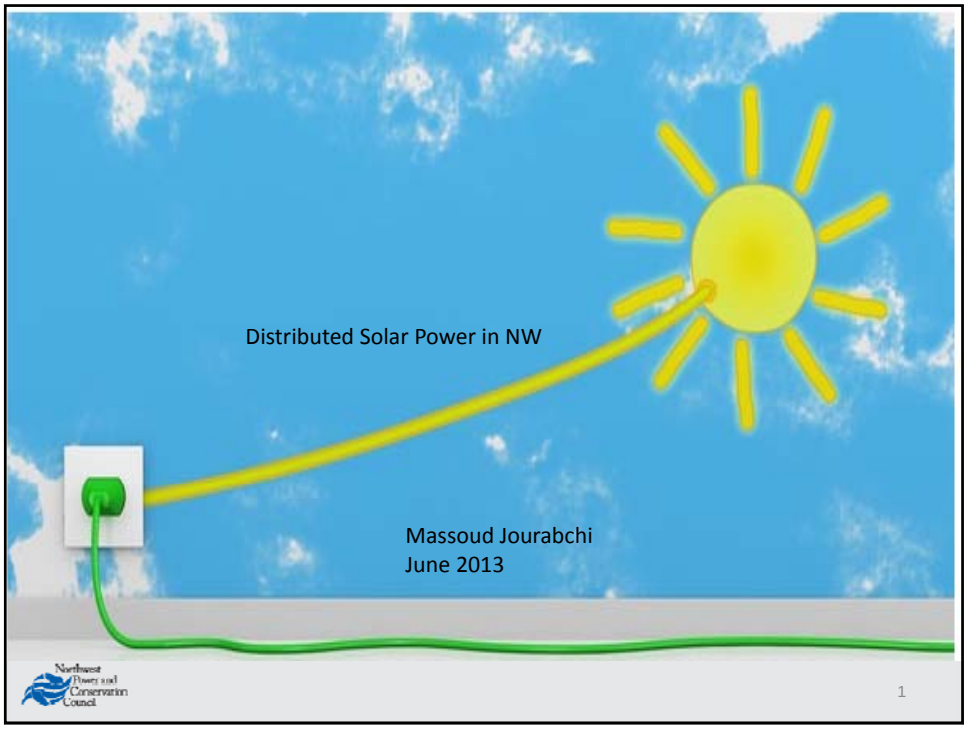
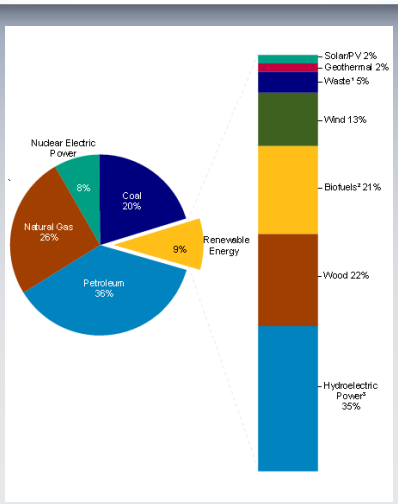
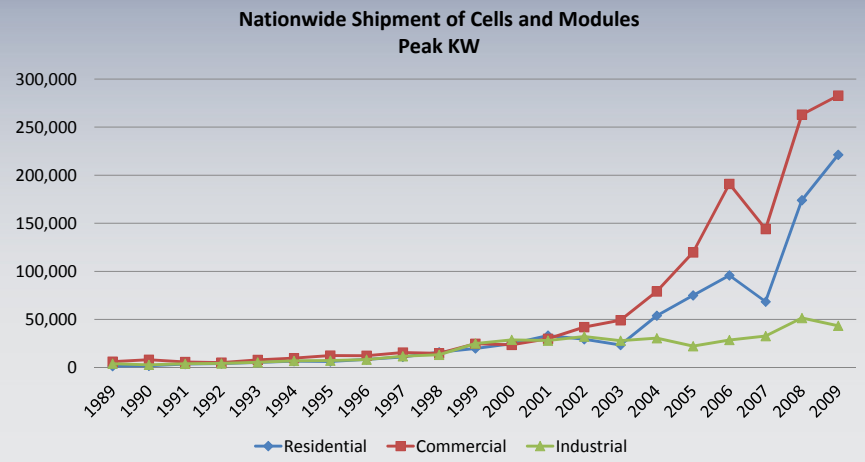


