Climate Project

Ports can be reimagined as intermodal hubs that enable low-carbon, resilient transfers across maritime, rail, and road systems—cutting emissions while strengthening supply chains and protecting nearby communities.

Decarbonizing Ports and Shipping

Ports are the crossroads of global supply chains and human impact. Nearly 90% of global goods move through ports on multiple modes of transport, concentrating economic activity and environmental pressures in a relatively small number of places. Port activity exposes neighboring communities to air pollution, congestion, and flood risk, making decarbonization inseparable from resilience and local well-being. These impacts arise from decisions about how energy is produced, stored, and used across port operations.

Ports function as large, complex energy systems—where fuels, power, infrastructure, and operations intersect—and represent one of the most powerful leverage points for a more sustainable and resilient future. Rethinking ports and shipping is an MIT Climate Project frontier, where MIT can deliver integrated, scalable impact. Because ports sit at the intersection of vessels, fuels, power grids, logistics, and communities, action on ports can accelerate decarbonization across entire maritime and freight systems.

Through the Climate Project, MIT can use ports and ships as system-level testbeds to examine tradeoffs before large-scale investments are locked in, helping to accelerate cleaner, more durable transitions across diverse contexts.

Support our work to decarbonize ports and shipping

We invite endowed and expendable gifts that will advance our efforts to build a cleaner energy future.

REIMAGINING PORTS AND THEIR COMMUNITIES

Ports are critical to modern life and commerce, but the communities surrounding them are vulnerable to public health, air-quality, and flooding risks, particularly in developing regions with limited financial capacity. If shipping emissions are significantly reduced, port communities will benefit from cleaner air, improved protection from rising seas and storm surges, and new jobs related to clean energy.

Electrifying ports can support more sustainable movement of goods while nurturing thriving local ecosystems and communities. Port systems with mixed-fuel infrastructure (ammonia, hydrogen, methanol, and electricity) become resilient hubs with efficient digital logistics and smart microgrids powered by renewable energy.

Redesigning ports to include tree-lined buffers, restored wetlands, and waterfront parks can lower heat stress and improve local air quality.

Access to back-up power systems and flood-resilient infrastructure could keep local hospitals, shelters, and communications running during natural disasters, while cleaner environments would reduce asthma, cardiovascular disease, and premature deaths.

The Role for MIT

Research in ports and shipping often addresses pieces of the problem in isolation – specific fuels, vessels, or operational changes – rather than how systems perform together. Ports of the future must handle vastly higher electrical loads as they become energy hubs requiring hundreds of megawatts of power capacity.

Alongside advances in battery systems (including solid-state batteries), power management, superconducting cables, propulsion, and port operations, MIT's distinctive contribution is the ability to integrate engineering, logistics, marine and atmospheric science, sensing and modeling, infrastructure design, and policy – and to test how these systems perform together under real-world operating conditions. This enables faster learning, smarter investment, and more durable pathways to scale than approaches that address fuels, vessels, or ports in isolation.

PORTS AND SHIPPING REALITIES

95%
of ships are powered by fossil fuels

3%
of global greenhouse gas emissions come from shipping alone – roughly equivalent to a major industrialized nation

80% of ports
worldwide face significant flood risk, with cascading impacts on global supply chains and frontline communities

Up to 1 gigaton
of CO_2e per year could be avoided by 2050 through coordinated decarbonization of ports and maritime systems

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