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COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

A resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy

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1. INTRODUCTION: WHY IS RESOURCE EFFICIENCY IMPORTANT?

Natural resources underpin the functioning of the European and global economy and our quality of life. These resources include raw materials such as fuels, minerals and metals but also food, soil, water, air, biomass and ecosystems. The pressures on resources are increasing. If current trends continue, by 2050, the global population is expected to have grown by 30% to around 9 billion and people in developing and emerging economies will legitimately aspire to the welfare and consumption levels of developed countries. As we have seen in recent decades, intensive use of the world's resources puts pressure on our planet and threatens the security of supply. Continuing our current patterns of resource use is not an option.

In response to these changes, increasing resource efficiency will be key to securing growth and jobs for Europe. It will bring major economic opportunities, improve productivity, drive down costs and boost competitiveness. It is necessary to develop new products and services and find new ways to reduce inputs, minimise waste, improve management of resource stocks, change consumption patterns, optimise production processes, management and business methods, and improve logistics. This will help stimulate technological innovation, boost employment in the fast developing 'green technology' sector, sustain EU trade, including by opening up new export markets, and benefit consumers through more sustainable products.

Using resources more efficiently will help us achieve many of the EU's objectives. It will be key in making progress to deal with climate change and to achieve our target of reducing EU greenhouse gas emissions by 80 to 95% by 2050. It is needed to protect valuable ecological assets, the services they provide and the quality of life for present and future generations. It will help us ensure that the agricultural and fisheries sectors are strong and sustainable and reduce food insecurity in developing countries. By reducing reliance on increasingly scarce fuels and materials, boosting resource efficiency can also improve the security of Europe's supply of raw materials and make the EU's economy more resilient to future increases in global energy and commodity prices.

A vision of where Europe should be in 2050 and a long-term policy framework can provide a clear path for businesses and investors. It is important to sharpen the focus on the action that has to be taken in the next ten years to put Europe on the right track and to speed up the transition.

2. THE EUROPE 2020 STRATEGY AND THE FLAGSHIP INITIATIVE A RESOURCE-EFFICIENT EUROPE

To enjoy the benefits of a resource-efficient and low-carbon economy, we need to fulfil three conditions:

– *First*, we need to take coordinated action in a wide range of policy areas and this action needs political visibility and support.

– *Second*, we have to act urgently due to long investment lead-times. While some actions will have a positive impact on growth and jobs in the short-term, others require an upfront investment and have long pay-back times, but will bring real economic benefits for the EU economy for decades to come.

– *Third*, we have to empower consumers to move to resource-efficient consumption, to drive continuous innovation and ensure that efficiency gains are not lost.

A resource-efficient Europe is one of seven flagship initiatives as part of the Europe 2020 strategy aiming to deliver smart, sustainable and inclusive growth[1]. This is now Europe's main strategy for generating growth and jobs, backed by the European Parliament and the European Council[2]. Member States and the EU institutions are working together to coordinate actions to deliver the necessary structural reforms.

This flagship initiative aims to create a framework for policies to support the shift towards a resource-efficient and low-carbon economy which will help us to:

– boost economic performance while reducing resource use;

– identify and create new opportunities for economic growth and greater innovation and boost the EU's competitiveness;

– ensure security of supply of essential resources;

– fight against climate change and limit the environmental impacts of resource use.

To achieve a resource-efficient Europe, we need to make technological improvements, a significant transition in energy, industrial, agricultural and transport systems, and changes in behaviour as producers and consumers. To give businesses the certainty which they need to invest now, and to ensure that future generations benefit from smart investment, we have to start taking action immediately, on the basis of a regulatory framework that provides long-term stability. Improving resource efficiency also provides an opportunity to keep costs under control by reducing material and energy consumption and thus to boost future competitiveness.

The EU has already shown that progress on resource efficiency is possible. Recycling has started to become a normal practice for businesses and households across the EU. Since 1990, we have reduced greenhouse gas emissions in the EU by more than 10% while our economies have grown by about 40%. We are reducing our reliance on fossil fuels by increasing energy efficiency and developing alternatives. However, we now need to accelerate progress, extend efforts to other areas and reap the benefits that a successful strategy can bring for competitiveness, job creation and prosperity.

