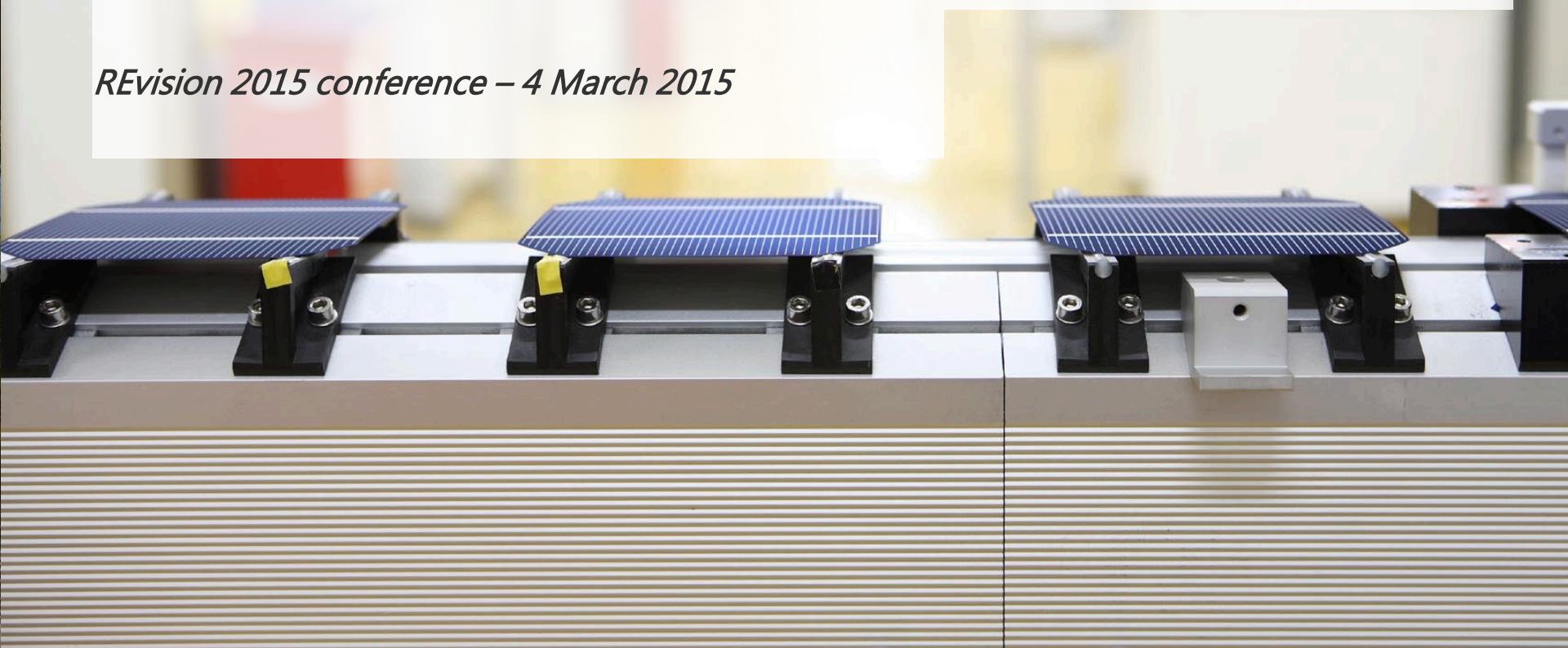


High integration of RES to the market and policies – challenges for Japan

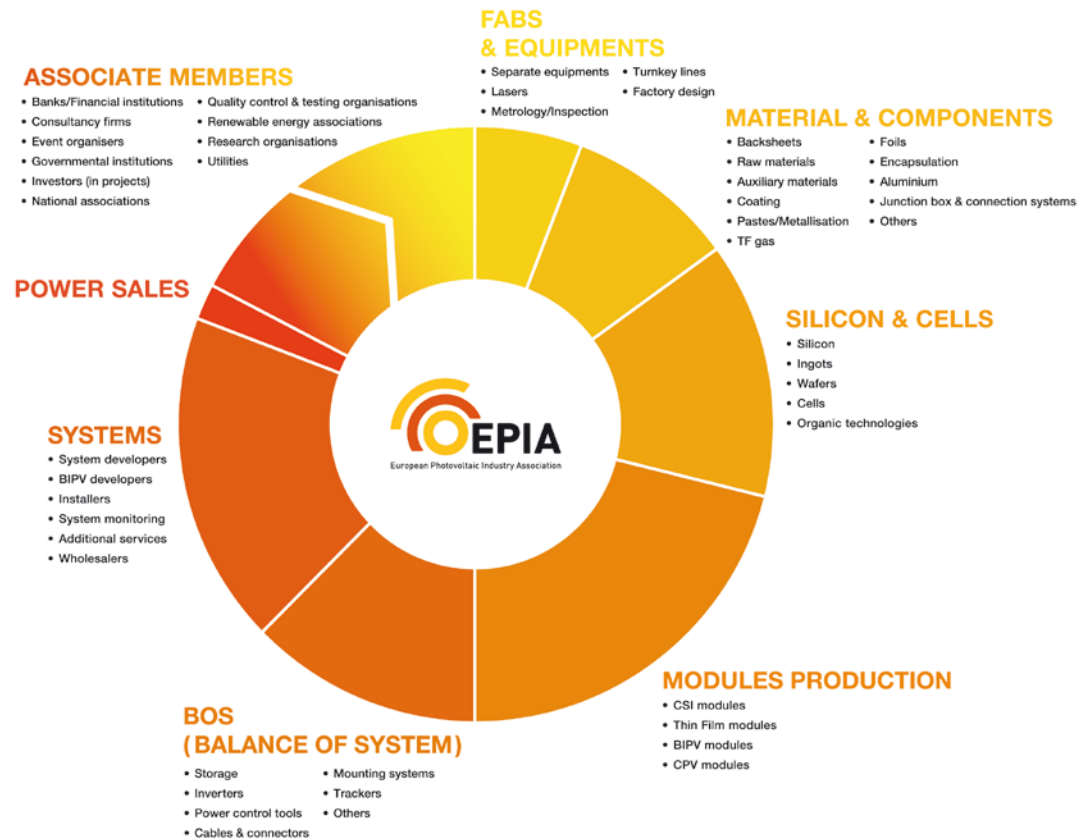
Alexandre Roesch, Head of Regulatory Affairs

