THE CENTER FOR
CLIMATE STRATEGIES

HELPING PEOPLE WORK TOGETHER TO BUILD A BETTER SAFER AND MORE JUST WORLD

MACROECONOMIC AND FISCAL IMPACTS OF EXPANDED UTILITY-SCALE SOLAR GENERATION IN MARYLAND

The Center for Climate Strategies (CCS) is a 501c3 nonprofit organization located in Washington, DC with global partners.

1850 M Street, NW, Suite 840, Washington, DC 20036
(202) 540-9121 office, (202) 540-9122 fax
www.climatestrategies.us

Contents

I. EXECUTIVE SUMMARY 3
II. BACKGROUND 5
III. METHODOLOGY 8
IV. RESULTS 12
Financial and Fiscal Impacts 12
Macroeconomic Impacts 15
Deployment Scenario 15
V. CONCLUSIONS 19

I. EXECUTIVE SUMMARY

This report provides the details of a macroeconomic and fiscal analysis of the impacts of increased deployment of utility-scale solar energy in the State of Maryland. This analysis was conducted by the Center for Climate Strategies (CCS), an independent, expert non-profit organization that provides technical assistance and capacity building to governments and stakeholders to integrate climate action planning, economic recovery, and social opportunity. In the United States (US), utility-scale solar projects are being deployed in record numbers and driving significant economic growth, particularly in the Mid-Atlantic region,[i] but are lagging in some states and localities. This study was undertaken to understand the economic and fiscal impacts of accelerating the construction and operation of large solar projects within the state of Maryland.

*Accelerated deployment of utility-scale solar to help meet in-state RPS demand is expected to increase new direct local investment in Maryland by up to **$442 million** by 2030.*

Policy measures passed into law in Maryland in 2018 significantly increase in-state demand for solar, rising to an estimated 5,000 megawatts (MW) by 2028.[ii] Despite this, the pace of Maryland solar additions in Maryland has declined significantly, from nearly 137 MWdc added in 2018 to only 122 MWdc of additions in 2019, and YTD 2020 additions are behind 2019 rates through the same period.[iii] Meanwhile, despite over 2,000 MW of solar under development in the PJM interconnection queue[iv] at the time of this writing, the pace of utility-scale solar permits granted in the state have declined from a total of eight licenses granted in 2018 to only two granted in 2019 and one granted through October of 2020.[v] Further, the average time of CPCN decisions have increased from approximately nine months through 2017 to between 1.5 years and indefinitely delayed in the period starting 2018 through the present date. This pace is inadequate to meet the state's RPS demand targets.

Specifically, CCS examined the potential fiscal and macroeconomic impacts of a policy change which would expedite the permitting process for new utility-scale solar projects in Maryland. The Maryland Public Service Commission (PSC) has the authority to make siting decisions for utility-scale solar projects by issuing a Certificate for Public Convenience and Necessity (CPCN). The proposed policy scenario examined by CCS, or "CPCN Process Policy Option (CPPO)," represents a series of potential changes under consideration by policymakers and the PSC that would streamline the current CPCN process, particularly in the context of the Maryland Court of Appeal's Perennial ruling which directly addressed the challenges with the current "dual permitting" regime between the state CPCN process and separate local level review of utility-scale solar projects. Proposed legislation to streamline Maryland's solar permitting process was introduced in Maryland's 2020 legislative session (SB 741/HB 1390), which was cut short due to the Covid-19 pandemic. Similar legislation is expected to be introduced in the 2021 legislative session. Additionally, in September of 2020 the PSC announced a rulemaking to amend regulations that would potentially streamline the state solar permitting process. Streamlining the permitting process in Maryland as assumed under the CPPO scenario would encourage new utility-scale solar project implementation within the state on an accelerated schedule.

To conduct its analysis, CCS evaluated two deployment scenarios. First, a "baseline" scenario was established of 768 MW, representing the total amount of new utility-scale solar expected to be constructed in Maryland by 2030 under existing policies. Second, a "CPPO Scenario" was modeled in which 2.4 Gigawatts (GW) of utility-scale solar is deployed in Maryland by 2030 as a result of CPPO implementation. This scenario assumes significant streamlining of the solar CPCN process that harmonizes local input into the process, allowing for efficient and timely processing of applications and final siting decisions. In this scenario, utility-scale solar is assumed to account for approximately 50% of the solar generation mandated by the Maryland Renewable Portfolio Standard (RPS) solar carve-out by 2028. CCS estimated the financial flows (direct economic impacts) from these projects, including new project financing, workforce investment, impacts on local supply chains, imports/exports and tax revenues from these projects. The financial flows served as inputs to the CCS "Macroeconomic Indicator Tool," which provides a visualization of impacts on macroeconomic conditions (Gross State Product (GSP) and jobs) as they are influenced by new policy design and financial spending or savings in the sector.

Key findings include that policy induced deployment of utility-scale solar will significantly increase new net sources of investment and associated tax revenue coming into the state. The CPPO scenario is expected to increase new net direct local investment in Maryland by **$441,883,693 over the next ten years with $77,613,133 in additional tax revenue** for state and local governments.

Table 1. Project Investment, Local Spending and Tax Revenue

	Baseline Scenario	CPPO Scenario	Net Impact
Net Project Investment	$297,610,932	$2,041,793,323	$1,744,182,391
Net Local Spending	$73,323,718	$515,207,411	$441,883,693
Net State and Local Tax	$11,912,329	$89,525,462	$77,613,133

Expansion of employment is also expected. The CPPO is expected to stimulate **an additional $341,138,875 in new wages** between 2020 and 2030. Gains in employment are primarily found in the construction sector during the first year of solar project implementation; however, significant employment benefits are also found during the project operational phase. This investment is particularly impactful in light of COVID-19. As a result of the pandemic, Maryland is estimated to have lost at least 3,000 solar energy jobs[vi] and 13,000 across the clean energy sector.[vii] Nationally, solar jobs are expected to drop by 38% from pre-COVID levels, and total installations will decrease by 18% or more.[viii] Efforts to expand utility-scale solar in Maryland can help to offset these losses and **produce over 1,000 additional jobs by 2023.**

Table 2. Net Labor Wages

	Baseline Scenario	CPPO Scenario	Net Impact
Construction Phase Labor Wages	$51,871,710	$355,871,710	$304,000,000
Operational Phase Labor Wages	$4,800,865	$41,939,740	$37,138,875
Total New Labor Wages	**$56,672,575**	**$397,811,450**	**$341,138,875**

These improvements are induced through a combination of structural improvements to the state economy and include a combination of positive, neutral, and negative effects, with a combined positive effect that is high to medium in comparison to the Business As Usual (BAU) power generation scenario. These impacts include: 1) no significant impact on energy costs or prices, and no associated macroeconomic impact; 2) no change in energy use and no associated macroeconomic impact; 3) significant shift to local production of energy and reduced energy imports with high, positive macroeconomic impact; 4) shift to the import of supply chain components, with low, negative macroeconomic impacts; 5) large shifts to employment-intensive energy generation with high, positive macroeconomic impacts; and 6) high levels of additional, new investment flowing into the state from external sources to support new generation, with high, positive macroeconomic impacts. A visualization of impacts on macroeconomic conditions (GSP and jobs) from this analysis are shown in Figure 1.

