

# Alternative Energy: Future Costs and Challenges

PECC Seminar  
November 8, 2013



**Powerful Thinking**  
for the global energy industry

## Core Points

Renewables poised for significant role, and getting cheaper -- no fuel costs, but need scale and some technological progress

Of these, solar PV (panels) is the one to watch

Carbon capture is potentially another game-changer -- IF it can advance to scale, which looks unlikely

Need strong government policies for all of these

Impact on electricity costs -- because of free fuel -- is not as great as you'd think

# Energy Forms Ranked by Cost: 2000-13

## Power Generation Costs: 2000-13

(\$/MWh)	2000	2010	2012	2013	% Chg. 2000-13
Gas (CCGT) US	63	57	43	45	-29%
Hydro	52	70	67	67	+30
Wind Onshore	75	114	79	77	+3
Coal US	56	80	75	75	+34
Geothermal	47	83	79	82	+74
Gas (OCGT) US	119	109	88	90	-24
Gas (CCGT) Europe	47	79	89	90	+91
Coal Europe	77	108	95	92	+20
Nuclear	73	96	99	100	+36
Coal w/CCS US	72	116	119	120	+67
Biomass	107	133	127	122	+13
Coal w/CCS Europe	95	133	136	135	+42
Gas (OCGT) Europe	94	140	156	156	+66
Solar PV	502	329	181	163	-68
Wind Offshore	NA	202	183	170	NA
Solar CSP	204	235	238	224	+15%
Wave-Tidal	NA	276	267	280	NA

Present and projected levelized cost of energy (LCOE), including capital, operating, fuel and carbon costs over the lifetime of a project, calculated as a break-even price for electricity delivered to the high-voltage grid. In constant 2013 \$. Source: Energy Intelligence

