



Solar Possibilities in Kansas Will Solar Work for Me?

BILL WOOD
PROJECT DEVELOPER
CROMWELL SOLAR



Farmers Utilize Solar for Crops and Livestock Production



Outline for Presentation

How a solar system works and the equipment

How to evaluate if your farm is a candidate for solar

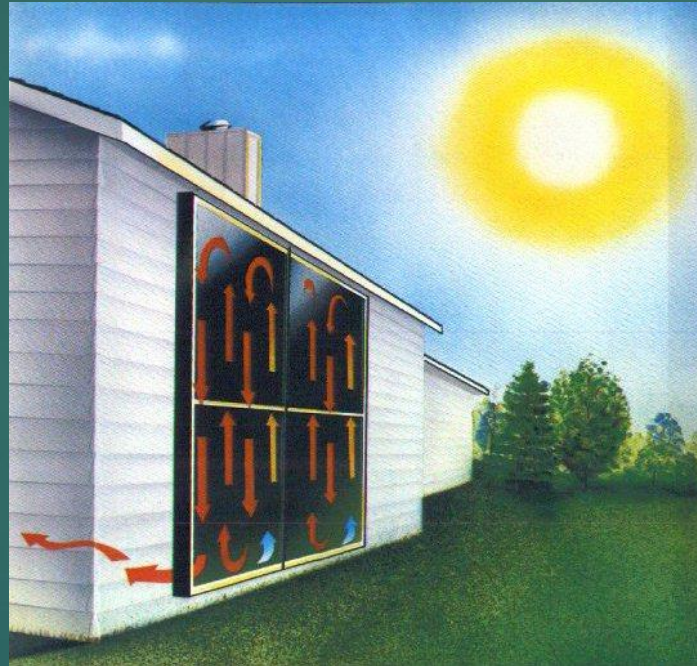
How do the financial numbers look

Types of Solar

Solar Hot Water



Solar Hot Air



Photovoltaic



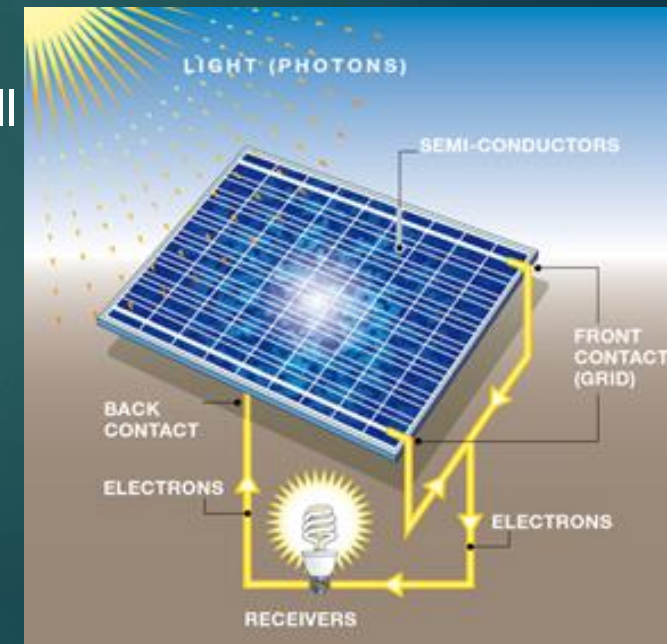
PV Effect

The solar photovoltaic (PV) effect is the process by which sunlight is converted directly into electricity. In 1839, Edmond Becquerel, a French physicist, discovered the process of producing an electric current in a solid material using sunlight. But it wasn't until 1954 that scientists at Bell Telephone discovered that, when exposed to sunlight, silicon created an electric charge.

Photovoltaic energy has been used to power small items like wristwatches and calculators. But there are ways to use solar PV technology to generate electricity on a much larger scale:

Monocrystalline silicon, polycrystalline silicon and thin film solar panels use small squares – cells – of conductive material to produce electricity for homes and businesses.

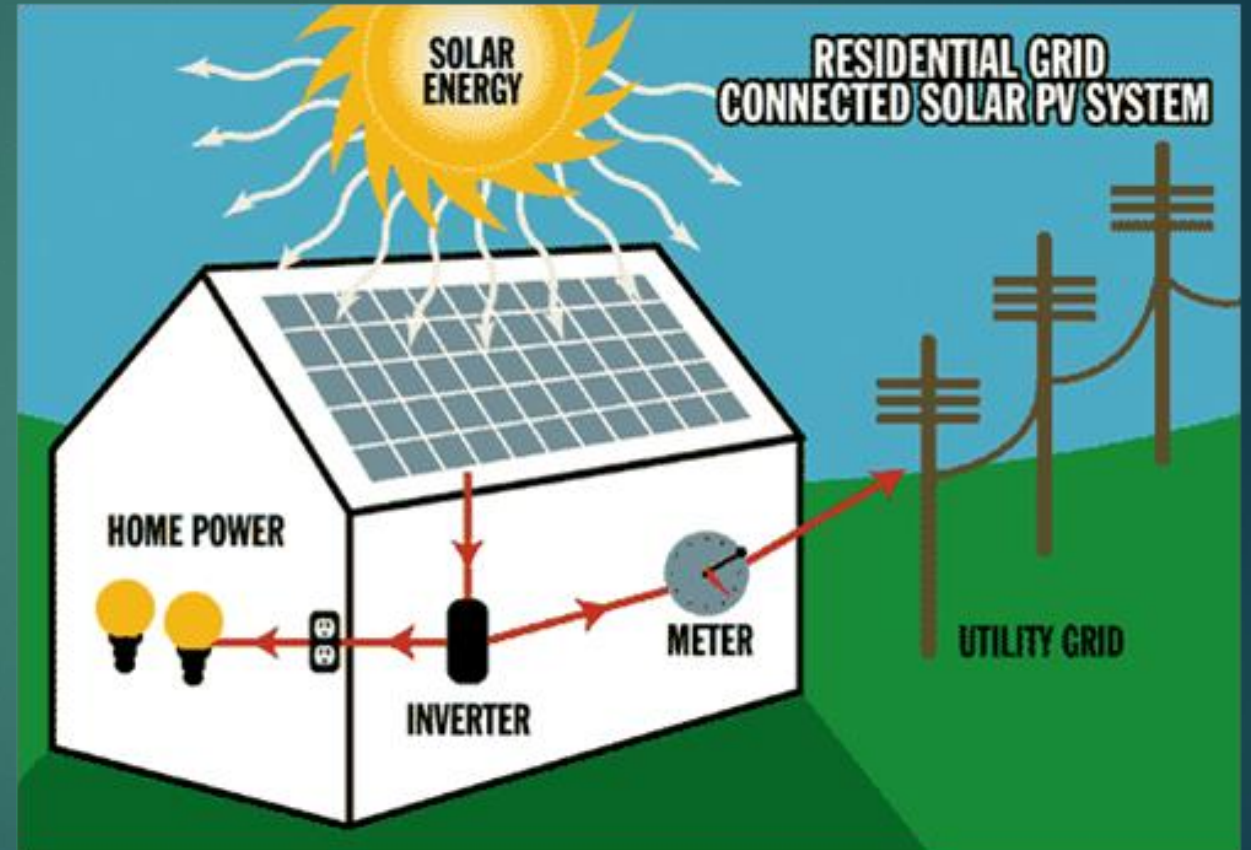
Photovoltaic cells are combined onto a panel (also called a module). A collection of panels is referred to as an array.



