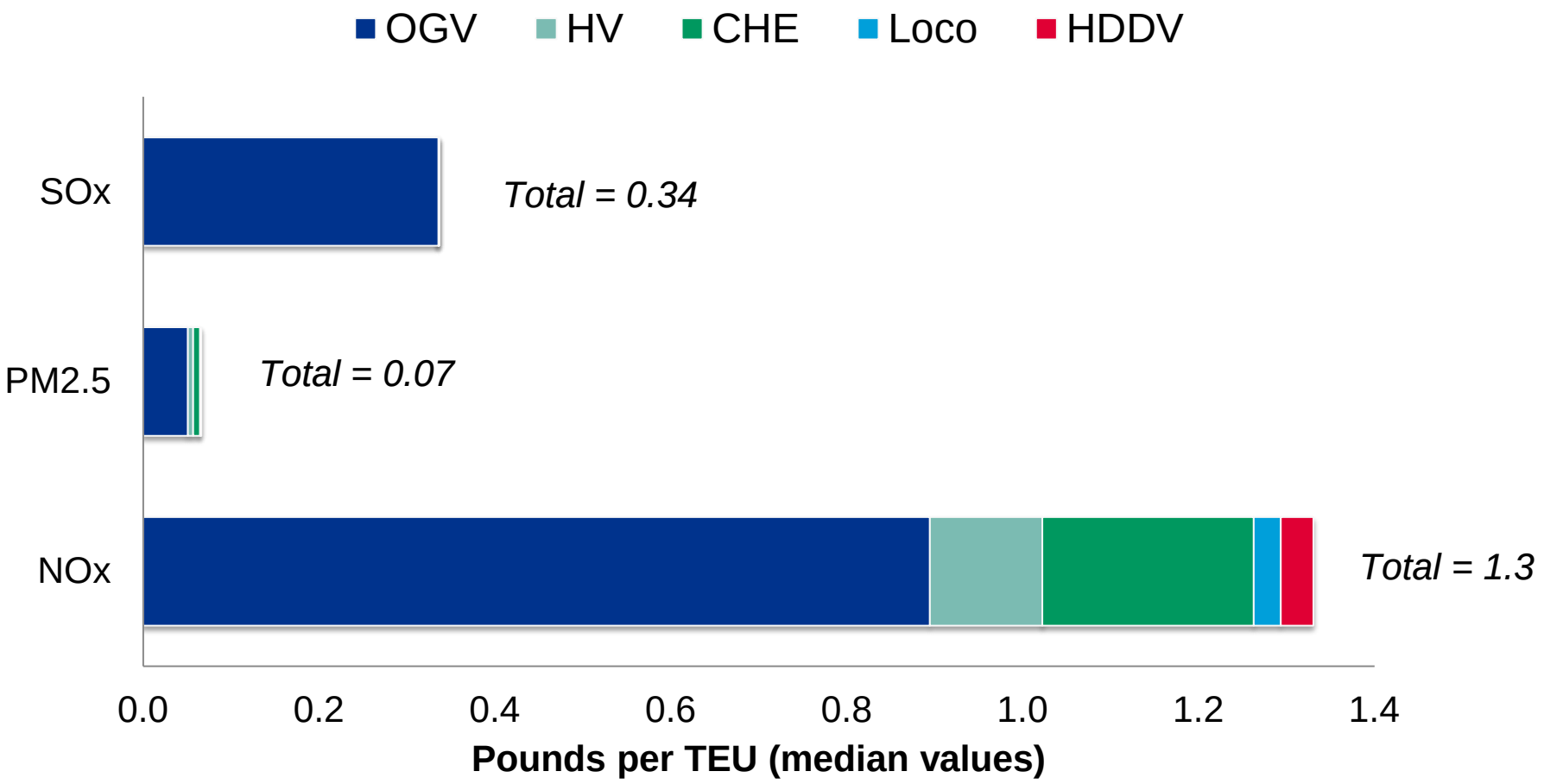
" The actual download speed, averaged across all participating ISPs, has tripled during this period, from approximately 10 Mbps in March 2011, to approximately 15 Mbps in September 2012, to nearly 31 Mbps in September 2014."



