

Shipping and Ports Decarbonization Transition:

Analysis of Potential Jobs Impact in the U.S.

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Executive Summary

This report evaluates the potential economic and employment impacts of federal investments in U.S. maritime decarbonization. By analyzing four distinct policy scenarios— the Next Generation Shipping Act (NGSA) (S1), the International Maritime Pollution Accountability Act (IMPAA) (S2), and two infrastructure-focused port electrification projects (S3, S4)—using a robust Input-Output (I-O) modeling framework, this study provides a comprehensive overview of how federal funding translates into macroeconomic growth, job creation, and labor income retention.

Methodology

This analysis utilizes the U.S. Environmentally-Extended Input-Output (USEEIO) framework to model economic ripples across sectors. The approach accounts for the portion of investment exiting the domestic economy for foreign imports, sector-specific union density, wage premiums, and state-specific differences. Each scenario was benchmarked against three counterfactuals: General Government Spending, Household Tax Cuts, and Road/Rail Infrastructure investment to assess comparative economic efficiency.

Key Findings

- **Investment in Zero-Emission Shipbuilding Creates 110,400 U.S. Jobs:** Zero-emission shipbuilding investments (as examined in scenarios 1 and 2) create more U.S. jobs than the other scenarios in this analysis, i.e., road/rail infrastructure investment or typical government spending patterns, because shipbuilding investments generate more activity in the domestic economy. IMPAA (S2) would create 5.57 jobs for every $1 million invested, or approximately 55,700 jobs after total investment, while the NGSA (S1) would create 5.47 jobs per $1 million invested, or 54,700 jobs after total investment.
- **Investment in Zero-Emission Shipbuilding Generates Significant Labor Income:** The NGSA is projected to generate ~$60 million-$245 million more labor income than general government spending, or things like road or rail infrastructure investment.
- **Port Electrification Would Create Hundreds of U.S. Jobs:** Port modernization projects (S3 and S4) would deliver major environmental and operational efficiency benefits. Because these projects are capital-intensive and rely heavily on specialized equipment often sourced internationally, modernization creates fewer direct jobs per dollar invested than shipbuilding (5.11 and 4.18 jobs per $1 million) but would still result in 273 and 105 jobs for each total project investment.
- **Shipbuilding and Port Modernization Work Best Together:** Shipbuilding investments generate more U.S. jobs and keep more investment in the domestic economy than other types of spending examined, like road/rail infrastructure investment or general government spending patterns. Port electrification and modernization projects create a similar number of jobs as road/rail infrastructure and standard government spending, but are essential for future U.S. port competitiveness, cutting pollution and supporting the transition to cleaner shipping.

Conclusion

Investment in shipbuilding infrastructure offers a highly efficient mechanism for driving domestic economic activity and high-quality job creation. While electrification and modernization efforts provide vital regional benefits, their economic efficiency is heavily dependent on domestic sourcing and supply chain strategy. This study highlights the need for balanced policy approaches that leverage the labor-intensive nature of shipbuilding and the critical modernization of port infrastructure.

Purpose

This project evaluates the potential employment and economic opportunities of public-led, United States federal government (U.S.) investment in maritime decarbonization. Under a set of policy-relevant investment scenarios, this assessment examines how the allocation of spending on maritime sector technologies and infrastructure translates to gross and net employment impacts, including the generation, shift, and/or displacement of jobs across additional sectors and the broader economy. Regional Input-Output (I-O) modeling is applied to estimate direct, indirect, and induced employment effects associated with investment scenarios. The analysis evaluates how the magnitude and variety of federal funding influence employment trends, mapping investment routes to specific occupations and industries. Furthermore, the findings examine the impact of labor intensity and domestic sourcing factors on job outcomes.

Introduction

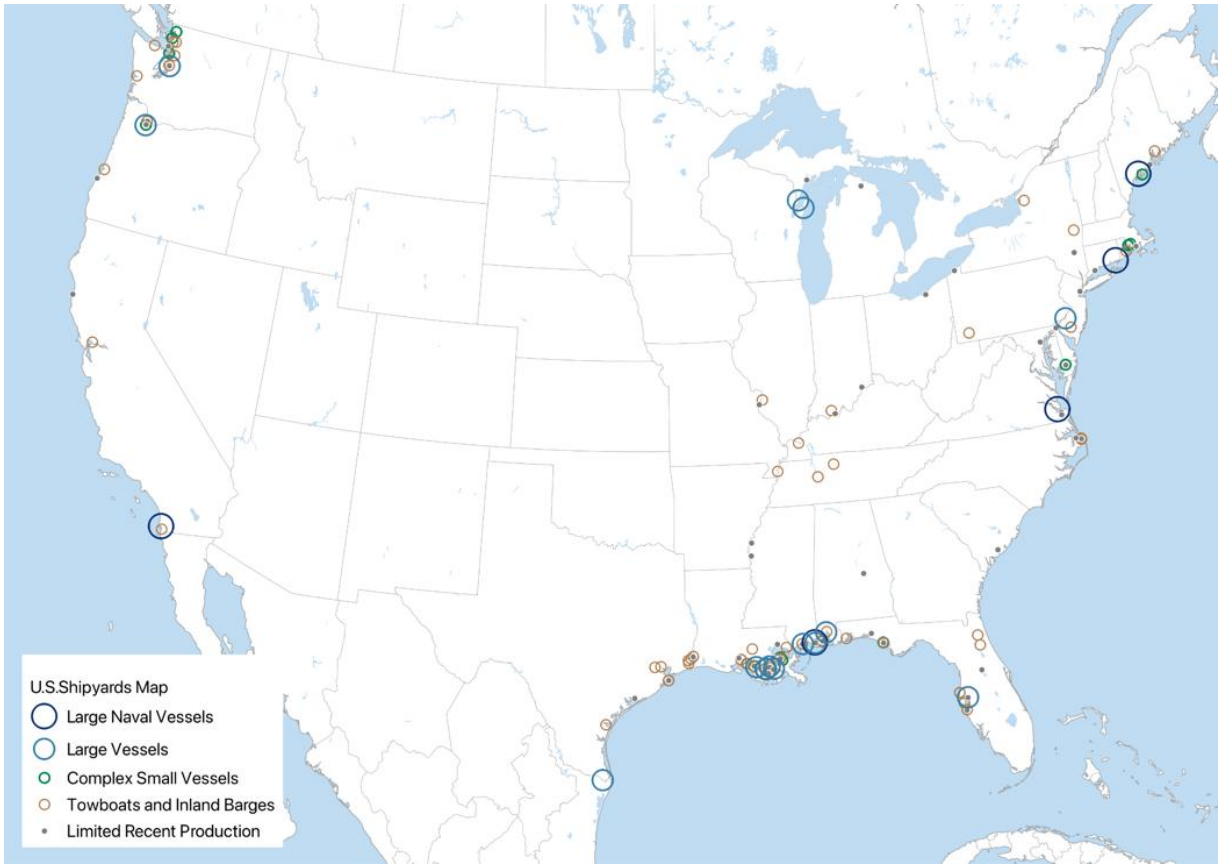
The United States domestic shipbuilding industrial base currently constructs less than 1% of the world's commercial ships, and the United States Flag Privately-Owned Merchant Fleet consists of just 188 vessels.[1]

For context, the People's Republic of China operates more than 5,500 documented vessels and possesses about 230 times the shipbuilding capacity of the United States.[2] Currently, the U.S. shipbuilding sector consists of 174 private shipyards spread across 29 states and the U.S. Virgin Islands, with facilities located primarily along the coasts, the Great Lakes, and major inland waterways such as the Mississippi River (Figure 1). Despite being small compared to industry size in other countries, shipbuilding is a significant economic driver in many U.S. regions.

Based on 2019 data, the U.S. private shipbuilding and repairing industry directly provided 107,180 jobs, generated $9.9 billion in labor income, and contributed 12.2 billion directly to the national Gross Domestic Product (GDP).[3] The latest government statistics put total employment in the sector at 102,645, down 4.2% from 2019.[4] The industry is heavily regionalized and often coupled with defense spending activity on naval vessels. Approximately 79% of all private direct employment in the industry is concentrated in just six states: Virginia (~29.9%), Connecticut (~18.5%), Mississippi (~11.9%), California (~7.3%), Maine (6.8%), and Louisiana (4.3%).[5] Furthermore, 78.7% of the industry's revenues are derived from military shipbuilding and repairs, while only 21.3% come from commercial operations. Mean hourly wages associated with the industry in those states range from $32.60 in Mississippi to $41.30 in California.[6]

[1] https://www.maritime.dot.gov/data-reports/us-flag-fleet-CY-2026
[2] SHIPS for America Act of 2025. https://www.congress.gov/bill/119th-congress/senate-bill/1541/text
[3] https://www.maritime.dot.gov/sites/marad.dot.gov/files/2021-06/Economic%20Contributions%20of%20U.S.%20Shipbuilding%20and%20Repairing%20Industry.pdf
[4] Bureau of Labor Statistics OEWS — national industry file, all occupations. https://www.bls.gov/oes/current/naics4_3366.htm
[5] https://www.maritime.dot.gov/sites/marad.dot.gov/files/2021-06/Economic%20Contributions%20of%20U.S.%20Shipbuilding%20and%20Repairing%20Industry.pdf
[6] Bureau of Labor Statistics OEWS — national industry file, all occupations https://www.bls.gov/oes/current/naics4_3366.htm

Figure 1
Map of U.S. shipyards by primary type of vessel constructed



The supply chain for shipbuilding touches numerous other sectors. The largest expense for shipbuilders is the procurement of raw materials and supplies, including steel plates, aluminum, and copper tubing, accounting for roughly 34.1% of total industry costs.[7]

When aggregating direct, indirect, and induced impacts, the U.S. Maritime Administration (MARAD) estimates that the shipbuilding industry supported an estimated 393,390 jobs, $28.1 billion in labor income, and $42.4 billion in GDP nationwide in 2019. This translates to a national employment multiplier of 3.67, indicating that each direct job in the private shipbuilding sector supports an additional 3.67 jobs in the broader economy and that the average labor income per direct shipbuilding job was approximately $92,770 in 2019. Estimates from the defense sector put those multipliers at between 1.7 and 1.95 for naval shipbuilding,[8] lower than the MARAD estimate, likely due to differences in the geographic scale of the analysis. Nationwide analyses tend to have lower leakage rates and tend to incorporate more sectors than studies focused on the county or state level.

In addition to shipbuilding, the modernization of port infrastructure through electrification and decarbonization presents another pathway for macroeconomic stimulus. A 2021 study by the Center for Environmental Public Policy at the University of California, Berkeley[9] modeled the economic effects of an $18.5 billion infrastructure investment aimed at decarbonizing major U.S. maritime ports over a 10-year period. Based on Impact Analysis for PLANning (IMPLAN) modeling, this work estimated that the $18.5 billion expenditure would support a total of up to 316,700 job-years, or an average of 31,670 jobs annually over the decade. The labor intensity of clean energy investments differs structurally from legacy systems.

[7] https://www.maritime.dot.gov/sites/marad.dot.gov/files/2021-06/Economic%20Contributions%20of%20U.S.%20Shipbuilding%20and%20Repairing%20Industry.pdf
[8] Keating et al (2015)
[9] https://oceanconservancy.org/wp-content/uploads/2021/09/Maritime-Port-Clean-Energy-Infrastructure-Jobs-Study.pdf

Research indicates that shifting $1 million in spending from fossil fuels to renewable energy or energy efficiency yields a net increase of five full-time equivalent jobs.[10]

Investment in shipbuilding and electrification has the potential to be a significant driver of economic growth in the U.S. This work undertakes to assess the detailed economic benefits of large-scale public investment by employing an Input-Output modeling approach with well-founded counterfactuals.

