

**Virginia = 25.34 MILLION ACRES\***  
**Virginia Solar = 965 ACRES**

(\*Source: [www.statemaster.com](http://www.statemaster.com))



Powered by Facts: Renewable Virginia Energy | [PoweredByFacts.com](http://PoweredByFacts.com)



Dear Representative,

Currently, less than .037% of electricity in Virginia is generated by solar<sup>i</sup> arrays that are located on only 965 acres across a state with more than 25 million acres. Not surprisingly, the Commonwealth ranks 20<sup>th</sup> in the nation in terms of solar energy and has moved backward from our ranking of 17 in 2016. We've made a lot of progress, but so have other states. While Virginia now has 290.89 megawatts (MW) of solar installed, the fact that we slipped four spots in our national ranking indicates that we are not taking advantage of a thriving industry. For example, North Carolina, with its similar topography and climate, is ranked 2<sup>nd</sup> in the nation for solar energy and has 3,784.80 MW of solar installed<sup>ii</sup>.

Despite all evidence to the contrary, some in Virginia still view renewable energy as a niche industry. If allowed to grow as it has in other states, renewable energy could positively affect almost every aspect of Virginia: from its economy and job market, to the safety of its sources of energy and the cost effectiveness of those energy sources. As Americans use more power-efficient devices and home insulation systems, the need for a flexible and robust grid based in renewable sources will become a determining factor in whether Virginia is a leading, competitive state.

Energy legislation and energy policy created now will be a defining factor in the lives of your constituents for years to come. As the Virginia General Assembly heads into another session, we no longer can afford to let our state sit on the sidelines of progress. Our residents and communities deserve a robust energy economy that embraces the challenges of a changing industry and offers safe and reliable access to energy.

As you embark on your journey as a member of Virginia's General Assembly, we hope that you prioritize renewable energy legislation and help the Commonwealth reach its potential.

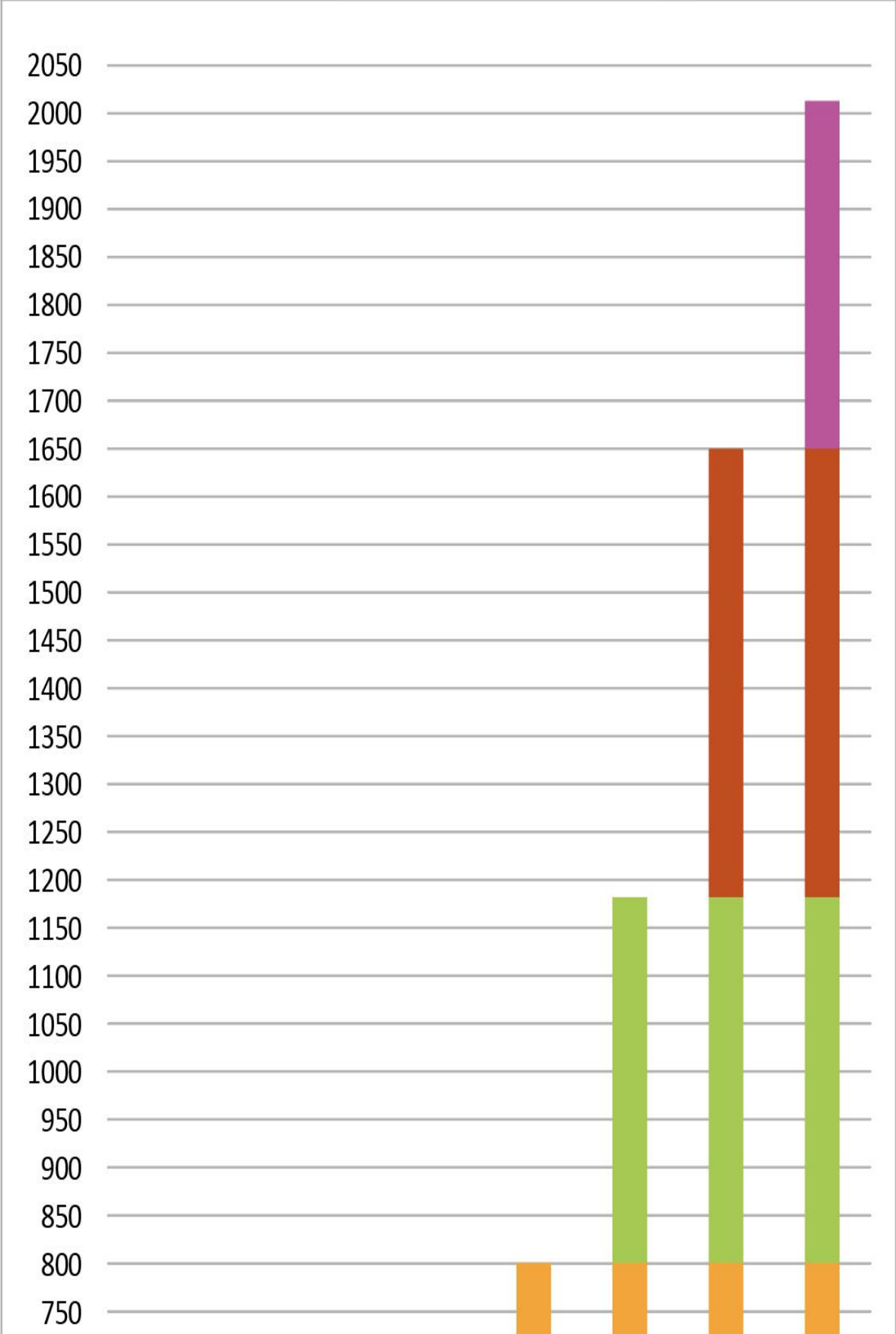
Sincerely,

A handwritten signature in black ink that reads 'Karen Schaufeld'.

