VACo Annual Conference

November 13, 2017

DMME
Virginia Department of Mines Minerals and Energy

Virginia's Diversified Energy Mix

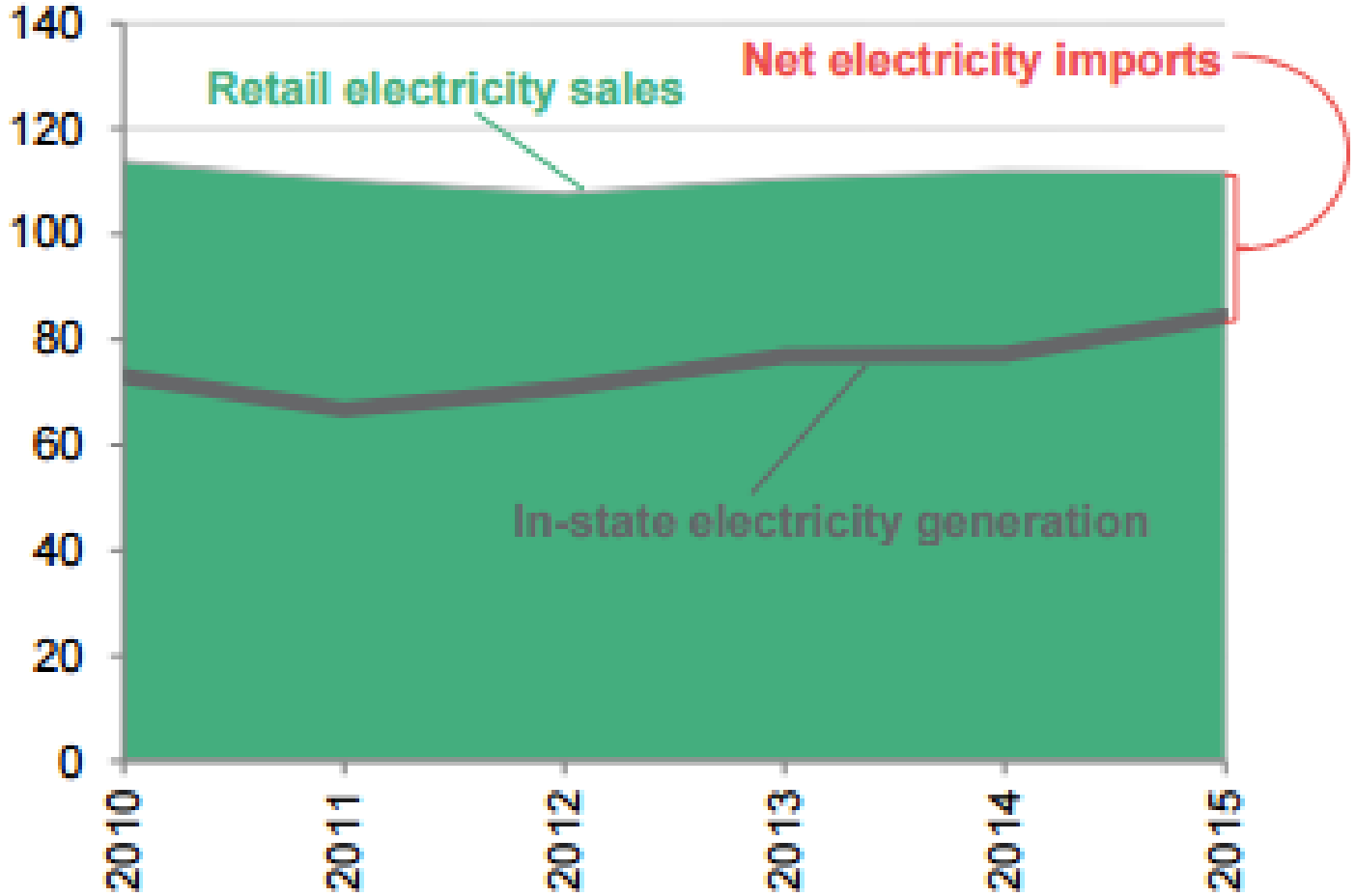
- Virginia truly embraces an "all of the above" strategy
  - Traditional energy resources
    - Nuclear, Gas, Oil, Coal
  - Renewable energy
    - Solar, Wind, Biofuel, Hydro
- Goal: Continue to increase energy capacity and diversity
- Why?
  - Increase economic development
  - Lessen reliance on imported energy
  - Provide hedge against future market volatility
  - Reduce carbon emissions

Virginia's Diversified Energy Mix

Utility-Scale Net Electricity Generation - 2017

	Virginia	**U.S. Average**
Petroleum-Fired	0.4 %	0.2 %
Natural Gas-Fired	53.9 %	35.6 %
Coal-Fired	15.2 %	32.1 %
Nuclear	27.5 %	17.8 %
Renewables	4.9 %	13.6 %

Sales and Generation

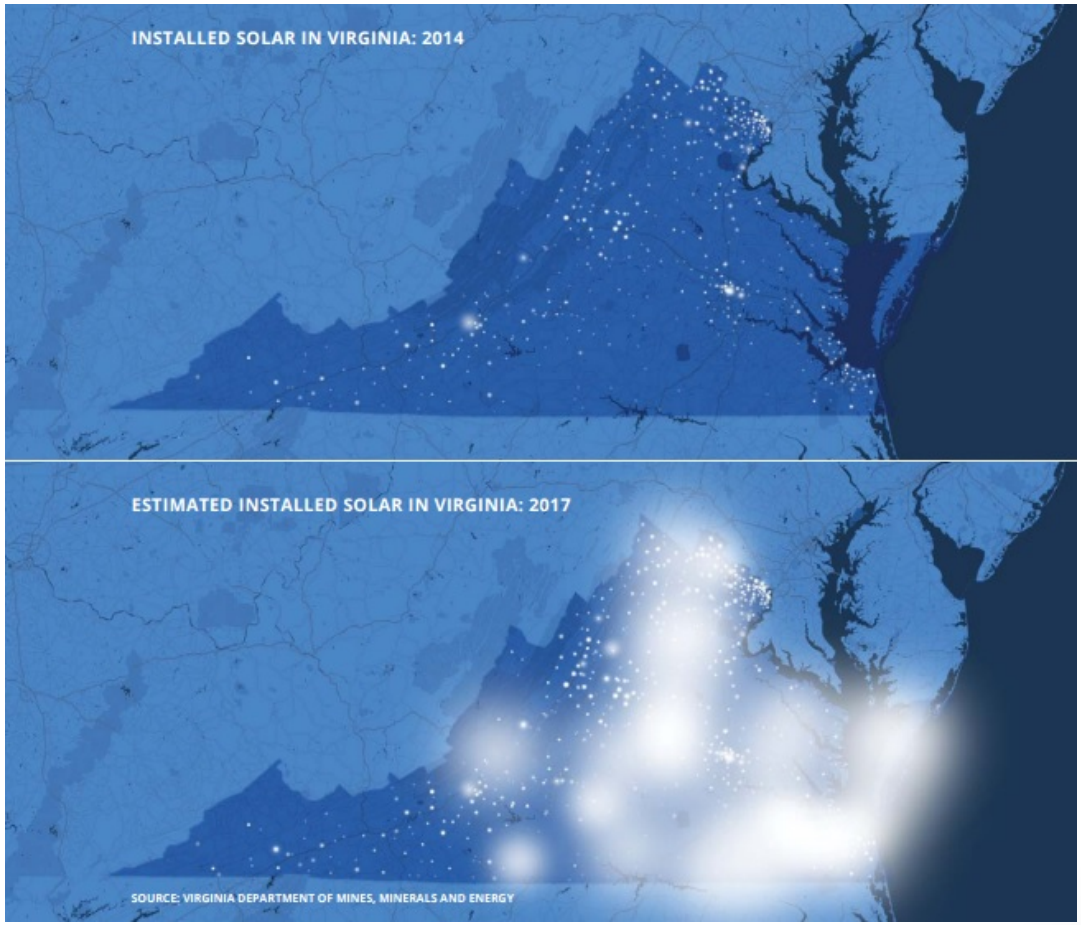


Energy Initiatives to Help Drive Energy Development and Diversity:

