TAMÁS FLEISCHER

HOW TO FUEL ECONOMIES: CONDITIONS FOR SUSTAINABLE ENERGY UTILIZATION*

1. Two Approaches to Sustainability: External and Internal Limits

Sustainability is a word in the title of this study, a word which, in my opinion, needs further interpretation.

The **Limits to Growth** was published in **1972** by the **Club of Rome**. The atmosphere of panic following the oil price hike in 1973 drew the world's attention to the fact that, one day, supplies of raw materials and energy resources may be exhausted. Thus it highlighted the limited character of the Earth and the necessity of placing limits on economic expansion.

The **exhaustion of raw materials and energy resources,** (i.e. the utilization limits of resources) is only one aspect of the finite nature of natural resources. A similar problem exists, when raw materials are expended in terms of the nuclear energy needed to compensate for the depletion of fossil energy resources, (i.e. these solutions are confronted by limitations on the burden which can be placed on the environment.)

Different **scenarios** were worked out according to the external limits of human activities. One of these scenarios was the determination of the condition of **zero development**. A less rigid condition is **limited development**. All these external conditions can be considered the marginal conditions of theoretical models; however, observing them in

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* A revised version of the study first published in: "Environmental Strategies and Economic Development: Dilemmas and Solutions in Eastern Central Europe" by **Hardy, P.–Láng, L.** [eds.] Budapest 1993.

practice is not feasible. In addition, the scenarios took into account the fact that imposing external conditions checked basic human activity, i.e. hindered and prevented its development.

However, if we survey individual 'industrialized' activities such as agriculture, industry, communications, energy production and city planning, we can see that the problem is not only the **infringement of the above-mentioned, neglected external limits,** (which cannot be continued in the long run), but also that **most of these activities are not carried on in isolation**. It is damaging to live in big cities not only because of the contamination of the land, air, water and soil, but also because we are failing to build an attractive environment and are becoming increasingly dissatisfied with the existing artificial one. Transport and/or agriculture for example not only pollute the environment, but we also have to deal with an increasing number of problems brought about by their side-effects. Agriculture even pollutes its own end-products.

When we consider the sustainability of our different activities, we have to outline not only the so-called **external limits**, but we also have to acknowledge the **internal limits** and **intra-procedural impossibilities**.

The conceptual trend, which may have originated from the **Brundtland report**, a significant stage of which was the **UN Conference in Rio de Janeiro in 1992**, primarily focused on the external limits and attempts to find ways of maintaining the different activities without transgressing those limits. **In the present study, without contesting the decisive nature of the external limits, I would like to pay more attention to internal limits and the distortions in our objectives which have occurred at a social level. First**, we have to investigate this level in the search for activities which can be maintained or, at least, draw attention to the fact that in the given case of the energy industry there are issues, such as carbon dioxide emission, where the social arguments constitute an important element in the discussion of **the effects of a sustainable energy policy**.

2. External Limits: Sustainability – Objectives and Values

The structure of values and objectives is frequently referred to in connection with sustainability. The point is that **a new set of values** has evolved over the last two decades. These new values are *opposed to the concept of technocracy and the desire to conquer nature*, i.e. opposed to the notion according to which increased production and increased consumption (including growing energy production and consumption) were unambiguously considered positive values. Only those matters considered important in a technological sense were regarded as valuable and their applicability demonstrated within a narrow utilitarian framework.

With the realization that there were other values, these have been reconciled with the concept of technocracy. Attempts to consider these other values through a cost/benefit analysis, the numerical definition of regional and social effects of different investments and, in certain cases, by expressing all these in financial terms can be regarded as such. While the new aspects served to supplement and refine the previous principles, the expansion of technical issues and the *application of multi-criteria, multi-aspect, multi-dimensional decision-making/ assessment models* has definitely come into fashion. The turning point comes with the realization that aspects initially considered secondary are, in fact, more universal on the one hand, and represent a bigger portion of the vital processes than the simplified technical-economic 'window' through which we have, in the past, tried to evaluate the world. In certain cases, it becomes evident that the new aspects do not supplement the previous ones, but overrule them; and ultimately a certain section of the previous aims and objectives prove to be unacceptable in a survey covering a longer term and relying on a wider scale of values.