This flagship initiative will help build a strategic and integrated approach which will ensure that concrete actions already decided for 2020 pave the way towards longer-term goals for 2050 and that appropriate further action is taken to achieve our objectives. It will ensure that we optimise the synergies inherent in such a broad-based strategy, and that we identify and tackle the trade-offs as part of well-informed policy making. It requires a coherent analysis of the reasons why some resources are not used efficiently. From this starting point, it will be possible to make the case for

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1 COM(2010) 2020, EUROPE 2020 A strategy for smart, sustainable and inclusive growth.

2 European Council 17 June 2010 Conclusions; Document EUCO 13/10. http://ec.europa.eu/eu2020/pdf/council_conclusion_17_june_en.pdf.

mainstreaming resource efficiency into a wide range of policies, and to develop a set of tools to allow policy makers to drive forward and monitor progress. This will help build the clear support and involvement of national, regional and local authorities, stakeholders and citizens.

3. EXPLOITING SYNERGIES AND ADDRESSING TRADE-OFFS

The complex and interlocking approach needed to build a resource-efficient Europe can only be achieved with a policy mix that optimises synergies and addresses trade-offs between different areas and policies.

The following are typical examples of synergies:

- jobs created in sectors linked to sustainable growth are often more secure, with high potential for exports and economic value creation;
- action on climate change and energy efficiency can increase energy security and reduce vulnerability to oil shocks;
- low-carbon technologies reduce emissions and often bring benefits in terms of air quality, noise and public health;
- taxes and subsidies on the use of energy or other resources can be used both to steer behaviour leading to reduced and more efficient consumption and to help restructure public finances away from labour taxation, which benefits job creation and economic growth;
- increasing recycling rates will reduce the pressure on demand for primary raw materials, help to reuse valuable materials which would otherwise be wasted, and reduce energy consumption and greenhouse gas emissions from extraction and processing;
- improving the design of products can both decrease the demand for energy and raw materials and make those products more durable and easier to recycle. It also acts as a stimulus to innovation, creating business opportunities and new jobs;
- improving energy efficiency reduces the need to generate energy in the first place and the need for infrastructures. This, in turn, eases pressure on land resources. For example, decreasing EU energy consumption by 1% would mean that we would not need the equivalent of 50 coal power plants or 25 000 wind turbines.

Resource-efficiency policies need to address appropriately trade-offs. In order to make the right choices both now and for the longer term, we need to consider the whole life-cycle of the way we use resources, including the value chain, and the trade-offs between different priorities. Having the information needed to weigh different choices will help policy makers decide where to focus efforts. These are some examples:

- action to reduce unilaterally greenhouse gas emissions domestically may have an impact on the competitiveness of energy-intensive industry and lead to production and the associated greenhouse gas emissions and employment being shifted abroad if corrective measures are not maintained;
- just-in-time production processes reduce the energy needed to store products in warehouses but may also require more transport. This may also be true for the collection of waste and recycling;

- deployment of 'green' vehicles reduces the use of fossil fuels but increases the demand for electricity and certain raw materials, some of which are subject to supply restrictions and concentrated in a few geographical areas (e.g. rare earth elements for electronic components and fuel cells, lithium for batteries);
- land used to produce food may compete with land use for energy and both may compete with land which supports biodiversity or provides ecosystem services such as absorbing carbon from the atmosphere;
- materials to improve insulation can significantly reduce the amount of energy required to heat a building, but could be more energy-intensive to produce;
- expanding nuclear power can reduce carbon emissions but requires further enhancing of nuclear safety, waste management and non-proliferation;
- desalination can provide a solution to water supply problems but it may increase fossil fuel consumption and greenhouse gas emissions.

