



Jason Rafeld
Executive Director

25th Annual Ohio Energy
Management Conference & Virtual
Institute

February 17, 2021

UTILITY SCALE SOLAR ENERGY COALITION

USSEC

OF OHIO

The Utility Scale Solar Energy Coalition is the trade organization representing utility scale solar developers, manufacturers, and industry leaders in the state of Ohio.

ohiosolarcoalition.com

Formed in 2020, USSEC has been working to provide industry perspectives and data to help inform a constructive dialogue with the Ohio Power Siting Board and other decision makers around the state.

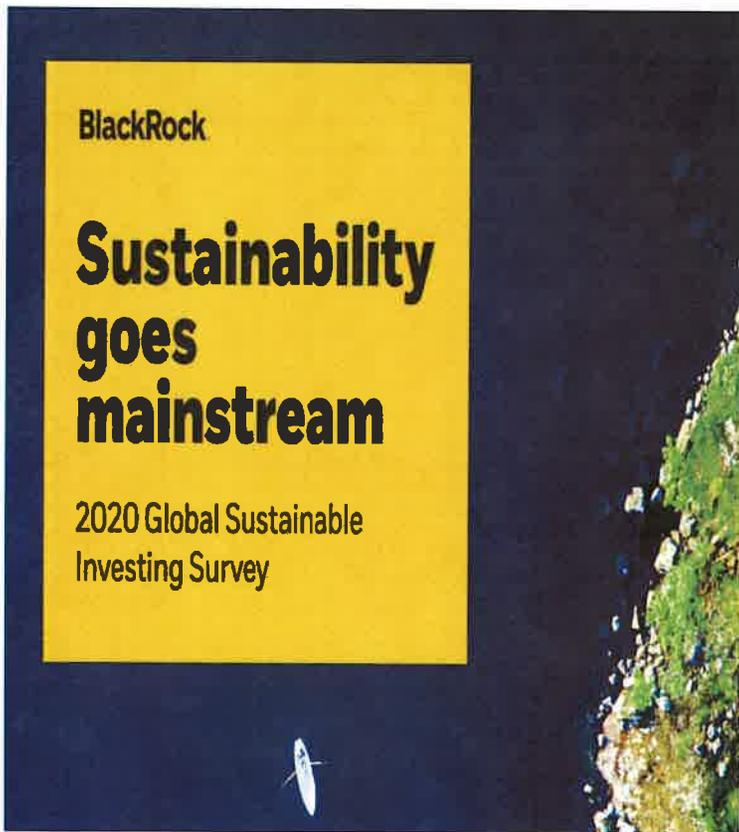


Why Ohio?

Geography
Topography
Greenfield Development
Panels More Efficient
Manufactured Here In Ohio
Demand For Clean Energy
Eastern States RPS
Solar Irradiance Levels

LOWER COST

According to NREL, the cost of silicon solar cells has fallen from \$76 per watt in 1977, to \$0.20 per watt in 2020.



425
investors

27
countries

\$25tn
assets under
management

Respondents are planning to double their sustainable assets under management in the next five years.



REBA

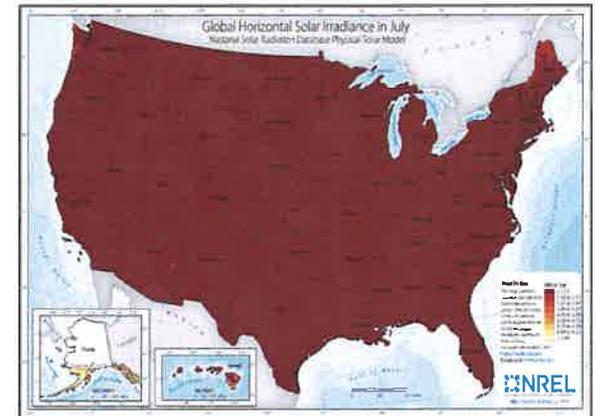
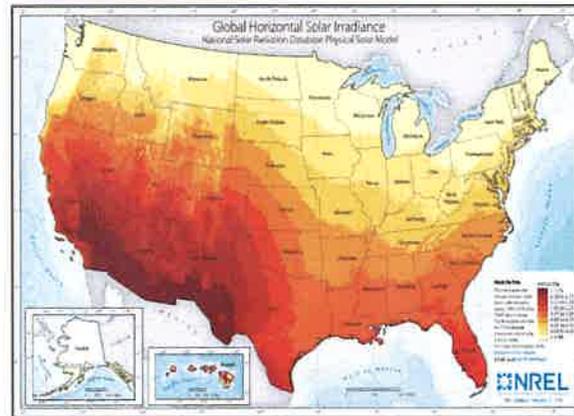
Renewable Energy Buyers Alliance



Average

July

Solar Irradiance Levels In Ohio



What Is It Doing For Ohio?

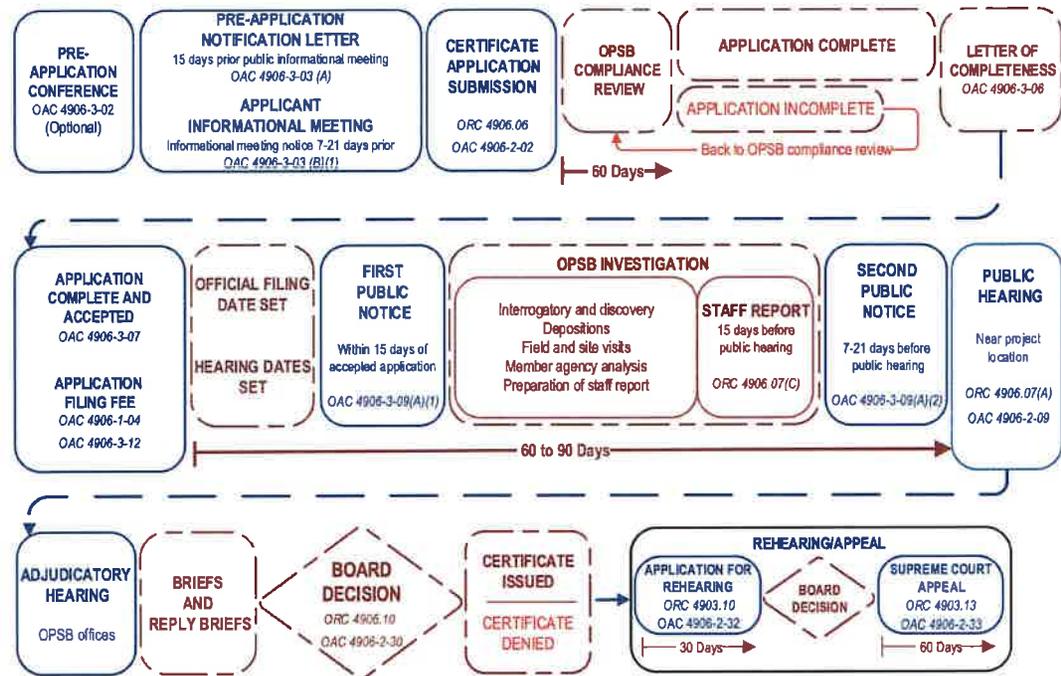
- Bringing business
- Providing the energy in demand from Ohio
- Keeping farms in the family
- Preserving farmland in agricultural communities



The Ohio Power Siting Board

Ohio | Power Siting Board

STANDARD APPLICATION PROCESS FLOWCHART



OPSB Solar Case Status



The Power of Numbers

Approved Solar Facilities			Potential Solar Facilities (Pending and Pre-application)		
Operational Megawatts (MW):			Potential Megawatts (MW):		
1,554.6			6,220.5		
Approved Solar Facilities (50 MW or greater)					
Case Number	Related Cases	Project Name	Approval Date	County	MW
17-0773-EL-BGN	NA	Hardin I*	12/31/20	Hardin	150
17-0774-EL-BGN	NA	Vinton	9/20/18	Vinton	125
17-1152-EL-BGN		Hilcrest*	2/15/18	Brown	200
	18-1267-EL-BGA		2/21/19		
18-1024-EL-BGN	NA	Willowbrook I	9/17/18	Brown, Highland	150
18-1334-EL-BGN	NA	Highland	5/16/19	Highland	300
18-1360-EL-BGN		Hardin II*	5/18/19	Hardin	170
	20-1321-EL-BGA		1/21/21		
18-1546-EL-BGN	NA	Nestlewood	4/18/20	Brown, Clermont	80
19-1880-EL-BGN	NA	Atlanta Farms	12/22/20	Pickaway	199.6
19-1881-EL-BGN	NA	Madison Fields	1/21/21	Madison	180
*under construction				TOTALS:	1,554.6
Pending and Pre-application Solar Facilities (50 MW or greater)					
Case Number	Project Name	Filing Date	County	MW	
18-1578-EL-BGN	Alamo	12/10/18	Preble	89.9	
18-1579-EL-BGN	Angelina	12/3/18	Preble	80	
19-1823-EL-BGN	Madison (Big Plain)	4/27/20	Madison	196	
20-1084-EL-BGN	Powell Creek	10/7/20	Putnam	150	
20-0931-EL-BGN	Fox Squirrel	10/14/20	Madison	577	
20-0972-EL-BGN	Yellowbud	7/21/20	Pickaway, Ross	274	
20-0979-EL-BGN	Arche	7/30/20	Fulton	107	
20-1288-EL-BGN	New Market	9/3/20	Highland	100	
20-1362-EL-BGN	Cleanview	12/18/20	Champaign	144	
20-1380-EL-BGN	Ross County	10/30/20	Ross	120	
20-1405-EL-BGN	Union County	12/24/20	Union	325	
20-1529-EL-BGN	Wheatsborough	pre-application	Erie	125	
20-1606-EL-BGN	Birch	pre-application	Allen, Auglaize	300	
20-1612-EL-BGN	Mark Center	12/18/2020	Defiance	110	
20-1677-EL-BGN	Cadence	2/1/2021	Union	275	
20-1678-EL-BGN	Hardin III	pre-application	Hardin	300	
20-1679-EL-BGN	Pleasant Prairie	pre-application	Franklin	250	
20-1680-EL-BGN	Yellow Wood	pre-application	Clinton	300	
20-1757-EL-BGN	Union Ridge	pre-application	Licking	108	
20-1760-EL-BGN	Juliet	pre-application	Wood	101	
20-1782-EL-BGN	Sycamore Creek	pre-application	Crawford	117	
20-1814-EL-BGN	Dodson Creek	pre-application	Highland	117	
21-0004-EL-BGN	Tynochlee	pre-application	Wyandot	120	
21-0036-EL-BGN	Marion County	pre-application	Marion	100	
21-0041-EL-BGN	Palomino	pre-application	Highland	200	
				TOTALS:	4,665.9

Ongoing Research

The Impacts of Solar on Agricultural Production





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ECONOMIC ACTIVITY OF OHIO'S UTILITY-SCALE SOLAR INDUSTRY

Dr. Gilbert Michaud, Ph.D.

Voinovich School of Leadership and Public Affairs, Ohio University

*Prepared for the 25th Annual Ohio Energy Savings & Management Conference
February 2021*



VOINOVICH SCHOOL OF LEADERSHIP AND PUBLIC AFFAIRS

Background

- Ohio is undergoing an energy transition
 - In Ohio, ~10 coal-fired power plants have closed since 2010; ~10 GW of capacity
 - 8 large, utility-scale solar PV projects (>50 MW) have been approved by OPSB -> 1.4 GW of capacity
 - 23 additional projects pending or pre-application -> 4.2 GW of capacity
- Various drivers for these projects (e.g., cost declines, business demand, public policy, etc.)
- What are the economic, workforce, and tax-related impacts of these utility-scale solar projects?

Utility-Scale Solar in OH

- 31 “late-stage” solar projects (as of 1/8/2021)
- Hillcrest and Hardin I & II under construction
- Many more projects in the pipeline for 2021 and beyond...



