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Consultant – Tesero Sol

Figure: Energy Systems Site Plan Overview. The image illustrates a proposed dual-section solar + battery system deployment, with Section 1 providing 5 MW solar + 12 MWh battery for BTM use, and Section 2 delivering 8 MW solar + 16 MWh battery for hybrid FTM/BTM use. Arrays and infrastructure are shown over an aerial site layout to support interconnection planning and load integration analysis.

Project Summary: Illinois BN Development

Location: Town of Normal, McLean County, Illinois
consultant: Dr. William Francis (Tesero Sol) , Philip Skipitaris, (Tesero Sol)
Grid Operator: Ameren Illinois – Subtransmission and Distribution
Project Type: Utility-scale Solar PV + Battery Energy Storage System (BESS)
Offtaker: Rivian (tentative)
Date: May 20, 2025

Recommendation

This site is well-positioned for a clean energy project utilizing Ameren's strong interconnection potential. A 5–30 MW solar + battery system is technically feasible with flexible options for both subtransmission (34.5 kV) and distribution (12 kV) interconnection.

- **Storage Strategy:** BESS supports, peak shaving, and grid support, enhancing project economics and system resilience.
- **Tax Credits:** Systems >5 MW are eligible for the full 30% ITC under §48E with prevailing wage compliance, plus potential 10% bonuses for domestic content and energy community siting. §45Y production credits are **not stackable** with §48E for the same facility. The low-income bonus is **not available** for projects over 5 MW.
- **Offtaker Integration:** Rivian's load profile and sustainability goals support either a direct behind-the-meter configuration or grid export via PPA or merchant model.

A front-of-meter interconnection with optional hybridization offers the most scalable path while aligning with Rivian's decarbonization initiatives.

0.1 System Operation

This project envisions a clean energy system comprising solar PV and battery storage, with Rivian serving as the offtaker under a long-term arrangement. The presence of a committed, sustainability-focused industrial customer allows for multiple viable interconnection configurations, each offering different advantages depending on commercial goals, system size, and flexibility requirements.

- **Option 1: Direct Interconnection to Rivian (Behind-the-Meter)**
  The energy system is sited adjacent to Rivian's facility and interconnected behind Rivian's utility meter. Energy flows directly to Rivian's operations, with the battery enabling load management, backup, and peak shaving.
  - *Benefits:* Immediate alignment with on-site demand, simplified settlement, no grid export permitting.
  - *Considerations:* Capacity may be limited by the facility's maximum demand and interconnection at the service entrance.
- **Option 2: Grid-Connected Export with Contracted Offtake (Front-of-the-Meter)**
  The system connects to the utility distribution or subtransmission grid and exports energy under a direct purchase agreement with Rivian. Energy may be scheduled for physical or virtual delivery.
  - *Benefits:* Scalable system size, geographic flexibility, eligible for wholesale compensation or fixed PPA pricing.
  - *Considerations:* Requires utility interconnection approval, export metering, and possibly wheeling agreements depending on delivery structure.
- **Option 3: Hybrid Model (BTM + Export)**
  A blended design in which a portion of generation serves Rivian's on-site load, while excess is exported to the grid. The battery supports both site operations and export arbitrage.
  - *Benefits:* Maximizes self-supply while monetizing surplus generation; supports flexible dispatch strategies.
  - *Considerations:* Requires more complex design and interconnection coordination; clear demarcation of use cases needed.

