By A. Fletcher Mangum

The economics of utility scale solar development

A municipal and industry consultant outlines the economics of utility scale solar

UTILITY SCALE SOLAR ENERGY is advancing rapidly. According to data from the U.S. Energy Information Agency, at the national level the net amount of electricity generated by utility scale solar facilities increased from 0.6 million megawatt hours in 2007 to 53.3 million megawatt hours in 2017 – an increase of 8,607 percent over ten years. Here in Virginia net electricity generated by utility scale solar facilities increased from zero megawatt hours as recently as 2015 to 0.3 million megawatt hours in 2017. And more utility scale solar facilities are coming on line every day.

U.S. ENERGY INFORMATION ADMINISTRATION

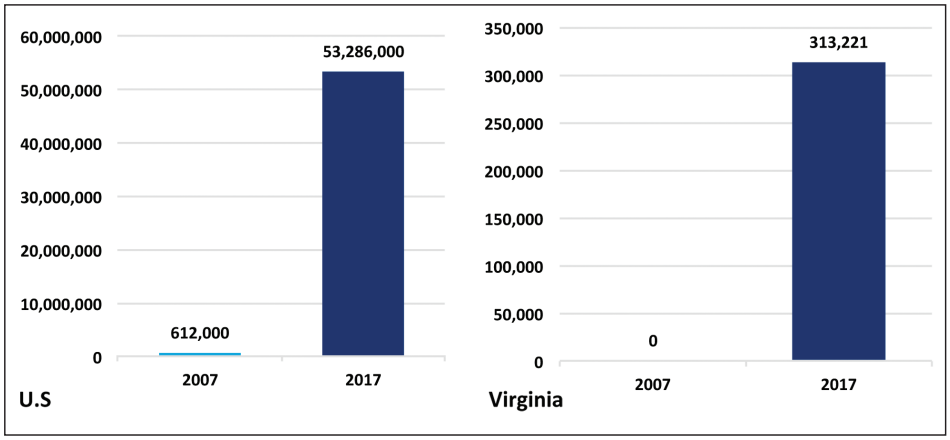

Figure 1: Megawatt Hours of Electricity Production from Solar Energy

Why the sudden interest in solar? A lot of it has to do with increased concern about the environment. It is important to realize that electricity production is the United States' largest source of greenhouse gas emissions. Nationwide in 2007, electricity production generated 2.5 billion metric tons of carbon dioxide emissions, with 2 billion metric tons of that total coming from coal-fired plants. But, where nationwide coal-fired plants produced 49 percent of electricity in 2007, by 2017 that figure had dropped to 30 percent.

Approximately three-fifths of that decrease in the electricity generated from coal power was attributable to the increased use of natural gas. However, the remaining two-fifths came from the increased use of solar and other renewable energy sources. Bottom line, as a result of the shift to cleaner energy sources, carbon dioxide emissions from electricity production dropped from 2.5 billion metric tons nationwide in 2007 to 1.8 billion metric tons in 2017.

Closer to home

In Virginia, the differences were even more stark even if the underlying trends were different. Where coal-fired plants produced 45 percent of electricity in Virginia in 2007, by 2017 that figure had dropped to just 12 percent. And where carbon dioxide emissions from electricity production were 47.2 million metric tons in 2007, by 2017 they had dropped to 31.2 million metric tons. Because Virginia has been a relatively late bloomer in the renewable energy market, almost all that decline came from the increased use of natural gas (in contrast to the national trend outlined above).

Economic considerations

In addition to increased concern about the environment there are also some important economic reasons for the sudden interest in solar. One is that industrial development prospects with high energy needs are becoming increasingly sensitive to the proportion of their energy requirements that are produced through renewable sources, and that has implications for economic development generally. This is especially true of data centers, which according to a recent analysis by the U.S. Chamber of Commerce spend on average about $7.4 million a year on energy costs.

That unusually high demand for energy has caused leading data center companies such as Amazon Web Services (AWS), Apple, Facebook, Google, and Microsoft to move toward sourcing 100 percent of their power needs from renewable energy to reduce their environmental impact. Moreover, they generally prefer to obtain that power from sources that are in reasonable proximity to their facilities. For that reason, data centers have become a driving force behind the development of utility scale renewable energy projects in general, and solar projects in particular.

