State energy factsheet: Virginia

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This report provides a fact-based overview of Virginia's power sector. It presents key metrics, highlights recent trends and discusses the outlook and opportunities for clean energy.

Findings

- Virginia (VA) is a net importer of electricity, roping in 33% more than it produced in 2015. Retail electricity prices are below the US average (11% below in 2015), and VA maintains a relatively clean generation profile (0.41tCO2/MWh in 2015).
- The state's power mix is changing: since 2010, gas-fired generation increased its share at the expense of coal – a phenomenon driven by falling gas prices and newly built gas capacity. In 2015, gas surpassed all other sources to solidify its place as the primary generation source.
- Renewables lack clear state policy support and accounted for only 5.6% of generation in 2015, nearly all from hydropower and biomass (including biogas and waste-to-energy). Our analysis, based on detailed and realistic inputs, suggests that several renewable energy technologies are or very soon will be economically viable in VA.
- Compared to other states, VA currently ranks near last in terms of overall energy efficiency efforts; state utilities spend small fractions of electricity revenues towards achieving *voluntary* state efficiency goals. But it has the potential to achieve substantial energy savings.

Table 1: Key power system metrics, Virginia versus US average, 2015

Metric	Units	VA	US average	Comment	Rank
Total retail electricity sales	TWh	112	74	***Above average*** electricity demand	10
Total generation	TWh	84	80	***Above average*** in-state generation	17
Retail electricity sales per capita	MWh	13.4	11.7	***Above average*** per capita demand	22
Retail electricity prices	¢/kWh	9.3	10.5	***Below average*** electricity prices	34
Generation from gas	%	39	33	***Above average*** reliance on gas for electricity	16
Generation from gas and renewables	%	45	47	***Roughly average*** reliance on gas and renewables	24
Energy efficiency score	ACEEE index	13	19	***Below average*** on efficiency efforts	31
Utility energy efficiency budget	% state revenue	0.0	1.6	***Below average*** utility efficiency budget	48
CO2 emissions rate	tCO2/MWh	.41	.49	***'Cleaner' than average*** generation profile	37

Source: Bloomberg New Energy Finance, US Energy Information Administration (EIA), US Census Bureau, ACEEE Notes: US 'average' represents a simple average across all 50 states, with the exception of retail prices and retail sales per capita (both are a weighted average). Ranks are in descending order (ie, 1 being highest, 50 being lowest). For some metrics it is 'good' to have a high ranking (eg, energy efficiency score); for other metrics it is 'good' to have a low ranking (eg, retail electricity prices, CO2 emissions rate).

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1. BIRD'S EYE VIEW OF VIRGINIA'S POWER SECTOR

Virginia (VA) ranks 10th in total electricity consumption (112TWh in 2015) and 17th in total electricity generation (84TWh in 2015), making it one of the nation's biggest electricity importers.[1] But VA is closing its domestic generation gap: between 2010 and 2015, in-state generation grew at a compound annual growth rate (CAGR) of 3.0%, while retail sales were roughly flat (Figure 1).

Figure 1: VA electricity sales and generation, 2010-15 (TWh)