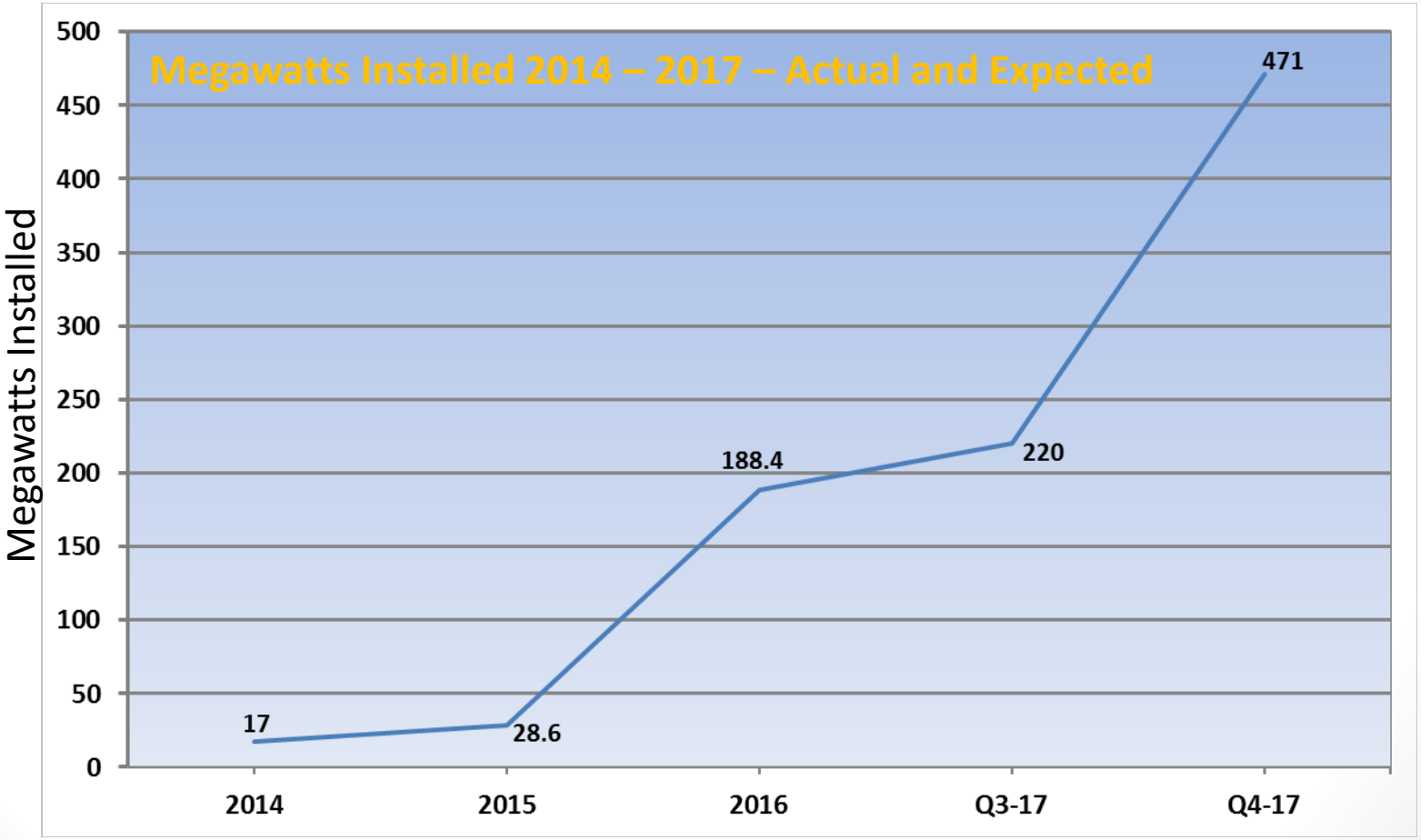
1. Solar, Wind and Pumped Storage Hydro
2. Commercial PACE Program

Solar Energy

- Rapid growth in the solar energy industry has taken place, both in the private and public sectors



Utility-Scale Solar (cont.)



Source: Virginia Department of Mines, Minerals and Energy

Utility-Scale Solar

- Initiatives Providing Momentum
  - In 2015, a law was enacted that set 500MW of utility-scale solar as “in the public interest,” making it easier for utilities to build and supply solar energy
  - Dominion Virginia Power conducted first-ever RFPs for utility-scale solar projects
  - Old Dominion Electric Cooperative to receive renewable generation from two Dominion Energy-owned solar facilities in Clarke and Northampton Counties.

Utility-Scale Solar

Dominion Energy Solar Projects

Dominion Projects Completed

Project Name	Location	Capacity (MW)	Offtaker
Clarke	Clarke County	10	ODEC
Remington	Fauquier County	20	COV/MS
Scott Solar 1	Powhatan County	17	All
Whitehouse Solar	Louisa County	20	All
Woodland Solar Center	Isle of Wight County	19	All
Amazon Solar Farm US East	Accomack County	80	Amazon (AWS)
	Total	**166.0**	

Utility-Scale Solar

Dominion Energy Solar Projects

Dominion - Under Development

System Owner	Location	Capacity (MW)	Offtaker
Buckingham Solar I / Amazon Solar Farm US East 3*	Buckingham	20	AWS
New Kent / Amazon Solar Farm US East 4*	Sussex	20	AWS
Scott II / Amazon Solar Farm US East 5*	Powhattan	20	AWS
Sussex	Sussex	20	AWS
Southampton	Southampton	100	AWS
Cherrydale	Northampton	20	ODEC
Oceana (energy & RECs to COV)	Virginia Beach	18	COV
Hollyfield		17	UVA
Puller	King William County	15	UVA
Essex	Dunnsville	20	All
	Total	**269.8**	

