4 Socio-Economic Impacts

4.1 Wealth Creation

A recent modelling of the world economy by the International Energy Agency (IEA) in collaboration with the OECD Economics Department and with the assistance of the International Monetary Fund (IMF) Research Department shows that there is a considerable negative impact of rising oil prices on macro-economic indicators such as Gross Domestic Product, Consumer Prices and Unemployment /IEA 2004/. The study analysed the difference of these indicators between a base case defined by an oil price of 25 $/bbl and a relatively sharp increase to 35 $/bbl as experienced in 2003/2004 for different regions and on global level (Figure 4-1).

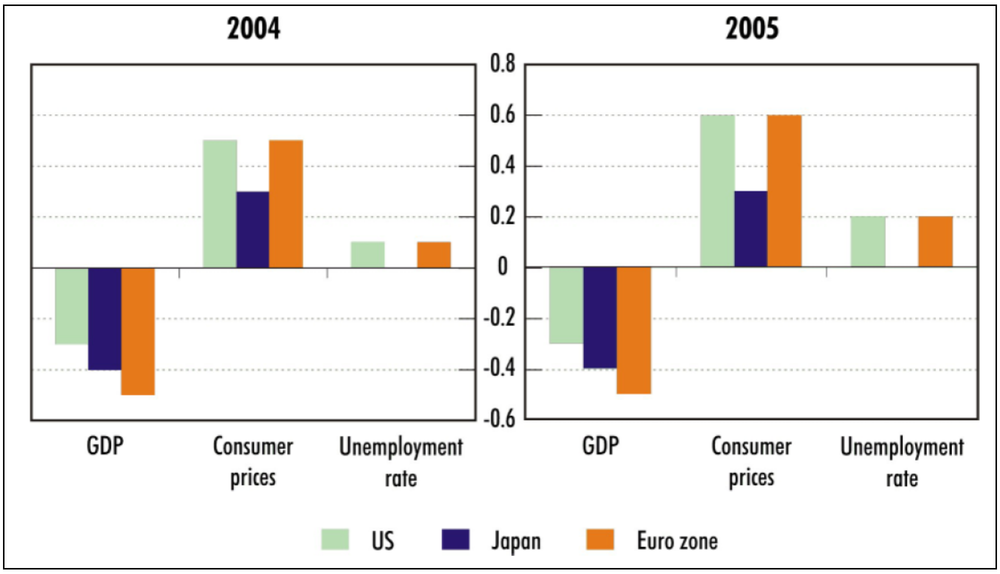

Figure 4-1: Short term impact of higher oil prices on the macro-economic indicators by Region/Country. Deviation from base case in percentage points. Oil prices are assumed to be 10 $/bbl higher than in the base case (25 $/bbl). The reaction of the GDP in the Euro region amounts to – 0.5 % /IEA 2004/.

In the case of a 10 $/bbl increase, the annual GDP in the Euro zone is reduced by 0.5 %, while consumer prices increase by 0.6 % and unemployment by 0.2 %. In absolute numbers, there is a loss of about 42 billion US-$ in GDP and about 400,000 jobs in all OECD countries. The average oil price level of over 50 $/bbl in 2005, however, is 25 $/bbl above the base case, with proportionally higher impact on the national economies. Moreover, fuel price escalation goes on undisturbed (60 $/bbl in January 2006) with up to 120 $/bbl expected for 2030 /HWWA 2005/.

Figure 4-2 shows the historical prices of fuel oil #2 in the past 30 years and the equivalent cost of energy from a concentrating solar collector field as projected for the next 30 years under the operating conditions of North Africa. The comparison shows that the primary solar energy cost will reach by 2015 a price level equivalent to that of fuel oil in the 1990ies. The crude oil price by that time was between 15 and 20 $/bbl. This cost reduction of solar energy can significantly help to counteract the negative impacts of fossil energy price escalation and to stabilize energy costs at a reasonably low level, if the renewable energy shares become significant. Also other renewables show such a trend. In contrary to the volatility of fuel prices, the learning curves of renewables are rather predictable within a reasonable range. However, a major requisite of cost reduction is the expansion of capacities and production /WETO 2003/, /EXTOOL 2003/.

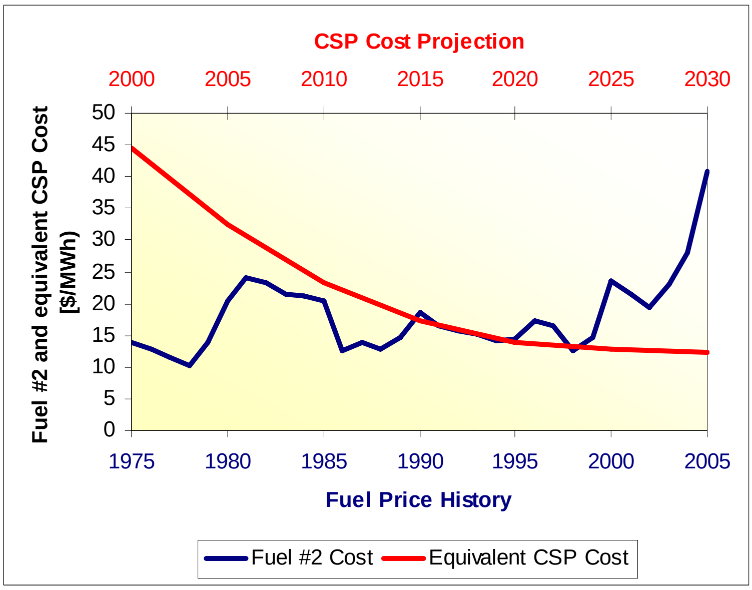

Figure 4-2: Historical prices of fuel oil #2 and cost of equivalent solar energy from concentrating solar power projected for a comparative time span of 30 years /oilnergy 2005/ and own calculations.

