Increasing Solar PV on Local Government Facilities & University Campuses

Karan Ravindra Gaikwad, Emily Carrillo, Hao Dong, Matthew Pilkay, Zekun Yang, Yiyang Zhang

PUBP/ISYE 6701

14 March 2025

Table of Contents

Introduction

As Metro Atlanta continues to face the ongoing climate crisis, the reduction of greenhouse gas (GHG) emissions has become a key priority. An effective solution is the expansion of solar photovoltaic (PV) systems, particularly in local and government facilities. Solar PV technology offers a clean, renewable energy source that lowers CO2-equivalent (CO2-e) emissions.

This research memo focuses on the expansion of solar PV systems in local government facilities and universities as a key GHG pollution reduction measure. In the sections that follow, we will address five key topics related to the expansion of solar PV in local and government facilities including CO2-e reductions, technical potential, co-pollutant impacts, financial implications, and equity considerations.

Unlike traditional methods that rely on standardized energy policy simulators (EPS) for analysis, our approach intentionally deviates from this by utilizing more region-specific and accurate data sources. EPS tools typically provide broad, generalized models that may not capture the unique conditions of the Metro Atlanta area. Instead, we opted for a combination of granular, localized data to ensure a tailored analysis. Specifically, we've integrated Google Sunroof's rooftop solar generation estimates, which provide detailed, site-specific data on potential solar energy production. Additionally, we rely on the National Renewable Energy Laboratory's (NREL) Electricity Annual Technology Baseline (ATB) for performance benchmarks and future projections, ensuring our analysis is based on the latest technological advancements. State-level energy forecasts from the U.S. Energy Information Administration (EIA) further complement our approach by offering insight into regional energy trends. This methodology allows us to capture the unique variables of the area, providing a more accurate and customized assessment of solar energy potential, as opposed to the generalized projections typically produced by EPS tools.

Topic One: CO2-e Reduction Potential by 2035 and 2050

Overall Penetration of Solar Roof Electricity Generation

To evaluate the potential CO_2-equivalent emission reductions from expanding solar PV systems on local government facilities and university campuses, we utilize Project Sunroof's

Data Explorer[1]. This dataset provides estimates of solar viability, total available roof space, and projected electricity generation potential across the 29 counties. Each county's solar potential is assessed based on:

- **Total Roof Viability (%):** The percentage of rooftops in a county suitable for solar PV installation.
- **Total Number of Viable Roofs:** The number of buildings that can support solar PV systems.
- **Total Roof Space (sq. ft):** The aggregate area of viable roofs available for solar panel installation.
- **Solar Capacity (MW DC):** The potential direct current (DC) power output if solar panels were installed on all viable roofs.
- **Electricity Production (M*MWh AC per year):** The annual alternating current (AC) electricity generation from fully utilizing solar PV potential.
- **Per-Roof System Size and Production:** Median values for system size (kW DC) and annual energy generation (kWh AC) per viable rooftop.

This dataset serves as the foundation for our CO_2-e reduction analysis, allowing us to quantify potential solar PV deployment and its emissions reduction impact across the 29-county. In later discussions, we focused on the main technical potential of MSA area which is around 22.91 GW.

County	Roofs %	Roof Space M (sq ft)	Total Roof Space M (sq ft)	Capacity (MW DC)	Capacity M* MWh AC per yr
Cherokee	79	90	113.9240506	2000	2.5
Pickens	75	17.8	23.73333333	404	0.495
Dawson	79	15.6	19.74683544	353	0.443
Bartow	78	62.8	80.51282051	1400	1.8
Forsyth	86	93.6	108.8372093	2100	2.7
Paulding	82	52.5	64.02439024	1200	1.5
Cobb	75	231	308	5300	6.5
Fulton	76	344	452.6315789	7800	9.9
DeKalb	70	189	270	4300	5.4
Gwinnett	84	301	358.3333333	6800	8.7
Barrow	81	38	46.91358025	863	1.1
Walton	79	46	58.2278481	1000	1.3
Haralson	75	16.6	22.13333333	376	0.463
Carroll	77	62.1	80.64935065	1400	1.8
Heard	75	8.4	11.2	190	0.836
Douglas	79	58.8	74.43037975	1300	1.7
Coweta	80	61.2	76.5	1400	1.7
Meriwether	76	14	18.42105263	317	0.398

Figure 1: Snapshot of Raw Data from Project Sunroof Explorer

[1] *"Project Sunroof Data Explorer by Google." 2025.* Google*. Google. Accessed March 10.* https://sunroof.withgoogle.com/data-explorer/.

Solar Panel Penetration Data		
sum of used space	2110.16	Roof Space M (sq ft)
sum of roof space	2708.44	Roof Space M (sq ft)
current overall penetration (%)	0.78	
Energy Generation Service Level		
Sum of energy generated per year	61.12	M*MWh
Expected full service level	78.45	M*MWh

Figure 2: Summary of Overall Penetration of Solar Panel Usage and Service Level

The raw data used in the calculation can be found in Appendix A

Assuming that all viable rooftop space is utilized for solar PV, the estimated distributed solar capacity would be 22.91 GW, representing the technical potential for rooftop solar across the MSA counties. Currently, however, less than 1% of this technical potential has been realized.

To refine this estimate, we conducted a focused analysis using specific data on government and educational institution buildings managed by the state of Georgia (8 million sq. ft) as well as additional university spaces (165 million sq. ft). This more targeted approach revealed that only 8% of the total suitable sunroof space (calculated at 2,110.159 million sq. ft) could feasibly be utilized[2]. This adjustment significantly reduced the maximum rooftop solar potential to 1.8 GW.

To improve rooftop solar adoption, we propose two ramp-up scenarios and estimate the corresponding CO2 emissions reductions for each:

- **Scenario 1**: Achieve 5% of the technical potential by 2030 and 20% by 2050.
- **Scenario 2**: Achieve 10% of the technical potential by 2030 and 50% by 2050.

