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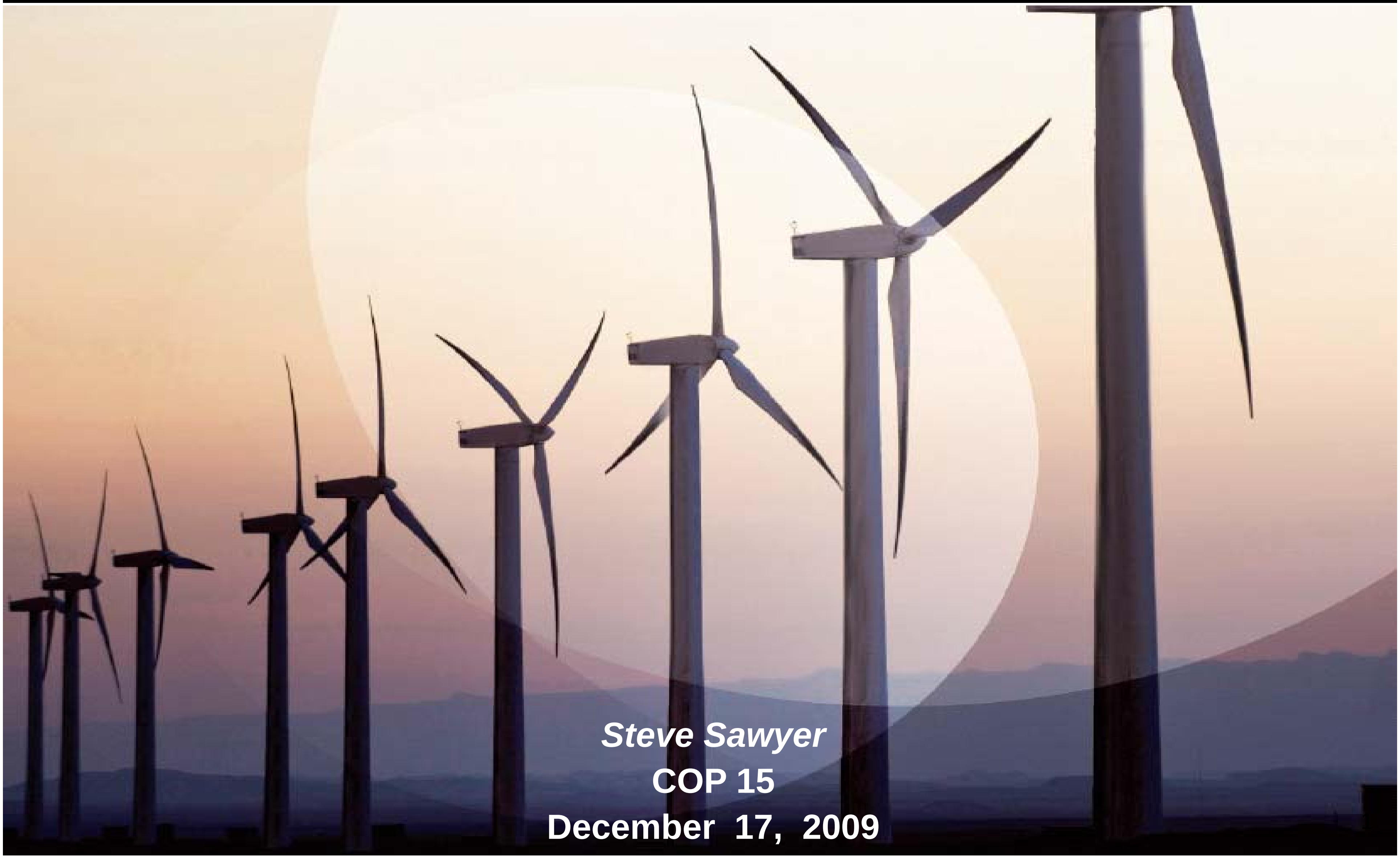
Global Wind Power Emission Reduction Leader



Steve Sawyer

COP 15

December 17, 2009

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Uniting the Global Wind Industry

C0 Members

REpower Systems
acciona Energía
LM Glasfiber
NORDEX We've got the power.
Vestas
GE Energy
Hansen Transmissions
ecotècnia
res power for good
SIEMENS
SUZLON
sinovel 华锐风电
IBERDROLA RENEWABLES
Gamesa

C2 Members

NRG SYSTEMS
bp
GARRAD HASSAN
GREENHUNTER ENERGY INC.
3TIER knowledge is power
Milbank
Clipper
المكتب الوطني للكهرباء Office National de l'Electricité
FRANCHINI ACCIAI S.p.A.
Shermco Industries
Parker

Associations

aee Asociación Empresarial Eólica
EWEA THE EUROPEAN WIND ENERGY ASSOCIATION
anev
Clean Energy Council
IWTMA
JWPA
Bundesverband WindEnergie e.V.
canwea
CREIA
AWEA AMERICAN WIND ENERGY ASSOCIATION

GWEC - Uniting the global wind industry and its representative associations

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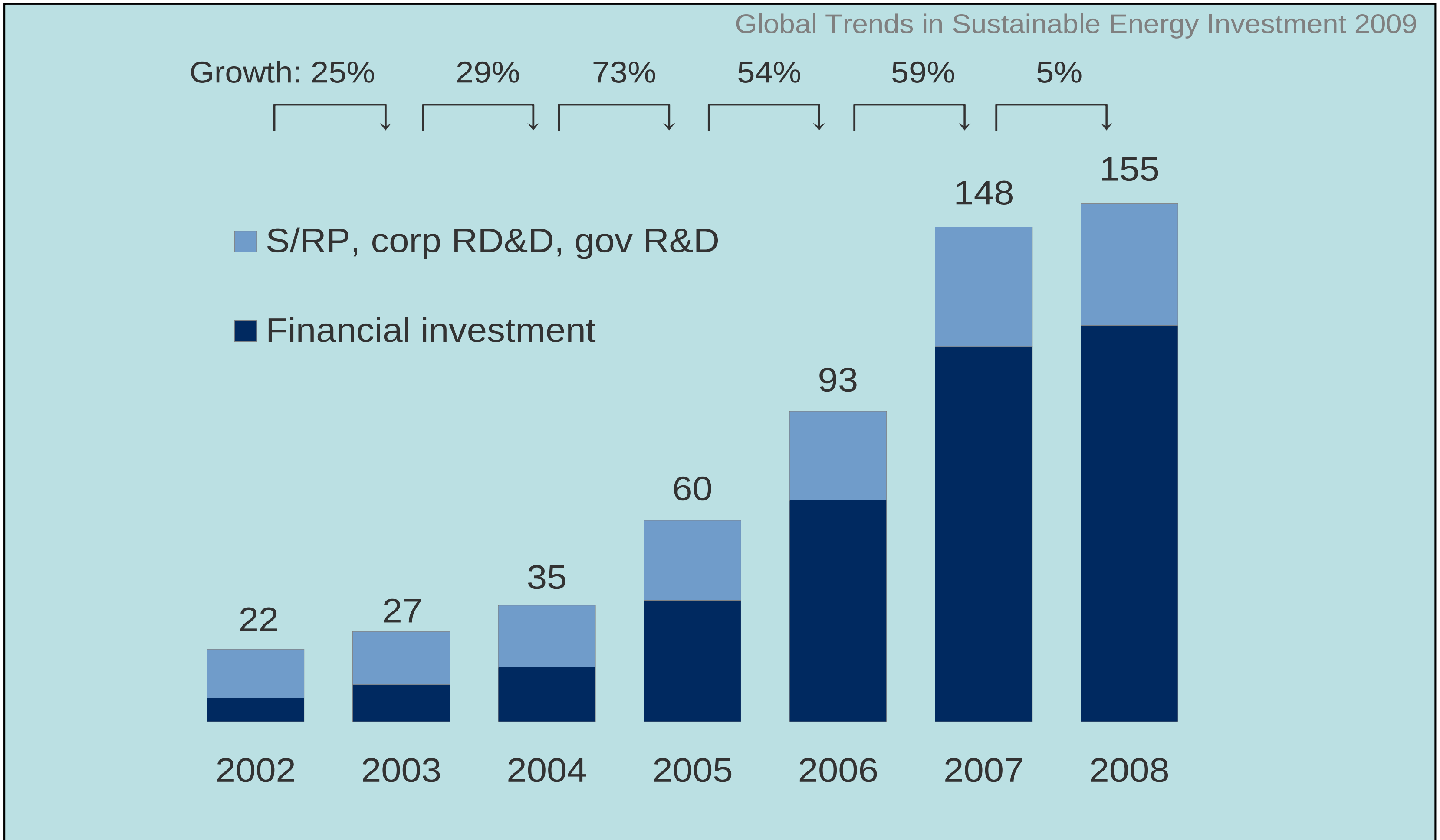
Overview

- Global RE investments
- Wind market overview
- Short and medium term projections
- The climate regime and what needs to be done
- A word on carbon
- Emissions reductions from wind power
- Conclusions

Global New Investment in Sustainable Energy: 2002-2008 ($ billions)



S/RP = small/residential projects. New investment volume adjusts for re-invested equity. Total values include estimates for undisclosed deals

Source: New Energy Finance

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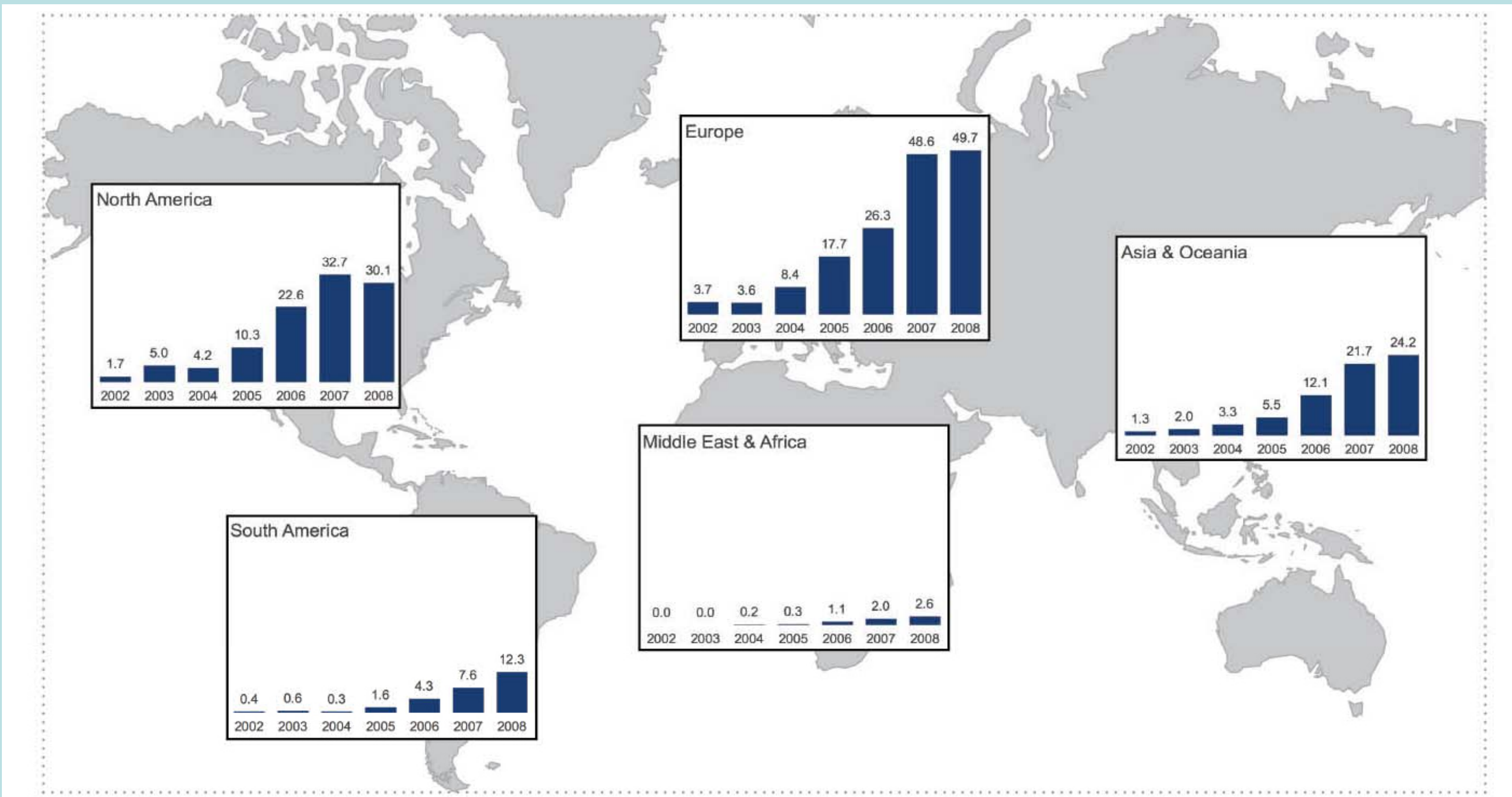
Financial New Investment by Region 2002-2008 ($ billions)

