Ir. Gaëtan Masson, Head of Business Intelligence

PV Markets Outlook

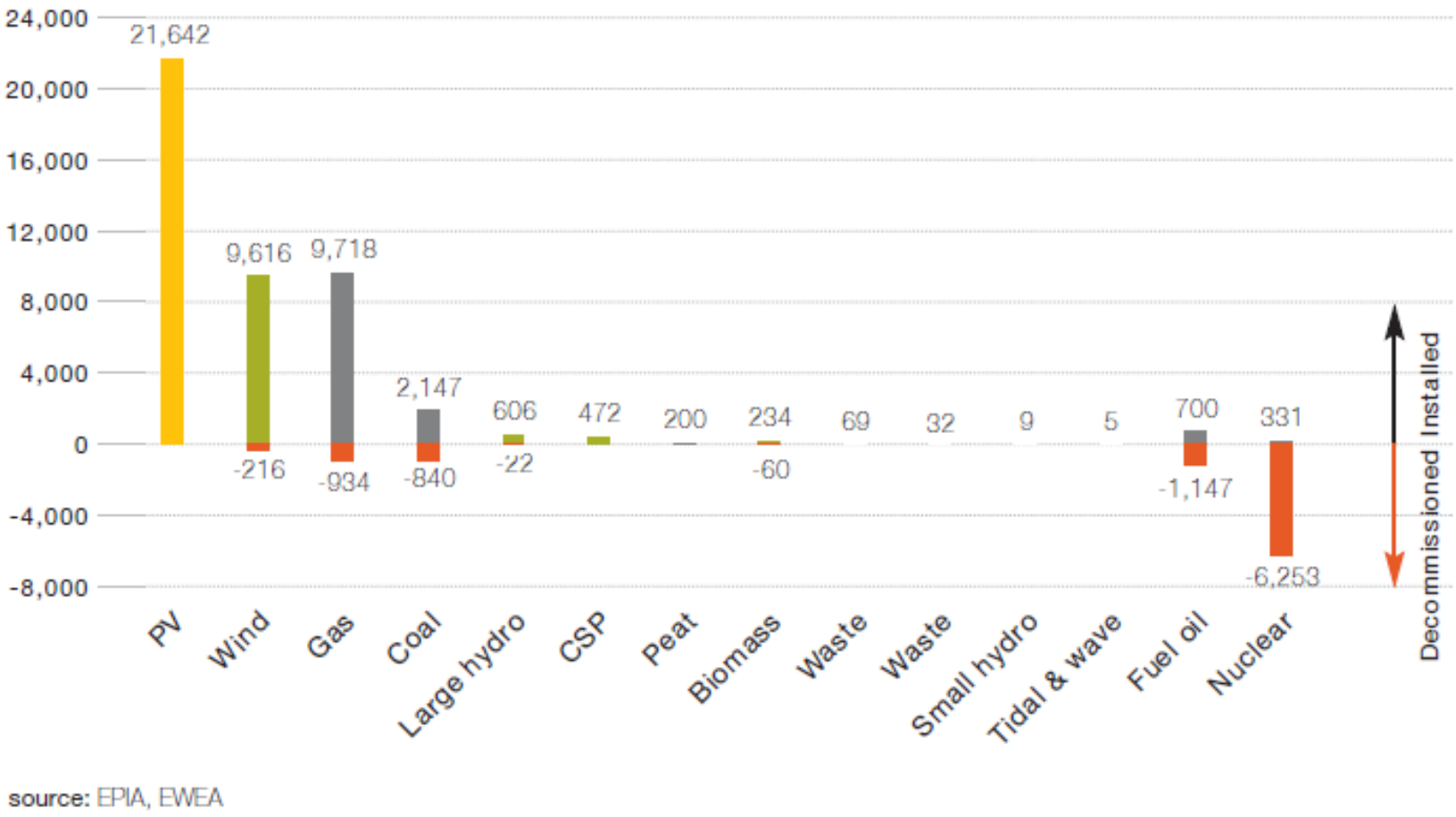
Intersolar 2012 Munich

EPIA
European Photovoltaic Industry Association

1st source of electricity installed in Europe in 2011

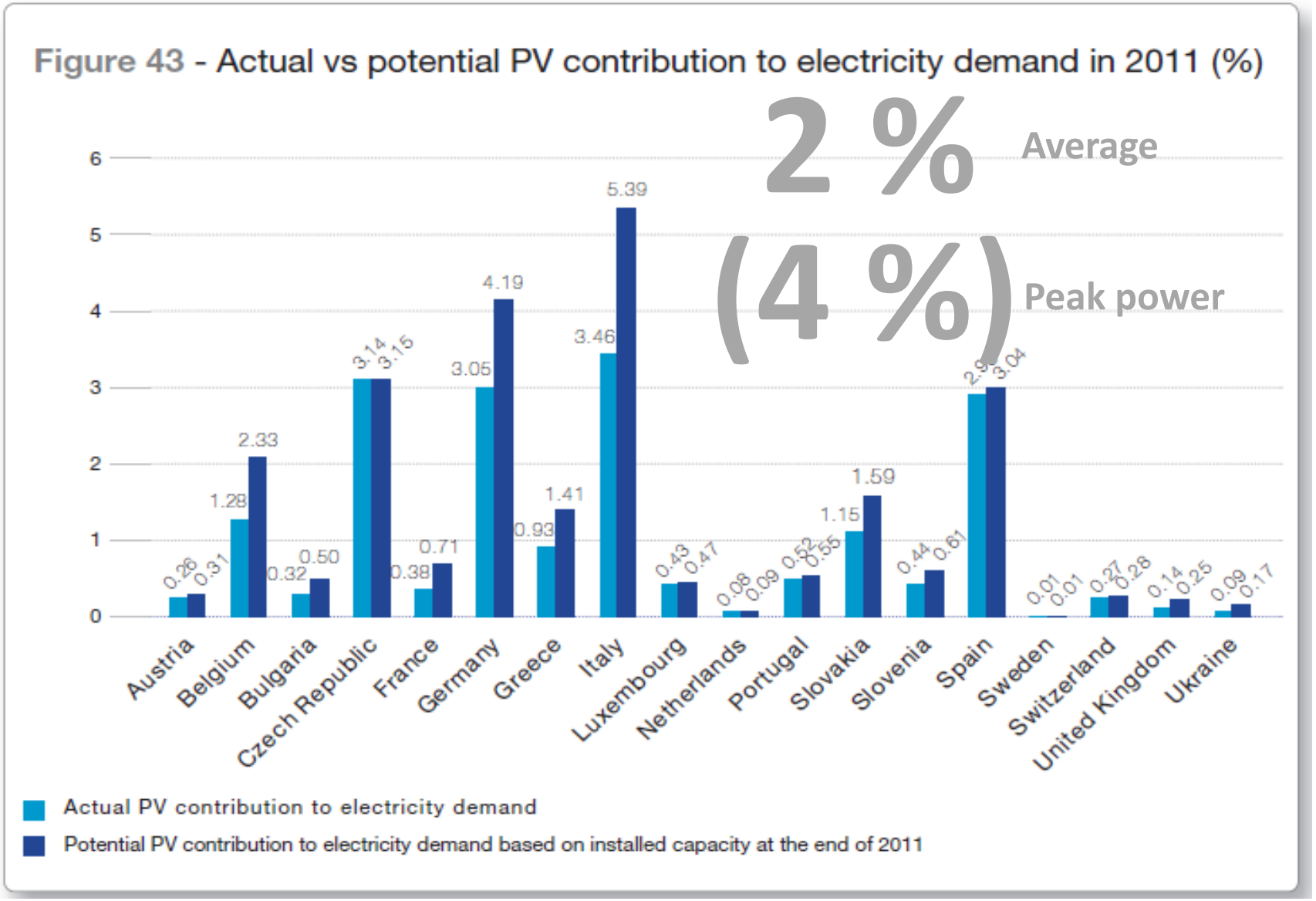
PV a the 1st source of electricity in 2011

Figure 41 - Power generation capacities added in the EU 27 in 2011 (MW)



source: EPIA, EWEA

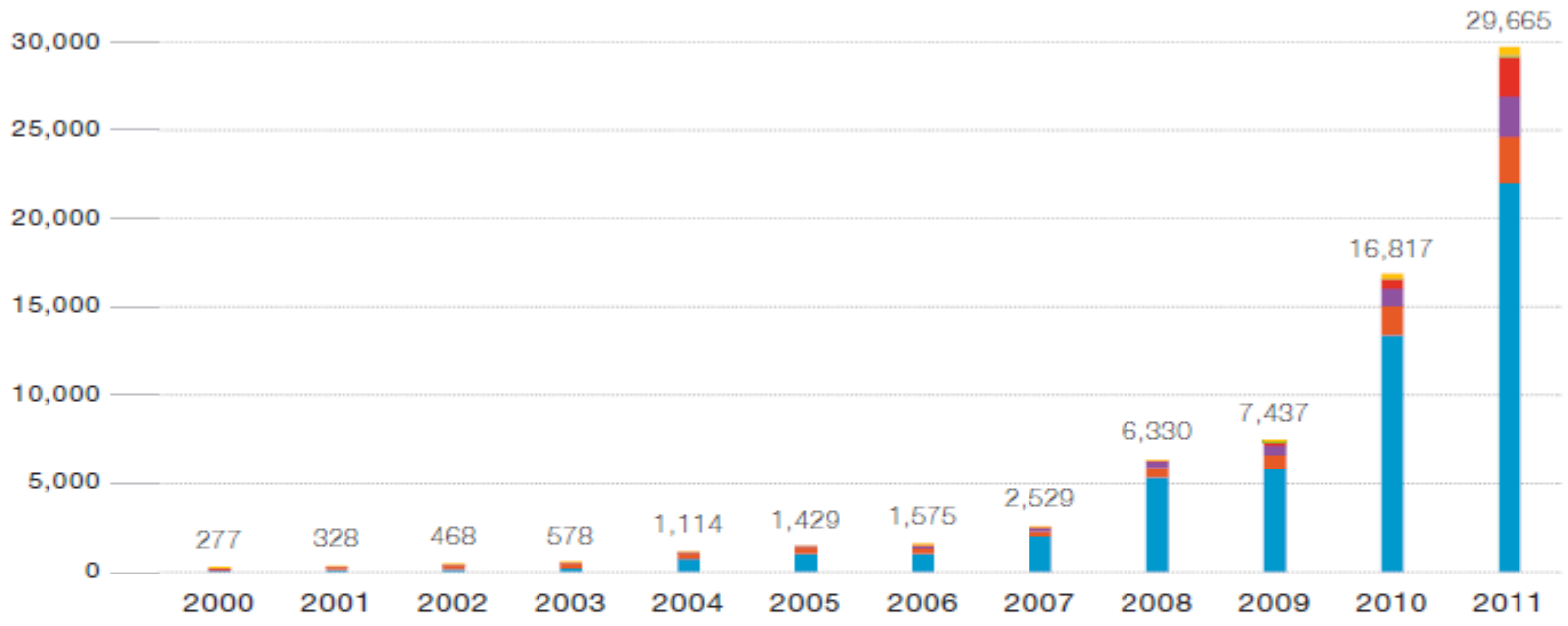
Share of electricity demand covered by PV



2011 market data

Evolution of new grid connected systems

Figure 2 - Evolution of global annual installations 2000-2011 (MW)



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
ROW	88	56	80	77	29	10	105	42	76	80	284	508
MEA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	21	45	131
China	0	11	15	10	9	4	12	20	45	228	520	2,200
America	23	31	46	65	92	117	149	212	349	539	983	2,234
APAC	114	136	186	225	276	296	322	283	563	766	1,618	2,653
Europe	53	94	142	201	708	1,002	987	1,972	5,297	5,803	13,367	21,939
Total	277	328	468	578	1,114	1,429	1,575	2,529	6,330	7,437	16,817	29,665

Market split – Europe / rest of the World

Figure 7 - European market split 2011 (MW; %)

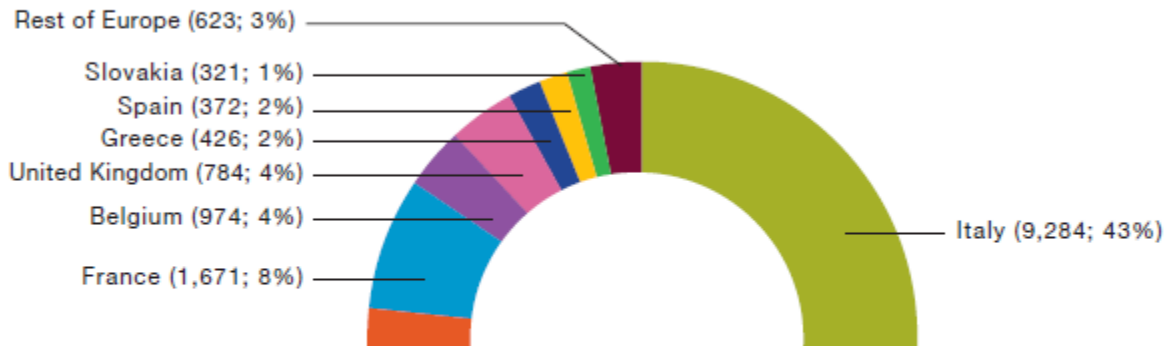
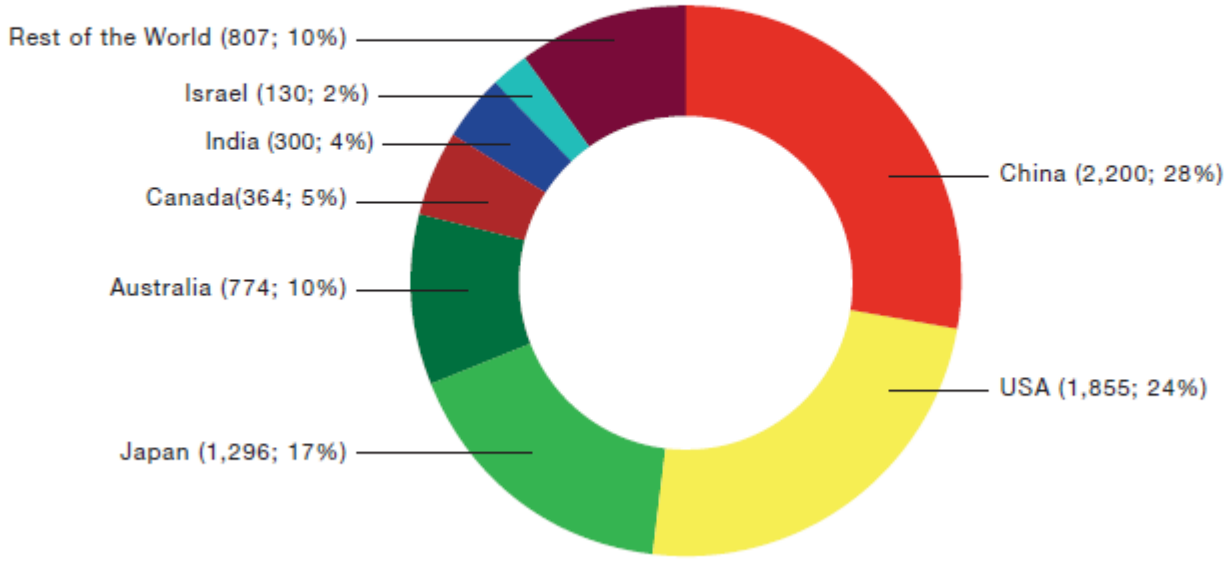
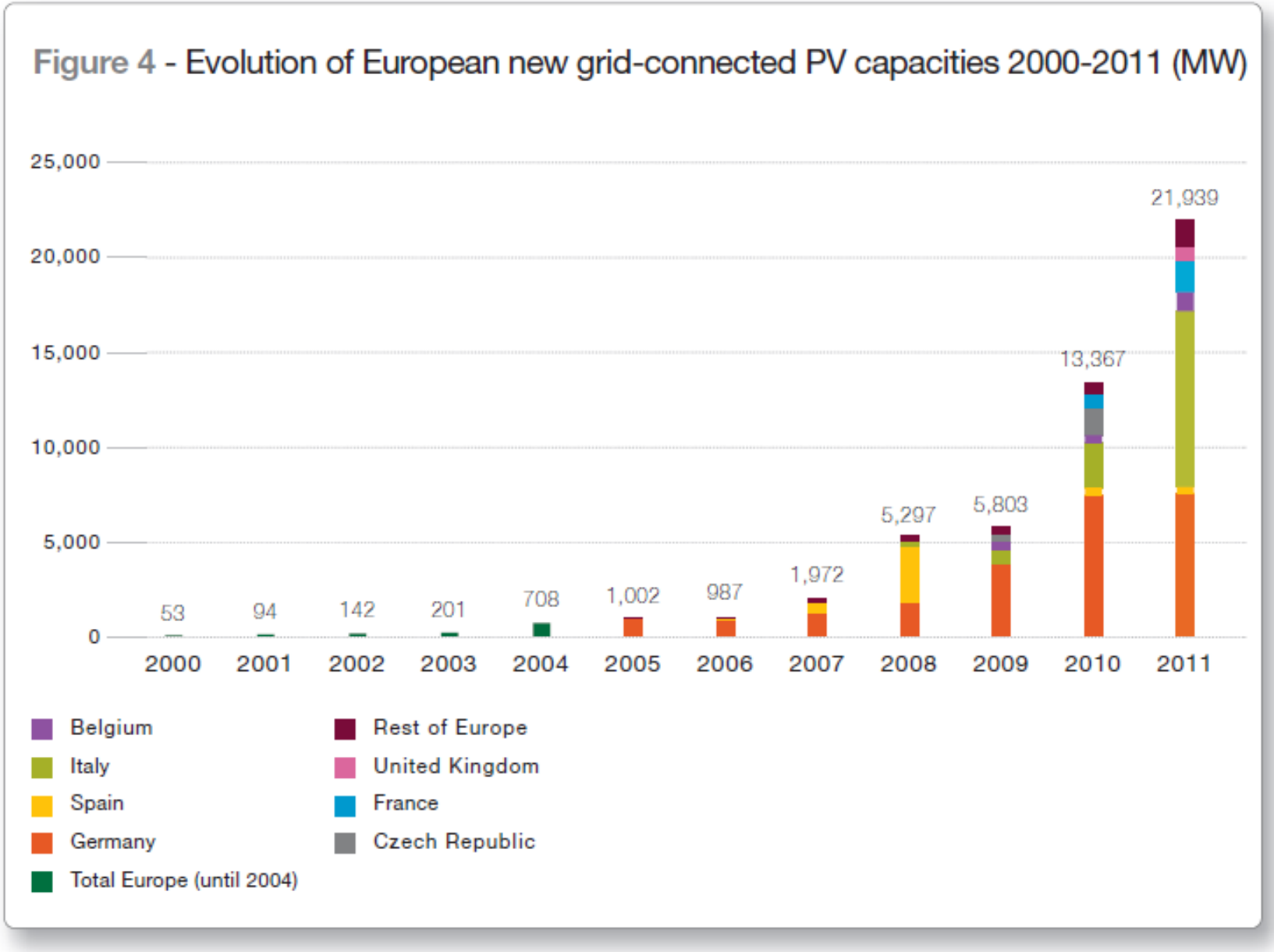


