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Market-based Options for Security of Energy Supply

Insuring against Disruptions of Energy Supply

Oil Security

Short- and Long-Term Policies

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and

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OIL SECURITY
SHORT- AND LONG-TERM POLICIES

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1 International policy measures in response to emergency

1.1 The IEA Emergency Response Measure

After the dramatic supply interruption during the 1973 oil crisis, the International Energy Agency (IEA) was established in 1974, with the primary mission of creating and regulating a mechanism to mitigate negative effects of future oil disruptions, and the long run goal of decreasing dependency on OPEC, adopting diversification strategies and conservation of supply (Peters, 2003). The mechanism of emergency response was adopted with the International Energy Programme (IEP), requiring IEA countries to implement a system of crisis management. Basically, the IEP commitments included reducing oil demand and sharing available oil in the event of major physical oil supply disruptions. IEA members are also required to hold oil stocks equivalent to at least 90 days of net imports in the previous year. The emergency program was supposed to get into effects in case of international disruption with a 7% loss of world supply.

More precisely, for all IEA member countries, emergency response system has been built on four main elements:

- stockdraw;
- demand restraint;
- spare production capacity; and
- fuel-switching capacity.

The stockdraw and demand restraint policies are considered the most feasible and effective ones in the IEA context, mainly for following reasons: there is a quite high oil stock capacity within IEA countries; the economic system of industrialized countries has a great dependence on oil (high demand); within all IEA countries there is a reduced spare capacity due to high oil production rate in all IEA members with inland oil reserves; finally, after the first oil shock all sectors but transport has become less oil dependent, with a reduced fuel switching capacity.

An example of this can be represented by IEA action during the First Gulf War, where IEA Contingency Response Plan has adopted all the four measures, making available within 15 days to the market 2.5 million barrels of oil per day (Peters, 2003). The biggest component of the response was stockdraw, with 2.086 mbd, followed by demand restraint measures (0.33 mbd), fuel switching (0.077 mbd) and surge production (0.017 mbd) (IEA, 2001).

Further measures oriented to information exchange and co-operation are complementary to the four main measures: operation and co-ordination of effective national emergency

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organisations; testing response measures and providing training in real-time emergency situations; mechanism for industry advice and operational assistance (Industry Advisory Board and Industry Supply Advisory Group); and, system for reallocation of available supplies, if necessary (IEA, 2001). For those support measures, emergency system requires harmonized, detailed and up-to-date energy statistics and data dissemination within official sources. At times of crisis, official statistical services and energy agencies should collect specific and up-to-date information (e.g. Questionnaire A of Reporting Oil Company, Questionnaire B for National Administration, other questionnaire as Complementary Oil Information Form) to be used by the Emergency Operations Team. Such data could be used to calculate the shortfall in supplies compared to normal situation, to monitor the oil market development for current and future months, and to calculate supply rights and obligations (Reece, 2002).

Stockdraw

Following the IEA definition, there are three different categories depending on which subject holds the oil stock: primary stocks are held by producing, transport (e.g. tankers, pipeline), and refining facilities and large distribution terminals; secondary stocks are held by small distribution stations, wholesalers and retailers; tertiary stocks are held by consumers. An alternative classification refers to the nature of oil stock: strategic stocks are oil reserves available in case of critical events at international level; operational or "industrial stocks" are oil reserves necessary for production process for energy industry (Pedde, 2000).

Following IEA estimations, in mid-2000, global primary oil stocks were estimated to be around 5.9 billion barrels (800 million tons), equivalent to about 90 days of world consumption. This total stock comprised 1.3 billion barrels of strategic stocks (virtually all of them in OECD countries) and 4.6 billion barrels of commercial stocks. The latter category included 2.7 billion barrels in OECD countries, 1 billion barrels in the rest of the world and 0.9 billion barrels of oil at sea or in transit. Generally speaking, about two-thirds of primary stocks are now covered by the reporting stock systems of OECD countries. The remaining third includes commercial stocks in non-OECD countries, in independent storage, at sea and in tanks awaiting export by producers. In particular, stocks in IEA net importing countries mid-2000 are estimated at about 2.7 billion barrels, an amount equivalent to some 114 days of net imports. Specifically for IEA European members, it has been estimated an approximate amount of stocks equivalent to 100 days of net imports, composed as follows: industry crude 299 mb, public crude 152 mb, industry product 529 mb, public product 189 mb.

In general, during the last decade, IEA countries have faced a common trend, with a growing role of public stocks and a more rationale stock management in private industries. An assessment of sustainability of IEA stocks in the case of a supply disruption of 5.6 mb/d (the worst oil crisis in terms of reduction of magnitude of supply shortfall during the period 1978-1981) gives different results for specific area. While Pacific countries would have stocks for more than 500 days (350 with public stocks and remaining with industry stock), North America and Europe would have respectively more than 370 and more than 390 days. Proportion of public and private stocks for those two areas would be more equivalent, especially for European countries, with the highest industry stocks compared to the other areas (Harks, 2003).

This last result could be partially negative for supply security, considering that not all the industry stock are considered as usable stock. In any case, stockdraw remains one of the most effective emergency response measures, valuing that IEA stocks seem adequate for a medium-scale disruption of short to medium term duration. It has been assessed that for a larger disruptions (up to 12 mb/d) it could also be handled adequately, but only for short periods of time (Kuolt, 2001).

