Solar Energy to Achieve Washington's Goals for the Built Environment

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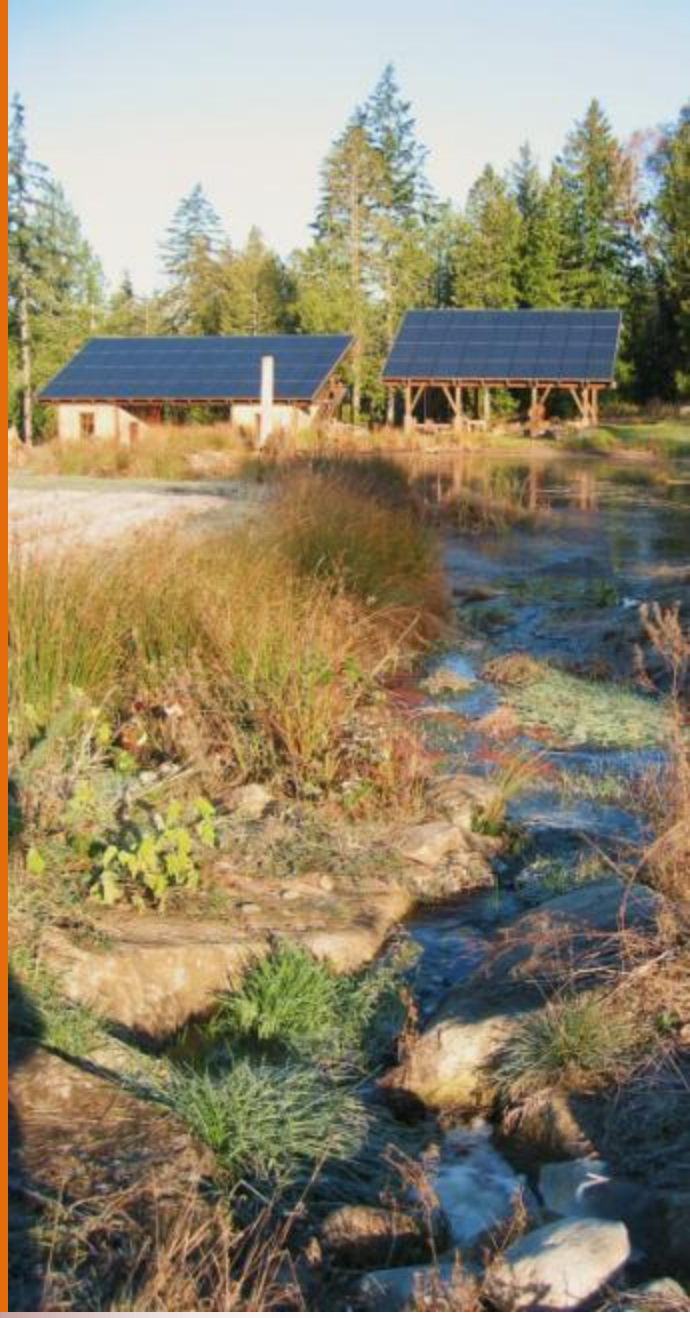
Abstract

Under present Washington law, public schools and state-funded agencies' facilities greater than 25,000 square feet must meet stringent green standards and reduce energy use over prior years by at least 10 percent. Legislation also mandates that by 2031, all Washington homes and buildings must achieve zero fossil-fuel greenhouse gas emissions. On a national level, US DOE has a zero energy goal for all new commercial buildings by 2030, and by 2050 for all existing buildings.

It is virtually impossible to achieve zero energy buildings without on-site power generation since the very definition of a zero energy building is that it must generate as much power as it consumes. Renewable energy, and in particular, solar energy, may be the most advantageous currently-available technology to make this happen. But no renewable technology is free, and most are not cheap. So how do we promote the use of these technologies?

What Does It Take?

- Overcoming barriers
- Incentives
- Regional manufacturers
- Availability of product
- Commitment
- Money
- Skilled workers
- Jobs



Reduction in Energy Use >Code

- WA State SB 5509 set green building requirements for new, major renovations
- Reduce energy by 10% min (plus vehicles)
- K-12 schools 10% energy use reduction
- Homes and buildings ZERO energy by 2031

Seattle Aquarium

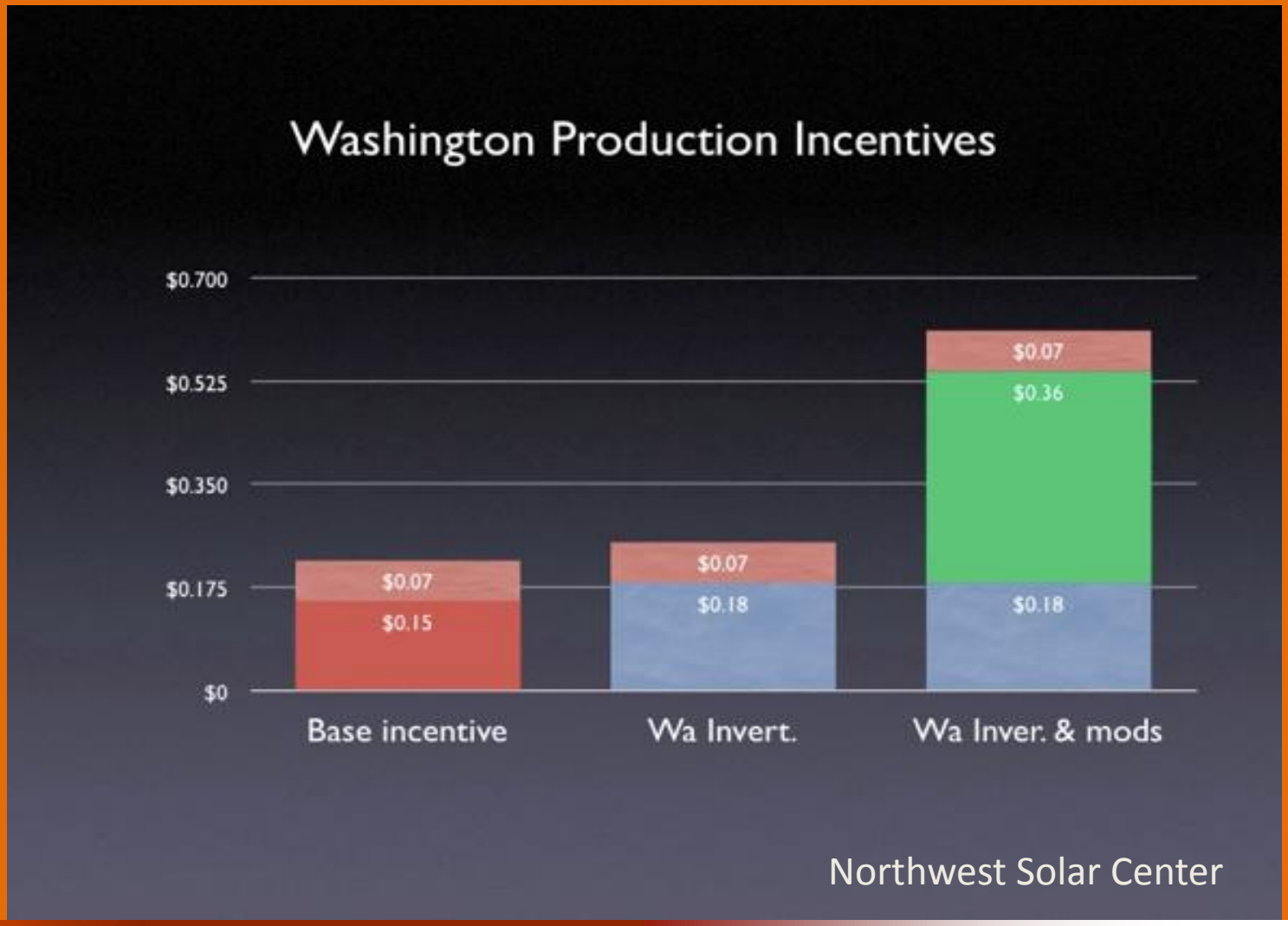
WA Utilities & Renewables

- Required to provide 15% from renewables by 2020 (for serving >25,000 customers)
- Out of 62 utilities in WA 17 qualify with 84% of WA's load

