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Developments in the Energy Markets

June 2019



Topics



- I. Worldwide Trends
- II. Developments in US
- III. Regional Developments
- IV. Maryland RPS Increase
- V. Purchasing Renewable Energy – Power Purchase Agreements (PPAs)

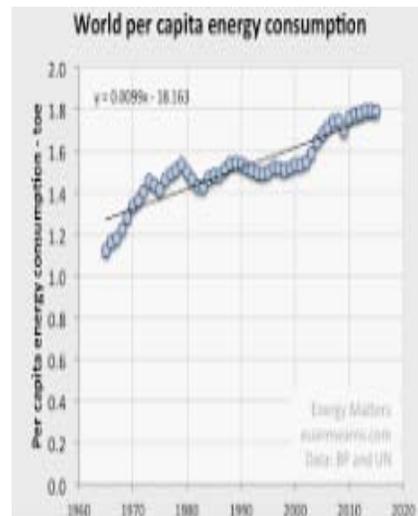
Long Term Trends in Energy



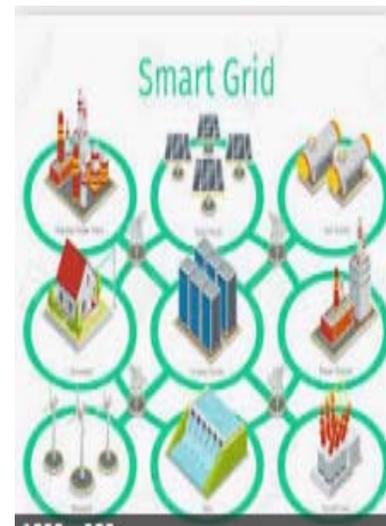
Populations Moving to Cities



Energy Consumption per Capita Increasing



Adaptive Grid



Decarbonization

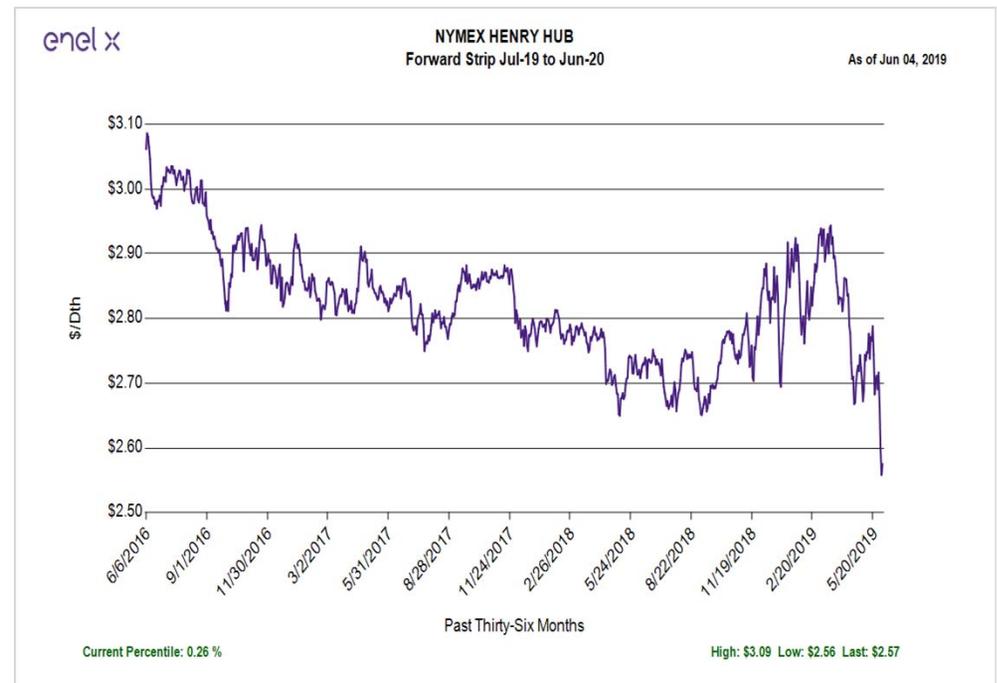
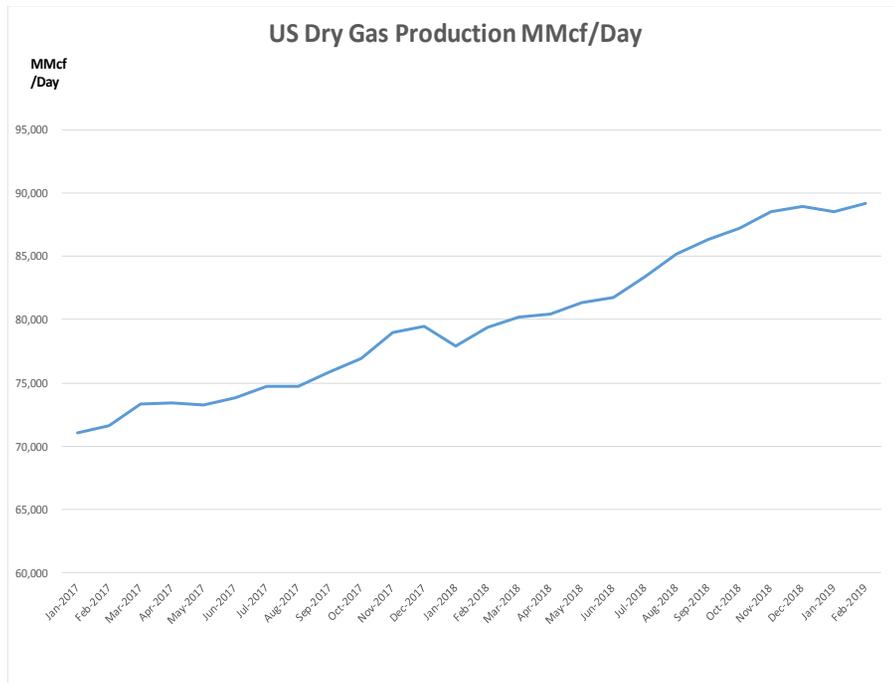


