Summary Economic Impacts of the ClimateTech Sector Policies of the Mass Leads Act

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Summary Economic Impacts of the ClimateTech Sector Policies of the Mass Leads Act

Prepared by the UMass Donahue Institute's Economic and Public Policy Research Group

Project Leader
Rod Motamedi, Assistant Director

Unit Director
Mark Melnik, Ph.D.

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Acknowledgments

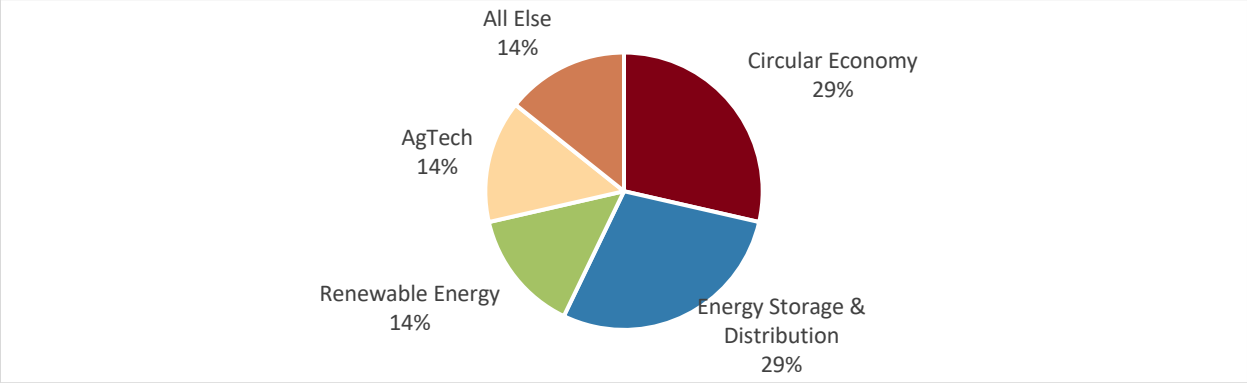
We would like to thank the staff of MassCEC for their help and guidance developing the assumptions for this analysis. Their knowledge of past and current programs was vital to assigning future spending and activities to the appropriate sectors of the economy. UMDI would like to especially thank Cat Foley, Elizabeth Cleveland, and Galen Nelson.

Key Findings

This report provides an early-stage economic impact analysis of the climatetech portion of the Mass Leads Act. The Healey-Driscoll administration has proposed the Mass Leads Act to support clean energy and climatetech with an investment of $1 billion over the next 10 years. Specifically, the Act provides $200 million to support offshore wind, $200 million to support early-deployment projects, $300 million of tax credits and incentives for climatetech companies, and $300 million of operating funds for the Massachusetts Clean Energy Center (MassCEC). The Act also makes changes to the existing offshore wind tax credit program which is another $350 million of funding. In total, the analysis includes $1.35 billion in investments, which will be administrated by MassCEC.

The Mass Leads Act provides funding to continue to support the robust and growing green economy in Massachusetts. According to a recent report from Time, of the 250 top sustainability-focused companies in the United States, 11 percent are in Massachusetts, second only to California with 46 percent of the top companies.[1] Once adjusted for the size of each state, Massachusetts has proportionally more companies on the list. California has over five times the population and GDP of Massachusetts while only having four times as many companies in the top 250.

Figure 1: Categories of Top Massachusetts-Based ClimateTech Companies



Source: *America's Top Greentech Companies 2024* Note: All Else includes Data & Analytics, Resources, and Carbon Capture & Offset Solutions.

The new streams of funding for climatetech from the Mass Leads Act directly create positive impacts throughout the economy. In addition, because these investments target early-stage and/or growing companies, each dollar invested by MassCEC attracts additional public and private investment. As a result, the economic impacts of the Mass Leads Act are multiplied by the other capital the Act's investments unlock and enable. Moving into the future, many of the companies that receive these

[1] Time. (2024). *America's Top Greentech Companies 2024.* Retrieved from: https://time.com/collection/americas-top-greentech-companies-2024/. Accessed on April 18, 2024.

investments will continue to grow and create yet more economic impacts from their jobs, wages, purchases, and revenues.

The economic impacts are presented before and after the addition of leveraged funds. The impacts after leveraged funds are inclusive of the impacts before the addition. The Mass Leads Act authorizes $1.35 billion of new and revised spending. The Act's impact does not stop at these first investments. The overarching goal of public investments in early-stage companies and technologies is to provide gap financing, unmet by the private sector, that enables ideas to move forward. As a result, these kinds of investments typically unlock significant additional private and federal investment to startups and other young companies that will multiply the Act's direct impacts. Based on MassCEC's past performance, new leveraged funds could amount to $5.66 of additional money for each $1.00 of MassCEC's investments.[2]

Employment and Income Impacts

Before accounting for the additional investments enabled by the Act, its spending creates or supports 1,440 direct, indirect, and induced jobs per year. These workers will earn $2 billion of additional compensation over 10 years. After leveraged funds, total annual jobs jump to 6,670 and with them total income rises to $9.3 billion over ten years.