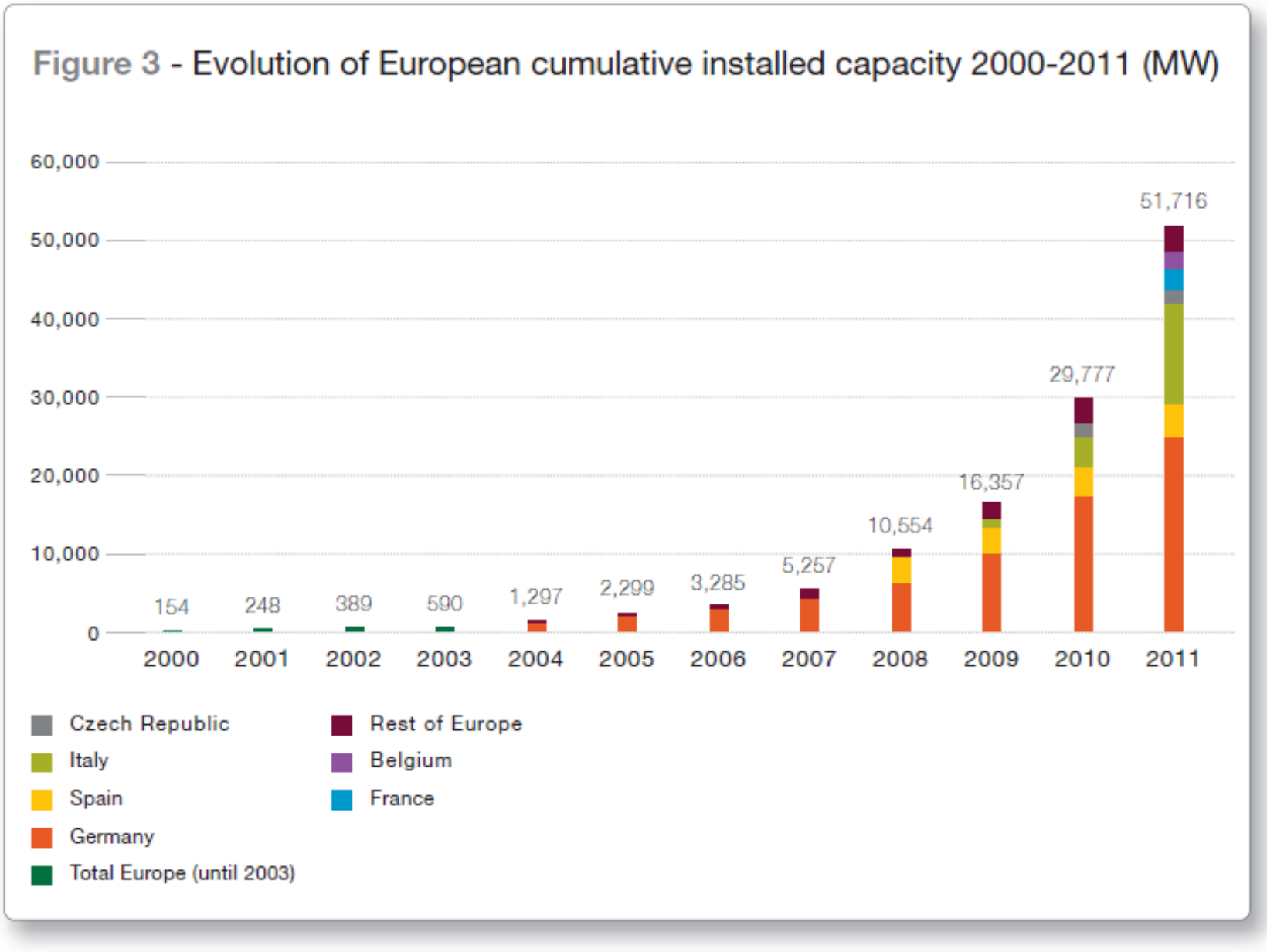
Figure 26 - Market share outside Europe 2011 (MW; %)



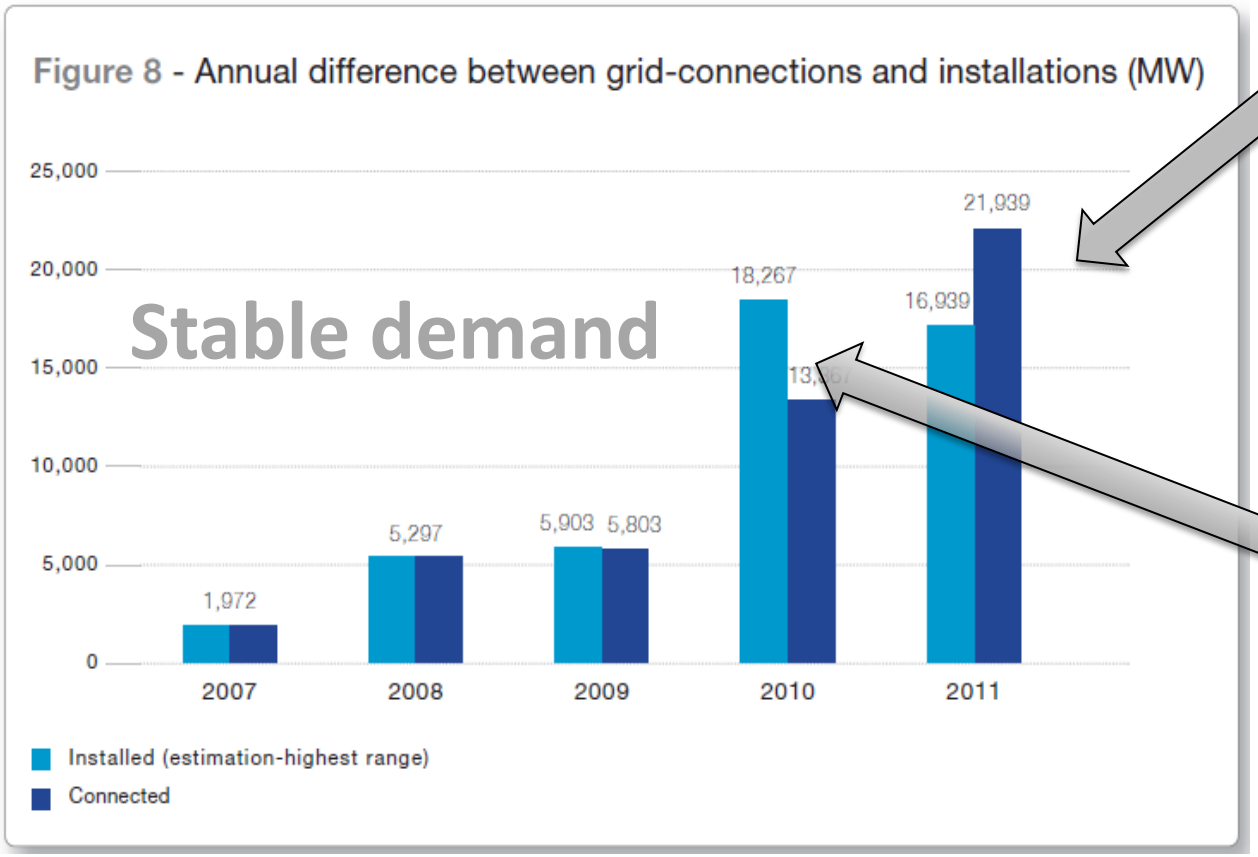
Main markets contributing to development



Main markets contributing to total capacity



Connections or installations in Europe ?

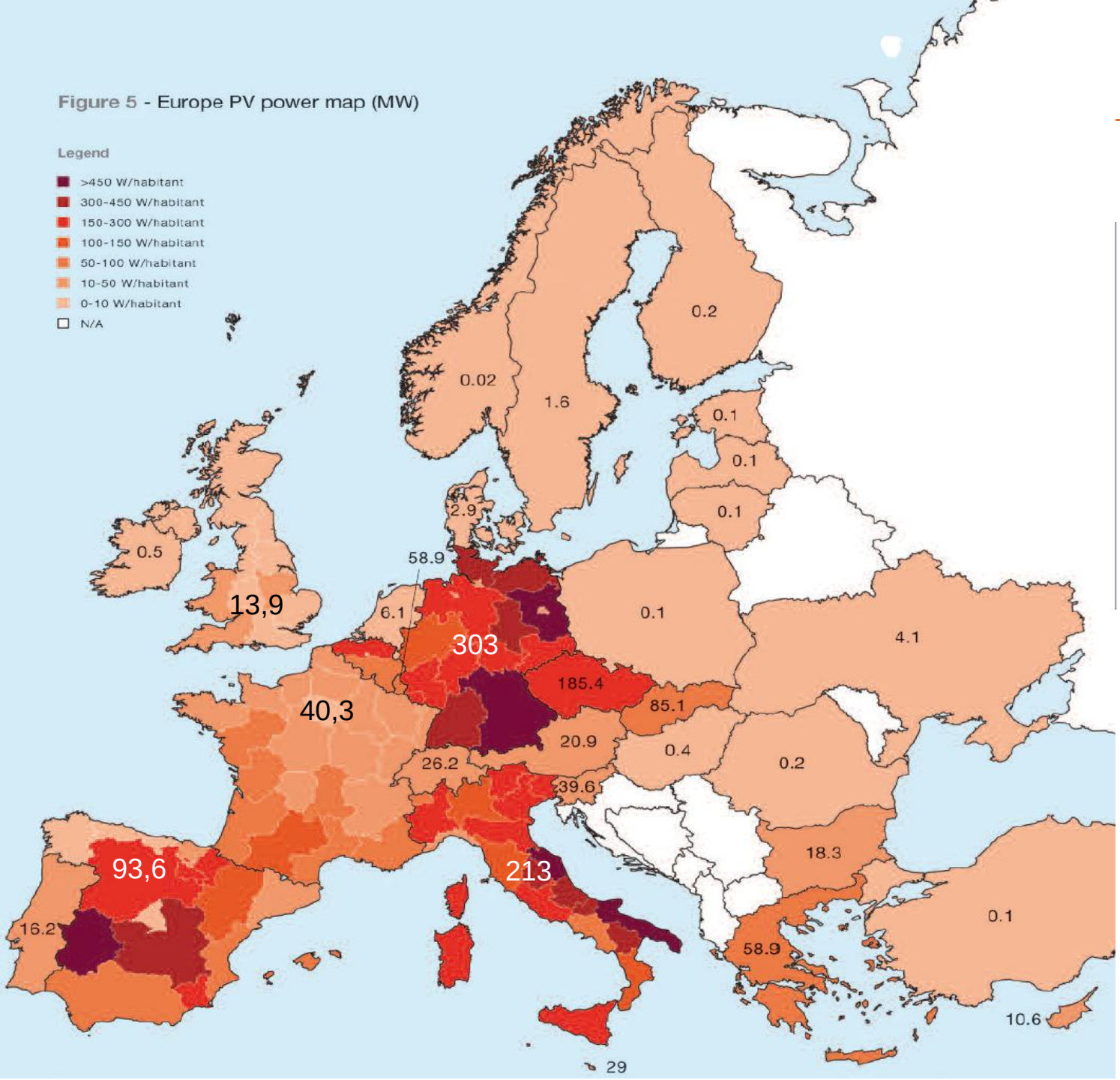


Connections rose in 2011 to 21.9 GW

Installations peaked in 2010

- EPIA counts systems connected to the grid in EU
- *Italy's « Salva Alcoa »: up to 3.5 GW installed in 2010 but connected in 2011*
- *France's 1.5 GW of 2010 installations*.

Figure 5 - Europe PV power map (MW)



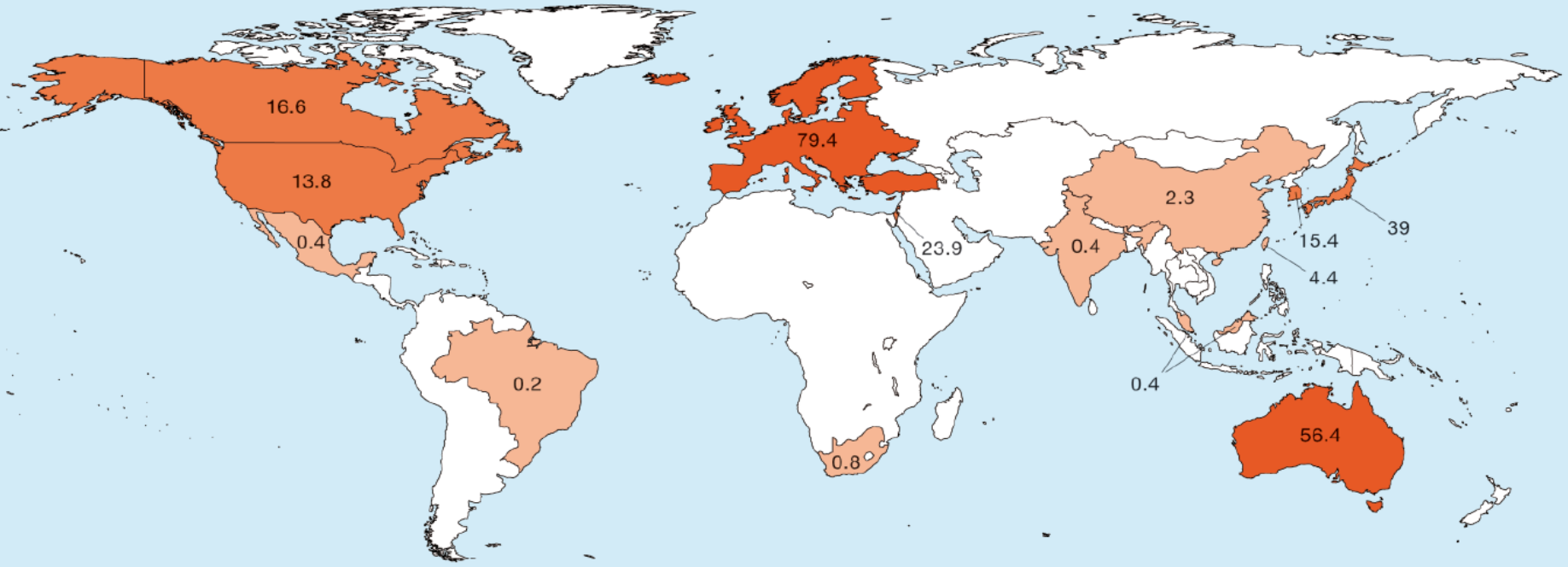
Austria	20.9
Belgium[a]	183.5
Bulgaria	18.3
Cyprus	10.6
Czech Republic	185.4
Denmark	2.9
Estonia	0.1
Finland[b]	0.2
France	40.3
Germany	302.8
Greece	58.9
Hungary	0.4
Ireland[c]	0.5
Italy	212.6
Latvia	0.1
Lithuania	0.1
Luxembourg[b]	58.9
Malta	29
Netherlands	6.1
Norway	0.02
Poland	0.1
Portugal	16.2
Romania	0.2
Slovakia	85.1
Slovenia	39.6
Spain[a]	93.6
Sweden	1.6
Switzerland[a]	26.2
Turkey[c]	0.1
Ukraine	4.1
United Kingdom	13.9

Europe[a]	Market 2010	Cumulative 2010	Market 2011	Cumulative 2011	W/habitant 2011
	13,367	29,741	21,939	51,680	79.4

[a] Russia data are not included in Europe on this map.

China	Market 2010	Cumulative 2010	Market 2011	Cumulative 2011	W/habitant 2011
	520	893	2,200	3,093	2.3

Legend
- N/A
- 0-10 W/habitant
- 10-50 W/habitant
- 50-100 W/habitant



America	Market 2010	Cumulative 2010	Market 2011	Cumulative 2011	W/habitant 2011
Brazil[b]	N/A	27	5	32	0.2
Canada	105	200	364	563	16.6
Mexico[b]	N/A	30	10	40	0.4
USA	878	2,528	1,855	4,383	13.8

[b] 2011 data are provisional.