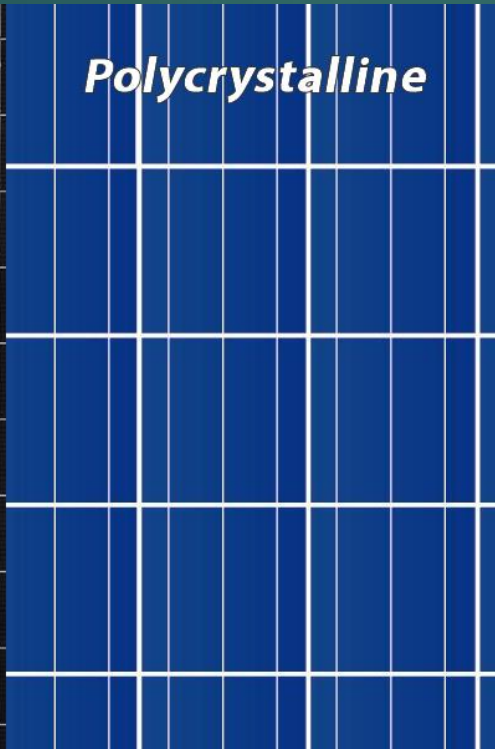
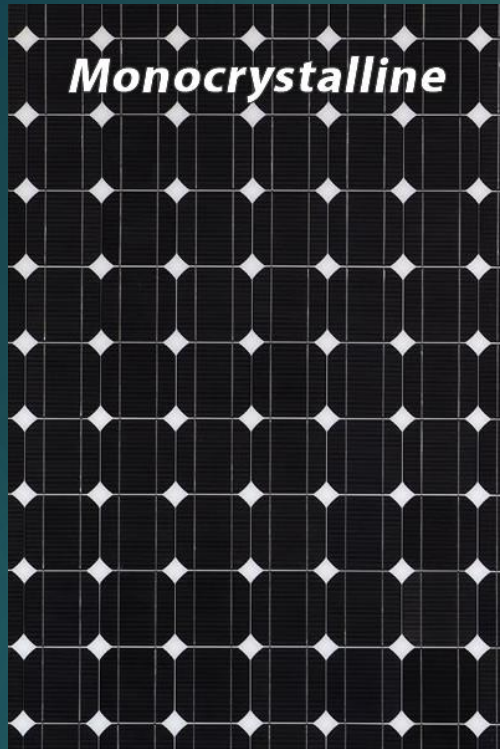
Components of PV System

Panels
Rack
Inverter

*Batteries not included



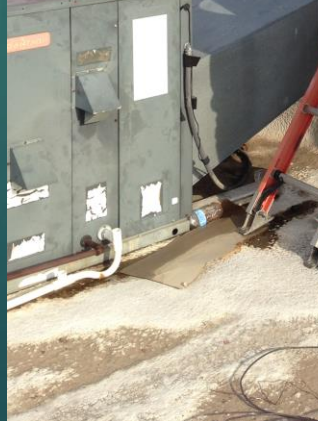
Types of PV Panels



Thin Film



Panels



Racking



Racking



Racking



Inverters



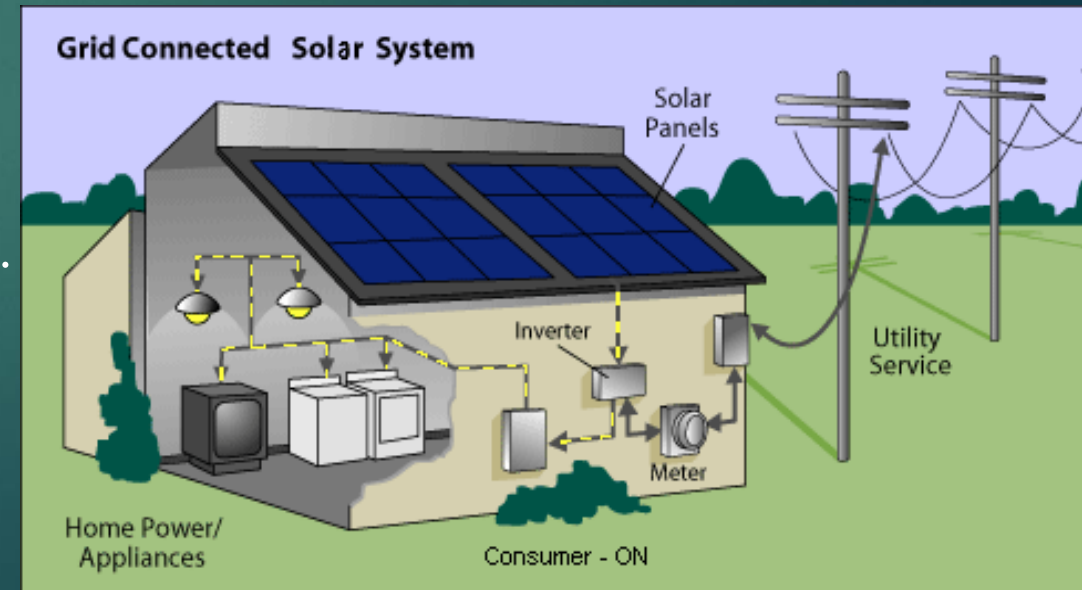
Inverters



Net Metering Monthly:

