Solar Panels

Presented by
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Introduction to Solar

Mr B Venu Reddy kumar

Photo courtesy Western Solar

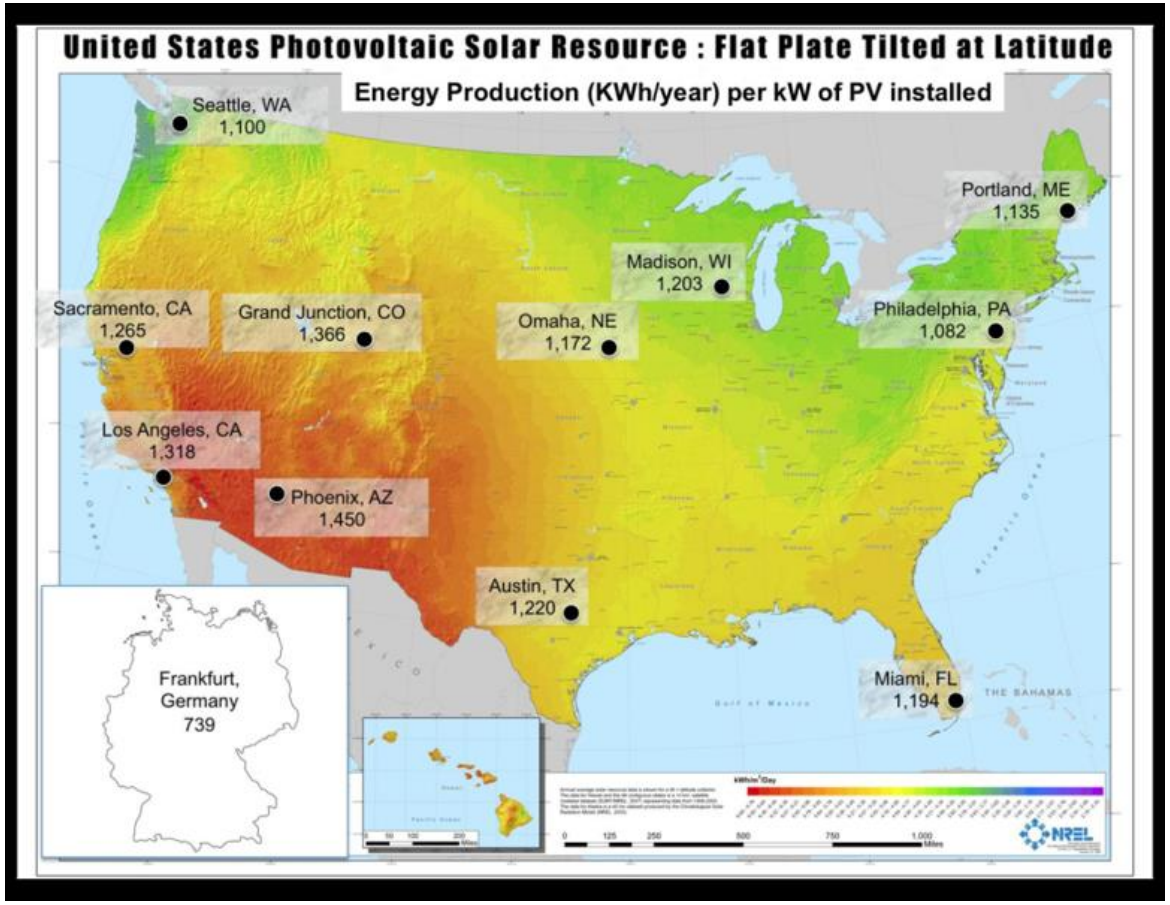
Why solar energy?

- Environmental concerns/reduce carbon emissions
- Save money on electric bills
- General interest in new technologies
- Increase in home value

Preview

- Does solar work in Washington?
- PV costs and benefits
- Other uses
- More resources
- Q&A

Does solar work in Washington?



