

# Energy Technology Perspectives 2014

## Solar PV Vision by 2050

Uwe Remme

Energy Technology Policy Division, IEA

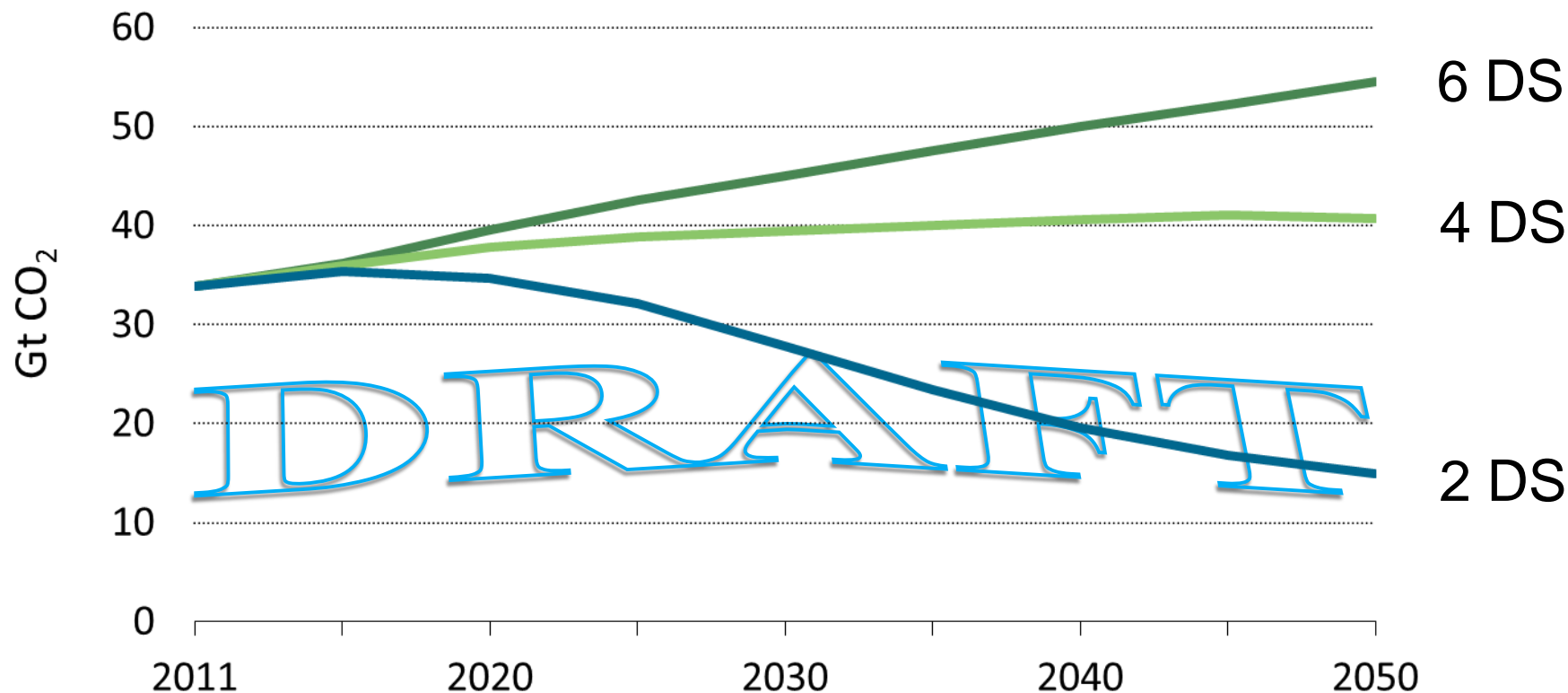
# Various IEA scenarios for PV

ETP  
2014

<i>Time</i>	<i>GW</i>	<i>TWh</i>	<i>Scenario</i>	<i>Source</i>
<b>2018</b>	<b>308</b> (370-390)	<b>368</b>		<i>Medium Term RE Market Report 2013</i>
<b>2020</b>	<b>210</b>	<b>298</b>		<i>IEA Technology Roadmap (2010)</i>
<b>2035</b>	<b>690</b>	<b>951</b>	<b>NPS</b>	<i>World Energy Outlook 2013</i>
	<b>990</b>	<b>1 389</b>	<b>450</b>	
<b>2050</b>	<b>3 155</b>	<b>4 572</b>		<i>IEA Technology Roadmap (2010)</i>
	<b>2 017</b>	<b>2 655</b>	<b>2DS</b>	<i>Energy Technology Perspectives 2012</i>
	<b>3 289</b>	<b>4 822</b>	<b>hiRen</b>	
<b>&gt;2060</b>	<b>12 000</b>	<b>18 000</b>	<b>« Testing limits »</b>	<i>Solar Energy Perspectives (2011)</i>

# Global CO<sub>2</sub> emissions: 3 very different futures

ETP  
2014

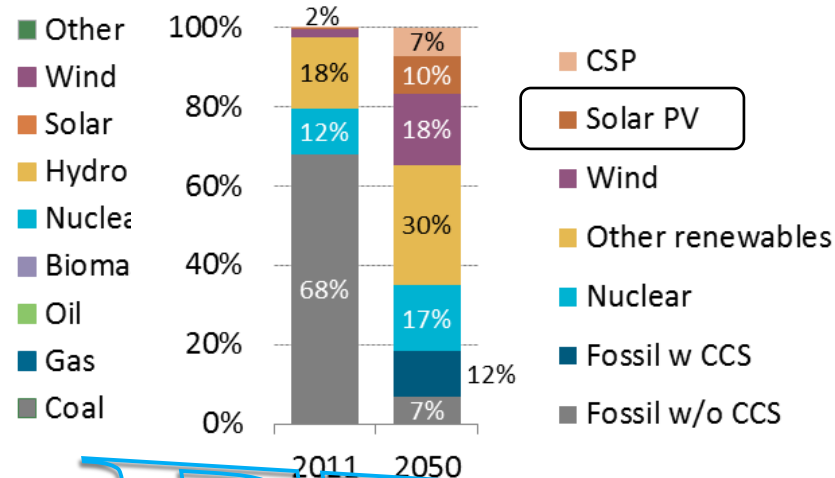
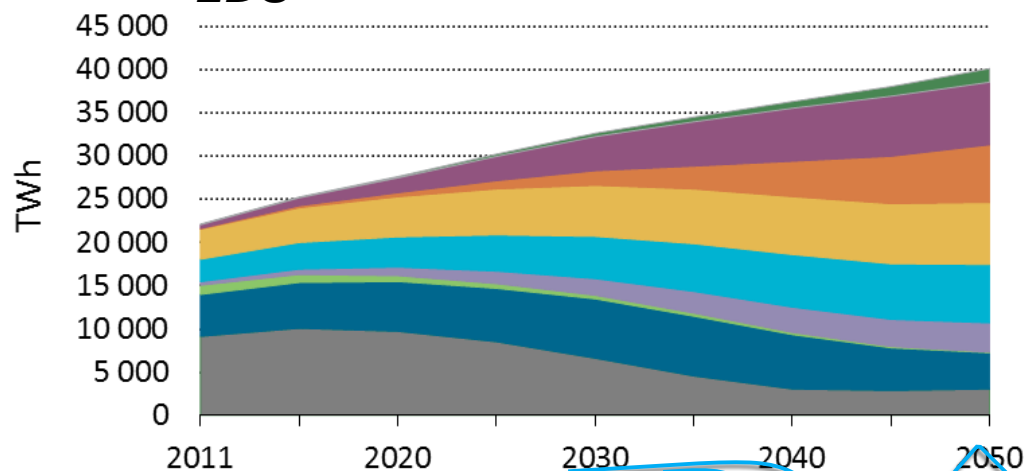