Karen G. Schaufeld  
Powered by Facts

# Virginia Annual Solar Installations

Megawatts (MW)





## **The Current State of Renewable Energy in Virginia**

Virginia now has 290.89 megawatts (MW) of solar installed, which represents approximately .037% of its total electricity generated. This is an increase from last year's total of 192.4 MW<sup>iii</sup>, and represents the state moving more than half of the way towards Dominion's goal of building facilities to generate 400 MW of solar energy by 2020.<sup>iv</sup> Despite the increase in MW, Virginia's national ranking for solar and renewable energy slipped from 17<sup>th</sup> in 2016 to 20<sup>th</sup> in 2017. This indicates that other states have embraced this highly competitive industry and are reaping its rewards, while Virginia has lagged behind. Our state also ranks 13<sup>th</sup> in growth projections for the next five years — an unnecessarily low ranking, given Virginia's climate and access to both ocean and mountain wind.<sup>v</sup>

Businesses have shown themselves willing to invest in solar and renewable energy, because it creates high-paying jobs, fulfills corporate social responsibility goals and provides facilities with access to energy that isn't vulnerable to outages or grid disturbances. Last fall, Amazon Web Services opened a new facility in Northern Virginia and announced a partnership with Dominion to install a solar array of 80 MW, to be distributed to five Virginia counties.<sup>vi</sup> IKEA's Woodbridge location has also installed solar arrays capable of producing 62 MW.<sup>vii</sup> In addition, Microsoft is partnering with Dominion and the Commonwealth of Virginia to build a 20 MW facility in Fauquier County.<sup>viii</sup>

The wind industry in Virginia is not as developed as the solar industry, but energy companies as well as universities, research groups and non-profits are investigating the expansion of this energy source. As with solar energy, Virginia's current net metering laws allow for the residential and commercial use of wind energy to offset energy costs.<sup>ix</sup> In March 2017, the Virginia Department of Environmental Quality approved the Commonwealth's very first commercial wind farm. Apex Clean Energy plans to build 25 wind turbines in a remote area of Botetourt County, which will have the capacity to power 20,000 homes.<sup>x</sup> This summer, Dominion Energy announced plans to build two experimental offshore wind turbines near Virginia Beach. With a scheduled completion date of 2020, the Coastal Offshore Wind Project is meant to gauge the viability and potential problems of industrial offshore wind.<sup>xi</sup>

### **Potential Land Use: Rooftops**

According to the 2016 U.S. census, there are 3,491,054 housing units in the state of Virginia, with approximately 2,297,113 homes being occupied by their owner (as opposed to a renter). While it's difficult to assess the solar capabilities of every single one of these owner-occupied units, this does let us know that 65% of Virginia homes could be eligible for installed solar arrays simply based on ownership.<sup>xii</sup> For some perspective of the potential scope of

residential solar, the Virginia General Assembly's 2015 goal of installing 500 MW by 2020 would power 82,000 homes — roughly 2.34% of the 2016 housing unit total.<sup>xiii</sup> When compared to the total number of houses that could be eligible for private solar arrays, that goal seems unnecessarily modest. And, in fact, the NREL estimates that rooftops in Virginia could provide 32.4% of the electricity used in the Commonwealth with 28,500 MW of installed solar panels.<sup>xiv</sup>

### **Potential Land Use: Military Bases**

Military bases are crucial to national security. With the military in need of safe and reliable energy, helping bases transition to solar power is an exciting and necessary opportunity. Solar is a viable solution for military bases, because they are easy to maintain, can be located almost anywhere and create energy even in cloudy weather.

There are 27 military bases, operated by the U.S. Army, Marines, Air Force, and Navy, on roughly 156,000 acres in Virginia. Since 2012, two of these bases, along with military bases around the United States, have been increasing their holdings in solar energy by teaming up with energy companies and allowing them to install major solar arrays on their bases. In 2016, a major renewable project was started at Fort Huachuca in Arizona between the U.S. General Services Administration (GSA) and the U.S. Army.<sup>xv</sup> Overall, the project was on 155 acres and provided 25 percent of the base's power. Within Virginia, the Navy has set a goal of acquiring 50 percent of its total energy consumption from alternative sources by 2020.<sup>xvi</sup> In 2012, the Navy built a solar farm that can generate up to 2.1 MW of electricity — enough to power 200 homes — at the Norfolk Naval Station.<sup>xvii</sup> The solar farm is set just outside the fence-line in Monkey Bottom, which is a marshy field and is not suitable for any other use. In early September of this year, Oceana Naval Air Station, located in Virginia Beach, began a partnership with Dominion Power to build a 21 MW solar-powered station on 100.34 acres of the base.<sup>xviii</sup> Dominion oversees the building, maintaining and operating the facility for 37 years.

