

# Powering a Thousand Points of Light: The Future of Distributed Energy

Tuesday, May 1, 2012; 9:30 AM – 10:45 AM

## Moderator:

**Raymond Wood**, Managing Director and Head of the US Power & Renewables Group;  
Global Head of Global Alternative Energy, Credit Suisse

## Speakers:

**Jonathan Art**, Portfolio Manager, Federated Kaufmann Fund

**David Crane**, President and CEO, NRG Energy

**Bill Green**, Macquarie Infrastructure and Real Assets

**Lynn Jurich**, President, Sunrun

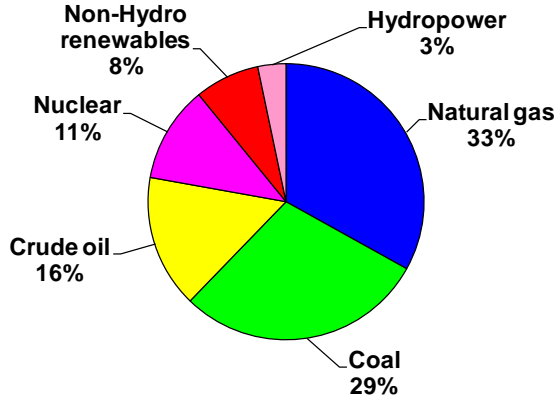
**Nancy Pfund**, Managing Partner, DBL Investors

# U.S. energy production and consumption

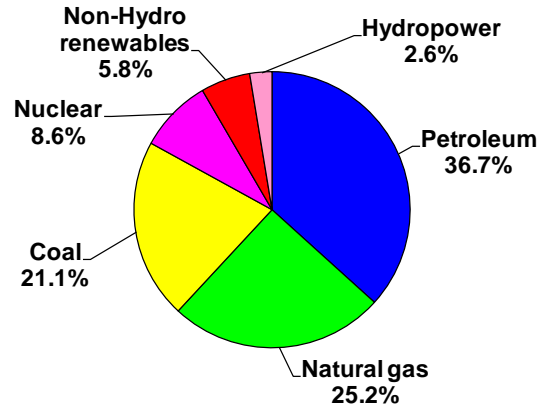


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U.S. energy production (2010): 74.9 quadrillion btu



U.S. energy consumption (2010): 98.0 quadrillion btu



Source: National Renewable Energy Laboratory.

# The distributed energy (DE) market is growing



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## *Current global market statistics*

- **The global market reached \$44.4 billion in 2009 and \$64.0 billion in 2010**
- **In 2010, renewable technologies represented \$31.8 billion and fuel-based technologies was \$32.2 billion**
- **By 2015 the distributed energy market is estimated to reach \$141 billion**
- **GE's 2010 acquisition of Dresser, Inc. for \$3 billion injected confidence in an uncertain DE industry**

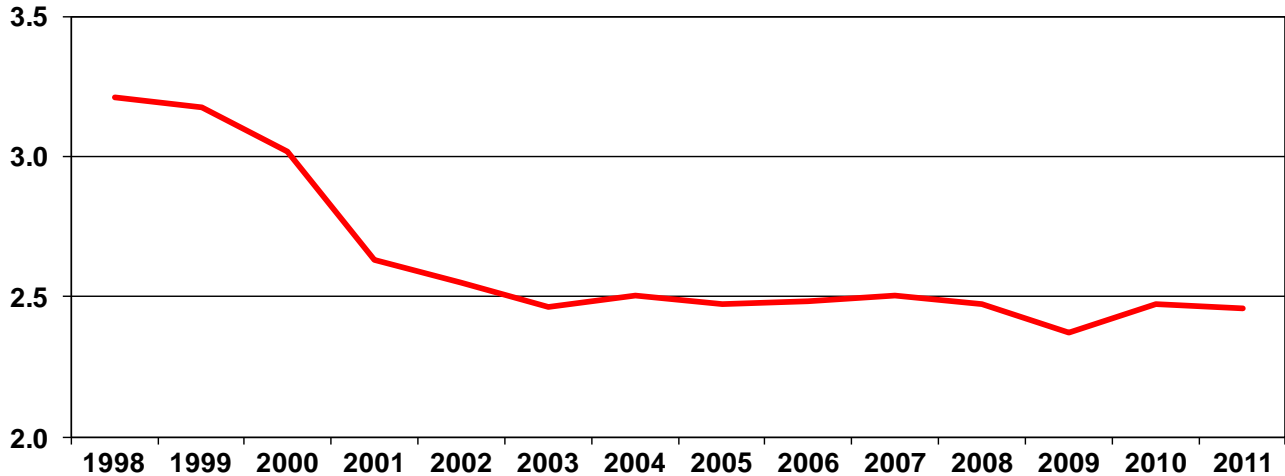
# Electric utility sourced energy generation has been declining in the U.S.



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*Net energy generation from electric utilities*

Billion megawatthours



Source: U.S Energy Information Administration.

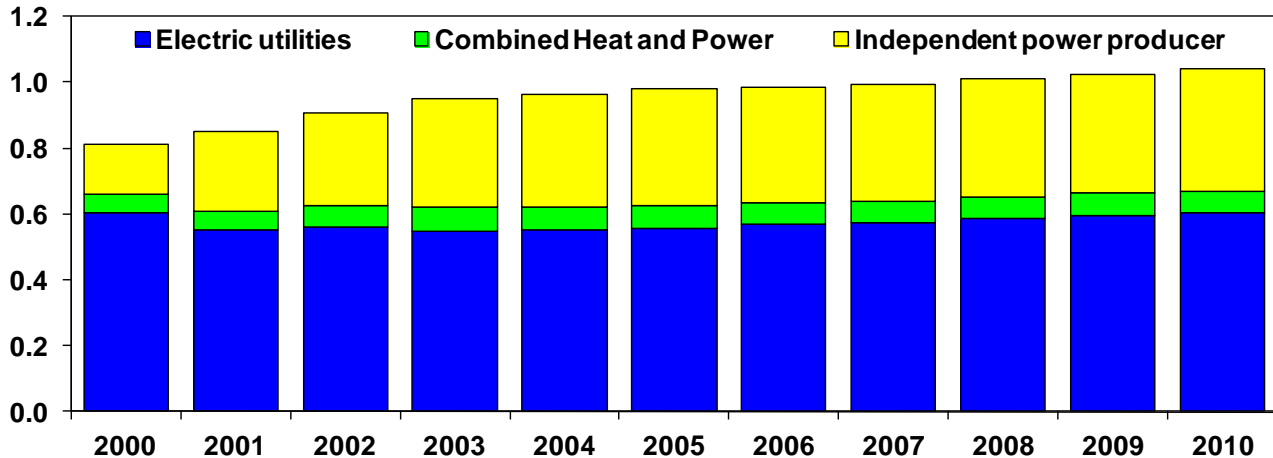
# U.S. non-utility electric power production has been on the rise in the last decade



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*U.S. net summer capacity by energy producer*

Million megawatthours



Source: U.S Energy Information Administration.

