



# GLOBAL WIND ENERGY OUTLOOK | 2016



*December 15, 2016*

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Associations



GWEC - Uniting the global wind industry and its representative associations

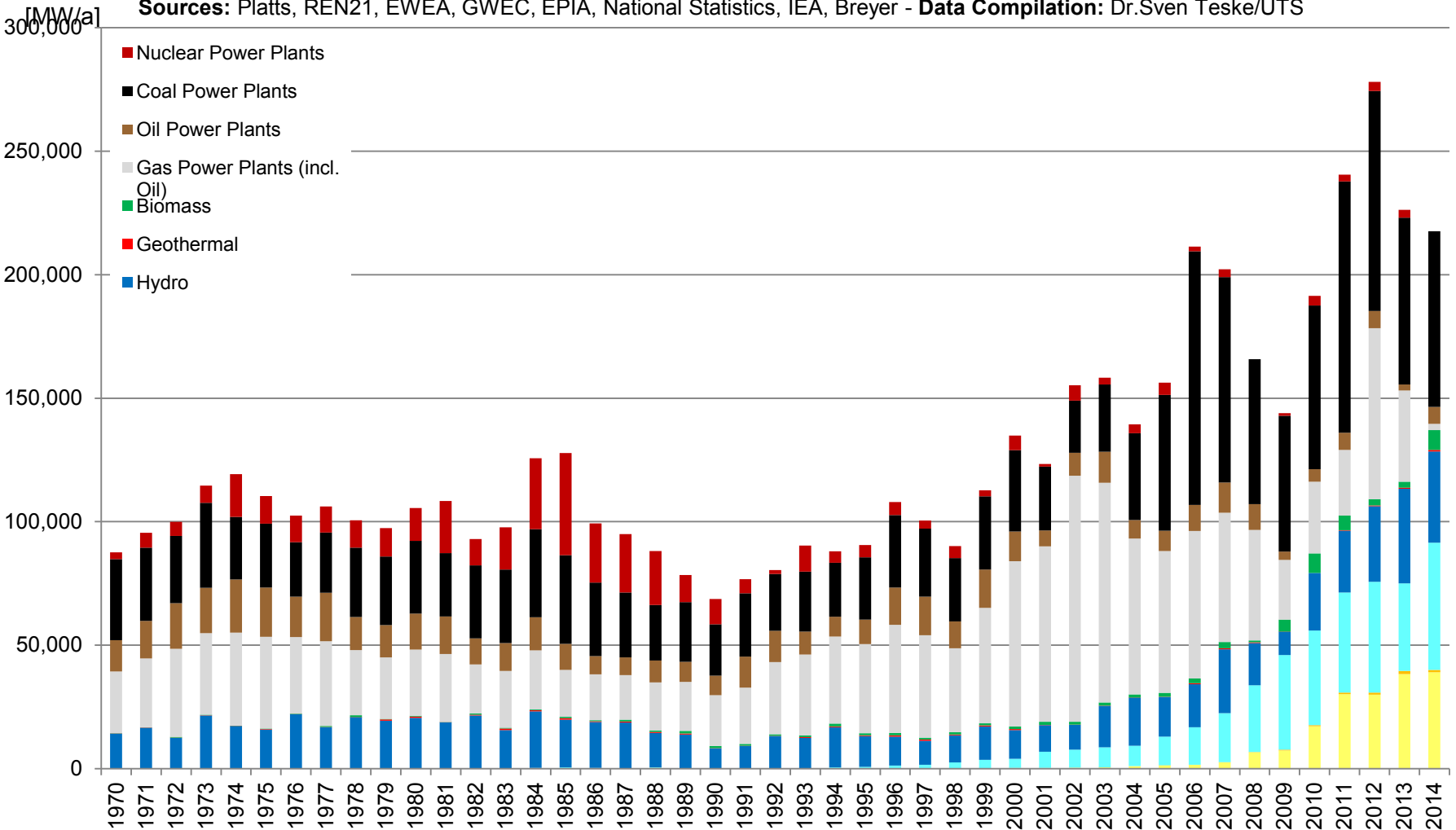
# Outline:

1. Status of global power markets
2. Status of global wind power markets
3. Short term projections
4. Global Wind Energy Outlook Scenarios
5. New markets
6. Conclusions and Looking Ahead

# The Current Renewable and Power Market

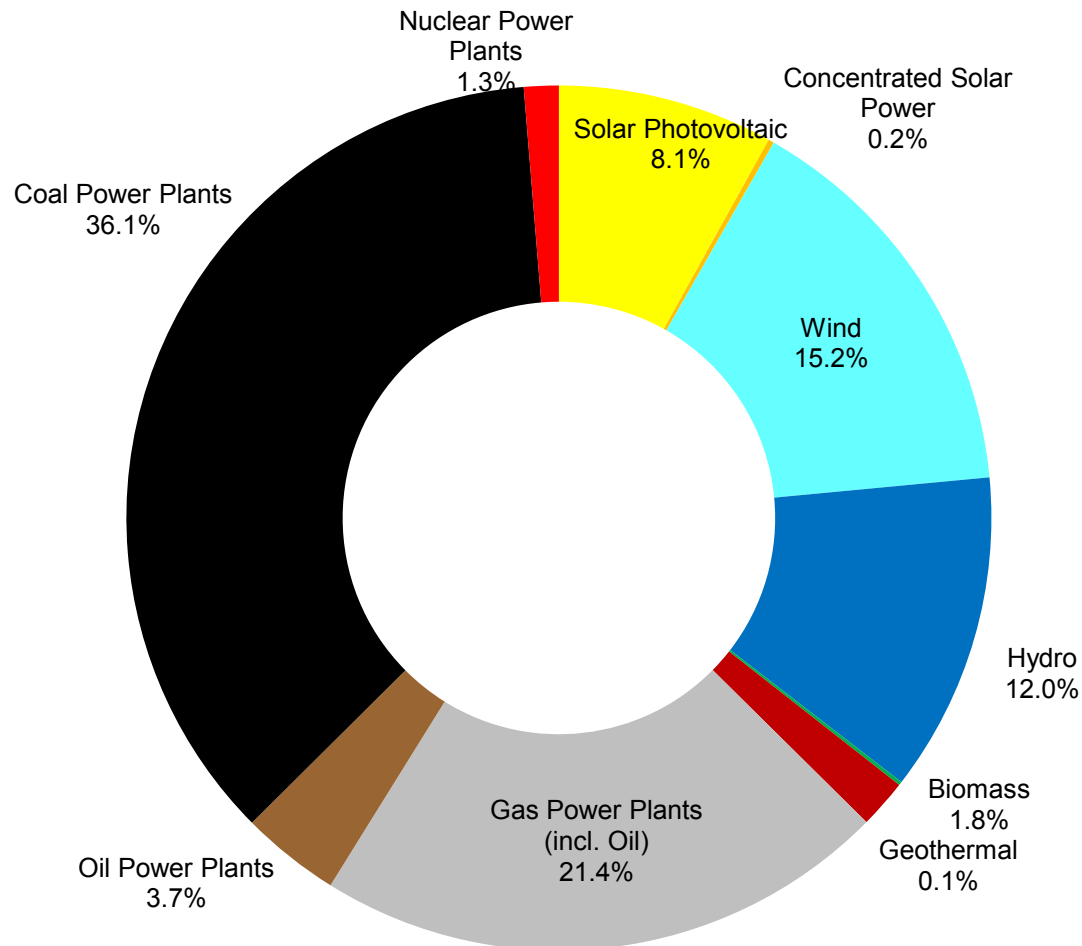
# Global Power Plants - Annual Market 1970 - 2014

Sources: Platts, REN21, EWEA, GWEC, EPIA, National Statistics, IEA, Breyer - Data Compilation: Dr.Sven Teske/UTS