Developments in the US



Fracking driven increases natural gas production

Driving down Energy Prices



PJM WESTERN HUB Monthly RT Averages - ATC

As of Jun 05, 2019

Lowest 5% (< \$26.11)
 Median = \$38.12
 Highest 5% (> \$76.57)

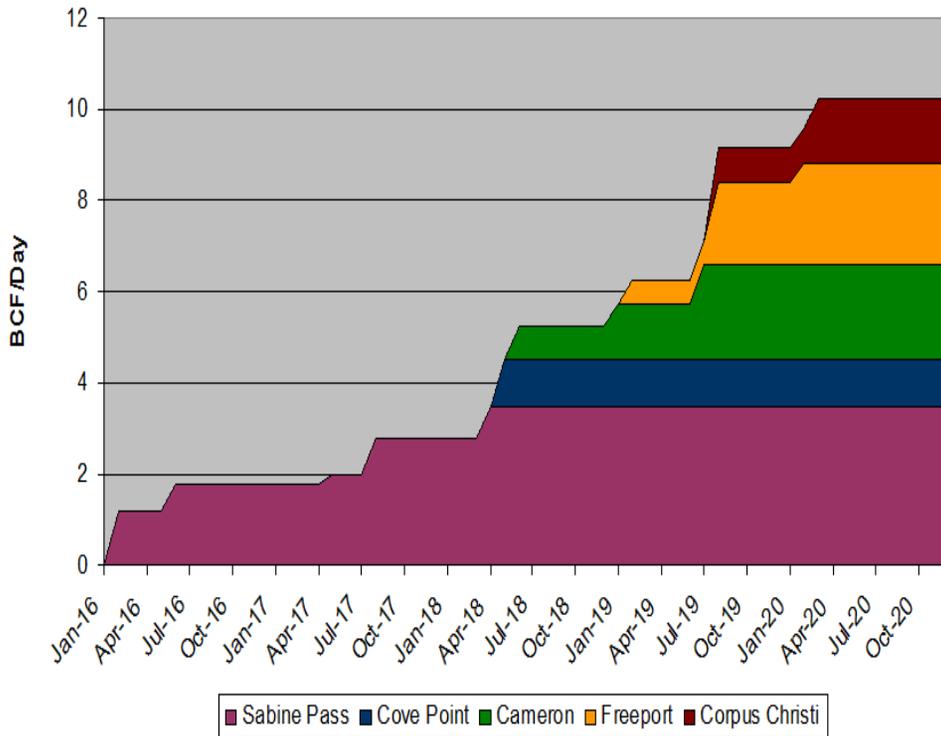
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Jan	\$ 49.53	\$ 54.57	\$ 44.63	\$ 66.80	\$ 59.32	\$ 51.92	\$ 52.78	\$ 33.19	\$ 36.46	\$ 123.88	\$ 38.12	\$ 29.69	\$ 31.80	\$ 79.95	\$ 30.47
Feb	\$ 42.05	\$ 56.39	\$ 73.93	\$ 68.29	\$ 46.31	\$ 44.36	\$ 44.40	\$ 30.11	\$ 34.94	\$ 70.16	\$ 71.44	\$ 27.01	\$ 25.67	\$ 25.54	\$ 27.84
Mar	\$ 49.97	\$ 58.34	\$ 61.02	\$ 70.48	\$ 41.63	\$ 37.31	\$ 40.12	\$ 29.92	\$ 39.95	\$ 73.99	\$ 43.21	\$ 23.65	\$ 31.70	\$ 34.42	\$ 29.22
Apr	\$ 44.55	\$ 49.89	\$ 58.74	\$ 69.12	\$ 34.48	\$ 38.31	\$ 43.69	\$ 29.24	\$ 38.32	\$ 38.65	\$ 33.38	\$ 30.94	\$ 27.84	\$ 35.90	\$ 25.40
May	\$ 43.64	\$ 48.55	\$ 53.89	\$ 59.84	\$ 33.40	\$ 42.33	\$ 48.20	\$ 34.26	\$ 38.67	\$ 42.13	\$ 32.45	\$ 24.13	\$ 29.27	\$ 35.69	\$ 24.62
Jun	\$ 53.72	\$ 45.78	\$ 60.19	\$ 98.50	\$ 33.25	\$ 49.00	\$ 49.90	\$ 27.55	\$ 35.87	\$ 40.93	\$ 31.12	\$ 26.79	\$ 25.88	\$ 29.63	\$ 24.67
Jul	\$ 66.34	\$ 63.47	\$ 58.89	\$ 91.80	\$ 32.42	\$ 60.43	\$ 54.64	\$ 44.43	\$ 47.02	\$ 36.25	\$ 34.29	\$ 30.14	\$ 29.52	\$ 31.01	
Aug	\$ 82.83	\$ 76.57	\$ 71.00	\$ 73.91	\$ 36.70	\$ 51.84	\$ 43.34	\$ 35.61	\$ 33.84	\$ 33.52	\$ 28.93	\$ 33.31	\$ 26.63	\$ 32.05	
Sep	\$ 76.82	\$ 34.40	\$ 60.14	\$ 66.04	\$ 30.38	\$ 44.27	\$ 40.33	\$ 34.22	\$ 35.40	\$ 35.26	\$ 32.16	\$ 30.28	\$ 30.37	\$ 32.94	
Oct	\$ 77.56	\$ 39.65	\$ 61.11	\$ 52.88	\$ 35.65	\$ 35.79	\$ 36.74	\$ 37.03	\$ 34.18	\$ 36.06	\$ 29.00	\$ 29.67	\$ 28.53	\$ 31.83	
Nov	\$ 62.01	\$ 44.83	\$ 55.25	\$ 54.50	\$ 33.03	\$ 37.98	\$ 34.73	\$ 40.23	\$ 34.00	\$ 36.44	\$ 26.79	\$ 26.11	\$ 29.76	\$ 35.96	
Dec	\$ 81.97	\$ 40.53	\$ 59.67	\$ 50.62	\$ 43.12	\$ 57.00	\$ 33.71	\$ 30.55	\$ 38.86	\$ 32.61	\$ 24.89	\$ 31.29	\$ 40.26	\$ 32.45	
Avg	\$ 61.09	\$ 51.11	\$ 59.77	\$ 68.53	\$ 38.30	\$ 45.93	\$ 43.56	\$ 33.90	\$ 37.33	\$ 49.95	\$ 35.23	\$ 28.59	\$ 29.82	\$ 36.57	\$ 27.46

