



## Building Integrated Solar

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## Building Integrated PV: An Emerging Market

Who will the industry turn to for installation?

Looking for an  
Electrician?



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## Building Integrated PV: An Emerging Market

### Definition of BIPV and BAPV

❖ BIPV as building-integrated PV, which requires that the building team along the entire supply chain - including architects, building designers, engineers, building owners and utility companies - work together to design and build the photovoltaic's into the building's very "skin" as an element, from the inception of the project onwards.

❖ BAPV, on the other hand, is defined as building-applied PV. In this process, the photovoltaic's are a retrofit, added to the building after construction is completed.

Source: GTM Research



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## Building Integrated PV: An Emerging Market

### Applications for Building-Integrated Photovoltaic's

- **Façade** – PV can be integrated into the sides of buildings, replacing traditional glass windows with semi-transparent thin-film or crystalline solar panels. These surfaces have less access to direct sunlight than rooftop systems, but typically offer a larger available area. In retrofit applications, PV panels can also be used to camouflage unattractive or degraded building exteriors.



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## Building Integrated PV: An Emerging Market

### Applications for Building-Integrated Photovoltaic's

- **Rooftops** – In these applications, PV material replaces roofing material or, in some cases, the roof itself.



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## Building Integrated PV: An Emerging Market

### Applications for Building-Integrated Photovoltaic's

- Glazing – Ultra-thin solar cells may be used to create semi-transparent surfaces, which allow daylight to penetrate while simultaneously generating electricity. These are often used to create PV skylights or greenhouses.



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## Building Integrated PV: An Emerging Market

### Industry Challenges

- Experienced installers
- Optimal system orientation
- Weather ability
- Lifetime expectancy
- Development of specific standards and building codes
- Performance and cost-competitive pricing



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## Identifying Opportunities





Illinois American Water  
Peoria, Illinois  
Solar canopy utilized for equipment cover with block heaters



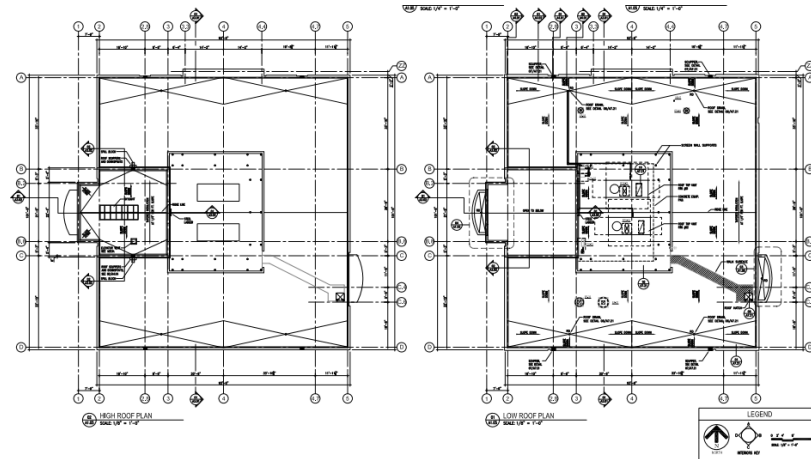
## Identifying Building Integrated Solar Opportunities