Renewables made up 9% of National Energy Consumption in 2011

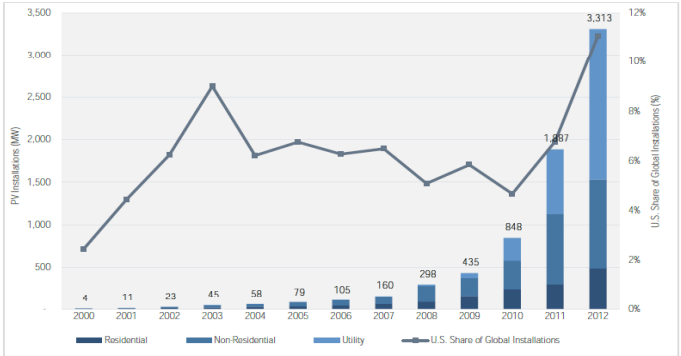


National Shipment of PV increasing



PV market is global and US represented 11% of global PV installation in 2012

Figure 2.1 U.S. PV Installations and Global Market Share, 2000-2012



Installations (MWdc)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Residential	1	5	11	15	24	27	38	58	82	164	246	302	488
Non-Residential	2	3	9	27	32	51	67	93	200	213	336	826	1,043
Utility	0	3	2	3	2	1	0	9	16	58	267	760	1,781
Total Installations	4	11	23	45	58	79	105	160	298	435	848	1,887	3,313

Regional Growth In Solar Energy Consumption

- Solar consumption both Thermal and PV has been on steady increase since early 1990s.
- From 2000-2010 Solar PV grow at annual rate of 13% and solar thermal grow at 9%
- Oregon has the largest level of solar installation and consumption followed by Washington.

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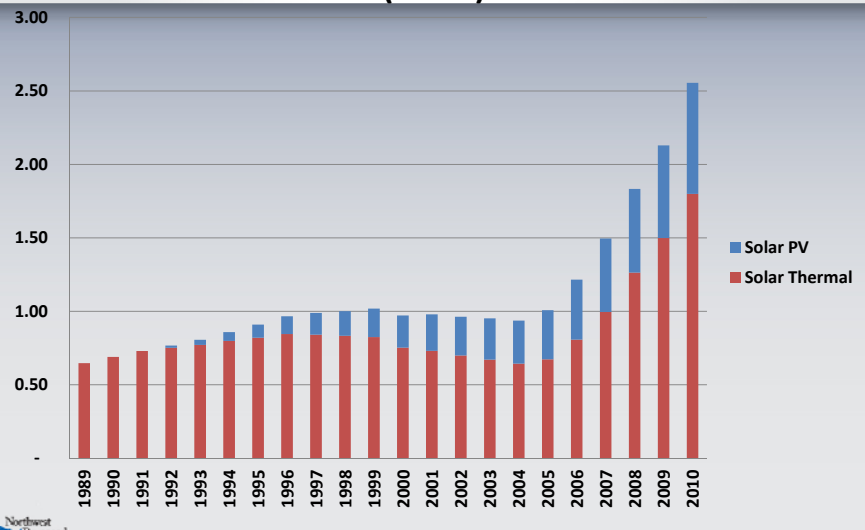
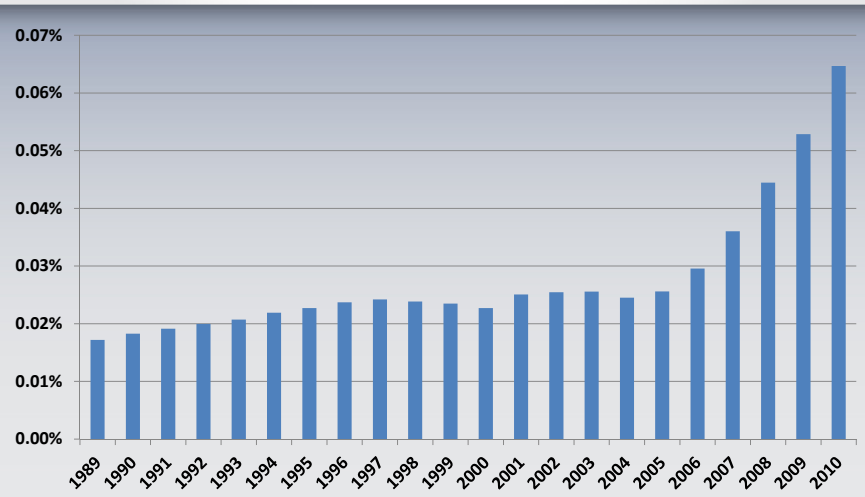
Northwest Solar Resource Consumption (TBTU)