In operational terms, stocks to meet IEA requirements are held within three types of oil stockholding systems, described as follows:

- Company stocks, divided into compulsory stocks and commercial stocks.
- Government stocks, financed with central government budget and held exclusively for emergency purposes.
- Agency stocks, maintained for emergency purposes by both public and private bodies, usually held under a co-operative cost-sharing arrangement (in order to allow industry meeting its legal requirements under the IEP Agreement).[1]

Within member countries of European Union, there is no harmonization into typologies of oil emergency stocks. Austria, Belgium, Greece, Italy, Luxemburg, Portugal, Sweden and United Kingdom have only company stocks, while Denmark, Finland, France, the Netherlands and Spain have both company and agency stocks. Germany and Ireland have all the three types, with company, agency and government stocks. The United Kingdom and Denmark have special rules due to their inland oil production (see below).

In order to address main issues about stocks, two main factors affect oil stock policies:

- the possible distortion of oil stock system, considering both operating and usable stocks; and
- the controversy in stocking oil product or crude oil.

In the first case, the additional volume of stocks hold by companies considered as ‘safety stocks’ (refinery and bulk terminals stocks), can be defined as “accessible stocks” but cannot really be usable, because any barrel that is consumed has to be replaced by another in order to keep pipelines, tankers and refinery units in operation.[2] The remaining part represents the usable commercial stocks, that represents effectively available oil emergency stock. In order to measure country compliance with the stock commitment, the IEA subtracts 10% from total stocks to reflect part of technically unavailable stocks.

The second issue concerns the great variation between member countries in the share of products ranging from 15% to nearly 100%. Industry stocks tend to include relatively high proportions of petroleum products which are used to meet seasonal fluctuations in consumer demand. Particularly in the European Union, product stocks are needed to meet the stockholding requirements which are defined in main product groups (and less in crude oil).

Numerous advantages of crude oil stocks over petroleum products are indicated in IEA commitments. Crude oil is generally cheaper to store and its quality is technically easier to maintain, and crude oil stocks also provide more flexibility because they can be processed into products that meet the specific demand patterns during a supply disruption.

Nonetheless, European Union’s legal basis of compulsory oil stocks disciplines[3] requires that the Member States must maintain at all times stocks of petroleum products at a level

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[1] Government stocks and agency stocks are usually referred to as public stocks.

[2] These operating stocks have typically made up a large portion of the primary sector inventory.

[3] Council Directive No. 68/414, 20 December 1968, amended by Directive 98/93 of 14 December 1998. Last proposal on oil emergency stock reforms is contained in EU COM(2002), 488 final.

corresponding to at least 90 days of average daily consumption in the preceding calendar year, with a maximum of 25% deducted in case of inland production.[4] According to EU directives, three categories of products are taken into account, considering that the level of 90 days must be maintained for each category:

- motor spirit and aviation fuel (aviation spirit and jet fuel of the gasoline type);
- gas oil, diesel oil, kerosene and jet-fuel of the kerosene type (middle distillates); and
- heavy fuel oil.

It is clear that the calculation method within EU's members is different from the IEA method for determining both the storage obligation and the actual level of stocks.

For the storage obligation, the difference results mainly from the fact that IEA uses, as the basis of its calculation of the 90 days, the total net oil imports of the preceding year for each participating country, while the European Union uses the inland oil consumption for the three categories of products mentioned above for each of its Member States (Peters, 2003).

For the level of stocks, the differences result mainly from the fact that on one hand, IEA converts stocks of finished products into crude oil equivalents by multiplying them by one of the two predetermined coefficients,[5] while the European Union converts the stocks of crude oil and feedstocks into finished products equivalents.[6]

Final difference between IEA requirements and EU rules relates to calculating unavailable stocks. At this purpose IEA applies a 10% deduction for unavailable stocks, mainly due to tank bottoms, while European Union does not apply any deduction for unavailable stocks (IEA, 2001).

In general, as a consequence of the differences between IEA and EU stock calculation methods, for countries having little or no domestic crude oil production in relation to their oil consumption, the IEA method of calculation implies a stockholding obligation higher than the community method of calculation applied to the same country.

Demand restraint

Demand restraint refers to short-term oil savings which can be achieved during the period of a crisis. The measures to achieve demand restraint fall into three main classes – persuasion and public information, administrative and compulsory measures, and allocation and rationing schemes. Demand restraint programmes reflect local demand patterns and economic structures, legislation and emergency response policies. Especially in the early phase of a crisis, some governments may prefer to use stocks in excess of their 90-day IEA commitment rather than introduce demand restraint measures. Most of the times compulsory measures and rationing schemes are to be considered only in the case of prolonged crisis (IEA, 2001).

In general, IEA countries must have ready a programme of demand restraint measures equal to 7% of oil consumption if supplies are cut by 7% (equivalent approximately to 3.2 mb/d), and 10% of oil consumption (equivalent approximately to 4.6 mb/d) if supplies are cut by more than 12% (Harks, 2003; Jacobi, 2002).

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[4] The actual obligation of the United Kingdom and Denmark is therefore 90 x 75% = 67.5 days of consumption.

[5] The two coefficients are: 1.065 in the case that of all product stocks minus naphtha are taken into account; 1.2 in the case of application of to the same products as the EU Council Directive (gasolines, middle distillates and fuel oil stocks).

[6] See Article 5 of Directive 68/414.

It is generally accepted that price changes resulting from tighter markets in a supply disruption would assist in balancing oil demand and supply, although their overall effect on the level of demand might be rather limited. The initial emphasis is likely to be on persuasion and light-handed measures to restrain end-use demand rather than on compulsory measures or allocation. The use of different demand restraint measures in adjacent regions or countries could result in distortions of consumption reductions, as in the case for the European Union where Commission has requested for a more coordinate demand restraint measures, in order to avoid distortion effects.