OPSB. (2021, January 8). <https://opsb.ohio.gov/wps/portal/gov/opsb/about-us/resources/solar-farm-map-and-statistics>

Economic Impacts of Solar – An Overview

- Input-output (IO) methods to quantify economic impacts in terms of jobs supported, wages, etc.

Total Economic Impacts

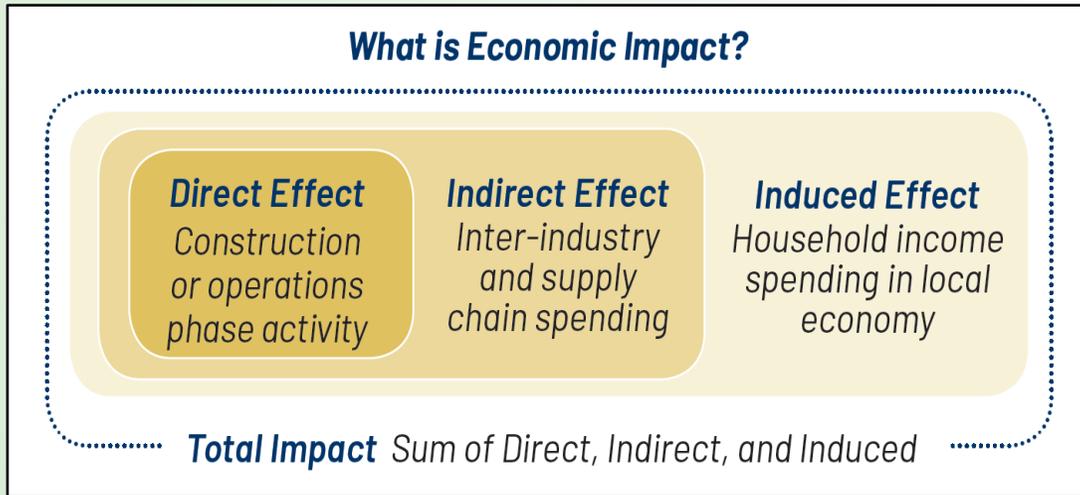
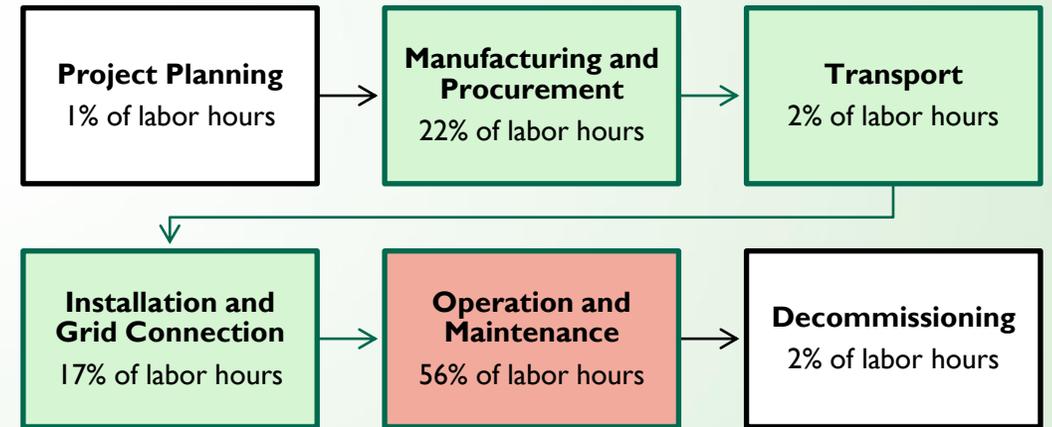


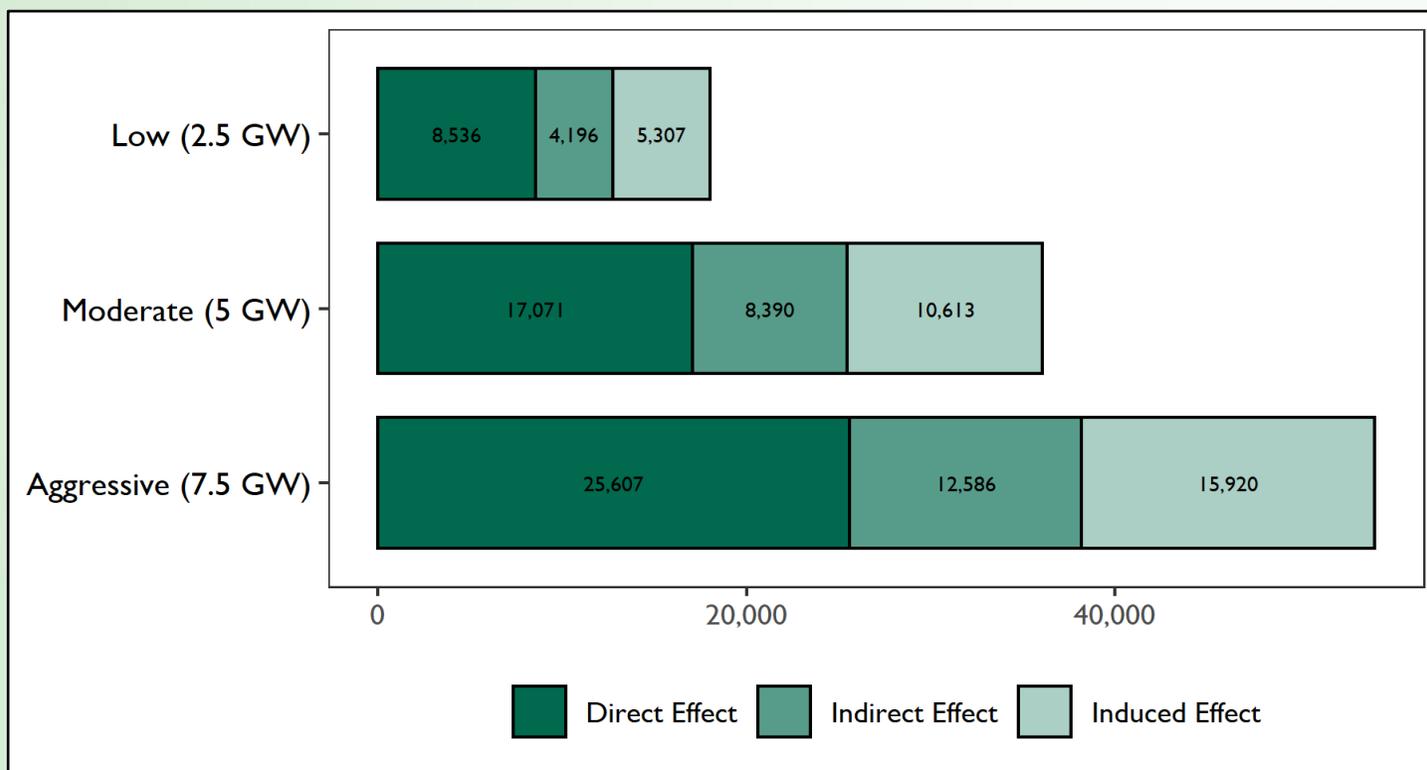
Figure developed by author.

Utility-Scale Solar Project Development Process



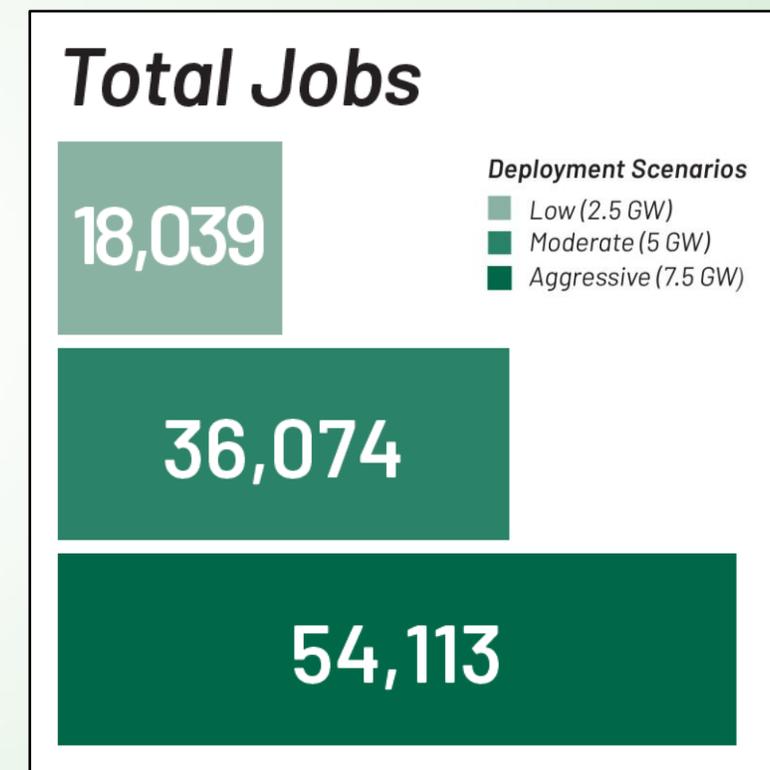
IRENA. (2017). Renewable energy benefits: Leveraging local capacity for solar PV. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Jun/IRENA_Leveraging_for_Solar_PV_2017.pdf