For national security reasons, it is imperative that military bases in Virginia and across the nation continue to invest in solar power and other renewable energy sources to create their own sources of energy that will allow them to continue mission-critical operations in the event of grid failure or a disruption due to a weather, terrorist or cyber event.<sup>xix</sup> In the case of a grid failure, it could potentially take months for bases to restore transformers and energy.<sup>xx</sup>

In the future, battery storage should be an integral part of these plans, as it has been implemented on a smaller scale by homeowners who have solar arrays and backup their systems with battery storage.<sup>xxi</sup> In fact, batteries work the same way on an industrial scale — the units charge, and are prevented from overcharging, during clear weather and are utilized at night or when heavy cloud cover obstructs the sun.<sup>xxii</sup> Battery packs are increasingly being recognized as crucial to grid safety and grid diversity. Puerto Rico provides a lesson on this. In September 2017, Hurricane Maria decimated the island's connected power grid. Had the grid been sectioned off and equipped with battery packs, the damage would have been contained and the grid restored almost immediately. Tesla is installing solar panels connected to batteries as part of the island's effort to create durable, regional grids.<sup>xxiii</sup>

### **Potential Land Use: Landfills**

Landfills are a viable option for solar installations because the land has already been cleared and generally cannot be used for other types of commercial development. Closed landfills are those that have been covered and are also monitored for leaching and groundwater

contamination. A closed landfill creates a large, open space where installed solar would not need to compete with other productive uses, such as agriculture.<sup>xxiv</sup> In addition, closed landfills are generally located away from environmentally sensitive ecosystems. Most landfills are designed to be easily accessible, and most have security systems installed, reducing the need to build new infrastructure.<sup>25</sup>

There are approximately 30 closed landfills in Virginia. One of these, the Prince William Landfill, has decided to install solar panels on its property, which will produce approximately 1.5 MW of electricity,<sup>xxv</sup> which could be used to power 5,000 homes.<sup>xxvi</sup> The former Ivy landfill in Albemarle County, Virginia, is moving forward with a negotiation for a 25-year lease to install a solar energy array.<sup>xxvii</sup> This potential solar farm could power about 1,000 homes and would be installed on 10-14 acres.<sup>xxviii</sup> At the Virginia Brownfields Conference in March 2017, it was noted that 28 landfills had been screened for solar.

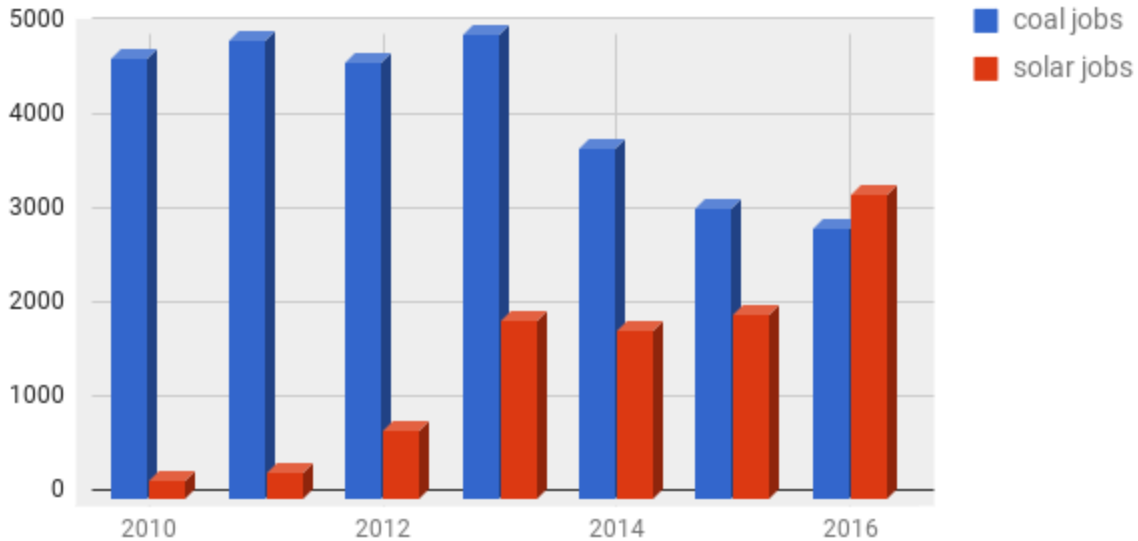
### **Potential Land Use: Coal Mines**

Like every state in the Appalachian Mountain range, Virginia's history has long been intertwined with coal. But it is becoming clear that the transition to a clean energy future not only must involve the participation and transformation of Virginia's coal industry and its displaced miners, but also could be very beneficial to places like the Commonwealth's southwestern panhandle. Ironically, it's the coal mines and miners themselves that may provide a crucial missing piece for the expansion of solar. The concept of using abandoned or unprofitable coal mines to install solar farms is not new — in West Virginia, Coalfield Development Corporation recently began training its miners to install solar panels, making them highly skilled workers in a growing industry.<sup>[i]</sup> In Pikeville, Kentucky, Berkeley Energy Group, a coal company, partnered with EDF Renewable Energy to transform their coal mine into a solar facility. The main stipulation of Berkeley Energy Group was that former miners had to be hired and trained for the construction and maintenance of the project.<sup>[ii]</sup>

Dominion Energy has been studying the viability of similar projects in Virginia. Last year, Senator Ben Chafin, a Republican from Virginia's 4th district, proposed a potential use for Virginia's many abandoned mine shafts: combining hydro power with solar and wind power. To do this, the empty shafts would be filled with water that would be pumped to the surface of the earth, into a reservoir, and then allowed to fall back into turbines in the mine shaft using energy from solar and wind. The force of the moving water would create batteries of energy that would balance out the natural variability of wind and solar.<sup>[iii]</sup> Although not yet in place, Governor Terry McAuliffe supports the plan, and it has received bipartisan support in the General Assembly.<sup>[iv]</sup>