Global Trends in Sustainable Energy Investment 2009



New investment volume adjusts for re-invested equity.
Total values include estimates for undisclosed deals

Source: New Energy Finance, UNEP SEFI

Global Renewable Power Capacity

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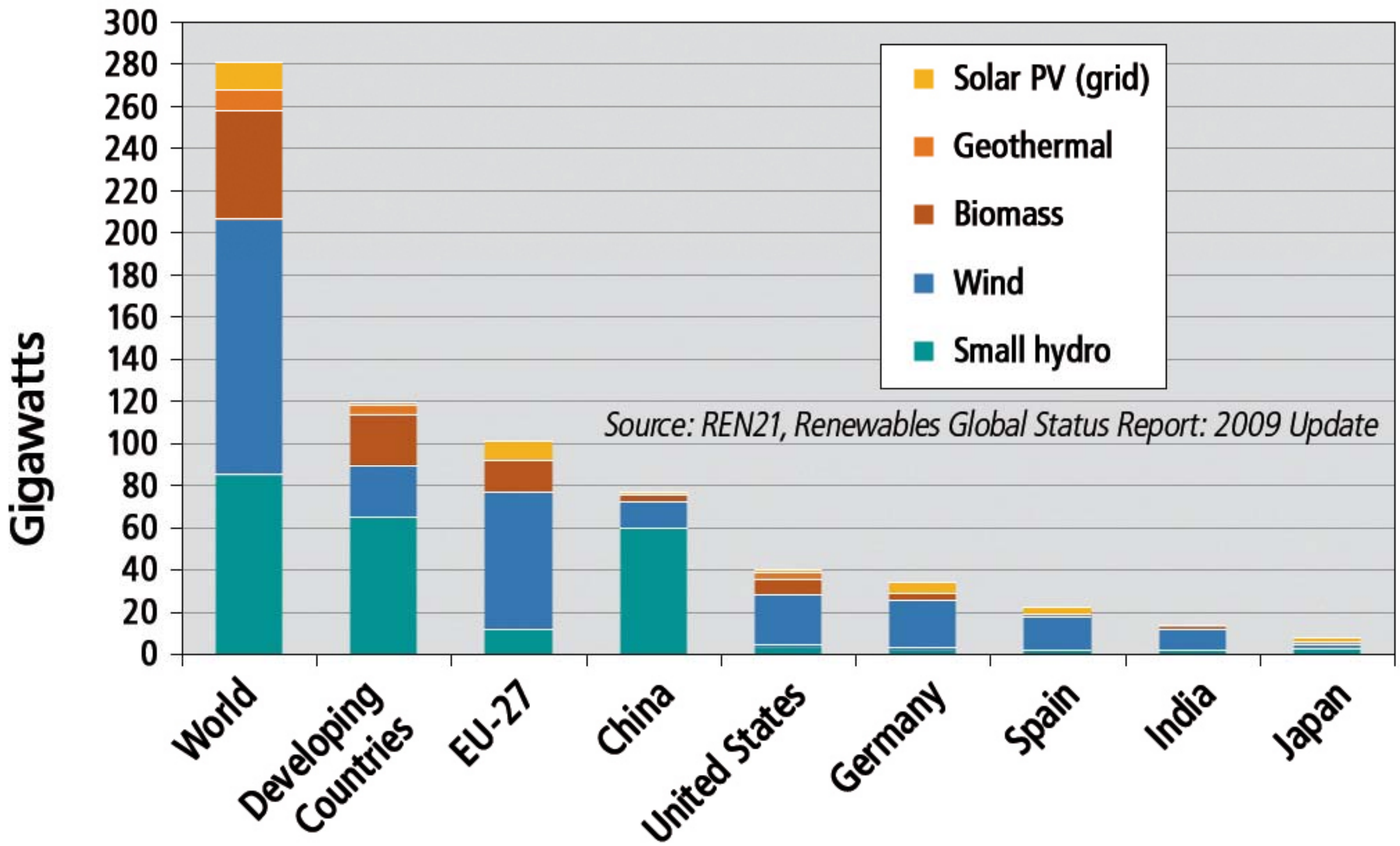
Figure 4.
Renewable Power Capacities, Developing World, EU and Top Six Countries, 2008



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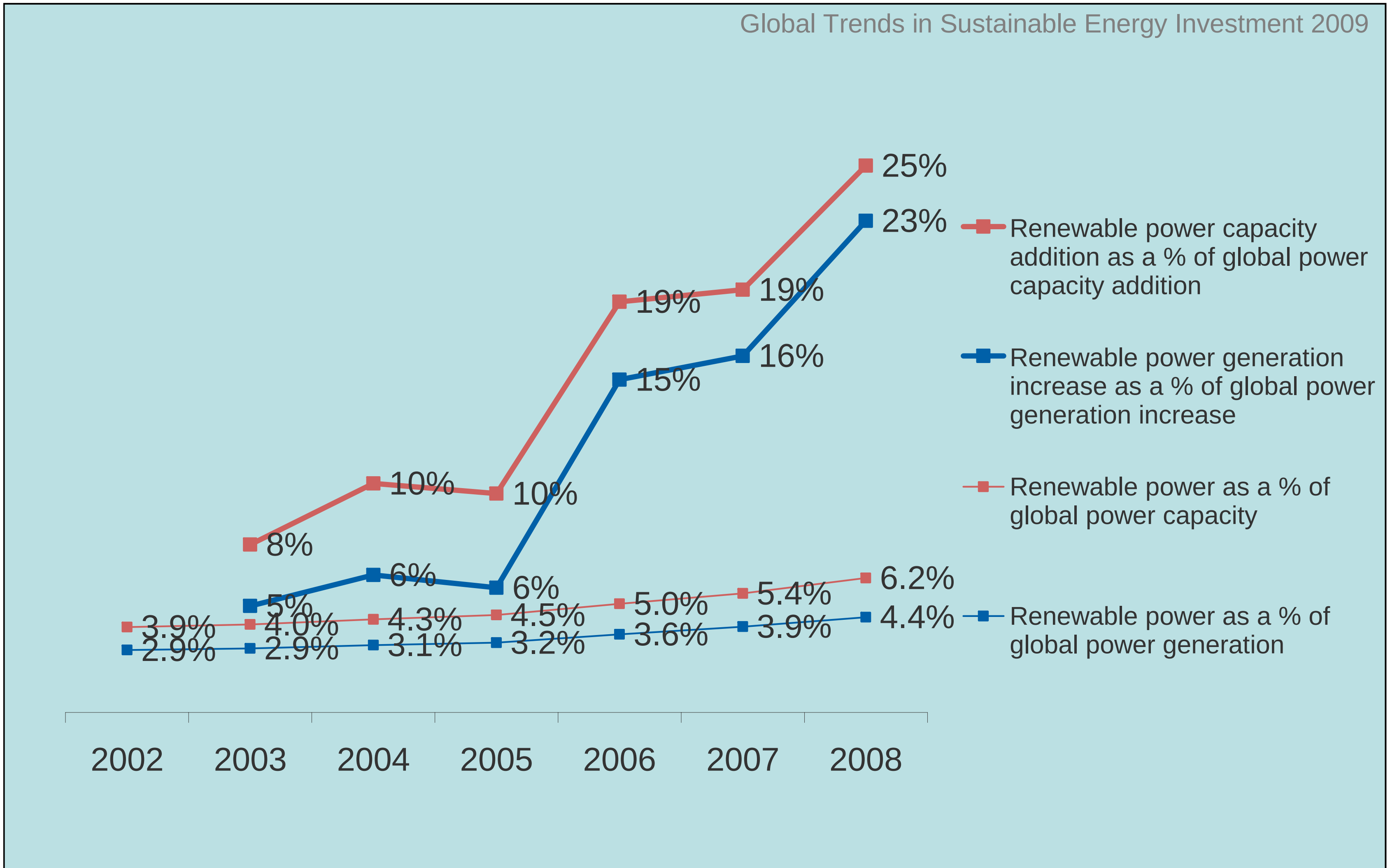
Global Renewable power* Generation and Capacity: 2002-2008 (% share)

