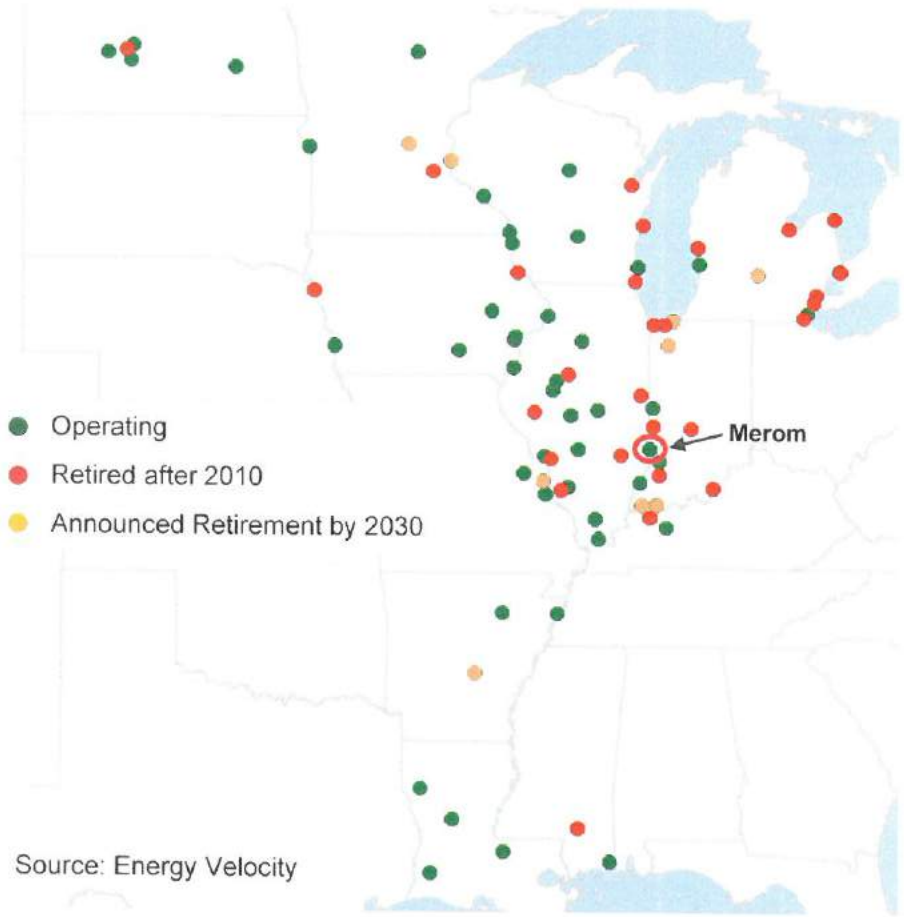
Henry County Planning Commission

February 20, 2020

Coal units in MISO – operating and retired as of June 2019

Location of Coal Units in MISO
Operating, Retired, Announced Retirement



Comments

- Since 2010, approximately 10% of coal-fired capacity has been retired in MISO*
  - 52 units total
  - Smaller units: 210 MW ave.
  - Most due to environmental compliance considerations
- Approximately 15% of remaining capacity has been announced for retirement in the next 10 years
  - 28 units total
  - Unit size: 420 MW ave.

**Greater than >100 MW*

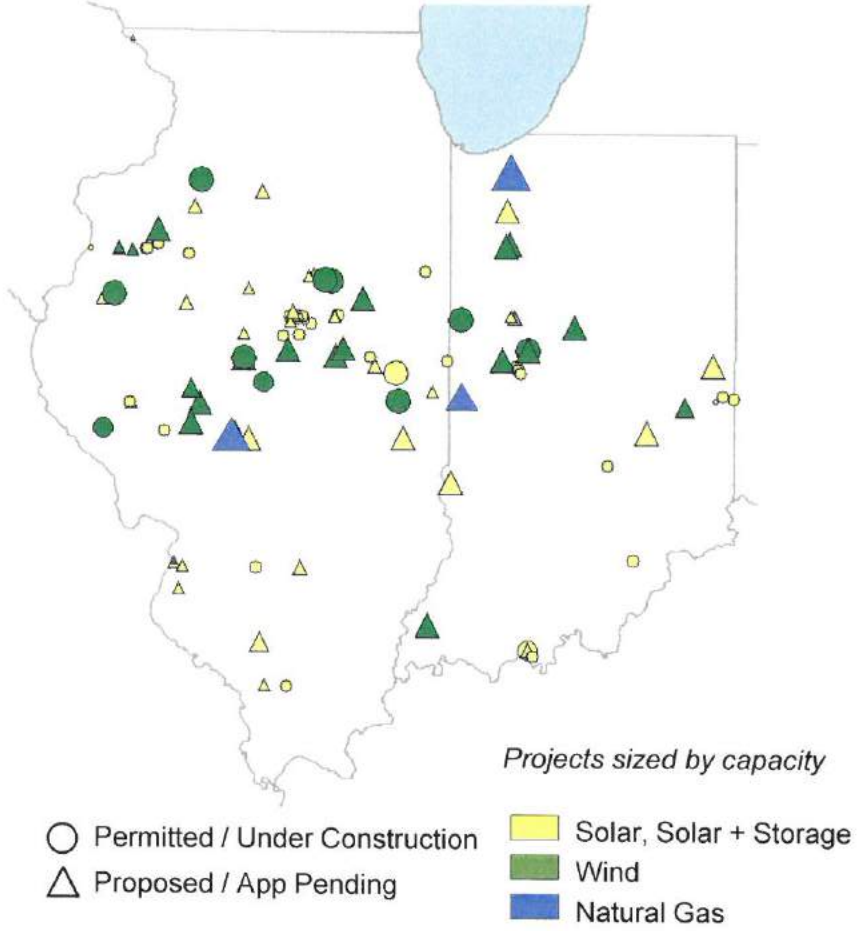
Many utility-scale alternatives are currently proposed and under development in the region