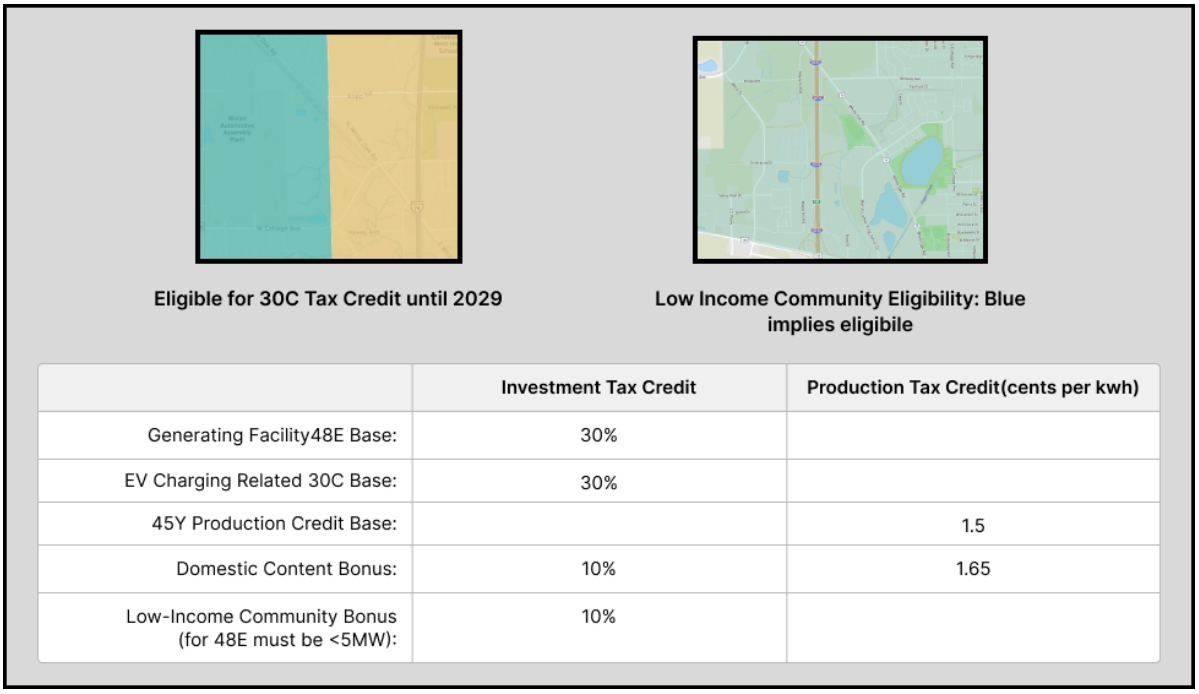
1 Site Overview

Figure 1: Overhead view of site:Project site located on W. College Avenue in Normal, McLean County, Illinois. The parcel spans approximately 237 acres based on BN Economic Development Council, and was last listed for sale at $25,648,500. Site status was most recently updated on February 27, 2025.

Figure 1: Left Wylie Road

Figure 2: Right Wylie Road

2 Grants & Incentives



	Investment Tax Credit	Production Tax Credit(cents per kwh)
Generating Facility48E Base:	30%	
EV Charging Related 30C Base:	30%	
45Y Production Credit Base:		1.5
Domestic Content Bonus:	10%	1.65
Low-Income Community Bonus (for 48E must be <5MW):	10%	

Figure 2

Table 1: Grants and Incentives for Large-Scale Energy Development in McLean County, IL

Program	**Administering Agency**	**Funding Scale**	**Eligibility / Notes**
Title 17 Loan Program (LPO)	U.S. DOE LPO	Up to 80% of project debt	Large innovative or commercial clean energy projects
Illinois CEJA – Utility-Scale Solar Procurements	Illinois Power Agency (IPA)	Long-term energy offtake contracts	5+ MW solar; eligible for REC procurement under CEJA
Illinois Finance Authority – Green Energy Bonds	Illinois Finance Authority	Tax-exempt bond financing	Public-private or merchant solar/storage partnerships
Smart Inverter Incentives	Ameren Illinois	Variable per MW	For grid-tied solar with smart telemetry; may ease interconnection

3 Interconnection Potential

Table 2: Ameren Subtransmission ICA Hosting Capacity Summary

Parameter	Feeder 1	Feeder 2	Feeder 3	Feeder 4	Feeder 5
Hosting Capacity (MW)	50.0	50.0	50.0	50.0	15.0
Operating Voltage (kV)	34.5	34.5	34.5	34.5	34.5
Existing Generation (MW)	0.025	0.000	0.788	1.079	1.079
Generation in Queue (MW)	0.000	50.0	8.3	20.2	20.2
Applications in Queue	0	10	3	5	5
Limiting Factors	None	None	None	None	POI Short Circuit Ratio Limited, High Voltage

