## "State of the U.S. Energy System: Importance of Geothermal and Waste Heat Power"

Southern Methodist University March 14, 2013 Dallas, TX





## FERC Independent Organized Wholesale Electric Markets



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Midwest ISO



PJM Interconnection



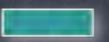
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ISO New England

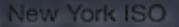
Southwest Power Pool



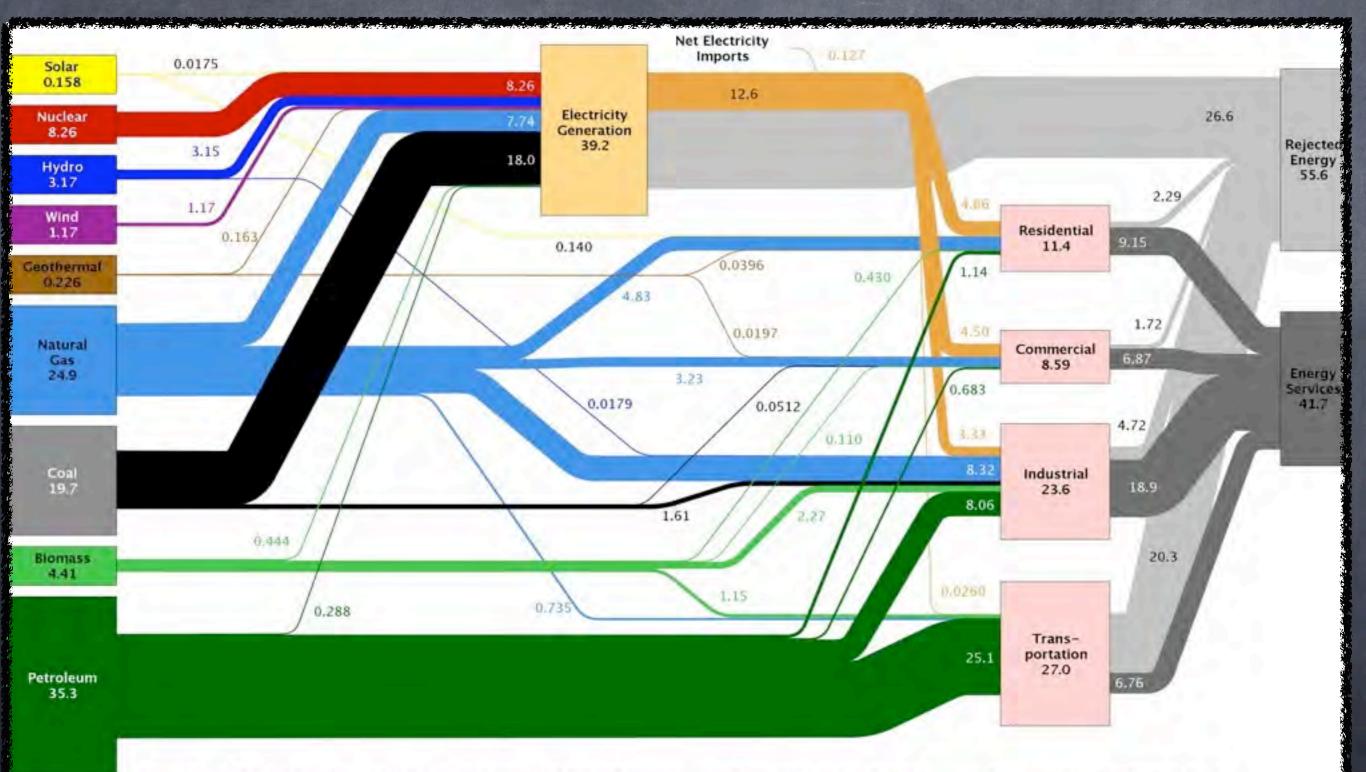
California ISO



Electric Reliablity Council of Texas



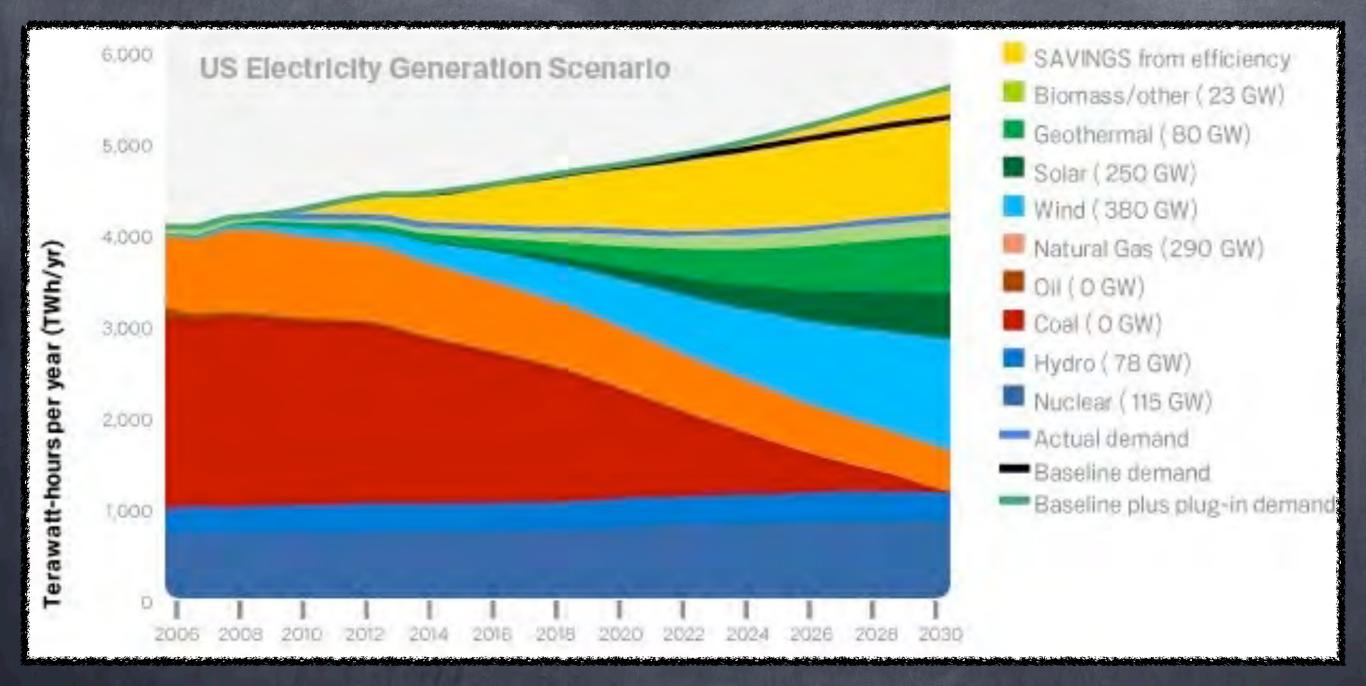
### Estimated U.S. Energy Use 2011- ~97.3 Quads



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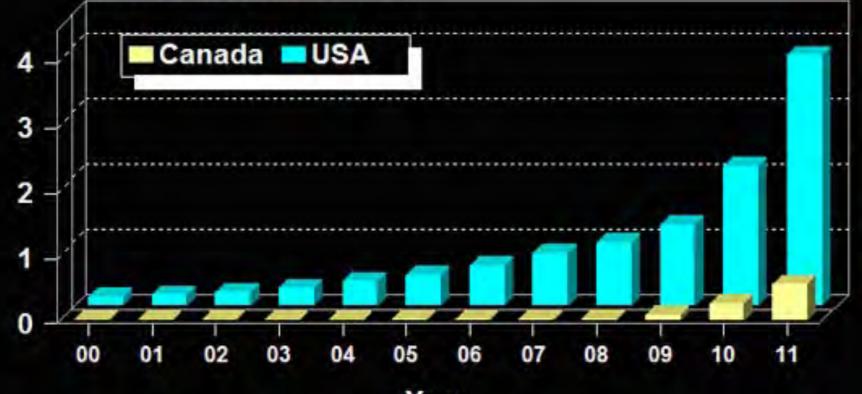
# **Google Electric Future**



