AICGS ISSUE BRIEF

DECEMBER 2005 04

European Energy Strategies After the Petroleum Age

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Is the energy sector entering a new era?

Why has it been so difficult to implement a European energy policy?

What is the best way to solve the problem of regional dependency?

Why has there been so little progress on implementing biofuels ?

What is the "strategic ellipse" and how does it affect future energy supplies?

Is solar energy the wave of the future?

Does a world without fossil fuels mean the end of mobility?

Securing the supply of energy is one of mankind's basic needs. The exploitation of fossil fuels, (coal, petroleum, and more recently natural gas), has been one of the foundations of the development of industrial society. The harnessing of these conventional energy sources paved the way for the rapid advances in civilization over the last two centuries. Without fossil fuels there would be no light for large parts of the population, no hot meals, no protection against the cold in winter or the heat in summer, and no modern household appliances, transportation, or communications. Yet secure energy supplies can by no means be taken for granted.

In the 1990s low prices for fossil fuels seemed to suggest that energy supplies were secure. However, recent surges in the price of petroleum, the number one source of energy, and power outages in North America and Europe have shown the urgent need to readopt the securing of supplies as an energy policy objective. The European Commission was right when it warned at the end of 2000 that the supply situation was about to become critical. At the time, however, many regarded this warning as an exaggeration.

For a longer-term sustainable strategy for the future, fossil fuels alone are by no means sufficient, despite their positive wealth effects in the past.

- Ecologists emphasize that burning fossil fuels produces CO2 emissions, the number one greenhouse gas. In the early stages of industrialization, scant attention was paid to these environmental implications. But in recent years global warming and freak climate phenomena have heightened the awareness of these problems at the international level. Now that even Russia has changed its tack, the only major industrialized nations that still reject the Kyoto Protocol are the United States and Australia. The launch of emissions trading in the EU raises legitimate hopes for more environmental efficiency and fairness.

- For geologists, fossil fuels have essentially unfavorable properties as resources. Since fossil fuels cannot be regenerated (at least for the foreseeable future), their use inevitably leads to depletion of these resources. The results of surveys on fossil fuel reserves and resources and how long they will last are far from comforting.

The estimated lifetime of hydrocarbon fuels—above all petroleum but also natural gas—give particular cause for concern. Data from the Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) (the Federal Institute for Geosciences and Natural Resources), shows that of the conventional hydrocarbons petroleum has the lowest static lifetime, only forty-three years (natural gas has a static lifetime of sixty-four years). When non-conventional reserves are added to potential resources (first tar sand and then oil shale), the lifetimes increase. Even then, the potential static lifetime for petroleum is less than seventy years. Recently, the BGR has reiterated the statement that oil supplies are limited. This is reinforced by the fact that annual petroleum consumption currently stands at 3.5 billion tons, with genuine new finds measuring only 1.2 billion tons—a 3:1 ratio.

- For economists, the time at which the use of reserves ends is of little relevance, however. Although lifetimes give an impression of when production will come to an end, they imply the security of supply over a period in which the energy source is in reality already becoming drastically depleted, resulting in a struggle for the remaining resources. From an economist's point of view, the more interesting date is when maximum production occurs. When output starts to decline—with demand remaining constant or even continuing to rise—strong reactions in prices and economic upheaval are possible.

The energy sector is entering a new era. The heavily populated Asian countries, China and India, continue to drive up demand—a trend that is currently seen in all commodity markets. Of course, overall demand will continue to fluctuate in the future for seasonal and cyclical reasons, but the trend will undoubtedly go upward. In order to meet the rising global demand for energy, supply must be increased considerably. But, as geologists keep reiterating, it will become increasingly difficult to boost supply in the future, particularly of petroleum. Consequently, a widening of the supply/demand gap and thus a rise in real prices is likely.