REvision 2015 conference – 4 March 2015



EPIA's mission

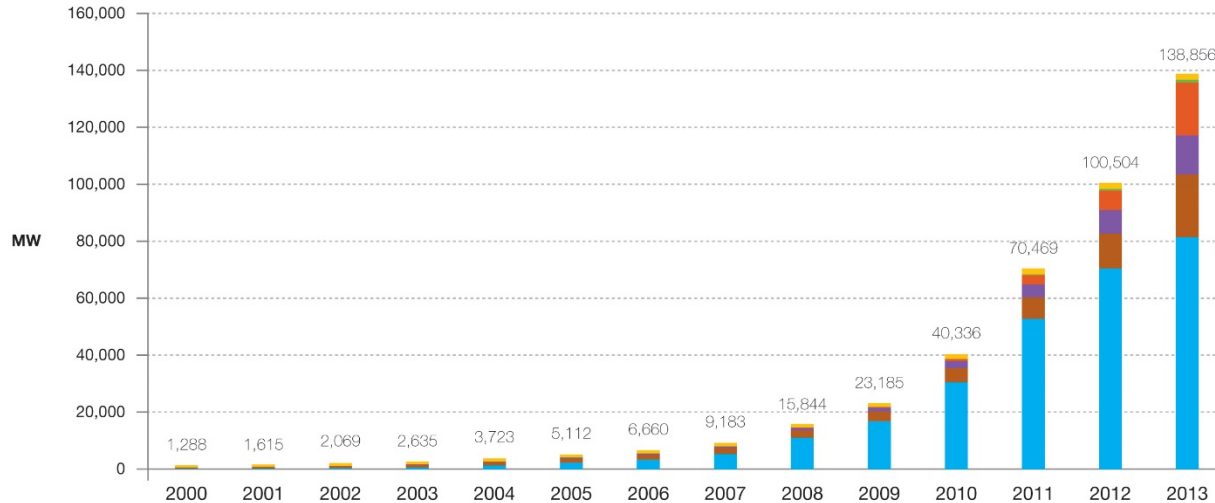
Shape the regulatory environment to promote the growing market opportunity for solar in Europe



30 years of
Excellence & Leadership

Market development in Europe

Born in Europe, PV is becoming mainstream globally



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
RoW	751	807	887	964	993	1,003	1,108	1,150	1,226	1,306	1,590	2,098	2,098	2,098
MEA	n/a	n/a	n/a	n/a	1	1	1	2	3	25	80	205	570	953
China	19	24	42	52	62	70	80	100	140	300	800	3,300	6,800	18,600
Americas	21	24	54	102	163	246	355	522	828	1,328	2,410	4,590	8,365	13,727
APAC	368	496	686	916	1,198	1,502	1,827	2,098	2,628	3,373	4,951	7,513	12,159	21,992
Europe	129	265	399	601	1,306	2,291	3,289	5,312	11,020	16,854	30,505	52,764	70,513	81,488
Total	1,288	1,615	2,069	2,635	3,723	5,112	6,660	9,183	15,844	23,185	40,336	70,469	100,504	138,856

RoW: Rest of the World. MEA: Middle East and Africa. APAC: Asia Pacific.
Methodology used for RoW data collection has changed in 2012.

