

Port Technical Assistance Program

A Proposed Initiative to Support U.S.
Ports Through Energy Innovation

January 2025

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Abstract

This document highlights the crucial importance of the maritime sector within the United States (U.S.) economy, serving as a key node for trade and global goods transportation. U.S. ports are currently grappling with challenges posed by rising shipping demands, the health impacts of diesel fuel reliance, and the technology adoptions of global trade partners due to increasing environmental regulations. This document proposes forming a technical assistance program, led by Pacific Northwest National Laboratory (PNNL), to help U.S. ports transition to sustainable energy solutions that not only improve environmental and community outcomes, but also enhance resilience to unexpected weather events and reduce pressure on local utilities.

Coordinated by PNNL, this initiative would offer a web-based platform of consolidated resources and tools for comprehensive strategic planning and cost-benefit analysis. It also seeks to establish a collaborative network between ports and national laboratories to facilitate the sharing of best practices. The document suggests that optimizing resource allocation and providing tailored support could be achieved through strategic categorization of ports within this network, with relevant attributes and examples detailed in the report.

The anticipated benefits of such a program could include increased efficiency and cost savings in port operations and the advancement of scientific innovation via alternative energy research. Also, it could enhance economic growth and competitiveness in international trade by enabling ports to meet shipping demands and develop resilient critical infrastructure through informed, long-term strategies.

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Acronyms and Abbreviations

DOE	Department of Energy
EPA	Environmental Protection Agency
GHG	Greenhouse Gases
IMO	International Maritime Organization
NPRN	National Port Readiness Network
PNNL	Pacific Northwest National Laboratory
U.S.	United States

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Introduction

The maritime sector plays a crucial role in goods transportation, serving as an intermodal hub that connects trade across trucking, rail, and air to ocean and inland waterway vessels. More than 90 percent of the world's goods are transported by marine cargo vessels (Tan and Tao 2019; Iris and Lam 2019). Because of rising global trade, shipping demand is projected to increase anywhere between 40 and 115 percent by 2050 relative to 2020 levels (IRENA 2021). However, with increasing weather events and greater utility demands from the electrification of other sectors, port operations are challenged to adapt while keeping pace with industry expansion.

Ports are also influenced by the needs of communities nearby. Maritime activity is a major source of greenhouse gases (GHGs) because ships and cargo handling equipment have predominantly utilized diesel-based fuels (Lindstad et al. 2021). Additionally, the additives in diesel-based fuels result in harmful pollutants such as sulfuric and nitric oxides (SO_x, NO_x) and particulate matter (PM) (Tan and Tao 2019). An estimated 70 percent of shipping emissions occur within 400 kilometers (~250 miles) of land, exposing hundreds of millions of people in coastal communities to toxic air particles (Vidal 2009). The effect of current maritime fuel use is hundreds of thousands of premature deaths and millions of cases of childhood asthma (Sofiev et al. 2018).

Electrifying equipment and incorporating renewable energy as distributed energy resources can have a twofold benefit: (1) increasing resilience by providing energy infrastructure to ensure operational continuity during unforeseen events and (2) reducing harmful pollution from older equipment.

However, as new energy options emerge, ports are weighing cost, reliability, benefits, and stakeholder needs to identify the best path forward. To navigate energy transitions and keep up with demands, ports need robust planning and regional coordination. A technical assistance program, led by Pacific Northwest National Laboratory (PNNL), could support this effort by helping ports pivot to new solutions and strengthen their long-term strategies in return for local economic resilience and improving community health.

Importance of Aiding Port Energy Transitions

Maritime ports are the critical link between global shipping and regional distribution of goods and resources, and they play a vital role in the U.S. economy, supply chains, and national security. However, U.S. trade is heavily shaped by the decisions and preferences of international shipping partners. To remain competitive and ensure smooth operations, U.S. port infrastructure must adapt to the technologies and fuel types adopted globally or risk disruptions to future trade.