During last decades, there has been a widely diffusive trend towards oil price deregulation in IEA countries. At the same time, many countries have maintained authorities in order to control price in case of declared oil supply disruptions. In a crisis or pre-crisis situation, it is now generally accepted that price increases resulting from tighter markets would assist in balancing oil demand and supply, notably in providing refineries with an incentive to increase output of the products in shortest supply, so that price controls would need to be used sparingly.

Member countries could use a variety of demand restraint measures during supply disruptions, which can be adapted flexibly to changing market conditions: reduced speed limits, carpooling, driving bans, odd and even registration plates, car less days, limited service station hours and restrictions on residential and commercial energy consumption due to heating and lighting (IEA, 2001). In addition to these recommendations, other regulatory measures could be implemented to reduce oil demand, as for instance high occupancy vehicle, vehicle maintenance requirements, direct traffic restrictions, free urban public transport, emergency switching from road to rail freight, removal of night time/week end driving bans for freight, non-petroleum fuel blending (Harks, 2003).

Crude oil allocation would ensure equitable distribution of available oil from domestic sources by supplying crude oil to refiners in proportion to the amount normally used. Petroleum product allocation would control the volume of products that refiners and other major suppliers may sell to wholesale customers in proportion to normal supplies. Special provisions usually apply for priority sectors such as health and security.[7]

Demand management and restraint for all IEA countries, and especially for EU, are crucial for longer-term crisis scenarios. Restraint measures today are designed mainly on road transport sector, the biggest oil consuming sector in OECD countries (>50%). According to the IEA projection, transport sector will constitute by 2030 the 64% of total oil consumption, with peak values for North America (70%). Thus this is the bulk of future incremental oil consumption, while alternative fuels are not yet available or sufficiently diffused, and price elasticity of transport sector remains very low in the short term. In addition, transport sector is a key factor for logistical supply chains, and there will be the necessity to implement further demand restraint mechanisms, as for example enhancing voluntary measures. Examples of such measures could be the reductions in discretionary trips, shifts in travel modes, increases in car-pooling arrangements, reduced commuting changes in vacation destinations or travel mode, choice of most efficient car, improved vehicle maintenance, more fuel-efficient driving, fuel switching for dual-fuel vehicles and all other energy saving technologies that could be implemented with further research (Harks, 2003).

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[7] In case of oil allocation, crude oil and products should be shared within the refining and distributing industries as well as between refining and distributing companies in accordance with historical supply patterns (Art. 9, IEP Agreement).

Other response measures: fuel-switching capacity and spare production capacity

Other response measures, such as the capability to switch from oil to other fuels, have been significantly reduced since the 1970s. In particular, growth of natural gas use has reduced the scope for fuel-switching in power generation. Oil-fired electricity generation in IEA countries now accounts for less than 7% of total electricity compared with one quarter in the mid-1970s. In individual countries, the amount of oil savings through switching will depend on the volume of oil use in dual or multi-fired installations or in power stations forming part of integrated systems. Nonetheless, in some countries the contribution of oil to electricity generation remains high and short-term (within 30 days) fuel-switching out of oil into alternative fuel could be a useful measure (Jacobi, 2002).

As a second response measure, oil-producing countries may be able to increase indigenous production in a crisis situation. The extent of such capacity would depend on particular circumstances, and would be constrained by the need to maintain good oil field practices. The aggregated capacity of IEA countries to increase oil production is small, but some oil-producing countries have such spare capacity. For Europe, spare production capacity could not be maintained for a very long time, due to current high production rate in North Sea Basin and projected reduction in domestic production after 2020, with a general agreement within all above described scenarios.

1.2 Main critiques of IEA Emergency Response

The IEA mechanism of emergency response is actually partially under revision by single member countries and at EU level. General criticism about IEA oil stock system concerns different aspects.

One of the main problem of the stockholding system relates to high costs of stock management for private industries. Oil stocks in strategic amounts could not be held by the industry in a highly competitive market, due to their production process changes in the direction of a just-in-time production, with as less as possible stocks. Furthermore, oil price volatility increased stock costs, and oil stocks held by industries have an opposite trend respect to oil price. The higher the oil price, the lower would be the oil stock (Harks, 2003; IEA, 2002).

Another issue directly connected to the first one concerns the growing role of future and spot markets in determining oil price, and the increasing price volatility, discussing if it is possible to use strategic reserves to lower oil price.

During the 1980s the IEA developed a sub-crisis mechanism, due to the necessity to implement a quick and flexible response to a supply disruption not large enough to activate the IEP.[8] The Coordinated Emergency Response Measures (CERM, July 1984) were designed as a flexible consultation process, and CERM Contingency Plans have been put in place at the start of First Gulf War, in anticipation of problems associated to the millennium bug and after the terrorist attack of September 11. After the adoption of the CERM, most of the IEA members have assumed statutory powers to initiate demand restraint measures even in sub-crisis situations (Kuolt, 2001).

[8] During the 1979 crisis (Iranian revolution), IEA emergency mechanism has failed with high negative impacts on economic growth. Main reason of such effects was the original IEA commitment to use oil strategic stock only in case of supply shortfall more than 7%. In that case, oil imports didn't reach such level, while oil prices more than doubled, and demand restraint measures and alternative supplies couldn't reduce price level (Emerson, 2003).