- Global CO<sub>2</sub> emissions (energy- and process-related) in the 2DS are reduced by 56% relative to 2011
- *hiRen* variant of 2DS for power sector: same reduction target as 2DS, but assumed delayed introduction of CCS (2030 instead of 2020) and slower deployment of nuclear

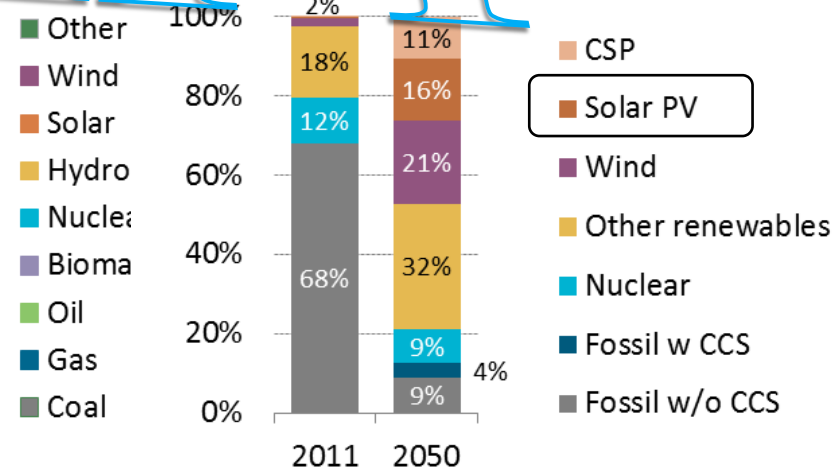
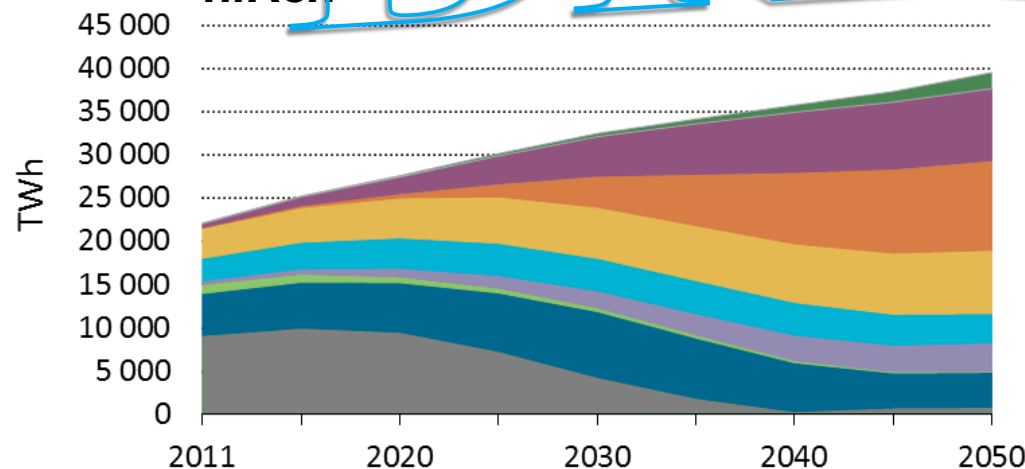
# Global electricity generation

