A Bright Future: Building a Solar Atlanta

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Executive Summary

Atlanta has vast untapped potential for solar energy. The city is blessed with 2800 hours of sunlight a year, far more than Germany, the world leader in solar power generation.

By taking advantage of its potential for rooftop solar photovoltaic (PV) installations, Atlanta can meet 10 percent of its total electricity needs with clean, renewable solar power by 2030. In addition, if Atlanta develops its potential for solar hot water systems at the same pace, solar power can help meet the water heating needs of nearly 40,000 Atlanta families.

Indeed, Atlanta and the rest of Georgia have already started tapping into the state's solar energy potential. In 2012, Georgia's installed solar is estimated at around 20 megawatts (MW), up from 1.8 MW in 2010. In November 2012, the Georgia Public Service Commission (PSC) approved a Georgia Power plan to purchase up to 210 MW of solar power by 2016.

The City of Atlanta can play an important role in this solar renaissance by supporting solar installed on homes and businesses inside the city and leading the charge for solar in Georgia and across the south.

Solar leadership will reduce the city's contribution to global warming, help improve air quality, and protect its environment. More solar power will also create jobs and boost manufacturing in Georgia. Putting policies in place to accelerate the growth of the solar energy market will allow Atlanta to start reaping these benefits immediately.

- **Utilizing all available rooftop space with suitable sun exposure, residents, businesses and government in the City of Atlanta could technically install nearly 1,400 MW of rooftop solar photovoltaic (PV) power systems by 2030—which would generate about 21 percent of the city's total forecast electricity use in that year.** Local, rooftop solar provides unique advantages for the electricity system because the power is generated close to where it will be used, reducing the loss of electricity that happens when it is transmitted long distances and minimizing the need to invest in power lines and other infrastructure and increasing the reliability of electricity service.

- **In order to achieve 10 percent solar power by 2030, Atlanta needs to develop about half (44 percent) of its total technical potential for solar PV installations in the next 18 years.** Atlanta can achieve this benchmark by growing its solar market by an average of 38 percent per year, a rate that other states with established solar markets have demonstrated to be possible, such as California (54 percent) and New Jersey (79 percent). This would yield 662 MW of local solar photovoltaic capacity by 2030—enough to power 58,000 of today's Atlanta homes.

- **Developing Atlanta's potential for solar water heating systems at the same pace as solar PV by 2030** would save an additional 66 MWh of electricity and 300 million cubic feet of natural gas per year. Combined, that much energy could meet the full water heating needs of nearly 40,000 of today's Atlanta households.

- **Combined, rooftop solar and solar water heating installations can help save more than 712,000 metric tons of global warming pollution annually by 2030, the equivalent of taking nearly 134,000 cars off the road.**

In addition to seriously cutting pollution associated with climate change, the displacement of fossil fuel power with solar power will help reduce soot, smog and mercury pollution, which damage public health. At the same time boosting the amount of solar in the city's energy mix will help conserve water.

Finally, increasing the market for solar power in Atlanta could make the city a leader in the regional solar power industry, create jobs, and boost the economy. A 2012 survey of the solar industry found that the solar industry has grown 13.2 percent since August 2011, which is more than ten times higher than the average employment growth rate in Atlanta of 1.3 percent. Moreover much of this growth is in the construction industry, one of the hardest hit markets during the recession.

Atlanta and other Georgia cities should enact policies to accelerate solar energy development.

Introduction

Atlanta has long been considered the capitol of the Southeast. Increasingly this leadership has manifested itself in "green" efforts. The city has successfully taken bold steps to protect and maintain the city's tree canopy, upgrade sewers that were major sources of water pollution and increase efficiency through the Atlanta Better Buildings Challenge.

Recently, Atlanta's mayors, beginning with Mayor Shirley Franklin, have pursued sustainability with research and activities, including launching the Mayors Office of Sustainability. For example, Atlanta was the first city in the state to determine its municipal carbon footprint, and by 2010, Atlanta reduced it by 12.5 percent.[1]

This leadership in the face of today's most serious environmental challenges couldn't come at a more critical time. Expensive and disastrous storms such as Hurricane Sandy clearly spell out how dangerous the consequences of global warming, including stronger storms, can be.

Global warming scientists also predict periods of more intense drought compounding the already serious droughts we have experienced in recent years. Atlanta relies on the Chattahoochee River and watershed for the majority of its water supply—the smallest watershed, or drainage area, which provides a major portion of water supply for any metropolitan area in the country.[2]

In addition to water challenges, Atlanta also faces air quality challenges. During smog season Atlanta's air quality is often dangerous for the elderly, infirm and young to breathe. In 2011 Atlanta's air ranked amongst the dirtiest in the nation.[3]

Solar energy is becoming an increasingly important part of the energy system around the world. For example, Germany is using solar power to help reduce its dependence on natural gas and nuclear power. In December 2011, the German solar industry installed almost twice as many solar energy systems than the entire United States managed to complete during the entire year—and Germany did it for much less cost per kilowatt.[4] More than a third of the homes in Israel have solar water heating systems, and China has more solar water heating capacity than the rest of the world combined—helping to reduce these countries' dependence on electricity and natural gas.[5]

In 2012, Georgia's solar capacity is estimated at around 20 megawatts (MW), up from 1.8 MW in 2010. In November 2012, the Georgia Public Service Commission (PSC) approved a Georgia Power plan to purchase up to 210 MW of solar power by 2016.[6]

There is no reason Atlanta can't lead the way in solar power in the same way it has led on other crucial sustainability initiatives.