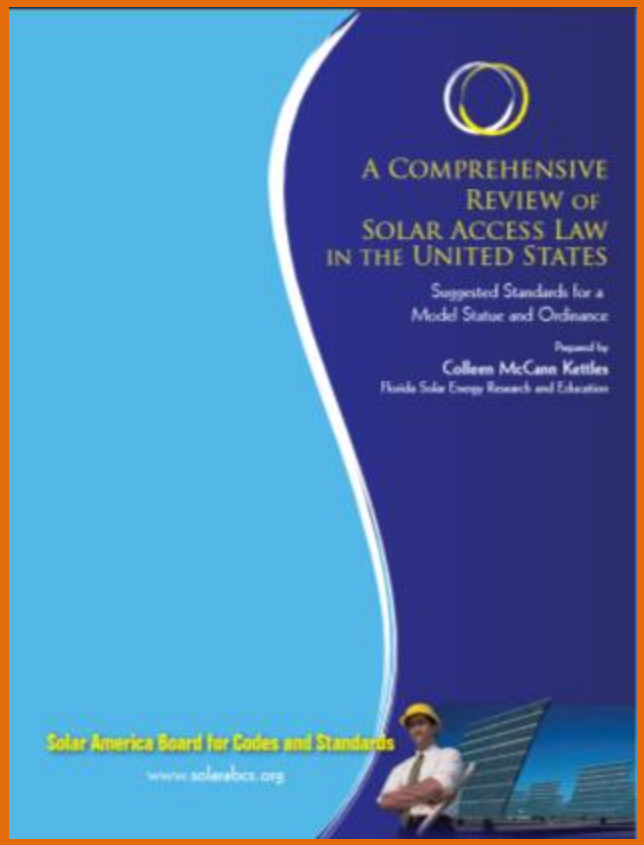
Washington State

- Unique performance-based 5101 á la German approach
  - Earn 15 cents per kilowatt hour up to $5K
  - Fixed over ten years
  - Multipliers if equipment from WA state
- Solar = slow payoff but durable, long-lived technology
- This incentive considered low
- Ten years considered too short due to long solar payback
- Money not from ratepayers as most FITs

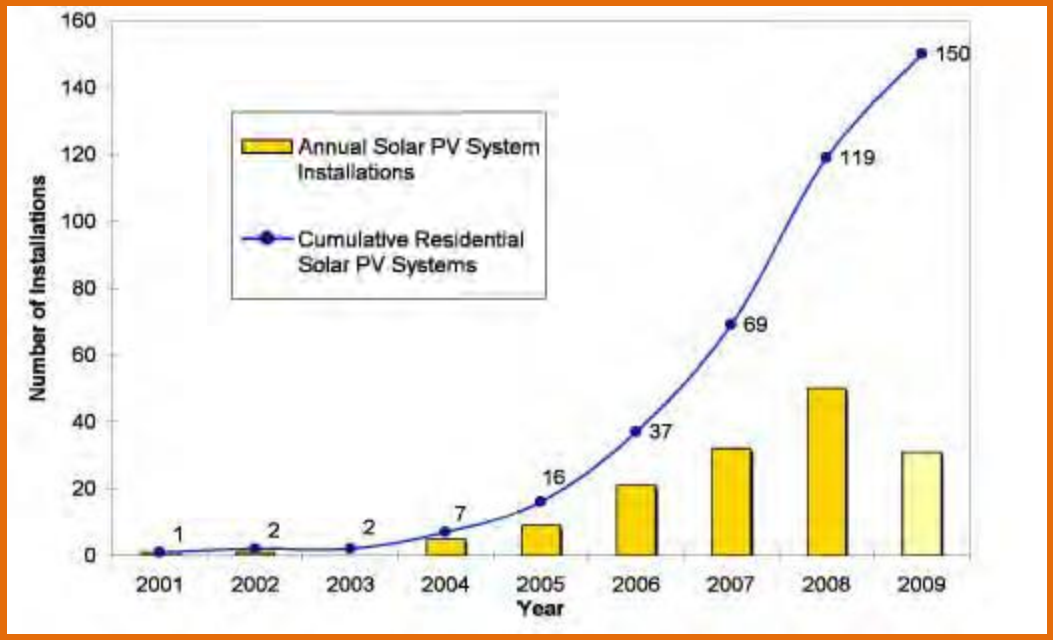
Washington Production Incentives



Seattle Solar Easement



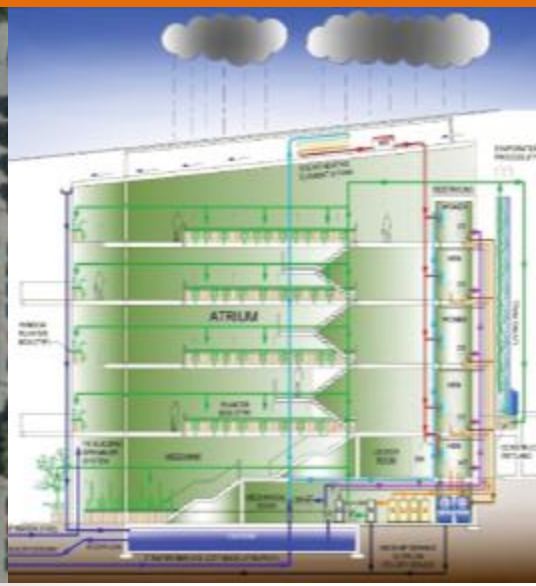
Residential Solar Photovoltaic Systems in Seattle



*2009 installation numbers are only through July of that year.
Source: Seattle Net Metered Accounts, Seattle City Light, 2009

WA Sunlight Rights

- No guarantee for access to sunlight
- Voluntary agreement for solar easements
- HOAs cannot prohibit homeowners from installing solar panels



“Living” Building

- Must produce as much energy as it uses

Bertschi School, Seattle

Green Building Program Leverage?

- LEED, Green Globes
- Are these helping? Not really…
- Not usually embedded in project – solar is often an afterthought
- Architecturally, shading, conduit locations, power rooms, etc. need up-front attention
- Solar 4 R Schools – 1.1 K system grants
- Living Building, however……

Has 5101 Made a Difference?

- Light and power companies in WA are *not* mandated to participate – but they do anyway
- Annual credit for producing grid-tied solar power ('til 2014)
- If equipment manufactured in WA, qualify for accelerated kilowatt credit multiplier (.36/KwH up to $2000 a year)
- Must re-apply each year with documentation of kWhs
- Tenants (not owner) not eligible for the credit
- One-to-one selling grid-tied power back to grid in WA – some other places do not have to pay fair amount

Numbers for Washington

- 75 systems – now up to 2,000
- Growth of solar – hurray!
- Three community solar projects