This turning point is, certainly difficult to absorb, especially in *a society of engineers. Engineers are traditionally concerned with the application of technology but* can become so involved in their *limited perspective* that they may fail to consider or even realize the wider issues and consequences which have become relevant.

Today we must ask **if the means justify the ends in the fields of industry and technology**. The debate has widened to include the consideration of a different set of values. New factors have entered the equation.

The traditional means by which engineers have been regulating rivers for centuries is now causing increasing problems, there are more widespread and more dangerous floods than ever before. The river flats rescued for agricultural purposes can be made fertile and productive for a short time, only by enormous efforts. The maintenance of shipping requires permanent technical service, after bigger and bigger artificial construction projects. The large scale environmental problems and devastation of the land represent a bigger concern in securing the proper water supply than the increase in consumption warrants.

The traditional ways by which traffic planners improved road conditions are now causing bigger disorder, crowds and traffic problems. Sooner or later, we have to realize that the objective itself, i.e. getting from 'a' to 'b' in a shorter period of time, cannot be achieved by the methods adopted for expanding the highways and improving driving conditions. The crowded, focal points of the cities, the squares and meeting places (i.e. the potential targets of traffic) all fall victim to the commercial development of communication.

The trend too of reducing work (both manual and technical) by a wider use of technology and automation and a more intensive use of energy is also open to question.

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As a consequence the forces opposing these trends have evolved and gained strength seeking to preserve and protect the environment and conserve valuable and limited resources. The fact that something has no directly predictable (or exploitable) value does not mean we can ignore the impact on the natural world. The environment is tangible and needs to be protected both in the short and in the long-term.

A point of impact quite often referred to in events and phenomena is represented by the natural environment as an external limit. As we considered before the regulation of water-ways devastates the forests, the fish stocks and dries up and impoverishes the agricultural land. Traffic and energy production pollute the air and contribute to the global warming of the Earth, etc. All these are genuine and far-reaching problems with extensive implications yet the technologists try to ease the contradictions by acknowledging only the immediate and visible effects and regarding these as the only limiting external criteria.

This approach could be acceptable if it contributed to the rapprochement of standpoints; it is easier to see the necessity for change when a new situation presents itself, than to admit that our previous standpoint has to be revised or should have initially been different. Unfortunately, this is not what is happening. The gap between the environment-friendly structure of values and the traditional technocracy can be used to pretend that new is not valid in a world of old values; or vice versa, ignoring the wider scale global impact and continuing on as before.

Therefore, we propose interpreting the meaning of sustainability on two levels.

The exclusivity of the techno-focused world concept cannot be maintained, since as a result of the previous methods developments encountered external limits. The soil, water, air, living nature, i.e. the different elements of the environment are being destroyed, polluted, diminished or degraded due to different activities. As a result of this, life on Earth generally or at least the existence of mankind will be jeopardized sooner or later, or will become harsher. Problems can also be generated in the short term and in such a direct way that certain minerals, raw materials and energy resources will become exhausted, rare, expensive and will need substitutes. *This realization can be called the change of values, i.e. we have had to realize that the quantity of resources which was considered given and unlimited is, in fact, limited, their quality is vulnerable, their replacement is expensive and in certain instances impossible.*

On the other hand, the techno-focused world concept cannot be maintained by the previous methods either, since development has encountered *internal limits* as well. Industry, communication, energy and agriculture, (i.e the economic activities) have become impossible in several fields from the point of view *of their own scale of values*, and are unable to achieve the objectives set. The Water management and communication planning were referred to above as examples and we can add energy utilization (to be discussed below in detail). These are facing problems which, partly independently of the long term effects of external limits, necessitate the revision and reconsideration of the traditional structure of objectives relevant to these activities.