Developments in the US (cont'd)

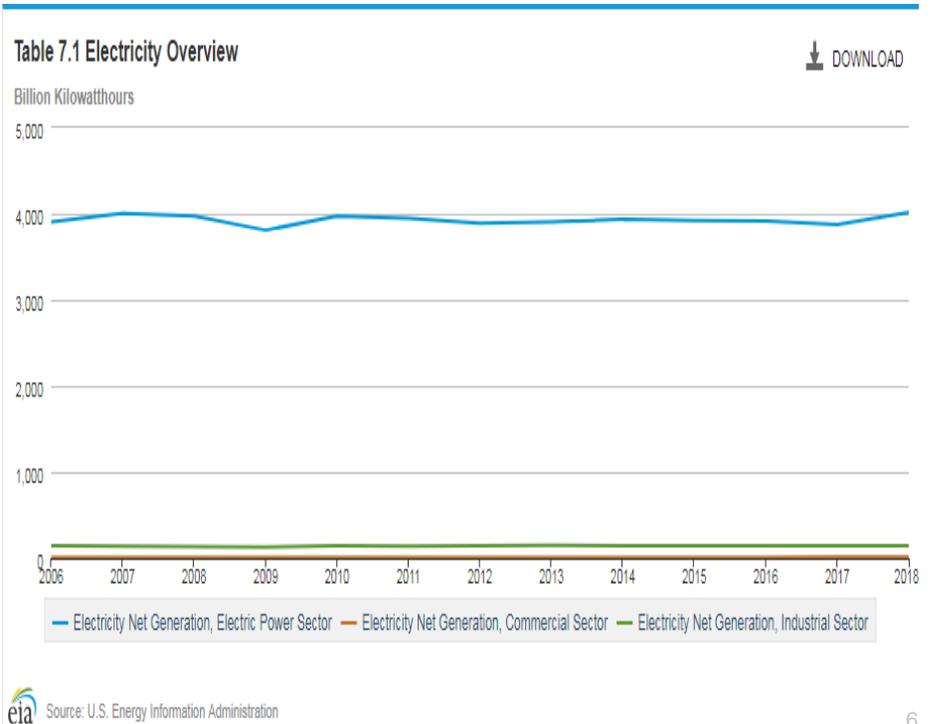


LNG Exports Expanding

Projected US LNG Export Capacity 2016-2020



Demand Relatively Stable



Regional Developments

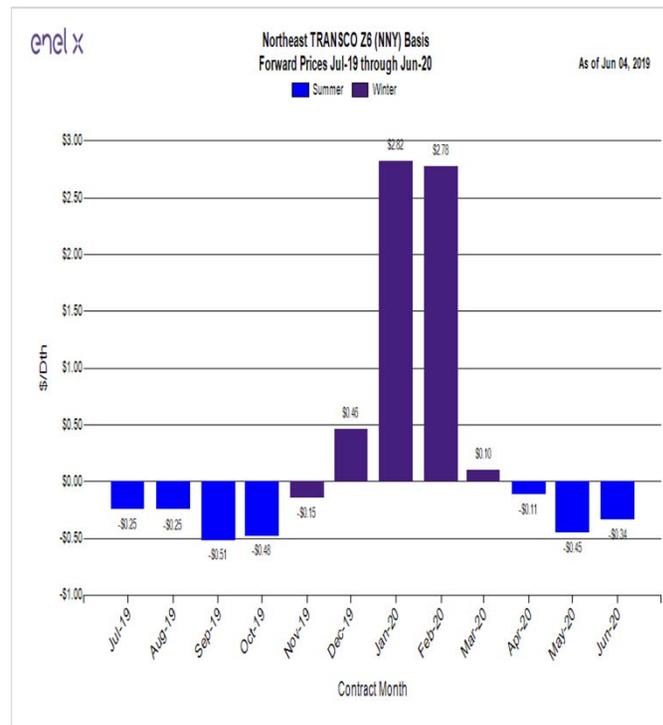
Federal (PJM) vs. State Interests



Open
Competitive
Markets

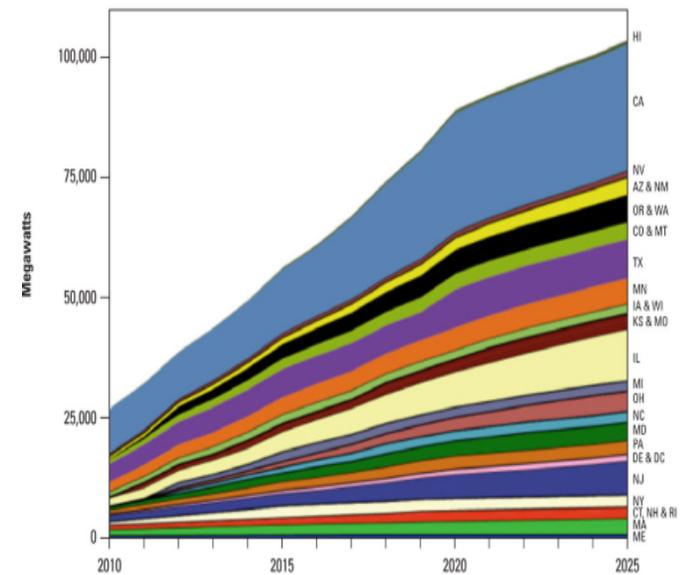
- Sustainability
- State Nuclear Subsidies

Natural Gas Pipeline Constraints - Winter Months



Increases in State Renewable Energy Requirements

Projected Renewable Energy Development from State Renewable Electricity Standards*



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Renewable Energy – Maryland Regulatory Front



- Maryland General Assembly passed bill on April 8, 2019 to increase % requirement of energy purchased from qualifying renewable sources to 50% by 2030. Bill became law and is effective October 1, 2019.
- Summary of current and new renewable requirement %'s and compliance payments for non compliance are summarized on the next slide.
- Rough estimate of annual cost increase per year from higher renewable % requirements per 1,000 MWhs annual usage provided on slide 12.
- Electric supply contracts signed prior to October 1, 2019 are grandfathered under the existing renewable requirements.

