



# 15 SIGNALS

EVIDENCE THE ENERGY TRANSITION IS UNDERWAY



# FOREWORD

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World leaders approved a universal climate agreement in Paris last year, drawing a line in the sand for the transformation of the world's energy system into a clean and sustainable form.

Signs that a global energy transition is happening are everywhere to be seen: in the growth of renewables, the rise of city-level climate actions, the stagnation of CO<sub>2</sub> emissions and in companies who are committing to science based targets as the foundation of their climate actions, to name just a few.

We felt it important to highlight 15 key signs or “signals” of the energy transition, to help raise awareness that the transition to a new, sustainable, equitable, just and fair global energy system has irrevocably begun.

What is needed now is to accelerate the transition and scale it up to have a chance of keeping global temperature rise to well below 2°C, trying for 1.5°C, as countries committed to in the Paris Agreement just eight months ago.

Global meetings – such as the G20 meeting taking place in China on 4-5<sup>th</sup> September; and the next UN climate talks starting in Marrakech on 7<sup>th</sup> November – gives opportunity to all stakeholders to say how and what they can contribute to accelerating the transition.

Ending fossil fuel subsidies, supporting the deployment of renewables and energy efficiency, increasing green finance and putting a just price on carbon are just some of the actions that can be taken right now to put pace into the transition.

As 2016 heads into the record books as likely the hottest year ever recorded in history, it is a reminder that we have precious little time left to act to keep global temperatures well below 2°C.

We have the Paris Agreement to guide our way. Now we need to implement it. Now is the time for action.

September 2016

# SIGNALS OF THE ENERGY TRANSITION

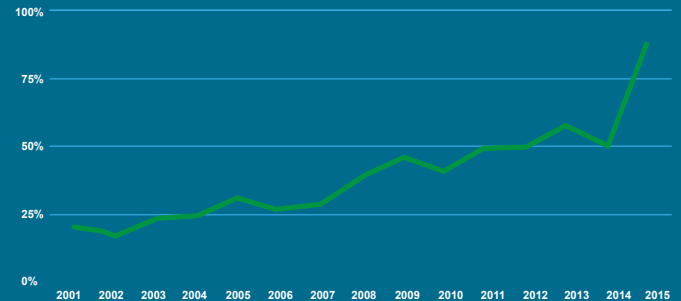


# RENEWABLE ENERGY

**Renewables accounted for 90 per cent new electricity generation globally in 2015, while contributing to half of it the year before.**

*(Source : Share of new electricity generation by renewables in the world, estimated by IEA.)*

Based on its analysis of preliminary data for the global CO<sub>2</sub> energy emissions data for 2015, the International Energy Agency showed that power generated by renewables is playing a growing role in slowing down energy related CO<sub>2</sub> emissions as they accounted for around 90 per cent of new electricity generation in 2015. Wind power alone produced more than half of it. This share by renewables has seen an exponential increase in the last years, from 50 per cent in 2014, to 90 per cent of new power nowadays. On the road through COP21, renewables are known to be a tipping point that needs to be amplified, especially by replacing old fossil fuel power plants with renewables.



Expansion in renewable power generation capacity worldwide

*(Source: IRENA, 2015)*



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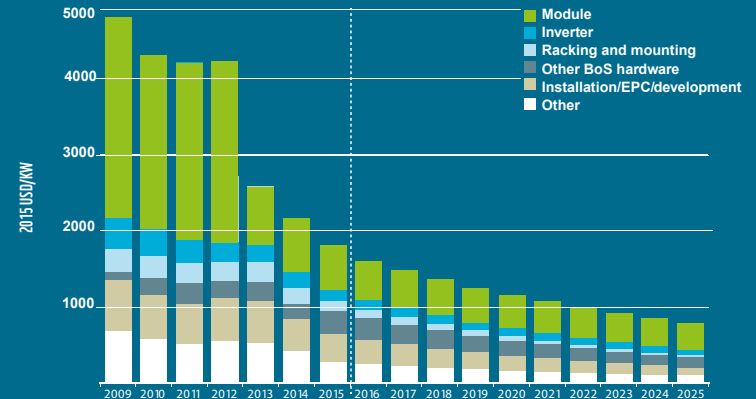
# SOLAR TECHNOLOGY COSTS DROPPING

Solar PV technologies electricity generation costs have decreased by more than 80 per cent since 2009. It is forecast to continue falling by up to 59 per cent in 2025, making solar PV the cheapest form of power generation.

