



AFTER COP 21 (PARIS):

FES 2030

FOSSIL EXIT STRATEGY 2030 FOR EUROPE

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FROM PARIS TO MARRAKECH

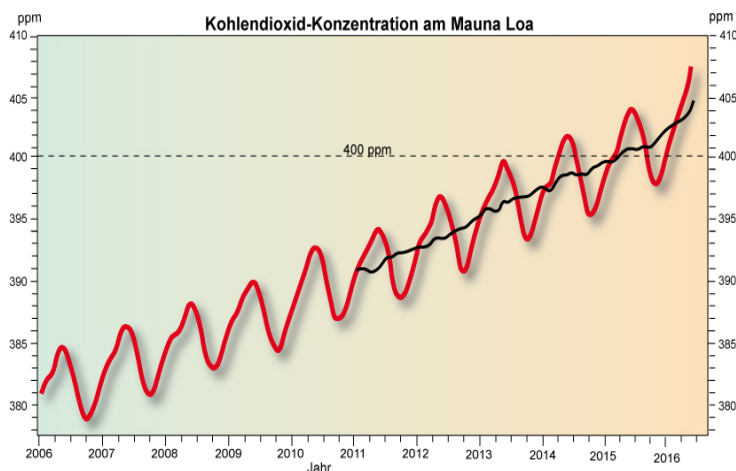
ENERGY AND CLIMATE POLICY AFTER THE PARIS AGREEMENT (COP 21)

THE FOSSIL EXIT STRATEGY FOR EUROPE

After COP 21 in Paris and COP22 in Marrakech, the European climate and energy policy will play a crucial role in the global climate debate. A responsible European climate policy in line with the targets of COP 21 is a prerequisite for successful climate mitigation policies worldwide. COP 21 requires the opening of a new chapter in the European climate policy.

1. THE PHYSICAL SCIENCE BASED DIMENSION OF THE CLIMATE PROBLEM

The climate discussion deals with inventory sizes and flows. The most alarming fact is the ongoing increase of the CO₂ concentration in the atmosphere. This concentration reached 400 ppm (parts per million) in 2014 for the first time in the human history. In January 2016, the concentration was already 403 ppm.



Critical threshold of 400 ppm

Following IPCC publications, a value of 420 ppm can be regarded as upper limit to keep a temperature rise below 2°C with a high probability. In order to achieve the COP 21 target – temperature rise only 1,5°C – the CO₂ concentration should not exceed 400 ppm. It should also be reduced in the future to below 350ppm!! (Source: IPCC 2014, summary for policy makers, mitigation of climate change, III. Working group, page 12)

The annual increase of this CO₂ concentration between 2014 – 2016 was about 2.6 ppm. At the end of the winter *on the Nordic hemisphere* the value is highest (May), because the lower absorption of CO₂ by the vegetation, at the end of the summer it is lowest. January shows a middle value of a year.

TABLE 1 DEVELOPMENT OF THE CO₂ CONCENTRATION IN THE ATMOSPHERE DURING 2014 – 2016, PPM

	CO ₂ concentration
January 2014	397.81
May 2014	401.88
January 2015	399.96
May 2015	403.94
January 2016	402.52
May 2016	407.7

Source: ftp://ftp.cmdl.noaa.gov/ccg/co2/trends/co2_mm_mlo.txt

The main reason of this growing concentration of CO₂ in the atmosphere is the huge flow of CO₂ emissions caused by burning fossil fuels. According to IPCC scenarios, the annual and average CO₂ emissions/capita/year should not exceed 1,6 ton CO₂ in this century to reach the climate targets with reasonable probability. The European CO₂ emissions in 2012 were 7,9 tons/capita – 5 times higher than they should be. As the emissions are already higher than the average, it is important to reduce emissions rapidly as soon as possible.

These physical facts underline the urgency of action: Future investment should go to renewable energies and better efficiency and not to fossil fuels. **If the flow of CO₂ goes on for one decade with only small changes, the threshold of 420ppm CO₂ in the atmosphere will be surpassed**



and the targets of Paris unreachable for centuries! The hope to compensate too high emissions now by negative emissions in the future is not justified! An essential part of the transformation of the energy system has to be performed before 2030!