Source: EIA State Energy Data System (SEDS)

6

Solar As Percent of Total Energy Consumption in the Northwest



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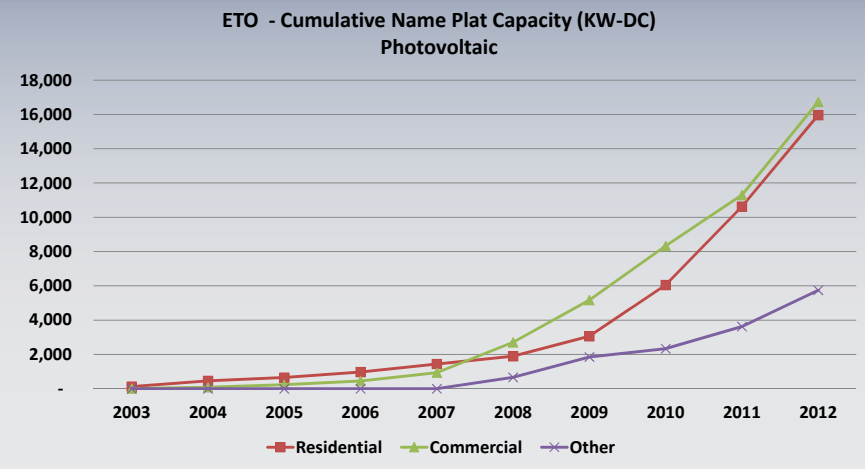
over 42 MW-DC of Peak PV capacity in Oregon



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Source: ETO Solar program database

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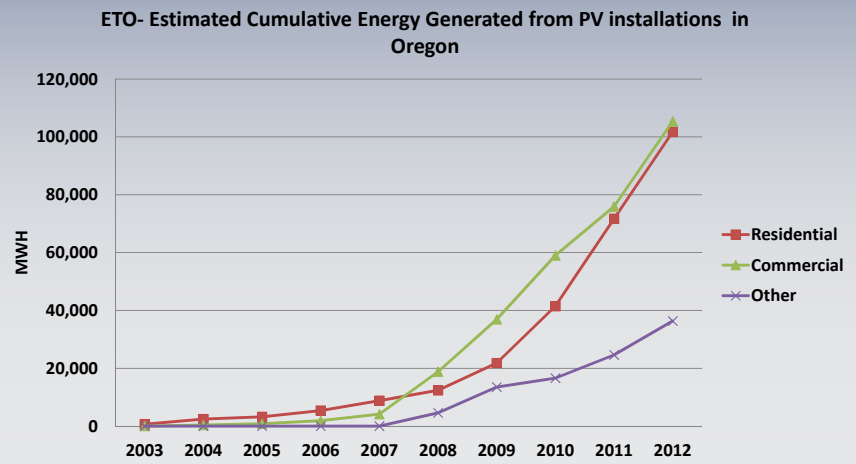
Roughly equal to 31 MWa of generation