- Over 36,000 MW of new projects are in the MISO interconnection queue
- Over 2,000 MW has been permitted or is under construction in IL and IN

Projects in the MISO Interconnection Queue

	Project Count	Project Capacity
Solar	147	21.5 GW
Solar + Storage	17	2.4 GW
Wind	39	6.6 GW
Battery Storage	16	1.1 GW
Combined Cycle	8	4.2 GW
Gas Peaking	5	0.5 GW
Total	**232**	**36.3 GW**

MISO Proposed Projects Map



Source: MISO Interconnection Queue; Velocity Suite – EIA, FERC, NRC, SEC, CEMS & other federal regulatory data

Coal Plant announcements since June 2019

- June 2019 - Duke Energy Indiana proposed a plan that calls for accelerating the retirement of seven coal units, and shuttering 10 units totaling more than 4 GW over the next seven to 19 years.

- July 2019 - American Electric Power Co. (Indiana Michigan Power) plan to retire its Rockport 1,300 MW Unit 1 by the end of 2028

- December 2019 - Indianapolis Power & Light Co. officials outlined their plans for retiring the 230 MW Unit 1 in 2021 and 415 MW Unit 2 in 2023 at the utility's massive Petersburg Generating Station.

- January 2020 - Hoosier Energy announced a plan to retire the coal-fired 1,070 MW Merom Generating Station in western Sullivan County in 2023

Grid Modernization

Rapid growth in variable renewable energy generation and new regulatory policies governing performance criteria for their interconnection with the grid are driving the demand for grid-modernization

Grid modernization can deliver greater quantities of zero-to low-carbon electricity reliably and securely, including handling variable renewables like wind and solar power. It can support the electric vehicle revolution and increase grid resilience to withstand climate impacts. It can spread economic opportunity in rural and urban communities through electricity and transportation infrastructure investment and upgrades. And, it can improve system efficiencies and reduce costs by reducing the need for expensive and dirty power plants that only run a few hours per year (these are called "peakers").

The US obtained about 10% of its electricity generation from wind and solar in the spring of 2017 (counting distributed solar), with some regions much higher on individual days. A modern grid will allow higher levels of renewable energy by improving weather prediction, limiting the effects of local variations, and providing storage and load flexibility (electricity demand that has some leeway to adjust up or down) so that backup power plants won't need to be kept running.

UCS modeling (in The US Power Sector in a Net Zero World) has shown that 55-60% of US electricity could be delivered from renewable energy by 2030, most of this from wind and solar. The US Department of Energy (DOE) explores a scenario of 20% wind power in 2030 in Wind Vision, and DOE's National Renewable Energy Laboratory (NREL) illustrates a pathway to even higher levels of renewables in 2050 in the Renewable Electricity Futures Study. Modernizing our grid will help us best take advantage of those new wind and solar resources.

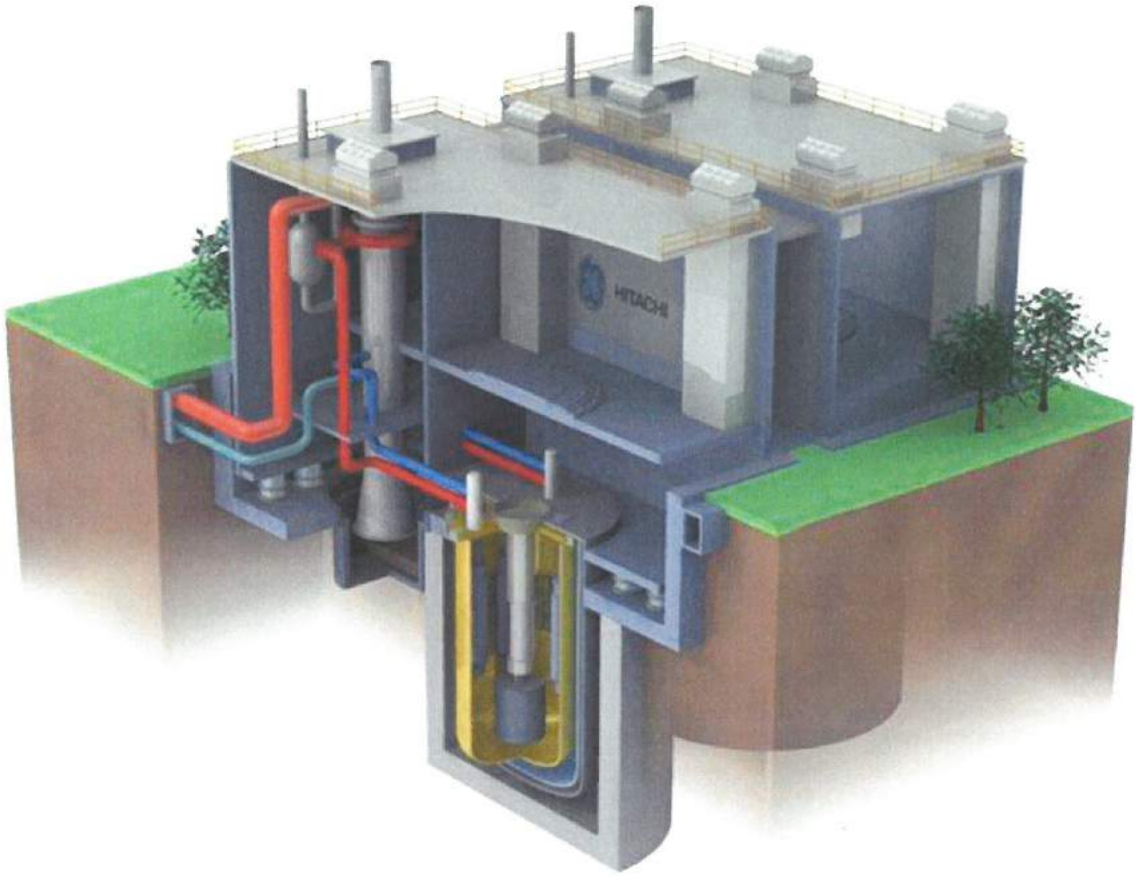
BESS – Battery Energy Storage System (AKA Utility Scale Battery Storage)