Maryland RPS % Requirements

New law (Senate Bill 516) Passed on April 8, 2019 by General Assembly and Not Vetoed by Governor
Effective October 1, 2019

Calendar Year Compliance	Tier 1 (ex Solar)		Solar		Tier II		New Compliance Payment (\$/MWh)	
	Old	New*	Old	New	Old	New	Tier 1	Solar
2019	18.45%	15.20%	1.95%	5.50%	0.00%	2.50%	\$30.00	\$100.00
2020	22.50%	22.00%	2.50%	6.00%	0.00%	2.50%	\$30.00	\$100.00
2021	22.50%	23.30%	2.50%	7.50%	0.00%	0.00%	\$30.00	\$80.00
2022	22.50%	24.60%	2.50%	8.50%	0.00%	0.00%	\$30.00	\$60.00
2023	22.50%	25.90%	2.50%	9.50%	0.00%	0.00%	\$30.00	\$45.00
2024	22.50%	27.20%	2.50%	10.50%	0.00%	0.00%	\$27.50	\$40.00
2025	22.50%	28.50%	2.50%	11.50%	0.00%	0.00%	\$25.00	\$35.00
2026	22.50%	30.00%	2.50%	12.50%	0.00%	0.00%	\$24.75	\$30.00
2027	22.50%	32.00%	2.50%	13.50%	0.00%	0.00%	\$24.50	\$25.00
2028	22.50%	33.00%	2.50%	14.50%	0.00%	0.00%	\$22.50	\$25.00
2029	22.50%	35.00%	2.50%	14.50%	0.00%	0.00%	\$22.50	\$22.50
2030+	22.50%	35.50%	2.50%	14.50%	0.00%	0.00%	\$22.35	\$22.35

* Note Tier 1 requirements may include an off shore wind Rec (OREC) % requirement to be determined in the future based on outcome of MD offshore wind project development outcome.

