SOLAR LEASING 101:

Utility Scale Solar Development Trends

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

Madison County

January 22, 2020

LEARNING OBJECTIVES

- Utility Scale Photovoltaic (PV) Solar Trends
- Ohio Solar Policy
- Solar Development in Ohio
- Utility-Scale PV Solar Construction
- Closing Thoughts and Questions

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Utility Scale Photovoltaic (PV) Solar Trends

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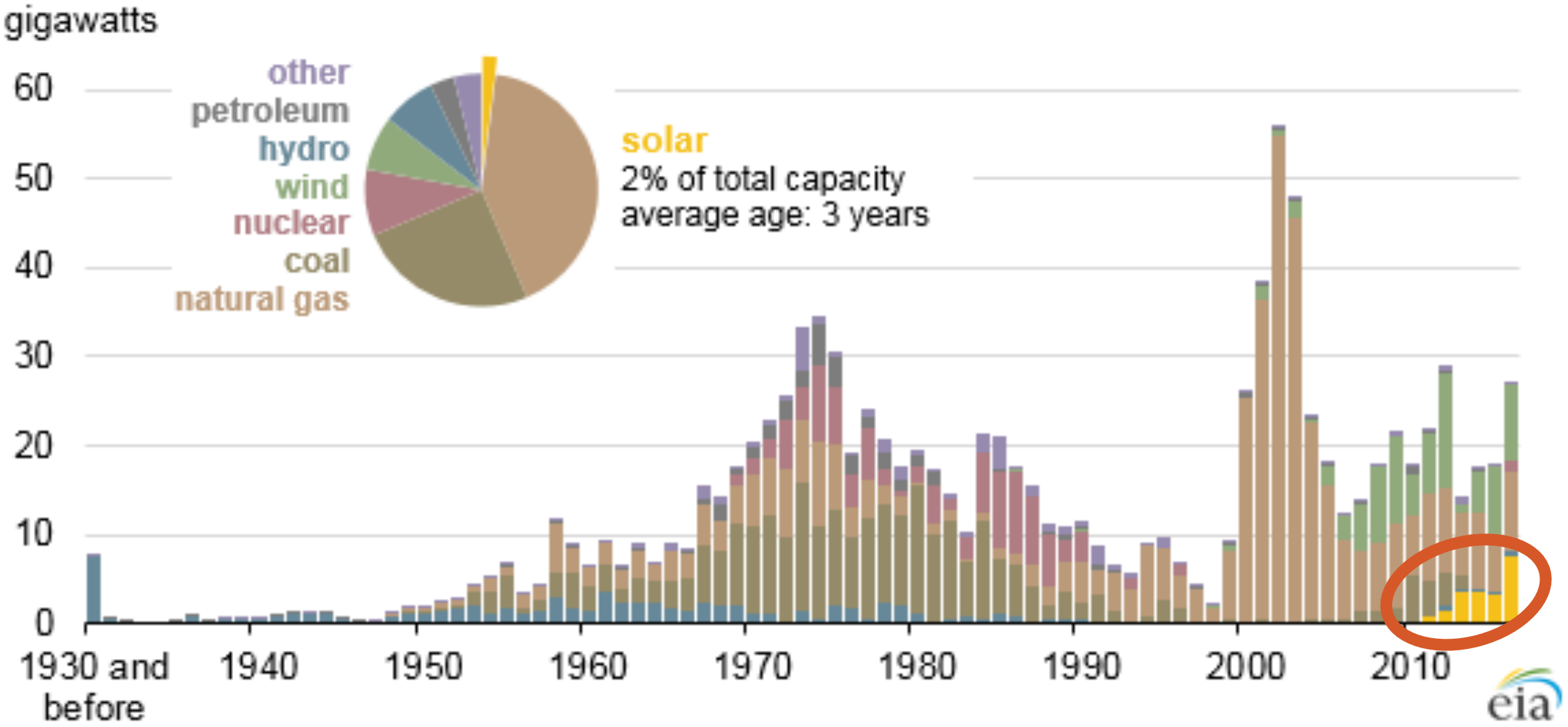
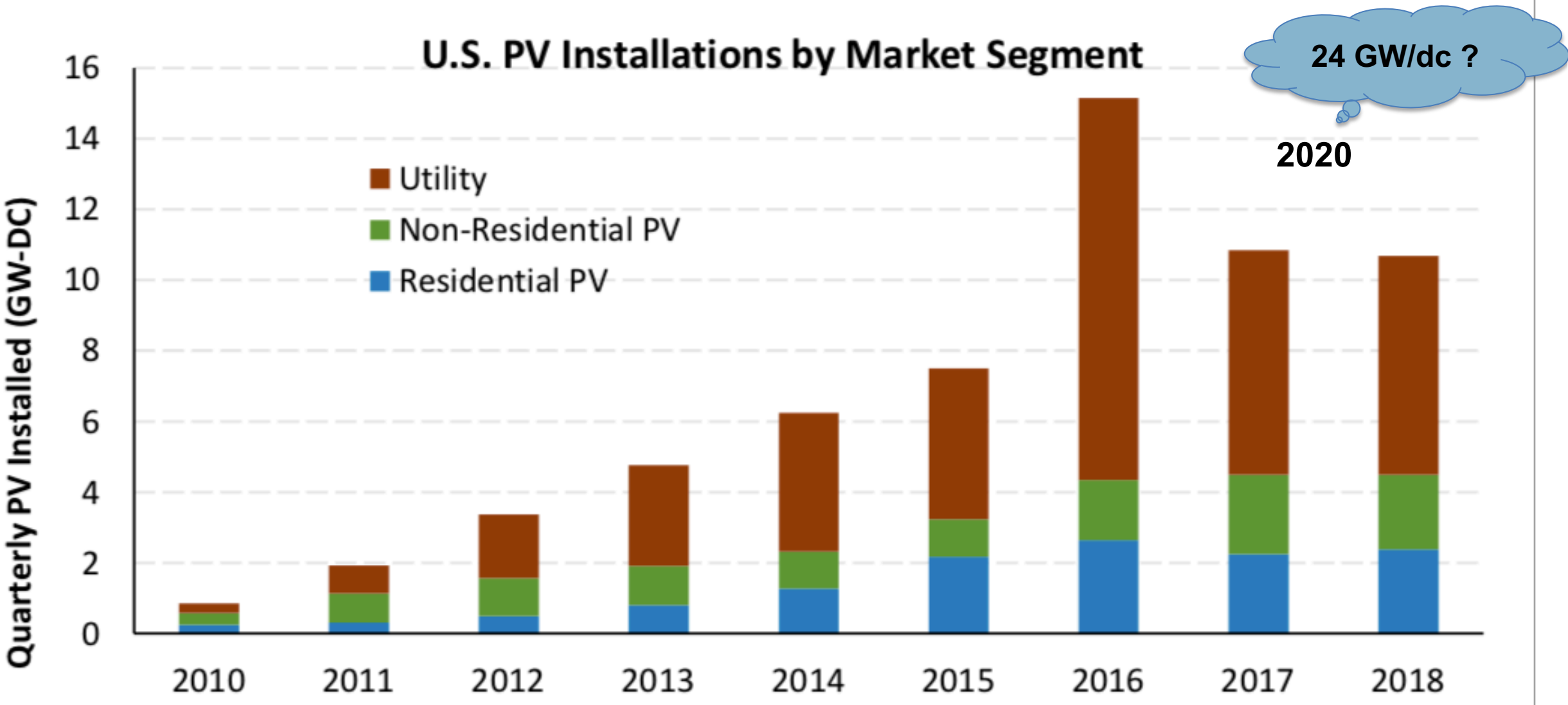
U.S. UTILITY SCALE ELECTRIC GENERATING CAPACITY ADDITIONS BY YEAR



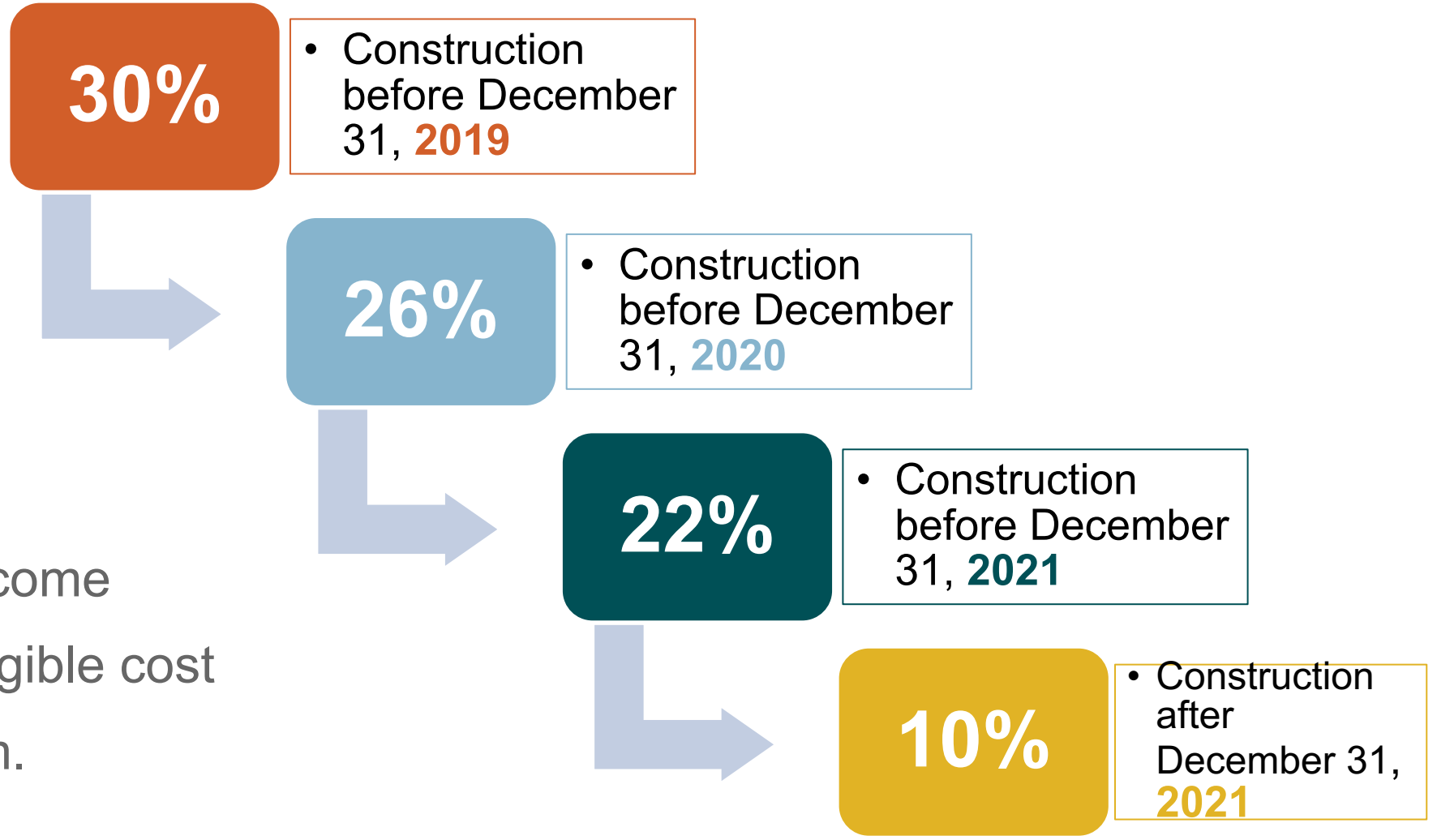
U.S. SOLAR INSTALLATIONS



Sources: Wood Mackenzie Power & Renewables /SEIA: U.S. Solar Market Insight 2018 Year-in-Review.

FEDERAL INVESTMENT TAX CREDIT FOR COMMERCIAL SOLAR PHOTOVOLTAICS

The solar investment tax credit (ITC) is a tax credit that can be claimed on federal corporate income taxes against the eligible cost of a PV solar system.