The original analysis was conducted by Greenlink Analytics in the *GHG Emissions Tracker Documentation*[3]*,*which we followed closely. However, we adjusted the technical potential to focus exclusively on government and university buildings instead of all available rooftop space.

Current Solar Adoption and Future Potential in Georgia

There are existing state policies that support the adoption of solar PV which mainly focus on financial incentives needed to reduce the cost of installation. A prominent state-level policy is the Solar Power Free-Market Financing Act (HB 57) of 2015, which allows third parties to own

---

[2] Georgia Building Authority. "Buildings Managed by the State of Georgia." Accessed March 14, 2025. https://gba.georgia.gov/buildings

[3] Environmental Protection Agency. *Atlanta MSA ARC PCAP.* March 2024. https://www.epa.gov/system/files/documents/2024-03/atlanta-msa-arc-pcap.pdf.

solar PV systems in the state. Under this policy, property owners, including public entities, can finance solar installations through power purchase agreements (PPAs). This financing model helps lower the heavy upfront costs traditionally associated with solar power adoption[4]. Several local initiatives and partnerships have also emerged to promote solar installations. Solarize Atlanta Campaign is a community-led bulk purchasing program that helps reduce the cost of solar installations by aggregating demand[5]. This program mainly targets homeowners and private businesses. Additionally, universities have adopted sustainability goals that prioritize the integration of renewable energy. For example, Georgia Tech has installed solar panels on campus buildings as part of its broader sustainability initiatives[6]. Overall, Georgia has made significant progress in utility-scale solar energy, with over 4,100 MW of installed capacity as of 2023[7]. However, overall solar adoption at the government and university levels still has room for growth. As of 2023, less than 5% of total solar capacity is coming from residential and commercial rooftop installations[8]. The low adoption is not due to lack of viability as 78% of rooftops (both commercial and residential) in Metro Atlanta are viable for solar[9].

Georgia's approach to solar adoption differs from other states that have seen more widespread solar adoption. For example, California, Massachusetts, and New York have prioritized solar energy in public institutions leading to higher adoption rates. These states provide extensive financial incentives and funding programs to support large-scale installations, along with favorable net metering policies which allows customers to sell excess energy back to the grid at retail rates[10]. In contrast, customers in Georgia still face challenges due to the lack of state-level incentives for commercial solar installations. States like California have solar mandates for new government buildings and have incentivized solar power projects at public universities, increasing overall solar adoption[11]. Georgia's comparatively slower pace can be attributed to limited financial incentives, a lack of emphasis on public building mandates, and regulatory frameworks that favor utility-scale projects.

---

[4] *Solar Power Free-Market Financing Act*, H.B. 57, 153rd Ga. Gen. Assemb. (2015). https://www.legis.ga.gov/

[5] "Atlanta Solar: Solarize Atlanta." 2024. *Solar CrowdSource*. September 3. https://www.solarcrowdsource.com/campaign/solarize-atlanta-2-0/.

[6] *2025.* Office of Sustainability. *Accessed March 13. https://sustain.gatech.edu/.*

[7] *"U.S. Energy Information Administration - EIA - Independent Statistics and Analysis." 2025.* State Energy Profile Data. *Accessed March 10. https://www.eia.gov/state/data.php?sid=GA*.

[8] "U.S. Energy Information Administration - EIA - Independent Statistics and Analysis." 2025. *State Energy Profile Data*. Accessed March 10. https://www.eia.gov/state/data.php?sid=GA.

[9] ***"****Project Sunroof Data Explorer by Google." 2025.* Google. *Google. Accessed March 10. https://sunroof.withgoogle.com/data-explorer/.*

[10] "Solar Market Insight Report." 2025. *SEIA*. February 3. https://seia.org/research-resources/us-solar-market-insight/.

[11] *"National Renewable Energy Laboratory (NREL) Home Page." 2025.* NREL. *Accessed March 10. https://www.nrel.gov/.*

Financial and regulatory barriers are perhaps the most pronounced. Despite available financing models, the initial costs of solar installation can still be difficult, especially for public institutions with limited budgets for capital improvement projects. While there are state incentives for residential solar installations, public entities and universities lack sufficient financial incentives to drive large-scale solar implementation. Additionally, Georgia's net metering policy, which compensates customers at the avoided energy rate[12], is less attractive compared to other states which typically allows customers to sell excess energy back to the grid at a market rate[13]. There is also infrastructure limits as the current grid may not be fully prepared for a significant increase in decentralized solar energy. The integration of solar energy into the grid will require advanced storage solutions and grid modernization. Additionally, underdeveloped areas are more likely to not be aware of the financial and environmental benefits of solar energy, nor do they have the available mechanisms to finance large-scale solar projects.

Georgia should expand financial incentives specifically for public institutions, such as grants and tax rebates. Additionally, providing low-interest loans or subsidies would make the adoption of solar PV more financially viable for universities and local governments. Implementing a more comprehensive net metering program, where solar producers are compensated at retail rates, would create further financial incentives by offsetting installation costs and generating long-term savings on energy bills. Expanding public-private partnerships, such as Solarize Atlanta, to include more public institutions could reduce installation costs through bulk purchasing and encourage broader adoption of solar energy. Ultimately, for these efforts to be effective, Georgia must invest in grid modernization and energy storage solutions to ensure the state can integrate increased solar energy production seamlessly.

State-wide policies are the primary focus of this analysis because they offer a more cohesive and scalable approach to solar energy adoption across Georgia. Implementing policies at the state level allows for uniformity, making it easier for universities and local governments to comply with regulations and benefit from incentives. State-wide policies are also typically easier to lobby for, as they can be championed by a broad coalition of stakeholders, including government agencies, educational institutions, and private solar providers. Additionally, by focusing on state-wide policies, the barriers associated with inconsistent local regulations can be minimized, ensuring that public institutions across Georgia have equal access to incentives, funding, and supportive regulatory frameworks. This centralized approach not only streamlines

---

[12] *"Business." 2025.* Home. *Accessed March 10.* https://www.georgiapower.com/business/products-programs/business-solutions/commercial-solar-solutions/commercial-rooftop-installations/how-it-works.html.