# Current initiatives



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- **Combined Heat and Power (CHP) Partnership: the EPA works closely with energy users, the CHP industry, state and local governments**
- **In 2009 CHP generation represented 9 percent of total U.S. energy capacity; 2030 target is 20 percent**

Source: BCC Research and the Distributed Energy Journal.

# Most commonly cited benefits of distributed power systems



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- **Reduce vulnerability of the power system**
- **Provide back-up generation to improve system reliability**
- **Reduce environmental impacts of power generation**
- **Offset costs of new or upgraded transmission and generation assets**

# Principal elements of distributed generation and storage



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<b>Solar</b>
<b>Wind</b>
<b>Combustion engines</b>
<b>Combined heat and power (CHP)</b>
<b>Microhydropower</b>
<b>Fuel cells</b>
<b>Storage</b>
<b>Microturbines</b>

Source: Brookings Institute Energy Security Initiative.

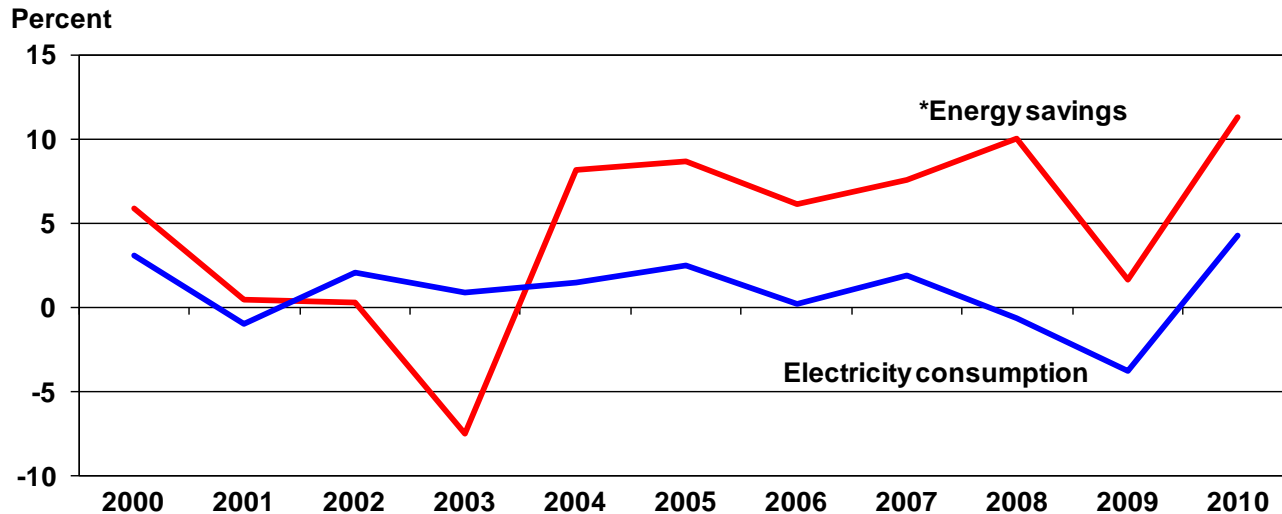


# Energy savings are outpacing consumption in the U.S.



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*U.S. annual percentage changes in megawatthours*



Source: U.S Energy Information Administration.

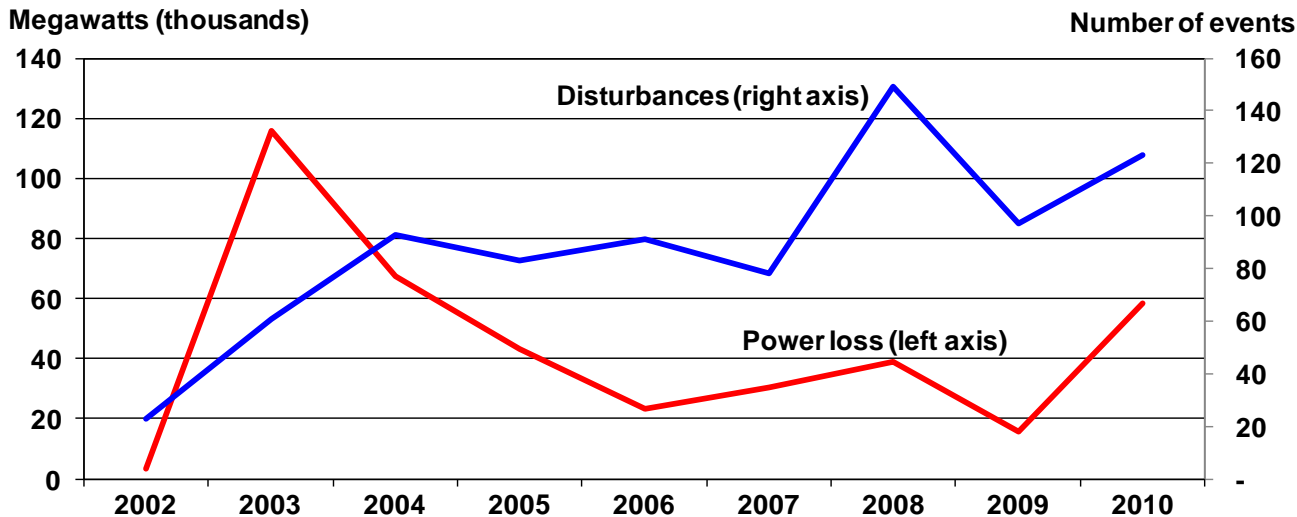
\*Savings represent energy efficiency and load management

# While the number of power outages have increased, power loss has been decreasing annually



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*U.S. power disturbances from 2002 – 2010\**



Source: U.S Energy Information Administration.