ETP  
2014

**2DS**



**hiRen**

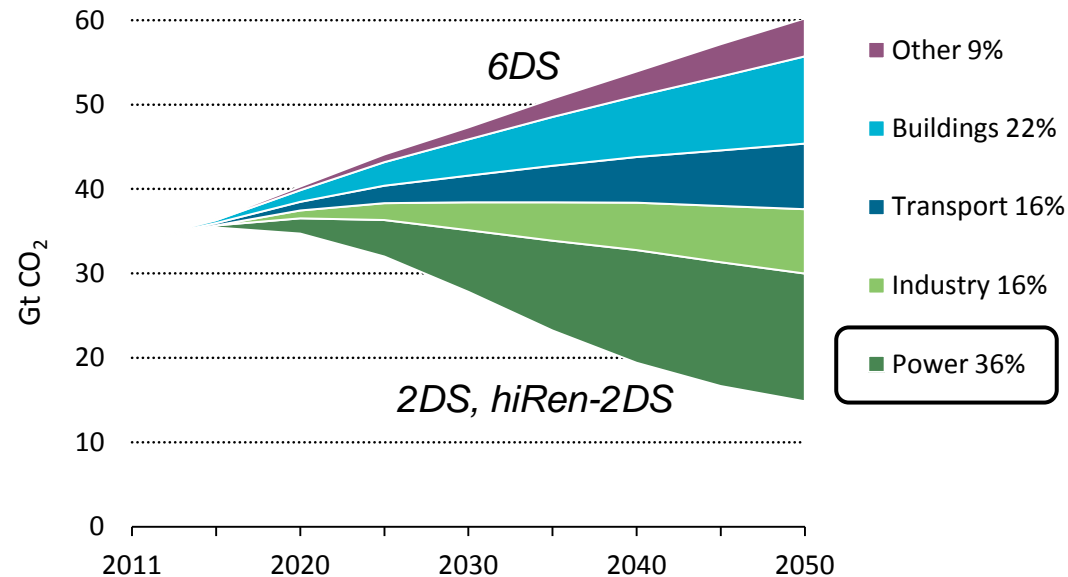




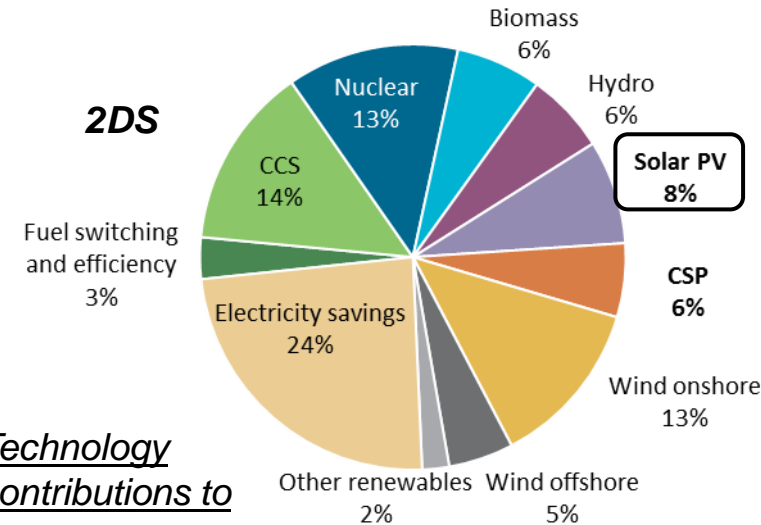
# Power sector key to decarbonise the energy system

ETP  
2014

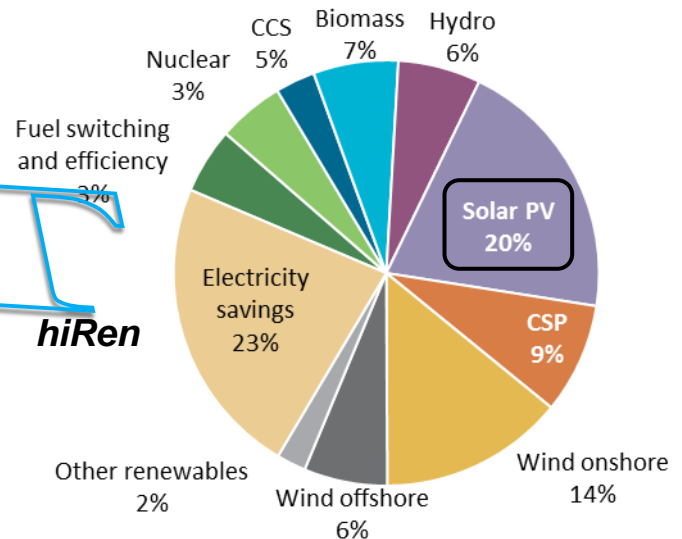
CO<sub>2</sub> reductions by sector (relative to 6DS)



**2DS**



Technology contributions to power sector reductions



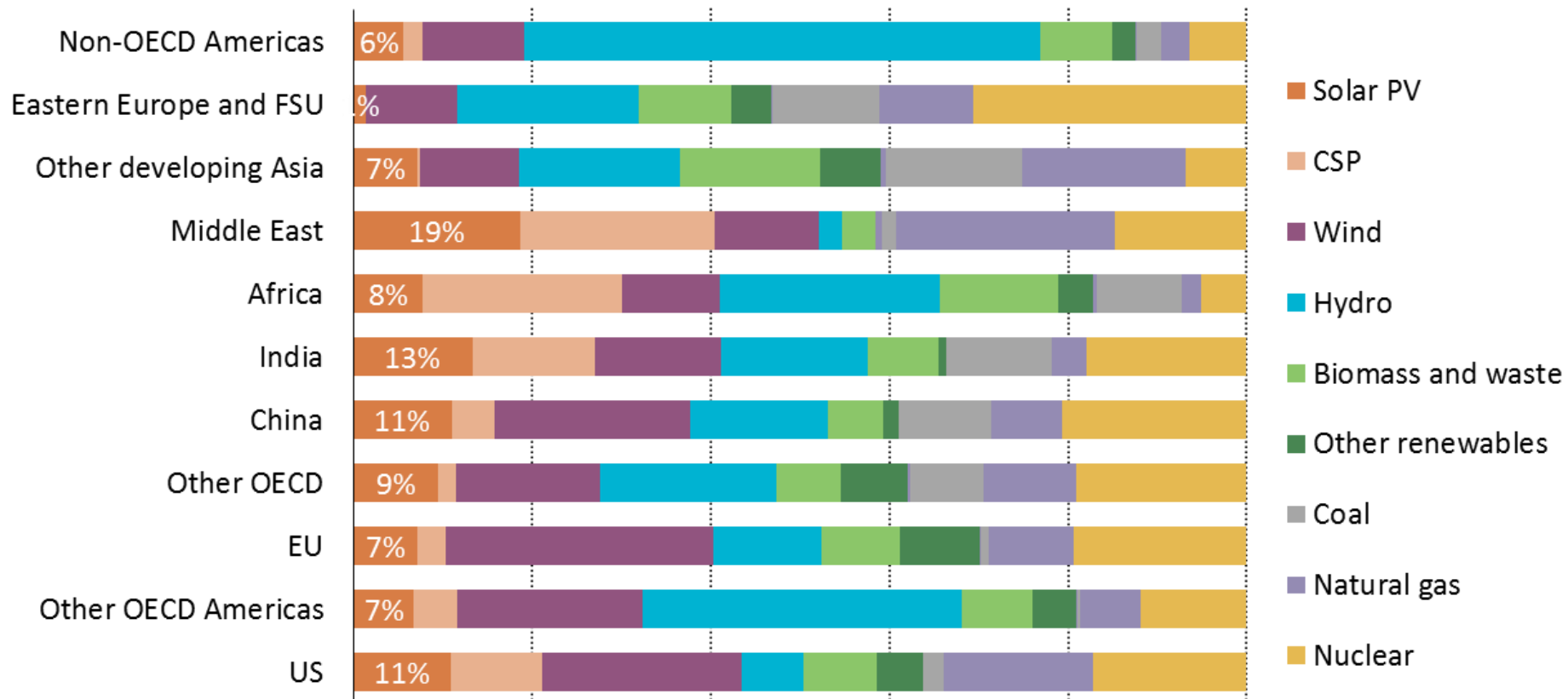
**hiRen**

■ Power sector provides for more than one third of the cumulative reductions to achieve the 2DS

■ Solar PV responsible for 20% of the reductions in the power sector in the hiRen variant