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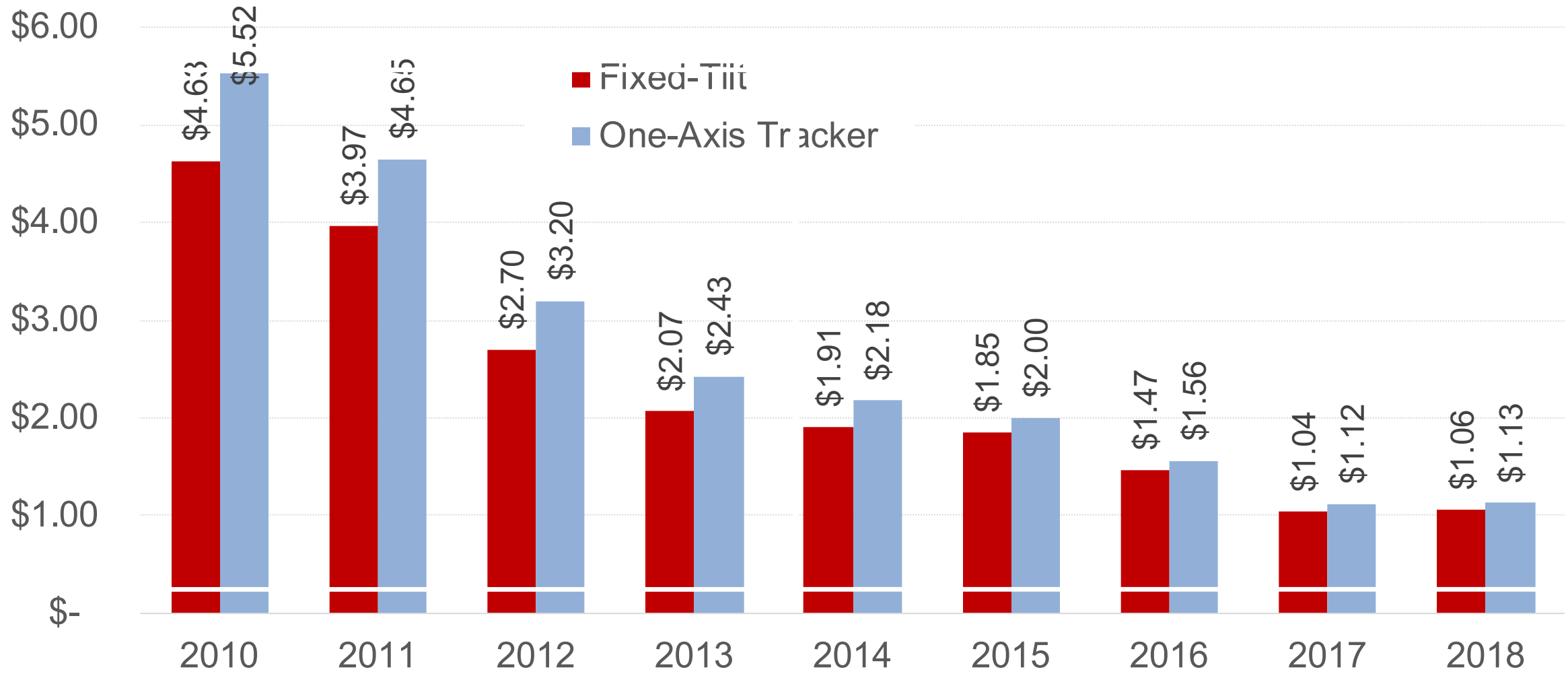
NREL SOLAR SYSTEM INSTALLATION COST $ PER DC/WATT (INFLATION ADJUSTED), Q4 2010–Q1 2018



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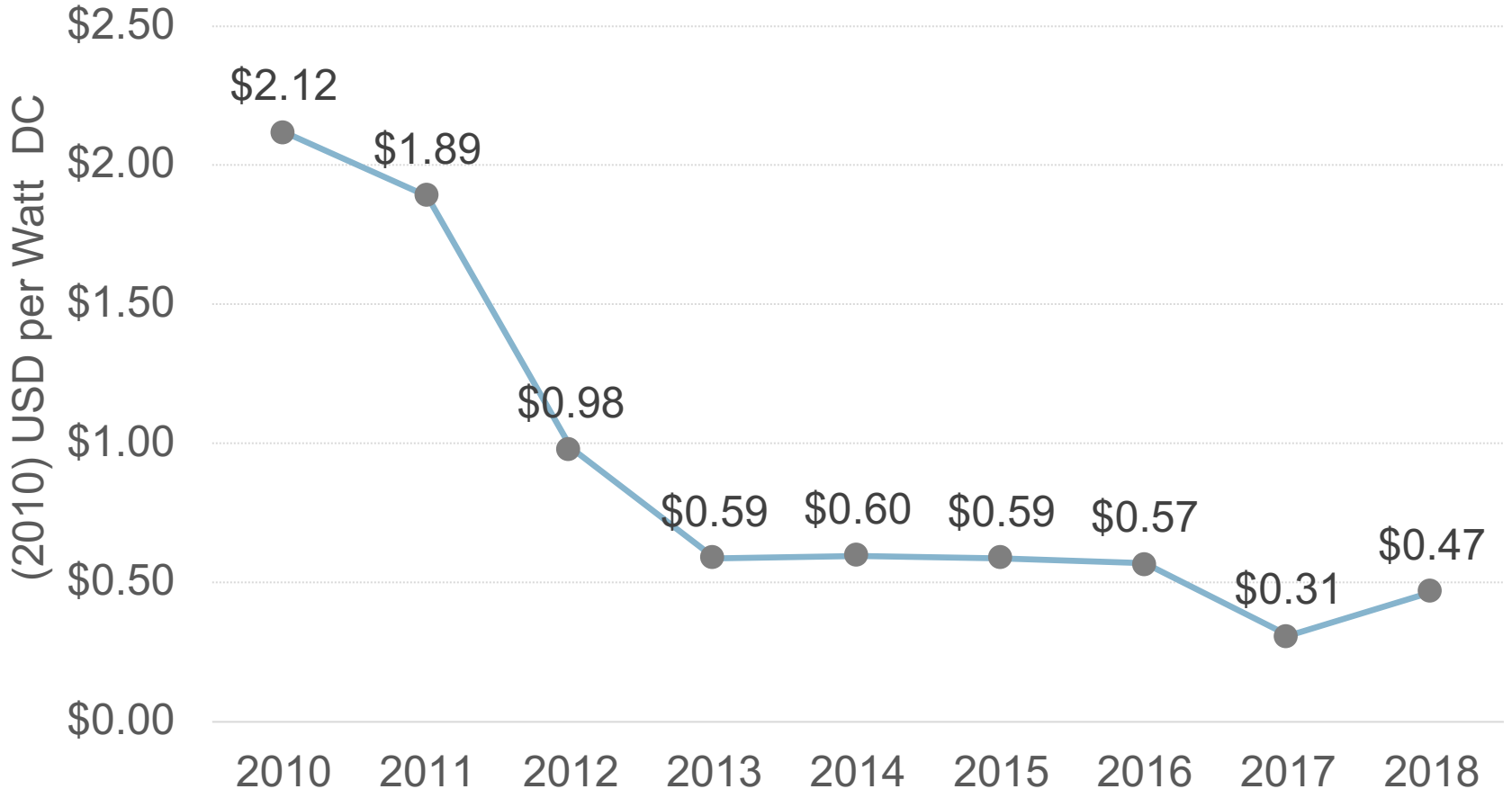
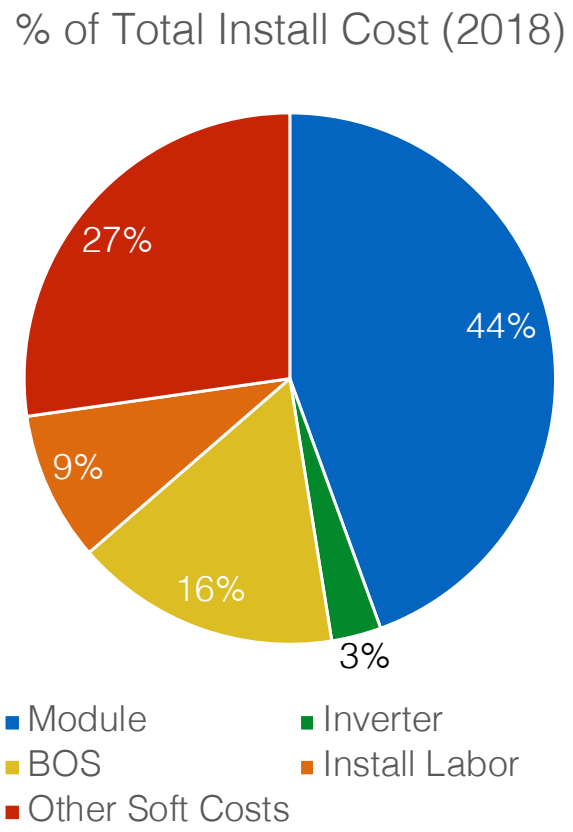
Source: NREL utility-scale PV system cost benchmark summary (inflation adjusted), 2010–2018