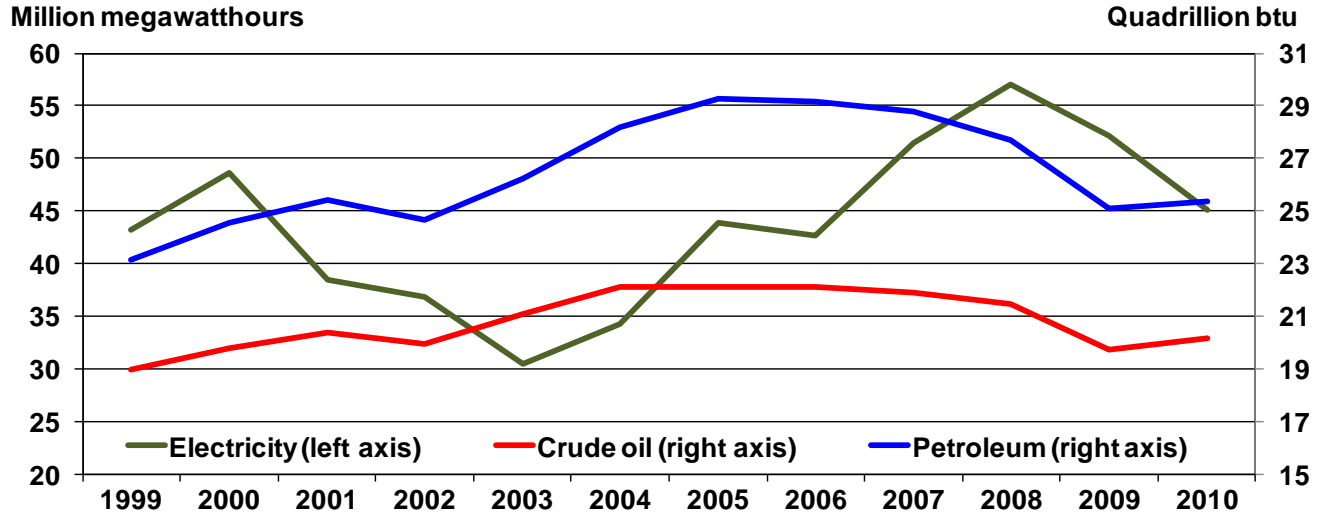
\*Approximately 130 million people have been affected

# Like oil, dependency on electricity is also decreasing in the United States



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## *U.S. oil and electricity imports*

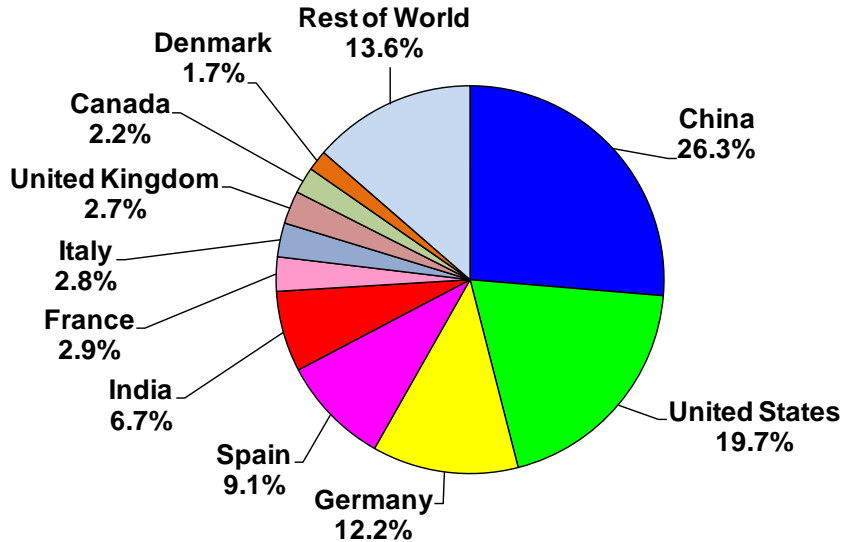


Source: U.S Energy Information Administration.

# Since 2010, China has surpassed the U.S. as the world leader in wind energy cumulative capacity



## *Wind energy cumulative capacity by global leader, 2011*



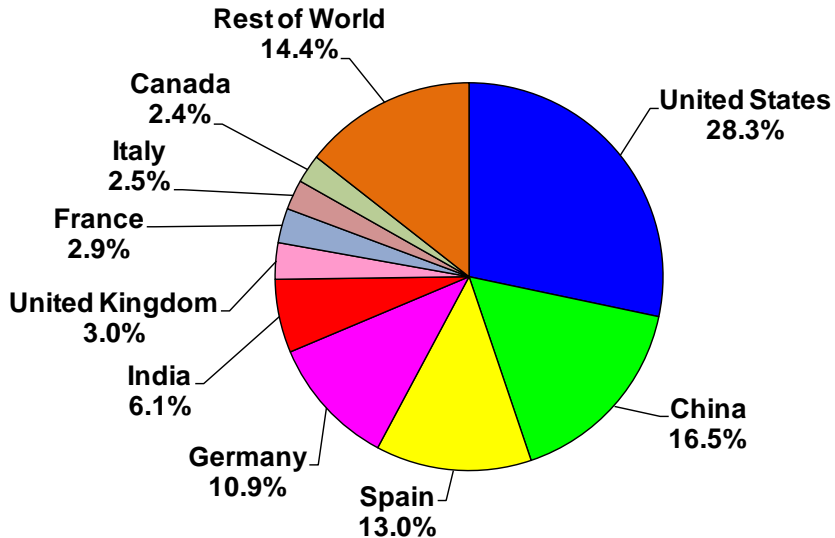
Source: National Renewable Energy Laboratory.

# Despite having 5 percent less wind capacity than China, the U.S. produced 42 percent more wind in 2010



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*Wind energy production by global leader, 2010*



Source: National Renewable Energy Laboratory.

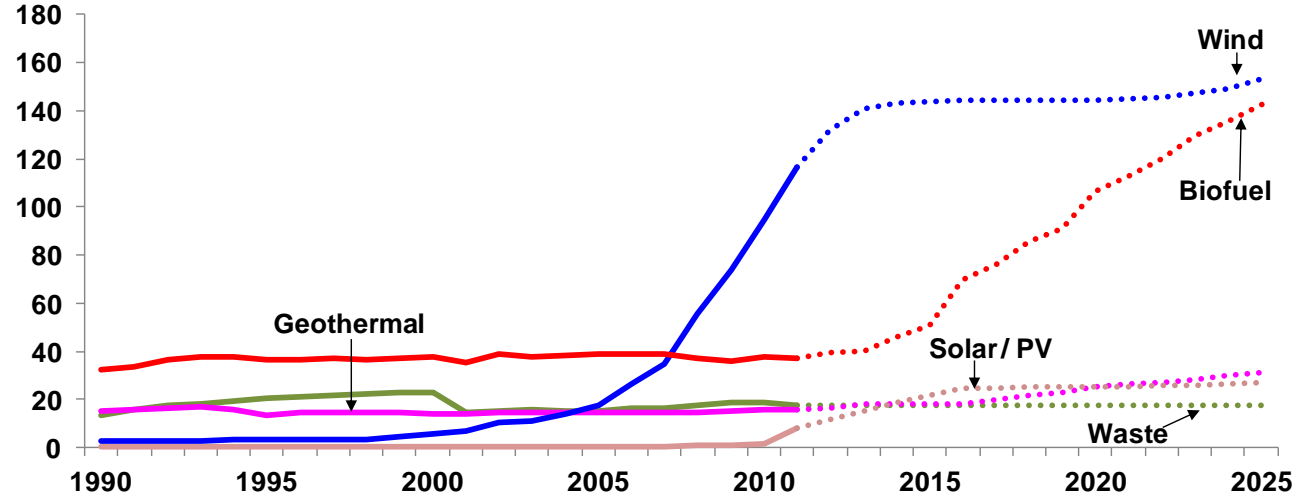
# Led by wind and biomass, the U.S. projects increases in renewable energy generation



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## *Domestic non-hydro renewable energy generation*

Billion kilowatt hours



Source: U.S. Energy Information Administration.