Utility-Scale Solar

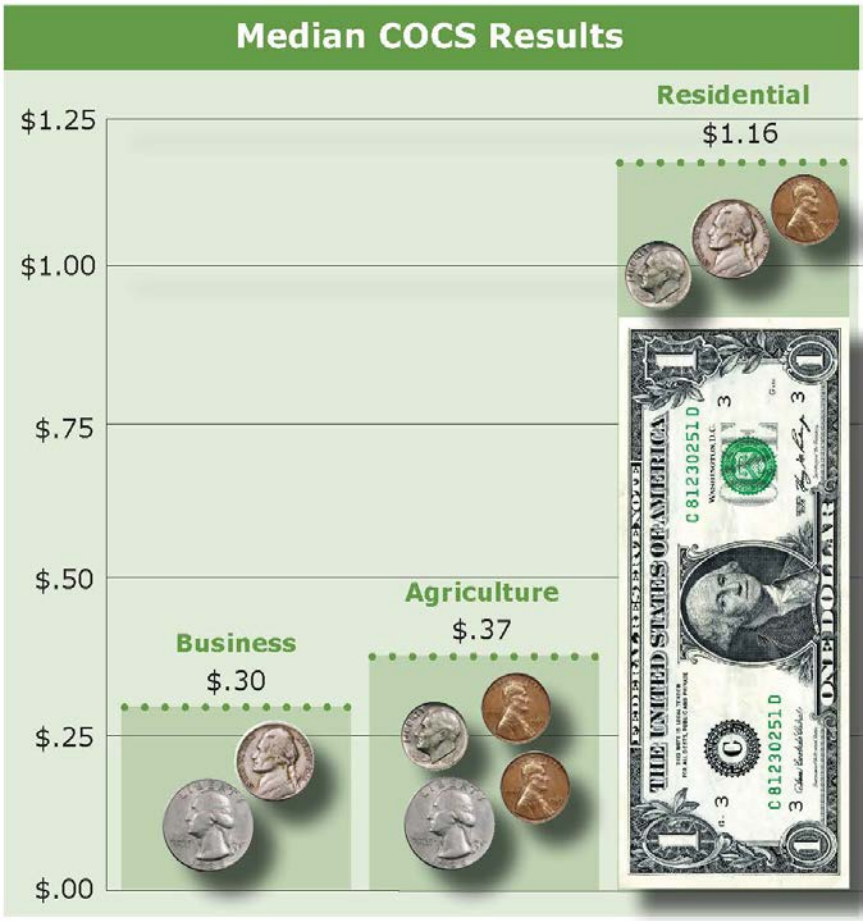
- Initiatives-Other
  - In 2016, a law was enacted that allows for solar to be classified as pollution control equipment, thereby exempting it from state sales and local machinery and tools taxes.
  - Level of exemption depends on project size and construction date.
  - Exemption could be considered a deterrent for localities ***BUT….***

Utility-Scale Solar

…Overall local land use costs/benefits should also be considered.

- Tools such as Cost of Community Services (COCS) studies can help determine revenues and expenses associated with competing land use types.
- In a 2016 study, The American Farmland Trust and the USDA jointly published the results of over 100 COCS studies from across the US.
- Evaluation of public costs and revenues from different land use options generally reflect residential development as a net fiscal loss.

Utility-Scale Solar (cont.)



Median cost to provide public services for each dollar of revenue raised.

Utility-Scale Solar (cont.)

- On average, a locality spends $1.16 for every $1.00 returned from residential use.
- Conversely, services that support commercial/industrial and agricultural land uses cost less than the revenue generated.
- This is reflected in the six COCS studies done for counties in Virginia.

Virginia	Residential	Commercial	Agricultural	Source
Augusta County	1 : 1.22	1 : 0.20	1 : 0.80	Valley Conservation Council, 1997
Bedford County	1 : 1.07	1 : 0.40	1 : 0.25	American Farmland Trust, 2005
Clarke County	1 : 1.26	1 : 0.21	1 : 0.15	Piedmont Environmental Trust, 1994
Culpepper County	1 : 1.22	1 : 0.41	1 : 0.32	American Farmland Trust, 2003
Frederick County	1 : 1.19	1 : 0.23	1 : 0.33	American Farmland Trust, 2003
Northampton Co.	1 : 1.13	1 : 0.97	1 : 0.23	American Farmland Trust, 1999

Utility-Scale Solar (cont.)

Solar Use

- Studies did not specifically address solar, but utility scale projects would behave similar to agriculture with respect to the cost of public services (or less due to reduced impact).
- The cost/revenue balance would be further advantaged if associated with the use of unproductive or underutilized land.
- While the exemption applies to Machinery and Tools (M&T) taxes, it does not apply to all M&T taxes.
- If a locality has an exemption on agricultural equipment, terms may be less revenue favorable than M&T exemption.

Utility-Scale Solar (cont.)

The property tax exemption applies to solar projects as follows :

- 20 megawatts or less with interconnection filed on or before December 31, 2018,
- 20 megawatts or less that serve state and private colleges and community colleges,
- 80 percent of the assessed value for projects in service on or after January 1, 2017,
- 5 megawatts or less with interconnection filed on or after January 1, 2019,
- 80 percent of the assessed value greater than 5 megawatts, with interconnection filed on or after January 1, 2019.
- The exemption for projects greater than 20 megawatts does not apply to projects that begin construction after January 1, 2024.

Permit By Rule (PBR) Process

- The Virginia Department of Environmental Quality (DEQ) offers a Permit By Rule (PBR) process for Renewable energy developers
- Offers a “one-stop” regulatory process that provides surety to developers
- Local government approval is the gating item
- Avoids permitting process via State Corporation Commission (SCC) and multiple resource agencies
- Legislation from last year increases the eligible size from 100MW to 150MW for solar and wind power projects

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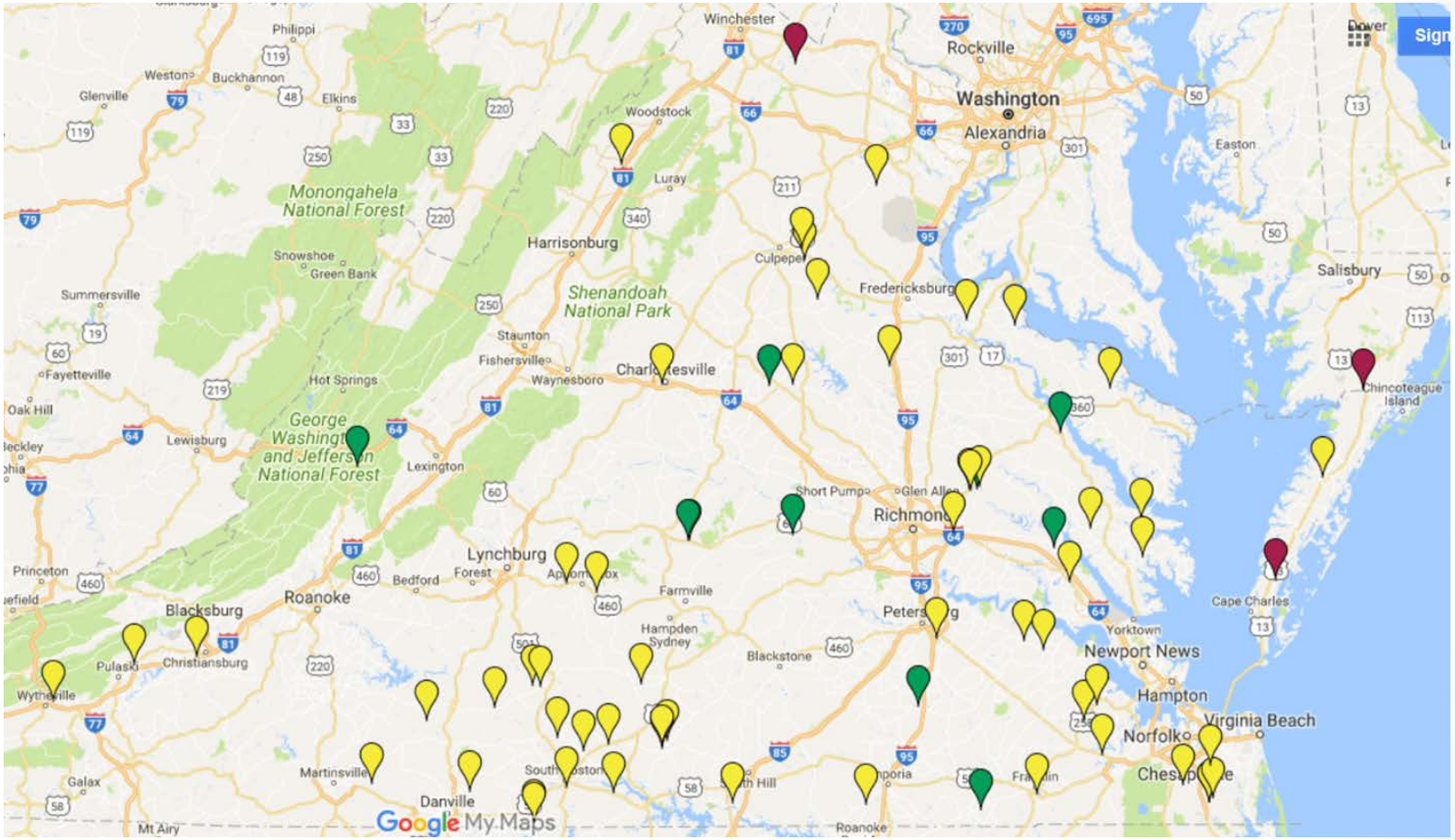
Permit By Rule Metrics