Source: SunPowerCorp.com First Phase of 250 MW California Valley Solar Ranch Energized

### Solar PV Development in North America

#### **Megawatts (Thousands)**

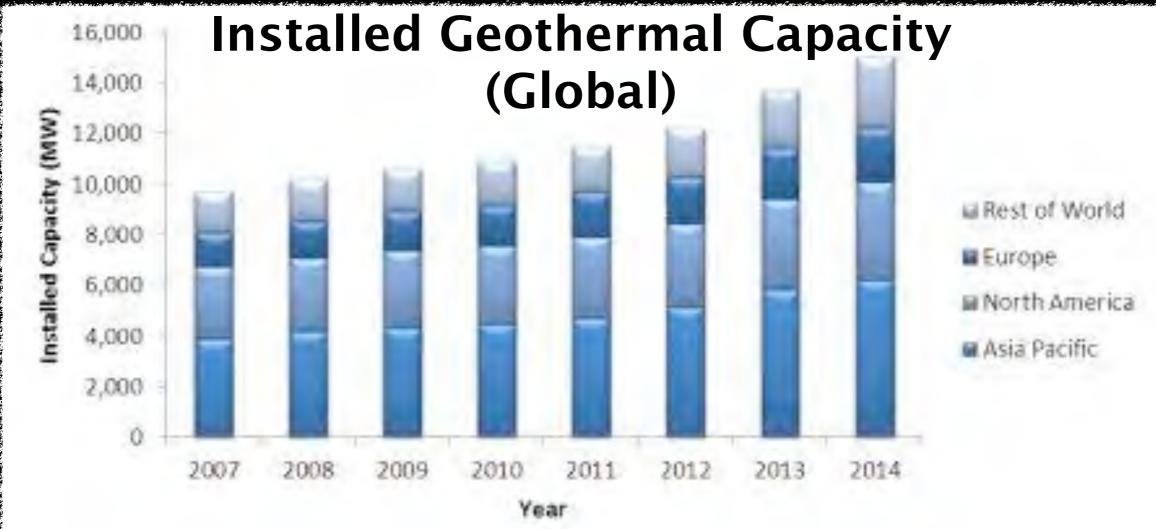


Year

Paul Gipe, wind-works.org

Source: SunPowerCorp.com First Phase of 250 MW California Valley Solar Ranch Energized





Source: Green.tmcnet.com

Source: The Sietch Blog

#### Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50m W/m <sup>2</sup>	Wind Speed" at 50 m m/s	Wind Speed" at 50 m mph	X
1234567	Poor Marginal Fair Good Excellent Outstanding Superb	0 - 200 200 - 300 300 - 400 400 - 500 500 - 600 600 - 800 > 800	0.0-5.6 5.6-6.4 6.4-7.0 7.0-7.5 7.5-8.0 8.0-8.8 >8.8	00-125 125-143 143-157 157-168 168-179 179-197 >19,7	. ~

<sup>9</sup> Wind speeds are based on a Weibull k value of 2.0

C2 67

#### Wind Power Classification

Wind Power Class	Resource Potential		Wind Speed* at 50 m m/s	Wind Speed* at 50 m mph	1
1234567	Poor Marginal Fair Good Excellent Gulstanding Superb	300 - 400 1400 - 500 500 - 600	6.4 - 7.0 7.0 - 7.5 7.5 - 8.0	0.0 - 12.5 12.5 - 14.3 14.3 - 15.7 15.7 - 16.8 16.8 - 17.9 17.9 - 19.7 > 19.7	

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Wind speeds are based on a Weibull k value of 2.0