2. THE PARIS AGREEMENT

The Paris Agreement builds on these natural science based facts. More than 190 countries decided at COP 21 'to limit global warming well below 2°C and pursue efforts to limit the temperature increase to 1,5°C above pre-industrial levels (Art. 2)' and as a consequence to stop using fuels by middle of this century. In such a scenario, developed countries should take the lead in abandoning fossil fuels.

The targets of Paris can only be reached if all countries start right now to reduce the flow of CO₂ emissions to the atmosphere. As 90% of these emissions are caused by burning fossil fuels, the transition of the energy system from fossil to renewable sources has to start immediately.

From a science based view, the use of fossil fuels has to be phased out at the latest by 2030 to achieve the targets of Paris with a high likelihood. Comprehensive efforts to absorb more carbon from the atmosphere by increasing substantially the global forest area have also to start immediately.

3. POLITICAL AND ECONOMIC FACTS

The consequences of the science based facts and the development in the real world do not coincide. The oil price dropped within the last two years by more than 50%. Low oil and gas prices are incentives to use more fossil fuels and thus further increase the emissions. Even in the European Union, the greenhouse emissions went up in 2015!

In addition, the EU targets for 2030 - minus 40% emissions as compared to 1990 and 27% RES share - do not comply at all with the targets of COP 21

In summary, one year after Paris, the developments are going into the wrong direction and the world is moving away from the targets of COP 21.

4. THE FOSSIL EXIT STRATEGY 2030: THE FRAMEWORK

The World as a whole and Europe as well need a fossil fuel exit strategy to achieve the targets of Paris. The core of this strategy should be an exit path that distributes the challenge of this fossil fuel replacement evenly over the present and coming generation.

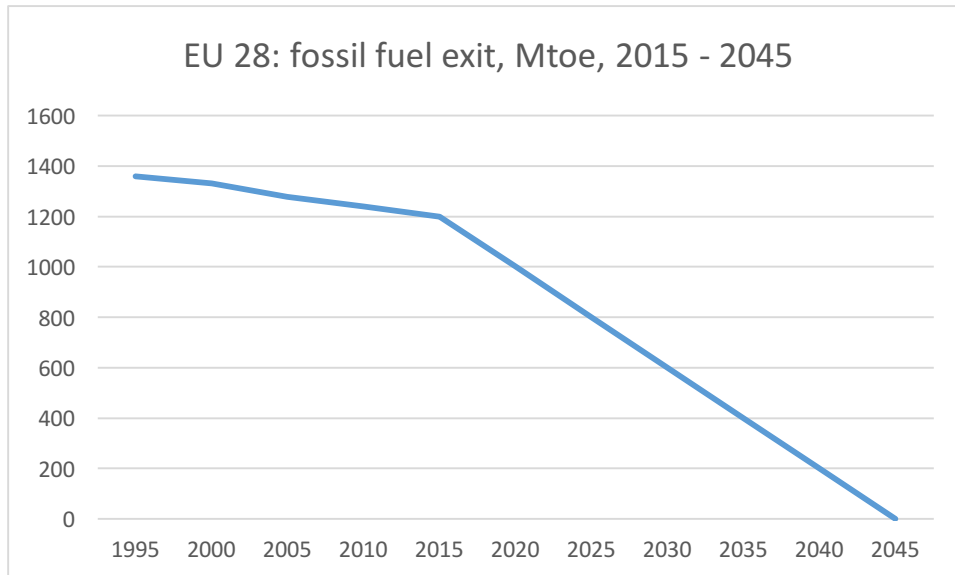
In order to reach the 2°C target with a high probability, the world should phase out the fossil fuels before 2030 – otherwise the concentration of CO₂ in the atmosphere will grow far above 420 ppm and it might become impossible to reach the targets of COP 21. The urgency of this energy transition is extremely high!

WBA realizes that such a fast transition of the energy system - a phase out of fossil fuels before 2030 - is not possible, neither in China, nor in the USA or in Europe. Yet, the transition to a fossil free energy system has to be reached as fast as possible to mitigate climate change.