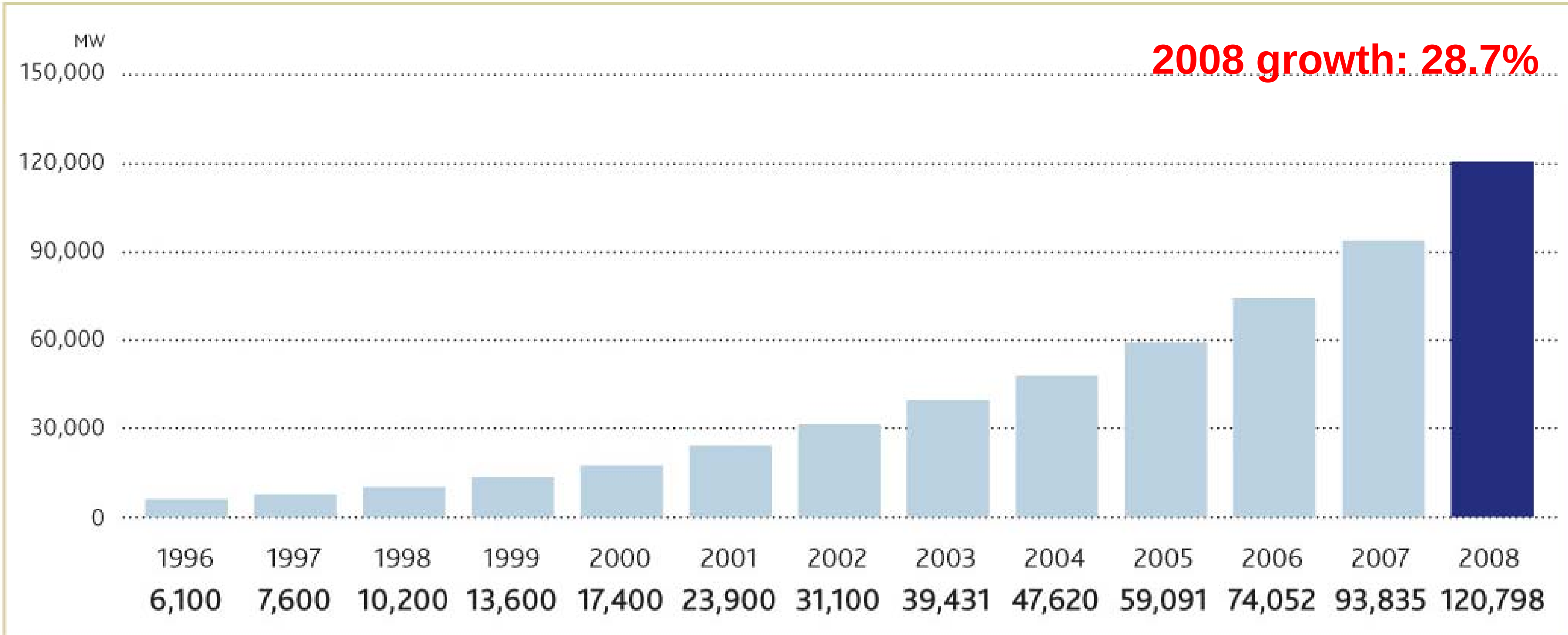


* Excluding Large Hydro

Source: New Energy Finance, UNEP SEFI

Wind Power: Cumulative Installed Capacity

GLOBAL CUMULATIVE INSTALLED CAPACITY 1996-2008



12 yr avg growth: 28.3%

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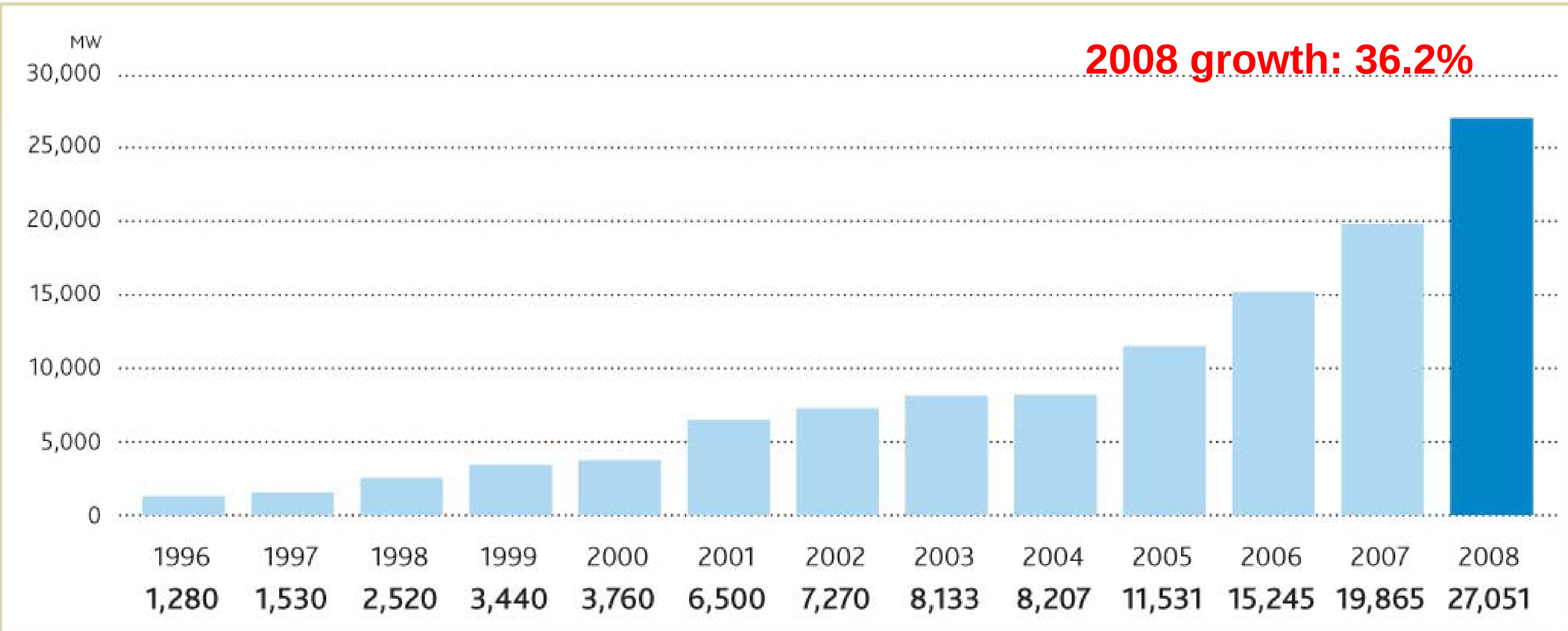
Annual Installed Capacity

GLOBAL ANNUAL INSTALLED CAPACITY 1996-2008



12 yr avg growth: 30.6%

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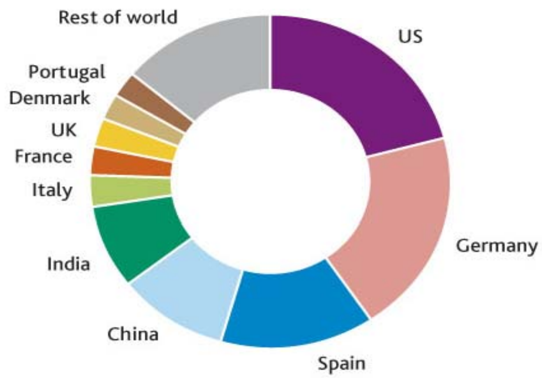
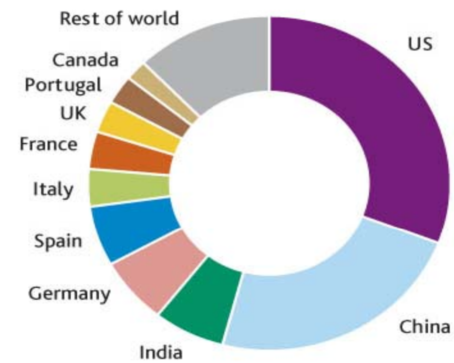
2008 Market Leaders

TOP 10 TOTAL INSTALLED CAPACITY 2008



	MW	%
USA	25,170	20.8
Germany	23,903	19.8
Spain	16,754	13.9
China	12,210	10.1
India	9,645	8.0
Italy	3,736	3.1
France	3,404	2.8
UK	3,241	2.7
Denmark	3,180	2.6
Portugal	2,862	2.4
Rest of world	16,693	13.8
Total top 10	**104,104**	**86.2**
World total	**120,798**	**100.0**

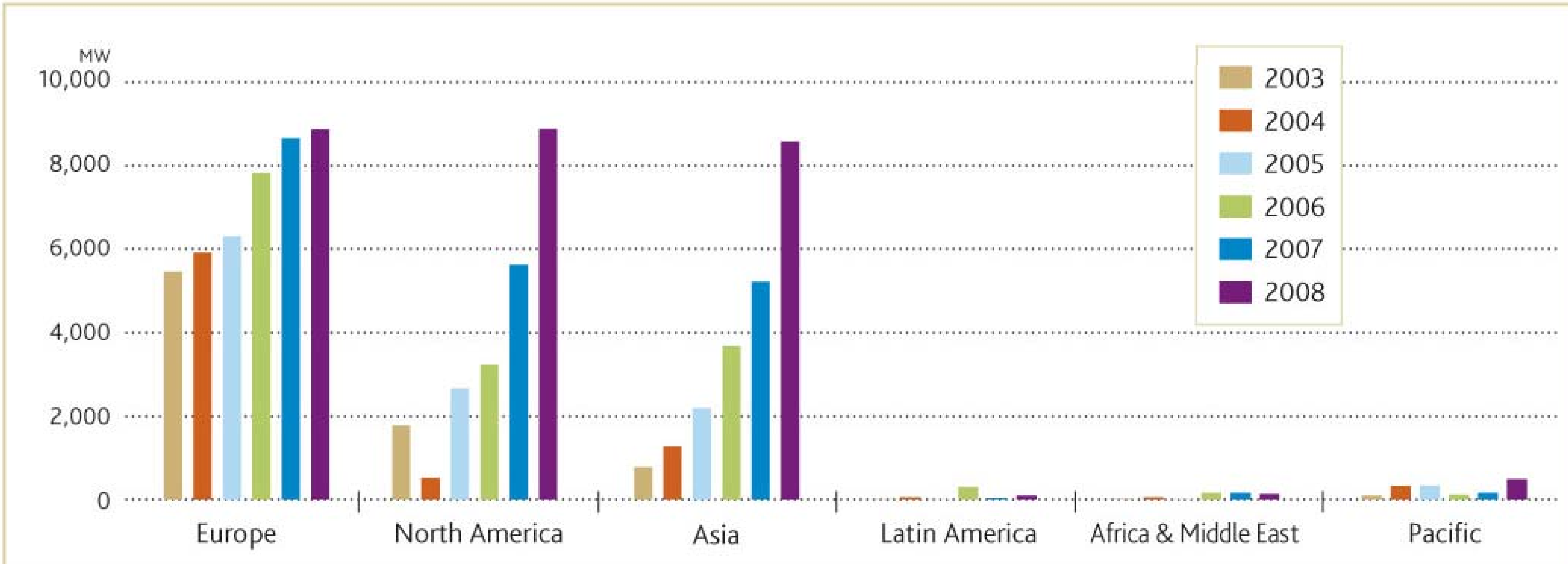
TOP 10 NEW CAPACITY 2008



	MW	%
USA	8,358	30.9
China	6,300	23.3
India	1,800	6.7
Germany	1,665	6.2
Spain	1,609	5.9
Italy	1,010	3.7
France	950	3.5
UK	836	3.1
Portugal	712	2.6
Canada	526	1.9
Rest of world	3,285	12.2
Total top 10	**23,766**	**87.8**
World total	**27,051**	**100.0**

Regional Breakdown

ANNUAL INSTALLED CAPACITY BY REGION 2003-2008



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Summary Status

- Three main markets: Europe, US and China – each with a strong political commitment
- China now home to largest manufacturing industry – will be #1 market in 2009, and #1 overall early in the next decade
- European market continues to broaden – new boom with offshore still some years away
- Latin America, Africa and the Pacific continue ‘on the verge of take-off’

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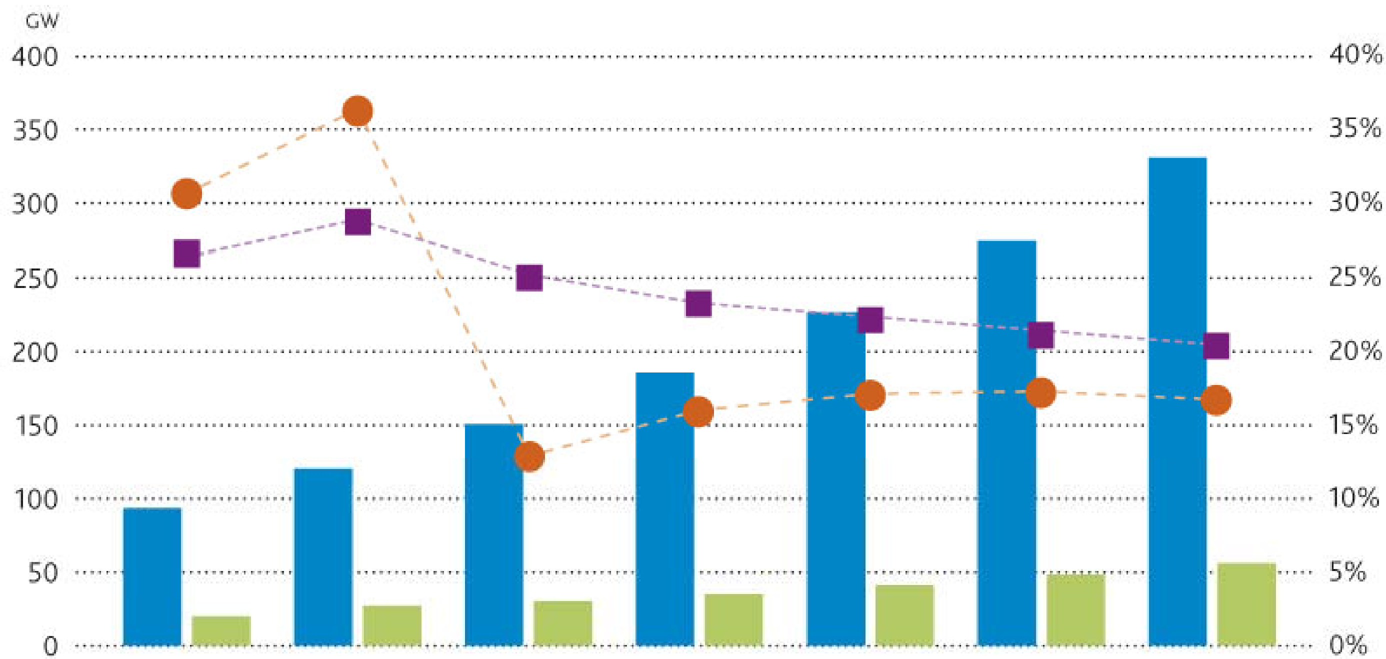
Projections to 2013