Input-Output Modeling

To evaluate the macroeconomic and environmental footprints of large-scale capital investments, policymakers and economists rely on a set of quantitative modeling tools. These tools trace how initial expenditures transfer through the economy across interconnected supply chains and household spending. Common options available to researchers include the proprietary IMPLAN model,[11] the U.S. Federal government's Regional Input-Output Modeling System (RIMS) II model,[12] sector-specific tools like Jobs and Economic Development Impact (JEDI),[13] and the open-source U.S. Environmentally-Extended Input-Output (USEEIO) model.[14]

IMPLAN is a commercial, black-box, deterministic I-O software system that has been widely applied to I-O modeling.[15] IMPLAN maps to the 540 distinct North American Industry Classification System (NAICS) industry sectors. It allows analysts to aggregate specific counties or states into custom study regions, and the model tracks direct, indirect, and induced economic effects. Like many I-O models, IMPLAN is a static model which assumes that wage levels, prices, and labor supply remain constant over time, thus, it is less suitable for forecasting dynamic policy shifts and price changes.[16]

RIMS II, developed by the U.S. Department of Commerce's Bureau of Economic Analysis (BEA), provides a low-cost set of federally-vetted regional multipliers. RIMS II provides both Type I and Type II multipliers, but the model lacks the purported geographic flexibility of IMPLAN and it operates with less industry detail, consolidating the economy into approximately 60 industry sectors.[17]

USEEIO is an open-source family of models developed by the U.S. Environmental Protection Agency that combines the BEA's economic 'Make and Use' tables with extensive environmental satellite tables to simultaneously model the static economic and environmental performance of U.S. goods and services. The entire USEEIO modeling framework is housed in an open-source R package called `useeior` that is maintained in a free and public GitHub repository; this avoids the black-box issues around IMPLAN, while maintaining an economically robust modeling system (Table 1). This analysis uses USEEIO to model the economic impacts of investment in U.S. Shipbuilding and electrification.



[10] Garrett-Peltier 2017 - https://doi.org/10.1016/j.econmod.2016.11.012
[11] https://implan.com
[12] https://apps.bea.gov/regional/rims/rimsii/
[13] https://www.nlr.gov/analysis/jedi/models
[14] https://www.epa.gov/land-research/us-environmentally-extended-input-output-useeio-models
[15] https://www.pnnl.gov/sites/default/files/media/file/FY2020_EIR_Document-IMPLAN%20flyer_FINAL.pdf
[16] https://www.ilw.com/seminars/JohnNeillCitation.pdf
[17] https://www.bea.gov/resources/learning-center/what-to-know-industries

Table 1

Comparison of features of available Input-Output Models

Feature	IMPLAN	RIMS II	USEEIO
Name	Impact Analysis for Planning	Regional Input-Output Modeling System	U.S. Environmentally-Extended Input-Output
Developer / Creator	Minnesota IMPLAN Group / IMPLAN Group LLC	U.S. Bureau of Economic Analysis (BEA)	U.S. Environmental Protection Agency
Cost & Licensing	Premium commercial software with annual licenses	Cost-effective with minimal fees for government-vetted multipliers for specific regions.	Free and open-source software.
Transparency	Proprietary black-box system.	Standardized federal methodology.	Fully transparent and reproducible via an open-source R package (useeior) hosted on GitHub.
Sector Granularity	More than 540 distinct industry sectors based on NAICS codes.	Approximately 60 broader industry classifications.	Multiple resolutions, including Detail (405 commodities by 405 industries), Summary (73 by 71), and Sector (17 by 15).
Geographic Flexibility	Highly customizable; allows aggregation of specific counties, states, or multi-state regions into custom study areas 16.	Limited; provides multipliers for standard states, MSAs, and counties. Non-trivial to create custom regional aggregations.	Primarily national or state-level. Results may be disaggregated using the stateior model, or through state- and sector-specific metrics.
Primary Limitations	High cost, static model (assumes constant prices and wages), and proprietary "black box" nature.	Low industry detail, static model, and lacks geographic customization.	Requires programming expertise (R/Python), and regional modeling requires additional processing.
Best Use Case	Highly detailed, custom-geography economic impact and supply chain studies.	Straightforward, budget-conscious economic impact assessments.	Detailed assessments requiring unified tracking of macroeconomic footprints alongside environmental and public health externalities.

Regulatory Investment Scenarios



Utilizing I-O economic analysis, this assessment examines four active or proposed policy-focused federal investment and regulatory scenarios, outlined below, to determine the prospective employment and economic consequences of decarbonizing the maritime industry.

The scenarios are intended to represent distinct economic pathways through which federal policy, public investment, and associated sector responses could influence spending patterns.

S1: Next Generation Shipping Act

Introduced to the U.S. Congress in 2026, The Next Generation Shipping Act[18,19] (NGSA) is a proposed policy that **would create a $1 billion dollar annual "innovation fund" through 2034.** NGSA funds would **finance the research, design, development, demonstration, and deployment of zero-emission[20] or low-greenhouse gas[21] (GHG) vessels, including the use of alternative fuels and technologies onboard U.S. ships, and the associated charging and fueling infrastructure for those vessels.** Funds would be distributed through the U.S. Maritime Administration (MARAD) as either grants or low-interest loans to projects that would reduce maritime GHG emissions by at least 90% on a lifecycle well-to-wake basis (e.g., direct vessel retrofit/ replacement or necessary supporting infrastructure).

The proposed policy includes prioritization criteria that favor projects that, for example, establish training programs for maritime workers and utilize project labor agreements, while also protecting and preserving high-quality maritime jobs by prohibiting vessel automation.

NGSA requires that contractors and subcontractors employed on projects funded under the program must pay wages and benefits comparable to those earned by unionized or skilled regional workers,[22] helping ensure projects support high-quality jobs. Furthermore, NGSA encourages meaningful consultation and participation from affected port communities throughout project development and implementation, preferably awarding projects where stakeholders affected by port operations are actively engaged. Lastly, eligible projects are given additional priority for environmental co-benefits, such as minimizing underwater noise emission or reducing biofouling.

Under Section 2.h of the proposed policy, $1,000,000,000 would be made available each year from 2026 through 2034 to "support the research, design, development, demonstration, and deployment of zero-emission vessels and retrofit or replacement of existing vessels with zero-emission technologies and charging or fueling infrastructure."[23] The exact spending breakdown under this scenario is uncertain, but we assume the following distribution of funds:

The assumed spending breakdown under this scenario is as follows (Table 2):

- Total Nominal Investment: $1,000,000,000
- Target Dollar Year: 2026
- 65% of funds will be allocated to supporting U.S. shipbuilding, and
- 35% will be allocated to electrification and infrastructure:
  - 15.75% is allocated to make ready effort,
  - 10.5% is allocated to electrical equipment, and
  - 8.75% is allocated to admin and professional services.

[18] https://barragan.house.gov/wp-content/uploads/2026/06/BARRAG_072_xml.pdf
[19] https://barragan.house.gov/wp-content/uploads/2026/06/NEXT-GENERATION-SHIPPING-ACT-1-pager.docx
[20] "zero-emission" refers to a vessel with no tank-to-wake emissions of any criteria pollutant, precursor pollutant, or greenhouse gas, other than water vapor during its operation.
[21] 90% reduction in emissions compared to a standard conventional marine fossil fuel baseline, quantified in g-CO_2e/MJ. While the specific reference fuel is not explicitly identified, it is likely to be VLSFO.
[22] Consistent with federal Davis-Bacon labor standards, https://www.dol.gov/agencies/whd/fact-sheets/66-dbra Wage rates vary by occupation and location, but are substantially higher than minimum wage
[23] https://barragan.house.gov/wp-content/uploads/2026/06/BARRAG_072_xml.pdf

Table 2
Scenario 1 Economic Sectors and Investment

Category	Segment Description	BEA[24] Detail Code	Allocation Share	Allocated Amount
Shipbuilding	Ship and boat building	336611/US	65.00%	$650,000,000
Make-Ready Electrical	Other structures (power/line + electrical install bulk)	2332D0/US	11.03%	$110,250,000
	Electricity (service upgrade/utility interconnect)	221100/US	4.73%	$47,250,000
Electrical Equipment	Power/distribution transformers	335311/US	4.73%	$47,250,000
	Switchgear and switchboard apparatus	335313/US	3.68%	$36,750,000
	Capacitors/coils/connectors and other electronic components	33441A/US	1.58%	$15,750,000
	Communication equipment	334220/US	0.53%	$5,250,000
Construction, Admin and Professional Services	Architectural, engineering, and related services	541300/US	5.25%	$52,500,000
	Commercial structures (foundations, pads, and structure)	2332A0/US	3.50%	$35,000,000
Total Baseline Allocation				**100%**

S2: International Maritime Pollution Accountability Act

The International Maritime Pollution Accountability Act[25,26] (IMPAA) is a proposed U.S. policy intended to reduce GHGs[27] and air pollutant[28] emissions from international maritime shipping while generating revenue to support domestic maritime and port decarbonization projects. **IMPAA would apply a pollution fee structure to large foreign-flagged cargo vessels serving the U.S., aiming to incentivize low-emission fuels and technologies. Funds from collected fees would be reinvested in the maritime sector to catalyze maritime decarbonization in the U.S.**, as well as address the effects of climate-altering and health-harming emissions, with a specific focus on protecting port and coastal communities.

IMPAA was first introduced in Congress in 2023 and later reintroduced in 2025 with a continued focus on establishing a maritime pollution pricing framework for U.S.-bound freight. The legislation proposes a $150 per ton carbon dioxide equivalent (CO_2e) fee on lifecycle, well-to-wake GHG emissions associated with inbound voyages, alongside additional fees on criteria air pollutants emitted within the U.S. economic exclusive zone (EEZ), occurring within 200 nautical miles (nm) of the shoreline. Fees apply for all imported freight, even if the cargo is offloaded in another country and then enters the U.S. by land or air.[29]

[24] Bureau of Economic Analysis
[25] https://www.congress.gov/bill/119th-congress/house-bill/4341
[26] https://kevinmullin.house.gov/2025/07/11/mullin-matsui-whitehouse-padilla-reintroduce-legislation-to-reduce-ocean-shipping-pollution-modernize-maritime-industry/
[27] CO_2, CH_4, N_2O
[28] NOx, SO_2, $PM_{2.5}$
[29] https://oceanconservancy.org/wp-content/uploads/2025/04/ModeShift-Report-v2.pdf

Under the proposal, **revenues generated from the fees would support programs including Jones Act[30] fleet modernization, alternative energy research and development, port electrification, ferry and harbor craft electrification, workforce development, and air quality monitoring in port communities.** The policy includes mechanisms intended to avoid double charging where equivalent emissions levies have already been paid under international or foreign government programs.

While the text of the IMPAA Act provides for additional investment in research and development of fuels, that investment is omitted from this analysis because the timeline and specific sectors for investment are uncertain.