WBA demonstrates a path to a fossil free energy system for Europe within 25 – 30 years as a guideline for energy decisions worldwide. As a first milestone, a halving in the use of fossil fuels by 2030 is proposed in this concept. Graph 1 shows the needed accelerated reduction in the use of fossil fuels in the coming years.

Graph 1: Development in the use of fossil fuel exit in EU 28, Mtoe, 1995 – 2045



This means for Europe: The use of fossil fuels, in the scale of 1 230 Mtoe by 2013, should be below 600 Mtoe by 2030 and near zero by 2045.

Table 2 shows the figures. Assumed is a reduction of 20% in the consumption of primary energy from 2013 to 2030, a decrease in nuclear energy due to the exit decision in Germany and the halving in the use of fossil fuels by 2030.

TABLE 2 EXIT STRATEGY FOR FOSSIL FUELS, EU 28, 2013 - 2030

	Fossil exit	Renewables growth	Nuclear & others	TOTAL
1995	1360	100	211	1671
2013	1230	197	239	1666
2020	1000	298	230	1528
2025	800	419	210	1429
2030	600	540	190	1330
2045	Near zero	750	100	900

Source: WBA calculations

This is a minimum reduction path for fossil fuels. According to this concept, 540 Mtoe renewable energy will be needed by 2030; this corresponds to 41% of renewables by 2030! If the energy consumption declines faster than assumed, the contribution of renewables could be smaller. On the other hand, if it declines slower, renewables should contribute more.



It can be concluded: 500 to 600 Mtoe renewable energy will be needed by 2030 in the European Union to comply with this fossil exit strategy – a fast transition but not fast enough to comply fully with the targets of COP 21.

5. A DEPLOYMENT STRATEGY FOR RENEWABLES TOWARDS 2030 IN EUROPE

Renewable consists of a mix of different sources such as bioenergy, hydro power, wind, solar and geothermal energy. By 2013, renewables as a total reached 197 Mtoe, the largest contribution came from bioenergy (128,1 Mtoe) followed by hydro (31,9 Mtoe) and by wind (20,2 Mtoe). More details see Table 3.

How can a quantity of 540 Mtoe renewables be supplied by 2030? The answer is rather simple: the political framework conditions have to secure that all renewable technologies can sufficiently grow at a technologically specific growth rate. The potential is available as well as the technologies. **What is missing so far is the political will!**

The growth rates assumed in this concept are as follows: wind energy continues to grow with 10% per year as in the past, solar electricity with 16%, smaller than in the last years, bioenergy with 3,9% and hydro with 2% per year. Table 3 shows the results:

TABLE 3 PARIS AGREEMENT; THE NEEDED DEPLOYMENT OF RENEWABLY ENERGY BY 2030, EU 28, MTOE

	unit	Renewable total	Bioenergy	hydro	wind	Solar	Geothermal, others
2013	Mtoe	196,8	128,1	31,9	20,2	10,6	5,9
2030	Mtoe	540	251	48	116	105	20
An. Growth %	%	5,9	3,9	2	10	16	3,2

Source: EU commission energy in figures, pocket book; WBA calculation

On this basis, the electricity generation from renewables would grow from 886 TWh in 2013 to 3330 TWh in 2030; renewables would generate more electricity by 2030 than the total electricity generation of 2013 (3260 TWh). Even if the electricity demand would be 20% higher by 2030 than now, renewables and nuclear would cover the whole demand. Fossil generation could be almost completely phased out.

Although such a strong growth of wind and solar energy is assumed, also the contribution of biomass must grow by almost 4% annually until 2030 (from 128Mtoe to 251 Mtoe) in order to replace fossil fuels fast enough. *90 – 95% of this biomass should come from Europe, the rest from region with a structural oversupply of biomass such as Canada or Russia.* The main markets for bioenergy should be the heating and the transport sector, and electricity generation, mainly during the winter period. In this period demand is high and generation from PV and hydro rather small. Bioelectricity or bio power can also play a crucial role for base load and balance year around in a system with a high share of variable reduction.



As a summary: Europe needs at least *by 2030*

- a strong growth of wind and solar electricity (from 320 TWh to around 2500 TWh in 2030),
- an almost complete phase out of fossil electricity generation
- a replacement of natural gas by bioenergy and solar heat in the heating sector and
- a doubling of bioenergy.

