Invenergy

2014 Nebraska Wind and Solar Conference

Utility Scale Solar

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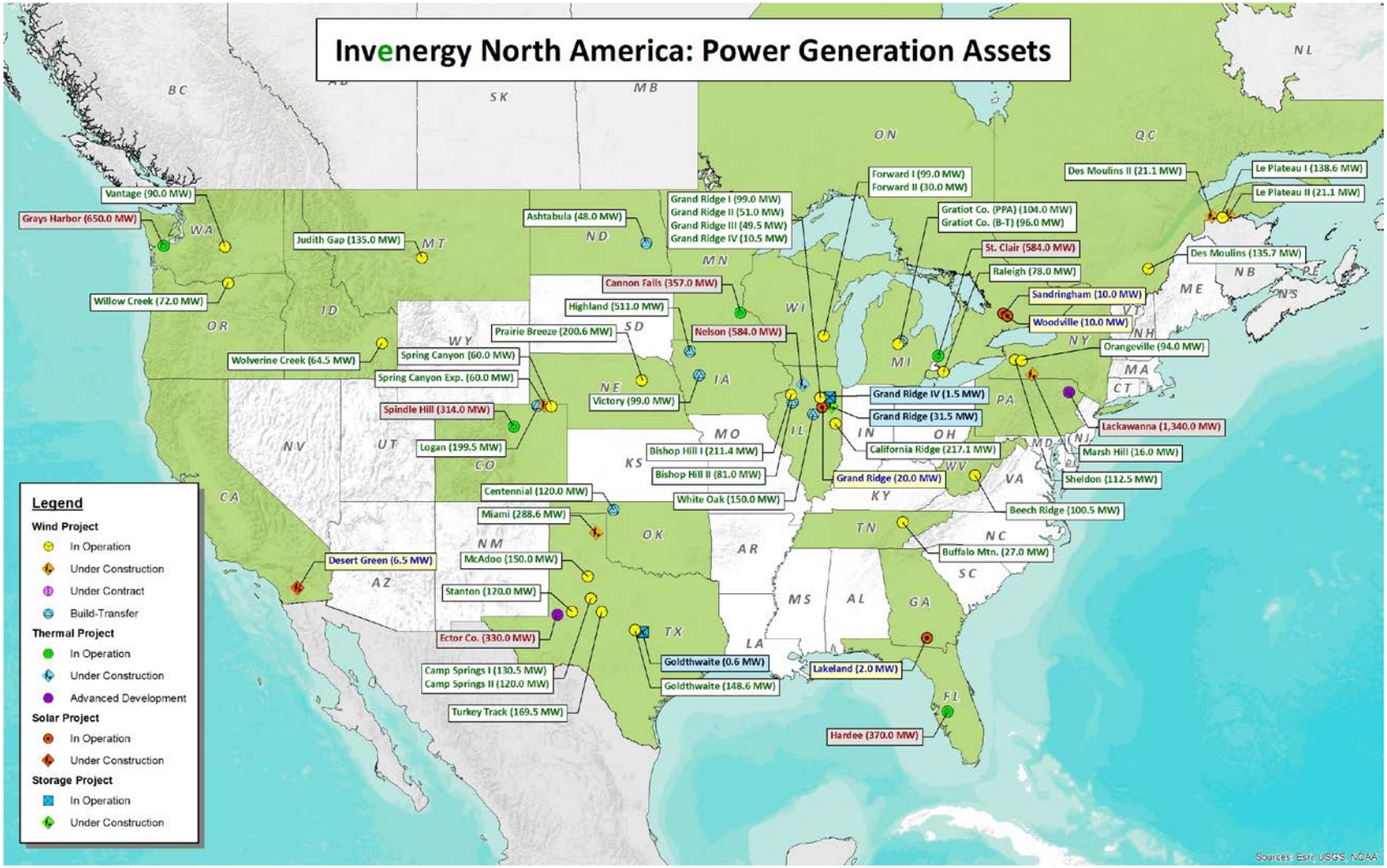
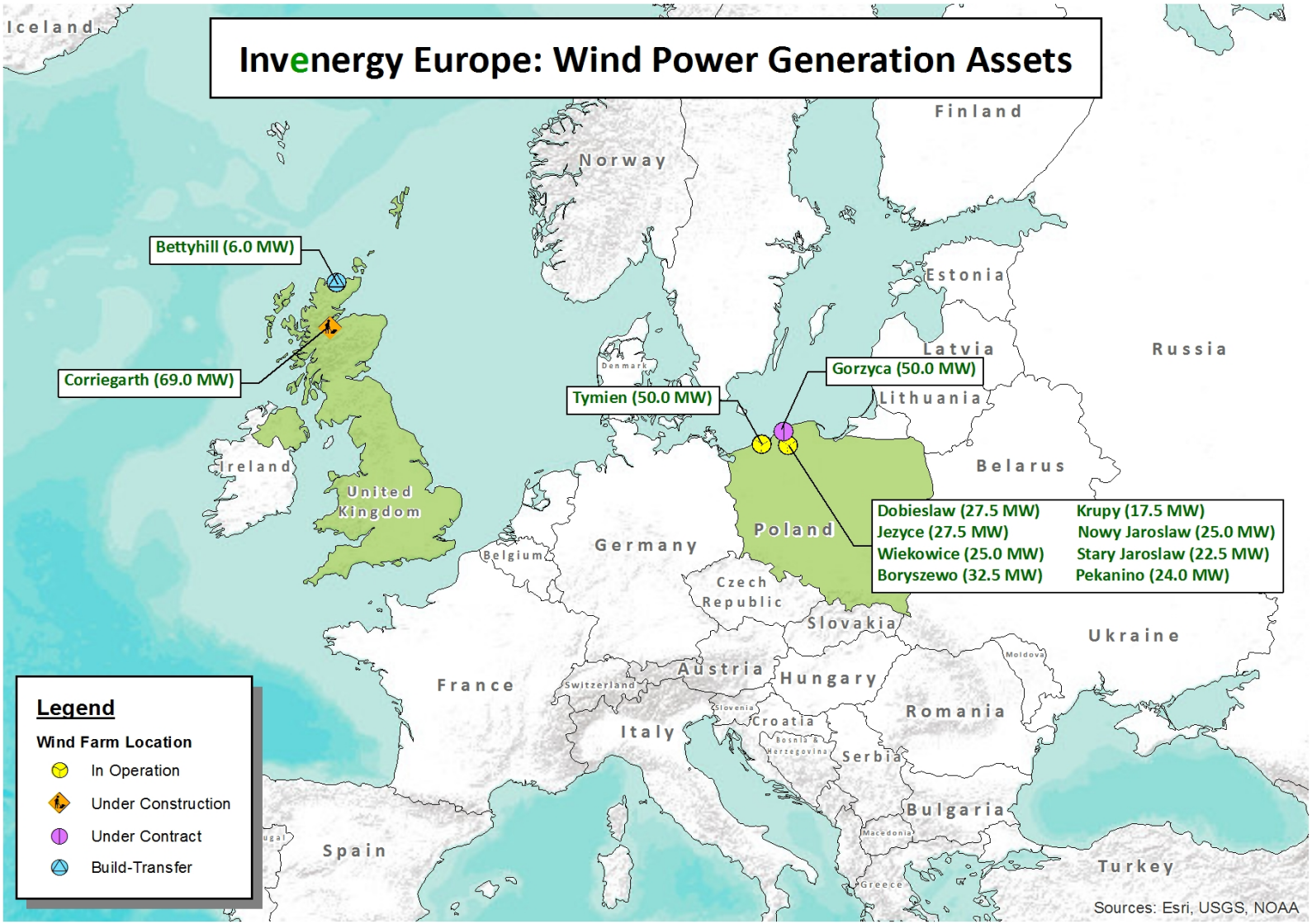