Estimated Annual \$ Cost Increase from Renewable % Increases



Calendar Year Compliance	Annual Usage (MWh)	Tier I				Solar				All Tiers			
		Required % Inc/-Dcr	REC Quantity Inc/-Dcr	Purchase Cost \$ Inc/-Dcr		Required % Inc/-Dcr	REC Quantity Inc/-Dcr	Purchase Cost \$ Inc/-Dcr		Purchase Cost \$ Inc/-Dcr		Purchase Cost \$/MWh Inc	
				Low \$10/MWh	High \$20/MWh			Low \$10/MWh	High \$20/MWh	Low \$10/MWh	High \$20/MWh	Low \$10/MWh	High \$20/MWh
2020	250	-0.50%	(1)	(\$12)	\$ (25)	3.50%	9	\$ 88	\$ 175	\$ 75	\$ 150	\$ 0.30	\$ 0.60
2021	1,000	0.80%	8	\$80	\$ 160	5.00%	50	\$ 500	\$ 1,000	\$ 580	\$ 1,160	\$ 0.58	\$ 1.16
2022	1,000	2.10%	21	\$210	\$ 420	6.00%	60	\$ 600	\$ 1,200	\$ 810	\$ 1,620	\$ 0.81	\$ 1.62
2023	1,000	3.40%	34	\$340	\$ 680	7.00%	70	\$ 700	\$ 1,400	\$ 1,040	\$ 2,080	\$ 1.04	\$ 2.08
2024	1,000	4.70%	47	\$470	\$ 940	8.00%	80	\$ 800	\$ 1,600	\$ 1,270	\$ 2,540	\$ 1.27	\$ 2.54
2025	1,000	6.00%	60	\$600	\$ 1,200	9.00%	90	\$ 900	\$ 1,800	\$ 1,500	\$ 3,000	\$ 1.50	\$ 3.00
2026	1,000	7.50%	75	\$750	\$ 1,500	10.00%	100	\$ 1,000	\$ 2,000	\$ 1,750	\$ 3,500	\$ 1.75	\$ 3.50
2027	1,000	9.50%	95	\$950	\$ 1,900	11.00%	110	\$ 1,100	\$ 2,200	\$ 2,050	\$ 4,100	\$ 2.05	\$ 4.10
2028	1,000	10.50%	105	\$1,050	\$ 2,100	12.00%	120	\$ 1,200	\$ 2,400	\$ 2,250	\$ 4,500	\$ 2.25	\$ 4.50
2029	1,000	12.50%	125	\$1,250	\$ 2,500	12.00%	120	\$ 1,200	\$ 2,400	\$ 2,450	\$ 4,900	\$ 2.45	\$ 4.90
2030	1,000	13.00%	130	\$1,300	\$ 2,600	12.00%	120	\$ 1,200	\$ 2,400	\$ 2,500	\$ 5,000	\$ 2.50	\$ 5.00



Purchasing Renewable Energy Through PPAs

Overview



- Climate change, sustainability and economics have accelerated interest in renewable energy nationwide and regionally by institutions, state and local governments, utilities, and technology firms.
- Universities have become more active in pursuing renewable energy including the formation of aggregation groups to cooperatively purchase renewable energy (refer to slide 3)
- Long term Power Purchase Agreements (PPA's) with renewable energy projects are the most common vehicle for large renewable energy purchases. Contracts are typically 20+ years to enable developers to secure financing to build projects (solar and wind farms).
- Renewable energy projects generally require a certain scale (20 MW +) to be most economical. There are ways for smaller organizations to participate in the larger scale projects.
- Under current law Federal incentives for renewable projects (Investment tax credit for solar and production tax credit for wind) decline after 2019. This has a significant impact on project economics.
- The market for solar net meter aggregations in Maryland (2 MWac maximum size), driven by special utility tariff has slowed due to permitting challenges, vendor retrenchment and uncertainty of the investment tax credit.

East Coast Universities Recent Renewable Energy Activity



- Johns Hopkins University – recently announced long term PPA purchase through Constellation with a solar farm in Virginia
- Georgetown University – Entered into 32.5 MW solar PPA to power 49% of the DC Campus load. Project located in Charles County MD.
- University of Pennsylvania and Temple University – engaged renewable energy consultants to develop renewable energy strategy and source renewable power purchase agreements (PPAs)
- Large Massachusetts University Aggregation – Issued RFI to qualified consulting firms to develop GHS reduction strategy for aggregation group. Considering all technologies as well as looking to enter into PPA(s) with new regionally based renewable energy projects.
- Baltimore Regional Cooperative Purchasing Committee (BRCPC) – energy purchasing cooperative that includes all Central Maryland Community Colleges is exploring legal authority to cooperatively purchase renewable energy through long term PPAs.