Evolution of global PV cumulative installed capacity 2000-2013

+42 GW

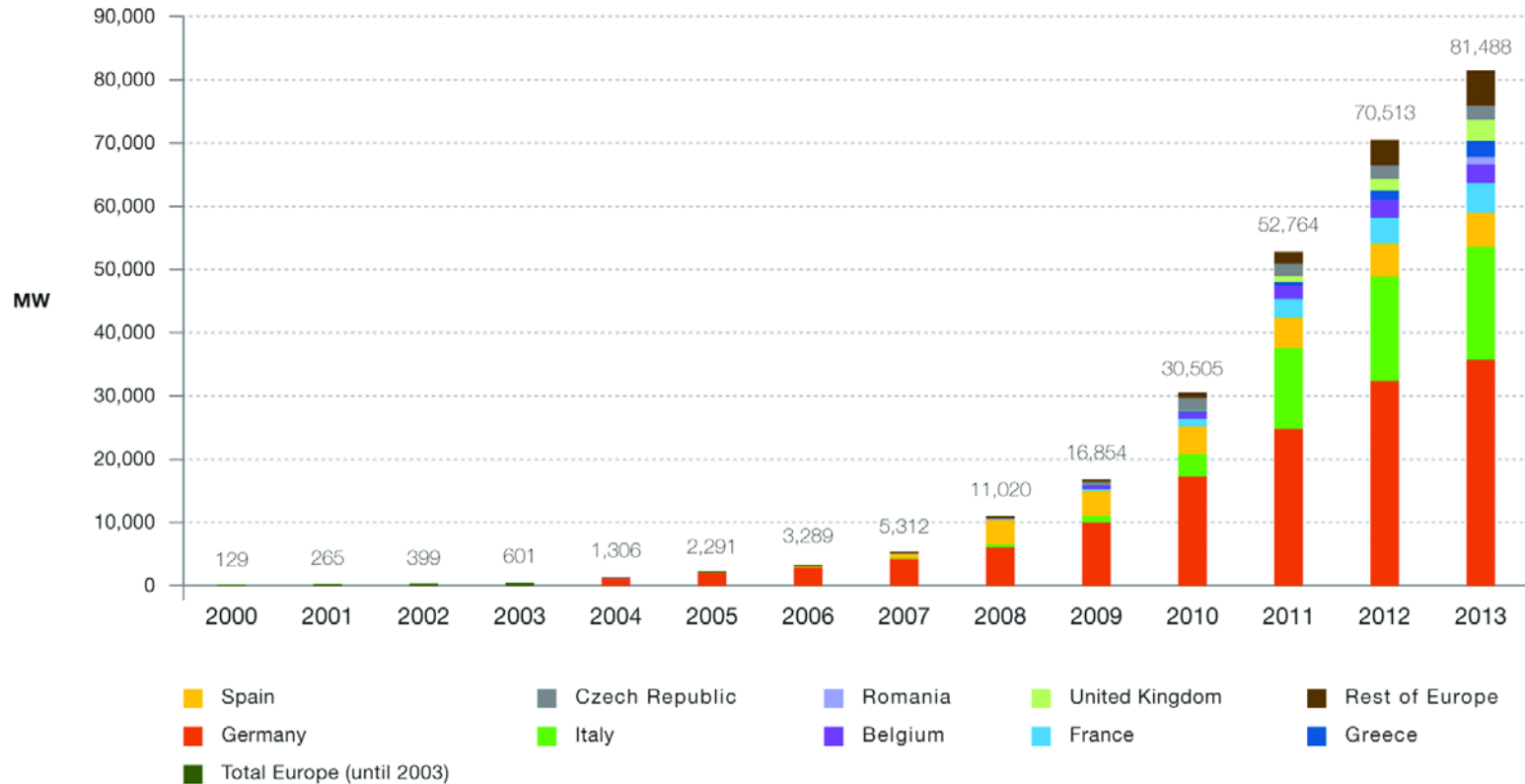
**TOP 3 MARKETS
IN 2014:**

CHINA

JAPAN

USA

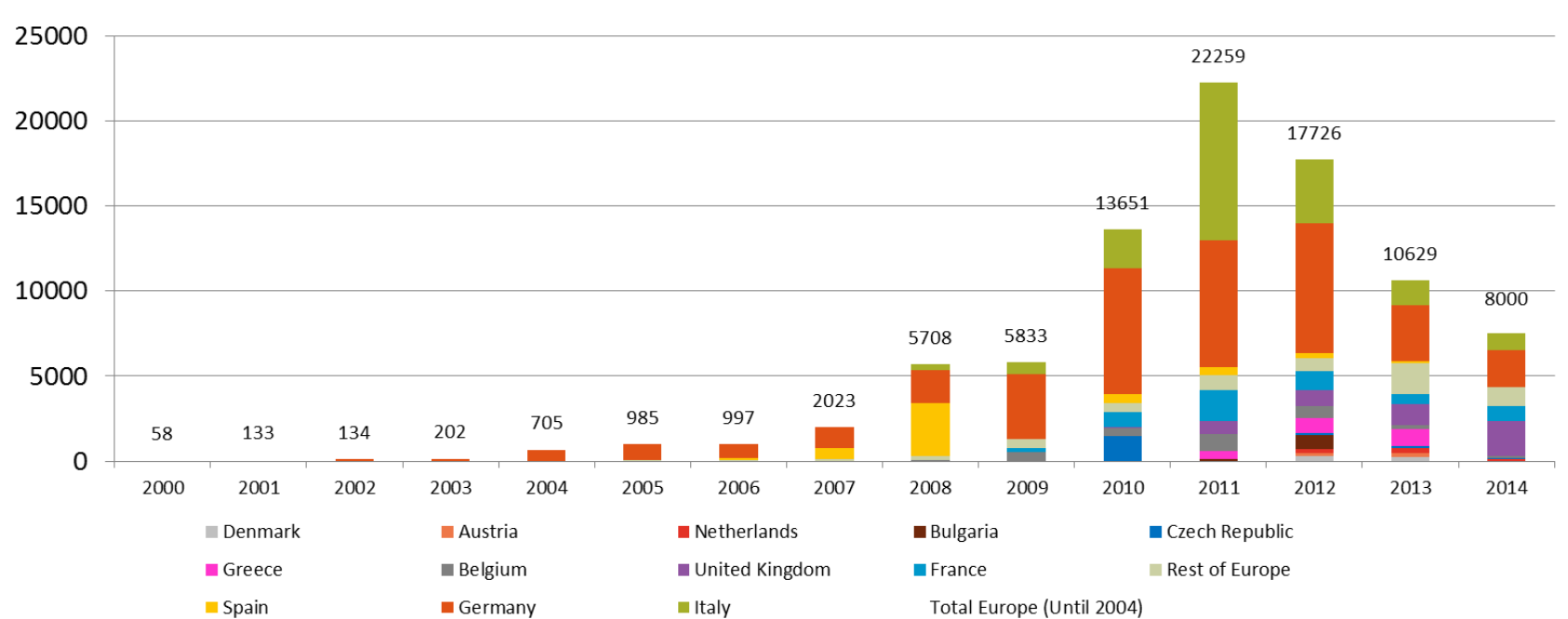
Solar covers the power needs of 30 million EU households