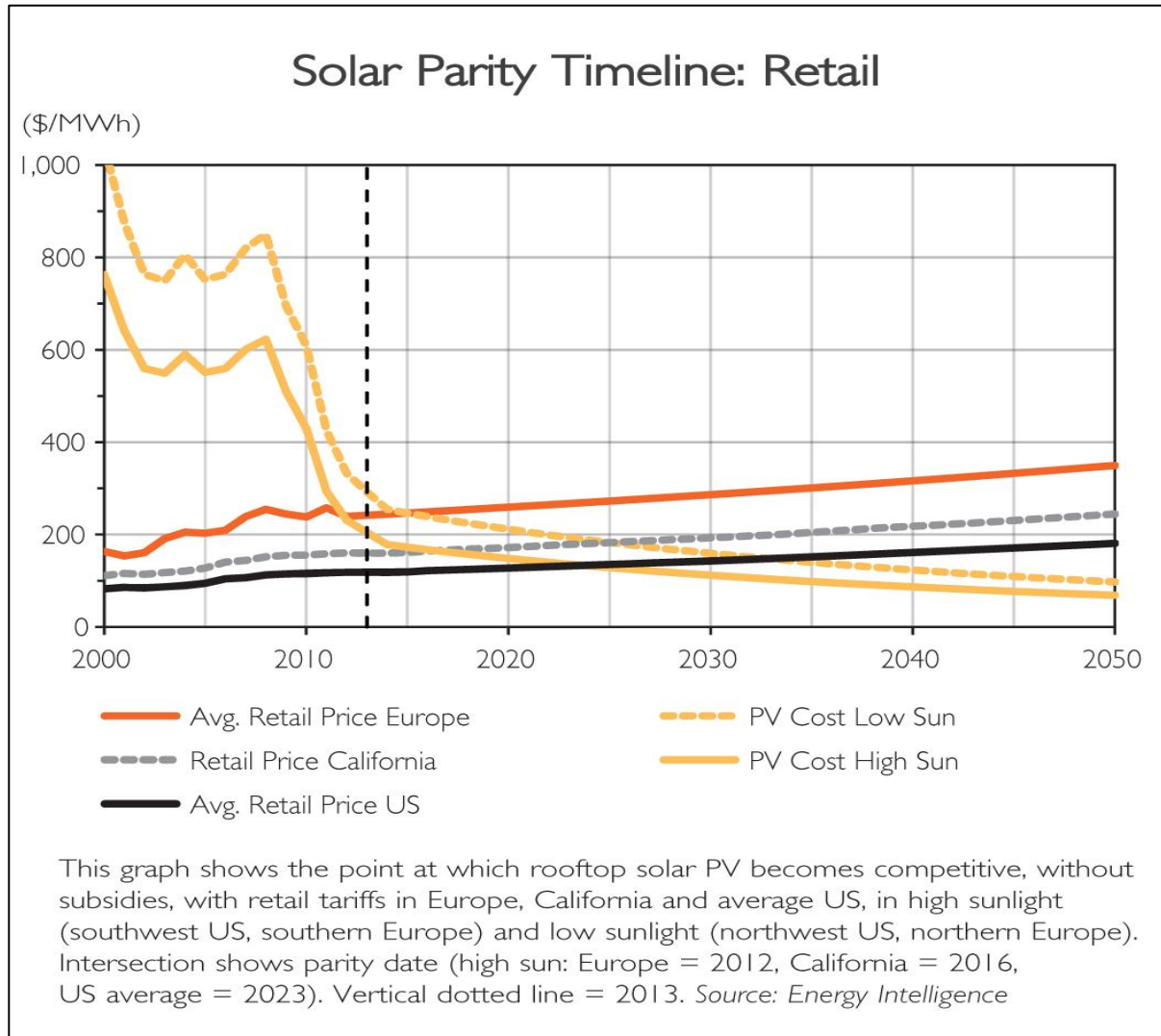
# Energy Forms Ranked by Cost: 2013-50

## Power Generation Costs: 2013-50

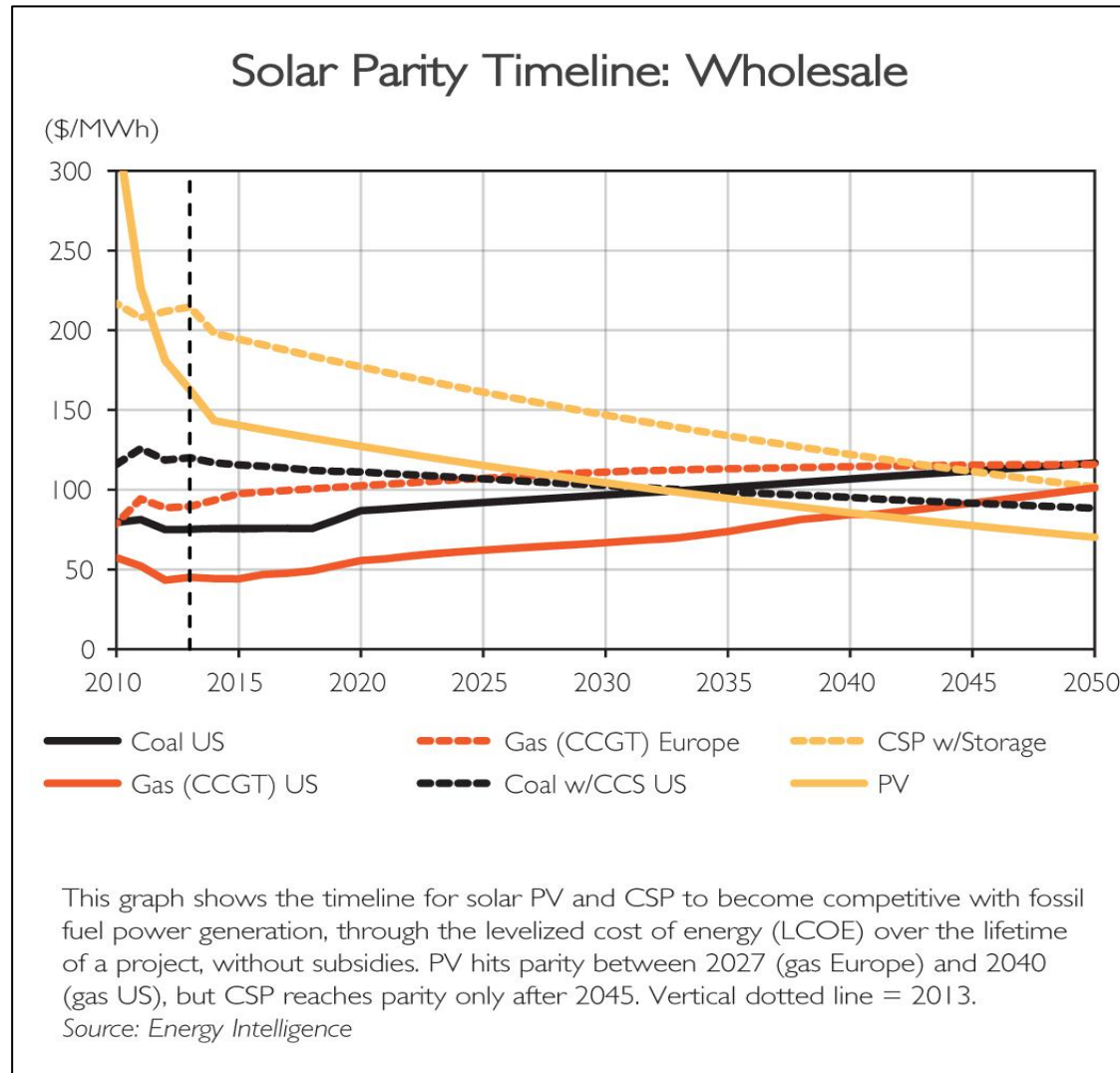
(\$/MWh)	2013	2020	2030	2050	% Chg. 2013-50
Wind Onshore	77	71	68	62	-19%
Geothermal	82	77	73	64	-22
Hydro	67	67	68	68	+1
Solar PV	163	127	104	70	-57
Nuclear	100	92	86	75	-25
Coal w/CCS US	120	111	103	88	-26
Coal w/CCS Europe	135	134	122	101	-25
Gas (CCGT) US	45	56	67	101	+125
Solar CSP	224	185	155	110	-51
Biomass	122	119	117	113	-7
Gas (CCGT) Europe	90	102	111	116	+29
Coal US	75	87	97	117	+55
Wind Offshore	170	154	144	127	-25
Wave-Tidal	280	226	186	127	-55
Coal Europe	92	108	120	127	+37
Gas (OCGT) US	90	106	123	176	+95
Gas (OCGT) Europe	156	176	189	199	+27%

Present and projected levelized cost of energy (LCOE), including capital, operating, fuel and carbon costs over the lifetime of a project, calculated as a break-even price for electricity delivered to the high-voltage grid. In constant 2013 \$. Source: Energy Intelligence

# Solar Power Becomes Competitive: Retail



# Solar Power Becomes Competitive: Utility



## Fuel and Carbon Prices

Fuel and Carbon Price Assumptions						
(\$/MMBtu)	2012	2013	2015	2020	2030	2050
Coal US	2.40	2.40	2.40	2.50	2.90	3.50
Coal Europe	3.90	3.70	4.60	4.70	4.80	5.00
Gas US	2.80	3.20	3.10	4.10	5.40	10.20
Gas Europe	9.40	9.80	11.00	11.50	12.20	12.90
(\$/ton)						
CO <sub>2</sub> US	0	0	0	15	28	60
CO <sub>2</sub> Europe	10	8	12	20	40	60

Projected coal, gas and carbon prices in Europe and the US, in constant 2013 \$.  
Source: IEA, EIA, Energy Intelligence

## El New Energy's Energy Cost Report

Download the report:

[www2.energyintel.com/EnergyCostsReport](http://www2.energyintel.com/EnergyCostsReport)

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