Total Economic Activity and GDP Impacts

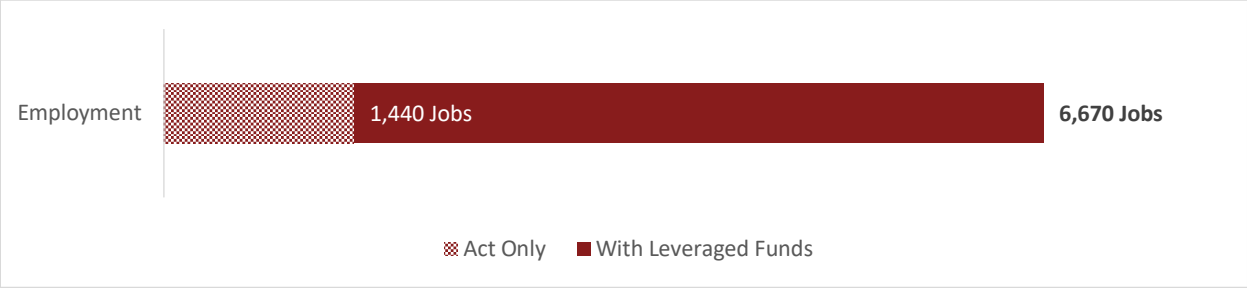
The Act's investments add $3.3 billion to total economic activity. After accounting for leakages out of the state from commuting, imports, and taxation, it adds over $2 billion to the Commonwealth's GDP. Over 10 years, leveraged funds would increase estimated total economic activity to $16.4 billion while adding $10.1 billion to Massachusetts's GDP. With the inclusion of leveraged funds, each dollar of investment from the Mass Leads Act will create or support over $12 of total economic activity.

State and Local Tax Revenue Impacts

The new household and business activity will create new state and local tax revenues. These rise from roughly $270 million before leveraged funds to an estimated $1.2 billion of new tax revenues after accounting for leveraged funds. The state is estimated to capture over half of these amounts.

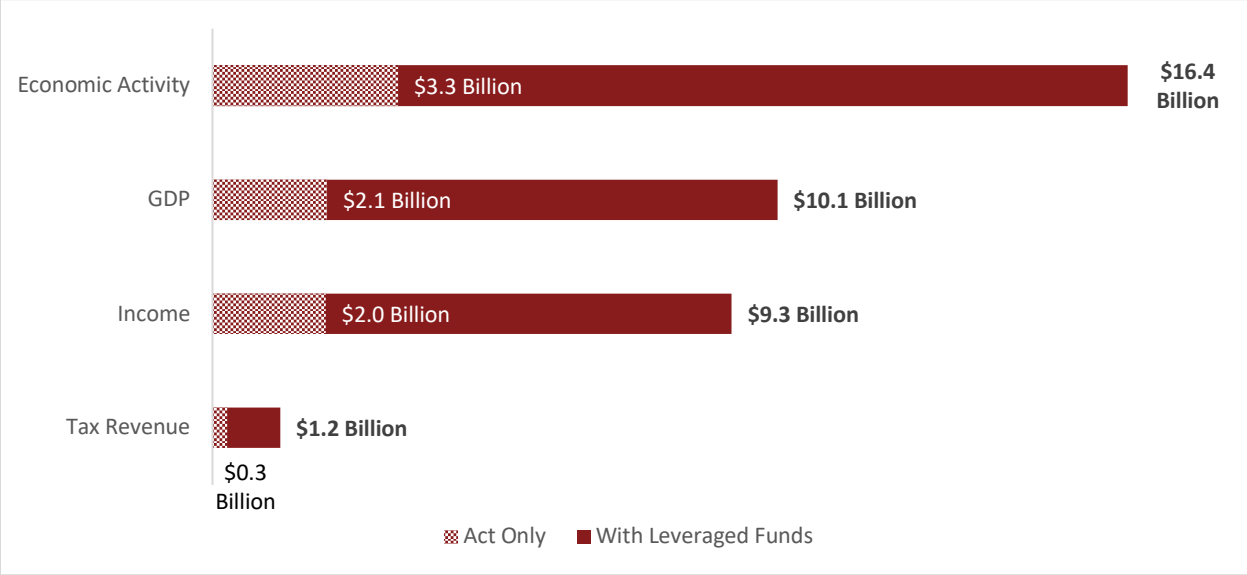
[2] MassCEC. (2022). *2022 Massachusetts Clean Energy Industry Report.* Retrieved from: https://www.masscec.com/sites/default/files/documents/2022%20Massachusetts%20Clean%20Energy%20Industry%20Report_Final.pdf. Accessed on February 27, 2024.

Figure 2: Summary Jobs Impacts of Mass Leads Act ClimateTech Policies before and after Leveraged Funds, 2025-2034



Source: MassCEC, PI+, UMDI calculations Note: Values rounded to nearest 10 jobs. Jobs are the annual average.