This trend is especially relevant to Virginia, because data centers are an increasingly important part of Virginia's economy. As our 2018 analysis for the Northern Virginia Technology Council showed, data centers support 43,275 jobs, $3.2 billion in labor income, and $10.2 billion in economic output in Virginia. Additionally, because data centers involve significant investment in computer equipment and other taxable business personal property but have a relatively small

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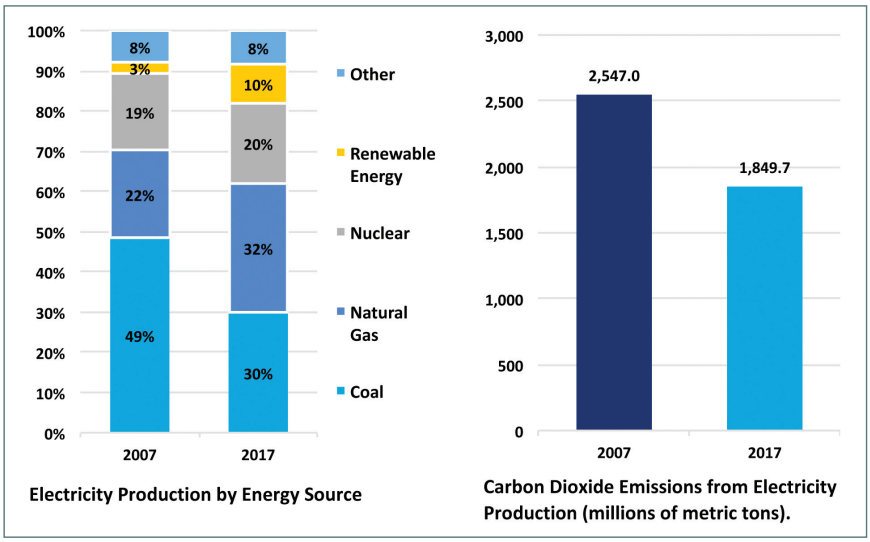

Figure 2: Electricity Production by Energy Source and Carbon Dioxide Emissions from Electricity Production in the U.S.

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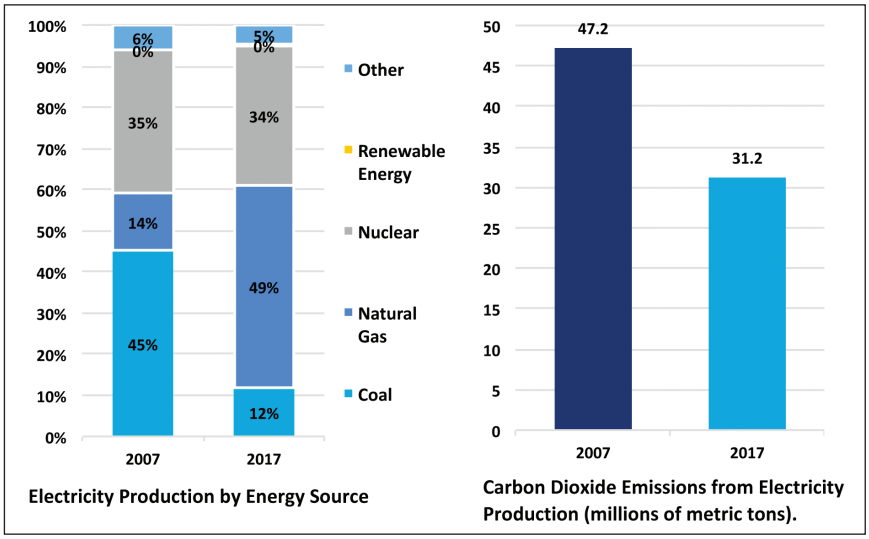

Figure 3: Electricity Production by Energy Source and Carbon Dioxide Emissions from Electricity Production in Virginia.

number of highly paid employees and therefore place little strain on local school systems or other local services, they provide a high net benefit to localities. For example, that same analysis showed that in Loudon County and Prince William County data centers generate more than $8 in local tax revenue for every $1 they generate in local service costs – a more than 8 to 1 benefit-to-cost ratio.