Therefore, an increasing, noticeable share of renewables is a key for stabilising the socio-economic indicators mentioned before. However, due to the present low share of renewables on primary energy, and even considering the high market participation and growth rates of renewables today, those beneficial effects will hardly become noticeable on a global scale before 2020. On the other hand, the simple fact that fossil fuels will increasingly have to compete with renewables all over the world will have a stabilising effect on fossil fuel prices.

The IEA study also predicts that lower prices than in the base case would bring economic benefits. The results of a second simulation, which assumes a $7 per barrel fall in oil prices compared to the base case over the full projection period of 5 years, suggests that the economic benefit of lower prices is as pronounced as the harm caused by higher prices. After the first two years of the sustained lower price case, GDP is 0.3 % higher whilst inflation and the rate of unemployment are 0.4 % and 0.2 % lower compared to the base case. This is more or less what could be expected theoretically if oil would be substituted by CSP or other renewable sources. Unfortunately, a full substitution within such a short time span of 5 years is not realistic at all.

However, there will be considerable socio-economic benefits from the increased use of renewables in Europe and world wide.

4.2 Reduced Subsidies and External Costs

"The private sector carries no obligation to address long-term energy security or environmental issues. It is the responsibility of governments, through market pricing and appropriate regulatory frameworks, to ensure that the private sector adequately responds to these challenges" /EEA 2004/. This is often done through energy subsidisation.

In a recent study, the European Environmental Agency has quantified the energy subsidies in the European Union /EEA 2004/. According to this analysis, the direct and indirect subsidisation of energy amounts to about 86 billion € per year (Table 4-1). They classify subsidies into three categories: on-budget subsidies, off-budget subsidies, and the failure to impose external costs.

On-budget subsidies are cash transfers paid directly to industrial producers, consumers and other related bodies, such as research institutes, and appear on national balance sheets as government expenditure. Grants may be given to producers, mainly to support commercialisation of technology or industry restructuring, and to consumers. On-budget subsidies also include low interest or reduced-rate loans, administered by government or directly by banks with state interest rate subsidy (Table 4-2).

Subsidies [billion €/y]	Coal/Lignite	Oil/Gas	Nuclear	Renewables	Total
on-budget	6,4	0,2	1,0	0,6	8,2
off-budget	6,6	8,5	1,2	4,7	21,0
external costs *	36,0	16,0	2,7	2,3	57,0
Total EU 15	**49,0**	**24,7**	**4,9**	**7,6**	**86,2**

*** average of minimum and maximum estimate to show the order of magnitude**

Table 4-1: Energy subsidies /EEA 2004/ in the European Union in 2001and externalities calculated from /ExternE 2003/

Off-budget subsidies are typically transfers to energy producers and consumers that do not appear on national accounts as government expenditure. They may include tax exemptions, credits, deferrals, rebates and other forms of preferential tax treatment. They also may include market access restrictions, regulatory support mechanisms, border measures, external costs, preferential planning consent and access to natural resources. Regulatory support mechanisms make up the other most significant area of off-budget support for the energy sector. These mechanisms most commonly take the form of price guarantees and demand quotas for specific energy sources. They are introduced to support environmental, economic, employment or energy security policy objectives. Some of these mechanisms, such as feed-in tariffs or competitive tenders can be described as ‘supply push’ mechanisms, in that they stimulate production. Others, such as purchase obligations are ‘demand pull’ mechanisms in that they create an artificial demand to which the market responds.

Research undertaken in the United States provides a useful indicator of the respective levels of total subsidy support for nuclear power and wind power at similar stages of technological development. According to this analysis, the nuclear industry in the USA received about 30 times more support per kWh electricity output than wind power in the first 15 years of the industry’s development with comparable power generation /Goldberg 2000/.

In contrast to fossil and nuclear power technologies, renewable energy, with the exception of large hydro-electric power, represents a range of technologies still in their infancy. Due to R&D inputs and wider commercial application, the capital costs of renewable energy have fallen considerably in the past and will fall further substantially, making production from renewable energy sources increasingly competitive. Rather than subsidy, the public support of renewables – if properly balanced – can be interpreted as a sound investment into a cheaper, less volatile and ecologically compatible energy supply. Especially support schemes like the renewable energy feed-in tariffs in Austria, Spain and Germany allow (force) the direct beneficiaries of this strategy, the energy consumers, to directly invest into their own area of interest.