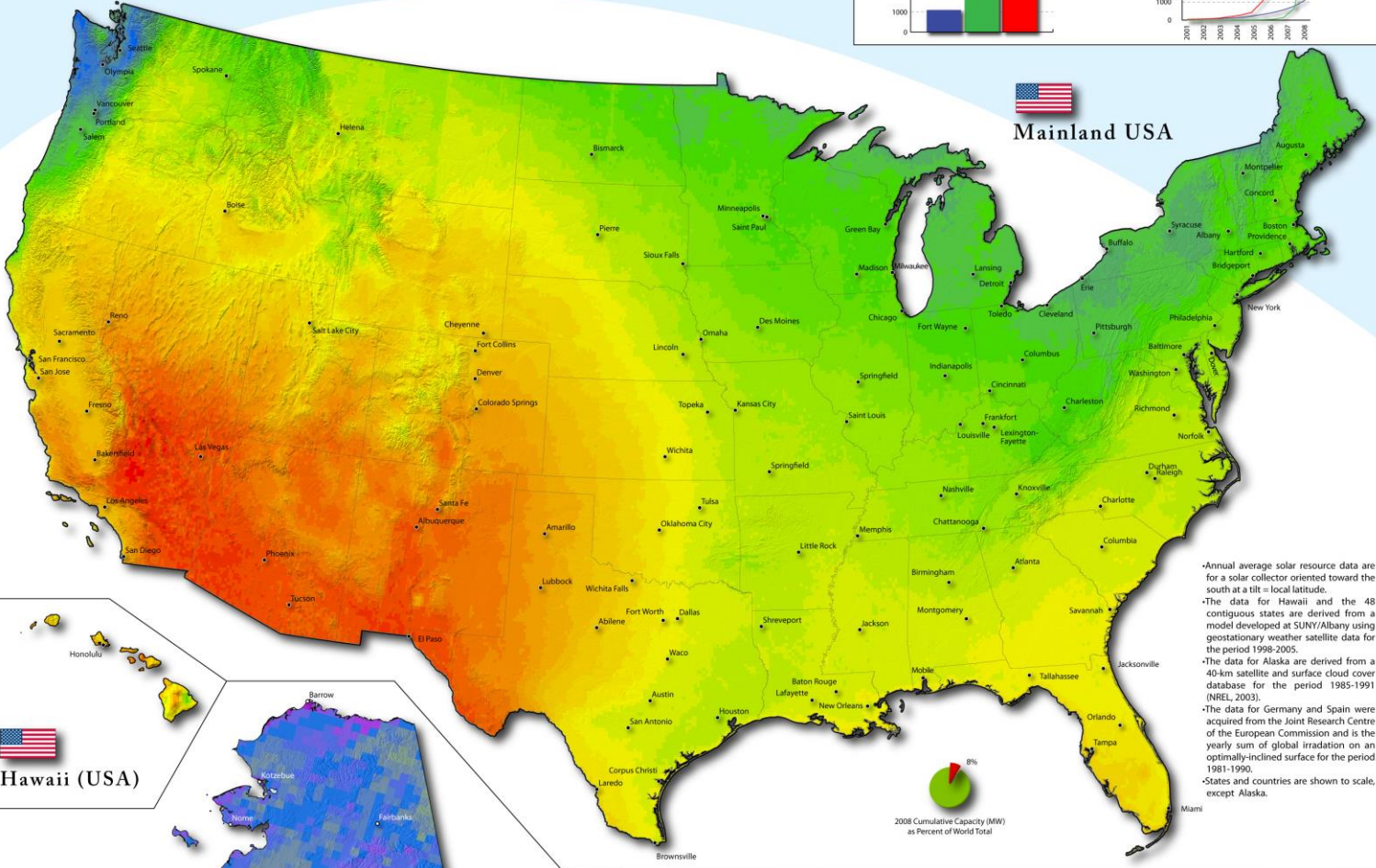
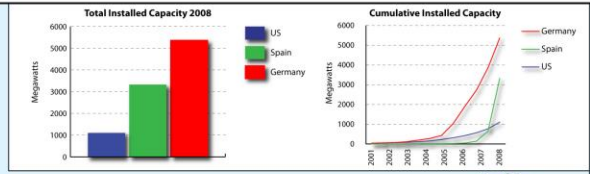
Like “Rollover Minutes” for electricity

- ▶ Over 99% of modern solar and wind systems for homes, farms and businesses are “grid-tied” and use the conventional grid instead of batteries.
- ▶ Most power generated by solar and wind is used onsite when it’s produced.
- ▶ When more renewable power is produced than needed at that time the excess is sent onto the grid and a credit is given for when power is needed. Solar Example: extra power made during the day is credited for when you need it at night. This credit system is 1:1 and known as net-metering.
- ▶ At the end of the month your account is “trued-up.”
- ▶ 95% of the electric companies zero out any excess.
- ▶ 5% credit you for any excess at 100% of avoided costs.