Figure 3: Summary Monetary Impacts of Mass Leads Act ClimateTech Policies before and after Leveraged Funds, 2025-2034



Source: MassCEC, PI+, UMDI calculations Note: Values rounded to $10 million, except taxes which are rounded to the nearest $1 million. Dollar values are cumulative.

The results highlighted in the previous chart do not include the economic activity that comes after early-stage investments and, as a result, are likely *less* than the total impacts the Commonwealth can expect in the future. Specifically, the results only include some of the early research and capital investments required to get new companies and technologies off the ground. While not all startups will succeed,

enough will survive and thrive to create ongoing economic impacts beyond those measured here. These businesses will have their own employees and revenues and, over time, yet more capital investment.[3]

The Commonwealth's and MassCEC's past performance provide reasons for optimism for positive outcomes of the Mass Leads Act's investments in climatetech. However, there are two notable potential obstacles: uncertainty over federal offshore wind policy and workforce constraints (see methodology for caveats and limitations). While the former is to some degree outside of the control of state policymakers, the latter is not. With slow population growth, an aging workforce, and already low unemployment, new workers may be hard to find. The Mass Leads Act includes ongoing funding for MassCEC, which funds extensive workforce development programs to address vital skills in offshore wind, solar, and other green jobs. These programs will continue to be important to underpinning the success of climate initiatives. There is also room to coordinate with other state policies that seek to improve access to education and workforce training by adult learners, the previously incarcerated, immigrants, rural residents, and other disadvantaged groups.

[3] These effects were excluded primarily due to time and data constraints.

Introduction

This report provides an early-stage economic impact analysis of the climatetech portion of the Mass Leads Act. The Healey-Driscoll administration has proposed the Mass Leads Act to address policy objectives in clean energy and climatetech and to provide funding for those objectives over the next 10 years. The Act includes the following funding sources:

- $400 million in bond funding available to MassCEC to support two main categories of capital investment:
    - $200 million facilitate the development of the offshore wind sector, and
    - $200 million for testing, validation, demonstration, and early deployment projects.
- $300 million in funds to establish a climatetech tax incentive program to provide incentives to and stimulate the growth of climatetech companies. The incentive program will be administered by MassCEC in conjunction with the Executive Office of Administration and Finance.
- $300 million over 10 years in operating funds for MassCEC, anticipated to be funded through the state operating budget.
- The Act also extends and makes modifications to the existing offshore wind tax credit program, which totals $350 million over ten years.
- In total, the climatetech policies of the Mass Leads Act represent $1 billion of new investment plus an additional $350 million of expanded offshore wind tax credits over 10 years.

The Mass Leads Act aims to build upon the momentum of climatetech in Massachusetts. According to a recent report from Deloitte, Massachusetts is second in the nation in the number of climatetech companies, being home to eight percent of the nation's total.[4] Fighting well above its weight, in recent years 12 percent of new climatetech companies and 16 percent of funding have occurred in the Commonwealth. Massachusetts has also captured 16 of the country's 77 megadeals since 2021.[5] MassCEC has long been a part of developing and supporting this ecosystem.

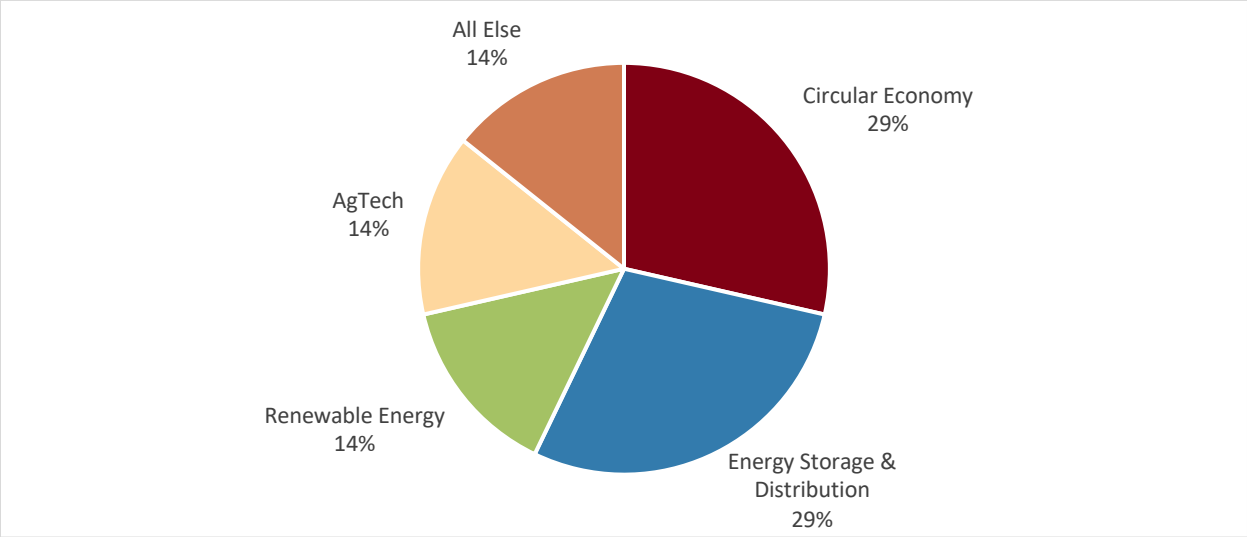
Showing even better performance at the top of industry, a recent report from Time put 11 percent of the 250 top sustainability-focused companies in the United States in Massachusetts, second only to