The IMPAA Act is expected to generate $10 billion over ten years, with the following shipbuilding and port-specific sectors included in the revenue distribution (Table 3):[31]

- Total Nominal Investment: $600,000,000
- Target Dollar Year: 2026
- 25% allocated for replacing (or retrofitting) Jones Act vessels with zero and low-carbon vessels ($250 million)
- 10% for ferry electrification ($100 million)
- 10% for harbor craft electrification ($100 million)
- 15% for the Clean Ports Program ($150 million)

Table 3
Scenario 2 Economic Sectors and Investment

Segment Description	BEA32 Detail Code	Allocation Share	Allocated Amount
Ship and boat building	336611/US	75.00%	$450,000,000
Power/distribution transformers	335311/US	6.25%	$37,500,000
Switchgear and switchboard apparatus	335313/US	5.00%	$30,000,000
Commercial structures	2332A0/US	5.00%	$30,000,000
Other nonresidential structures	2332D0/US	2.50%	$15,000,000
Electricity (generation/commodity)	221100/US	2.50%	$15,000,000
Capacitors, coils, connectors, and electronic components	33441A/US	1.25%	$7,500,000
Architectural, engineering, and related services	541300/US	1.25%	$7,500,000
Communication equipment	334220/US	0.75%	$4,500,000
Facilities support / O&M	561200/US	0.50%	$3,000,000
Total Baseline Allocation		**100.00%**	**$600,000,000**

[30] U.S. law (46 U.S.C. § 55102) that mandates goods transported between U.S. ports must be carried by vessels that are U.S. built, owned, crewed and operated: https://www.maritime.dot.gov/ports/domestic-shipping/domestic-shipping

[31] https://www.epw.senate.gov/public/_cache/files/2/b/2b792626-11a8-4d15-8bd2-3373c87e3dc7/7C45862511EF50392B282C8662B6221E33CC9E3C56154535A655D6389F320393.impa-act-one-pager-2025.pdf

[32] Bureau of Economic Analysis

This scenario assumes a $450 million investment in U.S. shipbuilding annually, including $250 million towards replacing and retrofitting the Jones Act fleet, $100 million each towards ferry and harbor craft electrification, and $150 million for the Clean Ports Program. The allocation of funds in the model assumes 75% directly to the ship and boat building sector (BEA 336611/US). Of the remaining 25% allocated to infrastructure development, 12.5% is distributed across electrification equipment (half of the infrastructure funds), 10% is allocated to make-ready effort and structures, and 2.5% is for professional services aligned with infrastructure development. The cost distributions of port electrification projects can vary widely and are uncertain based on a review of the literature, including for more common heavy-duty vehicle electrification efforts.[33] Site complexity, local regulations, public-private partnerships and utility cost-sharing, and project size can all affect the share of costs.

S3: Port Everglades Regional Emissions Reductions Project

The MARAD Port Infrastructure Development Program[34] (PIDP) is an ongoing discretionary grant program, which was first authorized by Congress as part of the National Defense Authorization Act for Fiscal Year 2010 (Public Law 111-84).[35] It was significantly expanded and competitively funded starting around 2019, and it has continued to receive annual appropriations since then, including through major funding packages such as the Bipartisan Infrastructure Law.[36] In 2026, nearly $489 million is available through the PIDP to support continued investment in maritime projects intended to strengthen port capacity and efficiency, improve freight and supply chain movement, modernize port infrastructure and operations, and support seafood-related businesses.[37]

The PIDP is a federal initiative focused on enhancing the capacity, reliability, efficiency, and competitiveness of freight networks and ports across the U.S., distinguishing it from regulatory programs specifically dedicated to low-emission investment or port decarbonization. However, in practice, many awarded projects pair port and operational modernization with energy-efficiency, emissions reduction, and/or electrification measures, as these investments often go hand-in-hand. As evidenced by PIDP project applications, ports increasingly view decarbonization investments as necessary to remain competitive, align with evolving international shipping practices and climate goals, and modernize aging infrastructure and equipment to support the evolving fleet.

The Port Everglades Regional Port Operations with Emissions Reductions Project[38] refers to a project underway, which has been **awarded more than $53 million in funding through the PIDP to Broward County, Florida in 2024.** Funds are intended to support the **replacement and deployment of hybrid and electric equipment used throughout the port, including:**

- 2 Tier 4 diesel reach stackers
- ~ 12 hybrid pickup trucks
- ~ 22 electric terminal tractors/yard trucks
- ~ 6 8,000lb forklifts
- 6 8x4 reefer racks (192 slots total)
- ~ 6 electric top-loaders
- 2 hybrid rubber-tired gantry (RTG) cranes.

In addition to equipment upgrades, **the project includes broader infrastructure and operational improvements to support port electrification and modernization through upgrades to the port's electrical system and charging infrastructure, installation of high-efficiency lighting, other terminal efficiency improvements, and also through a workforce development program.**

The assumed spending breakdown under this scenario is as follows (Table 4):

- Total Nominal Investment: $53,357,402
- Target Dollar Year: 2024

[33] See e.g. Borlaug, Brennan, et al. "Heavy-duty truck electrification and the impacts of depot charging on electricity distribution systems." Nature Energy 6.6 (2021): 673-682.
[34] https://www.maritime.dot.gov/PIDPgrants
[35] https://www.maritime.dot.gov/ports/port-infrastructure-development-program
[36] H.R. 3684 - the Infrastructure Investment and Jobs Act (117th Congress, 2021–2022) is the formal legislative reference for what is commonly called the Bipartisan Infrastructure Law, https://www.congress.gov/bill/117th-congress/house-bill/3684
[37] https://www.transportation.gov/briefing-room/trumps-transportation-department-announces-nearly-half-billion-investment-americas
[38] https://www.maritime.dot.gov/sites/marad.dot.gov/files/2024-11/PIDP%202024%20Project%20Descriptions_0.pdf

Table 4
Scenario 3 Economic Sectors and Investment

Segment Description	BEA Detail Code	Allocation Share	Allocated Amount
Other nonresidential structures (port heavy civil[39])	2332D0/US	40.40%	$21,556,390
Material handling equipment (cranes, hoists, and industrial trucks)	333920/US	26.60%	$14,193,068
Heavy duty truck (electric terminal tractors)	336120/US	11.10%	$5,922,671
Utilities buildings and infrastructure	233240/US	10.70%	$5,709,242
Environmental and other technical consulting	5416A0/US	2.80%	$1,494,007
Commercial structures	2332A0/US	2.20%	$1,173,862
Computer systems design services	541512/US	1.90%	$1,013,790
Metal structural products	332310/US	1.50%	$800,361
Computer terminals and peripherals	334118/US	1.50%	$800,361
Pickup trucks, vans and SUVs	336112/US	1.30%	$693,646
Total Baseline Allocation		**100.00%**	**$53,357,402**

S4: Clean Ports Program Grant at Port of Vancouver, WA

The U.S. Environmental Protection Agency (EPA) Clean Ports Program[40,41] (CPP) was established under the Inflation Reduction Act of 2022,[42] providing approximately $3 billion in funding to reduce emissions, improve air quality, and support long-term decarbonization at ports nationwide. Unlike the PIDP, which receives recurring annual appropriations, CPP was not established as a permanently funded or annually recurring grant program. CPP aims to address major sources of GHGs and air pollutants at domestic ports by supporting zero-emission technology deployment and planning activities, structured around two complementary funding tracks:

1 The "Zero-Emission Technology Deployment Competition" facilitates the purchase and installation of zero-emission cargo-handling equipment and supporting infrastructure, such as charging stations, shore power, and energy systems.

2 The "Climate and Air Quality Planning Competition" funds emissions inventories, strategy development, resilience planning, and community engagement.

[39] Major infrastructure/sitework required to build or upgrade a port, as opposed to the construction of port buildings
[40] https://www.epa.gov/ports-initiative/cleanports
[41] https://www.epa.gov/ports-initiative/clean-ports-program-awards
[42] https://www.congress.gov/117/bills/hr5376/BILLS-117hr5376enr.pdf

Applications under the CPP are prioritized based on how well they advance environmental and social objectives, particularly those that deliver benefits to disadvantaged communities that have nonattainment and/or air toxics concerns. Projects that demonstrate strong partnerships supporting more effective or broader-reaching port modernization and decarbonization efforts receive greater consideration. Much like NGSA, CPP promotes active engagement and significant involvement from impacted port communities throughout the project, including the planning, development, and operational phases. Moreover, weight is given to proposals that support workforce development, training opportunities, and the creation of high-quality jobs.

The EPA awarded the Port of Vancouver, WA a $22.5 million CPP grant for technologies aimed at improving operational efficiency and lowering emissions, supplemented by an additional $2.5 million contribution from the port itself. Funding supports upgrades aligned with the port's Climate Action Plan[43] to reduce GHGs and improve air quality through investment in **the deployment of zero-emission cargo-handling equipment and supporting infrastructure (i.e., track one of CPP funding). Investment plans include electric mobile harbor cranes with charging stations, and shore power infrastructure.[44]**

The assumed spending breakdown under this scenario is as follows:

- Total Nominal Investment: $25,060,505.34
- Target Dollar Year: 2024

The spending under this scenario falls into three primary buckets:

1. New electric cranes (~ $21.8 million),
2. Inland cruise terminal shore power infrastructure (~ $1.75 million), and
3. Electrical upgrades serving shore power and crane powering and charging (~ $1.75 million).

Investment in the terminal shore power and electrical infrastructure upgrades fall under similar categories, with those costs shared across power, distribution, and specialty transformers, switchgear and switchboard apparatus, capacitors, coils, connectors and electronic components, and other nonresidential structures (Table 5).

Table 5
Scenario 4 Economic Sectors and Investment

Segment Description	BEA Detail Code	Allocation Share	Allocated Amount
Material handling equipment (Cranes, hoists, and industrial trucks)	333920/US	87.00%	$21,802,639
Power, distribution, and specialty transformers	335311/US	4.00%	$1,002,420
Switchgear and switchboard apparatus	335313/US	3.00%	$751,815
Capacitors, coils, connectors, and electronic components	33441A/US	3.00%	$751,815
Other nonresidential structures	2332D0/US	3.00%	$751,815
Total Baseline Allocation		**100.00%**	**$25,060,505**

[43] https://www.portvanusa.com/assets/Final-CAP-11-12-21_SCREEN.pdf
[44] https://www.portvanusa.com/news/22-5-million-grant-to-deploy-expand-clean-energy-infrastructure-at-port-of-vancouver-usa/

Methodology



The policy-relevant scenarios are mapped to affected industries and occupations, including shipbuilding, construction, manufacturing, fuel production and distribution, port operations, energy infrastructure, and other connected sectors.

Through the I-O framework, the analysis captures how spending associated with these activities circulates through the broader economy, including indirect supply chain activity and induced effects generated by wage spending on goods and services.

This work applies an environmentally-extended input–output (EEIO) framework that estimates the domestic economic impact of discrete maritime and port investment scenarios compared against three policy-relevant counterfactual uses of the same funds.

I-O models are typically used to evaluate how a specific industry, policy shift, or capital investment ripples through a broader economy. I-O models assume a static economy, not subject to potential distortive effects of large-scale investment. These models trace the complex web of supply chain transactions and consumer spending behaviors to quantify macroeconomic footprints through various so-called "multipliers". The two primary metrics used to capture these aggregated impacts are Type I and Type II economic multipliers, which are built upon three foundational components: direct, indirect, and induced economic effects.

- **Type I Economic Effects (Direct and Indirect Impacts)** Type I multipliers measure the combination of the direct and indirect effects resulting from a change in economic activity. Type I effects measure how an industry purchases goods and services from other local industries.
    - **Direct Effects:** Economic activity, measured in terms of jobs, labor income, and Gross Domestic Product (GDP) generated directly within the target sector. In the context of port decarbonization, direct employment includes the workers hired specifically for on-site microgrid installation or energy efficiency retrofits.
    - **Indirect Effects:** The chain of intermediate inputs from other domestic businesses the primary industry must purchase to produce its final good or service. For example, when a shipyard builds a vessel, it must procure raw materials such as steel, copper, aluminum, and paint. Indirect economic impacts include the jobs and income supported at the external factories that produce the steel plates, aluminum, copper tubing, marine paints, and other raw materials required for the ship's construction.
- **Type II Economic Effects (Direct, Indirect, and Induced Impacts)** Type II captures the direct and indirect inter-industry effects of the Type I multiplier, and it adds the "induced" effects generated by household consumption. The Type II multiplier, frequently referred to as the Social Accounting Matrix (SAM) multiplier, provides a more expansive measure of economic footprint.
    - **Induced Effects:** Measures the jobs, labor income, and GDP resulting from the household spending of the wages earned by the workers in the direct and indirect phases of the project. Workers in the primary industry and the supply chain receive income, which they subsequently inject back into the broader economy through personal consumption. For example, if the government invests in a shipbuilding contract, a portion of that money goes to the shipyard workers' wages. Those workers then spend their income at local restaurants, grocery stores, and on housing, for example. Induced impacts involve personal, decentralized spending decisions that are structurally removed from the initial direct expenditure, making them inherently more difficult to estimate with precision.