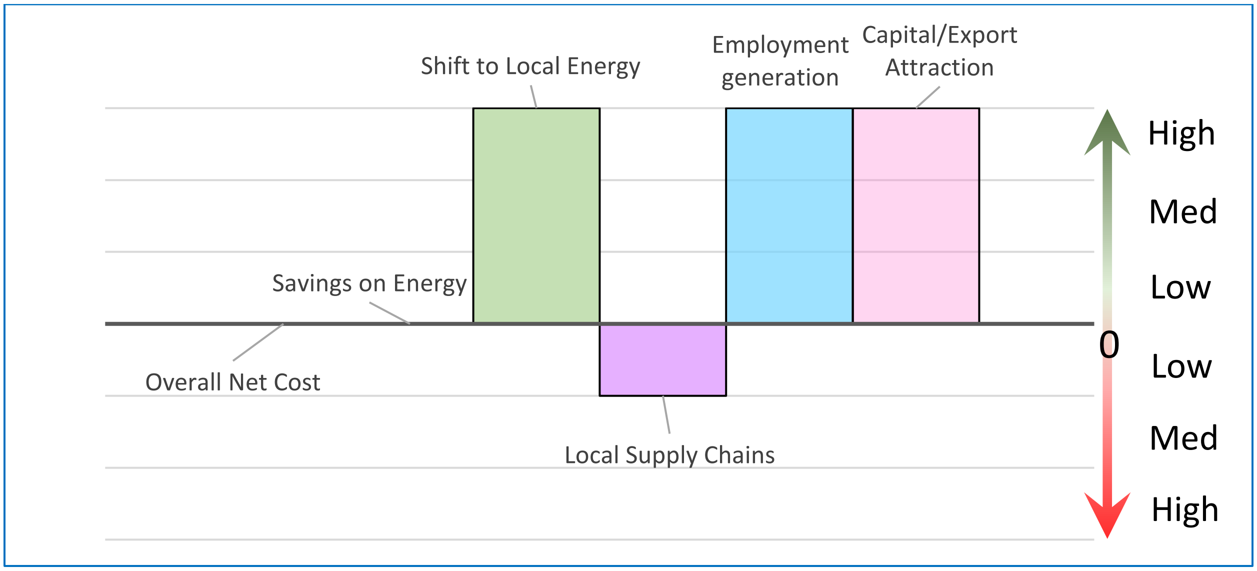


Figure 1. Macroeconomic Indicator Tool Results

Overall, CSS found that **expansion of economic growth is expected as a result of increased utility-scale solar deployment in the State of Maryland.** The CPPO is expected to stimulate, rather than suppress, economic activity. **It offers a significant positive influence on job creation, increased investment capital flowing into the state from external sources and increased local production of energy that would otherwise be imported.** The option will also encourage significant investment in labor-intense activities, particularly construction, which is associated with economy-wide employment growth, while also reducing net imports of electricity and increasing adoption of advanced technologies, thus driving economic activity to key local sectors.

II. BACKGROUND

Electricity demand in Maryland and throughout the US has historically been met through large, centralized generation resources, particularly from coal, natural gas, and nuclear power. However, due to increased domestic production of natural gas and rapidly falling costs for renewables, the domestic generation mix is undergoing a rapid transformation. Coal accounted for over 50% of total domestic electricity generation in 2000 but supplied only 23% in 2019.[ix] During that same time, natural gas grew from 16% to 38% of all generation, and sources of renewable energy have grown to supply 17% of all domestic electricity.

There are currently 14,272 MW of generation capacity within the state of Maryland, with over a third coming from the Calvert Cliffs Nuclear Power Plant. In 2018, Maryland consumed over 62,000,000 MWh of electricity, with 37.7% generated by nuclear power, 24.4% from natural gas, 27% from coal and 10.1%

from renewable energy[x] (Figure 2). Maryland is a net importer of energy, with 47%[xi] of its electricity coming from sources outside of the state. It sits within the territory of the PJM Interconnection (PJM) Regional Transmission Organization (RTO), which operates the largest power pool in the US, controlling the electric grid for 65 million people in 13 eastern states plus Washington, DC. PJM coordinates the flow of electricity between states, allowing blocks of electricity to be sold in a competitive wholesale market to utilities across the service territory.

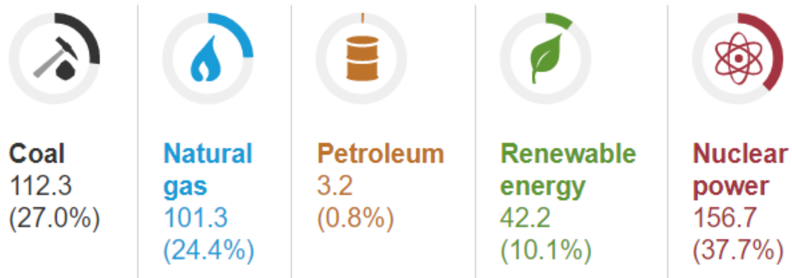


Figure 2. 2018 Maryland Electric Power Consumption by Source[xii]

Overall electricity demand in the Maryland is expected to remain flat over the next ten years[xiii], however total in-state generation capacity has dropped by one-third since 2007, and an additional 1,300 MW of in-state coal generation is expected to be retired by 2021, creating an increased demand for electricity imported from PJM. This has created a large opportunity for new generation to come online in Maryland to serve the power needs of its customers and create new economic growth and employment.

The average price of solar photovoltaics (PV) has dropped by 75% over the past decade,[xiv] and as a result, large centralized solar generation and distributed rooftop solar has played an increasingly significant role in Maryland. There are currently 324 MW of utility-scale solar installations in the state, producing approximately 465,500 MWh of generation annually, or about 1% of all electricity sourced in Maryland. Solar generation currently meets 4.15% of total energy demand, with majority coming from energy imported from PJM. As the demand for renewables increases, solar energy is positioned to fill the gap left by dwindling in-state capacity and rising demand for renewables, but this requires focused regulatory improvements and accelerated investment.

In 2019 the Maryland General Assembly passed SB516, the Clean Energy Jobs Act (CEJA), which mandates that 50% of all electricity consumed in Maryland to be generated from renewable resources by 2030, otherwise known as the Renewable Portfolio Standard (RPS). As part of CEJA, solar generation is mandated to account for 14.5% of all generation by 2028, increasing from 1.95% in 2019, 6.0% in 2020,[xv] 7.5% in 2021 and increasing by 1% annually thereafter (Figure 3). Utilities within the state meet this target through the purchase of Solar Renewable Energy Credits (SRECs), which are allocated to solar energy producers. SRECS are sold through the state's SREC market and serve as a financial incentive for the development of new solar within the state, providing an additional revenue stream to solar owners. Bid prices for SRECs fell to below $10 per megawatt-hour (MWh) in 2018 and remained low into early 2019, partially leading to the overall drop in solar projects. However, as a result of increased demand driven by the passage of CEJA, prices have risen $75/MWh, encouraging greater deployment of solar generation moving forward.

In addition to SRECs, the federal Investment Tax Credit (ITC) has provided a strong incentive to encourage the solar energy sector. The ITC allows owners of residential and commercial (including utility-scale) solar generation to receive an income tax credit equal to 30% of the cost of the PV system the year it becomes operational. Projects that began construction by 2019 were eligible to receive the full 30% credit, with projects beginning in 2020 receiving 26%, 2021 receiving 22% and 2022 receiving 10%. There is currently a Bill on the floor of the US House of Representatives to extend this credit through 2025, however its passage has yet to be determined. As a result, there is a significant push to gain approval for new solar projects throughout the U.S. as soon as possible as developers look to obtain this incentive.

Compliance Year	Tier 1 Non-Solar	Tier 1 Solar
2018	14.3%	1.5%
Pre-SB516 2019[16]	18.45%	1.95%
Post-SB516 2019[17]	15.2%	5.5%
2020	22.0%	6.0%
2021	21.93%	7.5%
2022	23.24%	8.5%
2023	23.87%	9.5%
2024	25.19%	10.5%
2025	26.49%	11.5%
2026	28.01%	12.5%
2027	30.02%	13.5%
2028	31.04%	14.5%
2029	33.06%	14.5%
2030+	33.56% - 34.9%	14.5%

Figure 3. Maryland RPS Targets

Based on the value of these incentives, falling technology costs and overall increased demand for renewables, it is expected that well over 3,000 MW of additional utility-scale solar[xvi] will come online in the PJM service territory by 2023, with a large portion deployed in Virginia (1,817 MW) and North Carolina (634 MW). Maryland is currently forecasted to deploy just 333 MW through 2023, and in the modeled baseline scenario, 768 MW total by 2030. To meet its RPS target through in-state generation, Maryland would need to deploy an additional of 500 MW of solar generation annually to deliver over 9,000,000 MWh of solar generation by 2028 as required. Despite its aggressive RPS targets, Maryland is currently positioned to rely heavily on energy imports for the vast amount of its required solar generation, and significant barriers exist to accelerating further deployment in state.