4. COMPONENTS FOR DELIVERING THE RESOURCE-EFFICIENT EUROPE FLAGSHIP INITIATIVE

A key aim of this flagship initiative is to increase certainty for investment and innovation by forging an agreement on the long-term vision and ensuring that all relevant policies factor in resource efficiency in a balanced manner. It provides a long-term framework for action in many policy areas, supporting policy agendas for climate change, energy, transport, industry, raw materials, agriculture, fisheries, biodiversity and regional development. These different components must be well coordinated.

The key components of the long-term framework will come in the form of a series of coordinated roadmaps to[3]:

- Outline what the EU needs to do to create a low-carbon economy in 2050, cutting greenhouse gas emissions by 80-95%, as part of global efforts to fight climate change, while improving energy security and promoting sustainable growth and jobs;
- Analyse how the EU can create an energy system by 2050 which is low-carbon, resource-efficient, secure and competitive. This should provide the necessary certainty for investors, researchers, policy makers and regulators;
- Present a vision for a low-carbon, resource-efficient, secure and competitive transport system by 2050 that removes all obstacles to the internal market for transport, promotes clean technologies and modernises transport networks;
- Define medium and long-term objectives and means for achieving them with the main aim to decouple economic growth from resource use and its environmental impact.

Medium-term measures should be consistent with this long-term framework. A number of such measures have already been identified. These include:

[3] An overview for 2011 is provided in Annex 1 based on the Commission Work Programme.

- An energy efficiency plan with a time horizon of 2020 which will identify measures to achieve energy savings of 20% across all sectors, and which will be followed by legislation to ensure energy efficiency and savings;
- Proposals to reform the Common Agricultural Policy, the Common Fisheries Policy, Cohesion Policy, energy infrastructure and trans-European networks for transport in the context of the next EU budget to align these areas with the requirements of a resource-efficient, low-carbon economy;
- A new EU biodiversity strategy for 2020 to halt further loss to and restore biodiversity and ecosystem services in the light of pressures on ecosystems;
- Measures to tackle the challenges in commodity markets and on raw materials[4] which will, amongst others, periodically assess critical raw materials and define a trade policy to ensure sustainable supplies of raw materials from global markets. These measures will help ensure coherence between the EU's raw materials and external policies, including the promotion of good governance, transparency of activities and creation of local valued added in developing countries. It will promote extraction, recycling, research, innovation and substitution inside the EU;
- A strategy to make the EU a 'circular economy', based on a recycling society with the aim of reducing waste generation and using waste as a resource;
- Early action on adaptation to climate change to minimise threats to ecosystems and human health, support economic development and help adjust our infrastructures to cope with unavoidable climate change;
- A water policy that makes water saving measures and increasing water efficiency a priority, in order to ensure that water is available in sufficient quantities, is of appropriate quality, is used sustainably and with minimum resource input, and is ultimately returned to the environment with acceptable quality.

Further information on actions to be taken at EU level and at Member State level is included in the description of the resource-efficient Europe flagship initiative in the Communication from the Commission on the Europe 2020 strategy[5]. The following box contains specific examples of EU action already under way. More examples of resource efficiency measures taken by Member States and international partners as well as a number of actions taken by business in a range of sectors to improve resource efficiency are provided on the Commission's website[6].

Concrete examples of EU action already under way

As recognised in the Europe 2020 Innovation Union flagship initiative, stricter environmental targets and standards which establish challenging objectives and ensure long-term predictability, provide a major boost for eco-innovation. The Kyoto Protocol is an example of this. Analysis by the European Patent Office and UNEP has shown that patenting rates in clean energy technologies significantly outpaced those related to fossil technologies after adoption of the Protocol in 1997[7]. At EU level, the Climate and Energy package has gone a step further: reducing greenhouse gas emissions by getting the prices right, targets guiding further action, fostering new technologies and diversifying energy supply. The European Emission Trading system is an example of how market forces can be harnessed to give incentives for more efficient use of resources. Innovation and future growth

4 COM(2011) 25.
5 COM(2010) 2020, p. 14-15.
6 http://ec.europa.eu/resource-efficient-europe
7 http://www.epo.org/topics/issues/clean-energy/study.html

opportunities are fostered by the resulting carbon prices which internalise the costs of high-carbon resources.

