Global Wind Energy Outlook Scenarios; GWEC

In 2016, wind power continued to push the boundaries of what many thought was possible. The fact remains that wind is one of the least cost options in many markets for new power generation, and this is even before factoring in environmental and health costs.

The Global Wind Energy Outlook (GWEO) explores the future of the wind energy industry out to 2020, 2030 and up to 2050. The team uses the International Energy Agency's New Policies Scenario from the World Energy Outlook as a baseline; and has included the IEA's 450 Scenario, as the climate consequences of different energy pathways have once again risen up the international political agenda.

The GWEC Moderate and Advanced Scenarios have evolved collaboratively over the years between the Global Wind Energy Council and the German Aerospace Centre. These scenarios for the future of the wind industry have contributed to an ongoing series of broader studies on global sustainable energy pathways up to 2050 conducted by DLR and Greenpeace International in collaboration with a number of industry associations including GWEC. The Energy Revolution scenario or 2°C Scenario has become one of the benchmarks in international energy scenario discussions, utilized by the IPCC, IEA and others.

All scenarios are compared with two different projected energy demand futures: the demand projections used in the IEA's World Energy Outlook, and a lower, Efficiency Scenario developed as an update of the original Efficiency scenario.

The upheaval in electricity markets around the globe and the wild swings in policy both in favour of and against renewable energy deployment make predictions about the future of this or any other industry challenging. However, it is also the case that as wind power plays a more and more central role in most future energy scenarios, that the various scenarios from industry, the IEA and others all begin to converge. Here GWEC presents four scenarios for each of the 10 IEA defined regions as well as global totals, looking towards 2020 and 2030 with longer term projections out to 2050.

IEA New Policies Scenario

The IEA's New Policies Scenario (NPS) is based on an assessment of current directions and intentions of both national and international energy and climate policy, even though they may not yet have been incorporated into formal decisions or enacted into law. Examples of this would include the emissions reduction targets adopted in Paris in 2015, the various commitments to renewable energy and efficiency at national and regional levels, and commitments by governments in such fora as the G-8/G-20 and the Clean Energy Ministerial. The New Policies scenario is now at the centre of the IEA's World Energy Outlook analysis; and we have extrapolated it out to 2050 for comparison purposes.

IEA 450 Scenario

The 450 Scenario (450), first introduced in the IEA's World Energy Outlook in 2010, 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, which would require the concentration of greenhouse gases (GHG) in the atmosphere to be limited to around 450 parts per million of carbon-dioxide equivalent (ppm CO2-eq) in the long-term. The basis of the 450 Scenario is, however, different. Rather than being a projection influenced by policy actions, it deliberately selects a plausible energy pathway to achieve the desired goal. Near term policy assumptions for the period to 2020 draw on measures that were outlined in the WEO Special Report on Energy and Climate

GWEC Moderate Scenario

GWEC's Moderate Scenario (MS) has many of the same characteristics as the NPS, taking into account all policy measures to support renewable energy either already enacted or in the planning stages around the world, and at the same time assuming that the commitments for emissions reductions agreed by governments at COP21 (Paris, 2015) will be implemented, although on the modest side. At the same time it takes into account existing and planned national and regional targets for the

uptake of renewable energy in general and wind energy in particular, and assumes that they are in fact met. Through the period out to 2020, the MS is very close to our annual five-year market forecast based on industry orders and planning as well as intelligence from our global network about new and emerging markets. After 2020 it is difficult to make a precise forecast given the current set of global uncertainties, but at that stage we assume that an even broader range of governments will begin to respond to essential asks of national energy security and long-term price stability offered by wind energy. Further, the cost of wind continues to come down and the price of conventional generation continues to go up.