[4] Deloitte LLP. (2023). *The Geography of Climate Tech.* Retrieved from: https://www2.deloitte.com/content/dam/Deloitte/br/Documents/ofertas-integradas/Deloitte-2023-GT-the-geography-of-climate-tech.pdf.

[5] Deloitte defines a megadeal as those over $100 million.

California with 46 percent of the top companies.[6] However, once adjusted for the size of each state, Massachusetts has proportionally more companies on the list. California has over five times the population and GDP of Massachusetts while only having four times as many companies in the top 250.

Figure 4: Categories of Top Massachusetts-Based ClimateTech Companies



Source: *America's Top Greentech Companies 2024* Note: All Else includes Data & Analytics, Resources, and Carbon Capture & Offset Solutions.

MassCEC's stated mission is to "accelerate the clean energy and climate solution innovation that is critical to meeting the Commonwealth's climate goals, advancing Massachusetts' position as an international climate leader while growing the state's clean energy economy."[7] MassCEC does this primarily through financing and supporting workforce development, early-stage companies and technologies, and pilot projects while partnering with industry, government, and universities to align efforts toward a cleaner energy future.

In this report UMDI estimated the economic impacts of the Mass Leads Act's climatetech investments. Because this bill is in the early stages of the legislative process, this analysis should be interpreted as a "first look" at the potential of the bill rather than a complete accounting of its impacts. Furthermore, it should be interpreted using the other caveats noted in the methodology appendix. Notable among those are that this analysis likely represents less than the full economic impacts of these policy changes while also focusing on the need for the Commonwealth and industry to continue to support ongoing workforce development efforts to ensure that workers with the required skills are available.

[6] Time. (2024). *America's Top Greentech Companies 2024.* Retrieved from: https://time.com/collection/americas-top-greentech-companies-2024/. Accessed on April 18, 2024.

[7] MassCEC. *About MassCEC.* Retrieved from: https://www.masscec.com/about. Accessed on February 27, 2024.

Economic Impact Results

Economic impact analysis is used to find out how a change in the economy creates economic activity beyond itself. These ripple effects are primarily caused by business-to-business transactions and consumer purchases. This analysis also includes the impacts of changes in trade relationships due to changes in the costs of doing business, which stem from the tax credits and incentives proposed in the Mass Leads Act. As is necessary with legislation just beginning the lawmaking process and is doubly true with one seeking to spur innovation, it is unknown what the bill will do with certainty. In the absence of that information, the next best alternative is to look at what the bill will fund, how similar funding has been used in the past, and what the impacts of that spending have been. In short, that is what this study does.

The PI$^+$ economic model used by UMDI for the study takes the direct effects of a change in the economy and uses its understanding of the Massachusetts economy to calculate indirect and induced effects. The direct effects are those that directly relate to the Mass Leads Act and primarily include spending on and spending by various industry sectors. The structure of PI$^+$ includes a description of supply-chain relationships between all the sectors of the economy and the import and export relationships between the regions of the Commonwealth and the rest of the nation and world. Combined, these elements of the model estimate the indirect changes. Additionally, PI$^+$ includes the employment and wage characteristics of each sector and the average consumption patterns of the residents of Massachusetts. These elements yield most of the induced changes, with the remainder comprising business investment and government spending. Therefore, the modeling process begins with the modeler entering the direct changes into the economic impact model, continues through the model's calculation of the indirect and induced effects, and ends with the analysis of the results by the modeler. The results of this process are described in this section of the report.

Impacts of the Mass Leads Act's ClimateTech Policies before Leveraged Funds

Our modeling results show that the activities supported by the Mass Leads Act create positive total economic impacts. Looking only at the Act's spending and before accounting for the additional investments enabled by the Act, it adds $3.3 billion of economic activity, which is $2.46 of economic activity for each $1.00 of spending and tax incentives of the Act. This activity supports 1,440 direct, indirect, and induced jobs in the typical year. Over the analysis's 10-year horizon, these workers earn approximately $2 billion in new income. After accounting for leakages out of the Commonwealth's economy though imports, commuting, and taxation, the Mass Leads Act's first-order effects add $2 billion to the GDP of Massachusetts over 10 years. The economic activity attributable to the bill also has tax ramifications, resulting in $27 million in average annual tax revenues and $266 million in cumulative tax revenues for state and local governments. Of this total, just over half goes to the state, or $150 million.