MODULE COST TRENDS

NREL UTILITY-SCALE PV BENCHMARK SUMMARY (INFLATION ADJUSTED), 2010–2018

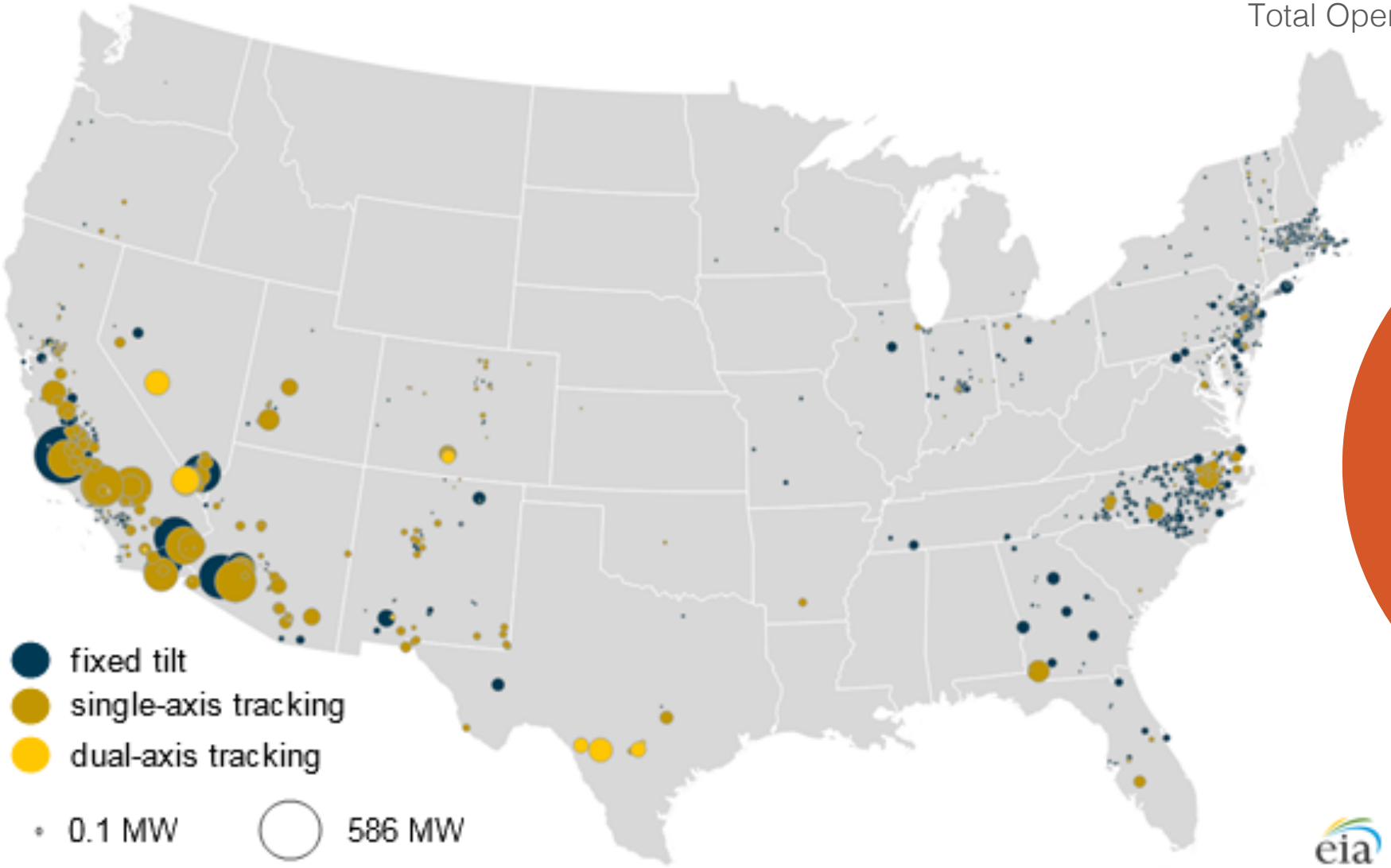


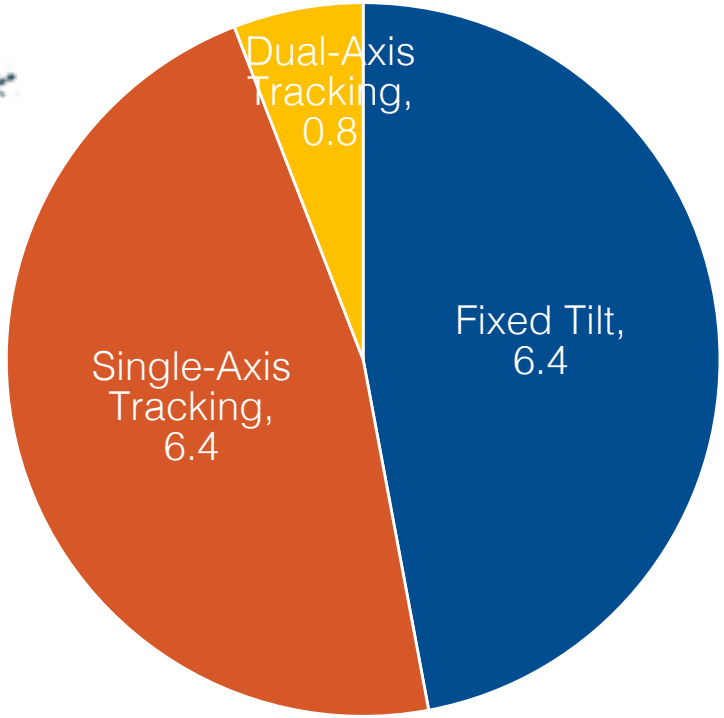


Source: U.S. Solar Photovoltaic System Cost Benchmark: Q1 2017. Available at: https://www.nrel.gov/docs/fy17osti/68925.pdf

OPERABLE UTILITY-SCALE SOLAR PV GENERATION UNITS (2015)

Total Operating Solar PV Capacity 13.6 GW





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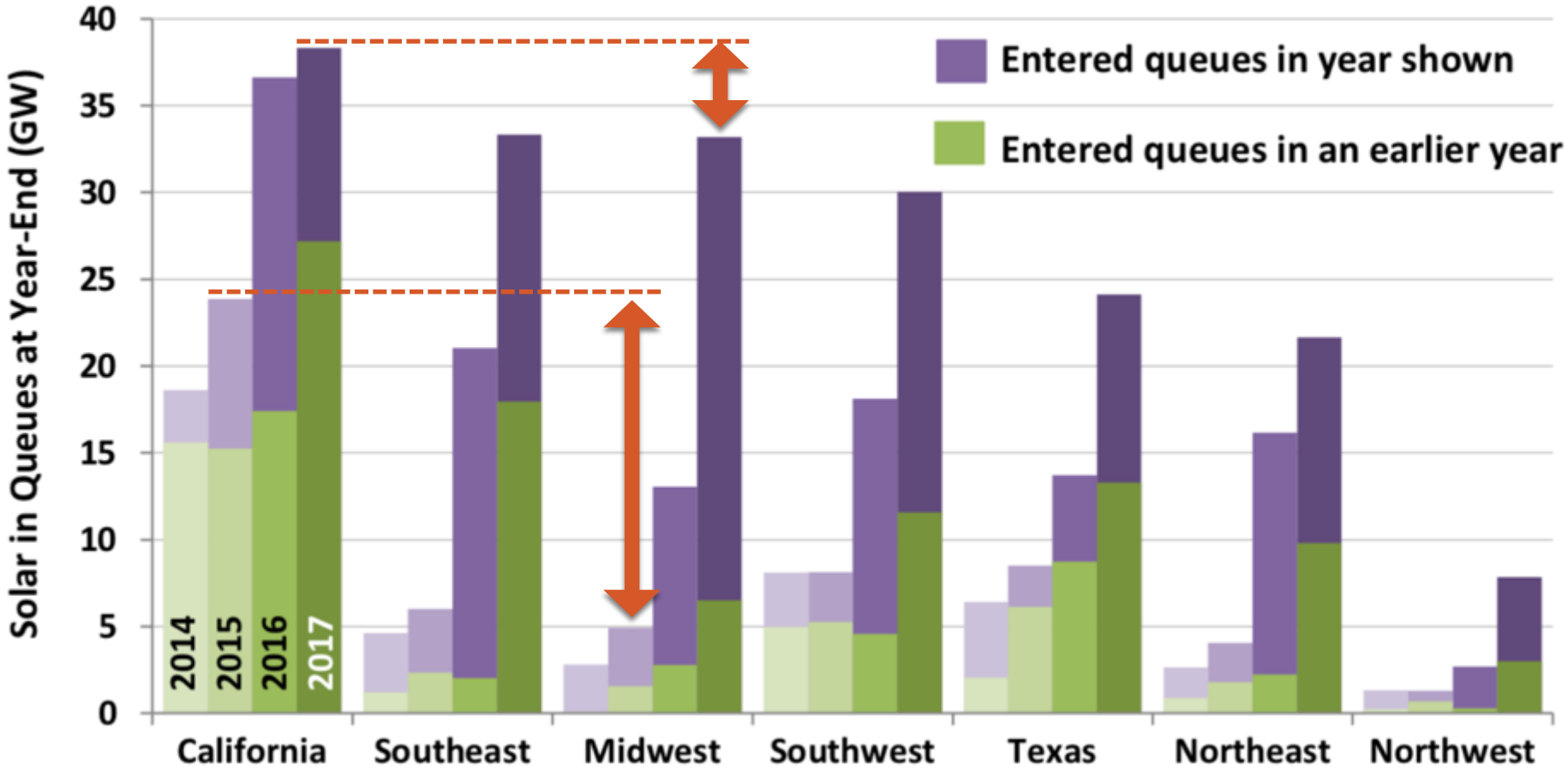
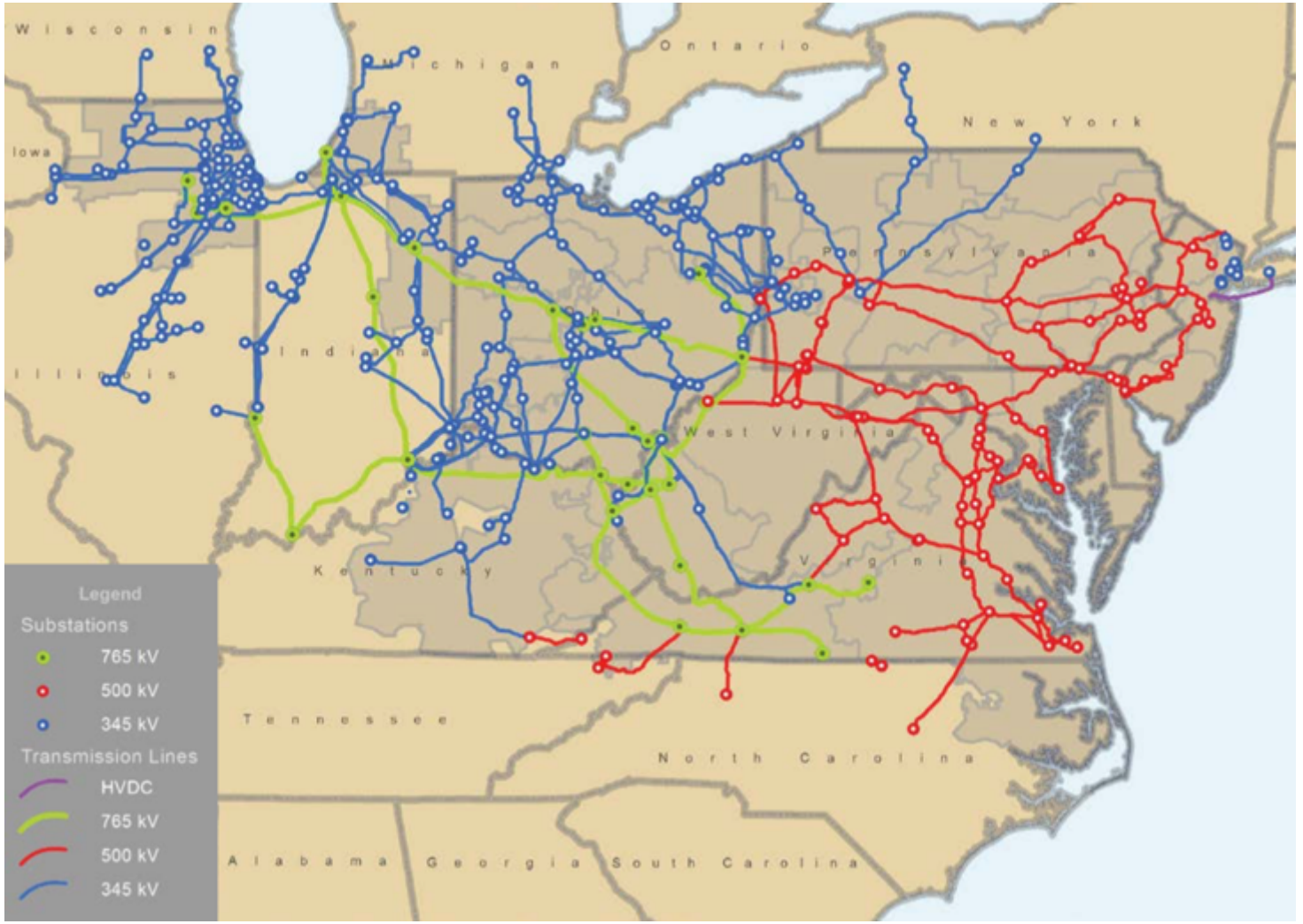
SOLAR CAPACITY INTERCONNECTION QUEUES



Source: Utility Scale Solar: Empirical Trends in Project Technology, Cost, Performance, and PPA Pricing in the United States – 2018 Edition. Lawrence Berkeley National Laboratory

NOTE: Although placing a project in the interconnection queue is a necessary step in project development, being in the queue does not guarantee that a project will actually be built.

OVERVIEW OF PJM

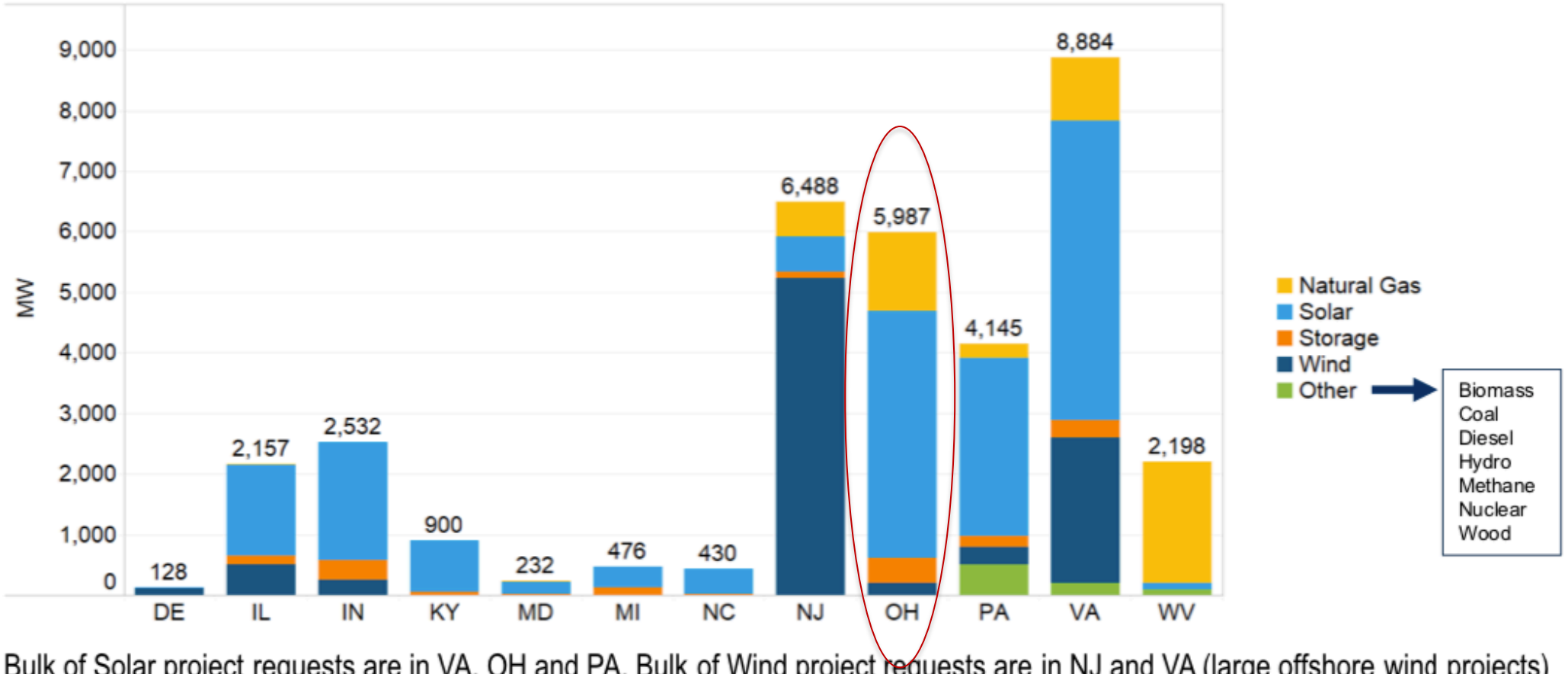


PJM is a FERC approved Regional Transmission Operator (RTO) who coordinates the movement of wholesale electricity across a high voltage transmission system in parts of 13 states in the northcentral/northeast region.