In 2008, the EU revised the legal framework for waste based on the entire product life cycle from generation to disposal, with emphasis on waste prevention, reuse, recycling and recovery ('waste hierarchy'). Member States must prepare waste management plans covering the type, quantity, sources of waste and collection systems. Waste prevention plans must also be drawn up with a view to breaking the link between economic growth and waste generation. Improved waste management could cut significantly CO_2 emissions. For example, each year the EU disposes of 5.25 billion euro worth of recyclables such as paper, glass, plastics, aluminium and steel. If this was recycled, the equivalent of 148 million tonnes of CO_2 emissions could be avoided annually. Improved management of municipal waste could result in 92 million tons of greenhouse gas emissions avoided in 2020 compared with 1995. At least 500 000 new jobs would be created in Europe if countries recycled 70% of their waste.

In the field of energy efficiency, the first nine measures under the Ecodesign Directive are expected to reduce power consumption by some 340 TWh by 2020, i.e. the equivalent of the output of 77 typical power stations. The recast Directive on energy performance of buildings which entered into force in July 2010 is expected to lead to a reduction of EU final energy consumption by 2020 in the order of 5%. Other EU policies, notably access to financing for energy efficiency under the Cohesion and Structural Funds, are also having positive results. France, for instance, will use available EU funds to more than halve energy consumption per square meter of its building stock.

Resources are often used inefficiently because the information about the true costs to society of consuming them is not available with the result that businesses and individuals cannot adapt their behaviour accordingly. Policy measures to improve resource efficiency and overall economic competitiveness must place greater emphasis on 'getting prices right' and making them transparent to consumers, for instance in transport, energy and water usage, so that prices reflect the full costs of resource use to society (e.g. in terms of environment and health) and do not create perverse incentives. In this respect, information and communication technologies can play a decisive role through, for instance, smart metering.

In addition, EU-wide, coordinated public support for R&D and innovation will be important to increase the availability and performance of the necessary technologies. As with all new technologies, there is a need to analyse up-front how to ensure the proper management of any potential negative impacts.

Policies to increase resource efficiency whilst supporting the competitiveness of EU industries should be well balanced and address both the demand side, e.g. via green public procurement and better information to consumers, and the supply side together. Moreover, resource efficiency will often be one of the core elements of sectoral strategies, but not the only one. In each policy area and for each policy instrument, appropriate analysis must be carried out using evaluation and impact assessment processes. The respective costs and benefits of action need to be analysed in depth to determine the most appropriate policies on a case-by-case basis.

5. BUILDING UP THE KNOWLEDGE BASE AND A CONSISTENT ANALYTICAL APPROACH

The analysis of initiatives under this flagship initiative must be based, where possible, on common assumptions, parameters and baselines, as well as on shared medium- and long-term visions. This will help ensure that the analyses provide a consistent basis for policy decisions to achieve greenhouse gas emission reductions and other relevant targets in a cost-efficient manner across the relevant sectors.

As a first step, in early 2011, the Commission will present joint modelling scenarios up to 2050 on climate, energy and transport policies. Annex 2 sets out common

assumptions and parameters for the reference scenario and a range of possible variations which are being examined and may be relevant for specific resource efficiency issues. The preliminary modelling results suggest that an 80% domestic reduction in greenhouse gas emissions by 2050 compared to 1990 levels is possible using technologies such as carbon capture and storage, renewable energies, nuclear power and electrification, if appropriate carbon prices, well-functioning infrastructures and markets can be achieved and the necessary technologies can be widely deployed. Subject to the achievement of the needed policy, infrastructure, technology and market developments, these preliminary modelling results suggest that the power generation, residential and industry sectors should be able to reduce emissions by more than 80%, the transport sector by around 60% and the agricultural sector by around 40%.