Evolution of European PV cumulative installed capacity 2000-2013

Market development until 2014 (preliminary)

Annual PV market in 2014: around 8 GW



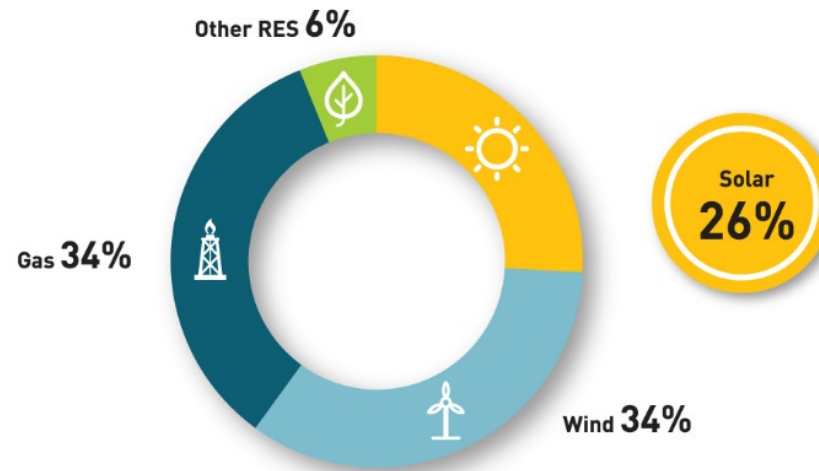
Solar PV: a key player in the energy transition