Each result is produced in two forms:

1. **Gross form** is where full investment is treated as domestic demand;
2. **Leakage-adjusted form** is where the import share of each sector's spending is removed before the demand vector enters the model. For example, if $100 is spent on a machine that includes imported components representing 40% of the cost, the leakage-adjusted domestic investment would be $60, which would be passed through the model.

Results of this assessment are presented in the leakage-adjusted form.



Core Framework and Model Structure

The analysis is built on the USEEIO[45] v2.0.1-411 model family, utilizing the `useeior` computational package.[46] The model operates within a 411-sector detail commodity-by-commodity matrix that represents the structural linkages of the United States economy.

More details about the applied methodology is provided in the **Appendix**.

Counterfactual (CF) Architecture

To evaluate the opportunity cost of the investment scenarios evaluated here, all scenarios are compared against three standard counterfactuals.

CF1: General Government Spending Pattern

This counterfactual acts as a baseline for broad public spending. It is modeled by blending the official federal final demand vectors within the USEEIO universe, akin to assuming that rather than investment in the selected scenario, public spending would follow existing spending budget patterns on non-defense sectors.

CF2: Tax Cut / Household Spending

This counterfactual simulates a broad-based personal tax cut that transfers capital back to consumers. This is akin to assuming that rather than investment in the selected scenario, funds would instead be transferred back to households in the form of a tax cut. Personal insurance and Social Security/pension contributions (12.5% in consumer expenditures, CEX)[47] are partially excluded. The 10.0 percentage points representing mandatory Social Security and pension transfers are financial transfers rather than direct purchases from domestic industrial sectors. The remaining categories are renormalized to a 90% allocatable spending base.

CF3: Road/Rail Infrastructure Alternative

Counterfactual 3 (CF3) establishes an opportunity-cost benchmark representing a competing public capital choice: reallocating the infrastructure funds away from maritime and port environments into general land-based transport networks, specifically highways, bridges, and rail systems. This approach queries the BEA's I-O Interactive Data API "Make-Use-Import (Before Redefinitions)" table. The API dynamically extracts the most recent annual data from the 'Government Consumption Expenditures and Gross Investment' column, filtering specifically for transport-focused civil construction and heavy equipment commodities. Leakage[48] is handled similarly to major scenario models. Material-heavy manufacturing inputs (such as steel, specialized machinery, and rail vehicles) pull empirical import penetration rates dynamically from the U.S. Census Bureau APIs to establish leakage rates. Non-traded elements (such as on-site civil labor and concrete procurement) retain a fixed 3% localized leakage floor.

[45] https://www.epa.gov/land-research/us-environmentally-extended-input-output-useeio-technical-content
[46] https://github.com/USEPA/useeior
[47] BLS Consumer Expenditure Survey (CEX) Annual Release (Table B)
[48] Leakage refers to spending that exits the domestic economy to purchase foreign commodities, rather than supporting domestic supply chains

Results



Domestic Economic Leakage Assumptions

To ensure that the economic impact analysis reflects realistic domestic production capture, we apply "leakage rates" to capital investments. These rates account for the portion of spending that exits the domestic economy to purchase foreign commodities, rather than supporting domestic supply chains.

The leakage rates utilized in this assessment are derived from two primary sources:

- **Trade-Exposed Manufacturing:** For industries subject to international trade (e.g., shipbuilding, specialized machinery, and electronics), rates are calculated as the ratio of imports to total domestic supply (imports plus domestic shipments), based on data from the U.S. Census Bureau's International Trade and Annual Investment and Economic Survey (AIES) datasets.
- **Non-Traded Sectors:** For sectors where international trade is minimal or data is unavailable (e.g., construction, engineering services, and utilities), leakage is estimated using empirical judgment parameters. These parameters reflect anticipated expenditures on foreign components within otherwise localized labor and material structures.

The specific leakage rates applied by sector are summarized in Table 6.

Table 6
Modeled leakage by industry segment

Industry Segment	BEA Detail Code	Leakage Rate	Source
Ship building and repairing	336611/US	0.0154	Census (2023)
Power, distribution, and specialty transformer mfg.	335311/US	0.4566	Census (2023)
Switchgear and switchboard apparatus mfg.	335313/US	0.5874	Census (2023)
Office and commercial structures	2332A0/US	0.0300	Judgment
Other nonresidential structures	2332D0/US	0.0300	Judgment
Electric power generation, transmission, and distribution	221100/US	0.0500	Judgment
Other electronic component mfg.	33441A/US	0.5155	Census (2023)
Broadcast and wireless communications equipment	334220/US	0.8307	Census (2023)
Architectural, engineering, and related services	541300/US	0.0400	Judgment
Facilities support services	561200/US	0.0200	Judgment
Power and communication structures	233240/US	0.0300	Judgment
Plate work and fabricated structural product mfg.	332310/US	0.0782	Census (2023)
Material handling equipment mfg.	333920/US	0.2661	Census (2023)
Computer terminals and peripheral equipment mfg.	334118/US	0.8988	Census (2023)
Light truck and utility vehicle mfg.	336112/US	0.2000	Judgment
Heavy duty truck mfg.	336120/US	0.3385	Census (2023)
Computer systems design services	541512/US	0.0400	Judgment
Environmental and other technical consulting services	5416A0/US	0.0400	Judgment

Union Parameters

To ensure the economic analysis accounts for the influence of collective bargaining on labor income, we apply union-specific wage adjustments to the standard I-O framework. Because default USEEIO models do not differentiate between unionized and non-unionized labor, this adjustment provides a more accurate estimate of regional labor income capture.

Parameters are derived from Bureau of Labor Statistics (BLS) Public Data API, utilizing:

- **Union Density:** Extracted from the Current Population Survey (CPS) labor union (LU) tables, identifying the percentage of private wage and salary workers holding union membership by sector.
- **Wage Premium Ratio:** Extracted from the CPS labor and earnings (LE) tables, which compares the median hourly earnings of union members against non-union workers to calculate the impact of collective bargaining on compensation.

Table 7 summarizes the sector-specific union density applied in this model. All parameters are based on the BLS annual average for 2024–2025.



Table 7
Union density by industry segment

Sector	Union Density	Source
Shipbuilding	7.4%	BLS CPS (2024/25)
Construction	11.1%	BLS CPS (2024/25)
Manufacturing	7.4%	BLS CPS (2024/25)
Utilities	17.8%	BLS CPS (2024/25)
Transport	13.6%	BLS CPS (2024/25)
Education	13.4%	BLS CPS (2024/25)
Services	3.8%	BLS CPS (2024/25)
Engineering	1.3%	BLS CPS (2024/25)
Wage Premium Ratio	1.367	BLS CPS (2024/25)

Type II Multipliers

To estimate the 'induced' economic impacts—those resulting from the re-spending of labor income within the economy—this analysis calculates Type II multipliers. While Type I multipliers capture direct and indirect supply chain effects, Type II multipliers incorporate a “household closure” that accounts for the subsequent circulation of wages and salaries throughout the domestic market (Table 8).

Table 8
Multiplier values by industry segment

Parameter	Multiplier	Source
Aggregate (Type II/Type I Ratio)	1.7611	USEEIO household closure augmentation
Shipbuilding (336611/US)	1.8155	USEEIO household closure augmentation
Other nonresidential structures (2332D0/US)	1.7424	USEEIO household closure augmentation
Material handling equipment manufacturing (333920/US)	1.7254	USEEIO household closure augmentation

The model utilizes specific ratios derived from the USEEIO household closure augmentation, reflecting the aggregated economic stimulus per dollar of final demand.

Scenario Results

Investment and Leakage

The investment and leakage results demonstrate a clear relationship between the nature of the procurement and domestic retention. Shipbuilding initiatives, such as the Zero-Emission Vessel Innovation Act (S1), exhibit the highest domestic capture, with a leakage rate of 1.5% ($984.6 million of the $1 billion total retained domestically) (Table 9).

Regional electrification and modernization projects, Scenarios 3 and 4, carry higher leakage rates (14.3% and 28.4% respectively). This higher leakage is attributed to the cargo-handling equipment and technology components that are more frequently sourced through international supply chains compared to heavy structural shipbuilding.

Table 9
Investment and estimated leakage by Scenario

Scenario	Investment ($M)	Leakage Rate (Wtd)	Leaked Investment ($M)	Domestic Investment ($M)
S1: NGSA	1000	0.074	74.5	925.5
S2: IMPAA	600	0.086	51.7	548.3
S3: Port Everglades	53.3	0.143	8.1	48.2
S4: Port Vancouver	25.4	0.284	7.5	18.9

Jobs

Employment impacts in this analysis are measured across two distinct tiers, illustrating how federal investment ripples through the economy.

- **Type I Employment (Direct + Indirect):** Direct jobs represent the immediate positions created or sustained at the project site or primary manufacturing facility (e.g., shipbuilders, site construction crews, and electrical engineers). Indirect jobs encompass the supply chain effects, capturing employment generated as project contractors purchase materials, energy, and business services from other domestic firms.
- **Type II Employment (Direct + Indirect + Induced):** Induced jobs are generated when workers in the direct and indirect categories spend their labor income on housing, healthcare, retail, and other consumer goods and services, creating a secondary wave of economic activity throughout the broader regional and national economy.

Job creation varies significantly by investment type (Table 10). **Shipbuilding-centric scenarios** (S1 and S2) are inherently labor-intensive, employing skilled trade workers, engineers, and manufacturing personnel over the duration of a project. This leads to higher job creation metrics per million dollars invested, even when accounting for leakage.

Equipment-heavy port electrification projects (S3 and S4) show lower total job counts per dollar. In these scenarios, a higher proportion of investment is directed toward the purchase of capital-intensive machinery (e.g., electric cranes and terminal tractors), subject to high leakage from purchases of equipment from overseas. While these projects create critical high-skill installation and maintenance roles, the primary expenditure is concentrated on hardware rather than the continuous, high-volume labor processes found in shipbuilding.

Table 10
Type I (Direct + Indirect) and Type II (Type I + Induced) leakage-adjusted jobs

Scenario	Type I Jobs	Type II Jobs	Jobs per 1M
S1: Next Generation Shipping Act	5,062	10,013	5.47
S2: IMPAA Shipbuilding + Ports	3,051	6,056	5.57
S3: Port Everglades Electrification	246	481	5.11
S4: Port Vancouver	79	169	4.18

Comparing these, IMPAA (S2) is the most efficient at job creation per dollar invested at 5.57, closely followed by NGSA (S1) at 5.47. The infrastructure-focused scenarios (S3 and S4) show lower job-per-dollar metrics, attributable to a higher proportion of investment directed toward capital-intensive machinery (such as cranes and tractors); Also higher leakage rates than the labor-intensive processes of shipbuilding and infrastructure development.

The job categories (Table 11) associated with the NGSA (S1) and the IMPAA (S2) are primarily driven by the shipbuilding and repairing sector (BEA 336611/US), which accounts for approximately 46% and 54% of the jobs created in these scenarios, respectively. Beyond the core labor-intensive shipbuilding sector, a significant portion of employment is generated in supporting professional services, particularly architectural, engineering, and related services (BEA 541300/US), and employment and business management services. Shipyards and associated industries may employ thousands of workers, necessitating proper labor management. Though smaller in scale, these scenarios also include roles in infrastructure development, such as skilled electrical installation and power transformer manufacturing,

reflecting the integration of electrification technologies into these large-scale maritime projects.

The Port Everglades Electrification project (S3) demonstrates a workforce heavily concentrated in infrastructure development, with the largest share of jobs falling under "Other nonresidential structures" (BEA 2332D0/US) and power and communication structures. These job categories capture the construction and infrastructure activities associated with the project, including make-ready work and installation of electrification infrastructure. This scenario also includes jobs in material handling equipment manufacturing (BEA 333920/US) for the procurement of hybrid cranes and terminal tractors. Specialized technical support positions, including environmental consulting and computer systems design, contribute to the project's focus on planning and modernizing existing port operational systems.