Map courtesy Western Solar

Long summer days = more hours to capture sun's energy

Solar systems keep working on cloudy days collecting scattered light

Seattle: 1,100 kwh/yr

Miami: 1,194 kwh/yr

LA: 1,318 kwh/yr

Solar Washington

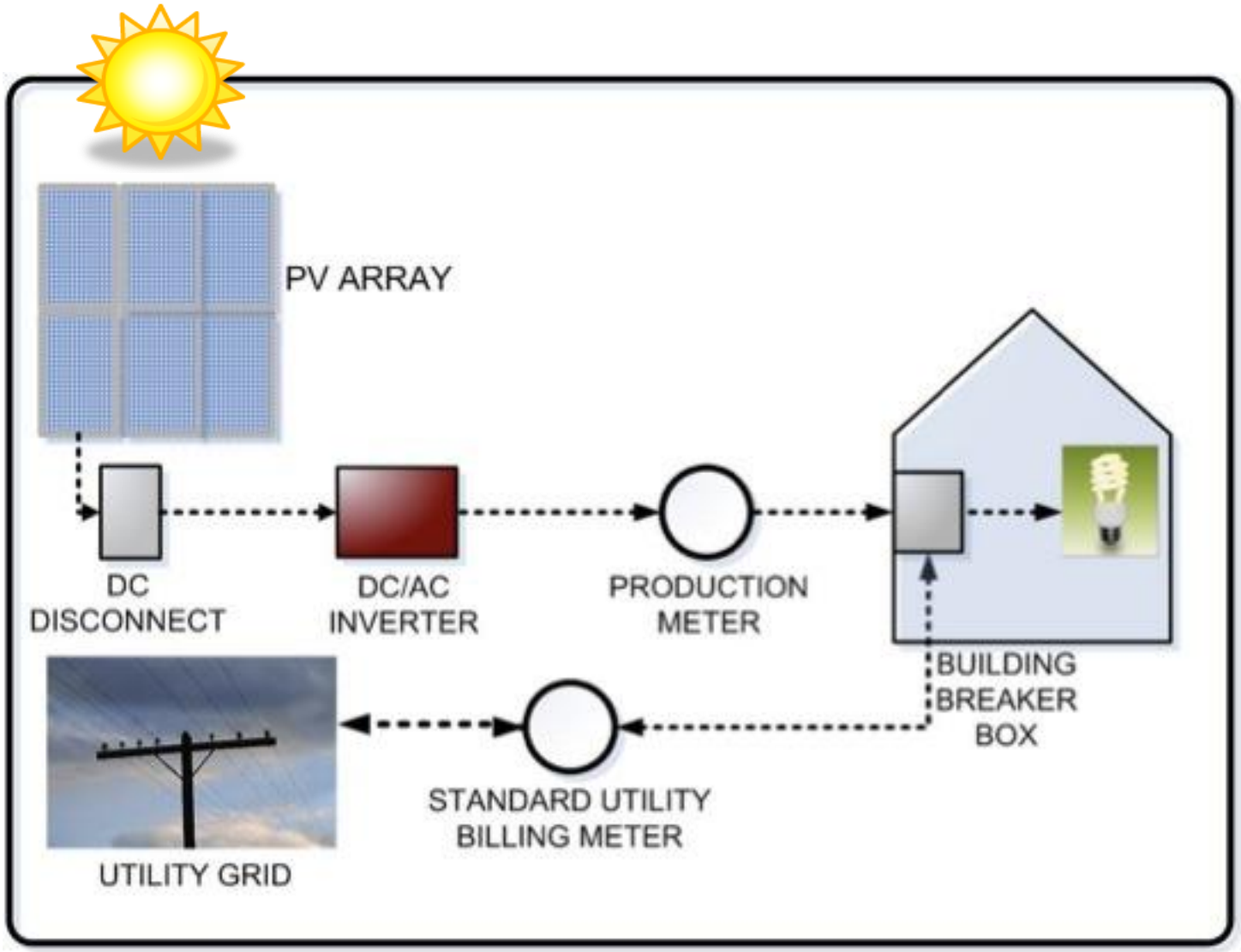
How can you use solar in your home or business?