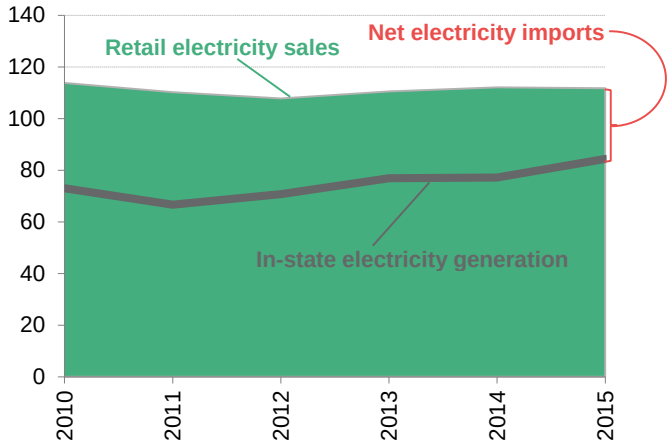
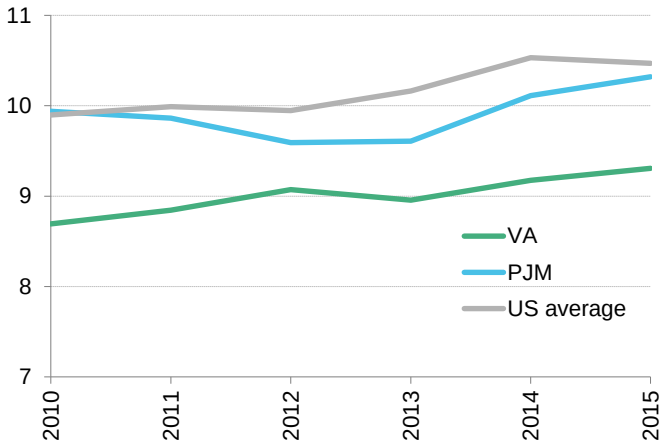


Figure 2: VA retail electricity prices relative to regional (PJM) and US averages, 2010-15 (nominal ¢/kWh)



Source: Bloomberg New Energy Finance, EIA Notes: PJM is VA's wholesale power market, composed of 13 neighboring states.

The retail price of electricity in VA was 9.3¢/kWh in 2015, 7% higher (in nominal terms) than in 2010, yet 9.8% below regional and 11% below US averages (Figure 2). Nuclear continues to provide baseload power for VA, but there have been changes in its fossil mix with natural gas increasing share at the expense of coal. Gas-fired plants provided a record 39% of electricity in 2015 – up from just 23% in 2010. Meanwhile, generation from renewables – mainly biogas, biomass and waste-to-energy – grew from 3.6% to 5.6% over that period (Figure 3).

Figure 3: VA electricity generation mix by technology, 2010-15 (%)

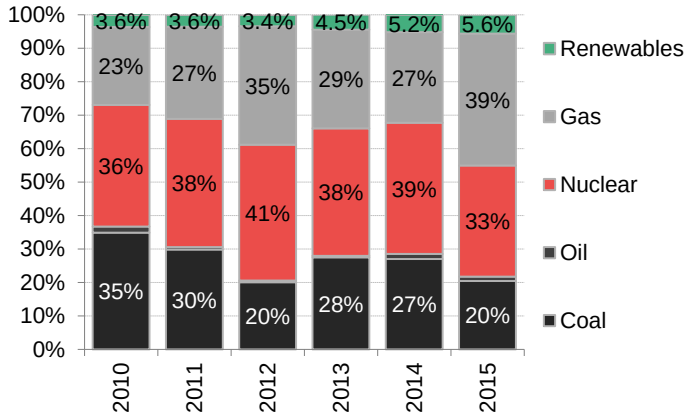
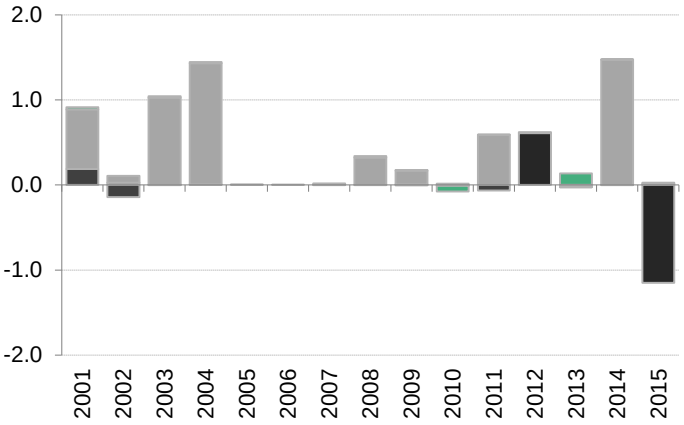


Figure 4: VA capacity additions (build, above x-axis) and retirements (below x-axis), 2001-15 (GW)



Source: Bloomberg New Energy Finance, EIA Note: Build is almost entirely gas; new renewable build is too small to be seen clearly in chart. Generation only includes production from utility-scale units.