PJM INTERCONNECTION REQUEST

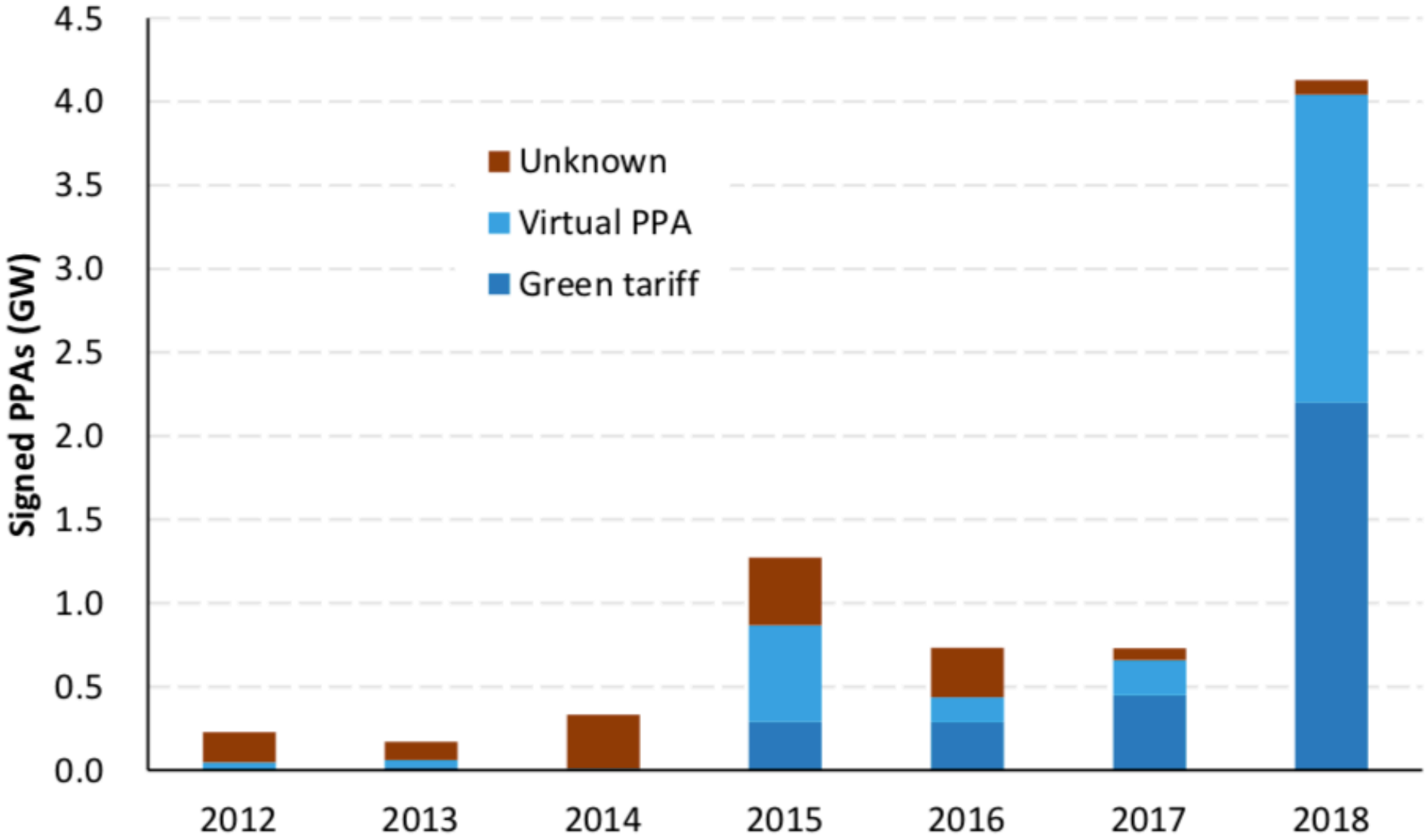
Recent Queue Trends: Z2 - AE2

Generation Interconnection Requests (Queue AE2) by State - Requested Energy



Bulk of Solar project requests are in VA, OH and PA. Bulk of Wind project requests are in NJ and VA (large offshore wind projects)

U.S. OFF-SITE CORPORATE SOLAR PPAs



Sources: BNEF, "Corporate PPA Deal Tracker," as of April 2, 2019, database of "Corporate PPAs," accessed 04/09/19.

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Ohio Solar Policy

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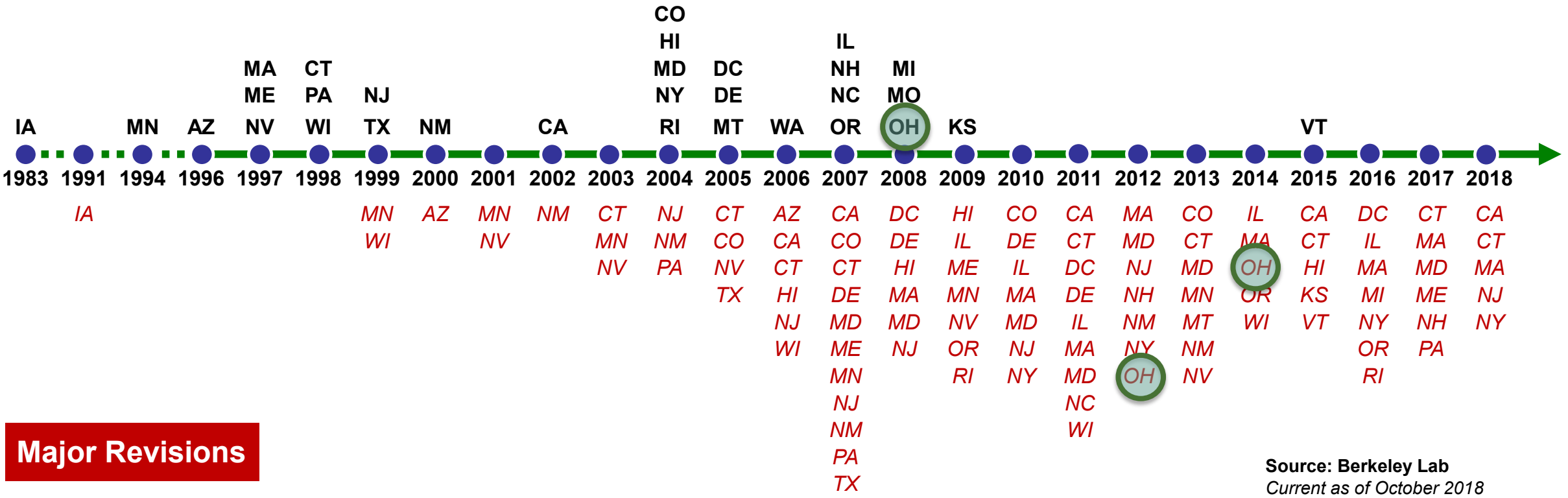
MOST RPS POLICIES HAVE BEEN N PLACE FOR A DECADE OR MORE

RPS Enactment



Major Revisions

Source: Berkeley Lab
Current as of October 2018

OHIO S.B. 232 ALTERNATIVE ENERGY ZONE POLICY

- Program provides owners of alternative energy projects with an exemption for the public utility tangible personal property tax and consolidates tax liabilities into one flat fee. The recipient pays a per-megawatt tax based on the facilities' total nameplate capacity for power production.

- In order to qualify, the owner must apply to Development Services Agency before December 31, 2022 for renewable energy projects.

- For projects greater than 20 MW in size, the Development Services Agency will forward the application for exemption to the local county commissioners and to each taxing unit in the affected counties.

  - County commissioners must approve the exemption by resolution within 30 days
  - If the county rejects the application or fails to act, the exemption is denied
  - County can establish itself an “alternative energy zone,” thus approving all projects

PAYMENT IN LIEU OF TAXES (PILOT) PROGRAM

- Require PILOTs of $7,000 per MW for qualified solar projects
- $6,000 to $8,000 per MW for all other renewable energy projects
- County commissioners may negotiate additional service payments, not to exceed $9,000 per MW when combined with the PILOT payment.
- The PILOT is to be allocated just as tangible personal property tax is allocated — to local governments and school districts. Any additional service payment required by the county is to be deposited in the county general fund. § 5727.75(E)(1)(b).

ALTERNATIVE ENERGY ZONE MAP

Approved AEZ Projects

Applications Denied

John Werkman
Ohio Development Services Agency
Tax Incentives Manager
(614) 466-6791
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OHIO POWER SITING BOARD

New solar facilities with a generating capacity of 50 MW or more must obtain a certificate from the Ohio Power Siting Board

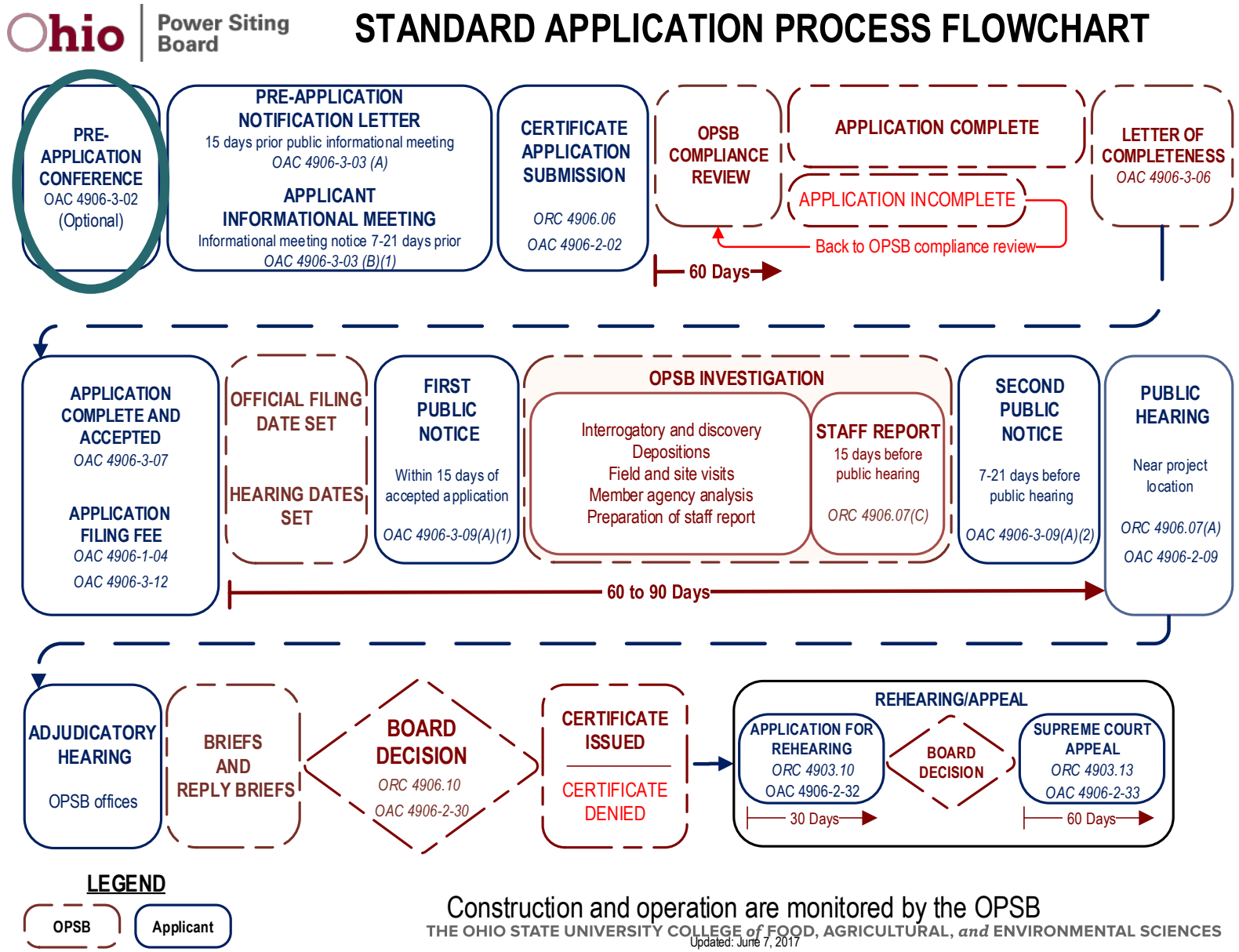
OHIO ADMINISTRATIVE CODE 4906: OHIO POWER SITTING BOARD

4906-4 CERTIFICATE APPLICATIONS FOR ELECTRIC GENERATION FACILITIES

4906-4-01	Purpose and scope.
4906-4-02	Project summary and applicant information.
4906-4-03	Project description in detail and project schedule in detail.
4906-4-04	Project area selection and site design.
4906-4-05	Electric grid interconnection.
4906-4-06	Economic impact and public interaction.
4906-4-07	Compliance with air, water, solid waste, and aviation regulations.
4906-4-08	Health and safety, land use and ecological information.
4906-4-09	Regulations associated with wind farms.