https://news.energysage.com/utility-scale-battery-storage/

https://www.eia.gov/todayinenergy/detail.php?id=40072

Storage can inherently act like load (charging from the grid when electricity prices and demand are both low) or like a generator (pushing electricity back onto the grid when demand and prices are both high). What's more, whereas power plants may take minutes or even hours to turn on, battery storage can start injecting electricity onto the grid in milliseconds.

SMRs - Small Modular Reactors



https://www.energy.gov/sites/prod/files/2018/01/f47/Small%20Modular%20Reactors%20-%20Adding%20to%20Resilience%20at%20Federal%20Facilities%20.pdf

SMRs are designed to provide valuable resilience services as a secure, reliable, and flexible source of primary and backup power. SMRs, coupled with transmission hardening, could provide highly reliable, non-intermittent, clean, and carbon-free power. SMRs can also easily store two years' worth of fuel on-site. Certain SMR designs allow for output to be varied over days, hours, or minutes, thereby enabling the SMR to ramp up quickly in the case of a grid outage and adjust to be in line with changing load demands.

This Report identifies the need for energy resilience and how an SMR can provide such a service for federal agencies. As an illustrative example, this Report focuses on the SMR project being developed by the Tennessee Valley Authority ("TVA") in Oak Ridge, Tennessee on a site adjacent to critical U.S. Department of Energy ("DOE") and National Nuclear Security

RICE – Reciprocating Internal Combustion Engines

https://www.power-eng.com/2017/04/18/questions-and-considerations-for-rice-generation-facilities/#gref

https://www.eia.gov/todayinenergy/detail.php?id=37972

https://www.fairbanksmorse.com/hubfs/Resources/whitepapers/MGK%20Guide%20to%20Reciprocating%20Engine%20Generators%20and%20Microgrids%20v4%20(1).pdf

https://www.kiewit.com/plant-insider/current-issue/reciprocating-engines-not-just-backup-anymore/

Natural gas reciprocating engine generators are capturing increasing market share due to emissions regulations and lower fuel costs.

A **reciprocating internal combustion engine** (**RICE**) is any **internal combustion engine** which uses **reciprocating** motion to convert heat energy into mechanical work

Stationary Reciprocating Internal Combustion Engines (RICE) are engines that utilize the expansion of gases and the resultant increased pressure from the combustion of fuel inside a confined cylinder(s) to move one or more pistons back and forth in order to rotate a shaft and produce mechanical power. The mechanical power can be used directly to produce electricity.

RICE generators require less gas pressure than normal combustion turbines and run cooler because they turn heat into mechanical power. Therefore they do not require water cooling systems

Renewable Energy Pricing

Wind and solar power generation prices vary drastically. If the sun is shining bright in the sky at high noon on a given day, the "cost to generate" of a given solar farm is very low. The "cost to generate" is a bit higher in the morning and the evening...due to less sunlight. A 1MW solar farm will have a higher "cost to generate" than a 10MW solar farm at any given point in time. Economies of scale apply. The larger the installation, the lower the "cost to generate". Wind essentially operates the same way. The wind "cost to generate" is very low when the wind is blowing optimally and is a bit higher with marginal winds. The more turbines in place the lower the "cost to generate". Likewise if the company has multiple solar farms or wind farms throughout the MISO footprint, they can "sell" power into the market from different locations, where their "cost to generate" is low, when the market is "buying" at a higher price.

Wind and solar companies can, and have, lowered their overall cost of generation by building multiple facilities in multiple places and "selling" the power into the market when it is the least expensive to generate (wind blowing and/or sun shining) and the market is "buying" at a higher price.