European countries—and their vessel owners—are already making aggressive energy transitions to meet self-imposed climate targets (The European Climate Law 2021; FuelEU Maritime Initiative 2021). In addition, the International Maritime Organization (IMO) is set to release new benchmarks for carbon emissions reductions in the maritime sector in 2025 (IMO n.d.). These benchmarks include a goal to achieve net-zero well-to-wake GHG emissions “by or around” 2050 and incremental benchmarks between now and mid-century to ensure progress (DNV 2024).

The European Union provides strong legislative support for adopting renewable technologies and low-carbon fuels in the maritime sector, while U.S. ports face significant challenges in pursuing similar initiatives (FuelEU Maritime Initiative 2021). These challenges—faced by ports nationwide—often stem from the unique characteristics and activities of each port, compounded

by a complex, multi-stakeholder environment that lacks national regulation. A technical assistance program through PNNL could act as a unifying force, offering guidance and coordination akin to the role EU regulations play, helping U.S. ports navigate energy transitions more effectively.

Such a program could provide essential resources and tools to inform and help weigh the cost-benefit complexities of electrification, renewable resources, and alternative fuels. For ports that are more advanced in their sustainability efforts, the technical assistance program could also provide access to cutting-edge scientific research from a national laboratory to facilitate the advancement of technology and innovation.

Individual ports have a compounding effect on the entire maritime industry, which makes operations of individual ports crucial to maintain. This program would offer valuable resources to ports aiming to maintain operational efficiency while planning for sustainable long-term growth. It would foster stronger partnerships, not only between national laboratories and ports, but also among the Department of Energy (DOE), ports, and their stakeholders.

PNNL Leads on Port Energy Innovations

Considering the current state of the maritime industry, DOE could play a critical role in supporting commercial ports across the United States. The maritime sector is essential to the economy but faces significant challenges, including the complexity of meeting diverse operational needs. These factors hinder ports' ability to navigate energy transition options effectively. Additionally, many ports struggle with limited resources for long-term planning.

DOE has an opportunity to connect ports with the strategic planning expertise and scientific innovations available through the national laboratories. PNNL could serve as a key facilitator and coordinator of these resources, helping ports leverage these capabilities effectively.

Technical assistance for energy transitions at ports would be a collaborative and cross-laboratory effort, benefiting the entire national laboratory network. Many DOE offices are well-positioned to invest in projects to develop tools to support these efforts, including the Vehicle Technologies Office, the Bioenergy Technologies Office, the Hydrogen and Fuel Cell Technologies Office, the Office of Clean Energy Demonstrations within the Office of Energy Efficiency and Renewable Energy, and the Office of Electricity. There is also potential to develop capabilities beyond one particular entity since other laboratories, such as the National Renewable Energy Laboratory, Sandia National Laboratories, Argonne National Laboratory, and Oak Ridge National Laboratory, are already involved in similar mission-driven research.

PNNL is well-positioned to lead this initiative as a unifying facilitator that can leverage the diverse tools and resources in house, as well as at other laboratories. Located on the West Coast, PNNL benefits from proximity to major Washington ports and access to PNNL-Sequim, the only marine-focused research facility in the DOE complex. PNNL also maintains strong relationships with various ports and key national stakeholders, including the Environmental Protection Agency (EPA) and the U.S. Maritime Administration.

PNNL Technical Assistance Experience

PNNL is well-prepared to provide both program leadership and technical support to the U.S. maritime sector. Ports need robust planning and regional coordination to navigate energy transitions and keep up with demands. PNNL can aid in long-term strategizing and utilization of energy storage to help ports build resilience against future risk scenarios. Relevant examples of PNNL's expertise in recent and ongoing projects are highlighted below.