OHIO POWER SITING BOARD STANDARD APPLICATION PROCESS FLOW

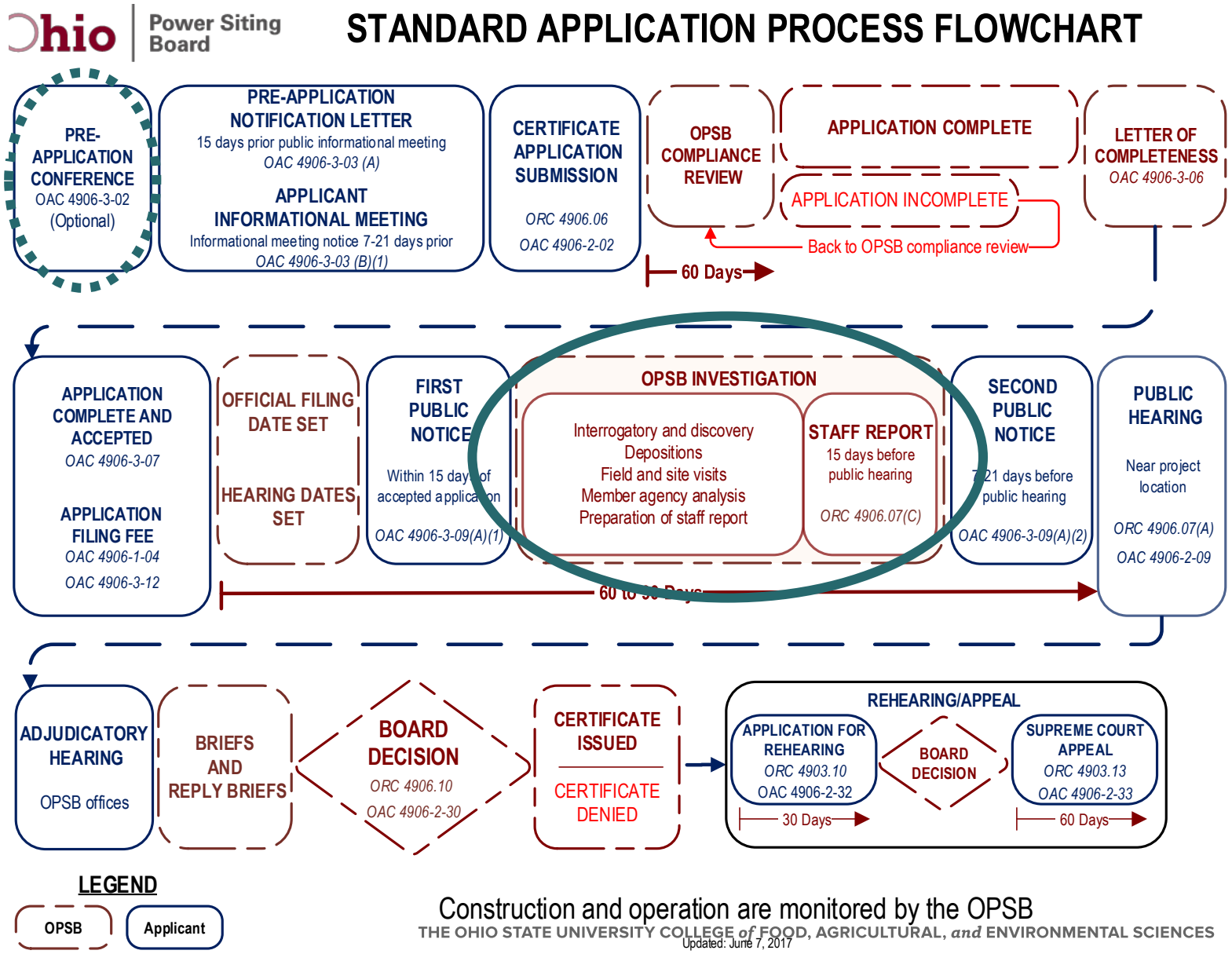
1) Prior to filing an application to build a new utility facility, the developer is required to hold a **public meeting** to share details of the project, gather input, and hear the public's concerns. Representatives from the OPSB attend the pre-application meeting to discuss the siting process and public participation.



Updated: June 7, 2017

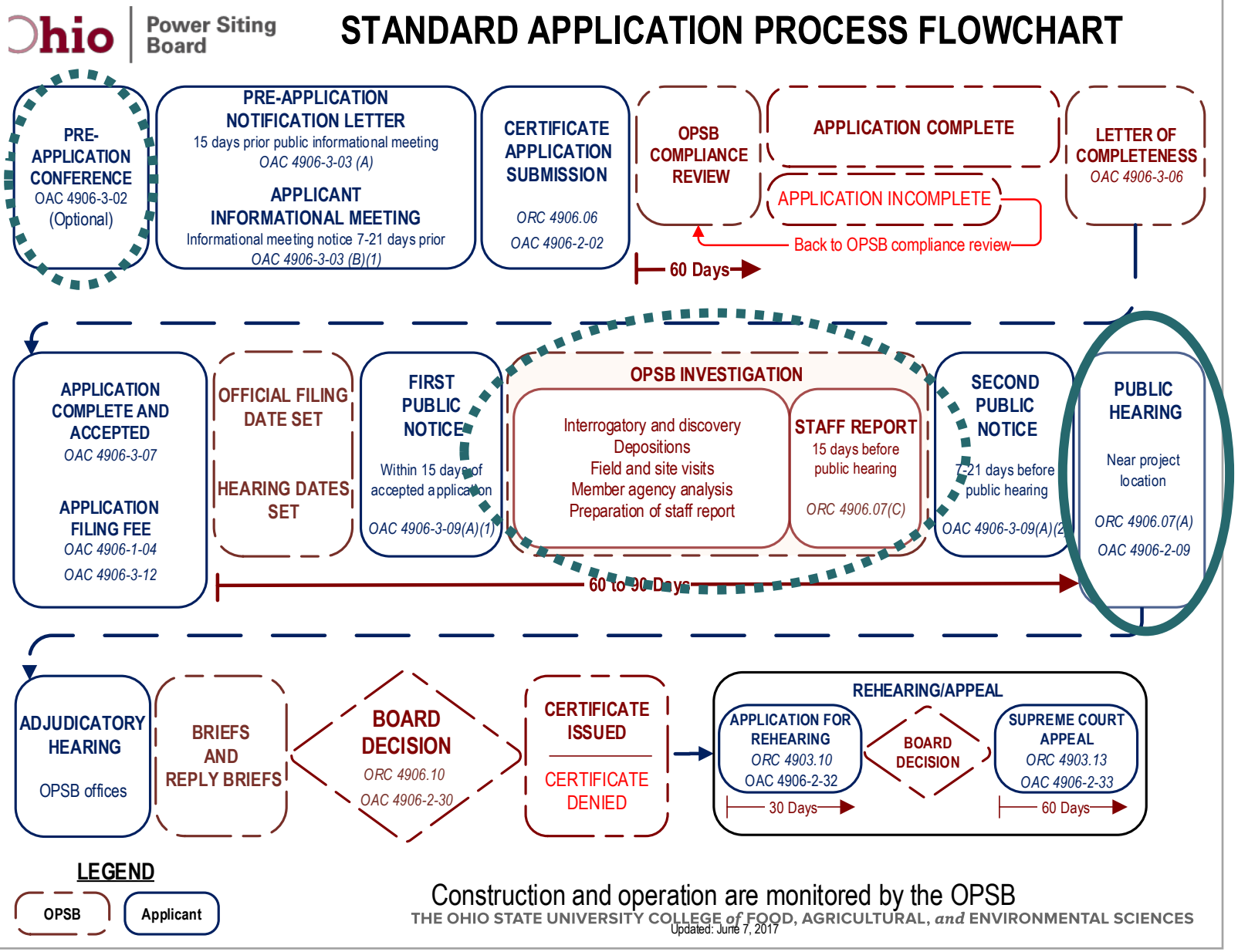
OHIO POWER SITING BOARD STANDARD APPLICATION PROCESS FLOW

2) Interested parties are encouraged to **submit informal written comments** to the OPSB. Informal comments are filed in the public comments section of the case record and inform the OPSB during its investigation.



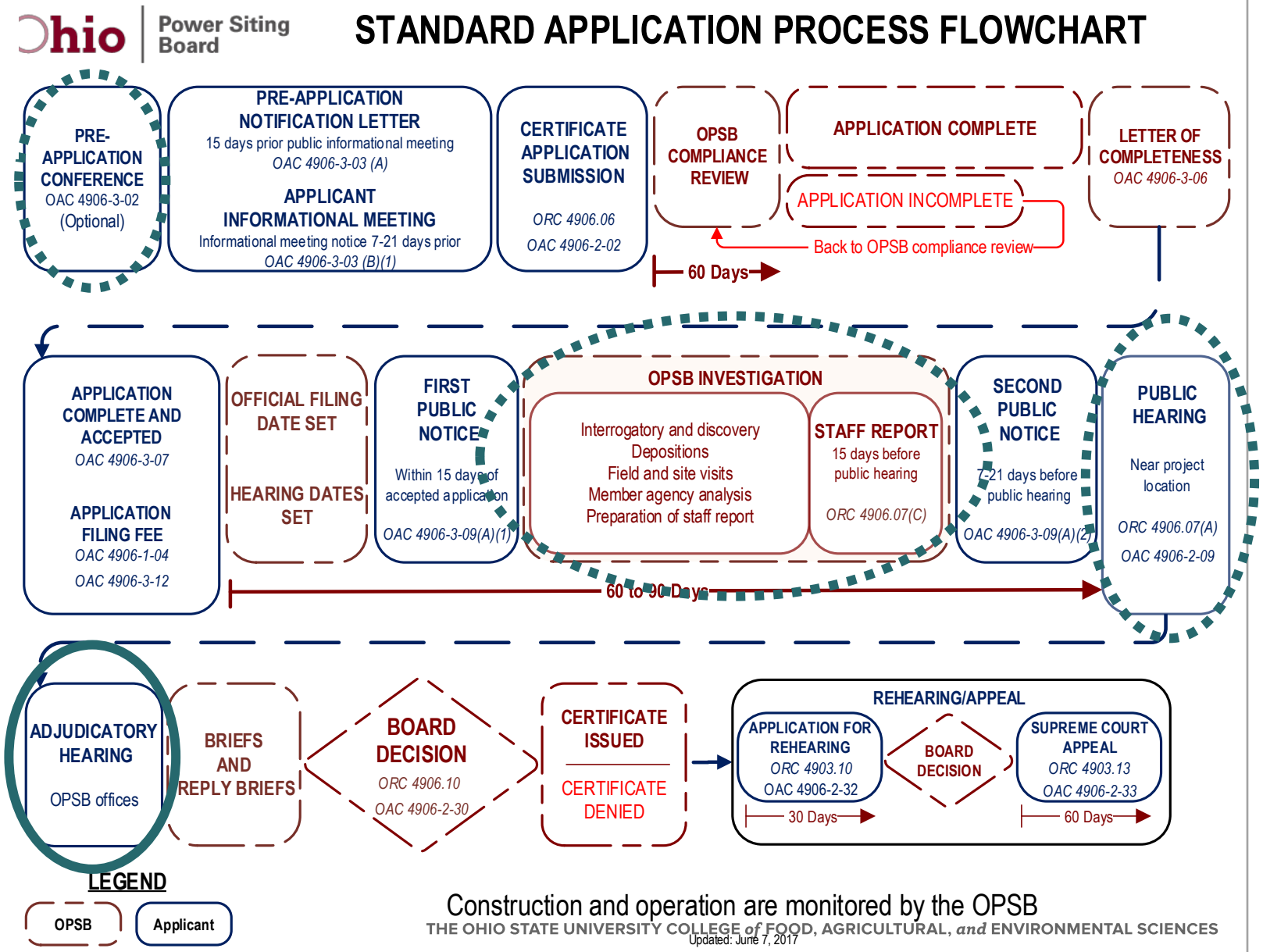
OHIO POWER SITING BOARD STANDARD APPLICATION PROCESS FLOW

3). After the OPSB staff makes its recommendation, they host a **formal public hearing** where community members can provide sworn testimony or submit written statements to the case record.