In addition to CERM, few IEA countries, as for example US, Japan and Korea, have adopted national mechanisms to use strategic reserves to smooth price when no high supply disruption has taken place. In particular, United States have made a number of sales and exchange with private oil companies from the Strategic Petroleum reserve (SPR) with the main objective of lowering consumer prices. Even the EU, as pointed out in the Green Paper (EU, 2000) and in the Communication on Coordinated measures on the security of energy supply (EU, 2002), should consider establishing a strategic oil reserve for helping to mitigate and modify erratic price fluctuations serving as a safety net in addition to the 90 days' existing reserves for finished products. Initially, part of the stocks covering more than 90 days could be managed at Community level and where necessary be used for anti-speculative measures. Especially within the EU members there is no agreement about using strategic stocks for price smoothing, due to energy security concerns (Emerson, 2003).

Furthermore, the IEA emergency system relates only to OECD countries. Considering the great oil import dependence from Middle East export for countries in Developing Asia Region, the fact that these countries neither hold strategic stocks nor participate in emergency sharing mechanisms, could be a great source of instability in case of disruptions (Mitchell, 2002).

1.3 EU proposal for improving emergency stock management

The Community measures are characterised by a lack of solidarity between Member States which is not compatible with the objectives of an internal energy market, since energy crises affect all EU countries. More fundamentally, there is no Community decision-making power to dispose of oil stocks on the market. All the following critical issues have been underlined several times within the Green Paper and various Communications and proposal for Directives of the Commission.

First requirement from the Commission is the necessity for a harmonisation of Community oil stocks policy. In the event of a crisis, the European Commission may, at the request of a State or on its own initiative, fix a target in terms of a reduction in consumption. However, the Commission has no powers to order stock disposal, and furthermore there is no Community mechanism for using oil stocks which establishes solidarity between States in the event of supply problems The decision to release oil stocks is a matter for the States, although consultations are arranged at Community level for coordination purposes. Uncoordinated action would have little or no impact in view of the size of the oil market.

A second problem derives from mixing at industry level of strategic and operational stocks, due to lack of ad hoc monitoring system and stockholding agencies at national level. Only some of the Member States have set up public institutes responsible for holding all or part of their security stocks, with a resulting fragmentation of the storage system that affects the proper functioning of the market and causes distortion of competition between refiners and non-refiners which have low levels of operational stocks.[9] In addition, the amount of oil products which can actually be mobilised in the short term in the event of a crisis is very uncertain since operators' security stocks are mixed up with their operational stocks.

The Green Paper and the Directive COM 2002 488 on security of energy supply have already considered various proposals in general terms: looking at ways of strengthening the system of

[9] It must be borne in mind that the independent distributors or importers of refined products need only limited operational stocks, whereas the refining companies would, in any event, hold significant stocks for operational purposes, even where there is no requirement to hold security stocks.

oil reserves system by placing their use on a Community footing; the possibility of extending the oil reserves mechanism to natural gas reserves. Summing up, main actions to be implemented at European Union in order to improve the security stocks system could be listed as follows:

- a better harmonisation of national storage systems, with the institution of public and private agency;
- a wider coordinated use of security stocks; and
- an increase in the physical amount of oil stocks.

Harmonisation of national storage systems

The fragmentation of the storage mechanisms adversely affects the proper functioning of the internal market in energy. The independent distributors or importers of refined products which need only limited operational stocks consider these obligations as a net cost that they have to bear, whereas the refining companies would in any event hold stocks for operational purposes. Storage obligations may therefore cause distortion of competition. To remedy this situation, all Member States should set up a public body to hold oil stocks which will own stocks representing at least one third of the new obligations imposed. This is very partial alignment of the rules on stocks in the Member States and does not cover all requirements, but it will help to improve the functioning of the internal market increasing competition.

An operative example of a public stockholding body could be represented by the Dutch National Agency COVA, that holds all stocks in excess of stocks in the refineries. COVA is an independent stockholding agency under Dutch law characterised as a non-profit foundation which is exempted from corporate tax. In order to finance such compulsory stockholding agencies, main options to cover storage costs and rent on loans adopted at European level could be the following (Beverdam, 2002):

- full compensation by levy on oil products charged to end consumers;
- inclusion of such costs in retail price for private oil companies/importers without financial support by government;
- compensation by state budget without any charge to end consumers; and
- compensation of costs for the agency covered by levy on oil products charged to end consumers.

Coordinated use of security stocks and harmonisation of intervention criteria

Community legislation provides only for mutual consultations between technical experts from the Member States, under the control of the Commission, for the purposes of releasing stocks, while each State is able to dispose of stocks however it wishes. The mechanism currently used by the IEA (the CERM) is subject to the rule of unanimity between the 26 participating countries. Furthermore, even if action is taken under the aegis of the IEA, a broad discretion has been left to the States as to how they can contribute to the measure with a lack of unique action.

In the future, the European Community must be able to decide on a common strategy which will be adopted by all Member States to provide an effective response to a physical or economic disruption of oil supplies. This strategy will give details of the measures to be taken, their objectives, their duration and the resources that the Member States will have to provide.

In addition to the conventional criterion for the use of stocks in case of a physical disruption, it is therefore necessary to provide for common rules on the use of security stocks in order to react in a unified and coordinated manner in the event of an economic risk, mainly due to price volatility in the markets. Common rules will help to ensure the solidarity and unity of action needed for the proper functioning of the internal market in the event of a crisis.

