

Future is here – clean energy now!

Clean energy revolution is already underway, but must accelerate

Background briefing accompanying the IPCC AR5 WG1 launch. 25.9.2013

Since the last IPCC report on climate change (2007), global emissions have gone up¹, not down, and we're on track towards catastrophic warming of about 4°C by 2100². The outlook seems grim, but there's more than meets the eye. Since 2007, renewable energy has made a true breakthrough globally. It's bigger, it's cheaper, it's growing fast and it's ready to challenge fossil fuels. At the same time, the might of coal has begun to crumble and even oil demand projections are now questioned. The window of opportunity is still open for preventing catastrophic climate change, but transition to clean energy must speed up big time.

Every six years, top climate scientists from around the world provide governments with the latest comprehensive assessment on climate change and what's it to us. It is about that time again. The Working Group 1 report of the Intergovernmental Panel on Climate Change, out on 27 September 2013, will outline what's new in climate science since 2007. The rest of the chapters forming the IPCC Fifth Assessment Report (on impacts, adaptation and mitigation) will be published in 2014.

This background briefing will give a snapshot on what has happened in the field of clean energy since 2007.

Here's the problem

The global energy sector is the largest contributor to human-caused climate change, accounting for two thirds of global emissions³. **In the past five years, coal burning was responsible for 70% of the record CO2 emission growth**, and it causes 44% of global fossil CO2 emissions⁴. To prevent climate chaos (warming of 2 degrees or more), **global emission growth needs to stop well before 2020** and head towards zero around mid century. Renewable energy and smarter use of energy have to replace fossil fuels and **most proven reserves of fossil fuels must stay in the ground**, as even the International Energy Agency (IEA) now says⁵. That's a tall order.

Here's the good news – the clean energy revolution has already started

- In 2011, renewable energy supplied 19% of global final energy and 22% of electricity, with traditional biomass and hydro still dominating. But **modern renewables are growing fast** – in fact, faster than we thought. Back in 1999 and 2001, Greenpeace and European renewable energy industry associations challenged the pessimistic projections of the International Energy Agency (IEA). We said that by 2010 wind and solar could be *six to eight times bigger* than what the IEA was projecting. In real life solar and wind grew *even faster*.
- **There's now 10 times more solar photovoltaic**, 6 times more concentrating solar thermal power and 3 times more wind power capacity in the world than in 2007.⁶
- Last year **over half of all new installed electric capacity worldwide was renewables**. In the EU the share was almost 70%, mostly due to solar and wind power. The United States added more capacity from wind power than any other technology, and all renewables made up about half of total electric capacity additions during the year.⁷ Of actual new output the shares would be less, due to lower capacity factors.
- Wind, solar, biomass and waste-to-power, geothermal, marine and small hydro technologies produce 6.5% of world's electricity⁸. In some countries, modern renewables are reaching much

higher levels already, proving that renewables work on large scale. For example, **Denmark is on its way to produce 50% of its electricity with wind power by 2020**⁹.

- In 2011, global investment in renewable energy hit a record US\$257bn, **a six-fold increase over 2004**. For comparison, investment in new nuclear energy was only US\$7.3bn¹⁰.
- China has established itself as the leader in renewable energy investments. The other top countries for so-called new renewables capacity to date (non-hydro) are the United States and Germany, followed by Spain, Italy and India. But other countries are getting up to speed too. In **Japan clean energy investments, mostly solar, increased by 75% last year**, while South Africa became the fastest growing clean energy market¹¹.
- China has doubled its cumulative wind capacity each year between 2006 and 2011. Last year, for the first time ever, **China's wind power generation increased more than generation from coal** – the year being exceptionally low for coal growth¹².