• Total Notices of Intent	74
• Number of Solar PBRs Granted	13
• MW permitted	523
• Projected operational MW	327
• Total Projected PBR MW	2,968
• Number of Acres	29,045

DMME
Virginia Department of Mines Minerals and Energy

Permit By Rule Distribution



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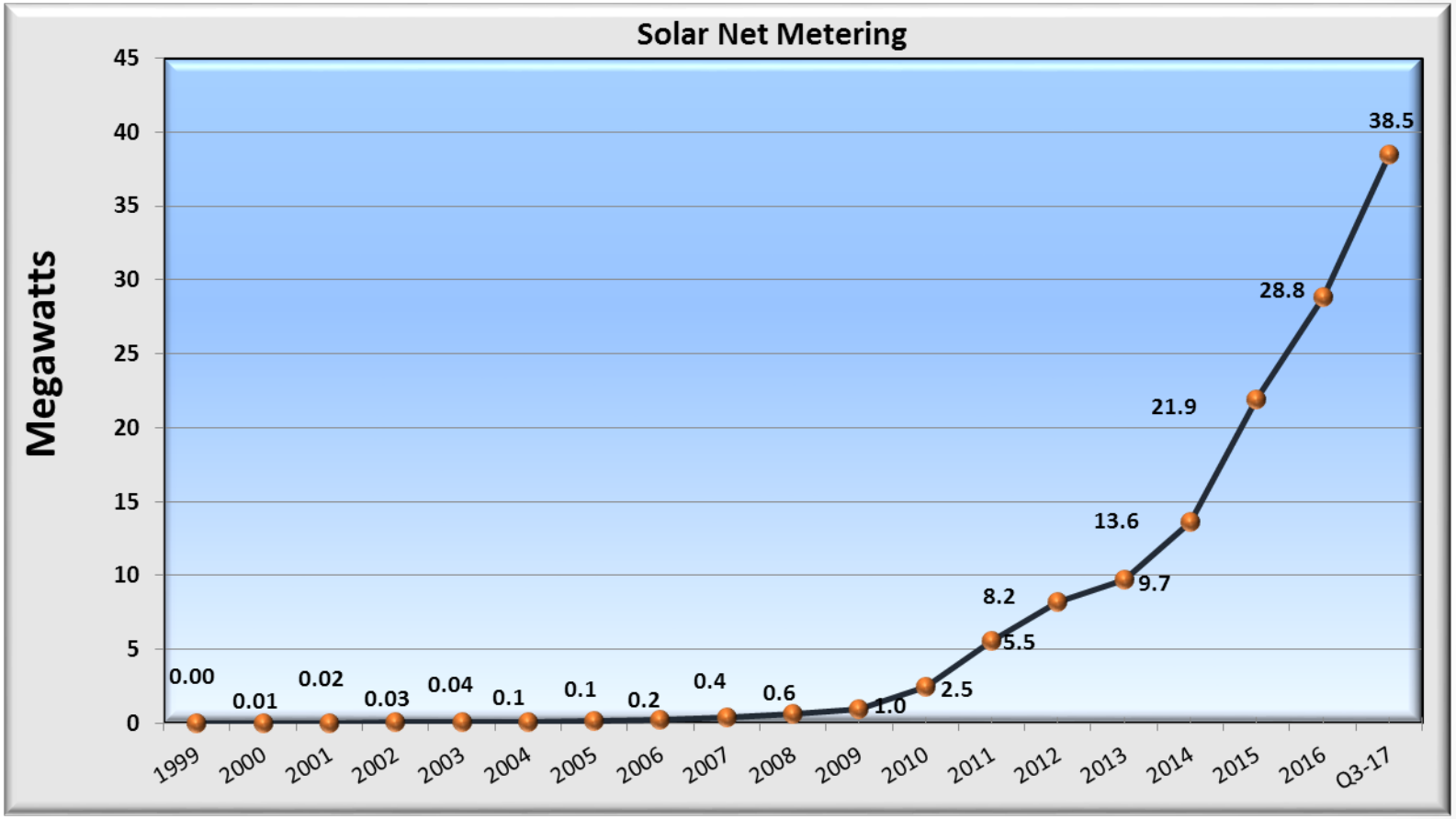
Distributed Generation (Net Metering)

- Previous legislation increased the maximum size for a solar generation system allowed on commercial properties from 500kW to 1MW
- In the last several years, Virginia has realized more growth in small-scale solar deployment than at any time in history
- Grown from 13.6 MW in 2014 to 38.5 MW Q3 2017

Distributed Generation (cont.)



- Represents an increase of 283% since 2014.

Innovation in Solar Energy

- Emphasis on **creative partnerships** to achieve greater solar deployment across the Commonwealth
- **Facebook Announcement**
  - Partnering with Dominion Virginia Power to make the largest single solar purchase in Virginia
  - Dominion will expand its photovoltaic portfolio to meet the needs of Facebook's recently announced 1 million-square-foot Virginia facility.
- **Microsoft's Fauquier County Solar Facility**
  - Public Private Partnership
  - 20MW facility owned by Dominion
  - Renewable Energy Credits (RECs) will be retired by Microsoft
  - Taxpayers will save money with low-cost electricity

Innovation in Solar (cont.)

Community Solar

First community solar program was established in 2016

- BARC Electric Cooperative constructed a 550 kw solar system that allows customers to purchase “solar energy blocks”
- Partially funded through grants from USDA and ARC

2017 Legislation required Dominion and Appalachian Power to conduct community solar pilot programs

Small Agricultural Generator Program

2017 legislation allows small agricultural generators to sell a defined amount of electricity generated from farm-based generating facilities to their electric utilities.

Innovation in Solar (cont.)

Power Purchase Agreements (PPA's)

- Innovation is in the relationship between the developer and customer.
- PPA's can be structured as service contracts where developer owns and operates solar equipment and sells electricity as delivered to customer meter.
- Agreements are typically 20 years so care must be taken in avoiding terms that may conflict with those of a service contract.

Innovation in Solar (cont.)

Power Purchase Agreements (PPA's)

Basic terms are:

- payment for delivered kwh only (no take-or-pay)
- customer does not control dispatch
- equipment is decommissioned at end of term (or fair market value option).

Program offers and partnerships using this approach are becoming more frequent and popular and will help drive the deployment of small-to-mid scale projects.