For new utility-scale solar to come online, it first must be awarded an interconnection agreement by PJM, which states that the power grid can effectively absorb and distribute new generation into the system. There are currently 2200 MW of solar generation in the PJM queue at various stages of development which could potentially come online in Maryland by 2023. However, a large portion of these projects will be unable to gain approval due to grid constraints, competition within the service territory and permitting challenges or delays.

Upon approval from PJM, projects must then gain approval within the state of Maryland. The Maryland PSC has the sole authority to make siting decisions for utility-scale solar projects by issuing a CPCN. The PSC is mandated to take local concerns into consideration and ensure the solar arrays are ultimately in the public interest, directing the Department of Natural Resources (DNR)'s Power Plant Research Program (PPRP) with issuing environmental reviews and recommending permitting conditions for the PSC's consideration. The PPRP currently requires an additional application process at the county-level as a condition of recommending approval and providing environmental reports and draft permitting conditions to the PSC, and also requires the PSC to give a local jurisdiction's recommendation significant weight when making a decision to approve or deny a CPCN permit. Despite the 2018 Maryland Court of Appeal's Perennial ruling that the PSC's siting authority preempts local zoning and describing the role of local governments as *participants* in the CPCN process, Maryland's PPRP continues to require that CPCN applicants first go through a separate local process prior to processing CPCN applications or receiving CPCN approvals.

As a result, the MD CPCN process is one of the lengthiest approval processes in the US and creates a competitive disadvantage for Maryland solar developers in the region. Under this "dual permitting" process, projects have languished indefinitely without a final review from PPRP or have been denied by the PSC due to the lack of environmental reports and permitting conditions that PPRP has withheld from the PSC. While Maryland has over 2,000 MW of projects in the PJM queue, Virginia currently has over 23,000 MW and Pennsylvania over 11,000 MW of solar at various stages of development.[xvii]

A coalition of Maryland clean energy constituents has recommended that the Maryland General Assembly and the PSC undertake a review of the existing CPCN process and the ability for approval to be expedited in order to increase solar deployment within the state. CCS has undertaken this study to review the potential for favorable macroeconomic impacts through accelerated development of utility-scale solar in Maryland, and to understand the benefits and drawbacks of increasing the rate of solar deployment in the state through passage of such a policy, referred to in this report as the "CPCN Process Policy Option (CPPO)." The goal of this study is to review the potential direct economic costs and benefits associated with expanded utility-scale solar generation in the state resulting from CPPO, and to analyze the potential for macroeconomic improvements to the Maryland economy, including stimulus to net economic growth and employment.

III. METHODOLOGY

To conduct its analysis, CCS used its "Macroeconomic Indicator Tool." This indicator tool allows visualization of expected impacts on macroeconomic conditions (GSP and jobs), as they are influenced by key policy implementation design parameters and financial flows associated with the implementation of specific sector level policies and measures in all economic sectors (broadly including all energy and resources sectors). It does so through rating and scaling the influence of six key indicators that drive the direction and scale of macroeconomic impacts. The use of these empirically based indicators to assess a policy or measure provides clarity on the causes and effects of macroeconomic change from specific policy actions, a framework for understanding important types of macroeconomic impacts of such actions, and a tool for mapping the potential for such an action to impact the macroeconomy based on the changes in financial spending and savings that it creates.

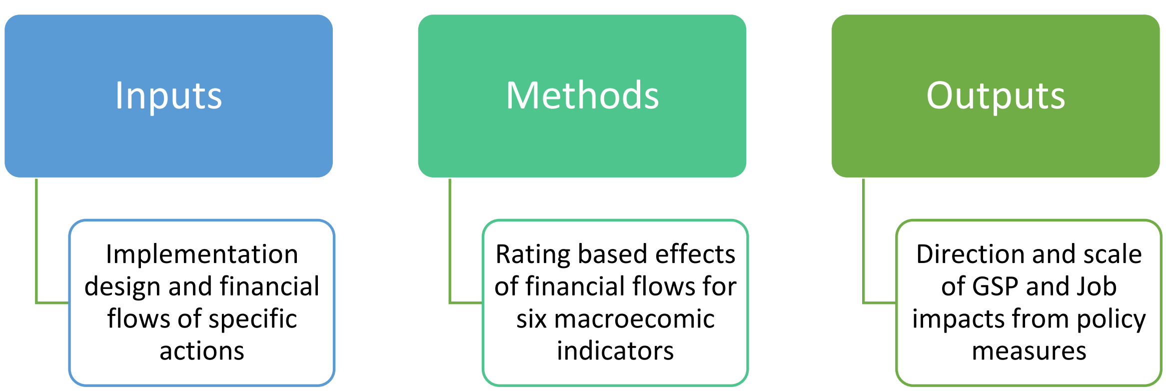


Figure 4. Macroeconomic Indicator Tool Functionality

These six key indicators were developed through generally accepted procedures for economic and statistical analysis, including multivariate regression analysis, of the results of advanced macroeconomic modeling (using the widely applied REMI model) to analyze a wide range of low carbon policies and measures in all sectors contained in several US state climate action plans conducted by CCS. A detailed report of this study is available at www.climatestrategies.us/library/library/download/905.

The six indicators associated with macroeconomic gains from implementation of low carbon policy measures include:

1. Shifts to technologies and practices with lower net implementation costs than those in the BAU scenario
2. Shifts that generate overall savings on energy spending
3. Shifts toward greater use of locally produced energy
4. Shifts to local supply chains
5. Shifts to activities that require greater spending on labor
6. Shifts to greater use of external investment and/or greater net exports

The GSP and employment effects associated with these indicators result from shifts or changes in the pattern of spending (expenses) and savings and revenues (income) caused by adoption of new policy measures, as estimated by macroeconomic modeling using the REMI model. The REMI Policy Insight Plus model used by CCS for state climate action analysis estimates the indirect (or multiplier) effects of spending and savings patterns across 170 sectors and then evaluates equilibrium based changes in these effects based on a specified policy intervention. Using REMI based macro indicators can provide insight on the direction and scale an individual policy action can impact to the broader economy based on statistical analysis of empirical modeling and a clear structural analysis of macroeconomic impacts that can be expected. This macro tool is not designed to provide precise the same point estimates of GSP and job impacts as the REMI model, and it does not substitute for macroeconomic modeling with a greater level of detail. But it does provide critical insight, direction, scale of structural macroeconomic effects.

Indirect macroeconomic assessment is distinct from direct microeconomic (and financial) analysis of options, because its purpose is to identify and estimate the *indirect* effects of proposed policy action-induced changes on the economy as a whole, as well as impacts on different economic sectors, groups of people, and business types and sizes. Typical results from such analyses estimate changes in economy-wide and sector-level employment (jobs), GSP (or economic growth), personal income, personal consumption expenditures, changes in price and productivity, and even changes in population as people respond to changes in income, cost of living, and the availability of work. These and other outputs of macroeconomic analysis can also offer insights on the impacts on competitiveness of each individual proposed policy action. Assessments of these impacts can also be produced for aggregate collections of proposed actions, both within and across sectors.