Recent Announcements – State and Local Governments



- Washington DC Government:
 - Passed bill to require **100% of electricity provided to** DC be derived from renewable sources by 2032
 - Previously entered into long term PAA with regionally located wind farm
- City of Philadelphia
 - Announced plan to purchase 100% of electricity from renewable sources by 2030
 - Final stages of signing 25 year PPA with 70 MW solar farm located outside of Gettysburg
- Virginia Governor announcing Virginia has capacity to lead Off Shore Wind development:
 - Location and deep expertise in ship building
 - capacity for offshore turbines to generate power for 500,000 homes
- New York
 - New York City investing **\$4 billion** of pension funds into climate change solutions including renewable energy
 - New York State announced award of 170 MWac solar project to delivery energy starting at the end of 2022.
- California recently signed into law that **100% of electricity generated in the state** must be from carbon neutral **sources by 2045**

GHG Reduction/Renewable Energy Goals

- Leadership:
 - supporting efforts to combat climate change, carbon reduction
 - encourage and support sustainability
- Environment
 - cleaner air and lower emissions
 - No net material adverse environmental impact
- Cost neutral – renewable energy cost over contract term will at worst be equal to conventional energy
- Meeting stakeholder interests
- Branding
 - Institution good citizenship
 - Support student enrollments

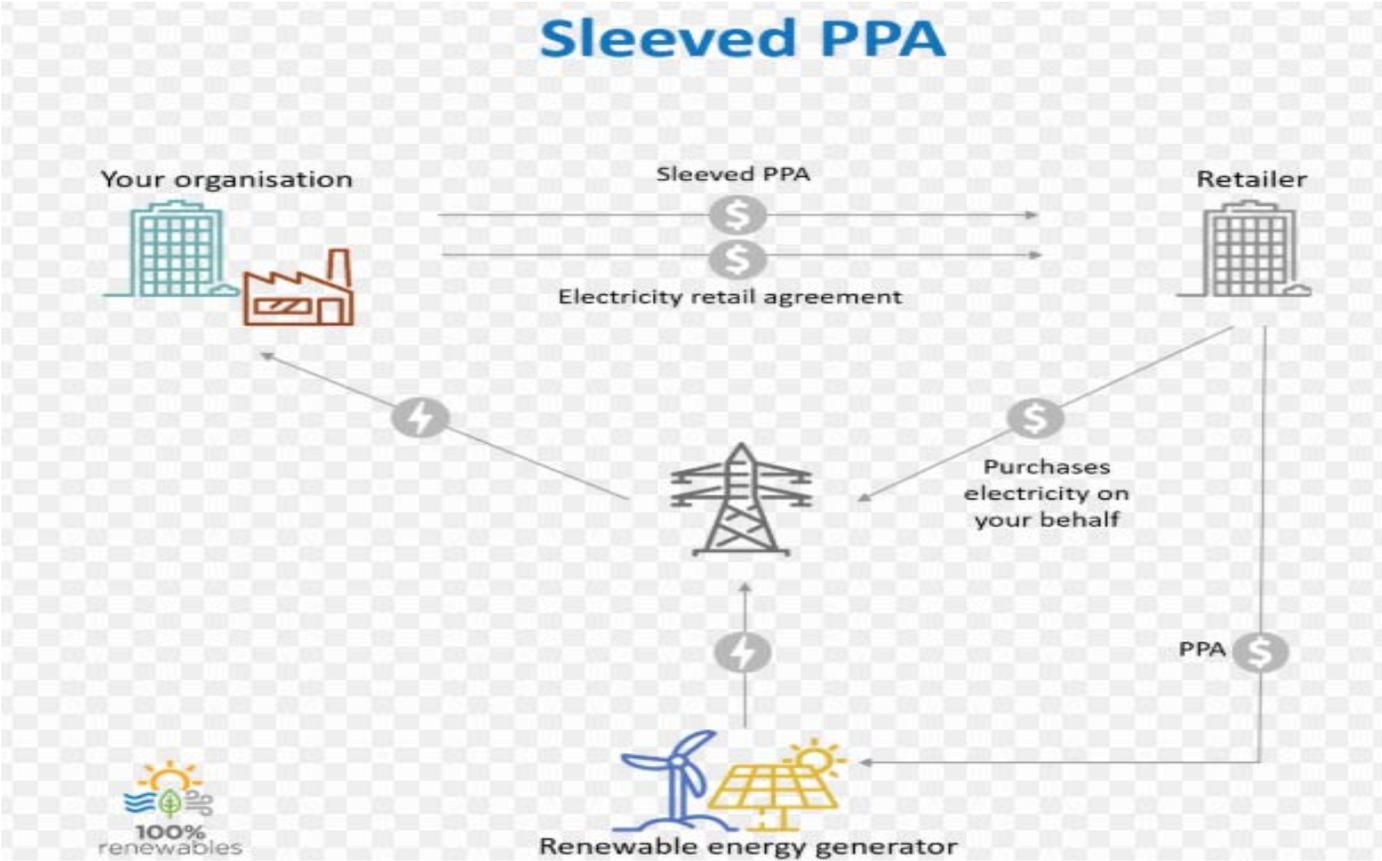
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Why PPAs