3. Internal Limits: Sustainability from the Aspect of Mechanisms, Tasks Realized, Methods of Energy Utilization

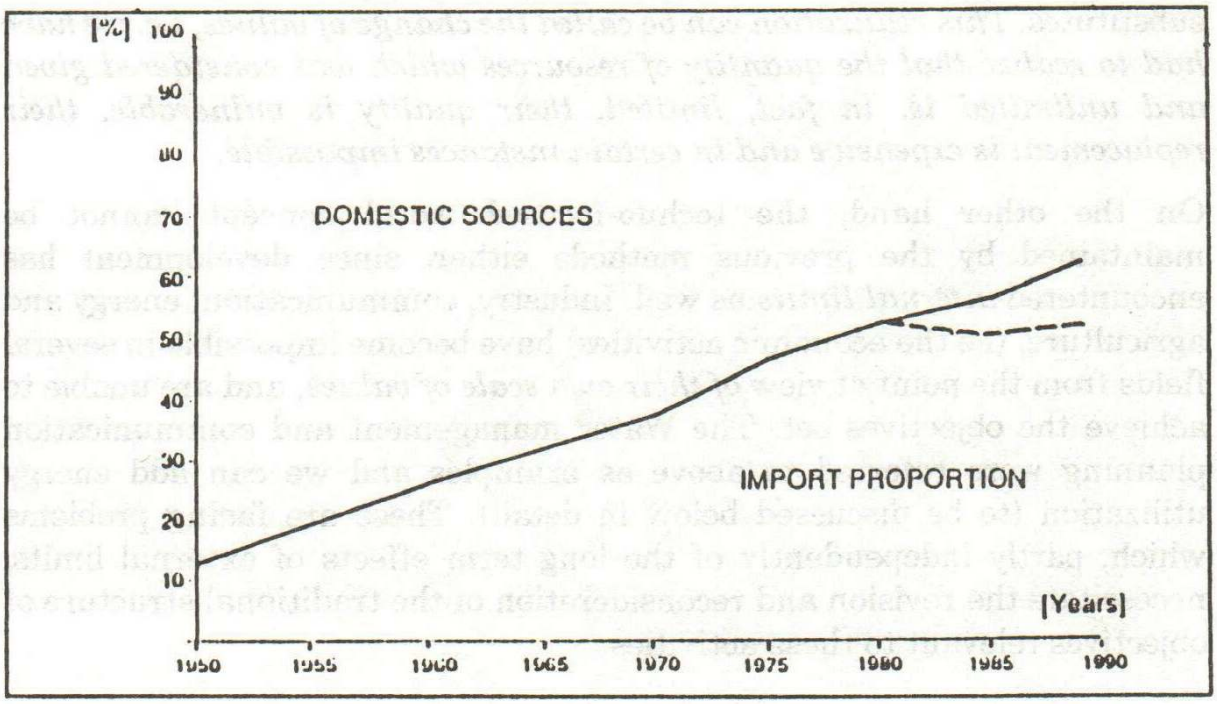
3.1. The Good Old Days...

It is obviously a generalisation to consider 'en bloc' the forty years of energy policy for 1949–89. However some conceptual principles characterising the era can be determined in retrospect. These principles even applied through the oil crisis of 1973.

I consider three basic tenets to be the pillars of the entire energy policy of this period:

Figure No 1

Trends in the Import Structure of Energy Resources from 1950 to 1990



[Source: Central Statistical Office Data]

– the projected requirements/demands for energy supplies, as intangible objectives constitute the basis of all future energy strategies;