One-Time Construction Phase Employment Impacts

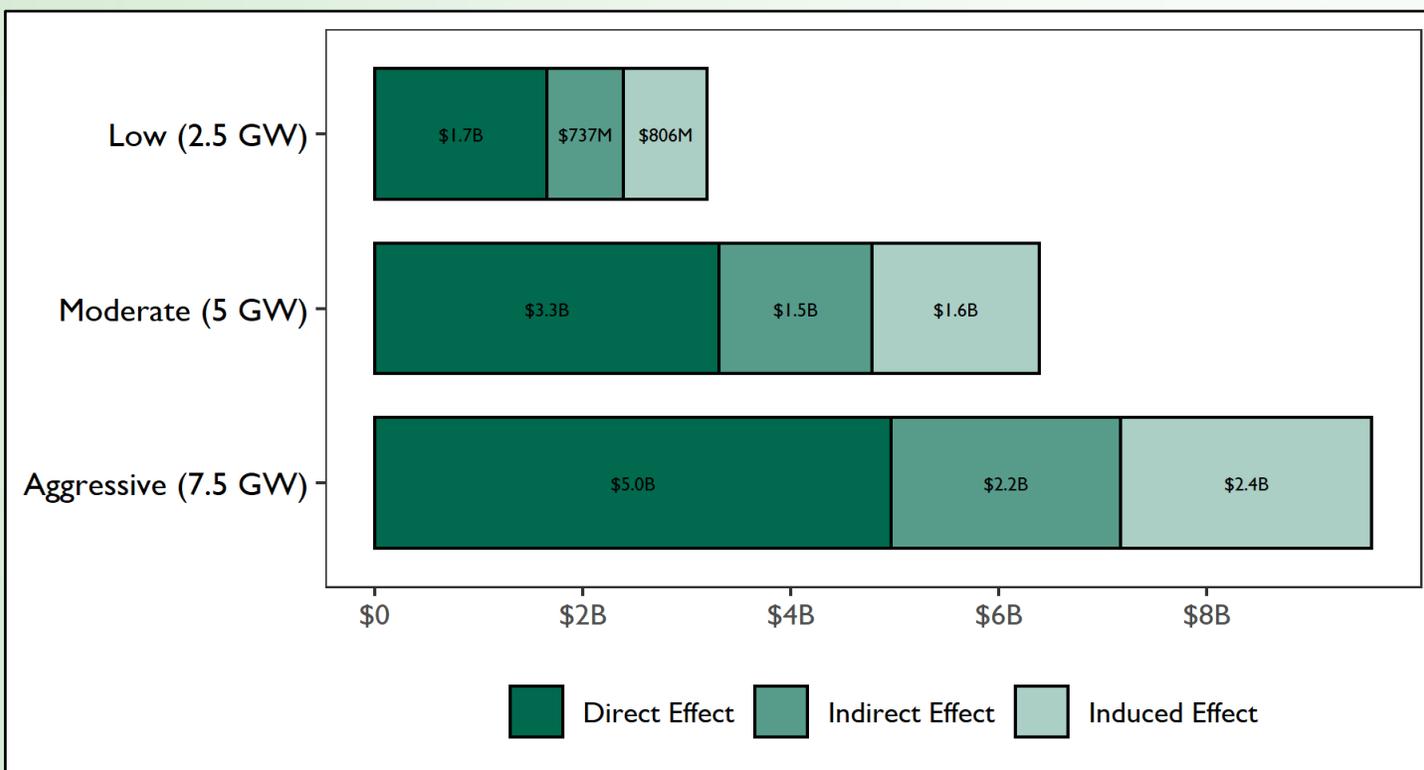


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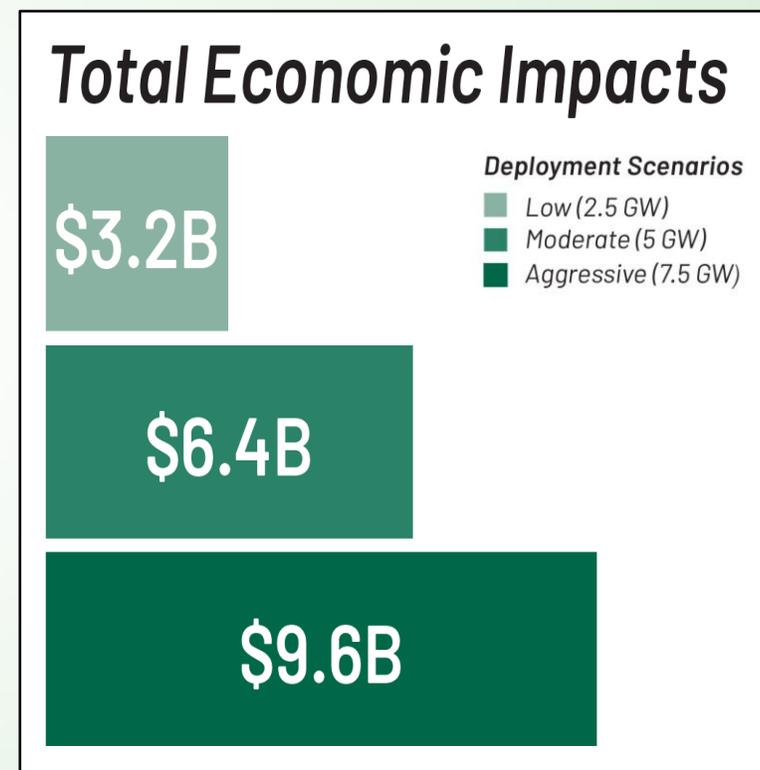
Employment expressed as full-time equivalents (FTE).



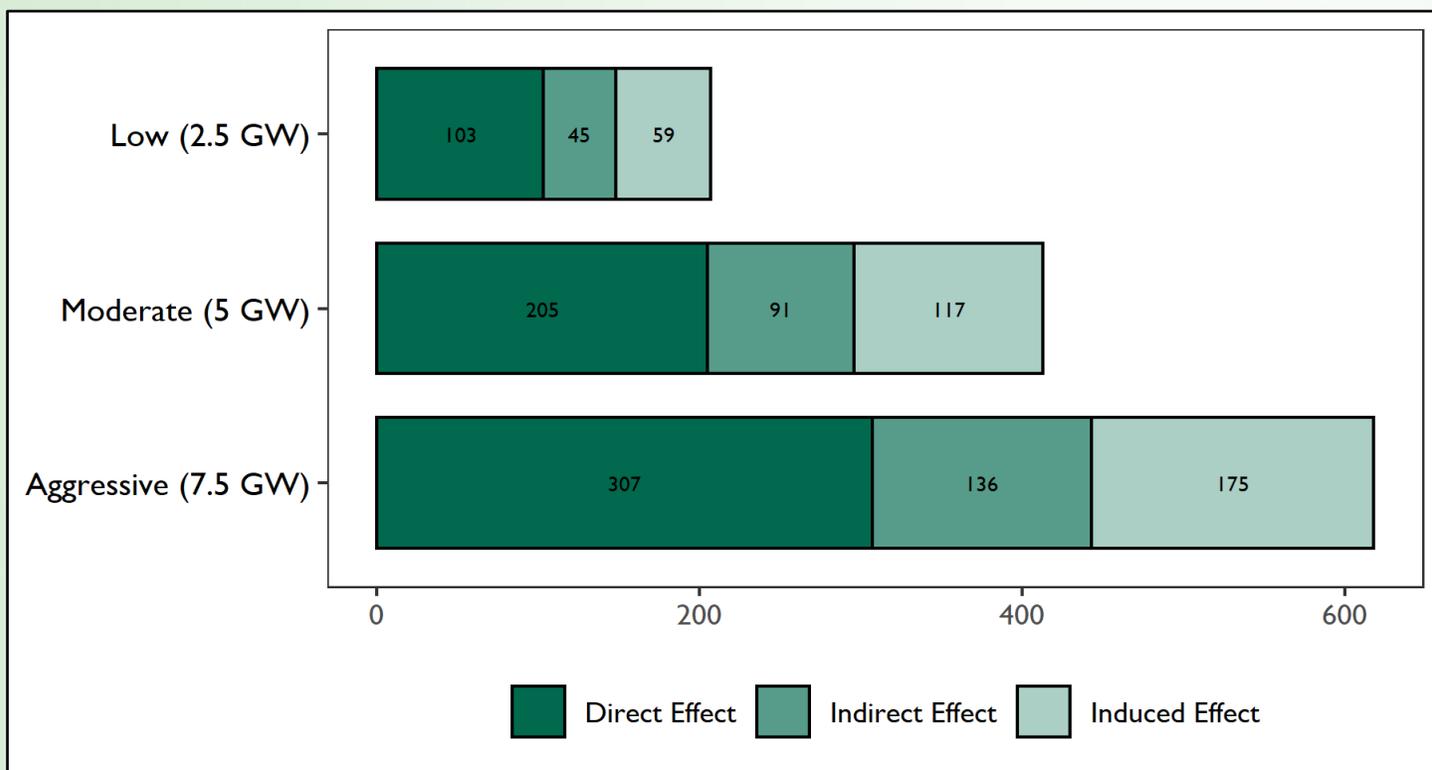
One-Time Construction Phase Economic Impacts



Figures developed by author.