From marginal to essential

- Some countries and regions are already producing **high levels of their annual electricity with wind**, like Denmark (30%), Portugal (20%), Spain (16%) and Germany (8%)¹³. In the US there are now nine states that are getting 10% or more of their electric power from wind power, with Iowa (25%) and South Dakota (24%) topping the list¹⁴.
- Temporarily, or on favourable months, shares can be much higher. In Spain, wind power reached a record peak on 24 September 2012, covering 64% of the country's electricity supply¹⁵. For three months in 2012, **wind produced almost 35% of the electricity consumed in the state of Tamil Nadu in India** (with population of 72 million)¹⁶.
- In China, wind power alone produced 2 % of the country's electricity needs in 2012. If it doesn't sound much, consider that it was 100 TWh, and **more than the production of China's nuclear power plants**¹⁷.
- **Solar is still catching up**, but reaching annual production levels of about 6% in Italy¹⁸, 5% in Germany¹⁹ and 4% in Spain²⁰. In July 7, 2013, German solar power output reached a momentary record of 23.9 GW and overall solar delivered more than 20% of that day's total electricity²¹. On household level, solar is becoming mainstream. By early 2012, an estimated one in five homes in South Australia had rooftop solar PV²².
- **In just two years from now China aims to achieve more than 4-fold increase of solar PV**, from 8GW end of 2012 to 35 GW in 2015²³. In comparison, the whole of global PV capacity today is about 100 GW. **India aims to set up the world's largest solar power plant (4 GW)** in its state of Rajasthan, to set a trend for large-scale solar power development and to lower costs²⁴. By 2022 India's National Solar Mission (NSM) aims to install 20 GW.
- **Philippines, which has the second biggest capacity on geothermal**, today produces 29% of its electricity with renewables, targeting 40% by 2020.²⁵
- All sources combined, renewable energy shares in power mix are higher: Denmark 40%, Portugal 43%, Spain 32%, Italy 27% and so on. Very high shares are typically explained by hydropower, like Brazil (85%), Costa Rica (94%) and Ethiopia (89%).²⁶ **Since the beginning of 2013, renewables have supplied an average 44% of Spain's electricity needs**, beating both fossil fuel and nuclear power generation. Thanks to renewables, Spain has become a net electricity exporter to its neighbouring countries²⁷. In the first quarter of 2013, Portugal met 70% of its electricity needs with renewables. 27% was wind²⁸.
- In the MENA region **Morocco is leading, aiming for 42% of its electricity generation to be renewables (solar, wind and hydro) in 2020**²⁹. **Saudi Arabia aims to have 54 GW of renewable energy by 2032**. Solar PV and CSP alone will add up to 41 GW, accounting for a third of Saudi Arabia's overall nominal electricity generation capacity in 2032³⁰.

- Heat from modern biomass, solar, and geothermal sources also represents a significant portion of the energy derived from renewables, supplying hot water and space heating (and some cooling too) for tens of millions of buildings worldwide. **Solar collectors are used in more than 56 countries** and geothermal energy for heating in at least 78 countries.³¹
- Countries with renewable energy targets more than doubled between 2005 and 2012.³²

Towards 80 - 100 % renewables

- In terms of transformative, or even revolutionary changes, all eyes are now on Germany, one of world's largest economies, a heavily industrialized market economy that has committed to an **ambitious clean energy transition (energiewende)**. It aims to meet 80% of its electricity and 60% final energy with renewables by 2050, while phasing out nuclear power. Today Germany gets almost 23% of its electricity from renewables, **up from less than 8 % in 2002**.³³
- Denmark aims to achieve a fossil fuel free society already before Germany, by meeting **100% of its heat and power needs with renewable energy by 2035** and all energy by 2050.³⁴
- Some cities, regions and institutions around the world have set or even achieved targets on 100% renewables on power or total energy³⁵. A rapidly expanding number of global companies too are committed to sourcing all their electricity from renewables – like IKEA, Google, Apple, Facebook, Salesforce and Walmart. Unilever will double its use of renewable energy to 40% of total energy requirement by 2020 and Proctor and Gamble to 30% by 2020, both aiming at 100% RE on a longer term.