Increasing stocks

In this situation, in which mechanisms for using security stocks will play an important role, the volume of the oil stocks will have to be increased. The current minimum volume of 90 days consumption will have to be increased to 120 days no later than 1 January 2007, in order to improve effectiveness of these crisis measures (Art. 2, COM 2002, 488 final). These stocks will be increased gradually, taking account of the possibilities of expanding the necessary storage capacities.

Analyzing results for US stock draw system, it has been pointed out that an increase in the Strategic Petroleum Reserves (SPR) could have great economic benefits. According to the US Administration, actually the SPR crude oil can be drawn down at a maximum rate of 4.3 mb/d without pipeline or tanker loading bottlenecks. New investments for enhancing SPR drawdown capability to a maximum rate of 7.0 mb/d (increasing reserves up to 700–800 billion barrels) could bring to an increase in net economic benefits in the range of 1.5–1.7 billion US$96 (Leiby and Bowman, 2000).

2 Possible long-term measures

The government is a major player in the energy market and, in some cases, it is the dominant one, influencing price, outputs and capital structure. Privatisation did not change this feature; it changed the form of interventions, and the mechanisms of influence shifted from the boardrooms of nationalised industries to more explicit policy instruments and regulatory control. But the idea that governments could simply retreat from the scene and leave it to competitive markets is an illusion - energy is just too important to the economy and society, and, it suffers from multiple market failures. Governments throughout Europe and now in the USA have realised this after the cheap and abundant energy decades of the 1980s and 1990s (EU, 2000; Toman, 2002).

In a context of oligopoly within government constraints, such as the energy market, the first market failure upon which energy policy should concentrate is security of supply. Energy is complementary with the whole economy, meaning that customers will typically want stable and predictable prices, in line with their investments in durables, housing and capital stock at any point in time. It follows that the way to think about security of supply is to start with some idea of the level of fairly stable prices that customers might be willing and able to pay, and to see whether, given this demand, there are ‘secure’ supplies available. Rapid adjustments to energy shocks are typically difficult to achieve and very costly (as in California) (Helm, 2002).

In general, energy policies implemented to avoid disruptions in oil, gas and electricity supply must contribute to the management of risk and the improvement of flexibility (IEA, 2001).

According to the EU Green Paper, a strategic sense of direction in regards to key goals is needed. At this purpose, the following criteria are proposed in order to provide a first orientation:

- Energy policies must balance the economic, social and environmental dimensions of development and economic growth.
- They must contribute to the management of risk and the improvement of flexibility, in order to avoid disruptions for the energy system.
- Energy policies should result from processes in which information and research are consciously managed.

In this section focus will be posed on long-term policy actions to reduce risk of supply disruption. Energy policies in oil, gas and electricity sectors have been differentiated into demand-side and supply-side measures.

All following considerations must take account of the distinction between economic and security policies, because economic policies require adherence to cost/benefit rules, while security policies rely on worst-case analyses (Lynch, 1999).

2.1 Demand-side policies

Demand-side policies can be represented into three main groups:

- enhancing energy saving and efficiency and reducing oil intensity, with investment in research and technology;
- reforming taxation of energy products and state aids, with removal of energy subsidies;
- enhancing stable prices, special for transport sector.

Enhancing energy saving and efficiency (with investment in research and technology)

From a macroeconomic perspective, reducing petroleum intensity of industrialized countries economy is a key action to increasing energy security (Toman, 2002).

In the EU energy saving took off to some extent after the oil crises, but over the last ten years it has dropped off appreciably, improving by only 10% in ten years against 25% in the 1980s (EU, 2000).

Community action to date has been limited. Europe has failed to continue the implementation of the considerable efforts to improve energy efficiency which were agreed after the first oil crises. The EU “SAVE” Directive (1993), requires to the Member States to develop and implement energy savings in the residential, tertiary and industrial sectors, through various initiatives, such as energy certification of buildings, billing of heating and cooling costs according to consumption, third party financing in the public sector, thermal insulation of new buildings, regular inspection of boilers, and energy audits of energy-intensive industries.

Latest estimates calculate out of the huge technical potential for improved energy efficiency (estimated at 40% of current energy consumption) considerable economic potential for cost-effective improvements in energy efficiency of at least 18% of current energy consumption. This potential is equivalent to over 160 Mtoe, roughly the final energy demand of Austria, Belgium, Denmark, Finland, Greece and the Netherlands combined. The non-realisation of that potential is a result of market barriers which prevent the diffusion of energy-efficient technology and the efficient use of energy (EU, 2000).

It is important to underlie the role of market failures and consequent governmental intervention to allow energy efficiency improvements being cost-effective. As pointed out in Brown (2001), misplaced incentives inhibit energy-efficient investments in each sector of the economy. This is typically labeled the “principal-agent problem” in the economics literature. This problem occurs when an agent has the authority to act on behalf of a consumer, but does not fully reflect the consumer’s best interests. Examples of this failure are numerous. Architects, engineers, and builders, who generally seek to minimize first costs, select the energy technologies that homeowners and apartment dwellers must use. In this case, the consumer’s best interest would be better met by selecting technologies based on life-cycle costs.

Another example of market failures is represented by imperfect information, where suboptimal investments in energy efficiency often occur as the result of insufficient and incorrect information. Market efficiency assumes free and perfect information, although in reality information can be expensive and difficult to obtain–in the energy sectors as elsewhere.