The Port of Vancouver scenario (S4) is the most specialized scenario related to hardware procurement. Nearly 45% of total jobs in this scenario are tied directly to material handling equipment manufacturing (BEA 333920/US), as the investment is heavily focused on the installation of new electric harbor cranes. The remaining roles are distributed across infrastructure installation, specialized component manufacturing including transformers and electronic components, and machine shop services. Thus, highlighting a project scope that centers on site-specific assembly and equipment installation rather than broad industrial manufacturing.

Table 11
Top 10 Type I and Type II jobs by economic sector

Scenario	BEA	BEA Description	Jobs Type I	Jobs Type II	Type I %
S1: NGSA	336611/US	Ship building and repairing	2,359	2,360	46.6%
S1: NGSA	2332D0/US	Other nonresidential structures	361	361	7.1%
S1: NGSA	541300/US	Architectural, engineering, and related services	240	270	4.7%
S1: NGSA	561300/US	Employment services	129	214	2.5%
S1: NGSA	2332A0/US	Office and commercial structures	123	123	2.4%
S1: NGSA	335311/US	Power, distribution, and specialty transformer manufacturing	81	81	1.6%
S1: NGSA	561400/US	Business support services	70	100	1.4%
S1: NGSA	561600/US	Investigation and security services	65	92	1.3%
S1: NGSA	550000/US	Management of companies and enterprises	62	137	1.2%
S1: NGSA	561700/US	Services to buildings and dwellings	62	126	1.2%
S2: IMPAA	336611/US	Ship building and repairing	1,633	1,634	53.5%
S2: IMPAA	2332A0/US	Office and commercial structures	105	105	3.5%
S2: IMPAA	561300/US	Employment services	76	127	2.5%
S2: IMPAA	335311/US	Power, distribution, and specialty transformer manufacturing	64	64	2.1%
S2: IMPAA	541300/US	Architectural, engineering, and related services	63	81	2.1%

Scenario	BEA	BEA Description	Jobs Type I	Jobs Type II	Type I %
S2: IMPAA	2332D0/US	Other nonresidential structures	49	49	1.6%
S2: IMPAA	561400/US	Business support services	46	64	1.5%
S2: IMPAA	561600/US	Investigation and security services	43	59	1.4%
S2: IMPAA	550000/US	Management of companies and enterprises	38	83	1.2%
S2: IMPAA	561700/US	Services to buildings and dwellings	38	76	1.2%
S3: Everglades	2332D0/US	Other nonresidential structures	74	74	30.2%
S3: Everglades	233240/US	Power and communication structures	29	29	11.6%
S3: Everglades	333920/US	Material handling equipment manufacturing	23	23	9.4%
S3: Everglades	5416A0/US	Environmental and other technical consulting services	6	6	2.4%
S3: Everglades	444000/US	Building material and garden equipment and supplies dealers	5	6	1.9%
S3: Everglades	423A00/US	Other durable goods merchant wholesalers	5	7	1.9%
S3: Everglades	336120/US	Heavy duty truck manufacturing	4	4	1.8%
S3: Everglades	2332A0/US	Office and commercial structures	4	4	1.8%
S3: Everglades	541300/US	Architectural, engineering, and related services	4	6	1.7%
S3: Everglades	541512/US	Computer systems design services	4	4	1.6%
S4: Port Vancouver	333920/US	Material handling equipment manufacturing	35	35	44.8%
S4: Port Vancouver	2332D0/US	Other nonresidential structures	3	3	3.3%
S4: Port Vancouver	423A00/US	Other durable goods merchant wholesalers	2	3	2.9%
S4: Port Vancouver	335311/US	Power, distribution, and specialty transformer manufacturing	2	2	2.3%
S4: Port Vancouver	550000/US	Management of companies and enterprises	2	3	2.2%
S4: Port Vancouver	331110/US	Iron and steel mills and ferroalloy manufacturing	2	3	2.2%
S4: Port Vancouver	332710/US	Machine shops	2	2	1.9%
S4: Port Vancouver	423800/US	Machinery, equipment, and supplies	1	2	1.7%
S4: Port Vancouver	33441A/US	Other electronic component manufacturing	1	2	1.7%
S4: Port Vancouver	33399B/US	Fluid power process machinery	1	2	1.5%

Investment Benefits

"Value Added" represents the net economic contribution to the national economy, while the "Value Added per Dollar" metric highlights the economic efficiency of each investment. The Labor Income and Union-Adjusted Labor Income columns provide critical insight into wage retention. By adjusting base labor income to reflect sector-specific union density and wage premiums, these figures capture the higher-quality economic returns associated with projects utilizing skilled or unionized workforces.

Value Added measures the specific economic contribution generated by the project within the domestic economy. **Value Added isolates the economic value created internally by the project itself. It is the sum of:**

- **Labor Income:** Wages, salaries, and benefits paid to workers
- **Operating Surplus:** Profits earned by the business and returns on capital investment
- **Taxes on Production:** Taxes paid to government entities (net of subsidies) that are associated with the production process

A higher Value Added per Dollar indicates that a greater portion of each invested dollar is effectively utilized for domestic compensation and economic growth.

The leakage adjusted investment benefits table (Table 12) demonstrates the economics of each scenario. Shipbuilding-focused scenarios (S1 and S2) yield higher value added per dollar, ~0.88 for both scenarios, indicating strong domestic economic returns. These scenarios also demonstrate substantial labor income retention, particularly when adjusted for union density. Scenarios S3 and S4, while providing critical infrastructure upgrades, show slightly lower efficiency metrics (0.848 and 0.776, respectively), reflecting the higher share of investment allocated to specialized, capital-intensive equipment rather than to localized labor and value-added processes.

Table 12
Leakage-adjusted value added and labor union

Scenario	Value Added Adj. ($M)	Value Added Per Dollar	Labor Income Adj ($M)	Labor Income Union Adj ($M)	Union Density Wtd
S1: NGSA	816.4	0.882	560.2	573.4	0.081
S2: IMPAA	480.9	0.877	337.5	345.5	0.078
S3: Port Everglades	40.9	0.848	24.3	24.9	0.091
S4: Port Vancouver	14.7	0.776	7.6	7.8	0.075

State-Level Breakdowns

The tables detailing state-level investment (Table 13) and job creation (Table 14) across the four policy scenarios demonstrate significant regional variation based on the focus of each initiative. Scenarios prioritizing shipbuilding and infrastructure (S1 and S2) show the highest levels of both investment and employment, with economic benefits concentrated in states possessing strong existing maritime industrial bases, such as Virginia, Connecticut, and Mississippi. Conversely, scenarios focused on port electrification and equipment upgrades (S3 and S4) result in more targeted investment, with notable activity in states such as Florida, California, and Texas, where specific modernization projects are centered.

Overall, the data illustrates that shipbuilding pathways yield higher aggregate job growth and broader economic reach, while infrastructure-specific projects provide localized benefits to port-intensive regions. S4 is of particular note as 87% of investment is estimated to go toward the purchase of foreign-made equipment, resulting in a high leakage rate, and thus comparatively low rates of investment and job creation.

Table 13
State-Level Investment, by Scenario (Top 15 States)

State	S1: NGSA	S2: IMPAA	S3: Port Everglades	S4: Port Vancouver
CA	58.82	38.72	0.70	0.26
VA	169.09	121.27	0.32	0.18
TX	32.45	20.66	1.14	0.43
FL	32.75	21.39	6.88	0.24
CT	103.65	74.23	0.02	0.00
NY	9.70	4.95	0.27	0.10
MS	65.44	46.81	0.22	0.11
PA	12.21	7.71	1.83	0.33
IL	9.46	6.00	0.96	0.34
OH	7.25	4.24	3.53	0.86
GA	7.55	4.66	0.42	0.20
NC	6.43	3.72	0.36	0.06
MI	4.34	2.16	1.31	0.48
WA	15.49	10.28	0.35	0.16
NJ	3.86	1.89	0.27	0.13

Table 14
State-Level Jobs, by Scenario (Top 15 States)

State	S1: NGSA	S2: IMPAA	S3: Port Everglades	S4: Port Vancouver
CA	963	603	45	6
VA	788	548	11	2
TX	708	438	37	5
FL	556	348	59	4
CT	453	317	4	1
NY	411	250	22	3
MS	297	207	4	1
PA	296	183	18	3
IL	273	168	16	3
OH	256	157	20	4
GA	236	145	13	2
NC	231	141	13	2
MI	213	130	14	3
WA	208	131	10	2
NJ	194	118	11	2

Net Benefits: Scenario Investment vs. Counterfactuals

The net benefit of each maritime investment scenario is estimated by comparing its projected economic impacts against three distinct counterfactuals:

1. General government spending (CF1),
2. Household tax cut (CF2), and
3. Road/rail infrastructure investment (CF3).

Values marked in bold represent positive deltas (Table 15), where the investment scenario generates a higher net result, in jobs, value added, or labor income, than the counterfactual.

Shipbuilding Pathways (S1 and S2) consistently generate positive net gains in employment and labor income across nearly all comparisons. When compared to standard government spending, tax cuts, or land-based infrastructure, shipbuilding investments are an effective mechanism for net domestic job creation and wage retention. The labor-intensive nature of shipbuilding, coupled with low leakage rates, means that these funds typically generate greater domestic economic activity than broad counterfactual spending approaches.

> The S1 scenario is projected to generate 2,162 to 2,659 more jobs than any of the modeled counterfactuals, and approximately $60 million to $245 million more labor income. Scenario S2 is projected to generate approximately 610 to 910 more jobs than the counterfactuals.

Electrification and Modernization (S3 & S4): Scenarios focused on port electrification and equipment upgrades generally show more modest or negative net returns when benchmarked against the counterfactuals. These projects provide critical localized utility, but their reliance on specialized, capital-intensive equipment, often manufactured overseas, and thus with higher leakage rates, makes them less efficient at producing net macroeconomic gains compared to the broad labor-intensive pathways seen in S1 and S2.

Table 15

Net benefits, Scenario Investment vs. Counterfactual

Scenario	Investment ($M)	Leakage Rate	Domestic Investment ($M)	Counterfactual	CF Leakage Rate	Delta Jobs Type I Adj	Delta Jobs Type II Adj	Delta Value Added Adj ($M)	Delta Labor Income Adj ($M)	Delta Union Labor Income Adj ($M)
S1: NGSA	1000	0.074	925.5	vs.Govt. Spending	0.034	**518**	**933**	-91.7	-4.1	**1.0**
S1: NGSA	1000	0.074	925.5	vs.Tax Cut (HH)	0.04	-385	**1,430**	-88.9	**181.3**	**187.4**
S1: NGSA	1000	0.074	925.5	vs.Road/Rail	0.066	**669**	**1,358**	-4.5	**88.8**	**88.5**
S2: IMPAA	600	0.086	548.3	vs.Govt. Spending	0.034	**325**	**608**	-64.0	-1.1	**2.1**
S2: IMPAA	600	0.086	548.3	vs.Tax Cut (HH)	0.04	-217	**906**	-62.3	**110.2**	**113.9**
S2: IMPAA	600	0.086	548.3	vs.Road/Rail	0.066	**415**	**863**	-11.6	**54.6**	**54.5**
S3: Port Everglades	56.3	0.143	48.2	vs.Govt Spending	0.034	-10	-30	-10.2	-7.5	-7.3
S3: Port Everglades	56.3	0.143	48.2	vs.Tax Cut (HH)	0.04	-61	-2	-10.1	**3.0**	**3.2**
S3: Port Everglades	56.3	0.143	48.2	vs.Road/Rail	0.066	-1	-6	-5.3	-2.2	-2.4
S4: Port Vancouver	26.4	0.284	18.9	vs.Govt Spending	0.034	-41	-71	-9.3	-7.3	-7.3
S4: Port Vancouver	26.4	0.284	18.9	vs.Tax Cut (HH)	0.04	-65	-58	-9.2	-2.4	-2.4
S4: Port Vancouver	26.4	0.284	18.9	vs.Road/Rail	0.066	-37	-60	-7.0	-4.9	-5.0



Conclusion

Shipbuilding-focused scenarios, specifically the NGSA and IMPAA initiatives, demonstrate high domestic spending retention and labor intensity, resulting in high job creation and economic value-added metrics compared to the counterfactuals modeled. The analysis confirms that these pathways stimulate the domestic economy and established maritime industrial bases, creating a high volume of skilled, labor-intensive roles.