The fact that resource efficiency requires action in such a broad range of areas means that modelling is particularly complex. Existing models focus on specific policy areas and sectors such as energy and transport. They cannot capture fully the impact of resource use on ecosystems, enterprises, the economy and society as a whole, or the interdependence of policy measures. The Commission will undertake further analytical work to estimate economy-wide impacts, and to improve its ability to model in other areas relevant to resource efficiency, such as agriculture, industry and environment.

Building up the knowledge base will also require further work to evaluate policies and collect life-cycle data to further develop policies and prepare impact assessments, drawing, amongst others, on the activities in various sectors under the Framework Programmes on Research. In this context, it will also be needed to develop more harmonised and transparent ways of measuring environmental impacts.

6. RESOURCE EFFICIENCY AS AN INCREASING GLOBAL CONCERN

Given the global dimension of key environmental issues such as climate change, biodiversity, land use, deforestation, external impacts of consumption and production patterns, competitiveness, security of supply and access, the EU needs to address resource efficiency issues internationally and to cooperate closely with key partners, including with candidate countries and those in our neighbourhood. There are good reasons for doing so:

First, there is growing international awareness of the strategic importance of avoiding risks to supply of resources such as rare earths, fishing grounds, land, energy, and water. Technological developments, such as lithium for electric car batteries, are often tied to key raw materials which are sourced from across the globe.

Second, concerted action at global level can help mitigate the rise in global demand. Resource efficiency should therefore be a key element of our external relations, notably with major resource consumers such as emerging economies. For example, one of the most important consequences of emerging economies' growing position as energy consumers is that they will increasingly determine how energy is used on a global scale. The same is true for other key commodities. This has consequences for global supply patterns, but also for the interests of European manufacturers, investors and consumers in the emerging economies.

Third, international cooperation can lead to exchanges of skills, technology and best practice. Partners are making major efforts to increase their resource efficiency. Examples are Japan's so-called '3Rs-concept' of 'reduce, reuse, recycle'; China’s draft

new 5-year plan and heavy investments in 'clean technologies'; and South Korea's championing of 'green growth'. The EU must further increase its work in these areas to bolster its competitive position and benefit from the opportunities this creates. There is much scope for international cooperation in these areas. For example, the European Commission is driving forward cooperation with China on resource efficiency in areas such as grids, power generation and the building sector through ministerial-level dialogues, concrete research programs and expert-level cooperation.

Through its external commercial relations, the EU should continue efforts to provide a level playing field for industry, to improve the conditions for sustainable supply of raw materials, and to promote the liberalisation of trade in environmental goods and services so as to ensure industry's international competitiveness. Better deployment of green technologies would secure environmental benefits and improve the efficiency of production processes and thus support the most efficient use of scarce natural resources globally.

The EU has a strong interest in deepening cooperation on resource efficiency with international partners. This would contribute to the EU's objective of sustainable development and high-impact poverty reduction strategies in resource-reliant developing countries. It would also help to reduce the fast growing demand for global resources by encouraging the shift to cleaner modes of energy generation and transmission. The Rio+20 international conference on sustainable development in 2012 will focus on the 'green economy' and environmental governance and will provide a good opportunity for the EU to address resource efficiency with global partners.

7. GOVERNANCE AND MONITORING PROGRESS

The EU needs tools to monitor and measure progress on resource efficiency. Some key benchmarks are already provided in the Europe 2020 headline targets of 20% greenhouse gas emission reduction (30% if the conditions are right), 20% renewable energy sources, and 20% improvement in energy efficiency. However, indicators are needed to cover issues such as the availability of natural resources, where they are located, how efficiently they are used, waste generation and recycling rates, impacts on the environment and biodiversity. The Commission is working to ensure that appropriate indicators are available for monitoring and analytical purposes on the basis, for example, of the sustainable development indicators.

Effective governance and monitoring of progress are essential to ensure that the EU achieves greater resource efficiency in its production and consumption. Actions under the resource-efficient Europe flagship have close links to other flagship initiatives under the Europe 2020 strategy, in particular those on industrial policy, the innovation union, the digital agenda and the agenda for new skills and jobs[8] and related Member State actions.