Fuel cycle externalities are the costs imposed on society and the environment that are not accounted for by the producers and consumers of energy, i.e. are not included in the market price (Table 4-3). They include damage to human health, the natural and built environment, and include non-compensated effects of air pollution, occupational disease and accidents. They also include the external costs of climate change. In theory, if the costs of external impacts are known, they should be incorporated into the price of the energy concerned. In that way, producers, consumers and decision makers could get accurate price signals and reach optimal decisions about how to use the resources. In practice, the measurement of environmental impacts and associated costs is a complex and evolving science, and neither markets nor governments effectively price these costs. EU governments have recognised this and have invested in modelling, in particular through the European Commission’s ExternE project, which has demonstrated that most renewable energy sources have significantly lower environmental impact per kWh than fossil fuels, and have similar immediate impacts to nuclear power, without the same risk of accident and nuclear materials proliferation (Figure 4-3).

Due to the subsequent cost reduction of renewables, their increased utilisation can slowly relieve the European economies from the heavy burden of energy subsidies and external costs, at the moment amounting to about 80 – 100 billion € per year in the EU 15 alone, not accounting for the political and nuclear external costs involved. It will depend on the speed of market introduction and expansion of renewables, if this burden can be unloaded from European society before major damages to economy and environment take place and become irreversible.

On the other hand, the additional burden on the public energy budget during the market introduction phase of renewables is relatively low, as the share of renewables in this phase is low, too. Once the share of renewables becomes bigger – specially after the break even point with fossil fuels – it's cost will be lower, thus effectively combating energy cost escalation (Figure 4-7).

The subsidisation of technologies that have been introduced to the market more than 50 years ago like fossil or nuclear power, and the – transient – necessary support for the market introduction of renewables are of totally different quality: the former is a real, long term and potentially unlimited and increasing subsidisation of technologies that have already passed beyond their economic summit and become more and more expensive the longer they are subsidized. In contrast to that, the support of renewables has the quality of a limited, initial investment necessary to achieve a better, cheaper and more compatible energy supply system.

Both the present RD&D strategy and the energy subsidisation schemes of the European region must urgently change from the visible dead end track of fossil and nuclear power to a sustainable path based mainly on renewable energy and a well balanced mix of resources and technologies.

Government intervention	Examples
Direct financial transfers	Grants to producers
	Grants to consumers
	Low-interest or preferential loans to producers
Preferential tax treatments	Rebates or exemption on royalties, duties, producer levies and tariffs
	Tax credit
	Accelerated depreciation allowances on energy supply equipment
Trade restrictions	Quota, technical restrictions and trade embargoes
Energy-related services provided by government at less than full cost	Direct investment in energy infrastructure
	Public research and development
Regulation of the energy sector	Demand guarantees and mandated deployment rates
	Price controls
	Market-access restrictions
	Preferential planning consent and controls over access to resources
Failure to impose external costs	Environmental externality costs
	Energy security risks and price volatility costs

Table 4-2: Types of energy subsidy. Adapted from /IEA,UNEP 2002/.

Social Costs (quantified in ExternE)

- Damages to Health (e.g. pollution of air and water)
- Damages to Materials and Buildings (e.g. acid rain)
- Damages to Crops (e.g. over nutrition, acid rain)

Environmental Costs (quantified in ExternE)

- Damages to Ecosystems (e.g. over nutrition, acid rain)
- Greenhouse Effect (e.g. desertification, weather extremes, global climate change)
- Environmental Overuse (e.g. deforestation)
- Smog (e.g. Asian Brown Cloud)

Political Costs (not quantified)

- Political and Military Presence to Secure Energy Resources (e.g. USA in Saudi Arabia)
- Wars on Resources (e.g. Persian Gulf Wars)
- Political Decisions Influenced by Dependency on World Market (e.g. see today's newspaper)

Nuclear Costs (partially quantified in ExternE)

- Nuclear Waste Disposal for over 25 000 years (still unsolved)
- Protection of Transport of Nuclear Waste Materials (Castor Transports in Germany)
- Hazard of Nuclear Accidents (e.g. Tschernobyl, no insurance available for such risks)
- Proliferation of Nuclear Materials (e.g. Threat of Dirty Bombs with Plutonium)

Table 4-3: Types and examples of external costs. The first two categories are quantified in the ExternE project of the European Commission in Figure 4-3.