1/3 of investments went to PV in the last 10 years

Renewable

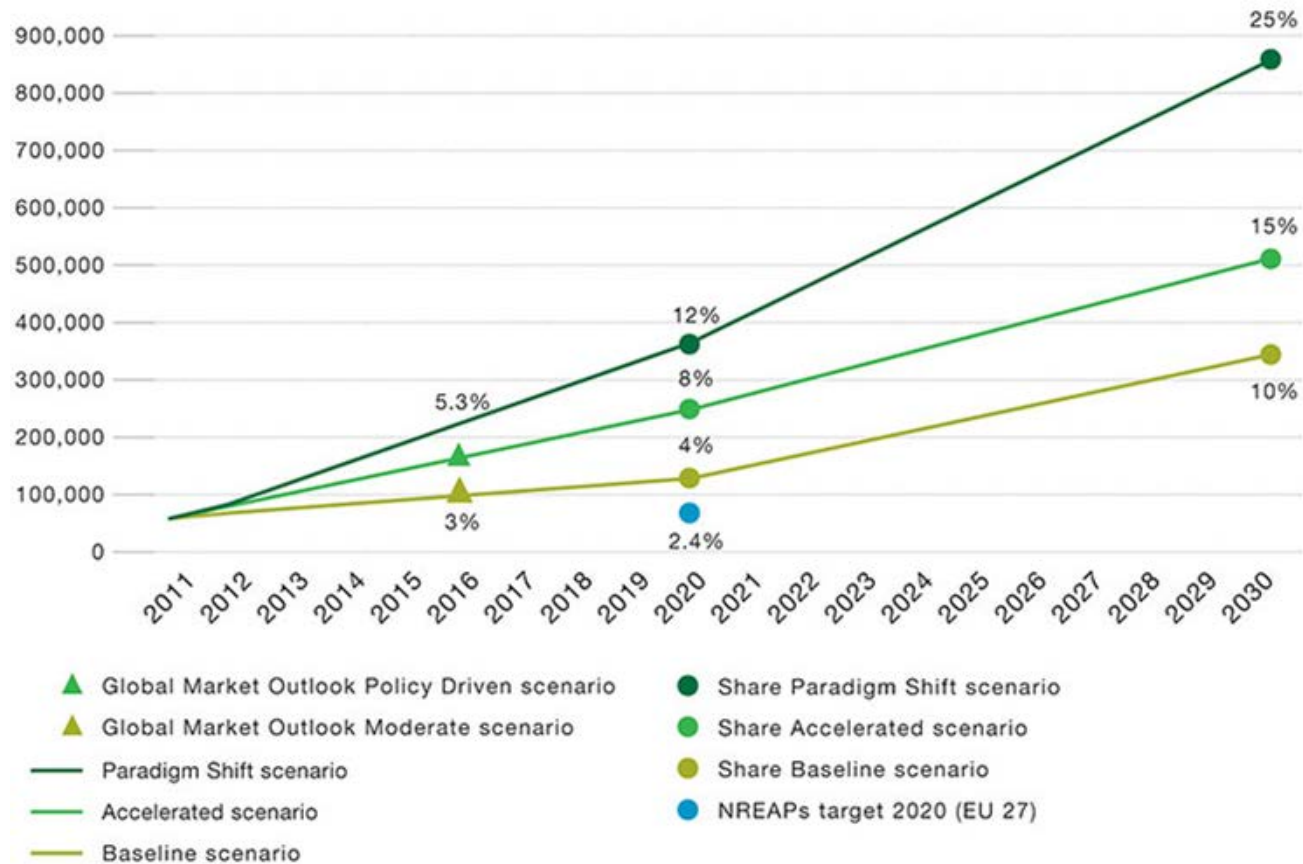
Solar power is becoming a mainstream source of energy

Net power generation capacities added in the EU 28 between 2000-2013



Source: EPIA, ESTELA, EU-OEA, EWEA, Platts PowerVision, PV CYCLE.

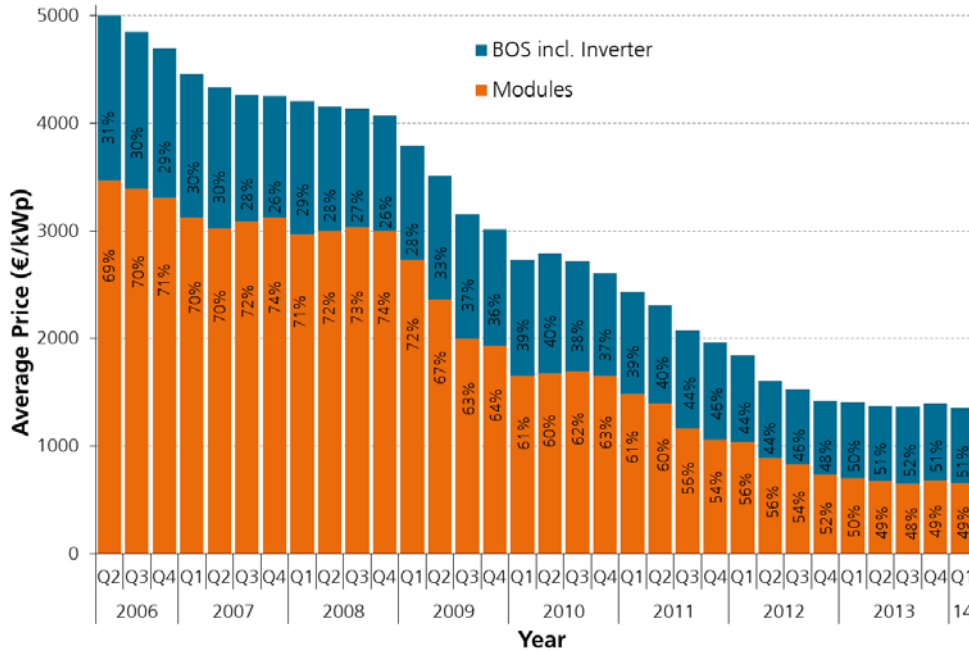
PV will be a major clean power source by 2030