*(Source: IRENA 2016, The Power to Change: Solar and Wind Cost Reduction Potential to 2025)*

According to the International Renewables Energy Agency (IRENA), solar PV module prices present from 18 per cent to 22 per cent learning rates and rapid deployment with around 40 per cent growth in cumulative installed capacity in each 2012 and 2013, and around 30 per cent in 2014 and 2015. This led to a decline of 80 per cent in PV module prices between 2009 and 2015. This created a buyer's market that could be spurred in the coming years with the right policy measures.

Global weighted average utility-scale solar PV total installed costs, 2009-2025







# INVESTMENTS IN RENEWABLES SOARING

Global investments in renewable generation hit a new world record, with US\$286 billion invested in 2015, more than double dollar allocations to new coal and gas generation. Since 2013 more renewable power capacity has been installed annually around the world than fossil and nuclear together.

(Source : IRENA, 2014-2015)

According to REN21, total global investments in renewable power and fuels reached a new record in 2015 with US\$285.9 billion\* invested. This represents a 5 per cent increase compared to 2014 and exceeds the previous record of US\$279 billion reached in 2011. **Global investment in new renewable power capacity was more than double the US\$130 billion allocated to new coal- and natural gas-fired power generation capacity.** Among top investments, solar technologies accounted in total for US\$161 billion investments – with a 12 per cent growth compared to 2014 – and wind for US\$109 billion – with a 4 per cent growth compared to 2014. Biggest country investors include China, US, Japan, the UK and India.

\*not including hydropower projects >50MW



(Source: REN21, Global Status Report, 2016)



# INCREASING NUMBER OF COUNTRIES RUNNING TOTALLY ON RENEWABLE ENERGY

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On the 8<sup>th</sup> of May 2016, renewables supplied Germany almost all its power demand, marking a milestone in its “energiewende”.

In 2015, renewables in Germany accounted for 32.6 per cent of gross domestic power consumption. The country targets a minimum of 50 per cent renewables in this field by 2030. As the current level of coal in the mix remains a problem to be solved for Germany, the country ranks among world champions in the deployment of renewable technologies, being the second country in the world with total renewable power capacity per capita. On the 8<sup>th</sup> of May 2016, renewables supplied 87.6 per cent of domestic electricity consumption due to extremely favourable weather conditions leading to negative electricity prices. This symbolic moment illustrates the powerful energy transition happening in Germany: “Agora Energiewende”. Other countries with a high share of renewables such as Portugal, Denmark and Cost Rica have also succeeded in reaching almost a full supply power demand from renewables. In Portugal, all renewables provided 48% of its electricity in 2015 according the Portuguese renewable energy association.



On the 8<sup>th</sup> of May 2016, renewable energies supplied almost full power demand in Germany

*(Sources: German Federal Ministry for Economic Affairs and Energy)*



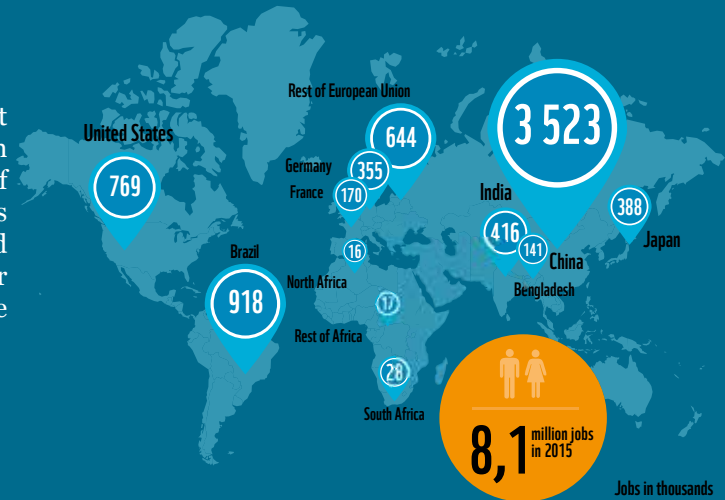
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# JOBS IN RENEWABLE ENERGY INCREASING

Renewable energy employment hit a record in 2015, with 8.1 million jobs recorded.