The city can lead the way in Georgia towards a future in which all electricity comes from zero-emission, renewable sources of power. By championing, streamlining, and supporting local, rooftop solar installations, the city can

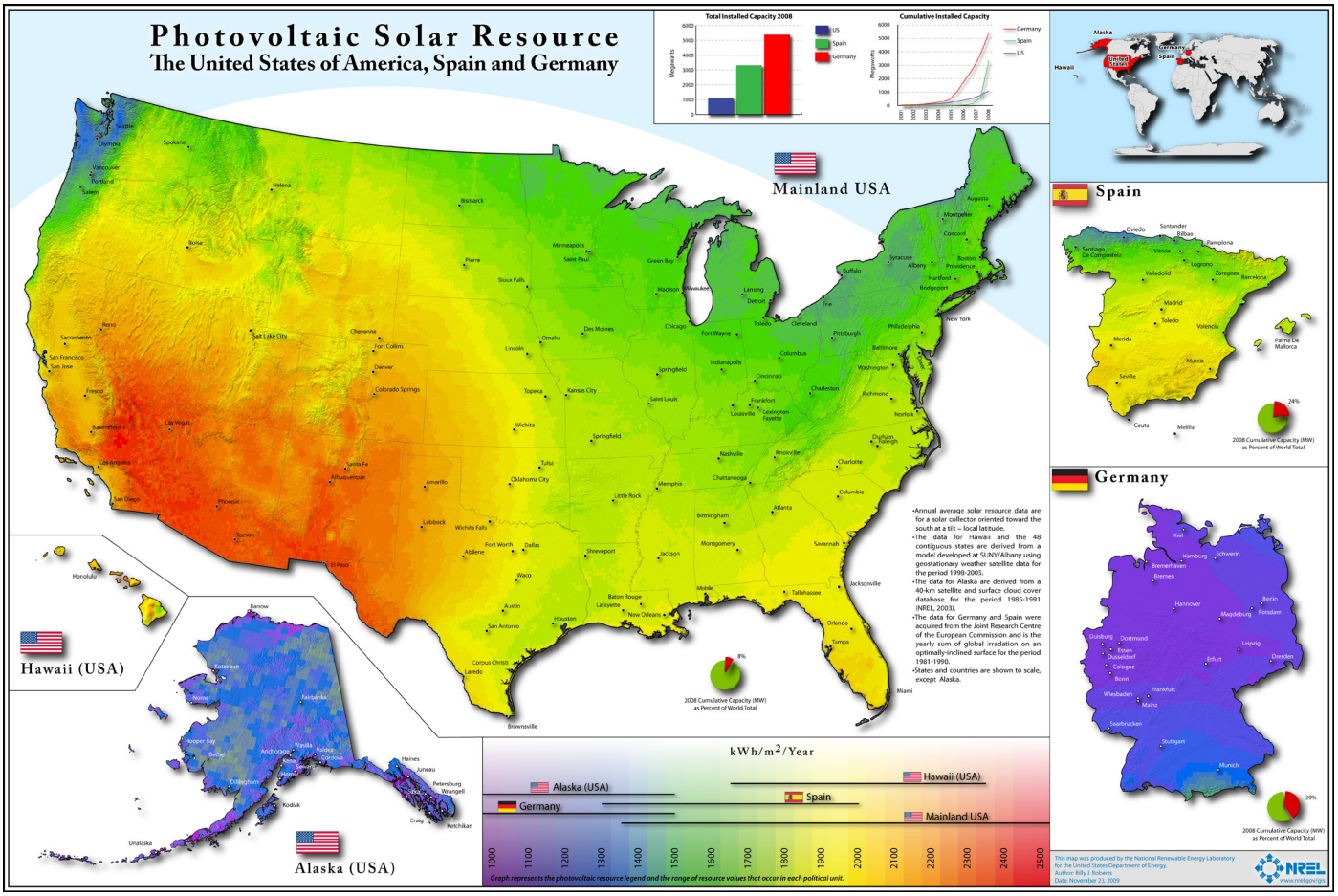


Figure 1. *Georgia gets more sun than Germany, the leader in solar capacity.*

play an important role in solar development in Georgia and the rest of the south. Eventually, Atlanta's electricity system may even become an important source of energy for transportation, providing power to recharge batteries in electric and plug-in hybrid-electric cars.

In order to make this vision a reality, however, Atlanta must take bold action now to accelerate the deployment of distributed solar energy systems.

In this report, Environment Georgia Research & Policy Center examines the potential for solar power to contribute to Atlanta's electricity and water heating needs. Further, the report examines the environmental and economic benefits of developing a stronger market for solar energy.

We conclude that solar energy can open the door for every citizen to play an important role in building a clean energy future for Atlanta. The city has a significant opportunity to create jobs, reduce pollution, and decrease the risk posed by global warming for future generations, all while leading the way for a state and region that lag in local installed solar capacity.

Atlanta Has Massive Untapped Solar Potential

Sunlight is a massive energy resource that can help power Atlanta's future. Capturing this energy can provide electricity and hot water for households and businesses in Atlanta.

The Sun Shines on Atlanta

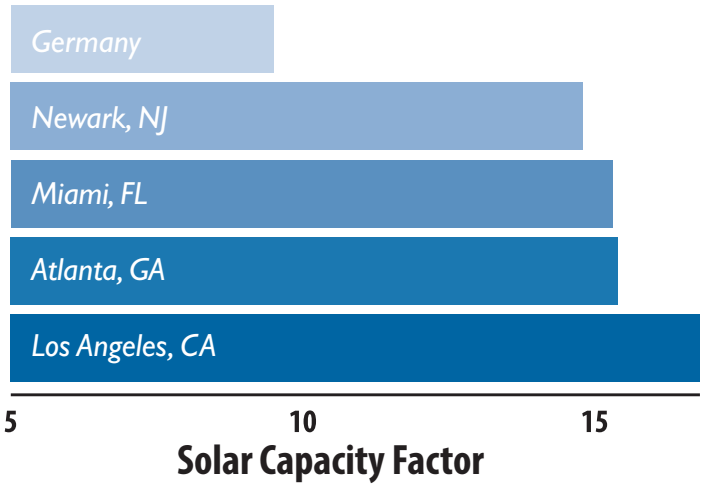
In short, the sun in Atlanta is up for the job. On average Atlanta has over 2800 hours of sun a year[7], far more than Germany which has between 1200 and 1800 hours of sun in different parts of the country and has the world's largest solar energy market.[8]

Solar resource quality at a given location can be measured by the average output of a solar photovoltaic panel over the course of a year. Output depends on the intensity of the sunlight reaching the panel, which varies from hour to hour with the weather and the passing of day and night, and from season to season with the angle of the sun and the length of the day.