A variety of mechanisms is available for supporting the development and adoption of energy-efficient technologies. These include direct funding for research and development, the setting of industry standards, changing relative prices through subsidies and taxes. Considering the key barriers to investment in energy efficiency, (uncertainties about saving performance or possible disputes over contracts, etc.), one of the financial methods to give insurance to investors could be a formal insurance of predicted energy savings, transferring risk over a larger pool of projects and reducing barriers to market entry for smaller firms (Mills, 2003).

Progress in residential and commercial buildings energy efficiency is a key long term demand side policy to reduce energy intensity, because the two sector account for about one third of total final energy use in EU.

Energy-saving policies could be implemented for direct effect on energy consumption and for indirect effects on environmental protection, both on supply and demand side (Sun, 2003).

Taxation and subsidies

With regard to demand, the Green Paper is calling for a real change in consumer behaviour. It highlights the value of taxation measures to steer demand towards better-controlled consumption which is more respectful of the environment. Taxation or parafiscal levies are advocated with a view to penalising the harmful environmental impact of energies. The transport and construction industries will have to apply an active energy savings policy and diversification (EU, 2000).

A country that is a net importer of oil and petroleum products, as European Union, when is faced with a foreign exchange shortage may resort to petroleum taxation in order to restrain its consumption and conserve foreign exchange. As a counter effect, any resort to increased taxation of imported products to address these problems should normally apply to all taxable imports, not just petroleum products. Moreover, restoration of external balance should primarily be pursued through tighter financial policies and exchange rate adjustment. The resulting increase in process discourages petroleum consumption, and encourages both more efficient use of energy and the development of alternative technologies over time. Major petroleum importing countries may also raise taxes on oil in an effort to constrain the ability of oil producers to influence international crude oil prices (Gupta-Mahler, 1995).

Removal of energy subsidies

One of the most important factor that affects energy over-consumption is the large quantity of subsidies, both in the industrial sector and for households, coming from the past development policies. Such state aids impose a heavy burden on economic efficiency, and on the environmental performance (IEA, 2001).

Direct subsidisation of energy consumption may be justified only in situations where energy is a necessity, as in the least developing countries. For OECD countries, subsidy removal in the industrial sector can entail a number of gains, improving dynamics behaviour through transparency and accountability.

The fiscal instrument should aim to eliminate national distortions and distortions between energy producers, encourage more energy saving and lead to the internalisation of damage caused to the environment.

An effective energy efficiency policy will require a large number of actions (Brown, 2001; IEA, 2001; Stanford, 1997):

- establishing (and maintaining) an effective market structure;
- providing complete information to the market actors;
- ensuring access to technologies;
- developing a supportive institutional framework.
- public–private R&D partnerships;
- voluntary, information and technical assistance programs;
- regulatory policies; and
- financing, investment enabling, and fiscal policies.

Reduction of oil price inelasticity, especially for transport sector

Focusing on transport sector, there is the necessity to reduce the oil price inelasticity of transport demand. A number of policy actions can be implemented in this direction, mainly through higher investments in R&D: development of light-duty vehicle fuel economy, with an estimated reduction in new car fuel intensity assessed on the order of 25% by 2010; development of alternative fuels, such as fuels derived from cellulosic feedstock (ethanol or methanol produced in advanced biological conversion processes); hydrogen fuel.

2.2 Supply-side policies

Diversification of import sources and routes (investments in infrastructures), diversification of fuel types (role of renewables and nuclear), increasing co-operation with producing countries and IEA non-member countries, promotion of efficient, transparent and robust market are the key measures in the medium and long term (EU, 2000; IEA, 2001).

Strategies for the long time are mainly divided into two different actions:

- supply diversification: cooperation with exporting and transit countries; and
- promoting technological progress and expanding energy supply capacity.

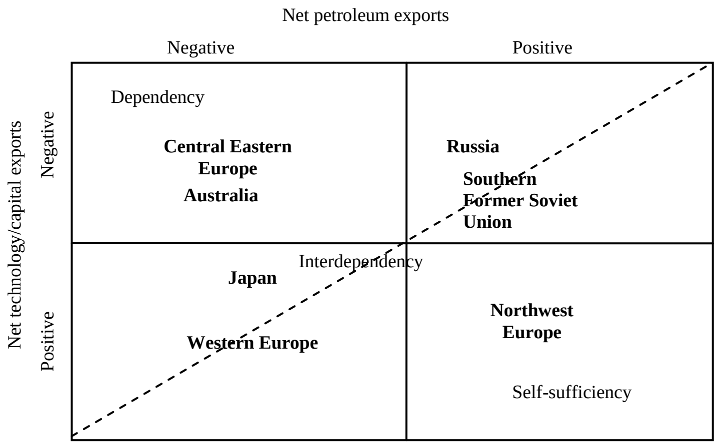
Cooperation and institutional promotion for supply diversification

Following Priddle (1998), supply diversity has two different components: a first one is the diversification of sources, in terms of exporting partners; a second one is the diversification of routes to market. Large infrastructure projects must make economic sense to the private sector interests that will have to finance them. If investment costs are high for one route compared to others, but it is a strategic route for security, the hopeful governments along the prospective routes will need to offer fiscal of other incentives to compete.

Two general frameworks to enhance supply security with focus on transport routes have been supported by EU, the Energy Charter Treaty and the Euro-Mediterranean Energy Partnership. A third action of EU, implemented as a programme and not as an international agreement, is the Interstate Oil and Gas Transport to Europe (INOGATE).