*(Source: IRENA 2016 Renewable Energy and Jobs)*

According to IRENA, global renewable energy employment increased by 5 per cent in 2015 to reach 8.1 million. In contrast to other depressed labour markets, total number of jobs in renewables worldwide continued to rise. Solar PV was the highest employer with 2.8 million jobs globally, followed by liquid biofuels and wind energy. Asia accounts for 60 per cent jobs worldwide. The top five with jobs in renewables are China, the EU, Brazil, the US and India.





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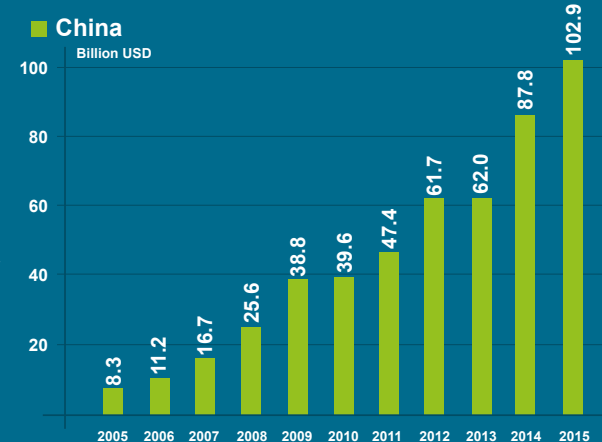
# CHINA IS THE WORLD'S LARGEST INVESTOR IN RENEWABLES

Chinese investments in renewables increased by 17 per cent to US\$103 billion – making it again world's leading champion in renewables.

(Sources: REN21 Global Status Report 2016)

China ranks as the world's leader in total renewables capacity, according to the REN21 annual report; in investment in renewables capacity (topping US\$102.9 billion by 2015) and in solar PV, solar water heating, wind and geothermal power. It is also the largest employer in renewables, with a total of 3.5 million jobs. Denmark, Germany, Sweden, Spain and Portugal are the top five countries in terms of renewables if we look the numbers in terms of total renewable power capacity per capita.

However, in 2015, the annual wind power curtailment in China reached 33.9 billion kilowatts-hour, with an average rate of 15 per cent. In the first half of 2016, it reached a record high level of 21 per cent, which shows that the current managing mechanism and infrastructure of China's power sector does not match the speedy investment in renewable energy.



Total New Investments in China in Renewable Power and Fuels from 2005-2015” - Source: BNEF and REN21, Global Status Report, 2016





# AFRICA IS THE WORLD'S LARGEST MARKET FOR OFF GRID SOLAR PRODUCTS

**Sub-Saharan Africa was the largest market for off grid solar products in the world with 1.37 million units.**

*(Sources: REN21, Global Status Report, 2016)*

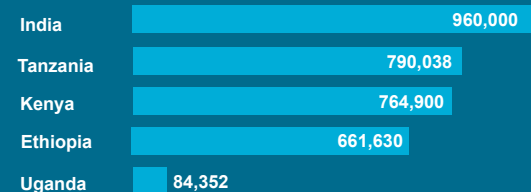
Sub-Saharan Africa hit 1.37 million units sold in off grid solar in 2015. Despite this record, access to clean energy remains one of the main challenges for the region in the next year. 53 per cent of sub-Saharan Africa lacks access to electricity.

Meanwhile, the African region is part of the Africa Renewables Energy Initiative (AREI) that aims to target a 10GW renewables capacity by 2020 and 300GW by 2030.

As the end of 2014, four sub-Saharan countries were particularly leading in the global top five countries with their number of solar lighting systems: Tanzania, Kenya, Ethiopia, Uganda.