- Supports new renewable projects
 - displace fossil fuel generation/reduce carbon footprint
 - Improve regional air quality
- Economical
 - Scale – Projects 20 MW + become more economical
 - Term length (20+ yrs.) provides lower costs
 - Available economic incentives (Production and Investment Tax Credits, Federal Grants)
 - Avoid capital expenditures
- Lower risk
 - Do not build, own or operate projects – just buy what is produced
- Manage long term energy price risk – long term fixed price



How Can Smaller Institutions Participate?



- Consider forming aggregation group
- Reach out to peers/affiliate groups
- Reach out to major renewable developers to piggyback off of existing or future projects by taking a portion of the project's output
- Many Maryland community colleges belong to consortiums that have their own PJM account which is the best model for integrating renewable PPA arrangements.

Renewable Energy PPA Risks



- Financial risk:
 - PPA contract rate/cost may exceed the conventional energy rate/cost over PAA term
 - Project is never built and favorable PPA contract rate cannot be replaced
- Renewable project may initiate adverse community or environmental outcomes
- Delays in commercial operation date due to :
 - Financing
 - Permits
 - Community opposition
 - Grids Interconnection
 - Equipment/labor issues

Risks of Inaction



- Ongoing exposure to stakeholder challenges (citizens, community groups, special interest groups, employees, students, alumni).
- Good Governance – Many Universities are either buying or in the process of buying renewable energy.
- Contrary or unfavorable to University Branding
 - Sustainable
 - Progressive
 - Support clean energy future