Table 1: Summary Economic Impacts of the Mass Leads Act ClimateTech Policies before Leveraged Funds, 2025-2034

Economic Activity Summary	Employment (Jobs)	Economic Activity (M)		GDP (M)		Personal Income (M)		State and Local Tax Revenue (M)	
	Annual	Annual	Total	Annual	Total	Annual	Total	Annual	Total
MA	1,440	$330	$3,320	$200	$2,050	$200	$2,030	$27	$266

Source: MassCEC, PI+, UMDI calculations Note: Values rounded to nearest 10 jobs or $10 million, except taxes which are rounded to the nearest $1 million.

The table below disaggregates the total impacts by individual program. The breakdown highlights some notable differences between them. While the Early Deployment Projects and OSW Industry Support programs create the fewest average jobs, they compare favorably on the monetary measures such as total economic activity, GDP, and income despite also receiving $100 million less funding than either the ClimateTech Tax Credits or MassCEC. This difference is primarily caused by the industries that are supported, namely construction and professional, scientific, and technical services, which create relatively more dollars of economic activity per worker. With $350 million, the OSW Tax Credit program receives $50 million more funding than any other program and creates a proportionally large employment and GDP impact. It does this through lowering the costs of doing business for port facilities and various manufacturing sectors, which are other relatively high productivity sectors.

Table 2: Summary Economic Impacts of the Mass Leads Act ClimateTech Policies by Program, 2025-2034

Economic Activity Summary	Employment (Jobs)	Economic Activity (M)		GDP (M)		Personal Income (M)		Tax Revenue (M)	
	Average	Average	Total	Average	Total	Average	Total	Average	Total
Early Deployment Projects	120	$40	$350	$20	$200	$20	$190	$2	$25
OSW Industry Support	170	$50	$500	$30	$300	$20	$200	$3	$26
OSW Tax Credits	590	$120	$1,240	$80	$790	$80	$840	$11	$110
ClimateTech Tax Credits	260	$40	$430	$30	$260	$40	$390	$5	$51
MassCEC	300	$80	$780	$50	$490	$40	$380	$5	$50
Total	1,440	$330	$3,300	$200	$2,040	$200	$2,000	$26	$261

Source: MassCEC, PI+, UMDI calculations Note: Values rounded to nearest 10 jobs or $10 million, except taxes which are rounded to the nearest $1 million. Due to both rounding and modeling methodology, these totals may not match those in

Table 1.

Impacts Including Leveraged Funds

The impacts discussed above capture only the impacts related to the spending of the Act itself. In doing so, they miss a significant part of the economic ripple effects of this investment. The purpose of this bill and those like it is to unlock and enable additional economic activity by providing gap financing that enables early-stage companies and technologies to move forward. As a result, these kinds of policies typically unlock significant additional private and federal investment that will multiply the Act's direct impacts. Over the past decade or so, each dollar of MassCEC funding has induced an additional $5.66 of private and federal investment, which multiplies and enhances the effects of Act's investments.[8] Over 10 years, these additional monies would increase estimated total economic activity to $16.4 billion while adding $10.1 billion to Massachusetts's GDP. Total annual jobs jump to 6,670 and with them total income rises to $9.3 billion over ten years. This new household and business activity will create an estimated $1.2 billion of new state and local tax revenues, with the state capturing over half of that amount.

With leveraged funds, total economic activity increases by $12.22 for each $1.00 of Mass Leads Act investment in climatetech. Put another way, the bill's funding comprises 8% of the total economic impact, meaning that more than $9 of every $10 of the impacts of the bill arise from its economic ripple effects on businesses that do not receiving any money from these programs or additional funding unlocked and enabled by the Mass Leads Act.[9]

Table 3: Summary Economic Impacts of the Mass Leads Act ClimateTech Policies with Leveraged Funds, 2025-2034

Economic Activity Summary	Employment (Jobs)	Economic Activity (M)		GDP (M)		Personal Income (M)		Tax Revenue (M)	
	Annual	Annual	Total	Annual	Total	Annual	Total	Annual	Total
MA	6,670	$1,650	$16,370	$990	$10,110	$920	$9,290	$121	$1,214

Source: MassCEC, PI+, UMDI calculations Note: Values rounded to nearest 10 jobs or $10 million, except taxes which are rounded to the nearest $1 million.

Based on expected patterns of spending, the construction sector is the sector that sees the most jobs. This is because the terms of the new bond issuance require the funds for offshore wind and early deployment projects be spent on capital projects, which have primarily been construction projects in the past. This study allocates 20 percent of the Act's total funding to construction. On top of the increases supported by climatetech-related activity, the construction sector grows along with the rest of the economy because every other sector will also use some construction, whether for new buildings, rehab

[8] MassCEC. (2022). *2022 Massachusetts Clean Energy Industry Report.* Retrieved from: https://www.masscec.com/sites/default/files/documents/2022%20Massachusetts%20Clean%20Energy%20Industry%20Report_Final.pdf. Accessed on February 27, 2024.