MARKET FORECAST 2009-2013



	2007	2008	2009	2010	2011	2012	2013
Annual installed capacity (GW)	19.9	27.1	30.4	35.2	41.2	48.2	56.3
Cumulative installed capacity (GW)	93.8	120.8	151.2	186.4	227.6	275.8	332.1
Annual install capacity growth rate	30.7%	36.2%	12.5%	15.7%	17.0%	17.0%	16.8%
Cumulative capacity growth rate	26.7%	28.7%	25.2%	23.3%	22.1%	21.2%	20.4%

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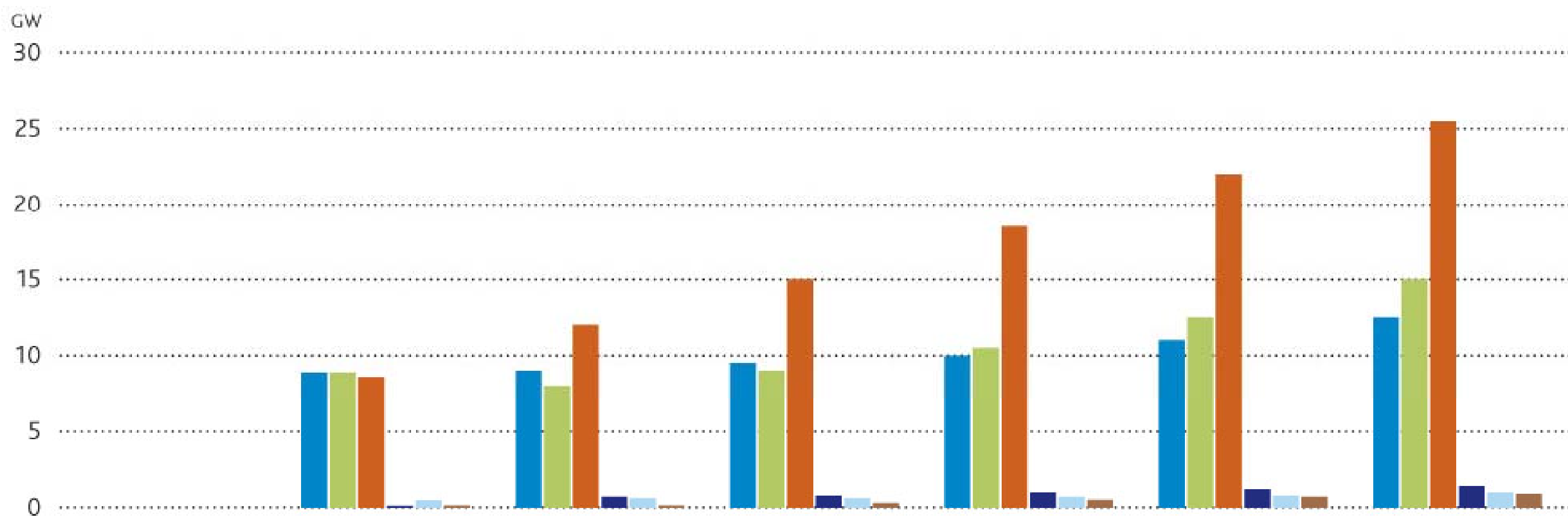
Annual market to 2013 by region

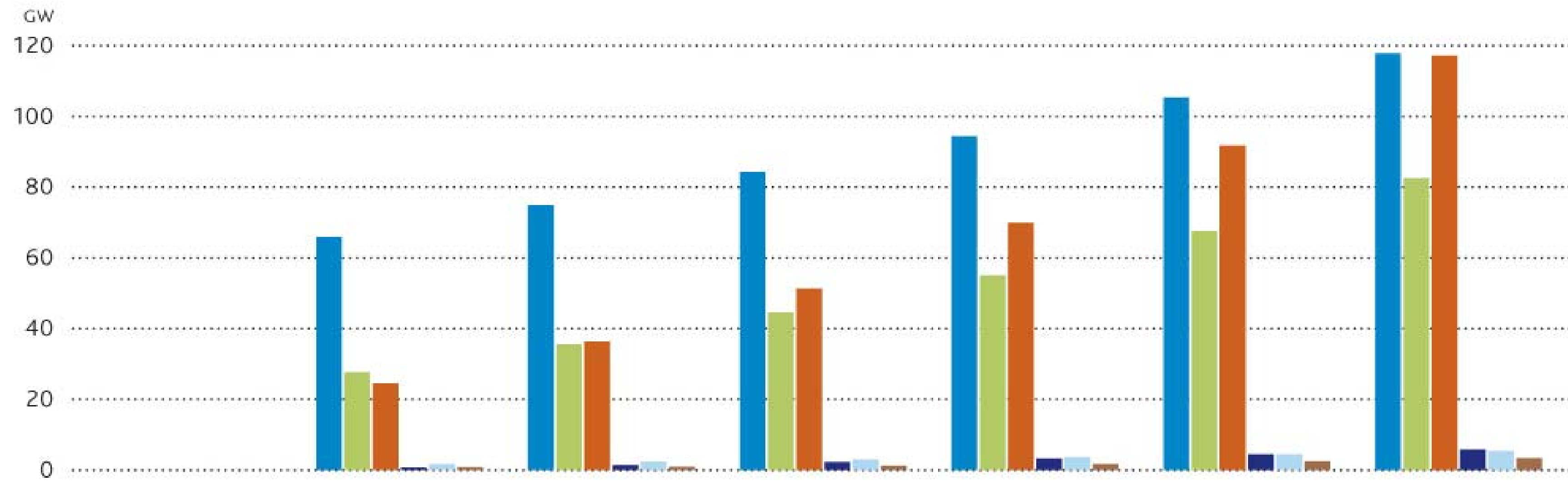
ANNUAL MARKET FORECAST BY REGION 2008-2013 (GW)



	2008	2009	2010	2011	2012	2013
Europe	8.9	9.0	9.5	10.0	11.0	12.5
North America	8.9	8.0	9.0	10.5	12.5	15.0
Asia	8.6	12.0	15.0	18.5	22.0	25.5
Latin America	0.1	0.7	0.8	1.0	1.2	1.4
Pacific	0.5	0.6	0.6	0.7	0.8	1.0
Middle East & Africa	0.1	0.1	0.3	0.5	0.7	0.9

2009-2013 by Region

CUMULATIVE MARKET FORECAST BY REGION 2008-2013 (GW)



	2008	2009	2010	2011	2012	2013
Europe	66.0	75.0	84.5	94.5	105.5	118.0
North America	27.5	35.5	44.5	55.0	67.5	82.5
Asia	24.4	36.4	51.4	69.9	91.9	117.4
Latin America	0.6	1.3	2.1	3.1	4.3	5.7
Pacific	1.6	2.2	2.8	3.5	4.3	5.3
Middle East & Africa	0.7	0.8	1.1	1.6	2.3	3.2

Main Assumptions – wind power growth

"Reference" scenario:

- most conservative scenario, based on International Energy Agency (IEA) 2007 World Energy Outlook
- IEA assessment has then been extrapolated out to 2050 by DLR

"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

"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; clear commitment to climate protection and a low carbon energy future.

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Scenarios (2)

Main Assumptions – Demand Development

“Reference” scenario:

- based on International Energy Agency (IEA) 2007 World Energy Outlook; IEA assessment has then been extrapolated out to 2050 by DLR
- Projects growth in electricity demand from about 16,000 Twh at present to:
    - 23,697 Twh in 2020
    - 29,254 Twh in 2030
    - 42,938 Twh in 2050

“Energy Efficiency” scenario:

- Ecofys study, based on rigorous implementation of existing technology, and continuous innovation to 2050, reduces demand by 35% by 2050
- Projects growth in electricity demand from current levels to:
    - 21,095 Twh in 2020
    - 23,937 Twh in 2030
    - 30,814 Twh in 2050

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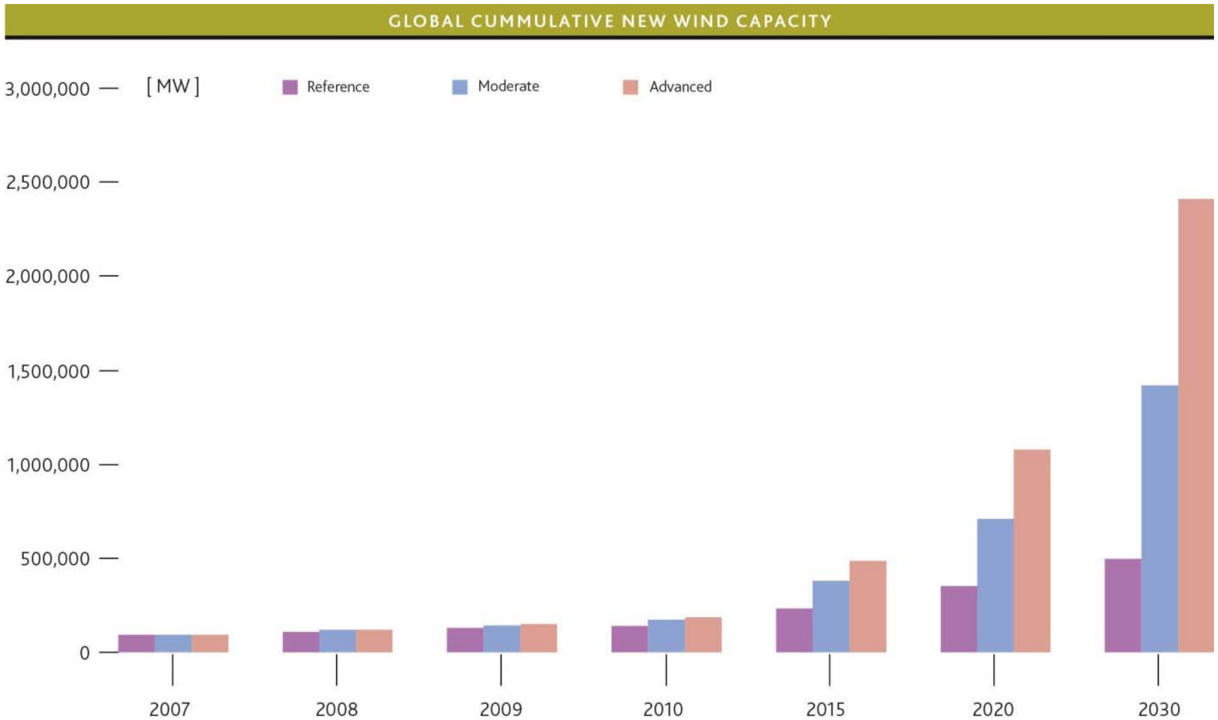
Production



GLOBAL CUMULATIVE CAPACITY [MW] AND ELECTRICITY GENERATION [TWh]

Year		2007	2008	2009	2010	2015	2020	2030
Reference	[MW]	93,864	109,739	128,046	139,000	232,956	352,300	496,730
	[TWh]	206	240	280	304	571	864	1,218
Moderate	[MW]	93,864	117,735	143,376	172,280	378,954	709,332	1,420,436
	[TWh]	206	258	314	377	929	1,740	3,484
Advanced	[MW]	93,864	119,837	149,841	186,309	485,834	1,080,886	2,375,374
	[TWh]	206	262	328	408	1,192	2,651	5,939