MEA	Market 2010	Cumulative 2010	Market 2011	Cumulative 2011	W/habitant 2011
Israel	45	66	130	196	23.9
South Africa[b]	N/A	40	1	41	0.8

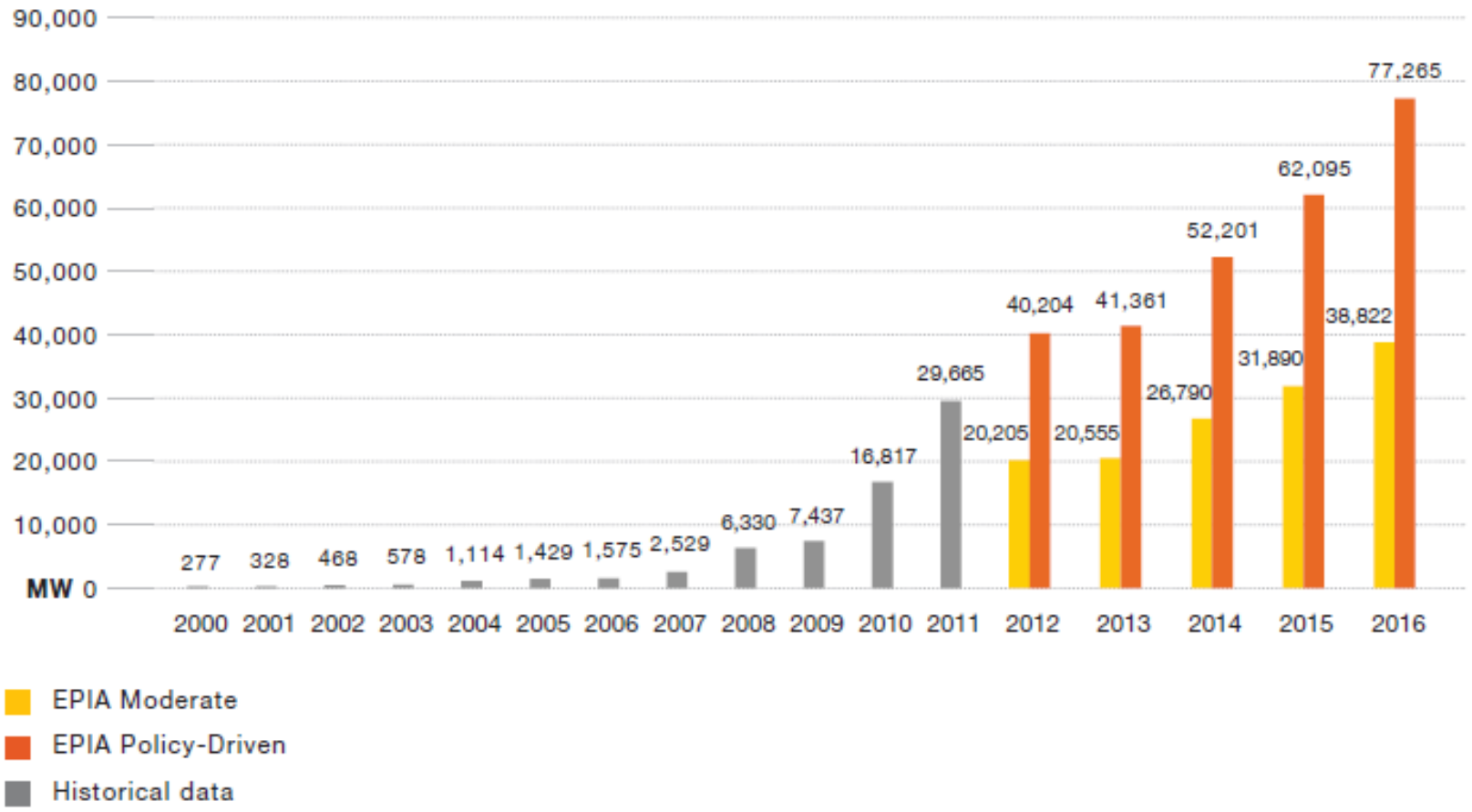
[b] 2011 data are provisional.

APAC	Market 2010	Cumulative 2010	Market 2011	Cumulative 2011	W/habitant 2011
Australia	387	524	774	1,298	56.4
India	60	161	300	461	0.4
Japan	991	3,618	1,296	4,914	39
Korea	138	662	92	754	15.4
Malaysia	0.5	11	N/A	11	0.4
Taiwan	13	32	70	102	4.4

World demand - 5 years forecasts

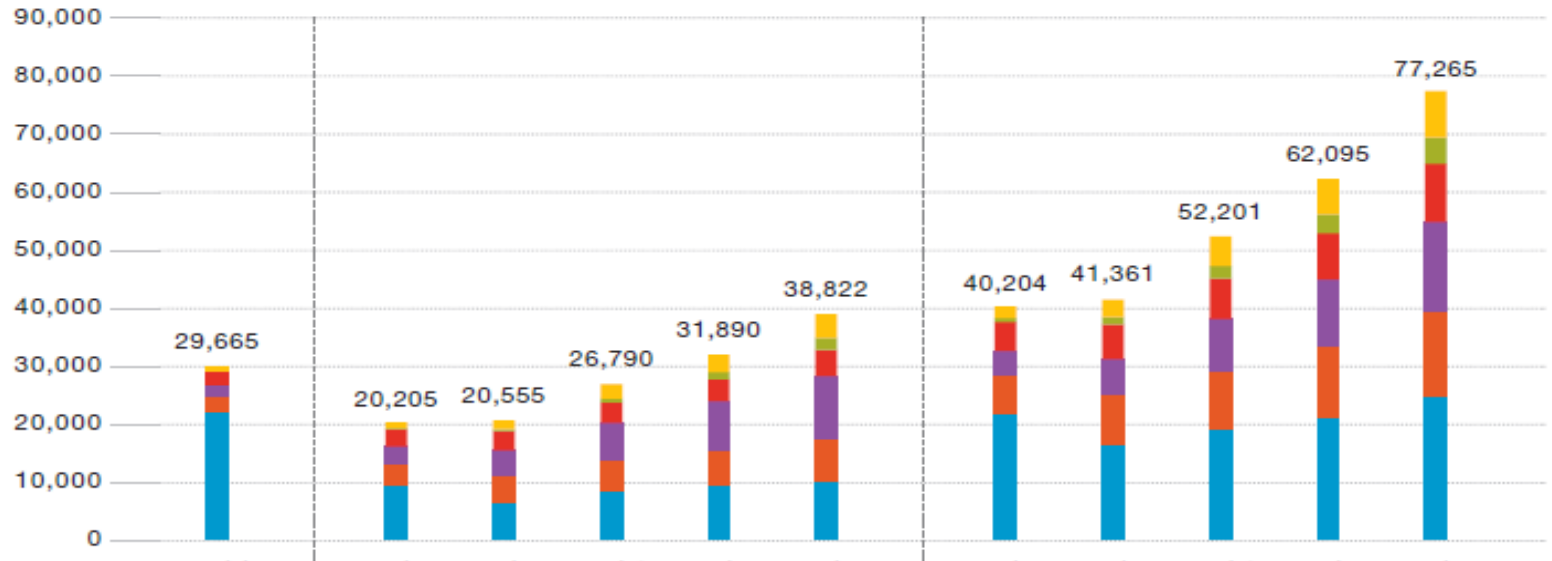
5 years global PV market forecasts (2016)

Figure 28 - Global annual market scenarios until 2016 - Moderate and Policy-Driven (MW)



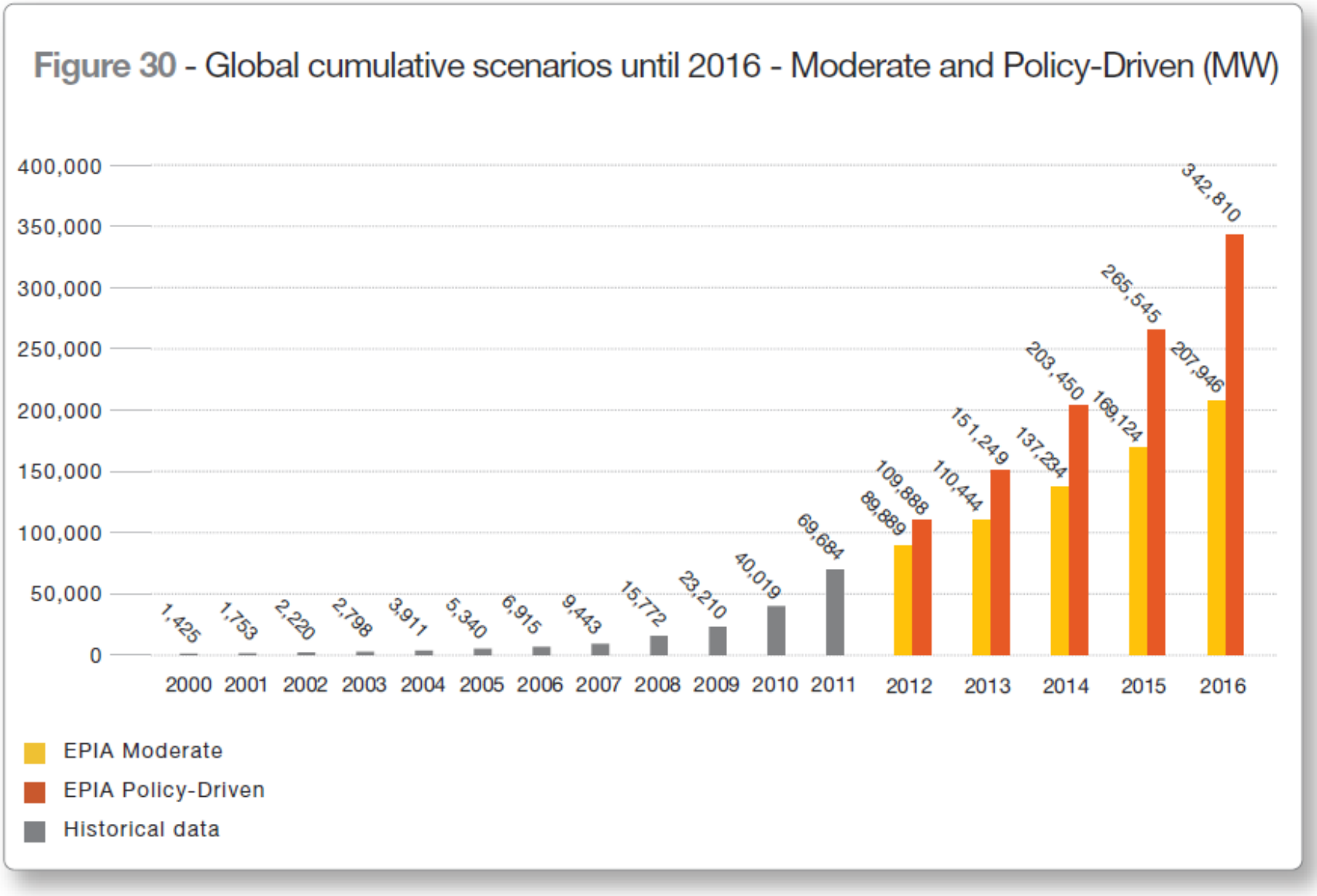
Global Market Outlook

Figure 29 - Evolution of global annual market scenarios per region (MW)



	2011	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
ROW	508	1,000	1,500	2,500	3,000	4,000	2,000	3,000	5,000	6,000	8,000
MEA	131	160	350	650	1,250	2,100	700	1,250	2,200	3,250	4,500
China	2,200	3,000	3,250	3,500	3,750	4,500	5,000	6,000	7,000	8,000	10,000
America	2,234	3,250	4,650	6,650	8,650	11,150	4,350	6,250	9,200	11,900	15,700
APAC	2,653	3,360	4,290	5,030	5,890	6,800	6,520	8,270	9,760	11,780	14,220
Europe	21,939	9,435	6,515	8,460	9,350	10,272	21,634	16,591	19,041	21,165	24,845
Total	29,665	20,205	20,555	26,790	31,890	38,822	40,204	41,361	52,201	62,095	77,265
	Historical data	**EPIA Moderate**					**EPIA Policy-Driven**				

Up to 340 GW in 2016



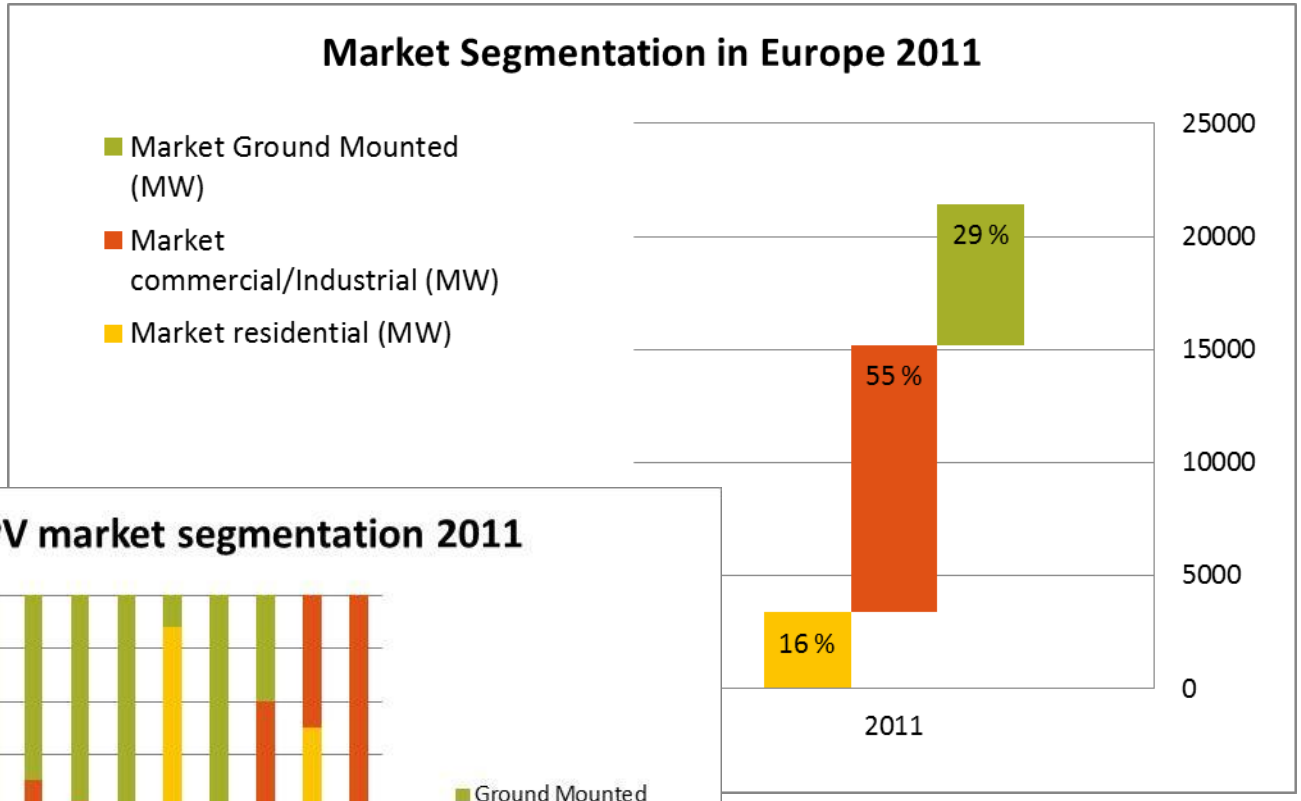
Global cumulative capacity per region

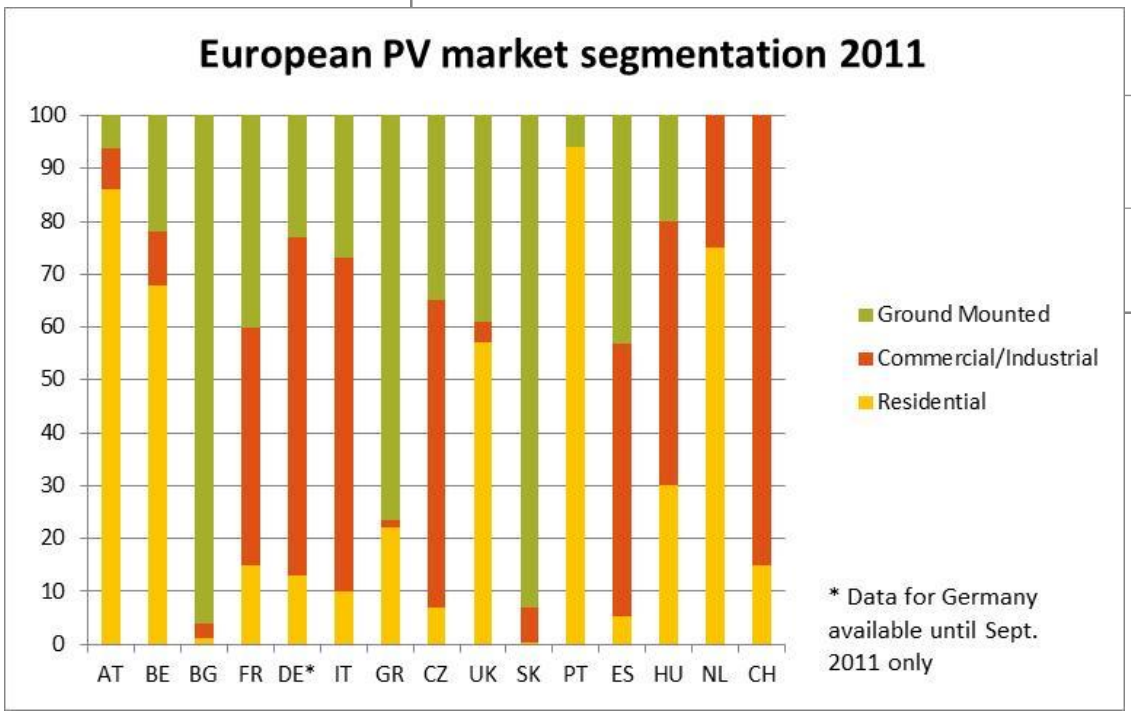
Figure 31 - Evolution of global cumulative installed capacity per region 2011-2016 (MW)

	2011	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
ROW	1,717	2,700	4,200	6,700	9,700	13,700	3,700	6,700	11,700	17,700	25,700
MEA	336	500	850	1,500	2,700	4,800	1,000	2,30	4,500	7,700	12,200
China	3,093	6,100	9,300	12,800	16,600	21,100	8,100	14,100	21,100	29,100	39,100
America	5,053	8,300	13,000	19,600	28,300	39,400	9,400	15,700	24,900	36,800	52,500
APAC	7,769	11,100	15,400	20,400	26,300	33,100	14,300	22,600	32,300	44,100	58,300
Europe	51,716	61,200	67,700	76,100	85,500	95,700	73,400	89,900	109,000	130,100	155,000
Total	69,684	89,900	110,400	137,200	169,100	207,900	109,900	151,200	203,400	265,500	342,800
	Historical data	**EPIA Moderate (cumulative)**					**EPIA Policy-Driven (cumulative)**				

Segmentation in a demand-driven market

Market segmentation in EU





Segmentation is mainly a result of political choices if access to capital is equaly spread among segments.