To make matters worse, the emerging relative shortage of raw materials will be accompanied by a growing regional concentration of supplies in the coming decades. This pertains particularly to hydrocarbons, petroleum, and natural gas. The issue of regional dependency and how to cope with it will thus pose a challenge to politicians and the corporate sector. Projections recently published by the International Energy Agency (IEA), give cause for concern. According to the IEA, production in the oil sector will have to be stepped up by nearly 60 percent by 2030. As output of the OECD countries will be nearly halved in the same period and production increases from Russia and the Caspian region will not be enough to offset even the OECD declines, the lion's share of the production expansion is bound to come from the OPEC countries. The market share of OPEC will again exceed 50 percent (37 percent in 2002), and the power of the production cartel will once more become a price factor.

Unlike in the three decades following the first oil crisis, we can no longer bank on non-OPEC countries in the (constant) conflict between cartel power and economic laws. The non-OPEC deposits are partly depleted (e.g. North Sea oil) and, due to increasing exhaustion, cannot be (re)activated, even if prices do rise. Moreover, according to the IEA, the major burden of output expansion will have to be shouldered by the so-called Gulf OPEC (Iran, Iraq, Saudi-Arabia, Qatar, Kuwait, and the United Arab Emirates). As some of these countries are far from being havens of political stability, satisfying the growing demand for oil is not even assured in the medium term.

Regional dependency has also increased noticeably in the natural gas sector. Three large new net importers are likely to emerge over the coming three decades: the United States, China, and India. As in the oil market, the natural gas growth market of the future will see proximity to the supplier countries and the security of delivery flows becoming the greatest challenges. The looming supply and demand trends in petroleum and natural gas reveal the fragility of our present-day sourcing structures. Seventy percent of conventional global oil reserves lie in the region extending from the Middle East to western Siberia, an area that forms a geographical ellipse. Extending this ellipse slightly northward captures almost 70 percent of the world's conventional natural gas reserves. On the supply side, we thus find a concentration of major energy sources in comparatively insecure regions whose importance will grow considerably in the future. For this reason, many refer to this region as the "strategic ellipse."

Energy Strategies to Boost the Security of Supplies

The foreseeable shortage of hydrocarbons must be addressed with intelligent, future-proof strategies. In the longer run, only a broad range of measures can ensure a secure supply of energy. The needs of the moment call for the use of all available measures—the diversification of energy carriers and technologies as well as the mobilization of all conservation, reactivation, and efficiency-boosting strategies.

In the interim period, when hydrocarbons are still available but the regional concentration of supplies becomes increasingly important, industrial countries like Germany and France or the entire EU should muster the courage to develop modern geo-policies of their own. At present, a confusion of competences still stands in the way of a common European strategy. The ministers of economic affairs in the EU member states insist that energy policy remains within their jurisdiction, while the competing power companies act in their own interests.

Ultimately, responsibilities are likely to be assigned at both the national and European levels. The EU could assume the task of formulating the overall strategy, while the member states flesh it out with their own specific objectives. This would have the advantage that historically developed country-to-country relationships are not left unexploited. One important strategic objective should be the stabilization of supplier countries located in the "strategic ellipse." An overall strategy should also encompass building up, developing, and securing the energy infrastructure. This includes specific projects such as the construction of pipelines or port facilities.

But a geo-policy driven by energy strategy considerations must not be allowed to obstruct the establishment of competitive markets in Europe. On the contrary, direct market access for suppliers from the ellipse and North Africa is an important precondition for the creation and furtherance of competition, particularly for natural gas, which in Europe will continue to be delivered mainly through pipelines.

Management of the supply flows to Europe should under no circumstances be left to Russia alone. In recent months, Russia has already perceptibly increased its influence over the large deposits in Turkmenistan and Kazakhstan and the transport route across the Ukraine. If natural gas transports are monopolized before they reach Central Europe, a free and open market with low competitive prices will not be possible.