This assessment can be done through varying degrees of quantification. A fully detailed quantitative approach yielding point estimates requires a specialized analytical tool that empirically describes the operation of the economy in question (such as through spending patterns), the interaction of its various sectors internally and with the outside world, and the economy's unique profile of key equilibria, such as supply, demand and prices. Empirically derived indicators (or factors) can substitute, albeit more generally, for this more detailed approach when based on explicit policy action design parameters and estimated financial flows associated with implementation. Based on the policy action design and financial flows identified in the direct impact analysis of the deployment scenario policy actions for solar power, a factor-based macroeconomic assessment of the proposed solar power policy actions was conducted to scope potential employment and economic growth impacts.[xviii]

The positive presence (upward effect) of any of the six factors described above as a consequence of policy action implementation is positively associated with growth in GSP, with the exception of the fifth factor which is statistically associated with growth in economy-wide employment rather than GSP. The negative presence (downward effect) of any of these factors, however, is identified as a cause for concern regarding the option's potential impact on the economy if implemented as designed. For example, an option that envisions additional or substitute spending on a labor-intensive activity like installation of equipment would be positively associated with the "job creation" factor, while an option that achieved savings through reducing an existing labor-intense activity would be negatively associated with the same factor, and that would be identified as a cause for concern. Each of the six factors is independent; a policy option projected to have multiple streams of spending and saving may have multiple, distinct influences on the economy and each of the six factors are independent such that a given option may have multiple macroeconomic effects. Factors may also be interactive.

The scale of a specific financial flow estimated in the microeconomic analysis can provide a general scale of positive or negative macroeconomic impact within the sector or subsector that it drives, but the total amount of money involved is still informative as to the likely scale of economic stimulus or risk that financial flow may pose. As a result, based on all financial flows in the microeconomic impact analyses of two solar deployment scenarios, each financial flow was assigned to the top ("high") third, middle ("medium") third, or bottom ("low") third. The size of the impact related to each factor is shown through the size of the column as either high, medium or low, and the positive or negative incidence of each factor is shown by the direction (upward or downward) of the column from the midpoint.

By assessing each cost and savings component identified in the direct (microeconomic) impacts analysis for the presence of one or more of these six factors, and identifying whether the cost or savings is positively or negatively associated with the identified factor, this factor based rating process develops a strategic, multi-faceted evaluation of each policy action scenario likely impact on the economy for design and implementation decisions. All figures presented are net impacts on the Maryland economy as a result of increased deployment of utility-scale solar generation beyond existed forecasts.

For this analysis, the ratings for high, medium or low impacts for GSP and employment was established as proportionate to sector level spending effects based on financial flows estimated over the time period 2020-2030 (discussed further below). The threshold for impact was set as follows:

- High: Cumulative financial impact is (+/-) $100,000,000 or more
- Medium: Cumulative financial impact is between (+/-) $10,000,000 and $100,000,000
- Low: Cumulative financial impact is (+/-) $10,000,000 or less

Net impacts are expressed for each of the six macroeconomic indicators. While a microeconomic input may have impact upon more than one indicator, each financial flow is limited to a single area to avoid double counting and be conservative in this analysis.

CCS reviewed numerous studies, reports, data sets and other resources related to the energy sector in Maryland and nationally to develop a microeconomic impact assessment that would serve as inputs to the macro indicator tool. While numerous reports were used in this analysis, CCS primarily relied upon two existing studies:

1) "Benefits and Costs of Utility-scale and Behind the Meter Solar Resources in Maryland," prepared by Daymark Energy Advisors on behalf of the Maryland PSC in 2018

2) "Economic Impacts of the Cherrywood Solar Farm on Caroline County and the State of Maryland," produced by the University of Baltimore in 2018

Using these reports as a baseline, CCS estimated financial flows associated with utility-scale solar generation deployment in Maryland. These estimates were compared against national level solar technology reports, including "U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018," published by the National Renewable Energy Laboratory (NREL) and the NREL "2020 Annual Technology Baseline." Using these figures in conjunction with historic and forecasted deployment of solar within the state of Maryland, PJM, and nationally, CCS took a conservative approach in developing a baseline (or "BAU") scenario for utility-scale solar deployment in Maryland through 2030. This baseline scenario is the total new utility-scale solar that will be deployed in Maryland through 2030 if no changes are made to existing policies and the current pace of utility-scale solar permitting and additions continues through 2030 and incorporates those currently permitted projects that are expected to be constructed and brought online over the next 24 months. In this BAU case, 768 MW of new utility-scale solar are expected to be deployed within Maryland between 2020 and 2030, as shown in can be found in Table 3. A deployment scenario was then for developed for comparison against the baseline to quantify the potential impact of CPPO. In this scenario, 2,367 MW of new utility-scale solar is deployed by 2030. This level of deployment would enable utility-scale solar to account for 50% of the total solar generation mandated by the MD RPS by 2028.

Table 3. Solar Deployment Scenarios

Year	Baseline Scenario (MW)	CPPO Scenario (MW)
2020	39.9	39.9
2021	40	40
2022	188	288
2023	100	400
2024	100	400
2025	50	200
2026	50	200
2027	50	200
2028	50	200
2029	50	200
2030	50	200
Total MW	**768**	**2368**

Disaggregated financial flows (costs and savings) by year associated deployment scenario was then compared against the modeled BAU scenario. This was done to determine the **net** effect of CPPO upon each of the microeconomic variables (discussed below), and their impacts upon each of the six macroeconomic indicators. The result is a visualization of the expected impact that a new policy which increases the deployment of utility-scale solar in the state of Maryland will have.

This study limited its scope to analysis of direct microeconomic impacts associated with deployment of new utility-scale solar generation. These financial flows are specific to investment dollars that flow from and into the state as a result of specific solar project development. Therefore, expenses associated with project materials, construction labor, or taxes have been analyzed; however, revenue from energy sales or indirect job creation have not been included. Numerous additional benefits and financial flows are associated with utility-scale solar generation including emissions reductions and associated human health improvements, reduced energy costs, energy sales and avoided price volatility of fossil fuels. These and other factors have not been factored into this analysis.

The financial flows analyzed in this study includes:

- Local expenditures on materials
- Expenditures on imported goods
- Purchases and leases of land
- Project overhead and soft costs
- State and Local Tax revenue during the first year of the projects
- Ongoing annual State and Local tax revenue generated by the projects
- Displaced land productivity
- Displaced direct and induced labor
- Construction labor costs
- Operations and Maintenance (O&M) costs

Deployment scenarios were modeled for the period 2020-2030, with financial flows aggregated to assess impacts on the Maryland economy. It should be noted that utility-scale solar projects have an expected operational life of 20 years or more. As a result, the projects reviewed in this analysis will continue to have significant economic benefit in Maryland past 2030. The scope of this study was limited in focus to the near-term impacts of increased deployment of solar and took a conservative approach, and therefore did not include benefits beyond 2030 as part of the impact assessment.

Given the size of the PJM market and the planned decomissioning of existing in-state generation, it is unlikely that growth in the Maryland utility-scale solar sector will have specific impacts on energy prices in the state, nor will it directly lead to any additional curtailment of existing in-state generation resources. As a result, the analysis will look at productivity from solar generation, as well as existing productivity from lands that could instead be used for new solar generation, and associated economic development. Any potential reduction in demand from natural gas or coal generation, and associated economic impact, is expected to be experienced entirely outside of the state, if at all.