The Energy Charter Treaty was originally envisaged as a vehicle to promote the flow of western investment and technology into the energy sector of the eastern transition states of the Former Soviet Union and the flow of energy from the east to the west (Papaioannou, 1995). The treaty was signed in December 1994 by 49 countries and the European Union. It came into effect on April 16, 1998, with ratification of 30 countries. The general aim of the treaty is to implement an international market in crude oil and oil products, and in growing regional markets in natural gas.

Figure 1. Signatory states of the Energy Charter Treaty



Source: Andrew-Speed, 1999.

The Treaty is intended to provide a long-term framework for investment and trade in energy amongst the participating countries, preferably through the participation of western own companies with investment and technologies to develop eastern petroleum resources. The value added of the Treaty is the specific component of transit rights for pipelines, including into the Treaty pure transit countries as Central Europe (Andrew-Speed, 1999). For a comprehensive framework of the Treaty, see figure 1. From an economic point of view, the Treaty, as well as the following Mediterranean Partnership, could be interpreted as a solution to market failures, enhancing free flows of investment and technology in the development of new sources of energy supply (Mitchell, 2002).

The Euro-Mediterranean Energy Partnership between the 15 EU member states and the 12 Mediterranean countries of North Africa and Eastern Mediterranean is functioning since 1995, with the Barcelona Declaration, as an action plan to develop a Free Trade area by 2010, with particular attention to energy market. As in the Energy Charter Treaty, this process is highly motivated by the mutual interests that both parties have (Kagiannas et al., 2003). The industrialized countries (EU) expect from the process to create a stable climate for energy investment and security of supply. The Mediterranean countries see the partnership as a privileged channel for investment and technical assistance. A lot of similarities exist between the Euro-Mediterranean Partnership and the Energy Charter Treaty.

The 12 Mediterranean Partners involved are far from being uniform, with on one side net energy importing countries (Lebanon, Jordan, Cyprus, Palestine and Malta), and on the other side net energy exporting countries as Algeria, Egypt and Syria. As pointed out in Kagiannas et al. (2003), Turkey is a distinct case, because it is located at the crossroads between EU and the major energy producers in Central Asia and Middle East, and it has an importance in energy supply not proportionate to its own actual energy resources.

Main purpose of the partnership is to assure the EU priority of the existence of a zone of stability and prosperity on the other side of the Mediterranean. As in the Treaty, main objective of the Partnership is to create appropriate framework conditions for investments and activities of energy companies, extending energy networks. There are two main reasons for developing close collaboration between the EU and the Mediterranean countries, under the EU perspective:

- Geographical proximity to Europe, given the importance of transit of energy sources from neighboring regions, such as the Gulf and Caspian region.
- The cumulative volume of oil and gas reserves in the Mediterranean countries as a strategic source of energy supply security.

The first factor seems to be the most important, in a context of economic growth in the Southern Mediterranean countries, that will result in massive increases in their domestic energy demand, and in a reduction of available energy for export to the EU.

Furthermore, the projected growth of energy exports in the next decades is a potential source of great pollution of the Mediterranean Sea, while the economic growth of the area could have negative effects on climate change. An agreement such as the Euro-Mediterranean Partnership is an effective policy tool to enhance the environmental protection, by securing safe and clean production, transport and use of energy and by encouraging efficiency and renewable energy in the Mediterranean countries.

Finally, the INOGATE programme was launched in 1995 to promote the construction and interconnection of oil and gas transport infrastructures between the EU and the regions of the Caspian Sea, Black sea, Mediterranean and Southeast Europe. INOGATE has been signed by 17 countries of Southeast Europe –including Turkey – the Caucasus and Central Asia, and provides a framework for solving questions relating to the operation, maintenance and safety of energy infrastructures.

Specific cooperation policy for Central and Southeast Europe (CSE)

Connected to the transit route problem on one side, and to possible competitive role of transition economies on Russian oil and gas market on the other side, specific policy actions would be implemented to reduce risk of disruption in CSE, risk of aggressive policies on energy markets and inefficiencies in energy systems. Following Bergasse (2002), main task of OECD and EU countries is to give assistance to achieve market oriented long-term energy policy goals, enhancing efficient energy economy and increased energy security.

Central and Southeast Europe, are oil net importing countries, and would seem to be in all projection scenarios in the unenviable position of total dependency, because they are net importing countries of energy and technology (capital). At the same time CSE are vital transit countries and have a great negotiation power with neighbor both importing and exporting countries (see Figure 1).

An effective regional energy system among oil consumers as EU, oil producers as Russia and Caspian area and transit countries as CSE is vital to satisfy requirements for security of energy supply, and the transit fees could form an important source of income for CSE (Andrews-Speed, 1999). At the same time, negotiation power of transit countries could be tempered because CSE are dependent on foreign investment for technological improvement in the energy system.

Main constraints on energy security in CSE are: high dependence on hydrocarbon imports from Russia; low operational availability and efficiency of energy sector; disruptions of supply for technical and commercial issues; insufficient oil stocks. Main objectives of West Europe are to share with CSE countries information and statistics on trade, supply and demand, and on oil stocks level. Furthermore, it is necessary to share experience on oil demand emergency plans and on new institutions to regulate energy market, such as energy regulatory authorities, competition authorities, market operators, energy policy associations, consumer organizations (Cross, 2003).