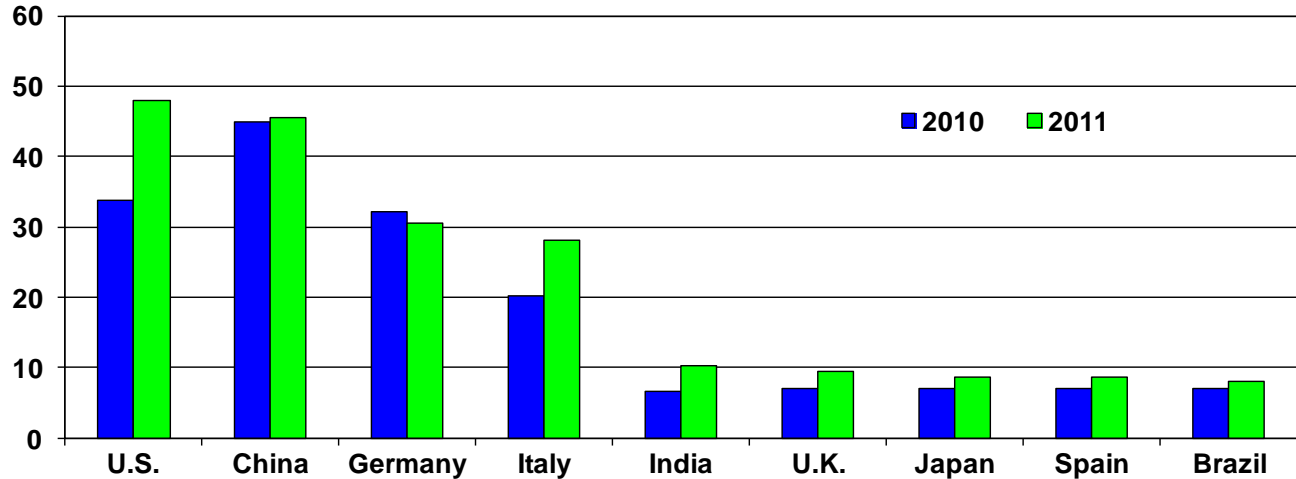
# U.S. leads the world in clean energy investment



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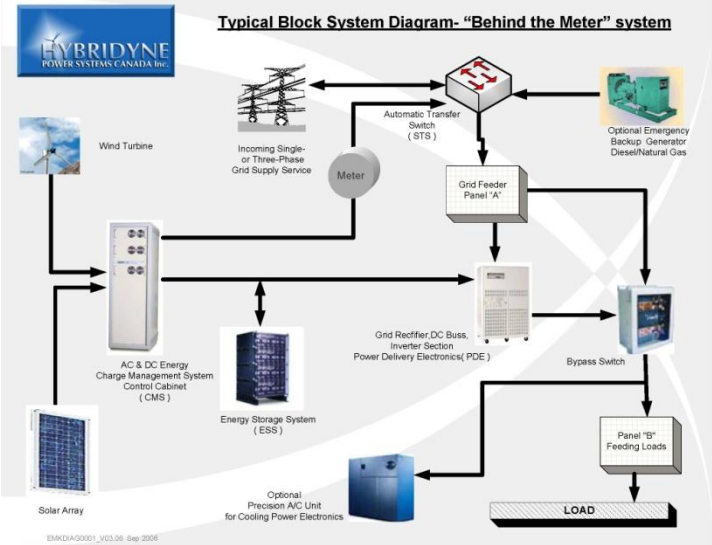
## *Investments by global rank*

US\$ billions



Source: Bloomberg New Energy Finance and Pew Environmental Group.

# Behind the Meter system



Source: Hybridyne.



# Small-scale distributed generation

2010 figures

Rank	Company	Annual electricity consumption (GWh)	Percent RE of electricity
1	Kohl's Corporation	1,413	100.4
2	Whole Foods Market Inc.	817	100.0
3	Toronto-Dominion Bank	318	94.4
4	Swiss Reinsurance Co Ltd	74	78.1
5	Nordea Bank AB	144	76.7
6	Adobe Systems Inc.	54	74.8
7	Vestas Wind Systems A/S	285	73.6
8	News Corp	831	67.0
9	CLP Holdings Ltd	1,438	66.3
10	Deutsche Bank AG	766	64.9

Source: Bloomberg New Energy Finance.

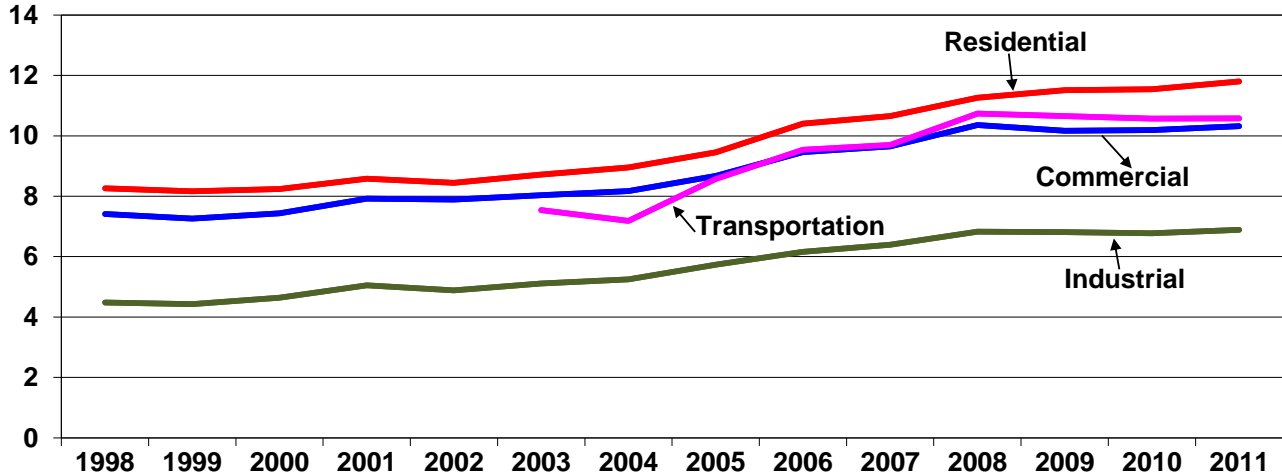
# U.S. retail price of electricity is increasing

*Average retail price by end-use sector*



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Cents per kilowatt hour



Source: U.S Energy Information Administration.

\*Transportation data available from 2003.