In Atlanta, a one kilowatt solar panel using today's technology will capture enough sunlight to generate 1,345 kWh of electricity over the course of an entire year, the average Georgia home uses over 14,000 kWh over the course of a year.[9] In other words, on average, the solar panel will generate electricity at full capacity about 15.4 percent of the time—a value called the panel's "capacity factor."

In comparison, the same solar panel in Germany would only capture enough sunlight to deliver a 9.5 percent capacity factor. In Newark, NJ, the capacity factor is 13.5 percent and the city of Miami's capacity factor is slightly less than Atlanta's at 15.3 percent.

Figure 2. *Comparison Of Solar Energy Resources.*



Atlanta's solar resource compares favorably with other locations where solar energy is taking off. A one-kilowatt solar panel in Germany—by far the worlds' most developed photovoltaic market—would deliver a capacity factor of about 9.5 percent.[10]

The Benefits of Local Solar

Empty rooftops represent a prime location to place solar energy systems where they won't interfere with other land-uses. Rooftop solar

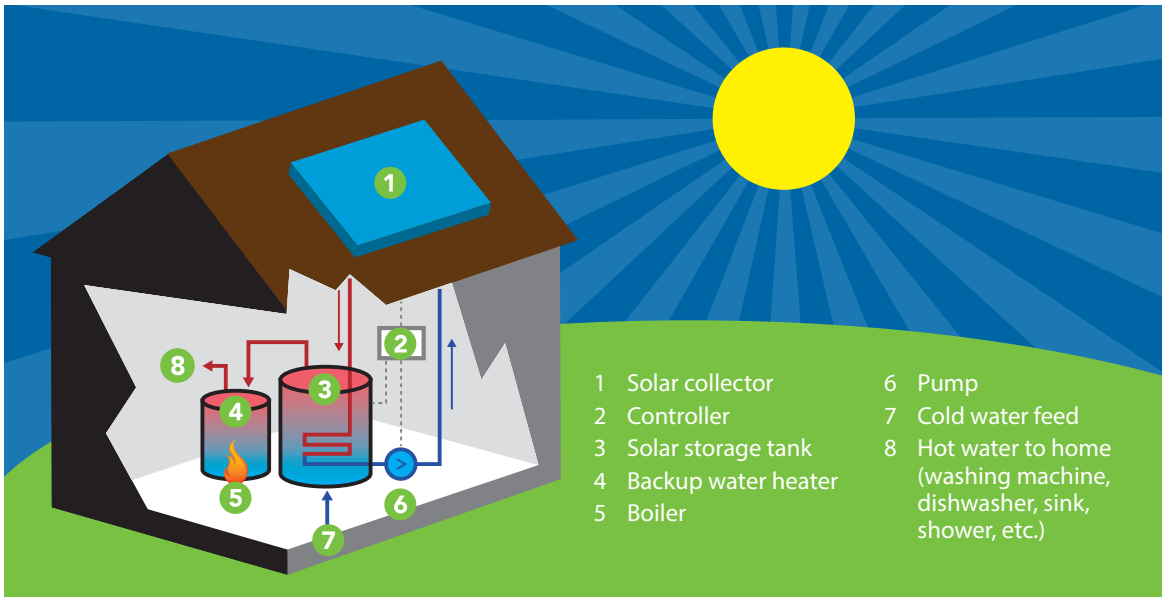


Figure 3. *Diagram of a roof-mounted, residential solar water heater.*

also creates energy for the building or neighborhood where it is used, reducing loss of electricity during transmission. Rooftop solar energy technologies turn sunlight into electricity and use solar heat to provide hot water for local consumption.

Rooftop Solar Photovoltaic Panels

Solar photovoltaic (PV) panels capture the energy in sunlight and turn it into electricity. Panels produce the most power when they are placed on a roof with optimal sun exposure. Appropriate locations face south and are not shaded by trees or other objects for most of the day. Buildings with rooftop solar PV systems are typically connected to an electric grid, which provides power during cloudy weather or at night and captures any extra electricity produced by the panels during periods of sunny weather. Since rooftop solar panels generate electricity close to where it will be used--and often at times of the day when demand for electricity is high and the cost of supplying electricity is also high—solar technology can reduce the need to invest in cross-country power lines and help increase the reliability of electricity service.

A typical home solar installation ranges from 3 to 8 kilowatts in capacity, taking up 300 to 800 square feet of rooftop area.[11] Solar PV systems on commercial buildings can exceed 100 kW in size, especially on large warehouses.[12]

Assuming that the pace of building new homes, warehouses and other building continues unchanged, and ignoring any potential for solar technology to improve beyond the year 2015, Atlanta will technically be able to support **1,490 MW of rooftop solar PV power systems by 2030—which would generate about 21 percent of the city's forecast electricity use in that year.**[13] (See Figure 3.) Excluding the area required for full penetration of solar water heating systems, Atlanta's technical rooftop solar PV potential would be about 1400 W.