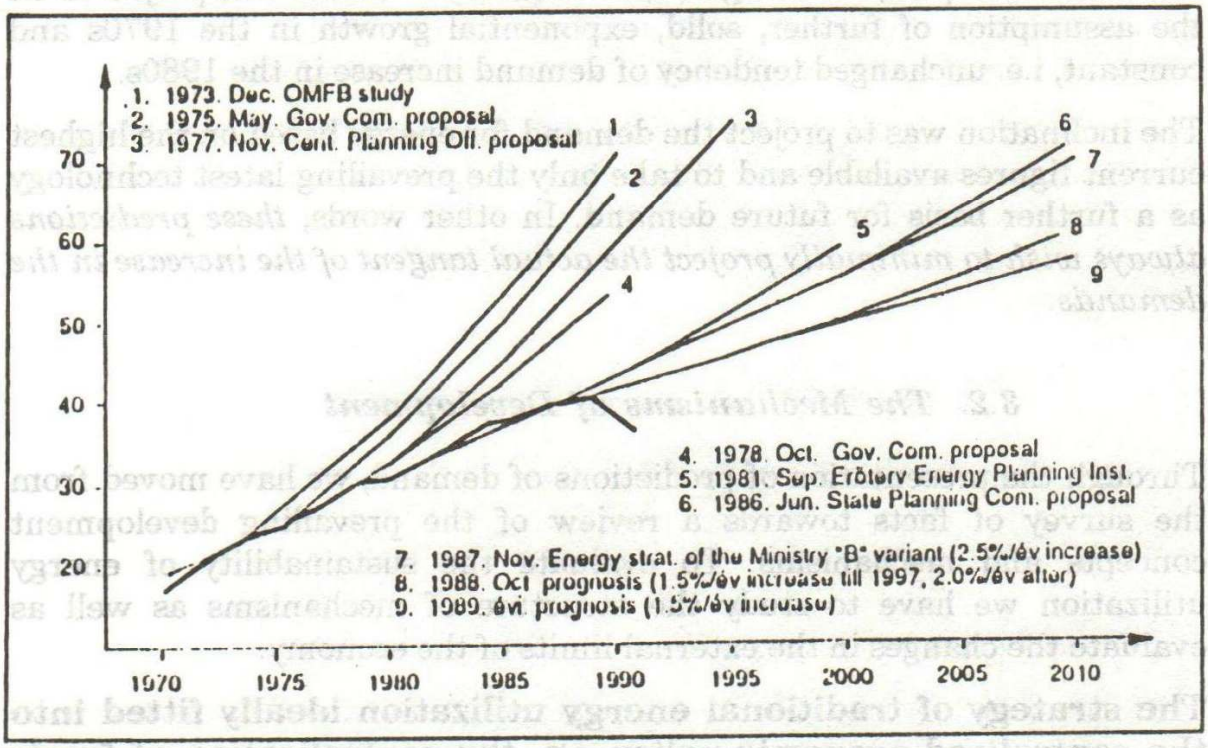
– the necessity of additional energy supplies is unambiguously expressed as one of the preconditions for desirable economic development/growth;

– the ample and cheap energy supply of the country is secured by Soviet imports.

Figure No 1 displays the trends in the import of energy in Hungary since 1950. It can be stated that the import ratio has been steadily increasing from 12% as of 1950 to 61% to date. A discrimination in the case of nuclear

Figure No 2

Prediction of Electrical Energy Demands from 1973 to 1989



[Source: Kapolyi [10]]

combustibles considering both statistical aspects was made in the Figure, i.e. taking into account the import of heater bars (continuous line) on one hand and the domestic production of uranium (dotted line) on the other.

By every criteria we can see one of the critical elements of the domestic energy industry, i.e. the great and continuously increasing import dependence, which, considering that the supply side in the given period was almost exclusively the Soviet Union, furthermore meant a unilateral, concentrated dependence.

Figure No 2 shows the prediction of electrical energy demand for 1973 to 1989 based on the compilation of *Kapolyi*. Our first, clear observation is that the **predictions, without exception, overestimated the expected increase in the demand for energy supplies, furthermore**, it can be acknowledged that the earlier the prediction the higher the assumption it makes for expected future demand.

In fact, **the rate of increase in demand has been continuously falling since 1970**. This can be seen in *Figure No 2:* the graph showing the statistics gradually curves downwards, while the forecasts are based on prevailing targets, i.e. the forecasters accepted that the increase ratio had declined in the past, but the given, momentary situation was projected on the assumption of further, solid, exponential growth in the 1970s and constant, i.e. unchanged tendency of demand increase in the 1980s.

The inclination was to project the demand for energy based on the highest current figures available and to take only the prevailing latest technology as a further basis for future demand. In other words, *these predictions always wish to minimally project the actual tangent of the increase in the demands*.

3.2. The Mechanisms of Development

Through the presentation of predictions of demand, we have moved from the survey of facts towards a review of the prevailing development concepts and mechanisms. To evaluate the sustainability of energy utilization we have to study the structure of mechanisms as well as evaluate the changes in the external limits of the economy.

The strategy of traditional energy utilization ideally fitted into the centralized economic policy, i.e. the centralization of funds and their central redistribution. At the same time we must accept that even in the Western economies the energy sector is under government

control to some extent or is linked to quasi-government co-operatives holding a position of near monopoly. Here then even the participants in market economies competing for state orders are not totally free from an element of the specific mechanisms which we can see operating under the conditions of redistribution.