- **Electricity from Solar**
  - Solar photovoltaics (PV)
- **Heat from Solar**
  - Passive solar
  - Solar thermal/hot water
  - Solar air heater

Solar photovoltaics *(solar PV)*

A solar PV system generally consists of photovoltaic modules (aka "solar panels") installed as an array (series of panels) on a rooftop to generate electricity to be used by the home or business.

Photo courtesy A&R Solar



How a solar PV array captures the sun's rays and delivers energy to a home

Diagram courtesy NW SEED

Solar PV installation overview

- Solar vocabulary
- Issues to consider
- Determining system size
- Solar incentives in Washington
- Costs and benefits

Solar vocabulary

- **A kilowatt (kW) is an instantaneous measure of power. (1000 watts = 1kw)**
- **A kilowatt-hour (kWh) is a unit of energy**
  - Equivalent to one kilowatt (1 kW) of power expended for one hour (e.g. Ten 100 watt light bulbs burning for 1 hour)
- **1 kW of PV produces about 1,100 kWh/yr in Western Washington, 1,300 in Eastern Washington**
  - Average home uses about 9,000 kWh/yr

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Solar vocabulary, cont.

- ***Module*** or ***Panel*** is a solar photovoltaic panel.
- ***Array*** is a series of solar panels installed together to generate electricity.
- ***Inverter*** converts DC electricity to AC electricity.
- ***Racking*** connects the solar panels to the roof.
- ***Production Meter*** measures the amount of kwh generated by a solar system.
- ***Production Incentive*** is money that the State of Washington will pay for each kwh generated by solar panels.
- ***Net Metering*** is a utility program letting solar homeowners bank unused kwh for future use.

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Considerations with Solar PV

- Trees or other shade that will fall on the PV array
- Roof considerations: Which direction does your roof face? Is your roof in good shape? Roof space? Roof tilt?
- Other variables such as structural issues, roof access, other roof uses: antennas, chimneys, skylights.
- Do you have a Homeowner's Association? Do they have requirements for solar installations?
- Utility net-metering policy.

Determining system size

- **Your goals for electric bill offset**
- **Roof space available for PV**
- **Roof shading / orientation / pitch**
- **Depends on your budget or your investment goals**
  - Complexity of installation will impact budget

Solar incentives (PV)

- **Federal 30% tax credit**
  - *Systems must be placed in service before **December 31, 2016***
- **State sales tax exemption**
  - *For solar PV systems of 10kW or less; expires **June 30, 2018**.*
- **WA State Production Incentives**
  - *Provides PV system owners with a payment of $0.15 to $0.54 per kilowatt-hour of solar energy produced Non-WA equipment: $0.15; WA inverter only: $0.18; WA modules only: $0.36; WA inverter + WA modules:$0.54. Payments will be made until **June 30, 2020**. Maximum of $5000 per year.*
- **Localized incentives**
  - *Check with your local PUD or Utility for additional incentives.*
- **Net metering (100kw system size limit); *does not expire***
- **Federal Modified Accelerated Cost-Recovery System (aka accelerated depreciation); *only for businesses, not residences***

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Sample PV Costs: Made-in-WA equipment

Based on a 6 KW system (@ $5/watt): $30,000

30% Federal Tax Credit: $9,000

Start-up Cost: $21,000

Production Incentive over 5 years: $17,820

Net Metering Credit value over 25 years: $14,520

25 year net: $11,340

Not including increased home resale value or rise in electric prices!

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Sample PV Installation Costs: Not Made-in-WA equipment

Based on a 6 KW System (@ $4.25/watt): $25,500

30% Federal Tax Credit: $7,650

Start-up Cost: $17,850

Production Incentive over 5 years: $4,950

Net Metering Credit value over 25 years: $14,520

25 year net: $1,620

Not including increased home resale value or rise in electric prices!