OHIO POWER SITING BOARD STANDARD APPLICATION PROCESS FLOW

4) Finally, individuals, organizations, and governments may request to formally intervene in the case and **participate as a party of record** in the case proceedings.



OPSB - How to Stay Connected

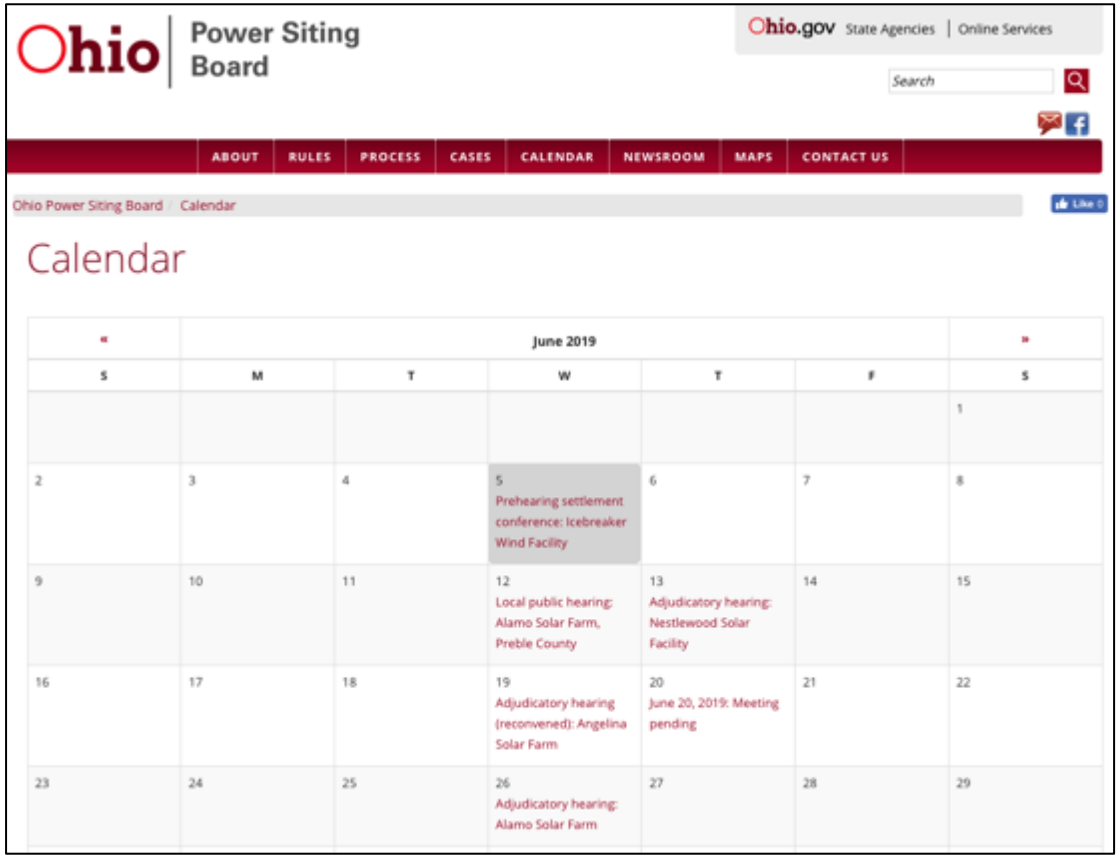
- Sign up to receive news releases and Board meeting agendas
- View case documents online
- Create an account and subscribe for case updates
- Developers are required to file a copy of application with local libraries
- Local newspapers publish required notifications of hearings/meetings
- Follow the OPSB on Facebook
- View the OPSB Calendar

Email: contactOPSB@puco.ohio.gov

Phone: 866-270-OPSB (6772)

Website: www.opsb.ohio.gov

Mail: Ohio Power Siting Board, 180 E. Broad Street, Columbus Ohio 43215



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Solar Development in Ohio

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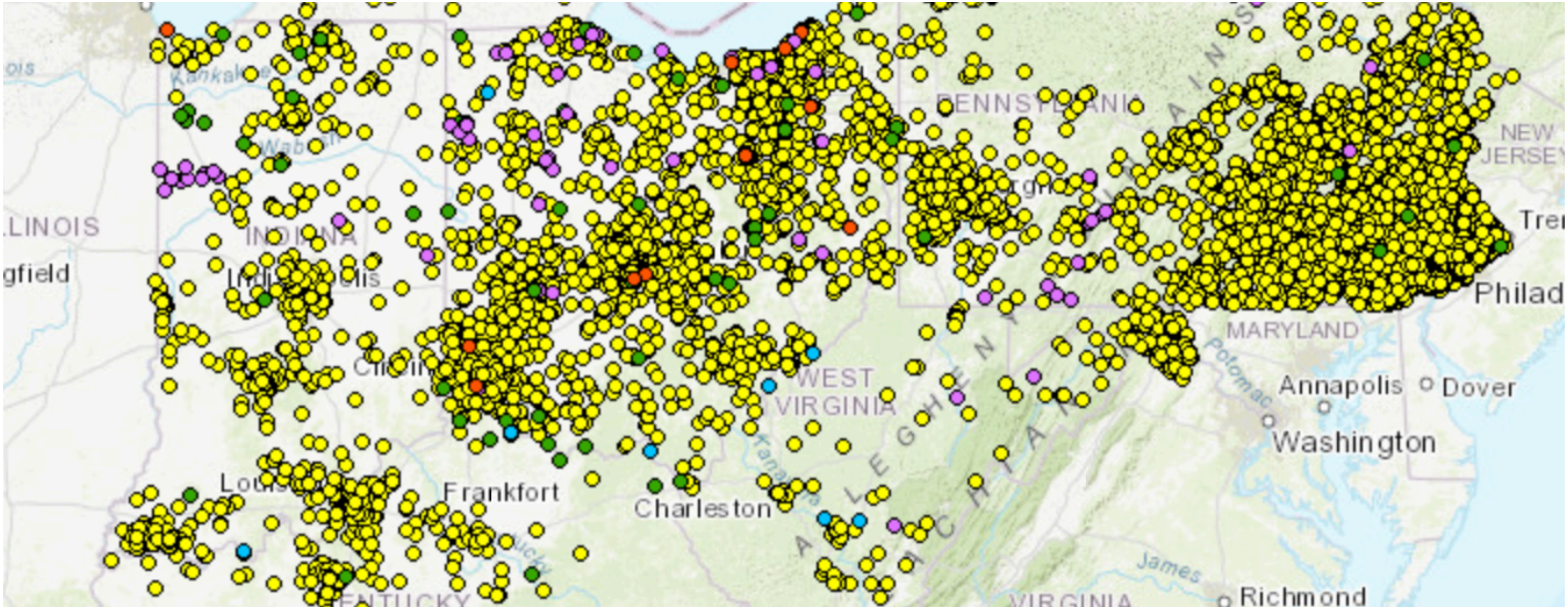
RENEWABLE ENERGY FACILITIES REGISTERED WITH PUCO



https://www.puco.ohio.gov/utility-maps/electric-maps/ohio-certified-renewable-facilities/

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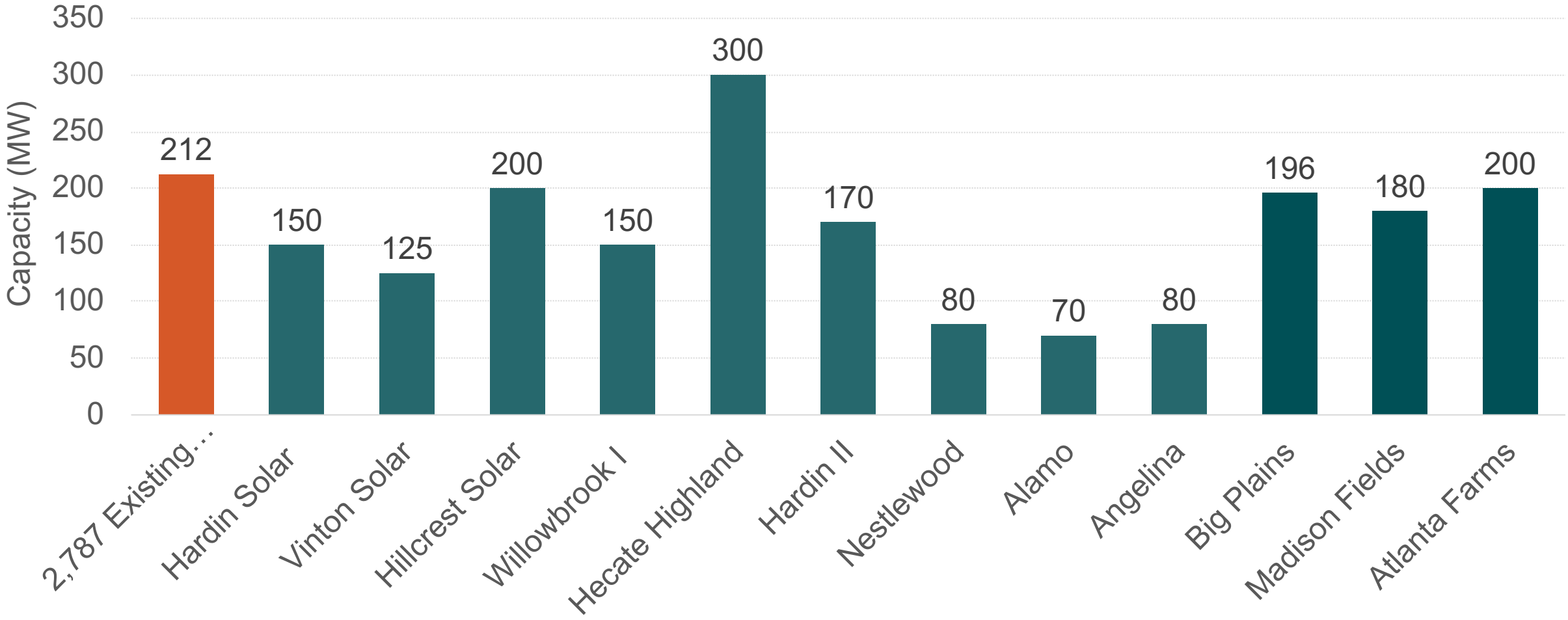
COMPARING EXISTING SOLAR CAPACITY WITH PLANNED PROJECTS CURRENTLY UNDER REVIEW WITH THE OPSB