Energy Transitions

PNNL will be a collaborator in three port projects funded by **EPA's Clean Ports Grant program** (EPA n.d.), which is aimed at helping decarbonize U.S. maritime ports. PNNL received approximately \$1.3 million in total funding across three ports to help with planning strategies for clean energy transitions and port resilience. The port partners are the Maryland Port Administration (Port of Baltimore), the Port of Alaska, and the Port of Bellingham.

DOE's **Energy Transitions Initiative Partnership Project** is a technical assistance program launched in 2020 that provides 18 months of technical support to aid energy transitions and resilience in remote island communities. This support comes from both the national laboratory system, as well as from locally based regional organizations (such as nonprofits or universities) that can provide additional resources and local context.

Port-related examples of this program supported by PNNL included the Alaska Longline Fisherman's Association, who requested support in decarbonizing their fishing fleet, and the Port of Port Orford, which requested support in energy generation and resilience for their port.

The **Clean Energy to Communities Program**, funded by DOE, connects national laboratory experts with groups pursuing energy transitions. This program has two tracks: one providing in-depth 3-year technical assistance, as well as short-term technical assistance funding, typically 40 to 60 hours over three to four months, to address immediate clean energy challenges. Eligible entities include ports, local cities, tribes, metropolitan and regional planning organizations, and schools (NREL n.d.).

PNNL has supported the community of Sitka, Alaska, through an in-depth partnership as the community holds interest in providing shoreside electrical power at berth for the cruise ship terminal and planning for the resilience of the nearby port community.

Building on efforts to equip ports with tools and insights for electrification, the **Concise Guide on Hydrogen for Ports** is a module that will inform port decision-making around hydrogen. It will offer a high-level overview of current options in hydrogen-based fuels, the latest research in production and storage, and best practices for seaport integration. This document will draw on expertise from industry consultants, national laboratories (including PNNL), the Hydrogen Safety Panel, and key stakeholders such as the American Bureau of Shipping and leading U.S. ports.

PNNL researchers conducted **Port Hydrogen Studies** which explored the feasibility of hydrogen fuel cell applications at U.S. ports, including Los Angeles, Long Beach, New York, Houston, and SEATAC (Steele and Myers 2019). They assessed which diesel-dependent equipment could be replaced with hydrogen alternatives by cataloging port equipment and estimating usage patterns and fuel consumption for each respective port. Drayage trucks were found to have the highest hydrogen demand, followed by yard tractors and container handling equipment.

Researchers at PNNL are working on **Additional Maritime Fuel Studies** to evaluate alternative fuels' potential to reduce both carbon emissions and other pollutants across their entire life cycle. Emissions reduction in the maritime industry may not always be achievable through electrification alone because some equipment and vessels require fuel to manage heavy loads and extended operations. Currently, diesel-based fuels like heavy fuel oil—known for high carbon intensity—are widely used, emitting pollutants that harm nearby communities. The studies on alternative marine fuels support ports in assessing future fuel choices, infrastructure needs, safety measures, and the trade-offs of fuel decisions.

Resilience Development

Port of Anacortes Case Study: A recent example of a scalable process involving technical assistance at PNNL was a case study with the Port of Anacortes in Washington State. The port is a gateway to nearby island communities and an emergency response site for Skagit County, so maintaining operations is critical. The analyses provided by PNNL on the feasibility of on-site renewables, such as solar panels and a port microgrid, not only supported the port's energy transition efforts, but will also assist in future grant applications and the development of external communication materials.

Resilient Ports Project: A microgrid is a stand-alone power system that is resilient to future power disruptions. It can incorporate renewables and energy storage, which form a microgrid. PNNL has been involved in microgrid research for years, more recently at critical infrastructure

sites like the Seattle waterfront. PNNL has collaborated with Seattle City Light to explore using a large battery to meet increased charging demands of future hybrid-electric ferries, as well as serve as backup power to power cranes for offloading ships and operations in a disaster scenario.