Virginia has 71,521.44 acres of land devoted to active coal mining. It is also home to hundreds of abandoned coal mines, all of which boast some level of contamination or structural deficiency that makes them unsuitable for human habitation, agriculture, or development. Much in the same way that landfills and marshy areas are perfect for generating solar energy because they have virtually no other use, abandoned mining areas also would be well suited for solar facilities. In terms of the working mines transitioning to solar and wind facilities, we don't yet have data on how many energy executives are considering making such a transition or what variables would propel them to do so. However, as energy is a market issue, and the market is moving in the direction of solar energy, there is reason to hope that Virginia coal companies will follow the example of their West Virginia and Kentucky counterparts and consider buying into the renewables industry.

## Coal Jobs Versus Solar Jobs in Virginia



source: Solar Foundation and the Virginia Department of Mines, Minerals and...

There has been a 40% drop in the number of people working in the coal industry in the past five years, but there are new jobs in solar that they could enjoy. In fact, in a state once dominated by coal, solar now employs more people than mining companies.<sup>[vi]</sup> According to the Solar Foundation, as of 2016, there were more than 3,230 jobs for solar power in the state while coal had less than 2,900, according to the Department of Mines, Minerals, and Energy.<sup>[vi]</sup>

The Solar Foundation also has reported that new analysis shows that Virginia could gain 50,400 new solar jobs if it developed enough solar energy to meet 10% of residents' electricity consumption by 2023.<sup>[vii]</sup>

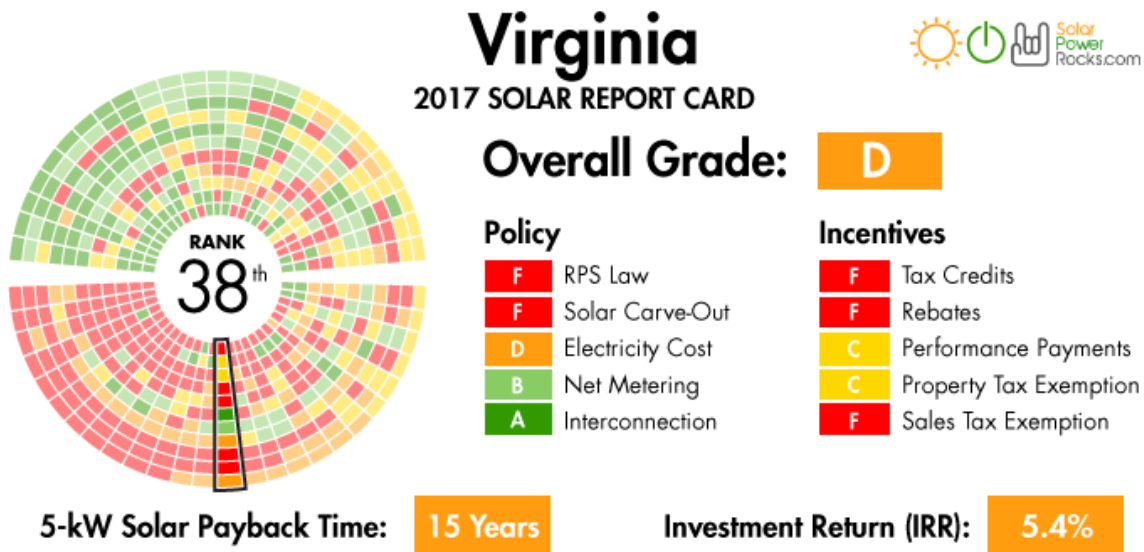


## Conclusion

As we have established in this report, solar and renewables are underutilized in the Commonwealth. When examining the numbers, it was found that on rooftops, military bases, landfills and coal mines, there is a conservative possibility for 119,509 MW solar. If Virginia uses even 1 percent of the available area across all areas, it would produce an extra 1,195 MW of solar. If Virginia were to install only 5%, it would add an extra 5,975 MW of solar.

There is much that could – and should – be done, but it must start at the policy level. Virginia has a long way to go to catch up with other states in solar and renewable energy. We have made progress in the past few years with bipartisan support of renewable and solar energy legislation that will support the future growth of the industry, create jobs, boost our state and local economies and lower costs for the ratepayer. However, the Commonwealth continues to get poor ratings for its solar policies, solar carve-outs, cost of electricity, tax credits, rebates and sales tax exemption.<sup>xxix</sup>

Here is a snapshot of where Virginia stands today:



Our largest utility – Dominion Energy – also falls short. In a recent annual benchmark review of clean energy published by the non-profit Ceres, Dominion consistently ranked last among 30 utility companies in the areas of Annual Energy Efficiency and Lifecycle Energy Efficiency.<sup>xxx</sup> The latest numbers available also show that Dominion Energy was ranked 24<sup>th</sup> out