GWEC Advanced Scenario

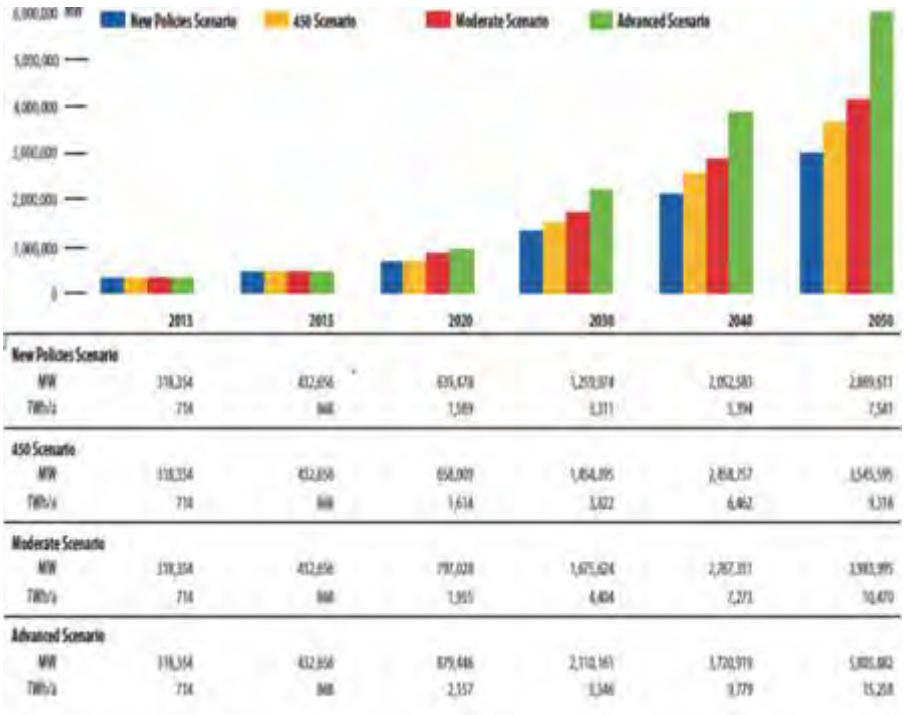
GWEC's Advanced Scenario (AS) is the most ambitious, and outlines the extent to which the wind industry could grow in a best case Wind Energy Vision. It assumes an unambiguous commitment to renewable energy in line with industry recommendations, the political will to commit to appropriate policies and the political stamina to stick with them. Further, it does NOT assume massive new build nuclear or a large take up of carbon capture and storage technologies, as is the case in the IEA scenarios.

The AS also assumes that governments enact clear and effective policies on carbon emission reductions in line with the now universally agreed objective of keeping global mean temperature rise below 2°C above pre-industrial temperatures. Wind power is critical to meeting the first objective in that battle which is getting global emissions to peak and begin to decline before the end of this decade.

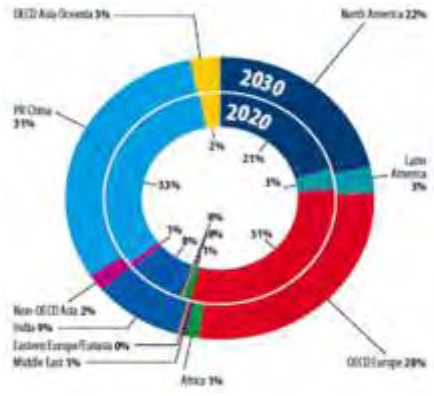
Scenario Results

The IEA New Policies Scenario projects that annual wind energy markets will match the stellar results from 2014 and cross the 50GW mark in 2016 as well; and then shrink to just under 38 GW/annum by the end of the decade. It then projects an increase to near 2015 levels in the middle of the next decade, gradually decreasing to a net of 43 GW/annum by 2030 and essentially stays in the mid-30s in terms of GWs installed per annum, remaining at for the rest of the period out to 2050 in net terms. On the basis of this, cumulative installed capacity would still reach 639 GW by 2020, and 1,260 GW by 2030. The latter is almost 300 GW higher than the NPS projections two years ago. By 2050, NPS foresees global wind installations reaching 2,870 GW.

GLOBAL CUMULATIVE WIND POWER CAPACITY



REGIONAL BREAKDOWN: NEW POLICIES SCENARIO

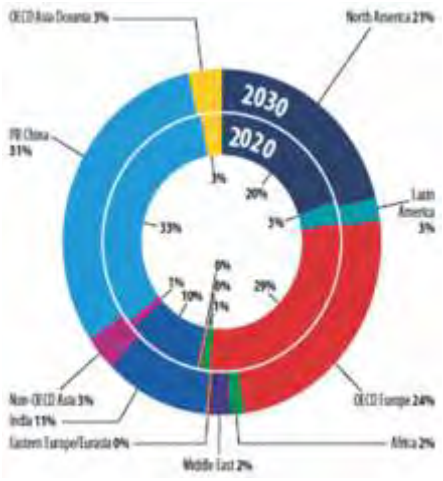


	2020	2030
North America	126,961	252,784
Latin America	18,749	36,196
OECD Europe	186,878	323,091
Africa	6,575	15,908
Middle East	1,072	8,009
Eastern Europe / Eurasia	668	1,117
India	50,063	111,938
Non-OECD Asia	5,213	21,796
PR China	201,178	364,801
OECS Asia Oceania	15,322	34,598
Global Total / MW	639,478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

WIND ENERGY

The 450 Scenario also sees 2016 at 2014 levels, but is substantially higher than NPS installations out to 2020, for a total of 658 GW. It then projects a marked increase in installations with cumulative installed capacity reaching 1,454 GW by 2030, which is almost 200 GW higher than the NPS projections. By 2050, this scenario foresees global wind installations reaching 3,546 GW.