While the formation of industrial production and services based on this gave grounds to small and medium-size workshops even in the golden age of big factories, in the full cycle of energy supply, i.e. in the exploitation of resources, energy production and distribution, a dominant role is played by a few monopolies/trusts. From the consumers' point of view, this means that *the higher the level of development established by a country, the greater the extent our every day lives become dependent on the nature of our energy supply*.

Nobody disputes that it is more convenient to switch on the electricity than to collect wood from the forest or to take coal and wood from the basement and light a fire in the stove or cooker. Nevertheless, there was a certain advantage to local heating besides its numerous disadvantages, that is the consumer was in possession of his own reserves and could himself decide how to economize and was, in the case of an emergency, provided with supplies, for a while at least. Conversely, the household well supplied with energy in the modern economy is dependent on conduits and the consumer is not able to do without these services, even for a short time. Although not so directly dependent, industrial production too is, to all intents and purposes, based on a fixed energy supply and in several aspects becomes subordinate to it.

In a system where the government redistributes funds and subsidises prices; where costs are covered centrally and not by the consumer, certain strategies are developed by the energy producers to obtain finance. In these strategies the fulfilment of the actual task i.e. the production of energy takes second place to convincing the funds' distributors of the need for development. Proving to the authorities that the cancellation or postponement of a development threatens a serious crisis possibly dangerous to the political establishment was a strong lever.

In this type of bargain system non-production in certain key-sectors could pose a big threat to the whole economy. These sectors are in a stronger position than those where production is better or more profitable yet which are not so economically strategic. In a closed economy the earlier in the

production process an industry is situated the more powerful it becomes. That is why the supplier of energy is in a good position compared to, let's say, the producer of consumer goods or services.

At the same time, a hierarchy built on technological principles, subordinated to the main and sub-distribution systems and with unilateral dependence of subsequent levels, serves as an example of the establishment of the authority of a central administration. In more developed cases this authority extends to education, public health, even wholesale and retail distribution chains. A situation of reciprocity developed whereby technical improvement consolidated already established networks (communication improvements the building of major and minor road systems, the termination of redundant railroads, new telephone junctions and networks) and the improved networks themselves enabled an increasing technical approach and encouraged development in this direction. The administration supported its increasingly rigid hierarchical system precisely for practical/technical reasons and instituted policies accordingly (the fusion of villages, the closing down and centralisation of institutions and schools, etc.). The result of all this, and still in evidence in the energy industry of today, is that the distribution system existing under conditions of monopoly and operationally regarded as valid (although not proved to be) is the only possible direction of development. It is to be extended further and elements of privatization will be subordinate to this and not to other factors.

There are several consequences of this starting point. The whole philosophy of energy utilization is stuck at the security level of the corporate monopoly/trust, i.e. the ample availability of energy is secure, if it is supplied by the trust. Security of supply for the consumer should be provided by the plurality of choice, selection from among competing suppliers, the independence of local purchase possibilities and not when the consumer himself is just a secondary player in the tug of war between the government and the trusts. It is not a coincidence that the exploitation of local energy resources, the variety of possible local supplies and the advantages of supply flexibility originating from this are generally left out of chapters on energy strategies describing supply security. Indeed the reverse can be seen on the level of actual developments, i.e. the setback of any such existing possibilities and maintenance of regulations unfavourable to local energy production.

Another consequence of the strategy built on crises or threatening with crisis is that the foundation of proper operation, viz. the maintenance of existing equipment and procedures is never as important as the acquisition of new developments, since these are usually well-supported by the sector with funding. Thus, the neglect of maintenance works, the running down of existing projects and the constant reference to their bad condition becomes an integral part of the strategy in the struggle for investments.

It is the non-existence of certain developments which provides the clearest reference to this bargaining process over central funds. Self-interest dictates that it is always of most benefit to the 'owners' of the existing structure to demonstrate a need for development or improvement than argue in favour of a new structure. That is why long term developments are often governed by deficiencies in the current structure, however much these developments are suitable only for preserving the existing status quo. No matter how the number of coal miners, the exploitable coal stocks and the demand for coal are almost simultaneously reduced, the separate factional interests pushing for development succeeded in increasing the tension, prolonging the process and demonstrating the need for further central intervention and assistance.