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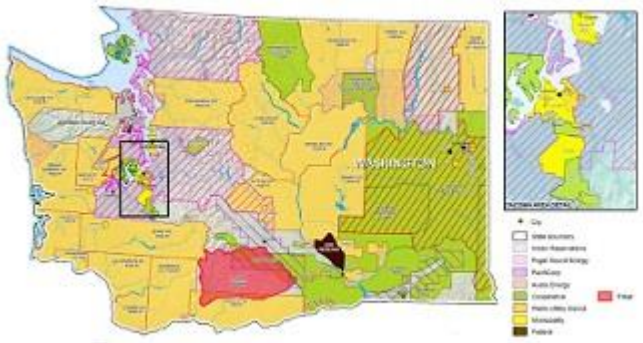
Other benefits of Solar PV

- Increased home values
- Longer warranties
- No moving parts
- Low maintenance (Inverter replacement)
- Unlimited resource / free fuel (the sun!)
- Creates local jobs
- Low interest loans are available

Check with your local utility & city



Washington has several dozen utilities and municipalities scattered throughout the state.

- ***Depending on where you live in Washington state, your utility may have its own, unique interconnection and net metering requirements and policies.***
- ***Check with your utility and jurisdiction and ask about the following:***
  - ***Interconnection and permitting processes***
  - ***Net metering hook up and process***
  - ***If your utility participates in the state production incentive program***

Visit **solarwa.org/utilities-municipalities-washington-state** to contact your utility

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Going ahead with a PV installation

- **Get quotes from installers**
  - ***Installers will do a site assessment and take care of getting permits, etc.***
  - ***Check your utility's web site for a list of qualified installers in your area***

- **Loans**
  - ***Check your bank or credit union to see if they offer loans***

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Other considerations to stretch your electricity further

- **Reduce power consumption (turn off lights, etc.)**
- **Keep PV solar system shade free**
  - ***Simple maintenance such as hosing off panels once or twice per year; otherwise a solar PV system should operate effectively***
- **Should your house be more efficient?**
  - ***Check with your local utility for energy efficiency programs (incentives/ rebates/ low interest loans).***
  - ***Efficiency can make solar go further!***

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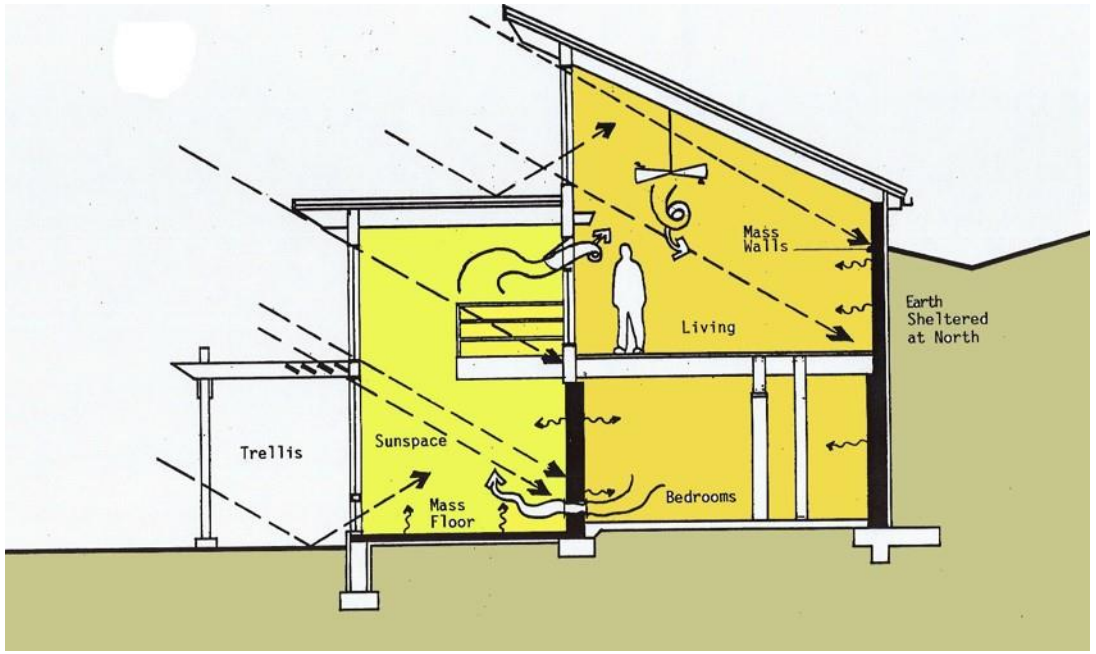
Additional uses of solar