Photovoltaic Solar Resource

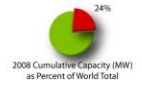
The United States of America, Spain and Germany



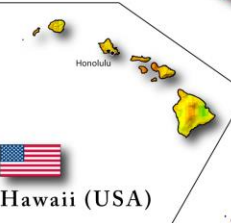
Mainland USA



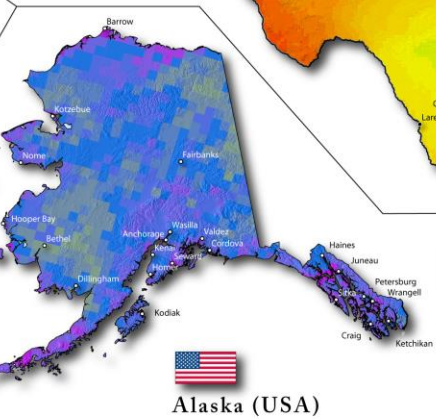
Spain



Germany

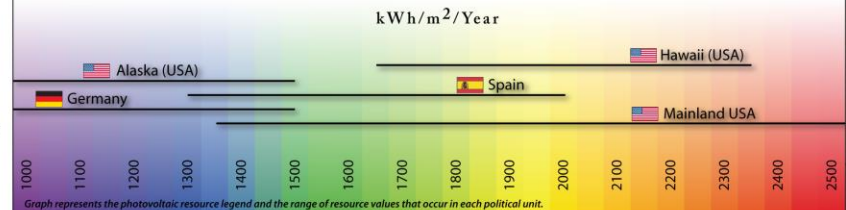
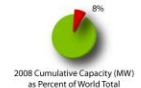


Hawaii (USA)



Alaska (USA)

• Annual average solar resource data are for a solar collector oriented toward the south at a tilt = local latitude.
 • The data for Hawaii and the 48 contiguous states are derived from a model developed at SUNY/Albany using geostationary weather satellite data for the period 1998-2005.
 • The data for Alaska are derived from a 40-km satellite and surface cloud cover database for the period 1985-1991 (NREL, 2003).
 • The data for Germany and Spain were acquired from the Joint Research Centre of the European Commission and is the yearly sum of global irradiation on an optimally-inclined surface for the period 1981-1990.
 • States and countries are shown to scale, except Alaska.



1991 4/2016 2016

N



Google Earth

1991

Imagery Date: 5/11/2015 38°47'47.67" N 95°25'11.55" W elev 1145 ft eye alt 1638 ft

5/2015



Google Earth

Imagery Date: 5/11/2015 39°03'24.71" N 95°24'44.90" W elev 905 ft eye alt 1487 ft



© 2016 Google

Google Earth

1991

Imagery Date: 3/27/2016 38°43'45.17" N 94°50'10.25" W elev 1034 ft eye alt 1273 ft

5/2014



Google Earth

1991

Imagery Date: 5/6/2014 38°43'44.96" N 94°50'10.69" W elev 1033 ft eye alt 1273 ft