The governance and monitoring will take place in the framework of the Europe 2020 strategy and will integrate the relevant elements of the EU Sustainable Development Strategy in order to ensure overall coherence. They will be based on an analysis of EU policies and those of individual Member States in their National Reform

[8] COM(2010) 614, COM(2010) 546, COM(2010) 245, COM(2010) 682.

Programmes as part of the Annual Growth Survey exercise[9]. This will be done as part of the European Semester for 2012.

8. CONCLUSION

Focusing on resource efficiency in policy making is both a necessity and an opportunity for the EU. This flagship initiative sets out a framework to help ensure that long-term strategies in areas such as energy, climate change, research and innovation, industry, transport, agriculture, fisheries and environment policy produce results on resource efficiency.

As a next step, the Commission will make concrete proposals for strategies to improve resource efficiency in the various policy areas as outlined in Annex 1.

The Commission invites the Council, the European Parliament, national parliaments, the Committee of the Regions, the European Economic and Social Committee, candidate countries and stakeholders to contribute to the further development of these strategies and the promotion of resource efficiency.

[9] COM(2011) 11 - Europe 2020 Annual Growth Survey: Advancing the EU's comprehensive response to the crisis.

Annex 1: Initiatives foreseen in 2011 to deliver on the resource-efficient Europe flagship[10]

1st quarter 2011	Low-carbon economy 2050 roadmap	This will outline possible pathways to a low-carbon economy to reduce greenhouse gas emissions by 80 to 95% by 2050 while improving the EU's energy security and promoting sustainable growth and jobs, including milestones, sectoral contributions and policy implications for the next few years
1st quarter 2011	European Energy Efficiency Plan 2020	This will identify measures to achieve energy savings of 20% across all sectors and will be followed by a directive on energy efficiency and savings in the 3rd quarter 2011
1st quarter 2011	White Paper on the future of transport	This will present a vision for a low-carbon, resource-efficient, secure and competitive transport system by 2050 that removes all obstacles to the internal market for transport, promotes clean technologies and modernises transport networks
1st quarter 2011	Communication on a 2020 EU biodiversity policy and strategy	This will set out the commitments that the EU should consider taking in the context of international efforts and in the light of pressure on ecosystems. The strategy will establish a number of sub-targets underpinning the action
1st quarter 2011	Communication tackling the challenges in commodity markets and on raw materials	This will, amongst others, identify critical raw materials and define integrated measures to help ensure sustainable supply of raw materials to the EU, from domestic resources as well as from global markets, underlining also the role of trade policy in this area. It will promote extraction, recycling, research, innovation and substitution inside the EU. Finally, it will improve coherence between the EU's raw materials and external policies
1st quarter 2011	Revision of the Energy Taxation Directive	This will modernise the framework for energy taxation so that it will better support the high-priority objective of sustainable growth, promoting a more resource-efficient, competitive and greener economy
2nd quarter 2011	Roadmap for a resource-efficient Europe	This will build on and complement other initiatives, the main aim being to increase resource productivity and decouple economic growth from resource use and its environmental impact
2nd/3rd quarter 2011	Common Agricultural Policy Common Fisheries Policy Cohesion Policy Energy infrastructure instrument TEN-T revision	Proposals to reform these policies will help align them with current policy priorities, in particular with the Europe 2020 strategy and this flagship initiative
4th quarter 2011	Energy Roadmap 2050	This will explore possible paths towards a low-carbon, resource-efficient EU energy system and the policy challenges related to that

[10] See the Commission's Work Programmes for 2010 and 2011 - COM(2010) 135 and COM(2010) 623.