Solar Lighting Systems





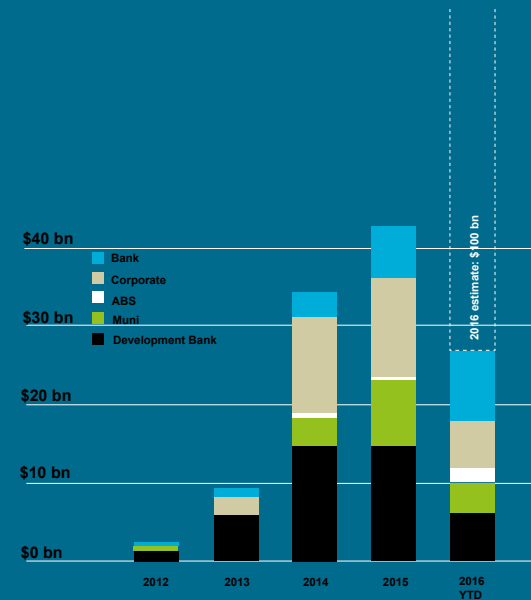
# GREEN BONDS GROWING

The green bonds market grew at an impressive compound growth rate, from close to zero in 2007 to an outstanding US\$118 billion by mid-2016.

*(Sources: WWF, Green Bonds must keep the green promise!, June 2016; and Speech of MA Jun, Chief Economist of People's Bank of China; Climate Bond Initiative; Bloomberg New Energy Finance)*

Green bonds are attractively simple structures, offering investors additional disclosure and accountability and providing a means to ring fence funds for investments in sustainable agriculture, energy-efficient buildings, clean energy, industry and transportation, water and waste, even biodiversity conservation, to name just a few investment fields.

By mid-2016 the market amounted to US\$118 billion of outstanding bonds labelled as green or climate aligned. More recently, China adding significant momentum to this global trend. In December 2015, the People's Bank of China released "Green Financial Bonds Bulletin", which defines the first standard for green bond in China and helped unlock the potential of the Chinese market. During the first quarter of 2016 alone, China had issued US\$ 8.2 billion of green bonds, which accounts for half of new issuances of green bonds worldwide. The green bond market bears great potential for the future and can help to accelerate the energy transition to keep global temperature increase well below 2°C, but still needs standards to address all major and sustainability challenges.





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# SCIENCE BASED TARGETS TO PUT BUSINESS ON A BELOW 2°C TRAJECTORY

More than 170 large companies, including energy intensive ones, signed on to adopt science based targets.

*(Sources: CDP, The Business End of Climate Change: How corporate action supported by smart policy can keep temperature rise below 2°C, 2016)*

The Science Based Targets initiative, run by WWF, CDP, WRI and the UN Global Compact, invites companies to set their emissions targets in line with keeping climate change well below 2°C. Partners assumed that 2,000 companies will be setting Science Based Targets by 2030. As of August 1st 2016, 176 large companies have committed to doing this, and 18 have already had their targets reviewed and approved. The initiative also aims to lift corporate ambition and help businesses pursue bolder solutions to climate change.

2°C target

1,9°  
1,8°  
1,7°  
1,6°  
1,5°

Proximus  
AMD  
Pfizer  
NRG Energy  
General Mills  
Coca-Cola enterprises  
Enel Kellogg Company  
International Post Corporation (IPC)  
Lundbeck A/S  
Autodesk  
Dell Inc  
Host Hotels & Resorts Inc.  
Sony  
Thalys  
PostNord  
Procter & Gamble Company  
UBM plc

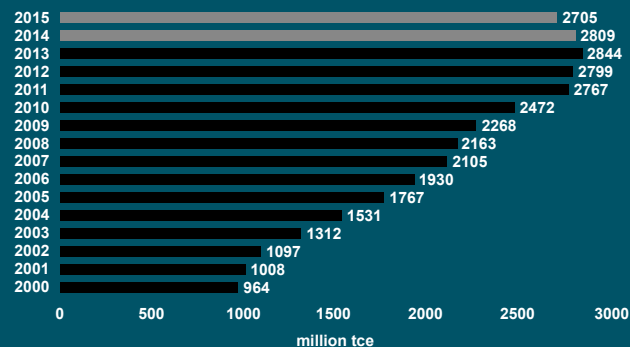


# CHINA'S COAL CONSUMPTION MAY BE PEAKING

## China may have already reached a coal consumption peak.

*(Sources : China Energy Statistical Yearbook 2014  
China National Economic and Social Development  
Statistics Bulletin 2015)*