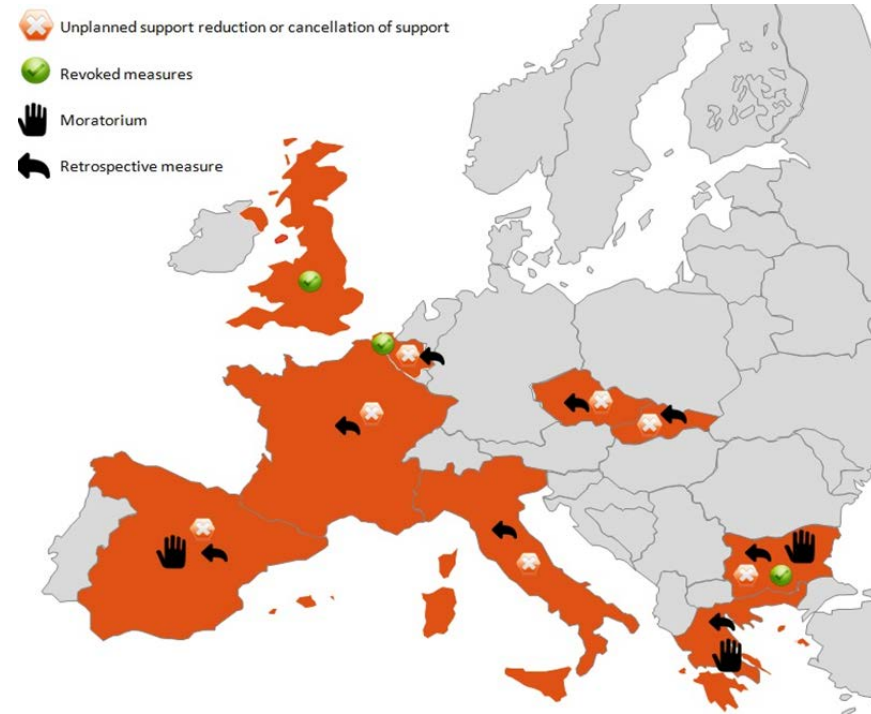
Solar PV in Japan: Key lessons learnt from European experience

KEY MESSAGE 1: Dynamic support mechanisms are key

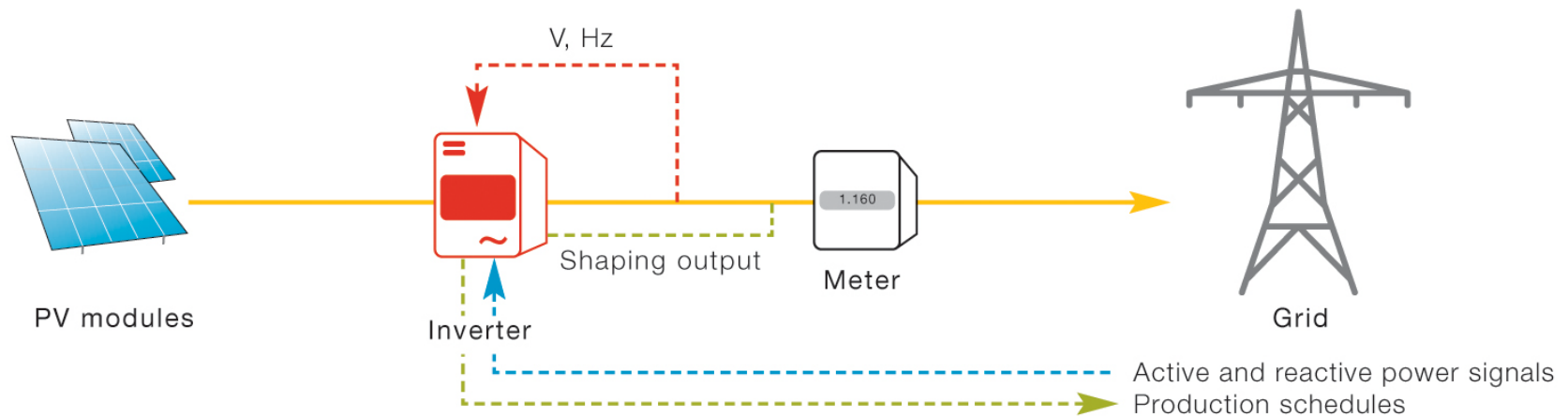
Price of rooftop PV system in Germany



Overview of retroactive and retrospective changes in Europe



PV is smart grid



**THE SECOND MOST DEPLOYED “SMART GRID TECHNOLOGY”
AFTER SMART METERS**

CONSUMERS BECOMING A SOURCE OF FLEXIBILITY

Focus: PV capabilities to support system operation



Type of functionality	Functionality name	FCR	FRR	RR	FFR	RM
Technical	Active Power Control	X	X	X		X
	Active Power Delta Control Mode	X	X	X		
	Active Power Limitation Control Mode	X	X	X		X
	Active Power Gradient Control Mode	X	X	X		X
	Frequency Sensing	X	X		X	
	Frequency Sensitivity Mode (or Droop Control)	X	X			
	Active Power Setpoint Processing	X	X	X	X	X
	Setpoint Priority Management	X	X	X	X	X
	Temporary Active Power Increase				X	
Operational	Ability to Calculate Actual Active Power Production	X	X			
	Power production forecast		X	X		X
	Communication and Control Interface	X	X	X	X	X
	Communication and Control Interface with the SO	X	X	X	X	X