Rooftop Solar Hot Water Systems

Virtually any building with a need for hot water and a roof exposed to the sun can take advantage of solar hot water. The U.S. Department of Energy's National Renewable Energy Laboratory estimates that 40 percent of homes and 60 percent of commercial buildings in the Southeast have appropriate characteristics to support a solar hot water system.[14]

Solar water heating systems use simple technology to capture solar energy and heat water for a home, commercial building or factory. Tens of millions of households worldwide—particularly in Israel and China, but also increasingly in the United States—use solar water heating extensively.[15]

Solar water heating systems take up very little space. A dark surface and liquid-filled tubes are enough to effectively capture the energy in sunlight.[16]

Preheating water before storing it in an insulated tank reduces the amount of electricity or natural gas required to further heat the water to a usable temperature. In Atlanta, solar hot water heating systems can cut the energy use of a standard water heater by more than half.[17]

- **Developing 44 percent of Atlanta's full potential for solar water heating systems by 2030** would save an additional 80 MWh of electricity and 400 million cubic feet of natural gas per year. Combined, that much energy could meet the full water heating needs of more than 50,000 of today's Atlanta households.[18]

Utility Scale Solar

Solar energy systems can also be placed on vacant land with adequate sun exposure or on creative locations such as on top of capped landfills, along freeways, attached to utility poles or parking lots, rather than on buildings. The technical potential for this type of solar energy in Atlanta is limited only by availability of appropriate locations and transmission lines to carry the electricity to market.

Georgia Power has recently stepped up its investment in utility scale solar. In 2011 it received approval from Georgia's Public Service Commission to add 50 MW of large, utility scale solar to its portfolio. The Public Service also approved, in November 2012, a Georgia Power Plan that includes 120 MW of additional utility-scale solar by 2017.[19]

PV solar array at Hickory Ridge Landfill. Photo courtesy of Carlisle Energy.

This report's calculations focus on Atlanta's potential for local, rooftop solar so is still an underestimate of Atlanta's technical solar potential. Also, less-common uses for solar power beyond the scope of this report have huge potential for saving money, especially in heating and cooling. Solar hot water can be used to heat buildings, and new technologies allow solar power to be used to cool buildings as well.

Finally, the efficiency of solar panels has been increasing, so that more electricity can be produced from a solar panel of the same size. As efficiency continues to increase, Atlanta's solar potential will grow even if the amount of rooftop and land area available for solar power stays the same.[20]

With only a few megawatts of solar PV currently installed, Atlanta's solar potential is an enormous untapped resource.

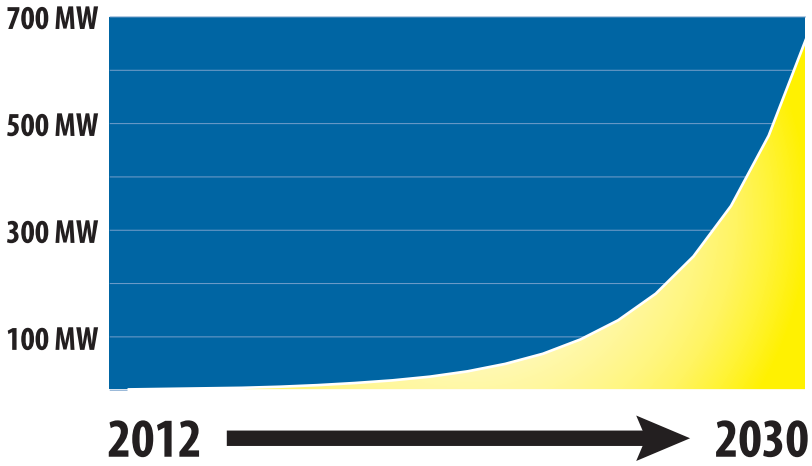
Growing Local Solar In Atlanta

Realizing Atlanta's potential

Atlanta could be getting much more of its energy from solar power. The real question is how quickly solar power can be installed in the city. The limit to the speed of installation for solar power is for the most part not technical—rather, it depends on the policies that are in place and what effect they can have on increasing solar installations.

Many governments have put policies in place to encourage solar installation and build their solar industries. These places—including countries such as Germany, Japan and Spain, and states such as New Jersey and California—have seen their solar power markets skyrocket over the past decade. In 2008 more than 75 percent of the solar power installed in the world was in Germany, Spain, and Japan, because of the policies favorable towards the installation of solar power.[21]

Figure 4. *Projected solar PV capacity to reach 10 percent of consumption by 2030.*



To lay out a vision for a future course of rooftop solar PV development for Atlanta, we looked at aggressive growth rates that have been achieved in other parts of the country including California (54 percent) and New Jersey (79 percent).[22] We also considered the growth rate currently proposed by Georgia Power (45 percent) in their Advanced Solar Initiative proposal.

We set a benchmark goal of obtaining 10 percent of Atlanta's projected electricity use in 2030 from solar. Using an annual electricity generation estimate of 1,345 kWh per kW in Atlanta, we calculated that Atlanta would need 662 MW of solar PV capacity—about 44 percent of its technical potential—to reach this benchmark.[23]

Southface, an Atlanta-based non-profit, estimated that the current solar capacity of Atlanta to be roughly between 2 and 3 MW.[24] To be conservative, we assumed 2 MW of installed capacity for the actual city of Atlanta as the starting point for our solar market growth scenario.

To achieve the benchmark of 662 MW by 2030, the city will have to increase solar PV capacity by an average of 38 percent every year. The experience of other states and a Georgia Power proposal prove that the right policy mechanisms can make this goal a reality.

Solar Power Protects Atlanta's Environment And Strengthens The Economy

Atlanta has the potential to become a leader in solar power. Besides supplying energy for Atlantans, realizing this potential would help the City reduce its global warming emissions, clean up its air, conserve water and otherwise improve the environment. Building out solar power would also create jobs in the state and stimulate the local economy.

Solar Power is Cleaner and Safer Than Other Energy Sources

Investing in solar power can reduce global warming pollution and help to create a cleaner, healthier future for Atlanta. By displacing electricity generated from fossil fuels (the predominant source of energy for most Georgia homes), solar power can cut emissions of carbon dioxide, the leading cause of global warming, as well as speed progress in reducing soot, smog and mercury pollution, which damage public health. At the same time, solar power can help to conserve Atlanta's supplies of fresh water, reducing the amount of water that would otherwise be consumed in steam-driven power plants.