Rapidly declining costs, increasing competitiveness, people power

- The costs of renewable energy technologies, particularly solar PV and onshore wind, have been rapidly declining. According to Bloomberg (BNEF), **solar PV module prices have fallen by 80% since 2008**, while wind turbine prices have fallen by just under 30% since 2008. As construction costs for conventional fossil fuel generation are increasing – and fuel costs likely too – **renewables are increasingly competitive in a growing number of markets**, even without subsidies. The trend can be expected to accelerate further.³⁶
- According to a recent HSBC report, wind energy is now cost competitive with new-build coal capacity in India, and solar is likely to follow suit sometime between 2016-18³⁷. Meanwhile, BNEF has concluded that unsubsidised renewable energy is already **cheaper than electricity from new-build coal** and gas-fired power stations in Australia³⁸. In Brazil wind has become so competitive that government doesn't want it to compete directly against coal and gas³⁹.
- The drastic price reductions of solar PV, in particular, are increasingly attracting consumers of all sizes to produce clean power by themselves, **as it becomes cheaper for consumers to self-generate electricity for their own consumption than to purchase from the grid**. Consumers will increasingly turn from passive consumers to active "prosumers", who produce energy too.
- In Germany **farmers and private citizens, largely through energy cooperatives, own about half of the country's installed renewable energy capacity**⁴⁰. In Denmark three-quarters of the country's wind turbines are owned by wind co-operatives⁴¹. The cooperative enterprise model allows people, local communities and regions to be the driving force behind the big transformational process in the energy sector.
- Decentralised renewable energy (DRE) with low variable costs, and solar in particular, has started to put significant **pressure on conventional power generators**. Every kilowatt-hour produced by solar panels, wind turbines or other DRE owned by consumers themselves means reduced demand for the utility's product. On a liberalised energy market, solar and wind that offer electricity close to zero marginal costs push out coal and gas plants from the merit order

while depressing market prices. This is eating profits of traditional utilities with fossil fuel plants. Solar power in particular, that produces most electricity when demand for electricity is high too cuts peak power demand, which traditionally has brought big parts of utility profits. Ironically, after all the claims about renewables being too small and too expensive, they are now in Europe and the US, in particular, perceived as too cheap and too big.⁴²

Fossil fuel future is not as inevitable as it may appear

- While renewables have grown, the many problems of fossil fuels from air pollution to water shortage and toxic spills have become yet more evident since 2007.
- In the past decade, coal use grew fast. But now **the might of coal is crumbling**. The falling costs of renewables, the emergence of shale gas in the US (with its own problems), air pollution regulations, bad governance, lower demand projections, worsening water constraints and growth of local anti-coal movements are all reducing the attractiveness and competitiveness of coal – differently in different markets. The latest blows for coal were the World Bank and the European Investment Bank decisions to stop almost all lending to coal projects.
- According to Bloomberg, of the 111 coal-plant proposals in Europe in 2008, only two have actually materialised. Many more have been closed or shelved – and more will be before 2015, as the new directive limiting air pollutants kicks in.⁴³ **In the US, a strong anti-coal movement has seen more than a hundred proposed coal plants derailed in recent years**⁴⁴. Over the next four years, 27 GW in 175 coal power plants in the US are expected to be shut down (retired) corresponding to about 8.5% of total capacity⁴⁵. Some expect closures of 45 GW⁴⁶..
- Canada's largest province, Ontario, has pledged to shut down all of its coal plants by 2014 (down from 25% in 2003). In 2012, wind power already provided more electricity than coal (3%).⁴⁷ In Australia, the expansion of the world's biggest coal export terminal in Newcastle has been delayed and looks likely to be shelved,⁴⁸ while the massive coal ports planned in the US Northwest seem to be hitting the same dead end. From Turkey⁴⁹ to Thailand **people are successfully defeating coal**, defending their rights for clean air, clean water and good health.
- Even in China and India, where big coal growth has been assumed to take place, coal's future no longer seems straightforward. In China, elevated public concerns on air quality are **changing the energy outlook for the country**. Beijing's "airpocalypse" – an exceptionally serious air pollution episode last January – was a culmination point for a political awakening that's been building since 2011. The government's plan to improve air quality, released in September 2013, calls on three key economic areas **to peak and decline their coal consumption by 2017 and bans new conventional coal-fired power plants in these regions**. After 10 years of rapid coal growth this is an unprecedented turn around in China's energy policy.⁵⁰
- The plan has been accompanied by ambitious targets for cutting coal consumption in the provinces of Shandong, Hebei, Tianjin and Beijing, as well as in the 16-million people megacity Guangzhou, that together use more coal than the whole of the European Union. Their coal use has been growing at 6% year, but now they aim at cutting coal consumption by 10% from 2012 levels by 2017. This is a **dramatic reversal of trends in just four years**. More Eastern coastal provinces are expected to make their announcements following the national plan.
- **India's coal industry is choking** under inefficiency, corruption and environmental concerns. The country has plans to build a coal fleet nearly twice the size of the entire US coal fleet, but much of this is unlikely to materialise – simply because securing coal supply will be a major bottleneck⁵¹. The stock price of Coal India (a state-owned company and the world's largest coal producer) has nosedived and the company poses a serious financial risks to any investor⁵².
- All in all, coal's attractiveness for investors is declining. Recently the investment bank Goldman Sachs struck a damning blow to the prospects of thermal coal, with a report entitled **'The window for thermal coal investment is closing'**⁵³. Similar views have been echoed by