The port electrification and modernization efforts evaluated in S3 and S4 highlight a distinct economic profile. These projects deliver essential infrastructure improvements, aligned with long-term policy objectives and efforts to enhance port operational efficiency. They rely heavily on specialized, capital-intensive equipment (e.g., cranes and tractors) often sourced through international supply chains. This reliance results in higher economic leakage and more modest macroeconomic multipliers when assessed against broader investment counterfactuals.

It is critical to distinguish between macroeconomic efficiency and project-level utility. While S3 and S4 may appear net-negative when benchmarked against aggregate national economic drivers such as shipbuilding or general infrastructure, this perspective overlooks the specific policy intent. Electrification investments are foundational for future port competitiveness and regional air quality. Therefore, a strategic policy approach should not view these scenarios as mutually exclusive. The findings suggest that a balanced investment portfolio, combining the high-multiplier job creation potential of domestic shipbuilding with the strategic, infrastructure-focused modernization of port operations provides a clear pathway to achieving national economic growth, as well as regional efficiency while meeting policy goals.

Appendix



Estimated Cost Assignments

Port Everglades

Item	Unit cost	Total	NAICS	NAICS Description	Examples
Concrete RTG run (PET terminal)	-	$ 3,000,000	237990	Other Heavy and Civil Engineering Construction	• Residual after equipment; consistent with electrification infrastructure benchmarks • $8M to $30M to build a new 66-kilovolt substation • $2.3 for upgrades to support nine grid-electric RTGs ○ https://ww2.arb.ca.gov/sites/default/files/2025-10/DRAFT%202025%20CHE%20Technology%20Assessment.pdf

Electric 8K forklifts	$ 240,000	$ 1,440,000	333924	Industrial Truck, Tractor, Trailer, and Stacker Machinery Manufacturing	• 250K to 900K battery-electric forklift + 10K per charger
					  ○ https://callift.blog/2023/07/18/californias-core-is-updated-for-2023-2024-what-you-need-to-know/
					  ○ https://ww2.arb.ca.gov/sites/default/files/2025-10/DRAFT%202025%20CHE%20Technology%20Assessment.pdf

Electric terminal tractors	$ 270,000	$ 5,940,000	336120	Heavy Duty Truck Manufacturing	• Orange EV T-Series.
					  ○ https://orangeev.com/husk-e-2/yard-trucks/electric-yard-trucks-are-delivering-lower-tco/
					• 300K to 400K battery-electric yard truck + $30K to 60K per charger, versus 95K to 170K for diesel-powered yard truck (hybrid assume somewhere in the middle)
					  ○ https://ww2.arb.ca.gov/sites/default/files/2025-10/DRAFT%202025%20CHE%20Technology%20Assessment.pdf

Electric top loaders	$ 790,000	$ 4,740,000	333924	Industrial Truck, Tractor, Trailer, and Stacker Machinery Manufacturing	• CARB CORE voucher base: Taylor ZLC994 electric loaded handler ~$790K (2023)
					  ○ https://callift.blog/2023/07/18/californias-core-is-updated-for-2023-2024-what-you-need-to-know/
					• 150K to 450K battery-electric loader, no information on charger cost
					  ○ https://ww2.arb.ca.gov/sites/default/files/2025-10/DRAFT%202025%20CHE%20Technology%20Assessment.pdf

Electrification plan + workforce development	-	$ 1,500,000	541690	Other Scientific and Technical Consulting Services	• Professional services; comparable planning grants ($300K–$3M)

Item	Unit cost	Total	NAICS	NAICS Description	Examples
High-mast lighting	-	$ 2,000,000	237130	Power and Communication Line and Related Structures Construction	• Port lighting project benchmarks; $80–150K per mast installed
Hybrid pickup trucks	$ 58,200	$ 698,400	336110	Pick-up trucks, light duty, assembling on chassis of own manufacture	• Ford F-150 PowerBoost. ○ https://www.kbb.com/best-cars/hybrid-pickup-trucks/

Hybrid RTG cranes	$ 3,100,000	$ 6,200,000	333923	Overhead Traveling Crane, Hoist, and Monorail System Manufacturing	• GPA/Konecranes: $170M ÷ 55 units = $3.1M/crane (2023).
					  ○ https://gaports.com/press-releases/port-of-savannah-adding-55-hybrid-yard-cranes/
					  ○ https://www.konecranes.com/press-releases/georgia-ports-authority-orders-55-hybrid-konecranes-rtgs-as-part-of-major-capacity-increase-in-the-port-of
					• $2.15M for hybrid RTG equipment; no new infrastructure is required for traditional diesel or hybrid RTGs
					  ○ https://wpassets.porttechnology.org/wp-content/uploads/2019/10/04173302/PTI_90_Innovative_Container_Handling.pdf
					• $1.8M to $2.5M for grid-electric RTG versus $1.2M to 1.3M for diesel-powered RTG
					  ○ https://ww2.arb.ca.gov/sites/default/files/2025-10/DRAFT%202025%20CHE%20Technology%20Assessment.pdf

OCR gate system (Crowley) – Construction	-	$ 1,200,000	236220	Commercial and Institutional Building Construction	• Camco / Identec terminal gate OCR system pricing
					• 8 lanes at Crowley terminal, assumes $375k.lane
					• POLB North Gate Expansion $12,721,545 for 12 lanes. Extensive site work.
					  ○ https://vendors.planetbids.com/portal/19236/bo/bo-detail/121697#
					• Seattle, Terminal 5 Gate. Expand and relocate 6 gates to 12, 8 with scales. $12,316,000
					  ○ https://www.nwseaportalliance.com/about-us/planning/2022-pidp-grant-application-terminal-5

OCR gate system (Crowley) – Hardware	-	$ 800,000	334118	Computer Terminal and Other Computer Peripheral Equipment Manufacturing	
OCR gate system (Crowley – Software	-	$ 1,000,000	541512	Computer Systems Design Services	

Item	Unit cost	Total	NAICS	NAICS Description	Examples
Reefer racks – civil/foundation works	-	$ 3,692,044	237990	Other Heavy and Civil Engineering Construction	• Derived from Portland IMT: $14.2M PIDP (2023) for reefer yard incl. racks, power, and lighting ○ https://www.maine.gov/dot/sites/maine.gov.dot/files/inline-files/Portland%20IMT%20Reefer%20Yard%20Modernization%20Cost%20Estimate.pdf. 17,796,534.38 for 420 spaces, or $42,372/space • 192 spaces at $42,372/space
Reefer racks – electrical power distribution (45%)	-	$ 3,692,044	237130	Power and Communication Line and Related Structures Construction	
Reefer racks – structural steel fabrication (10%)	-	$ 820,454	332312	Fabricated Structural Metal Manufacturing	

Tier-4 diesel reach stackers	$ 900,000	$ 1,800,000	333924	Industrial Truck, Tractor, Trailer, and Stacker Machinery Manufacturing	• AmeraMex/Taylor: ~$900K retail value per unit (NASDAQ, June 2024)
					  ○ https://ammx.net/ameramex-international-delivers-second-reach-stacker-related-to-7-million-us-military-rental-agreement/
					  ○ https://www.nasdaq.com/press-release/ameramex-international-delivers-second-reach-stacker-related-7-million-us-military
					• $830K to 860K diesel-powered reach stacker, no charger required
					  ○ https://ww2.arb.ca.gov/sites/default/files/2025-10/DRAFT%202025%20CHE%20Technology%20Assessment.pdf

Electrical upgrades + civil works (charging)	-	$ 14,834,458	237990	Other Heavy and Civil Engineering Construction	• Residual after equipment; consistent with electrification infrastructure benchmarks; $8M to $30M to build a new 66-kilovolt substation; $2.3 for upgrades to support nine grid-electric RTGs ○ https://ww2.arb.ca.gov/sites/default/files/2025-10/DRAFT%202025%20CHE%20Technology%20Assessment.pdf

Port Vancouver

Item	Qty	Unit cost (est.)	Subtotal (est.)	BEA Code	Source / basis

Two new electric Liebherr (German-based) mobile harbor cranes	2	$10,905,253	$21,810,505	333920	• $7.2-8.0M USD Liebherr LHM600 at Port Canaveral, FL 2025
					  ○ https://vertikal.net/en/news/story/40837/second-lhm-600-for-cape-canaveral
					  ○ https://finance.yahoo.com/news/port-canaveral-8m-crane-hit-144713432.html
					• Adjusted to 2026, +~20% electric premium

Power, distribution, and specialty transformer manufacturing			$1,000,000	335311/US	• $400K spent on Berth 8/9 Electric Crane Power Infrastructure
					  ○ https://www.portvanusa.com/assets/2025-Final-Budget-web.pdf
					• Based on an early demonstration project for ZE/NZE CHE Equipment, charging infrastructure can be up to $750,000 per outlet.
					  ○ https://pantheonstorage.blob.core.windows.net/environment/Maritime-Clean-Air-Strategy-Discussion-Draft.pdf

Switchgear and switchboard apparatus manufacturing			$750,000	335313/US	• Inland vessels: Port of Kiel ferry & cruise terminal at 4.5 MW 1.5M EUR (~1.75M USD) ○ https://open-science.canada.ca/server/api/core/bitstreams/b040017b-79d3-4029-b38d-64ad06e3ae40/content
Capacitors/coils/connectors and other electronic components			$750,000	33441A/US	
Other nonresidential structures			$750,000	2332D0/US	

Methodology Details

Uniform Analytical Boundary Conditions

To isolate the domestic economic footprint and maintain analytical symmetry across all simulations, the modeling approach enforces a strict boundary condition:

- Domestic Satellite Requirements Matrix and Domestic Leontief Inverse Matrix are applied uniformly across all investment scenarios and counterfactuals. This isolates the supply-chain impacts to domestic production rounds, preventing an artificial inflation of benefits in pathways with high import components.
- Direct Final Demand Execution: Macroeconomic footprints are extracted by applying final demand shock vectors (f) directly to the total requirements matrices. The methodology strictly avoids intermediate output diagonalizations that would result in double counting inter-industry transactions.

Price Deflation and Reporting Basis

The underlying USEEIO matrix coefficients are benchmarked to constant 2012 dollars. Therefore, nominal dollar investment values should be deflated to prevent distortions caused by cumulative inflation.

Deflation Mechanics

Nominal scenario totals are converted to real 2012 dollars before being multiplied by the Leontief inverse:

$$Total_{2012} = \frac{Total_{Nominal}}{Deflator_{Year}}$$

The Deflator represents the structural price change relative to 2012 (2012 = 1.0). Rather than deflating estimates to 2012 using the consumer price index, the model uses the Producer Price Index (PPI) (Series: WPSFD4131).[49] This ensures that price adjustments reflect the industrial and capital-intensive nature of infrastructure procurement, rather than consumer price changes.