# Generation mix 2DS in 2050

ETP  
2014



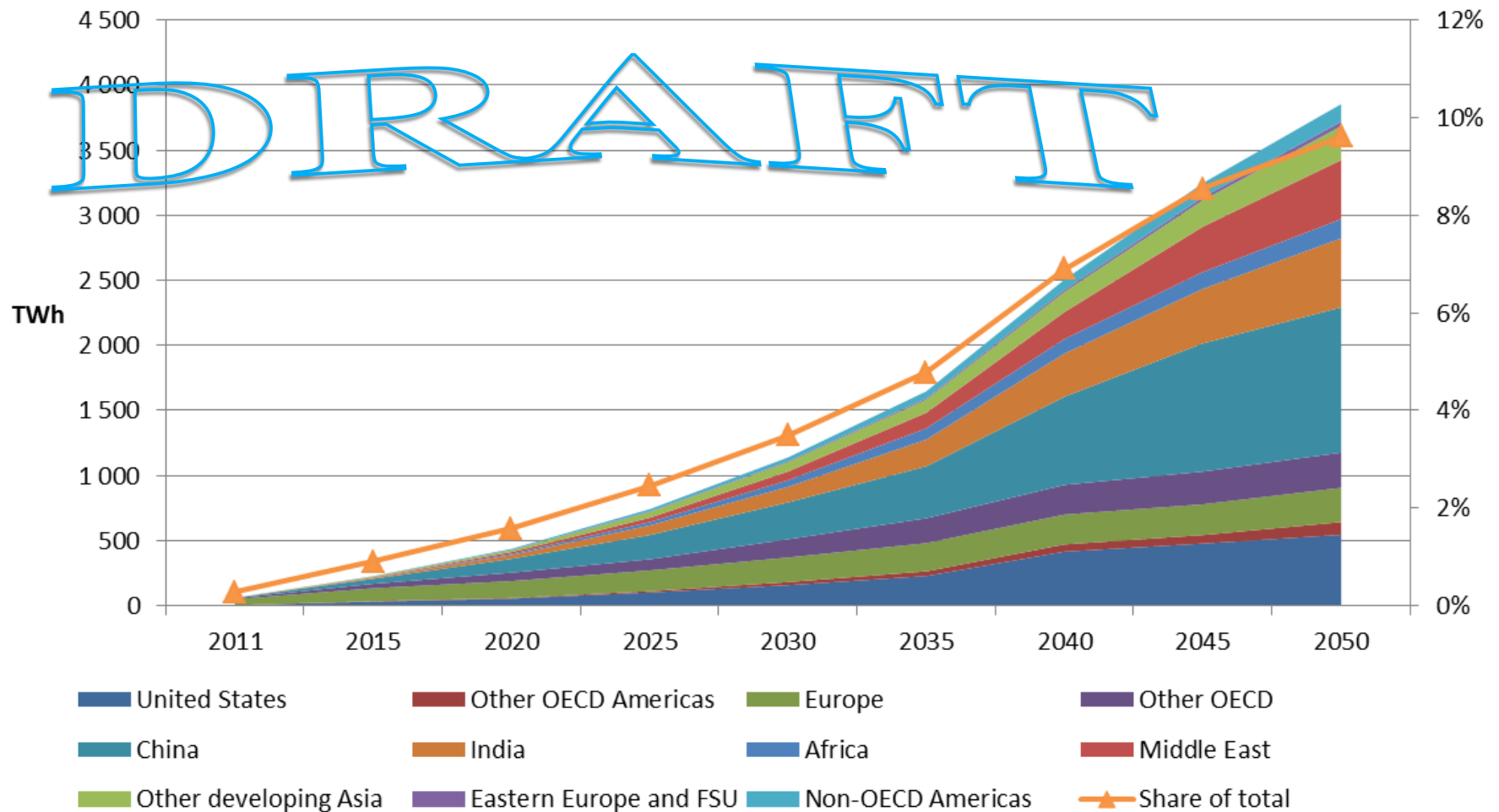
0% 20% 40% 60% 80% 100%

Generation mix 2050

DRAFT

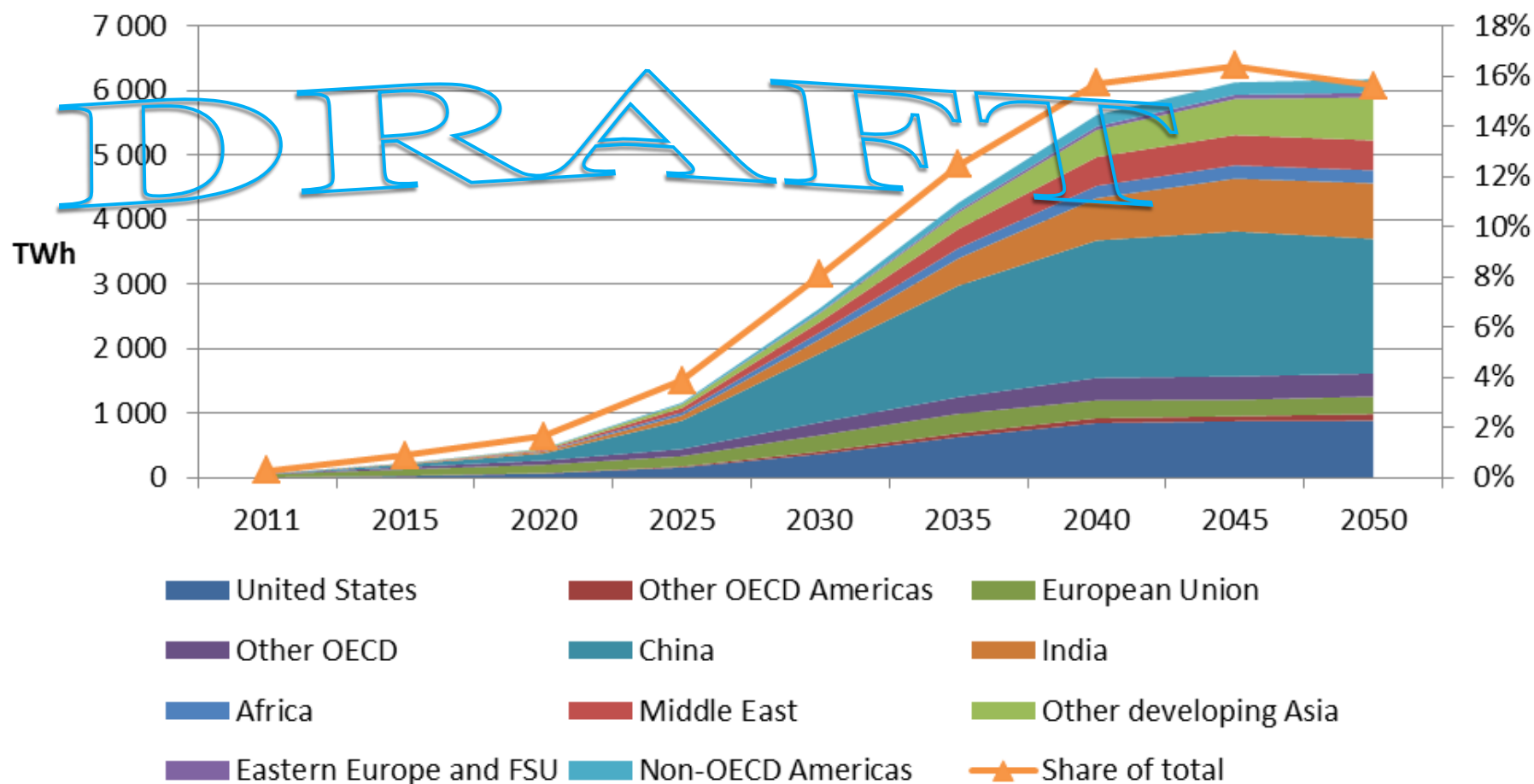
# PV generation in 2DS

ETP  
2014