Invenergy North America: Power Generation Assets
Vantage (90.0 MW)
Grays Harbor (650.0 MW)
Judith Gap (135.0 MW)
Willow Creek (72.0 MW)
Wolverine Creek (64.5 MW)
Spring Canyon (60.0 MW)
Spring Canyon Exp. (60.0 MW)
Spindle Hill (314.0 MW)
Logan (199.5 MW)
Desert Green (6.5 MW)
Ashtabula (48.0 MW)
Grand Ridge I (99.0 MW)
Grand Ridge II (51.0 MW)
Grand Ridge III (49.5 MW)
Grand Ridge IV (10.5 MW)
Cannon Falls (357.0 MW)
Highland (511.0 MW)
Prairie Breeze (200.6 MW)
Victory (99.0 MW)
Nelson (584.0 MW)
Bishop Hill I (211.4 MW)
Bishop Hill II (81.0 MW)
Centennial (120.0 MW)
Miami (288.6 MW)
McAdoo (150.0 MW)
Stanton (120.0 MW)
Ector Co. (330.0 MW)
Camp Springs I (130.5 MW)
Camp Springs II (120.0 MW)
Turkey Track (169.5 MW)
Goldthwaite (0.6 MW)
Goldthwaite (148.6 MW)
White Oak (150.0 MW)
Forward I (99.0 MW)
Forward II (30.0 MW)
Gratiot Co. (PPA) (104.0 MW)
Gratiot Co. (B-T) (96.0 MW)
St. Clair (584.0 MW)
Raleigh (78.0 MW)
Grand Ridge IV (1.5 MW)
Grand Ridge (31.5 MW)
California Ridge (217.1 MW)
Grand Ridge (20.0 MW)
Lakeland (2.0 MW)
Hardee (370.0 MW)
Des Moulins II (21.1 MW)
Le Plateau I (138.6 MW)
Le Plateau II (21.1 MW)
Des Moulins (135.7 MW)
Sandringham (10.0 MW)
Woodville (10.0 MW)
Orangeville (94.0 MW)
Lackawanna (1,340.0 MW)
Marsh Hill (16.0 MW)
Sheldon (112.5 MW)
Beech Ridge (100.5 MW)
Buffalo Mtn. (27.0 MW)
Legend
Wind Project
In Operation
Under Construction
Under Contract
Build-Transfer
Thermal Project
In Operation
Under Construction
Advanced Development
Solar Project
In Operation
Under Construction
Storage Project
In Operation
Under Construction
Sources: Esri, USGS, NOAA