This fast deployment of renewables in Europe until 2030 is a minimum requirement to reduce the flow of CO₂ fast enough in order to prevent a CO₂ concentration far above 420 ppm in the atmosphere. Certainly not only Europe but also North America, Australia, China, the Middle East should follow the same pattern. But who, if not Europe, has the capacity to start this transition?

6. ADDITIONAL CONSIDERATIONS

Europe a leader in global renewable deployment

According to a declaration of the Commission, the European Union should become a global leader in the deployment of renewable energy. A policy as proposed, that tries to comply with the climate targets would allow Europe to achieve this target.

Improved security of supply for Europe

The domestic production of fossil fuels is dwindling. Table 4 shows this for the gas sector. The declining production of fossil fuels in Europe increases the dependency on imports and endangers the security of supply.

TABLE 4 EUROPEAN GAS SUPPLY: 1995 – 2012, MTOE

	1995	2012	Change in %
Production	191	133	-30%
Net imports	146	259	+ 77%
Gross inland consumption	336	393	+ 17%

Source: EU commission energy in figures, pocket book

A responsible climate policy would simultaneously improve the supply security. By 2013, Europe consumed 557 Mtoe petroleum products, 387 Mtoe natural gas and 286 Mtoe coal. The proposed growth of renewable electricity would strongly reduce the demand for coal but also, in combination with the expansion of biomass in the heating sector, the demand for gas. The demand for coal and gas might decrease by more than 70%, petroleum products would lose less than 50% of the present quantity by 2030. Hence, a responsible climate policy has a strong impact on the strategies to improve the security of supply. Capital flows should be re-designated from fossil infrastructure projects to renewables, to district heating systems in cities and better efficiency!



7. CURRENT EUROPEAN ISSUES CONCERNING THE FUTURE POLICY FOR RENEWABLES

Low oil price

The decline of oil prices over the last two years favours the use of fossil fuels and new investment in fossil fuels. This will make it more difficult to achieve the climate targets.

Increasing CO₂ emissions

Eurostat disclosed recently that within the EU 28, the CO₂ emissions increased the first time for several years in 2015. This is an alarming fact and in full contradiction to the new climate targets. It underlines the need for a general carbon tax now!

European policy targets for 2030: minus 40% emissions, at least 27% renewables

The targets have been defined several years ago. These targets do not comply with the outcome of COP 21. The share of renewables has to be much higher by 2030 – more than 40% - and the reduction of emissions stronger.

European emission trading system

As a consequence of the reduced oil prices, the cost of the emission of one ton CO₂ became by more than 100 Euro cheaper than before. On the other hand, the price of emission allowances is lower than 10 Euro per ton.

In addition, the trading system only addresses large emitters. The building sector, transport, medium sized companies are not included. After several decades of experience, it is clear, this system failed and does not meet the new requirements of a fossil fuel exit strategy.

Auction system for renewable electricity

The planned auction system for renewable electricity favours large utilities and investors and makes it almost impossible for decentralized small companies to invest in renewable electricity any more. It will slow down the speed of the penetration of renewable electricity. As a consequence, the market for fossil driven power plants will be protected and the CO₂ emissions will stay too high. This concept is in contradiction to the needed fossil fuel exit strategy and to all efforts to strengthen the regional economic development.

The 7% cap on biofuels

The introduction of the 7% cap on biofuels undermined the confidence of investors and is one of the reasons why almost no new investment in biofuels takes place in Europe. In addition, the concept of double counting reduces the existing targets by 50%. Europe cannot reduce the use of fossil fuels fast enough if the use of biofuels in the transport sector is so strictly limited.



Bioenergy: sustainability, carbon neutrality, potential

Biomass is chemical stored solar energy. The plants absorb carbon from the air in the form of CO₂ and build up carbon hydrates via the photosynthesis. The carbon in biomass flows back to the atmosphere within the natural carbon cycle. Solar energy powers this process.