Three WA Manufacturers

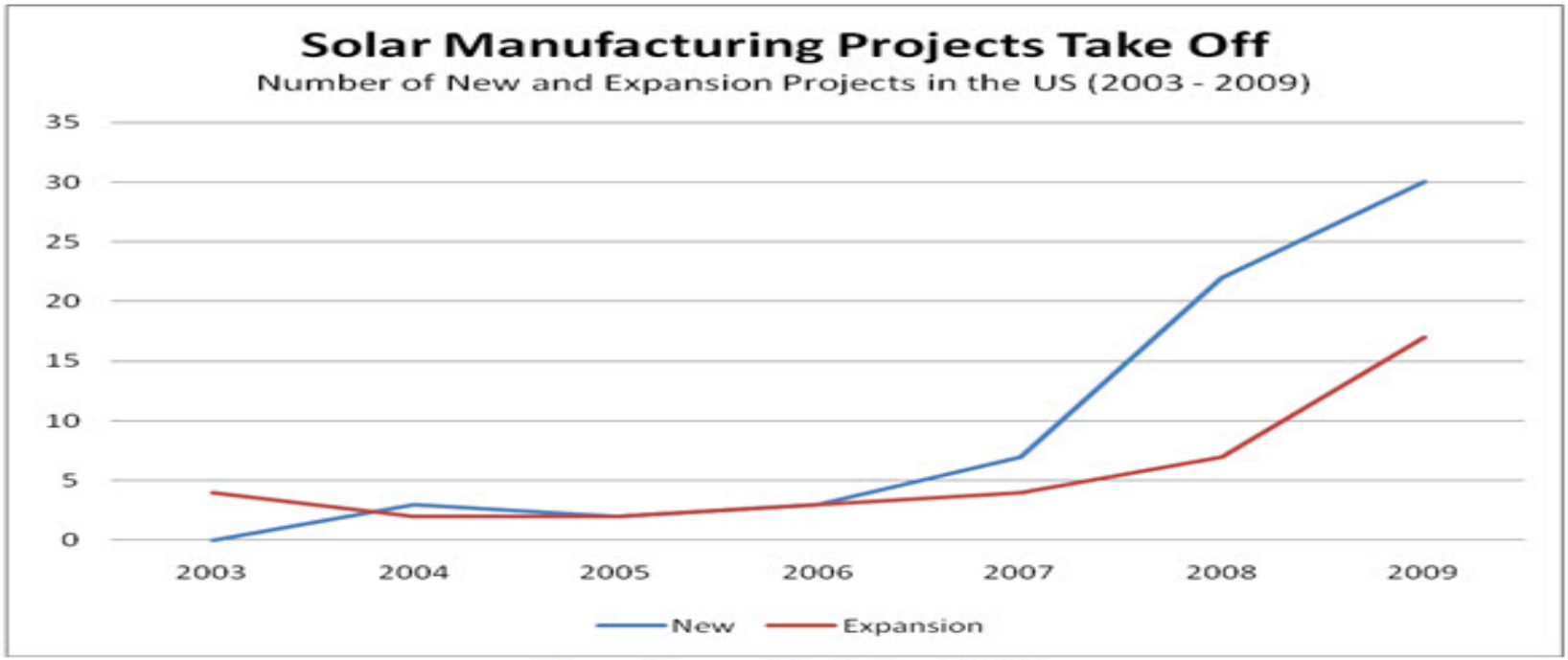
- Solar modules – Silicon Energy
- Inverters – Outback Power Systems & Silicon Energy
- Solar Cells and Modules - REC



Inverter Manufactured in WA

Overseas Manufacturers

- Manufacturing incentives usually help overseas companies – Asia & Europe
  - China = 51% - coal used to manufacture, plus transport



Source: Conway Data, June 2010

Oregon's Mandates

- Renewable Energy Standard 2007, requiring utilities to provide 25 percent from renewable sources of energy by 2025
- Public entities required to spend 1.5% of their construction budgets for new or renovated buildings on on-site solar
- 2009 law requires 25 megawatts of new solar electric systems from homes and small-scale commercial systems within five years
- Two largest electric utilities must develop or purchase the equivalent of 20 megawatts of solar power annually within a decade

Oregon FIT

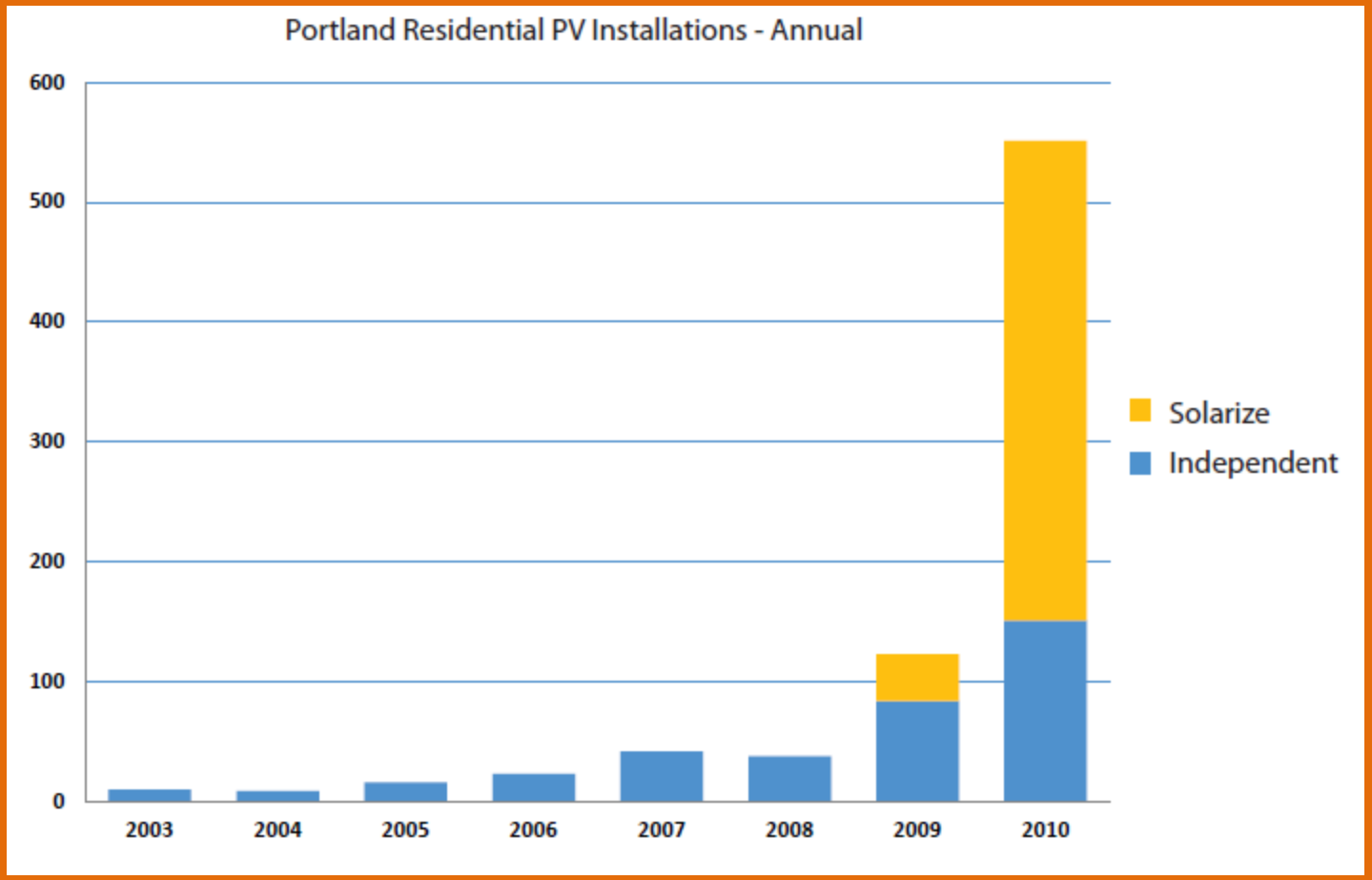
- Oregon power companies to buy solar power
- Funded by ratepayers
- Tariff locked in at 58.5 cents/hour for 15 years
- Re-sell same electricity at 8 cents per kWh
- Goes down 10% each time offered

Solar in Oregon

- Business tax credit increased from 35% to 50% – largest!
- Homeowner tax credit up to $6000 based at $3 per watt
  - $1,500 maximum can be claimed per year
- Pepsi Cola, Klamath generates all power for plant -172 kW
  - Cost over $1million will pay itself in about 10 years (by 2014)
- Incentives for solar water heating – residential, commercial


Pepsi Cola, Klamath Falls

Solarize Portland, Oregon



http://www.solaripedia.com/files/

California

- About 85% of all solar installations in the country
- ~20% of their total energy mix comes from renewable sources – goal for 30% by 2020
- Last fall, LA pubic utility voted to *reduce* solar incentives