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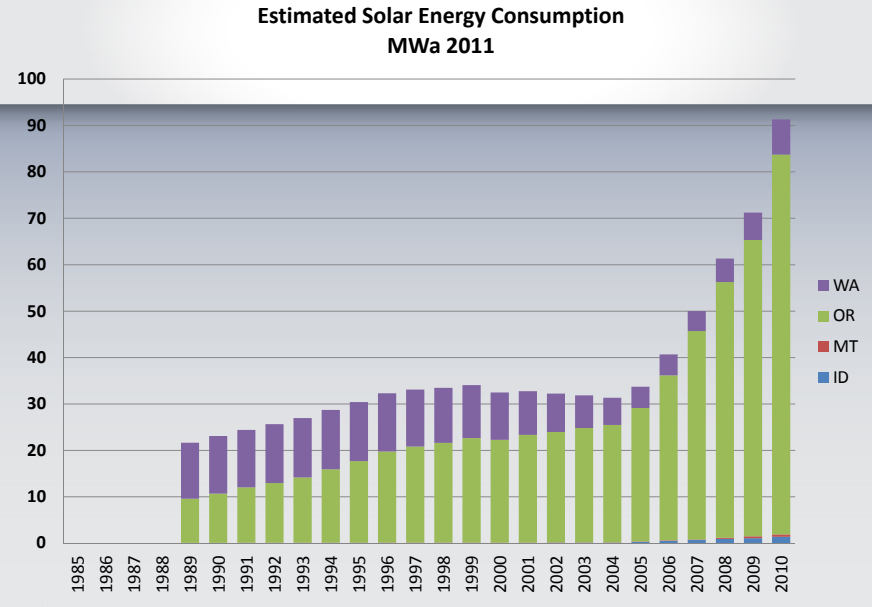

Based State Energy Data System
(includes Solar thermal and PV)

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Using EIA 861 dataset we estimate that
there were about 46 MW of
Net metered Photovoltaic Capacity installations -as of 2011

Net Metered Installs as of 2011	Residential	Commercial	Industrial	Total
Idaho	0.6	0.9	0.03	1.6
Montana	1.4	0.9	-	2.3
Oregon	14	16	1	31
Washington	7	3	0	11
Regional Total	23	21	1	46

YEAR	2011			
Net Metered Installs as of 2011	Residential	Commercial	Industrial	Total
Idaho	330	41	3	374
Montana	601	197	-	798
Oregon	4,080	567	35	4,682
Washington	2,014	271	1	2,286
Regional Total	7,025	1,076	39	8,140

Number of net metered installed increased from 6000 in 2010 to over 8000 in 2011

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Oregon has had good growth in Rooftop PV due to Incentives

	2009	2010	2011	2012
Average of Cost/W	7.89	6.43	6.58	5.31
Average of Net Cost/W	2.95	1.58	2.22	1.63

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Of course there is a range in installed costs

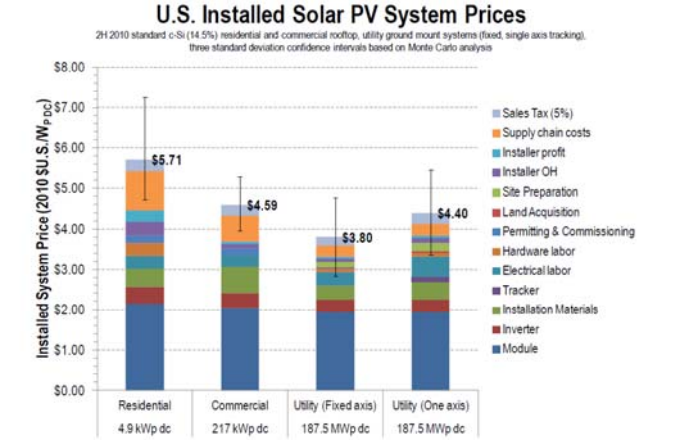

Figure 7. Benchmark 2010 PV system prices, all three sectors: breakdown by element.

In Oregon in 2011 installed costs* had a range of $2 - $8 With average of $6.50 Per DC w

* Not excluding incentives

Solar Has Popular Support

- *92 percent of voters believe it's important for the U.S. to develop and use more solar energy*
- *85 percent of voters view solar energy favorably (60 percent very favorable)*
- *78 percent of voters say government should support growth of solar energy with incentives*

With high popularity, why rooftop solar installs are not more prevalent in NW?

