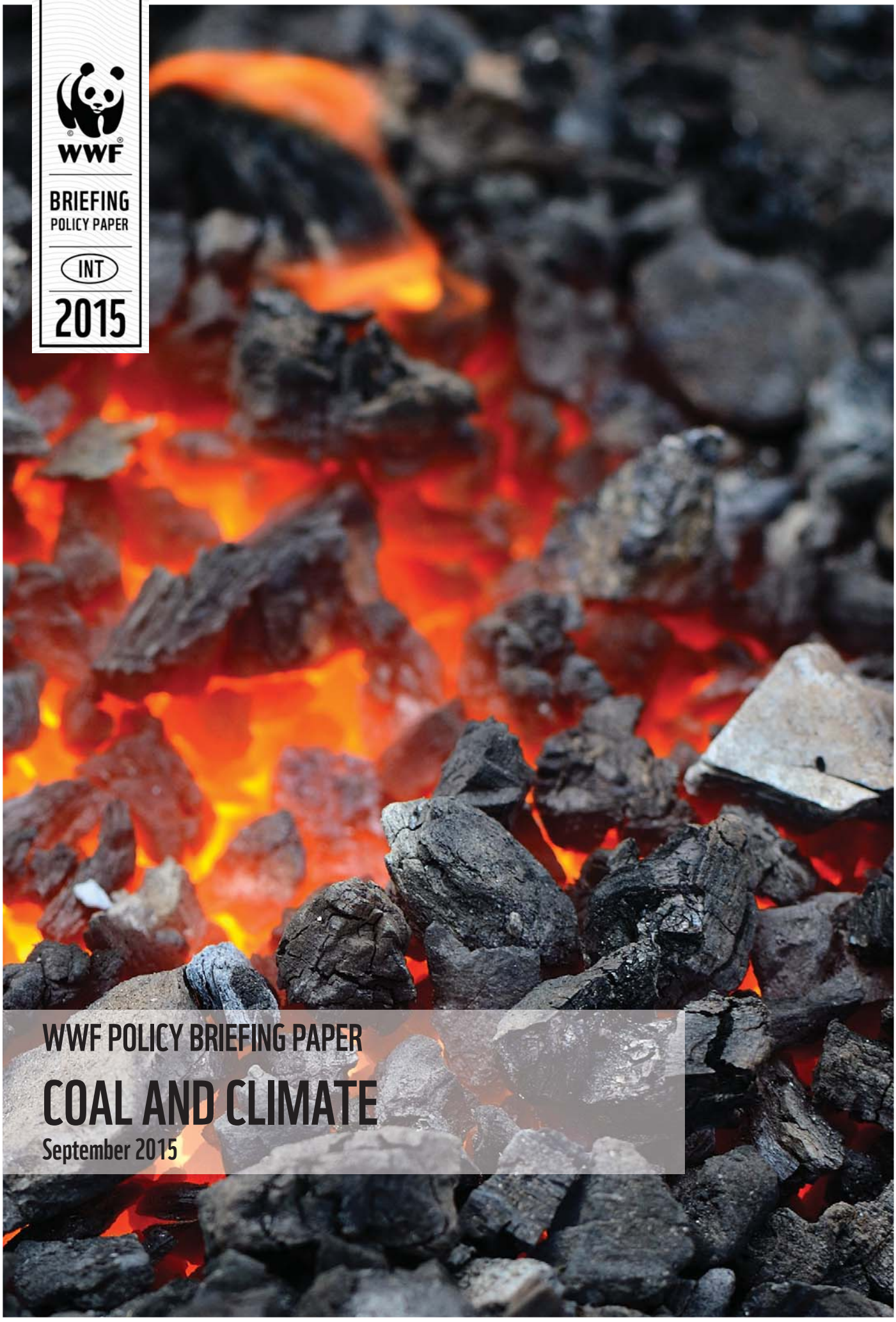

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COAL AND CLIMATE

September 2015

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This Policy Briefing paper on Coal, developed in the context of the global climate debate is intended to inform the global WWF network and the public on a variety of issues that are pertinent to a global energy transition to clean renewables and energy efficiency. The target audiences for this Brief include policy makers in the energy community, CSOs, think tanks and climate/sustainable development stakeholders and negotiators.