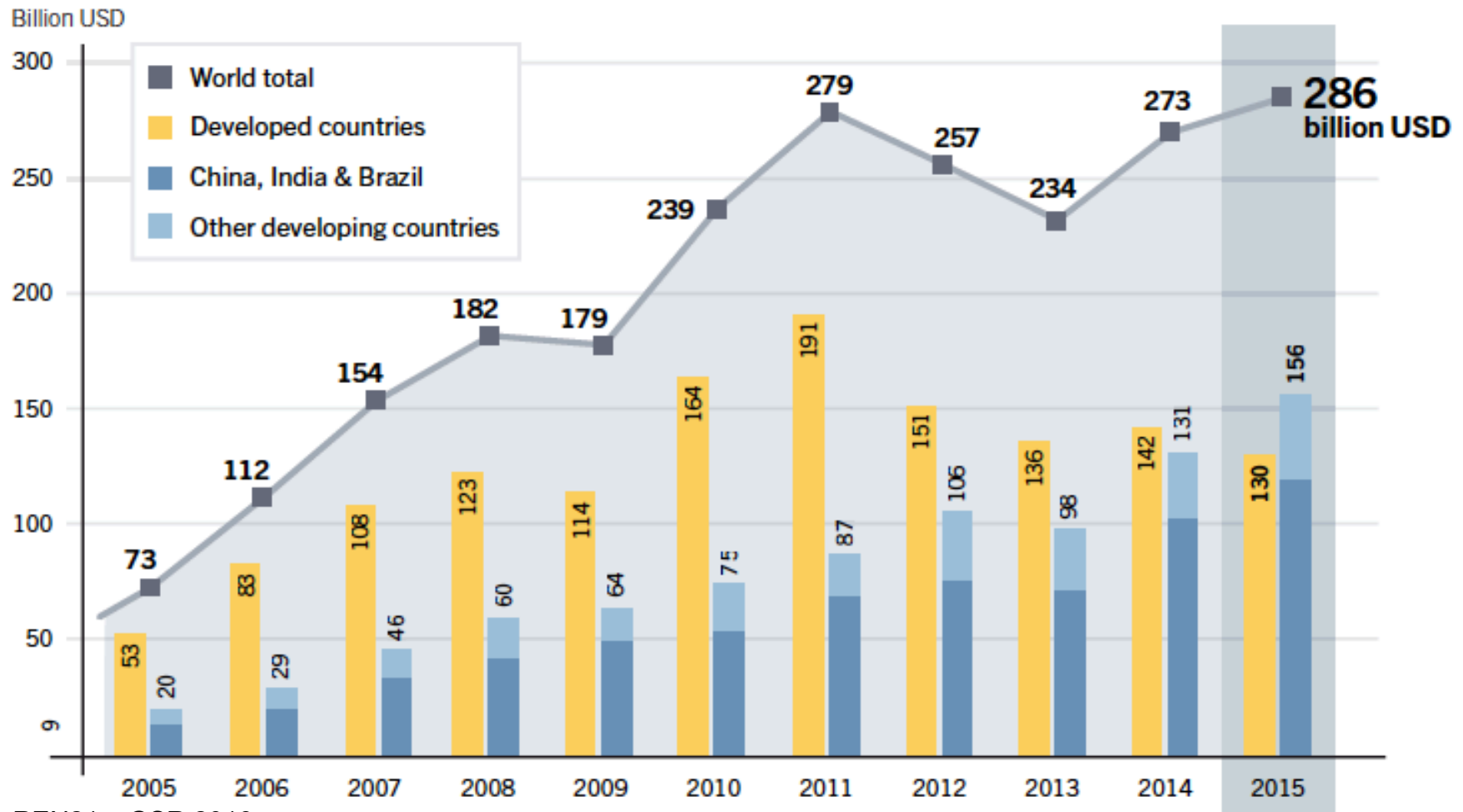


# Global Power Plant Market Conditions:

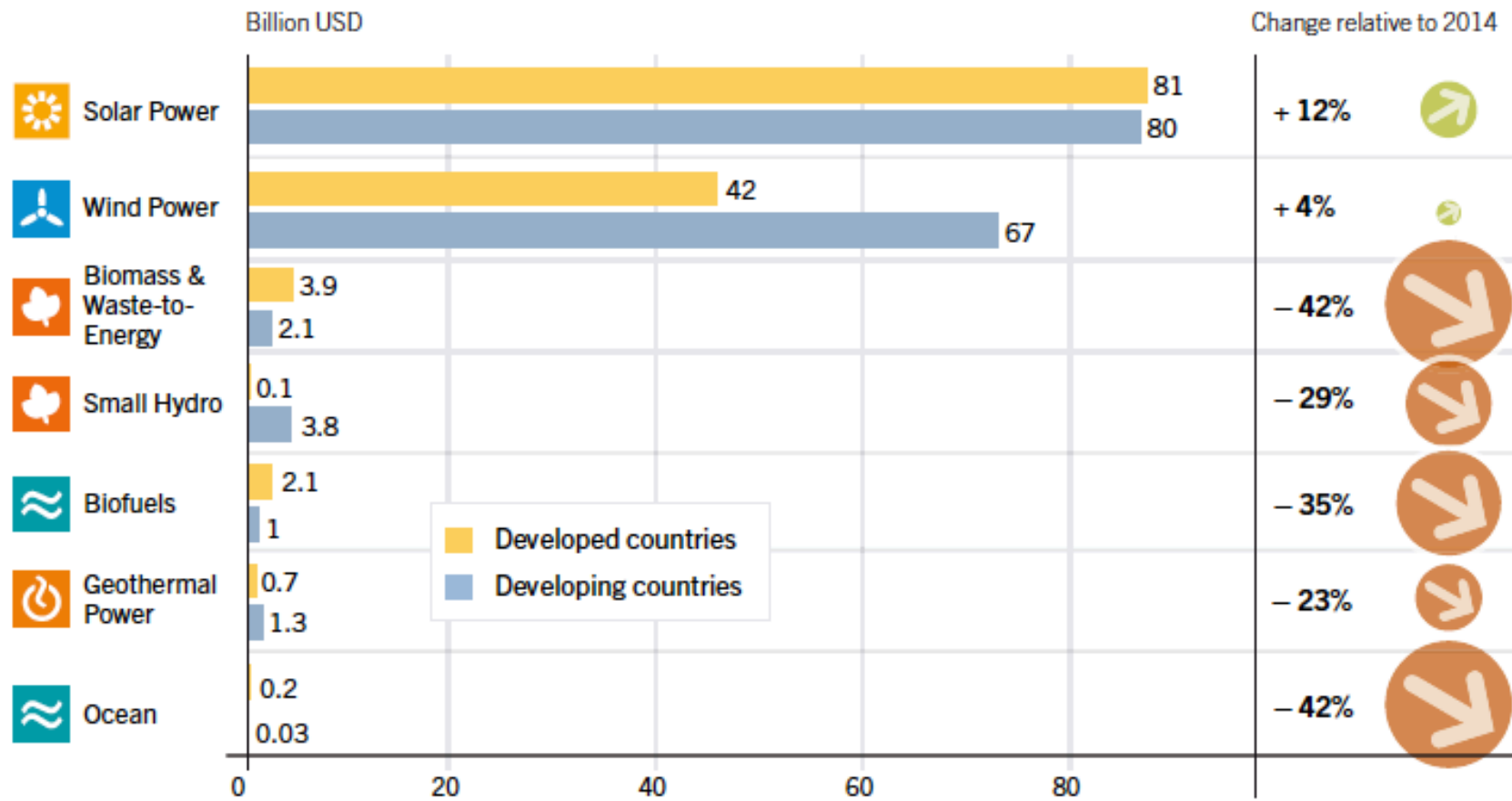
## Global: Power Plant Market Shares: 2004 - 2014



## Global New Investment in Renewable Power and Fuels, Developed, Emerging and Developing Countries, 2005–2015



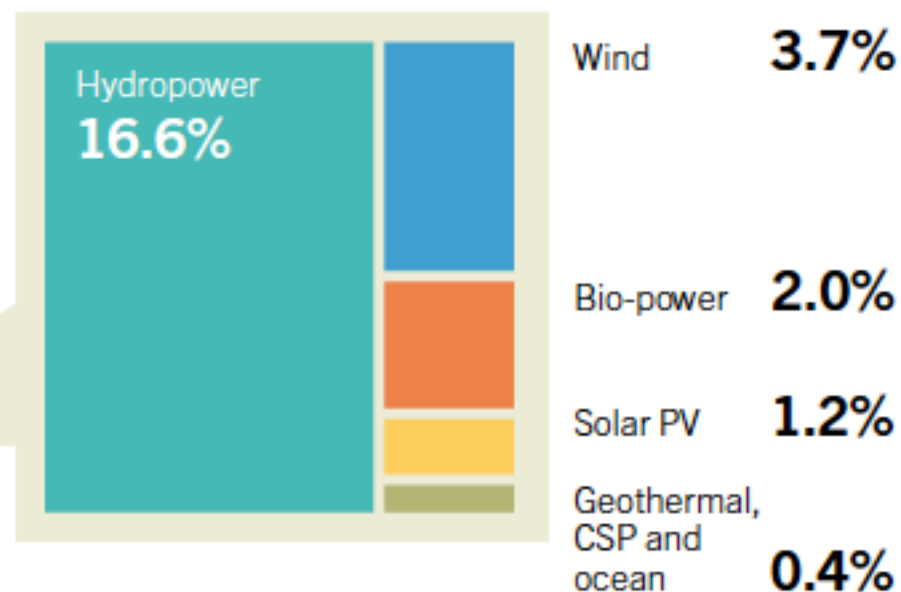
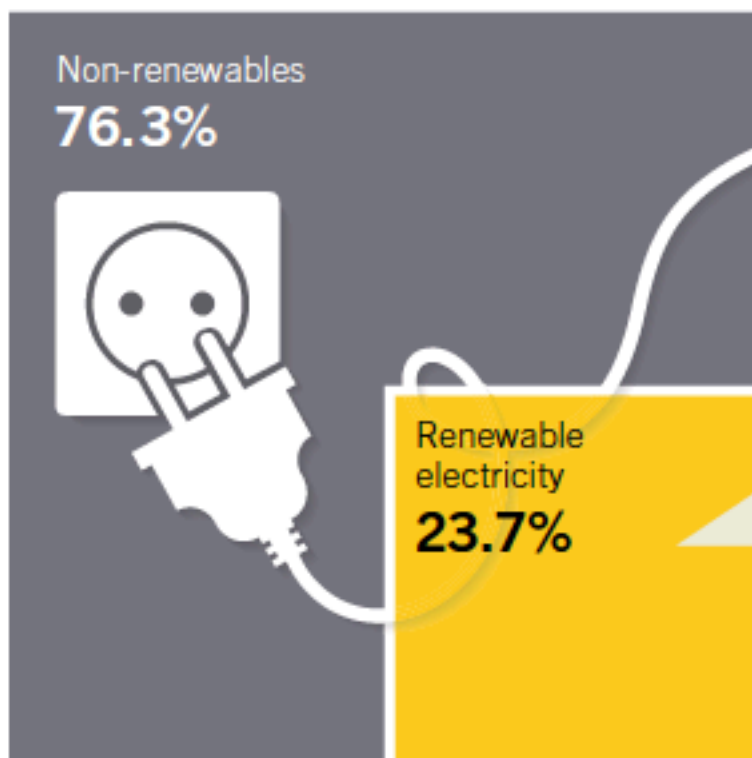
## Global New Investment in Renewable Energy by Technology, Developed and Developing Countries, 2015



Source: BNEF



## Estimated Renewable Energy Share of Global Electricity Production, End-2015

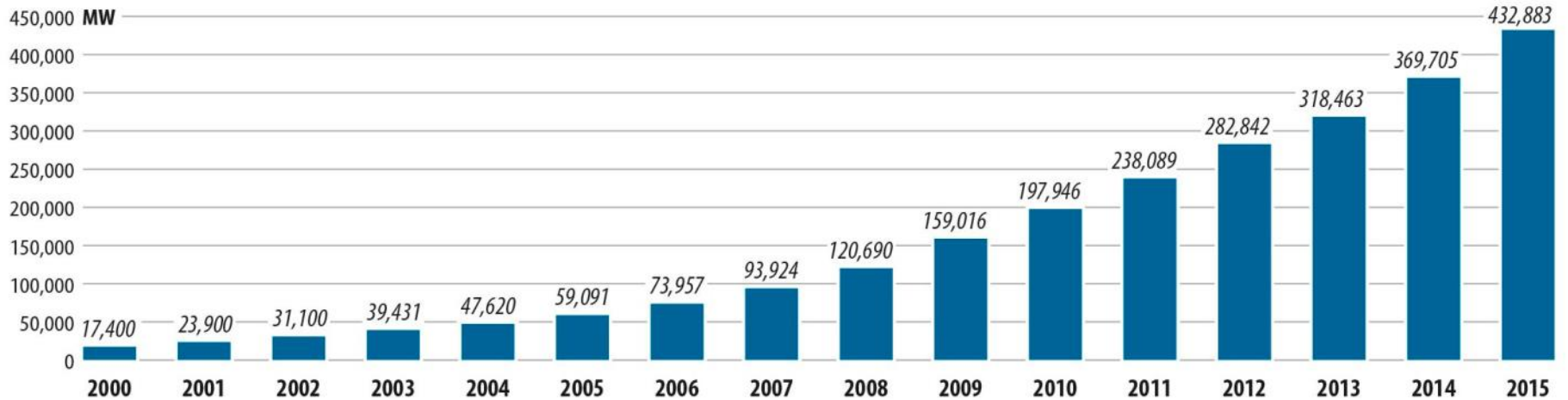


Based on renewable generating capacity at year-end 2015.  
Percentages do not add up internally due to rounding.