Port Electrification Handbook: Following a successful microgrid project with Seattle, PNNL explored whether other ports might have similar interests. Previously, most electrification information was either project-specific or too technical for ports to use in proposals or grants. By engaging with various ports, PNNL identified shared interests among them. Based on these insights, PNNL developed the Port Electrification Handbook (PNNL 2024a), which provides foundational information on microgrids and decarbonization technologies, along with guidance for creating strategies to reduce harmful pollutants and build resilient infrastructure.

PNNL is prepared to leverage its diverse experiences and capabilities in finding energy solutions and building resiliency within the maritime sector. The following section outlines the proposed framework for PNNL to identify ports and determine how to apply the technical assistance across the United States.

Technical Assistance Program Recommendations

Specific, tailored approaches to energy innovation will not be possible across the hundreds of ports in the United States. However, the proposed technical assistance program aims to create a more standardized framework to help U.S. ports align with the progress seen on the global maritime stage. The approach must be both comprehensive enough to address the wide range of challenges and flexible enough to adapt to the diverse types of ports across the country.

One recommendation to achieve this is by categorizing ports. This approach will better align specific needs—based on their activities and stage of energy transitions—with the capabilities and tools that can be provided by DOE and the national laboratories.

Port Categorization

Categorical organization can leverage the wider influence of DOE while effectively addressing the diverse needs of ports across the country. By grouping ports with similar characteristics, the program can prioritize funding to develop resources that will be most relevant for the largest number of ports. Also, it will illuminate the key areas of opportunity where PNNL is best prepared to help ports that would benefit from different types of technical assistance.

The following categories are not exhaustive but are recommended based on the findings in the U.S. Port Foundations Analysis (PNNL 2024b). Due to limited data availability highlighted in the Port Foundations Analysis, this report classifies the approximate percentage (rounded to the nearest whole number) of ports from a sample of 150 drawn from the Department of Transportation's 2024 list of highest-tonnage maritime ports (referred to here as the Principal Ports List) (Bureau of Transportation Statistics 2024). This amount is approximately 42 percent of all the reported commercial maritime ports as listed by the U.S. Coast Guard (a total of 360, respectively) (EPA n.d.).

While not part of the current list, two additional factors worth considering are the presence of a regional DOE Hydrogen Hub and the port's governance structure. A Hydrogen Hub region can significantly shape the available fuel and energy options, while governance influences the port's authority to implement changes. These factors were excluded because Hydrogen Hub projects are still in early stages and their impact may not be immediately relevant. Additionally, limited data on governance structures made a comprehensive analysis challenging.

Table 1 shows the six chosen factors that are suggested to organize ports for the technical assistance program based on data availability and thorough analysis.

Table 1. Six proposed categories to organize U.S. ports: size (based on tonnage), location, environmental impact, socioeconomic vulnerability, potential resilience hub, and development stage in energy transitions. Each category includes a definition, its relevance for characterizing ports, and its priority for assistance.