Innovation in Solar (cont.)

- **RVA Solar Fund (example)**
  - A recent competitive grant program of The Community Foundation to support solar by public bodies in the Central Virginia region.
  - Provides grants from $20,000 to $100,000 to support admin costs, staff and teacher training, and/or sustainability initiatives
  - Power Purchase Agreement (PPA) =>buy power, not panels
  - Solar PPAs to fund an estimated $12 million for solar arrays

Innovation in Solar (cont.)

ELIGIBILITY

- Eligible region
  - 13 county Richmond MSA
  - Eligible area for PPA Pilot Program

- Eligible grant recipients
  - County, city, and/or town governments
  - K-12 public schools
  - Each grant recipient can aggregate multiple solar-ready facilities

Innovation in Solar (cont.)

RVA Solar Fund Key Dates

- **November 17**: deadline for submitting a non-binding Notice of Interest.
- **December 1**: applicants invited by TCF to submit full application
- **January 26**: full applications due

To Apply: click "**Get Started**" at www.rvasolarfund.org

Solar Jobs

- Virginia is one of the fastest growing solar job markets in the country
- According to The Solar Foundation, Virginia is ranked 20th in the country for solar jobs, with 3,236 jobs
- **65% growth between 2015 and 2016**
  - 2.65 times greater than the national solar growth rate (24.5%)
  - 2nd in the Southeast
  - Tied for 9th in the U.S.
- Types of Jobs:
  - Installation: 1,750 (46% increase)
  - Project Development: 575 (108% increase)
  - Manufacturing: 300 (88% increase)

Solar Policy

Rubin Solar Collaborative Workgroup

- Mark E. Rubin, J.D., facilitator of the group and Director at the Virginia Center for Consensus Building.
- On June 19, the process of soliciting input regarding Virginia solar programs and policies began with a public meeting at VCU.
- More than 80 members of the public participated
- Subgroup meetings took place leading up to a public session held October 30, 2017 in Richmond.
- Based on feedback, policy topics were developed in several key areas, one being land-use.
- Topics are under discussion and final recommendations are pending.

Rubin Group on Land Use

- Unless a local zoning ordinance provides otherwise, allow a substantial accord determination to be combined with a special or conditional use request for a large solar facility.
- Code change proposal that allows a homeowner to install solar on their property without the property being subject to a owner's association that otherwise regulates such installation. Residential solar would still be subject to local setback provisions, historic areas, etc.

Rubin Group on Land Use

Code change proposal to say that unless a local zoning ordinance provides otherwise:

- Owner of agricultural property has the right to put a solar installation on their property to serve the electricity needs on their property.
- Owner of property zoned for commercial or industrial uses has the right to put a solar installation on their property to serve the electricity needs on their property.

Wind Energy

- 2017 saw the reinvigoration of the Virginia Offshore Wind opportunity and the strongest evidence to date that European developers will bring investment to the U. S. East Coast.
- Dominion Energy partnered with Denmark's Ørsted (formerly DONG Energy), the world offshore wind leader, to develop the Coastal Virginia Offshore Wind Project (CVOW) 24 nautical miles off Virginia Beach.
- CVOW will include two, 8 MW wind turbines located in the federal research lease area. The project is expected to be operational in 2020. It would be only the second offshore wind project in the nation and the first owned by an electric utility; and it will be an important first step toward commercial-scale offshore wind development.

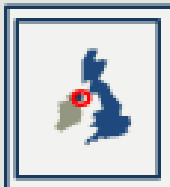
Wind Energy

- The project opens the door to long-term commercial wind development and will provide the critical operational, weather and environmental experience needed for large-scale development in the adjacent 112,800-acre site leased by Dominion Energy from BOEM. Full deployment could generate up to 2,000 megawatts of energy—enough to power half a million homes.
- The project also opens the door to attract wind power manufacturing to Virginia's ports. Virginia could potentially be the base for the entire U.S. East Coast supply chain, hosting a large portion of the manufacturing and support industry.

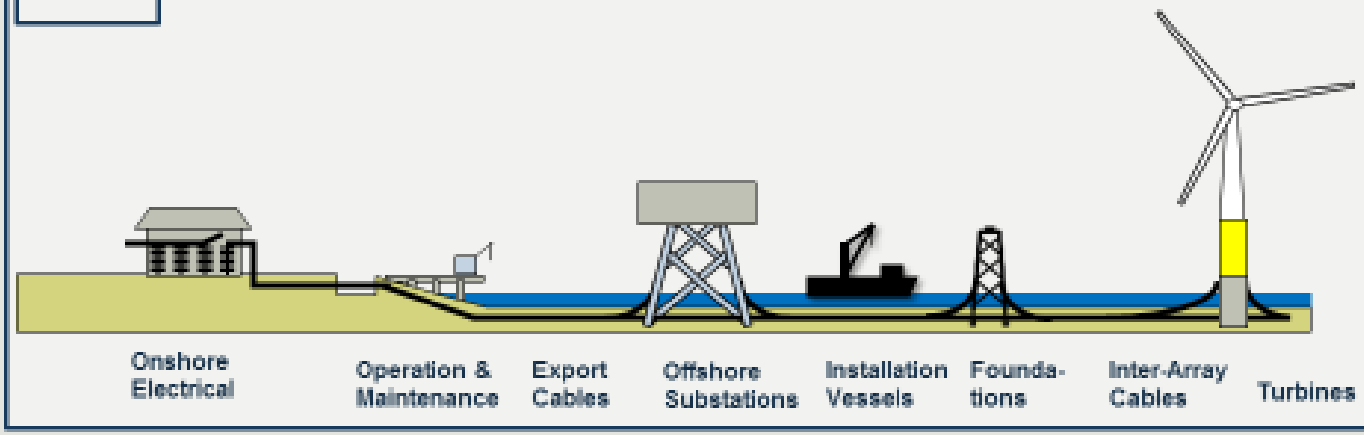
Wind Energy

Offshore Wind Can Create Economic Development Opportunities in Virginia for Ports and the Supply Chain

Focus on Ports – Case Study from Belfast Harbor, Northern Ireland, presents Opportunities For Investment in Virginia's Extensive Port Infrastructure



DONG Energy signed a long-term lease on the $60m state-of-the art Offshore Wind Terminal at Belfast Harbor, the first custom built installation and pre-assembly harbor in the UK and the source of 300 full time jobs

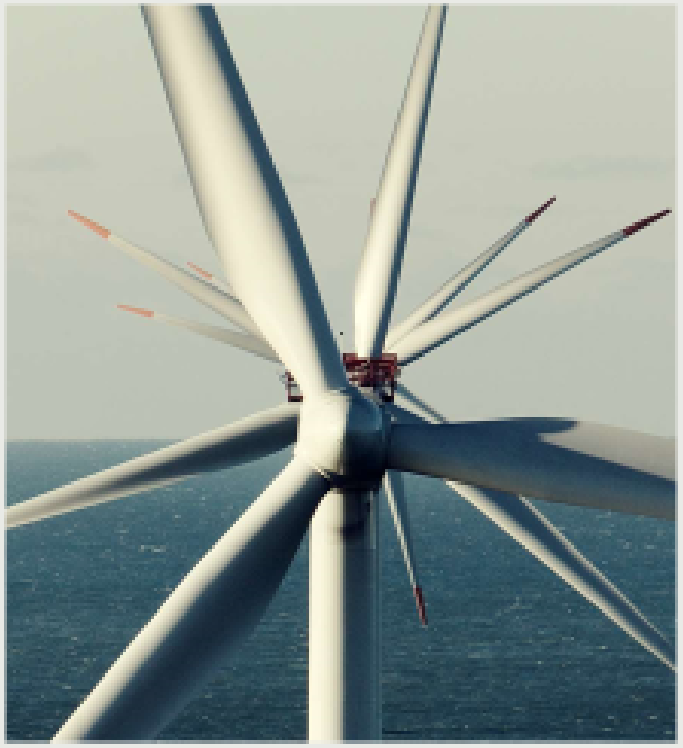


DONG energy

Wind Energy

DONG Energy's Next Steps in Virginia

- Entered EPC arrangement to build Mid Atlantic's first OSW project, Coastal Virginia Offshore Wind, with commissioning expected by 2020.
- Entered strategic partnership with Dominion to explore large, commercial scale project. Project site has potential to build up to 2,000MW
- DONG Energy is considering establishing a small office in Richmond or Norfolk
- Will commence exploration of Norfolk and other port and supply chain opportunities