Invenergy Europe: Wind Power Generation Assets
Bettyhill (6.0 MW)
Corriegarth (69.0 MW)
Tymien (50.0 MW)
Gorzyca (50.0 MW)
Dobieslaw (27.5 MW)
Jezyce (27.5 MW)
Wiekowice (25.0 MW)
Boryszewo (32.5 MW)
Krupy (17.5 MW)
Nowy Jaroslaw (25.0 MW)
Stary Jaroslaw (22.5 MW)
Pekanino (24.0 MW)
Legend
Wind Farm Location
In Operation
Under Construction
Under Contract
Build-Transfer
Iceland
Norway
Finland
Estonia
Latvia
Russia
Lithuania
Belarus
Ireland
United Kingdom
Denmark
Germany
Poland
Belgium
Czech Republic
Slovakia
Ukraine
France
Switzerland
Austria
Hungary
Moldova
Romania
Slovenia
Croatia
Italy
Bosnia & Herzegovina
Serbia
Bulgaria
Macedonia
Spain
Greece
Turkey
Sources: Esri, USGS, NOAA

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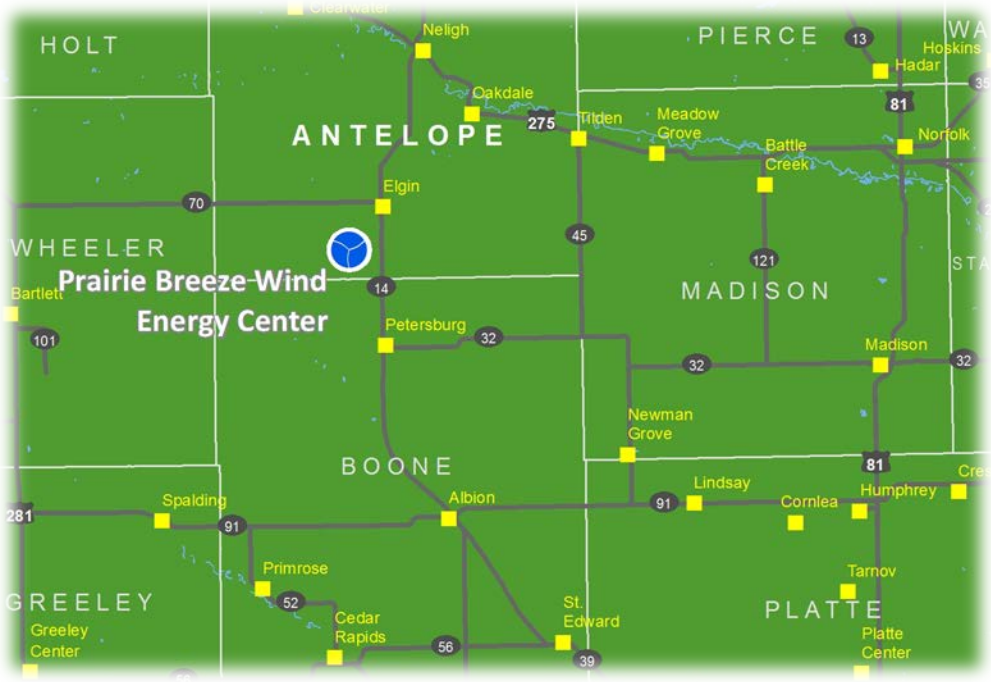
Prairie Breeze Wind Energy Center

Project Facts

- Commercial Operation: May 2014
- Size: 201 MW – 118 wind turbines
- Location: Antelope/Boone Counties
- Off-taker: OPPD contracted for full output
- Employment: Fourteen (14) full-time Invenergy Services employees



Elgin, NE

Invenergy Wind Portfolio

Invenergy is sixth largest owner of wind assets in United States as measured by AWEA (Dec, 2013)

Our current wind portfolio consists of 5,188.2 MW*

- 45 operating wind projects = 4,082.3 MW
- 8 wind projects in construction = 986.9 MW
- 2 wind projects under contract = 119 MW
- Invenergy is the first in the United States to install GE Brilliant Wind Turbines, which co-locates a 2 hour, 200kW battery with a 2.5 MW wind turbine.

Logan County Wind Farm, Colorado

** Figures include projects that Invenergy has built or developed and then transferred to other utility companies.*

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Invenergy Thermal Overview

Project	Location	COD	Size of Facility
Hardee	Florida	Acquired 2003	370 MW
Spindle Hill	Colorado	2007	314 MW
Grays Harbor	Washington	2008	620 MW
Cannon Falls	Minnesota	2008	357 MW
St. Clair	Ontario	2009	584 MW
Nelson	Illinois	In Construction	584 MW
			Total: 2,829 MW

Hardee Power Station - The Hardee Power Station is a 370 MW facility consisting of a 220 MW combined cycle system and 150 MW peaking system. The plant is located east of Tampa, Florida.

Spindle Hill Energy Center - In 2007, the 314 MW Spindle Hill Energy Center commenced commercial operation. The plant is located in Frederick, Colorado.

Grays Harbor Energy Center - In 2008, the 620 MW Grays Harbor Energy Center, located southwest of Seattle, Washington, commenced commercial operation.