Segmentation evolution

- FiTs and incentives used to favour **all segments** *in developed countries*
- **Rooftop applications** (self-consumption / net-metering) will reach competitiveness first in
  - OECD (Europe, North America, Japan, Australia)
  - China
  - BIPV applications could develop

- **Utility-size ground mounted** applications will thrive in developing countries (need for capital, governement-driven or private sector-driven installations).
  - MENA, US, China, India, Thailand, etc.

- Hybrid systems
  - India, South America, Africa

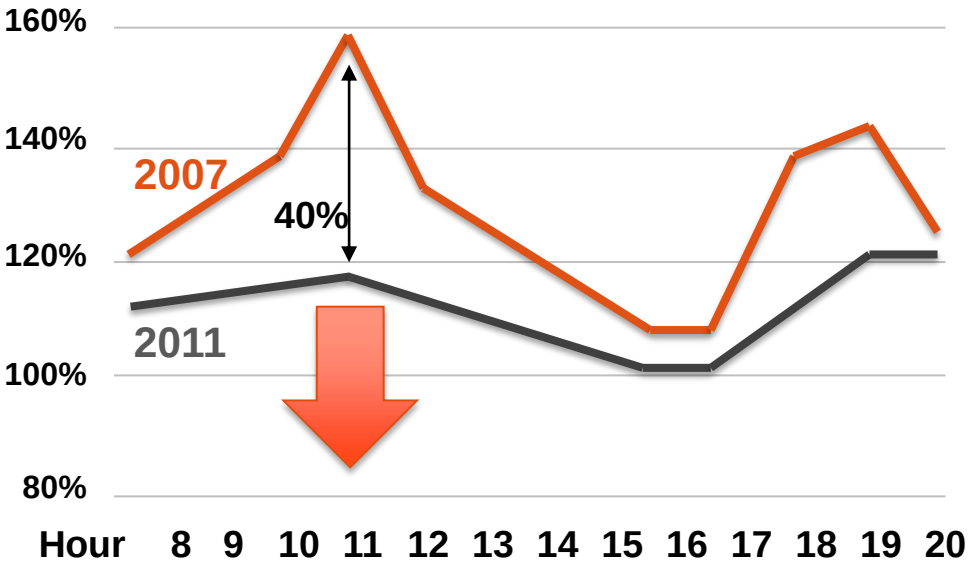
Competitiveness in Policy-Driven Markets

« Grid parity » for electricity consumers

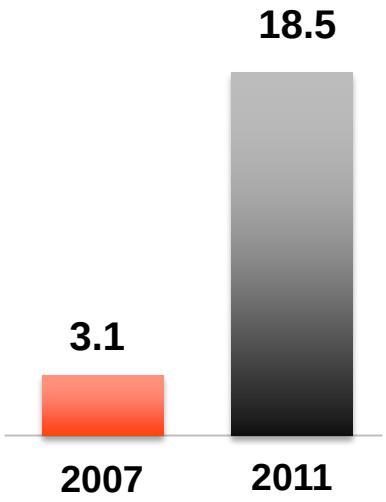
- Forget « **grid parity** » definition – Think « **competitiveness** »
- **Rooftops** (local consumption) vs **Utility-scale**,
  - *On rooftops: net-metering or self-consumption schemes with taxes and grid costs compensation. Valorize self-consumption ? Valorize excess electricity ?*
  - For utility-scale, investment perspective (generation value competitiveness) or wholesale price competitiveness.
  - *Diesel- parity ? Time for hybrid systems in mini-grids ?*
- Incoming competitiveness is based on 3 main assumptions:
  - **Electricity** prices **increase** (retail / wholesale)
  - **PV** system price **decrease**
  - **No** major additional **system costs** before 2020

PV effect on electricity market prices: Germany

Electricity price index on EPEX in 2007 and 2011 (average peak to base price ratio in %)



PV production (TWh)



Solar power reduces average trading prices on liquid wholesale markets

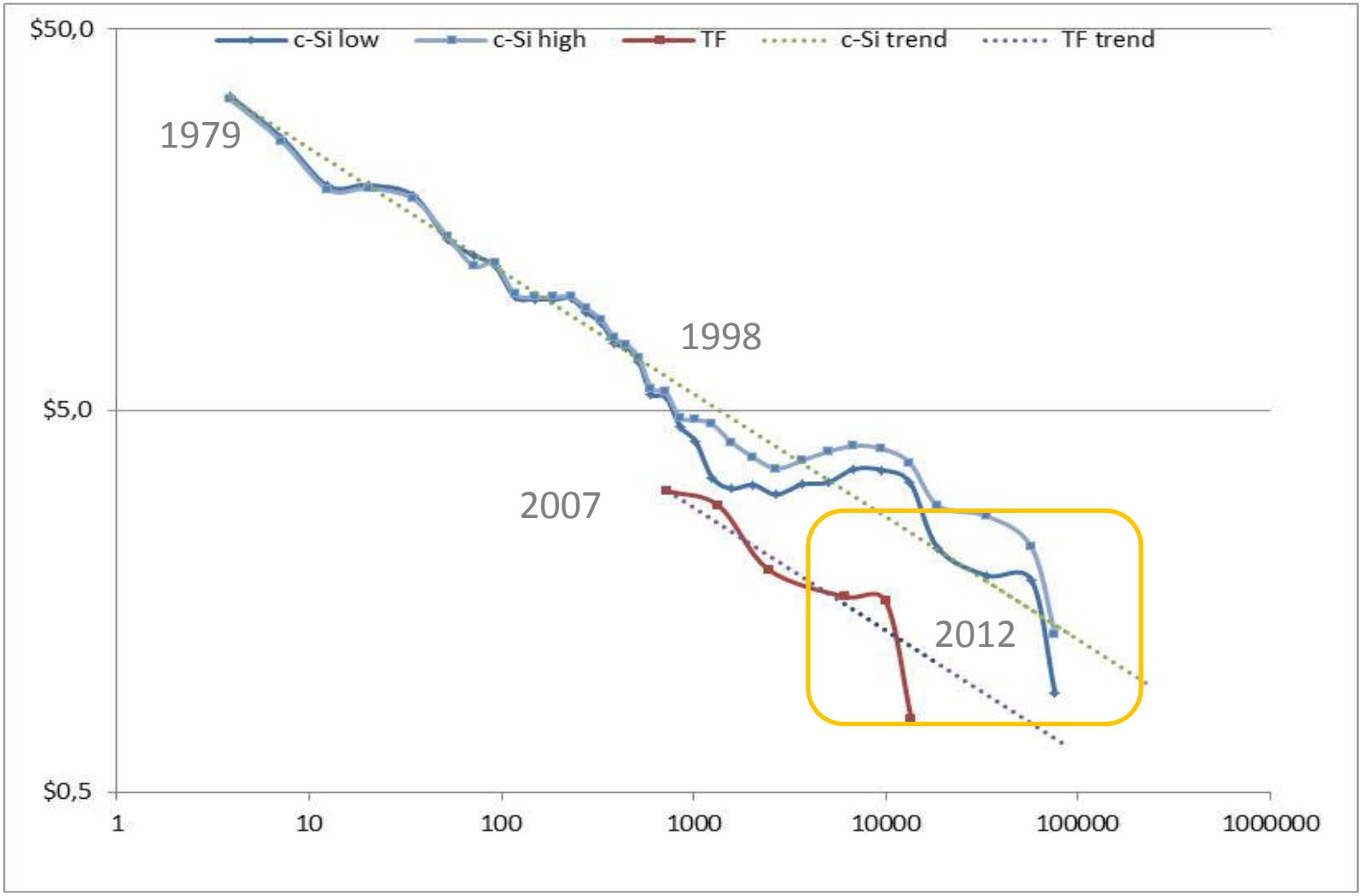
(Merit Order Effect)

What about competitiveness with reduced wholesale prices ?

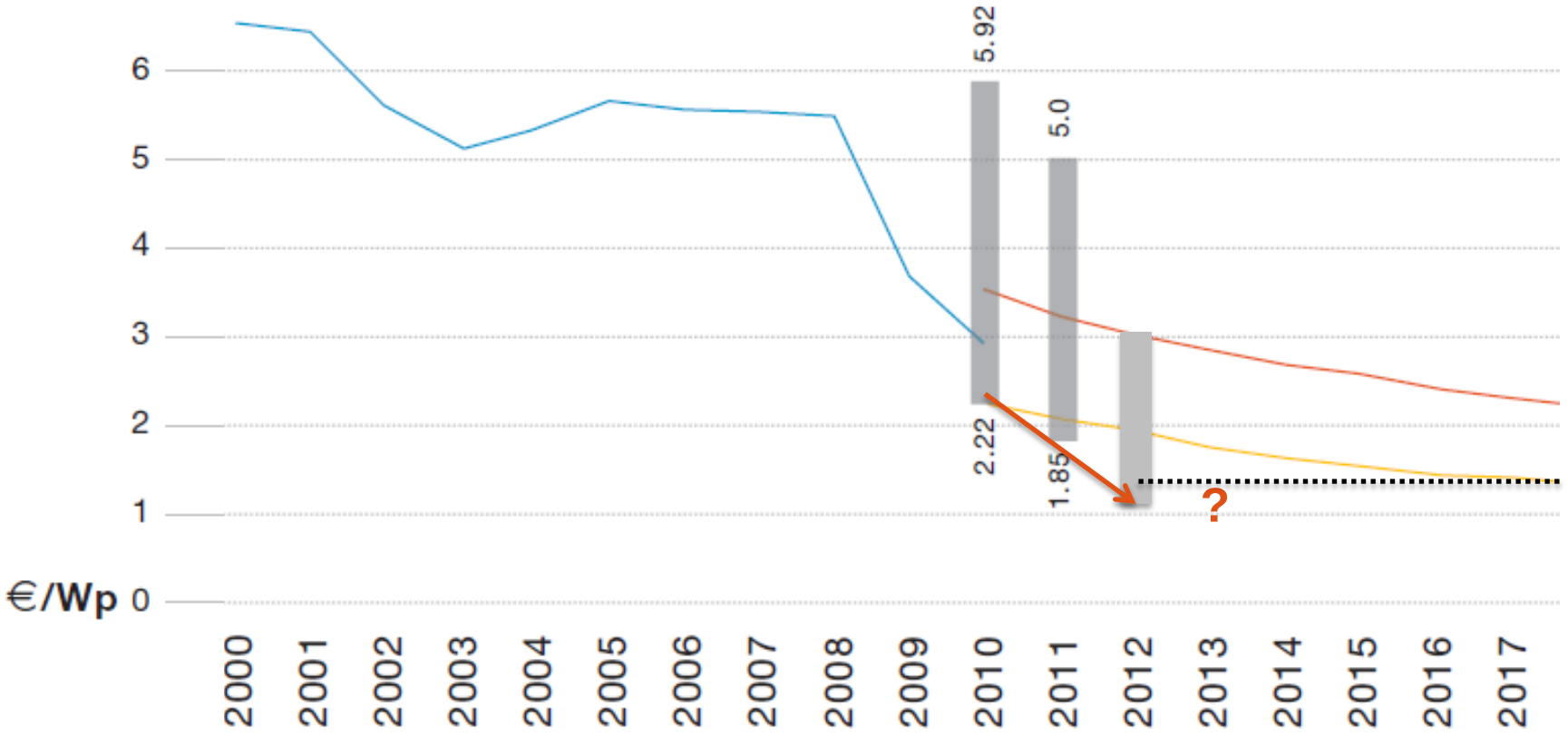
Source: IZES - Institut für Zukunftsenergiesysteme, BSW - Bundesverband Solarwirtschaft

Module Prices Experience Curve

- Module prices are going out of the learning curve
- Prices expected in 2016-2018 have been reached yet.

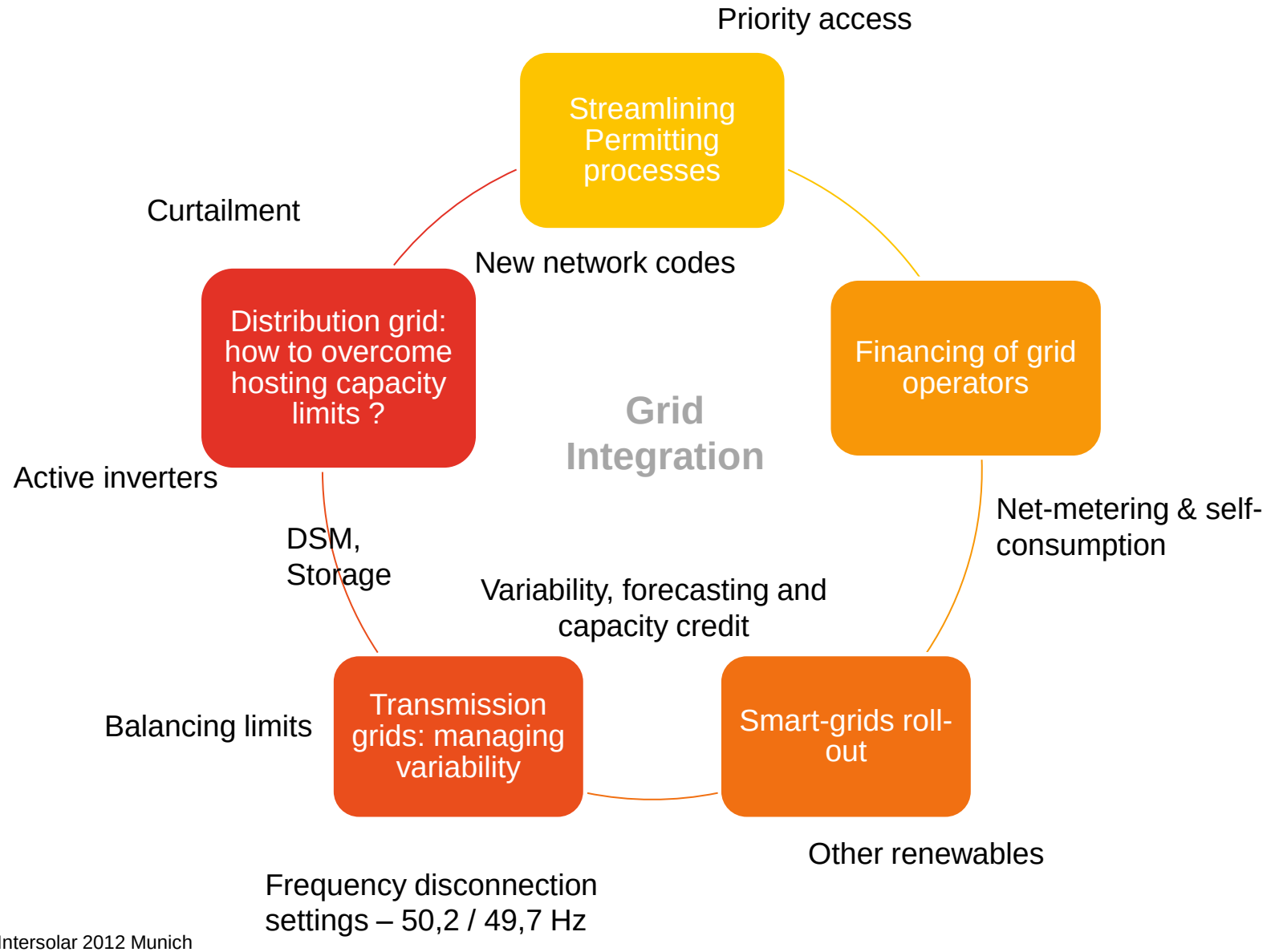


PV System Price Evolution



- **PV system price decrease has been fuelled by technological improvements and economies of scale.**
- **Prices of PV modules and systems went down dramatically end of 2011.**
- **Is that price decrease sustainable ? Or are we going to see relatively flat prices ?**

Grid Integration ?



Conclusions

- Competitiveness is close under some conditions.
- Before competitiveness, policy rules PV markets.