INTRODUCTION

A main goal of WWF's climate and energy work is to provide and advocate for sustainable energy solutions through our vision of 100% renewables by 2050 supported by ambitious energy efficiency and conservation measures. Yet, we cannot afford to lose sight of the grave threats posed by long-term carbon "lock-in" through the unabated and continued expansion of fossil fuels, particularly coal. Doing so would be tantamount to forfeiting forever our chance to secure a safe, stable climate.

Our focus in this paper is on coal for energy (thermal coal and lignite) as it has seen the highest absolute growth of any energy source over the past decade. It also has the highest CO2 emissions intensity among all the fossil fuels when combusted and is currently the largest single source of anthropogenic greenhouse gas emissions. Coal-fired power plants account for just 40% of global electricity production, but they are responsible for more than 70% of its emissions.[1]

Coal for energy represents about 85% of all coal consumed. The remainder is mainly coking (metallurgical) coal used, primarily, for steel production, which deserves a separate, more nuanced debate. The need for infrastructure steel, particularly in developing countries, deserves more leeway until the time when alternative solutions are available.

[1] Foster, Vivien, Bedrosyan, and Daron. 2014. Understanding CO2 Emissions from the Global Energy Sector, World Bank, Washington DC © World Bank. https://openknowledge.worldbank.org/handle/10986/17143

SUMMARY OF KEY COAL POSITIONS OF WWF

In order to prevent dangerous climate change, the world's coal consumption needs to peak and then start to decline before 2020, in line with most climate scenarios and most recently the IEA "450 Scenario".

By 2035, based on the "450 Scenario", global coal consumption must be almost 35% below 2011 levels while CO2 emissions from coal must be reduced by more than 40% compared to today.

In order to be in line with WWF's position of a 100% renewable energy world, coal must be completely phased out of the global energy system by 2050, or earlier.

The journey to a coal-free future will need to be led by the industrialized world - the OECD and Russia - with a goal of phasing out coal from their energy systems in the next 20 years (by 2035).

Therefore, governments in these nations need to urgently introduce legislation that ensures an immediate halt to the construction of new coal plants. Secondly, the immediate phase-out of highly inefficient (so-called 'sub-critical') coal plants must also happen as part of a rapid decline and eventual phase-out of coal use.

By 2030 at the latest, there should be no new coal in developing countries. This implies that 'late 'coal needs to be retired by mid-century. It must be noted that coal-rich China and India are some of the very few countries that might still need to build a few new coal plants until 2030, but the rest of the world can and must end new coal much earlier because it makes economic sense for these countries to follow such pathway. India in particular is still a very energy-poor country and needs international technology and finance support not only to curtail the present strong growth of coal but also invest into cleaner alternatives such as the new 100 GW solar programme.

Technology and finance cooperation mechanisms amongst nations (North-South, South-South, North-North) must be part of the transition and integrated into any future international climate treaty to hasten the transition from coal to clean renewables and energy efficiency in both the developed and developing world.

It is thus important that governments immediately stop all public multilateral and bilateral funding, as well as financial support from Export Credit Agencies for any coal project, upstream or downstream. Governments also need to confirm the exclusion of any coal project in the Clean Development Mechanisms (CDM) under the UNFCCC, or any other international CO2 offset-project mechanism.

We further urge OECD governments to ensure a full phase-out of all subsidies for coal mining, production and use immediately, and all other goverments by 2020 at the latest.

Governments must develop progressive Emission Performance Standards (EPS - gCO2/kWh) or total carbon emissions budgets over a certain time period for existing and new power generation plants with baselines depending on national circumstances.

BACKGROUND

If we are to prevent dangerous climate change, as well as other negative impacts of coal (e.g. local air pollution), the world's coal consumption needs to peak and then start to decline before 2020, for instance in line with the IEA "450 Scenario". More importantly, coal must be completely phased out of the global energy system by 2050, or earlier. The energy transition must be achieved through a rapid move to a 100% renewable energy supply, supported by massive investments in energy efficiency.

However, coal is a complex issue from historical and equity perspectives. It largely fueled the industrial revolution that began 200 years ago that enabled today's developed countries to prosper and grow their economies. If not adequately addressed, the growing use of coal that is expected to continue in the coming decades, particularly in developing countries, poses a conundrum as we strive to stabilize the global climate system within a safe level.