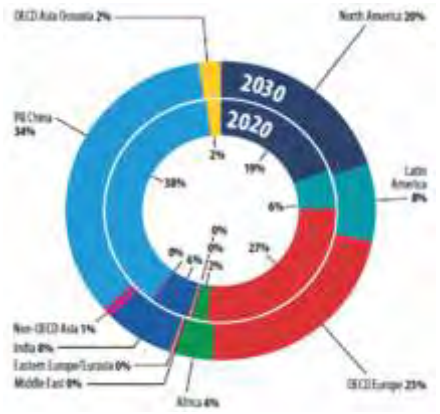
REGIONAL BREAKDOWN: 450 SCENARIO



	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
OECS Asia Oceania	16,836	47,295
Global Total / MW	658,009	1,454,395

The GWEC Moderate Scenario follows the lines of our short term market projections prepared for our annual market update out to 2020, with annual market size reaching almost 80 GW/annum by 2020 for a total installed capacity of 797 GW. We expect robust growth in the period after 2020. By 2030 total installed capacity would reach nearly 1,676 GW. By 2050, this scenario foresees global wind installations reaching 3,984 GW.

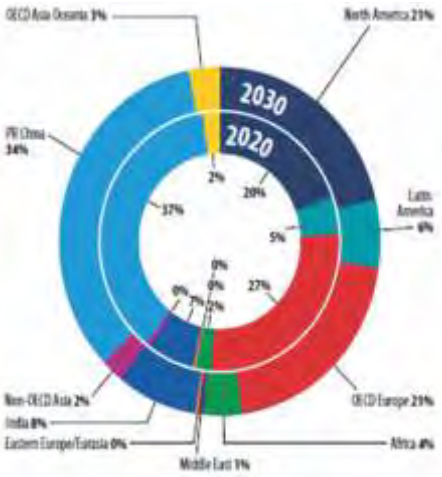
REGIONAL BREAKDOWN: MODERATE SCENARIO



	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
OECS Asia Oceania	13,364	32,887
Global Total / MW	797,028	1,454,395

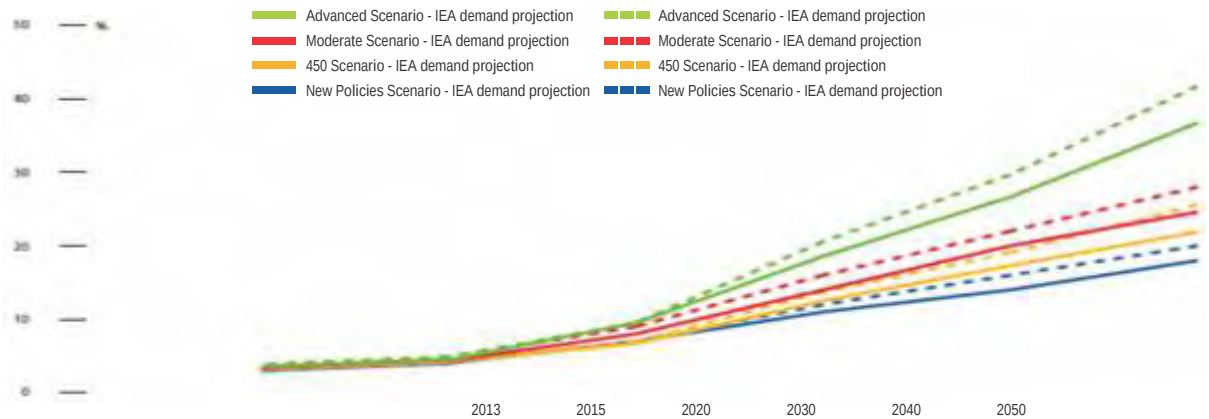
The GWEC Advanced Scenario maintains ambitious growth rates throughout this decade, assuming that a broad, clear commitment to the decarbonisation of the electricity sector emerges quickly with the ratification of the 2015 Paris Climate Agreement. Annual market size would top 100 GW by the end of the decade, bringing total installed capacity to just over 879 GW by 2020, and to 2,110 GW by 2030, which could only occur with comprehensive and robust climate action globally and essential political will to tackle the climate challenge. By 2050, this scenario foresees global wind installations reaching 5,806 GW. This is almost 3,000 GW higher than the current baseline scenario of the long-term NPS projections for the wind sector.

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
OECS Asia Oceania	17,242	57,084
Global Total / MW	879,446	2,110,161

WIND POWER SHARE OF GLOBAL ELECTRICITY DEMAND



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