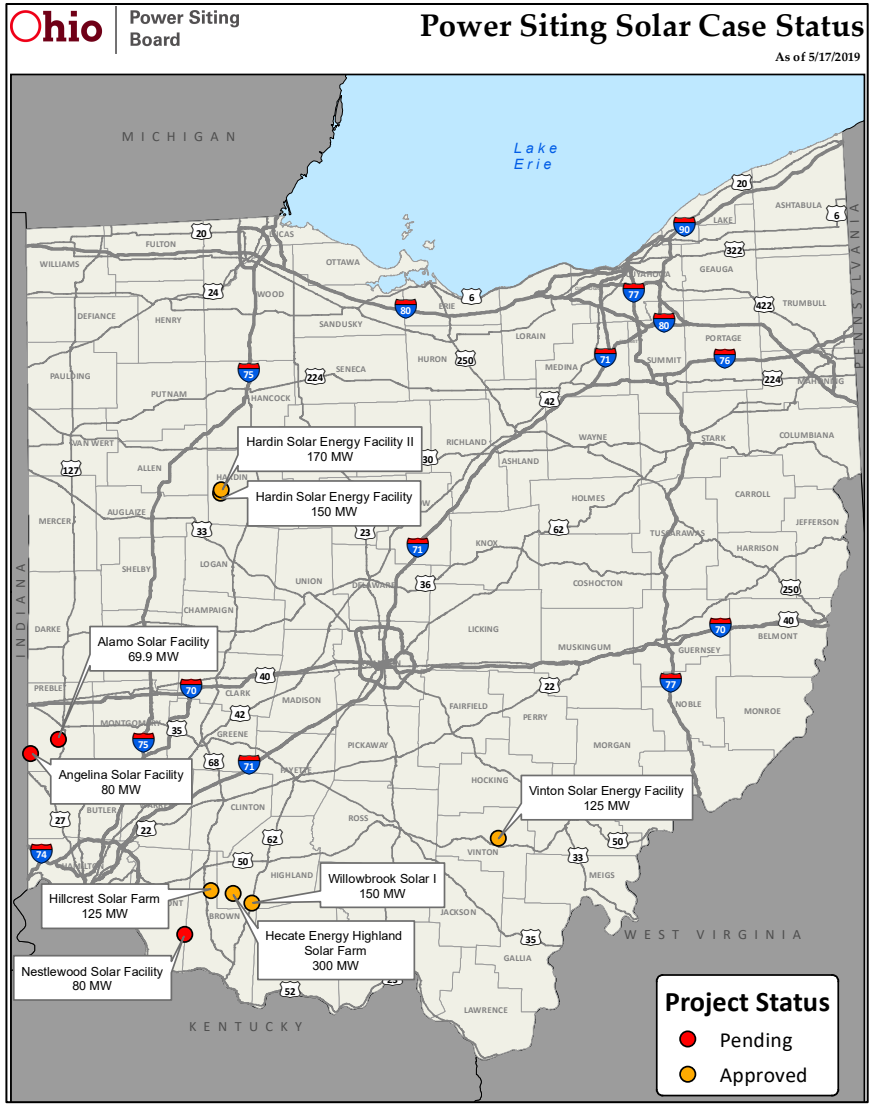


Source: Source: Ohio Power Sitting Board. 2019. Large Solar Facility Siting. Available at: https://www.opsb.ohio.gov and Public Utilities Commission of Ohio. February, 2019. Ohio's Alternative Energy Portfolio Standard - Certified Renewable Energy Facilities.

UTILITY SOLAR DEVELOPMENT 50 MW OR GREATER

Project Name	County	Size (MW)	Status
Hardin Solar	Hardin County	150 MW	Approved
Hardin II	Hardin County	170 MW	Approved
Vinton Solar	Vinton County	125 MW	Approved
Hillcrest Solar	Brown County	200 MW	Approved
Willowbrook I	Highland County	150 MW	Approved
Hecate Highland	Highland County	300 MW	Approved
Nestlewood	Brown/Clermont	80 MW	Pending
Alamo	Preble County	70 MW	Pending
Angelina	Preble County	80 MW	Pending
Big Plains	Madison County	196 MW	Pre-App
Madison Fields	Madison County	180 MW	Pre-App
Atlanta Farms	Pickaway County	200 MW	Pre-App

Total = 1,900 MW



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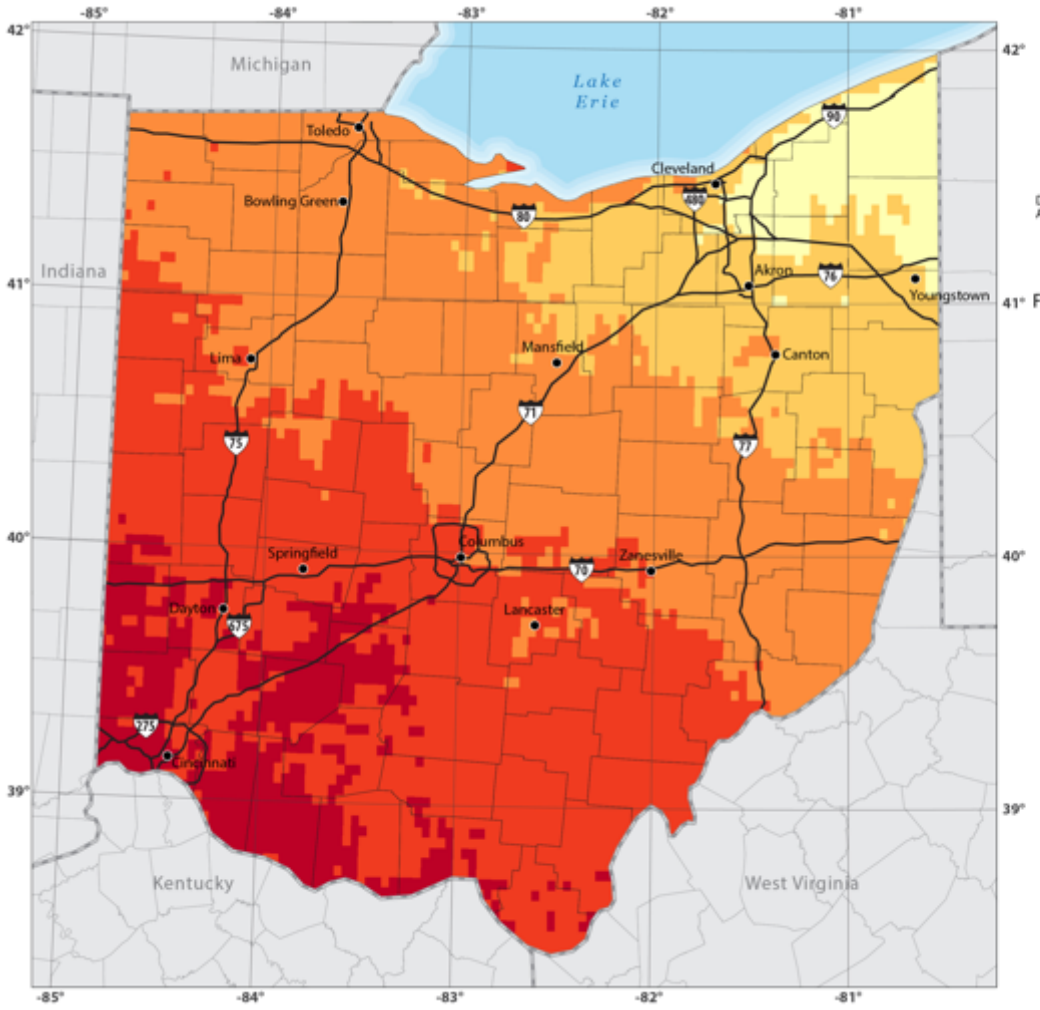
OHIO SOLAR RESOURCE MAP

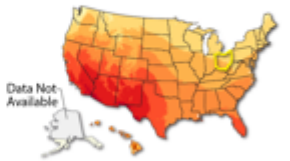
Table 1: State Ranking of Photovoltaic Solar Cumulative Capacity Installed Through February 2019			
Rank	State	Net Summer Capacity (Megawatts)	GHI** (kWh/m2/day)
1	CA	18,876	5.15
2	NC	4,135	4.63
3	AZ	3,231	5.78
4	TX	2,448	4.96
5	NJ	2,240	4.17
6	MA	2,164	4.06
7	NV	2,027	5.35
8	FL	1,623	4.91
9	NY	1,529	3.90
10	UT	1,100	4.68
25	Ohio	208.3	4.03

** Global Horizontal Irradiance for this chart is based on the location of the state capital.

Sources: U.S. Energy Information Administration, Form EIA-860, 'Annual Electric Generator Report' and Form EIA-860M, 'Monthly Update to the Annual Electric Generator Report.'
Global Horizontal Irradiance is based on data from the National Renewable Energy Laboratory System Advisory Model typical meteorological year data developed using methods described in the technical notes.



Global Horizontal Solar Resource of Ohio



Fifty-state Resource Range (kWh/m²/Day)

7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 1.0

4.2 4.1 4.0 3.9 3.8 3.7

Ohio Resource Range

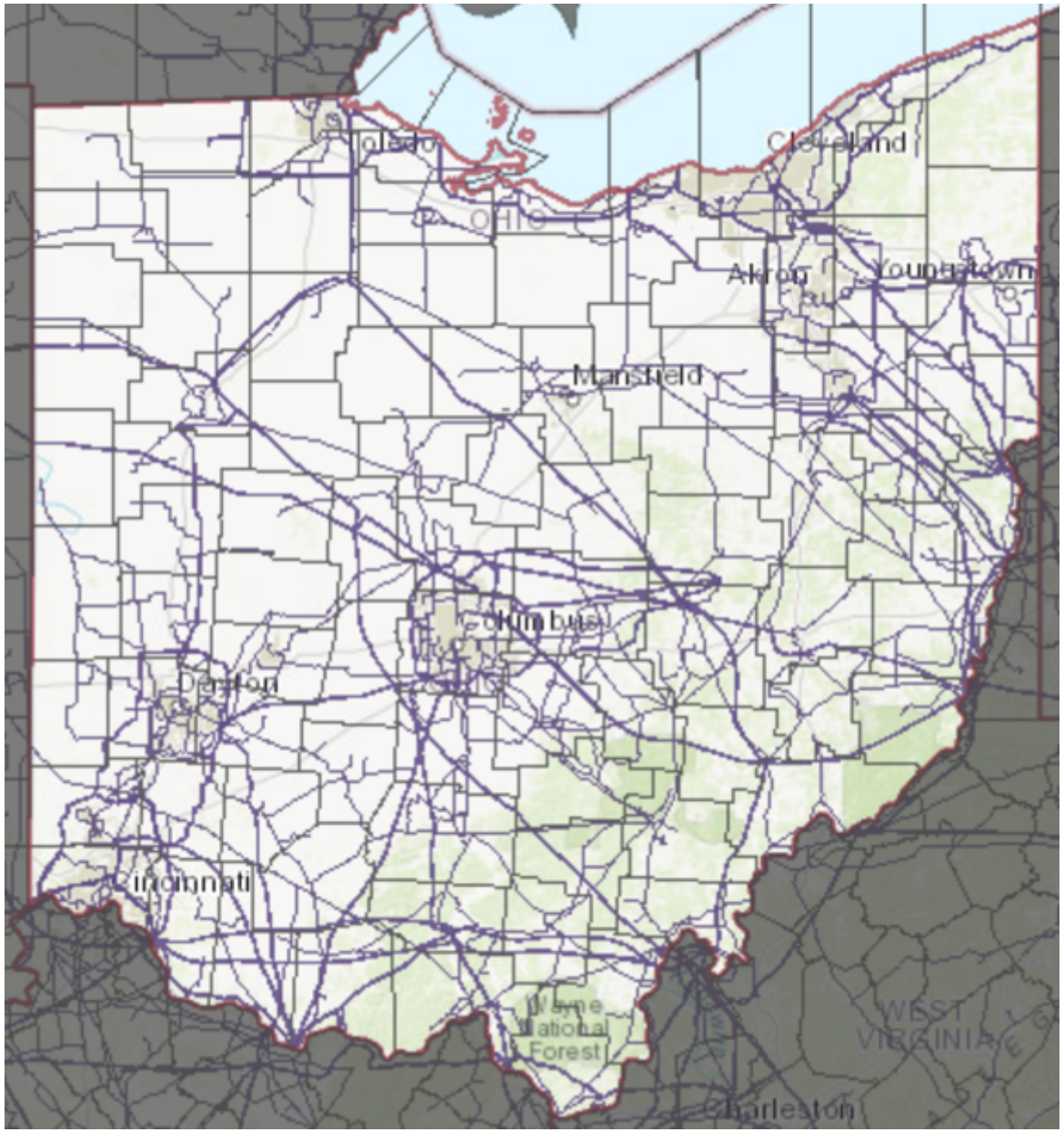
This data provides monthly average and annual average daily total solar resource averaged over surface cells of 0.038 degrees in both latitude and longitude, or, nominally, 4 km in size. The insolation values represent the resource available to horizontal flat plate collectors. The data are created using the PATMOS-X algorithms for cloud identification and properties, the MMAC radiative transfer model for clear sky calculations, and the SASRAB model for cloud sky calculations. The data are averaged from hourly model output over 8 years (2005-2012).