Wind Energy

- While Virginia's onshore wind resource is not as robust as offshore, there is still plenty of opportunity
- **Rocky Forge Wind**, Botetourt County, VA
  - After years of development, in March 2017, Rocky Forge was formally approved by the Virginia DEQ
  - 25 turbines, 75MW of electricity
  - Construction in 2018

Pumped Storage Hydro (PSH)

- With the rapid growth of intermittent renewable resources, coupling these resources with energy storage is vital in order to capture the full value and promote further development.
- Energy storage provides load balancing for times when renewable resources are unavailable.
- Battery storage is all the talk, but among the available methods, PSH contributes 97% of the total domestic storage capacity.

Pumped Storage Hydro (PSH)

- PSH utilizes low cost off-peak capacity or renewable sources to pump water from a lower reservoir to a higher reservoir, storing energy in the form of potential energy.
- During periods of greater load demand, water is released through a turbine to generate and dispatch electricity to the grid. PSH can be open or closed loop and consist of underground or surface reservoirs.

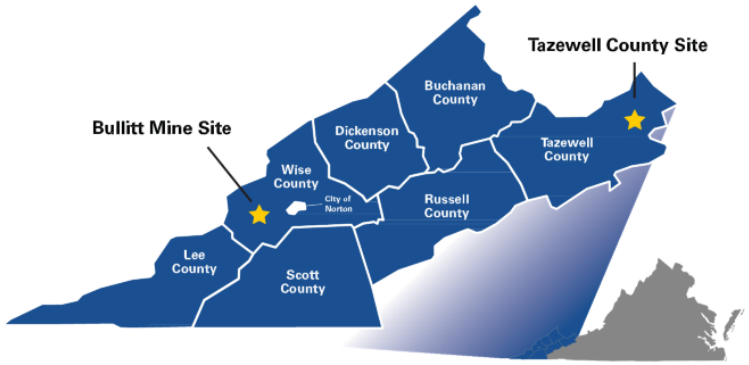
Pumped Storage Hydro – Utility Scale

- This past session, legislation was passed and signed that allows for an investor-owned utility to recover the costs associated with pumped hydroelectricity generation and storage facilities that utilize associated on-site or off-site renewable energy resources as all or a portion of their power source.
- The measure stipulates the project(s) be located in the coalfield region of Virginia.

Pumped Storage Hydro – Utility Scale

Powering Southwest Virginia

The Coalfield Region



Dominion Energy welcomes you!

For more information, visit DominionEnergy.com/PoweringSWVA

Dominion Energy

Pumped Storage Hydro – Utility Scale

Economic Impacts

A study conducted by Chmura Economic & Analytics found that the development and construction of a pumped hydroelectric storage project would have significant economic impacts in the Southwest region, from 2017 - 2027 including:

2,083
Jobs During Development and Construction

$320 Million
Total Economic Impact

$2.0 Billion
Infrastructure Investment

Additionally, once the potential station begins operations, the Southwest region will continue to receive annual benefits, including:

Up to 50
Permanent Station Jobs

$37 Million
Annual Economic Impact

$12 Million
Annual Local Tax Revenue

NOTE: Values are approximate, based on economic modeling

For more information, visit DominionEnergy.com/PoweringSWVA

Dominion Energy

Pumped Storage Hydro – Utility Scale

Site Selection Criteria for a Pumped Hydroelectric Storage Facility

Key Considerations

Water Availability - Evaluation Of Potential Water Sources

- Initial system filing
- Replenishing water lost via evaporation and seepage

Favorable Geographic Conditions

- Sufficient vertical relief between reservoirs - to maximize generation potential when water is released into the lower reservoir
- Proximity to transmission - to minimize the cost of connecting the system to the grid
- Suitable geology - evaluationof potential hazards to construction and operation, such as karst geologic formations
- Land availability - exclusion of sites with competing land uses, such as recreation resources, wildlife management areas, conservation land, protective easements, etc.

Environmental And Cultural Concerns

- Wild and scenic rivers, criticalwetlands
- Concentrated urban areas
- National cemeteries and state or local parks
- Endangered species habitats
- Native American tribal lands

For moreinformation, visit DominionEnergy.com/PoweringSWVA

Dominion Energy

Pumped Storage Hydro – Utility Scale

Development Schedule

An Overview

Site Selection Process:

- Complete site screening & risk ranking of all sites under consideration
- Select initial sites

Preliminary Permit Application:

- Dominion Energy has filed a Preliminary Permit Application with the Federal Energy Regulatory Commission (FERC)

Pre-Feasibility & Feasibility Studies:

- Begin an in-depth study of the initial sites
- Complete a variety of studies including: geological, environmental, layout, electrical transmission/ interconnect,construction cost estimates, and more
- Select preferred site

Preliminary Application Document (PAD)

- Submit Preliminary Application Document (PAD) for preferred site to start FERC application process