China accounts for nearly half of the world's coal consumption, the coal dependence makes China the biggest carbon emitter globally. This has caused severe air pollution and other environmental problems domestically. Along with the slowing down of China's economic growth and the Chinese government's effort to restructure its industries, China's coal consumption has been in decline since 2014 with a 3.7 per cent drop in 2015.



China's coal consumption (2000-2015)





# COAL INDUSTRY DECLINING

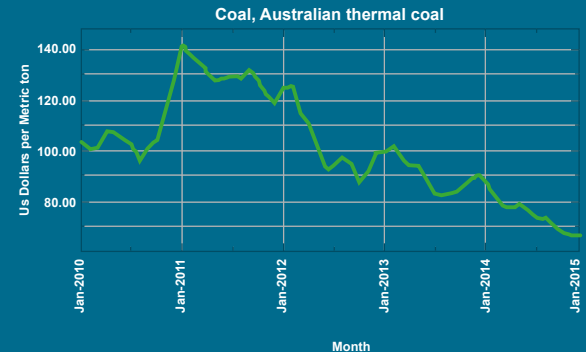
## The coal industry faces declining prices and higher costs leading to some bankruptcies.

(Sources: WWF, *Megatrends in the global energy transition*, December 2015  
Sierra Club and CoalSwarm, *Boom and Bust: Tracking the global coal plant pipeline, 2015 and 2016 reports*)

In order to hold temperature increase below 2°C, two thirds of fossil fuels proven reserves must stay in the ground. There are increasing signs that the unrestricted burning of environmentally damaging fuels is also reaching its limits in the real world. **Since 2010, two out of three planned coal power plants have been put on the back burner or completely abandoned and only one finally completed.** The parallel collapse in the use of coal in China, Europe and the USA in recent years combined with signs of coal market decline will soon have global impact, on emissions as well as on the industry. In 2016, US mining giant Peabody Energy, which used to be the world largest private coal company, filed for bankruptcy. In total, coal-based US companies which filed for bankruptcy in 2016 lost \$30 billion USD in stock-market-value since 2010.

In 2015, a report by Wood Mackenzie found that 33 per cent of coal mines in Queensland (Australia) were running at a loss, including 50 per cent of thermal coal mines. **In China, coal production dropped dramatically by 9.7 per cent in the first half of 2016.**

Newcastle Coal Benchmark Coal Price, January 2010 - January 2015



(Sources: Index Mundi)



This is the size of  
**ONE TONNE CO<sub>2</sub>**

Take up the challenge  
- reduce every way YOU can.  
**Now!**

# GLOBAL CO<sub>2</sub> EMISSIONS FROM ENERGY STALLING

**Global energy related carbon dioxide emissions stalled for the second year in a row in 2015, despite a 3 per cent economic growth.**

*(Source: International Energy Agency, Global energy-related CO<sub>2</sub> emissions data, 2016.)*

In its preliminary global CO<sub>2</sub> energy emissions data in 2016, the International Energy Agency (IEA) showed that global emissions from energy stood at 32.1 billion tons in 2015, following a flat trend for the second year in a row. The link between the global economy, which continued to grow, and energy related emissions growth is therefore weakening. Improvements in energy efficiency, a spur in renewables led by wind as well as the decline of coal use in the two biggest world emitters are advanced by IEA as the main drivers of this trend.