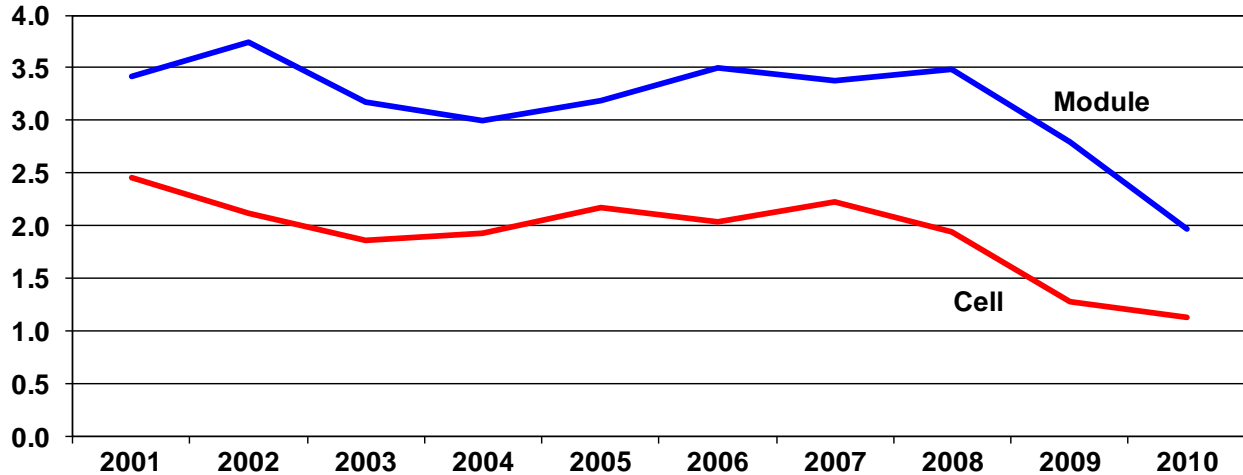
# Prices of solar power are decreasing

*Average price of photovoltaic cells and modules*



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Dollars per peak watt



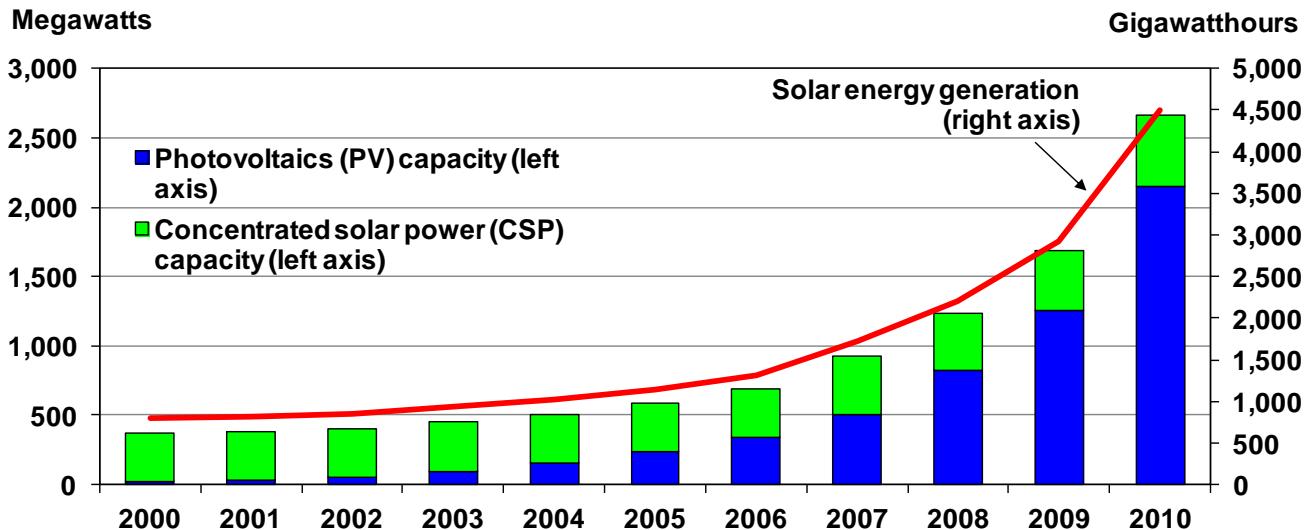
Source: U.S Energy Information Administration.

# Solar energy capacity and generation is increasing in the U.S.



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## *U.S. total installed solar energy capacity and generation*



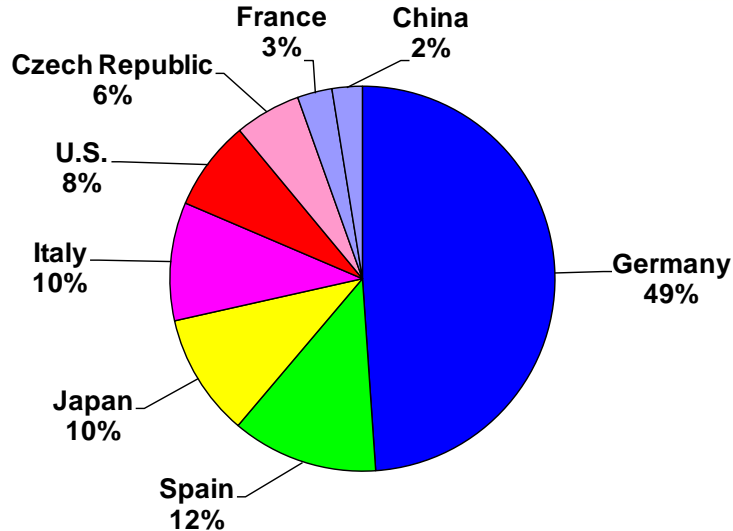
Source: National Renewable Energy Laboratory.

# Germany leads the world in installed solar energy capacity



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*Global installed solar energy capacity leaders, 2010*



Source: National Renewable Energy Laboratory.

# California leads the U.S. in solar energy development



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*U.S. leaders in photovoltaic (PV) development, 2010*

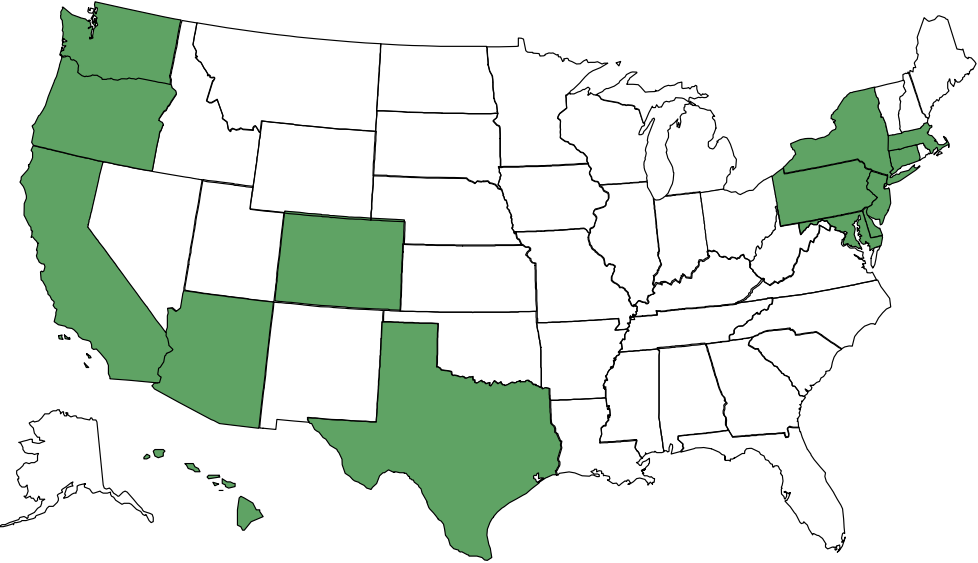
State	PV Cumulative Capacity (2010, MW)
California	1,021.70
New Jersey	259.9
Colorado	121.1
Arizona	109.8
Nevada	104.7
Florida	73.5
New York	55.5
Pennsylvania	54.8
Hawaii	44.7
New Mexico	43.3