Table 3: Distribution Hosting Capacity by Location

Location	Hosting Capacity (MW)	Existing Gen. (MW)	Queue (MW)	Apps in Queue	Phases	Voltage (kV)	Orientation
Across RR by N White Oak Rd	8.0	0.35	0	0	ABC	12	OH
By Wylie Street	8.0	0.06	0	0	ABC	12	OH
By W Market	8.0	0.06	0	0	ABC	12	OH
St / Hwy	7.69	0.05	14.98	4	ABC	12	OH

Ameren Illinois' available hosting capacity for both subtransmission and distribution-level interconnection at and around the project site. ***Ameren Subtransmission ICA Hosting Capacity Summary*** highlights five 34.5 kV subtransmission feeders, each with up to 50 MW of available hosting capacity except Feeder 5, which is limited to 15 MW; system constraints for this feeder related to short circuit ratio and high voltage. ***Distribution Hosting Capacity by Location*** presents 12 kV distribution feeder data near N White Oak Road, Wylie Street, and W Market Street, each with up to 8 MW of hosting capacity. Notably, one segment by W Market Street shows a queue of 14.98 MW across four applications, indicating active interest and potential competition for available capacity. These data points inform interconnection strategy by identifying optimal feeder locations for grid-tied solar and storage deployment.

Definitions

Phases: Refers to the electrical phase configuration of the distribution feeder. "ABC" indicates a three-phase circuit, which is preferred for large-scale distributed energy resource (DER) interconnection due to its balanced load-carrying capability and higher hosting capacity.

Voltage: Represents the nominal line-to-line operating voltage of the feeder, expressed in kilovolts (kV). In these tables, 12 kV corresponds to standard distribution-level service, while 34.5 kV applies to subtransmission feeders, suitable for medium- to large-scale interconnections (typically 5–30 MW).

Orientation: Denotes the physical construction method of the feeder. "OH" stands for overhead, indicating that the circuit is mounted on utility poles. This affects installation constraints, right-of-way access, and sometimes line losses or exposure to weather-related risk.

Limiting Factors: Lists any technical constraints that may reduce a feeder's ability to host additional DER capacity. Common examples include short circuit ratio limitations, high voltage sensitivity, reverse power flow risk, or thermal capacity limits. "None" indicates that the feeder currently shows no constraint in the hosting capacity model, though site-specific issues may still arise during interconnection review.

Figure 3: Ameren Illinois Subtransmission and Distribution Hosting Capacity near Normal, IL. This map supports preliminary siting analysis for grid-interconnected solar and storage projects by highlighting feeder availability and geographic proximity to priority loads.