For more information, visit DominionEnergy.com/PoweringSWVA

Dominion Energy

Pumped Storage Hydro – Utility Scale

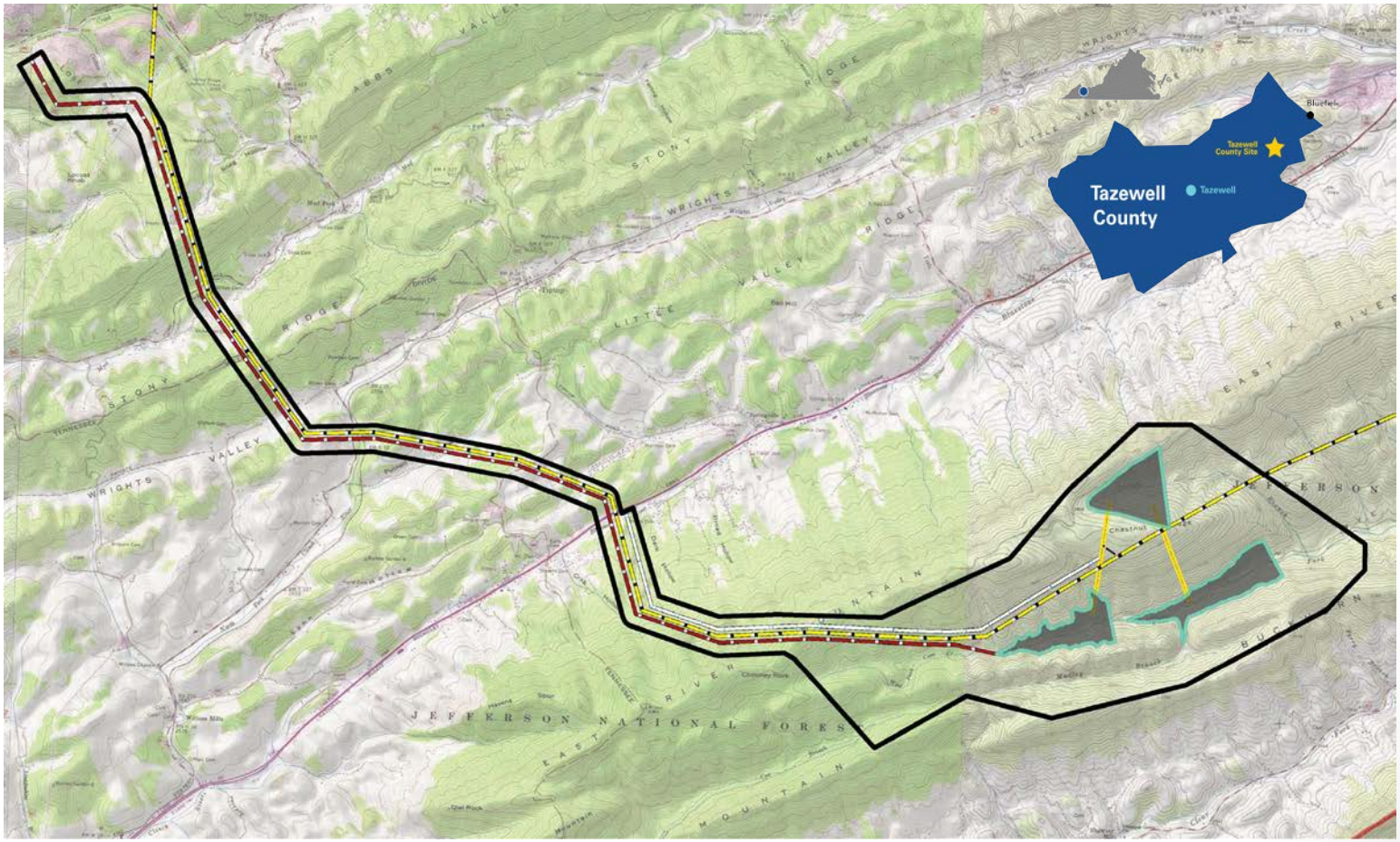
Pumped Hydroelectric Storage

FEDERAL/STATE/LOCAL AGENCY	PERMIT, APPROVAL or CONSULTATION
Federal Energy Regulatory Agency (FERC)	FERC License, Environmental Report/EIS
U. S. Army Corps of Engineers (ACOE)	Clean Water Act Section 404 Permit Rivers and Harbors Act Section 10 Permit
U. S. Fish and Wildlife Service (USFWS)	Endangered Species Act Section 7 Consultations Migratory Bird Treaty Act Consultation
Virginia Department of Environmental Quality (VDEQ)	Virginia Water Protection Permit/Water Quality Certification Water Withdrawal Permit Construction Stormwater Permit
Virginia Department of Game and Inland Fisheries (VDGIF)	Protected Species Consultation
Virginia Department of Conservation and Recreation (VDCR)	Scenic Rivers Consultation Natural Heritage Program Consultation
Virginia Department of Agriculture and Consumer Services (VDACS)	Protected Species Consultation
Virginia Department of Historic Resources (VDHR)	National Historic Preservation Act Section 106 Consultation – Archeological/Architectural Resources
Virginia Marine Resources Commission (VMRC)	River and Stream Crossing Permit Joint Permit Application
Native American Tribes	National Historic Preservation Act Section 106 Consultation
County/Local Governments	County/ Local Permits
Virginia State Corporation Commission (SCC)	Coordinated Environmental Review and Wetlands Review

For more information, visit DominionEnergy.com/PoweringSWVA

Dominion Energy

Pumped Storage Hydro – Utility Scale
Proposed Tazewell Site



PSH – Retired Mine Sites

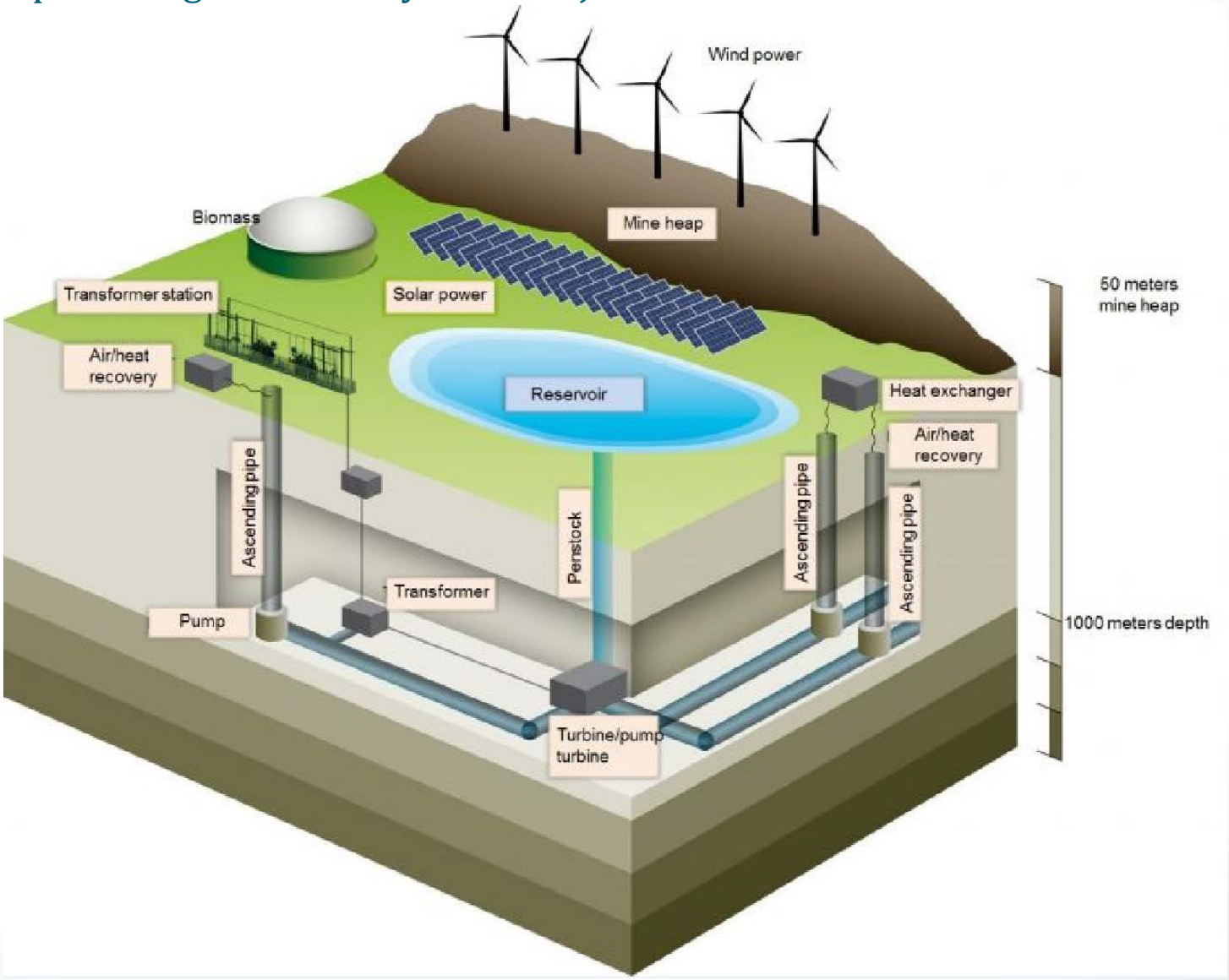
- Virginia's deep coal mines often contain tremendous water resources.
- For example, one mine pool in Appalachia (the old Bullitt Mine), is estimated to hold over 4 billion gallons of water.
- Estimates are that 1 billion gallons of water could potentially supply a 150 MW PSH facility.
- With available access to the mine, extensive mine mapping and significant historical surface mining above the pool, DMME sees closed-loop PSH as a potential "emerging technology" and valuable post mine land-use option.