A long-term future for energy without higher shares of renewables is inconceivable; their price competitiveness will be buoyed by the growing scarcity of fossil fuels. Hopes are pinned on renewables to better secure energy supply in the longer term. Sources of energy like solar, wind, hydroelectric, and tidal power can neither be renewed, nor can they be depleted by humans. Biological energy resources (e.g. rapeseed, trees) incline to depletion only when used excessively. If, however, the exploitation rate does not exceed the natural regeneration rate, these resources will be inexhaustible. Moreover, renewables like trees and plants–unlike fossil fuels–have the great advantage of being CO2-neutral if the entire life cycle is considered.

The benefits of alternative energies are the conservation of resources and environmental protection. Their contribution to securing the supply of energy and ensuring economic efficiency is strongly dependent upon the geographic characteristics of the specific countries (e.g. hours of sunshine, availability of water for energy purposes). In the industrialized world, new renewables like wind or solar energy are not yet competitive without special government protection. However, their competitiveness would be boosted if all carriers–last but not least fossil fuels–were charged with their external costs. Two examples of renewables are solar and bioenergy:

- Solar energy, that is photovoltaic and solar thermal technology, is not just competing with the traditional fossil fuels but, in the longer term, also must hold its own in competition with other new energy sources. At present, the level of subsidization is still extremely high in countries like Germany and Spain. Given the hopes that have been pinned on the future of solar energy by governments and publics, the solar industry now needs to invest in research and development and to boost its competitiveness. If it succeeds in lowering the costs of energy production and CO2 avoidance, this investment in the future should pay off for everyone.

- Bioenergies deserve far more attention as we look ahead. While the new renewable energy carriers like solar and wind energy have attracted much public interest, the "old renewables" lead a rather shadowy existence. Bioenergies are the all-rounders among the renewables, since only biomass is suitable both for the generation of electricity and heat as well as the production of fuels. Biofuels are no longer a niche product. Should oil prices rise to $100/barrel and beyond, biofuels would become

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competitive, even at the current technological stage. In the heat market, pellet heating–which is already competitive today–would be clearly superior to oil and gas. Biofuels are also becoming increasingly attractive for power generation. By 2030, the cost of producing one kWh of power should fall to 7.5 cents for biogas and 6 cents for solid biomass.

Hopes for the modernization of power plants are pinned on CO2-free coal-fired power plants and safe fourth-generation nuclear power stations that produce much less nuclear waste. They could trigger a renaissance in coal and nuclear energy, even in Germany. In addition, massive R&D efforts are needed to smooth the way for solar hydrogen energy. Decentralized supply structures based on efficient fuel cells would reduce the risks of widespread power outages. Moreover, too little attention is still being paid to energy conservation and efficiency, particularly in the private consumer sector.

Currently, ecological, economic, and political aspects are not given equal consideration in the debate on energy and environmental issues. Looking forward, however, there is hope that actual developments–the growing scarcity of fossil fuels and increasing environment degradation–will exercise normative power at the political level. There would still be time to act if consensus were reached that the present almost entirely fossil-based energy supply remains sufficient in the medium term but is not enough in the longer term. Owing to the gradual depletion of petroleum and gas reserves and the need to reduce the environmental problems related to energy consumption, the energy mix of the future will contain a far lower proportion of fossil fuels than it does today.

Using silicon as a storage medium in hydrogen technology could be a milestone for a solar-based energy mix in the future, since a major obstacle to a hydrogen industry based on renewables is the still unresolved problem of storage and transport. Silicon's advantage is that it mobilizes a previously unexploited method: solar energy, for example, can be stored for an unlimited time and transported safely.

If the groundwork for the future is laid today, a world without fossil fuels will not necessarily mean the end of mobility. The ability to provide comfortable ambient temperatures will not be impaired, nor will the lights go out. After all, there are legitimate reasons for hoping that human intelligence, innovation, zest for action, and capacity to understand what is needed will lead to a more sustainable energy mix in the not too distant future. ■

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