- **Price decrease has triggered a rapid feed-in tariff decrease in several countries.**
- FiTs lower than retail electricity prices will push for higher self-consumption.
- **Net-metering schemes could be used but opposition from traditional utilities and grid operators should be expected (Spain, France…)**
- PPAs are on the verge of becoming more interesting than FiT

- But… additional grid costs could delay competitiveness.
- **Low cost of financing remains to be achieved.**
- **And finally… what about prices evolution on the medium term ?**

www.epia.org

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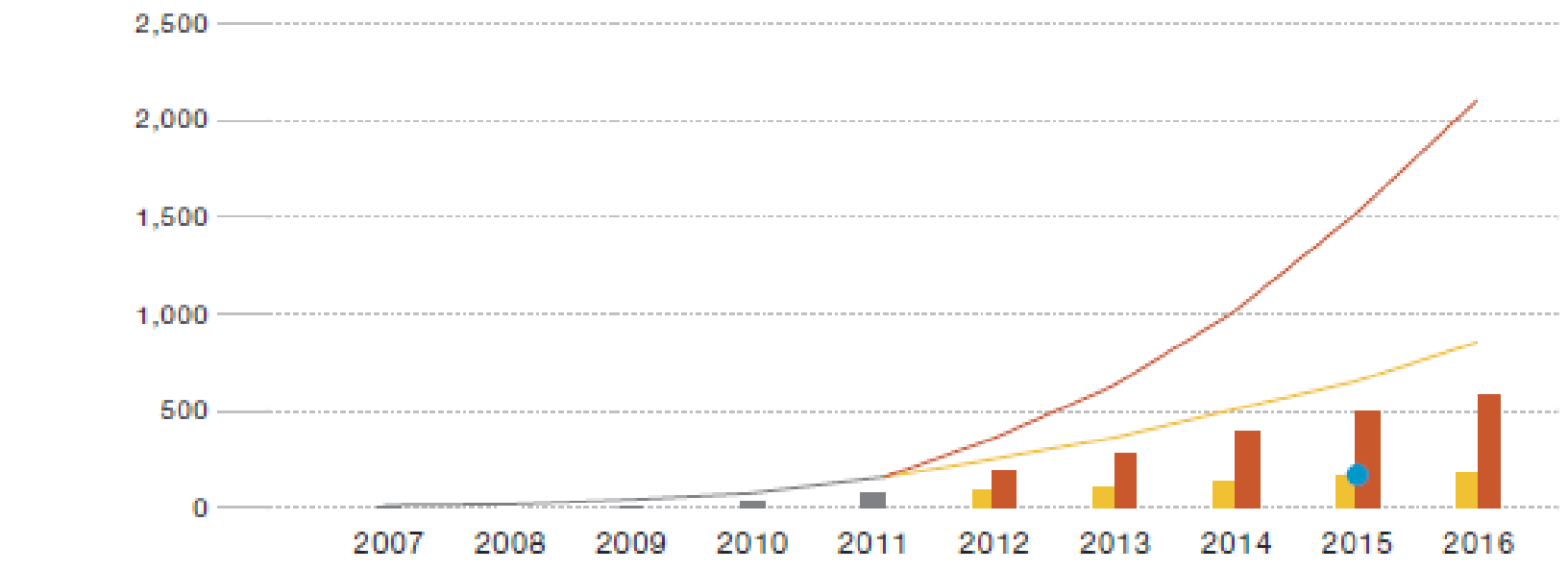
Austria – 0.17 GW

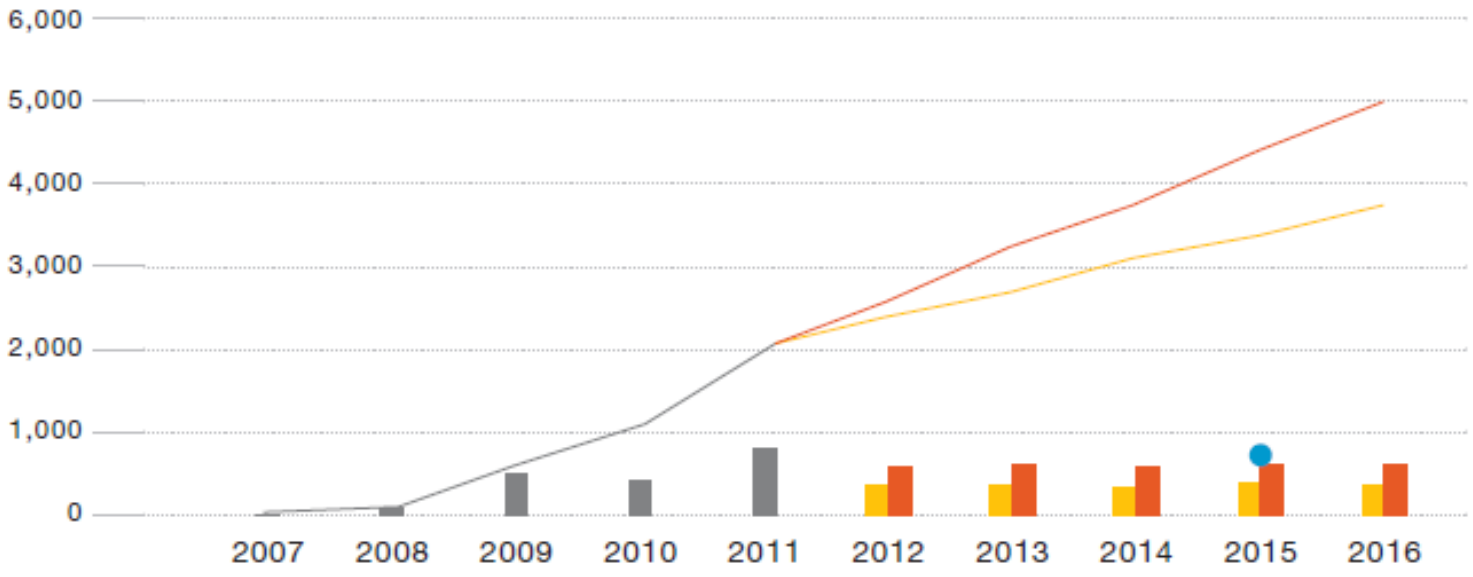
Figure 13 - Austria (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	2	5	20	43	80	100	120	140	160	180
EPIA Policy-Driven						200	300	400	500	600
EPIA Moderate (cumulative)	28	33	53	96	176	280	400	540	700	880
EPIA Policy-Driven (cumulative)						380	680	1,100	1,600	2,200
National target 2015									179	

Belgium – 2 GW

Figure 14 - Belgium (MW)

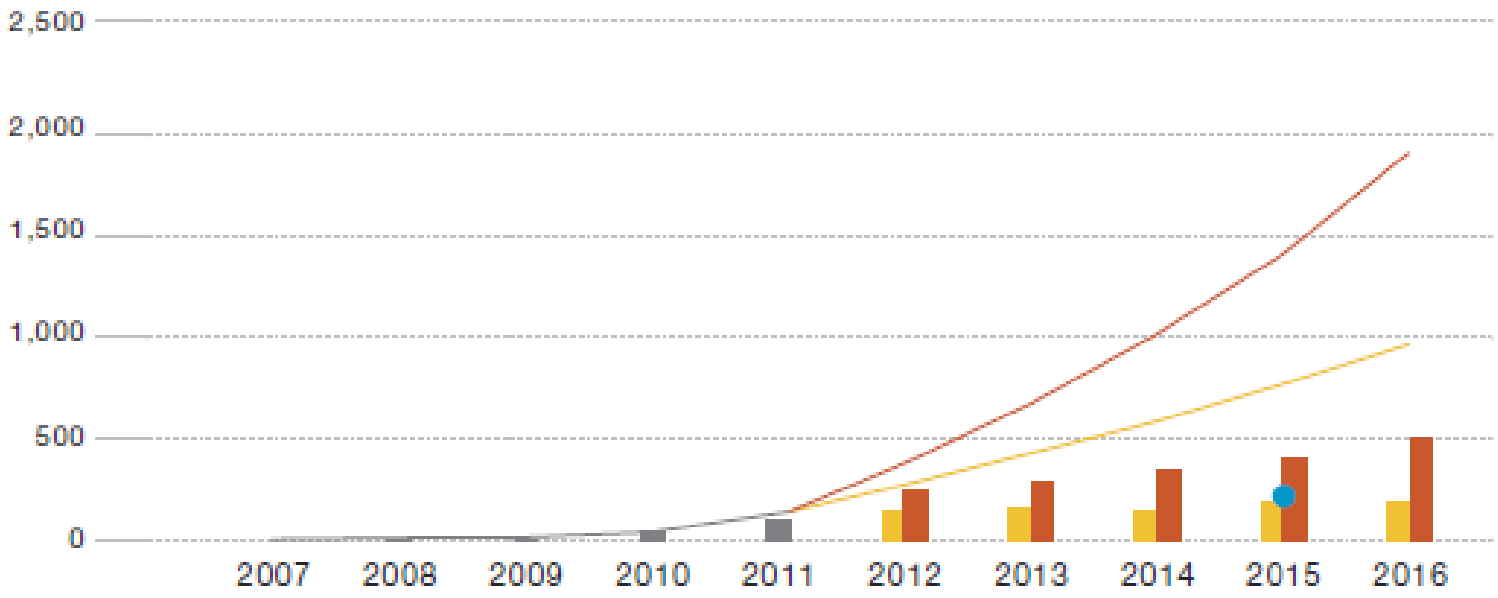


	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	23 [22]*	81 [77]	519 [494]	417 [397]	974 [928]	350	350	350	350	350
EPIA Policy-Driven						600	600	600	600	600
EPIA Moderate (cumulative)	27 [26]	108 [103]	627 [597]	1,044 [994]	2,018 [1,922]	2,400	2,700	3,100	3,400	3,800
EPIA Policy-Driven (cumulative)						2,600	3,200	3,800	4,400	5,000
National target 2015									713	

* AC figures officially reported.

Bulgaria – 0.14 GW

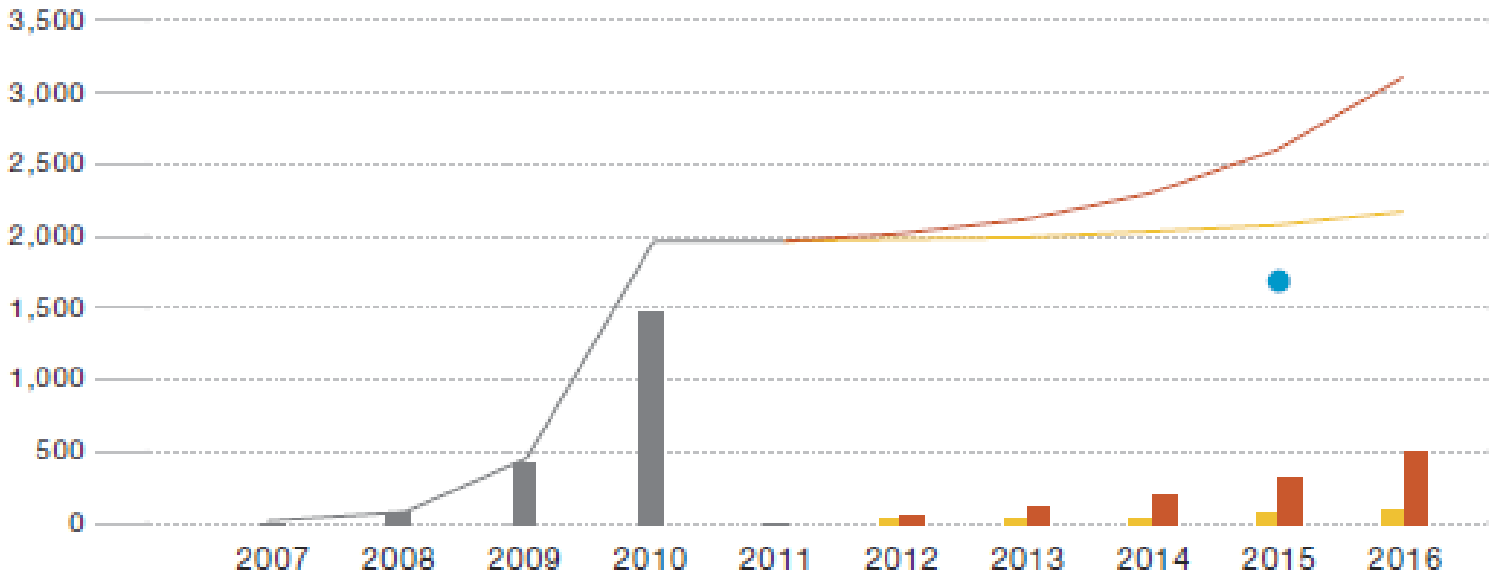
Figure 15 - Bulgaria (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	0	1	6	28	100	150	150	150	200	200
EPIA Policy-Driven						250	300	350	400	500
EPIA Moderate (cumulative)	0	1	7	35	135	280	430	580	780	980
EPIA Policy-Driven (cumulative)						380	680	1,000	1,400	1,900
National target 2015									220	

Czech Republic – 2 GW

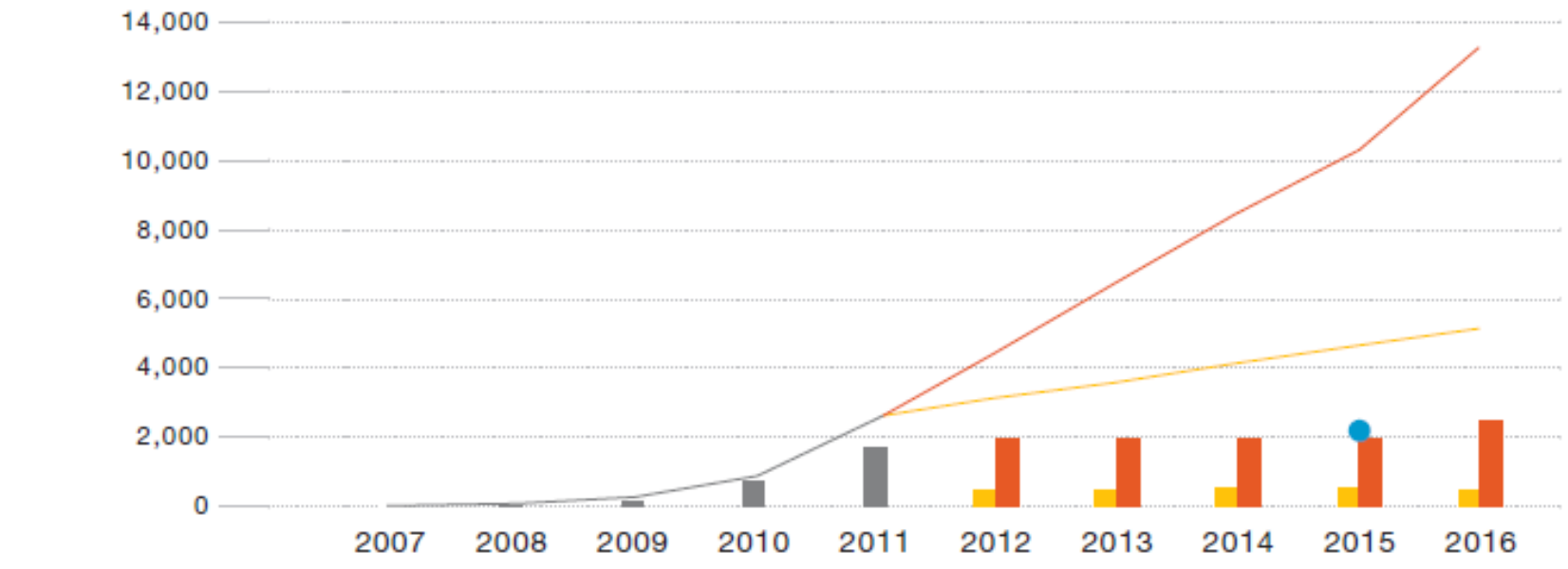
Figure 16 - Czech Republic (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	3	61	398	1,490	6	10	20	30	60	100
EPIA Policy-Driven						50	100	200	300	500
EPIA Moderate (cumulative)	3	64	462	1,952	1,959	2,000	2,000	2,000	2,100	2,200
EPIA Policy-Driven (cumulative)						2,000	2,100	2,300	2,600	3,100
National target 2015									1,680	

France – 2.7 GW

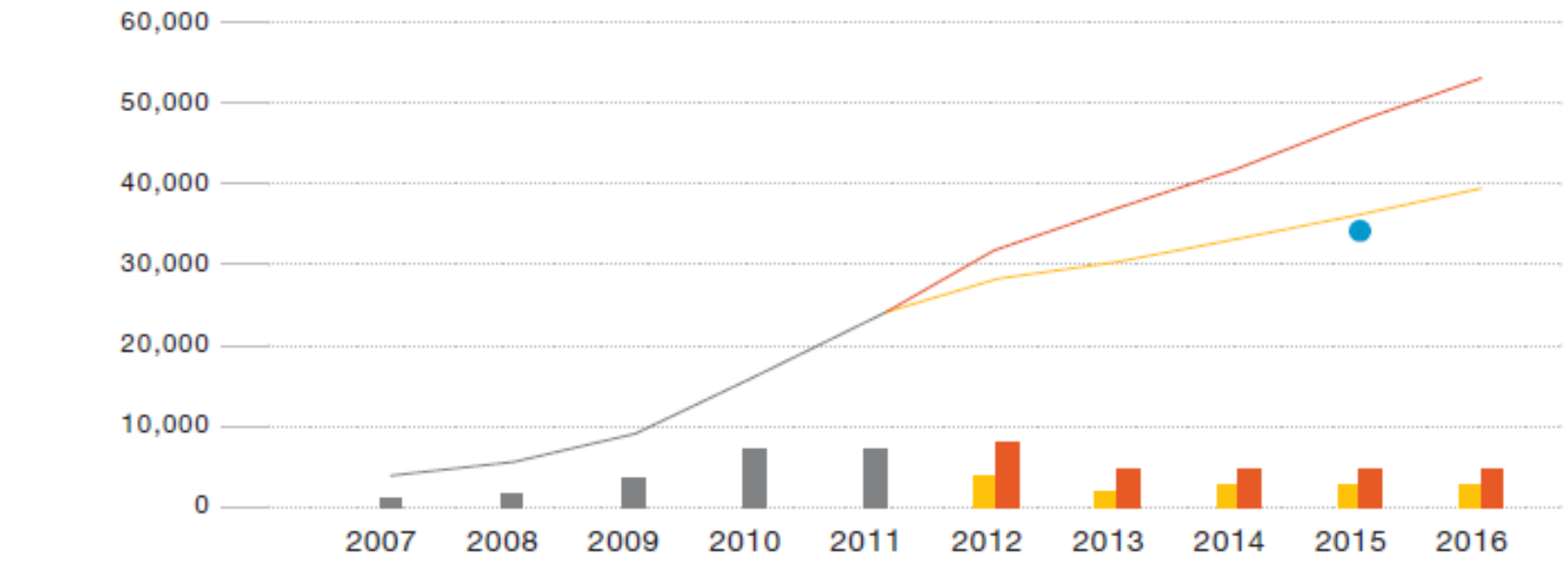
Figure 17 - France (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	13	58	185	719	1,671	500	500	500	500	500
EPIA Policy-Driven						2,000	2,000	2,000	2,000	2,500
EPIA Moderate (cumulative)	26	84	269	988	2,659	3,200	3,700	4,200	4,700	5,200
EPIA Policy-Driven (cumulative)						4,700	6,700	8,700	10,700	13,200
National target 2015									2,151	