# PV generation in hiRen variant

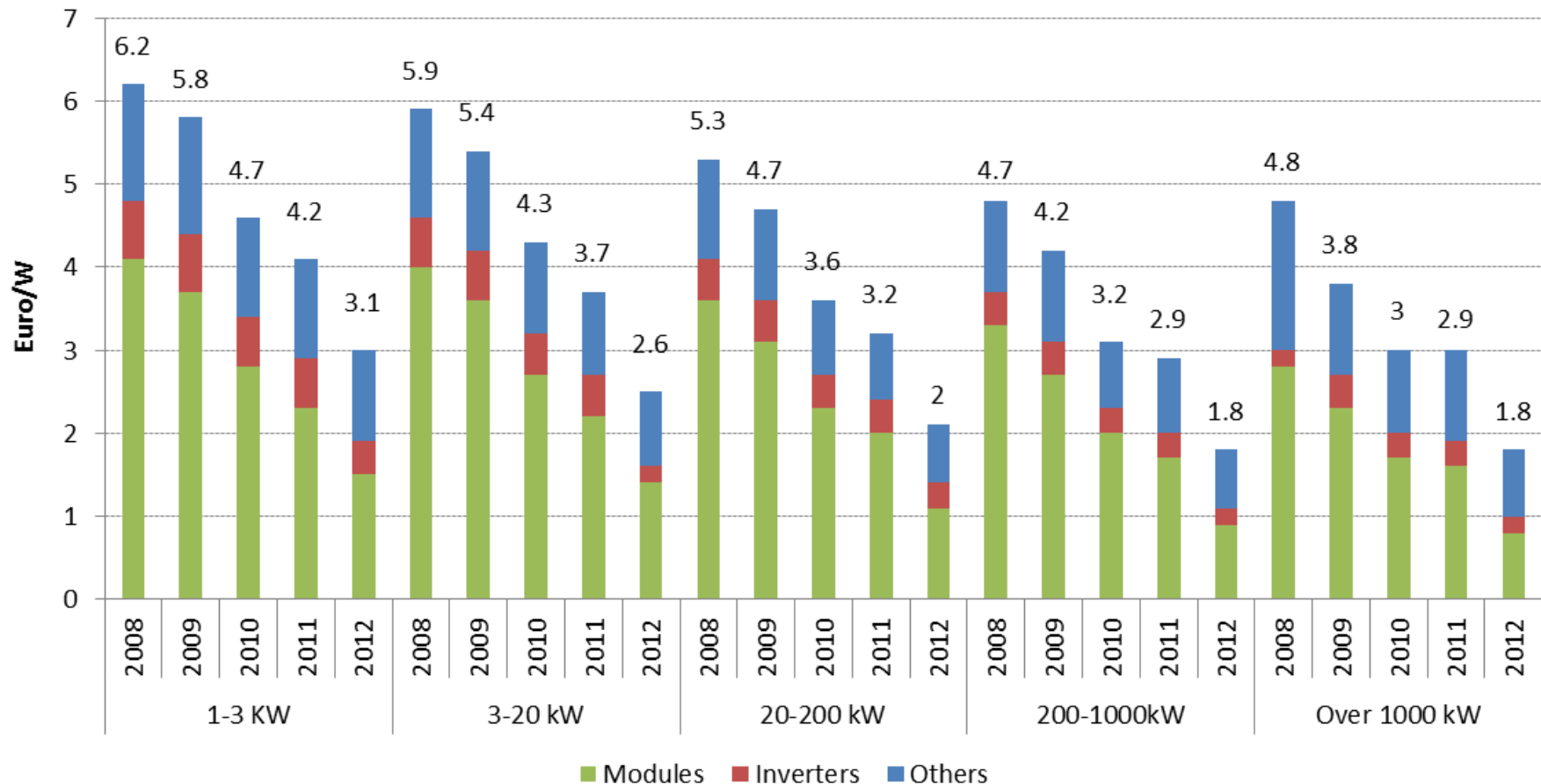
ETP  
2014





# Rooftop PV system costs in Italy

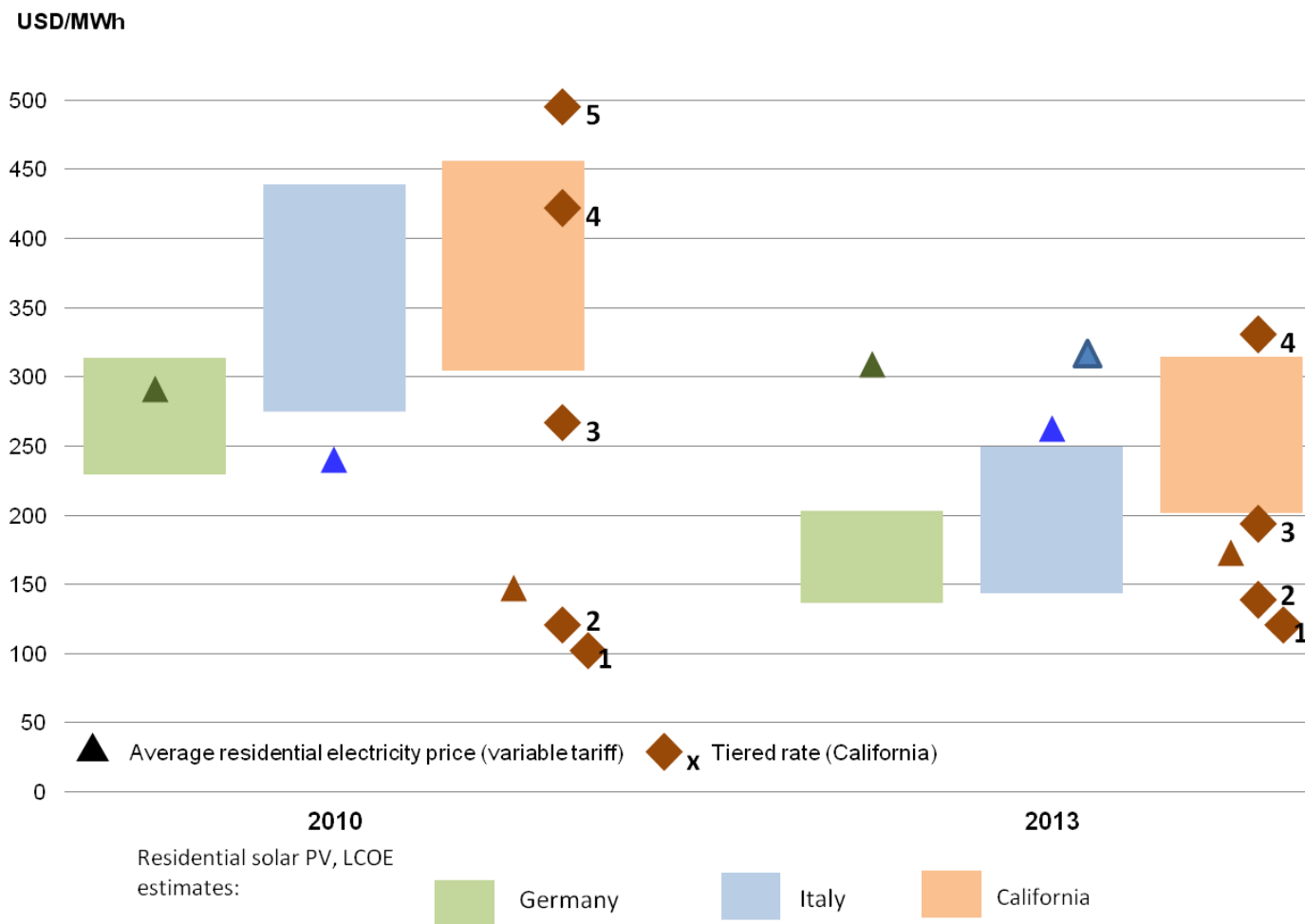
ETP  
2014



- In some markets, costs of PV systems of all sizes