The energy industry, by applying the above mechanisms, managed to establish substantial sectorial power. At the end of the 1970s, savings in energy utilization became an important slogan in Hungary. Nevertheless, the sector succeeded in maintaining control over energy saving programs not losing it to external forces. On the contrary, the energy rationalization programs under the sector's control served as a suitable means of intervention for its own benefit. Accordingly, saving remained a slogan, while the energy industry obtained 41% of the 5-year plan's total investments in the first half of the 1980s. The sector is neither interested in savings of energy nor in such an increase of the current low prices presently stimulating waste, which might result in a substantial decrease of consumption.

3.3. Change in the Political System and Sustainability

The reference structure the previous energy policies were based on, collapsed at the end of the 1980s.

Two direct and conclusive events shook the Hungarian energy debates in 1989–1990, i.e.

the collapse of the Soviet Bloc (the COMECON's foreign trade structure and the whole Rouble-settlement system),

the oil price shock caused by the Gulf crisis in 1990.

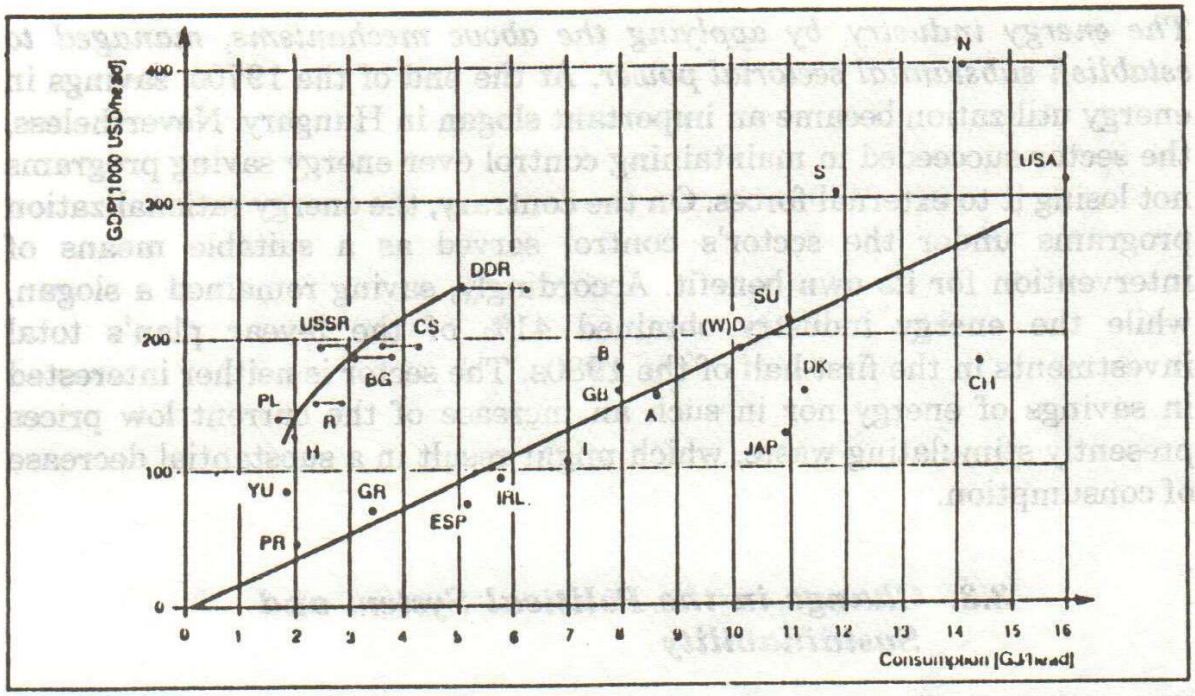
A comparison with the developed countries and other market economies demonstrated substantial disadvantages in the energy efficiency of all the socialist countries *[Figure No 3].*

The planning and security philosophy based on total demands became obsolete in establishing a realistic energy strategy.