[1] Virginia's net import numbers may be misleading: Mount Storm, a 1.6GW coal-fired power plant located in neighboring West Virginia and owned by Virginia utility Dominion, wheels roughly 10TWh into Virginia annually.

Natural gas has been the fuel of choice for building new power plants in VA, accounting for 84% of capacity additions since 2001. Given US EPA regulations, VA may have built its last coal plant ever in 2012, with the commissioning of the 585MW Virginia City Hybrid Energy Center – a coal plant that burns up to 20% biomass (Figure 4).

2. SUSTAINABLE ENERGY DEPLOYMENT

2.1. Natural gas

While the amount of natural gas extracted in VA has slowed over the last four years, the amount of gas burned for power generation has grown sharply – at a compound annual growth rate of 12% from 2010-15 – eclipsing total in-state production for the first time in 2012 (Figure 5). Increased natural gas production flowing out of the Northeast (specifically, the Appalachian Basin) has driven gas prices down nationwide, but especially in VA (which is linked to the 'App Basin' through a major pipeline), improving the economics of the state's gas-fired power plants (Figure 6). As a result of these low prices and continued gas build, gas-fired generation has surpassed coal-fired generation every year since 2012.

Table 2: VA policies relevant to sustainable energy sectors

Renewables
Voluntary renewable energy portfolio goal
Sets a voluntary goal for investor-owned utilities (IOUs) to procure 15% of base year (2007) retail electricity sales by 2025 from eligible renewable technologies
Net metering
Net excess generation from non-residential (<1,000kW) and residential (<20kW) eligible renewable systems is credited to customer's next bill at retail rate
Energy efficiency
Voluntary energy efficiency resource goal
Calls for 10% electricity savings by 2020 relative to 2006 base retail sales
Various state financial incentives for energy efficiency
Loan programs for energy efficiency projects in state facilities; other personal and property tax incentives

Source: Bloomberg New Energy Finance, ACEEE, DSIRE

Figure 5: VA natural gas production and power sector consumption, 2010-15* (Bcfd)

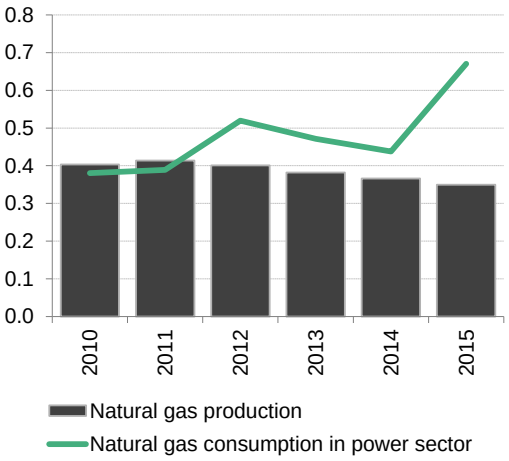
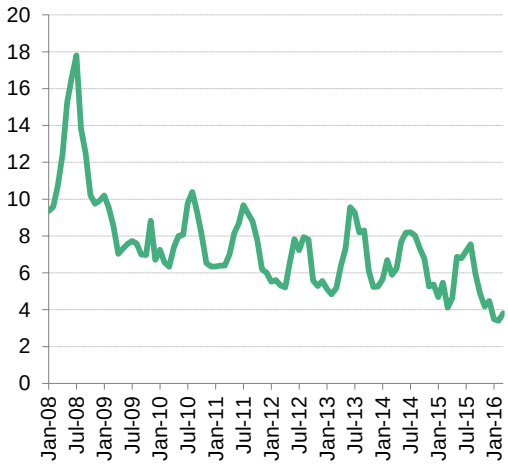


Figure 6: VA natural gas price (citygate), 2008-March 2016 ($/MMBtu)



Source: Bloomberg New Energy Finance, EIA Note: 'Citygate' refers to the point at which a distribution gas utility receives gas from a natural gas pipeline company or transmission system.