AIM FOR 100% RENEWABLES

Whatever policies governments adopt to ambitiously address the twin and interconnected challenges of "affordable energy for all" and climate protection must be supported by inclusive and participatory approaches (e.g. multi-stakeholder energy planning) that empower citizens and communities, particularly the poor and marginalized and those who will be negatively affected by the energy transition. A "just transition"[2] for coal-dependent economies, including those to be affected, such as coal miners and conventional energy workers, is a prerequisite for this fundamental change in energy policy that aims to achieve 100% renewables by mid-century. It is important that the benefits of the transition – more sustainable economies that are energy secure, with safer jobs in growing numbers from the clean energy industry, and less vulnerable to balance of payment impacts and price volatility of imported fossil fuel; cleaner air and water and thus better health for communities; enhanced ecological balance and a stable climate - must accrue to the broader economy, particularly the poor and including the informal economy.

The more democratic characteristics of renewable energy sources can lead to a more dispersed and decentralized energy development model that benefits the majority, compared to the highly centralized fossil-fuel system dominated by large utilities. There are many examples worldwide of small companies, communities and even ordinary farmers owning renewable energy power plants. A most important part of the transition is providing energy access to the more than 3 billion poor people who do not have access to modern energy services, critical to improving people's lives and attaining development goals. UN Secretary General Ban Ki-Moon's Sustainable Energy for All (SE4ALL) by 2030 objectives - to provide universal access to affordable, reliable, economically viable, socially acceptable and environmentally friendly generated electricity; to improve energy efficiency; and to increase the share of renewable energy in the global energy mix – affirm that the transition to a 100% renewables by 2050 must be a global priority for economic, social, environmental and climate reasons.

The reason for ending the world's collective reliance on coal was recently laid out by the Intergovernmental Panel on Climate Change (IPCC): if humanity is to have a fair chance of not exceeding 1.50C by end of this century, compared to pre-industrial levels, it must not breach the IPCC's global carbon cumulative emissions budget of 655 - 815 Gt CO_2 between now and 2050.[3] More than two thirds of the world's cumulative global greenhouse gas emissions (about 50 Gt annually) come from energy-related CO_2 emissions[4]. With about 14 Gt CO_2 emissions, coal is the single largest CO_2 emissions source of all fossil fuels (32 Gt). Between 1990 and 2012, and compared to oil (+1.2 Gt) and gas (+2.5 Gt), CO_2 emissions from coal have grown the largest at +5.5 Gt[5]. However resulting from various clean energy policies (renewables and energy efficiency) by particularly China, Japan and the EU, overall energy-related CO_2 emissions globally stalled in 2014. One key reason was the decline of coal use in those countries[6] which led to an approximate stabilization of coal use worldwide .[7]

About four-fifths of all coal consumption (and related emissions) occurs in just four nations and regions - China (50%), US (12%), India (9%) and the EU (8%). While India and China have experienced a high growth of CO_2 emissions over the past decade as a result of the rapid rise in energy needs, industrial development and city infrastructure, coal use in the OECD has declined by

[2] In this regard, WWF will soon develop a comprehensive paper to elaborate on the different aspects of the "just transition" that are mentioned in this paper.
[3] IPCC, Summary For Policy Makers Working Group III, page 19; 2014
[4] IPCC, Summary For Policy Makers Working Group III, page 6; 2014
[5] IEA, CO2 Emissions From Fuel Combustion, pp 50-61; 2013
[6] IEA, Energy and Climate Change, pp 25-31; 2015
[7] BP, Statistical Review of World Energy; 2015

about 11% since 2007. However, the OECD, together with Russia, is still a major coal consumer with almost 30% of the global total[8].

COAL IS FINANCIALLY AND ECOLOGICALLY COSTLY

Coal has the highest carbon intensity of any fossil fuel when combusted and is, therefore, arguably the single biggest threat to the global climate system. The resulting local air pollution caused by combusting coal is also a public health menace contributing significantly to 4 million premature deaths annually, mostly in the developing world [9]. In addition, coal is extremely financially costly to society. It has been recently estimated by UNEP that outdoor air pollution, mainly from the use of fossil fuels, particularly coal, cost China about $US 1.4 trillion, India $US 0.5 trillion and the OECD $US 1.7 trillion, in 2010[10]. That represented annual GDP losses of 30%, 38% and 5%, respectively from air pollution alone.