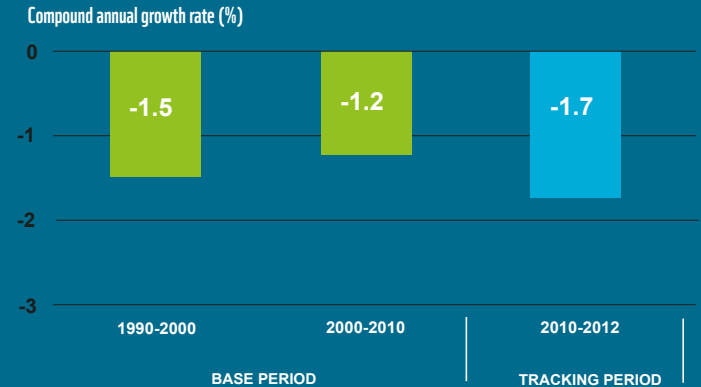
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# ENERGY INTENSITY IMPROVING

The decline in annual global energy intensity accelerated to more than 1.7 per cent on 2010 to 2012, but needs to go much faster to meet 2030 sustainable development goals.

*(Sources: Sustainable Energy for All 2015: Progress Toward Sustainable Energy)*

The improvement of energy efficiency and energy savings constitute a critical pillar of the energy transition. Global efforts on this matter can be tracked through energy intensity which connects economic growth with energy use. According to Sustainable Energy for All, progress in improving primary energy intensity (units of energy per unit of GDP) has led to a 1.7 per cent decline a year over 2010-2012 (World Bank 2013). It is a better rate than the previous decade but it is still not enough to meet the Sustainable Energy for All goal of 2.6 per cent a year. This recent trend was primarily driven by high-income countries (from 1.5 per cent a year from 2000 to 2010 to 2.6 percent from 2010 to 2012).





# CITIES RISING TO CLIMATE CHALLENGE

(Sources: UNEP, Climate commitment of subnational actors and business, 2015)

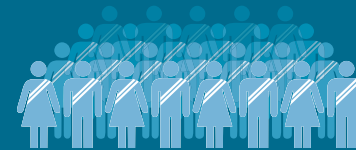
Cities are at the forefront of climate action. Towards COP21, hundreds of local governments joined their forces to launch initiatives and networks to advance their contribution to fight climate change and accelerate action: like the C40, the Covenant of Mayors (CoM) or the Carbonn Climate Registry (cCR). According to UNEP, the total achievements of additional emission reductions of these three city level initiatives is expected to reach 1.08GtCO<sub>2e</sub> by 2020 as compared to a current policy scenario. In addition, cities networks and 700 mayors declared their intention to strengthen their efforts to reach a 3.7GtCO<sub>2</sub> annual reduction by 2030 in urban areas.

From 2010 to 2015, the ICLEI Carbonn Climate Registry reporting platform recorded 1 681 actions on concrete action plans already implemented by 600 cities and regions in 62 countries to fight climate change. These communities represent 8 per cent of the world population.

Categorization of methods of climate action



(Sources: ICLEI e.V. 2015)



**700 cities**  
 commit to reduce their emissions  
 by 3.7GtCO<sub>2e</sub> per year  
 by 2030

Power Now

402.

Total Energy  
Generated

1325

CO<sub>2</sub>Saved

755



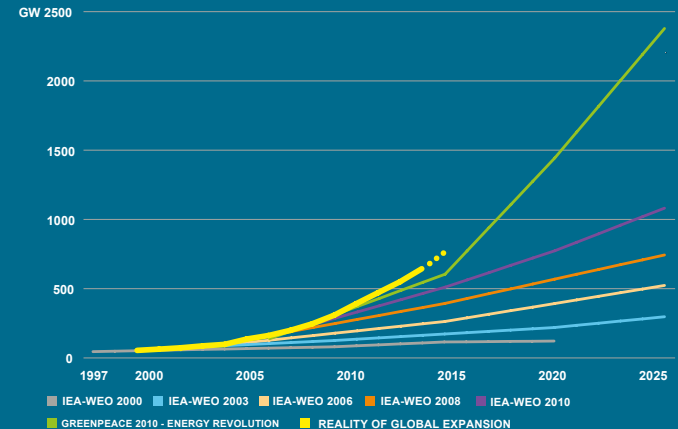
# FORECASTS AND REALITY

**Overachievements: comparing projections done by international energy outlooks for global expansion of renewables with reality shows that international agencies have underestimated the potential of these technologies.**