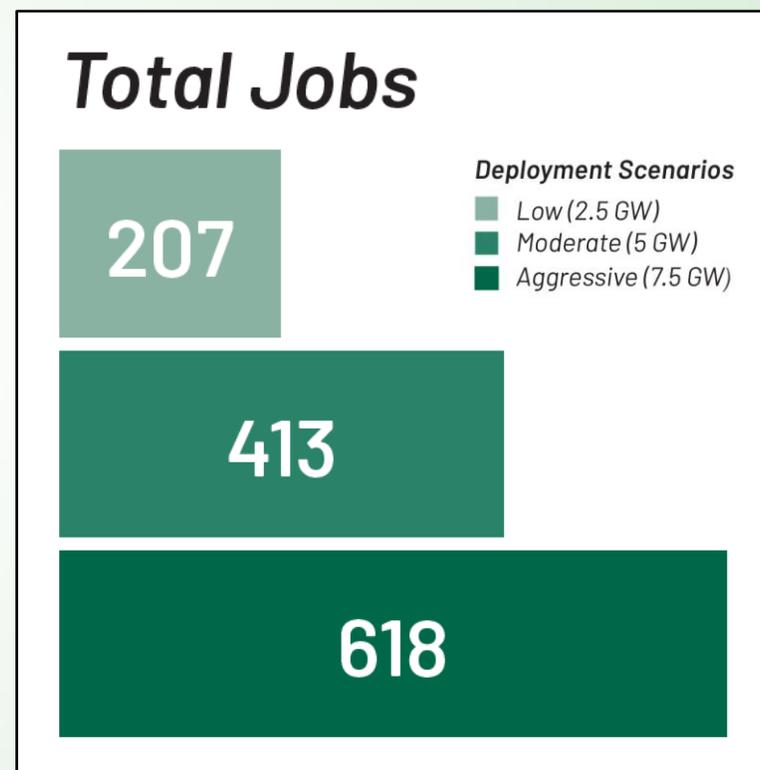


Annual O&M Phase Employment Impacts

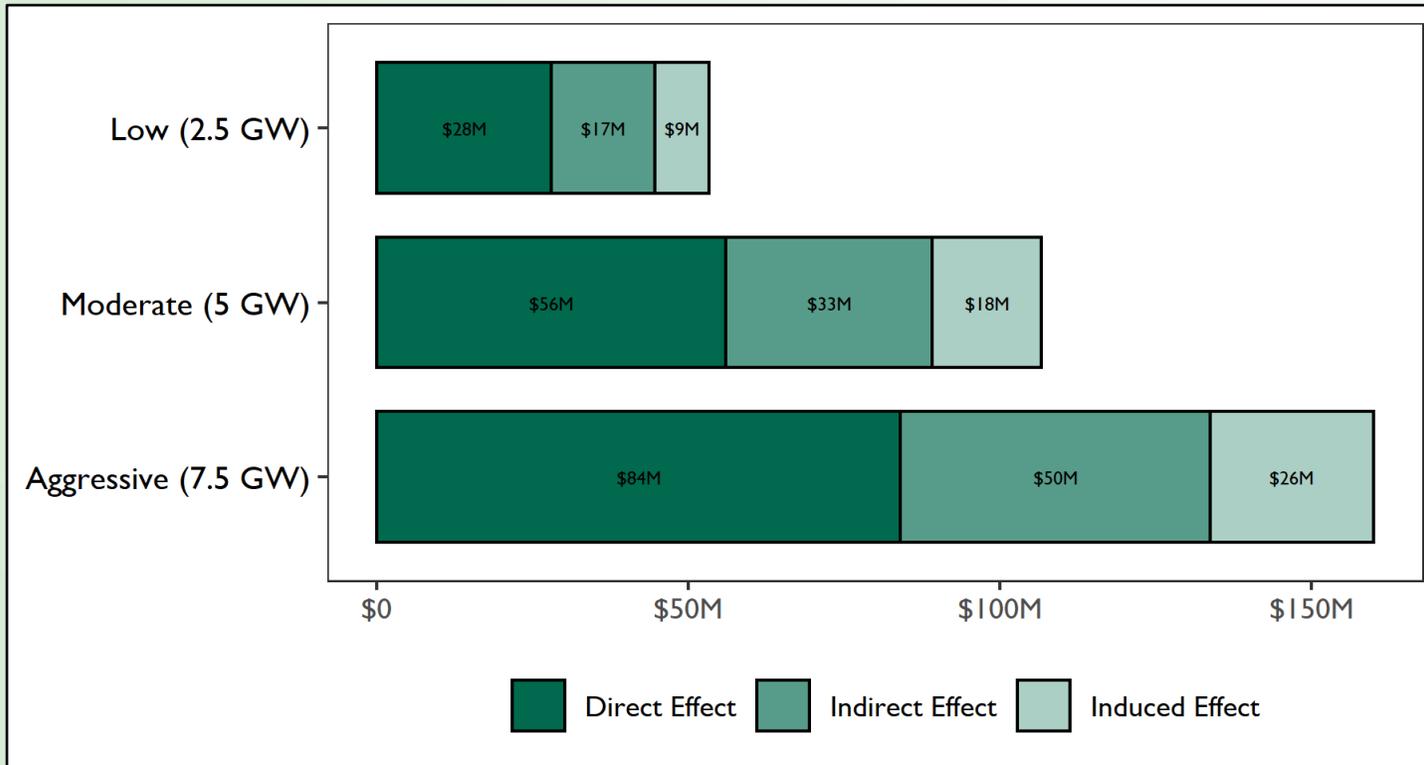


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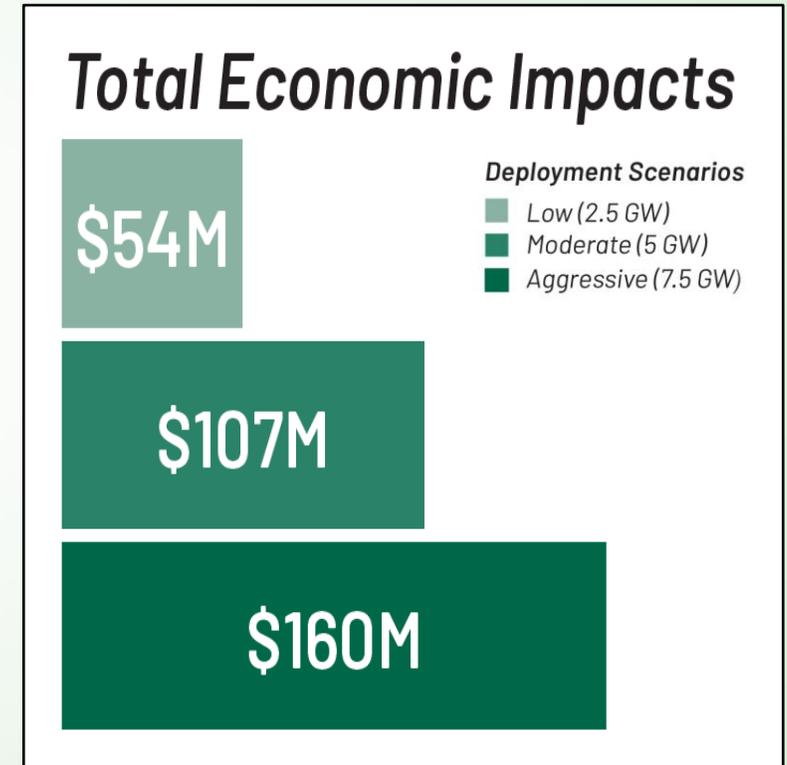
Employment expressed as full-time equivalents (FTE).



Annual O&M Phase Economic Impacts



Figures developed by author.



Workforce Impacts

	Estimated Ohio Workforce in 2020
A: Needed Across all Phases	
Electrical Engineers	6,422
Engineering Technicians	3,224
B: Manufacturing	
Advanced Manufacturing Technicians	3,382
Computer Control Operators	1,288
Industrial Engineers	15,248
Mechanical Engineers	15,709
Environmental Engineers	1,242
Materials Scientists	669
C: Onsite Labor (Const. + O&M)	
Electricians (Solar PV Installers)	25,316
IT Specialists	19,017
Software Engineers	5,875
Structural Engineers	8,293

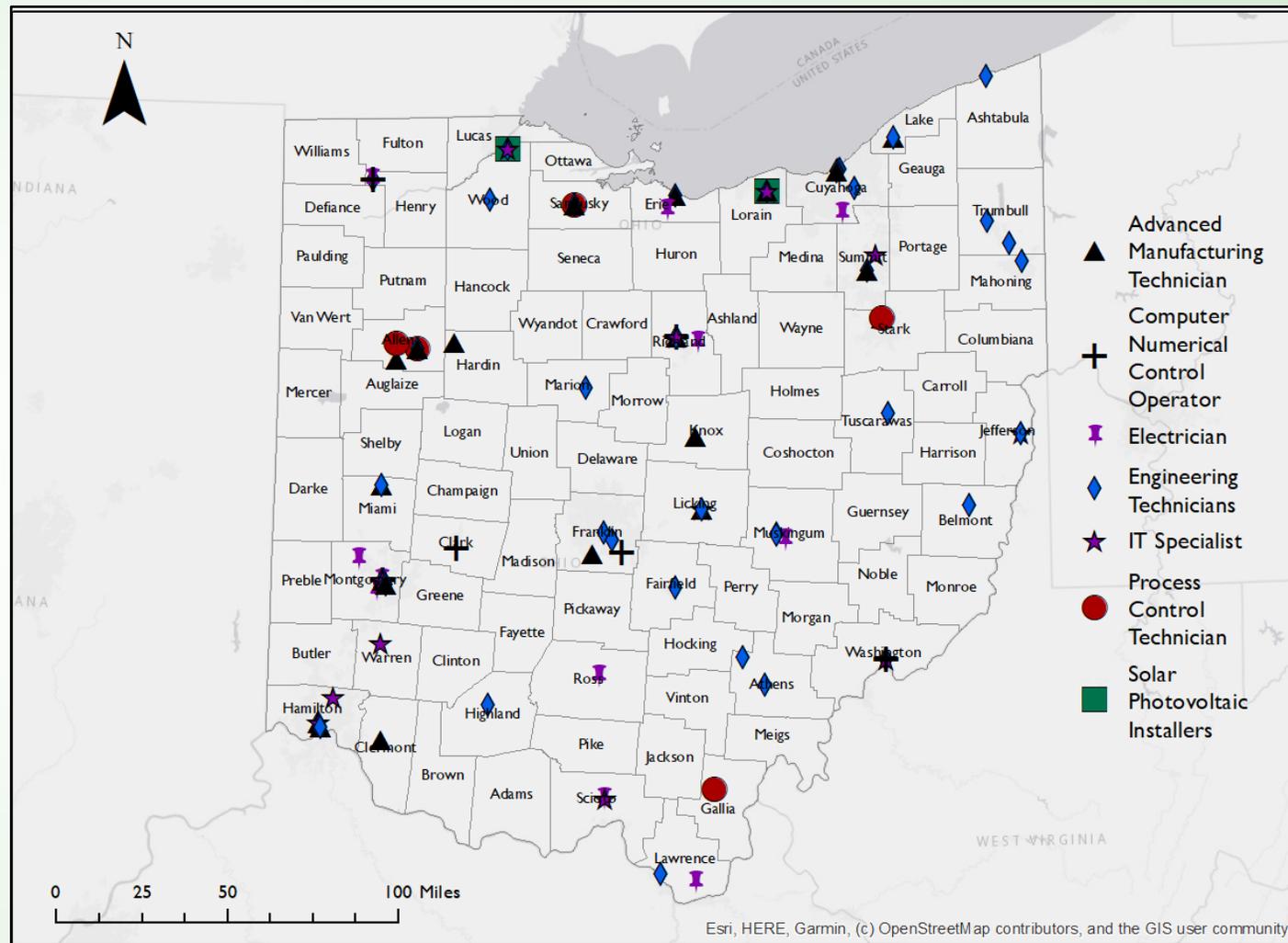


Figure developed by author, with data from CareerOneStop, United States Department of Labor, Employment and Training Administration. (2020). *Find local training*. Retrieved from <https://www.careeronestop.org/FindTraining/find-training.aspx>

Estimated Ohio workforce in 2020 and projected annual increase in employment is based on the Ohio Occupational Employment projections Report 2016–2026.

Workforce Impacts – Wages

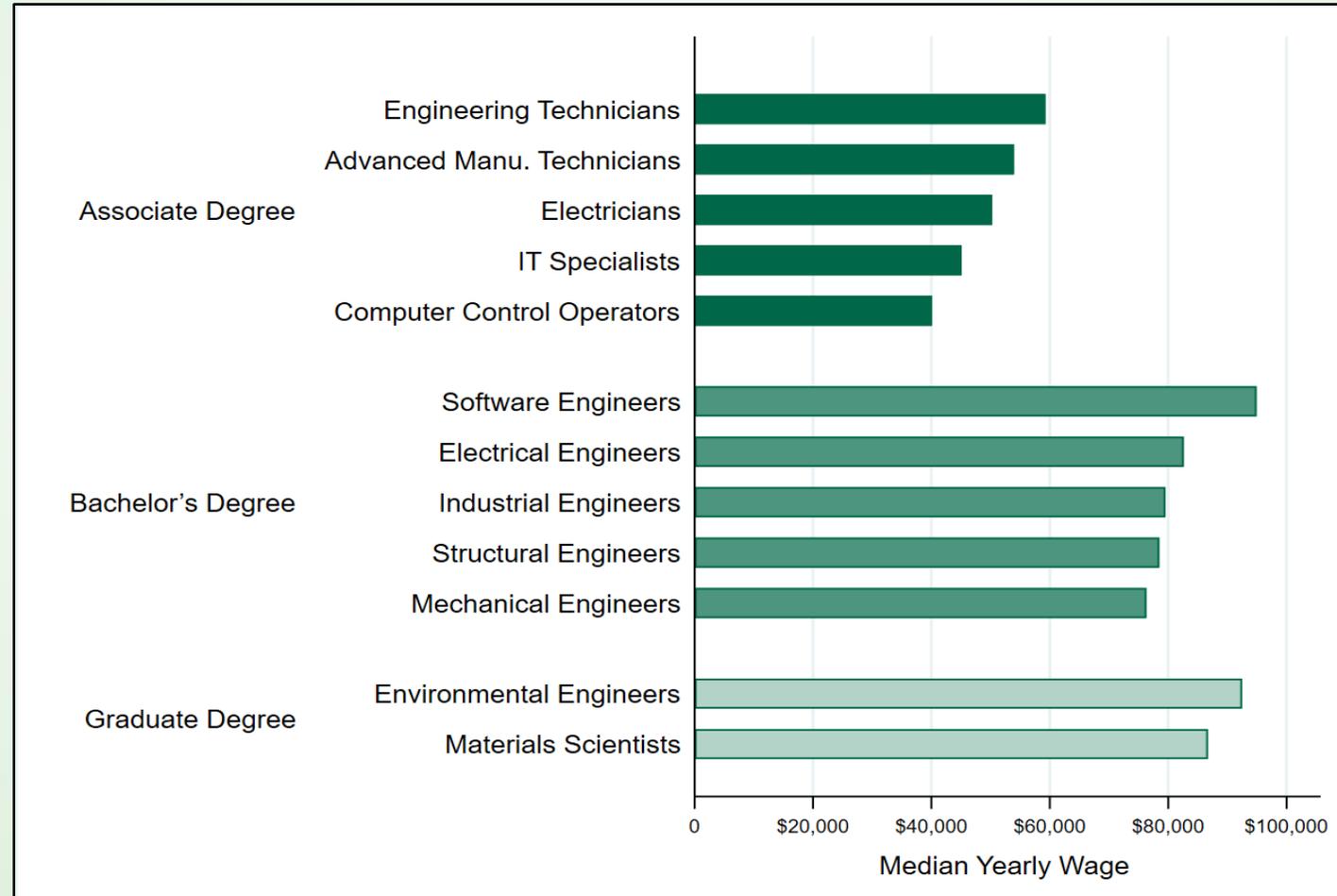
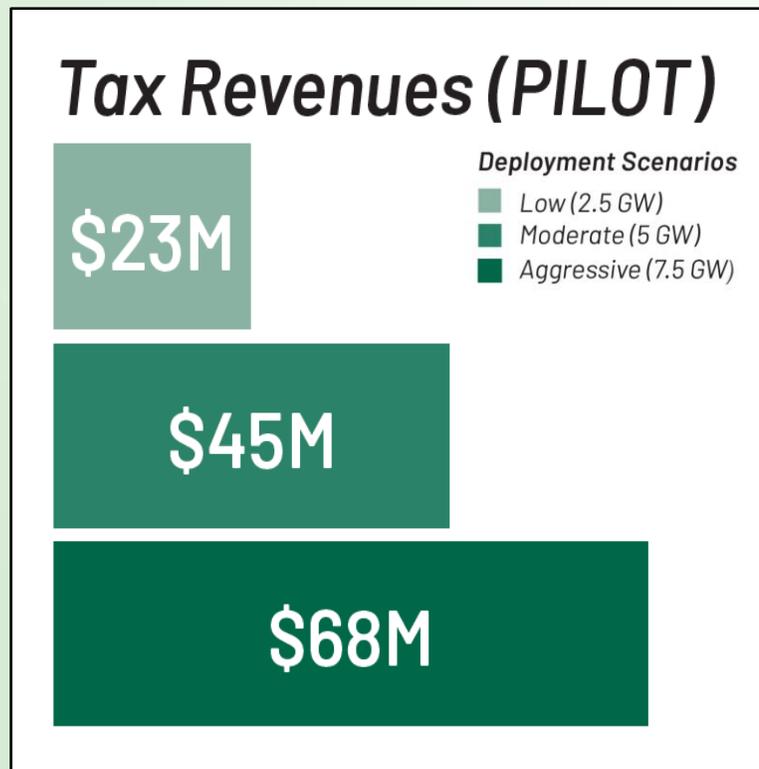


Figure developed by author, with data from O*NET (see: <https://www.onetonline.org/>).