Locality	Estimated Fiscal Benefit	Estimated Fiscal Cost	Benefit / Cost Ratio
Loudoun County	$142,970,214	$17,602,642	8.1
Prince William County	$21,519,155	$2,532,087	8.5

Table 1: Estimated Benefit to Cost Ratio Associated with Data Centers in 2016

Data Source: "The Economic and Fiscal Contribution that Data Centers make to Virginia," produced for the Northern Virginia Technology Council by Mangum Economics, February 2018.

Although much of that overall economic impact is in Northern Virginia, home to the largest concentration of data centers on the planet, it also spreads to Southern Virginia with Microsoft's over $2 billion data center in Mecklenburg County. More recently, with the opportunities provided by the newly constructed MAREA and BRUSA (and the soon to come SAEx1 and Dunant) subsea cable landings in Virginia Beach, it is also spreading to places such as Henrico County in Central Virginia where QTS is expanding its existing data center facilities and Facebook has announced $2 billion in new data center investment.

Another economic reason for the sudden interest in solar is that solar facilities, like data centers, are a clean industry that is capital intensive and thereby generate substantial local tax revenue, while imposing few costs on local services. And we believe this remains true even when one takes into account legislation enacted in 2016 in which the General Assembly provided an 80 percent tax credit on the capital equipment used in solar facilities larger than 20 megawatts. Consider that even with that hefty tax credit, a typical 80-megawatt solar facility with $100 million in capital investment generates around $2.2 million in local tax revenue over 40 years at an average county tax rate of $0.66 per $100 of assessed value (by statute, solar equipment is taxed as real property). Moreover, that figure does not include any increased tax revenue from the land itself, which can be substantial when the property is removed from agricultural use, because agriculture remains a heavily subsidized industry.

Finally, solar facilities can also be an attractive alternative relative to the most likely other use for that land: residential development. According to data from the Virginia Auditor of Public Accounts, in FY 2018 Virginia counties spent about 57 percent of their budgets on schools. As any local planner knows, rooftops mean more school children, along with more traffic, libraries, parks, fire and safety services, etc., etc. As a result, although residential development has benefits it is rare that it actually pays for itself, which is why localities need revenue from commercial and industrial development to close the gap in their budgets.

Concern about the Composite Index

One concern that has been raised about solar facilities is the impact that a solar facility can have on a locality's Composite Index (i.e. the index that the Virginia Department of Education uses to assess the locally funded portion of localities' school budgets based on each locality's "ability to pay"). Each locality's Composite Index is based on three factors – the locality's total real property tax base, total adjusted real income, and total taxable retail sales. Of these, the total real property tax base receives the largest weight. Therefore, hypothetically, a large capital investment could increase a locality's Composite Index and thereby increase the required local contribution to the county's school budget.

In actuality, changes in a locality's Composite Index are driven by changes in the locality's total real property tax base relative to the changes in all Virginia localities' total real property tax base. As a result, for any one capital investment to have an impact on a locality's Composite Index, it would have to drive a percentage change in the locality's real property tax base that was larger than the percentage change in the real property tax base across all Virginia localities. Between Virginia's 2016-18 and 2018-20 Composite Index calculations, that change was 3.8 percent. Of course, 3.8 percent of Craig County's $515 million total real property tax base is substantially different from 3.8 percent of Loudoun County's $75 billion total real property tax base. But on average across all Virginia counties, that would imply a capital investment from a single solar project of around $1.8 billion, once one considers the fact that 80 percent of that investment would be untaxable and would therefore not add to the locality's real property tax base. Not even the largest solar facility comes even close to approaching that level of investment.

Does utility scale solar make sense?

The bottom line is that all local economic considerations are indeed truly local. It's always best for a municipality to decide for itself whether a project is desirable given local conditions. However, based on the numbers outlined above, we believe that in many circumstances solar energy development makes sense for localities from both an environmental and from an economic perspective.

About the author: *Dr. A. Fletcher Mangum is CEO and Founder of Mangum Economics, and a member of the Governor's and the General Assembly's Joint Advisory Board of Economists. His firm has assessed the economic and fiscal impact of solar facilities for localities and several industry firms in Virginia and other states. You may contact him at fletcher@mangumeconomics.com.*