Cannon Falls Energy Center – In 2008, the 357 MW Cannon Falls Energy Center commenced commercial operation. The plant is located in Cannon Falls, Minnesota.

St. Clair Energy Center – In 2009, Invenergy completed the construction and commissioning of the 584 MW St. Clair project located in St. Clair Township, Ontario, Canada.

Invenergy Storage Portfolio

- Invenergy has expanded its business reach into the energy storage sector. It completed the Grand Ridge Storage Pilot project in 2012, and the Goldthwaite Storage project in 2014.
- Invenergy is seeking to add over 100 MWs of new energy storage projects in the next few years in RTO market areas having a high concentration of intermittent generation.

GRAND RIDGE STORAGE PILOT

- Completed pilot energy storage project in 2012
- 1.5MW/375kWh Lithium Titanate Oxide (LTO) Battery
- Provides dynamic regulation service (DREG) to PJM

GOLDTHWAITE STORAGE

- Three GE 2.5MW – 120 meter rotor turbines with 300kW/600kWh GE Durathon batteries
- Utilize existing inverter to maximize generator output
- Three applications:
  - Ramp Control
  - Predictable Power
  - Frequency Regulation

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Invenergy Solar Portfolio

- Invenergy is also active in the solar PV sector, completing the largest PV project in Illinois in 2012: the 20 MW Grand Ridge Solar facility which is adjacent to its 210 MW Grand Ridge Wind facility.
- In 2013 Invenergy completed two 10 MW solar PV projects in Ontario.
- Invenergy selectively pursues solar projects in areas where it is already developing other projects.

Project	Location	COD	Size
Grand Ridge Solar	Illinois	2012	20 MW
Sandringham	Ontario	2013	10 MW
Woodville	Ontario	2013	10 MW
Lakeland I	Georgia	2013	1 MW
Lakeland II	Georgia	2013	1 MW
Desert Green	California	2014	6.5 MW
		Total:	48.5 MW

Grand Ridge Solar - LaSalle County, Illinois

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Utility Scale Solar – Nebraska

- Solar Basics
- What is the solar resource in Nebraska?
- How have solar costs changed over time?
- What is important to development of solar energy in Nebraska?