© 2016 Google

Google earth



1991

Imagery Date: 4/3/2016

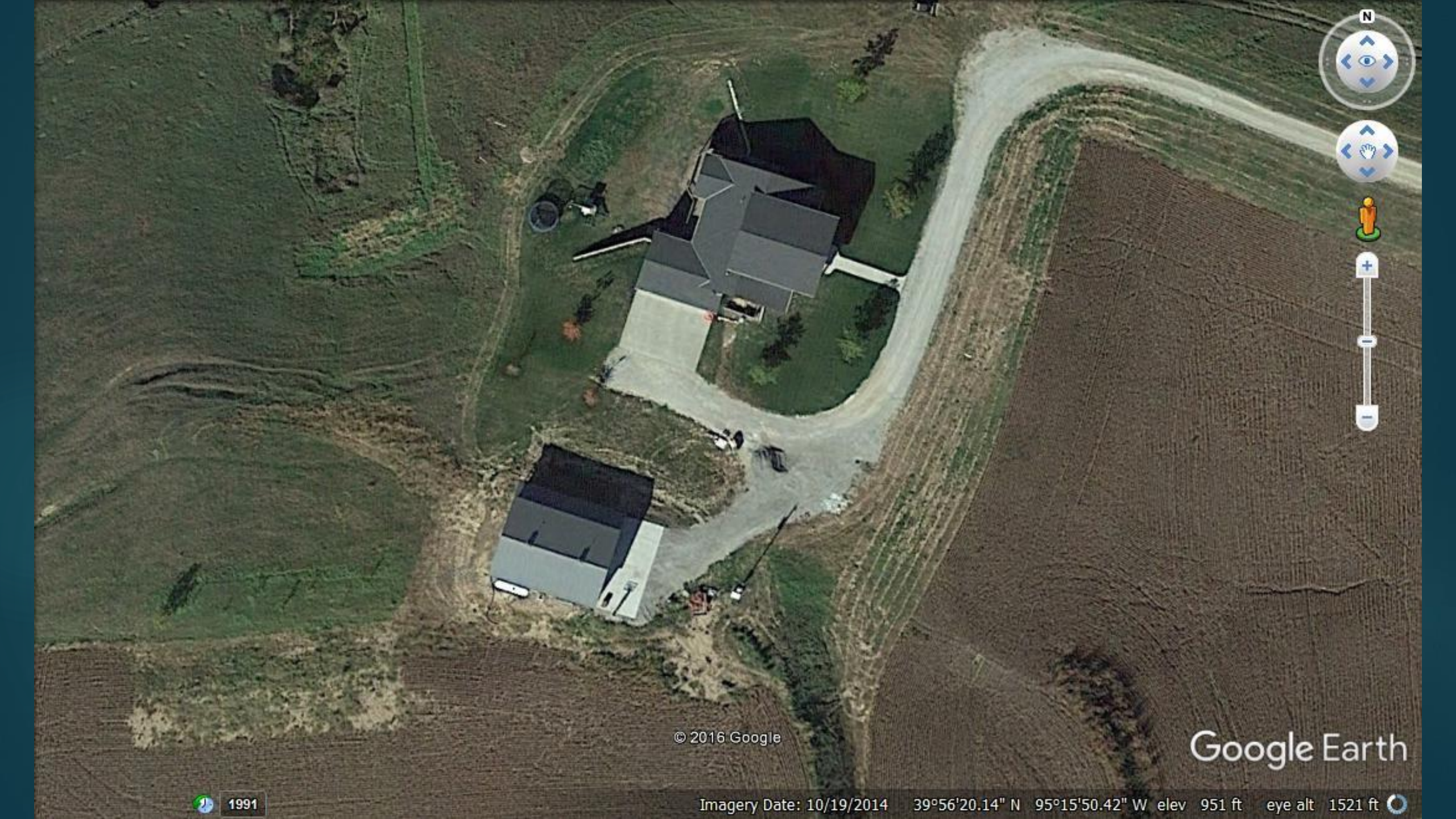
39°09'15.03" N

95°10'51.93" W

elev 1045 ft

eye alt 1316 ft





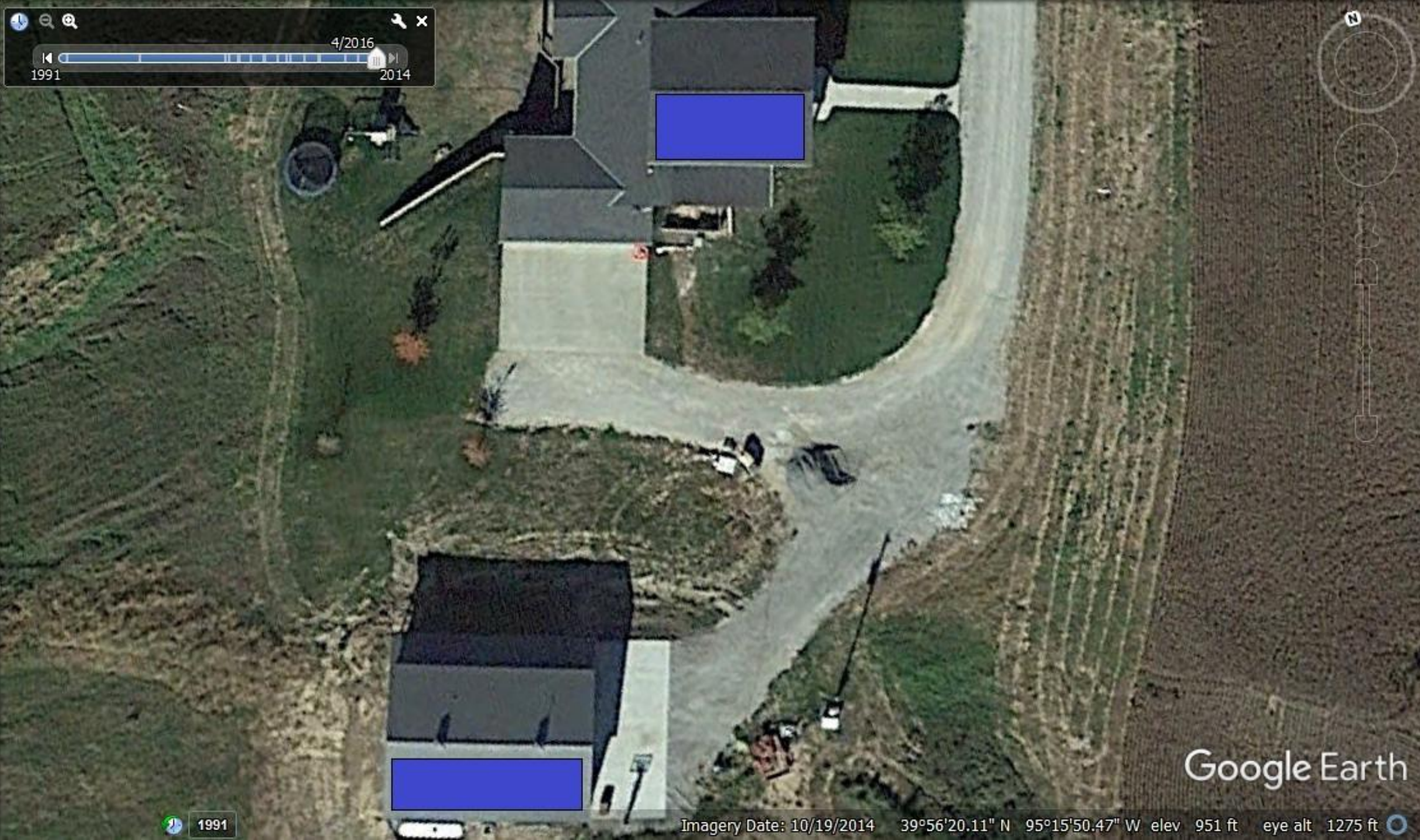
© 2016 Google

Google Earth

1991

Imagery Date: 10/19/2014 39°56'20.14" N 95°15'50.42" W elev 951 ft eye alt 1521 ft

4/2016
1991 2014



Google Earth

1991

Imagery Date: 10/19/2014 39°56'20.11" N 95°15'50.47" W elev 951 ft eye alt 1275 ft

Why go Solar?

▶ Environmental

- ▶ Average RESIDENTIAL system will keep over 500,000 pounds of greenhouse gasses out of our atmosphere over the first 25 years of the system
- ▶ Being a steward of our natural resources