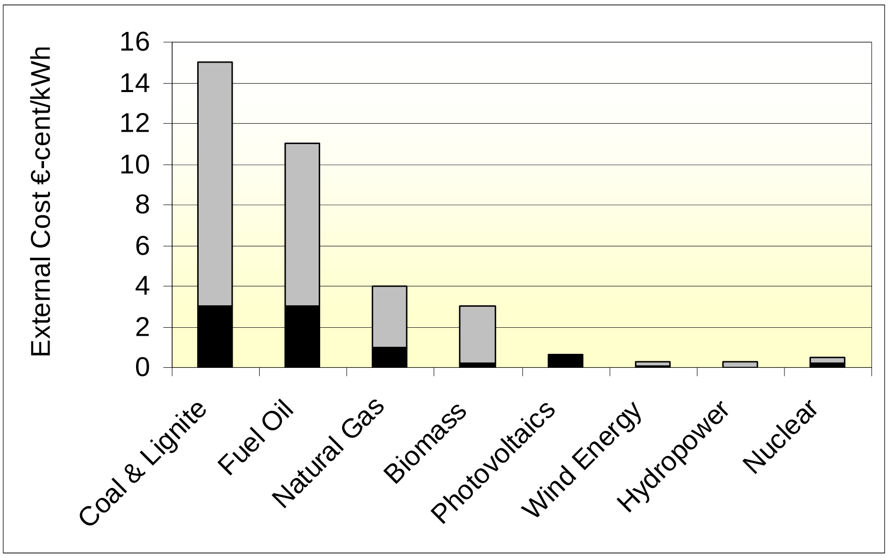

Figure 4-3: External cost range for electricity production in the EU 15 countries for existing technologies in € cent per kWh according to /ExternE 2003/ (minimum black, maximum grey). Nuclear externalities do not include all costs . ExternE does not ether include political costs according to Table 4-3. Please refer to /Krewitt and Schlomann 2006/ for more recent analysis.

4.3 Improved Diversity and Security of Supply

There is a clear answer to the question of security, well established in the financial and insurance business: the diversification of the portfolio of assets. This has been recognised by the Green Paper on Sustainable, Competitive and Secure Energy of the European Commission that has set out the energy realities facing Europe /EU 2006/. According to this paper, Europe's energy policy should have three main objectives:

- Sustainability : (i) developing competitive renewable sources of energy and other low carbon energy sources and carriers, particularly alternative transport fuels, (ii) curbing energy demand within Europe, and (iii) leading global efforts to halt climate change and improve local air quality.
- Competitiveness: (i) ensuring that energy market opening brings benefits to consumers and to the economy as a whole, while stimulating investment in clean energy production and energy efficiency, (ii) mitigating the impact of higher international energy prices on the EU economy and its citizens and (iii) keeping Europe at the cutting edge of energy technologies.
- Security of supply: tackling the EU's rising dependence on imported energy through (i) an integrated approach – reducing demand, diversifying the EU's energy mix with greater use of competitive indigenous and renewable energy, and diversifying sources and routes of supply of imported energy, (ii) creating the framework which will stimulate adequate investments to meet growing energy demand, (iii) better equipping the EU to cope with emergencies, (iv) improving the conditions for European companies seeking access to global resources, and (v) making sure that all citizens and business have access to energy.

The present situation and future trends of the energy sector present several serious challenges to the European Union. Future security of supply, particular of oil and gas is uncertain, and indigenous production is declining rapidly. High oil and gas prices weigh on the budget of consumers and companies and gas and electricity prices pose a potential threat to competitiveness of EU companies. Greenhouse gas emission, particularly CO_2, are persistently stable or even slightly increasing at a time where Kyoto commitments and post 2012 climate policy would require clear decreases in emissions.

Security of Supply

The TRANS-CSP scenario starts in the year 2000 with the 5 major sources of power generation used at present in Europe, that is coal, nuclear power, natural gas, fuel oil and hydropower (Figure 4-6). In 2050, the power demand is covered by 10 major sources, including the renewables portfolio with 7 new resources, and fading out expensive oil and risky nuclear power. Most of the renewable energy sources used are domestic, thus doubling the diversity of resources and at the same time reducing the dependency on energy imports.

The import of solar electricity through HVDC lines is a security issue, as the sudden outage of power lines with 5 GW capacity would be a challenge for the present UCTE grid. At the moment, the short term primary reserve of the European grid allows for outages of about 3 GW. In case of an outage of a bipolar 5 GW HVDC line, the immediate outage is 2.5 GW if only one conductor is affected, while 2.5 GW can be maintained for about 10 minutes through back-currents by earth, enough time to activate further reserve capacities, while conventional power lines fail totally within split seconds /Peschke, Olshausen 1998/. Thus, the outage of one conductor of a bipolar, 5 GW HVDC line would be the maximum tolerable failure within the present European utility grid.

The same limits are valid for the operation of nuclear fusion plants scheduled to have 5 GW flat base capacity /HGF 2001/. In any case it will be necessary to strengthen the European electricity grid by a HVDC infrastructure – similar to electricity highways – that allows for the quick transfer of electricity over long distances to compensate possible outages of high capacity at single points. HVDC will thus become anyway the basis for network stability in the future.

The TRANS-CSP scenario proposes a HVDC import capacity of 100 GW from CSP plants in Northern Africa with average 7000 full load operating hours per year, through 20 lines with 5 GW capacity each (Chapter 2). If the CSP plants would normally operate with only 90 % of their capacity, they would have a reserve capacity of about 10 %, thus being able to compensate a short term outage of 2 complete lines with 10 GW. The rotating masses of the steam turbines would act as short term primary reserve capacity, but CSP can also act as long term reserve with base load characteristics. Short term reserve capacities are very important for grid stability. CSP plants can fully provide those services for grid stabilisation.