The end result comprises a now much larger pool of renewable energy resources throughout the MISO service area. These resources have been able to buy and sell into the market at competitive prices. When there were few renewable energy resources they struggled "selling" into the market at a competitive rate. As the cost to build has decreased, these resources have grown and have been strategically located throughout the Midwest. Their ability to generate power at an average competitive cost has become a reality.

The trend over the past five years for renewable energy resources has been a steep slope downward. Wind and solar energy resources are competitive in the market because of their average price. That average price today is less than the average price of coal. Natural gas still has a slightly lower average price due to the very low gas prices we have seen in the wholesale natural gas market.

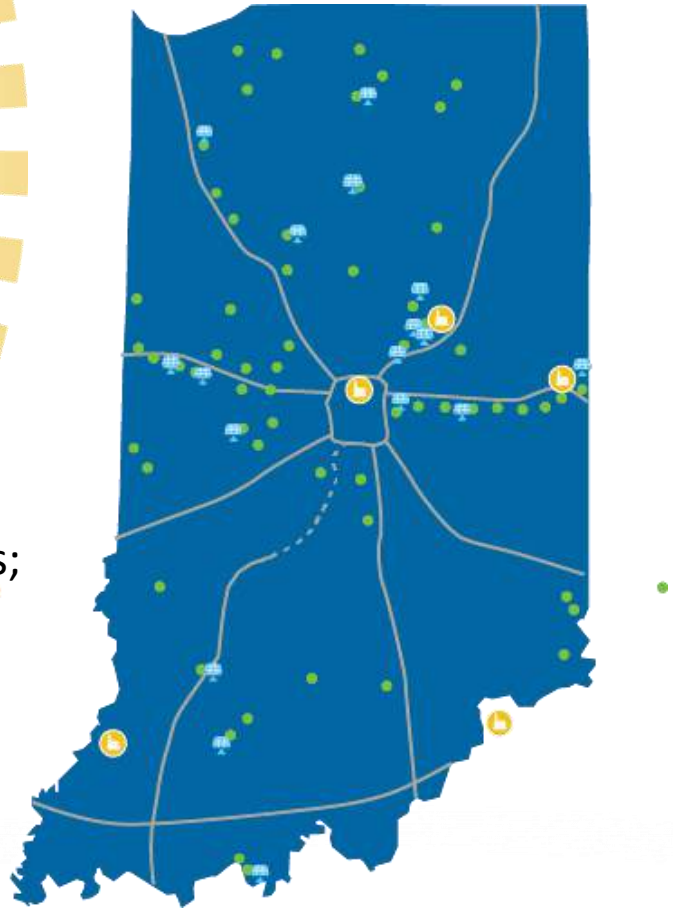
The average cost of coal generation has trended upward. Primarily because of huge expenditures needed to meet the EPA requirements as well as the shutdown of coal plants around the country. Spinning reserve also does add to the overall average cost of coal generation.

IMPA Solar Park Projects

Jack Alvey

IMPA Background

- Not for profit, joint agency, political subdivision of the State of Indiana
- Began operations in 1983. Provides wholesale power to 61 municipal electric utilities
- Ownership of 524 MW base-load coal
- Ownership of 419 MW of natural gas combustion turbines
- 73 MW of solar power generating at 25 solar parks; 500 kW generating in Henry County
- Five more parks under construction (25 MW) with seven additional parks (37 MW) with 2020 construction start dates
- Multiyear power supply diversification plan



IMPA Solar Parks Model

Located within or adjacent to Members' service territories

Connected with Members' distribution systems

10 MW or less

All generation stays local

- Henry County communities served: Dunreith, Knightstown, Lewisville, Middletown, Spiceland and Straughn

- Spiceland Solar Park
  - Approx. 500 kW
  - 1,938 modules
  - Fixed tilt system
  - 6385 S. SR 3, Spiceland, IN 47385
  - Completed in 2017

A Fit for the Community

- Experience with dozens of towns, cities and counties
- Initial suitability screening during potential site selection
- Present zoning consideration

Zoning and Land Use Considerations

Size threshold exclusion – 10 MW

Reasonable setbacks, especially in municipalities with limited land

No unreasonable buffering standards. Limited to abutting residences.

Typical Construction Process

Construction period averages 8-10 months

Deliveries for equipment – Spiceland Solar Park module deliveries on ~2.5 trucks

Site secured with a 7’ chain link fence with 1’ barbed wire

Approximately 25 workers at a time installing posts, modules and doing electrical work

Interconnection with Members’ electric distribution system

Solar Parks – Post Construction

Indiana Municipal Power Agency will own the land and maintain responsibility to mow the grass, as well as generally maintain the property.

The solar parks have a low profile, no odors, and noise is mitigated by equipment type, locations and enclosures.

The only traffic will be occasional utility vehicles to conduct routine checks, tests and maintenance. The site otherwise operates without personnel present.

Spiceland Solar Park

Benefits to Henry County & IMPA Member Communities

- Stable, low cost power resource added to IMPA, the member's wholesale power supplier
- Low rates aid in economic development efforts and renewable resources offer a potential advantage over other sites when competing for new industry
- Investment by IMPA in a member community and county, providing additional revenue for local authorities
- Forward thinking approach toward energy and diversifies power supply portfolio
- Community education and involvement opportunities

Thank you

Questions?