2.2. Renewables

Virginia's renewable energy and energy efficiency goals are voluntary

VA has a *voluntary* renewable portfolio goal of procuring 15% of base-year (2007) electricity sales from renewables by 2025. In 2015, however, renewables provided less than 6% of electricity generation. Nearly all of this came from biomass (including biogas and waste) and hydropower facilities. Between 2010 and 2015, VA built only 165MW of utility-scale renewable capacity, alongside an estimated 17MW of distributed solar (Figure 7). Cumulative installed renewable capacity reached 5.1GW in 2015 (Figure 8), including an estimated 24MW of residential and commercial-scale solar capacity (Figure 9).

Virginia has little utility-scale wind or solar capacity compared to other states of similar size

Figure 7: VA renewable capacity additions, 2010-15 (MW)

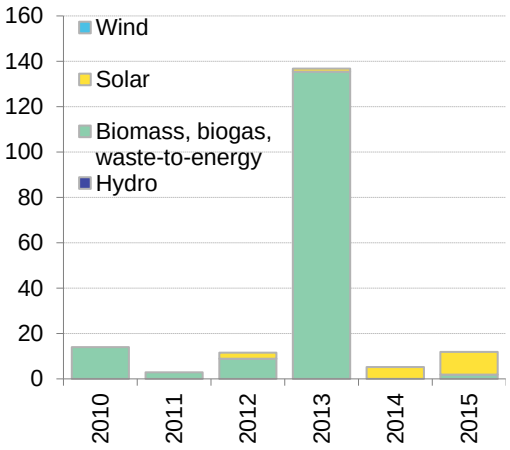
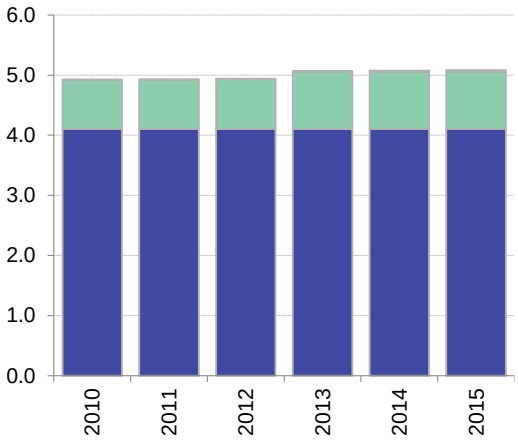
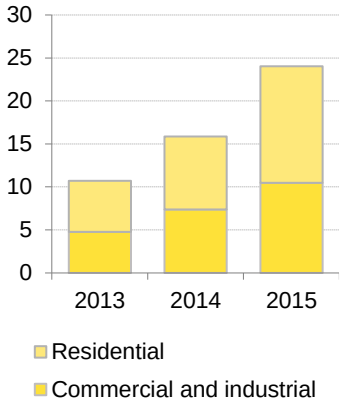


Figure 8: VA cumulative renewable capacity, 2010-15 (GW)



Source: Bloomberg New Energy Finance, EIA Note: includes BNEF data on distributed (ie, residential, commercial, and industrial) solar capacity. Solar numbers are given in DC MW. The majority of hydroelectric capacity is pumped storage and thus does not contribute materially to renewable energy generation.

Figure 9: VA cumulative installed distributed solar PV capacity, 2013-15 (MW)



Source: Bloomberg New Energy Finance

Utility-scale solar PV has been slow to take off, with an estimated 2MW of total installed capacity at end 2015; the pipeline, however, is more promising: two additional 20MW solar projects were recently permitted (expected to be online in 2017). Another source of potential growth may be in community solar: the BARC Electric Cooperative commissioned the state's first community solar project (0.6MW) in August 2016.

In the absence of explicit state-level support for renewables, Virginia has been a hotspot for corporate procurement of renewable energy. Both Amazon and Microsoft have recently inked contracts with new-build utility-scale solar projects of 260MW and 20MW, respectively, with the involvement of local utility Dominion Energy. The projects are expected to be commissioned in 2017-2018 (and thus are not included in the figures above) and are additional to the two 20MW projects noted previously.