2011	Smart grids	This will provide a framework for implementing smart grids in Member States to increase energy efficiency, support the uptake of renewable energy and build an infrastructure for electric vehicles
2011	Security of energy supply and international cooperation	This will be a comprehensive analysis of the external dimension of the EU's energy policy
2011	Review of priority substances mentioned in the Water Framework Directive	This will review the priority substances which pose risks to or via the aquatic environment at EU level
2011	Strategy for the sustainable competitiveness of the EU construction sector	This will identify ways to strengthen competitiveness of the sector while meeting current and future societal challenges until 2020
2011	European strategy and Action Plan towards a sustainable bio-based economy by 2020	This will include completing a European Research Area and implementing a European Innovation Partnership in the bio-economy sectors. It will promote the integration of different sectors and policies across the bio-economy, improve framework conditions for innovation and stimulate reform in Member State R&D and innovation systems
2011	Strategic Transport Technology Plan	This will present a medium-term strategic agenda for research, innovation and deployment, outlining how advanced transport technology can contribute to the objectives of the White Paper on the future of transport, including the implementation of a European Innovation Partnership on Smart Mobility
2011	Revision of the legislation on monitoring and reporting of greenhouse gas emissions	This will improve monitoring of the climate Europe 2020 headline target while aiming at reducing unnecessary administrative burden

Annex 2: Key EU modelling assumptions and possible parameter variations

(showing the lower and upper end values of the range for modulating each assumption or parameter either individually or jointly in order to establish sensitivities and develop policy scenarios. The relevant variations have to be chosen according to the focus of the specific analysis.)

Parameter	Reference scenario (Current trends and policies)	Low-end variation	High-end variation
Policies	Only current policies and measures including ETS, 20% RES and non-ETS greenhouse gas reduction targets.	Fragmented action on climate change – Copenhagen Accord for non-EU actors.	Coordinated climate change action at a global level consistent with 2°C.
GDP growth	Medium-term as defined in 'Europe 2020 strategy'. 'Sluggish recovery' - Europe will suffer a permanent loss in wealth but start growing again at growth rates consistent with long-term GDP projections of DG ECFIN's 2009 Ageing Report.	'Lost decade' - Europe will have suffered a permanent loss in wealth and potential for future growth.	'Sustainable recovery' - Europe is able to make a full return to earlier growth path and raise its potential to go beyond.
Fossil fuel import prices	Oil price around 105 USD (2008)/bbl in 2030; 125 USD (2008)/bbl in 2050; consistent development of gas and coal prices.	Fossil fuel prices as in reference; significant risk of oil shocks (e.g. doubling of oil price) in case of resource constraints coming to the fore.	Low oil import prices of 80 USD/bbl. in 2030 and 70 USD in 2050, consistent with global climate action.
Carbon Capture and Storage	Large-scale demonstration successfully completed by 2020; commercial uptake starts after 2020 depending on competitive situation at prevailing carbon prices.	Significant delay of deployment and subsequent cost reductions due to delay in successful demonstration and/or lack of public acceptance of the technology.	Faster deployment due to higher carbon price incentives. Widespread application, also for gas and industrial processes.
Nuclear energy generation	Replacement of old nuclear plants by new ones on existing sites. New nuclear plants in Poland and Italy. Nuclear in Belgium and Germany is phased out in line with legislation as specified in the scenario.	Less nuclear capacity due to low public acceptance of nuclear energy.	Resolving safety and waste concerns leading to greater public acceptance, Member States implement planned changes to nuclear policies.