Johnson Melloh Solutions

5915 Stockberger Place
Indianapolis, IN 46241

Phone: 317-536-6106

www.johnsonmellohsolutions.com

JMS
A VEREGY COMPANY

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Agenda

01 How it Works

02 Why it Works

03 Installation

04 Post Installation

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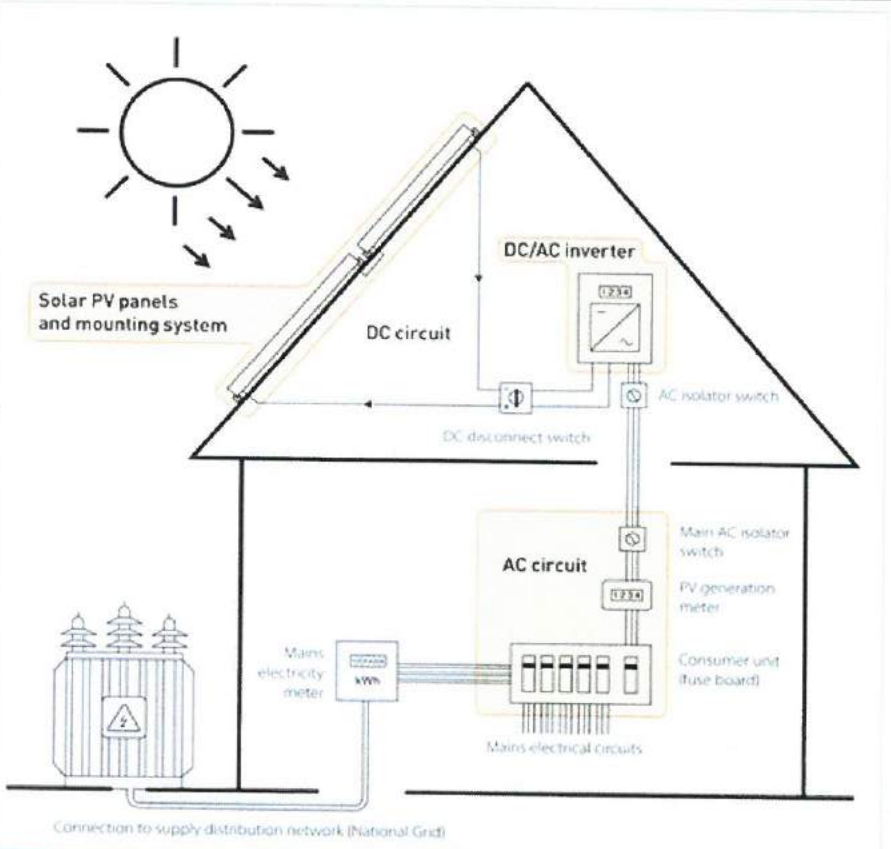
01 How it Works

- Sunlight hits the surface of the photovoltaic cell on the solar panel.
- An inverter converts the direct current (DC) electricity into alternating current (AC) electricity. AC electricity is what is used by household appliances.
- The meter monitors production received from the solar panels and the inverter and sends the information to the utility through a wireless signal.
- The solar electricity from the inverter flows through this service panel first to your home and then to the grid, if there is excess production.
- The electricity meter reads the power that you use from the grid as well as the excess solar electricity that flows to the grid from your solar system.

Source: https://www3.epa.gov/climatechange/kids/solutions/technologies/solar.html



02 Why it Works

- Consumer can offset or provide a portion of their electrical usage
- Consumer can hedge inflation of electrical rates from their utility provider
- Consumers are motivated by federal, state, local tax credits, rebates and other incentives
- Solar energy is clean, quiet and renewable
- Energy consumption and demand is increasing over time
- System maintenance cost is low

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03

Installations of Solar Array

Engineering

- Interconnection Agreement/ Preliminary Design
- Permit Drawings
- Construction Drawings
- As-Built/Record Drawings

MILESTONES
Solar Scope
Engineering
Phase 1 - Preliminary / I.A
Phase 5 - IFP / 100% Construction Drawings
Phase 6 - As-Builts / Record Drawings
Administration
Phase 1 - Job Start - Up
Phase 2 - Material Procurement
Phase 3 - Subcontractor Procurement
Phase 4 - Close-Out
Construction
Phase 1 - Mobilization
Phase 2 - Site/Civil
Phase 3 - Solar Array
Phase 4 - AC/DC Installation
Phase 5 - SCADA & Monitoring
Phase 6 - Testing/Commissioning/ Close-out
Phase 7 - Final Completion / PunchList

03

Installations of Solar Array

Administration

- Job Start Up and Close Out
- Permitting
- Inspections

MILESTONES
Solar Scope
Engineering
Phase 1 - Preliminary / I.A
Phase 5 - IFP / 100% Construction Drawings
Phase 6 - As-Builts / Record Drawings
Administration
Phase 1 - Job Start - Up
Phase 2 - Material Procurement
Phase 3 - Subcontractor Procurement
Phase 4 - Close-Out
Construction
Phase 1 - Mobilization
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Installations of Solar Array

Material Procurement

- Modules (Solar Panels)
- Inverters
- Optimizers
- Racking
- Electrical Equipment (Gear)
- Monitoring Equipment
- Other Project Specific Requirements (Fencing)