0 25 50 75 100 km

0 20 40 60 mi

This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy.
Nicholas Gilroy, April 4, 2017

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

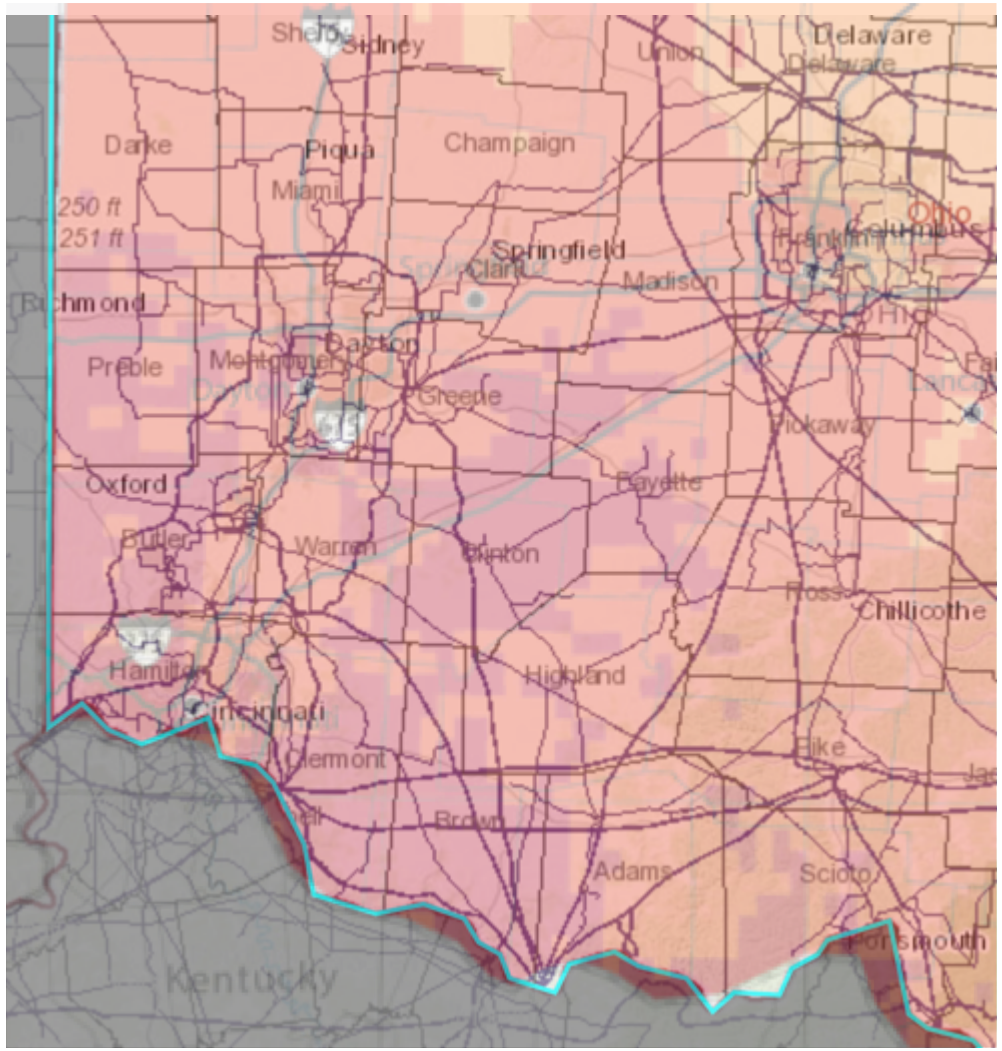


PROXIMITY TO TRANSMISSION LINES AND INTERCONNECTION

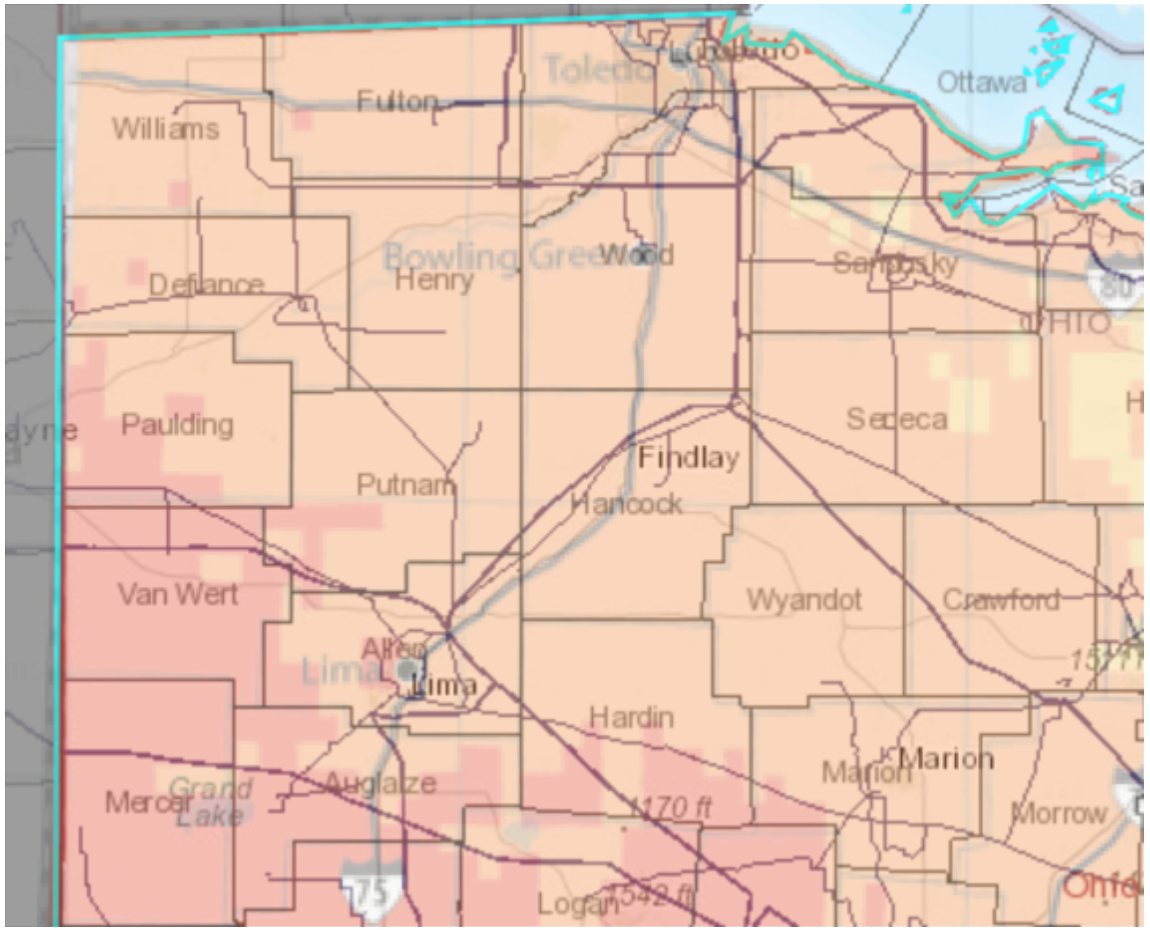
- Ohio's transmission grid consists of 6,983 miles of high voltage transmission lines and 112 miles of low voltage transmission lines.
- To reduce project cost, developers will seek sites with low interconnection costs.
- Pre-application studies help developers strategically identify optimal grid interconnection locations, while dismissing problematic sites that require additional upgrades in grid infrastructure.

COMPARISSON OF TRANSMISSION LINES

Southwest Ohio



Northwest Ohio



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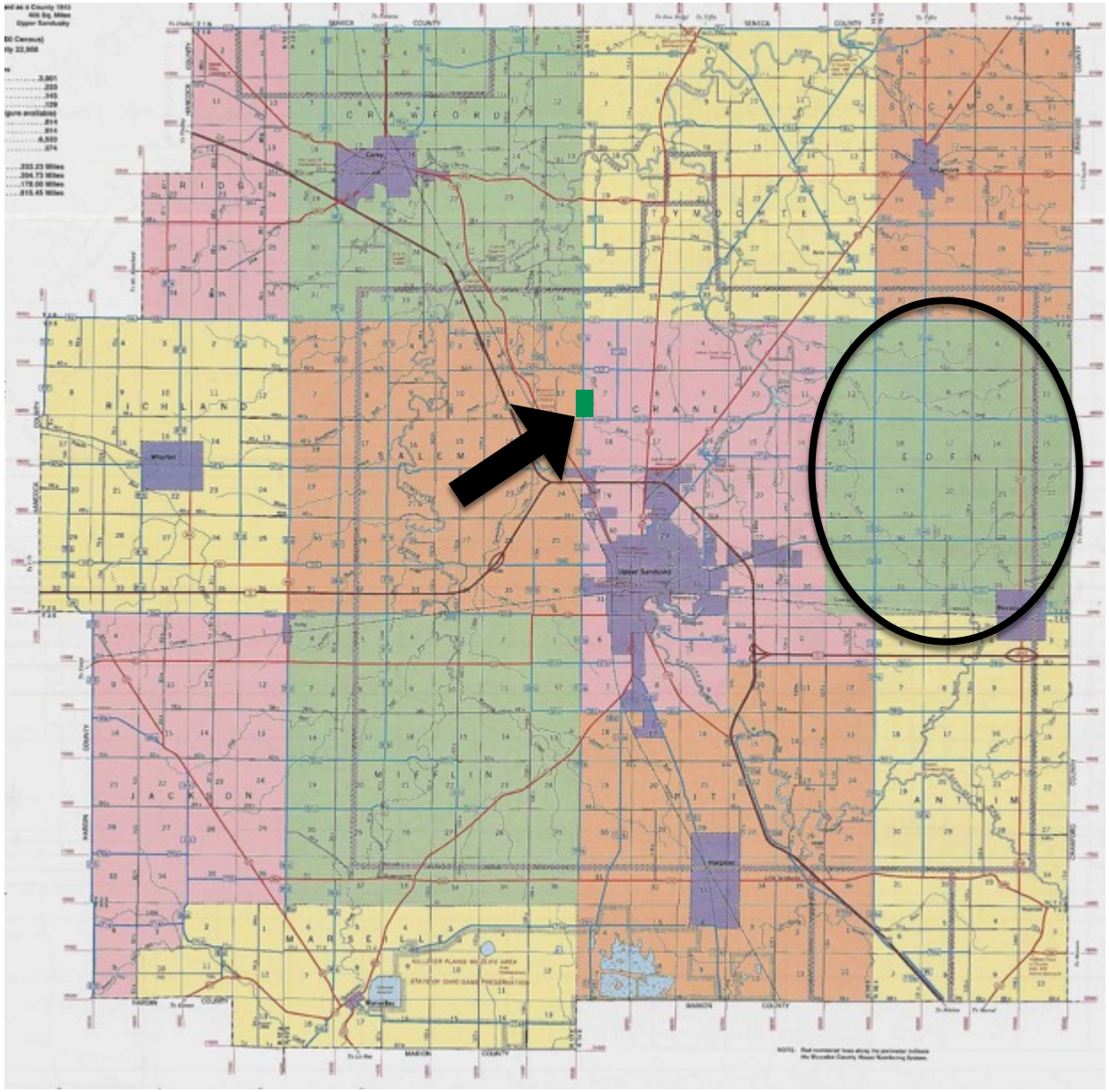
WYANDOT COUNTY SOLAR PROJECT

UNDERSTANDING THE SCALE OF DEVELOPMENT

- 1,900 MW of solar development in hopper

- OPSB Applications – The 12 projects combined have a project area of over 21,000 acres or **32 Sq. Miles**

    - **Eden Township is 30 Sq. Miles**



With research, guidance, and collaboration…..large facilities could provide:

- Water quality protection – Perennial ground cover that reduces runoff, soil conservation, vegetated wetland and waterway buffers
- Habitat value – Pollinators, small mammals, birds, reptiles
- Agricultural opportunities – beehives, hay production, grazing, high-value hand-picked crops, pollinator benefits for nearby crops

Vegetation benefits to PV:

- Increased PV efficiencies – Lowers temperatures beneath panels
- Reduced O&M costs – With low height vegetation and/or grazing

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Utility-Scale PV Solar Construction


CAT


CAT CP-563C


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Thank You!

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