# Status Wind Power Market

**2015 growth: 17%**

**GLOBAL CUMULATIVE INSTALLED WIND CAPACITY 2000-2015**

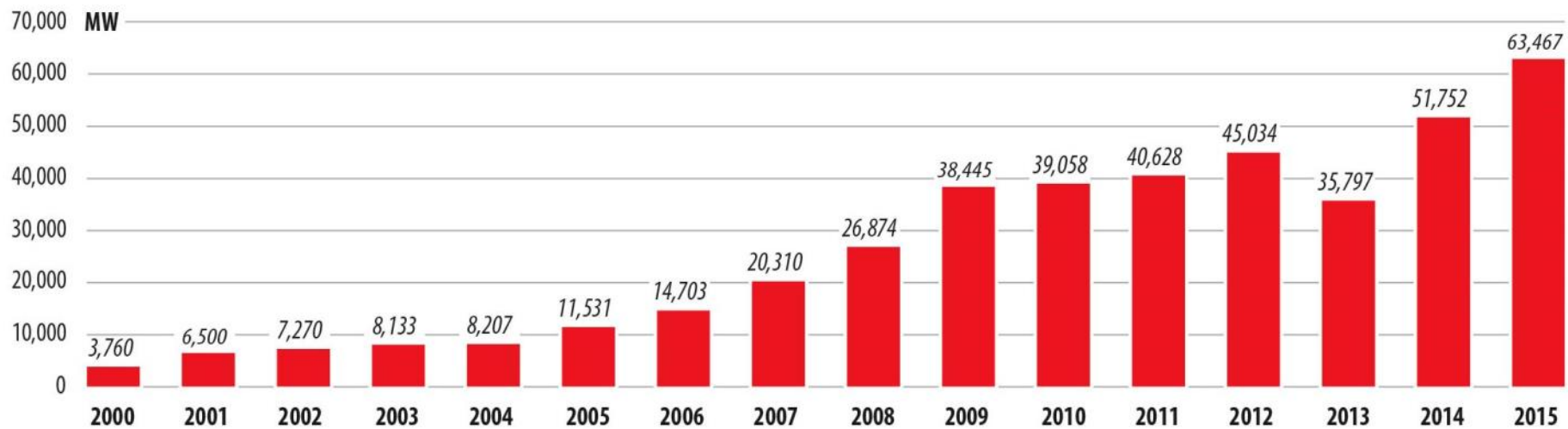


Source: GWEC

**16 yr avg. growth: 24.2%**

**2015 growth: 22%**

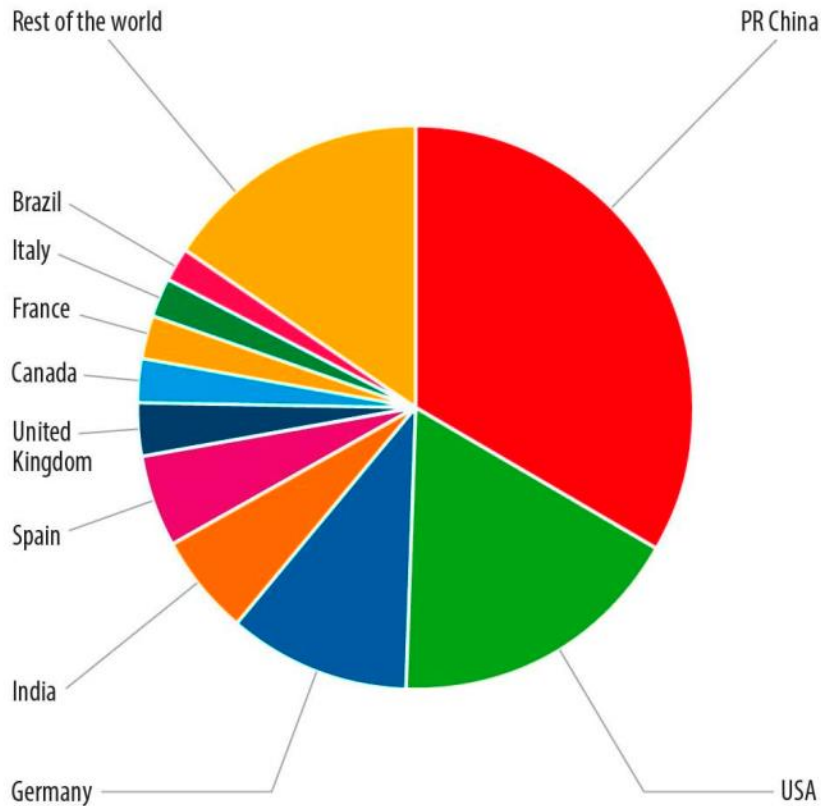
**GLOBAL ANNUAL INSTALLED WIND CAPACITY 2000-2015**



Source: GWEC

**16 yr avg. growth: 24.9%**

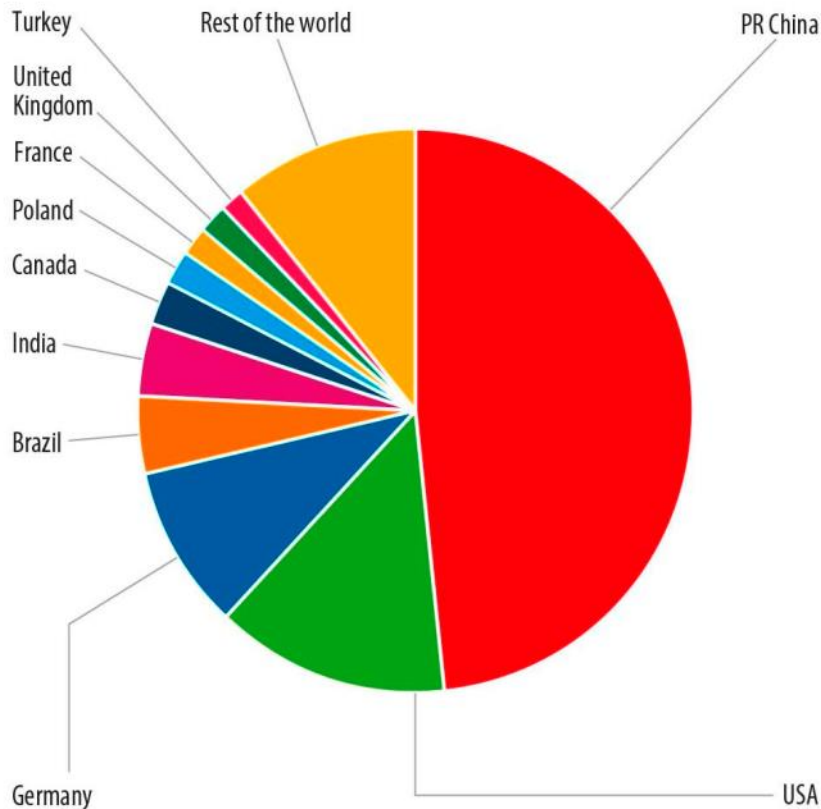
**TOP 10 CUMULATIVE CAPACITY DEC 2015**



Country	MW	% Share
PR China	145,362	33.6
USA	74,471	17.2
Germany	44,947	10.4
India	25,088	5.8
Spain	23,025	5.3
United Kingdom	13,603	3.1
Canada	11,205	2.6
France	10,358	2.4
Italy	8,958	2.1
Brazil	8,715	2.0
Rest of the world	67,151	15.5
<b>Total TOP 10</b>	<b>365,731</b>	<b>84.5</b>
<b>World Total</b>	<b>432,883</b>	<b>100</b>