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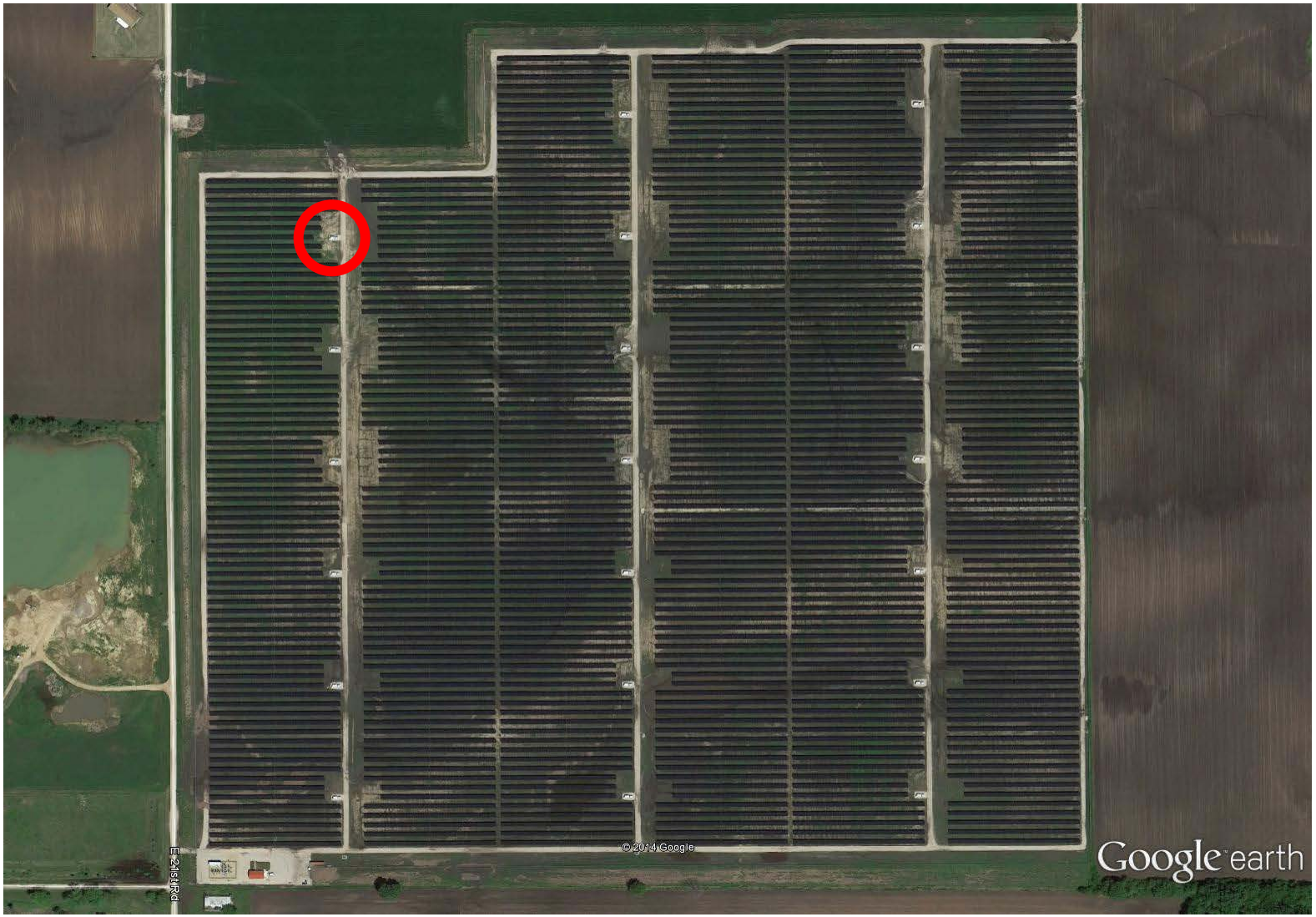
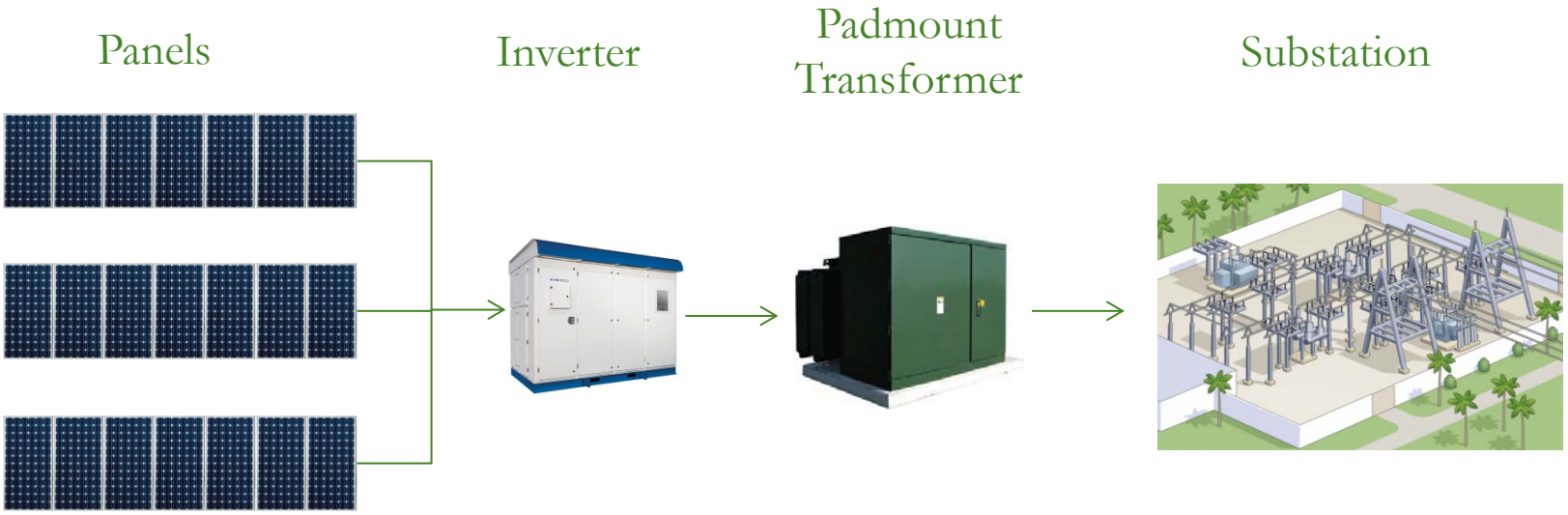
Solar Basics – Aerial View