Preventing Global Warming Pollution

On average, a household in Atlanta produces about 20,217 pounds of carbon dioxide in a year, the leading pollutant driving global warming. This is about the same amount of carbon dioxide produced by the average car in a 1.8 years.[25] A disproportionate amount of carbon dioxide is produced during the hours of the day when energy demand is highest—at these times, emissions are 50 percent higher than average.[26] In contrast, solar power produces zero global warming pollution (outside of any fossil fuels used during manufacture or installation of the system), and would replace the most fossil fuels during peak hours, when sunlight is the strongest.

Replacing coal and other fossil fuels with solar power would help Atlanta do its fair share to mitigate the worst effects of global warming and help lead the state of Georgia and the South towards taking on similar reductions in global warming pollution.

- If Atlanta ramps up solar capacity to achieve 10 percent solar by 2030 and installs solar hot water systems at a similar pace, the city will save approximately 712,000 metric tons of global warming pollution annually by 2030, the equivalent of taking nearly 134,000 cars off the road—cutting carbon pollution in Georgia by 8 percent by 2030[27].

Preventing Soot and Smog Pollution

Solar power can help clean Atlanta's air and improve public health. By displacing dirtier

Atlanta does not meet federal health standards for air pollution.

power sources, solar power can help prevent emissions of pollutants that damage our lungs and cause asthma, bronchitis, lung cancer and heart attacks.[28]

Partially because of this pollution, the City of Atlanta does not meet federal health standards for ozone pollution.[29]

Reducing Water Usage

Solar power has the additional benefit of conserving water in a drought prone state. Traditional power plants depend heavily on a constant supply of water to produce steam and provide cooling.[30] In fact, it requires more water, on average, to generate the electricity that lights our rooms, powers our computers and TVs, and runs our household appliances, than the total amount of water we use in our homes for everyday tasks—washing dishes and clothes, showering, flushing toilets, and watering lawns and gardens.[31] Georgia's electric utilities are responsible for over 49 percent of the water withdrawals in the state.[32]

In Atlanta, which relies heavily on the Chattahoochee River for drinking water supplies, this connection is important. Georgia Power's Plant McDonough, located outside of Smyrna, Georgia draws cooling water from the Chattahoochee River.

In contrast, solar photovoltaic systems generate electricity using very little water. For example, a homeowner might periodically wash dust off of his or her solar panels. Replacing traditional electric production with solar power will relieve some of the stress on the Chattahoochee River, Atlanta's drinking water source.

Preventing Mercury Pollution

Mercury emissions from coal-fired power plants and other industrial sources are making the fish in Georgia's rivers, lakes and streams unsafe to eat. Burning coal releases mercury into the air that eventually contaminates rivers and lakes, where bacteria convert it to a highly toxic form that bioaccumulates in fish.[33]

Mercury is a neurotoxin that is particularly damaging to the developing brain. In early 2004, EPA scientists estimated that one in six women of childbearing age in the U.S. had levels of mercury in her blood that sufficiently high to put her baby at risk of learning disabilities, developmental delays and problems with fine motor coordination, among other health impacts. [34]

In 2011 the Department of Natural Resources released a fish advisory for water bodies around Georgia. Every single major watershed had a waterway in which the fish were unsafe to eat at high levels due to mercury contamination.[35]

Reducing Mining

Extraction of coal is also increasingly destructive. Although there is no coal mining in Georgia currently, mountaintop removal methods have scarred other parts of the Appalachians with mines, some as big as the island of Manhattan, and afflicted the area's communities with polluted air and poisoned water. Georgia

is one of the top two consumers of coal mined using mountaintop removal processes.[36]

By leading the way towards more solar power, Atlanta can displace coal power, and the pressure to mine for coal will be reduced.

Solar Power Can Create Jobs and Strengthen Atlanta's Economy

Atlanta's progress toward local solar power can benefit the city's economy. By building a thriving rooftop solar market Atlanta will capture local installation jobs that cannot be outsourced. Solar power also helps to replace energy expenditures for fuel or materials produced out of state with labor and material produced at home. This keeps more of Atlanta's energy dollars in the local economy.

With more than 1700 Georgians employed in the solar industry in 2010, Georgia has the 18th largest solar job market in the nation, according to The Solar Foundation's 2011 Solar Jobs Census.[37]

A 2012 survey of the solar industry found that the solar industry has grown 13.2 percent since August 2011,[38] which is nearly ten times higher than the average employment growth rate in Atlanta of 1.6 percent.[39] Moreover much of this growth is in the construction industry, one of the hardest hit markets during the recession.[40]

Nationwide, more than half of all jobs in the solar industry are in system installation[41] providing an important buffer to a construction industry which is still recovering and continuing to report losses in some cases.[42]

Manufacturing

Atlanta's network of universities, experts and innovators make it an ideal site for developing and manufacturing solar energy technology, as evidenced by Suniva Solar Manufacturing, a metro-Atlanta solar cell manufacturing company that was started by Scientists at Georgia Tech. Other Georgia-based solar manufacturers include Cantsink in Lilburn and Mage Solar in Dublin.

Building a photovoltaic system requires creating cells from silicon and glass, installing wires and other electrical components, and assembling them into a unit. Manufacturing a megawatt of solar photovoltaic panels requires approximately six full-time employees working for a year.[43]

Building Trades, Construction and Installation

Installation of a solar hot water or PV array involves local construction firms and general contractors, boosting local economies. According to the 2010 Solar Job Census conducted by the Solar Foundation, Georgia is home to 149 solar firms.[44]

Solar power and other forms of renewable energy generate more total jobs per unit of energy produced than fossil-fuels technologies.[45] Compared to coal and gas-fired power, solar energy creates on the order of 9 times as many jobs, and wind and biomass create on the order of 75 percent more job.

The Story of Suniva

When Dr. Ajeet Rohatgi began teaching at the Georgia Institute of Technology in 1985 he brought with him an internationally recognized reputation for excellence in photovoltaics and started the photovoltaics program at Georgia Tech, which has become one of the top programs of its kind in the nation.