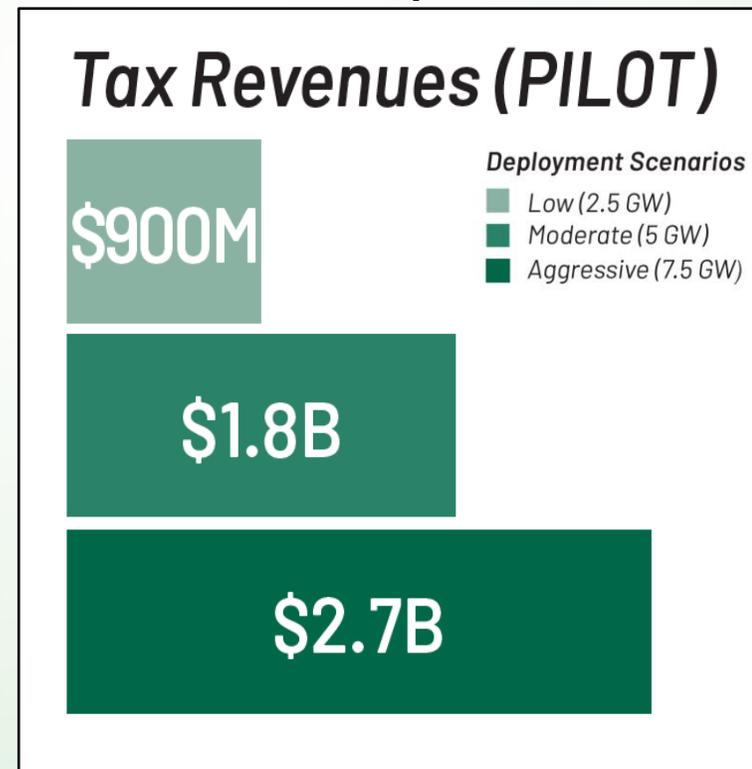
Tax Revenues via PILOT Program (Ohio)

- Service payment of \$7,000–\$9,000/MW of nameplate capacity required in lieu of property taxes (SB 232, 2010). Benefit local schools, health systems, senior citizens, etc.

Annual



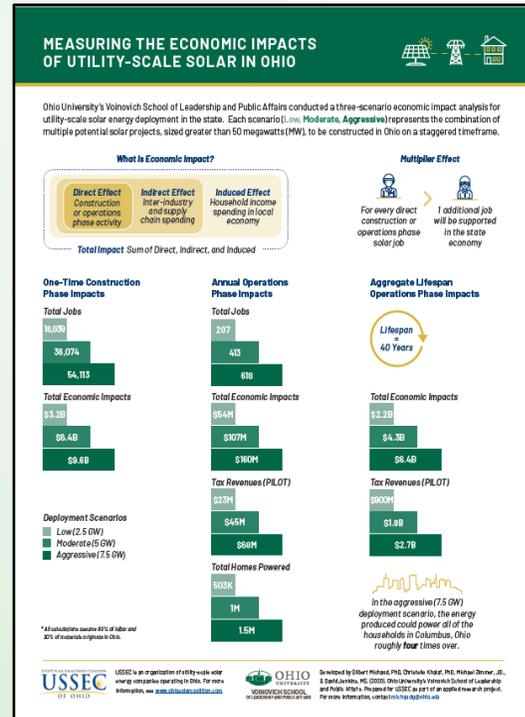
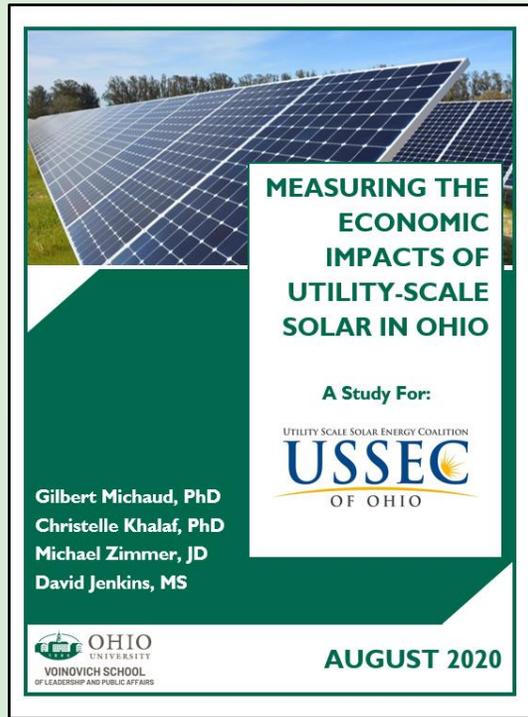
Lifespan



Figures developed by author. Ohio Revised Code. (2019). 5727.75 Exemption on tangible personal property and real property of certain qualified energy projects. Retrieved from <http://codes.ohio.gov/orc/5727.75>.

Wrap-Up

- Several large, utility-scale solar projects emerging across Ohio
- Multitude of positive benefits that solar energy is bringing to communities
 - Economic growth, durable job creation, income generation, and new economic clusters



For the full report, as well as a one-page overview, please see: <https://www.ohio.edu/voinovich-school/news-resources/reports-publications/utility-scale-solar>

For additional questions/comments, email michaudg@ohio.edu



Ohio's Solar Expansion

A compelling opportunity for end-users of electricity, landowners, and local communities

25th Annual Ohio Energy Savings and Management Conference
February 2021

Open Road Renewables Background

- Austin, TX-based utility-scale renewable energy project development company
- Open Road principals formerly with:
 - Pioneer Green Energy (1,500 MW of operating/under construction wind and solar)
 - SunEdison (developed 18 operating solar projects in PJM)
- Extensive development experience in large-scale solar
- Midwest focus; solar project size generally in the 100-200 MW range (which sit on 1,000 – 1,500 acres)
- Active in Ohio for the past ~5 years
 - Under Construction: 200 MW Hillcrest Solar Project in Brown County
 - Permitted: 150 MW Willowbrook in Highland County
 - Active at the Siting Board: 3 projects totaling ~300 MW (Preble and Champaign Counties)
 - Earlier stage development: ~5+ projects
- Multi-disciplinary skillset development team of “swiss army knife” problem solvers
- Founding member of the Utility-Scale Solar Energy Coalition of Ohio (USSEC)

What's driving the interest in solar in Ohio?

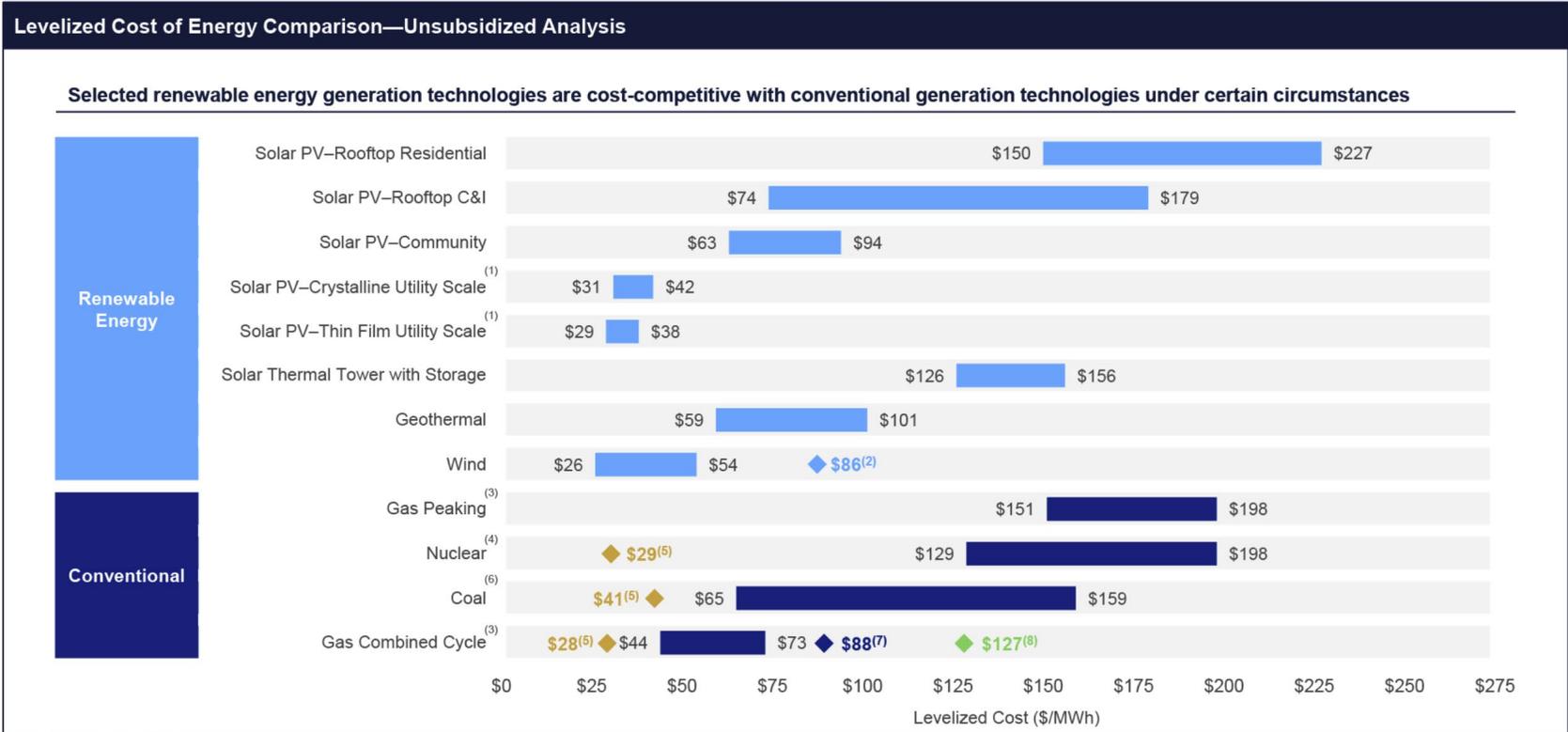
- Within the marketplace, there are 3 Key Drivers:
 - Declining Cost of Solar
 - Corporate Demand
 - State and PJM-wide RPS Demand
- So, why Ohio?
 - 10M+ acres of tillable land
 - Robust transmission system....though injection capacity is limited
 - Underlying PJM wholesale marketplace
 - Local opportunity for economic development
 - Thorough and Constructive siting regime at the Ohio Power Siting Board

What are the “lessons learned” thus far?

- Local engagement: early and often
 - There’s an opportunity to build trust by engaging with the local community as the project begins to clear early feasibility milestones
- Local engagement: best to connect with many stakeholders
 - Its best to engage with folks across the community from the neighbors to the County Commissioners to to the County Engineer to the County Auditor to begin answering questions and building trust
- There are a finite number of project sites that are viable as a result of the transmission infrastructure and injection capacity constraints
- There’s a balance of property rights between participating landowners and neighbors when it comes to appropriate setbacks from property lines and other considerations
- Working through the OPSB process, especially when complemented by local engagement, is a well-established process that allows for constructive engagement by a wide group of stakeholders

What's driving the interest in solar in Ohio?