[13] *"Net Metering." 2024.* SEIA. *September 5.* https://seia.org/net-metering/#:~:text=What%20Is%20Net%20Metering?,electricity%20serves%20nearby%20customers'%20loads.

the adoption process but also encourages widespread participation in renewable energy efforts across all regions of the state.

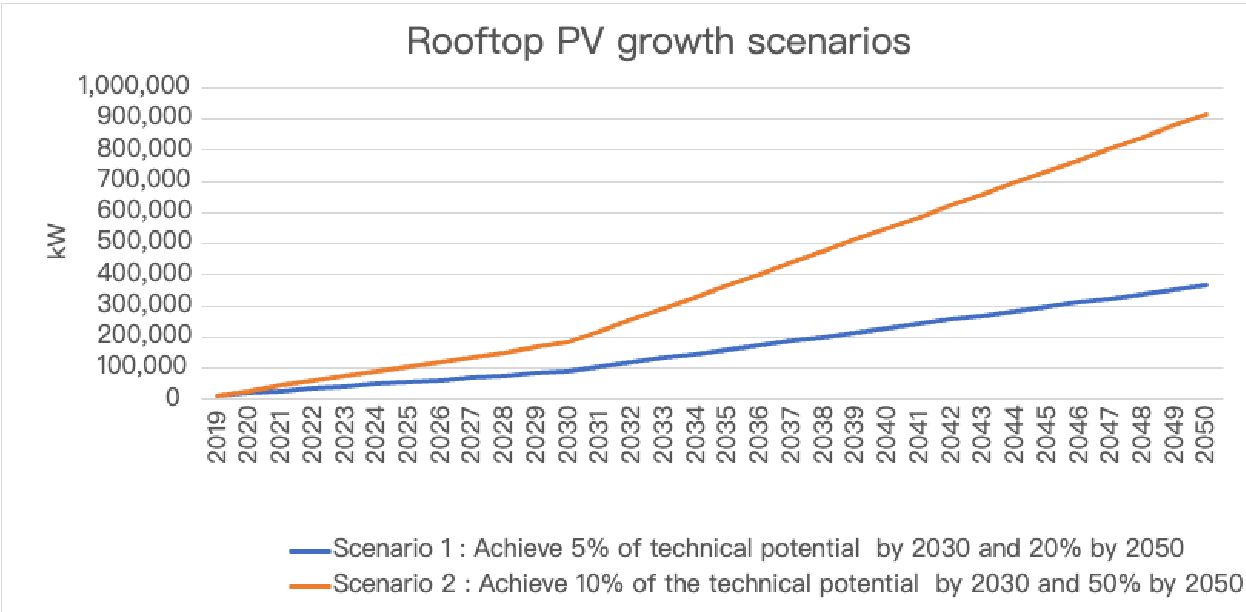

Figure 3: Rooftop PV growth scenarios for scenarios 1 and 2

Year\GHG Reduction (MT CO2-e)	Scenario 1	Scenario 2
2035	152,097	1,403,432
2050	298,709	3,299,867

Figure 4: GHG Reduction for Scenarios 1 and 2 by 2035 and 2050

Topic Two: Estimating the Technical Potential of Solar PV for CO2-e Reduction in Metro Atlanta by 2035 and 2050

The technical potential for deploying solar PV systems was evaluated using a maximum realistic deployment scenario, without considering cost, focusing purely on the physical and technical limitations of available resources. This scenario explores the possibilities under the assumption of utilizing all feasible spaces for installation, based on data from various sources.

Technical Capacity and Constraints

As is stated in Topic 1, the maximum technical capacity for solar PV across the 29 Metro Atlanta counties on government and university campuses is approximately 1.8 GW. This number was utilized in the maximum technical potential analysis shown in the below table and figures.

Year	Distributed Solar PV (kW)	Power Generation (kWh)	Emissions Avoided (MT CO2-e)	Cumulative GHG Reductions (MT CO2-e)
2030	790,283	1,473,058,043	286,290	1,352,259
2035	998,887	1,739,027,766	372,152	2,805,557
2045	1,572,547	2,270,967,211	401,214	6,545,643
2050	1,833,302	2,337,459,642	390,356	8,530,090