His success attracted the attention of venture capitalists and the research of Georgia Tech students was put to work at Suniva, a Norcross based manufacturer of PV solar cells, the panels that are used to collect and convert sunlight to energy. Suniva cells have been used in installations around the world and the company has been named Georgia's fastest-growing small mid-market company, employing a diverse and constantly expanding workforce as they work to keep up with their manufacturing abilities.

Policy Recommendations

Getting more energy from solar power, especially local solar power generated on the rooftops of buildings where it will be used, would have clear benefits for Atlanta. With so much at stake it is critical that the city start the process of ramping up its solar power today, setting an example for other Georgia cities and leading the state. However, there are a number of barriers that are preventing the city from taking advantage of its large solar potential.

For Atlantans considering installing solar panels on their homes or businesses, one of the largest barriers is the cost of solar panels. However, the cost of solar power is dropping and will continue to decline as production ramps up. Prices have fallen by more than 80 percent since 1980.[46] Analysts at the U.S. Department of Energy forecast that if solar production continues to increase, the installed cost of solar PV systems will fall by 50 percent or more by 2015, making solar electricity price competitive with other sources of electricity—even in states with relatively low-cost electricity like Georgia.[47]

There are additional barriers to installing solar power on homes and small businesses, from fees imposed by utilities to the daunting prospect of an installation project. By helping homeowners and small businesses finance solar power and removing the other barriers to installing rooftop solar systems, Atlanta can start to put solar on a level playing field with other sources of electricity.

Existing Policies and Incentives

In addition to federal incentives the state of Georgia offers the Clean Energy Property Tax Credit (CEPTC) which gives homeowners a 35% income tax credit on solar electric and solar water heating devices installed on a residence (maximum of $10,500 credit for solar electric and $2,500 for solar water heating property).[48] The CEPTC is currently scheduled to expire December 31st 2014 and is capped at $5 million per year.[49]

While this was an important first step and should be continued, there are many more policies that the city can pursue independently to ensure the growth of solar power.

Set a Goal

City leaders and decision makers should set and embrace a goal of generating 10 percent of Atlanta's electricity with solar power by 2030, and in the short term breaking the 15 MW mark in Atlanta by 2020. Ultimately, outside forces will continue to bring the cost of solar down and Atlanta will only be able to capitalize and become a leader in the solar south if it sets ambitious goals that reach beyond city infrastructure and looks to inspire and encourage all Atlantans with smart forward-looking policy.

Create a solar ready building code to increase the use of solar energy in new construction.

One of the most efficient ways to increase the amount of solar power is to require new homes to come with solar panels, or with the option of

installing solar panels. By planning solar into new homes, builders can ensure that new homes are oriented properly with un-shaded roof space for the panels. Including solar panels in new homes also costs about 25-33 percent less than retrofitting an existing home for solar[50]

A growing number of cities and states have solar requirements for new homes. New Jersey requires builders to offer solar panels in new developments of more than 25 homes. New homes in New Mexico must be wired for solar power.[51]

To achieve more, Atlanta should require all new buildings and retrofitted buildings to be solar ready by 2020 and include some sort of renewable power by no later than 2030. Such a step would build on the momentum generated by the Atlanta Better Buildings Challenge, and is consistent with steps that President Obama has ordered for federal buildings.[52] Moreover, the European Union will require net-zero energy construction for all new buildings beginning in 2019.[53]

At a minimum, builders incorporating solar into their building plans should benefit from streamlined permitting and reduced or eliminated permitting fees.

Remove barriers to going solar, including minimizing challenges with interconnection and permitting.

Different jurisdictions across the state have varying permitting and interconnection procedures and fees, which add unnecessary friction to the process of installing solar energy systems. Sunrun's report "The Impact of Local Permitting on the Cost of Solar Power," surveyed solar permitting around the country and found that inefficient permitting and inspection processes were adding $2,516 to each residential installation.[54]

Atlanta should strive to make sure permitting and interconnection costs drop with technology costs. The Office of Buildings oversees solar permitting for local residential and commercial installation in Atlanta. The fee for an average residential solar permit is $225.00 and the turnaround for a permit is approximately 10 days. This is better than many of the jurisdictions surveyed in the SunRun report, but improvements, such as online filing and streamlined turn-around, should be investigated.

Airports Going Solar

Airports have the benefit of large roofs surrounded by open space, often the perfect ingredients for a solar installation. Aditionally, especially in the case of Atlanta's Harsfield-Jackson International Airport, rooftop solar can expose millions of passengers flying into and out of the airport to the benefits of solar.

Harstfield-Jackson has a demonstrated commitment to sustainability. The new international terminal opened in 2012 features design to improve the airports water and energy efficiency. According to the airports website the terminal is in the process of receiving its Silver LEED certification.

The possibility of solar PV and hot water at the airport was explored in a 2008 Georgia Tech report, "Sustainability Options at the Harsfield-Jackson Atlanta International Airport." In 2008 the authors found that solar hot water would be a good economic investment for the airport, while PV remained too expensive.

The report should be revisted and the new and lower costs of PV instillation should be investigated and the experiences of airports, that have gone solar, including the Chattanooga (pictured above) and Denver airports, should be taken into account.

The cost of interconnection is not under the jurisdiction of The Office of Buildings but can also add significant costs to a solar project and should be investigated and standardized.

Establish Partnerships and Educate

Major universities, businesses and more in the City of Atlanta have sustainability goals and should join in the cities efforts to reach 10 percent solar by 2030. They can also help promote public understanding and solar literacy. Community solar programs that negotiate bulk solar equipment purchases for entire neighborhoods should be coordinated and facilitated.

Provide New Solar Financing Options For Homeowners And Businesses

Most solar financing options are most easily accomplished through utility-wide programs or state level programs. However, cities around the country are finding success with innovative programs that allow homeowners and businesses to more easily invest in local solar.