CATEGORY: PORT SIZE					
<ul style="list-style-type: none"> Definition: Determined by annual tonnage as provided in the Principal Ports List (<i>Bureau of Transportation Statistics 2024</i>). The sizes are based on the distribution of port tonnage and definition of a small water port set by EPA's Clean Ports Program framework. Small Port (< 8 million tons annually), Medium Port (≥ 8 million tons and < 20 million tons annually), Large Port (≥ 20 million tons annually). 					
Subcategories	Small		Medium		Large
%	61%		17%		21%
Relevance:	Port size reflects both the economic and emissions impacts for supporting energy transitions. Additionally, ports with higher throughput may have greater access to funding sustainable development initiatives.				
Priority:	Most U.S. ports are small ports, but these ports often lack dedicated environmental staff to aid in energy transition activities.				
Other:	NA				
CATEGORY: PORT LOCATION					
<ul style="list-style-type: none"> Definition: Determined by the state listed for each of the U.S. ports as provided in the Principal Ports List (<i>Bureau of Transportation Statistics 2024</i>). The geographical regions are defined according to the map (<i>Mappr 2024</i>) for the West Coast (<i>including HI and AK</i>), Southwest, Midwest, Southeast (<i>including Puerto Rico and Virgin Islands</i>), and Northeast. 					
Subcategories	West Coast	Southwest	Midwest	Southeast	Northeast
%	21%	9%	29%	31%	10%
Relevance:	A port's geographical location affects the type of operations at the port, access to renewable energy resources, and proximity to other transportation nodes.				
Priority:	Location can aid identification of relevant options for ports and which tools will be best leveraged to make long-term strategies.				
Other:	NA				
CATEGORY: ENVIRONMENTAL IMPACT					
<ul style="list-style-type: none"> Definition: The presence of unhealthy levels (<i>EPA 2020</i>) of pollution resulting from fossil fuel combustion in the surrounding areas of the port. This report defines unhealthy pollution levels for a port that scores at or greater than the 80th percentile (<i>EPA 2024</i>)¹ for particulate matter or diesel particulate matter as reported by the EPA's EJ Screen database (<i>EPA 2021</i>). 					
Subcategories	Low Impact			Significant Impact	
%	38%			62%	
Relevance:	The adoption of alternative fuels and electrification can reduce the pollution surrounding ports, which affects both human and environmental health.				
Priority:	Reducing the high levels of PM and diesel particulate matter, which harm the human respiratory system (<i>Agrawal et al. 2016</i>), would benefit not just the nearby communities but the port workers and staff.				
Other:	NA				
CATEGORY: SOCIOECONOMIC VULNERABILITY					
<ul style="list-style-type: none"> Definition: Significant socioeconomic vulnerability refers to the presence of disadvantaged communities located near the ports. Disadvantaged communities are defined using the EPA's EJ Screen Database (<i>EPA 2021</i>) indicator, the Supplemental Demographic Index (<i>SDI</i>). Significant vulnerability is set for a port scoring at or above the 80th percentile for the SDI (<i>EPA 2024</i>).² 					
Subcategories	Low Vulnerability			Significant Vulnerability	
%	18%			82%	
Relevance:	Research has shown that communities near ports have a higher probability of being disadvantaged, making certain populations disproportionately vulnerable to pollution resulting from maritime activities (<i>Greer et al. 2024; Ptacek 2024</i>).				
Priority:	Energy transitions and infrastructure development at ports can create jobs and opportunities, benefiting areas with higher vulnerability.				
Other:	NA				

¹ The percentile threshold was set to align with the percentile indicated by the EPA Clean Ports Program for greater environmental and social vulnerabilities (EPA 2024).

² The SDI threshold was set to align with the EPA Clean Ports Program, which evaluates areas with increased environmental and social vulnerability (EPA 2024).

CATEGORY: POTENTIAL RESILIENCE HUB		
<ul style="list-style-type: none"> • Definition: Ports that need to stay operational during unforeseen events due to their function in areas critical to <ul style="list-style-type: none"> - National Security: Ports on the Principal Port list that are part of the National Port Readiness Network (NPRN), a cooperative dedicated to maintaining ports' readiness for force deployment during national defense emergencies (<i>Maritime Administration 2024</i>). - High-Density Populations: Ports on the Principal Port list that fall within a 10-mile radius of a city with a U.S.-Census-recorded population (<i>U.S. Census Bureau 2021</i>) of 200,000³ or greater. 		
Subcategories	Ports Part of NPRN	Proximity to High-Density Populations
%	11%	28%
Relevance:	Maritime ports serve as critical infrastructure and vital access points for supplies and transportation during emergencies.	
Priority:	Enhancing infrastructure to support critical operations using renewable resources, battery storage, and microgrids strengthens national security.	
Other:	NA	
CATEGORY: DEVELOPMENT STAGE		
<ul style="list-style-type: none"> • Definition: A port that has a publicly available emissions inventory report, demonstrating their leading role in energy transition and strategic planning. • The percentage of ports in an advanced stage of development is based on the number of ports on the Principal Port list with publicly accessible emission inventories. 		
Subcategories	Leading	Other
%	17%	83%
Relevance:	Ports without such inventories may benefit from technical assistance in evaluating their emission footprint and determining the best methods to mitigate their pollution levels.	
Priority:	Maritime ports without emission inventories could benefit from broader strategic planning and a focus on low-risk, well-established technology options.	
Other:	A port may have completed an emissions inventory but chose not to make it publicly available. As a result, the percentages are estimates and not intended to be comprehensive for ports across the United States.	