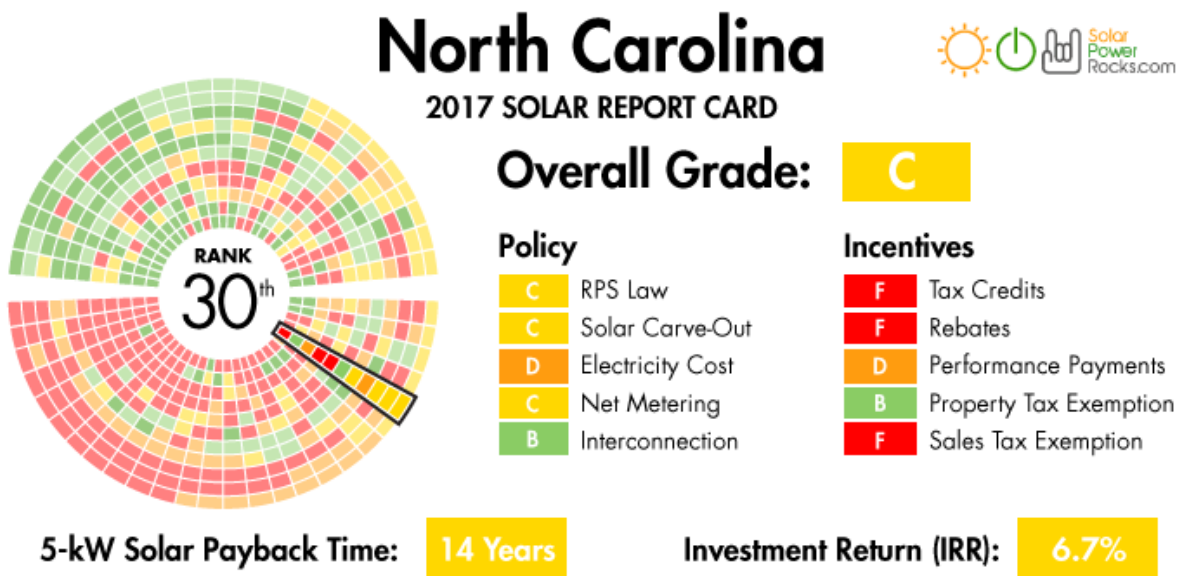


of 30 in renewable energy sales as a percentage of retail sales, 30 out of 30 in incremental energy efficiency and 29<sup>th</sup> out of 30 in life-cycle energy efficiency, which are the estimated savings of all energy efficiency.<sup>xxxii</sup>

While these rankings take into account several factors besides solar, Dominion openly admitted in its yearly Integrated Resource Plan that solar energy has “optimal economics” and “low to zero emission characteristics” and is “cost competitive” with other traditional forms of power.<sup>xxxiii</sup> However, they tempered this prediction with a warning that solar power can be unreliable and creates challenges with consistency.<sup>xxxiii</sup> In that same report, Dominion anticipated that its grid soon would be transformed from the traditional one-way system of delivery to a series of two-way meters capable of receiving and giving instant “energy injections” to diversify the grid. The concept of modernizing an existing grid through partnerships with utility companies is not new; Dominion Energy can look to the examples of several peer companies in other states for guidance.

Ironically, Dominion has seemed to overcome those challenges in North Carolina, a neighbor of Virginia with a similar climate and a similar history of coal production. Dominion serves as a main utility provider in North Carolina, which is ranked 2<sup>nd</sup> in the United States in 2017 for solar energy, boasts 427,000 homes powered by solar and has 7,112 solar industry jobs.<sup>xxxiv</sup> In addition to residential net metering and solar purchase programs, Dominion oversees three solar facilities in North Carolina, with a total megawatt capacity of 159.<sup>xxxv</sup> Interestingly, North Carolina has a relatively low residential electricity rate at \$0.1091 per kWh, which is 8.16% less than the national average, and lower than Virginia’s average.<sup>xxxvi</sup> This is crucial, because it proves that solar energy can be a competitor in the energy market, even in areas where prices are already low due to an abundance of fossil fuels.

Here is a snapshot of where North Carolina is today:



When it comes to the cost of electricity, the current retail cost of electricity in Virginia is **\$0.12** per kilowatt hour (one kw of power sustained for one hour)<sup>xxxvii</sup>. However, in 2017, the rate per kWh of electricity generated by solar from June through September was **\$0.11**, while the rate from October through May was **\$0.095**. Both of these numbers are lower than the retail price of electricity. Whether or not you are selling solar-generated electricity back to Dominion or using solar to decrease your energy bill, ratepayers see a profit of **\$0.01** to **\$0.03** per kWh.<sup>xxxviii</sup> The average yearly savings for a person using solar panels to offset their energy bill is **\$702**.<sup>xxxix</sup>

Overall, Virginia has the possibility to be doing more with the production of solar throughout the state. The following graphic from Solar Jobs shows what Virginia could look like in the future, if we *did* incorporate more solar into our energy mix:



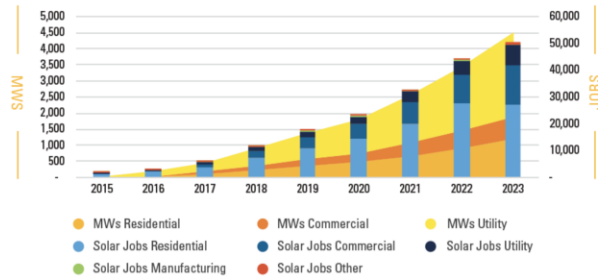
# VIRGINIA SOLAR JOBS POTENTIAL

What if the Commonwealth of Virginia got 10% of its electricity from the sun by 2023? What are the impacts and implications?



## JOBS IMPACT

### VA SOLAR CAPACITY & JOB GROWTH SCENARIO



**15x** more solar jobs than in 2016

**THAT'S AN EXTRA +50,400 VIRGINIA JOBS**

more than double the amount of all other VA fuel and power generation jobs in 2016 combined.