Property assessed clean energy (PACE) financing is a powerful tool that allows a city to offer loans for energy efficiency improvements or renewables installation that are paid back through property tax bills over several years. PACE financing has faced regulatory confusion for residential properties but is being used successfully to help finance solar and other clean energy upgrades on commercial properties in cities around the U.S., including here in Atlanta where the fund is managed by Ygrene Energy Fund.[55]

The city should investigate further financing opportunities that could be extended to residential homeowners. This could include working with Georgia Power and solar installers to ensure the Georgia Power Advanced Solar Initiative is maximized in Atlanta.

State And Utility Level Recommendations

While not the focus of this report, there are important steps that the state legislature and Public Service Commission could take in Georgia to make local solar even more viable in Atlanta.

For example, some companies specialize in installing solar panels on roofs for the buildings' owners for free, especially those of large businesses, then charge the owners for the power they use from the system through an agreement called a "power purchase agreement," or PPA, which establishes a fixed price for the electricity for a decade or longer. These agreements allow businesses and homeowners to use solar power without the hassle of purchasing a system, and protect them against electricity price increases.

Currently, however, this kind of arrangement, with a third party, is under a legal cloud in Georgia. The state's major investor owned utility Georgia Power argues that PPAs will create unregulated utilities[56], not allowed in Georgia's Territorial Electric Service Act. This act was passed before companies starting using PPAs, however, and PPAs do not create the risks that utility regulation guards against. This type of financing has the potential to speed up solar power installation in Georgia and should be allowed.

There are also enormously popular state solar tax credits that are set to expire in 2014 and should be extended and expanded.

Methodology

Solar PV Potential

This analysis focuses on the potential for both solar PV and solar water heating on the rooftops of Atlanta-area buildings. Electricity and hot water generated on top of buildings can be used locally, increasing grid efficiency and reliability.

Solar PV Potential Technical

To estimate the total technical potential for rooftop solar PV in the city of Atlanta, we relied upon *Rooftop Photovoltaics Market Penetration Scenarios*, a report carried out by Navigant Consulting for the National Renewable Energy Laboratory.[57]

Taking into account factors such as tree and other shading, roof tilt and orientation, and the room needed on roofs for other objects such as chimneys and fan systems, Navigant estimated that 22 percent of residential roof space and 60 percent of commercial roof space in states with warm climates (such as Georgia) could be used for solar panels, on average.[58]

Navigant found that installing solar panels on all suitable residential and commercial rooftop space in Georgia in 2008 would result in 17,915 MW of solar PV capacity. Navigant also estimated total solar roof potential through 2015, based on a forecast for increasing rooftop space as new buildings are constructed.[59]

In order to determine the technical potential for rooftop solar installations specifically in the city of Atlanta, we took the proportion of developed land in Atlanta versus the state of Georgia as a proxy for the proportion of Georgia's solar-eligible rooftop space located in the city of Atlanta. Land use/land cover data for Atlanta and the state of Georgia were obtained from the Multi-Resolution Land Characteristics Consortium's National Land Cover Database (2006), analyzed via ArcGIS. We applied the percentage of Georgia's developed land within Atlanta (1.78 percent) to the statewide technical potential calculated for 2008 in the Navigant report to obtain an estimate of technical potential for the city of Atlanta.

Navigant also assumed that solar PV technology would increase in average efficiency from 13.5 percent in 2007 to 18.5 percent in 2015—meaning that the same amount of rooftop area could host a larger capacity of improved solar panels.

To estimate total solar PV potential in Atlanta in 2030, we extrapolated Navigant's trend of Georgia's technical PV potential from 2007-2015, and ignoring any potential for further improvement in solar technology beyond 2015. To the extent that solar PV technology moves beyond 18.5 percent efficiency, Atlanta rooftops might be able to hold additional solar capacity.

We calculated that at 18.5 percent conversion efficiency, installing the full 1,490 MW of Atlanta's technical PV potential in 2030 would require approximately 77 million square feet of rooftop area.[60]

Subtracting out the area required by solar hot water systems at full penetration (see below) would reduce area available for PV by 6.2 percent, yielding a total technical potential in 2030 of 1,400 MW. We did not attempt to make an estimate of the technical potential for non-rooftop solar installations, which would be limited only by the availability of acceptable open land area with adequate sun exposure.

Achievable Vision

To layout a vision for a future course of rooftop solar PV development for Atlanta to pursue, we set a benchmark goal of obtaining 10 percent of Atlanta's projected electricity use in 2030 from solar (see below for calculation of future electricity demand). Using an annual electricity generation estimate of 1,345 kWh per kW in Atlanta (per the National Renewable Energy Laboratory's *PVWatts 2.0* tool), we calculated that Atlanta would need 662 MW of solar PV capacity—about 44 percent of its technical potential—to reach this benchmark.[61] We then developed a solar growth scenario that would allow Atlanta to reach this benchmark, starting in 2012.

Southface, an Atlanta-based non-profit, estimated that the current solar capacity of Fulton and DeKalb counties is about 5.6 MW.[62] To be conservative, we assumed 1 MW of installed capacity for the city of Atlanta as the starting point for our solar market growth scenario.

To achieve the benchmark of 662 MW by 2030, the city will have to increase solar PV capacity by an average of 38 percent every year. With the right policy mechanisms, it is possible to achieve this average annual growth rate, as demonstrated by other states with established rates of solar PV market growth, such as New Jersey and California.

Energy Output

We calculated the energy output of solar PV panels in Atlanta using an annual electricity generation estimate of 1,345 kWh per kW, per the National Renewable Energy Laboratory's *PVWatts 2.0* tool.[63]

Solar Water Heating Potential

Technical Potential and Energy Savings—Residential

To calculate technical potential and energy savings for residential and commercial solar hot water systems, we first needed an estimate of the number of residential buildings that will exist in Atlanta in 2030, as well as an estimate of their energy consumption and savings through solar water heating.