To determine a list of target ports from the six categories for PNNL’s technical assistance program, 150 ports were evaluated on a numerical score based on the attributes listed in Table 1. Ports were given a one for each of the following categories: significant environmental impacts, socioeconomic vulnerability in nearby communities, or lacked a public emissions inventory. Ports received a two for factors indicating resiliency potential, such as proximity to dense populations or membership in the National Port Readiness Network (NPRN). This category was weighted more heavily due to its potential to drive positive outcomes for larger impacted communities and enhance national security.

The final Priority Score was calculated by summing all the attribute scores and dividing by the total possible score, with 100 percent indicating a port met every category. The top-scoring 16 ports are listed in the next section, along with a discussion on how this ranking could guide PNNL’s efforts in a supportive program.

Port size was excluded from the final score because the intent of this analysis was to focus on functional similarities rather than tonnage; size based on tonnage values does not capture the entire commercial activity at a port. Given that 61 percent of the ports analyzed are smaller-sized, this report does highlight that there is a significant opportunity to support a majority group of ports.

³ The threshold for a high-density population area was set at 200,000 because the Bureau of the Census and U.S. Department of Transportation denotes it as a transportation Management Area (Federal Transit Administration n.d.).

PNNL-Facilitated Ports Network

U.S. ports serve diverse functions, making it challenging to develop a one-size-fits-all solution for energy transitions and cleaner initiatives. However, the commonalities outlined in the previous section suggest that ports can be grouped based on shared challenges tied to their operational roles.

Creating resources aligned with these common needs would also help stretch funding further, as a one-on-one technical assistance model would be cost-prohibitive. The proposed PNNL technical assistance program aims to be the facilitator of a self-sustaining ports information exchange, grouping ports with similar challenges to share best practices with each other. Also, this method would inform what type of technical assistance to offer and which PNNL-developed tools to invest in to service the greatest need among the port groups. This collaboration and resource sharing would help ports innovate energy transitions while avoiding stranded assets by learning from relevant past experiences.

One proposed method of grouping ports is seen in Table 2. The top three ports, scoring 100 percent, face similar challenges related to environmental pollution, vulnerable communities, and resilience opportunities, highlighting the areas of support that PNNL could provide. The next four ports, scoring 86 percent, face challenges similar to those of the first group. However, a key distinction is that the second group is at a more advanced stage in their energy transition and emission reduction efforts. This progression may suggest a greater need for innovative solutions and a higher willingness to explore options with lower technology readiness levels compared to the first group.

Table 2. A list of the top-scoring 16 ports based on their categorical similarities.

PORT NAME	STATE	SIZE	EARLY STAGE?	PROX. TO HIGH POPULATION?	NPRN?	SOCIOECONOMIC VULNERABILITY?	ENVIRONMENTAL VULNERABILITY?	PRIORITY SCORE
Philadelphia Regional Port	PA	L	Y	Y	Y	Y	Y	100%
Port of Jacksonville	FL	M	Y	Y	Y	Y	Y	100%
Port of Alaska (Anchorage)	AK	S	Y	Y	Y	Y	Y	100%
Port of Long Beach	CA	L	N	Y	Y	Y	Y	86%
Port of Tacoma	WA	L	N	Y	Y	Y	Y	86%
Port of Oakland	CA	M	N	Y	Y	Y	Y	86%
San Diego Unified Port	CA	S	N	Y	Y	Y	Y	86%
Port of Savannah	GA	L	Y	N	Y	Y	Y	71%
Port of Beaumont	TX	L	Y	N	Y	Y	Y	71%
Tampa Port Authority	FL	L	Y	Y	N	Y	Y	71%
Port of New Orleans	LA	L	Y	Y	N	Y	Y	71%
Port of Greater Baton Rouge	LA	L	Y	Y	N	Y	Y	71%
South Jersey Port District	NJ	L	Y	Y	N	Y	Y	71%
Port of Corpus Christi	TX	L	N	Y	Y	Y	N	71%
Port of Miami	FL	M	Y	Y	N	Y	Y	71%
Port of Honolulu, O'ahu	HI	M	Y	Y	N	Y	Y	71%