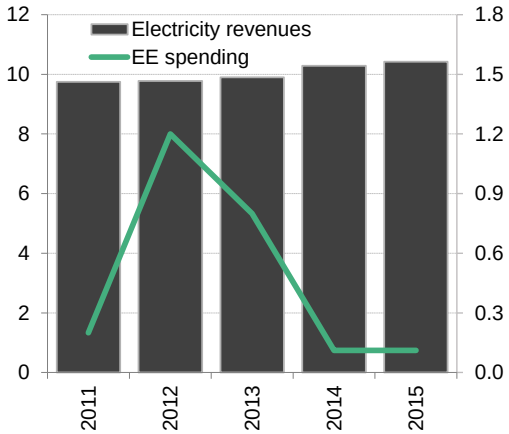
The state has no utility-scale wind installations, but it houses six manufacturing facilities that produce components for the wind industry, and various entities have been exploring opportunities for offshore wind.

2.3. Energy efficiency

VA ranks near the bottom of the state list (33rd) in terms of its overall energy efficiency efforts, according to a scoring system devised by the American Council for an Energy Efficient Economy (ACEEE). It gave the state a relatively low overall efficiency score (13 out of 50) and a *negative* score (-0.5 out of 20) for utility and public benefits programs and policies (a component of ACEEE's overall score). Figure 10 shows VA's annual utility electricity revenues (black bars, left axis, $bn) and utility energy efficiency program spending (green line, right axis, $m) from 2011 to 2015 while Figure 11 shows how VA stacks up to its neighbors on the latter metric. For reference, utilities in Maryland (MD) and New Jersey (NJ) – states that operate in the same wholesale power market as VA – dedicated 3.7% and 1.7% of state-wide electric revenues to efficiency programs, compared with 0.0% for utilities in VA in 2015.

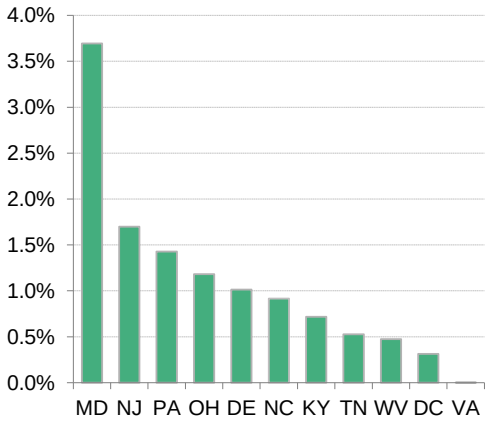
VA utilities spend near-zero percentages of electricity revenues on energy efficiency programs

Figure 10: VA utility electricity revenues (left axis, $bn) and utility electric program spending (right axis, $m), 2011-15



Source: ACEEE

Figure 11: States' utility electric program spending as a fraction of state-wide electricity revenue, 2015 (%)