Source: GWEC

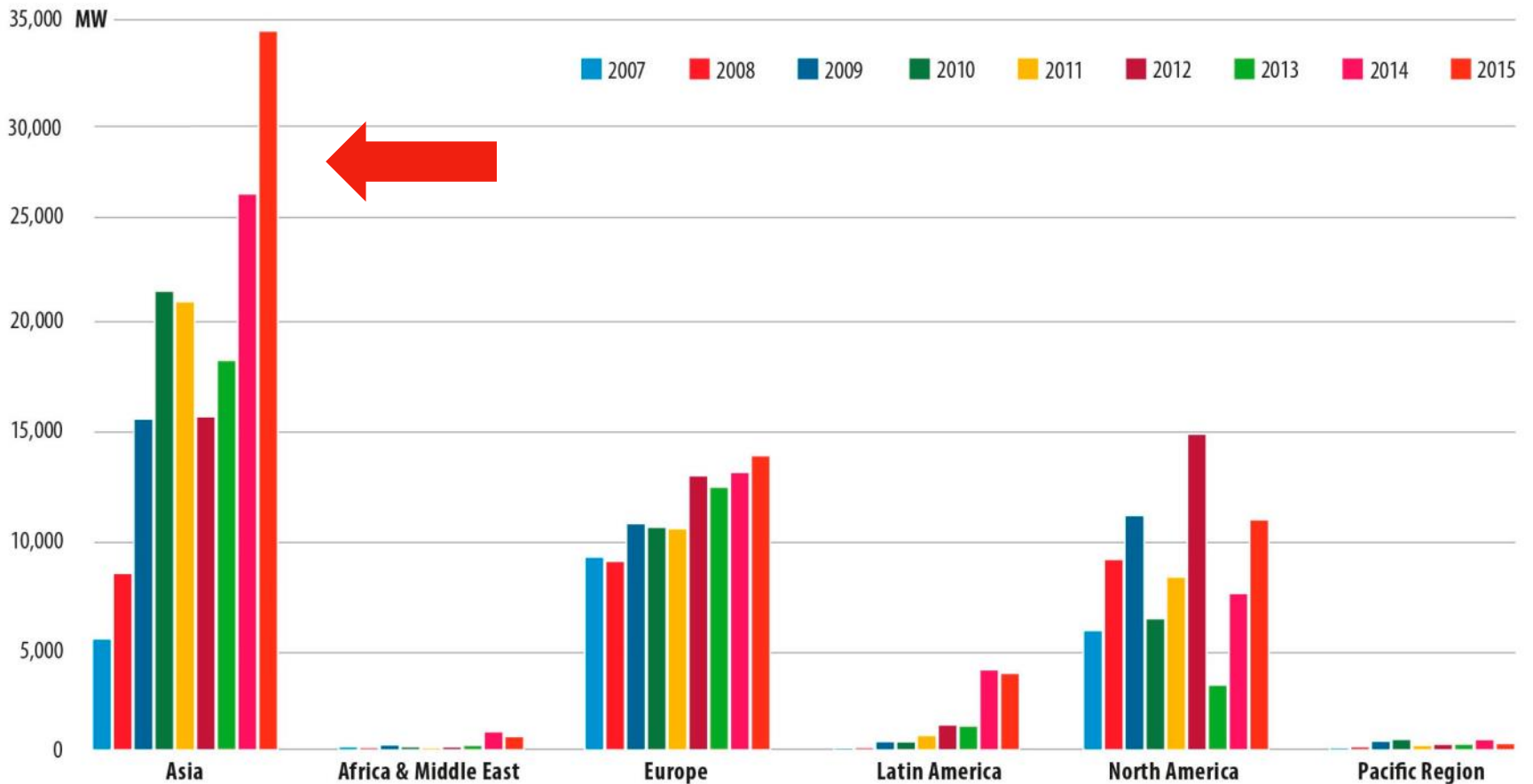
**TOP 10 NEW INSTALLED CAPACITY JAN-DEC 2015**



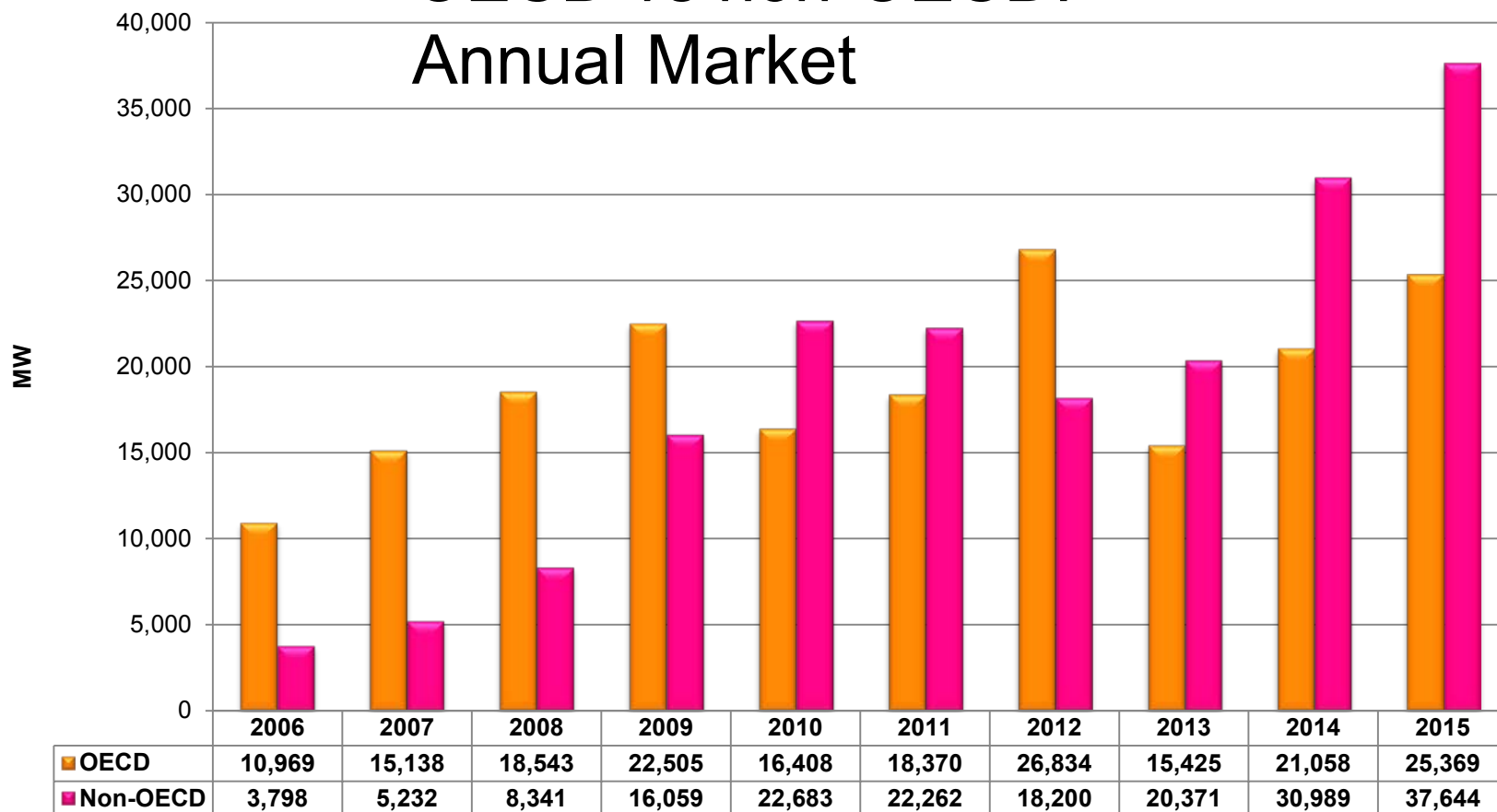
Country	MW	% Share
PR China	30,753	48.5
USA	8,598	13.5
Germany	6,013	9.5
Brazil	2,754	4.3
India	2,623	4.1
Canada	1,506	2.4
Poland	1,266	2.0
France	1,073	1.7
United Kingdom	975	1.5
Turkey	956	1.5
Rest of the world	6,950	11.0
<b>Total TOP 10</b>	<b>56,517</b>	<b>89</b>
<b>World Total</b>	<b>63,467</b>	<b>100</b>