20MW Grand Ridge Solar - LaSalle County, Illinois

Solar Basics – Electrical

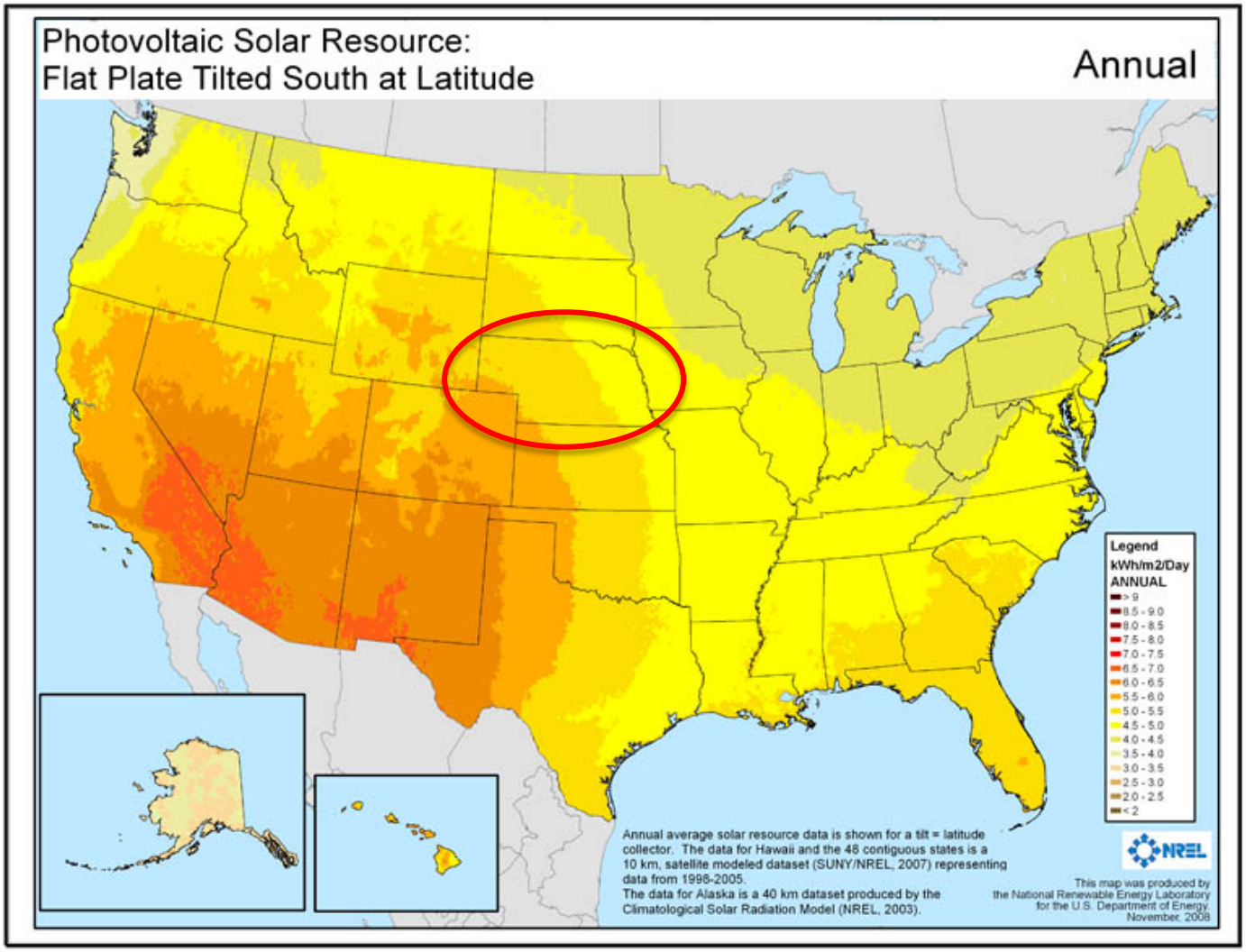
1. Energy generated by the solar panels
2. Energy (current) converted from DC to AC by inverter
3. Voltage stepped up for distribution by padmount transformer
4. Energy sent from transformer to substation