Bernstein Research (advisor of leading investment managers) in their recent report titled **The Beginning of the End of Coal**⁵⁴.

- And it's not just coal, as the recent front cover of the Economist suggests, referencing **oil** as yesterday's fuel. Analysts at investment bank Citi argue **that oil demand may be approaching a tipping point much earlier than market expects**, and could peak by 2020⁵⁵. Improving fuel efficiency and growing oil-to-gas switching would cause this. If it happens that demand falls, expensive carbon – likes of Canadian oil sands and Arctic oil drilling – could become unprofitable. That's an inconvenient projection for oil majors, who are already warned about rising costs and declining return, and questioned about the economic sustainability of their capital expenditure programmes.⁵⁶

But more needs to be done

- Despite renewables growing, fossil fuels remain dominant in the global energy mix. They are still supported by subsidies that amounted to \$523 billion in 2011, which was **six times more than support to renewables**⁵⁷. The average unit of energy produced last year was still about as dirty as it was 20 years ago⁵⁸. Clearly, it's not enough to promote renewables. We need to get rid of fossil fuels too, by dismantling their traditional privileges, by tackling large market failures that are still preventing clean energy from being taken up and by scaling up energy savings and energy efficiency measures big time.
- Greenpeace's [Energy \[R\]evolution scenario](#), developed together with the German Space Agency (DLR) and in cooperation with the Global Wind Energy Council (GWEC) and the European Renewable Energy Council (EREC) and cited as **"the most widely recognized and thorough projection made by renewable energy advocates"**⁵⁹ outlines how ambitious energy efficiency measures can keep energy demand 40% lower than under business as usual in 2050. Renewable energy can grow to meet 65% of global electricity needs by 2035 and 94% by 2050. Of total primary energy, the share of renewables could be 82% in 2050. Nuclear can be phased out and the number of fossil fuel-fired power plants drastically reduced.
- **In terms of policy frameworks**, catalysing a shift to clean energy requires
 - 1) Clear and reliable prioritization of renewables and efficiency in national policy schemes
 - 2) Clear signals for the energy industry and investors that fossil fuels are on their way out
 - 3) Robust, binding targets for renewables as well as long-sighted, reliable policies for grid and market integration, including for decentralised RE
 - 4) Pollution limits, pollution pricing to fully internalise true environmental costs, and phasing out of subsidies for fossil fuels and nuclear
 - 5) Strong energy efficiency measures – from production to transmission and use – with the help of efficiency standards and innovative financing schemes.
 - 6) Bold international cooperation

So let's just do it!