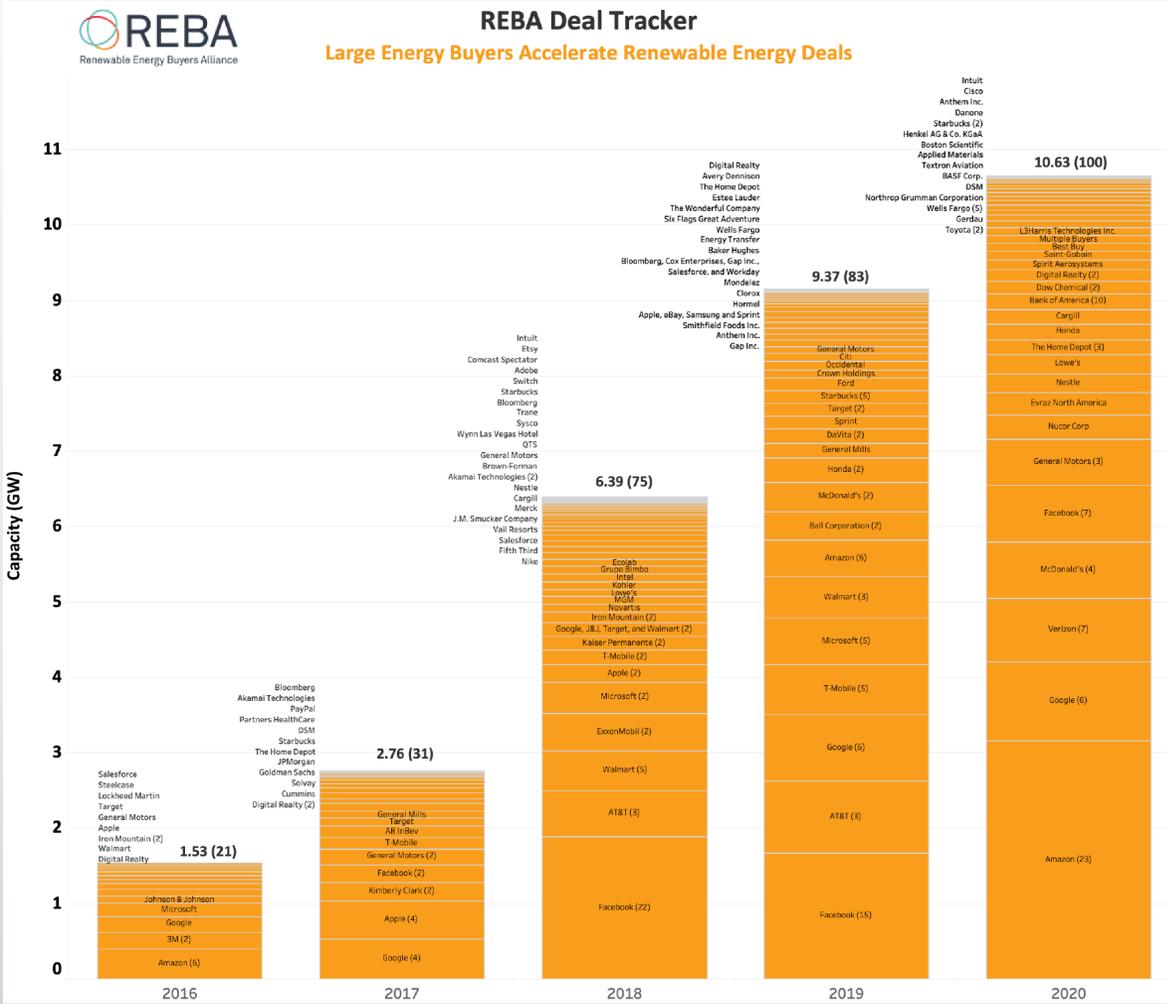
- Declining Cost of Solar
 - Comparison of Solar vs other generating technologies



Source: Lazard

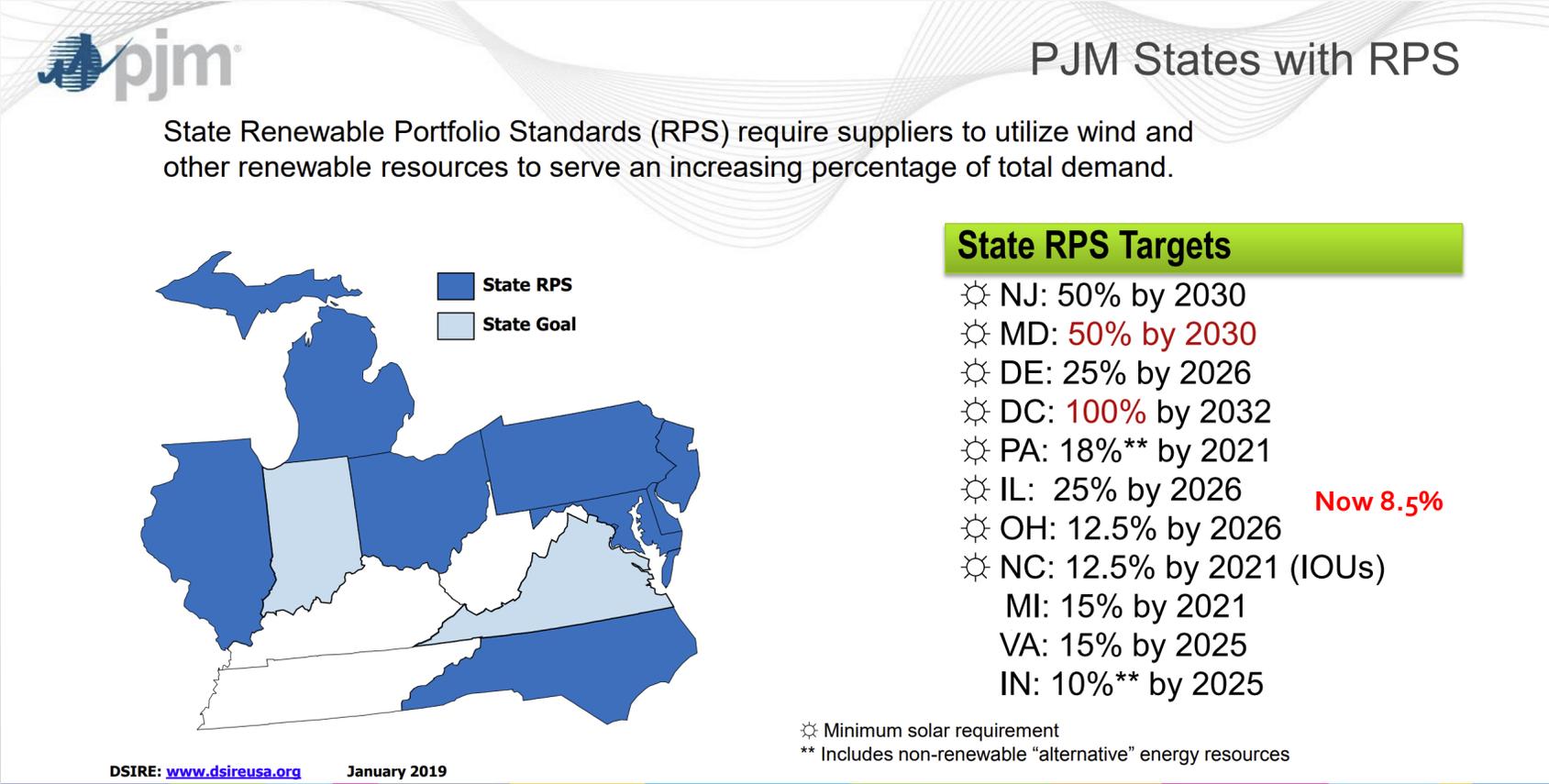
What's driving the interest in solar in Ohio?

- Corporate, University, and Municipal Demand



What's driving the interest in solar in Ohio?

- OH-based and region-wide RPS demand



Source: PJM

How does a solar project come to life?

- With the supply side of the equation (i.e. falling cost of solar) and demand side of the equation (Fortune 500 & RPS demand) understood, how does a utility-scale solar project come to life?
 - 4-5 year Development cycle: Identifying candidate sites
 - 12-18 month Construction cycle
 - 40+ year Operating life
 - Decommissioning

Site identification...there's a limited number of candidate sites

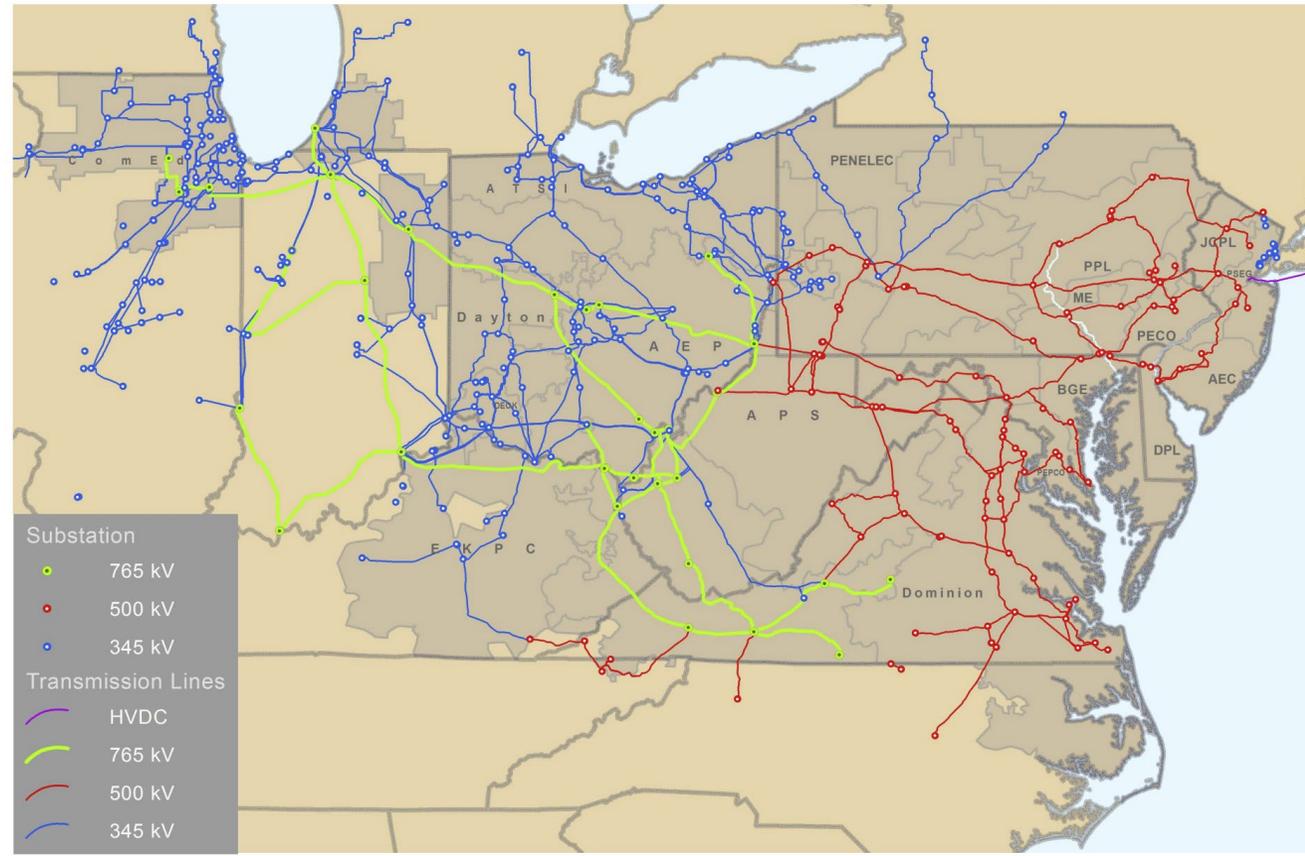
- 4-5 year Development cycle



Site identification...there's a limited number of candidate sites

- 4-5 year Development cycle

Map 1: PJM Backbone Transmission System



Once a site has been identified, what are the next steps?