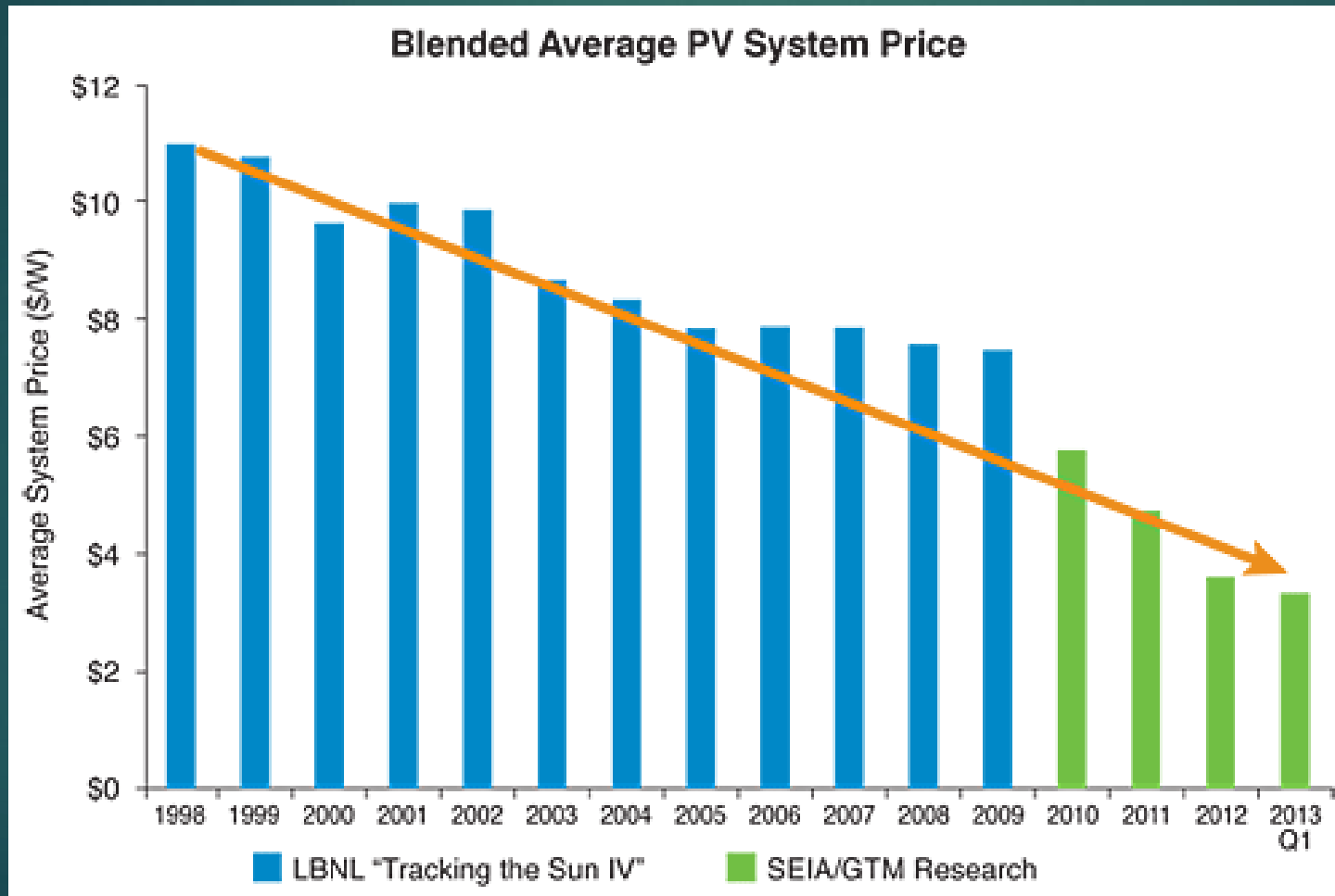
▶ Economic

- ▶ Conventional electricity rates keep climbing
- ▶ Incentives are good
- ▶ Paybacks are great
- ▶ Alternative financing exists now in Kansas

▶ Impression

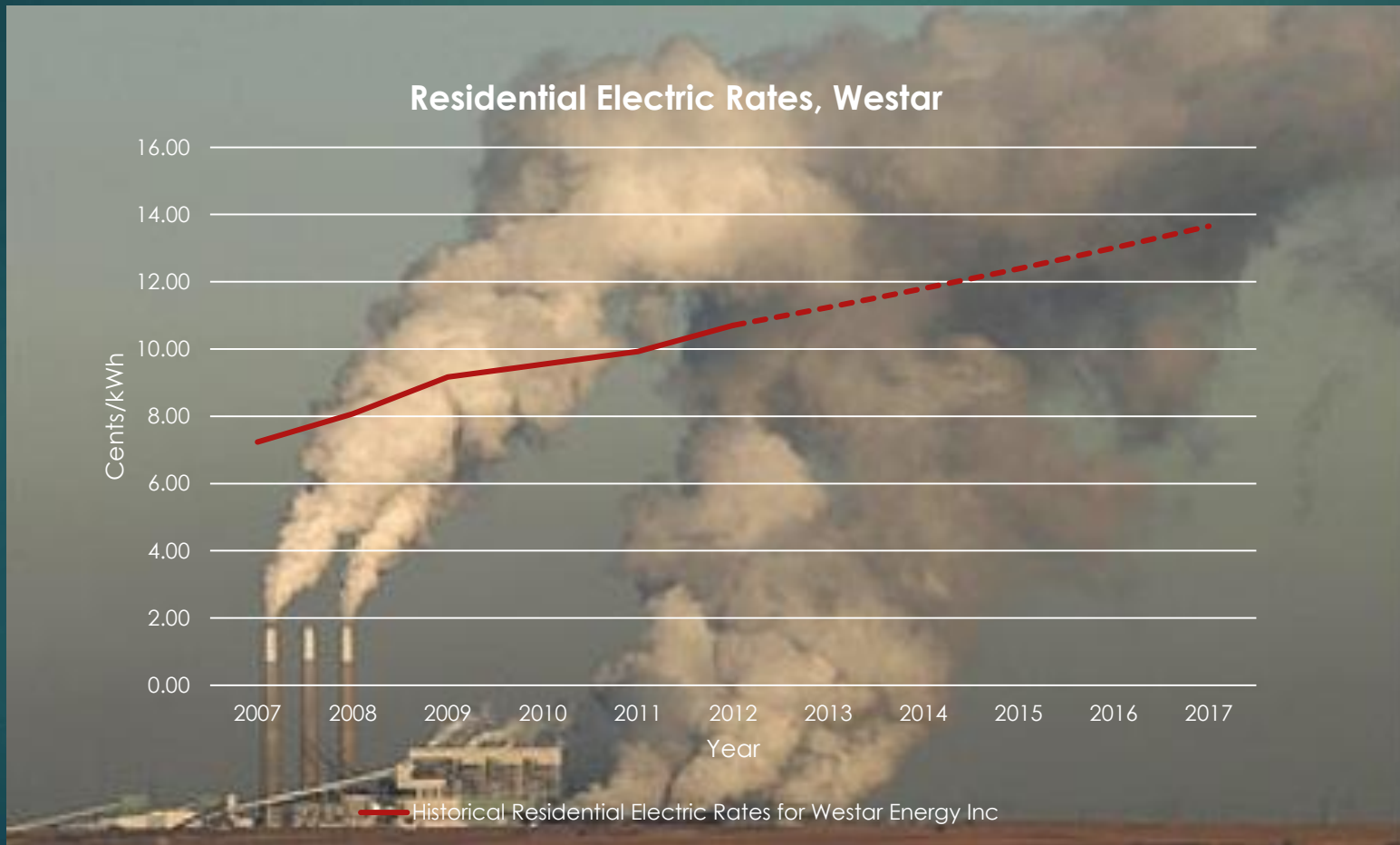
- ▶ Visually communicates your values while encouraging other people