Governator on Sam's Club Roof in California
Photo: David McNew Getty Images

Germany

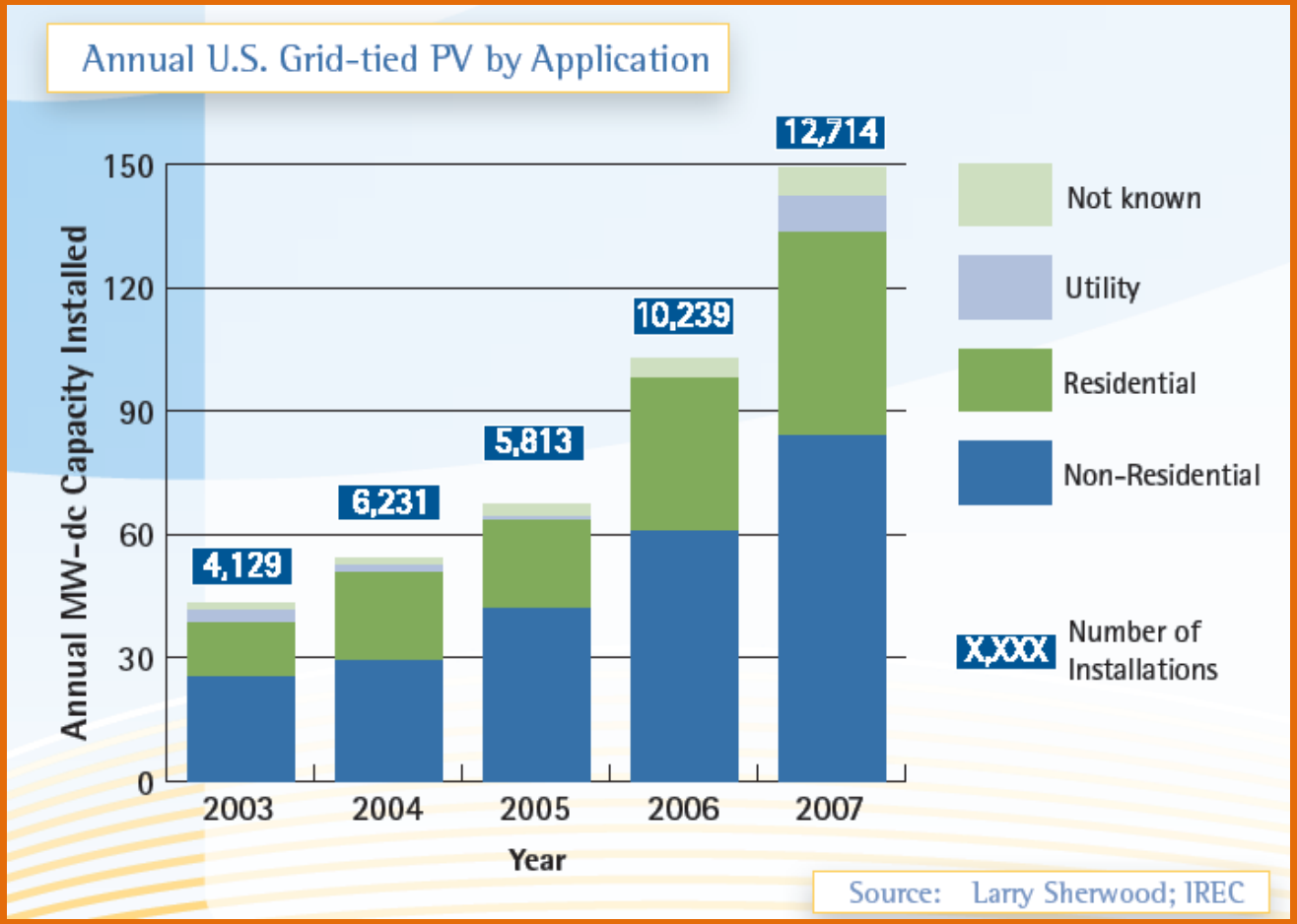
- Germany's Renewable Energy Act of 2000 helped put the country at the top in the solar industry.
- Germany generates over half of the world's solar electricity
- Two-thirds of Germany is farther north than Seattle
- As of 2010 Germany was the world's third-largest manufacturer of solar modules
- Its industry grew from 1,500 jobs in 1999 to 74,500 in 2008, according to data from Washington Solar Incentives but……

Impact of Solar Incentives

- Analysis finds strong participation response to incentives in many states after 2006 (when federal investment tax credit was reinstated for residential installations and was increased for non-residential installations)
- Recent participation correlates to combination of state and federal incentives
- Tax programs typically spent far less per participant than the cash incentives

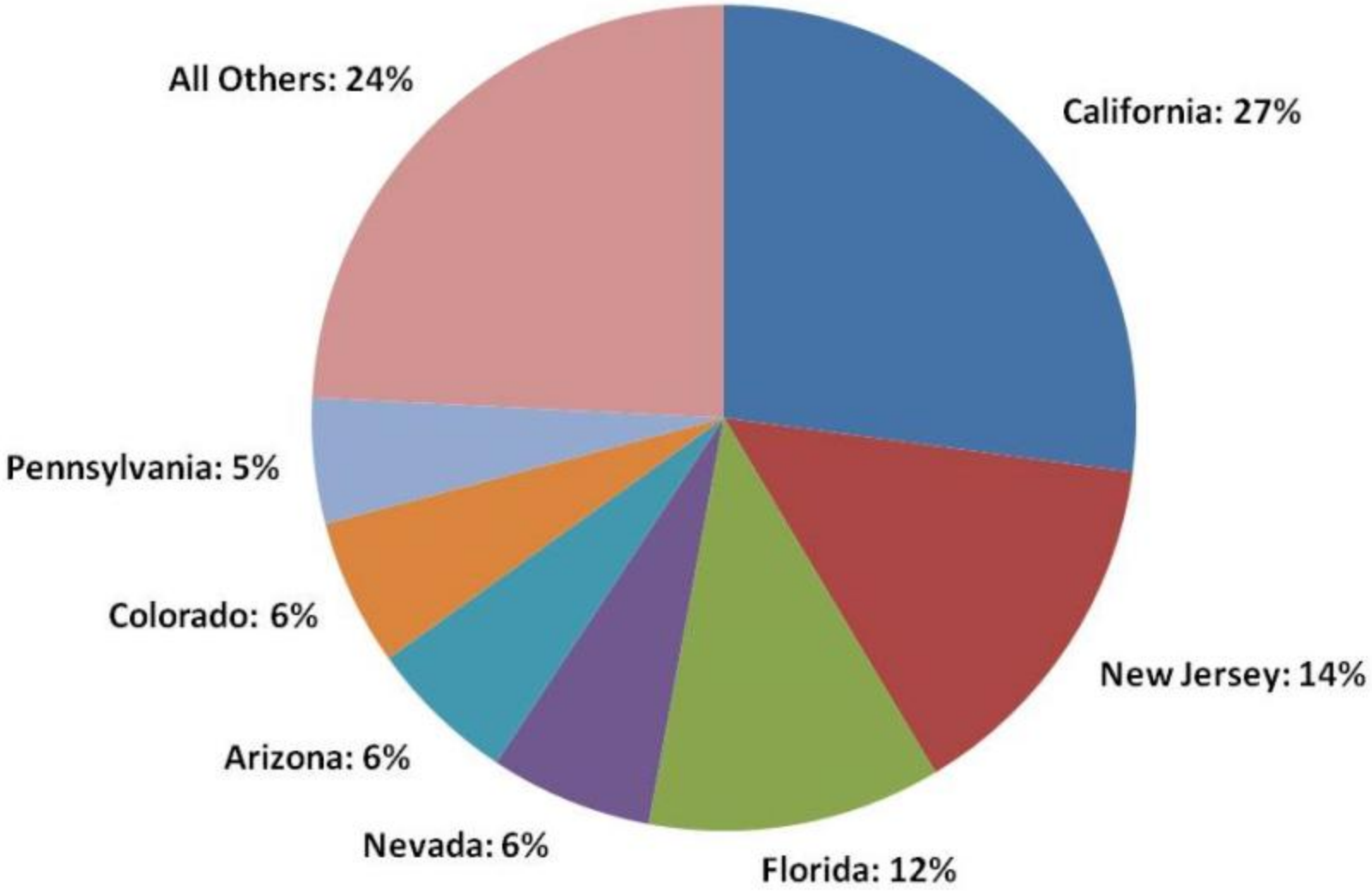
THE IMPACT OF SOLAR INCENTIVE PROGRAMS IN TEN STATES
http://www.solaripedia.com/files/848