Renewable PPA(s) Considerations/Impact

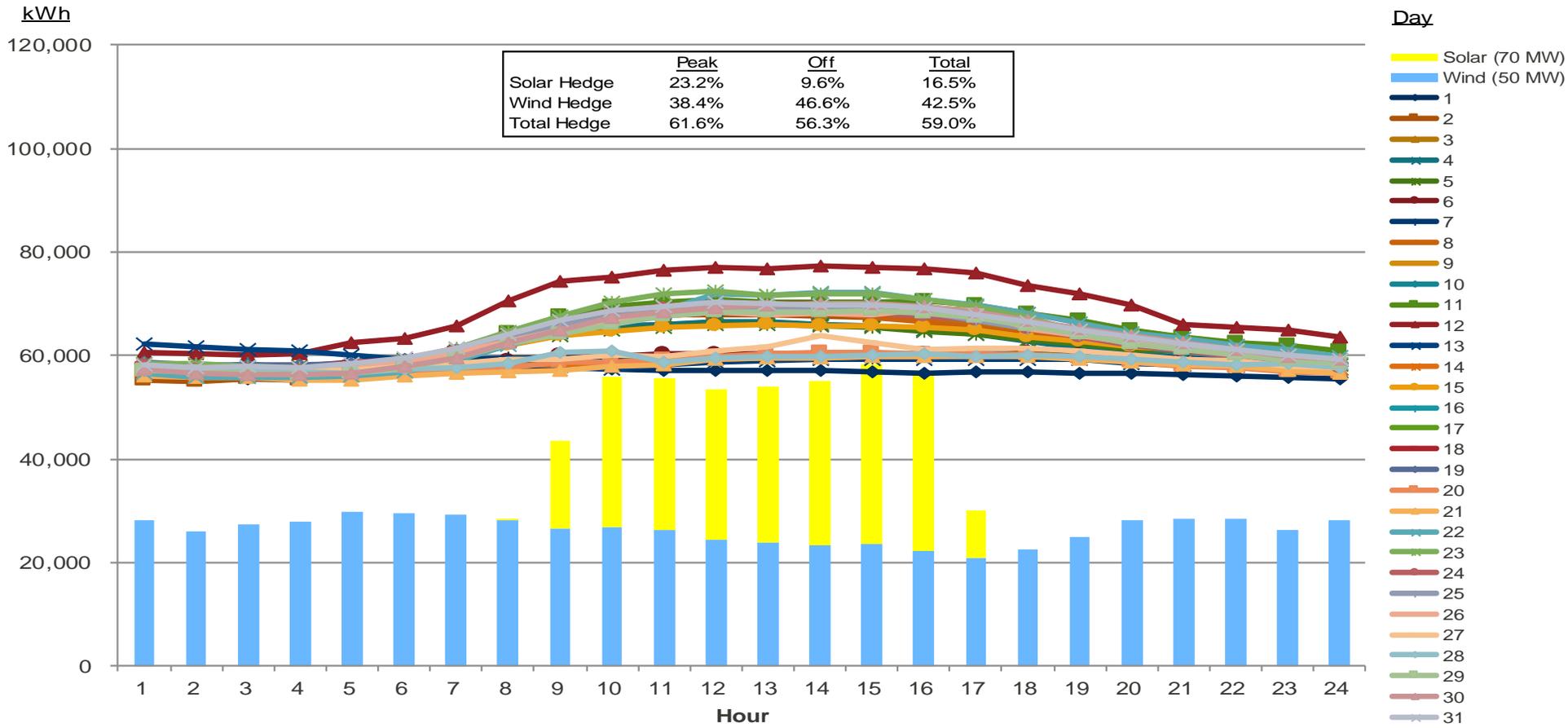


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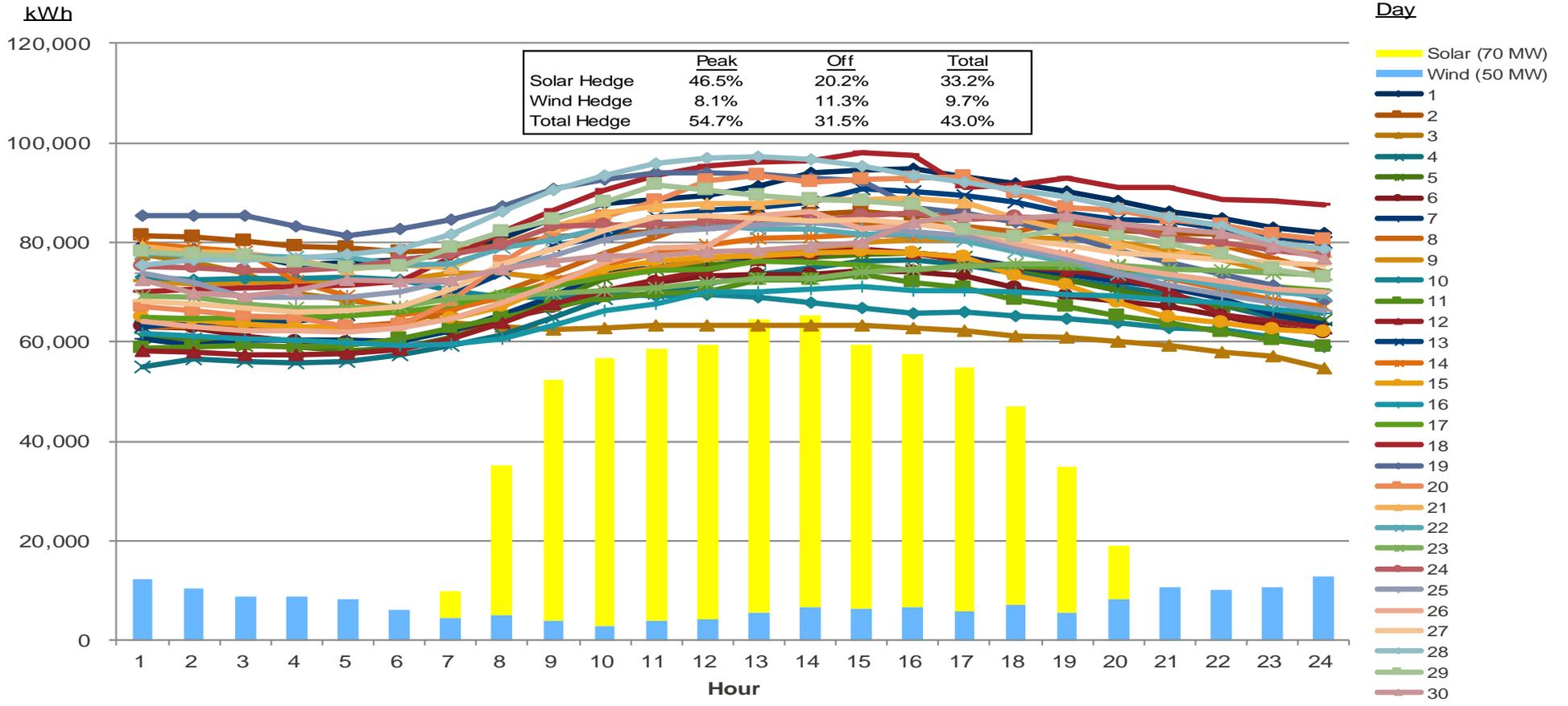
- What % of future energy usage will be targeted by renewable PPA agreements
- Preference of renewable type (impacts hedging)
- Regionally based project?
 - Will PPAs settle at project node, west hub or utility delivery pricing points
 - Physical delivery or financial settlement
- Budgeting – may provide more certainty but given intermittent nature of renewables there most likely will remain significant hourly price exposure/volatility.

What does a PPA hedge look like?

ABC University, Daily Load Profile - Jan 2018



ABC University, Daily Load Profile - Jun 2018





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