Figure 5: Maximum Technical Potential

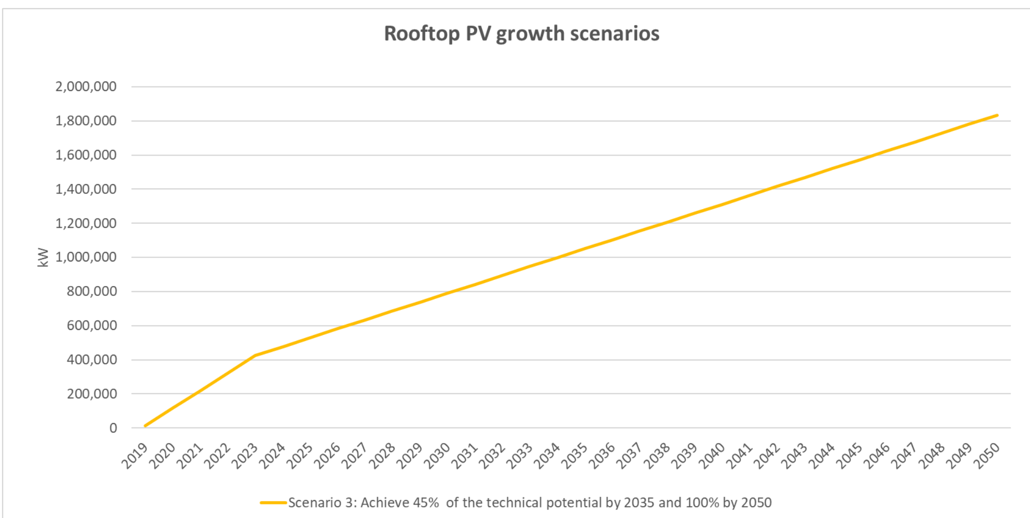

Figure 6: Rooftop Distributed Solar PV Capacity Projection, 2019 to 2050

The raw data and calculation can be found in Appendix B

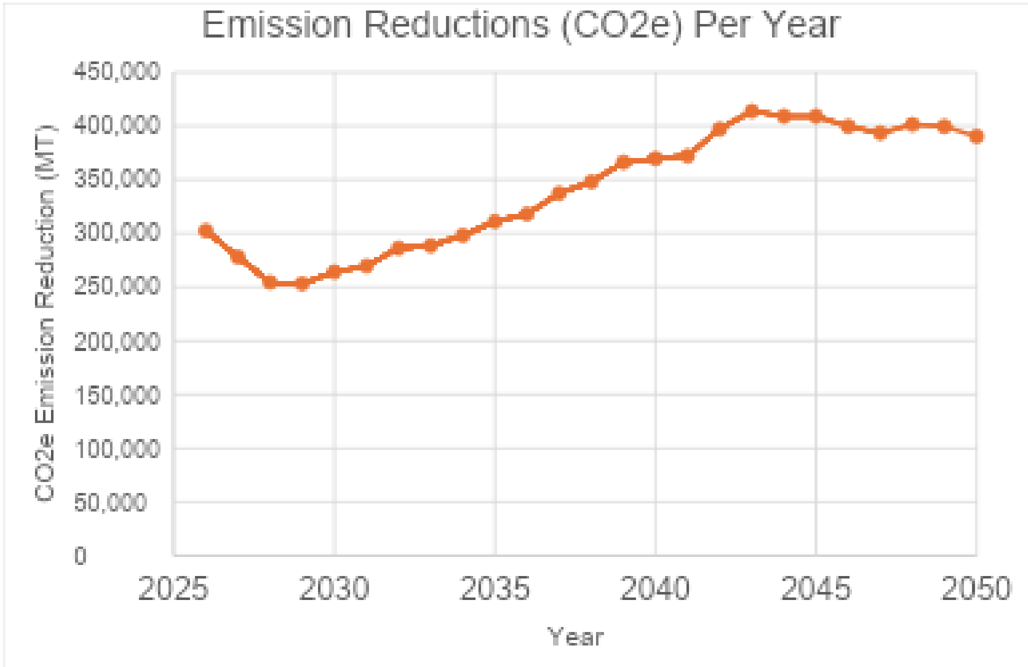

Figure 7: CO2e Emission Reduction per Year

Analysis of Key Metrics for 2035 and 2050

By 2035, the capacity is projected to reach 998,887 kW, representing a 45% realization of our technical potential. By 2050, the capacity will grow to 1,833,302 kW, achieving 100% of the technical potential. This represents a consistent year-on-year growth rate.

The power generation is expected to reach 1,739,027,766 kWh by 2035 and will further increase to 2,337,459,642 kWh by 2050. The growth in power generation closely correlates with the increase in capacity, demonstrating significant advancements in energy production.

Emissions reductions will achieve 372,152 MT CO2-e by 2035, growing to 390,356 MT CO2-e by 2050. This incremental increase highlights the effectiveness of emissions reduction per installed kW over time.

Cumulative reductions by 2035 are projected to be significant, with the total reaching approximately 8,530,090 MT CO2-e by 2050, underscored by consistent yearly increments in solar capacity and efficiency gains.

The technical potential scenario for deploying solar PV systems presents a robust opportunity to significantly reduce greenhouse gas emissions while enhancing the region's energy security and sustainability. Strategic implementation supported by strong policy frameworks and continuous technological advancements is essential for realizing these targets. To accelerate solar PV adoption, Georgia should enhance incentives and streamline regulatory processes while staying informed on advancements in solar technology to ensure efficient deployments. Additionally, upgrading infrastructure to handle increased solar capacity is crucial for meeting future energy demands and ensuring grid stability.

Topic Three: Co-Pollutant Benefits

Co-pollutants refer to air pollutants that are emitted alongside GHGs from fossil fuel combustion, particularly in coal and natural gas power plants. These pollutants include carbon monoxide (CO), lead, ozone, particulate matter ($PM_{2.5}$), nitrogen oxides (NO_x), sulfur dioxide (SO_2), and volatile organic compounds (VOC). These pollutants contribute to air pollution, smog formation, and respiratory diseases, making their reduction an essential part of climate mitigation strategies.

The co-pollutant emission changes for the State of Georgia in carbon monoxide (CO), nitrogen oxides (NO_x), $PM_{2.5}$, PM_{10}, sulfur oxides (SO_x), and volatile organic compounds (VOCs) were estimated for the periods 2025-2030 and 2025-2050 using the EPS tool. However, the EPS tool did not include options for lead or ozone emissions. Building on this analysis, we modeled the maximum technical potential for solar PV adoption in Georgia. The EPS parameters were adjusted as follows: the Distributed Solar Carve-Out was increased to 24%, requiring that a portion of total retail electricity demand be met by distributed solar systems on residential and commercial buildings. Additionally, the Distributed Solar Subsidy was set to 50%, where the government would reimburse building owners for half of the installation costs of new distributed solar PV systems.

	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_x	VOC
2025-2030 Co-Pollutant Reduction (MMT)	-0.072	-0.020	-0.12	-0.57	-0.013	-0.62
2025-2050 Co-Pollutant Reduction (MMT)	-0.31	-0.044	5.3	4.5	-0.010	5.5

Figure 8: Estimated co-pollutant emission changes resulting from increasing use of solar PV from 2025 – 2030 and 2025 – 2050.