PVs Installed in US

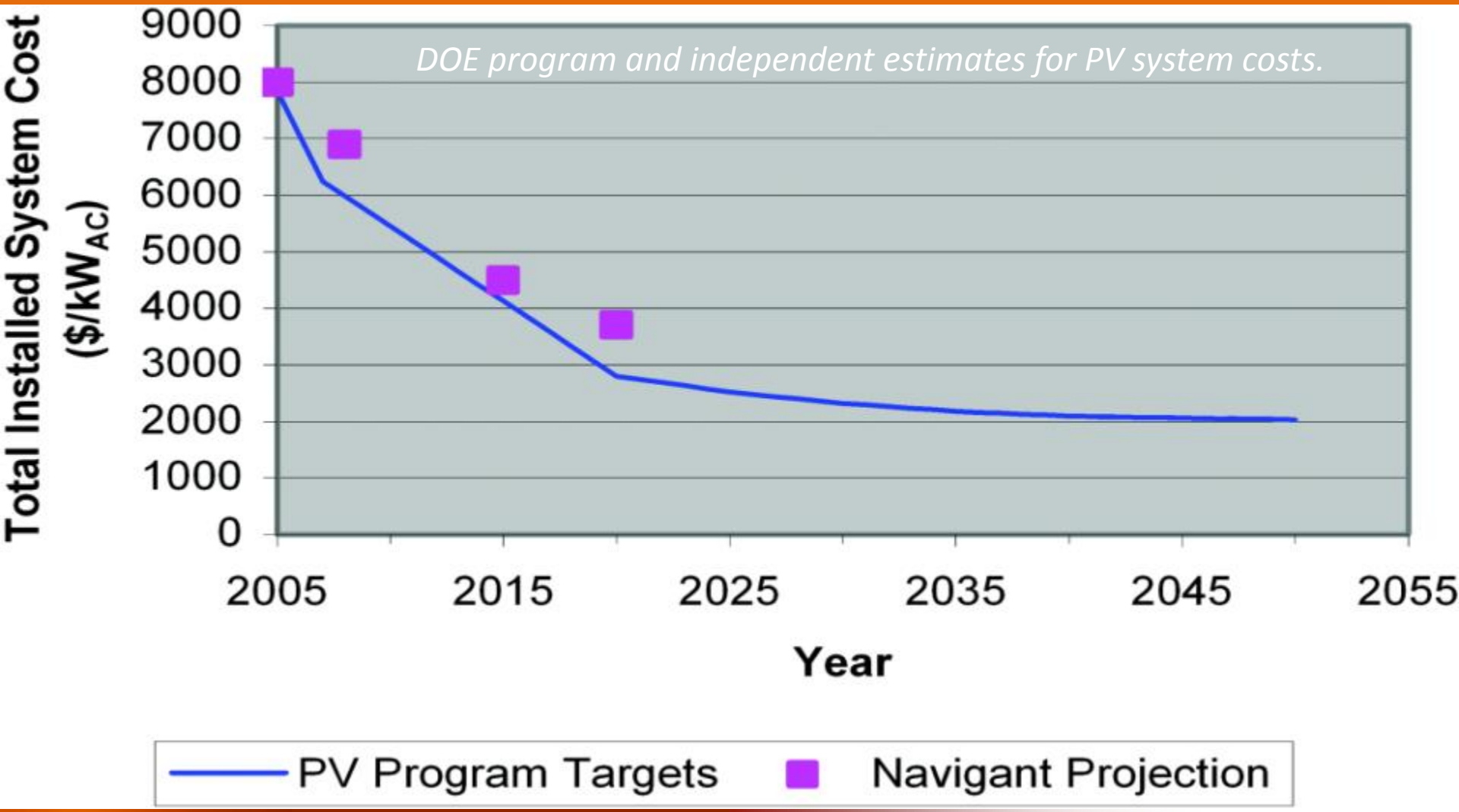


U.S. Solar Electric Installed Capacity 2010

The top 7 states accounted for 76% of the market in 2010



Estimated PV Cost Projections

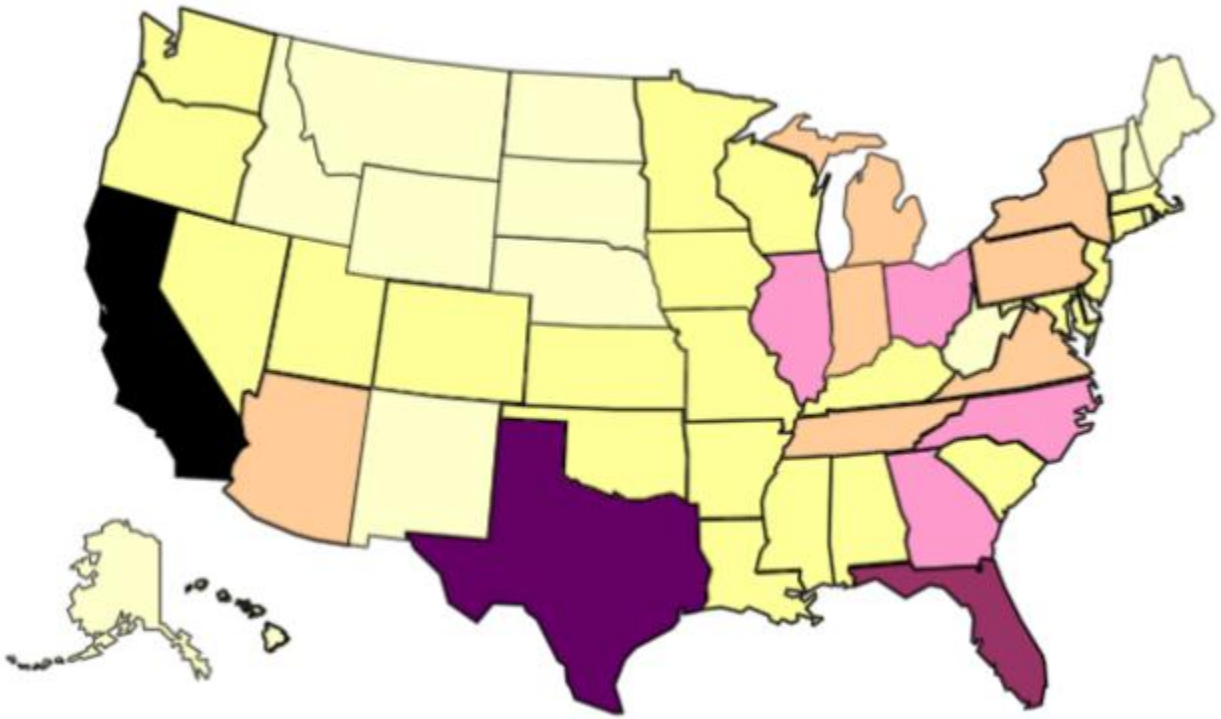


Potential Available Rooftops

- Residential and commercial rooftop space in the U.S. could accommodate up to 710,000 MW of solar electric power (if all rooftops were fully utilized, taking into account proper orientation of buildings, shading from trees, HVAC equipment, and other solar access factors)
- For comparison, total electricity-generating capacity in the U.S. today is about 950,000 MW (2005)

Rooftop PV Potential in 2015

(Independent of economics)



Range			Unit	Color
Greater than		75000	MW	
75000	to	65000	MW	
65000	to	55000	MW	
55000	to	45000	MW	
45000	to	35000	MW	
35000	to	25000	MW	
25000	to	15000	MW	
15000	to	5000	MW	
5000	to	1000	MW	
1000	to	0	MW	