- **Heat from Solar**
  - **Passive solar**
  - **Solar thermal/hot water**
  - **Solar air heater**

Heat from Solar: Passive solar



Building a structure that collects heat from the sun and retains it in materials that store heat, known as thermal mass.

Solar heat is transferred from where it is collected and stored to different areas of the structure by conduction, convection, radiation and even small fans and blowers.

Photo courtesy Ryan Bradt

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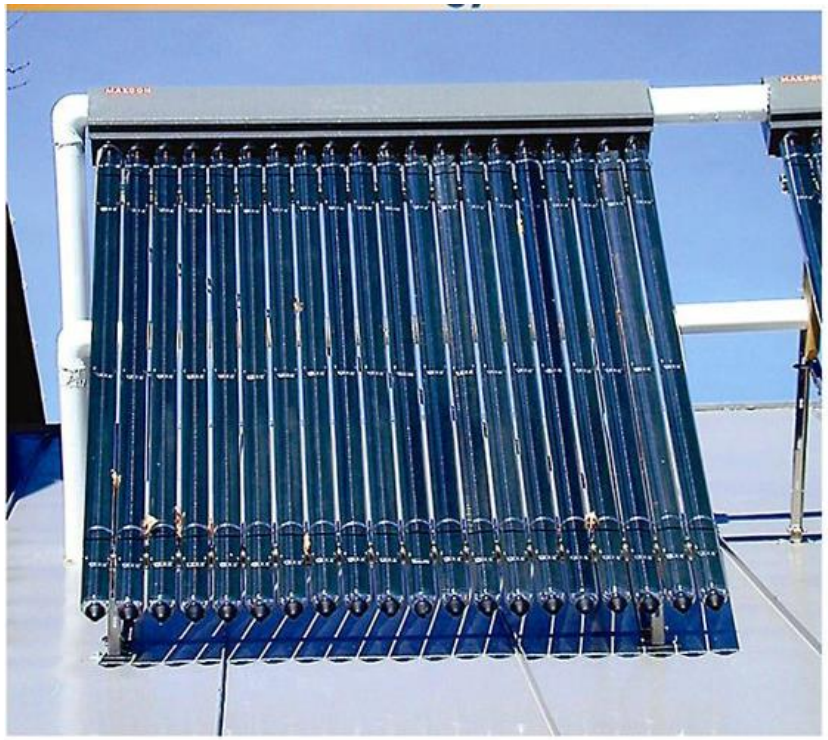
Heat from Solar:
Solar thermal/hot water



DOE/NREL, Alan Ford

Used to heat residential, commercial or industrial water supplies as well as space heating and pools.

A collector - typically fastened to a roof or a wall facing the sun – is used to heat an anti-freeze solution that is either pumped (active system) or driven by natural convection (passive system) through it.

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Heat from Solar: Solar air heater

Energy from the sun is captured by an absorbing medium and used to heat air.

Works like a greenhouse by circulating air from inside a home through the system mounted on the exterior wall.

Photo courtesy Ryan Bradt

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Other ways to participate in solar

Seattle Aquarium/Seattle City Light

- **Community Solar**

Resources

- **Solar Washington**
  - www.solarwa.org
- **National Renewable Energy Laboratory**
  - www.nrel.gov
- **DSIRE (Database of State Incentives for Renewables & Efficiency)**
  - www.dsireusa.org

Credits

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REFERENCE

www.solarwa.org