Extended Skeleton Energy Scenario, version 20 November 2003

	Cautious world	Future unlimited	Satisfied citizen	Challenging world
Supply	The cautious world is a world with a global economy. Easy excess to international markets with almost no resource constraints. Fossil resources still play the most important role in energy supply. Even a slight increase in this field could be recorded (because a lack of technological innovation regarding the implementation of alternative resources). Imports from outside the EU (Algerian gas, Russian oil) have increased while the production of North Sea oil and gas has decreased. Substantial growth of wind energy by using the existing technology. Many off-shore wind parks were implemented between 2005 and 2015. Hardly any growth in other renewables because of lack of commercial interesting technology.	High economic growth in a global economy has led to a truly international market. The EU countries buy on a global market which can easily provides the needed energy. New tapping of gas and oil fields as well as better and efficient exploitation (new techniques) of the resources has led to an high increase of oil and natural gas supply. Also a growing renewable energy market contributes to a sufficient supply. Besides the well known wind energy, solar energy, biomass, geothermal heat and others are used for energy production. LNG from oil exploitation, new sources in the Wadden Sea region (very common in south Europe).	The economic growth rates have continuously increased but emphasis is on the regional markets and trade within the EU. These trade relations shaped also the energy market. Imports from outside the EU have become scarce and expensive. North Sea oil and gas are important energy sources for fossils and meet 50% of the demand. Due to the high prices, only a small increase of oil and gas supply has been recoded in the past. The strong EU nations supported the extension of renewable energies, but the low technological innovation led to an increase of just the existing technologies. Wind energy is the most used one, so that huge offshore wind parks have been built in the North Sea and the Baltic. Private households are also using solar energy for their warm water system. Some LNG sources and terminals in the Wadden Sea region.	Low economic growth but high mobility of the people and medium freight traffic growth have led to an increase of energy supply (more than in Cautious world) The emphasis is laid on domestic production of oil and gas. Heavy use of North Sea oil and also electricity imports from Norway (water power). Focus on decentralized energy supply (energy and heat systems) and savings when ever possible. Use of solar panels for warm water in private households.

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Demand	Big demand increase by developing countries and particularly by China. This has led to some pressure on the market, but higher exploration in some countries compensated the pressure. Within the EU, the demand increased only very slightly because of the low economic growth and mobility. Sustainable development strategies and the implementation of EU regulations gained a better energy efficiency in the EU countries, particularly in the new member states. Due to the economic situation in a cautious world, the people take care of their household budget, which stimulated to energy saving. This influenced also the total demand in the WSR.	Regardless the different scenarios in Northwest Europe, a growing demand is requested by developing countries, India and China. This of course, will lead to some pressure on the market, but higher explorations will compensated the pressure. Big demand increase on world level but medium growth in Europe due to high economic growth, increasing mobility and a global market. (Higher increase will be compensated by efficiency and decoupling of economic growth and energy consumption). Because of the efforts of the new EU countries to adjust their economy to the requirements of the whole EU, the high growing rates demand a high energy consumption. Also a more efficient economy is related to energy use which has led to an increased demand. Due to a changed life style and higher mobility of the people, the consumer demand has also increased dramatically. Energy saving is no issue, comparable to the US at the beginning of the millennium.	Increasing demand on global scale. High economic growth of the regional markets led also to an increase of energy demand in the EU and the Wadden Sea region. Passive consumers and the low mobility keep the increase quite moderate. The high oil and gas prices on the world market made domestic exploration and developments in the EU attractive. Efforts in a better energy efficiency by using the existing technology in almost all sectors has had positive effects on the demand (keep it low to moderate). Also energy saving is taken seriously in this world, by private, industrial and public sector.	Increasing demand on global scale. Moderate demand increase in the EU countries. Economic challenges are taken by new enterprises which contribute to an increased demand. This goes also for the production of high tech products and the high technological innovation in different sectors. Also the substantial goods traffic and mobility of the society demands more energy. The energy consumption of the transport sector has increased from 30% in 2000 to 33% in 2020 of the total consumption.[1] The technological innovation is also used to invest in better energy efficiency, which keeps the demand quite moderate. Also savings contribute to this.

[1] IEA, World Energy Outlook 2002

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Renewable	Wind energy is the most common renewable energy source. Even without any financial subsidies the huge off-shore wind farms are able to compete on the energy market. Solar energy is a growing market for heating and warm water systems but not for electricity. Biomass and wave energy have not a big share in the renewables (low technological innovation)	High economic growth and technological innovation have supported to developing renewable energy techniques. (Development of market driven renewables are linked to economic growth). Hydrogen is a world star, the energy sources for the production of H_2 are solar and wind energy. Biomass also has become a common energy source, particularly in rural areas (liquid manure, organic waste in agriculture).	The lack of technology made it difficult getting renewables to gain a higher market share. The well proven wind energy is the only star of alternative energy techniques (electricity). Solar energy is used by the households and tourism industry (heating, warm water systems).	Wind energy is used with the available technology. Investments in solar and hydrogen technology have been made and have found application in some sectors. Also fuel cells have been further developed. These new techniques are used on regional markets and no break through in exports.