A HVDC backbone will considerably increase the redundancy of the European electricity grid /Fischer et al. 2004/. While the transmission of electricity through the AC grid in case of an outage is limited to about 3 GW, the capacity of a HVDC grid is virtually unlimited compared to the maximum unit capacity that could suffer an outage. Therefore, a HVDC backbone grid will probably be implemented in Europe within this century to enhance security and stability. A spin-off of this grid will be the possibility to interconnect the best sites for renewable energy use from hydropower, wind and solar energy (Figure 4-4). This will increase the compensation effects of fluctuating renewable energy resources within the power system, because the time correlation of the different sources decreases considerably with their distance. Thus, a HVDC electricity system will not only increase the redundancy of supply, but also will smoothen the temporal fluctuations of the renewable energy mix.

The technical vulnerability of highly dispersed electricity generation from relatively small units of renewable power generators is much lower than that of a system based on large centralised power generators. E.g. drastic measures are necessary to protect nuclear reactors from September 11 type attacks, with considerable (external) costs for society, while it is virtually impossible to attack simultaneously the highly dispersed wind and solar electricity generators of a renewable energy mix. The technical vulnerability of the present electricity grid is rather high, but a HVDC backbone will effectively reduce the vulnerability of the transmission system of the future.

We assume a capacity credit of wind power of maximum 16 % and 0 % for PV. Our scenario shows a subsequently fading demand for flat base load power plants with constant capacity, and increasing demand for quickly reacting gas fired power plants to provide firm capacity on demand. This is due to the fact that the fluctuating wind and PV resources will primarily substitute base load capacity, reducing the consumption of energy, but they cannot replace major shares of firm capacity.

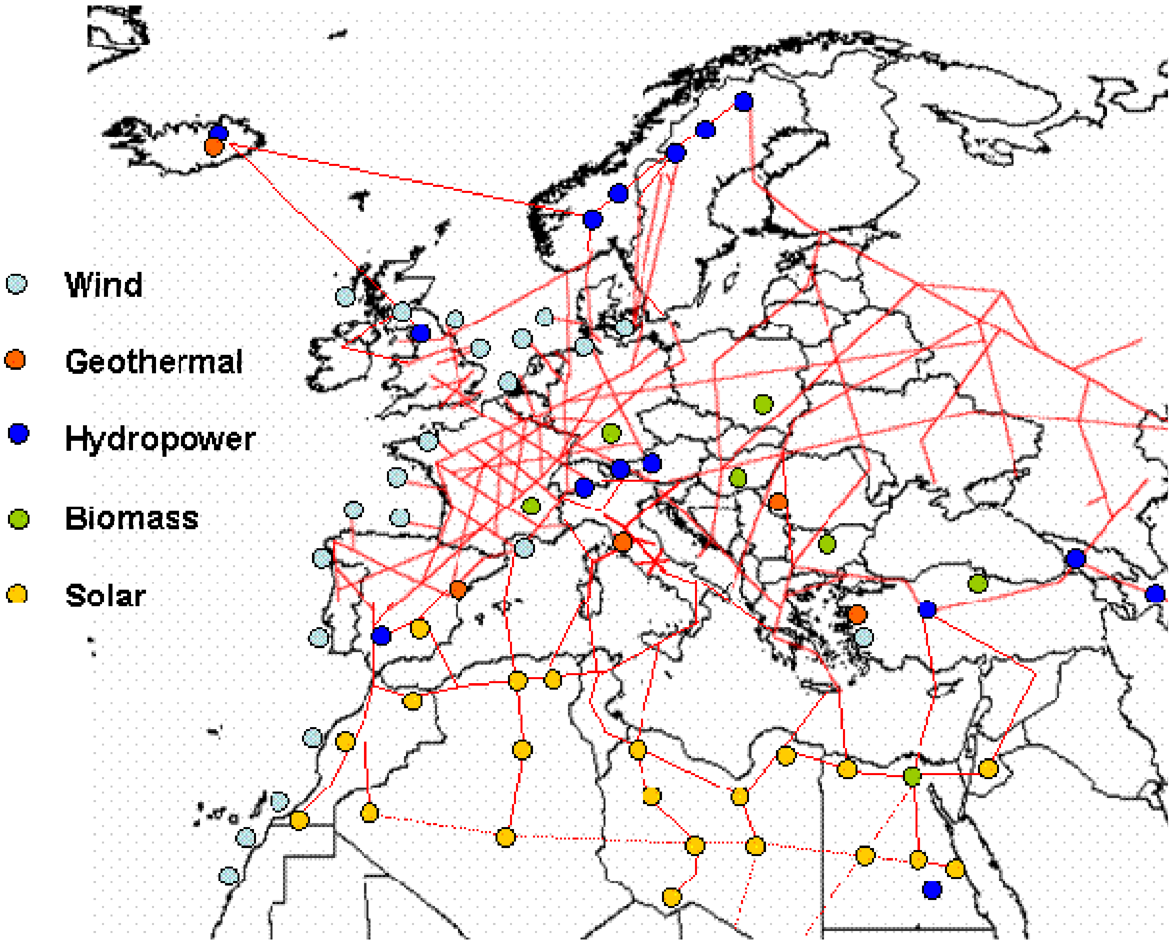

Figure 4-4: Vision of a Trans-European HVDC grid acting as “electricity highways” to increase the redundancy of power supply and to activate the best sites for renewable electricity generation. Based on /Asplund 2004/ with modifications according to the results of TRANS-CSP.