In addition, coal's extraction, processing and combustion are also serious threats to freshwater supplies and critical ecosystems, such as Borneo's rainforests and India's tiger habitats. In the International Energy Agency's (IEA) "New Policy Scenario", withdrawal and consumption rates of precious freshwater are estimated to grow by 20% and 85%, respectively, in the global energy sector between now and 2035. Coal today consumes almost 50% of all freshwater demand in the energy sector. This share will most likely stay the same in the "New Policy Scenario" while the low-carbon "450 Scenario" of the IEA projects a strong decline in water demand because wind and solar PV require hardly any water compared to all fossil and nuclear fuels[11].

Despite the stagnation of global coal use in 2014 and the projection by several institutions to stabilize coal use also in 2015, we are currently far away from a low-coal pathway. Since 2003, coal consumption has grown by about 45% globally, much more than oil (10%) or gas (29%) [12]. Further, coal consumption and associated CO2 emissions are projected to increase by another 45% and 40%, respectively, by 2035, based on the IEA's "Current Policy Scenario"[13]. The threat of long-term carbon "lock-in" is very real: 1,199 new coal-fired power plants, with an estimated installed capacity of more than 1,400GW (equivalent to 80% of present coal power capacity), are either under construction or planned globally, with China and India together accounting for 76% of the new/planned capacities[14]. The more recent CoalSwarm database from October 2014 lists 2266 coal plant units under construction or planned globally totaling 1491 GW[15]. This alone might be enough to 'help' breach the global carbon budget. [16]

To be in line with IEA's "450 Scenario", global coal consumption must peak before 2020 and, by 2035, coal consumption must be almost 35% below 2011 levels while CO2 emissions from coal must be reduced by more than 40% compared to today[17].

The IEA has concluded that more than two thirds of all presently economically available fossil fuel reserves (80% for coal, in view of its higher carbon intensity) must be "left in the ground" if we are to meet the internationally agreed 20C threshold under its "450 Scenario". (Note: WWF is advocating for a 1.50C threshold.) Even if Carbon Capture and Storage (CCS) is applied widely, this requirement of leaving more than two third of fossil fuels in the ground does not change appreciably[18]. As to whether CCS for coal is any reliable option in the future to curtail CO2 emissions remains highly questionable. The first global large scale CCS coal power plant in the US (Kemper project) is scheduled to have costs of $US 9,500 per kW capacity installed and is 5 – 10 times more costly than recent solar or wind projects across the globe. A large cost differential will prevail over the decades to come even if "Technology Learning" and "Economies of Scale" might bring costs down by up to 50% in 2030[19].

[8] BP, Statistical Review of World Energy; 2014
[9] WHO, Burden of Ambient Air Pollution - http://www.who.int/phe/health_topics/outdoorair/databases/FINAL_HAP_AAP_BoD_24March2014.pdf?ua=1; 2014
[10] UNEP, Year Book 2014, emerging issues update - Air Pollution: World's Worst Environmental Health Risk; 2014
[11] IEA, Water For Energy, pp. 501 – 527, in: World Energy Outlook 2012; 2012
[12] BP, Statistical Review of World Energy; 2014
[13] IEA, Table For Scenario projections, pp. 572 – 575, in: World Energy Outlook 2013; 2013
[14] WRI, Global Coal Risk Assessment, p. 1, 2012
[15] http://endcoal.org/plant-tracker/
[16] Assuming that 80% of present annual coal emissions are about 11.5 Gt CO2, and life of coal-fired power stations are about 45 years, resulting CO2, unless plants are retired earlier or equipped with CCS, is about 540 Gt CO2 from coal alone – as against a proposed global carbon budget of maximum 815 Gt CO2e until 2050
[17] IEA, Table For Scenario projections, pp. 572 – 575, in: World Energy Outlook 2013; 2013
[18] IEA, Existing carbon reserves and energy infrastructure lock-in pp. 98 - 100, in: Redrawing the Climate/Energy Map; 2013
[19] IEA, Energy and Climate Change, p.119; 2015