have declined twofold in five years.

# Grid parity of decentralised PV

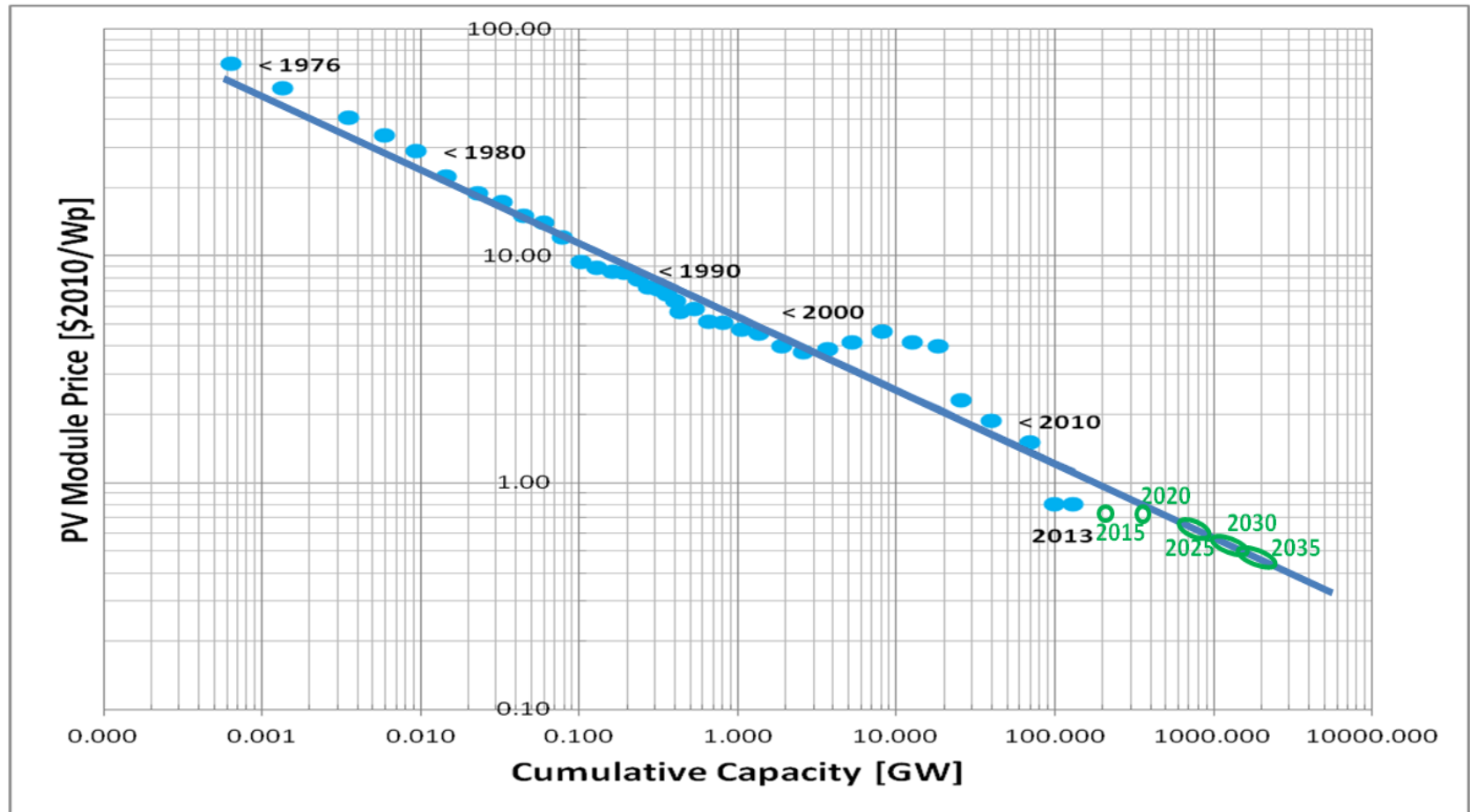
ETP  
2014



- PV is at grid parity in Germany, Italy and California for households with large consumption.