Emissions footprint as a metric

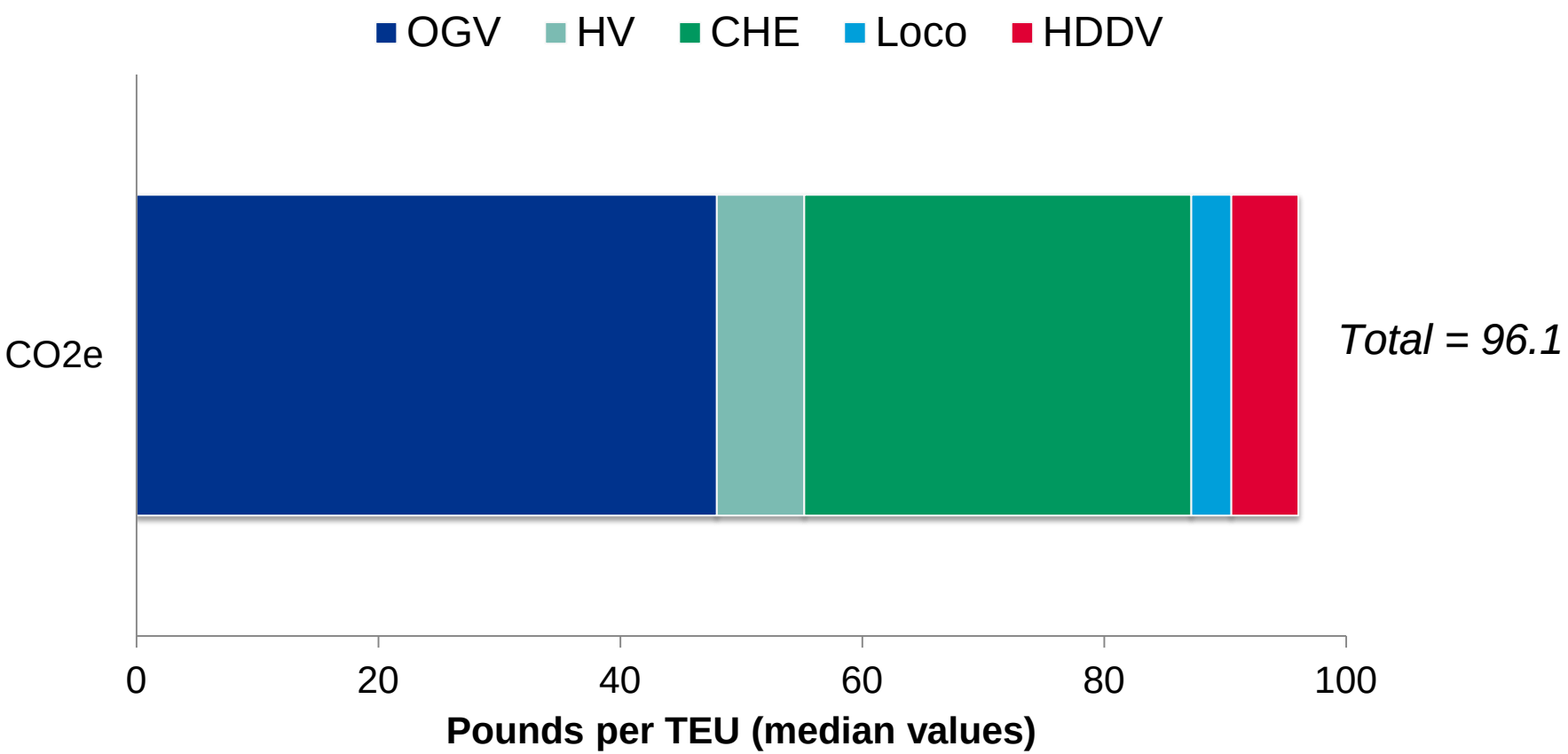
- Methods
  - N = 9* (major North American container ports with publically-available emission inventories)
  - Emissions associated specifically with twenty-foot equivalent units (TEUs)
    - OGV: Containerships
    - HV: Assist tugs
    - CHE: by container terminal or by specific equipment (e.g., top loaders, side picks)
    - Locomotive: switcher if on-dock rail
    - Truck: by container terminal for idling, gate, and on-terminal
  - Base year: 2012* for both emission inventory data and container throughput

Emissions/TEU (SOx, PM2.5, NOx)



Source: EDF, unpublished results, 2016.