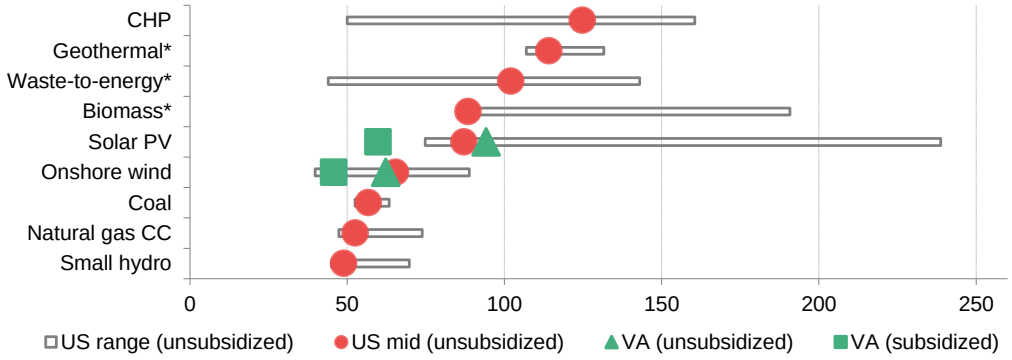
Source: ACEEE

3. OPPORTUNITIES

The Bloomberg New Energy Finance levelized cost of electricity (LCOE) analysis compares the cost of producing electricity from different technologies (Figure 12). The long thin rectangles show the range of unsubsidized LCOEs for these technologies in the US. The red circles show US or global average LCOEs (prior to the inclusion of policy – ie, unsubsidized); the green triangles and squares show subsidized and unsubsidized Virginia-specific LCOEs, respectively, for onshore wind and solar PV. (These are the two technologies for which Bloomberg New Energy Finance already has detailed, state-specific inputs.)

Several clean energy technologies are already, or on the verge of being, economically viable in Virginia

Figure 12: Unsubsidized levelized cost of electricity (LCOE) of select technologies in the US*, and subsidized and unsubsidized LCOE of onshore wind and solar PV in VA, H1 2016 ($/MWh)



*Source: Bloomberg New Energy Finance Notes: *LCOE for waste-to-energy in this report is a global estimate, biomass and geothermal are Americas region estimates; all other LCOEs in Figure 12 are either US or VA-specific. Variations in VA versus US average result from variations in capacity factor, capex and financing rates. Bars indicate the range of unsubsidized LCOE for each technology in the US. Key policies such as the $23/MWh Production Tax Credit (PTC) and accelerated depreciated (MACRS) bring down unsubsidized LCOEs to subsidized levels. LCOE for combined heat and power (CHP) is for reciprocating engines with CHP. LCOE for small hydro assumes 56% capacity factor, but this can vary significantly depending on annual rainfall conditions.*

Renewables

- The LCOE analysis indicates that, in VA, several clean energy technologies are already, or are on the verge of becoming, economically viable without incentives (unsubsidized LCOE close to or below that of a natural gas combined-cycle turbine): namely, small hydro and onshore wind. Solar PV on a subsidized basis is approaching cost competitiveness as well.
- Taking into account the benefit of the federal Production Tax Credit (ie, subsidized), onshore wind currently offers the lowest-cost opportunity for new-build generation, according to the LCOE. At present, Dominion reports that it is prospecting close to 250MW of new onshore wind capacity in the state, although no utility-scale wind farms have been built to date.
- Given that VA is one of the three largest waste-importing states in the nation there is considerable room for growth in waste-to-energy capacity. Additionally, although Virginia is already the third-largest state in terms of biogas power capacity (134MW), the American Biogas Council estimates the state has enough biomethane production potential to more than double its biogas systems.
- In June 2016, the governor issued Executive Order 57, which convenes a new workgroup, led by the state's Secretary of Natural Resources, to study and ultimately determine a strategy to reduce carbon emissions from the state's power sector. The order builds upon earlier orders and goals set by the governor, including a requirement for state agencies to procure at least 8% of their electricity from renewables by the end of 2018.

Natural gas

- The LCOE analysis also highlights the economic merit of natural gas combined-cycle turbines – especially if proposed new natural gas pipeline capacity materializes, which would increase southward flowing natural gas from the Appalachian Basin. The state benefits from its proximity to the Williams' Transcontinental (Transco) system, a major gas pipeline and key source of future takeaway capacity from Northeast natural gas producers in the Appalachian Basin.

Energy efficiency

- Energy efficiency represents an obvious area of opportunity for Virginia (and an area in which the state has room for improvement). ACEEE places VA's energy efficiency savings potential at 23% cumulative energy savings in 2030 relative to 2012 consumption. That's equivalent to avoiding 25TWh of generation in 2030. Additionally, in the 2016 session the legislature passed a bill requiring the State Corporation Commission to evaluate a system which would promote uniform systems of measuring and validating achievements from utility energy efficiency programs. Utility-led programs are perhaps the largest area with unexploited potential, having received a *negative* score from ACEEE in 2016.

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