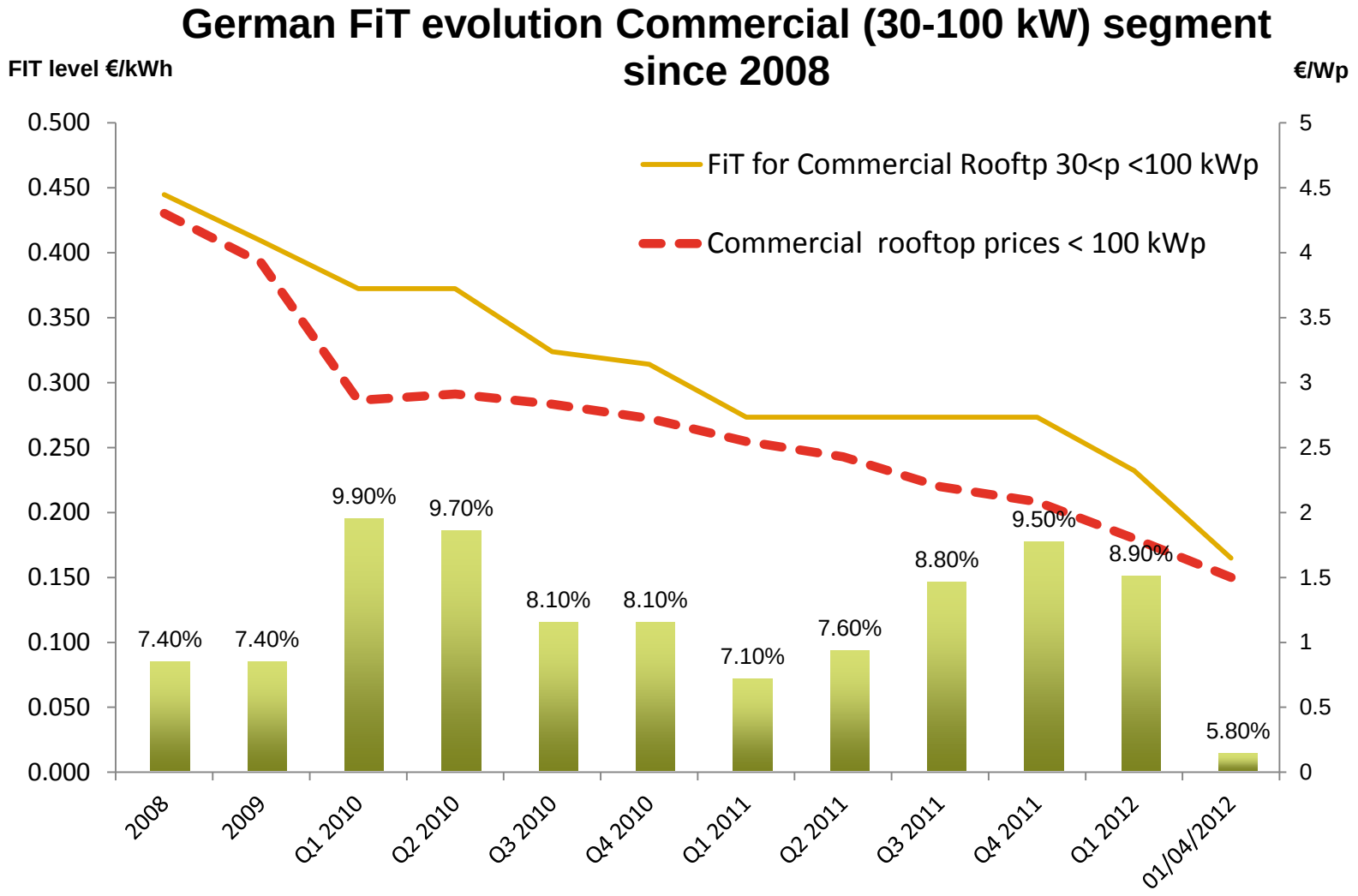
Germany – 25 GW

Figure 18 - Germany (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	1,271	1,809	3,806	7,408	7,485	4,000	2,000	3,000	3,000	3,000
EPIA Policy-Driven						8,000	5,000	5,000	5,000	5,000
EPIA Moderate (cumulative)	4,170	5,979	9,785	17,193	24,678	28,700	30,700	33,700	36,700	39,700
EPIA Policy-Driven (cumulative)						32,700	37,700	42,700	47,700	52,700
National target 2015									34,279	

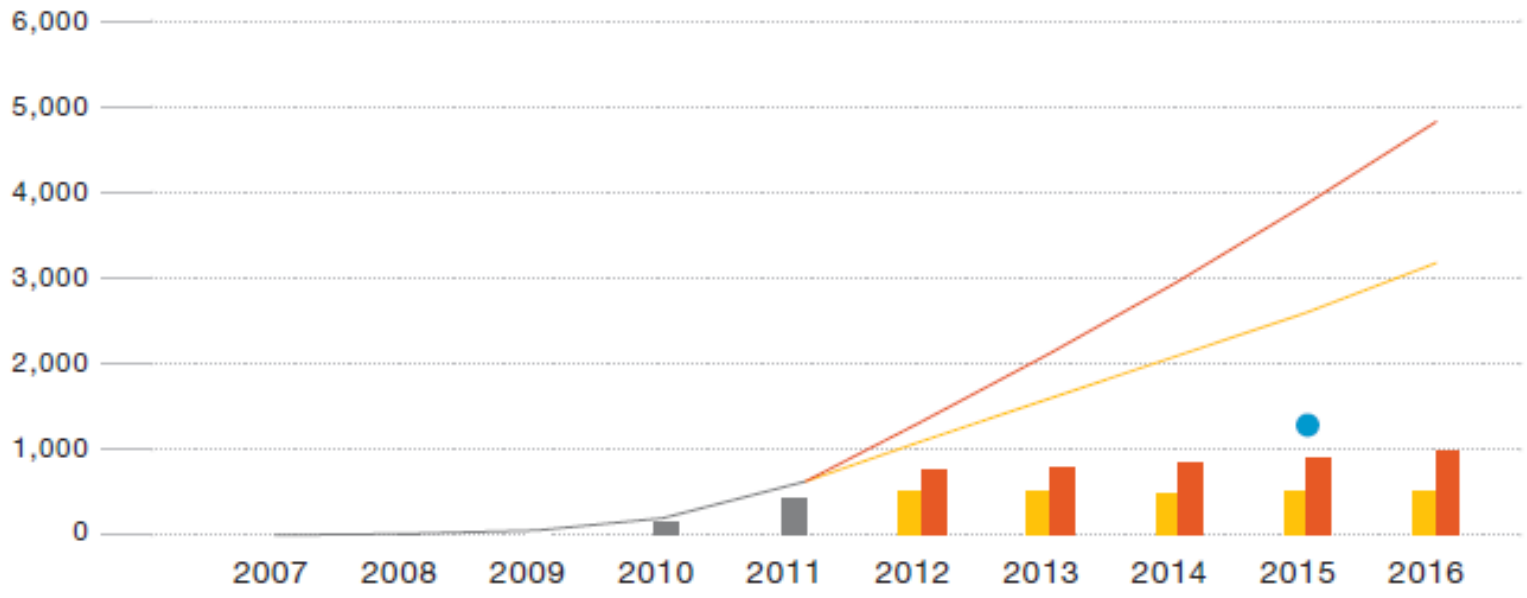
What happened in 2011 ? The German case



Corridor schemes failed in Germany due to the fast price decline.

Greece – 0.6 GW

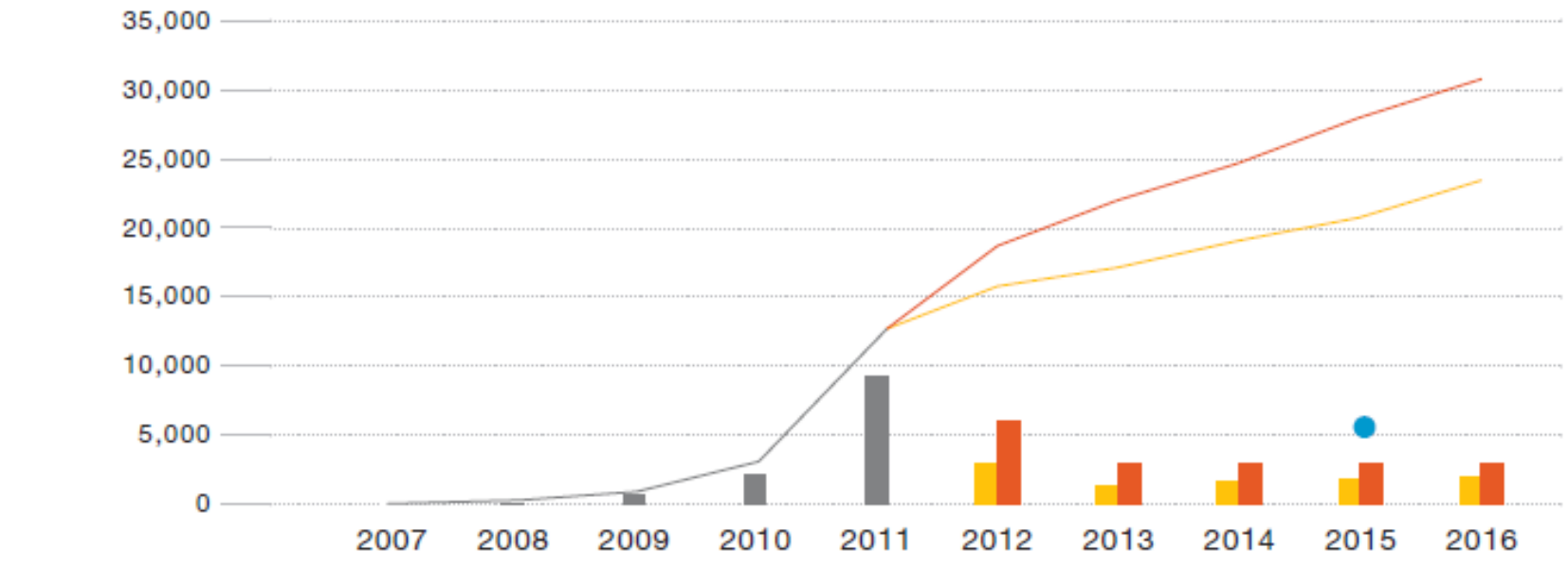
Figure 19 - Greece (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	1	10	36	150	426	500	500	500	500	500
EPIA Policy-Driven						750	800	850	900	1,000
EPIA Moderate (cumulative)	8	18	55	205	631	1,100	1,600	2,100	2,600	3,100
EPIA Policy-Driven (cumulative)						1,400	2,200	3,000	3,900	4,900
National target 2015									1,270	

Italy – 13 GW

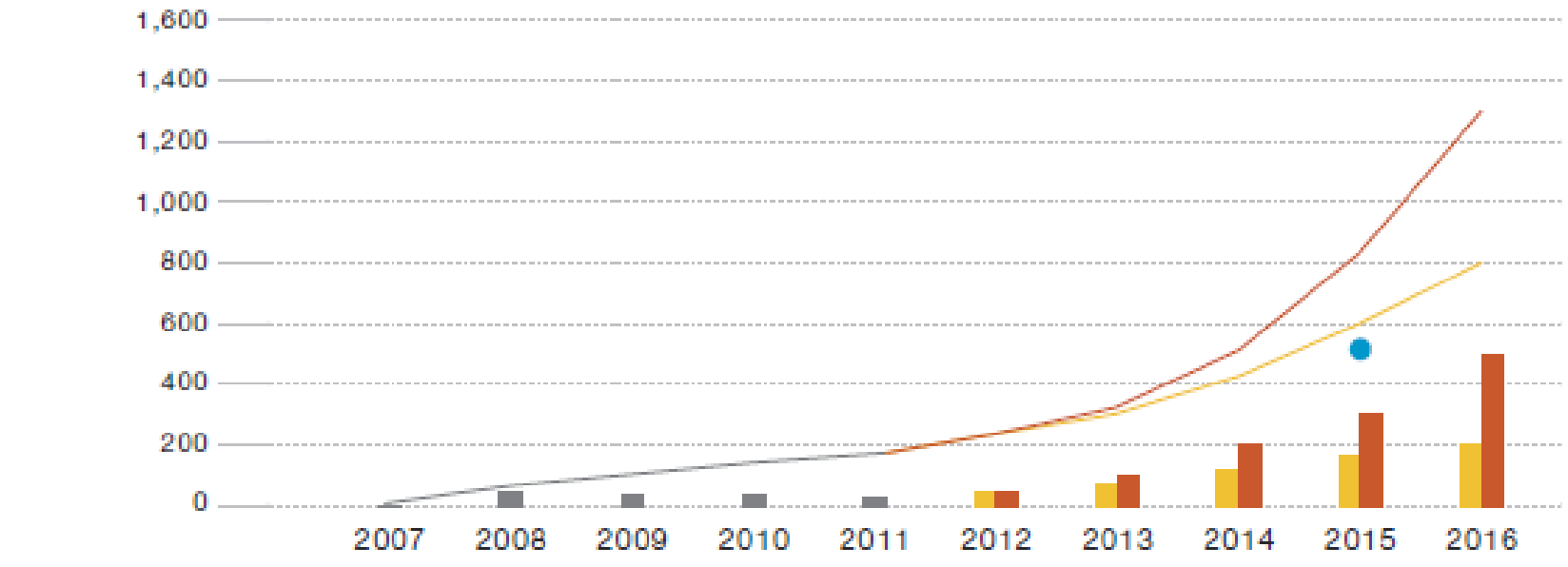
Figure 20 - Italy (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	58	338	712	2,326	9,284	3,000	1,500	1,750	2,000	2,000
EPIA Policy-Driven						6,000	3,000	3,000	3,000	3,000
EPIA Moderate (cumulative)	93	432	1,144	3,470	12,754	15,800	17,300	19,000	21,000	23,000
EPIA Policy-Driven (cumulative)						18,800	21,800	24,800	27,800	30,800
National target 2015									5,500	

Portugal – 0.18 GW

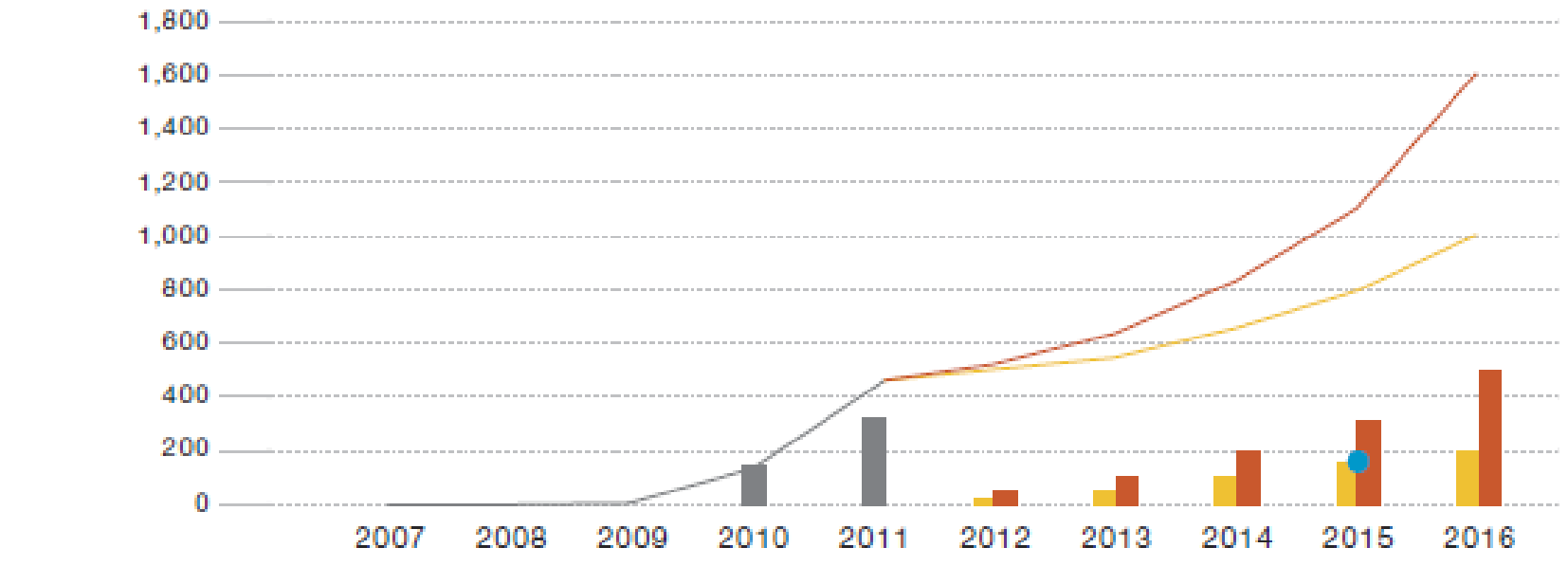
Figure 21 - Portugal (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	13	52	44	38	33	50	80	120	170	200
EPIA Policy-Driven						50	100	200	300	500
EPIA Moderate (cumulative)	16	68	112	150	183	230	310	430	600	800
EPIA Policy-Driven (cumulative)						230	330	530	830	1,300
National target 2015									540	