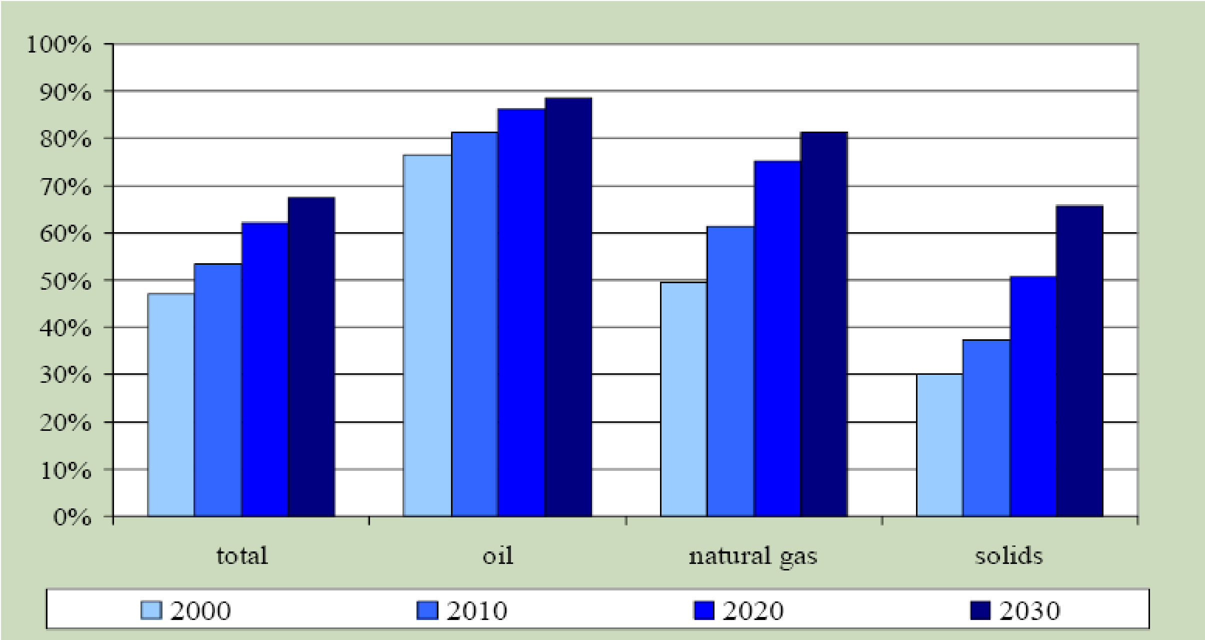

Figure 4-5: Energy import dependency in the EU 25 expected in a scenario that follows present policy trends /EU 2006/

In order to benefit from gas fired firm capacity and at the same time reduce the consumption of natural gas, it will be important to install renewables at the same or at a faster rate than gas fired plants. Gas fired peaking plants and renewables combine very well. On the other hand, considering the long investment cycles of 40-50 years, investments into constant capacity base load plants should be considered carefully. With a well balanced mix of technologies, it will be possible to substitute coal and nuclear base load capacity by renewables and natural gas, without stressing too much the gas resources. In the TRANS-CSP scenario, there is an interim doubling of gas consumption until 2030, which is then retrogressive and ends in 2050 with the same consumption as today (Figure 4-6). Coal consumption is maintained steady until 2030, then it goes back to 40 % of the 2000 value by 2050. Part of the demand for natural gas will be supplied by coal gasification, depending on the cost of both options. Nuclear power is faded out. In this mix, there is certain room for variances of the shares of gas, coal and nuclear plants which will depend on the respective national and European energy policy and subsidisation.

The TRANS-CSP scenario maintains a minimum firm power capacity of 125 % of the national peak load in each country. However, as peaking demand does not occur simultaneously in all countries the overall peak load will be smaller. With a well balanced mix of renewable and fossil backup power plants, and the considerable backup capacity of a HVDC grid interconnecting all European regions, the TRANS-CSP scenario shows an effective way to increase substantially the security of European electricity supply.