*(Sources: WWF, Megatrends in the global energy transition, 2015  
Matthieu Metayer, Christian Breyer, Hans-Josef Fell, The projections for the future and quality in the past of the World Energy Outlook for solar PV and other renewable energy technologies, 22.09.2015)*

So far, institutional outlooks have totally underestimated the deployment of renewables and their future spread. For instance, the International Energy Agency (IEA) has missed in its projections the renewables boom for decades, only being able to adjust its forecasts on the expansion of renewables in relation to the existing developments. These misleading results have been shown in a recent WWF report (Megatrends in the global energy transition, 2015). Greenpeace and Global Wind Energy Council forecasts were the only one close to reality for renewables. Renewables can be seen as disruptive innovations with the potential to completely replace established products in existing markets or even whole sectors of industry.

Forecasts and reality of global expansion in renewable energies





## A just, fair and equitable energy transition

Why does WWF advocate for a just energy transition? The energy transition is happening – this report shows some signs of this change – and is an unstoppable long-term trend. This energy transition, as many other historical transitions, is based in the change in market forces due to technological innovations. We witness a destructive creation, new adopted and adapted technologies shaping a key market for the economy: the energy market. The energy transition has multiple effects. As energy is a basic input for all production processes, this change impacts many other fields of the economy and is reshaping our societies.

WWF advocates for this transition to be accelerated to avoid dangerous global warming that could have huge impacts in nature and humankind. In a creative destruction process there are always winners and losers and accelerating this process might increase the transition tensions. Addressing the transition negative impacts, particularly those in the most vulnerable sectors of society is a must, in line with the recently adopted UN Sustainable Development Goals (SDGs).

Current global energy systems are not just. First, billions of people live without access to clean and reliable sources of energy. Second, low income households spend a larger proportion of their income on energy services [than higher income households] hindering opportunities to accumulate the needed wealth to escape from poverty. These two elements of energy poverty subsequently bring about other serious problems such as gender inequity, social injustice and environmental degradation.

WWF's mission “to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature” embraces the spirit behind the SDGs to align the human footprint with what science dictates for sustainability. Making the energy transition equitable and fair contributes to build up human harmony with nature. However, our approach is not only about making just the transition, but enhancing the possibilities of transforming the future energy system in one that founds a more equitable society. The characteristics of the innovative energy technologies allow the new energy system to be more distributed, interdependent, less centralized and interactive. These features open the alternative to a more economically balanced system. The just energy transition cannot be just about the transition.

