Community Solar Adoption Final Report

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Overview

Community solar is a rising concept in renewable energy, allowing individuals and organizations to benefit from solar energy without bearing the full financial and maintenance burden. Instead of installing panels on their own premises, subscribers benefit from a shared solar array, where the power generated is sold to utility companies. In return, the utility provides discounts on subscribers' bills, making renewable energy more accessible to a broader audience. This model is especially advantageous for non-profit organizations and tax-exempt institutions, which often face budget constraints but are eager to reduce their carbon footprint.

The sponsor of this project, the Indiana Energy Independence Fund, aims to identify suitable "anchor organizations" for community solar projects—institutions that could host or participate in these solar initiatives. A previous team compiled a database of potential non-profit candidates served by municipal utilities. Our project builds on their foundation by refining and enhancing this dataset, aiming to produce a polished, actionable list of top community solar candidates.

Purpose

This project aims to identify and evaluate suitable candidates for community solar projects in Indiana. The existing dataset of non-profit organizations served by municipal utilities needed refinement to ensure accuracy and relevance. Key issues included inconsistent address matching, lack of detailed solar potential data, and unclear criteria for viable projects.

Community solar expands renewable energy access without individual installations. By refining candidate identification, we can accelerate solar adoption in Indiana, supporting environmental sustainability and providing significant cost savings for non-profits. This effort also contributes to Indiana’s energy independence and resilience goals.

Key stakeholders and communities benefit directly. The Indiana Energy Independence Fund, our sponsor, will receive a refined list of potential participants, enhancing their advocacy and implementation efforts. Non-profits, including schools and religious institutions, will reduce energy costs, reallocating savings to their core missions. Local communities will enjoy economic and environmental benefits through lower utility bills and increased access to renewable energy. Public officials and policymakers will gain detailed reports to support informed decision-making, promoting renewable energy initiatives that align with broader sustainability goals. This collective impact fosters stronger, more resilient communities and advances Indiana’s transition to a sustainable energy future.

Methodology

To identify and refine candidates for community solar projects, we used a data-driven approach focused on accuracy, scalability, and actionable insights. This process integrated automation, solar data analysis, and criteria-based filtering to streamline site selection. We began with a dataset of nonprofits served by municipal utilities from a previous semester, supplemented by Google Solar data to assess solar potential through sunshine hour quantiles and estimated energy output.

To enhance accuracy in address matching and organizational identification, we leveraged APIs and web scraping tools, including Google Maps API and Selenium. Our technology stack included Python for data processing, Excel for data organization and presentation, and Jupyter Notebooks for process documentation. We calculated potential energy outputs and translated them into tangible metrics, such as the number of homes each solar array could power.

Challenges, such as inconsistent address data and discrepancies in solar potential estimates, required refining our web scraping and API methods and adjusting our calculation model for regional variances. These solutions ensured precise energy output predictions and reliable site identification.

By combining automation, data analytics, and domain-specific research, our methodology proved robust and scalable, offering a reproducible framework for identifying viable community solar candidates and advancing sustainable energy efforts in Indiana.

Impact/Outcomes

Our solution automated key processes, including address matching, solar energy output calculations, and the creation of a custom candidate selection metric, significantly improving data accuracy and efficiency. By streamlining the identification of potential solar sites, we freed up resources for other tasks, making the process more scalable and sustainable.

We transformed complex solar data into clear, stakeholder-friendly metrics, such as the number of homes each site could power. This translation of technical data into tangible benefits helped public officials and community leaders better understand and support the initiative, fostering stronger community backing.

By refining the candidate list using our custom metric, we enabled the sponsor to prioritize high-impact projects, increasing the likelihood of successful solar adoption and maximizing return on investment. To further support stakeholder engagement, we developed a reusable, visually appealing report template that presents site-specific information clearly and effectively, providing actionable insights and strengthening partnership-building efforts.

The long-term impact extends beyond individual projects. The Indiana Energy Independence Fund is now positioned as a leader in renewable energy advocacy and implementation. Nonprofits will benefit from reduced energy costs, freeing resources for their missions, while

local communities gain greater access to renewable energy, lower utility bills, and a reduced environmental footprint. Positive feedback from stakeholders highlights strong support and indicates significant potential for expanding community solar across Indiana, promising lasting economic and environmental benefits.

Results

This semester, the Accelerating Community Solar Adoption in Indiana project focused on identifying and analyzing potential solar panel sites using geospatial data and refining methodologies from previous teams. Key accomplishments include:

- Geospatial Analysis of Potential Sites: Leveraged GIS tools to analyze location data, focusing on tax-exempt organizations like schools and religious institutions. This analysis identified high-potential sites based on factors such as rooftop area, solar irradiance, and proximity to existing infrastructure.

- Data Integration and Cleaning: Collected and integrated datasets from multiple sources, including municipal records and energy providers. The data required extensive cleaning to ensure accuracy, particularly in aligning parcel data with organizational addresses.

- Solar Benefit Calculations: Developed a model to estimate potential energy savings and environmental impact. The model incorporated variables such as average energy consumption, solar panel efficiency, and local energy costs. Initial calculations suggest that participating organizations could reduce energy costs by up to 30% annually while significantly lowering their carbon footprint.