IV. RESULTS

Financial and Fiscal Impacts

As noted, financial impacts of policy implementation, or direct microeconomic impacts, serve as inputs to macroeconomic assessment and provide important fiscal effects such as increased tax revenue for state and local governments. Results of this assessment are broken into the following categories:

1) Total Project Costs – This represents the estimated total net investment associated with utility-scale solar deployment as a result of CPPO. An aggregated total project cost figure is provided for years 2020-2030, along with total expected direct local spending, labor costs and total expected state and local tax revenue (Table 4).
2) Construction Phase Spending – This represents the total investment in construction, labor and year 1 operations for new utility-scale solar projects as a result of CPPO for years 2020-2030, as well as associated state and local tax revenue (Table 5).
3) Operational Phase Spending – This represents the total project costs for operation and maintenance of new utility-scale solar projects as a result of CPPO for years 2020-2030, as well as associated state and local tax revenue (Table 6).
4) Lost Economic Productivity – This represents the total estimated economic productivity that is expected to be lost due to conversion of agricultural lands to solar farms for years 2020-2030 (Table 7).
5) Net Fiscal Impact – This represents the total estimated tax revenue that is expected to be received from state and local governments result of CPPO for years 2020-2030 (Table 8).

For each of these measures, the scenario was evaluated for the potential impact of implementation of CPPO. For each, as a first step, financial flows associated with CPPO were assessed on an annualized basis and then aggregated to measure in total dollars of new expenditures within the State of Maryland, as well as to and from sources outside of the state, for construction and operation of new utility-scale solar projects. As stated above, financial flows were compared against a baseline solar deployment forecast, resulting in estimations of net project impacts. All figures, tables and other data presented below are shown as total additional dollars that will be spent for construction and operation of new utility-scale solar projects in Maryland as a result of CPPO.

Table 4 presents aggregated **net** spending for utility-scale solar projects through 2030 for the two modeled scenarios, including detail regarding total expected dollars spent directly within the state, with associated tax revenue to be collected by state and local governments during project construction and operation. It is expected that the majority of project investment will originate from funding sources outside of Maryland, resulting in new local investment. The majority of solar component materials (modules, inverters, etc.) will be imported from outside of the state, while Balance of System (BOS) electrical components such as wiring will be sourced locally.

Table 4. Total Project Costs, 2020-2030

	Baseline Scenario	CPPO Scenario	Net Impact
Net Project Costs	$297,610,932	$2,041,793,323	$1,744,182,391
Net Local Spending	$73,323,718	$515,207,411	$441,883,693
Net State and Local Tax	$11,912,329	$89,525,462	$77,613,133

Table 5 identifies the expected net direct local spending and tax revenue through 2030 for the construction and year one operation of new utility-scale solar projects as a result of CPPO. Taking a conservative estimate, it was assumed that 50% of land will be purchased and 50% of the land will be leased on an annual basis. Estimates are based only upon purchase/lease of existing agricultural lands; this study has excluded the use of existing forests, brownfields or other potential sites to provide a high estimate of any lost productivity from current land use, which is represented in Table 6. It was assumed that utility-scale solar will require 7.5 acres of land per MW installed.

Table 5. Construction Phase Net Spending through 2030

	Baseline Scenario	CPPO Scenario	Net Impact
Construction Phase Labor	$51,871,710	$355,871,710	$304,000,000
Land Purchases/Year 1 Leases	$10,596,691	$57,631,711	$47,035,020
Construction Phase Tax Revenue	$7,753,124	$53,191,179	$45,438,055

Table 6 identifies the expected net local spending and tax revenue through 2030 for operational phase of utility-scale solar projects in the state. As noted, it was assumed that 50% of the land will be leased, resulting in annual payments to landowners in Maryland. All land was assumed to be agriculturally productive. Using existing studies regarding the economic impact agriculture in Maryland, CCS developed an all-inclusive figure for lost agricultural productivity. This figure included dollars from sales from agricultural products, state and local tax revenue from sales and property taxes, direct jobs from agricultural labor and indirect jobs created by agricultural supply chains. These figures were integrated into the analysis to provide the high-range estimate of any lost productivity from current land use.

For purposes of this study, lost land productivity, investment and associated tax revenue was only taken into account for the years 2020-2030. In addition, it is well established that redevelopment of agricultural lands for solar projects results in significantly increased job creation and property value, and resultant state and local tax revenue. The aggregate value of new utility-scale solar projects as a result of CPPO will continue to increase throughout the operational life of the installation, well beyond the time period reviewed in this study.

Table 6. Operational Phase Net Spending through 2030

	Baseline Scenario	CPPO Scenario	Net Impact
Operational Phase Labor	$4,800,865	$41,939,740	$37,138,875
Operational Land Leases	$2,196,414	$18,227,664	$16,031,250
Operational Phase Tax Revenue	$4,159,205	$36,334,283	$32,175,078

The figures presented in Table 7 show the total lost productivity from existing agricultural production as a result of conversion of agricultural lands to solar farms. As stated above, this includes revenue from agricultural product sales, direct and indirect labor and state and local tax revenue. While indirect jobs and associated economic development were incorporated as a negative (lost) value in study, these additional values were not included as a benefit resulting from new solar installations to take a conservative estimate of net value.

Table 7. Lost Agricultural Productivity through 2030

	Baseline Scenario	CPPO Scenario	Net Impact
Lost agricultural productivity and revenue	-$4,980,810	-$41,334,883	-$36,354,073

The figures presented in Table 8 show the total combined expected net fiscal impact of new utility-scale solar projects as a result of CPPO. It is assumed that additional taxes on real estate and personal property will not arise until the year following completion of the construction. Tax revenues are highest during the construction phase of the project (year 1), however state and local tax revenue experiences are significant annual increase above BAU during the operational phase as well.

Table 8. Net Fiscal Impact through 2030

	Baseline Scenario	CPPO Scenario	Net Impact
Construction Phase Tax Revenue	$7,753,124	$53,191,179	$45,438,055
Operational Phase Tax Revenue	$4,159,205	$36,334,283	$32,175,078
Total Net Tax Revenue	**$11,912,329**	**$89,525,617**	**$77,613,288**

Macroeconomic Impacts

Results of the financial impacts analysis above, including implementation design parameters and assumptions, were used as inputs to macroeconomic assessment using the Macroeconomic Indicator Tool. Results are described and displayed graphically for the deployment scenario, with the six factors shown side by side for each option. The size of the impact related to each factor is shown through the size of the column as either high, medium or low, and the positive or negative incidence of each factor is shown by the direction (upward or downward) of the column from the midpoint.

By assessing each cost and savings component identified in the direct (microeconomic) impacts analysis for the presence of one or more of these six factors, and identifying whether the cost or savings is positively or negatively associated with the identified factor, this factor based rating process develops a strategic, multi-faceted evaluation of each policy action scenario likely impact on the economy for design and implementation decisions. Figures presented are net impacts on the Maryland economy as a result of increased deployment of utility-scale solar generation beyond the BAU forecast.

Net impacts are expressed for each of the six macroeconomic indicators. While a financial flow may have impact upon more than one indicator, the financial flow is limited to a single area to avoid double counting and be conservative in this analysis. High, medium or low impacts for GSP and employment was established as proportionate to sector level spending effects based on financial flows estimated over the time period 2020-2030.

Deployment Scenario

The CPPO scenario represents an additional 1,600 MW of utility-scale solar to be deployed in Maryland over the next ten years above the baseline for a total of 2,368, or about 11.2% of existing generation capacity within the state. This would bring total capacity of existing, planned and forecasted utility-scale projects to approximately 2,700 MW in 2030, which could generate 5,200,000 MWh annually. The current RPS target for solar generation by 2028 is 14.5% of total demand, approximately 9,000,000 MWh annually, leaving a gap of 4,800,000 MWh to be supplied from in-state rooftop solar resources or through imported solar generation. The CPPO scenario would require approximately 17,750 acres of existing agricultural land in Maryland to be repurposed for solar generation, which is less than 1% of 2,000,000 acres of total productive farmland currently operating in the state.[xix] A visualization of expected impacts on macroeconomic conditions (GSP and jobs) from this scenario are shown in Figure 5.