November 26, 2018

John Doe
123 Fourth St.
Paradise, AL 12345

Dear Mr./Mrs. John Doe:

Open Road Renewables is developing a solar energy farm near your property in ABC County, Ohio. The solar farm will consist of a collection of solar panels installed on the ground that will deliver energy to the Dominion power lines that serve your region. The project will generate clean, quiet energy as well as provide financial benefits to participating property owners and to the community at large.

Our solar farm is in the design stage. We are currently working with a handful of land owners in your area and would like to discuss the potential to participate in this opportunity through either a long-term lease or provide us an option to buy part of your land.

The solar farm offers significant financial benefits to property owners who participate. Once the solar farm begins generating electricity, property owners with a long-term lease receive annual payments that are significantly higher than agricultural rents or timber revenues. Due to the low impact of the equipment, the land will be returned to agricultural use at the end of the lease. Property owners who prefer to provide us an option to buy receive a purchase price that is well above market rates.

We at Open Road have many years of experience developing successful energy projects across the country, including a number of solar farms now in operation. We are passionate about making the promise of clean energy and economic security a reality for communities across the country. In fact, Open Road considers its relationships with property owners participating in our solar farms to be the key ingredient for success. In that regard, we would be happy to introduce you to other property owners, from Maryland to Texas to Georgia, with whom we have worked and now enjoy the benefits of participation.

I would greatly appreciate the opportunity to discuss our plans with you, by phone or in person, at your earliest convenience. Please feel free to call or e-mail me using the information below. I look forward to exploring this opportunity with you.

Kind regards,



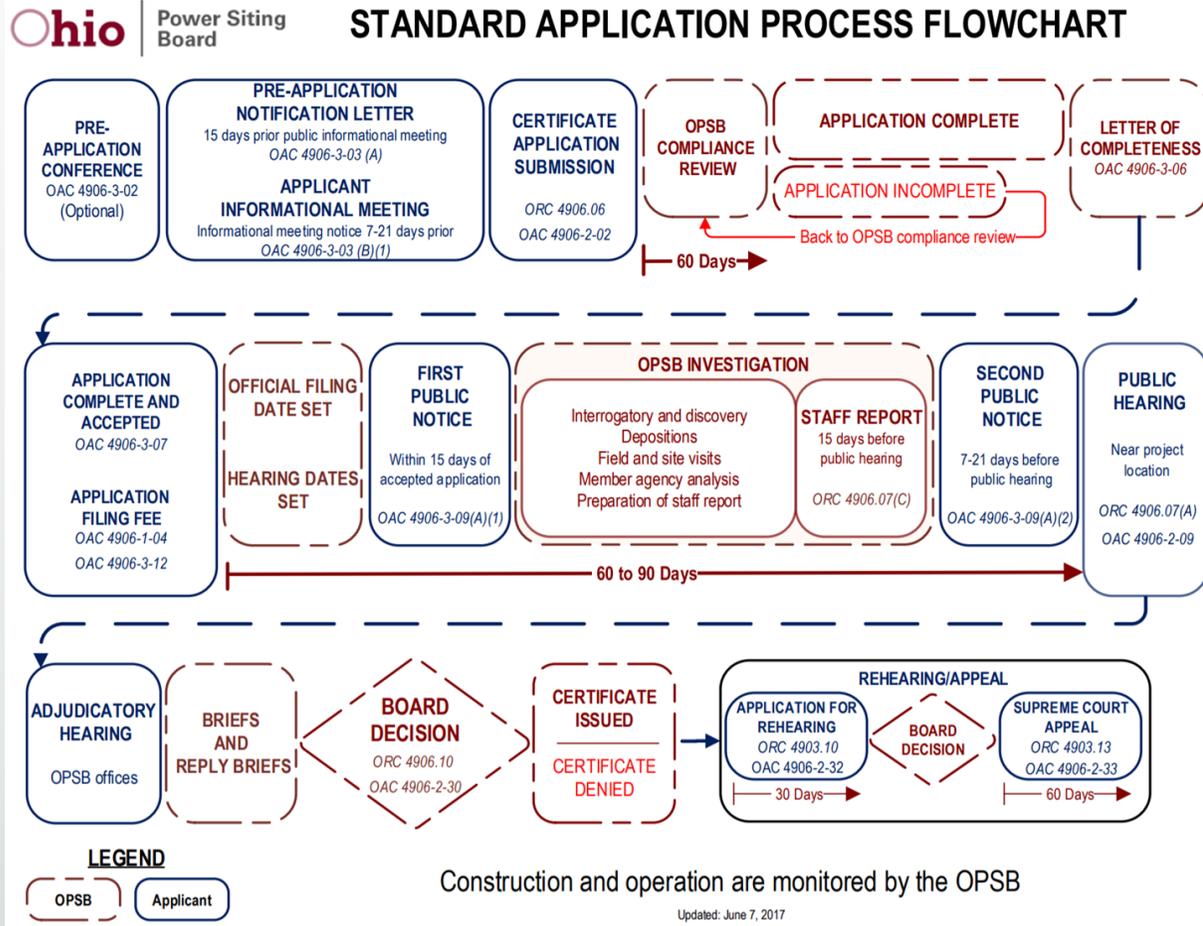
Mike Volpe
Vice President
(404) 769-3824
Mike@openroadrenewables.com



Once a site has been identified, what are the next steps?



Once a site has been identified, what are the next steps?



The Ohio Power Siting Board’s mission is to support sound energy policies that provide for the installation of energy generation and transmission infrastructure for the benefit of Ohio citizens, promoting the state’s economic interests, and protecting the environment and land use.

- Board is comprised of:
 - Public Utilities Commission Chairman
 - Director of EPA
 - Director of Department of Agriculture
 - Director of Development Services Agency
 - Director of the Department of Health
 - Director of the Department of Natural Resources
 - Member of the public (always an engineer)
- The board oversees all projects over 50MW
- **Significant opportunity for local involvement in process.**

Addressing common concerns through Siting Board conditions

Notable conditions that have been proposed by OPSB Staff on recent project(s):

- Must establish a landscape and lighting plan:

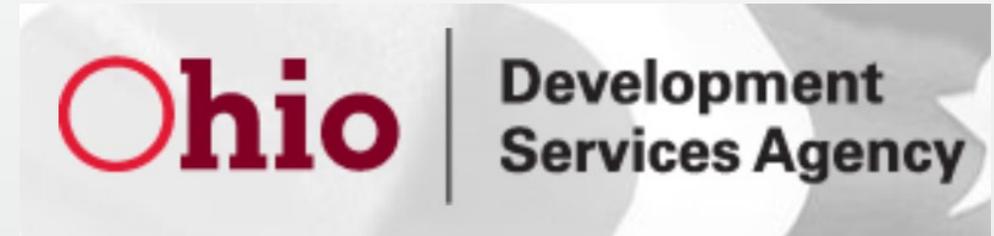
"Unless alternative mitigation is agreed upon with the owner of any such adjacent, non-participating parcel containing a residence with a direct line of sight to the fence of the facility, the plan shall provide for the planting of vegetative screening designed by the landscape architect to enhance the view from the residence and be in harmony with the existing vegetation and viewshed in the area. The Applicant shall maintain vegetative screening for the life of the facility and the Applicant shall replace any failed plantings so that, after five years, at least 90 percent of the vegetation has survived."

- Mitigate drain tile damage and repair any damaged tile in accordance with ASTM F499-02
- Establish a vegetation management plan
- Road Use and Maintenance Plan requirement
- Local Fire and EMS training
- Bonded decommissioning plan prepared by a licensed Professional ENG

Finding win-wins with local communities

Local Economic Development Opportunity

- Landowner Payments
- Construction & Operations Jobs
- Local Tax Revenue
 - Payment in Lieu of Taxes
 - \$7000/MW/YR paid to local taxing jurisdictions
 - Majority of this payment will go to the local School districts
 - Additionally, “need-based” funding that local School districts receive from the State will not be decreased by PILOT proceeds
 - \$2000/MW/YR paid to the County General Fund
 - Additional Local Benefits:
 - Road Use and Maintenance Agreement
 - Training and Equipment Agreement with Emergency Services
 - Scholarship or Workforce Training Agreement with local university or vocational school
 - 80% of Construction and Operations jobs must be filled by Ohio residents



Transitioning from the development to construction phase

Solar construction takes 9 – 12 months and is designed to have a minimal impact on the land. No concrete is used for foundations and use of heavy machinery is limited to deliveries, piling installation, and burying electrical cables.

- Pilings & Racks
 - No foundations → piles driven into ground 6 – 10 feet
 - Racking is mounted at 6-10 feet off the ground (on high end of module)
 - Single-axis trackers (rotate east-to-west)
- Solar Modules (“panels”)
 - Non-reflective glass (<2% reflection)
 - Rows of modules are 15 – 20’ apart



What happens after a solar project comes online?

- Largely a passive land use....the solar panels collect energy and deliver it to the bulk transmission system
- The off-taker of the power generally locks in a fixed rate for solar energy for 15-20 years
- At the end of the 15-20 years, the project will continue operating and generate revenue from the “merchant” PJM wholesale market
- PJM views solar facilities as “Reliability Resources” with 60% of their facility nameplate being eligible in the PJM Capacity Market
- Every year the project will make sizable payments to the local county government supporting schools, townships, and other local governmental needs
- At the end of the project’s useful life (35-40 years), all of the equipment is removed and the land is returned to productive agricultural land



Should Ohioans support utility-scale solar development?

- Utility-scale solar is now a least-cost resource that has the potential to keep OH's wholesale energy costs low
- Energy resources that don't have any fuel-costs, like solar, have the ability to act as a natural hedge to natural gas price fluctuations and reduce energy price volatility for end users
- Farmers across the state have the opportunity to increase the revenue (and reduce volatility) on their tillable acreage by participating in a solar project
- While some communities initially oppose solar development, ORR believes that communities' concerns can be addressed by best-in-class development, construction, and operations
- We believe that the PILOT revenue from solar projects has the ability to provide a meaningful contribution to local school, township, and county budgets
- We believe there is a compelling economic argument for utility-scale solar for end-users of electricity, participating landowners, and communities that host these facilities
- Feel free to contact me at Mike@OpenRoadRenewables.com



ustainability
YMP  SIUM

2020



GM Strategy – Energy Transformation



**Buy Better/Invest Smarter =
Spend Better/Respond Smarter**

Energy Procurement / RE100 "Zero Emissions"

- Advocacy/Policy
- Rates
- PPA/Procurement
- RTO Stakeholder Engagement
- Reliability and outage control/mitigation

Public Investor Reporting

- CDP Reporting
- DJSI
- RE100 Reporting
- Fleet Customer Requests
- EPA Energy Star/Greenpower
- Communications

Systems

- GM2100, added RE Dashboard
- Energy OnStar (EoS)
- Edison Energy

GM Sustainability Goals

- 2040 100% electricity (RE)
- 2030 100% U.S facilities (RE)
- Absolute reduction of carbon by 31% from 2010 baseline
- Reduce Energy Intensity by 20% from 2010 baseline

Processes

- Savings opportunities
 - E\$PI's
 - EPC's
- Energy Conservation Engineer work
- Energy Treasure Hunts
- 50001 Ready
- CUC Equipment (large energy users)

GM Sustainable Energy, Supply, & Reliability Team Plus Energy Carbon Optimization