Source: National Renewable Energy Laboratory.

# Most Active States in Solar Adoption



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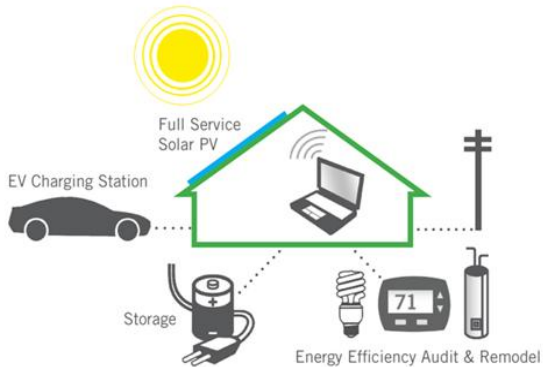


## Solar Is A Disruptive Energy Delivery Platform



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- Solar energy is the pathway to a customer relationship to serve many energy needs including energy efficiency
- With a solar lease a supplier develops a 20-year contracted customer relationship
- This is game-changing

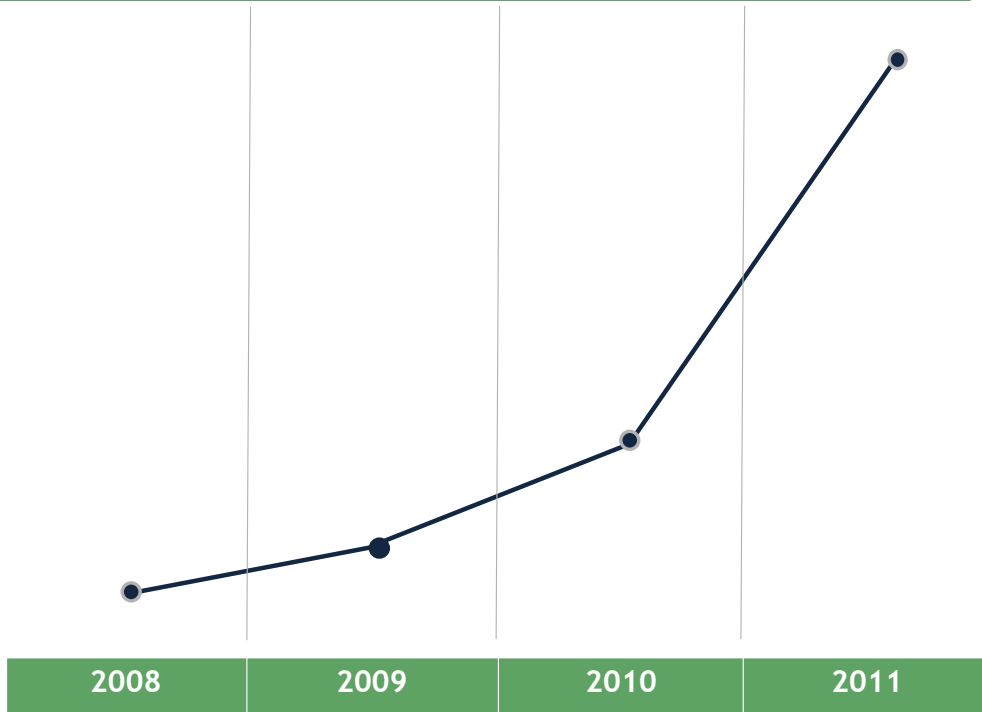




## Impact of ITC on Creation of Solar Tax Equity Funds: One Company's Experience



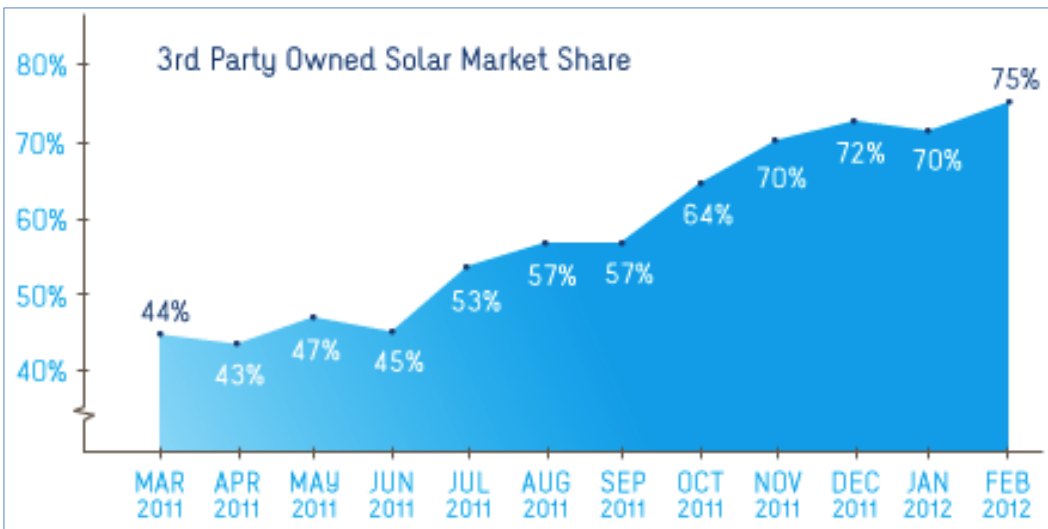
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## Financing Products Can Drive Tremendous Growth in Residential Solar Adoption



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\*Graph source- SunRun



## Military Bases Represent A Key Driver for Solar Growth



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SOLARSTRONG™

- 120,000 Home Potential
- >\$1 Billion in projects (\$350 Million in debt financing)
- 5 Year Deployment



Soaring Heights Communities, Davis Monthan Air Force Base  
The Largest Solar-Powered Community in the Continental U.S.  
6 MW Project, Including Ground Mounts and 2.7 MW of Roof Mounts

## Solar Is Not Limited To Wealthy Neighborhoods: Multifamily Housing, Schools and Not-For-Profits Increasingly Enjoy Its Benefits