Slovakia – 0.5 GW

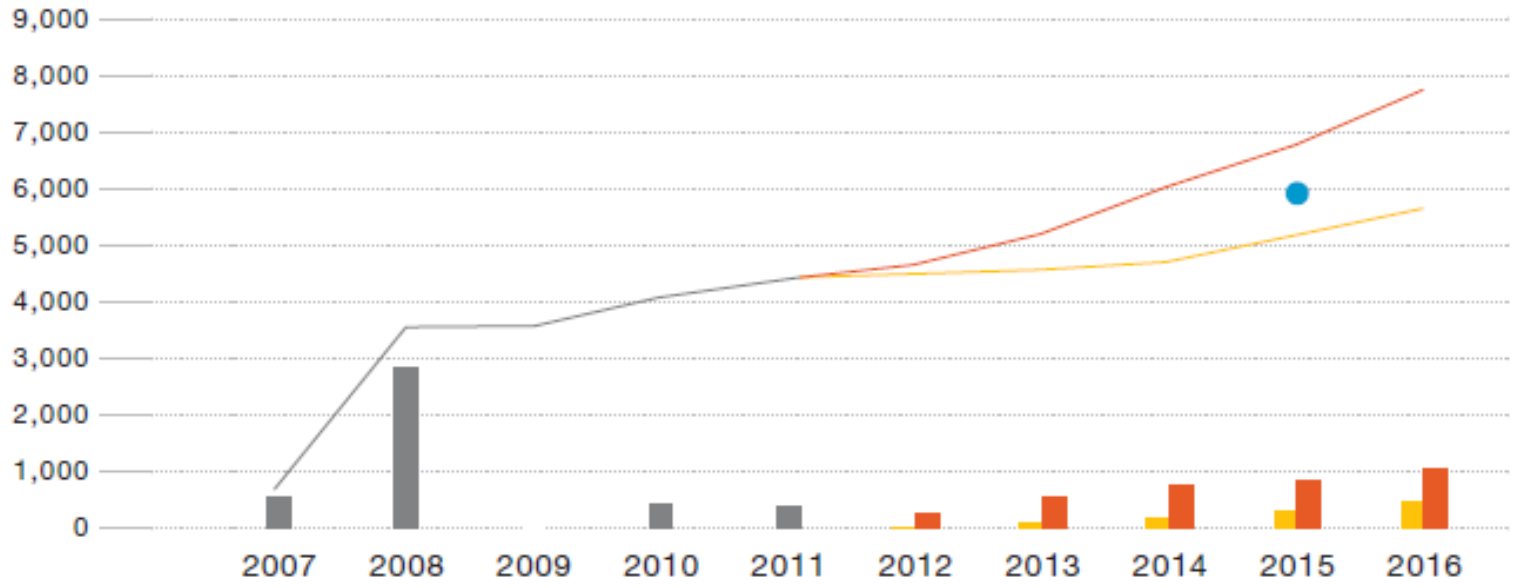
Figure 22 - Slovakia (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	0.3	0.3	0.1	145	321	30	50	100	150	200
EPIA Policy-Driven						50	100	200	300	500
EPIA Moderate (cumulative)	2	2	3	148	468	500	550	650	800	1,000
EPIA Policy-Driven (cumulative)						520	620	820	1,100	1,600
National target 2015									160	

Spain – 4.4 GW

Figure 23 - Spain (MW)

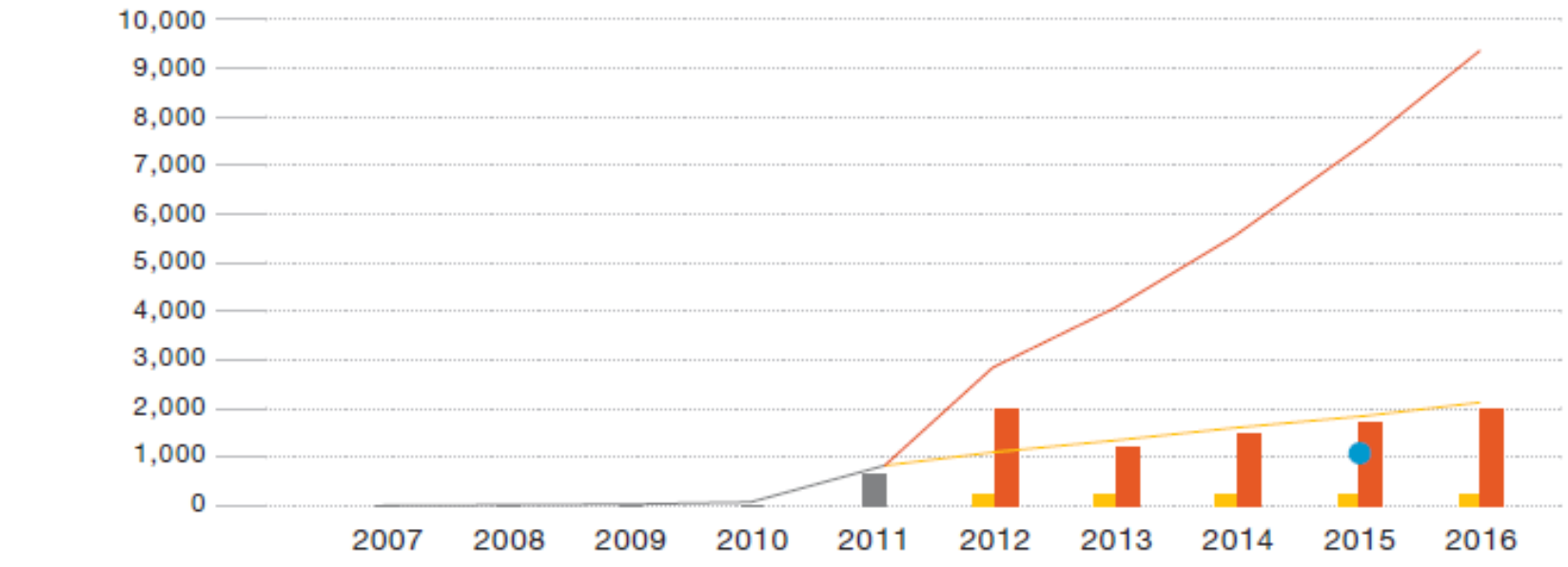


	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	569 *[542]*[a]	2,843 *[2,708]*[a]	20 *[19]*[a]	441 *[420]*[a]	372 *[354]*[a]	50	100	200	300	500
EPIA Policy-Driven						300	500	750	850	1,000
EPIA Moderate (cumulative)	724 *[690]*	3,568 *[3,398]*	3,588 *[3,417]*	4,029 *[3,837]*	4,400 *[4,191]*	4,500	4,600	4,800	5,100	5,600
EPIA Policy-Driven (cumulative)						4,700	5,200	6,000	6,800	7,800
National target 2015									5,918	

* AC figures officially reported.

United Kingdom – 0.9 GW

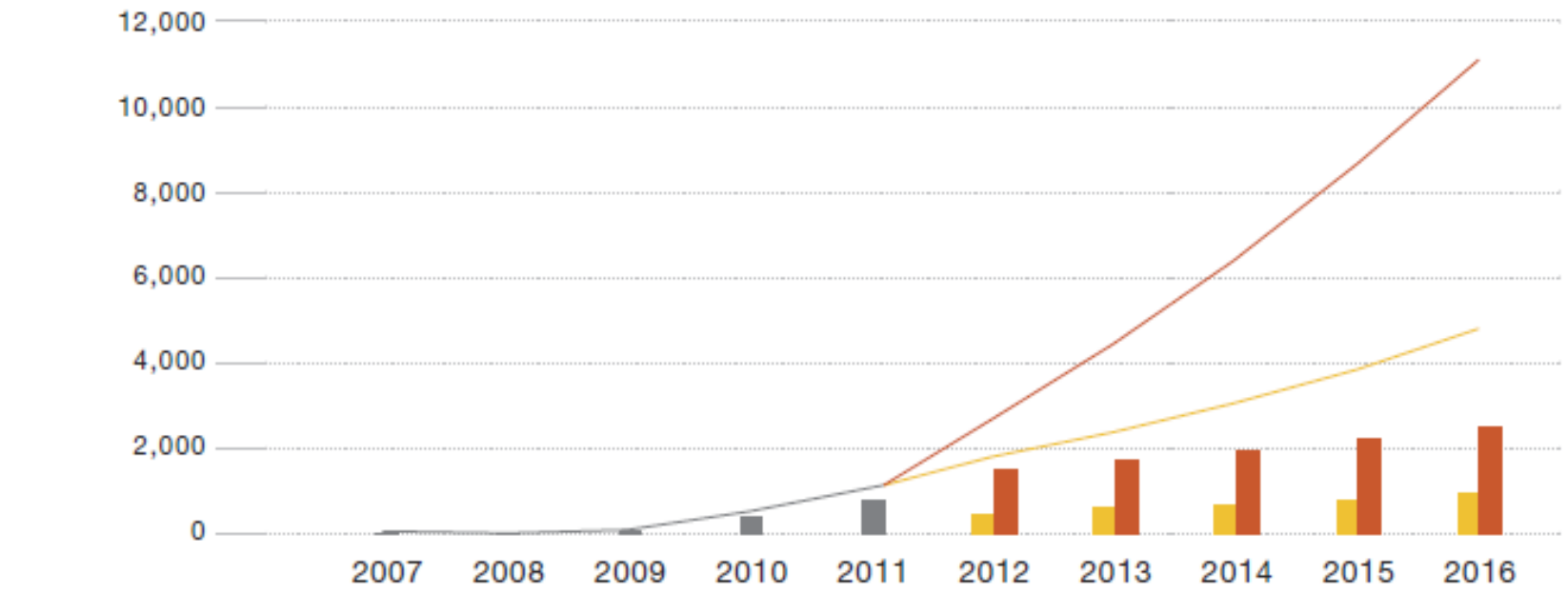
Figure 24 - United Kingdom (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	4	6	7	62	784	250	250	250	250	250
EPIA Policy-Driven						2,000	1,250	1,500	1,750	2,000
EPIA Moderate (cumulative)	16	22	29	91	875	1,100	1,400	1,600	1,900	2,100
EPIA Policy-Driven (cumulative)						2,900	4,100	5,600	7,400	9,400
National target 2015									1,070	

Australia – 1.3 GW

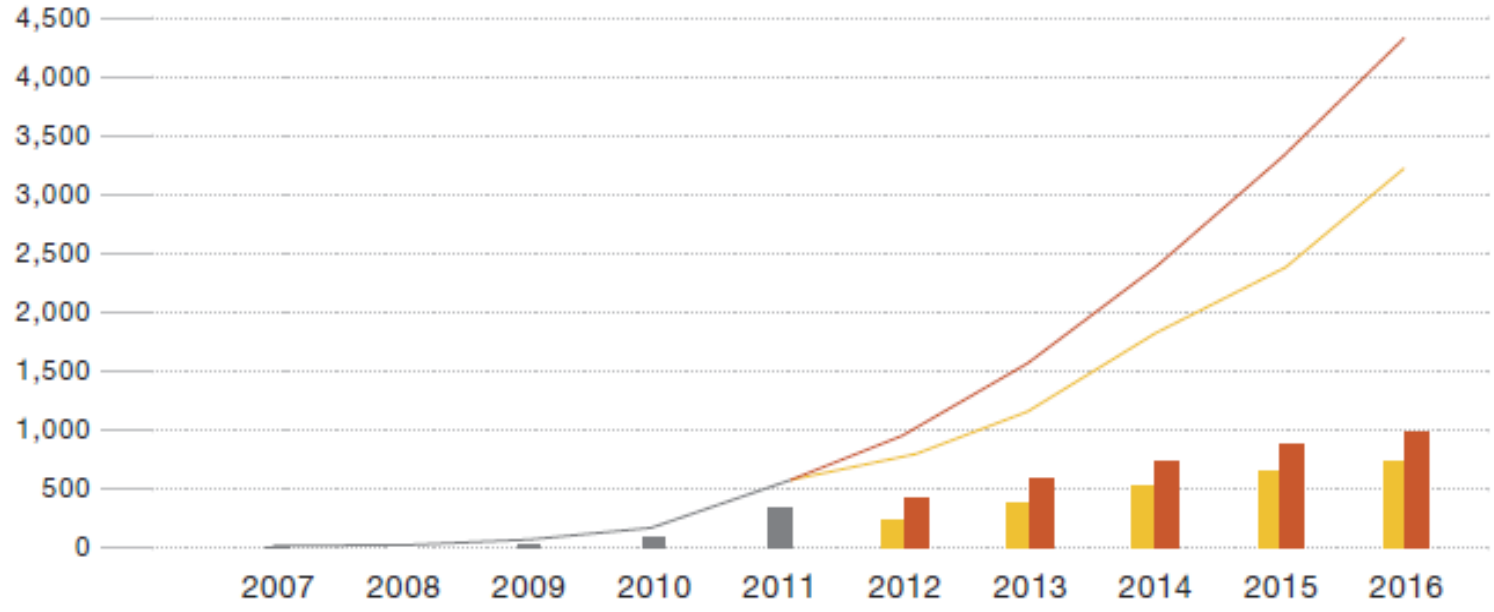
Figure 32 - Australia (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	6	12	79	387	774	500	600	700	800	1,000
EPIA Policy-Driven						1,500	1,750	2,000	2,250	2,500
EPIA Moderate (cumulative)	46	58	137	524	1,298	1,800	2,400	3,100	3,900	4,900
EPIA Policy-Driven (cumulative)						2,800	4,500	6,500	8,800	11,300

Canada – 0.6 GW

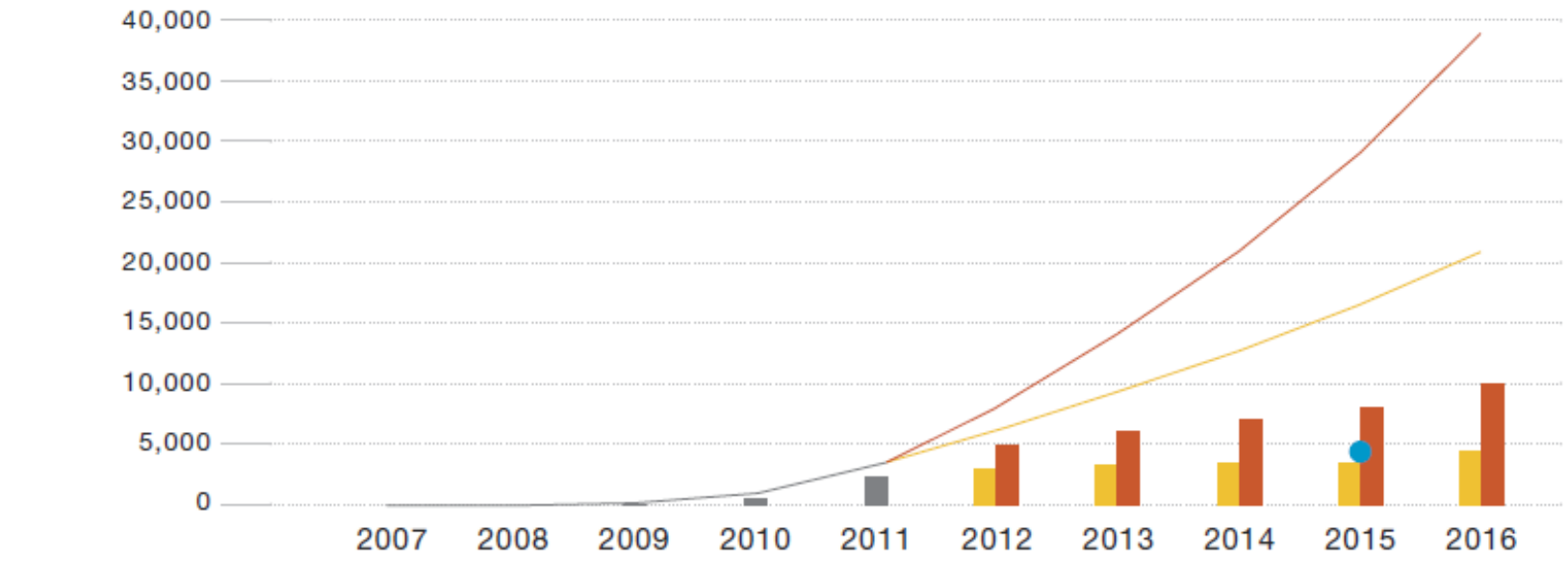
Figure 33 - Canada (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	5	7	62	105	364	250	400	550	650	750
EPIA Policy-Driven						450	600	750	900	1,000
EPIA Moderate (cumulative)	26	33	95	200	563	810	1,200	1,800	2,400	3,200
EPIA Policy-Driven (cumulative)						1,000	1,600	2,400	3,300	4,300

China – 3 GW

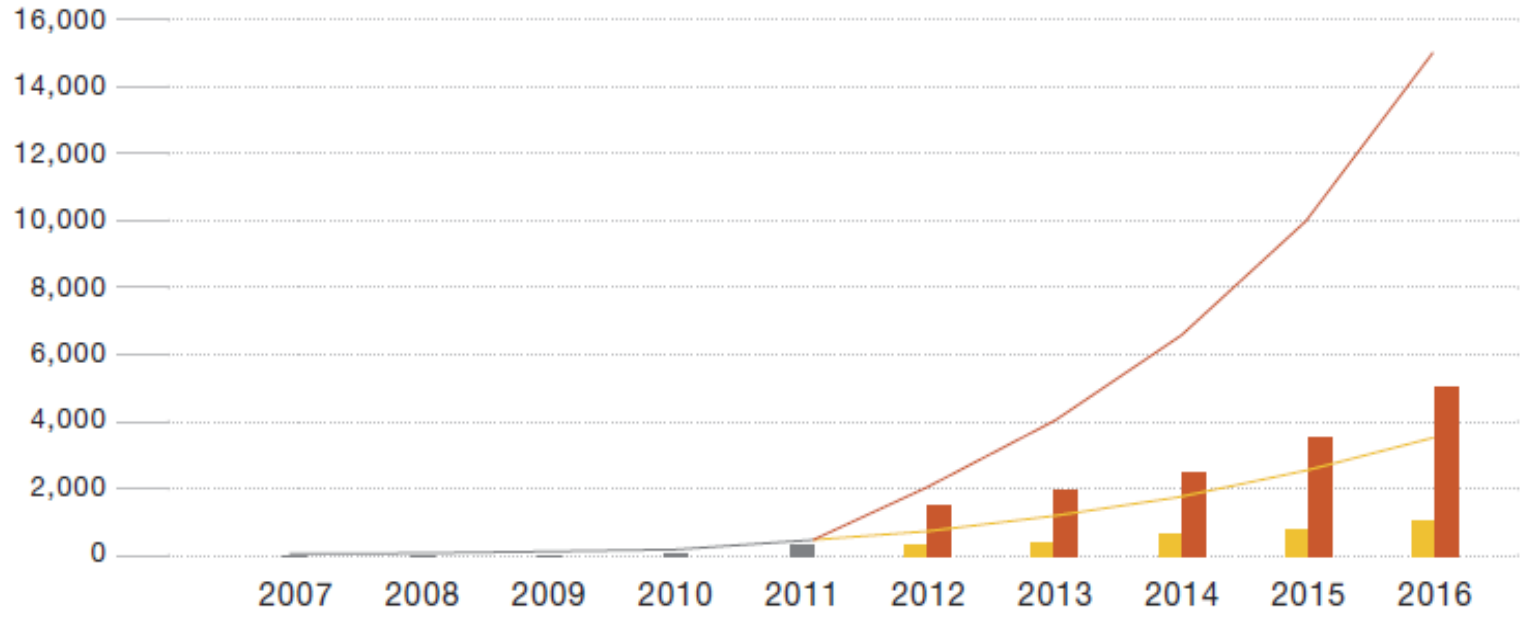
Figure 34 - China (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	20	45	228	520	2,200	3,000	3,250	3,500	3,750	4,500
EPIA Policy-Driven						5,000	6,000	7,000	8,000	10,000
EPIA Moderate (cumulative)	100	145	373	893	3,093	6,100	9,300	12,800	16,600	21,100
EPIA Policy-Driven (cumulative)						8,100	14,100	21,100	29,100	39,100
National target 2015									5,000	