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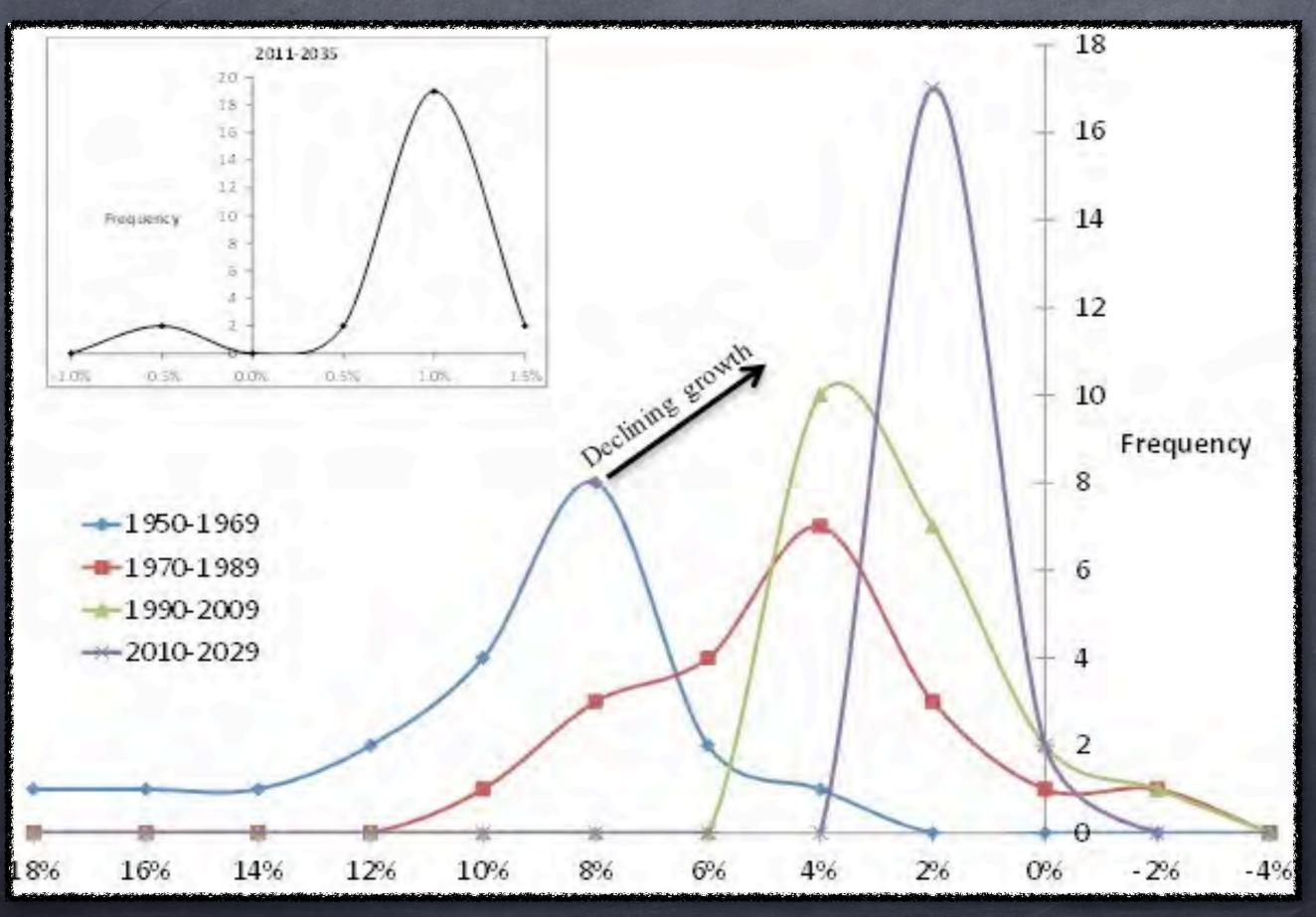
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	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
	Wind Resource Wind Power Wind Speed" Wind Speed"   Power Potential Density at Som W/m at 50 m m/s mph   1 Poor 0-200 0.0-5.6 0.0-12.5
	1   Poor   0 - 200   0.0 - 5.6   0.0 - 12.5     2   Marginal   200 - 300   5.6 - 6.4   12.5 - 14.3     3   Bair   300 - 400   6.4 - 7.0   14.3 - 15.7     4   Good   400 - 500   7.0 - 7.5   15.7 - 16.8     5   Excellent   500 - 600   7.5 - 8.0   16.8 + 17.9     6   Cutstanding   600 - 800   8.0 + 8.8   17.9 - 19.7     7   Superb   > 800   > 8.8   > 19.7

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#### **Distribution of Electric Load Growth**