MILESTONES
Solar Scope
Engineering
Phase 1 - Preliminary / I.A
Phase 5 - IFP / 100% Construction Drawings
Phase 6 - As-Builts / Record Drawings
Administration
Phase 1 - Job Start - Up
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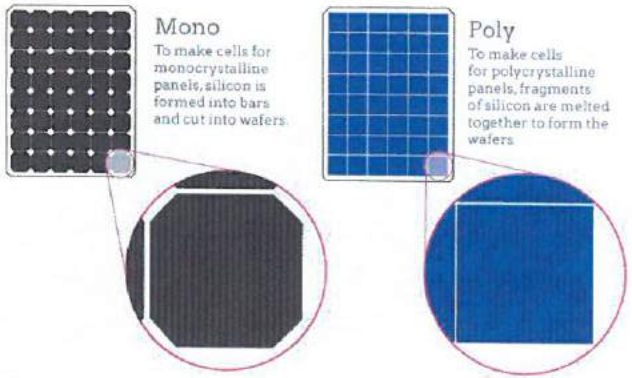
Solar Panels



255W – 400W

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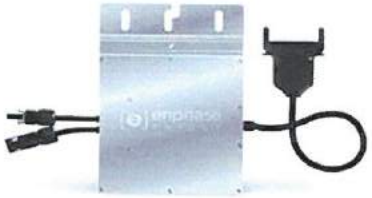

Enphase Microinverter

SolarEdge Power Optimizer

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Ground Mounted Fixed Tilt

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Single and Dual Axis Trackers

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Roof Mounted

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03

Carports and Structures

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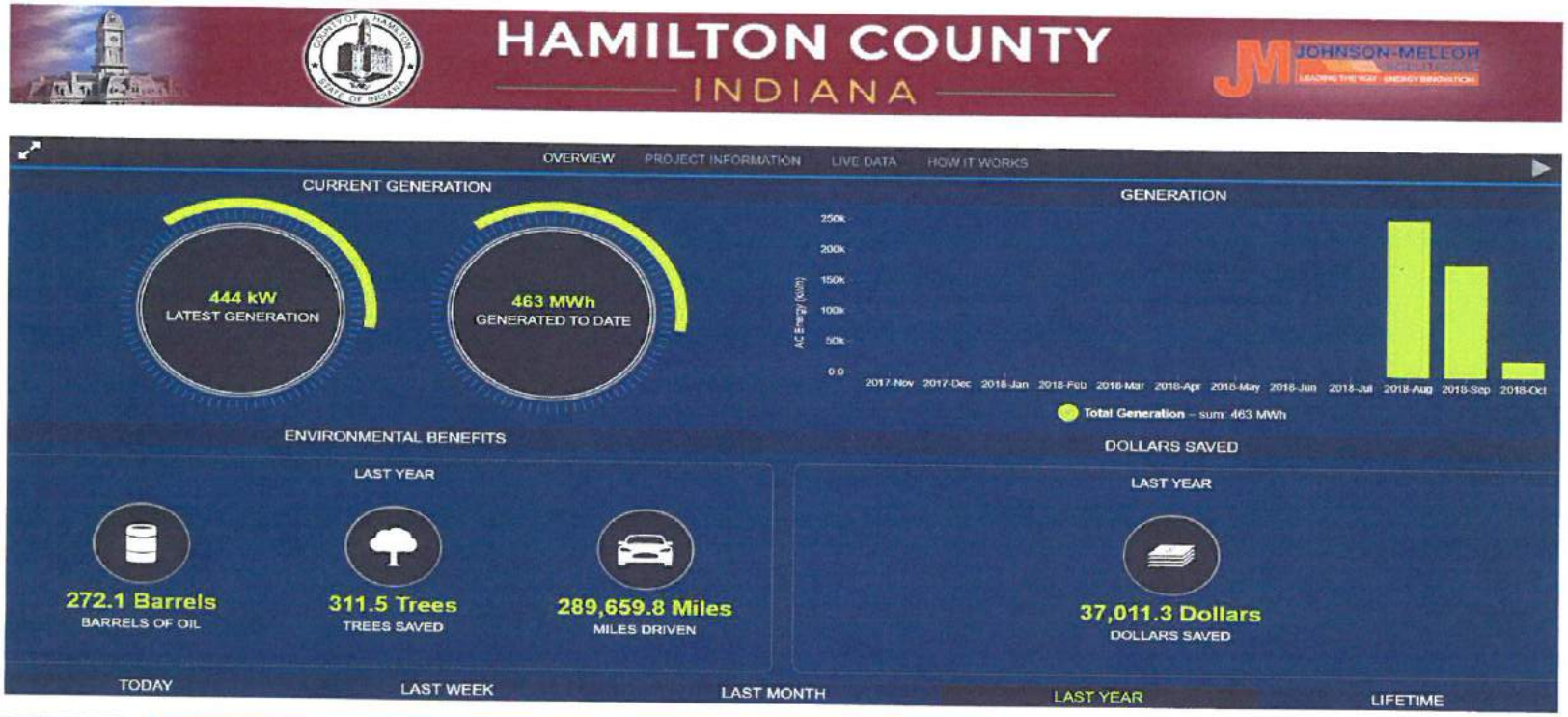
Monitoring

03



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Installations of Solar Array