ASSUMING VIRGINIA ADDS 15,000 MW OF SOLAR IN 7 YEARS

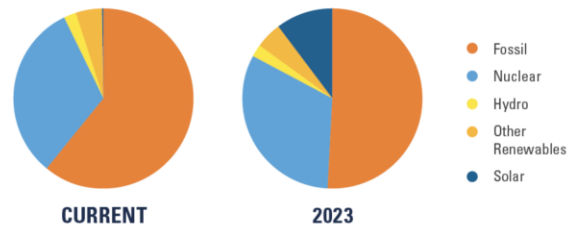
RESIDENTIAL SOLAR WILL PROVIDE MORE JOBS THAN THE OTHER SOLAR SECTORS.



## ENERGY IMPACT

**LOTS OF SOLAR NEEDS TO BE INSTALLED... BUT IT CAN BE DONE, AS HAS HAPPENED IN OTHER STATES.**

### VA ELECTRICITY MIX VS. 2023 SCENARIO



## GROWTH IMPACT

### SOLAR INSTALLED 2016



**61%** VA needs to hit 61% annual solar installation growth to achieve 2023 goal.

**87%** CA + NC averaged 87% annual solar installation growth in previous 6 years.

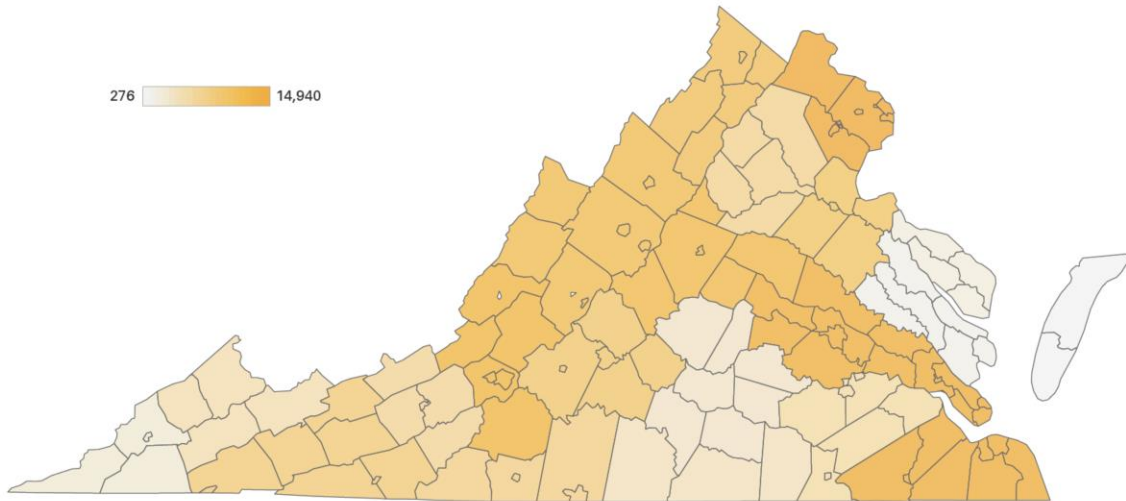
Solar growth scenario figures are from The Solar Foundation based on labor intensity modeling unique to each solar sector along with the following sources: PJM 2017 Load Forecast Data; Dominion Virginia Power 2017 Integrated Resource Plan; GTM Research/Solar Energy Industries Association Solar Market Insight; U.S. National Renewable Energy Laboratory PV Watts; the U.S. Energy Information Administration; and the U.S. Bureau of Labor Statistics.

[VIRGINIA.SOLARJOBSCENSUS.ORG](http://VIRGINIA.SOLARJOBSCENSUS.ORG)





# VIRGINIA SOLAR JOBS POTENTIAL



## PROJECTED SOLAR JOBS IN 2023 UNDER 10% SOLAR SCENARIO BY VA PLANNING REGION (PDC)

Lenowisco PDC	494
Cumberland Plateau PDC	770
Mount Rogers PDC	1,173
New River Valley RC	966
Roanoke Valley-Alleghany RC	2,403
Central Shenandoah PDC	1,811
Northern Shenandoah Valley RC	1,699
Northern Virginia RC	14,940
Rappahannock-Rapidan RC	1,039
Thomas Jefferson PDC	2,162
Region 2000 LGC	1,593

West Piedmont PDC	1,098
Southside PDC	540
Commonwealth RC	500
Richmond Regional PDC	6,485
George Washington RC	1,621
Northern Neck PDC	431
Middle Peninsula PDC	316
Crater PDC	862
Accomack-Northampton PDC	276
Hampton Roads PDC	10,027

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We need legislators from both sides of the aisle to work together to pass legislation that will make it easier for businesses and individuals to adopt renewable energy. This will include ensuring that Virginia's utility companies understand that they too will benefit from this shift through better asset protection, better service to customers and a more robust state economy that benefits everyone.

### **Proposed 2018 Legislation**

The following legislation is under consideration in the 2018 Virginia General Assembly. These bills are recommended by the Rubin Group and have broad support from a wide array of groups, including the solar community, professional real property groups, the agricultural community, the business community and the environmental community.

**SB284** — The purpose of this legislation is to facilitate development of solar facilities in Virginia to enable ratepayers to obtain the benefit of this clean energy during the remaining period of the federal investment tax credit, which currently ends on December 31, 2023. This legislation declares that 4,000 megawatts of large scale solar is in the public interest and an additional 500 megawatts of distributed generation solar (rooftop solar) is in the public interest. The State Corporation Commission will still safeguard the ratepayers by ensuring that the new solar generation is needed, the cost recovery is reasonable and prudent, and all the other requirements for new energy projects are met.