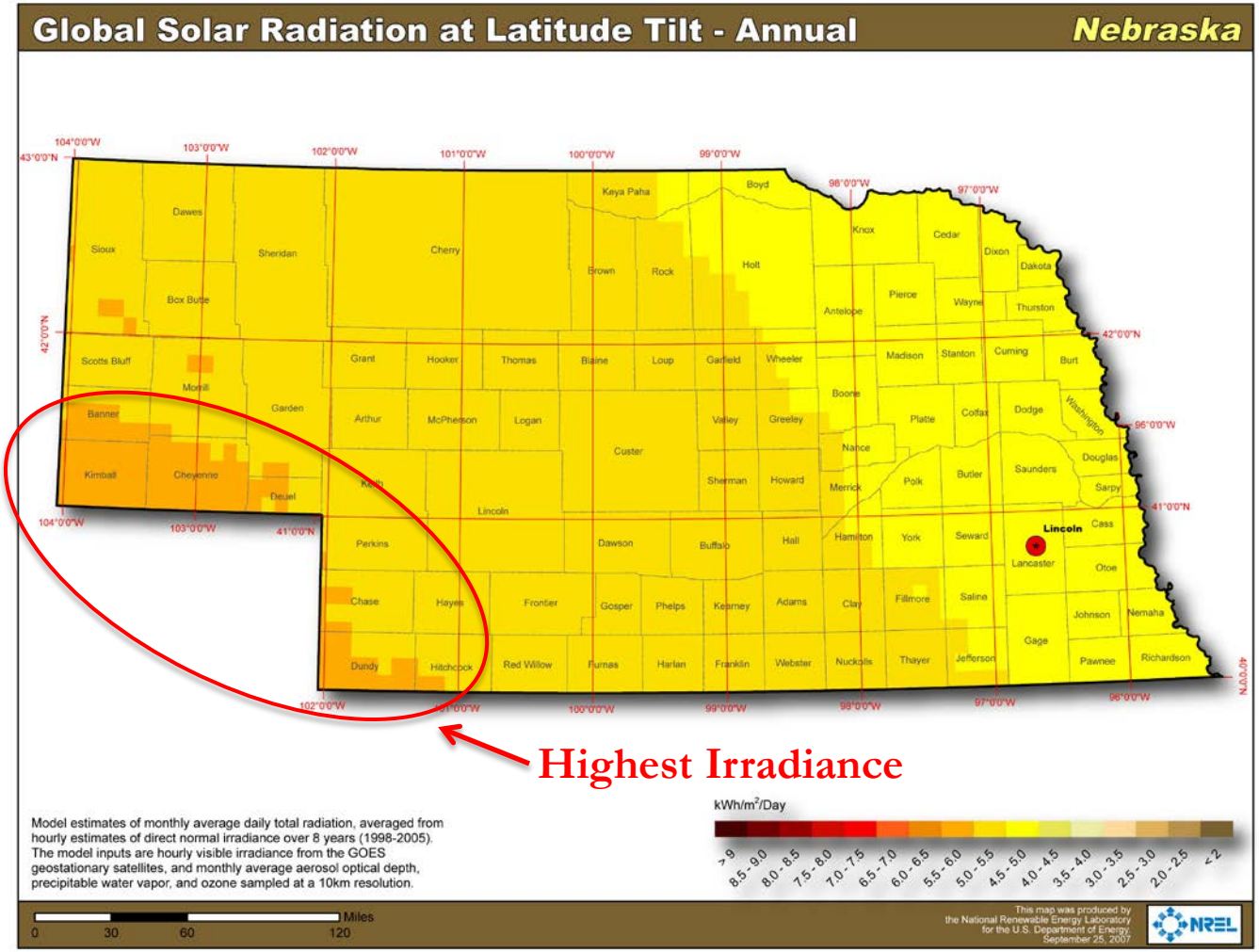
Solar Basics – Major Components

- Racks
  - Securely holds panels to face sun
- Solar Panels
  - Converts solar energy into DC electricity
- Inverters
  - Converters DC to AC
- Transformers
  - Increases AC voltage
- Interconnection
  - Connect to electrical distribution system