- The renewable energy breakthrough we've witnessed, coupled with growing problems related to fossil fuels and elusive future perspectives of coal, all mean that a shift to clean energy can happen faster than anticipated. **We can still turn global emissions into a decline before 2020**, with measures outlined by Greenpeace, the UNEP⁶⁰ and the IEA⁶¹, among others. Key is to accelerate the switch from fossil fuels to smart and clean energy systems, but we also need to protect our forests and peatlands and to reduce emissions in agriculture.
- **Governments, business leaders and investors will be under increasing pressure** to stop chasing new oil we can't afford to burn anyway in places like the Arctic. A recent report produced by a number of climate change investor coalition groups finds that fund managers worth in the region of \$14 trillion say climate change is a material risk that influences their investment decision⁶². Storebrand, Norway's second-largest insurer and a leading pension fund in the Scandinavian region, recently decided to divest from 6 oil sands companies and 13 coal

companies to reduce its fossil fuel exposure. By excluding these companies, the pension fund aims to reduce its exposure to fossil fuels to secure long-term, stable returns for its clients⁶³.

- **A new global climate agreement that is due to be signed in 2015** can and must further catalyse a shift away from fossil fuels and help vulnerable communities adapt to the impacts we can no longer avoid. **Countries must start making pledges for their post-2020 emissions reductions targets already in 2014**, to leave time to assess their adequacy and fairness, in light of the agreed target of keeping warming below 2 degrees Celsius – and reviewing the goal in light of 1.5 degrees warming.
- **A shift to a smart energy system powered by renewable energy will come with multiple benefits**, from clean air, avoided climate disasters and saved water resources to energy security and local employment. And not just in theory: the Spanish economy has gained €3 for every €1 of wind power incentives it has given, according to the Spanish Wind Energy Association. So while Spain is going through difficult economic times, wind power incentives have had a positive net effect on the economy, bringing resilience⁶⁴. Same is true for Greece, where the rapid solar PV development between 2009-2012 spurred some 4 billion EUR in investments and created 20,000 jobs (which is about the same as the total workforce of the Public Power Corporation) and 30,000 indirect jobs⁶⁵ amidst a profound economic crisis and a completely stagnated economy. Now those panels are producing energy from sun and freeing their users from volatile fossil fuel prices.
- In most cases, renewable energy is also **the best way to meet the energy needs of those 1.3 billion people who still lack access to electricity**, as it's fast, reliable, affordable and doesn't drain scarce water resources from other needs.

Citizen action around the world is already stopping coal plants and coal mines; forcing governments to introduce pollution regulation; increasing renewable energy production; pushing universities, cities, churches and pension funds to divest from fossil fuels; defending the Arctic from oil drilling, and so forth. The Energy Revolution has started. Are you on board?

On false solutions

Some suggest nuclear power should be an important 'tool in the box' to limit carbon emissions. But this "tool" is broken and out-of-date. Finland, a wealthy high-tech country, was the first OECD country to start building nuclear in the name of climate protection. The government decided on a new plant in 2002, construction started in 2005 and the plant was to be ready in 2009, to help Finland to meet its Kyoto target. Today the reactor is still under construction, and won't be ready before 2016⁶⁶ – if even then. In the mean time, the costs have gone through the roof, from original contract price of about 3 bln EUR to about 8.5 bln EUR⁶⁷. The Finnish case is in no way unique. At least 23 of the 66 units currently under construction have encountered delays, many of which have lasted for several years⁶⁸. In preventing climate chaos, we have limited time and money to spend and must prioritise those technologies with the greatest potential to meet our energy needs and cut emissions. Nuclear isn't among them.

Contacts for comments and interviews with the Greenpeace delegation:

- Kaisa Kosonen, Senior Political Advisor, +358 50 368 8488 or kaisa.kosonen@greenpeace.org
- Stephanie Tunmore, Climate Campaigner, +44 7796 947 451 or Stephanie.Tunmore@greenpeace.org
- Greenpeace International press desk: +31 20 718 24 70 or pressdesk.int@greenpeace.org

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