- Large scale solar projects create billions of dollars of economic impact, generate tax revenues for localities and attract Fortune 500 Companies to Virginia. Solar is complimentary with timber and agribusiness, and gives farmers stable lease revenues to help maintain family farms.
- This legislation has broad support from the solar community, the agricultural community, the business community and the environmental community.

**SB285** — The purpose of this legislation is to establish a clear timeline and completion date for solar projects, in accordance with the December 31, 2023 deadline of the federal investment tax credit. This will allow Virginians to reap the rewards of their rightful credits and benefits.

- The purpose of this legislation is to establish a completion date in solar cases as a 3-month period from the date of the hearing, so there can more certainty about the timing of solar projects, particularly within the timelines set by the federal investment tax credit.
- This legislation was requested by the solar community. We believe there is no opposition to this legislation.

**SB179 & HB509** – The purpose of these proposed bills is to clarify the comprehensive plan approval process for solar facilities. Existing Virginia Code Section 15.2-2232 requires that any public area, street, park or utility structure be “in substantial accord” with the locality’s comprehensive plan. These are common provisions in local government ordinances currently but there is no consistency statewide.

In fact, the interpretation among local zoning officials varies widely on whether it is even necessary for the Planning Commission to decide that a solar facility is “in substantial accord” with the comprehensive plan. This legislation would enable local zoning officials from rural Virginia to rely upon state law as to the determinations of substantial accord for solar facilities.

- According to these bills, a solar facility would be substantially in accord with the locality’s comprehensive plan if:

- the solar facility is permitted by-right in that zoning district;
  - the solar facility is “behind-the-meter” that serves that property (like rooftop for residential dwellings and net-metered solar facilities or small agricultural generators for agricultural zoned properties); or
  - the solar facility is determined by the locality to be a large-scale facility that should be a feature shown on the comp plan, and is advertised and approved concurrently with a conditional use, special exception or other legislative approval process.
- This legislation has broad support from the solar community, professional real property groups, the agricultural community, the business community and the environmental community. However, VACO and VML oppose this legislation because its provisions are limited to consideration of solar facilities and not all determinations of substantial accord under Virginia Code Section 15.2-2232.

**SB429 & HB508** – This legislation establishes the allowance of solar facilities on a roof and ground-mounted solar arrays, if in compliance with the zoning restrictions. The purpose of this legislation is to create a new code section in Title 15.2 to confirm that a private property owner of real property zoned residential, agricultural, commercial, industrial, institutional or mixed use would have a right to put a solar array on their roof or grounds to serve the electricity needs on their property.

- The property owner would still need to comply with setbacks, Chesapeake Bay, historic district and other applicable requirements of the locality’s ordinances, as well as be subject to any condo or property owner’s association that otherwise regulates such installation.
- This legislation has broad support from the solar community, professional real property groups, the agricultural community, the business community and the environmental community. VACO and VML each have a policy position against any legislation that puts parameters around any local land use authorities and as a result, VACO and VML oppose this legislation.

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<sup>i</sup> <https://www.seia.org/state-solar-policy/virginia-solar>

<sup>ii</sup> <https://www.seia.org/state-solar-policy/north-carolina-solar>

<sup>iii</sup> Solar Energy Industries Association: Virginia Solar. 2017 September 12. SEIA; {accessed 2017 December 11}. <https://www.seia.org/state-solar-policy/virginia-solar>

<sup>iv</sup> Virginia Places: Energy in Virginia. c1998-2017. {accessed 2017 December 11}. <http://www.virginiaplaces.org/energy/>

<sup>v</sup> SEIA.

<sup>vi</sup> DMME: Virginia Solar Energy Development Authority Annual Report.

<sup>vii</sup> SEIA.

<sup>viii</sup> DMME: Virginia Solar Energy Development Authority Annual Report.

<sup>ix</sup> Virginia Department of Environmental Quality: Net Metering. Richmond (VA); {accessed 2017 December 14}. <http://www.deq.virginia.gov/Programs/PollutionPrevention/VirginiaInformationSourceforEnergy/DistributedGeneration/NetMetering.aspx>

<sup>x</sup> Associated Press. 2017 March 3. Plans approved for Virginia’s first commercial wind farm. WTOP.

<sup>xi</sup> Guess, Megan. 2017 July 13. Virginia utility agrees to install two offshore wind turbines for study. ARSTechnica (Biz & IT).

<sup>xii</sup> United States Census Bureau: Quick Facts: Virginia. 2016 July 1; Washington (DC); {accessed 2017 December 12}. <https://www.census.gov/quickfacts/VA>

