**Introduction**

The Solar Endowment is an initiative by the Midwest Renewable Energy Association (MREA) with support from the U.S. Department of Energy SunShot Initiative. The purpose of the project is to showcase the investment and programmatic potential of on-site solar energy projects to university governance boards in an effort to generate investment through the university foundation, advance favorable board policies to govern investments in solar assets, and provide a roadmap for universities across the country to deploy solar photovoltaic energy (PV) on their campus and make investments that advance their foundation and sustainability goals.

The Purdue Solar Endowment team included undergraduate and graduate students, faculty, and staff from a number of university departments.

**Purdue University Background Information**

The Wade Utility Plant provides roughly 30-50% of Purdue’s annual electrical consumption while the remaining portion is purchased through the local utility provider, Duke Energy. Duke sells a base amount of electricity to Purdue a year in advance, and any additional electrical consumption is purchased through a Real Time Pricing (RTP) agreement.

**Decision Making Process and Key Stakeholders**

Purdue has an internal goal to provide 10% of the university’s energy from renewable sources by 2025. In addition, the Clean Power Plan states that Indiana’s carbon emissions must be reduced by 30% from 2005 levels by the end of 2030.

Figure 1 shows the key points of contact for the Solar Endowment team and provides the tiers through which a PV project must progress. Review and approval of each tier is needed before progressing to the next level.

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**Figure 1 - Stakeholder Hierarchy**
Potential PV Locations
PV system generation was estimated using the National Renewable Energy Lab’s (NREL) PVWatts® free online software. TurningPoint Energy provided the estimated cost per watt that was used in calculations. Carbon offsets were assumed to be 2,240 pounds of CO$_2$ per 1,000 kWh compared to coal energy production.

PV sites were ranked based on cost, magnitude, alignment with existing university policy, ease of installation and integration, potential for carbon offsets, and compatibility with the university development plan. The ground-mounted systems for PV arrays are preferable to stakeholders due to their lower cost and greater size potential. The following three sites are ranked in the order they appear from most to least suitable.

**Western Field**
This 2,239 kW DC ground-mounted array would be on the campus’ western field. The system would cost $1.90/WDC to install ($4,254,100 total) and would interconnect with a nearby substation. This site would make an excellent location for a ground-mounted PV system due to the absence of redevelopment plans and location outside of the main housing and academic buildings. The single location system would annually generate 3,792,904 kWh of energy and offset approximately 5,707,480 pounds of CO$_2$ annually compared to coal power.

**Hilltop Apartments**
This 179 kW DC rooftop array would be mounted on the three rooftops of the Hilltop Apartments on campus. The system would cost $2.80/WDC to install ($501,200 total) and would
have interconnections to a nearby building. The interconnection costs are low and the energy this system produces would primarily be used at the site. The site area calculations only included south-facing roofs and currently do not have any plans for redevelopment. The multiple location system would offset an estimated 456,292 pounds of CO2 each year compared to coal power. The system would annually generate 242,476 kWh of energy.

**Southern Parking Lot**

![Southern Parking Lot](image)

This 3.924 kW DC canopy style array would sit over the southern parking lot on campus. It would cost $2.75-3.25/WDC to install ($7,455,600 total) and would have underground interconnections to a nearby substation. Though this parking lot is one of the largest potential sites for solar development, it is currently unpaved and may see further development in the future. The single location system would generate 5,133,289 kWh of energy annually, offsetting an estimated 10,002,747 pounds of CO2 each year compared to coal power.

**Financial Recommendations**

The recommended financing structure for the project is a land leasing agreement with Duke Energy. This structure would have Duke Energy absorb all taxes and fees. All initial costs for the system and risk would be the responsibility of Duke Energy. With this structure, the project would be cash flow positive immediately. The value of the land lease would be negotiated between Purdue and Duke Energy. No rough value has been provided by Duke Energy but would, at a minimum, cover the opportunity cost of the land. This could include recreational or farm land value.

**Next Steps**

With the possible development of 500 acres of land near the airport, it is crucial to present findings to Purdue’s Master Planning staff for their consideration on solar PV deployment. Ideally, this would occur in early 2018 before further progress is made on land development. Future work considerations also include a more diverse financing structure analysis and the modification of the modeling platform.