[9] These values exclude the economic impacts of the climatetech tax credit and incentive program from the multiplier calculation because much of its effects on business growth are already captured in the analysis.

and redesign, or maintenance and repair. The presence of transportation and warehousing in the top five is for similar reasons. The sector receives funding directly and is a part of economic growth broadly.

The second largest sector by employment impact is education. The jobs for educational services primarily reflect the direct impacts of MassCEC's workforce development programs. As is discussed elsewhere in this report, these programs are crucial to the success of the economic changes envisioned by the Mass Leads Act. The Commonwealth will need more trained and qualified construction workers, technicians, and tradespeople to tackle the specialized jobs within the green economy. Also noteworthy is that educational services create or support about half the total jobs as the construction sector despite only creating a third as much total economic activity. This difference is due to the much higher labor intensity of education compared to construction.

The picture behind the total impacts for professional, scientific, and technical services and manufacturing is more multifaceted than the others. In this analysis, both are targeted through spending and tax credits and incentives. As a result, some jobs are created by the ability of firms to use a grant to purchase goods and services while other jobs are created through the increase in competitiveness gained by firms receiving credit against their taxes. By lowering the tax burden, credits and incentives lower the cost of doing business and increase a firm's ability to compete in the marketplace. This increase in competitiveness translates into an increase in revenues, which then creates more demand for workers.

Table 4: Top Sectors by Share of Total Employment Gains, 2025-2034

Sector	Share of Jobs
Construction	**20%**
Educational services	**10%**
Manufacturing	**10%**
Transportation and warehousing	**9%**
Professional, scientific, and technical services	**8%**
Remaining 18 sectors	**44%**

Source: MassCEC, PI+, UMDI calculations

It is likely that even after adding in the leveraged funds this analysis still undercounts the ultimate impacts that the Commonwealth will receive from the climatetech provisions of the Mass Leads Act. Primarily due to time and data constraints, this analysis excludes the impact related to the ongoing operation of the businesses that receive funding through the Act's bond financing and tax credits. These businesses will have their own employment, wages, revenues, and investments, which, in turn, will have additional indirect and induced economic impacts. As startup companies, these firms are also likely to behave differently than the typical mature firm. As they become established, they will have more upfront investment in structures and equipment. Though some will eventually fail, they will still create economic impacts during their operating lives, with their small size and venture funding providing some insulation from larger economic disruptions.

Appendix: Methodology

Relying primarily on data provided to the research team by MassCEC, UMDI estimated the economic impacts of the Mass Leads Act. The materials reviewed included the clean energy industry report referenced elsewhere, previous solicitations for MassCEC programs, internal program strategy documents, and discussions with staff. The bill assumes 10 years of financial support for climate initiatives, which the research team modeled from 2025 through 2034. Because this bill is in the early stages of the legislative process, this analysis should be interpreted as a "first look" at the potential of the bill rather than a complete accounting of its impacts. Other caveats and limitations are noted at the end of this section.

Economic Impact Methodology

The economic impact analysis relied on assumptions developed in cooperation with MassCEC to assign the spending authorized by the Act to the appropriate sectors of the economy. The research team used the PI$^+$ economic impact model developed by Amherst-based Regional Economic Models, Inc. ("REMI") to translate the Act's provisions into total economic impacts. The PI$^+$ model used for this study is a six-region model of Massachusetts. The region configuration is shown in the table below. For the purposes of this study the regions were aggregated into a single region representing the state as a whole.

Table 5: Region Configuration of PI$^+$ Model

Model Region	County
Metro Boston	Essex
	Middlesex
	Norfolk
	Suffolk
Southeast	Bristol
	Plymouth
Pioneer Valley	Franklin
	Hampden
	Hampshire
Central	Worcester
Berkshires	Berkshire
Cape and Islands	Barnstable
	Dukes
	Nantucket

The Act itself determines the main categories of authorized spending. The task of the research team was breaking down the large categories into the variables needed by the model, such as spending, employment, investment, and so on. The table below shows how the research team and MassCEC staff allocated spending across subcategories.

Table 6: Allocation of Program Funding

Program	Funding ($M)	Construction	Soft Costs	Fit-out and Equipment
Early Deployment Projects	$200	45%	10%	45%

Program	Funding ($M)	Construction	Soft Costs
OSW Industry Support	$200	90%	10%

Program	Funding ($M)	Costs of Business
OSW Tax Credits	$350	100%

Program	Funding ($M)	Costs of Business
ClimateTech Tax Credits	$300	100%

Program	Funding ($M)	Education Services	Public Administration	Production of IP	Prof., Tech., Scientific Services	R&D	Mfg.
MassCEC Funds	$300	50%	6%	7%	5%	22%	11%

Source: MassCEC, UMDI

The next step was to connect each subcategory to one or more variables available in the REMI model. Those connections are described below.