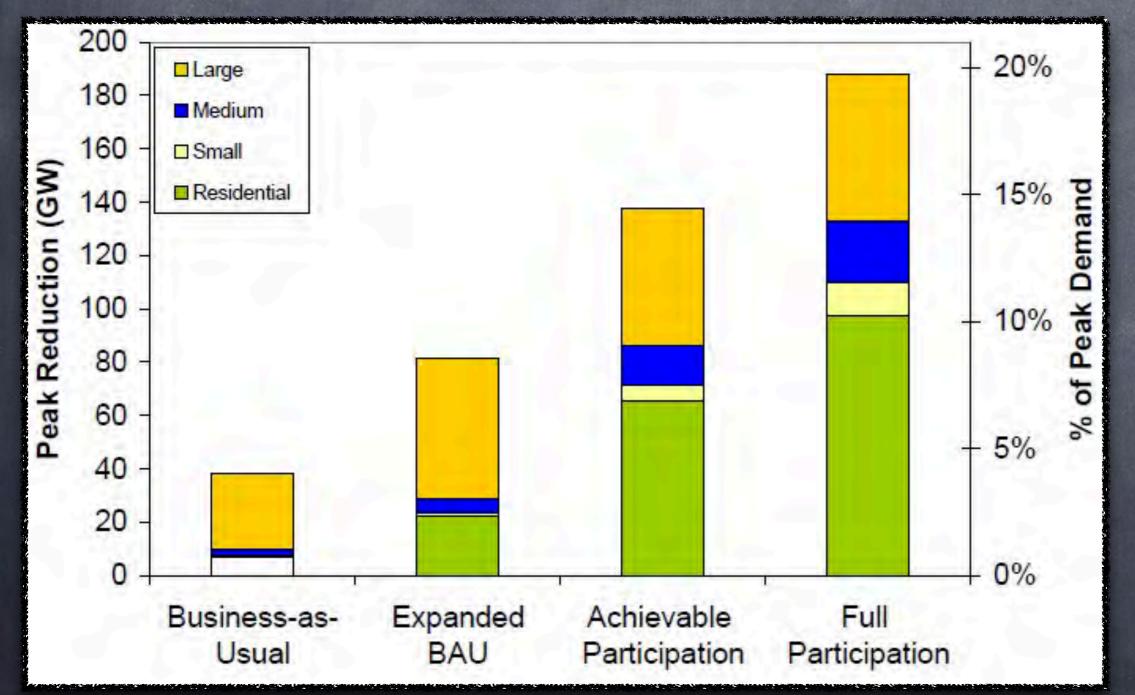






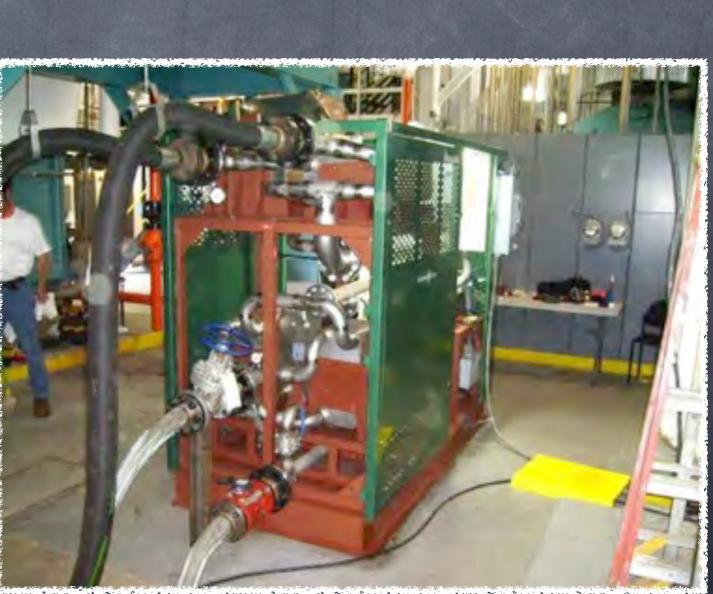


## FERC Assessment of DR Potential – at 2020



Demand Response Potential





# **Geothermal Systems**





Source: Wikipedia