# Experience curve for PV module prices

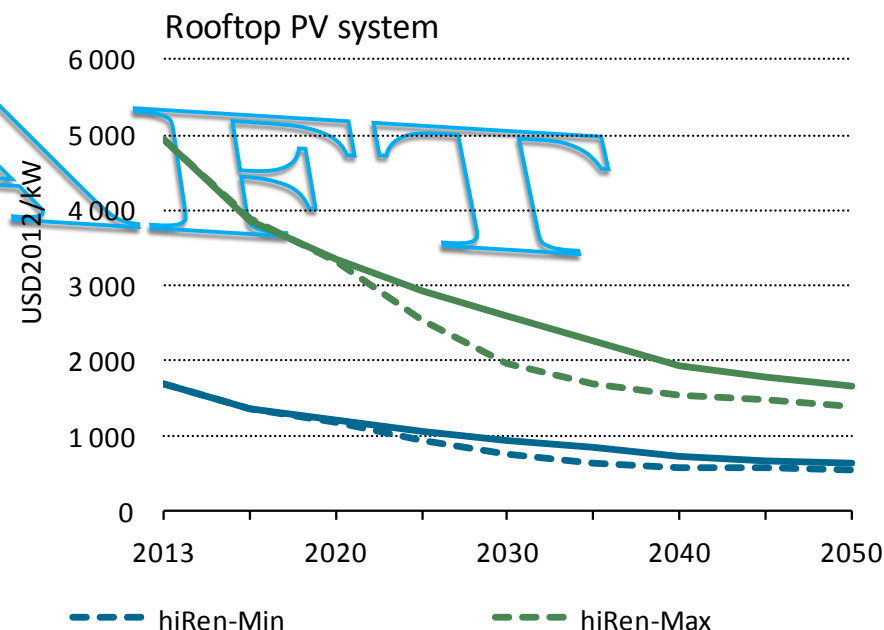
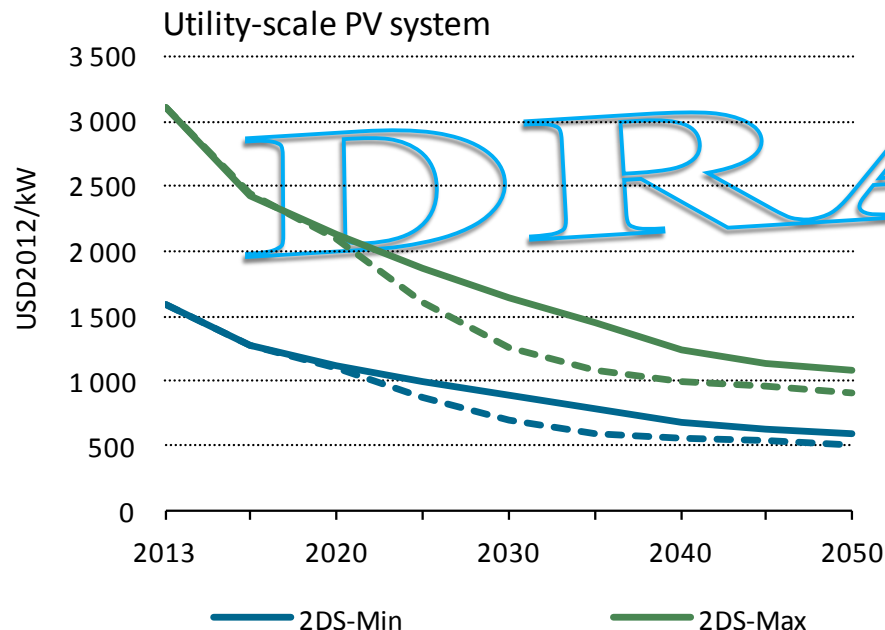
ETP  
2014



- Based on proven learning rates, the cost of PV modules could be further reduced by 50% or more by 2035.