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### Essex Housing Complex

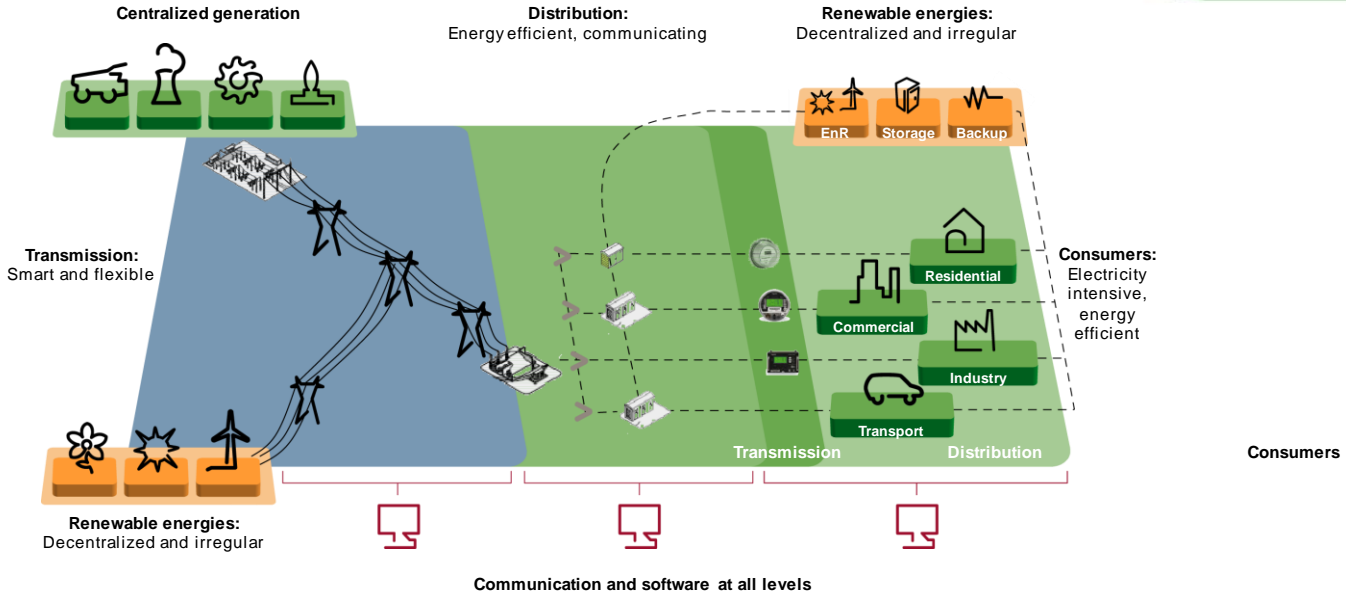
System Size	250 kW
Installed	June 2009
Type	Various Roof Types
Location	Lancaster, CA
Industry	Multifamily Housing

### Project Open Hand

System Size	23 kW
Installed	August 2007
Type	Commercial Flat Roof
Location	San Francisco, CA
Industry	Nonprofit



# Snapshot of the grid in the future

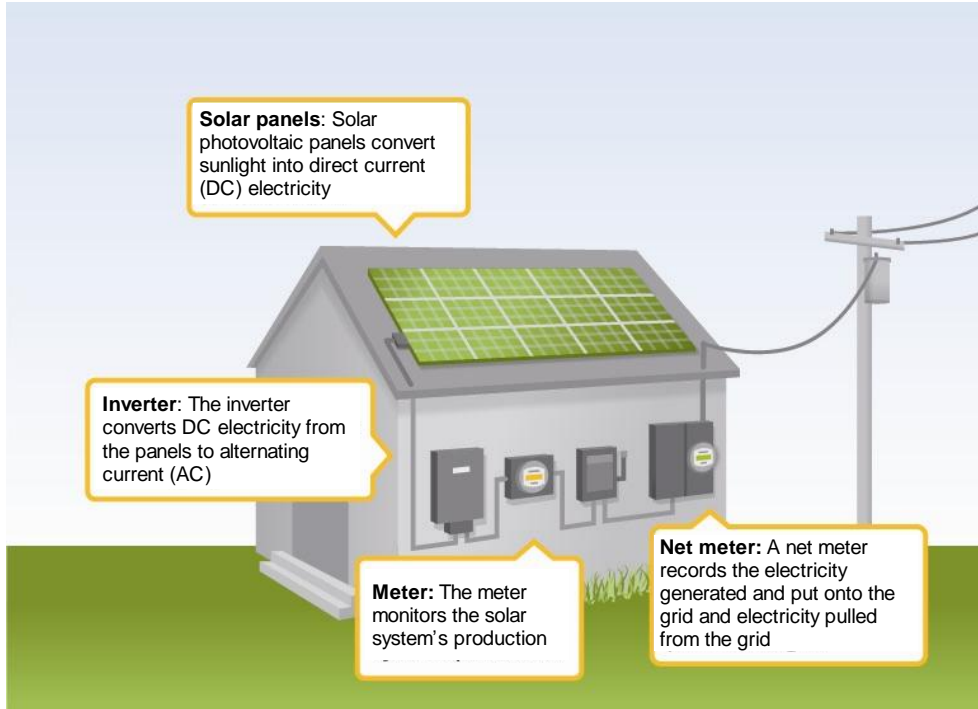


The smart grid is changing all stages of the electrical value chain

# How a grid-connected residential solar system works



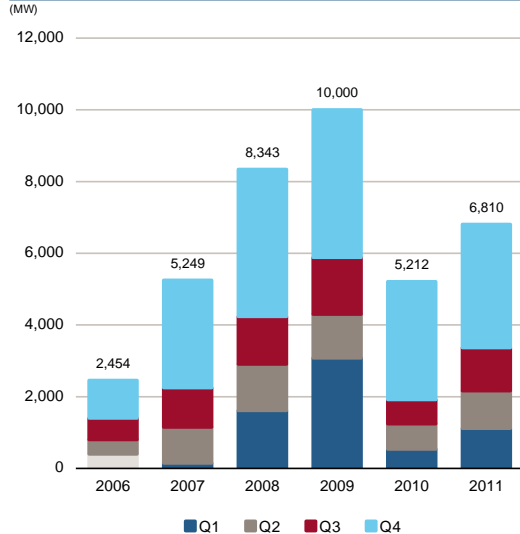
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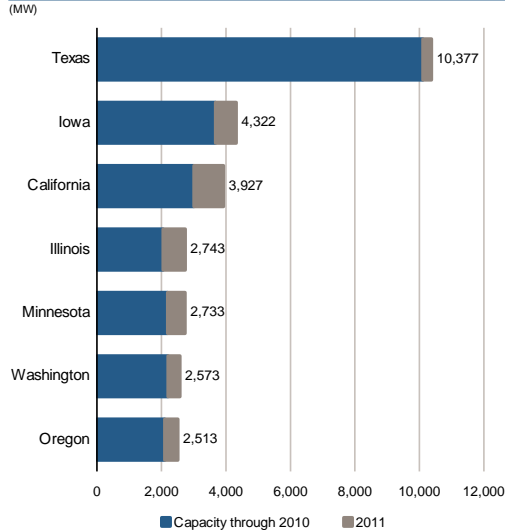
# U.S. wind installations