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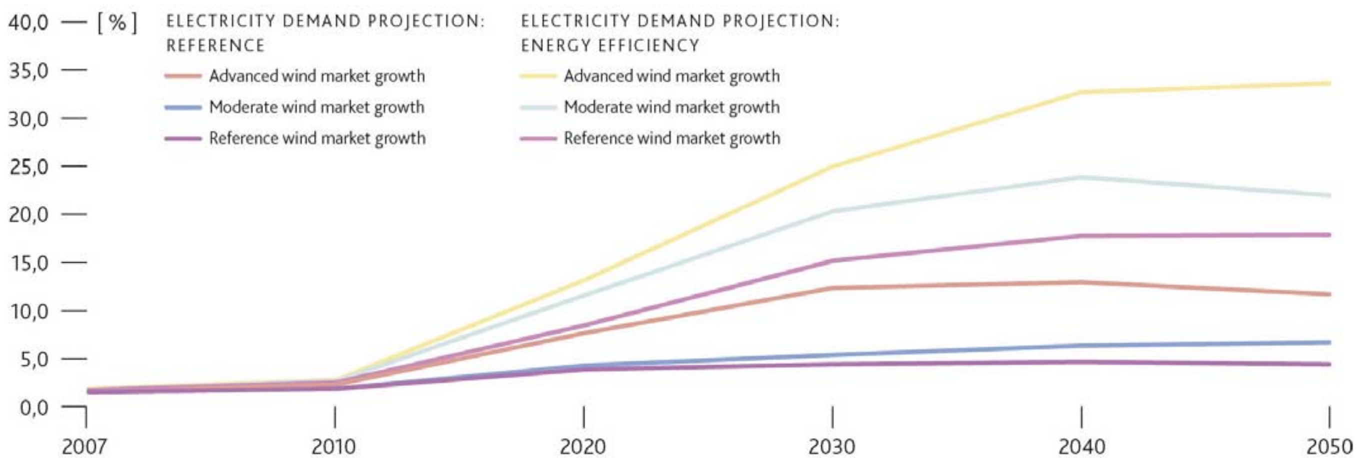
% of global electricity

WIND POWER PENETRATION OF WORLDS ELECTRICITY SUPPLY



3 DIFFERENT WIND MARKET DEVELOPMENT SCENARIOS - WITH DIFFERENT WORLD ELECTRICITY DEMAND DEVELOPMENTS

		2007	2010	2020	2030	2040	2050
REFERENCE WIND MARKET GROWTH – IEA PROJECTION							
Wind power penetration of world's electricity in % – Reference (IEA Demand Projection)	%	1.4	1.7	3.6	4.2	4.4	4.2
Wind power penetration of world's electricity in % – Energy Efficiency	%	1.4	1.7	4.1	5.1	5.8	5.8
MODERATE WIND MARKET GROWTH							
Wind power penetration of world's electricity in % – Reference	%	1.4	2.1	7.3	11.9	12.5	11.2
Wind power penetration of world's electricity in % – Energy Efficiency	%	1.4	2.1	8.2	14.6	16.4	15.6
ADVANCED WIND MARKET GROWTH							
Wind power penetration of worlds electricity in % – Reference	%	1.4	2.3	11.2	19.7	23.1	21.2
Wind power penetration of world's electricity in % – Energy Efficiency	%	1.4	2.3	12.6	24.0	30.3	29.5

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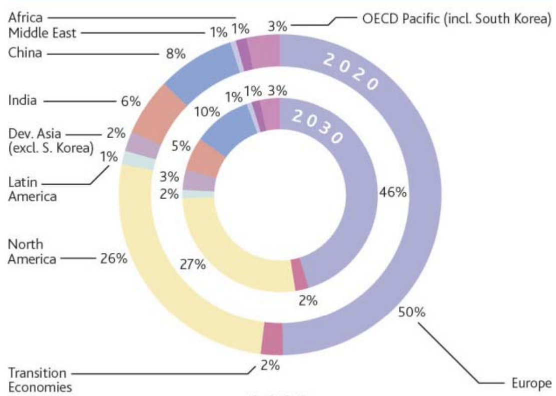
Regional Breakdown Reference

REGIONAL BREAK DOWN: REFERENCE SCENARIO [GW]



2020

Europe	176 GW
Transition Economies	7 GW
North America	92 GW
Latin America	5 GW
Dev. Asia (excl. S. Korea)	7 GW
India	20 GW
China	27 GW
Middle East	2 GW
Africa	4 GW
OECD Pacific (incl. South Korea)	12 GW

2030

EUROPE	227 GW
Transition Economies	11 GW
North America	132 GW
Latin America	8 GW
Dev. Asia (excl. S. Korea)	16 GW
India	27 GW
China	49 GW
Middle East	4 GW
Africa	7 GW
OECD Pacific (incl. South Korea)	16 GW

- Europe remains dominant;
- North America only other major market;
- China's development slows dramatically, as does India's.

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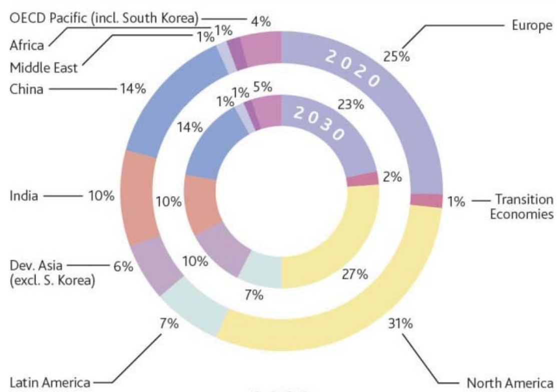
Regional Breakdown Moderate

REGIONAL BREAK DOWN: MODERATE SCENARIO [GW]



2020

Europe	182 GW
Transition Economies	9 GW
North America	214 GW
Latin America	50 GW
Dev. Asia (excl. S. Korea)	40 GW
India	69 GW
China	101 GW
Middle East	8 GW
Africa	10 GW
OECD Pacific (incl. South Korea)	30 GW

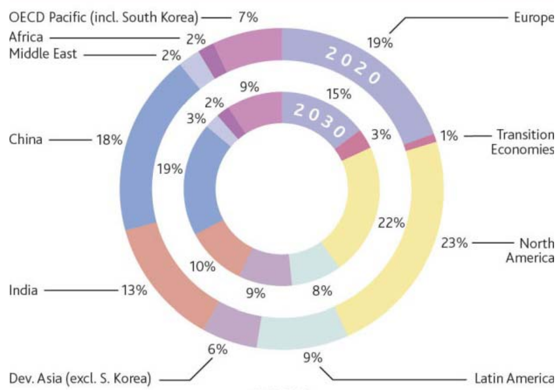
2030

EUROPE	306 GW
Transition Economies	34 GW
North America	366 GW
Latin America	103 GW
Dev. Asia (excl. S. Korea)	140 GW
India	142 GW
China	201 GW
Middle East	20 GW
Africa	21 GW
OECD Pacific (incl. South Korea)	70 GW

- Follows present trends;
- North America passes Europe;
- China and India growth continues apace;
- Latin America, Developing Asia, and OECD Pacific become substantial markets;
- Africa and Middle East start to grow just before 2020

Regional Breakdown Advanced

REGIONAL BREAK DOWN: ADVANCED SCENARIO [GW]



2020

Europe	213 GW
Transition Economies	10 GW
North America	243 GW
Latin America	100 GW
Dev. Asia (excl. S. Korea)	61 GW
India	138 GW
China	201 GW
Middle East	25 GW
Africa	17 GW
OECD Pacific (incl. South Korea)	75 GW

2030

EUROPE	353 GW
Transition Economies	75 GW
North America	520 GW
Latin America	201 GW
Dev. Asia (excl. S. Korea)	211 GW
India	235 GW
China	451 GW
Middle East	63 GW
Africa	52 GW
OECD Pacific (incl. South Korea)	215 GW

- Europe, North America and China dominate;
- Latin America begins to seriously tap its vast potential;
- Other regions begin to develop more fully a bit later.

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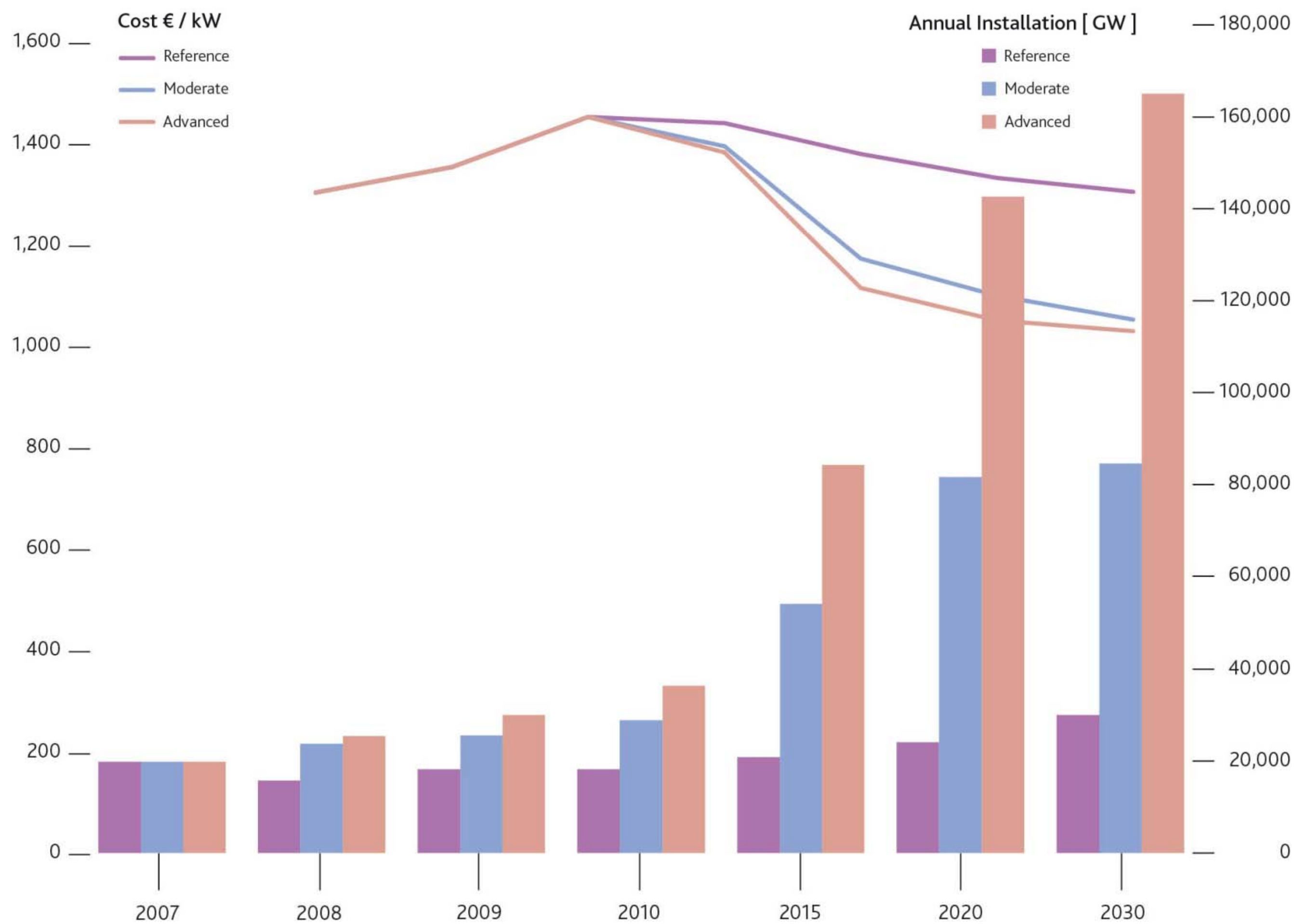
Development of Costs