The deployment of solar PV energy is widely acknowledged for its role in reducing greenhouse gas emissions. However, our analysis indicates that certain pollutants, such as PM_{10} and VOCs, are projected to increase, particularly between 2025 and 2050. While pollutants like NO_x and SO_x show only modest reductions, most emissions experience minimal decreases during the 2025-2030 period. Notably, by 2050, PM_{10} and VOC emissions rise significantly, suggesting that the long-term expansion of solar PV energy could result in net increases in specific co-pollutants.

The manufacturing process for solar panels, particularly those made from crystalline silicon, requires substantial energy, much of which is derived from fossil fuels. This leads to emissions of pollutants like sulfur oxides (SO_x) and nitrogen oxides (NO_x). Additionally, certain photovoltaic technologies, such as cadmium telluride (CdTe) and copper indium gallium selenide (CIGS), utilize hazardous metals like cadmium and selenium. Improper handling during manufacturing or accidental releases can pose environmental and health risks[14].

Regarding transportation and installation, the logistics involved in moving raw materials to manufacturing sites and distributing finished solar panels to installation locations often rely on vehicles powered by fossil fuels, contributing to particulate matter (PM_{10}) and NO_x emissions.

At the end of their lifecycle, solar panels can become a source of electronic waste. If not properly managed, toxic materials such as lead and cadmium may leach into the environment, contaminating soil and water. Recycling can mitigate some of these impacts, but the process can be energy-intensive and may require the use of hazardous chemicals, which, if not managed correctly, can result in further emissions[15].

Health and Environmental Impacts

The adoption of solar photovoltaic (PV) energy is a crucial step toward enhancing environmental sustainability and improving public health. Transitioning to solar energy reduces reliance on fossil fuels, leading to a substantial decrease in greenhouse gas emissions and air pollutants such as sulfur dioxide (SO_2), nitrogen oxides (NO_x), and particulate matter (PM). These pollutants are associated with respiratory conditions like asthma and bronchitis and are known to contribute to premature mortality[16].

---

[14] Fraunhofer Institute for Solar Energy Systems. *Life Cycle Assessment of Solar Photovoltaic Systems*. 2021.
[15] International Renewable Energy Agency. *End-of-Life Management: Solar Photovoltaic Panels*. 2016.
[16] *2025.* EPA. *Environmental Protection Agency. Accessed March 12.*
https://www.epa.gov/americaschildrenenvironment/health-respiratory-diseases.

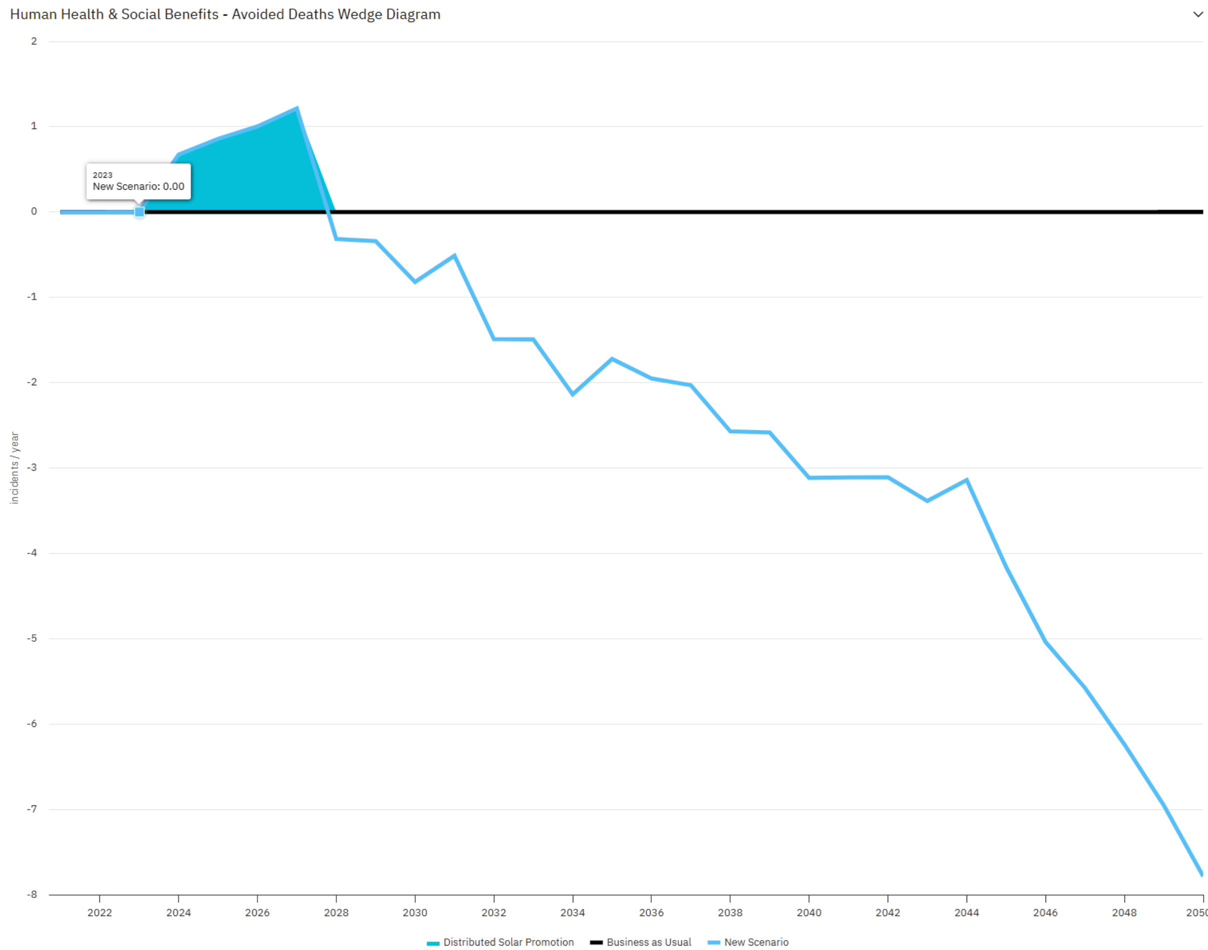

Figure 9 - Human Health & Social Benefits – Avoided Deaths Wedge Diagram

The accompanying graphs illustrate the projected health benefits associated with increased solar PV adoption. The first graph demonstrates the estimated reduction in premature deaths over time under a scenario that promotes distributed solar energy. The graph shows an initial slight increase in avoided deaths, followed by a consistent decline in mortality incidents, reaching nearly eight fewer cases per year by 2050. This decline highlights the long-term benefits of reduced air pollution in preventing premature deaths.