- Cost speak loudest, Regional Low electricity rates, increases payback period
- Incentives are not high and consistent.
- Space requirements
- Trees
- Variability in output (location, location, location)

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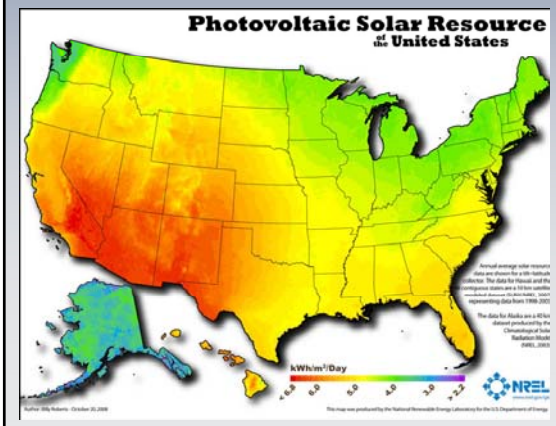
NW Climate Should Not a Detrimental to PV



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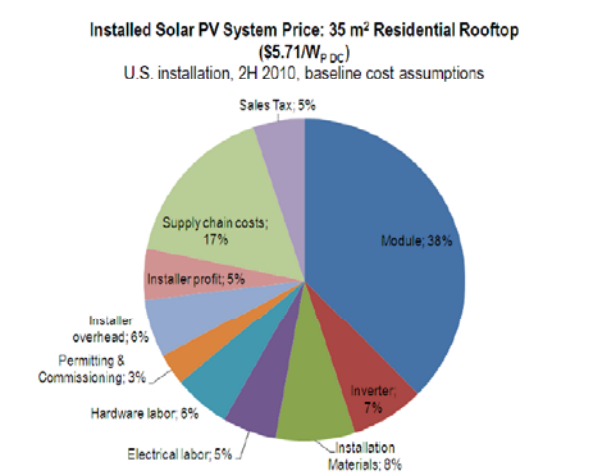
Cost play a major role in installation rate



Cost of Modules represent about a third of total cost of install.

Soft cost can be lowered by better economy of scale in installation.
Greater certainty in costs.

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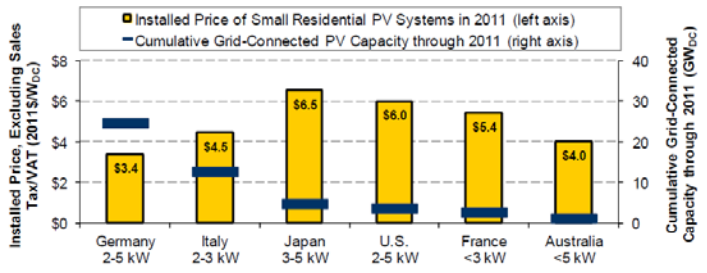
The Installed Price of Small Residential PV in the United States Is Higher than in Other Countries

The lower prices in other countries largely reflects differences in "soft costs," which may be driven partly by differing levels of deployment scale, though other factors are also likely at play



Notes: The U.S. data point represents the median price of 2-5 kW residential systems installed in 2011, and unlike other figures presented in this report, excludes sales tax. All other installed price data represent the "turnkey price of typical PV applications" reported in each country's IEA PVPS Country Report, for the particular size range shown. For Germany, the reported price in each year's country report represents the year-end price, and the value plotted in the figure is the average of the year-end 2010 and year-end 2011 values, in order to provide greater comparability to the other values, which represent annual averages for 2011. Cumulative installed capacity data for each country derive from REN21 (2012).

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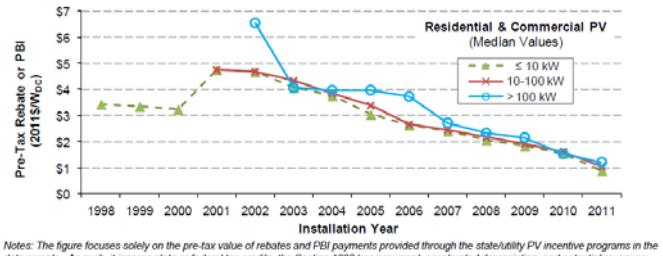
State/Utility Cash Incentives Continued Their Steady Decline in 2011

Median cash incentives from state/utility incentive programs in 2011 ranged from $0.9-$1.2/W across the three system size categories shown, falling by 21-43% relative to 2010 and by 80% relative to the historical peak