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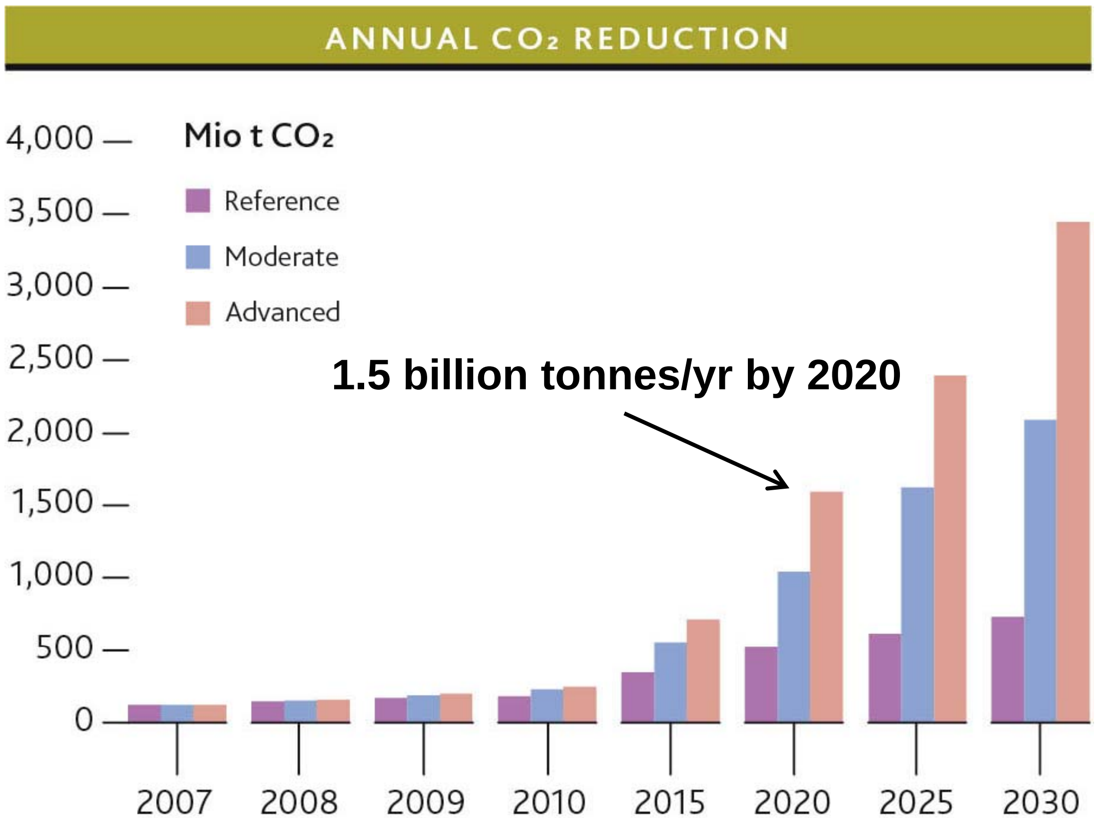
Investment and Employment

INVESTMENT AND EMPLOYMENT

	2007	2008	2009	2010	2015	2020	2030
REFERENCE							
Annual Installation [MW]	19,865	18,016	18,034	18,307	20,887	24,180	30,013
Cost € / kW	1,300	1,350	1,450	1,438	1,376	1,329	1,301
Investment € billion /year	25,824,500	25,873,673	25,910,012	26,545,447	28,736,673	32,135,267	39,058,575
Employment Job-year	329,232	387,368	418,625	424,648	479,888	535,074	634,114
MODERATE							
Annual Installation [MW]	19,865	23,871	25,641	28,904	54,023	81,546	84,465
Cost € / kW	1,300	1,350	1,450	1,392	1,170	1,096	1,050
Investment € billion /year	25,824,500	32,225,716	37,179,828	40,220,810	63,182,874	89,390,391	88,658,740
Employment Job-year	329,232	397,269	432,363	462,023	882,520	1,296,306	1,486,589
ADVANCED							
Annual Installation [MW]	19,865	25,509	30,005	36,468	84,160	142,674	165,000
Cost € / kW	1,300	1,350	1,450	1,379	1,112	1,047	1,026
Investment € billion /year	25,824,500	34,437,535	43,506,723	50,304,975	93,546,253	149,352,592	169,297,423
Employment Job-year	329,232	422,545	499,967	572,596	1,340,016	2,214,699	2,810,395

Climate Imperative



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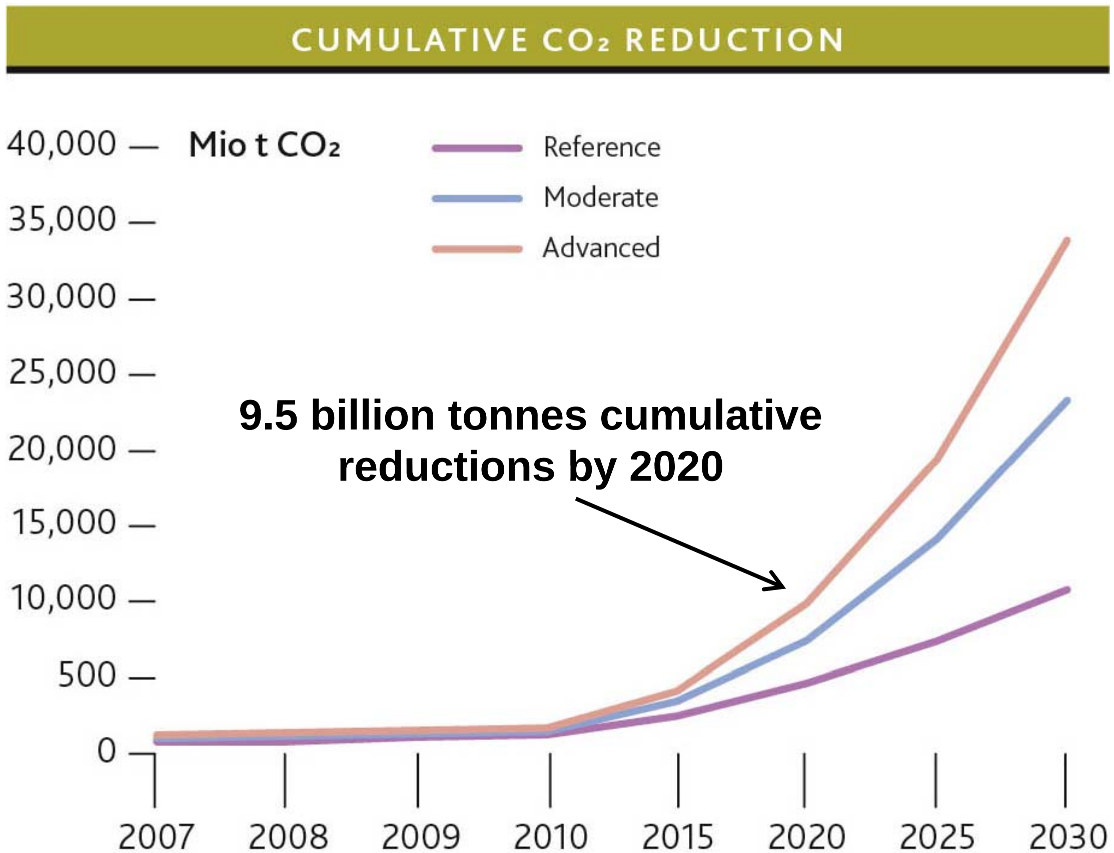
Climate Imperative



The Road to Success in Copenhagen
Four (not so easy) Pieces

- **Mitigation:** *25-40% + 'significant deviation'*
- **Adaptation:** *Operationalise the Fund and….?*
- **Technology:** *Honour 1992 deal in a way that makes sense in 2009 and beyond*
- **Finance:** *Needs a solid package within the UNFCCC*

Mind the gap!

Post 2012 Energy Sector Mitigation: Four key outcomes

1) The overall **ambition of targets**; Annex 1 aggregate must be at the upper end of 25-40% reductions and maintain legally binding architecture of Kyoto Protocol.

2) **Price of carbon**: If the targets are sufficiently rigorous, and prices are not artificially constrained, there will be:
    - a large global market;
    - game-changing' CO_2 prices in excess of € 50/tonne.

3) Technology Transfer/Cooperation/Deployment which is practical and makes business sense

4) Expanded CDM/New Mechanisms

    1) Electricity Sectoral Mechanism

    2) Programmatic CDM

Power Sector Emissions to 2020

1 - Imperative for global emissions peak prior to 2020;

2 - Power sector is largest source of emissions - 38% of CO_2, and about 25% of overall emissions;

3 - In practical terms, there are 3 options for making major emissions reductions in the power sector out to 2020: Efficiency; Fuel switching from coal to gas; and renewables, mostly windpower and hydro;

4 - Wind energy is the most cost-effective and timely option on the supply side out to 2020: 2600 Twh/year and 1.5 billion tonnes/year by 2020.

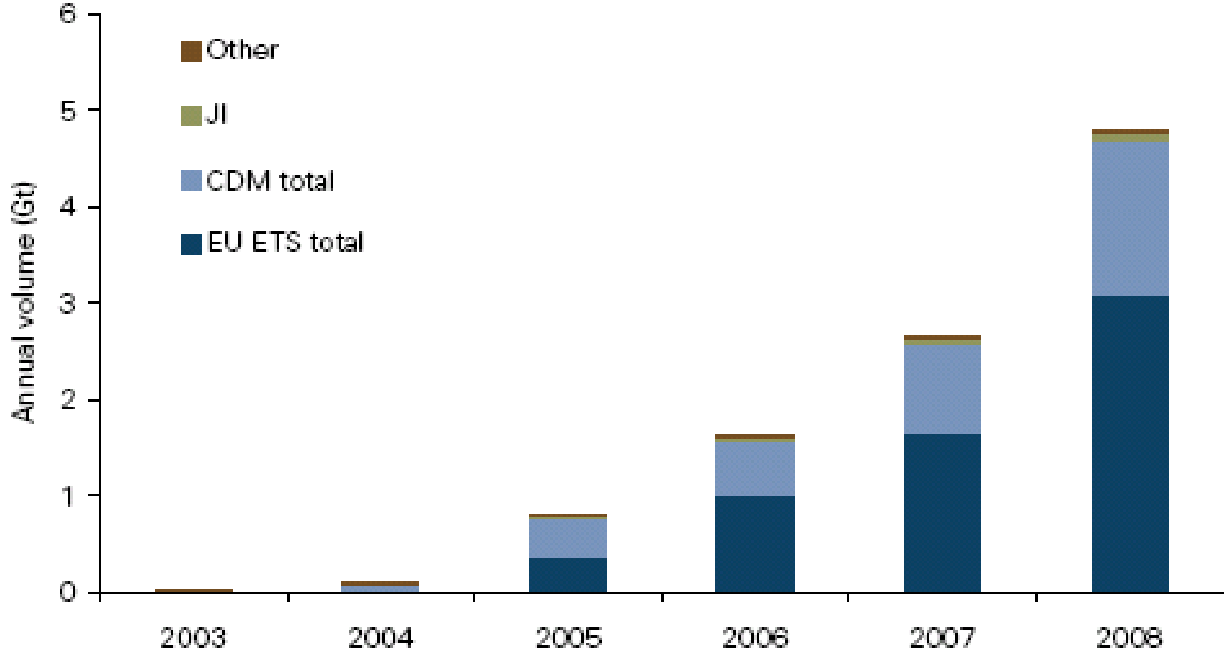
5 - Post 2012 carbon market design will have major impact – carbon market ***necessary but not sufficient condition*** to achieve rigorous climate protection objectives