The origin of the carbon molecule marks the big difference between fossil fuels and biomass. The carbon in fossil fuels would remain in the earth crust for ever if humans would not dig it out. The carbon molecule stored in biomass is released either by decay of the biomass as it happens in nature or by using it for food, feed, energy or material purposes. Hence sustainable produced biomass is a carbon neutral energy source. Its use does not increase the carbon content of the atmosphere, as long as the production of biomass is equal or bigger than its use – this is one of the important criteria of sustainable biomass production as it is the case in Europe.

In Europe the carbon stock in forests is growing, especially in those countries with a strong bioenergy sector like Sweden or Austria. Biomass is generally produced in a sustainable manner in the EU on the basis of comprehensive European and national regulations for agriculture and forestry. There is no need for further binding sustainability criteria on European level for biomass originating from the member states.

Globally, despite the ongoing deforestation in certain regions, the total carbon stock in vegetation is growing year by year (land sink).

It is true: there are GHG emissions along the supply chain of biomass for harvesting, for transport, processing and other activities. In this context, there is no principal difference between fossil and bioenergy supply chains. As long as the energy system is dominated by fossil fuels, each economic activity is connected with GHG emissions. The fact of supply chain emission is not an argument against biomass but an argument against the high share of fossil fuels in the energy system. Following this reasoning would mean: stop economic activities to avoid emissions. But this is no solution. To reduce these supply chain emissions, the use of fossil fuels in the energy system has to be reduced but not the use of biomass.

The sustainable potential of biomass coming from the European continent is by far not used. It comprises by-products of agriculture, forestry, organic waste, better utilisation of not used or not needed land for energy crops, better use of existing forests for wood production for material and energetic use. The sustainable potential of biomass in Europe can be estimated as of today with at least 250 Mtoe.

Biomass for energy offers various benefits such as a supply of the markets for heat, electricity and transport fuels; it is stored solar energy and reduces the cost of energy storage; it creates new jobs during the construction and operation of bioenergy plants, it allows the productive use of land not needed for food supply, it improves energy security.



More than 75% of the biomass is used for heating purposes, a rather small share goes for transport fuels and electricity. Also in the future the main role of biomass is seen in the heating sector followed by transport fuels and electricity.

8. FES, THE FOSSIL EXIT STRATEGY 2030: A FEW PROPOSALS

After COP 21 and COP22, Europe as well as the world face – in a historical view – the last chance to limit global warming below 2°C. This chance will be lost for centuries if the concentration of CO₂ in the atmosphere continues to grow as in the last decades. The European Commission started different initiatives to reduce CO₂ emissions from bioenergy supply chains or land use change. These activities address a tiny portion of the total CO₂ emissions of Europe, far less than 10%! The future policy must focus on the main source of CO₂ emissions, that is the burning of fossil fuels and therefore develop a straightforward Fossil Fuel Exit Strategy.

If the EU policy tackles the minor issues and ignores the main problem the climate policy will fail, in Europe and worldwide. Europe is the only continent able to implement a fossil fuel exit strategy fast enough: the solar potential is here, the technology is available, so far only the political will is missing! With a successful climate policy Europe could urge other continents to follow the European Example.

Proposal 1: The Carbon tax

A general answer for many questions concerning the transformation to a fossil free energy system is the phasing out of all subsidies for fossil fuels and nuclear energy and the implementation of a general tax on fossil CO₂ emissions. Such a step would encourage the growth of bioenergy and other renewables but also incentivise all efforts for better efficiency without any administrative burden. Sweden with a carbon tax of 121 Euro/ton CO₂ demonstrates how fast and efficient the transformation of the energy system can be attained using this steering instrument. Step by step the carbon tax should replace the ETS. As a carbon tax is introduced other taxes should be reduced to keep the tax burden for the economy and the society stable.

This proposal has also to be seen under the aspect of the low oil prices in the year 2015 and 2016. Low oil prices hinder the reduction of fossil fuel emissions and thus accelerate climate change. The Agreement of Paris and the current oil glut offer a window of opportunity to go for general carbon taxes in Europe. The global institutions such as the World Bank, the UN and the IMF encourage and should more encourage the national states to take this step, even if a common global or European solution is not yet feasible.