[49] https://data.bls.gov/timeseries/WPSFD4131

Empirical Deflator Controls

Annual averages are derived from historical BLS datasets (benchmarked to the 2012 base level μ = 182.375):

Year	Annual Average	Deflator
2012	182.375	-
2023	247.412	1.3566
2024	253.048	1.3875
2025	260.083	1.4261
2026 (through May)	266.949	1.4637

Reporting Basis Harmonization

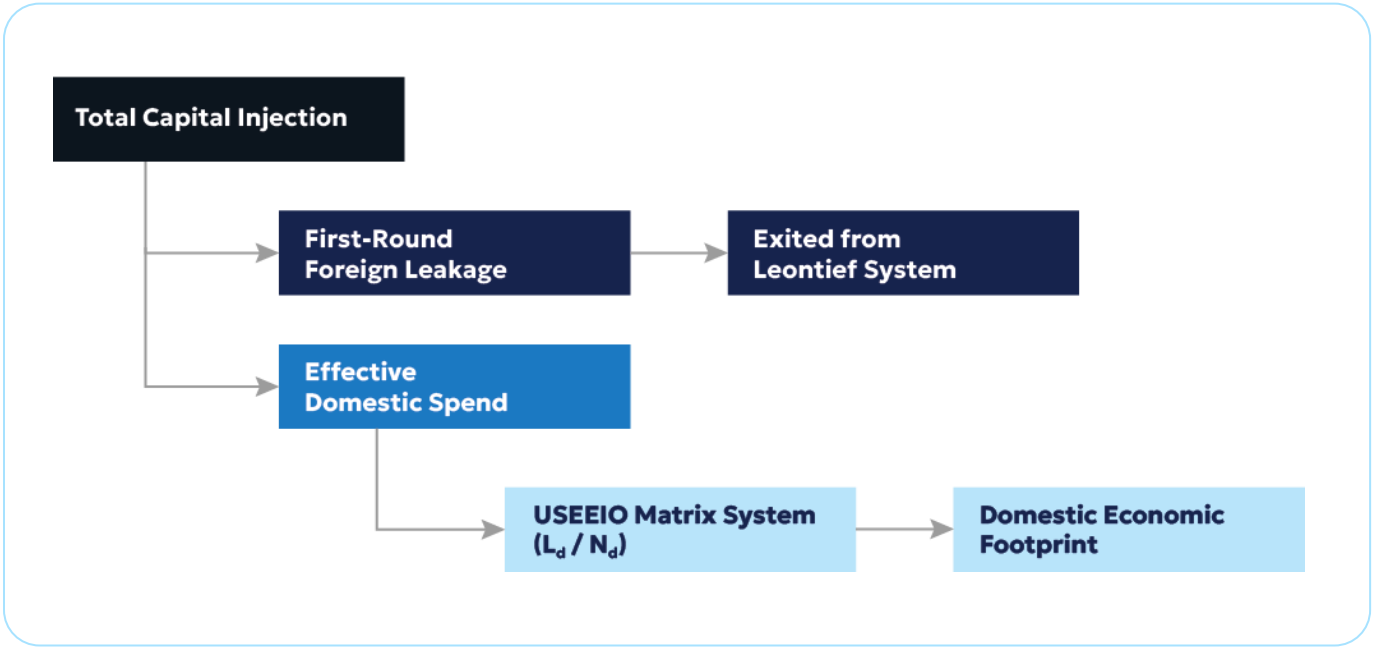
All dollar-denominated impacts (Value Added, Gross Investment, and Labor Income) are reinflated from the internal 2012 model results to a uniform 2026 dollar (2026$) reporting basis using the 2026 target PPI factor (1.4637). Physical metrics, such as employment counts or structural multipliers, remain scale-invariant and are not deflated or subsequently re-inflated.

First-Round Import Leakage Calibration

The methodology accounts for international supply chain "leakage," recognizing that a portion of any capital injection may exit the domestic economy to purchase foreign commodities. The model establishes an adjusted domestic demand vector:

$$f_{adjusted} = f \times (1 - leakage\ rate)$$

Impacts are processed and reported under two distinct metrics: Gross Footprint (upper-bound capacity assuming 100% domestic retention) and Leakage-Adjusted Footprint (realistic domestic structural capture).



Traded Manufacturing Sectors

For trade-exposed manufacturing categories (e.g., steel, transformers, cranes, and electronics), we dynamically calculate empirical import penetration ratios by calling the U.S. Census Bureau APIs to determine the fraction of imports in each sector.

1. Numerator (Imports): Fetched from the Census International Trade API,[50] aggregating annual generic import customs value by 6-digit NAICS code.
2. Denominator (Total Domestic Supply): Sourced via the Census Annual Investment and Economic Survey (AIES) API,[51] extracting total value of domestic shipments.

The empirical penetration rate is formalized as:

$$Leakage\ Rate = \frac{Imports}{Imports\ +\ Domestic\ Shipments}$$

Multi-sector aggregates (e.g., BEA detail code 333920/US for Material Handling Equipment, which spans NAICS 333921–333924) are blended via share-weighted empirical values.

Non-Traded Sector Assumptions

Sectors that cannot be broadly traded internationally do not utilize the Census API and default to fixed, empirical judgment parameters representing localized labor and material tracking:

- Commercial / Heavy Construction (BEA Codes 2332A0/US, 2332D0/US): 3% leakage (accounting for niche foreign equipment components within domestic civil labor structures).
- Utilities / Electricity (BEA Code 221100/US): 5% leakage.
- Engineering & Technical Consulting (BEA Codes 541300/US, 5416A0/US): 4% leakage.
- Facilities Support and Operations (BEA Code 561200/US): 2% leakage.

Type II Household Closure & Multiplier Derivation

Standard USEEIO frameworks capture Type I effects (direct industrial demands and indirect business-to-business supply chain transactions). To capture Type II induced effects (i.e., economic activity stimulated by supply-chain workers spending their labor income), this work applies an endogenous matrix closure.

The standard USEEIO direct requirements matrix (the A matrix) is an $n \times n$ matrix mapping transactions strictly between industrial sectors. To capture the induced effects of workers spending their wages, the model executes a household closure, expanding the matrix to an $(n+1) \times (n+1)$ system. This is achieved by appending two structural vectors:

- **The Household Row:** This vector represents labor income paid per dollar of industrial output, derived by extracting employee compensation from the value-added satellite matrix and dividing compensation by total industry output.
- **The Household Column:** This vector represents the consumer spending pattern using the Personal Consumption Expenditures (PCE) vector from the model's final demand matrix and then normalizes it to shares. To prevent the model from overstating the strength of the induced loop, this column is scaled by a Domestic Marginal Propensity to Consume (MPC) wedge. This wedge dynamically accounts for income leakages that occur before consumer cash hits the domestic market: personal income taxes, personal savings rates, and the share of consumer goods met by foreign imports.

The Domestic Marginal Propensity to Consume (MPC) Wedge

To avoid over-closing the system, and thus overstating induced jobs, the household column vector is adjusted downward by a structural leakage factor. The Domestic MPC isolates the fraction of a dollar of labor income that recirculates strictly into domestic commodities:

$$\begin{aligned} Domestic\ MPC = &(1 - Personal\ Tax\ Rate) \\ &\times (1 - Saving\ Rate) \\ &\times (1 - PCE\ Import\ Share) \end{aligned}$$

[50] https://api.census.gov/data/timeseries/intltrade/imports/naics
[51] https://api.census.gov/data/timeseries/aies/basic

These parameters are derived from BEA tables:

- Personal Tax Rate: 12.1% (BEA National Income and Product Accounts (NIPA) Table 2.1, personal current taxes relative to total personal income)
- Saving Rate: 3.7% (BEA NIPA Table 2.1, personal saving relative to disposable personal income)
- PCE Import Share: Derived from the model's internal matrices by evaluating total consumer demand against import-adjusted domestic consumer demand

Convergence and Matrix Inversion

Once the augmented direct requirements matrix is constructed, the system is tested for mathematical convergence. It calculates the spectral radius (the maximum absolute eigenvalue) of the augmented matrix. If the spectral radius is less than 1.0, the infinite mathematical loop of spending converges, meaning the matrix can be inverted.

The augmented Leontief Inverse matrix is then computed by subtracting the augmented direct requirements matrix from an identity matrix and calculating the inverse. This resulting matrix represents the total requirements—direct, indirect, and induced—per dollar of final demand delivered to the economy.

Because the household sector was added as a row and a column inside the matrix, the system treats "Households" as though it were a producing industry. Running impacts through the entire matrix would erroneously count phantom jobs generated within the household sector itself. Therefore, we extract the top $n \times n$ submatrix of the augmented Leontief Inverse, to isolate producing industrial sectors, and then we drop the added household row and column. The result is that direct physical employment coefficients (jobs per dollar of industrial output) from the environmental satellite matrix are multiplied only against this extracted industrial submatrix and households are not double counted.

Post-Hoc Union Labor Income Adjustments

Default USEEIO Input-Output tables do not distinguish between unionized and non-unionized labor. We apply an empirical wage-adjustment to evaluate how collective bargaining density impacts regional labor income capture.

Using data pulled from the BLS Public Data API v2, the model is augmented to update estimates to account for sector-specific union activity using the following two surveys:

1. **Union Density:** Extracted from the Current Population Survey (CPS) Labor Union tables,[52] it identifies the percentage of private wage and salary workers holding union membership by broad sector group
2. **Wage Premium Ratio:** Extracted from the CPS LE tables,[53] it compares median hourly earnings of union members against non-union workers

Rather than assuming a flat unionization rate across the entire economy, the model's value-added satellite vectors are adjusted as follows:

- **Baseline Derivation:** Baseline employee compensation values by industry are pulled from the core USEEIO value-added satellite table and then divided by total industry output to establish a vector of baseline labor income coefficients.
- **Blended Factor Compounding:** For each sector in the model, the blended wage factor is calculated. This factor represents the mathematical sum of the unionized workforce share multiplied by the wage premium ratio, combined with the non-unionized workforce share valued at a baseline rate.
- **Vector Propagation:** The baseline labor income coefficients are multiplied by these sector-specific blended wage factors to generate a union-adjusted compensation coefficient vector.

When the final demand vector is processed through the Leontief total requirements matrix, the resulting total economic output vector is multiplied directly by the union-adjusted coefficient matrix.

[52] https://download.bls.gov/pub/time.series/lu/
[53] https://download.bls.gov/pub/time.series/le/

Up/Downstream Sectors, by Scenario

S1: Upstream industry inputs

Scenario	Direction	Rank	Code	Name
S1: Next Generation Shipping Act	Upstream (supplier to sector)	1	336611/US	Ship building and repairing
S1: Next Generation Shipping Act	Upstream (supplier to sector)	2	333618/US	Other engine equipment manufacturing
S1: Next Generation Shipping Act	Upstream (supplier to sector)	3	331110/US	Iron and steel mills and ferroalloy manufacturing
S1: Next Generation Shipping Act	Upstream (supplier to sector)	4	334511/US	Search, detection, and navigation instruments manufacturing
S1: Next Generation Shipping Act	Upstream (supplier to sector)	5	550000/US	Management of companies and enterprises
S1: Next Generation Shipping Act	Upstream (supplier to sector)	6	423A00/US	Other durable goods merchant wholesalers
S1: Next Generation Shipping Act	Upstream (supplier to sector)	7	533000/US	Lessors of nonfinancial intangible assets
S1: Next Generation Shipping Act	Upstream (supplier to sector)	8	531ORE/US	Other real estate
S1: Next Generation Shipping Act	Upstream (supplier to sector)	9	541300/US	Architectural, engineering, and related services
S1: Next Generation Shipping Act	Upstream (supplier to sector)	10	561300/US	Employment services
S1: Next Generation Shipping Act	Upstream (supplier to sector)	11	423800/US	Machinery, equipment, and supplies
S1: Next Generation Shipping Act	Upstream (supplier to sector)	12	333613/US	Mechanical power transmission equipment manufacturing
S1: Next Generation Shipping Act	Upstream (supplier to sector)	13	221100/US	Electric power generation, transmission, and distribution
S1: Next Generation Shipping Act	Upstream (supplier to sector)	14	33291A/US	Valve and fittings other than plumbing
S1: Next Generation Shipping Act	Upstream (supplier to sector)	15	331490/US	Nonferrous metal (except copper and aluminum) rolling, drawing, extruding, and alloying