Carbon Markets

…from ~zero to € 92 billion (125 bn USD) in just four years

Figure 2.1: Stairway to 2008

Reported and estimated contracts 2003-08, Gt CO2e



Source: Point Carbon

Carbon Markets

Wind CDM projects		
Country	Projects	MW
India	334	6149
China	416	23204
Mexico	15	1827
Brazil	10	674
South Korea	13	354
Cyprus	6	271
Egypt	4	406
Chile	5	171
Morocco	3	92
Dominican Republic	2	165
Costa Rica	2	69
Nicaragua	1	40
Philippines	1	33
Panama	1	81
Mongolia	1	50
Jamaica	1	21
Colombia	1	20
Israel	1	12
Argentina	1	11
Vietnam	1	30
Uruguay	2	64
Sri Lanka	1	10
Cape Verde	1	28
Thailand	1	3
Ecuador	1	2
Total	825	33784

Source: http://www.cdmpipeline.org

Number (%) of CDM projects in each category

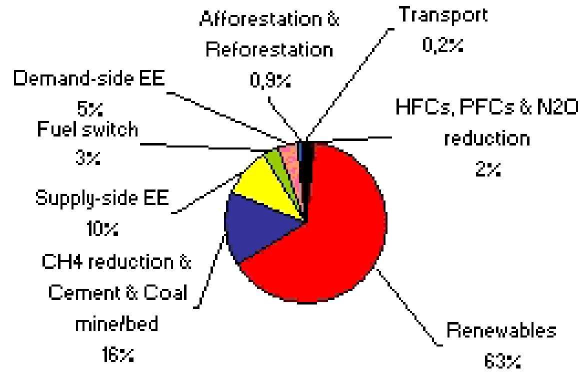
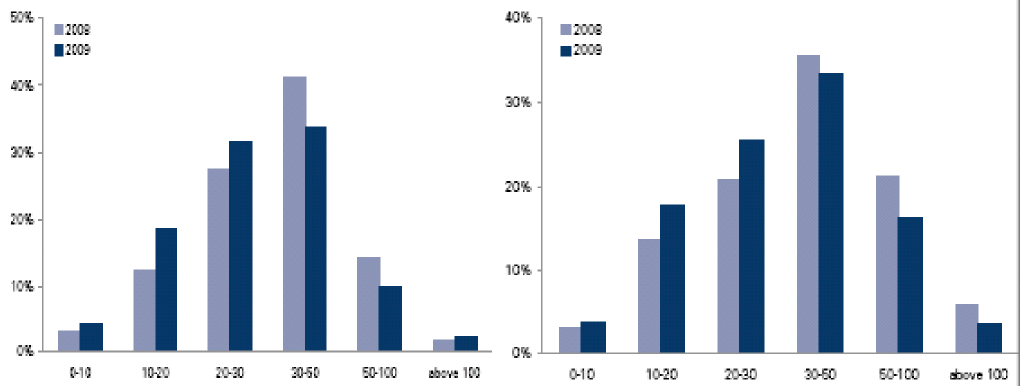


Figure 4.12: Price expectations, 2020

Expectations for global CO2 price level in 2020, in EUR (left) and USD (right). N=1966.



Source: Point Carbon

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At global level - Wind's contribution to pledges for Copenhagen

Current UNFCCC pledges

\+ USA climate bill:

-17%-20% of 2005 emissions

= aggregated Annex I pledges

➔ 11%-18% of 1990 emissions

Versus Global Wind in 2020

- 1081 GW installed capacity
- 2650 TWh produced

➔ 1591 Mt CO_2 avoided

Party	Information relating to possible QELROs	
	Range or single value by 2020, percentage	Reference year
Australia	-5% up to -15% or -25%	2000
Belarus	-5% to -10%[1]	1990
Canada	-20%	2006
European Union	-20 to -30%	1990
Iceland	-15%	1990
Japan	-15%[2]	2005
Liechtenstein	-20 to -30%	1990
Monaco	-20%	1990
New Zealand	-10 to -20%	1990
Norway	-30%	1990
Russian Federation	-10 to -15%	1990
Switzerland	-20 to -30%	1990
Ukraine	-20%	1990

Source: UNFCCC Secretariat – FCCC/KP/AWG/2009/10/Add.4/Rev.2

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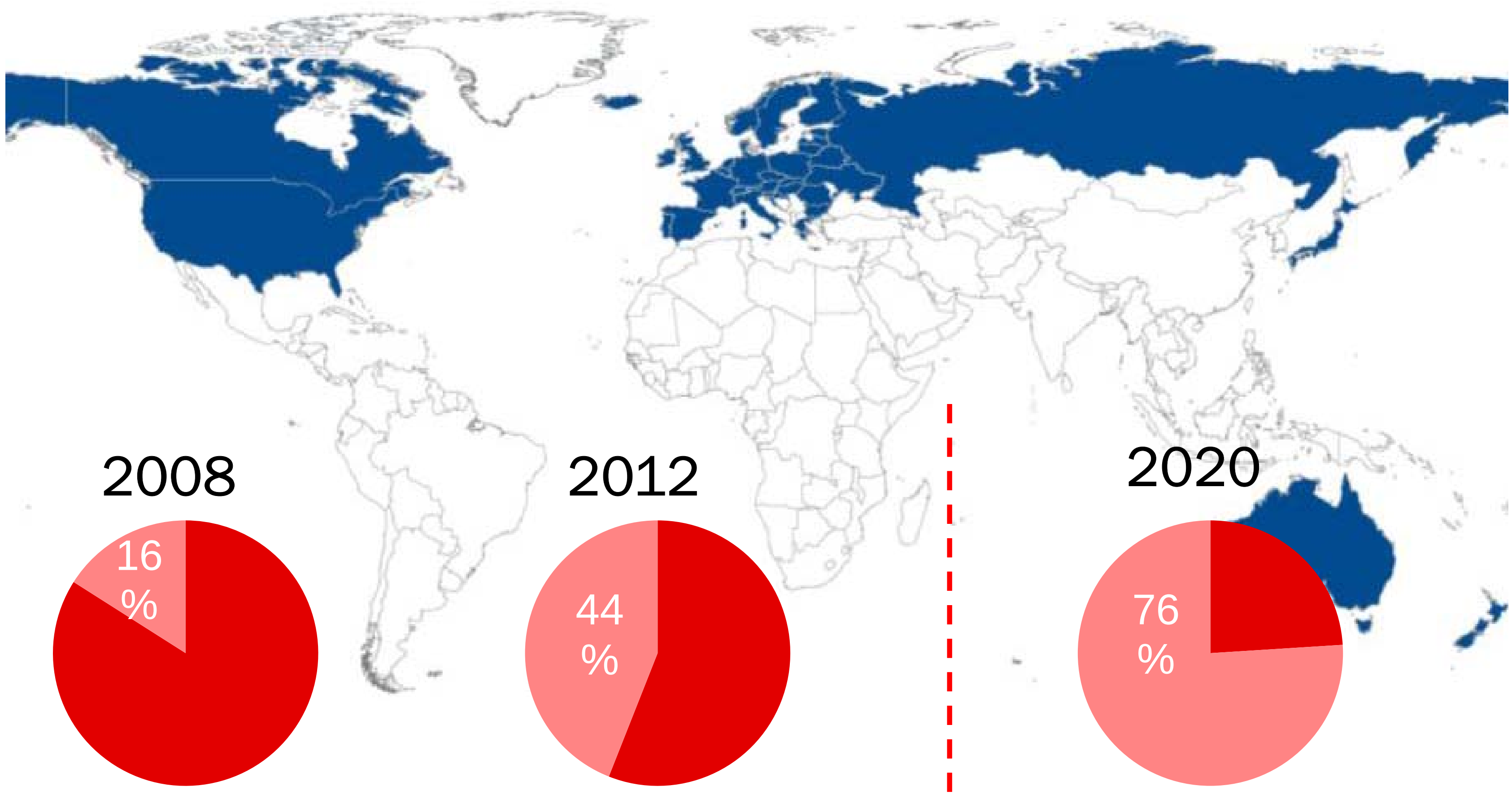
Annex I - Global Wind in 2020 will avoid…



16% of Annex I
2008 Kyoto target

44% of Annex I
2012 Kyoto target

76% of Annex I
2020 pledges (11%)

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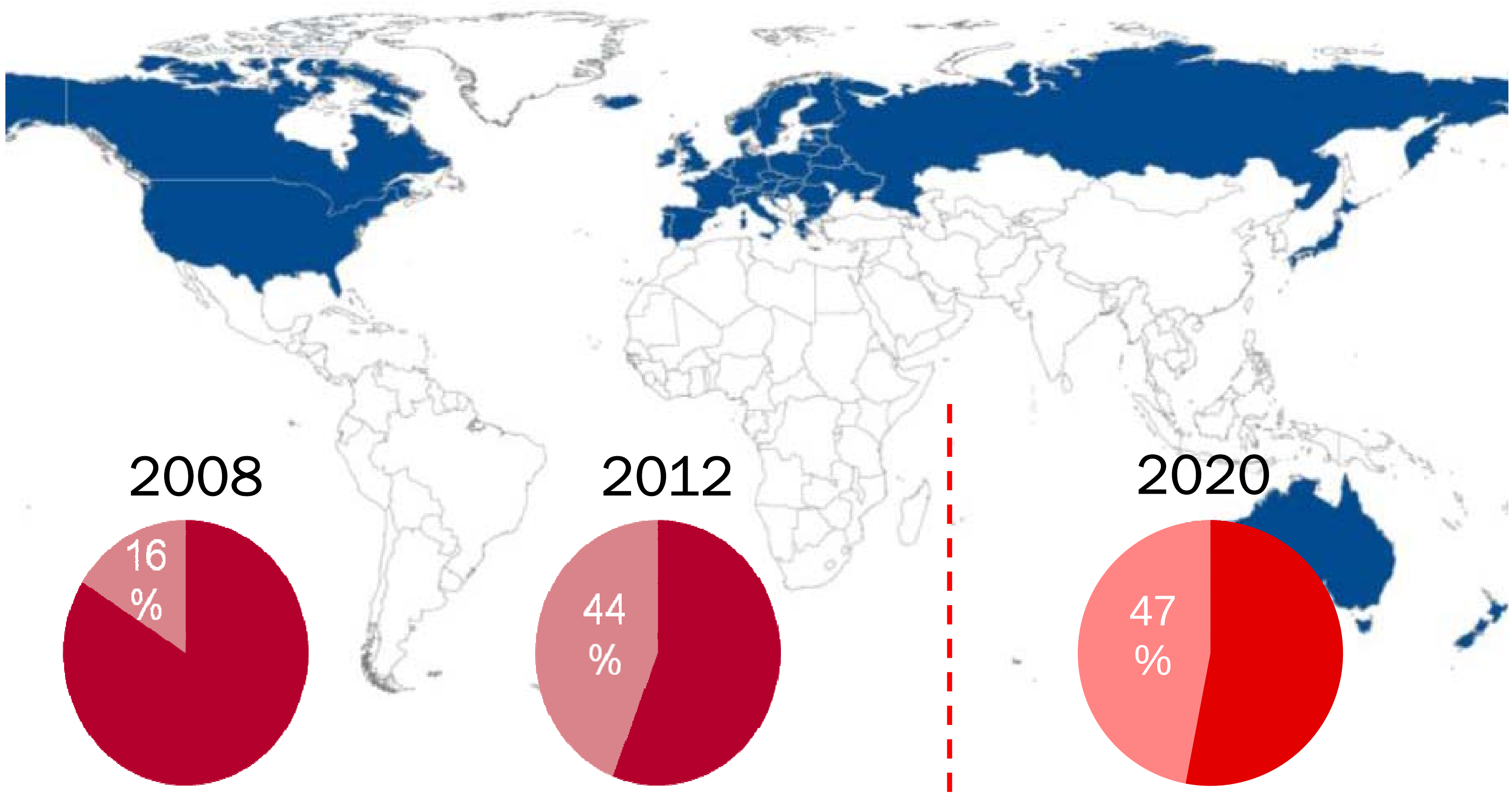
Annex I countries – Global Wind will avoid…