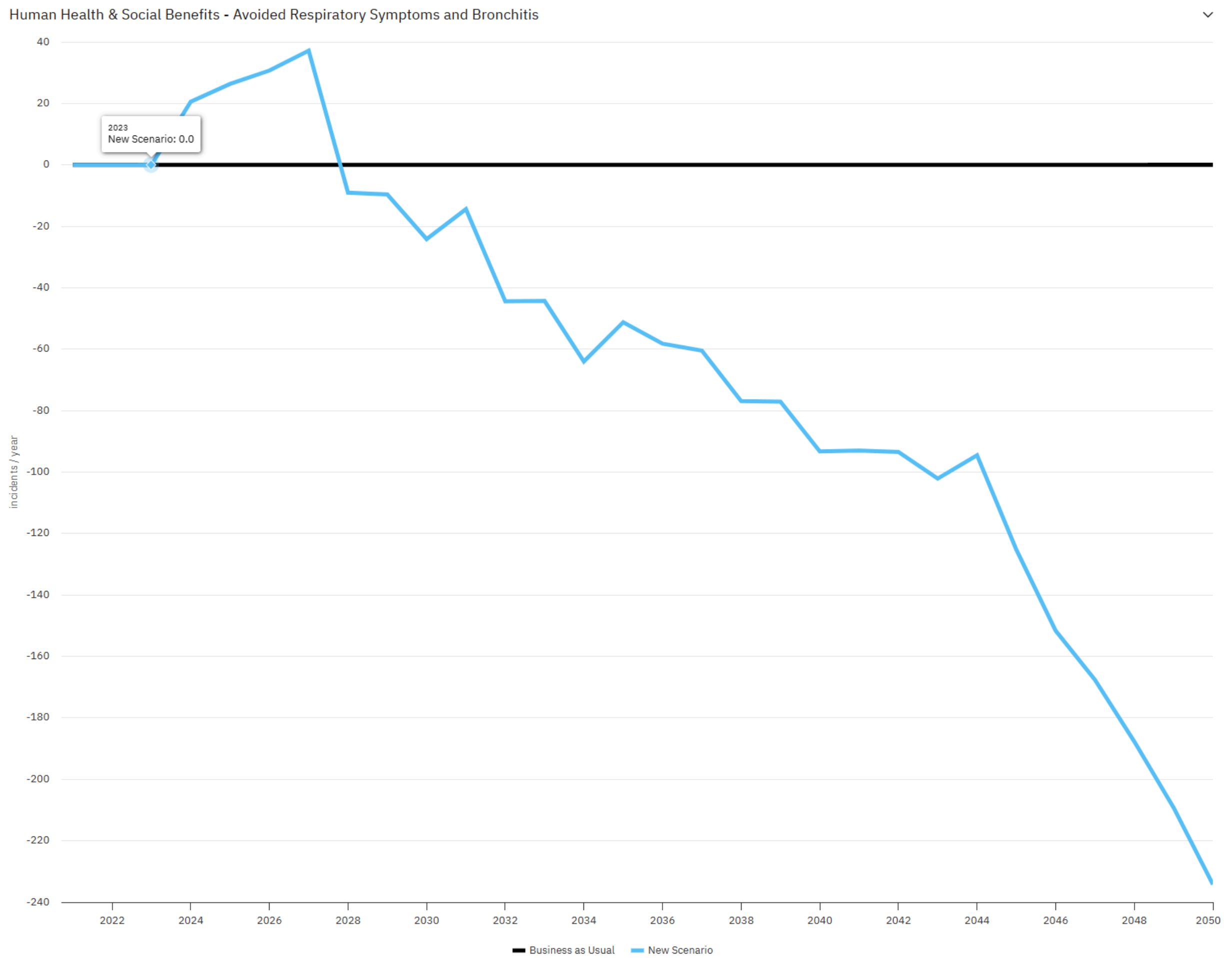

Figure 10- Human Health & Social Benefits – Avoided Respiratory Symptoms and Bronchitis

Similarly, figure ten, presents a substantial decline in the number of respiratory illnesses and bronchitis cases over the years. By 2050, the implementation of solar PV could prevent over 200 cases of respiratory illness annually. The decreasing trend aligns with reductions in air pollutants that exacerbate respiratory conditions. As a result, public health outcomes will improve, reducing the burden on healthcare systems and enhancing the quality of life for communities.

Beyond health benefits, the economic implications of solar PV adoption are significant. Reducing the incidence of respiratory diseases and premature deaths will alleviate pressure on healthcare infrastructure and lower associated medical costs. Furthermore, the shift to solar energy enhances energy resilience, ensuring that critical public institutions maintain power during grid disruptions[17]. The financial savings from solar energy can be reinvested into educational programs, research, and essential public services[18].

While solar PV adoption has a transformative impact, it is essential to address potential challenges, such as the embodied emissions from solar panel manufacturing. However, these effects can be mitigated through policies promoting renewable energy sources in solar production and lifecycle recycling initiatives. By integrating solar PV into public infrastructure, institutions can serve as leaders in sustainability, reinforcing their commitment to environmental responsibility while fostering a healthier and more resilient future.

Topic Four: Financial Costs, Savings, and Economic Impacts of Solar PV for CO2-e Reduction

The proposed expansion of rooftop solar PV is analyzed for its potential to reduce CO_2 emissions while providing economic benefits through energy cost savings. This is contextualized within the energy policy framework and decarbonization goals of the Metro Atlanta area.