- Construction for Early Deployment Projects → Construction
    - The team chose to use the general construction category because it reflects the average of all construction activities which is well suited to a scenario where the team does not know the combination of commercial, industrial, and infrastructure structures.
- Soft Costs for all scenarios → Professional, Scientific, and Technical Services

- The industry sector covers all consulting, engineering, and design firms, which represent the bulk of soft costs in early projects and offshore wind.

- Fit-out and Equipment for Early Deployment Projects → Investment spending on nonresidential equipment

  - Using the general nonresidential equipment category allows the team to capture the wide range of capital goods purchased by growing companies from computers to machinery without having precise knowledge of the types of firms or products produced.

- OSW Tax Credits and Incentives Program

  - This program modifies an existing tax credit program by making changes to expand the pool of eligible businesses. The primary effect of tax credits is to reduce the costs of doing business to the firms that receive them. The research team split the benefiting sectors into two main groups:

    - Support activities for transportation received half the benefit to represent the prominent presence of port improvements and infrastructure in this program.

    - Various manufacturing sectors received the other half proportional to their existing size in the Commonwealth's economy. The sectors are:

      - Fabricated metal product manufacturing
      - Machinery manufacturing
      - Computer and electronic product manufacturing
      - Electrical equipment, appliance, and component manufacturing
      - Other transportation equipment manufacturing
      - Miscellaneous manufacturing
      - Plastics and rubber products manufacturing

- ClimateTech Tax Credits and Incentives Program

  - While this program is designed to support all manner of climatetech companies doing a wide variety of things, given that these companies are young and in their early stages of development, they are likely to behave more like Professional, Scientific, Technical Services companies before transitioning into other activities as they mature. However, even in their early stages they will have some manufacturing footprint. As a result, 75

percent of the total benefit was applied to the professional services sector and the remaining 25 percent was allocated to the same set of manufacturing sectors and in the same proportions as with the OSW tax credits program.

- MassCEC Funding
    - This program reflects funding to support the ongoing activities of MassCEC. As a result, UMDI and MassCEC chose several subcategories to best capture those activities.
    - Workforce development programs for offshore wind → Education Services
    - MassCEC operating funds → Public administration
    - Research and innovation support for offshore wind → Production of intellectual property
    - Planning, analysis, and engagement for offshore wind → Professional, Scientific, Technical Services
    - Grant money for startup and early-stage companies → Investment in research and development
    - Grant money to support production of climate tech → Manufacturing

The research team calculated impacts to state and local government revenues outside of the model. The Federation of Tax Administrators (FTA) "was organized in 1937 to improve the quality of state tax administration by providing services to state tax authorities and administrators. These services include research and information exchange, training, and intergovernmental and interstate coordination."[10] As part of this mission, FTA provides data on the tax burdens of all states and DC, including revenues as a percentage of personal income. Because personal income is an output of the PI+ model, we could apply the rate for Massachusetts to the results to estimate the total revenues going to the state and all local governments as a result of the economic activities attributable to the proposed Act. The most recent data for state and local totals available from FTA at the time of writing was for 2021. In that year, total state and local tax collections in Massachusetts were equal to 13.1 percent of personal income. The most recent data for the state alone is from 2022 and is 7.4 percent of personal income.

[10] Federation and Tax Administrators. *About FTA.* Retrieved from: https://www.taxadmin.org/about-fta. Accessed on February 27, 2024.

The additional impacts from leveraged funds were calculated using the method below. The impacts of the tax incentives program were removed from the total impacts before the application of the leveraged funds multiplier because granting state tax credits does not necessarily lead to additional private and federal investments in the same way that more direct forms of financial support have done. Thus to avoid overestimation, we removed those impacts before adding the leveraged funds.

> The Act's spending entered into the PI$^+$ model → Results from PI$^+$ model → Results from Tax Incentives Program were subtracted from the total impacts → Remainder Multiplied by 5.66

Caveats and Limitations

Limitations that apply to this analysis generally relate to uncertainty and obstacles.

- This analysis reviews early-stage legislation. The bill may not pass in its current form and any modifications could result in material changes to the assumptions made in this analysis.

- The goal of the Mass Leads Act is to promote innovation, which, by definition, is difficult to predict in advance. As noted elsewhere, this study does not include the economic impacts of the firms created and empowered by the Act. While we cannot know exactly which firms and technologies would result from the Mass Leads Act, we could make assumptions based on past outcomes. Making these assumptions robust and useful would take time and data that was not available for this analysis. Therefore, economic activity beyond some early-stage research and capital investment was excluded. Its addition would likely increase the economic impact of the Mass Leads Act.

- This analysis includes the impacts of the existing offshore wind tax credit and incentive program. Though the proposed modifications will expand eligibility, the Act does not increase funding therefore not all benefits captured here from that program will be net new.