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- <sup>xiii</sup> Virginia Conservation Network: Solar Power in Virginia: Know Your Rights. c2017; Richmond (VA); {accessed 2017 December 13}. <http://www.vcnva.org/solar/>
- <sup>xiv</sup> <https://www.nrel.gov/docs/fy16osti/65298.pdf>
- <sup>xv</sup> GSA: U.S. Military Breaks News Ground with Largest Solar Installation. 2017 August 13; Washington (DC): U.S. General Services Administration; {accessed 2017 December 11}. <https://www.gsa.gov/node/83985>
- <sup>xvi</sup> Pearce 2017.
- <sup>xvii</sup> Vergakis, B. 2016 July 19. Solar energy facility planned for Oceana Naval Air Station. *The Virginian-Pilot*.
- <sup>xviii</sup> Hodies, E. 2017 September 29. Solar farm nearing completion at Oceana Naval Air Station. *The Virginian Pilot*.
- <sup>xix</sup> Pearce, J.M. 2017 September 18. Solar power could protect the US military from dangerous threats to the electric grid. *Business Insider (Science)*.
- <sup>xx</sup> Pearce, J.M. 2017 September 18. Solar power could protect the US military from dangerous threats to the electric grid. *Business Insider (Science)*.
- <sup>xxi</sup> <https://www.solar-electric.com/learning-center/batteries-and-charging/battery-types-for-solar-electric-systems.html>
- <sup>xxii</sup> <https://www.bloomberg.com/news/articles/2013-12-06/tesla-s-industrial-grade-solar-power-storage-system>
- <sup>xxiii</sup> <http://fortune.com/2017/10/23/tesla-could-be-tapped-to-rebuild-puerto-ricos-electrical-grid/>
- <sup>xxiv</sup> Barton, G., Bodis, K., Jager-Waldau, A., Kougiyas, I., Moner-Girona, M., Szabo, L., Szabo, S. 2017 September. A methodology for maximizing the benefits of solar landfills on closed sites. *Renewable and Sustainable Energy Reviews*. 76: 1291-1300.
- <sup>xxv</sup> Tipple, S. 2015 June 1. Solar panels coming to Prince William landfill. *Potomac Local*.
- <sup>xxvi</sup> <http://potomaclocal.com/2015/02/03/prince-william-eco-park-solar-plant-landfill-energy-production/>
- <sup>xxvii</sup> Suarez, C. 2017 June 27. RSWA to seek deal for former landfill that could become solar array. *Central Virginia Homes*.
- <sup>xxviii</sup> <http://www.nbc29.com/story/35767811/rswa-approves-solar-project-at-the-ivy-material-utilization-center>
- <sup>[i]</sup> Clancy, K., Grumke, K., Toombs, Z. 2017 October 26. West Virginia Company Trains Coal Miners To Install Solar Panels. [TheDenverChannel.com](http://TheDenverChannel.com)
- <sup>[ii]</sup> Ridder, K. 2017 June 15. Kentucky Coal Mine Has Brighter Future as Solar Farm [blog]. *Appalachian Voices*. {accessed 2017 December 11}. <http://appvoices.org/2017/06/15/kentucky-coal-mine-solar-farm/>
- <sup>[iii]</sup> Ryan, J. 2017, May 24. Old Coal Mines Have a Place in the Future of Clean Energy. *Bloomberg (Climate Changed)*.
- <sup>[iv]</sup> Pierobon, J. 2017 March 13. In Virginia push for pumped hydro storage, questions arise about viability [blog]. *Southeast Energy News*. {accessed 2017 December 11}. <http://southeastenergynews.com/2017/03/13/in-virginia-push-for-pumped-hydro-storage-questions-arise-about-viability/>
- <sup>[v]</sup> Pope, M. 2017 June 16. For First Time in History, Solar Jobs Outnumber Coal Jobs in Virginia. [wvtf.org](http://wvtf.org)
- <sup>[vi]</sup> <https://www.thesolarfoundation.org/solar-jobs-census/factsheet-2016-va/>
- <sup>[vii]</sup> [http://www.thesolarfoundation.org/wp-content/uploads/2017/10/TSF\\_VAFactSheet\\_FINAL4.pdf](http://www.thesolarfoundation.org/wp-content/uploads/2017/10/TSF_VAFactSheet_FINAL4.pdf)
- <sup>xxix</sup> <https://solarpowerrocks.com/2017-state-solar-power-rankings/#VA>
- <sup>xxx</sup> Mullen, D., Bakal, D. 2016 June. “Benchmarking Utility Clean Energy Deployment: 2016.” [www.ceres.org/cleanenergyreport](http://www.ceres.org/cleanenergyreport)
- <sup>xxxi</sup> 2016 Ceres Benchmarking Utility Clean Energy Deployment report based on 2014 numbers.
- <sup>xxxii</sup> Dominion Energy. 2017 May 1. “Virginia Electric and Power Company’s Report of Its Integrated Resource Plan.” Richmond: VA.
- <sup>xxxiii</sup> IRP.
- <sup>xxxiv</sup> SEIA: North Carolina Solar. (c) 2017. Washington (DC): Solar Energy Industries Association; {accessed 2017 December 21}. <https://www.seia.org/state-solar-policy/north-carolina-solar>
- <sup>xxxv</sup> Dominion Energy: North Carolina Solar Projects. (c) 2017. Richmond (VA): Dominion Energy; {accessed 2017 December 27}. <https://www.dominionenergy.com/about-us/making-energy/renewables/solar-generation/north-carolina-solar-projects>
- <sup>xxxvi</sup> Electricity Local: Residential Electricity in North Carolina. (c) 2017. {accessed 2017 December 21}. <https://www.electricitylocal.com/states/north-carolina/raleigh/>
- <sup>xxxvii</sup> <https://www.npr.org/sections/money/2011/10/27/141766341/the-price-of-electricity-in-your-state>
- <sup>xxxviii</sup> <https://www.energysage.com/net-metering/dominion-energy/>
- <sup>xxxix</sup> <https://solarpowerrocks.com/virginia/>