Subcontractor Procurement

- Architect/Engineer
- Surveyor
- Geotechnical Contractor
- Civil Contractor
- Racking Contractor
- Electrical Contractor
- Fencing Contractor
- Roofing Contractor
- Landscaping Contractor

MILESTONES
Solar Scope
Engineering
Phase 1 - Preliminary / I.A
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03

Construction Sequence
Phase 1 - Mobilization
Phase 2 - Site/Civil
Phase 3 - Solar Array
Phase 4 - AC/DC Installation
Phase 5 - SCADA & Monitoring
Phase 6 - Testing/Commissioning/ Close-out
Phase 7 – Punch List / Final Completion

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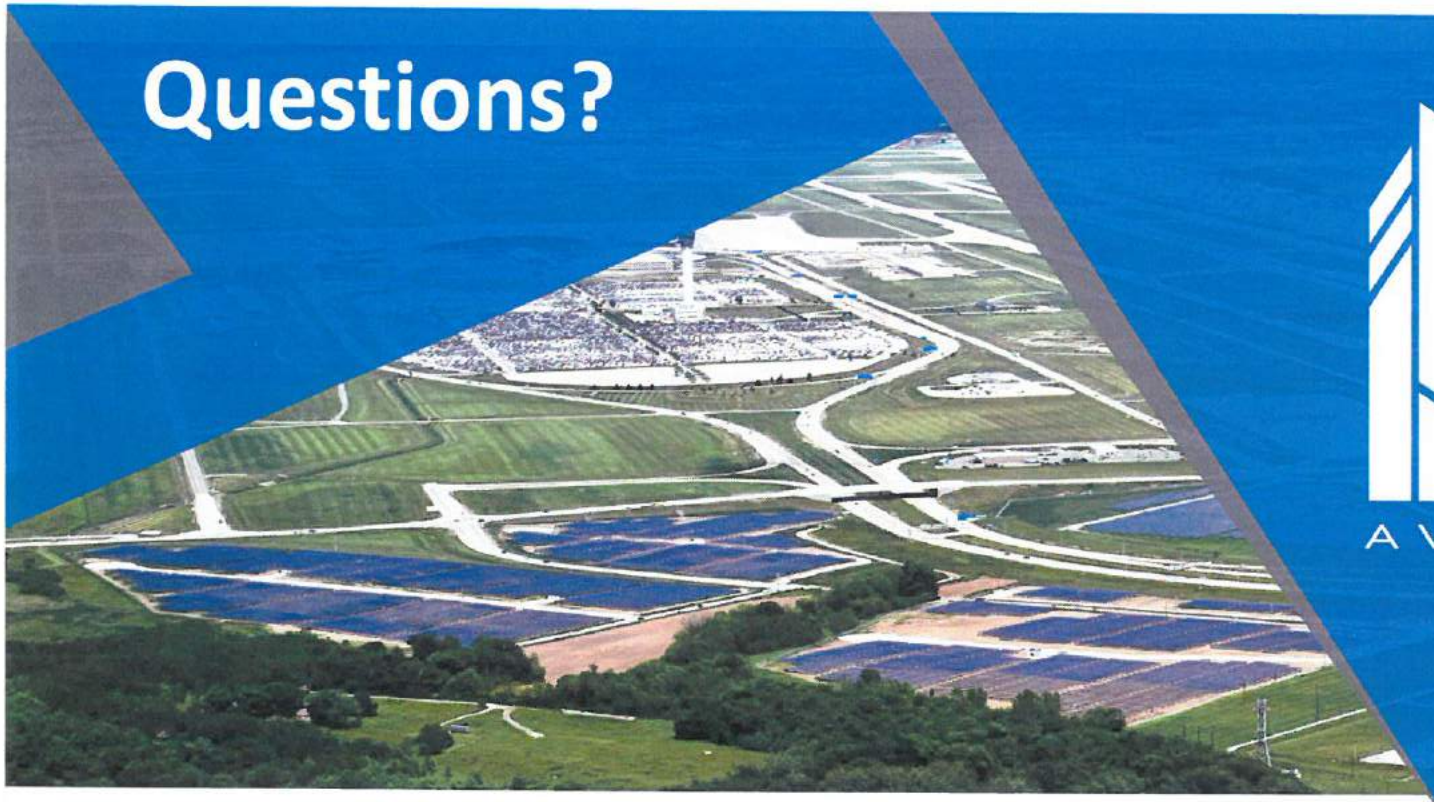
04 Post Installation

- Measuring and Verification
- Operation and Maintenance
- Continuing Education

Questions?



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Thank You!

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Indianapolis, IN 46241

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www.johnsonmellohsolutions.com

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HAMILTON CO. PUBLIC SAFETY COMPLEX

Noblesville, IN

PROJECT HIGHLIGHTS:

- Ground Mounted Solar Array
- Rooftop Mounted Solar Array
- LED Lighting
- Solar Maintenance
- Demand Management
- Remote Monitoring

Project Duration:
Solar: 8 months
Completed 2018

Project Size:
3.1MW Solar Array

Contract Amount:
$ 8 Million

Project Contact:
Kurt Schneider
317-607-6991
kschneider@johnsonmellohsolutions.com

Client Contact:
Steve Wood
317-776-8446
mayor@northvernon-in.gov

OBJECTIVES:

Johnson Melloh Solutions, a Veregy company, collaborated with Hamilton County in Indiana to design and install a Guaranteed Energy Savings Project. JMS installed 3.1MW of solar, as well as LED lighting. JMS currently utilizes remote monitoring and demand management technology to ensure a productive and stable system, while performing routine maintenance to the solar arrays when necessary. With a combination of solar servicing and demand management, JMS is helping Hamilton County stabilize one of the most variable items in its budgets – the cost of energy.