HOW GM WILL ACHIEVE 100% RENEWABLE ENERGY



INCREASING
ENERGY
EFFICIENCY



SOURCING
RENEWABLES



ADDRESSING
INTERMITTENCY
THROUGH
BATTERY STORAGE



INFLUENCING
POLICY TO
DRIVE SCALE



GENERAL MOTORS

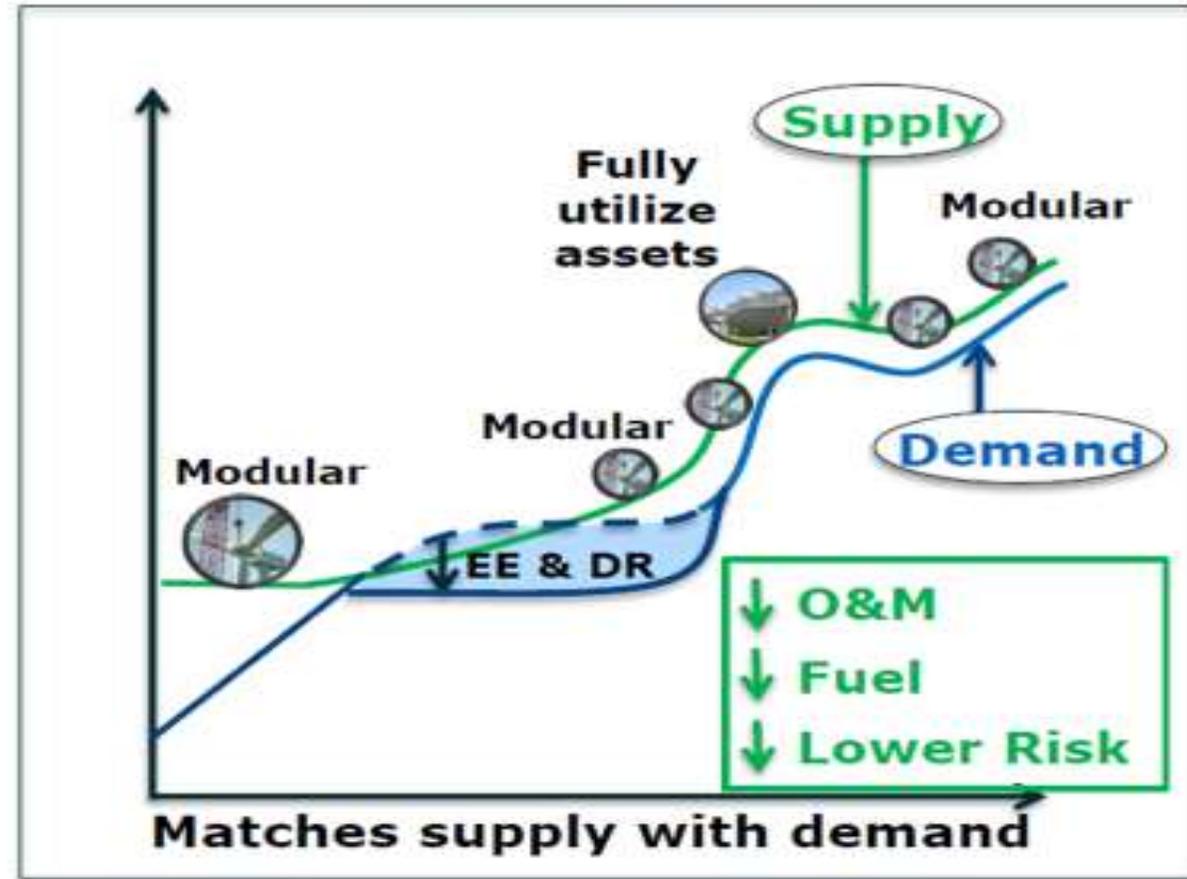


Clean & Lean Utilities and GM Powerhouse (CUC)/WWTP "Procurement

Old Utility Model



Clean And Lean





OVERVIEW OF GM'S ENERGY MANAGEMENT PROCESS & GLOBAL MANUFACTURING SYSTEM

Integrating Energy into your business plan will make it a sustainable part of your operations

What is needed to be successful?

- Top leadership support
- Resources (dedicated people and budget)
- Establish Energy as a pillar of business plan

Tool kit for implementation

- Benchmarking*, Goals, and Scorecards
- Meter data, dashboards
- Continuous commissioning
- Budgeting and forecast
- Energy Savings Project Implementation Process
- Recognition



GM has been an Energy Star® partner for 20 years

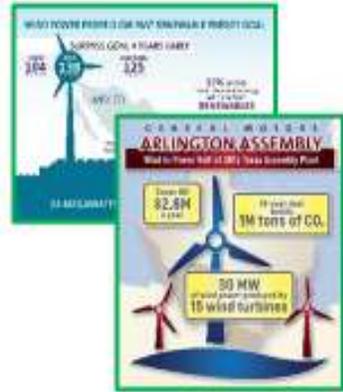


RENEWABLE ENERGY AS A STRATEGIC INVESTMENT

Offsite PPA

Green Tariffs

Onsite Investment



First Solar is a pioneer in PV module circularity, recovering as much as 90 percent of the materials, including its CadTel semiconductor, from every module processed at its recycling facilities in Ohio. (Photos and captions are courtesy of First Solar, Inc.)

General Motors is Leading a Sustainable Renewable Energy Transition in the U.S.

New solar agreement brings renewable power to the Midwest and will push GM beyond the 1 GW threshold of renewable electricity use

2020-09-30



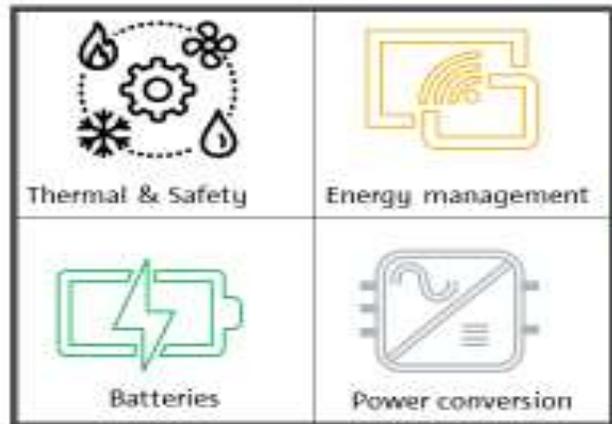
- GM will source 180 MW of solar power from a new project in Arkansas developed by First Solar, Inc.
- The solar modules will be sourced from First Solar, Inc. – America's largest solar manufacturer.
- The deal will source power for 100 percent of GM's Wentzville Assembly and Lansing Delta Township Assembly, with the remaining power allocated to Lansing Grand River Assembly.
- When the project comes online in 2023, GM expects to be over 60 percent of the way toward its goal of sourcing 100 percent renewable electricity for GM's sites in the U.S. by 2030.

DETROIT – General Motors announced today a new power purchase agreement for a 180-megawatt solar project, the equivalent of about 47,882 U.S. homes' electricity use for one year. The solar energy will come from a new solar field in Arkansas originally developed by First Solar, Inc. and will use photovoltaic solar modules. With this agreement, GM has



ENERGY STORAGE SYSTEMS (ESS) AND THEIR USE CASES

ESS Architecture

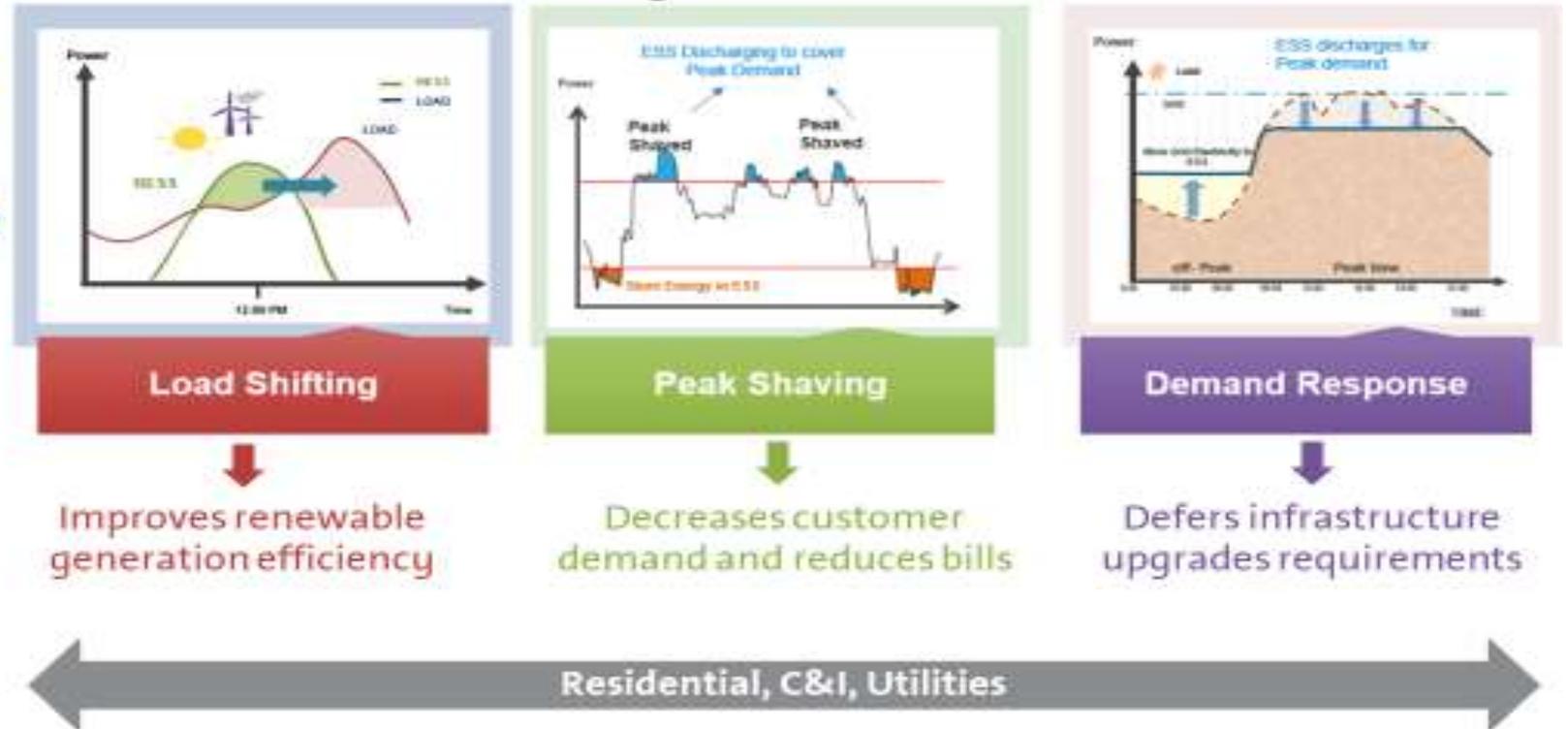


Leveraging:

- 1st use battery modules
- 2nd life battery modules



Example of Functions enabled by ESS on the electrical grid that benefit a range of customers





2020 GM Announcements





GENERAL MOTORS
SPRING HILL VEHICLE ASSEMBLY
WILL BE POWERED BY THE SUN

1ST
This is the first large-scale solar project for GM.

50%
This project is expected to bring GM's use of renewable energy to more than 50% in the U.S. by 2023.

3 GREAT VEHICLES
The Cadillac XTS, Cadillac XT6 and GMC Acadia SUVs* are all assembled at Spring Hill.

100 MW
It will have a 100 megawatt capacity produced by the sun.

18k
This is equivalent to the power consumed by nearly 18,000 US households per year**

*Cadillac XTS, XT6 and GMC Acadia built in Tennessee from U.S. and globally sourced parts. **According to the EPA Droughtwise Gas Equivalency Calculator.



General Motors is Leading a Sustainable Renewable Energy Transition in the U.S.

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Combines:
1) Locally
Source
Panels
2) Circularity

GM surpasses 1GW of RE
Procurement equivalent output

- 2000 Corvette Z06s
- 110 million LEDs
- 750,000 homes



Awards and Organizations



GM EPA Green Power Award

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General Motors Receives EPA Green Power Leadership Award

NATIONAL AWARDS HONOR LEADING GREEN POWER USERS



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Questions?