PSH – Retired Mine Sites

- This concept would entail pumping water from the abandoned mine cavity up to an surface reservoir and then allowing it to flow back into the mine cavity, passing through a turbine to produce electricity. The abandoned mine would act as a lower reservoir until water is pumped back to the surface reservoir.
- Dominion has engaged with the Department of Mining and Minerals Engineering of Virginia Tech to evaluate the feasibility of using this concept.
- Virginia Tech will perform various studies, including hydrogeologic, mine stability, subsidence, water quality, impact of water cycling and validation of capacity of the mine.
- Once the study is completed in early 2018, a determination will be made on whether to pursue this site.

Pumped Storage Hydro Concept

Conceptual Design for Germany Based Project



Commercial PACE Program

- Commercial Property Assessed Clean Energy (C-PACE) is a tax-assessment based financing mechanism for commercial property owners to fund energy efficiency, renewable energy, and water conservation projects with no upfront costs.
- Eligible building types in VA include: Commercial/office, Industrial, Manufacturing, Agricultural, and Multifamily with 5 or more units
- C-PACE may be used for retrofits, or as part of new construction capital stack
- Residential PACE (R-PACE) is for SF homes, townhouses, and apartments where units are individually-owned (not enabled in VA currently)

Commercial PACE Program

- C-PACE was enabled by statewide legislation (3/23/2015) and must be sponsored by a local government or county – a taxing jurisdiction.
- C-PACE assessment is collected with and like any other property tax and transfers to new owner upon property sale.
- In arrears is senior to mortgages - but only the past due assessment.

Commercial PACE Program

Benefits of C-PACE to Local Governments

- Creates local jobs and economic development opportunities
- Upgrades and preserves building stock
- Uses private capital for public benefits
- May complement other community development financing
- Program models can be low-cost to implement for municipalities

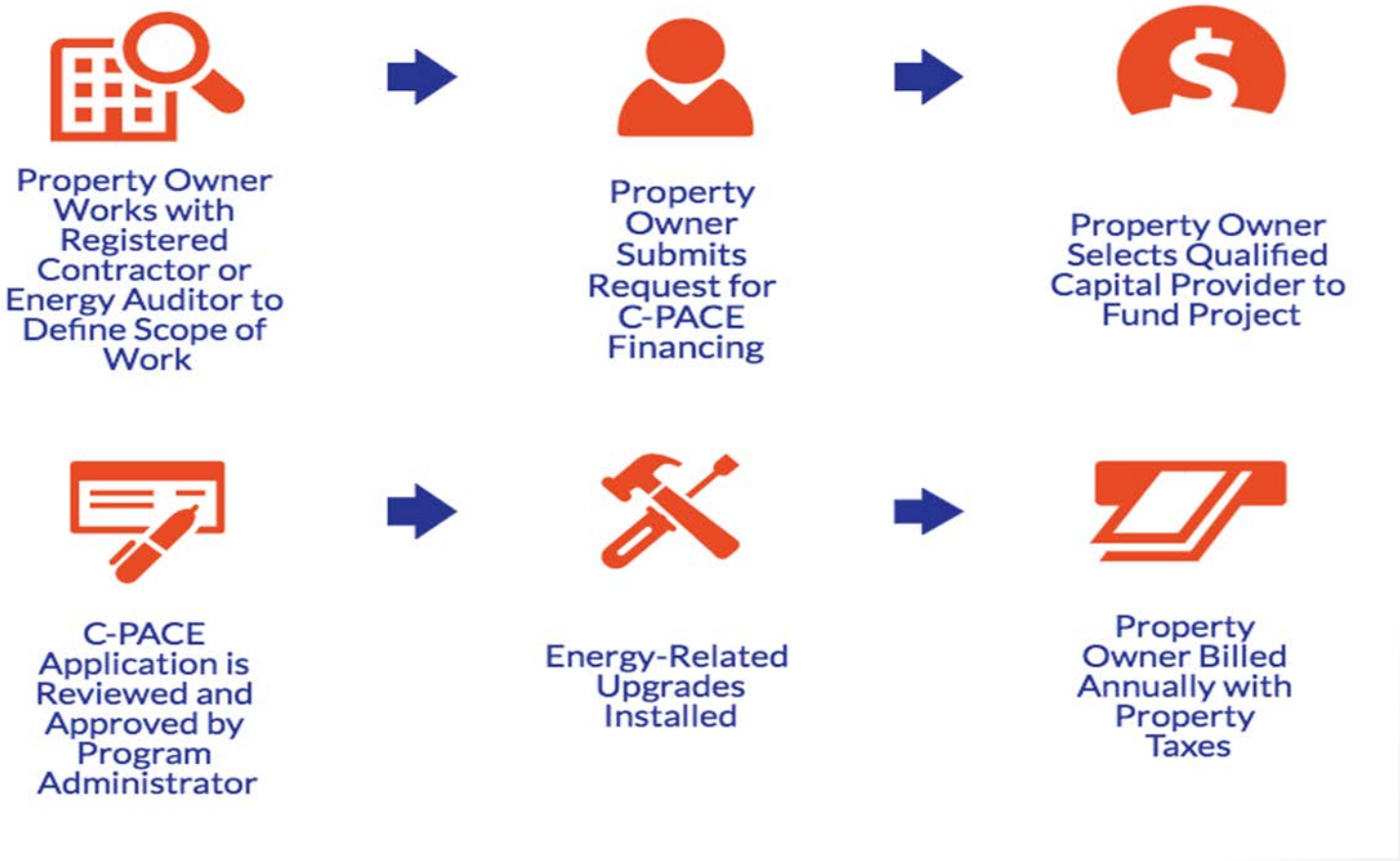
Commercial PACE Program

Benefits of C-PACE to Building Owners

- No Money Out of Pocket: 100% financing including soft costs
- Can finance renewable energy systems, EE retrofits, or both on the same project
- Extends capital budget: Paid for from operating savings
- Long-term financing (20-25yr): Reduces annual payment
- Comprehensive: Covers broader capital needs
- Transferrable: Assessments transfer to new owner upon sale

Commercial PACE Program

How Does C-PACE Work?



Commercial PACE Program

Status in VA

- Arlington will launch first PACE program in VA in Q4 2017; other local governments may “ride” Arlington’s contract through cooperative procurement
- Activity at County Council in: Loudon County, Fairfax County; Albemarle County/Charlottesville coordination; City Council interest in Norfolk
- DMME obtained $500K competitive grant award from US DOE to promote PACE in the Mid-Atlantic region (in coordination with DC and MD) and other stakeholders
- Momentum is building: DC and MD programs expanding rapidly (over $32 million in loans closed in 2017 through Q3)

Commercial PACE Program

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