We estimated the number of housing units in Atlanta in 2030 using data from the U.S. Census Bureau. Using 2009 estimates of population and housing units, we calculated a ratio of residents per household.[64] Holding this ratio constant, we then applied population projections to obtain an estimate of total housing units in 2030.[65] We assumed that 40 percent of residential buildings in the South Atlantic census region could install solar hot water systems at full technical potential, per the National Renewable Energy Laboratory.[66]

We calculated the amount of energy that could be saved by solar hot water systems in 2030 by assuming that a typical solar hot water system in Atlanta could replace 50 percent of the energy used to heat water in a typical residential building, per the National Renewable Energy Laboratory.[67] We broke down energy saved into electricity and natural gas fractions by using the percent of residential buildings in the South Atlantic census region that use electricity and natural gas to heat water, per the Residential Energy Consumption Survey and Commercial Building Energy Consumption Survey.[68] We then multiplied the number of systems by the average South Atlantic Region electricity or gas consumption per residential building for water heating, yielding savings in terms of kWh of electricity or cubic feet of natural gas. This calculation ignores any improvements in the energy efficiency of homes by 2030.

Technical Potential and Energy Savings —Commercial

To calculate technical potential and energy savings for the commercial sector, we first calculated the number of commercial buildings that currently exist in Atlanta. To do this, we used estimates of the number of commercial establishments in Atlanta from the U.S. Census Bureau and estimates of the number of commercial establishments per commercial building for the South Atlantic region, per the U.S. Department of Energy's *Commercial Building Energy Consumption Survey*.[69]

Given that the Census reports that there nearly 50,970 commercial establishments in Atlanta (2007 estimate), we calculated that there are about 40,600 commercial buildings in the city.[70] (The number of establishments per commercial building was listed as ranges in the *Commercial Buildings Energy Consumption Survey* for the South Atlantic Region—for example, about 75 percent of all commercial buildings in the region have two to five establishments per building. In order to be conservative in estimating the number of buildings, the highest number in the range was assumed when converting number of establishments to number of buildings.)[71]

Of Atlanta's 40,600 commercial buildings, we assumed that 56 percent use electricity for water heating, while 17 percent use natural gas, per EIA's *2003 Commercial Building Energy Consumption Survey* (*CBECS*), which lists fuel consumption and energy end-uses for commercial buildings in the South Atlantic region. Of those buildings, we assumed 60 percent can install solar water heating systems at full technical potential, per the National Renewable Energy Laboratory.[72] As in our calculation for energy savings in the residential sector, we assumed solar hot water systems could replace 50 percent of the energy used to heat water in commercial buildings in the South Atlantic region. We used the same methodology described above to calculate energy savings based on the South Atlantic region's average electricity or gas consumption for water heating for commercial building.

This number represents the energy savings Atlanta could achieve by immediately installing solar hot water systems on all existing and appropriate rooftop space.

To extrapolate this number to account for new buildings by 2030, we calculated the projected growth in commercial buildings space between 2008 and 2030 and applied that growth rate to the energy savings at full technical potential for solar hot water calculated above. To calculate the projected growth in commercial building space, we began with a 2004 Brookings Institution Metropolitan Policy Program report called *Toward a New Metropolis: The Opportunity to Rebuild America*. This report estimates the number of commercial workers by state in 2000 and 2030, and the building space that they require.[73] To interpolate those figures for intervening years, we assumed that the percentage of the population engaged in commercial work (determined using the Brookings Institution commercial workers data and U.S. Census Bureau population projections) would change at a steady rate between 2000 and 2030. Then, we calculated the total square footage of building space that those commercial workers would require using the Brookings Institution estimates of space requirements per worker. We found that Georgia commercial building area is likely to increase 42 percent by 2030 relative to 2008. We applied this growth rate to Atlanta and multiplied the city's 2008 natural gas and electricity savings by 42 percent. (This calculation assumes that with an increase in commercial square footage comes a corresponding increase in electricity and natural gas use, and therefore an increase in savings, as well.)

We combined the natural gas and electricity savings for both the commercial and residential sectors in 2030 by converting each to British thermal units (Btu). We then estimated the amount of rooftop area required to deliver those savings, based on solar radiation in Atlanta, per *PVWatts 2.0*. We subtracted the rooftop area required for solar hot water at full technical potential from the rooftop area required for solar PV at full technical potential in 2030 (see above).

Estimating Atlanta's Future Electricity And Hot Water Energy Needs

Calculations for the equivalent percent of Atlanta's future energy needs that solar output would represent were based on the following. To calculate Georgia's 2030 electricity consumption, we multiplied Georgia's 2010 electricity consumption (per EIA's 2010 *State Energy Data System*) by the projected growth rate for electricity consumption in the South Atlantic region through 2030, per EIA's 2012 *Annual Energy Outlook*.[74]

We then scaled this number down to the city of Atlanta according to the share of Georgia's Gross State Product (GSP) attributable to the city of Atlanta. To calculate this, we apportioned the Gross Metropolitan Product (GMP) of the Atlanta Metropolitan Statistic Area (MSA) to the city of Atlanta according to population (about 8.2 percent).[75] We then created a ratio of Atlanta's share of the GMP to Georgia's GSP.[76] We did this because Atlanta is the state's economic hub, and commercial and industrial demand for electricity is likely higher in Atlanta than in the rest of the state. As a result, we estimated that 5.3 percent of Georgia's electricity demand in 2030 will come from homes and businesses within the city of Atlanta.

Preventing Global Warming Pollution

We translated energy generation figures into global warming pollution as follows. We assumed that energy generated by solar PV would primarily replace non-baseload electricity generation. In the SERC South subregion, non-baseload electricity sources produce an average of 1,622 lbs of carbon dioxide per MWh.[77]

We assumed that electricity saved by solar water heating systems would not necessarily be timed to coincide with peak electricity demand, and therefore assumed that solar water heating would displace electricity at the total SERC South pollution rate of 1,325 lbs of carbon dioxide per MWh.[78]

For natural gas, we assumed that every million BTU would prevent 116.39 pounds of carbon dioxide pollution, per emission coefficients from the U.S. EPA.[79]

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