S1: Downstream industry users

Scenario	Direction	Rank	Code	Name
S1: Next Generation Shipping Act	Downstream (uses sector output)	1	336611/US	Ship building and repairing
S1: Next Generation Shipping Act	Downstream (uses sector output)	2	483000/US	Water transportation
S1: Next Generation Shipping Act	Downstream (uses sector output)	3	114000/US	Fishing, hunting, and trapping
S1: Next Generation Shipping Act	Downstream (uses sector output)	4	S00500/US	Federal general government (defense)
S1: Next Generation Shipping Act	Downstream (uses sector output)	5	311700/US	Seafood product preparation and packaging
S1: Next Generation Shipping Act	Downstream (uses sector output)	6	48A000/US	Scenic and sightseeing transportation and support activities for transportation
S1: Next Generation Shipping Act	Downstream (uses sector output)	7	335991/US	Carbon and graphite product manufacturing
S1: Next Generation Shipping Act	Downstream (uses sector output)	8	327992/US	Ground or treated mineral and earth manufacturing
S1: Next Generation Shipping Act	Downstream (uses sector output)	9	491000/US	Postal service
S1: Next Generation Shipping Act	Downstream (uses sector output)	10	541700/US	Scientific research and development services
S1: Next Generation Shipping Act	Downstream (uses sector output)	11	325910/US	Printing ink manufacturing
S1: Next Generation Shipping Act	Downstream (uses sector output)	12	325310/US	Fertilizer manufacturing
S1: Next Generation Shipping Act	Downstream (uses sector output)	13	311210/US	Flour milling and malt manufacturing
S1: Next Generation Shipping Act	Downstream (uses sector output)	14	311119/US	Other animal food manufacturing
S1: Next Generation Shipping Act	Downstream (uses sector output)	15	327400/US	Lime and gypsum product manufacturing

S2: Upstream industry inputs

Scenario	Direction	Rank	Code	Name
S2: IMPAA	Upstream (supplier to sector)	1	336611/US	Ship building and repairing
S2: IMPAA	Upstream (supplier to sector)	2	333618/US	Other engine equipment manufacturing
S2: IMPAA	Upstream (supplier to sector)	3	331110/US	Iron and steel mills and ferroalloy manufacturing
S2: IMPAA	Upstream (supplier to sector)	4	334511/US	Search, detection, and navigation instruments manufacturing
S2: IMPAA	Upstream (supplier to sector)	5	550000/US	Management of companies and enterprises
S2: IMPAA	Upstream (supplier to sector)	6	423A00/US	Other durable goods merchant wholesalers
S2: IMPAA	Upstream (supplier to sector)	7	533000/US	Lessors of nonfinancial intangible assets
S2: IMPAA	Upstream (supplier to sector)	8	531ORE/US	Other real estate
S2: IMPAA	Upstream (supplier to sector)	9	541300/US	Architectural, engineering, and related services
S2: IMPAA	Upstream (supplier to sector)	10	561300/US	Employment services
S2: IMPAA	Upstream (supplier to sector)	11	423800/US	Machinery, equipment, and supplies
S2: IMPAA	Upstream (supplier to sector)	12	333613/US	Mechanical power transmission equipment manufacturing
S2: IMPAA	Upstream (supplier to sector)	13	221100/US	Electric power generation, transmission, and distribution
S2: IMPAA	Upstream (supplier to sector)	14	33291A/US	Valve and fittings other than plumbing
S2: IMPAA	Upstream (supplier to sector)	15	331490/US	Nonferrous metal (except copper and aluminum) rolling, drawing, extruding, and alloying

S2: Downstream industry users

Scenario	Direction	Rank	Code	Name
S2: IMPAA	Downstream (uses sector output)	1	336611/US	Ship building and repairing
S2: IMPAA	Downstream (uses sector output)	2	483000/US	Water transportation
S2: IMPAA	Downstream (uses sector output)	3	114000/US	Fishing, hunting, and trapping
S2: IMPAA	Downstream (uses sector output)	4	S00500/US	Federal general government (defense)
S2: IMPAA	Downstream (uses sector output)	5	311700/US	Seafood product preparation and packaging
S2: IMPAA	Downstream (uses sector output)	6	48A000/US	Scenic and sightseeing transportation and support activities for transportation
S2: IMPAA	Downstream (uses sector output)	7	335991/US	Carbon and graphite product manufacturing
S2: IMPAA	Downstream (uses sector output)	8	327992/US	Ground or treated mineral and earth manufacturing
S2: IMPAA	Downstream (uses sector output)	9	491000/US	Postal service
S2: IMPAA	Downstream (uses sector output)	10	541700/US	Scientific research and development services
S2: IMPAA	Downstream (uses sector output)	11	325910/US	Printing ink manufacturing
S2: IMPAA	Downstream (uses sector output)	12	325310/US	Fertilizer manufacturing
S2: IMPAA	Downstream (uses sector output)	13	311210/US	Flour milling and malt manufacturing
S2: IMPAA	Downstream (uses sector output)	14	311119/US	Other animal food manufacturing
S2: IMPAA	Downstream (uses sector output)	15	327400/US	Lime and gypsum product manufacturing

S3: Upstream industry inputs

Scenario	Direction	Rank	Code	Name
S3: Port Everglades	Upstream (supplier to sector)	1	2332D0/US	Other nonresidential structures
S3: Port Everglades	Upstream (supplier to sector)	2	324110/US	Petroleum refineries
S3: Port Everglades	Upstream (supplier to sector)	3	211000/US	Oil and gas extraction
S3: Port Everglades	Upstream (supplier to sector)	4	423A00/US	Other durable goods merchant wholesalers
S3: Port Everglades	Upstream (supplier to sector)	5	541300/US	Architectural, engineering, and related services
S3: Port Everglades	Upstream (supplier to sector)	6	531ORE/US	Other real estate
S3: Port Everglades	Upstream (supplier to sector)	7	331110/US	Iron and steel mills and ferroalloy manufacturing
S3: Port Everglades	Upstream (supplier to sector)	8	444000/US	Building material and garden equipment and supplies dealers
S3: Port Everglades	Upstream (supplier to sector)	9	484000/US	Truck transportation
S3: Port Everglades	Upstream (supplier to sector)	10	550000/US	Management of companies and enterprises
S3: Port Everglades	Upstream (supplier to sector)	11	332310/US	Plate work and fabricated structural product manufacturing
S3: Port Everglades	Upstream (supplier to sector)	12	532400/US	Commercial and industrial machinery and equipment rental and leasing
S3: Port Everglades	Upstream (supplier to sector)	13	327390/US	Other concrete product manufacturing
S3: Port Everglades	Upstream (supplier to sector)	14	221100/US	Electric power generation, transmission, and distribution
S3: Port Everglades	Upstream (supplier to sector)	15	332320/US	Ornamental and architectural metal products manufacturing

S3: Downstream industry users

Scenario	Direction	Rank	Code	Name
S3: Port Everglades	Downstream (uses sector output)	1	2332D0/US	Other nonresidential structures
S3: Port Everglades	Downstream (uses sector output)	2	1111A0/US	Oilseed farming
S3: Port Everglades	Downstream (uses sector output)	3	1111B0/US	Grain farming
S3: Port Everglades	Downstream (uses sector output)	4	111200/US	Vegetable and melon farming
S3: Port Everglades	Downstream (uses sector output)	5	111300/US	Fruit and tree nut farming
S3: Port Everglades	Downstream (uses sector output)	6	111400/US	Greenhouse, nursery, and floriculture production
S3: Port Everglades	Downstream (uses sector output)	7	111900/US	Other crop farming
S3: Port Everglades	Downstream (uses sector output)	8	112120/US	Dairy cattle and milk production
S3: Port Everglades	Downstream (uses sector output)	9	1121A0/US	Beef cattle ranching and farming, including feedlots and dual-purpose ranching and farming
S3: Port Everglades	Downstream (uses sector output)	10	112300/US	Poultry and egg production
S3: Port Everglades	Downstream (uses sector output)	11	112A00/US	Animal production, except cattle and poultry and eggs
S3: Port Everglades	Downstream (uses sector output)	12	113000/US	Forestry and logging
S3: Port Everglades	Downstream (uses sector output)	13	114000/US	Fishing, hunting and trapping
S3: Port Everglades	Downstream (uses sector output)	14	115000/US	Support activities for agriculture and forestry
S3: Port Everglades	Downstream (uses sector output)	15	211000/US	Oil and gas extraction

S4: Upstream industry inputs

Scenario	Direction	Rank	Code	Name
S4: Port Vancouver	Upstream (supplier to sector)	1	333920/US	Material handling equipment manufacturing
S4: Port Vancouver	Upstream (supplier to sector)	2	331110/US	Iron and steel mills and ferroalloy manufacturing
S4: Port Vancouver	Upstream (supplier to sector)	3	423A00/US	Other durable goods merchant wholesalers
S4: Port Vancouver	Upstream (supplier to sector)	4	33399B/US	Fluid power process machinery
S4: Port Vancouver	Upstream (supplier to sector)	5	550000/US	Management of companies and enterprises
S4: Port Vancouver	Upstream (supplier to sector)	6	423800/US	Machinery, equipment, and supplies
S4: Port Vancouver	Upstream (supplier to sector)	7	S00401/US	Scrap
S4: Port Vancouver	Upstream (supplier to sector)	8	484000/US	Truck transportation
S4: Port Vancouver	Upstream (supplier to sector)	9	331410/US	Nonferrous Metal (except Aluminum) Smelting and Refining
S4: Port Vancouver	Upstream (supplier to sector)	10	335314/US	Relay and industrial control manufacturing
S4: Port Vancouver	Upstream (supplier to sector)	11	531ORE/US	Other real estate
S4: Port Vancouver	Upstream (supplier to sector)	12	335312/US	Motor and generator manufacturing
S4: Port Vancouver	Upstream (supplier to sector)	13	221100/US	Electric power generation, transmission, and distribution
S4: Port Vancouver	Upstream (supplier to sector)	14	211000/US	Oil and gas extraction
S4: Port Vancouver	Upstream (supplier to sector)	15	332710/US	Machine shops

S4: Downstream industry users

Scenario	Direction	Rank	Code	Name
S4: Port Vancouver	Downstream (uses sector output)	1	333920/US	Material handling equipment manufacturing
S4: Port Vancouver	Downstream (uses sector output)	2	2122A0/US	Iron, gold, silver, and other metal ore mining
S4: Port Vancouver	Downstream (uses sector output)	3	562HAZ/US	Hazardous waste collection treatment and disposal
S4: Port Vancouver	Downstream (uses sector output)	4	212230/US	Copper, nickel, lead, and zinc mining
S4: Port Vancouver	Downstream (uses sector output)	5	233230/US	Manufacturing structures
S4: Port Vancouver	Downstream (uses sector output)	6	2123A0/US	Other nonmetallic mineral mining and quarrying
S4: Port Vancouver	Downstream (uses sector output)	7	562910/US	Remediation services
S4: Port Vancouver	Downstream (uses sector output)	8	562212/US	Solid waste landfilling
S4: Port Vancouver	Downstream (uses sector output)	9	562111/US	Solid waste collection
S4: Port Vancouver	Downstream (uses sector output)	10	212100/US	Coal mining
S4: Port Vancouver	Downstream (uses sector output)	11	562OTH/US	Other waste collection and treatment services
S4: Port Vancouver	Downstream (uses sector output)	12	2332A0/US	Office and commercial structures
S4: Port Vancouver	Downstream (uses sector output)	13	213111/US	Drilling oil and gas wells
S4: Port Vancouver	Downstream (uses sector output)	14	212310/US	Stone mining and quarrying
S4: Port Vancouver	Downstream (uses sector output)	15	562920/US	Material separation/recovery facilities