POLITICAL CHALLENGES AHEAD

The rapid economic growth in some of the largest emerging economies in the developing world, such as China, India and South Africa, and other developing countries over the past 20 years has brought with it an exponential growth in thermal coal use. Most of these countries have yet to close the "development gap". WWF strongly believes that energy efficiency and renewable energies, not coal, will close this "development gap" more effectively in view of the multiple co-benefits of sustainable energy to society, including its positive impacts on public health, jobs, freshwater supplies, ecosystems integrity and energy security. WWF will, therefore, encourage governments, public and private financial institutions and other business actors within these countries to immediately stop investing in coal and focus instead in developing sustainable energy.

RENEWABLES CREATE MORE JOBS

However, policy interventions to transform the energy systems in these countries must be based on equity, justice and fairness. Equally, they must take into consideration the historical responsibilities of nations and must be based on the principles of benefit sharing and the right to develop. Clean energy for the 3+ billion poor people who do not have access to modern energy services must be an integral part of the transition. The transition must create green and decent jobs through the creation of a new sustainable energy industrial base and provide job re-training for sectors (e.g. coal miners, conventional energy workers) that will be negatively affected. It should be noted that renewables currently create more jobs compared to fossil fuels by a ratio of 3:1[20]. It is important that the transition must take into consideration each individual country's capacity to act and should incorporate safety nets for the poor, partly by reallocating resources currently spent on perverse and inefficient fossil-fuel subsidies.

Likewise, technology and finance cooperation mechanisms amongst nations (North-South, South-South, North-North) must be part of the transition and integrated into any future international climate treaty to hasten the transition from coal to clean renewables and energy efficiency in both the developed and developing worlds.

It is essential that the energy transition be accelerated in all countries threatened by large-scale coal expansion through unequivocal support for renewables and energy efficiency over coal and other fossil fuels. The transition might be easier for first movers and wealthier countries with abundant renewable energy resources. And it must be acknowledged that the initial economic investment needs of a transition might be higher, at least over the short- to medium-term, for coal-dependent, less developed economies.

However, the cost of inaction, or lukewarm efforts, is much higher for all societies, given the "global commons" impact of fossil-fuel emissions. A very recent research by Stanford University showed that the social cost of carbon might be more than $US 200/ton CO_2 and therefore create economic losses equivalent to 11% of global GDP annually[21]. Based on new economic research by the International Renewable Energy Agency (IRENA), the IPCC, Fraunhofer Institute (Germany), Lawrence Berkeley Laboratory (US), the IEA, Bloomberg New Energy Finance (BNEF, UK) and leading commercial banks (Goldman Sachs, Deutsche Bank, Citigroup), as well as experiences on the ground in developed and developing countries, renewables will require much lower initial economic investments compared to a few years ago and will increasingly achieve "grid parity" with fossil fuel electricity in most regions of the world within the decade. Already today, most renewables are cheaper per kWh than nuclear and some fossil fuels over lifetime[22].

[20] 1) http://cleantechnica.com/2012/03/30/renewable-energy-facts/; 2) http://reneweconomy.com.au/2013/graph-of-the-day-renewables-create-more-jobs-than-fossils-nuclear-97361

[21] https://earth.stanford.edu/news/social-cost-climate-change-too-low, 2015

[22] 1) Lazard, Levelised costs of energy production 8.0 (USA), 2014; 2) Fraunhofer/ISE, Levelised costs of electricity and renewable energy technologies (Germany), 2013; 3) World Energy Council (WEC and together with Bloomberg New Energy Finance), Costs of World Energy Technologies, 2013.

WHAT GOVERNMENTS NEED TO DO

The energy transition will create new services and industries that will grow rapidly. This growth should be aimed at maximizing the benefits to society as a whole. Other classical industries will be negatively impacted, such as thermal coal mining and conventional energy. Governments need to develop national and regional transition plans, including safety nets and job re-training for affected sectors, such as coal miners and conventional energy workers, in close coordination with the affected communities to ensure that they reap the economic and employment benefits of the new energy economy.