Proposal 2: Deployment plans for wind and solar electricity

Wind and solar electricity should grow sevenfold until 2030 to replace fossil fuels fast enough. Member states should be urged to develop a fossil free electricity supply by 2030. They need the possibility to apply those instruments that allow a fast enough transformation be it Feed-in-tariffs, Quota-systems or other instruments. The currently proposed auction system is



considered as a hindrance to reach the climate targets. It might protect big utilities against competition from smaller private investors at the expense of a successful climate policy and sustained regional development. Balancing and storage have to be handled, bioenergy can play a crucial role.

Proposal 3: Biofuel –binding minimum targets for 2030, push for e-mobility

Biofuels are an important and rapid option to reduce the use of fossil fuels in the transport sector. Minimum blending targets are proven instruments to increase the share of biofuels in the market. Biofuels not only serve to reduce CO₂ emissions but also to improve the fuel security. In addition, they deliver protein feed and reduce the European dependence on protein imports from abroad. The blending targets have to be related to the domestic potential of the European agriculture and the fuel consumption patterns in Europe.

Considering these facts a share of 15% biofuels for gasoline is proposed (ethanol or biomethane) and of 8% of biofuels for diesel latest by 2025.

In order to reach 15% biofuel in the gasoline market E10 should be introduced generally and E85 and other high blend fuels in addition and in combination with flex fuel vehicles.

With respect to the fuel security target at least 80% of the used biofuels should be produced in Europe from European feedstock.

With an increasing share of renewable electricity in the grid the efforts to develop e-mobility as a new transport system should also be increased. Maritime, aviation and heavy duty road transport and other machinery (e.g. agriculture), for these sectors, biofuels are often the only sustainable fuel.

Proposal 4: Mobilisation of biomass

The increased need for bioenergy requires a proactive policy to develop the European potential of biomass for energy. Such a policy should include incentives to plant energy crops on abandoned land or on land not needed for food production, incentives to a better use of waste and by products from agriculture and forestry.

Proposal 5: Transformation of the heating sector (Energiewende Wärme)

More or less 50% of the final energy demand is heat: heat for buildings, heat for industry. In cities more district heating and cooling grids are needed. The heat supply for district heating should be converted step by step to fossil free sources such as waste heat from the industry, heat from waste incineration, heat from biomass combustion in combined heat and power (with high efficiency) and from solar thermal installation.

Individual heating should be more and more based on fossil free sources such as biomass, solar thermal, heat pumps based on renewable electricity.



Stopping new fossil fuel infrastructure – e.g. new concessions for oil and gas, exploration and drilling etc.

9. SUMMARY

Currently the CO₂ concentration in the atmosphere goes up year by year by 2,6ppm. It surpassed already the critical threshold of 400ppm. If the concentration exceeds 420 ppm, the chance to achieve the targets of COP 21 might be gone.

The existing European concepts are not sufficient to comply with COP 21. COP 21 requires a faster transformation of the energy system. It is not enough to reach a low carbon economy by 2050. By then the CO₂ concentration would be far too high. The 15 years ahead are decisive to reach the targets of COP 21. Therefore, a new concept for 2030 is needed; it is summarized here under the heading:

Fossil Fuel Exit Strategy (FES) 2030.

The key parameters of FES 2030:

Key parameters:

- Halving the use of fossil fuels by 2030
- No fossil generated electricity with the exception of gas fired power plants to secure grid stability
- A seven-fold increase of electricity from wind and solar
- A Doubling of the use of biomass
- Stop investment in fossil fuel infrastructure

Key measures:

- A general tax on fossil CO₂ emissions in the size of 100 euro/ton
- A renewable heat strategy for district heat and individual heating
- Blending obligations for biofuels and a program e- mobility
- Deployment plans for wind and solar electricity
- An integrated concept to mobilize biomass for energy

Sufficient freedom for member states to choose those incentive mechanisms that fit best to reach their targets.

Europe has a specific responsibility to lead the way into a fossil free society. Technologies, know how, experience, capital, potential and positive examples are available as on no other continent. With a successful climate policy Europe could urge other continents to follow the European Example. Without European leadership no other continent will take the lead to implement COP 21 targets in time and the race against uncontrolled global warming will be lost globally. Given this background, the decision makers are urged to act accordingly.