Source: GWEC

**ANNUAL INSTALLED CAPACITY BY REGION 2007-2015**

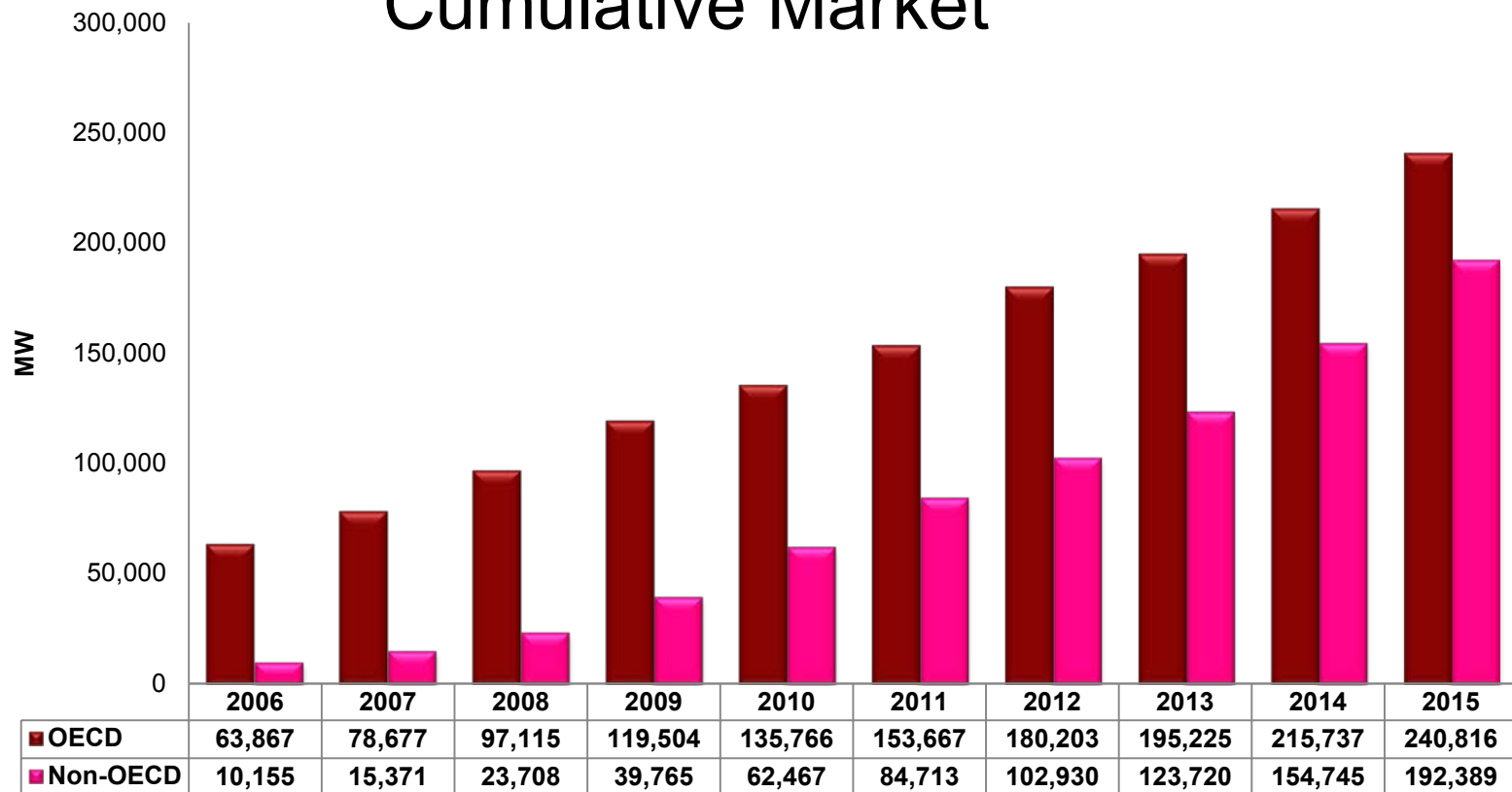


## OECD vs non-OECD: Annual Market

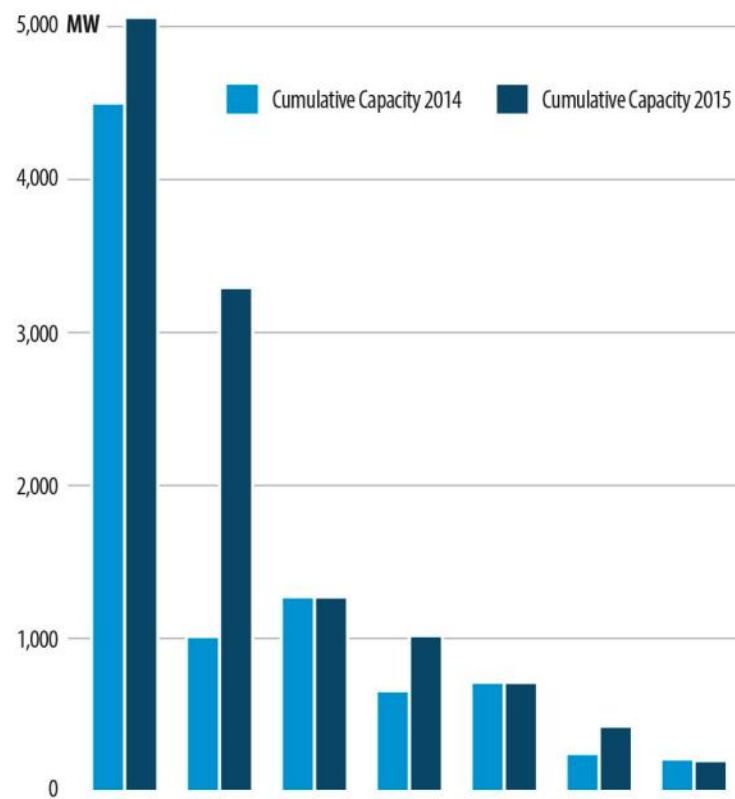




## OECD vs non-OECD: Cumulative Market

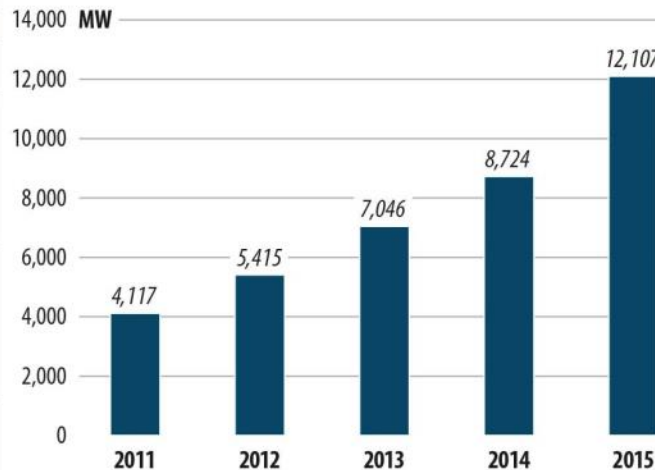


**GLOBAL CUMULATIVE OFFSHORE WIND CAPACITY IN 2015**

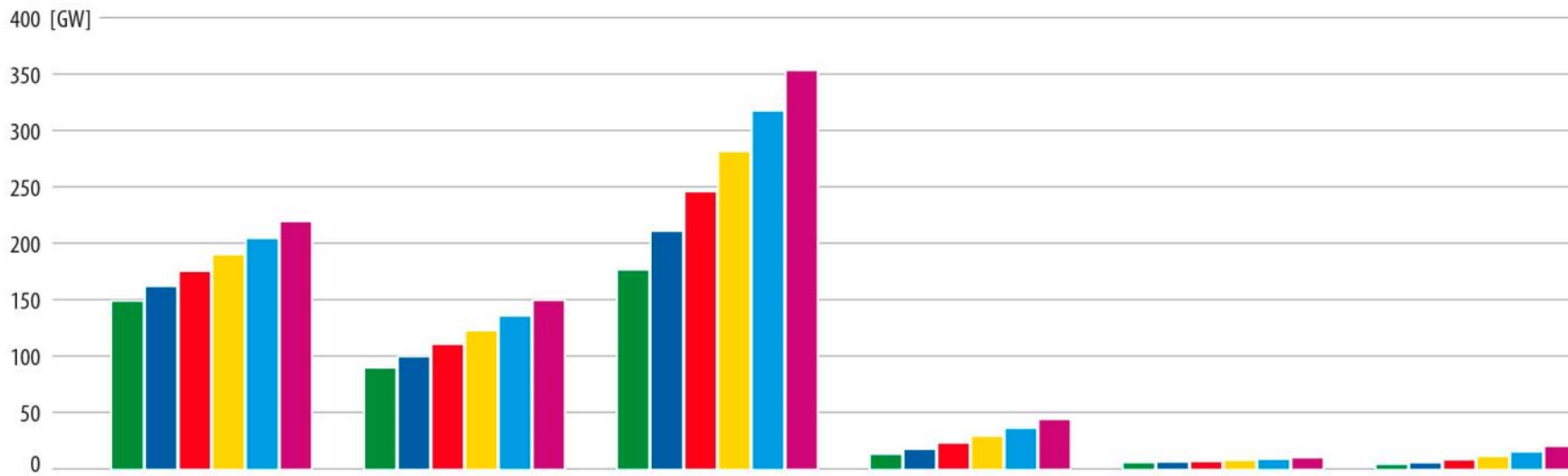


	UK	Germany	Denmark	PR China	Belgium	Netherlands	Sweden	Japan	Finland	Ireland	S Korea	Spain	Norway	Portugal	US	Total
<b>Total 2014</b>	4,500.4	1,012	1,271	654	712	247	212	50	26	25	5	5	2	2	0.02	<b>8,724</b>
<b>New 2015</b>	572.1	2,282.4	0	360.5	0	180	0	3	0	0	0	0	0	0	0	<b>3,398</b>
<b>Total 2015</b>	5,066.5	3,294.6	1,271.3	1,014.7	712.2	426.8	201.7	53	26.3	25.2	5	5	2.3	2	0.02	<b>12,107</b>

**ANNUAL CUMULATIVE CAPACITY (2011-2015)**



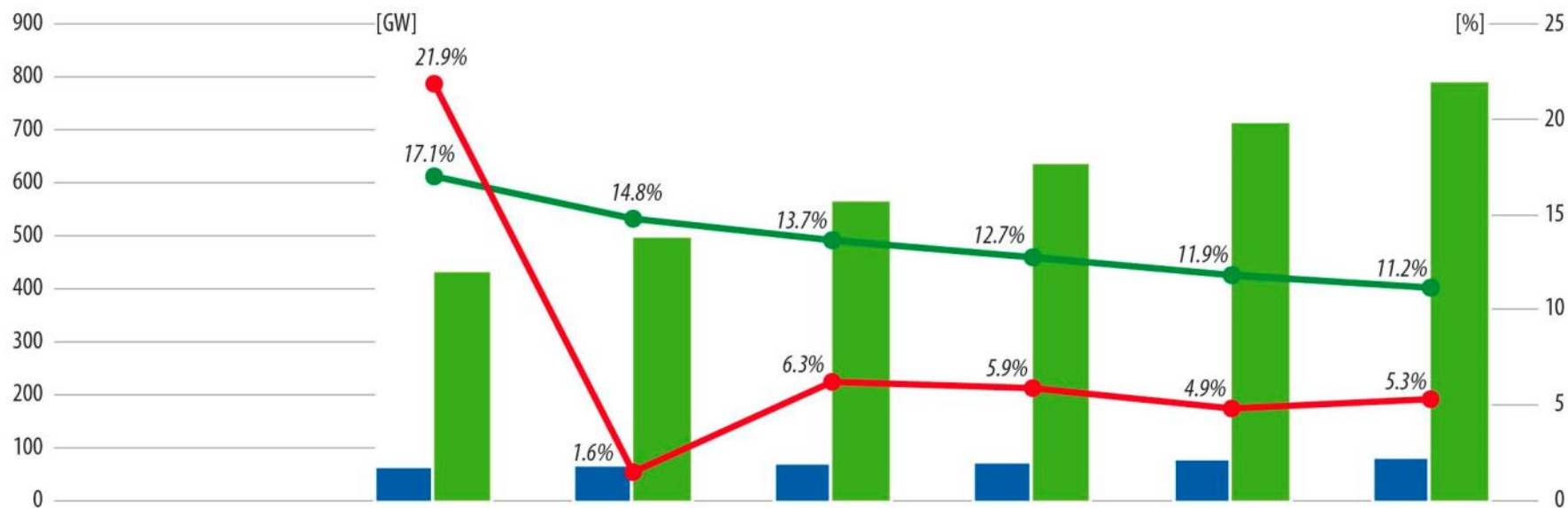
**CUMULATIVE MARKET FORECAST BY REGION 2016-2020**



	Europe	North America	Asia	Latin America	Pacific	Middle East & Africa
2015	148.1	88.8	175.6	12.2	4.8	3.3
2016	161.1	98.8	210.1	16.7	5.3	4.8
2017	174.6	109.8	245.1	22.2	5.8	7.3
2018	189.1	121.8	280.6	28.2	6.8	10.3
2019	203.6	134.8	316.6	35.2	7.8	14.3
2020	218.6	148.8	352.6	43.2	9.3	19.3