Figure 4: **Distribution interconnection overview map for McLean County, IL**

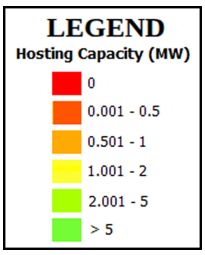


Figure 5: Inset: Site schematic overlay

4 System Breakdown & Capital Expenditures

Top: Right of Wylie Road

Bottom: Left of Wylie Road

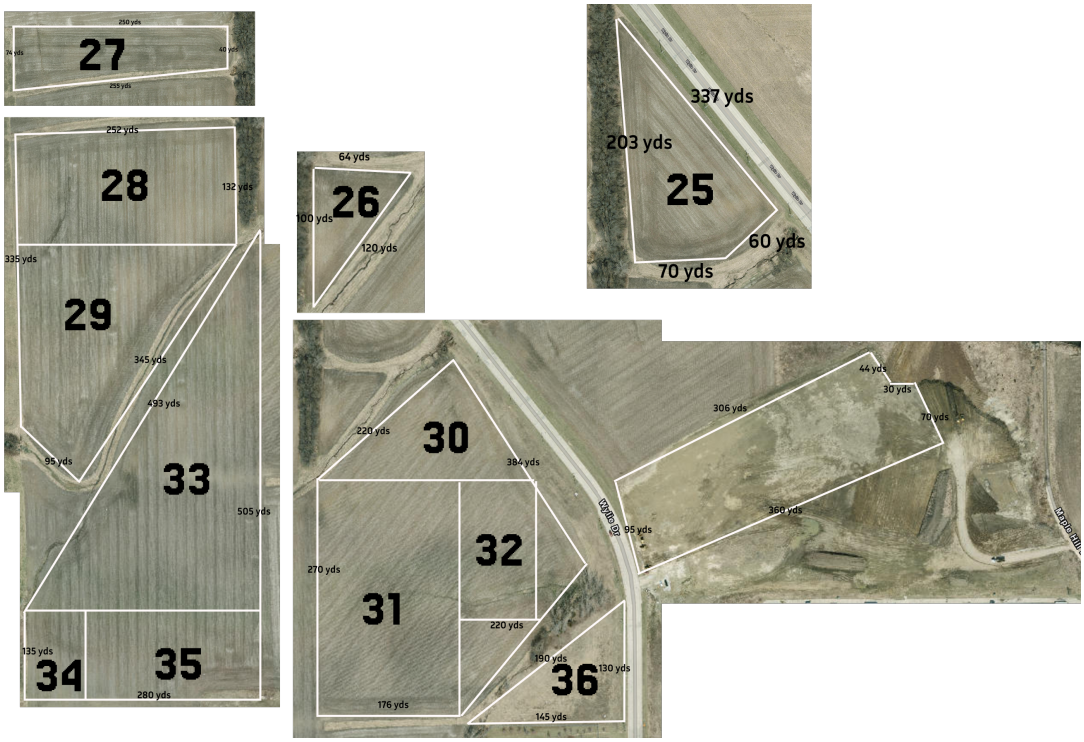


Figure 6: Site layout images divided by Wylie Road, section numbers correspond to the following tables

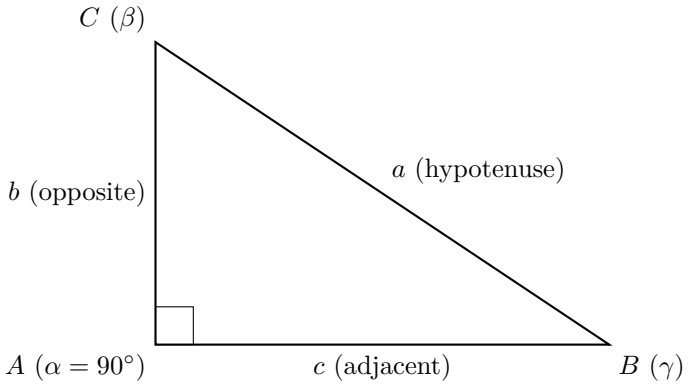
4.1 Potential System Breakdown

Solar System			
Sub-component	Count	Lower Limit	Upper Limit
Solar Panels	60,578	10,000,000 W	33,317,900 W
Combiner Boxes	180–250	Based on string config	–
Battery System			
Sub-component	Count	Lower Limit	Upper Limit
Battery Container Units	20–60	5 MW / 20 MWh	15 MW / 60 MWh
Transformers			
Sub-component	Count	Lower Limit	Upper Limit
Primary Transformer	1–2	10 MVA	35 MVA
Inverters			
Sub-component	Count	Lower Limit	Upper Limit
Central Inverter System	3–10	9.375 MWac	31.25 MWac

Table 4: System Component Summary Aligned with Real-World Hardware Specifications