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Technological development	Progress has been made in the development of new techniques, but mainly on the research sector. Fuel cells and H_2-technology are available but are not widespread used. (see also challenging world) The effectiveness of wind and solar energy production has increased. Also all standard technologies in energy production (coal, oil and gas) and energy use (traffic, heating, electricity) have become more efficient. Biogas production provides a small income for farmers, but the technique is quite old and inefficient.	The highest progress in technological development was made in the energy sector. Almost all production systems are working with more efficiency. The effectiveness in transformation from energy sources to electricity has increased (wind energy, solar electricity and biomass). The technological innovation made it possible to use all known resources for commercial production. Particularly, the H_2 technique has developed. The share of hydrogen driven busses (hybrid technique) in public transport is more then 20 %, and also electric cars for the urban traffic play an important role. Increase of biomass production by better techniques and usage of organic waste (also from households).	High investments in off-shore wind parks by using existing technology. Also the developments in better energy efficiency were undertaken by the well-known and understood techniques. When some techniques in 2000 were used only sporadic (insulation of houses, thrifty engines for industry and vehicles, etc.), these techniques are now used very commonly. Biomass similar to scenario 1. The political driven factors are still to weak to set the development of renewable better in motion.	Oil and gas are still the biggest sources in the world, but Europe is short of resources. The abandoning of nuclear energy has been postponed, power plants have a longer run. Solar energy has been further developed and hydrogen is the most popular new comer. Fuel cells are developed but have not reached market maturity. The life expectancy of it are too short. Weak policies for renewables and technological innovation.

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Social development	The behaviour in energy consumption has changed. People try to reduce their consumption because the available household budget decreased. Some pressure from governments and citizens to abandoning nuclear energy, and to avoid the use of other 'dirty' resources and processes.	The consumer demand has highly increased and for most people energy saving is not a big issue, but due to the very high consumption and energy costs, developments in saving and efficiency improvements in the private sector are on the way. The quality of life becomes more and more susceptible to the dependence of energy availability. Even in future unlimited the consciousness for the environment has increased (like satisfied citizens) because in a healthy world people are open for changes.	Community orientated people are aware of the environment and are aiming at energy saving. This concerns private travelling (car sharing), commuting (public transport), households (savings and better efficiency) and life style (consumerism).	The weak economy implies lower income, therefore savings in many areas To some extend social pressure on the government to faster develop renewables The economic pressure hinder the progress in solving other problems like energy savings.

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Political development	Implementation for stringent conditions for environment friendly distribution systems. Emission trading is a world wide business, high quality standards in energy production (as well as renewables) in the Wadden Sea region makes the WSR to a seller of emission certificates EU policies emphasized sustainable energy use but no sound regulations due to supply have been made. Countries still take own responsibilities. Implementation of road fees (freight traffic on highways)	Strong and efficient EU policies are striving for a supra-national energy policy. The increasing consumption as well as impacts on the environment like global warming made it necessary to regulate and coordinate the energy market with regard to sustainability. Within the EU, a continuation of liberalisation and globalisation of electricity and gas market has taken place. An effective emission trading system has been built to influence the developments of the energy market.	EU and national policies aim at a sustainable development and support energy savings (subsidies, taxes, etc.). Coal based electricity generation has been replaced by gas plants step by step. The storage of CO_2 in exploited gas and oil fields is part of new energy policies. Bilateral agreements due to imports of fossil energy have become more important.	There is little emphasis on sound energy policies. Political tension in the world makes it more difficult to get imports on the world market. The liberalization of the electricity and gas market has made not much progress because of stronger national policies Advanced implementation of road fees for all vehicles from 2010 on. Restructuring of taxes.
Price	The prices for oil and natural gas have been quite stable over the years. A barrel crude oil is on the level of $20 (same level as in 2000)[2] and the EU gas prices have slightly increased after 2010[3]. The EU electricity price has slightly increased though the consumption has decreased, a better efficiency of electricity production and the use of all available sources (plus decentralization). In 2000 the price was at the lowest level so every development required higher electricity prices.	High economic growth and the increasing demand has also effected the energy prices. Investments in new technologies, storage and distribution systems have found expression in higher prices. But due to a wide range of available energy sources and a big share of renewables, the oil and gas price has increased quite moderate (30-40 $). In general, the energy prices in Future Unlimited are much higher than in other scenarios.	The prices for crude oil and natural gas has increased. Europe is dependent on North Sea exploitations, which keeps the costs quite high. Because of massive savings and the use of wind power, the demand still is quite moderate, so only a medium growth of prices could be recorded. Oil prices of $ 30 or 35 per barrel on the world market are common. Available LNG substituted natural gas from the North Sea and import from Russia= cheaper.	The prices development is similar to the scenario Satisfied Citizens. EU and Norwegian imports cause the relative high price for fossils. Increase of gas and electricity prices because of lacks in liberalization (see above).

[2] Based on oil price scenarios IMF, source: IMF, Goldman Sachs, Bloomberg LP, NRC Handelsblad September 2003.

[3] Gas and electricity prices are based on EEA reference scenario, basic facts depict form the EU chapter in 'energy outlook 2002'.

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Distribution	Because of increased imports of gas and oil, a Pan European pipeline system is in the planning phase Old pipelines and bad pipelines are gradually substituted by better ones due to better legislation and to sustainability strategies. In general, the distribution of energy is of great importance. Particularly, the efficient transformation and storage of energy, produced by wind farms and solar techniques is still a big issue and causes some problems.	Investments in decentralized and local energy production contributes to a regional energy market. This is related to solar energy, combined power-hating systems and to some extend biomass energy. Hydrogen technology is used for storage and transportation of wind generated power. New oil and gas pipelines as well LNG terminals guarantee a distribution of fossil resources. For electricity distribution, how voltage direct current transmission cables are installed. New cable connections to off-shore power plants (wind farms).	The distribution has not much changed. Imports of oil and gas have not increased, so the existing pipeline systems are sufficient. A more decentralized supply (solar energy of households, wind farms, etc) and responsibilities on national and regional level require only short distances for energy distribution. Some LNG terminals have been built and distribution of the gas by pipelines.	The regional energy market provides short distances for energy distribution. Some developments in hydrogen and fuel cell technology solve problems in distribution. For oil and gas supply, existing pipelines and grids (2000) are sufficient.