Source: GWEC

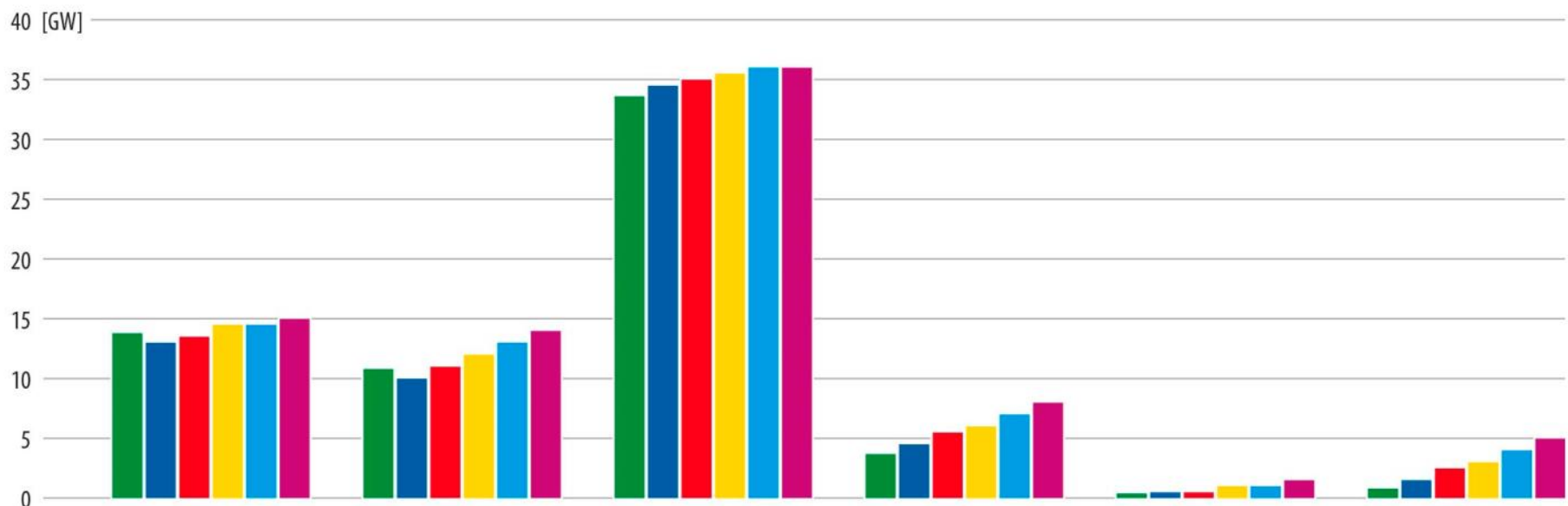
**MARKET FORECAST FOR 2016-2020**



<span style="color: green;">■</span> Cumulative [GW]	432.7	496.7	564.7	636.7	712.2	791.7
<span style="color: green;">●</span> Cumulative capacity growth rate [%]	17.1%	14.8%	13.7%	12.7%	11.9%	11.2%
<span style="color: blue;">■</span> Annual installed capacity [GW]	63	64	68	72	75.5	79.5
<span style="color: red;">●</span> Annual installed capacity growth rate [%]	21.9%	1.6%	6.3%	5.9%	4.9%	5.3%

Source: GWEC

**ANNUAL MARKET FORECAST BY REGION 2016-2020**



	Europe	North America	Asia	Latin America	Pacific	Middle East & Africa
2015	13.8	10.8	33.6	3.7	0.4	0.8
2016	13.0	10.0	34.5	4.5	0.5	1.5
2017	13.5	11.0	35.0	5.5	0.5	2.5
2018	14.5	12.0	35.5	6.0	1.0	3.0
2019	14.5	13.0	36.0	7.0	1.0	4.0
2020	15.0	14.0	36.0	8.0	1.50	5.0

Source: GWEC

## Key Findings

- Unexpected growth (22%) in 2015, mostly China, US and Germany. 2016 should be less spectacular.
- Wind supplied about half of all global power generation growth in 2015, more than any other technology
- 28 markets with more than 1,000 MW; 9 with more than 10,000 MW; Proliferation of new markets in Africa, Asia, and Latin America.
- Technology evolution continues, but incrementally, not spectacularly, except perhaps in offshore.
- Costs continue to come down and wind is the cheapest way to add capacity in a growing number of markets in Africa, Asia and Latin America, as well as the in US and Canada. Offshore costs still coming down the learning curve, but dramatic progress of late

# Development of Long Term Wind Market Projections

## The Scenarios – Main Assumptions

### ***IEA New Policies scenario:***

- based on International Energy Agency (IEA) 2015 World Energy Outlook
- IEA assessment has then been extended up to 2050 from UTS-ISF

### ***IEA 450 scenario:***

- based on International Energy Agency (IEA) 2015 World Energy Outlook: sets out an energy pathway consistent with the goal of having about a 50% chance of limiting the global increase in average temperature to 2 °C / 450 parts per million of carbon-dioxide equivalent (ppm CO<sub>2</sub>-eq)
- IEA assessment has then been extended up to 2050 from UTS-ISF

### ***GWEC Moderate scenario:***

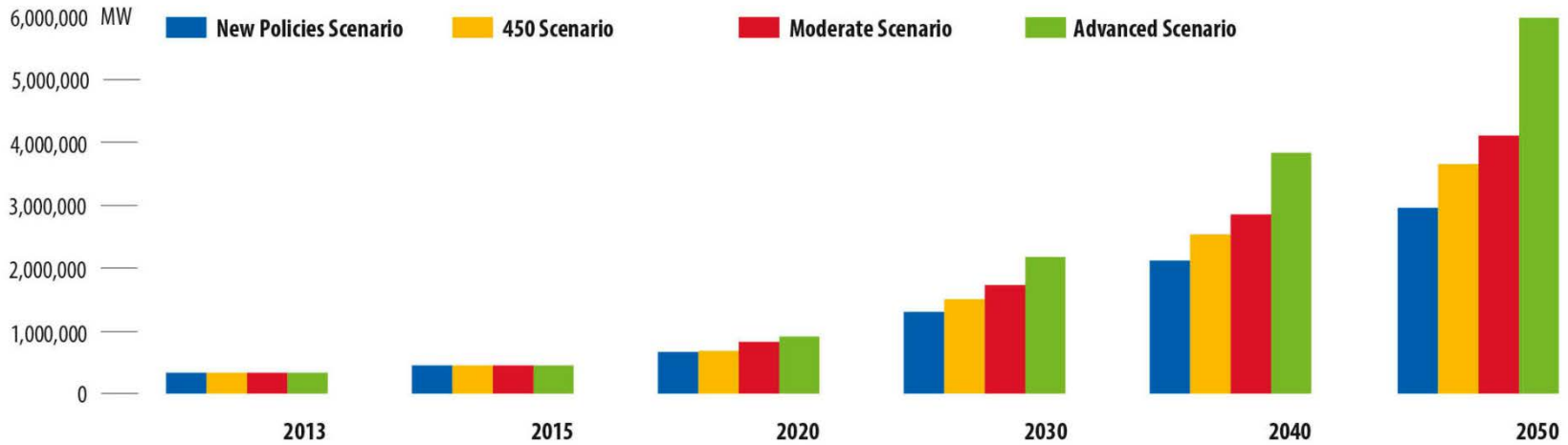
- takes into account all policy measures to support renewable energy either under way or planned around the world
- assumes that renewables or wind targets set by many countries are successfully implemented

### ***GWEC Advanced scenario:***

- assumption is that all policy options in favour of renewable energy are selected and the political will is there to carry them out



**GLOBAL CUMULATIVE WIND POWER CAPACITY**



**New Policies Scenario**

MW	318,354	432,656	639,478	1,259,974	2,052,583	2,869,611
TWh/a	714	868	1,569	3,311	5,394	7,541

**450 Scenario**

MW	318,354	432,656	658,009	1,454,395	2,458,757	3,545,595
TWh/a	714	868	1,614	3,822	6,462	9,318

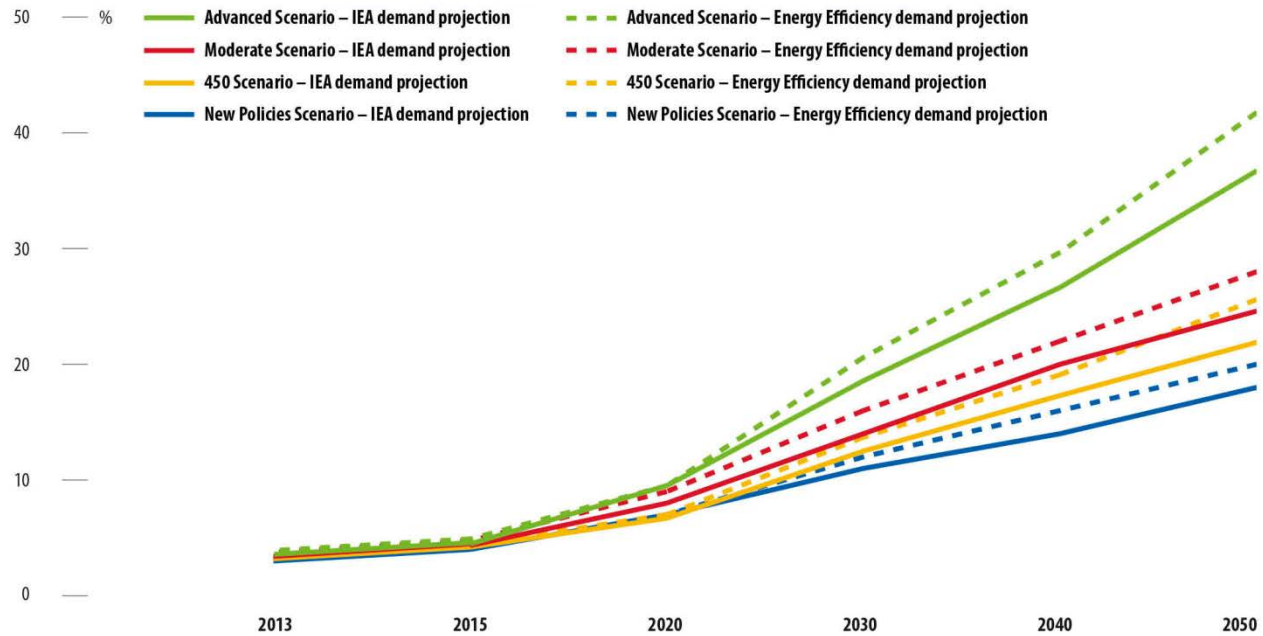
**Moderate Scenario**

MW	318,354	432,656	797,028	1,675,624	2,767,351	3,983,995
TWh/a	714	868	1,955	4,404	7,273	10,470