Notes: The figure focuses solely on the pre-tax value of rebates and PBI payments provided through the state/utility PV incentive programs in the data sample. As such, it ignores state or federal tax credits, the Section 1603 treasury grant, accelerated depreciation, and potential revenues from ongoing SREC payments. When calculating median values, systems in the data sample that received incentives solely in the form of ongoing SREC payments over time were excluded from the calculation. The high median incentive for >100 systems in 2002 reflects the large percentage of systems that received an incentive through LADWP's PV incentive program, which provided especially lucrative incentives in that year. Results are omitted from the figure if fewer than 15 observations are available.

In Oregon (ETO) Incentives as percent total cost were reduced from 42% in 2006 to about 38% in 2012

ETOs Recent cost of installations (PV only)

Average of $/W DC	Year				
Host Customer Sector	2008	2009	2010	2011	2012
Residential	8.8	8.4	6.6	6.6	5.7
Commercial	8.8	7.8	7.1	6.0	5.4
Government	7.7	8.8	6.6	6.5	5.9
Industrial			5.8		
Non-Profit	8.7	8.3	8.5	5.7	5.6

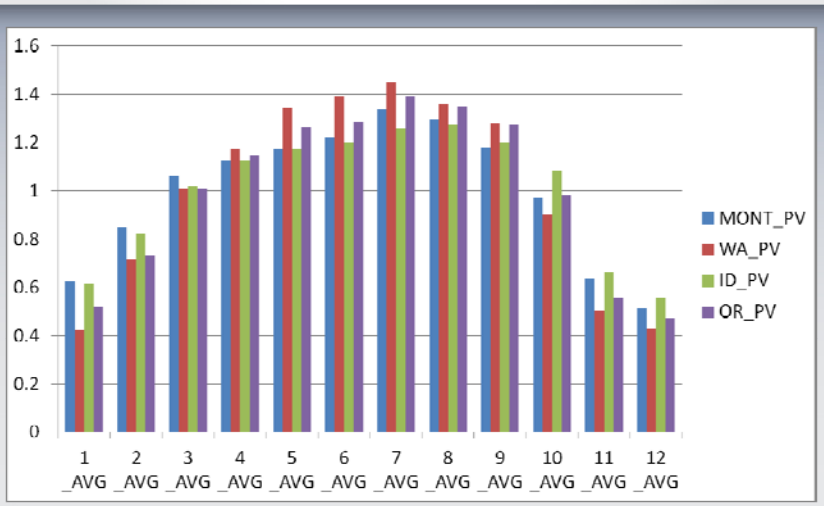
Forecasting Demand for Solar PV

- Council's long-term modeling considers the demand for solar PV as a Cogeneration demand.
- Cogeneration demand is estimated for each sector, and matched to historic levels.
- Model uses electricity rate and solar cost (capital and variable cost) on the simulation of decision to install.
- Forecast of rooftop solar generation and its contribution to system peak is used to lower system average and system peak.

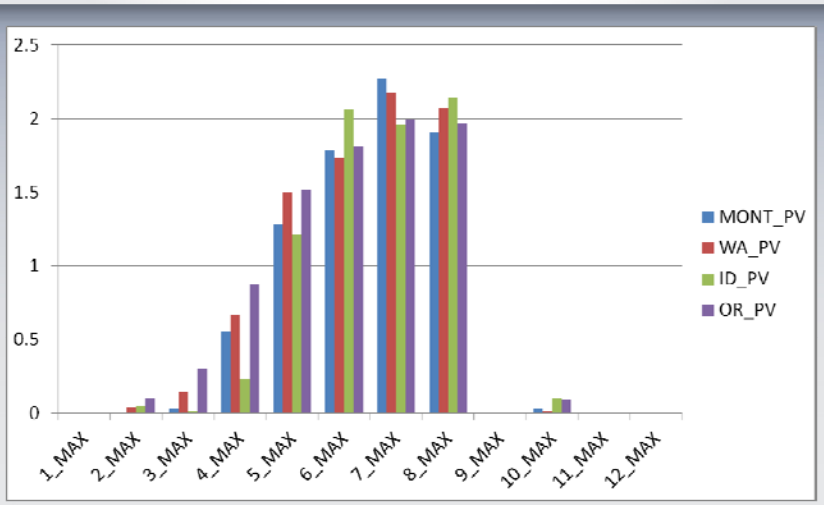
How Contribution to System Peak is calculated