Source: NREL 2008

www.nrel.gov/docs/fy08osti/42306.pdf

Washington Potential in MW

	Rhode Island	South Carolina	South Dakota	Tennessee	Texas	Utah	Vermont	Virginia	Washington	DC	West Virginia	Wisconsin	Wyoming
2007	1,036	7,619	1,106	11,774	42,773	3,691	708	13,565	9,025	,236	2,467	8,158	768
2008	1,090	8,208	1,174	12,561	45,863	3,985	749	14,506	9,646	,297	2,599	8,647	816
2009	1,145	8,817	1,245	13,370	49,089	4,279	789	15,444	10,309	,369	2,728	9,139	865
2010	1,200	9,422	1,317	14,206	52,320	4,603	830	16,421	10,989	,443	2,858	9,649	914
2011	1,255	10,039	1,388	15,049	55,632	4,927	872	17,417	11,681	,516	2,985	10,165	964
2012	1,312	10,694	1,461	15,912	59,039	5,261	915	18,448	12,395	,588	3,112	10,696	1,013
2013	1,369	11,398	1,538	16,829	62,708	5,625	959	19,538	13,152	,663	3,246	11,246	1,067
2014	1,428	12,133	1,618	17,776	66,527	6,006	1,004	20,667	13,938	,740	3,383	11,810	1,123
2015	1,487	12,902	1,700	18,757	70,499	6,407	1,050	21,837	14,755	,818	3,522	12,389	1,180

www.nrel.gov/docs/fy08osti/42306.pdf

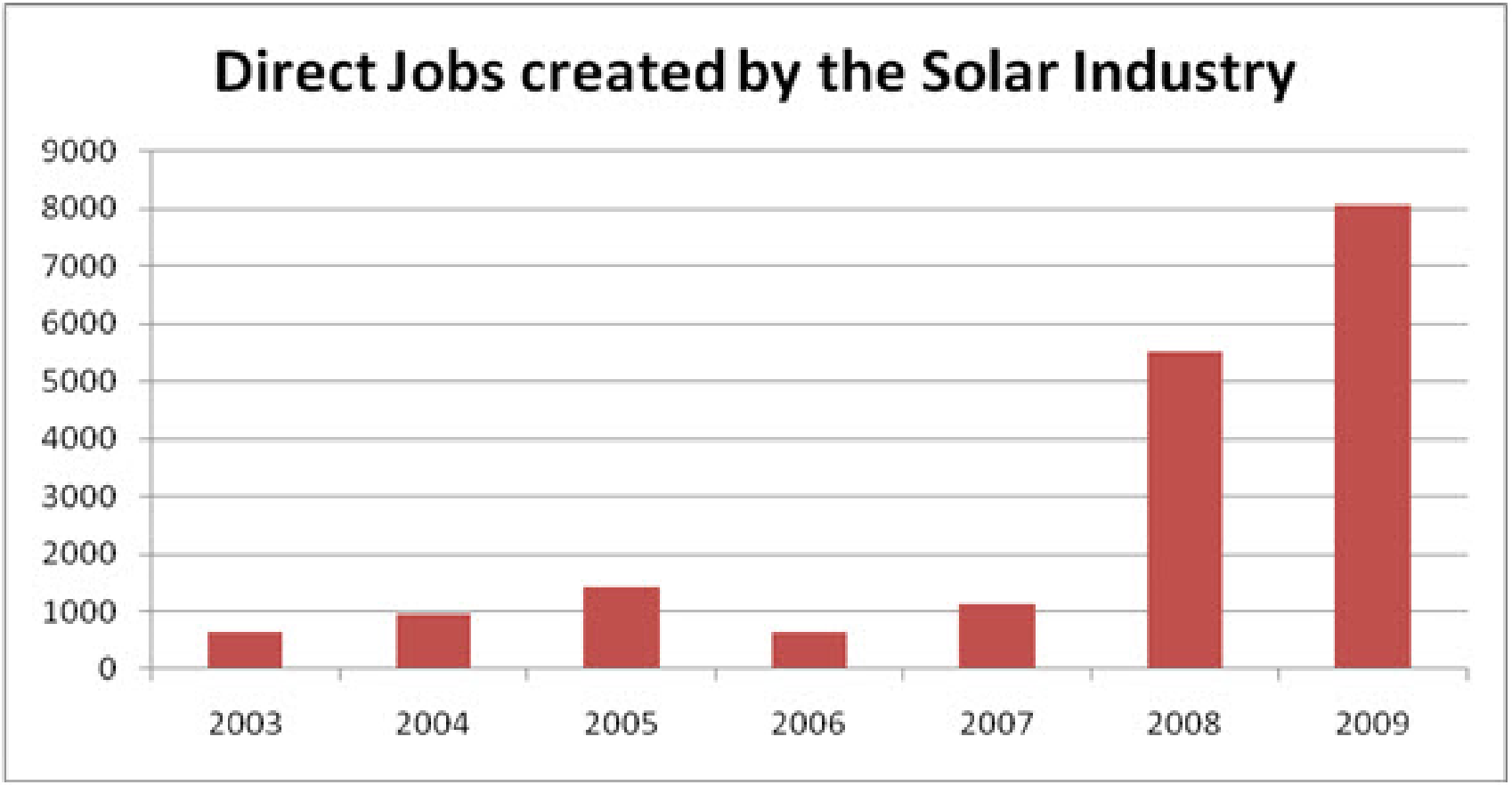
Transportation & Vehicles

- Impact on transportation of renewable energy
- V2G – vehicle to grid considerations
- LA is expected to encounter the largest growth in PHEVs over the next couple of years
- Projection: 119,069 EVs by 2019 LA's power comes from coal 52%, natural gas 26%, nuclear 11% and hydro 6% - green ~5%
- Seattle – hydro 91%, nuclear 4% (WA ¾ hydro)
- Evs - the size of the environmental footprint depends on which sources of power are used to "fuel" the EV

Solar Jobs Market

- As of August 2010, U.S. solar industry employs estimated 93,000 solar workers - defined as workers who spend at least 50% of their time supporting solar-related activities
- Over the next 12 months, more than 50% of solar firms expect to add jobs, while only 2% expect to cut workers.

Solar Jobs



Source: Conway Data, June 2010

Rank	State	Survey Responses[1]	Estimated Solar Jobs	Estimated Solar Firms[2]
1	California	17,352	**36,000**	1,072
2	Pennsylvania	3,193	**6,700**	282
3	Texas	3,068	**6,400**	170
4	Michigan	3,023	**6,300**	76
5	Wisconsin	2,885	**6,000**	89
6	Colorado	2,528	**5,300**	254
7	Georgia	2,157	**4,500**	62
8	Arizona	1,815	**3,800**	230
9	New York	1,654	**3,500**	225
10	Indiana	1,628	**3,400**	25