## Annual and quarterly installations



## Wind installations by state

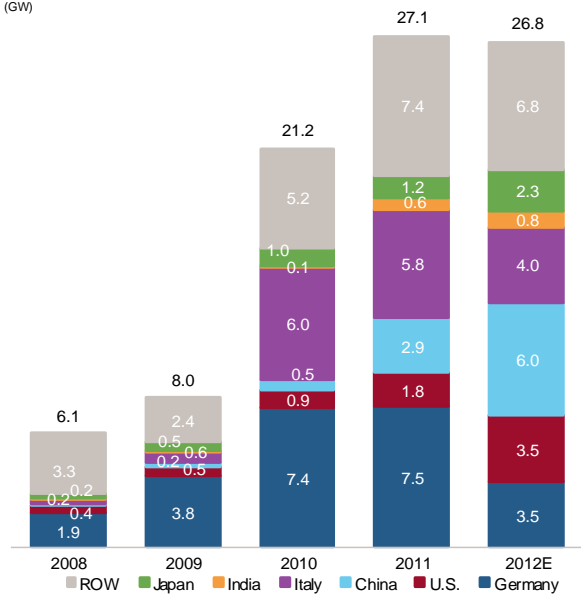


Installations rose 31% to 6,810 MW across 31 states in 2011. The cumulative installed wind capacity in the U.S. grew 17% from 2010, and now totals 46,919 MW

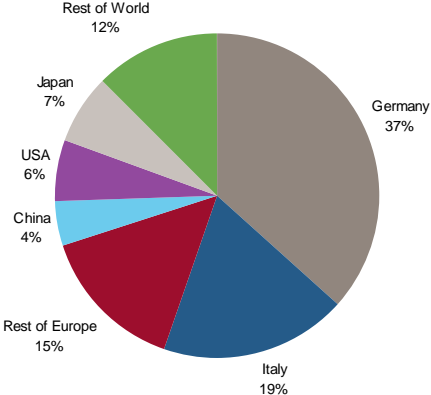


# Lower module prices to drive 2012 demand higher outside traditional solar markets

Global solar demand by region (2008 – 2012E)



Global cumulative capacity (2011)



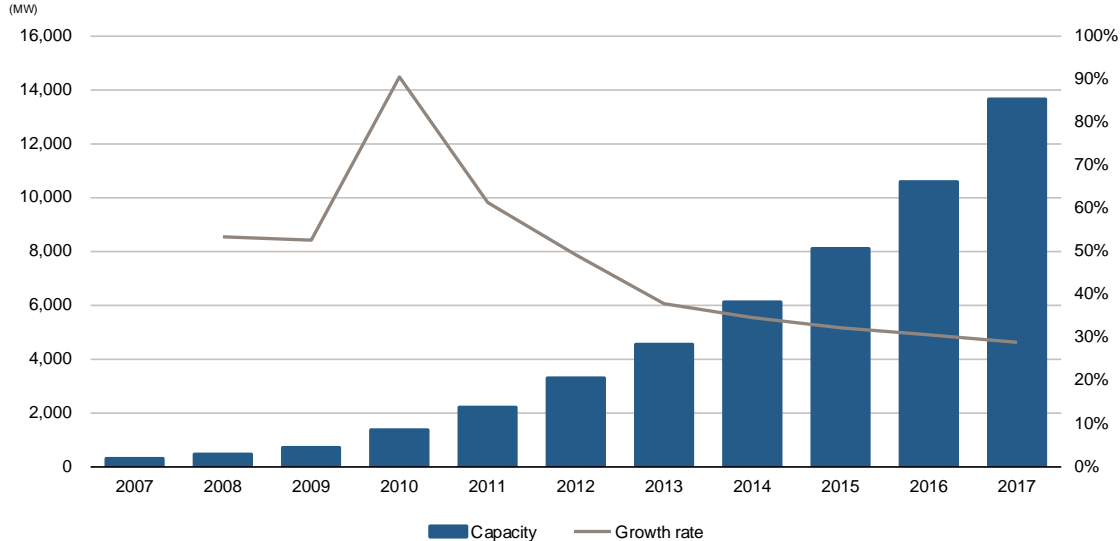
Percentages based on 67.4 GW of global installed PV capacity as of Dec. 2011

Source: Credit Suisse estimates, April 23, 2012.

# Residential solar power markets



## Cumulative installed capacity – United States

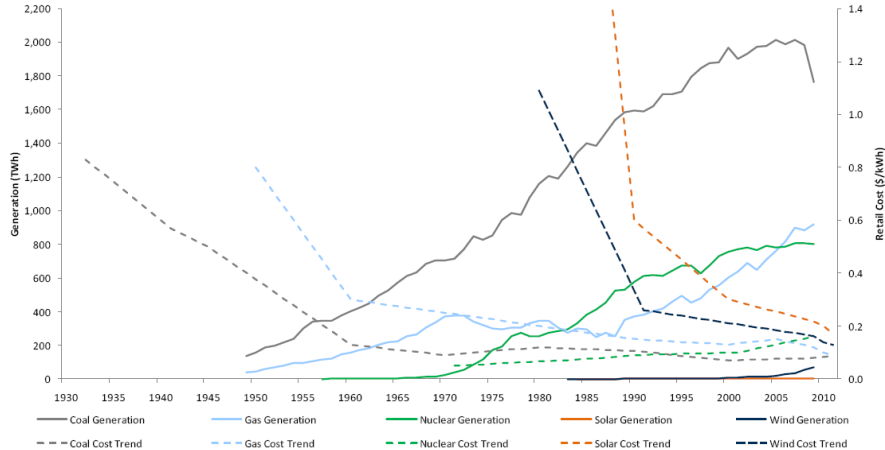


It is estimated that the United States residential solar power sector had 1,370 MW of cumulative installed capacity at the end of 2010, and is expected to grow at a CAGR of ~39% from 2010 – 2017

# Lower costs (and incentives) are necessary for renewables to be competitive



U.S. Electricity Generation and Retail Cost by Energy Source  
1930 – 2010



- LCOE = NPV of after-tax total lifecycle costs in \$/ lifetime energy production in MWh
- LCOE comparisons take into account the initial capital investment, the operating and maintenance costs, the fuel costs where appropriate, the tax benefits of depreciation, the capacity utilization, and the life of the asset

The rapid reductions in clean energy's cost structures are projected to continue and will bring these technologies to grid or retail parity over time