As pointed out in Bergasse (2003), main market and institution reforms in CSE concern a decentralized and market based energy system, that could bring overall economic benefits with social and environmental acceptance. To avoid conflicts of interests, it is necessary to developed a governmental regulatory system, with energy services provided by independent energy companies. For instance, from Czech experience, the policy must be based on general consensus of various bodies involved in the process (energy producers, suppliers, consumers, politicians, environmentalists, etc.). Thus regular discussion of various stakeholders during policy development is necessary. Furthermore, energy policies must be consistent with EU and IEA standards, regulation aligned with EU Directives, in particular regarding liberalisation of energy market and regulation on environmental issues. At the same time, five essential prerequisites of institutional set-up are to be implemented to build an energy market reform: accountability, transparency, protection of property rights, capacity building and coordination with other sector strategies (Kovacevic, 2003).

Summing up, emerging from Bargasse and Harks (2002), the reform process in Central Europe should include the following sequencing:

Policy development: As energy infrastructure requires medium/long term guidelines for all stakeholders and overall co-ordination, the elaboration of national energy policy provides visibility and reduces uncertainties, if supported by energy demand forecasts, a least cost plan and demand planning at national and regional levels.

Regulation: Energy policy provides the objectives for the legal and regulatory framework, that should be designed to enable viable and efficient energy markets through licensing, pricing and control of services, and these should be administered, monitored and enforced by an independent regulator. Energy laws can, in turn, be used to institute a systematic, dynamic, open, and responsive policy-making process.

Energy services restructuring: The ultimate aim of restructuring is to achieve decentralised and efficient market operators, including the development of good governance (transparency and accountability), corporatisation (creation of autonomous joint stock companies), customer-orientated strategy and unbundling of monopolistic activities.

Promoting technological progress and expanding energy supply capacity

In the IEA projections, improvements will continue to be made in supply-side technologies, including cost reductions. Efforts will continue on reducing the cost of finding and producing oil and gas, in the identification of reservoir, in the drilling engineering, or in high-pressure gas pipelines, LNG processing and gas-to-liquids production technology (IEA, 2002).

A peculiar role in such policy measures is recover by private firms, even if there exist a lot of barriers in producing a real economic convenience for private industries to develop and adopt new technologies with the only task of supply security. Analysing Dutch industrial sectors for example, it has emerged that energy saving is just one of the criteria on which a new technology is judged and that there are other complementary benefits such as increased capacity and improved product quality that are considered along with energy saving. Furthermore, at least in the firms' own perception, there is no systematic under- or overestimation of the relative importance of energy efficiency in overall investment decisions. It is therefore, possible that substantial further energy saving may still take place by incorporating energy efficiency as a decision variable when installing new machines or buildings. Even in this case, lack of information could constitute a great source of market failures, that can account for sub-optimal investment behaviour. Contextual policy measures such as subsidies and fiscal arrangements may therefore be supportive in steering investments towards higher energy efficiency. As a final result, the economic potential for cost savings is the most important driving force behind investment decisions, and public policies must intervene to reduce informational barriers and relative market failures. (de Groot et al., 2001).

As stated in IEA (2002), world's rising energy needs for at least the next three decades. But the increase in production and supply capacity that the projected growth in demand implies will depend on massive investment at every link in the energy-supply chain. The scale of investment will have to be larger than in the past. Global investment needs in the electricity-supply industry, for example, are expected to be almost three times larger over the coming three decades than over the last three. For OECD countries the investment will focus on enlarging and replacing an already existing, and on aggregate ageing, infrastructure based on established marketing and demand pattern.

Furthermore, the effect of new technologies on energy consumption has important policy implications in terms of environmental protection (Popp, 2001). To allow the innovation in energy system being effective it is necessary that technological change and development is best achieved if it is conformed as national innovation systems. These systems can be defined as a network of institutions - public and private - whose activities and interactions are central to the development, modification and diffusion of new technologies (Sagar and Holdren, 2002).

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About INDES

This publication, part of the INDES Working Paper Series, originates from the project "Insuring against Disruptions of Energy Supply – Managing the Risks Cost-Effectively" (INDES). INDES has been a one-year joint research project under the initiative of the Centre for European Policy Studies (CEPS) together with the Energy research Centre of the Netherlands (ECN) and the Fondazione Eni Enrico Mattei (FEEM). The project was supported by the Fifth Framework Programme and funded by the European Commission Directorate-General for Energy and Transport.

The INDES project focuses on market-compatible, cost-effective security of supply responses by the European Union. Security of supply is understood as insurance against risks, in which responsibility is shared between the EU, member states, energy companies and customers. Thus security of supply is seen as an economic risk-management strategy. Critical to such an approach is first the minimisation of the insurance 'premium' to achieve the degree of security that is politically called for. Second, there is a need to identify the best systemic actor able to 'hedge' the risk. This can be governments, companies, consumers or in some cases, the market itself subsequent to careful design. Based on these premises, INDES research has emphasised two areas: i) costs of energy supply disruptions and ii) costs of potential policy responses. Towards this end, robust methodologies to assess costs and a sound empirical basis for cost data were used as the precondition for informed policy choices reflecting both effectiveness and cost-efficiency. Following this work, INDES research sought to identify the appropriate market-compatible instrument and the associated actors that would convey the process, be they governments, companies or consumers.

INDES has operated around three axes. The first was academic workshops that developed and refined the methodological framework and empirical base. The second was stakeholder workshops that presented and discussed findings with policy-makers and other stakeholders. The third axis has been the promotion of publications – both academic and policy-relevant – that aim at participating in the existing academic debate and influencing policy-makers. For more information on the project and the series of working papers, visit the INDES website at http://www.energymarkets.info/indes/index.html.

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