- There is uncertainty around federal energy policy, especially offshore wind. With control of the White House and Congress in play in November and differing levels of support for green energy policies between the two main parties, it is unclear how long the current policy and financial support for renewable energy and green tech will last. Given the great expense and time required to permit, site, and develop offshore wind farms, policy predictability and federal support will be crucial for investors to bet on largescale energy infrastructure.[11] For example, Vineyard Wind required nearly a decade to go from leasing a site to the first operational turbine during which time any number of federal, state, and local policy and permitting challenges could

[11] For example, this factsheet from Biden-Harris administration highlights the role that the federal government plays in supporting offshore wind. The White House. (September 21, 2023). *FACT SHEET: Biden-Harris Administration Advances Offshore Wind Transmission, Strengthens Regional Supply Chain Buildout, and Drives Innovation.* Retrieved from: https://www.whitehouse.gov/briefing-room/statements-releases/2023/09/21/fact-sheet-biden-harris-administration-advances-offshore-wind-transmission-strengthens-regional-supply-chain-buildout-and-drives-innovation/. Accessed on March 8, 2024.

have derailed the project.[12] Given that many of the impacts in this analysis presuppose that the offshore wind industry will continue to develop, any curtailment of that trajectory will change these results.

- With the state's slow-growing population, aging workforce, and already low unemployment, new workers may be hard to find. Unemployment remains in the low three percent range, the Commonwealth's median age is 40 and increasing, and total employment today is hardly different than 2018.[13] UMDI's Population Estimated Program is also projecting little population growth in Massachusetts.[14] These factors combine to create tight labor market conditions that could form a barrier to future economic growth. Any constraints stemming from the size of the workforce would increase the timeframe and costs of new developments. The Mass Leads Act includes ongoing funding for MassCEC, which funds extensive workforce development programs to address vital skills in offshore wind, solar, and other green jobs. These programs will continue to be important to underpinning the success of climate initiatives. However, these programs require there to be available and willing workers. Some of those workers can be found by coordinating with other state policies that seek to improve access to education by adult learners, the previously incarcerated, immigrants, rural residents, and other disadvantaged groups, who collectively have higher unemployment rates than the state average.

[12] Vineyard Wind. *Permitting.* Retrieved from: https://www.vineyardwind.com/vw1-permitting. Accessed on March 8, 2024.

[13] See the *Place Explorer* from the Data Commons website for an easy-to-navigate set of consolidated public-source data: https://datacommons.org/place/geoId/25.

[14] UMass Donahue Institute. *Massachusetts Populations Projections.* Retrieved from: https://donahue.umass.edu/business-groups/economic-public-policy-research/massachusetts-population-estimates-program/population-projections. Accessed on March 8, 2024.

Appendix: Glossary of Economic Impact Terms

Employment: Employment is a count of jobs, not people, by place of work. It counts all jobs with the same weight regardless of whether the position is full-time or part-time or the labor of a self-employed proprietor.

Additionally, jobs are counted as **job-years**, which are equivalent to one job lasting for one year. This is a similar concept to "person-hours." Jobs often carry over from year to year and therefore the jobs in one year include many of the same jobs as in the previous year. For example, if a new business opens with 10 employees, then the host community of that business will have 10 more jobs than it would have had in every future year that the company maintains its workforce. For example, over 5 years, the business will have created 50 job-years (10 jobs at the company x 5 years = 50 job-years), though it is possible that it is not the same 10 people who are working there over time. When reviewing changes in employment across multiple years, knowledge of the concept of job-years is vital to proper interpretation. As shown in the example above, 50 job-years is not equivalent to 50 people with jobs or even 50 job slots.

Output: Output is the total economic value of production, sales, or business revenues, whether final (i.e., purchased by the end user) or intermediate (used by another business to produce its own output). It includes the value of inputs to production, wages paid to employees, capital expenses, taxes, and profit. It is useful as an indicator of business activity, but it should not be construed as net new economic activity.

Personal Income: Personal income is income and benefits from all sources (e.g., wages and salaries, government transfers, property income, etc.) earned by all persons living in an area. It excludes the income earned by non-resident workers who commute into an area, but it includes the income of residents who commute out.

Value Added: Value added is the value of all final goods and services created in an economy. It represents new economic activity and is also known as gross product or net economic impact. It differs from output by the value of inputs to production. Value added provides a useful summary of the economy, which is why all nations and US states report their economic growth in this way, calling it either gross domestic product or gross state product as appropriate. Its usefulness derives from the elimination of the double-counting inherent in output, which stems from the inclusion of inputs. An example of the double-counting of inputs can be found and simplified in the process of making and selling a loaf of bread. A farmer sells wheat to a mill, which then sells flour to a baker, who then sells bread to the final customer. The sale price of the bread includes the cost of all necessary inputs including growing the wheat, milling the flour, and baking the bread. Value added counts only the sale price of the bread to the final consumer, which is the net new value created in the economy. On the other hand, output counts the revenues earned by every business in the supply chain, which means that the value of the wheat and flour are counted more than once.