The success of today’s global economy means we rely on ships, and therefore ports, more than ever to get goods from point A to point B. This growing reliance on international goods has helped make transportation the fastest growing cause of greenhouse gas emissions. Ship emissions are projected to increase as much as 250% by 2050.

Prior to 2020, shipping fuel sulfur concentrations were 3,500 times greater than those that triggered the Volkswagen emissions testing scandal. In response to this, International Maritime Organization regulations (IMO 2020) mandate that international shipping fuel sulfur drop from 3.5% to 0.5% as of January 2020. The success of IMO’s 2020 sulfur regulation could solidify shipping’s position as the most environmentally efficient transport for cargo worldwide. However, reaching this goal requires going further than fitting scrubbers on vessels or producing low-sulfur fuel. Ports serve as crucial points of connection between the smaller components at play, such as ships, fuel, waste facilities, cargo, and on-land freight; the combined sustainability of these components is critical to IMO 2020’s success.

OPPORTUNITY FOR IMPROVEMENT

Data, statistics, and indexes play a necessary role in establishing a quantitative consensus around what sustainability means for ports. As such, an index was developed to compare the sustainability of 26 ports in light of the recent sulfur regulations. This index uncovered several opportunities for port improvements that would facilitate greater sustainability across the global supply chain to achieve IMO 2020.

No publicly available port sustainability index exists, which makes comparing port sustainability, and assessing readiness for IMO 2020, difficult. Privately available port sustainability indexes lack the transparency needed to support outside involvement, such as the allocation of federal funds towards port-sustainability projects. Transparency is necessary to assure communities that near-by ports are stewards of a sustainable economy, rather than close-doored polluters.
WASTING IMO 2020
Ships contribute a significant amount of waste to the ocean. The shipping industry is responsible for 20% of all marine litter, while some 34% of ship garbage ends up being discharged at sea. Ships discharge sewage, oily waste and chemicals, which can harm ecosystems, and release ballast water, which can spread invasive species. When port waste reception services are inadequate or missing, ship crews are more likely to dump waste overboard to reduce weight, thereby harming marine ecosystems.

The range of waste facilities offered by ports serve as valuable indicators of their sustainability and provide insight into port preparedness for IMO 2020. Their inclusion into this index allows for the establishment of sustainable port waste handling goals and the monitoring of progress towards those goals through metric-based assessments.

IMO waste reception facility categories were used as the basis of the port waste indicators established in this index. Port reception facility data was converted to binary data based on the existence of at least one facility per category, in order to reduce bias for large ports. The binary data was summed and normalized per category and each port was ranked on its ability to provide ships with a wide range of port waste reception facilities.

As IMO 2020 comes into effect, many ships will switch over to using scrubbers as a means to remove particulate matter, sulfur oxides and nitrogen oxides from their tail-pipe emissions. Because of this, ports should expect to handle much more scrubber waste, which has high concentrations of salts and sometimes metals. Yet of the 26 ports analyzed in this index, only 11 contained facilities to handle scrubber sludge and only two offered facilities to handle ballast water. Without the necessary waste facilities, ports will continue to hamper IMO 2020 goals.

RANKING CLEAN ENERGY ALTERNATIVES
There are multiple ways that ports can offer clean energy alternatives to reduce the carbon footprint and emissions of ships. Compliance with IMO 2020 will require vessels to either switch to low-sulfur fuel, install scrubbers to filter pollutants from high-sulfur fuel, or use liquid natural gas (LNG). Sulfur Emission Control Areas (SECAs) have previously instated similar or stricter regulations and serve as good case-studies for the success of IMO 2020.

Even in SECA regulated areas, ships idle in ports over long periods of time, producing harmful emissions. The typical cruise ship remains the most egregious portside polluter, combusting nearly 20 tons of fuel while at berth—comparable to 35,000 trucks idling for 10 hours. Dockside activity of this magnitude has been shown to cause approximately 400,000 premature deaths from lung cancer and heart disease and 14 million childhood asthma cases each year.

On-shore power supply (OPS), offers a solution to this, as it can reduce the NOx and PM2.5 emissions of the ships that use it by 62% to 90% per port visit. Accordingly, an OPS accessibility indicator was developed from port-specific OPS voltage information, by summing the maximum OPS voltage with the range of voltage values per port. This indicator highlights ports that both service ocean-going vessels as well as smaller ships.

Beyond OPS, ports can be sustainability stewards by supplying ships with LNG fuel, which can reduce greenhouse gas emissions of marine vessels by up to 21%. However, of the 26 analyzed ports, only 13 had LNG accessibility. Furthermore, although LNG is a low sulfur, IMO 2020 compliant fuel, its accessibility did not seem to be contingent on a port SECA status. Only 25% of SECA ports offered LNG, as compared to 69% of non-SECA ports. Given that pre-IMO 2020 regulations have not influenced LNG accessibility, its speculative whether we will see greater LNG expansion because of IMO 2020.
Interestingly, a cluster analysis illuminated a clear division in clean-power investment by ports. Only two of the ports within this study reported both LNG and OPS capabilities; all others chose to invest exclusively in one or the other. However, OPS and LNG are not comparable substitutes for each other: the former affects near-port auxiliary engines while the latter changes over-ocean propulsive emissions. Ports pursuing sustainability should invest in both options to pave the way towards a holistic decarbonization of shipping.

WHY EFFICIENCY MATTERS
While both LNG and OPS offer opportunities to cut emissions, neither are full-proof pathways to decarbonized shipping. Methane leaks associated with LNG and fossil-fuel powered OPS both have climate impacts. Today, reducing fuel usage remains both an economic and climate-based necessity – nearly as critical as accessibility to low-carbon fuel alternatives. An assessment of port wait-times, collected from Marine Traffic, serves as good indicator of port efficiency which results in reduced ship fuel usage. This indicator emphasizes ports engaging in efficiency programs, such as Virtual Arrival which drastically reduces overseas emissions, sometimes by up to half. In the coming years, a wait-time indicator may highlight how efficiently ports take on their new fuel testing responsibilities with the onset of IMO 2020, and where greater assistance or equipment is needed.

TRANSPARENCY AND DATA IN PORT SUSTAINABILITY
Improvements in the waste facilities, clean energy offerings, and efficiency of ports are critical for shipping sustainability and the success of IMO 2020. Public port sustainability indexes are crucial for monitoring progress in these areas. Still, while ports are likely to monitor other important indicators, like energy and water consumption, noise, and sediment and soil quality, none of this information is available to the public.

The story of port sustainability is a common one. We cannot accurately define, defend, and evaluate sustainability goals without the help of data, and we cannot progress toward goals without making that data public. With a balance between data, metrics, and stakeholders in mind, the path toward sustainability for ports and for other areas becomes a lot clearer.