The journey to a coal-free future will need to be led by the industrialized world - the OECD and Russia - with a goal of phasing out coal from their energy systems in the next 20 years (by 2035). Historically, these countries have contributed the largest share to global atmospheric CO2 emissions from fossil-fuel use and they are still among the highest per capita CO2 emitters today. These countries also have very high financial capacities to embark on investments for a transition to clean energy.

It should be noted that coal use has already declined slightly in OECD over the past decade and, hence, a phase-out by 2035 is fully achievable under the wider goal of securing a just and equitable distribution of burden and benefits among nations in the global transition to 100% renewables by 2050. Therefore, governments in these nations need to urgently introduce legislation that ensures an immediate halt to the construction of new coal plants. Secondly, the immediate phase-out of highly inefficient (so-called 'sub-critical') coal plants must also happen as part of a rapid decline and eventual phase-out of coal use. (In the US and the EU, about 55% and 35% of all coal plants respectively are 'sub-critical'[23].)

AN AMBITIOUS APPROACH IS NEEDED

The IEA's low-carbon "450 Scenario" (which is not a "well below" 2 degree scenario) projects a continued decline in the share of coal to below 10% of all energy consumption in OECD and Russia by 2035[24]. Therefore, thirdly, these governments need to introduce appropriate policies that ensure that by 2035 all coal consumption in OECD and Russia will cease. In support of this, design of electricity markets need to be adapted to a dominant share of variable renewables in the system. This also requires policies and measures (e.g. market-based instruments) that ensure supply adequacy and system reliability.

An ambitious approach in developing countries is also needed as coal consumption in these countries is growing and presently accounts for around 70% of global coal use. The IEA's "Current Policy" scenario projects an increase in coal use: for instance, in China and India by about 40% and 150%, respectively, by 2035. In contrast, the "450 Scenario" projects a decline by about 35% in China, and an increase of 10% in India by 2035 compared to today[25].

Recent WWF studies on moving to 100% renewables by 2050 show that China's coal-for-power use could decrease to about 70% by 2035 compared to 2011 levels[26], while India's coal use in the energy sector might grow substantially before peaking by 2030[27]. That illustrates that a few coal-dependent emerging economies will take more time to eventually phase out coal. It should be noted that China and India are some of the very few developing countries that might still need to build a few new coal[28] plants until 2030. India in particular is still a very energy-poor country and needs international technology and finance support not only to strongly curtail the present strong growth of coal of about 10% per year – and estimated to triple coal capacity by 2030 under a Business as Usual scenario - but also support for clean electricity growth and investments into cleaner alternatives such as the new 100 GW solar programme[29]. Nevertheless, WWF asks governments in all countries to strongly curtail the growth of new coal and to prioritize renewables and energy efficiency instead. WWF will work with governments in developing countries to create policies that will accelerate the transition to clean renewables and an end to new coal much earlier than 2030 because it makes economic sense for these countries to follow such pathway. By 2030 at the latest,

[23] IEA, Reducing the use of inefficient coal-fired power plants, pp. 58 - 62, in: Redrawing the Climate/Energy Map; 2013
[24] IEA, Table For Scenario projections, pp. 576 – 579 and pp. 612 - 615, in: World Energy Outlook 2013; 2013
[25] IEA, Table For Scenario projections, pp. 620 – 627 in: World Energy Outlook 2013; 2013
[26] WWF & ENTRI, China's Future Generation – Assessing the maximum potential for renewable power in China by 2050: 2014
[27] WWF & TERI, The Energy Report India – 100% Renewable Energy by 2050; December 2013
[28] 'New' includes also replacement investments in the coal fleet.
[29] IEA, Key World Energy Statistics, 2014: India's per capita electricity consumption is about one tenth of that of the OECD, its per capita coal consumption is one third of that of the OECD

there should be no new coal in developing countries. This implies that 'late 'coal needs to be retired by mid-century.

Shifting energy finance from fossils to clean renewables is an essential component of the just transition. It is thus important that governments immediately stop all public multilateral and bilateral funding[30], as well as financial support from Export Credit Agencies[31] for any coal project, upstream or downstream. Governments also need to confirm the exclusion of any coal project in the Clean Development Mechanisms (CDM) under the UNFCCC, or any other international CO2 offset-project mechanism.