Financial and Environmental Impact

- **Solar Cost:** The cost of solar installations has significantly decreased and is expected to continue to do so. By 2035, costs are estimated at \$1.2/W, dropping to \$0.7/W by 2050[19].
- **Grid Decarbonization:** The grid's carbon intensity is projected to decrease, affecting the net CO_2 savings from solar PV installations. Early adoption before 2035 will yield greater CO_2 savings per kWh[20].
- **Electricity Rates and Savings:** Assumed commercial electricity rates are \$0.12/kWh in 2035 and \$0.13/kWh in 2050. The financial analysis shows substantial savings over the lifetimes of the installations[21].

Methodology & Assumptions

This analysis assumes:

- **Solar Deployment Levels:** By 2035, approximately 300 MW and by 2050, 600 MW.
- **Solar Energy Yield:** An average production of 1,300 kWh per kW per year[22].

[17] International Energy Agency. *Solar PV and Health Benefits*. 2023. https://www.iea.org.
[18] U.S. Department of Energy. (2022). Solar energy technologies office. Retrieved from https://www.energy.gov
[19] *"Solar Installed System Cost Analysis." 2025.* NREL. *Accessed March 13. https://www.nrel.gov/solar/market-research-analysis/solar-installed-system-cost.html*.
[20] *"Sustainability." 2025.* Southern Company. *Accessed March 13. https://www.southerncompany.com/sustainability/clean-energy/net-zero-transition.html*.
[21] *"U.S. Energy Information Administration - EIA - Independent Statistics and Analysis." 2025.* EIA. *Accessed March 13. https://www.eia.gov/state/?sid=GA*.
[22] *"U.S. Energy Information Administration - EIA - Independent Statistics and Analysis." 2025.* EIA. *Accessed March 13. https://www.eia.gov/state/?sid=GA*.

- **Emissions Factors:** Average grid emission rates of 0.20 kg CO_2/kWh in 2035 and 0.05 kg CO_2/kWh in 2050[23].
- **Financial Assumptions:** Costs include upfront capital expenses with savings calculated from reduced electricity purchases[24].

Metric	**2035 Scenario (300 MW PV)**	**2050 Scenario (600 MW PV)**
Annual solar generation (MWh)	~**390,000** MWh	~**780,000** MWh
Annual CO_2 avoided (metric tons)	~**78,000** tCO_2	~**39,000** tCO_2
Upfront installed cost (million $)	**$360 M**	**$420 M**
Annual electricity cost savings (million $)	**$46.8 M**	**$101.4 M**
Cost per ton CO_2 avoided	~$**4,615**/ton	~$**10,770**/ton
Savings per ton CO_2 avoided	~$**600**/ton	~$**2,600**/ton
Net cost per ton (lifecycle)	**–$600**/ton (net savings)	Net savings (solar profitable)

Figure 11: 2035, 2050 results

The analysis indicates that rooftop solar PV installations would not only help in reducing CO_2 emissions but also result in significant financial savings due to lower electricity costs. These savings can be reinvested into public services, enhancing community resilience and sustainability. The accelerated adoption by 2035 is recommended to maximize reduction benefits. Policies should support joint procurement to achieve economies of scale, and "solar-ready" building codes could also further facilitate this transition.

Job Impacts

The projected expansion of solar PV will significantly boost employment across various sectors. As we move towards 2035, we anticipate the creation of 10,000–30,000 solar-related

[23] *"Sustainability." 2025.* Southern Company. *Accessed March 13.* https://www.southerncompany.com/sustainability/clean-energy/net-zero-transition.html.
[24] *"Solar Installed System Cost Analysis." 2025.* NREL. *Accessed March 13.* https://www.nrel.gov/solar/market-research-analysis/solar-installed-system-cost.html.

jobs in the region, reflecting about 2% of the national projection of 500,000 to 1,500,000 solar jobs. This includes direct jobs in design, construction, manufacturing, and operations & maintenance (O&M), as well as indirect and induced jobs throughout the local economy.

- **Construction/Installation:** Installing PV systems on government and university buildings will generate significant employment in construction trades. A typical 1,000 MW solar program can create approximately 3,333 construction jobs annually. For Metro Atlanta, achieving 4–5 GW of distributed PV by 2050 could continuously employ over 2,500 construction workers annually.
- **Manufacturing:** Hanwha Qcells, for example, has significantly expanded its solar panel manufacturing capacity in Dalton, GA, anticipating an 8.4 GW output by 2024, and creating over 4,000 jobs. This local production capacity supports additional indirect jobs in supply chains, such as metal fabricators and electrical suppliers.
- **Operations & Maintenance:** Solar PV is relatively low maintenance but does require consistent upkeep, including cleaning and inverter servicing. We estimate 0.2–0.4 O&M jobs per MW, translating to 1,000–2,500 jobs for Metro Atlanta's expected solar capacity of 5–12 GW by 2050.
- **Energy Sector and Other Indirect Jobs:** Additional employment will arise in energy sector roles such as grid integration and project finance, along with induced jobs in the broader economy due to increased local spending by those employed in solar-related jobs.

Year	Construction Jobs	Manufacturing Jobs	O&M Jobs	Annual Total	Cumulative Total
2035	1,200	800	400	2,400	2,400
2040	1,800	1,200	600	3,600	6,000
2045	2,000	1,600	800	4,400	10,400
2050	2,500	2,000	1,000	5,500	15,900

Figure 12

This comprehensive employment impact underscores the transformative potential of solar PV adoption in terms of job creation.

Economic Impacts

As the solar market expands, local businesses like solar installation companies, electrical contractors, and engineering firms will see significant growth. An active example is the current partnership between Atlanta's solar program and Cherry Street Energy, which has been proven successful in financing and deploying solar projects. Georgia's clean energy sector, which provided over 82,000 jobs in 2024[25], continues to grow creating additional demand for local goods and services.