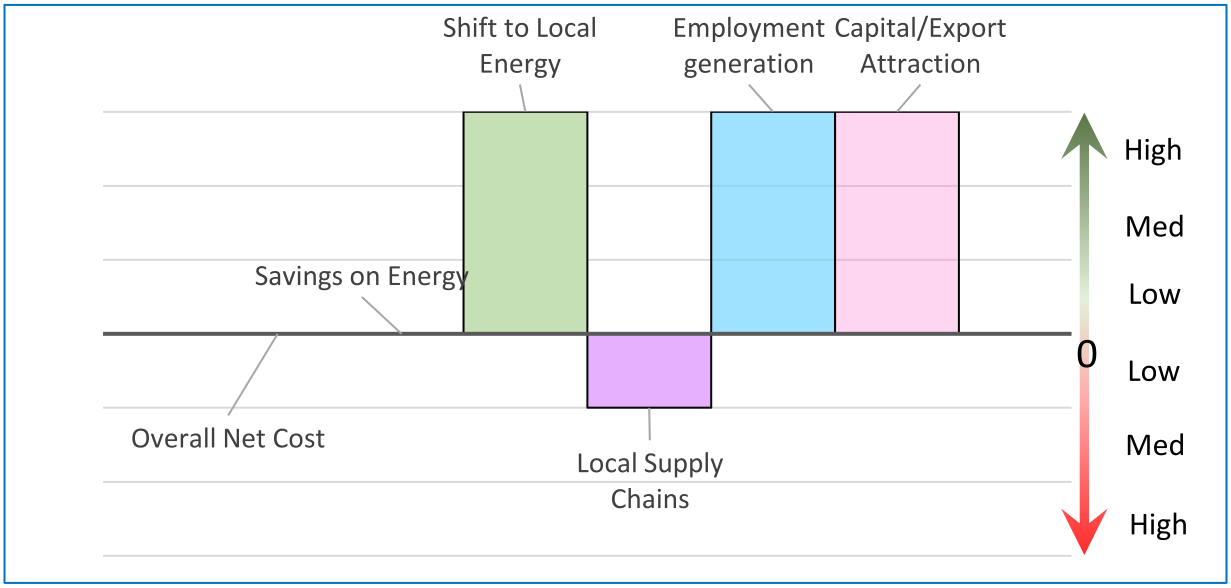
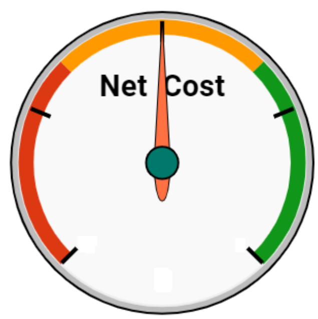


Figure 5. CPPO Deployment Scenario Results

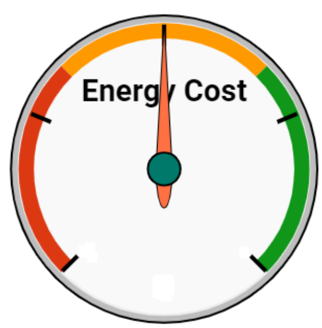
Macro Indicator Tool Results for the CPPO deployment scenario are detailed below.

<u>Overall Net Cost, No Macro Impact</u>



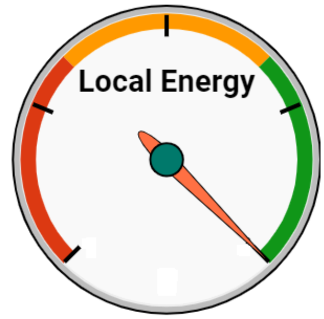
Shifts to technologies and practices with lower net implementation costs than those in the BAU scenario stimulate economic expansion by freeing up investment for new deployment. This analysis is focused on the direct impact of implementation of the proposed policy, which in this case is the direct impact of implementing new utility-scale solar, or not. As the alternative to implementing the project is to do nothing additional, or BAU, there is no net shift in overall implementation costs, it is either 100% cost or 0% cost. As a result, this first indicator is not applicable to this analysis.

<u>Savings on Energy, No Macro Impact</u>



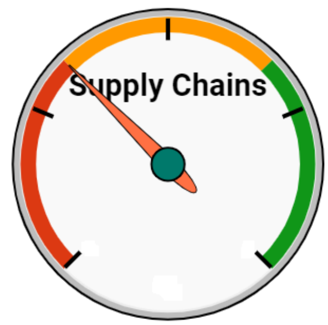
Shifts that generate overall savings on energy spending can also have an expansionary economic impact. Today, annual electricity demand in the PJM region is 782,955 GWh and is expected to grow to 839,830 GWh by 2030. In the CPPO scenario, net new generation is only forecasted to add approximately 3,000 GWh annually by 2030, or .36%. Due to the high percentage of imported power in Maryland, and the overall size of the market that Maryland operates, it is highly unlikely that the addition of utility-scale solar in this scenario will have any significant impact on local energy prices. None of the examined financial flows have a significant impact on this indicator and is therefore determined to be not applicable for this analysis.

Shifts to Local Energy, High Positive Macro Impact.



Shifts toward greater use of locally produced energy have an expansionary macroeconomic effect. Policy options that encourage more utilization of in-state energy resources can help stimulate local economies, since the initial spending and the associated multiplier effects tend to stay within their borders. The overall stimulus effect of utilizing local resources to provide renewable energy is particularly prominent in states such as Maryland that import large quantities of energy from outside. In this scenario, investment in new utility-scale solar as a result of CPPO has quantifiable benefits. In this shift, total new dollars flowing into the state as a result of locally produced energy captures the values associated with job creation, land purchases and investment in new construction that would otherwise be generated in another region. It is expected that implementation of CPPO will have a **high positive net effect** on the Maryland economy.

Local Supply Chains, Low Negative Macro Impact



Shifts to local supply chains have an expansionary macroeconomic effect. Projects which utilize the highest proportion of locally sourced materials will have the highest stimulating effect on the local economy, referred to as the Regional Purchase Coefficient (RPC). The majority of the components for utility-scale solar projects are manufactured outside of Maryland, and it is not expected that new manufacturing of solar components will be undertaken within the state of Maryland over the coming decade in a manner that would offset these imports. Imported goods account for about 55% of total project costs for utility-scale solar, which will have a dampening effect on local economies. However, this is somewhat offset by procurement of local electrical BOS materials, which accounts for 8% of total project costs, as well as through direct hiring of construction and O&M labor and the significant increase in overall net investment in the state.

In addition, local supply chains will be negatively impacted due to the loss of revenue and jobs associated with agricultural productivity in the state of Maryland. In the CPPO scenario, it is expected that approximately $41,000,000 in economic value will be lost due to conversion of productive farmland to utility-scale solar farms. There are extremely large revenue streams that will be captured through the sale of electricity from these sites; however, it is not clear that this revenue will stay within Maryland's borders based on asset ownership. As a result, this benefit has not been captured in this analysis. In analyzing the various financial flows associated with this indicator, it is expected that CPPO will have a low negative impact on local supply chains.

Employment Intensity, High Positive Macro Impact

Shifts to activities with greater labor intensity have an expansionary macroeconomic (employment) effect. Implementation of renewable energy projects are positively associated with job creation, typically being more labor intensive than fossil-fuel based energy sector projects, particularly in the construction sector. However, in the CPPO implementation scenario, it is expected that new solar generation projects would be a net addition of labor only and would not displace any energy sector labor within the Maryland due to the large amount of imported energy and the planned retirement of significant fossil-based generation in the next two years. As noted in the summary for Indicator 2, the portion of energy that new utility-scale solar in Maryland would provide is not a significant enough portion to have a substantial impact on the PJM market. However, were it to eliminate the need for existing generation, fossil or non, it would take the place of energy that would otherwise be imported. As a result, any loss of labor would take place outside of the state. In result, it is expected that new net investment in labor between 2020 and 2030 would total **$341,138,875**. It is expected that CPPO will have a **high positive impact** on increasing the level of spending on labor within Maryland.