PNNL could facilitate opportunities for the ports to collaborate and share lessons learned that are relevant to each other. Using this method could guide informed and tailored energy transition strategies relevant to each port grouping. A potential critique for the first categorical grouping of ports scoring 100 percent is that they differ in regional location and tonnage size. However, grouping ports across different areas and economic scales may be beneficial, as it could reduce regional competition and foster more constructive brainstorming. A ports consortium is a potential mechanism for PNNL to address unique port challenges without over-customizing solutions.

Additionally, as part of the program, PNNL would develop a diverse portfolio of projects to help ports that do not fit within the categorical organization. Insights from these case studies would be compiled into an online resource hub, offering information on innovative solutions, technology options, funding opportunities, and other developed tools. This repository would not only demonstrate PNNL's scientific innovation but would be accessible to ports who could learn and make informed decisions, accelerating the energy transitions and resilience efforts across the U.S. maritime sector.

Conclusion

Maritime ports serve as vital transportation hubs and intersection points among other sectors that are essential to the U.S. and global economies. They also remain critical resources to national security, both for military installations and distribution centers for supplies. It is, therefore, important to aid this sector in efforts to become more efficient and adapt to future energy needs.

A technical assistance program led by PNNL could act as a unifying resource, offering guidance, facilitating collaboration among ports, and sharing lessons learned to support their transition to new energy solutions. The many possible benefits from establishing a PNNL-facilitated network of categorized ports and offering a centralized hub of resources and tools, are described below.

Efficiency and Cost Savings

Electrification may involve significant upfront capital expenditures, but modern electrified equipment is more energy-efficient, resulting in long-term savings on fuel and maintenance costs. Electric equipment also requires less maintenance over its lifetime than fossil-fuel-based counterparts, saving the port money. Additionally, on-site renewable electricity generation offers the potential to sell excess power back to the local utility.

Economic Growth

Energy transitions will enable the United States to stay aligned with international trade partners, who will require specific infrastructure and fueling solutions to comply with regulations on environmental impacts. Upgrading equipment and facilities will also generate job opportunities in manufacturing, maintenance, and technology development related to these initiatives.

Resilient Critical Infrastructure

Implementing systems, microgrids, and on-site power solutions enables a port to maintain critical operations during power outages and disruptions caused by black sky events. Additionally, these systems provide flexible energy to meet varying energy demands during different operational seasons.

Energy Innovation Through Foundational Research

By adopting new energy solutions, ports not only improve their operational efficiency, but also create opportunities for groundbreaking research and technological advancements. These developments can have a ripple effect benefit for the broader economy by stimulating growth in related industries, creating jobs, and fostering global competitiveness.

Avoidance of Stranded Assets (strategic planning)

Ports would gain the ability to navigate the complexities of modern transportation systems, enabling them to plan and implement strategies that optimize operations across multiple sectors, including maritime, rail, trucking, and logistics. This approach would prevent redundant efforts and streamline the movement of goods between sectors. Furthermore, by addressing challenges, such as bottlenecks and inefficiencies, the program would improve the overall flow of goods, reduce delays, and enhance the competitiveness of ports in both domestic and international trade.

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