Section	**Acres**	**Length (ft)**	**Width (ft)**	**Panels**	**Size**
2	0.55	40	80	252	138,600
3	4.08	135	160	1,750	962,500
4	1.90	140	76	840	462,000
5	18.88	275	344	7,938	4,365,900
9	2.77	50	365	1,218	669,900
12	4.31	70	333	1,855	1,020,250
14	13.74	507	140	5,852	3,218,600
16	2.41	143	95	1,050	577,500
17	0.85	114	50	392	215,600
18	7.36	217	176	3,136	1,724,800
19	4.26	120	185	1,827	1,004,850
20	2.53	40	336	1,113	612,150
22	4.40	90	287	1,890	1,039,500
24	1.83	230	50	833	458,150
27	1.85	50	245	819	450,450
28	5.9	118	253	2,520	1,386,000
31	5.83	235	133	2,499	1,374,450
32	3.36	173	101	1,456	800,800
34	1.57	136	66	700	385,000
35	4.74	136	187	2,030	1,116,500
Totals	93.14			39,970	21,983,500

Table 5: Rectangular Sites and PV Systems



Section	Acres	Hypot. (yds)	Opp. (yds)	Adj. (yds)	α (°)	β (°)	γ (°)	Panels	Size
1	0.42	89	51	80	90	63	27	98	53,900
6	8.74	412	299	283	90	47	43	4,375	2,406,250
7	8.08	396	293	267	90	48	42	4,067	2,236,850
8	4.73	406	120	382	93	70	17	756	415,800
10	–	–	–	–	–	–	–	–	–
11	0. 81	129	75	105	90	54	36	252	138,600
13	1.66	156	120	140	78	59	48	700	385,000
15	1.14	132	95	121	90	46	44	427	234,850
21	5.78	315	180	336	90	64	26	1,316	723,800
23	3.84	315	130	286	90	63	27	980	539,000
25	2.30	202	130	173	90	53	37	840	462,000
26	0.72	120	72	97	90	52	38	252	138,600
29	4.84	306	213	220	90	46	44	2,352	1,293,600
30	2.90	233	145	194	85	56	38	1,078	592,900
33	7.12	392	201	343	90	58	32	2,212	1,216,600
36	1.92	193	133	140	90	46	44	903	496,650
Totals	55							20,608	11,334,400

Table 6: Triangular Siteswith Angles and PV Systems

4.2 Capital Expenditure and Potential Sub-Components

This section outlines the estimated capital costs and key hardware components for two scalable deployment options under the Illinois BN Development project. The estimates reflect realistic system configurations for grid-connected solar and battery energy storage systems (BESS), based on commercially quoted equipment and typical engineering, procurement, and construction (EPC) assumptions.

Option 1 includes a 10 MWdc solar PV system paired with a 5 MW / 20 MWh battery installation. This behind-the-meter configuration is suitable for direct use by a co-located offtaker (e.g., Rivian), and provides load-shifting, backup capacity, and renewable integration. All major components—solar modules, batteries, inverters, transformers—are selected from industry-proven vendors, and leverage the Inflation Reduction Act's §48E Investment Tax Credit (ITC) incentives. Estimated total installed cost is approximately $10.3 million.

Option 2 scales the system to a full utility-front-of-meter application, with a 30 MWdc solar PV array and 15 MW / 60 MWh of storage. This configuration maximizes renewable generation and grid export potential under a long-term power purchase agreement (PPA) or merchant energy model. With an estimated capital outlay of approximately $30.2 million, this deployment is eligible for up to 40% in federal tax credits when prevailing wage and domestic content criteria are satisfied.

The following tables summarize the cost structure and equipment assumptions for both options, followed by reference quotes from qualified manufacturers for solar panels, inverters, transformers, and battery systems.

Table 7: Option 1 – 10 MW Solar + 5 MW / 20 MWh Battery System

Component	Count	Size	Total Cost	ITC Potential (§48E)
Solar Panels (Qcells)	22,222	10 MWdc	$3,800,000	30% + 10% (Domestic)
Battery System (Powin Stack800)	20 units	5 MW / 20 MWh	$5,500,000	30% + 10% (Domestic)
Inverters (Solectria)	4	10 MWac	$500,000	30% + 10% (Domestic)
Primary Transformer (GE or V-Ga.)	1	10–15 MVA	$140,000	30% + 10% (Domestic)
Combiner Boxes	60	String config.	$200,000	30% + 10% (Domestic)
Interconnection Cost	–	Utility upgrades	$200,000	30%
Total (Estimated)	–	–	**$10,340,000**	**Up to 40%**