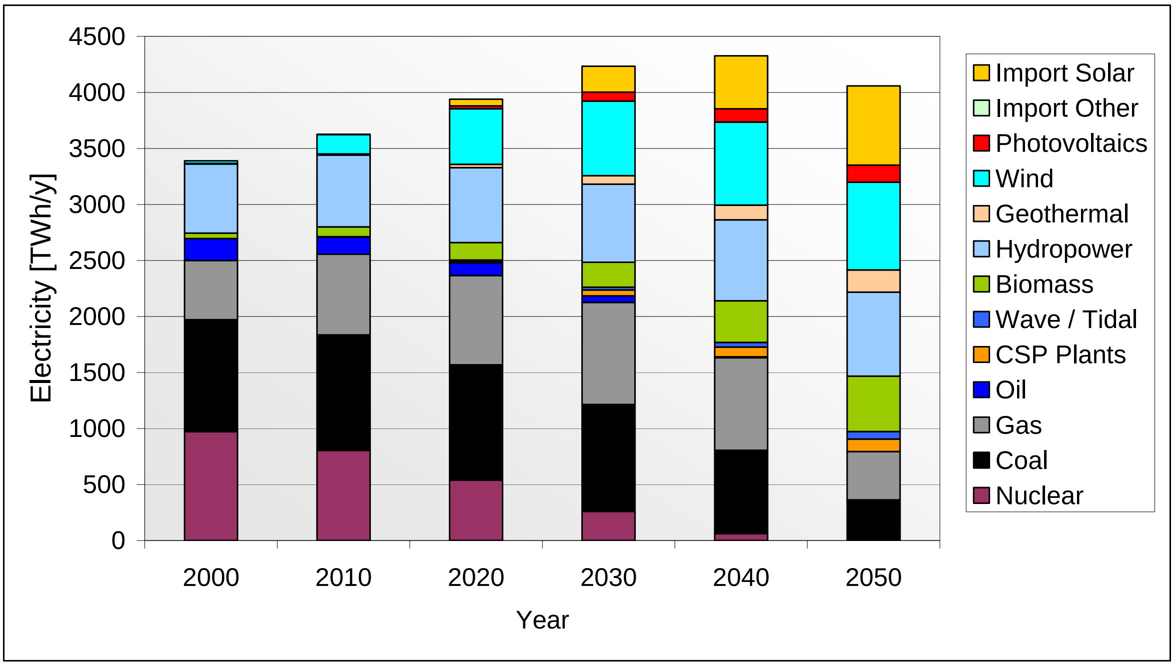

Figure 4-6: European electricity mix in the TRANS-CSP scenario (see Annex for single countries)

Economical Security

Managing the economical risk associated with energy supply is an increasingly important policy driver. Security of energy supply covers a wide range of issues — from protecting energy distribution infrastructure from disruption, to diversifying sources of supply and developing strategic stockpiles. In economic terms, risk is best measured by price volatility.

Governments have traditionally made planning decisions for new capacity based upon the lowest cost option between different technologies and fuels (Quotation from /EEA 2004/). This has tended to support more established fuel sectors rather than renewable technologies, which have higher capital costs but which may have other benefits in terms of diversifying supply and reducing import dependence. With investment decisions transferred to the private sector and downward pressure on electricity prices, the demand for lowest cost options has become even greater. Current electricity prices in Europe reflect rather the marginal cost of power generation of 3-4 €-cent/kWh, while the real cost which also covers the investments of new power plants is estimated to be in the order of 6 €-cent/kWh /EU 2006/. As a consequence, investments in the power sector are not realised in the required amount, creating an unbalanced situation of demand and supply. This is a common situation in developing countries, but has recently also influenced grid outages in USA, Denmark and Italy.

This creates problems for energy planners, who have recognised that current market designs do not guarantee an adequate level of security of supply. Over-reliance on fossil fuels can increase fuel price volatility — the likelihood that energy prices will fluctuate more widely and more often — and expose economies to significant macroeconomic costs.

Financial portfolio modellers seek to identify the efficient or optimal assets mix that produces the most economically efficient outcome for a given level of risk: efficient portfolios maximise expected return (or minimise expected cost) at any given level of risk, while minimising risk for every given level of expected return /Awerbuch and Berger 2003/.

Awerbuch and Berger examined the use of portfolio theory in reducing risk and potential costs and demonstrated that current energy mixes can be significantly enhanced, and that by adding renewable energy to energy portfolios dominated by fossil fuels, price risk could effectively be hedged. They compared the 2000 and projected 2010 EU 15 electricity generation mix and concluded that risk and cost can be reduced 'by adjusting the conventional mix and including larger shares of wind or similar renewable technologies' and that 'any expansion in natural gas should be accompanied by an increased deployment of renewables'.

The presence of each primary fuel in an energy portfolio with minimised risk has a real economic value, but this is currently disconnected from mainstream discussion, energy models and private sector investment decisions. Further work needs to be done to quantify the economic benefits of risk and cost management to ascertain the extent to which current levels of support reflect the potential benefits of renewable energy. What is clear is that the role of technologies for exploiting renewable energy in diversifying energy price risk is not yet fully recognised by the market.