The solar sector also attracts substantial investments. Public-private partnerships and third-party financing are bringing in outside capital, boosting construction activity and energy cost savings. Since 2022, Georgia has secured more than $15 billion in clean energy investments, including funds for solar manufacturing and electric vehicle (EV) battery plants[26], which have directly contributed to local economic growth and job creation.

The increasing use of solar PV is not possible without grid modernization, turning public facilities and campuses into self-sufficient microgrids. These microgrids improve resilience during power outages contributing to community stability[27]. Additionally, integrating solar energy with EV charging infrastructure supports broader EV adoption and can lead to further infrastructure projects.

Solar installations help reduce long-term energy costs for public institutions, allowing the financial savings to be redirected to other community priorities. Investments in solar energy also create a significant economic return by creating jobs and lowering energy costs[28].

Solar energy can also increase property values, potentially growing the local tax base. Additionally, counties may generate income from leasing land for community solar projects, creating a new revenue stream for local governments.

These economic advantages not only enhance Metro Atlanta's economy but also make it more attractive as a sustainable and innovative region. By focusing on environmental responsibility, the region has the potential to draw in new businesses and skilled workers who prioritize sustainability.

Metro-Wide GDP Contribution

For every gigawatt of solar capacity installed, around $1 billion in upfront capital is invested, in addition to operating expenditures. For example, a 5 GW increase in solar capacity by 2050 is estimated to contribute about $5 billion to the regional GDP. Considering the multiplier effects, there is an estimated economic impact of $10-20 billion over time [29].

Solar power adoption helps keep energy dollars circulating within the local economy. By reducing the need to import electricity, solar energy boosts local business and economic activities ultimately creating a more resilient economic environment that attracts new businesses and

[25] Georgia Solar Energy Association. *Annual Report on Georgia's Solar Energy Market*. 2024.
[26] U.S. Department of Energy. *Solar Energy Technologies Office*. 2022. https://www.energy.gov.
[27] International Energy Agency. *Solar PV and Health Benefits*. 2023. https://www.iea.org.
[28] U.S. Environmental Protection Agency. *Air Quality and Health Benefits of Renewable Energy*. 2022. https://www.epa.gov.
[29] National Renewable Energy Laboratory. *Economic Impacts of Solar Energy Adoption*. 2021. https://www.nrel.gov.

skilled workers, promoting long-term economic growth[30].

Conclusion

In conclusion, while our analysis of solar PV adoption in the Metro Atlanta region offers valuable models for cost-competitive carbon reductions, it is also essential to consider the equity impacts of these measures. Solar energy adoption presents significant environmental and economic benefits, but these benefits must be accessible to all communities, particularly those that have historically been under-resourced.

To promote equity in solar PV deployment, it is important to ensure that low-income and marginalized communities have access to affordable solar options, including through targeted subsidies, community solar programs, and incentives that lower installation costs. Additionally, workforce development opportunities in the solar industry should be expanded to create sustaining jobs in these communities.

By addressing these equity considerations, we can ensure that the benefits of solar PV adoption, such as reduced energy costs, improved air quality, and economic growth, are distributed evenly across all residents of Metro Atlanta. These benefits make solar PV a viable solution for Georgia's energy future. However, to truly see the potential of solar energy, it is essential to tackle the systemic barriers faced by underserved communities. Only by addressing such challenges, such as affordability, access to financing, and workforce development, can we ensure that all Georgians, regardless of background, can fully participate in and benefit from the transition to clean energy. This approach will foster a more inclusive, sustainable, and equitable energy future for the state.

[30] U.S. Department of Energy. *Solar Energy Technologies Office*. 2022. https://www.energy.gov

Appendices

Appendix A: MP-Solar_PV_analysis_ARC_V8 (version 1).xlsx

- Contains data on solar PV technical potential and CO2-e reduction estimates based on the analysis.

Appendix B: Problem1 29c data.xlsx

- Contains data used for CO2 reduction estimations across different scenarios.

References

Environmental Protection Agency. *Atlanta MSA ARC PCAP*. March 2024. https://www.epa.gov/system/files/documents/2024-03/atlanta-msa-arc-pcap.pdf.

Fraunhofer Institute for Solar Energy Systems. *Life Cycle Assessment of Solar Photovoltaic Systems*. 2021.

Georgia Building Authority. "Buildings Managed by the State of Georgia." Accessed March 14, 2025. https://gba.georgia.gov/buildings.

Georgia Solar Energy Association. *Annual Report on Georgia's Solar Energy Market*. 2024.

International Energy Agency. *Solar PV and Health Benefits*. 2023. https://www.iea.org.

International Renewable Energy Agency. *End-of-Life Management: Solar Photovoltaic Panels*. 2016.

National Renewable Energy Laboratory. *Economic Impacts of Solar Energy Adoption*. 2021. https://www.nrel.gov.

National Renewable Energy Laboratory. *Solar Installed System Cost Analysis*. 2025. Accessed March 13, 2025. https://www.nrel.gov/solar/market-research-analysis/solar-installed-system-cost.html.

Southern Company. "Sustainability." 2025. Accessed March 13, 2025. https://www.southerncompany.com/sustainability/clean-energy/net-zero-transition.html.

Solar Power Free-Market Financing Act, H.B. 57, 153rd Ga. Gen. Assemb. (2015). https://www.legis.ga.gov/.

Solar CrowdSource. "Atlanta Solar: Solarize Atlanta." September 3, 2024. https://www.solarcrowdsource.com/campaign/solarize-atlanta-2-0/.

U.S. Department of Energy. *Solar Energy Technologies Office*. 2022. https://www.energy.gov.

U.S. Energy Information Administration. "U.S. Energy Information Administration - EIA –

Independent Statistics and Analysis." 2025. Accessed March 13, 2025. https://www.eia.gov/state/?sid=GA.

U.S. Energy Information Administration. "State Energy Profile Data." 2025. Accessed March 10, 2025. https://www.eia.gov/state/data.php?sid=GA.