Table 8: Option 2 – 30 MW Solar + 15 MW / 60 MWh Battery

Component	Count	Size	Total Cost	ITC Potential (§48E)
Solar Panels (Qcells)	66,600	30 MWdc	$11,400,000	30% + 10% (Domestic)
Battery System (Powin Stack800)	60 units	15 MW / 60 MWh	$16,500,000	30% + 10% (Domestic)
Inverters (Solectria)	10–12	30 MWac	$1,200,000	30% + 10% (Domestic)
Primary Transformer (GE or V-Ga.)	2	30–35 MVA	$280,000	30% + 10% (Domestic)
Combiner Boxes	180	String config.	$500,000	30% + 10% (Domestic)
Interconnection Cost	–	Utility upgrades	$300,000	30%
Total (Estimated)	–	–	**$30,180,000**	**Up to 40%**

Note: §48E ITC applies to solar + storage projects. **Domestic content and prevailing wage** bonuses require documentation and compliance.

Note: In addition to the core equipment listed above, additional capital expenditures will apply for required balance-of-system infrastructure. These include, but are not limited to, civil site work (grading, trenching, access roads), perimeter fencing, stormwater management, SCADA and telemetry systems, communications equipment, security cameras, lighting, signage, and utility metering infrastructure. These elements are essential for permitting, commissioning, and long-term system operations.

Table 9: Solar Panels

Category	Manufacturer	Model	Est. Qty	Soft Quote (USD)	Domestic
PV Module	Astronergy (CHINT)	ASTRO 5 Twins 550W	18182-60,578	$100–$140/panel	No
PV Module	Qcells USA	Q.PEAK DUO BLK ML-G10+ (400–420W)	25,000–85,000	$135–$165/panel	Yes

Table 10: Inverters

Category	Manufacturer	Model	Est. Qty	Soft Quote (USD)	Domestic
Inverter	Sungrow	SG3125HV-MV	3–10 units	$120,000–$160,000	No
Inverter	SMA	Sunny Central UP (4600 kVA)	2–7 units	$140,000–$180,000	Some (TX)
Inverter	Huawei	SUN2000-3300	3–9 units	$125,000–$165,000	No
Inverter	Solectria (Yaskawa)	XGI 1500-250	40–120 units	$22,000–$28,000	Yes (MA)
Inverter	Gamesa Electric	Proteus PV 4700	2–6 units	$150,000–$200,000	No

Table 11: Transformers

Category	Manufacturer	Model / Type	Est. Qty	Soft Quote (USD)	Domestic
Transformer	ABB	Pad-Mounted Utility Transformer	1 per block	$95,000–$175,000	Some (US)
Transformer	GE Grid Solutions	Solar Transformer (15–35 MVA)	1–2 total	$105,000–$185,000	Yes
Transformer	Siemens	MV Substation Transformer	1–2 total	$110,000–$190,000	Some (US)
Transformer	Virginia-Georgia	Liquid-Cooled MV Transformer	1 per system	$90,000–$160,000	Yes

Table 12: Battery Systems

Category	Manufacturer	Model	Est. Qty	Soft Quote (USD)	Domestic
BESS	Powin	Stack800	20–60 containers	$230,000–$260,000 each	Yes (OR)

4.3 Solar Potential

Table 13: Monthly average Global Horizontal Irradiance (GHI) in Normal, IL. Data estimates derived from regional data in Champaign, IL. Source: SolarEnergyLocal.com

Month	GHI (kWh/m²/day)
January	3.67
February	4.23
March	4.81
April	5.69
May	5.48
June	5.87
July	5.99
August	6.00
September	5.88
October	4.81
November	3.93
December	2.96

Interpretation: The highest solar resource in Normal, IL occurs from April through September, with GHI values exceeding 5.5 kWh/m²/day—ideal for solar PV production. The lowest production is in December and January, reflecting typical Midwestern winter conditions. This seasonal variation is important for sizing energy storage and optimizing inverter loading ratios in grid-connected PV projects.