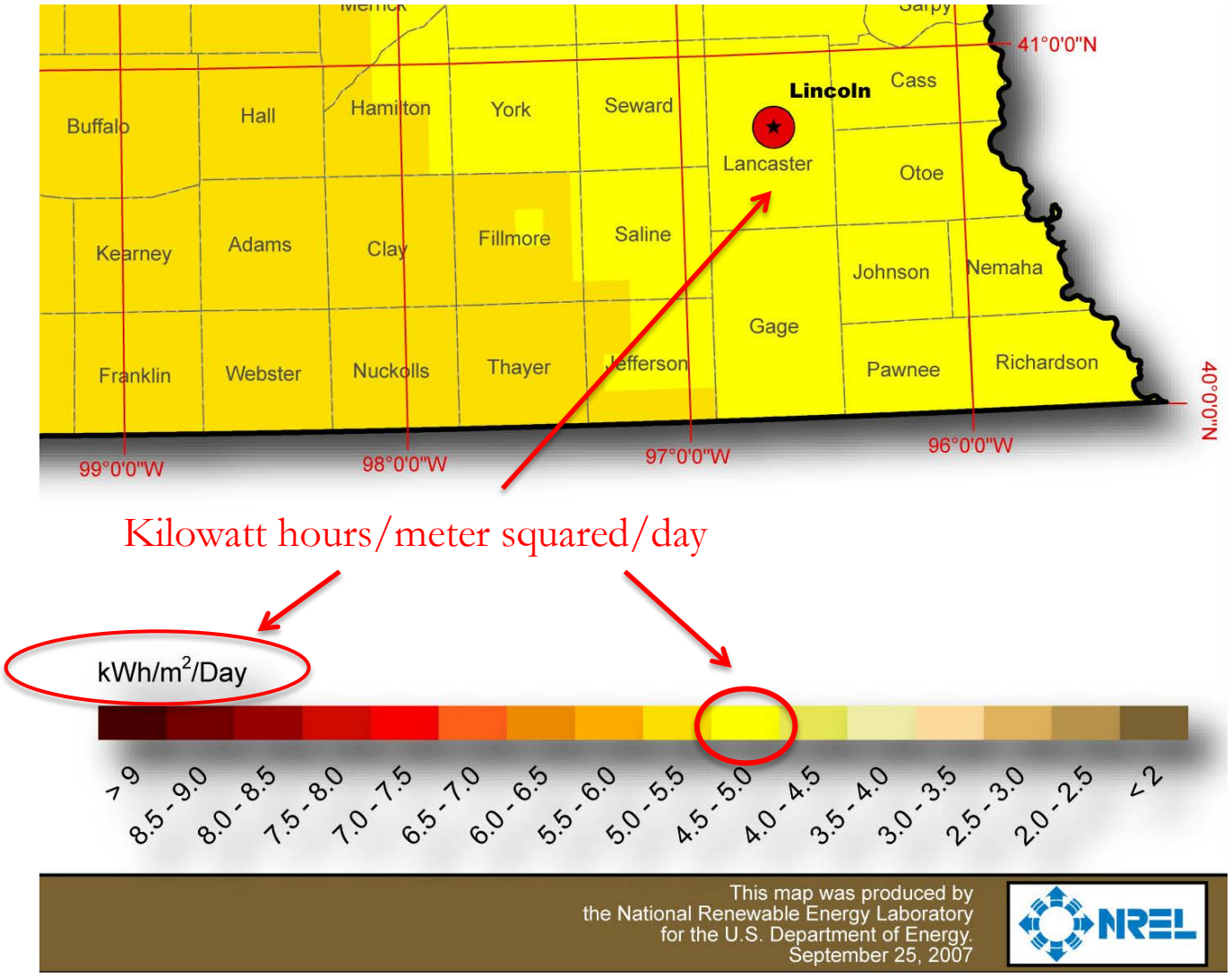
Solar Resource – United States



Solar Resource – Nebraska



Solar Resource – Lincoln/Omaha Area



Solar Resource – Regional Comparison

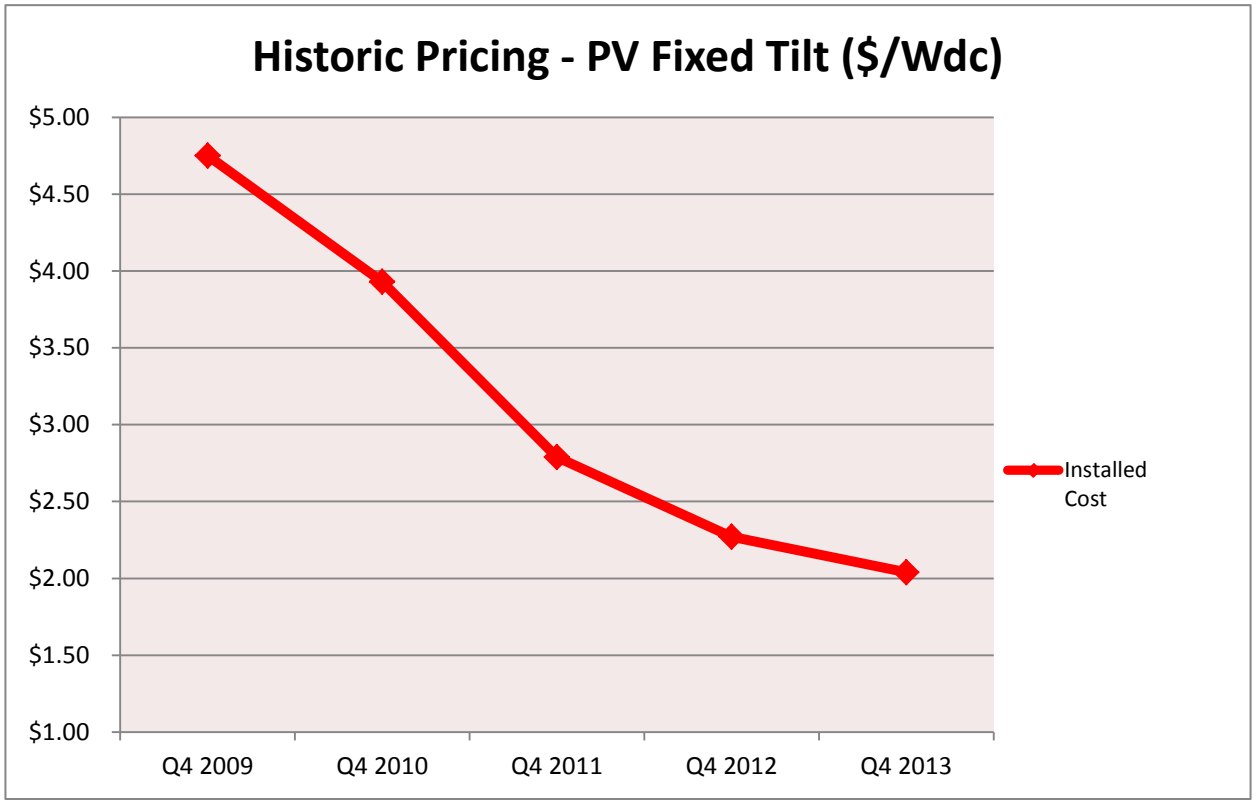
Translating the resource to a net capacity factor (NCF) to estimate energy production provides understanding of energy.

The following are regional NCF, assuming fixed tilt PV system for NE, Southern CO, and Southern NV.

Location	NCF (%)	50MW$_{ac}$ Plant
Nebraska	19% - 21%	88,000 MWh
Southern Colorado	27%	114,000 MWh
Southern Nevada	30%	131,000 MWh
NE Wind Farm	50%	219,000 MWh

Solar Installation – Historical Price Points

- Solar pricing has decreased dramatically over last five years, which allows for economical deployment in new locals, like Nebraska.



* NREL and LBNL capacity weighted information.

Solar Development – Keys

- Available Land
  - Range of 3 to 7 acres per MW installed
  - Land with little to no slope
  - Work with willing landowners to lease or purchase property
  - Nebraska – if it's flat, it's probably good for corn and beans so finding the right location is important

- Electrical infrastructure
  - Need available interconnection capacity
  - Preference for electrical infrastructure in close proximity
  - Low voltage = Lower cost

- Resource
  - Ideal to locate in areas with higher solar irradiance.

Solar Benefits and Opportunities – Nebraska

- Solar provides energy during daylight hours, typically close to peak demand – this could help balance intermittency of wind
- Decreasing prices allow for more economical installation at utility scale in areas not previously targeted
- Localized land use, typically one or two parcels adjacent to electrical interconnection
- No emissions or wastewater, small and infrequent water use, and low profile installation
- Relatively few moving parts (20-30 year life expectation)
- Potential for higher capacity credit in SPP


Thank You