Type of functionality	Functionality name	SSVC	FRCI
Technical	Reactive Power Setpoint Processing		X
	Reactive Power Control Scheme		X
	Reactive Power Control		X
	Voltage Control		X
	Power Factor Control		X
	Reactive Power Provision		X
	Fast Positive Sequence Reactive Current Injection Capability		X
	Fast Active Current Reduction Capability		X
	Fast Negative Sequence Current Provision		X

State of the art capabilities:

- Q provision based on V at the PCC
- Remote P management ($> \approx 30$ kW)
- Limited frequency sensitive mode

Advanced capabilities:

- P management based on V at the PCC
- Remote P management for small systems
- Q provision based on set points
- Q provision at night

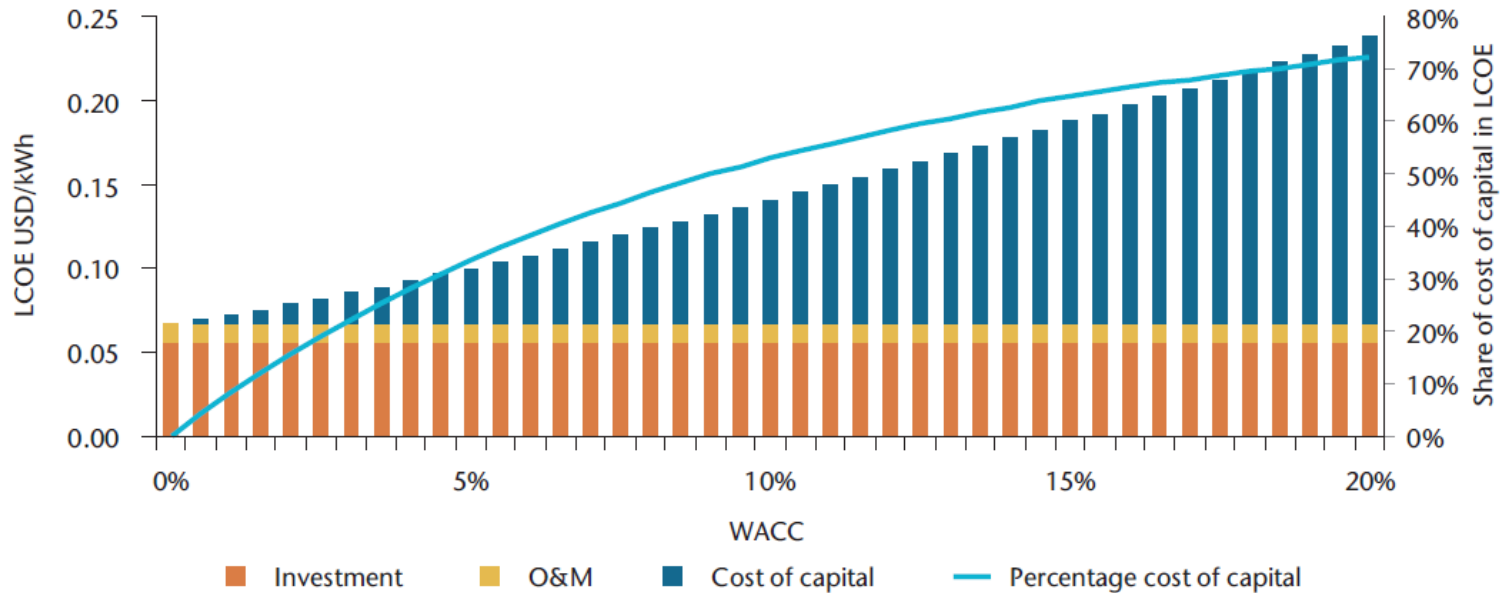
Capabilities under investigation:

- PV/others swarm management
- negative sequence current provision (phase imbalances),
- harmonic compensation and damping oscillations