WWF urges governments to provide unequivocal and preferential support for renewable energy and energy efficiency in developing countries threatened by coal expansion. In support of this, governments must develop progressive Emission Performance Standards (EPS - gCO2/kWh or total emissions budgets over a certain time period) for existing and new power generation plants with baselines depending on national circumstances. These regulations will progressively tilt the balance against carbon-intensive power sources, such as coal, and in favor of clean renewables.

In order to even the playing field for all energy sources, WWF demands a full internalization of all environmental, health and other externality costs of coal in the pricing of energy products. We further urge OECD governments to ensure a full phase-out of all subsidies for coal mining, production and use immediately, and all other goverments by 2020 at the latest. WWF suggests to redirect these resources into energy access for the poor, renewable energy and energy efficiency, as well as promoting a just transition (e.g. jobs re-training and targeted safety nets for the poor).

Only after all other renewable energy and energy efficiency options have been exhausted should CCS be allowed a limited role. CCS should be limited to existing coal-fired power stations and subject to truly safe geological CO2 storage[32]. WWF recognises that CCS will likely not play a major role in new power plant developments, but will probably be needed in the future for reducing industrial process emissions from metallurgical coal use in steel production.

SUPPORT A "RAPID AND JUST" TRANSITION

To mitigate the impacts of coal extraction on the natural environment, WWF calls on governments not to allow coal mining and infrastructure development that could negatively impact protected areas. (Note: WWF-UK is currently drafting a network position that defines "no-go" areas.)

As a matter of equity, relevant international institutions and industrialized countries must support developing countries in their efforts to achieve a "rapid and just transition" from coal to clean renewables through domestic action and international cooperation mechanisms.

During the energy transition towards 100% renewable energy supply by 2050, WWF calls on governments to enact policies in all coal-based developed and developing countries to ensure that energy services for all consumers – the industrial and residential sectors alike, are met reliably, affordably and most efficiently.

Finally, a high priority must be given to the global sustainable development pathway. The energy transition can be achieved with economies growing strongly, quality of life improved and the least fortunate being lifted out of poverty. If the transition is not made, the economic, social and environmental impacts could be catastrophic.

[30] Seize Your Power Key Campaign Messages p.5, About International Financial Institutions, bullet #1:" Fossil fuel projects and fossil fuel companies don't need money from development banks. That money should go to clean, affordable and reliable renewable energy access." May 2013
[31] Under the Rug: How Governments and International Institutions are Hiding Billions in Support to the Coal Industry, a joint report of WWF, WRI and OCI; June 2015
[32] A separate paper to update the network's CCS

CONCLUSION

Coal is a dirty fuel of the past that has no place in the clean, safe and equitable world that WWF seeks to secure.

Today, coal is artificially cheap, not least because of the perverse subsidies that it receives at all stages of production and combustion, as well as the exclusion of environmental and other externalities in its pricing. However, the truth is that it is socially, environmentally and developmentally an expensive energy option that gravely threatens the future prospects of humanity and the wider natural world in both developed and developing countries. Allowing coal to continue its expansion and, thereby, guaranteeing a long-term "carbon lock-in" (ensuring a renewables "lock out") is, arguably, the single biggest threat in our fight for a safe climate and a clean energy future. Therefore, we must urgently bring the Age of Coal to a close, but in a manner that is equitable and just and continues to promote and enable the development of the billions of people around the planet still blighted by poverty.

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COAL AND CLIMATE

PHASE-OUT COAL BY 2050

To prevent dangerous climate change, the world's coal consumption needs to peak and then start to decline before 2020, and be completely phased out of the global energy system by 2050, or earlier.

40% & 70%

Coal has the highest carbon intensity of any fossil fuel when combusted - it accounts for just 40% of global electricity production, but is responsible for more than 70% of its emissions.

2030

By 2030 at the latest, there should be no new coal in developing countries.

STOP CONSTRUCTION OF NEW COAL PLANTS IMMEDIATELY

The OECD and Russia must immediately halt construction of new coal plants and phase out coal from their energy systems in the next 20 years (by 2035).

FULL PHASE-OUT ALL COAL SUBSIDIES

OECD governments must ensure a full phase-out of all subsidies for coal mining, production and use immediately, and all other governments by 2020 at the latest.

WWF

Why we are here

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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