India – 0.5 GW

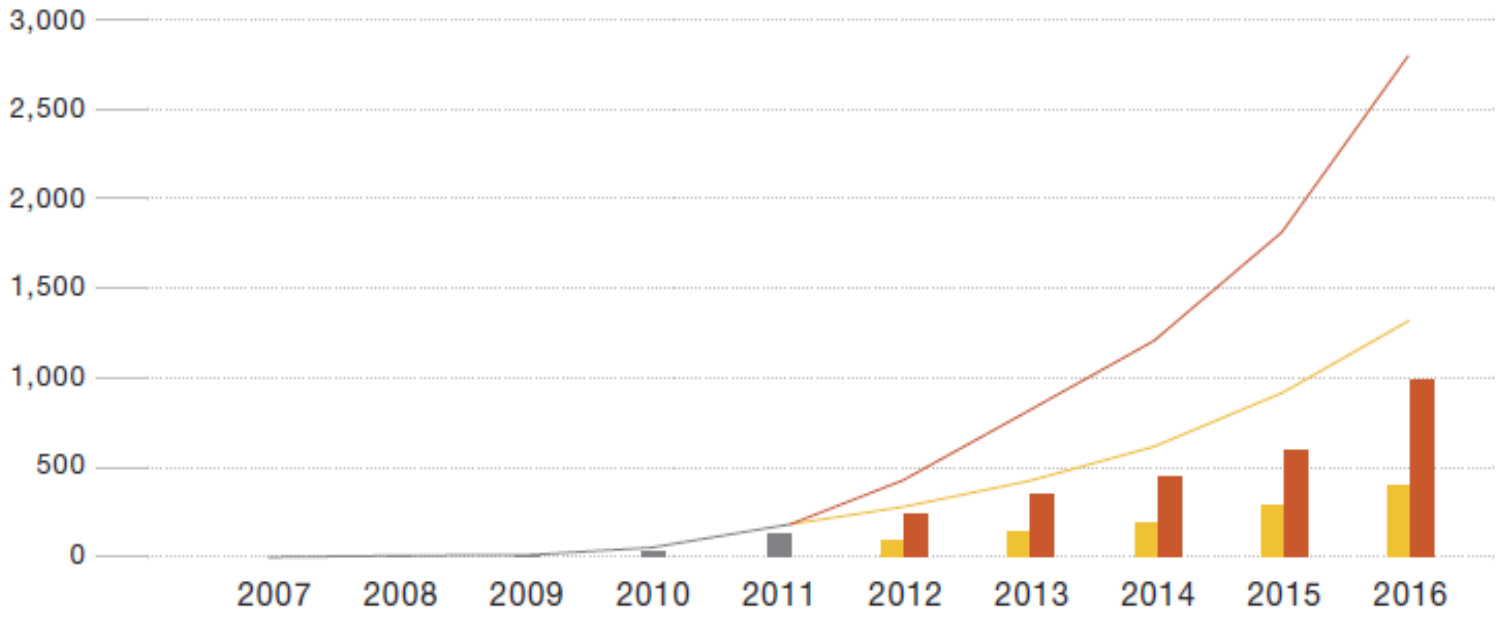
Figure 35 - India (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	20	40	30	60	300	300	450	600	800	1,000
EPIA Policy-Driven						1,500	2,000	2,500	3,500	5,000
EPIA Moderate (cumulative)	31	71	101	161	461	760	1,200	1,800	2,600	3,600
EPIA Policy-Driven (cumulative)						2,000	4,000	6,500	10,000	15,000

Israel – 0.2 GW

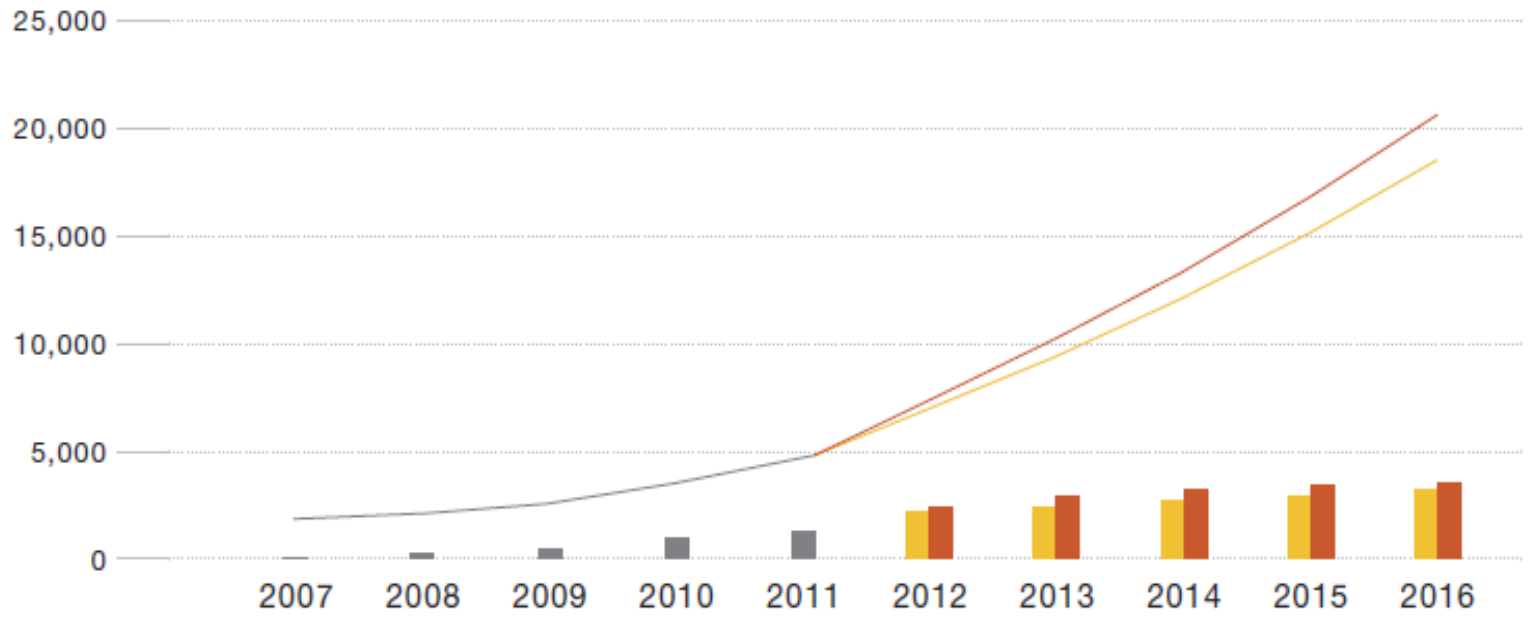
Figure 36 - Israel (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	N/A	N/A	21	45	130	100	150	200	300	400
EPIA Policy-Driven						250	350	450	600	1,000
EPIA Moderate (cumulative)	N/A	N/A	21	66	196	300	450	650	950	1,300
EPIA Policy-Driven (cumulative)						450	800	1,200	1,800	2,800

Japan – 4.9 GW

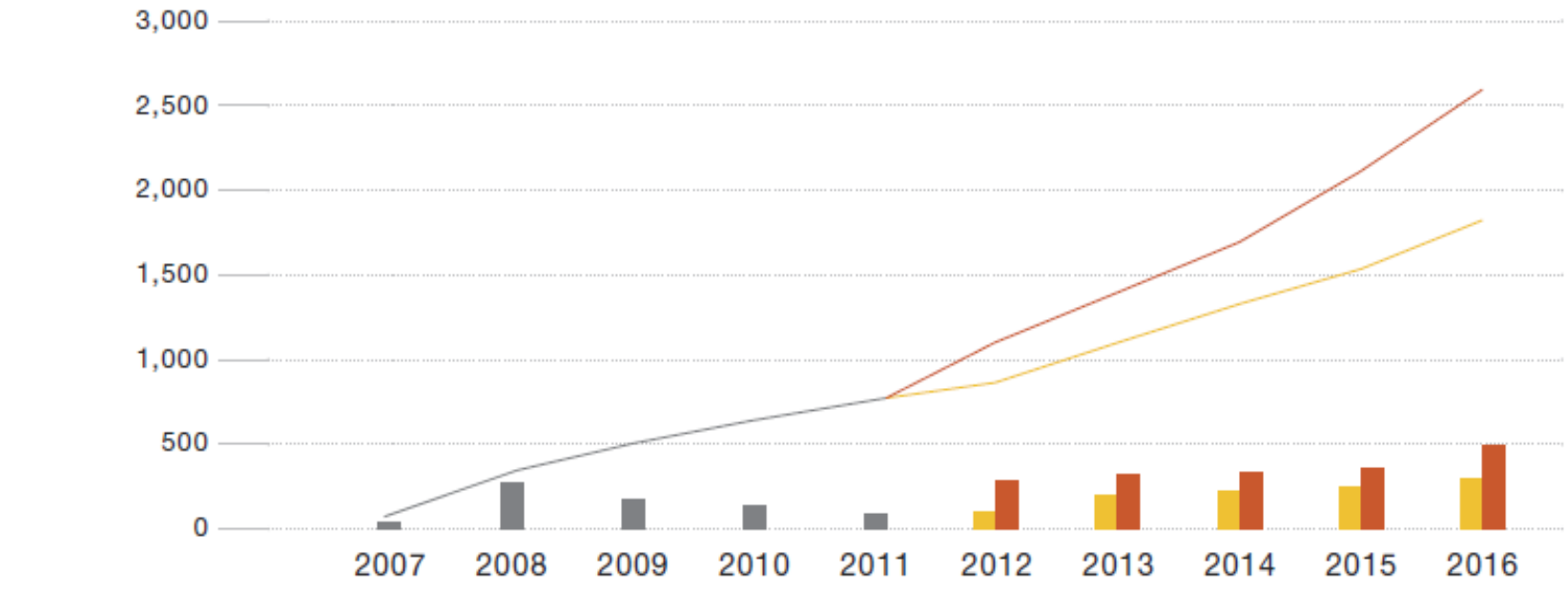
Figure 37 - Japan (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	210	230	480	991	1,296	2,200	2,500	2,750	3,000	3,250
EPIA Policy-Driven						2,500	3,000	3,200	3,400	3,600
EPIA Moderate (cumulative)	1,917	2,147	2,627	3,618	4,914	7,100	9,600	12,400	15,400	18,600
EPIA Policy-Driven (cumulative)						7,400	10,400	13,600	17,000	20,600

Korea – 0.75 GW

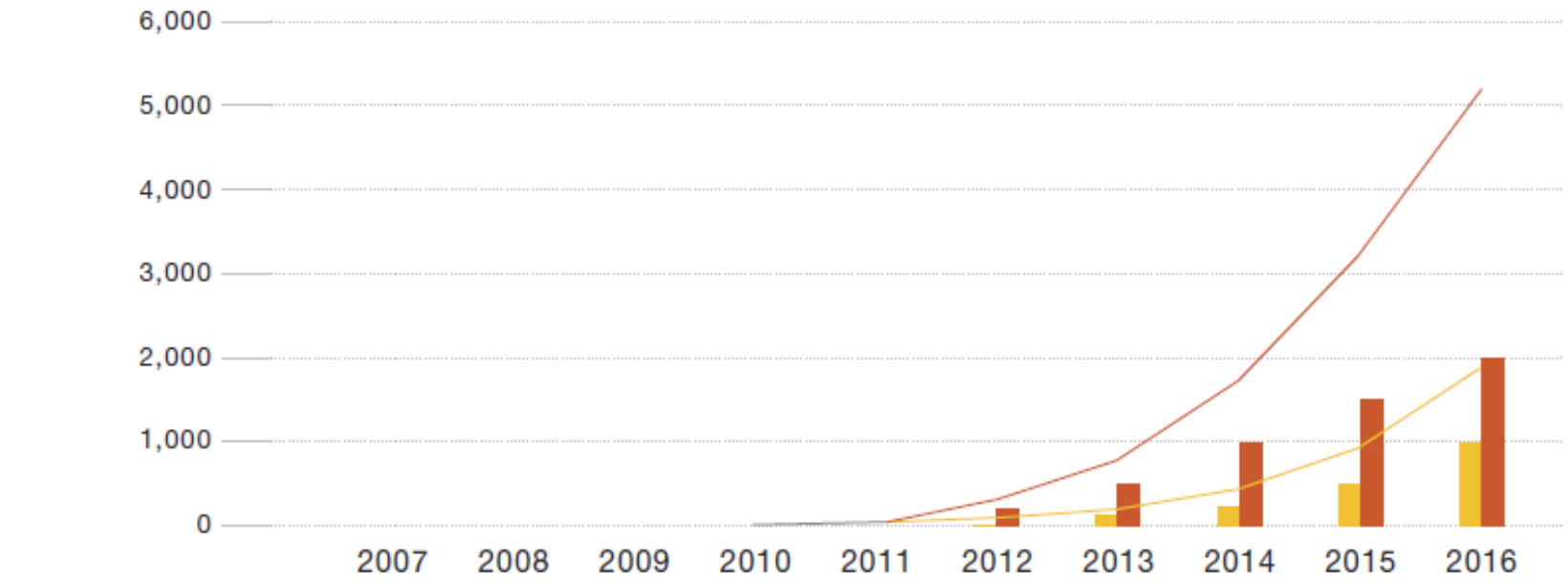
Figure 38 - Korea (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	45	276	167	138	92	100	200	225	250	300
EPIA Policy-Driven						300	320	340	360	500
EPIA Moderate (cumulative)	81	357	524	662	754	850	1,100	1,300	1,500	1,800
EPIA Policy-Driven (cumulative)						1,100	1,400	1,700	2,100	2,600

South Africa – 0

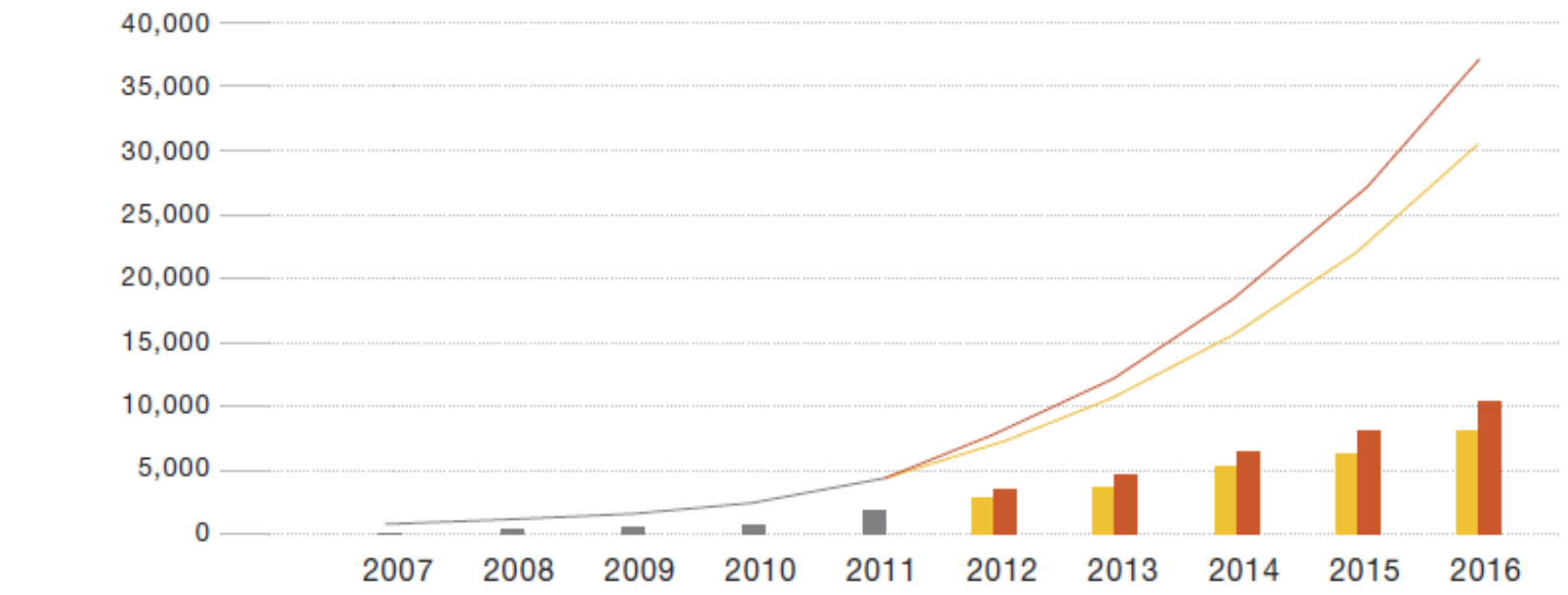
Figure 39 - South Africa (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	N/A	N/A	N/A	N/A	1	25	100	250	500	1,000
EPIA Policy-Driven						200	500	1,000	1,500	2,000
EPIA Moderate (cumulative)	N/A	N/A	N/A	40	41	70	170	420	920	1,900
EPIA Policy-Driven (cumulative)						240	740	1,700	3,200	5,200

USA – 4.4 GW

Figure 40 - USA (MW)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EPIA Moderate	207	342	477	878	1,855	2,800	3,700	5,100	6,400	8,100
EPIA Policy-Driven						3,500	4,600	6,400	8,000	10,200
EPIA Moderate (cumulative)	831	1,173	1,650	2,528	4,383	7,200	10,900	16,000	22,400	30,500
EPIA Policy-Driven (cumulative)						7,900	12,500	18,900	26,900	37,100