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JENNINGS COUNTY PUBLIC LIBRARY

North Vernon, IN

PROJECT HIGHLIGHTS:

- Rooftop Mounted Solar Array
- LED Lighting
- HVAC Upgrade
- Demand Management
- Building Envelope Upgrade

Project Duration:
Solar: 4 months
Completed 2014

Project Size:
200kW Solar Array

Contract Amount:
$ 715,545

Project Contact:
Kurt Schneider
317-607-6991
kschneider@johnsonmellohsolutions.com

Client Contact:
Mary Hougland, Director
812-346-2091
mary.hougland@jenningslib.org

OBJECTIVES:

Johnson Melloh Solutions, a Veregy company, collaborated with the Jennings County Public Library to design and install a Guaranteed Energy Savings Project. JMS installed a 200kW solar array, provided an upgraded HVAC unit, and equipped the library with all new LED lighting fixtures. JMS is helping the Jennings County Public Library stabilize one of the most variable items in its budgets – the cost of energy.

Utility Spend (over 5 years):

Before Guaranteed Energy Savings Project:	After:
$223,705	**$25,590**

Johnson Melloh Solutions
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THE CITY OF NORTH VERNON

North Vernon, IN

PROJECT HIGHLIGHTS:

- Ground Mounted Solar Array
- Rooftop Mounted Solar Array
- Solar Installation at 22 sites
- LED Lighting
- Solar Maintenance
- Demand Management
- Roofing Restoration
- Remote Monitoring

Project Duration:
Solar: 18 months
Completed 2018

Project Size:
2.38MW Solar Array

Contract Amount:
$ 5.1 Million

Project Contact:
Kurt Schneider
317-607-6991
kschneider@johnsonmellohsolutions.com

Client Contact:
Michael Ochs, Mayor
812-592-0352
mayor@northvernon-in.gov

OBJECTIVES:

Johnson Melloh Solutions, a Veregy company, collaborated with The City of North Vernon to design and install a Guaranteed Energy Savings Project. JMS installed 3,900 solar panels, equal to 2.38MW, across 22 different sites throughout the city, including the wastewater treatment plant. JMS currently utilizes remote monitoring and demand management technology to ensure a productive and stable system, while performing routine maintenance to the solar arrays when necessary. With a combination of solar servicing and demand management, JMS will help The City of North Vernon stabilize one of the most variable items in its budgets – the cost of energy.

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DANVILLE PUBLIC LIBRARY

Danville, IN

PROJECT HIGHLIGHTS:

- Rooftop Mounted Solar Array
- LED Lighting
- HVAC Upgrade
- 6,000 sq. ft. Addition Construction

Project Duration:
8 months
Completed 2017

Project Size:
47.3kW Solar Array

Contract Amount:
$ 761,000

Project Contact:
Kurt Schneider
317-607-6991
kschneider@johnsonmellohsolutions.com

Client Contact:
Loren Malloy, Director
317-718-8008

OBJECTIVES:

Johnson Melloh Solutions, a Veregy company, collaborated with the Jennings County Public Library to design and install a Guaranteed Energy Savings Project. JMS installed a 47.3kW roof-mounted solar array, upgraded HVAC, and constructed a 6,000 square foot addition to the library's main building. JMS also equipped the library with all new LED lighting. JMS is helping the Danville Public Library stabilize one of the most variable items in its budgets – the cost of energy.

Annual Utility Spend:

Before Guaranteed Energy Savings Project:	After:
$21,000	**$13,000 (including NEW 6,000 sq.ft. addition)**

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A VEREGY COMPANY

EVANSVILLE REGIONAL AIRPORT

Evansville, IN

PROJECT HIGHLIGHTS:

- Auto Canopy Solar Array
- Solar Maintenance
- Demand Management
- Increased Revenue
- Guaranteed Savings
- Remote Monitoring

Project Duration:
Solar: 7 months
To be completed 2020

Project Size:
1.3MW Ground & Auto Canopy Solar Array

Contract Amount:
$ 6.4 Million

Project Contact:
Kurt Schneider
317-607-6991
kschneider@johnsonmellohsolutions.com

Client Contact:
Nate Hahn
812-421-4401
nate@evvairport.com

OBJECTIVES:

Johnson Melloh Solutions, a Veregy company, collaborated with the Evansville Regional Airport and their current Aviation Consultant to provide the airport with a Guaranteed Savings project that incurred no debt while increasing overall revenue. JMS utilizes remote monitoring and demand management technology to ensure a productive and stable system, while maintaining the solar arrays. With a combination of solar maintenance and demand management, JMS will help the Evansville Regional Airport stabilize one of the most variable items in its budgets – the cost of energy. This project combines a 1.3MW Ground and Auto Canopy Mounted Solar System with Demand Management and Remote Monitoring.