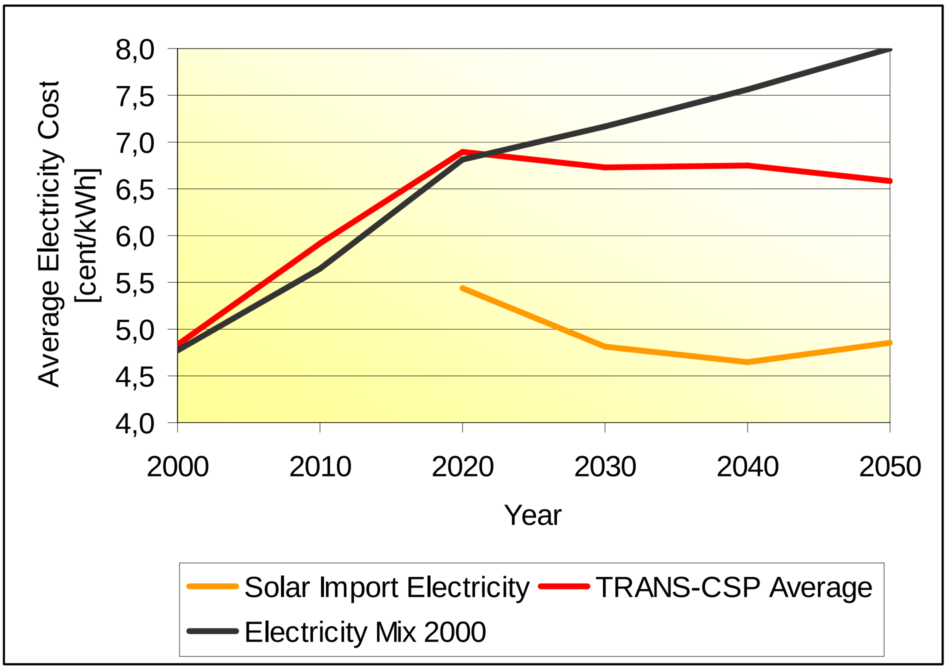

Figure 4-7: Average cost of electricity from new plants in the TRANS-CSP scenario and in a conservative scenario based on the electricity mix of the year 2000, in comparison to the cost of electricity imports from MENA for the example of Spain. For other countries please refer to the Annex.

Based on the investment cost and the development of the electricity mix defined in the TRANS-CSP scenario in Chapter 2 we have calculated the generation cost of each technology and of the average total electricity mix, neglecting those power plants that operate at marginal cost (Figure 4-7). As a reference case, we have calculated the same for a business as usual scenario based on the electricity mix of the year 2000. Starting in 2000 with an average cost of 4.8 cents/kWh, the average electricity cost escalates in both scenarios, with a little higher initial escalation in the TRANS-CSP scenario, due to the higher cost of renewables. Due to the low share of renewables, this difference is rather small. After 2020, the cost of the business as usual scenario keeps on escalating to 8 cent/kWh in 2050, while the trend of the TRANS-CSP scenario is reversed and the average cost is stabilised at about 6.5 cent/kWh. Within a range of 5.5 to 4.5 cent/kWh, the cost of import solar electricity from MENA is significantly lower than the average cost of both scenarios, thus contributing very economically to the European electricity mix.

It must be noted that the cost of the energy mix calculated here neglects the operation of older plants that have fulfilled their capital return and operate at marginal cost, so that the real cost level of the future electricity mix can be expected to be slightly lower than assumed here. Renewable energy technologies – that do not consume fossil fuels which make up the main part of the marginal cost of fossil plants – have an exceptionally low marginal cost of operation of less than 20 % of the cost of new plants, equivalent in most cases to less then 1 €-cent/kWh.

The above calculations confirm the statements given by the European Commission’s Green Paper on Sustainable, Competitive and Secure Energy /EU 2006/, the European Environmental Agency /EEA 2004/ and the Delphi project /EurEnDel 2004/ and show that an adequate mix of renewables including those from the Southern EUMENA region will substantially contribute to energy security in Europe.

Table 4-4 compares several security aspects of a strategy based mainly on renewables with another strategy dominated by nuclear power and fossil fuels. While the first represents a relatively low risk strategy based on proven or demonstrated technologies that need transient initial support to achieve further cost reduction, the second represents a high risk adventure based on the vague hope of major technological breakthroughs, and programmed for high cost and subsidisation.

In view of this comparison it is difficult to find any reason at all for a continuation of the nuclear-fossil energy strategy of the past. However, this strategy still dominates European energy policy, characterised not only by massive subsidisation of fossil and nuclear energy, but also by not supporting adequately or at least evenly the necessary renewable energy alternatives.

Electricity Mix dominated by Renewable Energy with Fossil Fuel Backup	**Electricity Mix dominated by Nuclear Power and Fossil Fuels**
Power on demand by a well balanced mix of renewable and fossil energy sources	Power on demand by using ideally stored forms of energy like uranium, coal, oil and gas
Supply based on many, mostly unlimited resources	Supply based on few, mostly limited resources
Domestic sources dominate the electricity mix	Energy imports dominate the electricity mix *
Low vulnerability of decentralised generation	High vulnerability of large central generation units
Low hazardous waste, recyclable materials	Disposal of nuclear waste and CO_2 unsolved
Low risk of contamination or major accidents	Risks of plutonium proliferation and nuclear accidents
Requires public investment over limited time span	Requires long-term continuous subsidisation
Low environmental impact	Climate change, pollution and nuclear radiation
Intrinsic trend to lower cost and less price volatility	Intrinsic trend to higher cost and price volatility
Requires a change of structures and thinking	Fits to present structures and thinking
Based on proven and demonstrated technologies	Requires major technological breakthroughs: o Safe fission and breeder technology o Commercial fusion reactor o Carbon capture and sequestration (CCS)
=> Low risk strategy	**=> High risk strategy**

* in spite of a convention that declares nuclear power as domestic source, Europe will fully depend on uranium imports after 2025 (today, 30 % of the European Uranium consumption is supplied by domestic sources, mainly in Eastern Europe).

Table 4-4: Comparing a renewable energy strategy for Europe with a nuclear – fossil energy mix