External Investment Attraction, High Positive Macro Impact

Shifts to greater use of external investment and/or greater net exports have an expansionary macroeconomic effect. Policy options that have the potential to attract out-of-state investment or federal government funds would be more beneficial to the state or regional economy than those that depend on in-state funding sources. As described, the federal ITC provides a significant incentive for solar developers sourced both in and outside of Maryland to install and operate new projects in the next three-to-five years. This new capital investment stimulates the equipment manufacturing sectors, construction sectors, and other private and public service sectors.

In Maryland, large impacts are expected for the construction sector as a result of CPPO, and significant tax revenue is expected to be generated for state and local governments as a result of these projects. As has been stated for other indicator areas, it is assumed that a significant amount of the investment funding necessary for implementation of solar projects resulting from CPPO will be come from sources outside of the state, and as a result will have a significant impact on the amount of total new funds invested in the state.

As stated in Indicator 4, a large portion of the total project investment will be allocated to imported goods, which will have a low negative influence on the economy of Maryland, specifically as it relates to imports and local supply chains. However, this negative influence is significantly offset by total local direct investment in local project costs and associated tax revenue. In the CPPO scenario, direct local spending grows to **$441,883,693,** while net state and local tax revenue totals **$77,613,133** for the time period 2020 – 2030. It is expected that CPPO will have a **high positive impact** on the shift to greater external investment and/or greater net imports.

Combined Effects, High to Medium Macro Impacts

Taken in total, the CPPO is likely to stimulate, rather than contract, Maryland's economy. The utility-scale solar deployment scenario produces a significant increase of investments flowing into the state, which is associated with a positive impact on the total amount of activity in the local economy. The CPPO scenario is projected to increase the amount of energy generated within the state, which enables the state to capture the value streams associated with solar development and to engage direct stimulus of labor-intensive activity, which spurs consumer spending and is associated with job gains not just from the option implementation, but economy-wide.

Figure 6. Combined Macroeconomic Indicator Tool Results

While the CPPO deployment scenario has a low negative impact on local supply chains in the near term due to largely imported materials for project implementation and displaced agricultural productivity, the positive impacts associated with the projects far outweigh this lost value. The scenario is shown to have significant potential to stimulate the Maryland economy through direct job creation, increased direct investment, and increased local production of energy. Taken as a group, these influences should be considered promising in terms of potential economic impact.

V. CONCLUSIONS

The goal of this study was to assess the macroeconomic impacts of increased deployment of utility-scale solar within the state in Maryland. This was examined by quantifying direct financial flows associated with utility-scale solar development as well as policy implementation design parameters, which were then analyzed against the six key macro-economic indicators detailed above. **Overall, expansion of economic growth is estimated as a result of increased utility-scale solar deployment in the State of Maryland.** CPPO is expected to stimulate, rather than suppress, economic activity in Maryland. **Increasing utility-scale solar deployment offers significant positive influence on job creation, increased investment capital flowing into the state from external sources and increased local production of**

energy that would otherwise be imported. The options also expend significant money on labor-intense activities, which is associated with economy-wide employment growth, while also reducing net imports of electricity and increasing adoption of advanced technologies, thus driving economic activity to key local sectors.

- ***Deployment of utility-scale solar will significantly increase new sources of investment and associated tax revenue coming into the state.*** In the CPPO scenario, direct investment increases to **$442,000,000** over the next ten years with almost **$78,000,000** in additional tax revenue for state and local governments. Studies have consistently shown that land value and associated tax revenue streams grow exponentially when land use is shifted from agricultural products to energy generation, which will provide continued economic benefit beyond the time frame reviewed in this study.

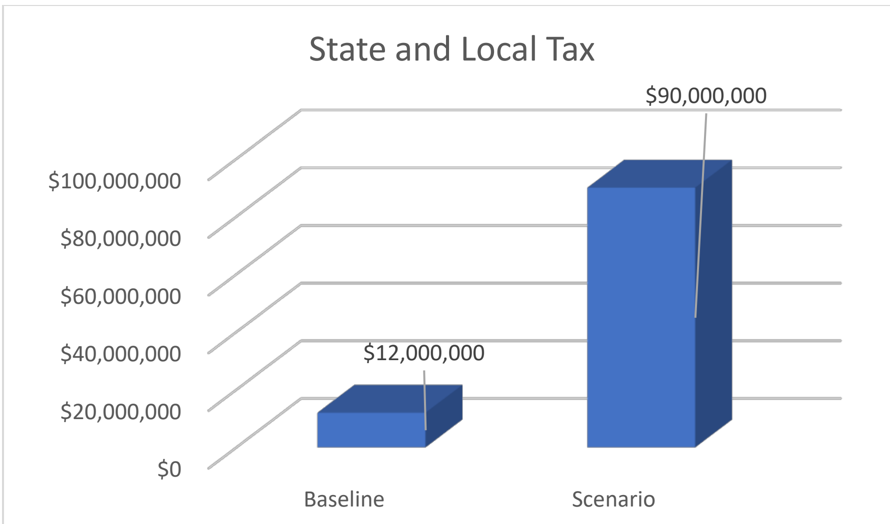


Figure 7. Tax Revenue (2020-2030)

- ***Increased deployment of utility-scale solar has little impact on net cost.*** When all of the financial flows are summed, the net implementation costs to the state of Maryland remain minimal. Project costs are absorbed almost entirely by the project developer, with little additional cost distributed directly to the state. As identified in Table 2, a large portion of the project costs will be allocated to project material, particularly solar modules. The majority of solar system components are manufactured outside of Maryland and will need to be imported. Electrical wiring and other components are expected to be procured from in-state suppliers. However, these costs will be incurred by the developer and will not have a positive nor negative impact on net cost of the projects to the State of Maryland.

- ***The utility-scale solar deployment scenario will not have a major direct impact on local energy prices.*** Maryland sits within the PJM Interconnection, which hosts over 180,000 MW of generating capacity delivering over 800,000 GWh of electricity per year. The CPPO deployment scenario represents less than 1% of all generation within PJM. The additional of generation capacity within the PJM market is expected to decrease energy prices through increased competition, and as the cost of solar components falls the cost of generation will be expected to fall as well. However, it is not expected that deployment of additional utility-scale generation in Maryland will have a strong influence on the price of energy for consumers.

- ***Utility-scale solar will have significant impacts on the amount of local energy production in Maryland.*** A large portion of the energy consumed in the state of Maryland is imported, with over 22,000,000 MWh imported in 2019. Increasing the supply of in-state generation will have a positive influence on local investment, tax revenue and associated growth in jobs as shown in Table 3. While electricity demand in the state of Maryland is expected to remain flat over the next ten years, overall load growth in PJM is expected to increase by 0.7% annually through 2035, increasing electricity delivery by 56,875 GWh,[xx] which offers the potential for energy exports were growth to increase significantly.