# WWF ASKS ON CLIMATE AND ENERGY FOR G20

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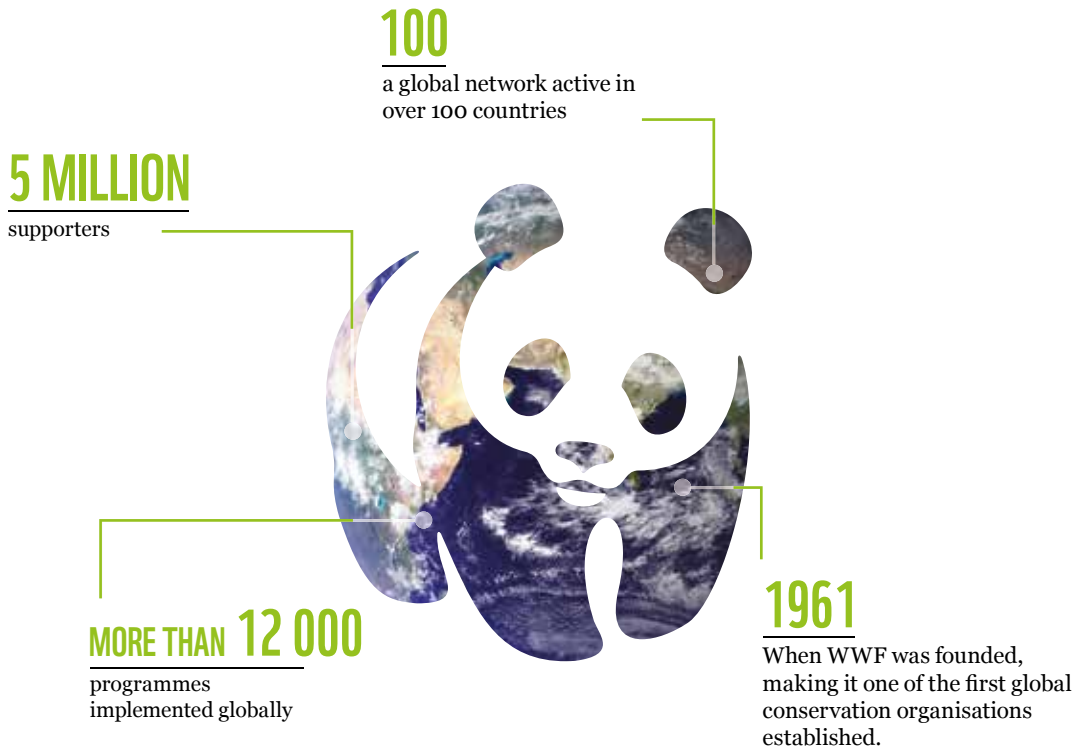
The G20 Heads of State have committed to stronger engagement and cooperation to fight climate change in several declarations since 2008, notably by eliminating subsidies for fossil fuels. The adoption of the Paris Agreement and decisions and of the UN 2030 Agenda for Sustainable Development in 2015 offer unique opportunities to align G20 actions with commitments under the Paris Agreement and integrate climate related goals and targets of the 2030 Agenda in G20 work streams.


WWF welcomes the G20's efforts to implement climate pledges, notably through the activity of the study group on Climate Finance, and other groups working on stronger consensus among G20 members to integrate environmental aspects in their deliberations, such as the G20 Task Force on Climate-related Financial Disclosures and the Green Finance Study Group (GFSG). WWF also strongly supports efforts at eliminating fossil fuels subsidies, welcomes progress to date and urges elimination by 2020.

WWF fully supports the Chinese Presidency's call for G20 members to "take active measures to implement the outcomes of the COP21 on climate financing and others". WWF also welcomes the Chinese Presidency's call to "strengthen cooperation on energy access, renewable energy and energy efficiency to ensure green, balanced and sustainable development".

At the G20 Hangzhou Summit, WWF asks the G20 to help the global transition to renewables energy by:

- Recognizing the COP21 outcomes, including the Paris Agreement and decisions and connecting commitments with G20 work on infrastructure, investment and financial sector reform and energy access;
- Supporting the ongoing work by the FSB Task Force on Climate-related Financial Disclosures and integrate the upcoming outcomes with the aim to detail further steps on how the financial sector can take account of climate change risks;
- Recognizing that environmental and social risk impact economic and financial stability;
- Recognizing the need for credible, fully developed and widely accepted standards for green bonds so as ensure consistency and comparability of such standards, including standardised terms and definitions, standardised disclosure, standardised certification requirements, the integration of green considerations into credit ratings, and credible dispute-resolution mechanisms
- Ensuring all possible support including fiscal and economic tools to reliable, safe, sustainable and clean energy access for all by 2030, notably by:
  - Developing an inventory of fossil fuel subsidies of all G20 member states with harmonised metrics and agreeing ambitious phase-out road-maps by 2018 in order to completely and equitably phase out fossil fuel subsidies by 2020 and reinforce this process by ‘third country’ peer-reviews;
  - Making energy efficiency and renewable energy an infrastructure investment priority for the Investment and Infrastructure Working Group;
  - Upgrading the Green Finance Study Group to a permanent Working Group to help green financial investments globally;
  - Speeding up efforts under the Action Plan on Energy Access to bring renewable, affordable and modern energy to the more than one billion people who lack energy access.



	<p><b>Why we are here</b> To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.</p> <hr/> <p><a href="http://www.wwf.fr">www.wwf.fr</a></p>
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