- We take hourly system load (NW system load) for each year, 1995-2010.
- Then take estimated average hourly PV generation (16 sites across the region)
- We then identify PV generation at the time of system peak for a given year, month and state.
- Then we establish ratio of generation at the time of system peak to the average annual generation for each year.
- These monthly and annual ratios are then averaged.
- The resulting values show contribution (reduction) in system peak due to roof-top PV systems.

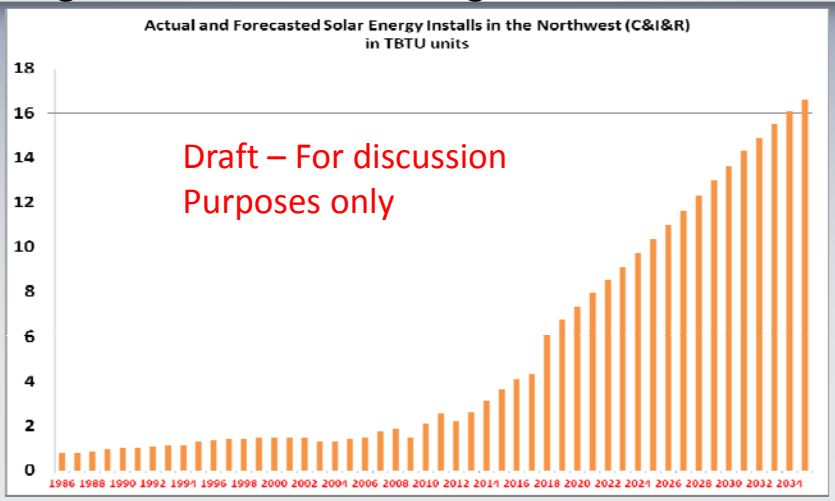
Ratio of Monthly Average to Annual Generation



Ratio of PV Generation at the time of System Peak to Average Annual Generation



From 2015-2035 Solar is expected to grow at 8% average annual rate



Work in progress. Includes Solar Thermal

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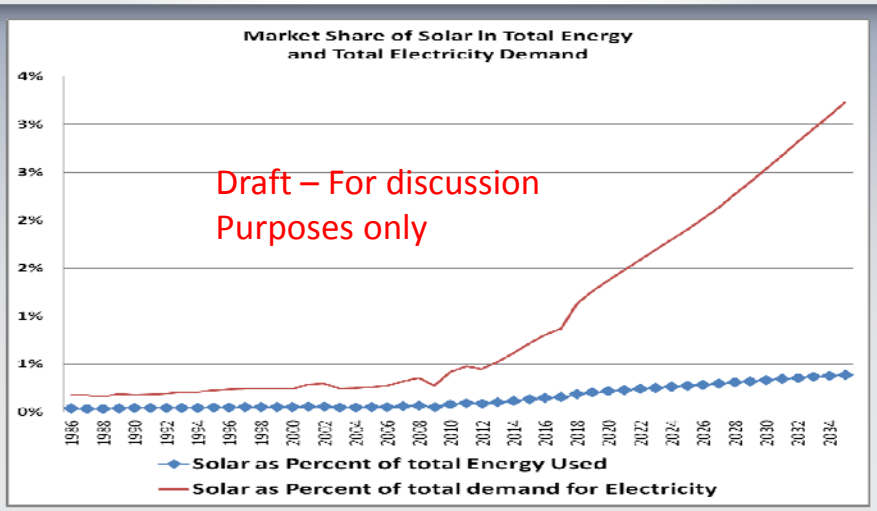
But Even With This High Growth Rate Solar Represents an small portion of Energy Mix in the Northwest



Work in progress. Includes Solar Thermal

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Next steps

- Update future trajectory of PV cost.
  - Keep rooftop PV trajectory consistent with utility PV cost.
- Test different scenarios
  - Incentives
  - Carbon tax

Questions ....