Estimated Jobs in Top 20 States as Percent of Total Solar Jobs

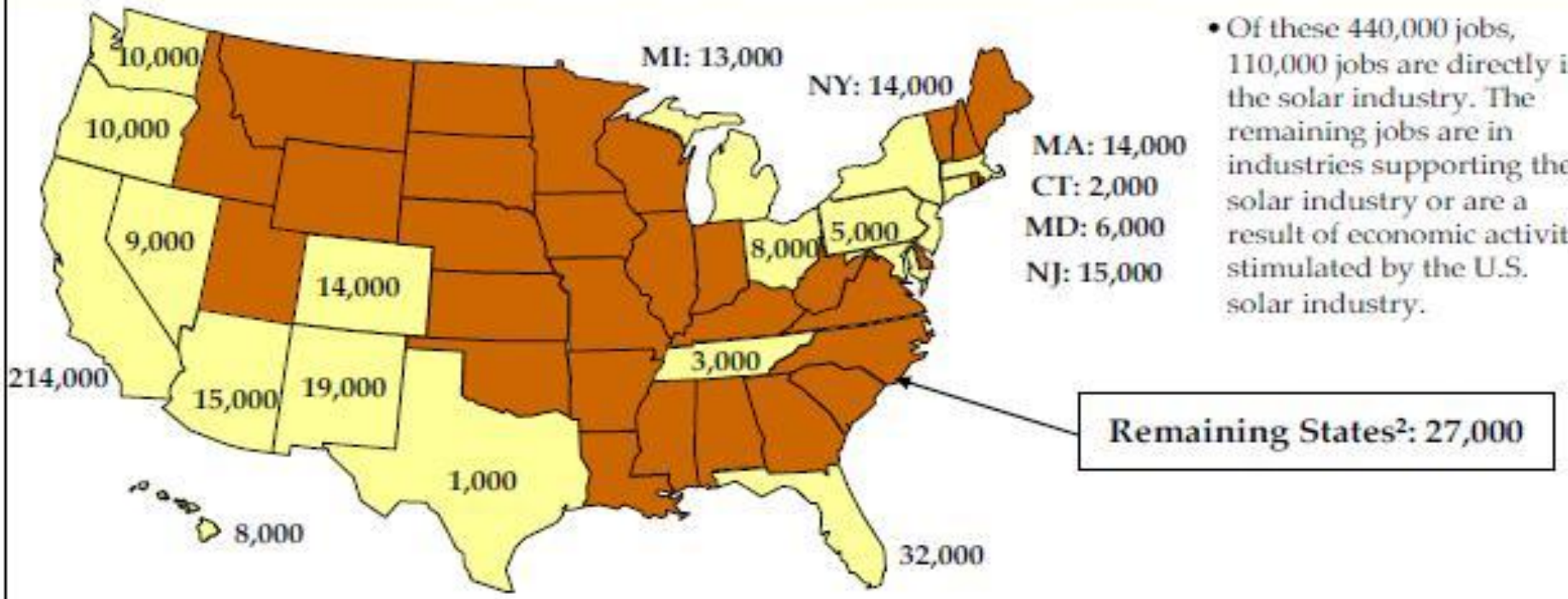
Washington Green Jobs

*www.energy.wsu.edu/.../Green_**Jobs_in_Washington_State**_2010.pdf*

Total Full Time and Part Time Green Jobs by Core Area								
	Energy Efficiency		Renewable Energy		Reducing Pollution		Poll. Cleanup-Mitigation	
	#	%	#	%	#	%	#	%
Full Time by Core Area	23,241	93%	1,523	75%	12,472	80%	3,815	85%
Part Time by Core Area	1,735	7%	503	25%	3,204	20%	668	15%
Total Full Time and Part Time*	24,976	100%	2,027	100%	15,676	100%	4,483	100%
Percent of All Green Jobs	52.9%		4.3%		32.2%		9.5%	

Solar Jobs

2016 Solar Direct, Indirect, and Induced Employment: 440,000 Jobs[1]



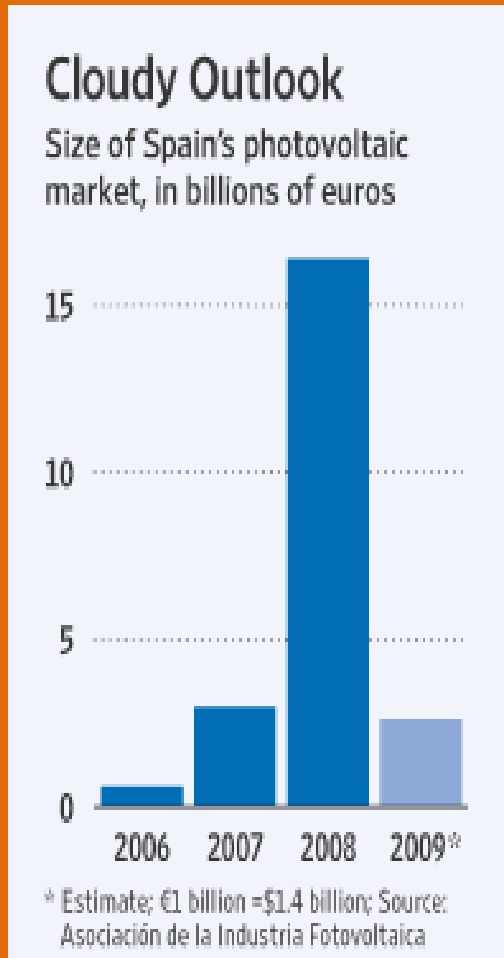
- Of these 440,000 jobs, 110,000 jobs are directly in the solar industry. The remaining jobs are in industries supporting the solar industry or are a result of economic activity stimulated by the U.S. solar industry.

Notes:

1. Refer to the appendix for definitions of direct, indirect, and induced . Figures might not add correctly due to rounding.
2. Remaining states defined as those with less than 1,000 people employed.

Study of Jobs in Spain, Germany

- Study in Madrid, for every "green job" created by Spain's solar *subsidies*, 2.2 jobs in other sectors were destroyed and $758,471 was spent to create each green job
- Study in Germany found per-worker subsidies for solar industry jobs are as high as $240,000



PV & Solar Thermal License

- No specific specialty solar PV license yet in WA (Califor does have and it works)
- Licensed electrical worker card reqd in WA
- Solar education would be implicit
- Need electrician – high voltage work
- Thermal – not so much
- 12 states require solar license (CA, OR)

Energy Saving Basics

- Improve the envelope – first line of defense
  - Insulation, windows, air/vapor sealing, siding
- Reduce energy consumption inside
  - Appliances, furnace, water heater, lighting

http://apps1.eere.energy.gov/consumer/your_home/energy_audits/index.cfm/mytopic=11190

Critical considerations

- Site and orientation
- Shading
- Durability of installation – good quality
- Installer is familiar with 690 of electrical code – standardized thru new 2011 for solar PV – electrician and meteorologist/astronomer
- Installer to have electrical contractor license and card-carrying trainees under journeyman

Solar Power Components

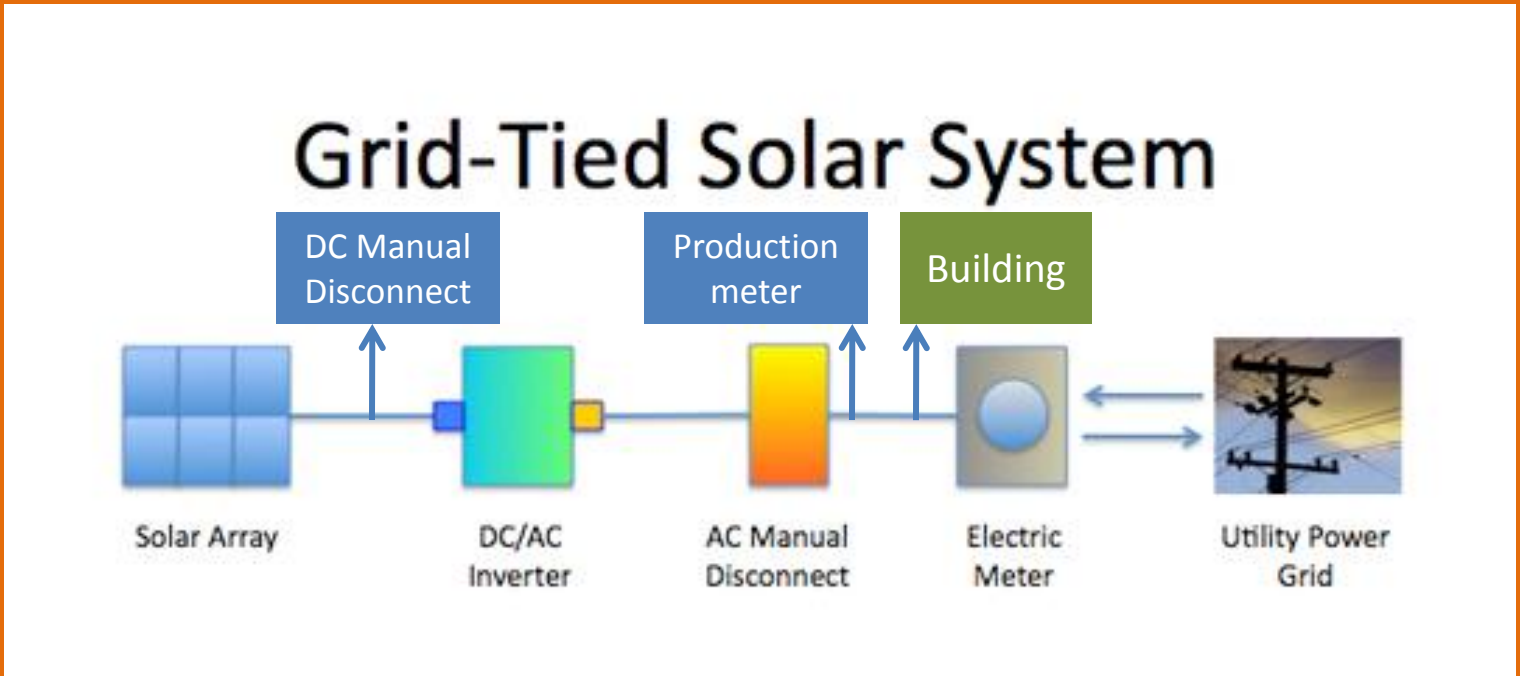
For conventional AC power for daily use:

- Solar panels (PVs or photovoltaics)
- Inverter

Off-grid systems additional:

- Charge controller
- Battery

Off-Grid Schematic



- Plus under 5101 add production meter

Tani Creek Farm

Capitol Hill Home

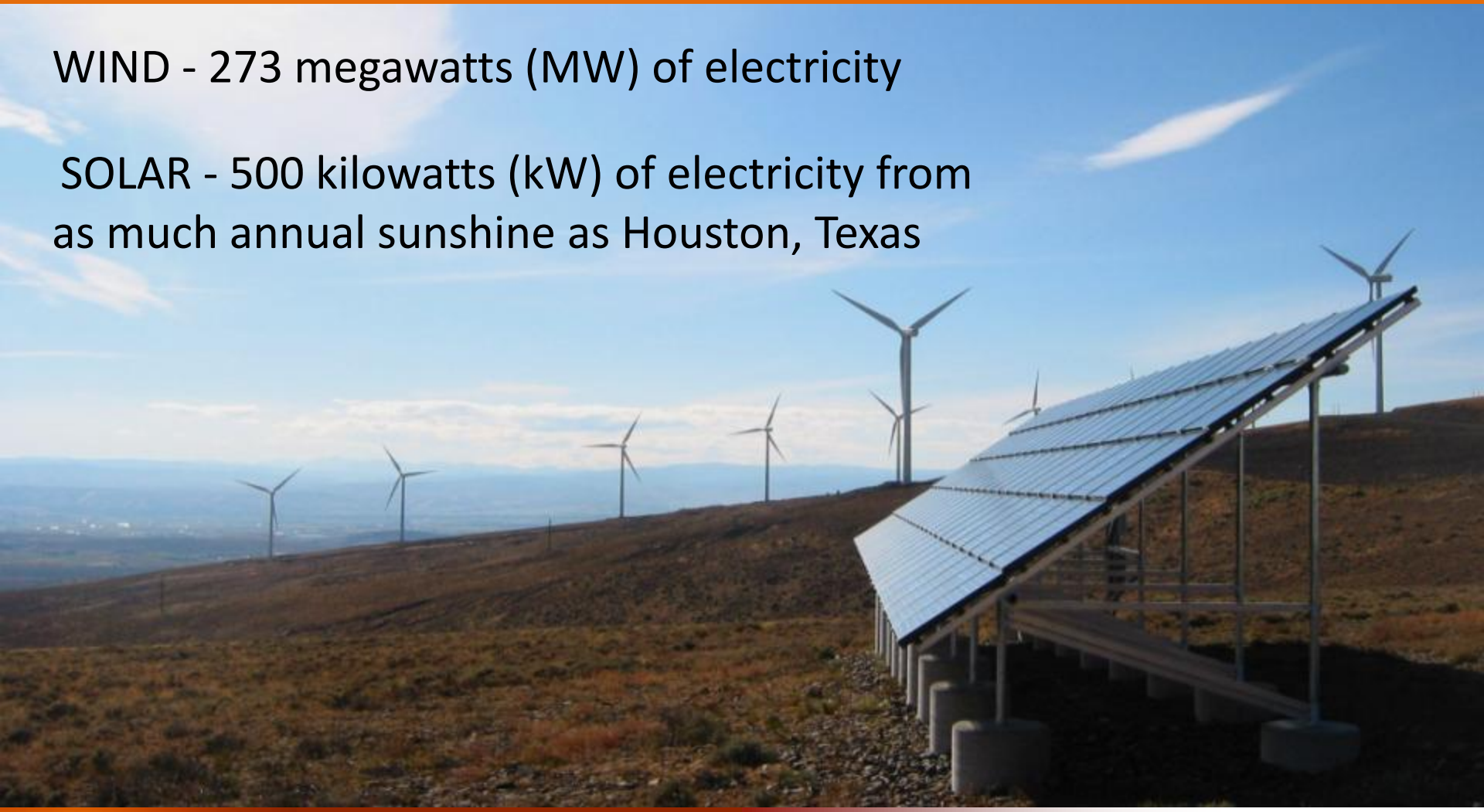
Mountlake Terrace Transit Center

Frog Pond Farm

High Point Neighborhood

SOLAR - 73.6 kW system

Wild Horse Wind & Solar Facility

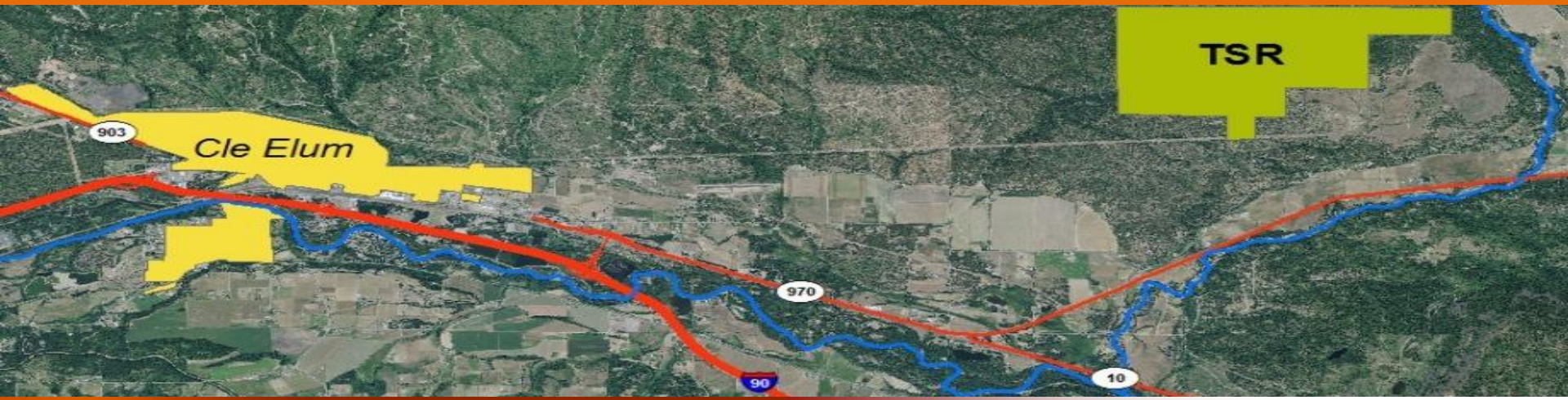


WIND - 273 megawatts (MW) of electricity

SOLAR - 500 kilowatts (kW) of electricity from as much annual sunshine as Houston, Texas

Teanaway Solar Reserve

- House Bill 1365 allows to be eligible for double renewable energy credits
- Power purchase agreement with utility
- 75 MW on 477 acres, 400K panels
- 250 jobs for two years, 30 permanent jobs



Renewable @ 3 Percent

- What happens when sun doesn't shine?
- Then what happens when renewables are at 30% of our power?
- Need storage – pumped hydro (uphill to existing dams)?

Renewable & Energy Incentives

- DSIRE Website – Washington State http://www.dsireusa.org/library/includes/map2.cfm?CurrentPageID=1&State=WA&RE=1&EE=1
- Federal tax credits for energy efficiency http://www.energystar.gov/index.cfm?c=products.pr_tax_credits