Renewable energy sources (RES)	Technology learning and cost reductions as observed in recent years plus removal of administrative obstacles. Gradual phase-out of subsidies for mature technologies and considerable investment in new and smart grids.	RES policies remain as in reference scenario, no new RES policy post-2020. Little technology learning from RES technology progress elsewhere.	More stringent climate policies, strengthening of national RES facilitation policies and European framework, e.g. stronger support and reinforced (smart) grid expansion facilitation, leading to acceleration of cost reductions and technology learning; early grid parity of solar and effective integration of solar in the market.
Energy efficiency	Moderate increase in energy efficiency. Decoupling of economic growth and energy use is taking place, but far from tapping the potential economic savings available.	Financial restrictions limit uptake of existing energy saving options in the major consumption sectors.	'Sustainable growth' scenario is aided by strong investment in energy efficiency technologies and solutions, which generates major energy savings.
Transport	Continuation of current trends where freight demand grows in line with GDP and passenger transport slightly lower than growth in GDP, mainly continued use of currently available car technologies.	Reference scenario trends combined with significant delays and limits in technical progress and cost reductions of low carbon technologies such as electric vehicles, lack of favourable policy framework.	Successful transformation towards demand management, 'getting prices right' and accelerated technological innovation, enabling widespread electrification.
Air Quality	Progressive tightening of air quality legislation beyond levels set out in air quality Directive (2008/50/EC), in particular (new) limits for PM_{10}, (new binding) limits for $PM_{2.5}$ (indicative levels provided for 2020 in air quality Directive), and (new) limit values for ozone with the view to enforcement beginning in 2020 and reaching compliance in Member States in 2030. Thereafter, slow progressive tightening of air quality legislation but still falling short of implementing levels of air quality with no significant negative impacts for health or the environment by all Member States by 2050.	Business as usual, which means implementation of existing legislation on air quality standards (SO_2, NOx, CO, PM, ozone, benzo(a)pyrene, heavy metals) with Member States mostly implementing them by 2020. Thereafter, tightening of air quality legislation but very likely still reaching levels of air quality with some significant negative impacts for health or the environment in 2050.	More ambitious air quality standards agreed for 2020 and beyond, thereby gradually achieving levels of air quality with no significant negative impacts for health or the environment (e.g. as outlined in the WHO air quality guidelines) and successful full implementation by Member States by 2050 .

Biodiversity	Full implementation of Natura 2000 in the EU, plus increase of the marine areas in the network with connectivity between the sites and protection factions for biodiversity under the Common Agricultural Policy.	Weak implementation of the Natura 2000 network requirements in the EU with weak connectivity between Natura 2000 sites.	Same as for reference, but with full protection of all biodiversity in the EU, restoration of biodiversity and ecosystem services as in the Biodiversity EU Strategy target, and implementation of the Green Infrastructure concept.
Waste management	Full implementation of existing EU waste legislation, notably in terms of achievement of recycling targets and waste reduction.	Failure to achieve the EU recycling targets by a few Member States, low waste reduction.	Meeting the waste prevention, reuse and recycling performances of the more advanced Member States, going beyond the minimum EU targets, waste reduction of 15%. Zero landfill in all Member States.
Freshwater	An increasing share of the EU is water-stressed and droughts are more frequent and widespread. Larger energy footprint of water use as a larger share will have to come from alternative water supplies such as desalination. Water Framework Directive requirements are implemented and good ecological status is obtained in most of the basins.	A large share of the EU is water stressed and droughts are more frequent and widespread (aggravated by climate change). Floods are also more frequent and/or intensive. High energy footprint of water use. Water Framework Directive requirements are only partly implemented and good ecological status is not obtained in all the basins.	Water demand management is in place to ensure a proper allocation of available resources to water users and the environment. The energy footprint of water consumption is low as water is being managed in a sustainable way.

Agriculture and land use	Agricultural production increases substantially, but moderate yield growth as result of modern technologies being gradually implemented in developing nations. The exporting country base is enlarged, but food/energy demand may still exert pressure on additional land, leading to some deforestation and new areas (mainly grasslands or marginal agricultural land) being brought under cultivation with resulting increased releases of greenhouse gas emissions and loss of biodiversity.	Agricultural production increases substantially in order to feed a larger and wealthier global population. Stagnating yields due to slow technological progress and extensive agriculture, resulting in low grain production in major exporting countries relative to the market demand and production concentrated in a relatively small number of exporting countries. Climate change effects maybe reduce periodically yields in wide areas, causing sharp increases in food prices which aggravate food security concerns. In response to strong demand pressures for food, deforestation continues as substantial new land areas are brought under cultivation. Intensification of agricultural production and deforestation puts more pressure to biodiversity and result in more greenhouse gas emissions releases.	Agricultural production increases substantially, but fast yield growth following e.g. seed/root improvement technologies, spot-irrigation, etc. So increased food/energy demand exerts less pressure on additional land, leading to reduced deforestation and new areas (mainly grasslands or marginal agricultural land) being brought under cultivation.