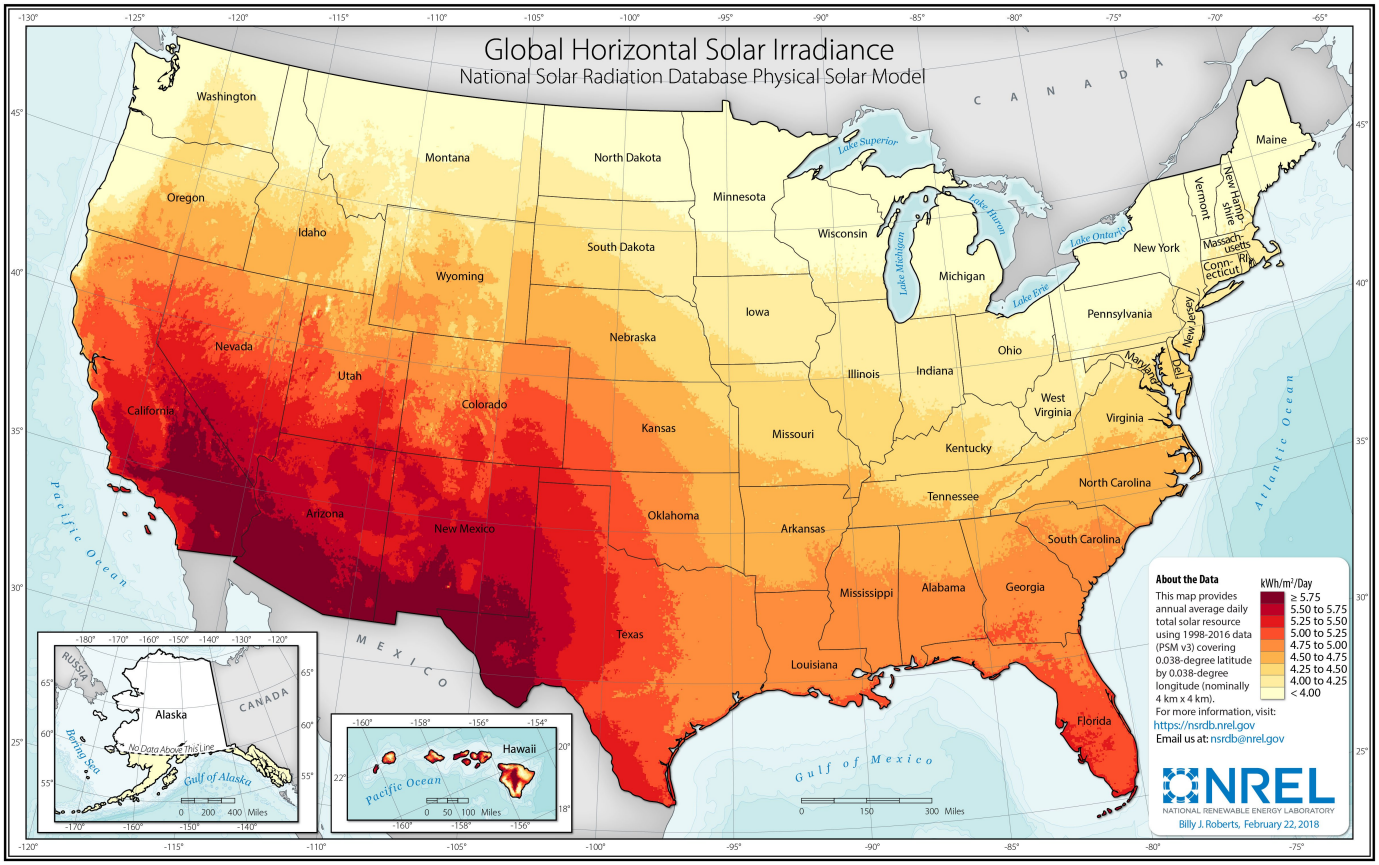


Figure 7: Global horizontal irradiance (GHI) is the total irradiance from the Sun on a horizontal surface on Earth.