Emissions/TEU (CO2e)



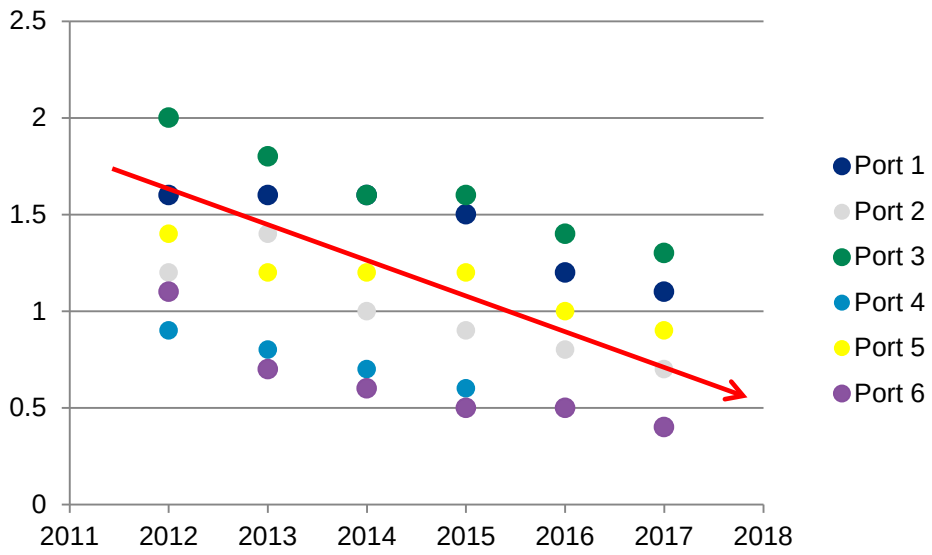
Source: EDF, unpublished results, 2016.

Limitations

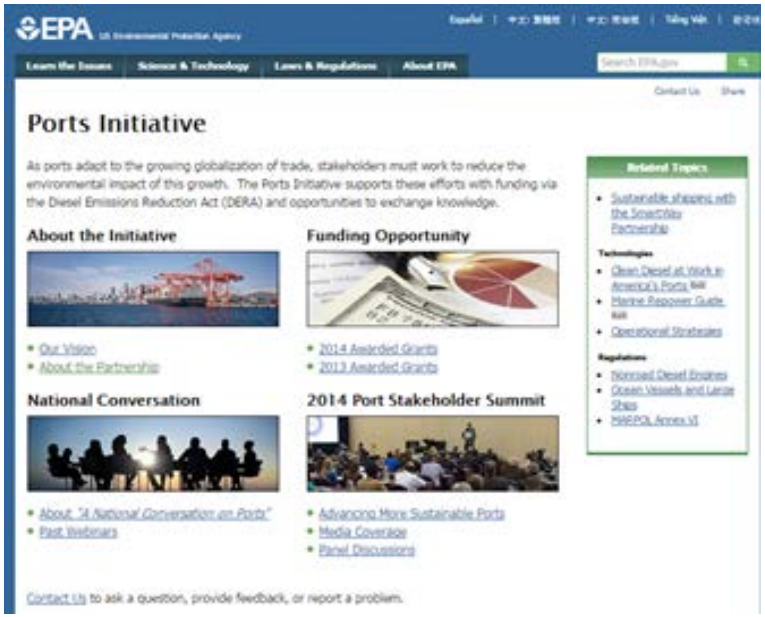
- Sample size – cost and effort to complete emissions inventory (EI) can be challenge for some ports given current approach to EIs
- EI – emissions estimation methods not always consistent depending on source (need for up-to-date guidance on standardized approaches)
- Health – emissions estimate only a proxy for health outcome
- Growth still could result in increased emissions, even with emissions decreasing per container – ultimate goal needs to be zero emissions

Opportunities

- Allow ports to benchmark their emissions performance against industry (not each other)



- Significant interest in emissions from ports and other goods movement activities



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