**Advanced Scenario**

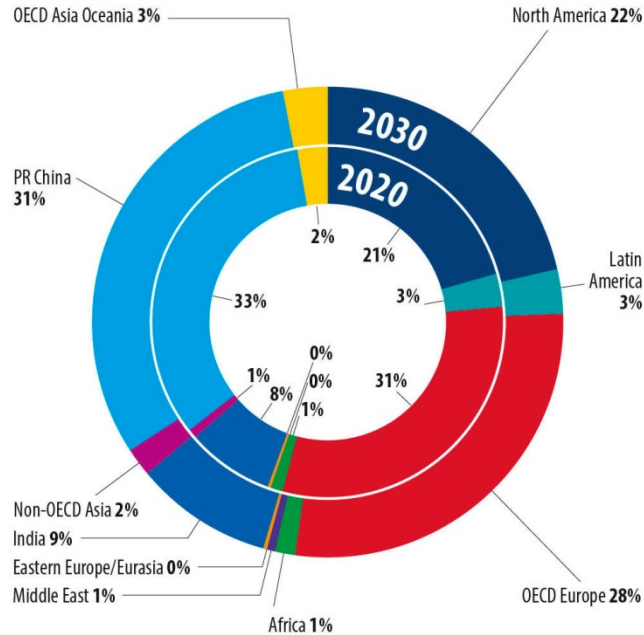
MW	318,354	432,656	879,446	2,110,161	3,720,919	5,805,882
TWh/a	714	868	2,157	5,546	9,779	15,258

WIND POWER SHARE OF GLOBAL ELECTRICITY DEMAND



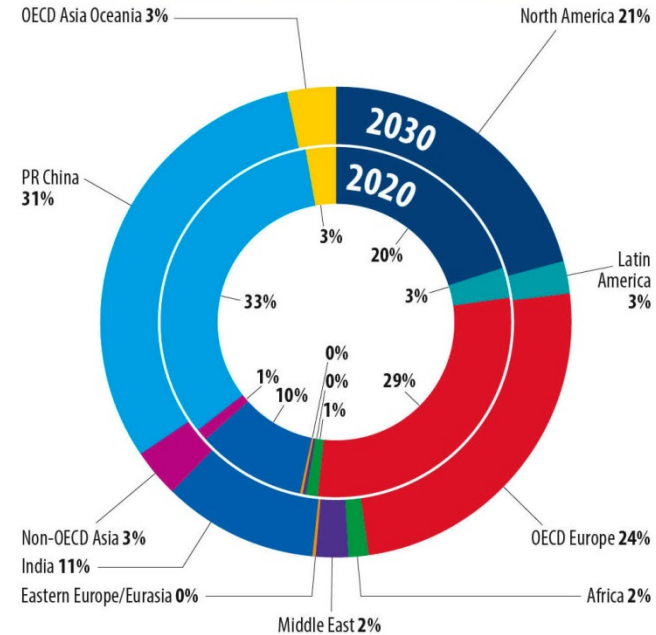
	2013	2015	2020	2030	2040	2050
<b>New Policies Scenario</b>						
IEA demand projection	3%	4%	7%	11%	14%	18%
Energy Efficiency demand projection	3%	4%	7%	12%	16%	20%
<b>450 Scenario</b>						
IEA demand projection	3%	4%	7%	13%	17%	22%
Energy Efficiency demand projection	3%	4%	7%	14%	19%	25%
<b>Moderate Scenario</b>						
IEA demand projection	3%	4%	8%	14%	20%	25%
Energy Efficiency demand projection	3%	4%	9%	16%	22%	28%
<b>Advanced Scenario</b>						
IEA demand projection	3%	4%	9%	18%	26%	36%
Energy Efficiency demand projection	3%	4%	9%	20%	29%	41%

**REGIONAL BREAKDOWN: NEW POLICIES SCENARIO**



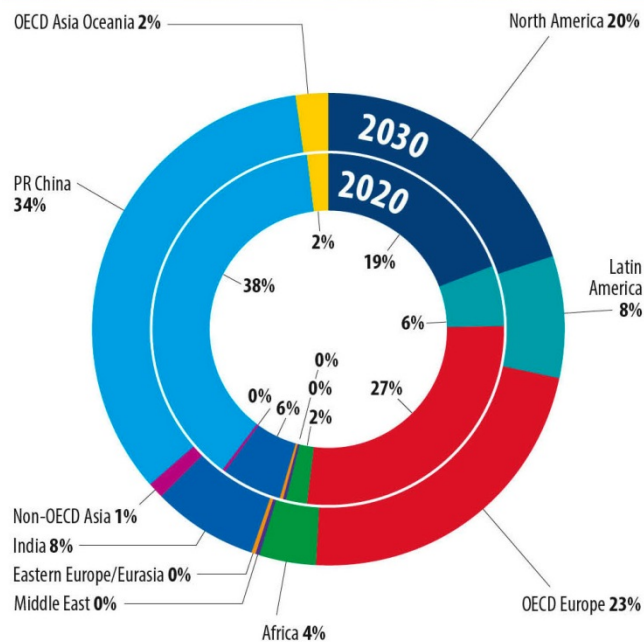
	2020	2030
North America	126,961	252,784
Latin America	18,749	36,196
OECD Europe	186,878	323,091
Africa	6,575	15,908
Middle East	1,072	8,009
Eastern Europe/Eurasia	668	1,117
India	50,063	111,938
Non-OECD Asia	5,213	21,796
PR China	201,178	364,801
OECD Asia Oceania	15,322	34,598
<b>Global Total / MW</b>	<b>639,478</b>	<b>1,259,974</b>

**REGIONAL BREAKDOWN: 450 SCENARIO**



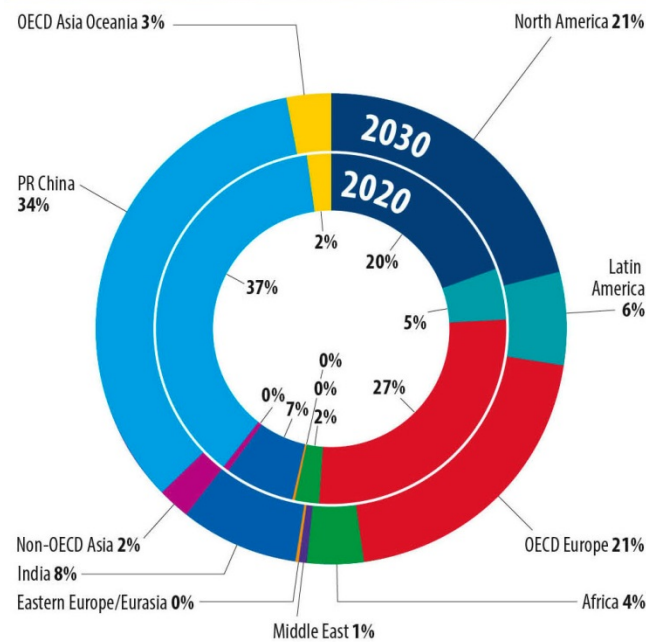
	2020	2030
North America	131,659	303,322
Latin America	18,913	35,830
OECD Europe	190,855	355,769
Africa	7,207	23,005
Middle East	1,501	30,124
Eastern Europe/Eurasia	722	1,982
India	67,098	155,736
Non-OECD Asia	6,411	49,250
PR China	216,806	452,081
OECD Asia Oceania	16,836	47,295
<b>Global Total / MW</b>	<b>658,009</b>	<b>1,454,395</b>

**REGIONAL BREAKDOWN: MODERATE SCENARIO**



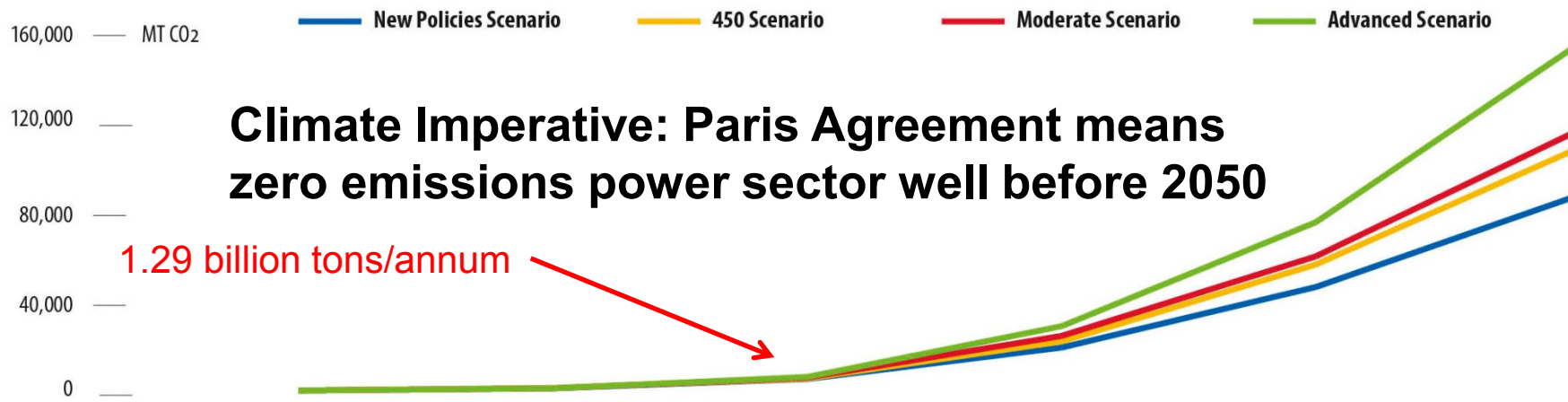
	2020	2030
North America	149,120	318,390
Latin America	42,997	129,491
OECD Europe	207,955	358,554
Africa	16,805	60,852
Middle East	777	4,995
Eastern Europe/Eurasia	644	1,895
India	44,734	116,257
Non-OECD Asia	2,344	14,842
PR China	291,439	541,577
OECD Asia Oceania	13,364	32,887
<b>Global Total / MW</b>	<b>797,028</b>	<b>1,675,624</b>