Source: REservicesS 2014

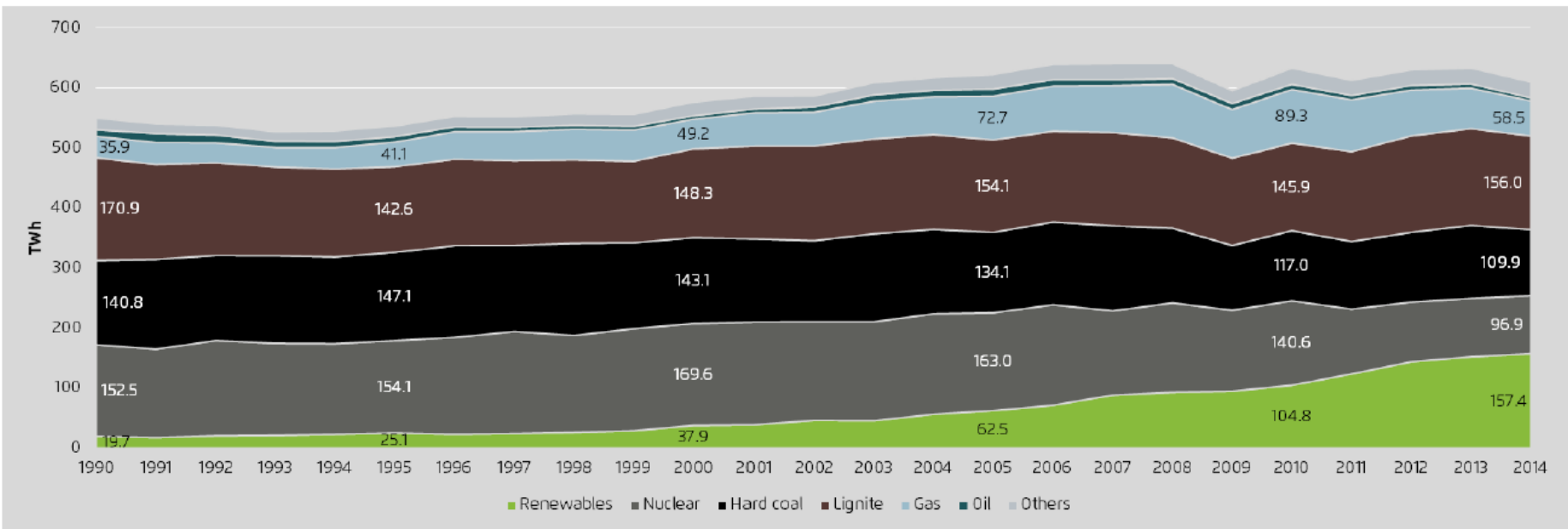
KEY MESSAGE 3: reduce cost of capital via long-term signals

When cost of capital reaches 9%, it makes up 50% of the LCOE



KEY MESSAGE 4: pilot the energy transition

Development of gross power production 1990-2014 in TWh



AG Energiebilanzen 2014

Source: Agora Energiewende

KEY MESSAGE 5: adapt market design

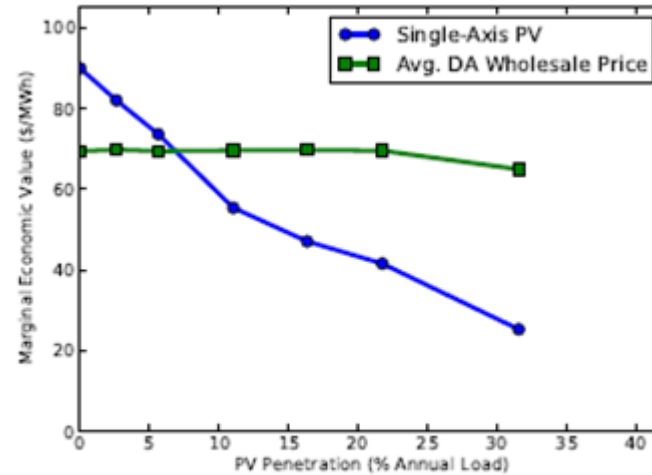
Energy-only markets
do not deliver



Ancillary service
markets do not
reflect variability



Challenges ahead:
governance and new
PV revenue streams



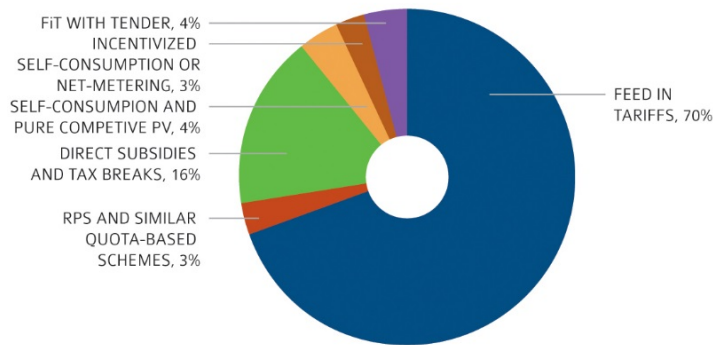
(b) PV

Marginal economic value and annual flat-block of power with increasing PV penetration

Source of graph: Ernest Orlando, Lawrence Berkeley National Laboratory

Bridging the vision, not patching the present

2013 MARKET INCENTIVES AND ENABLERS



- **SOLAR UPTAKE IS A FACT**
- **NEW SOLUTIONS, NEW CHALLENGES**
- **OLD APPROACHES WILL NOT DELIVER**

SOURCE IEA PVPS.

NEED FOR “SMART(er)” REGULATIONS TO:

**ENABLE
PROSUMERS**

**UNLOCK
NEW BUSINESSES**