JF Electric  
Edwardsville, Illinois  
Solar canopy utilized for equipment cover

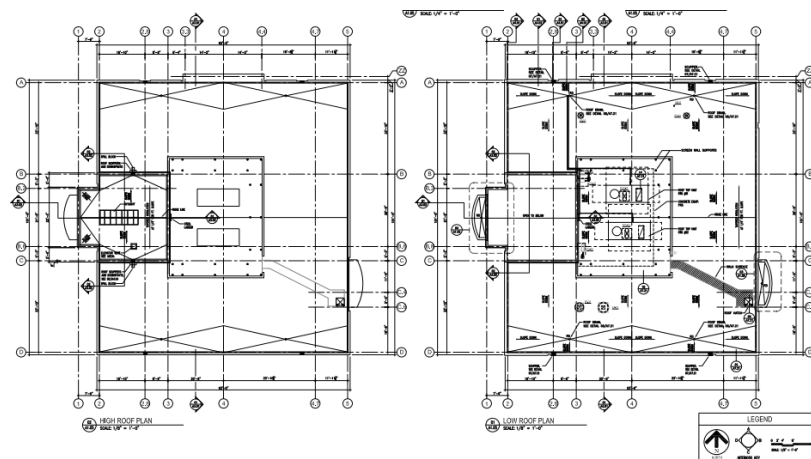


# Identifying Building Integrated Solar Opportunities



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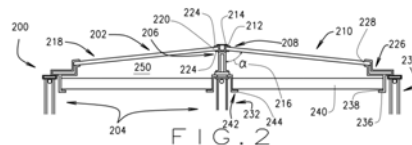
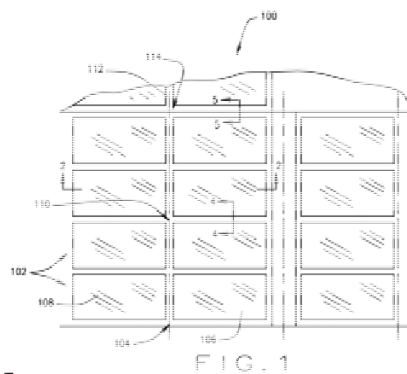


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## Photovoltaic Structural Integrated Insulated Roof System

Patent Pending

Photovoltaic roof system providing fully integrated water drainage, insulation, structural support, temperature, airflow and the ability to interconnect structurally and electrically.



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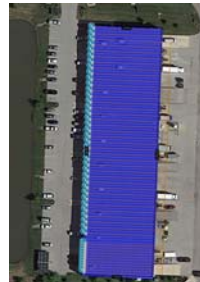
## Photovoltaic Structural Integrated Insulated Roof System

Patent Pending

System Metrics	
Design	EW-Roof System Test 1
Module DC Nameplate	429.0 kW
Inverter AC Nameplate	344.0 kW Load Ratio: 1.25
Annual Production	549.5 MWh
Performance Ratio	82.3%
kWh/kWp	1,280.8
Weather Dataset	TMY, 10km grid (38.65,-90.05), NREL (prospector)
Simulator Version	153 (443094f0ad-ea939843ef-fce6ca9f20-00aa149f23)



System Metrics	
Design	Conventional Ballasted
Module DC Nameplate	480.7 kW
Inverter AC Nameplate	392.0 kW Load Ratio: 1.23
Annual Production	686.4 MWh
Performance Ratio	85.0%
kWh/kWp	1,428.1
Weather Dataset	TMY, 10km grid (38.65,-90.05), NREL (prospector)
Simulator Version	153 (443094f0ad-ea939843ef-fce6ca9f20-00aa149f23)



## Integrating Energy Storage

### IPS-250 Integrated 250 kW/1000 kWh Energy Storage System

- Integrated AC Breaker with Shunt Trip
- Integrated DC Disconnect
- Integrated DC Input Fuses
- DynaCloud™ -Cloud-based Remote Monitoring and Diagnostics
- Integrated Transformer
- Black Start

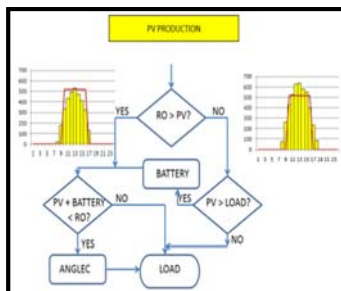


The IPS-250 is an integrated ESS solution providing a PDE 250 kW energy storage inverter combined with Samsung Mega-E batteries for a turn-key product.



## Remote Island Microgrid CuisinArt Resort, Anguilla

PDE provided engineering/design/equipment and construction management for an energy storage system to support a 1MW solar installation and reverse osmosis plant. This is the largest installation of its kind in the region and is a potential game changer for energy policy and delivery in the region. The system went live in August 2014, the resort can operate its reverse osmosis plant utilizing 100% renewable energy.



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500kVA off grid integrated Battery Energy Storage Inverter powering the largest RO Plant in the Caribbean with PV power only.



CuisinArt isolation bypass switches to transfer between PV and utility power.



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CusiniArt Reverse Osmosis Plant, which has been powered by Solar PV since 2014



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