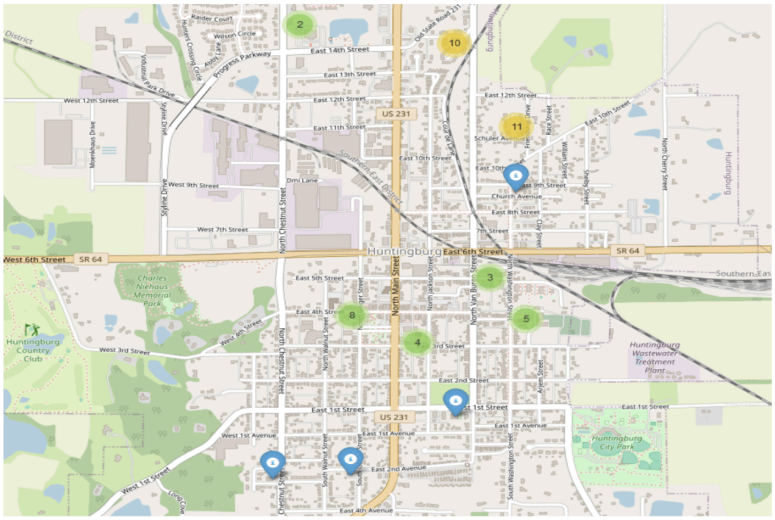
- Stakeholder Consultation: Engaged with community leaders and the Indiana Energy Independence Fund to validate findings and align recommendations with community goals. Feedback from these consultations helped refine site selection criteria and ensure the feasibility of proposed initiatives.

- Visualization Development: Created interactive dashboards to present geospatial analyses and potential energy savings. These visualizations were designed to make complex data accessible to stakeholders, enhancing their understanding of the project's impact.

- Automatic Report Generation: Created a template for automatically generating City reports. This report combines all the solar arrays for buildings on a single lot or associated with a single organization and combines them into a single array. This report also shows a visual representation via the maps generated in our other visualizations. It combines this tabular data and map data into a single report that can be quickly generated for all cities from our Solar Database.

Community Solar Report for HUNTINGBURG, IN

Utility Name: HUNTINGBURG MUNICIPAL ELECTRIC UTILITY
Utility Type: Municipal
Energy Community: Yes



Matched Place Name	Count	Max Array Panels Count	Nominal Power (W)	Predicted Mean Annual Power (kWh/year)	Equivalent Houses Powered	Annual CO2 Savings (ton)
Southridge High School / Middle School	1	9,053	2,715,866	3,288,913	311	2,299
Huntingburg Elementary School	1	3,571	1,071,386	1,297,448	123	907
Central Christian Church	1	1,244	373,200	408,349	39	285
Huntingburg Event Center	1	1,228	368,400	389,138	37	272
Huntingburg Housing Authority	10	1,044	313,264	379,363	36	265
Lincoln Village Apartments	10	1,037	311,100	312,258	30	218
St. Mary's Catholic Church & Rectory	1	961	288,300	306,542	29	214
Salem United Church of Christ	3	884	265,200	256,565	24	179
St Mary's Catholic Church & Rectory	4	732	219,600	198,123	19	138
Huntingburg United Methodist	1	460	138,000	143,600	14	100
YMI Club	1	410	123,000	133,359	13	93
A Kid's Place	1	411	123,300	125,784	12	88
VFW Post 2366	1	412	123,600	123,789	12	87
Huntingburg Eagles	1	360	108,000	114,692	11	80
Faith Community Church of the Nazarene	3	384	115,200	114,146	11	80
River of Life Church	1	350	105,000	107,222	10	75
New Life United Pentecostal Church	1	363	108,900	104,005	10	73
Christian Ministries of Huntingburg - Food Distribution Center	1	311	93,300	101,253	10	71
First Baptist Church	1	318	95,400	98,633	9	69
Huntingburg Church of Christ	1	244	73,200	71,816	7	50
Huntingburg Outreach Ministiries	1	167	50,100	53,481	5	37
Calvary Temple	1	177	53,100	52,324	5	37

These results demonstrate significant progress in laying the groundwork for future solar adoption initiatives, providing stakeholders with clear, actionable insights supported by data-driven analyses.

Conclusion

This semester, our group made significant strides in this project by identifying and analyzing potential sites for solar panel installation, focusing on tax-exempt and nonprofit organizations. Through geospatial analysis, data integration, and solar benefit modeling, we developed a clear, data-driven framework to support community solar adoption. Our consultations with stakeholders ensured that the proposed solutions were both practical and aligned with community goals.

By creating interactive visualizations and refining site selection criteria, we've provided stakeholders with actionable insights into the financial and environmental benefits of solar adoption. This solution not only addresses the immediate need for identifying viable sites but also establishes a scalable model that can be used to expand solar access across Indiana. We believe this framework equips our sponsor with the necessary tools to accelerate solar adoption, fostering energy independence and sustainability for communities throughout the state.

Recommendations for Future Work

To broaden the impact of this project, future efforts should evaluate alternative energy solutions such as ground-mounted solar installations, parking canopies, geothermal systems, and wind energy. These options could diversify renewable energy strategies, addressing unique site needs while expanding community engagement. Additionally, incorporating energy storage analysis, such as assessing the feasibility of battery systems, can enhance the utility and reliability of solar energy projects. Educational initiatives should highlight how these technologies improve energy resilience and support broader adoption.

Developing a searchable statewide database of potential renewable energy sites, complete with relevant data such as location and capacity, will provide a valuable resource for planning and advocacy. Furthermore, creating a tool to assess the regulatory framework at local, state, and federal levels can help stakeholders understand how policies influence the feasibility and scalability of community solar projects. This tool would also support efforts to align renewable energy initiatives with emerging legislation.

To ensure long-term sustainability, future work should evaluate the environmental impact of proposed projects, focusing on their contribution to reducing carbon emissions and promoting resource conservation. Detailed documentation of project methodologies and findings, combined with interdisciplinary collaboration, can guide future teams and maintain continuity. By integrating these recommendations, the project can evolve to meet emerging challenges and opportunities, fostering a sustainable and inclusive energy future.