- ***Local energy production produces significant employment investments while offsetting energy imports.*** Utility-scale solar projects have a strong positive influence on job creation, both during the construction and operational phases. These labor-intensive activities are associated with economy-wide increases in total employment – reflecting both the direct hiring to carry out these activities and the expansion of the job market that results as this new household income is spent on goods and services. By reducing imported energy, Maryland is able to capture the jobs, tax revenue and induced economic development that would otherwise be created in another state. In the CPPO scenario nearly **$400,000,000 is expected to be invested in construction, operations and maintenance jobs by 2030 in Maryland**. This investment is particularly impactful in light of COVID-19. As a result of the pandemic, Maryland is estimated to have lost at least 3,000 solar energy jobs[xxi] and 13,000 across the clean energy sector.[xxii] Nationally, solar jobs are expected to drop by 38% from pre-COVID levels, and total installations will decrease by 18% or more.[xxiii] Speeding up the recovery of this sector is vital to the Maryland economy, and efforts to expand utility-scale solar in Maryland can help to offset these losses and **produce over 1,000 additional jobs[xxiv] by 2023.**

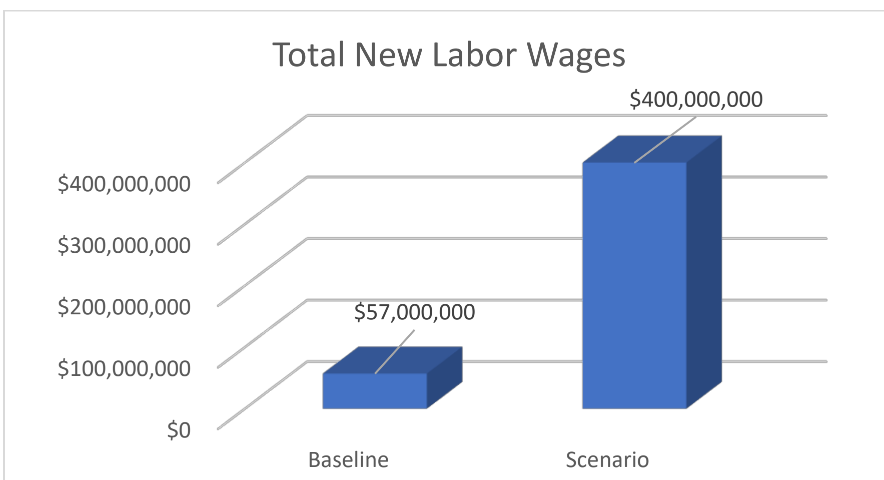


Figure 8. New Investment in Jobs ($)

- ***Utility-scale solar will have a low negative impact on local supply chains in the short term*** but ***is offset by expansion of direct employment gains.*** The majority of materials for utility-scale solar projects must be imported from outside of the state,with only electrical BOS components expected to be sourced from within Maryland. In addition, new solar generation is expected to cause the displacement of existing revenue streams associated with agricultural production. As a result, it is expected that in the short-term local supply chains may be negatively impacted. However, the total lost direct revenue and associated taxes captured by the state is less than the amount of direct investment in operations and maintenance jobs over the same period, which represents only a fraction of total investment in the state. When aggregated, economic benefits drastically outweigh estimated economic losses.

- ***Numerous economic benefits are expected to be generated by utility-scale solar projects beyond the financial flows reviewed in this study.*** The positive impacts of this deployment scenario are expected to result in significant direct investment in job creation within the state and expected to create significant indirect and induced jobs throughout the state as well. In addition, the emissions reduction benefit attributed to solar deployment will support GHG reduction targets in the state and produce additional health benefits.

It is important to note that this study is limited in scope to the years 2020-2030 and is primarily focused on the near-term economic stimulus impact of utility-scale solar projects. As a result, the economic benefit of projects developed in year 2030 have only one year of financial impact assessed in this review, despite having an operational life (and associated economic impact) of 20 years or more. Significant growth is expected as a result of the projects reviewed in this study projects far beyond what was modeled and could be shown were the time horizon for analysis be extended to 2050. The opportunity for CPPO to increase the deployment of utility-scale solar in Maryland is large, and the impact that this may have on the Maryland economy in the near term is significant.

---

[i] Energy Information Administration, 2020. "*Preliminary Monthly Electric Generator Inventory*." https://www.eia.gov/todayinenergy/detail.php?id=43815
[ii] Maryland Department of Natural Resources Power Plant Research Program, *"Final Report Concerning the Maryland Renewable Portfolio Standard as Required by Chaper 393 of the Acts of the Maryland General Assembly of 2017,"* December, 2019. https://dnr.maryland.gov/pprp/Documents/FinalRPSReportDecember2019.pdf
[iii] PJM Interconnection, "*Renewable Generators Registered in GATS,"* Generation Attribute Tracking System, 2020. https://gats.pjm-eis.com/gats2/PublicReports/RenewableGeneratorsRegisteredinGATS
[iv] PJM Interconnection, "*New Services Queue,"* 2020. https://www.pjm.com/planning/services-requests/interconnection-queues.aspx
[v] Maryland Public Service Commission, "*Certificate of Public Convenience Cases*," Public Comments, 2020. https://www.psc.state.md.us/make-a-public-comment/cpcn-cases/
[vi] Solar Energy Industries Association, 2020. "*COVID-19 Impacts on the Solar Energy Industry."*
[vii] BW Research Partnership, "*Clean Energy Employment Initial Impacts from the COVID-19 Economic Crisis,"* June, 2020. https://e2.org/wp-content/uploads/2020/06/Clean-Energy-Jobs-May-COVID-19-Memo-Final.pdf
[viii] Solar Energy Industries Association, "*COVID-19 and the US Solar Industry*https://www.seia.org/sites/default/files/2020-04/2020-April-SEIA-COVID-Factsheet.pdf
[ix]Energy Information Administration, 2020. "*Electricity in the United States."* https://www.eia.gov/energyexplained/electricity/electricity-in-the-us.php
[x] Energy Information Administration, 2020. "*State Energy Profiles: Maryland."* https://www.eia.gov/beta/states/states/md/overview
[xi] Public Service Commission of Maryland, "*Ten-Year Plan (2019-2028) of Electric Companies in Maryland."* https://www.psc.state.md.us/wp-content/uploads/2019-2028-Ten-Year-Plan-FINAL.pdf
[xii] Energy Information Administration, 2020. "*State Energy Profiles: Maryland."* https://www.eia.gov/beta/states/states/md/overview
[xiii] Public Service Commission of Maryland, "*Ten-Year Plan (2019-2028) of Electric Companies in Maryland."* https://www.psc.state.md.us/wp-content/uploads/2019-2028-Ten-Year-Plan-FINAL.pdf
[xiv] Solar Energy Industries Association, 2020. "*Solar Industry Research Data*." https://www.seia.org/solar-industry-research-data
[xv] Public Service Commission of Maryland, 2019. "*Renewable Portfolio Standard Report."* https://www.psc.state.md.us/wp-content/uploads/CY18-RPS-Annual-Report.pdf
[xvi] PJM Interconnection, 2019. "*Growth of Solar on PJM's Horizon*." https://insidelines.pjm.com/growth-of-solar-on-pjms-horizon/#:~:text=PJM%20predicts%20that%20power%20from,and%20New%20Jersey%20(seventh).
[xvii] PJM Interconnection, 2020. "*New Services Queue."* https://www.pjm.com/planning/services-requests/interconnection-queues.aspx
[xviii] The factor-based macroeconomic assessment is based on the study entitled "Summary of Key Factors Contributing to Macroeconomic Impacts of GHG Mitigation Options," by Dan Wei, Adam Rose and Noah Dormady of the USC Sol Price School of Public Policy. www.climatestrategies.us/library/library/download/905.
[xix] United States Department of Agriculture, 2019. "*2019 State Agriculture Overview: Maryland*." https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=MARYLAND
[xx] PJM Interconnection, "*Long Term Load Forecast,"* 2020. https://www.pjm.com/-/media/library/reports-notices/load-forecast/2020-load-report.ashx?la=en
[xxi] Solar Energy Industries Association, 2020. "*COVID-19 Impacts on the Solar Energy Industry."*
[xxii] BW Research Partnership, "*Clean Energy Employment Initial Impacts from the COVID-19 Economic Crisis,"* June, 2020. https://e2.org/wp-content/uploads/2020/06/Clean-Energy-Jobs-May-COVID-19-Memo-Final.pdf
[xxiii] Solar Energy Industries Association, "*COVID-19 and the US Solar Industry*https://www.seia.org/sites/default/files/2020-04/2020-April-SEIA-COVID-Factsheet.pdf
[xxiv] Job creation is estimated to be three installation jobs per MW, Solar Energy Industries Association https://mdvseia.org/wp-content/uploads/2018/03/SolarJobsCensus2017.pdf