Average Cost of Installed Systems



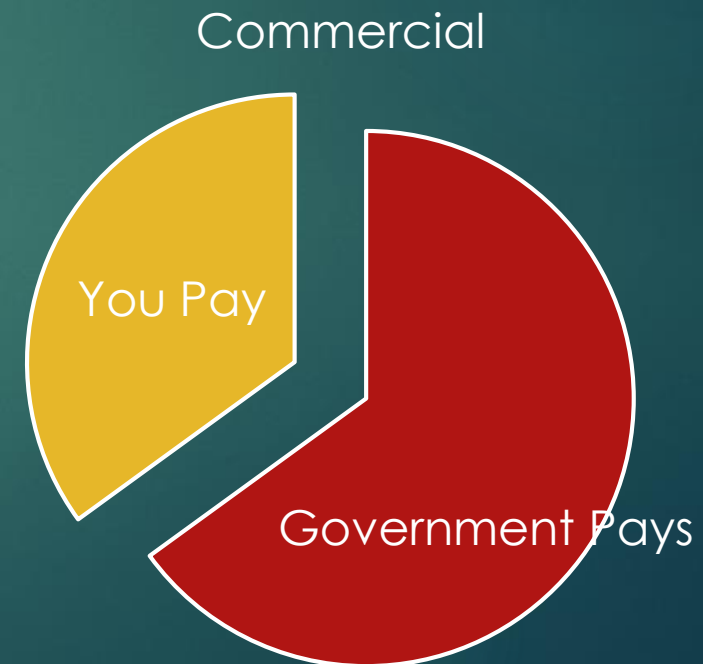
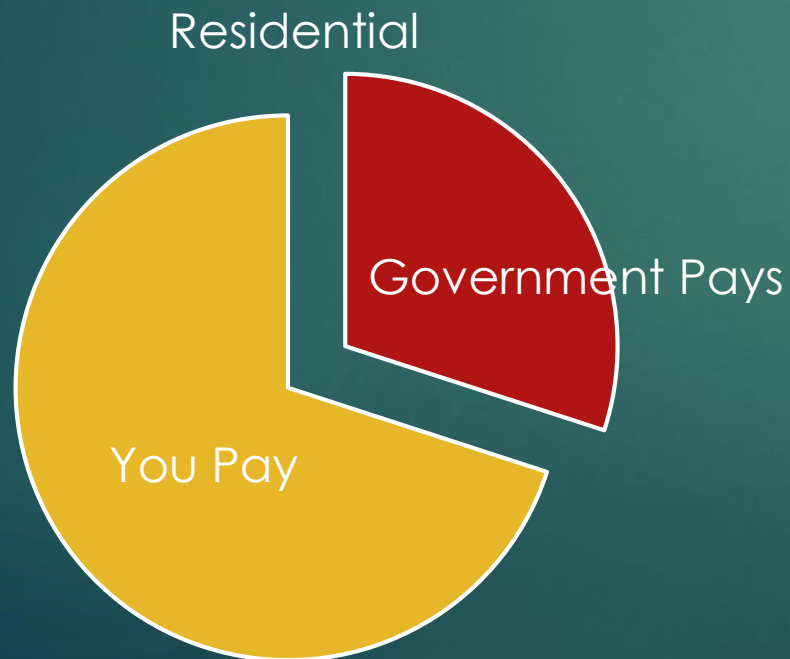
Economics of Solar

Conventional electricity rates keep climbing



Solar Incentives are good

- ▶ Federal Tax Credit (residential AND commercial)
 - ▶ 30% of total installed cost credited towards tax liability
- ▶ Accelerated depreciation (commercial)
 - ▶ As a tax advantage solar is allowed an accelerated 5 yr schedule despite a 40+yr life (Section 179 also possible) often worth about 35%