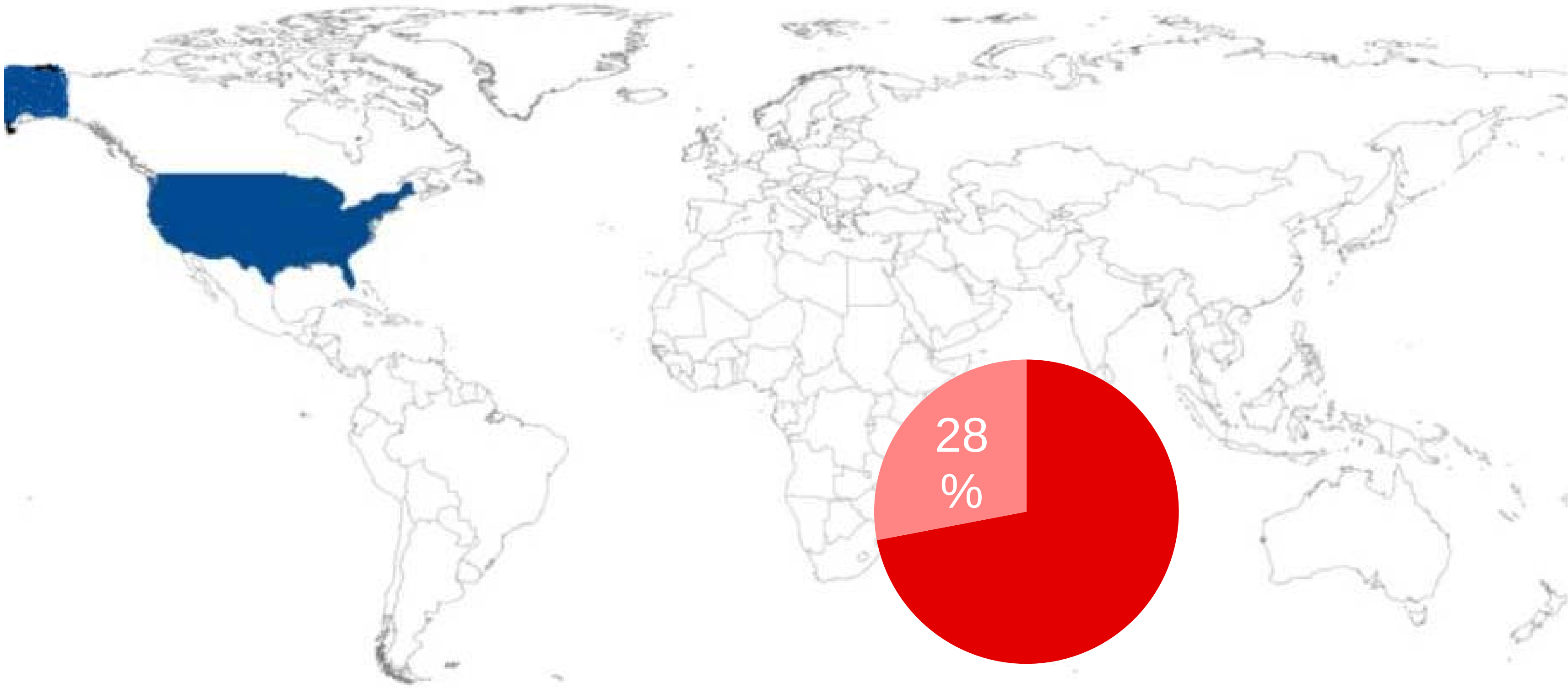


16% of Annex I
2008 Kyoto target

44% of Annex I
2012 Kyoto target

47% of Annex I
2020 pledges (18%)

USA - Wind in 2020 will avoid as much CO_2 as



28 % of US pledge for 2020

China - 15% from BAU by 2020 (energy)

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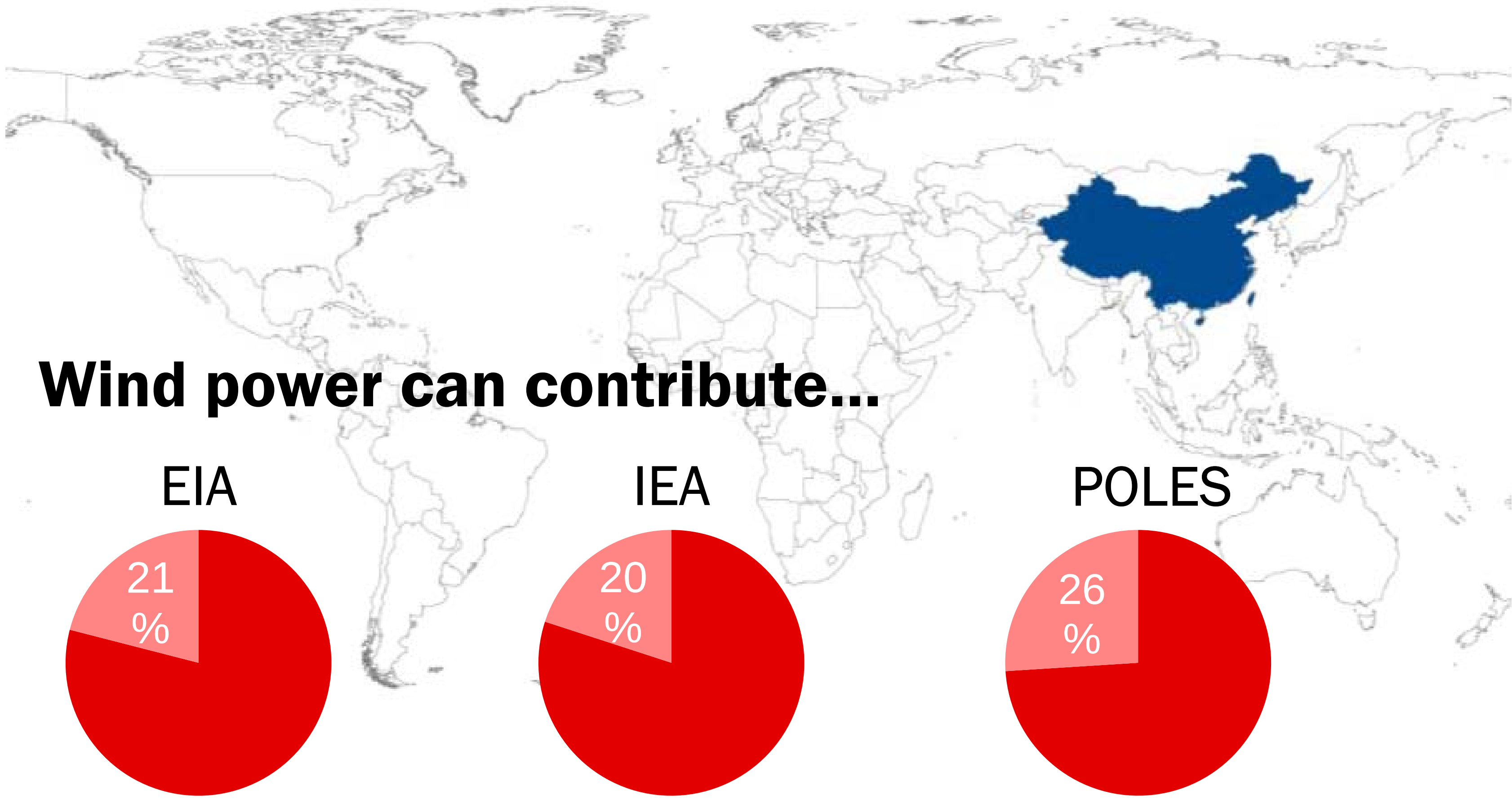
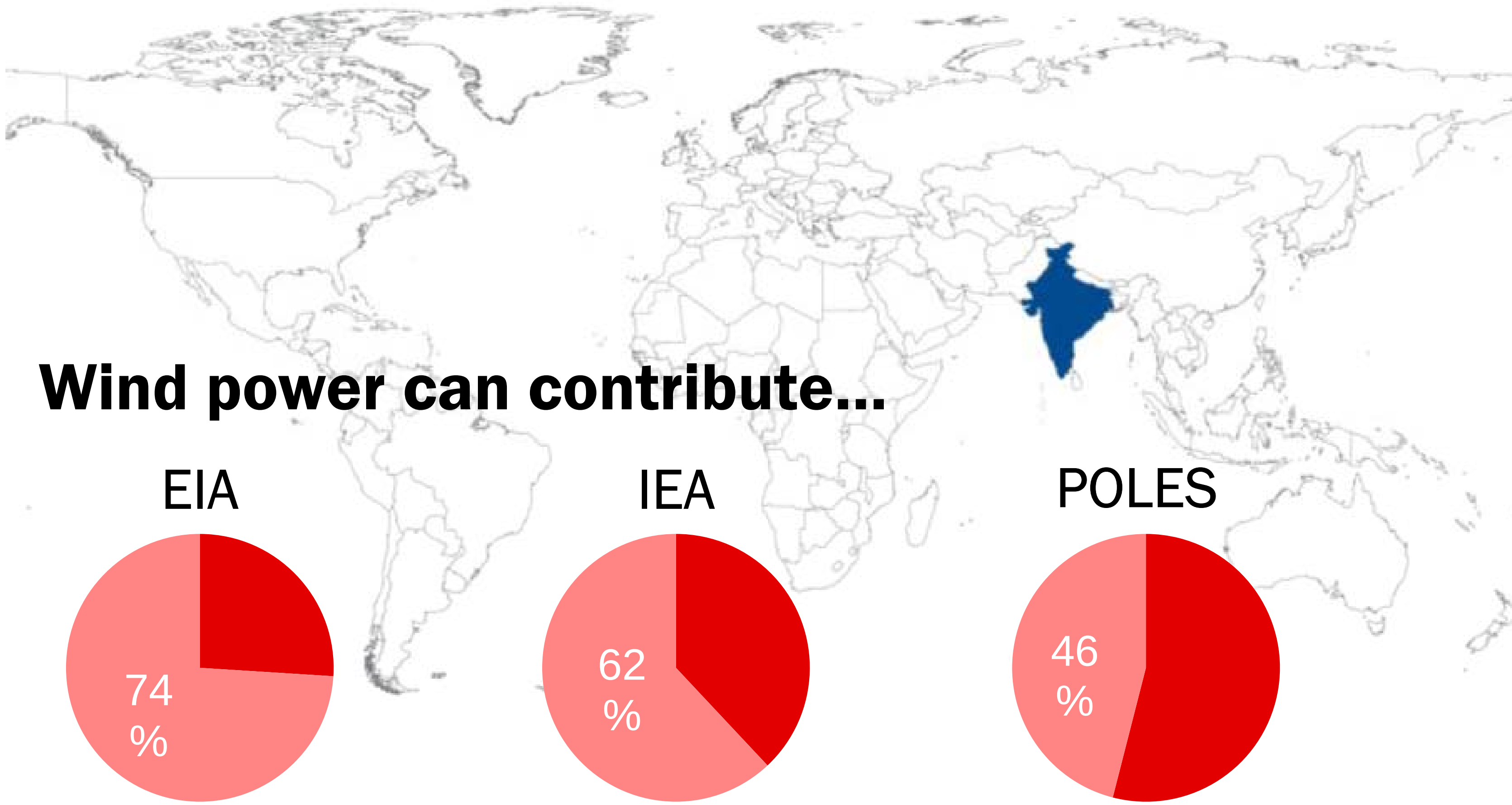
Wind power can contribute…



…20% to 26% of China's GHG reductions

India - 15% from BAU by 2020 (energy)

Wind power can contribute...



...46% to 74% of India’s GHG reductions

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Conclusions

- *Energy Revolution is underway – will it be in time?*
- *Asia becoming dominant in wind and other RE markets*
- *Wind can deliver a major share of the reductions needed*
- *Al emissions reductions targets need to increase dramatically*
- *The ‘cost’ of RE and the price of carbon: Price ≠ Cost ≠ Value*

Thank you

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"WHAT NATURE DELIVERS TO US IS NEVER STALE.
BECAUSE WHAT NATURE CREATES HAS ETERNITY IN IT."

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