**REGIONAL BREAKDOWN: ADVANCED SCENARIO**



	2020	2030
North America	165,181	413,970
Latin America	38,203	124,494
OECD Europe	227,217	398,691
Africa	18,337	72,229
Middle East	1,017	10,234
Eastern Europe/Eurasia	650	2,835
India	56,297	163,473
Non-OECD Asia	4,296	41,659
PR China	313,061	666,500
OECD Asia Oceania	17,242	57,084
<b>Global Total / MW</b>	<b>879,446</b>	<b>2,110,161</b>

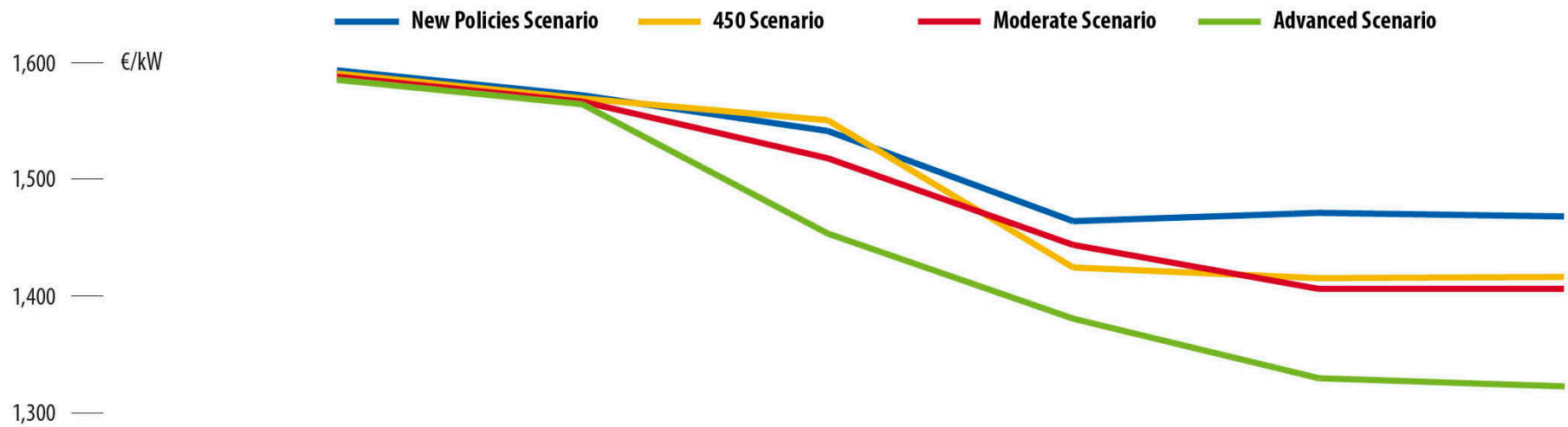
**CUMULATIVE CO<sub>2</sub> EMISSIONS REDUCTIONS**



**ANNUAL AND CUMULATIVE CO<sub>2</sub> EMISSIONS REDUCTIONS (MT CO<sub>2</sub>)**

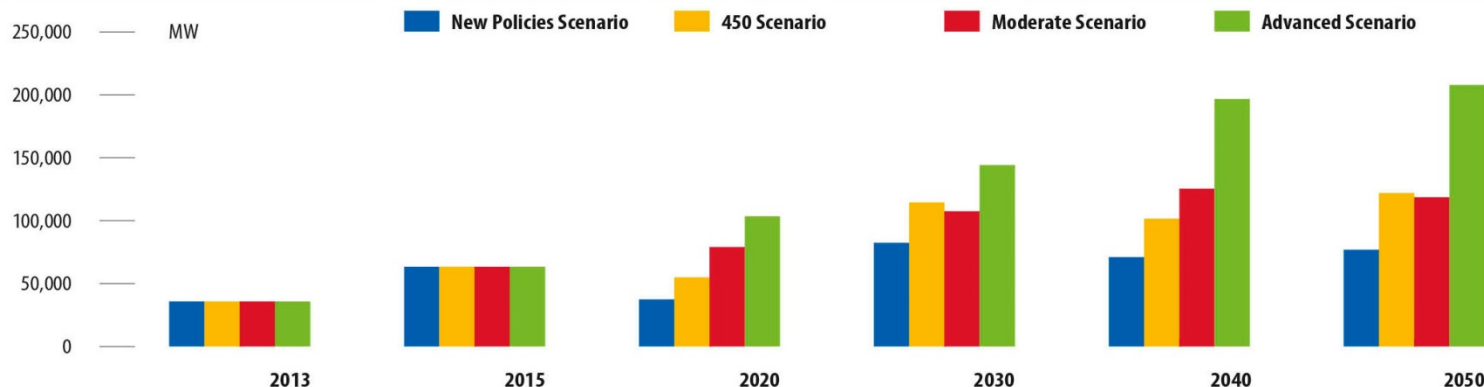
	2013	2015	2020	2030	2040	2050
<b>New Policies Scenario</b>						
Annual CO <sub>2</sub> savings	428	521	941	1,987	3,237	4,525
Cumulative CO <sub>2</sub> savings	2,112	3,105	7,247	21,223	48,137	87,610
<b>450 Scenario</b>						
Annual CO <sub>2</sub> savings	428	521	968	2,293	3,877	5,591
Cumulative CO <sub>2</sub> savings	2,112	3,105	7,279	22,730	54,687	102,639
<b>Moderate Scenario</b>						
Annual CO <sub>2</sub> savings	428	521	1,173	2,642	4,364	6,282
Cumulative CO <sub>2</sub> savings	2,112	3,105	7,850	26,393	61,770	116,043
<b>Advanced Scenario</b>						
Annual CO <sub>2</sub> savings	428	521	1,294	3,327	5,867	9,155
Cumulative CO <sub>2</sub> savings	2,112	3,105	8,153	30,702	76,953	153,634

**SPECIFIC COSTS (€/kW)**



	2013	2015	2020	2030	2040	2050
<b>New Policies Scenario</b>	1,592	1,571	1,541	1,465	1,472	1,469
<b>450 Scenario</b>	1,592	1,571	1,550	1,426	1,417	1,418
<b>Moderate Scenario</b>	1,592	1,571	1,518	1,445	1,408	1,408
<b>Advanced Scenario</b>	1,592	1,571	1,452	1,379	1,328	1,321

**TOTAL INSTALLED COST, INVESTMENT AND EMPLOYMENT**



**New Policies Scenario**

	2013	2015	2020	2030	2040	2050
Annual Installation MW	35,787	63,350	37,370	82,428	70,955	76,955
Cost € / kW	1,592	1,571	1,541	1,465	1,472	1,469
Investment € billion /year	57	100	58	121	104	113
Employment Job /year	606,076	1,029,681	696,841	936,232	1,080,374	1,316,408

**450 Scenario**

	2013	2015	2020	2030	2040	2050
Annual Installation MW	35,787	63,350	54,962	114,494	101,525	121,998
Cost € / kW	1,592	1,571	1,550	1,426	1,417	1,418
Investment € billion /year	57	100	85	163	144	173
Employment Job /year	606,076	1,029,681	931,654	1,385,182	1,370,137	1,682,231

**Moderate Scenario**

	2013	2015	2020	2030	2040	2050
Annual Installation MW	35,787	63,350	79,005	107,488	125,397	118,604
Cost € / kW	1,592	1,571	1,518	1,445	1,408	1,408
Investment € billion /year	57	100	120	155	177	167
Employment Job /year	606,076	1,029,681	1,290,079	1,374,111	1,469,931	1,866,633

**Advanced Scenario**

	2013	2015	2020	2030	2040	2050
Annual Installation MW	35,787	63,350	103,423	144,165	196,748	207,879
Cost € / kW	1,592	1,571	1,452	1,379	1,328	1,321
Investment € billion /year	57	100	150	199	261	275
Employment Job /year	606,076	1,029,681	1,634,721	2,426,331	3,588,875	4,202,612

# New Markets





## **How to stay on the *Advanced Scenario* track**

- The industry has been back on the *Advanced Scenario* track for the past two years. How to stay there?
- Governments are still subsidizing fossil fuel production and consumption to the tune of somewhere between \$US 500 billion and \$US 6 trillion per annum. This has to stop, and soon.
- New market designs are necessary to drive both electricity system transformation and the proper valuation of carbon-free and flexible generation. The old utility model is dead or dying just about everywhere;
- International institutions have to stop talking out of both sides of their mouths and top financing fossil fuel projects with international development finance.
- Renewables have won or are winning the price war; now we have to win the struggle over the system design;
- Any decision to build a fossil fueled power plant today means either: a) investing in a stranded asset; or b) governments weren't serious in Paris

## Conclusions

- Asian market driving global growth – Asia is power hungry
- European market uncertain, especially after 2020
- North America uncharacteristically stable through 2020
- Largest growth markets by percentage are in Africa and Latin America
- Downward price pressure continues
- Accelerating consolidation of players in the OECD and to some extent in China, but new players continue to emerge in Africa, Asia and Latin America

## Looking Ahead – Climate Policy

- ~4% of global electricity supply now, should be 6-8% by 2020, 18-20% by 2030, around 1/3 by 2050 if we are to get to grips with the climate problem;
- With the entry into force of the Paris Agreement, governments now need to demonstrate that they're serious about implementing the targets;
- Early implementation key to have any chance to meet 2 degrees C target;
- Either the 2 degrees target and especially the 1.5 degrees target means complete decarbonisation of the power sector well before 2050.
- Any decision to build a fossil fueled power plant today means: a) investing in a stranded asset; b) governments weren't serious in Paris

## Looking Ahead (2)

**The Paris Agreement needs to be embedded in concrete action plans** in order for wind power to achieve its maximum potential, but for the short term we will continue to face...

### **Uncertainty:**

- in international political landscape, and in various countries
- in the future of the carbon markets
- in 'new' climate-related funds

### **Focus on national/regional legislation and markets**

**Market drivers all still in place**, and increasingly prominent: energy security; cost stability; macroeconomic security; local economic development and job creation; local environment and climate



**Thank you!**

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