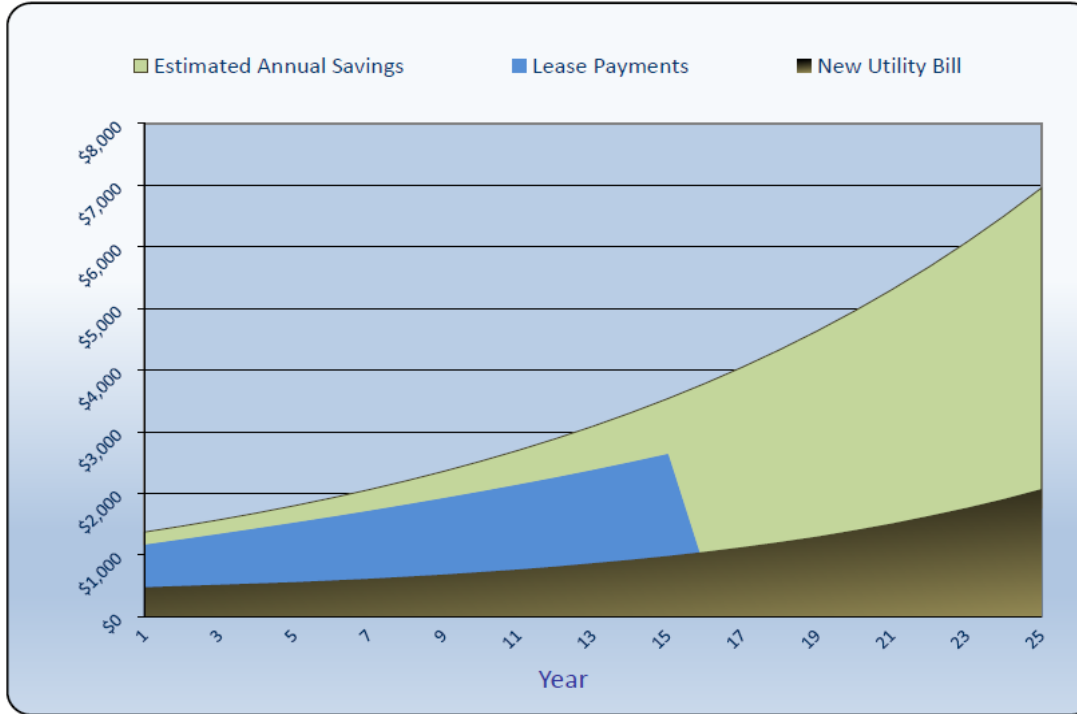
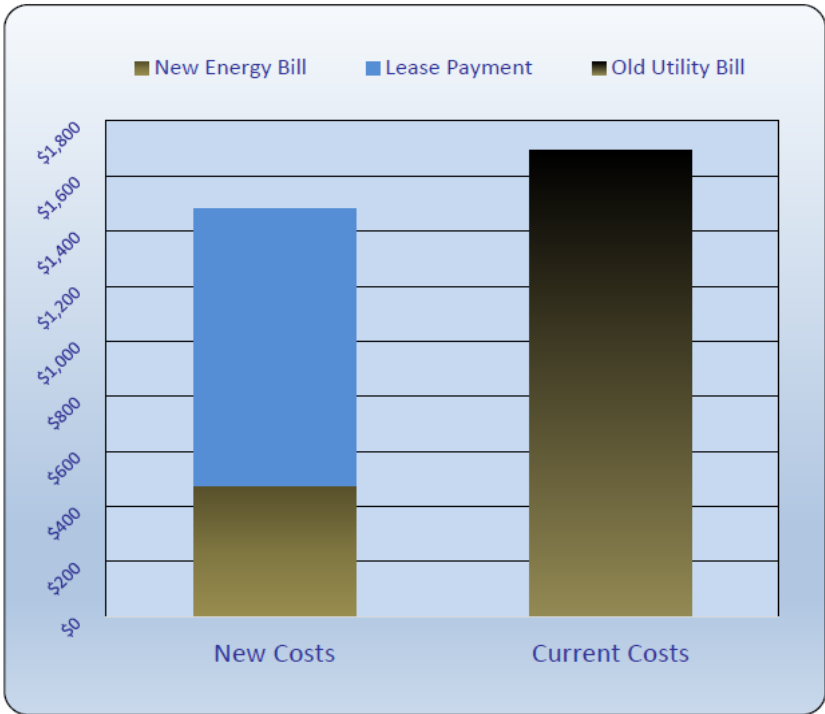


Solar Costs

- ▶ Lowered cost of solar has resulted in increasing solar installs.
- ▶ With NO state/utility rebates in Kansas:
 - ▶ Commercial paybacks ~6-8 yrs
 - ▶ Residential paybacks ~12-14 yrs
- ▶ Average home is 7.5 kW at a cost of \$23,000-\$25,000
- ▶ Homes range from \$10,000 to \$50,000 +



System Value:	\$21,964
Annual kWh production:	9,123
Year 1, Average Monthly Energy Savings:	\$101
Year 1 Monthly Lease Payment:	\$83
Cost to go Solar, Year 1:	-\$216
Estimated 25 Year Energy Cost Savings:	\$69,695



89% of your home's utility bill is eliminated by installing this solar array.
Over the 25 year panel warranty period, the system avoids: 474,543 lbs of pollution.




Est Yearly CO2	20873 lbs	Energy Inflation	7.00%
Initial Cost (incl. Tax)	\$22,221	Utility Rate	\$0.1035
Cost per Watt	\$3.42	Annual Degredation	0.8%
Commercial Depreciation Basis	\$18,888	Est. Federal Tax	35%
Depreciation Value	\$7,791.14	Est. State Tax	6.25%
First Year Net Cost	(\$10,721)	Est. Total Tax Bracket	41.25%

Year	Tax Credit	Other Rebate	Tax Impact of MACRS	Estimated Annual kWh	Estimated Energy Value	Estimated Cash Flow
1	\$6,666		\$3,896	9,075	\$938	(\$10,721)
2			\$974	9,002	\$996	(\$8,751)
3			\$974	8,930	\$1,057	(\$6,721)
4			\$974	8,857	\$1,122	(\$4,625)
5			\$974	8,785	\$1,190	(\$2,461)
6				8,712	\$1,263	(\$1,198)
7				8,639	\$1,340	\$142
8				8,567	\$1,422	\$1,564
9				8,494	\$1,509	\$3,073
10				8,422	\$1,600	\$4,673
11				8,349	\$1,698	\$6,371
12				8,276	\$1,801	\$8,172
13				8,204	\$1,910	\$10,081
14				8,131	\$2,025	\$12,107
15				8,059	\$2,148	\$14,255
16				8,059	\$2,278	\$16,532
17				7,986	\$2,415	\$18,947
18				7,841	\$2,560	\$21,507
19				7,768	\$2,714	\$24,221
20				7,696	\$2,877	\$27,098







Questions
Thank You