# Specific investments costs and LCOE

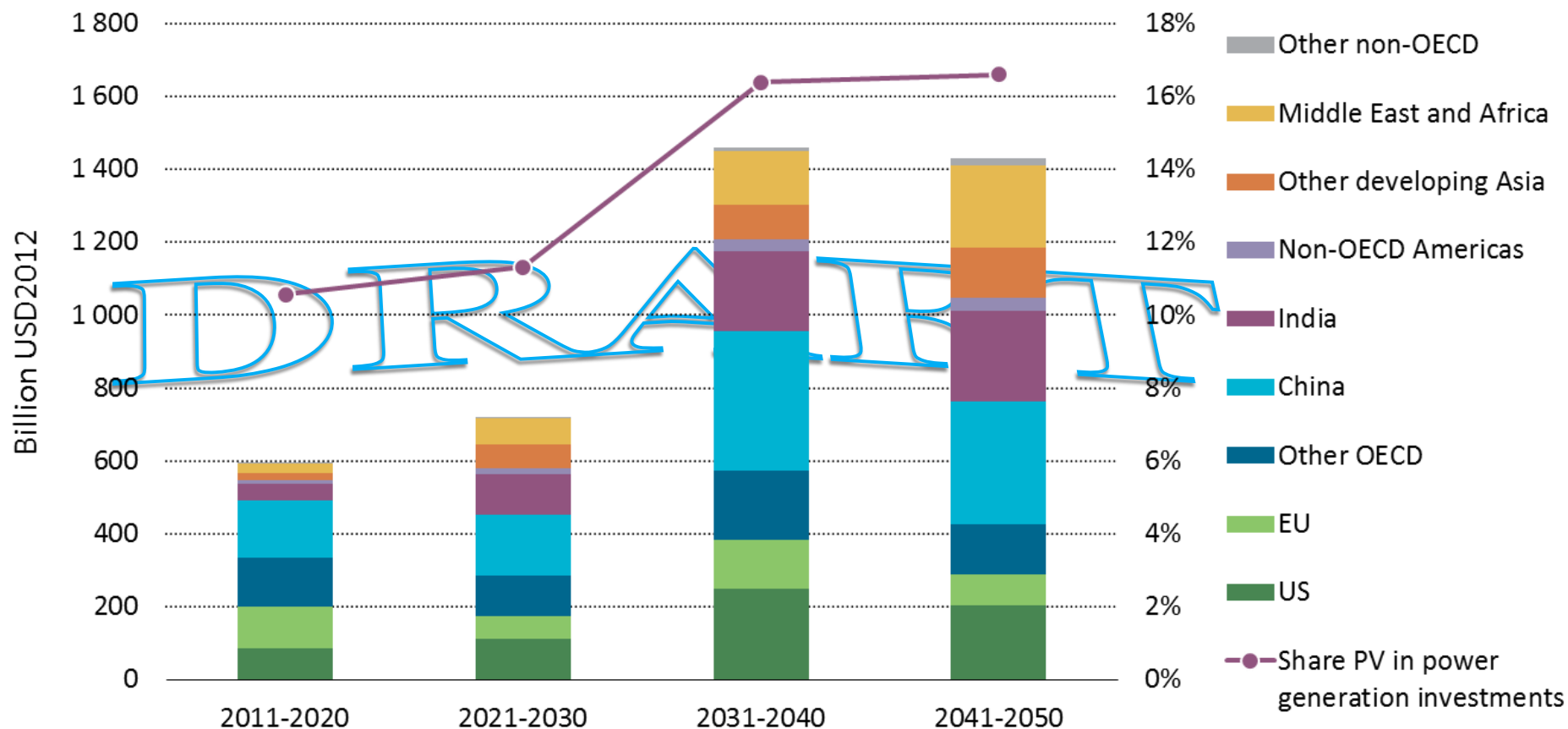
ETP  
2014



USD/MWh		2015	2020	2025	2030	2035	2040	2045	2050
Rooftop	Min	135	110	94	83	72	62	58	53
	Max	539	427	359	312	265	225	208	191
Utility-scale	Min	119	97	83	73	63	55	51	47
	Max	318	254	214	187	159	136	126	116

# Investment needs for solar PV in 2DS

ETP  
2014



■ 2DS: cumulative investments of USD 4.2 trillion, or 14% of cumulative power generation investments

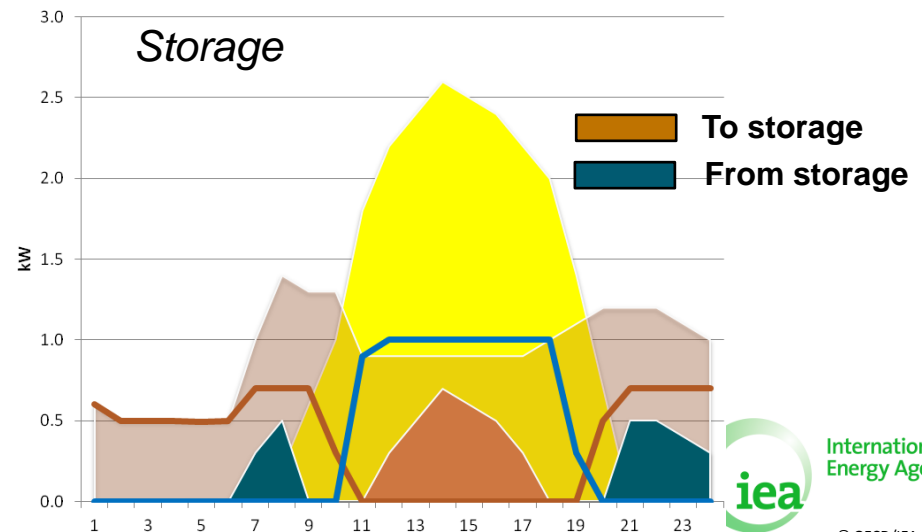
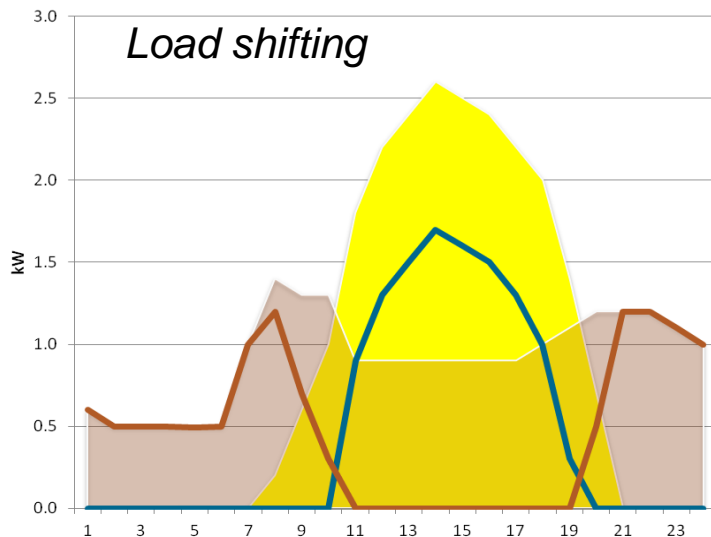
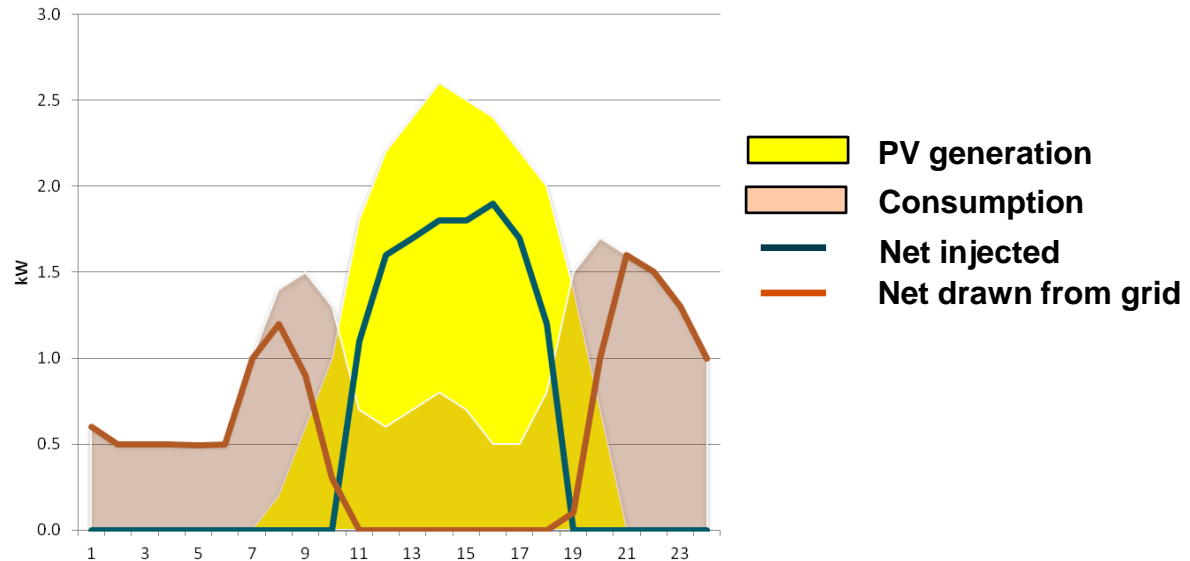
■ hiRen: cumulative investments increase by 60% to USD 6.8 trillion, or 21% of cumulative generation investments



# Decentralised PV generation and self-consumption

ETP  
2014

*Stylised household and rooftop PV system during a sunny day*



*Thank you!*