International comparisons indicated that the economies of central planning, Hungary included, might possess substantial energy reserves which could be released. It became more and more evident that, as opposed to previous reference, the health of the economy is not indicated by the

Figure No 3

Energy Effectivity of Centrally Planned Economies much less than that of Market Economies (1985)



[Source: Kerényi [11]]

ever-growing production of energy but rather the reverse, as the financing of energy production investment deprives industry of the material sources needed to change its structure. Although not inexpensive, this structural change would be the precondition for economically competitive production including the more efficient utilization of energy supplies. Hence, these countries adapted, as they were, to Soviet energy supplies and caught in the trap of 'cheap energy supplies' dedicated a substantial part of their income (and the foreign loans taken) to the construction of expensive energy producing equipment and it subsequently cost a fortune to make use of the comparative 'advantages' of 'cheap energy'. As they were not able to break free from this circle of dependence they tragically fell behind the world trend which followed a completely different course.

Figure No 3 demonstrates the energy utilization efficiency of the centrally planned economies which trails that of developed market economies.

The vertical axis of *Figure No 3* shows the primary energy utilization per capita of the individual countries in 1985. The horizontal axis demonstrates the national product per capita in GDP/capita indicating the level of development of a given country by applying the computation of Kerényi. The energy utilization of the European market economies is essentially proportionate to the level of development of the country, i.e. their per unit energy consumption computed to production units is almost the same. The group of Eastern European countries is clearly distinguished from the European market economies as they, consuming the same quantity of energy, reach only half the production level (the latter is demonstrated by domains instead of dots due to the inaccurate statistical data and the conversion difficulties in the national products of the countries).

Further to the collapse of the base pillars in 1989, the change in the content of the Hungarian energy strategies reflects primarily the continuation of the domestic changes. At the beginning of the year the concept still included the expansion by 2 x 1000 Megawatts of the nuclear power station by 1995 and a subsequent lignite power station of similar capacity which was to be constructed before the millennium. Furthermore, the projected energy requirement between 1992 and 1995 considered the inauguration of the Bős-Nagymaros Dam to be indispensable. This was expected to be completed by 1992 (producing energy for domestic purposes till 1996. After this time two thirds of the energy produced could have paid for the 30% (approx) involvement of the Austrian construction companies within twenty years.

In the spring of 1989 the subject of the ***Bős-Nagymaros Dam*** *became a key issue in the political establishment*; Miklós Németh, Prime Minister, dissenting from the traditional arguments, represented by Károly Grósz, Secretary General, suspended the construction works at Nagymaros for 2 months, then, in the fall, after the prolongation of the deadline, suspended the works at Dunakiliti as well, while the Parliament passed a resolution indicating the final termination of works in connection with Nagymaros.

Thus, the summer of 1989 was spent on permanent professional reassessments. The alignment points became obscure, and while certain interested parties in the energy sector were trying to adhere to the agreement, silently supporting the project, others realized that it was already obsolete even from a political point of view. That is, the other basic pillar of the demand-shortage concept of 1992–1995 was no longer valid, as the effort aimed at the domestic adaptation of the Soviet nuclear power plant with improved safety devices failed.

In the meantime Hungarian industrial production continued to decline while the increase in energy utilization reached new levels. The new situation required new forecasts, and the concept described above for the annual increase of 1.5–2.5% in the demand for electrical energy was worked out.

The new premises started a fresh avalanche. The expected demands for energy in the previous drafts could accommodate a nuclear, a coal-based, a hydrocarbon and a hydroelectric power plant, thus all sub-sectorial concerns could at least partially consider the strategy. Disputes, at the most, were developed in connection with their priority only. However, the new concept forced to absorb current reality passed a critical stage, as, due to the moderately planned increase of demands, the development of each sub-sector could not be accommodated in the concept even as a distant promise. As a direct result of this, competition between different concerns within the energy industry became intensified.

Energy policy has always focused its attention on 'what to develop'. Up till now, however, it was regarded as one of those technical and professional issues, which could be hidden from outsiders. The energy sector as a whole properly represented the interested parties in the political debates over the distribution of funds arguing the strategic significance of energy in a unified way. With the internal lobby-struggles becoming more and more public, the structure of reasoning has also become public and easy to survey. Suddenly, the contrasts become well-marked: the economy, at its

best, is stagnating, production is decreasing and everybody is discussing the environment and saving. Energy policy thus becomes one of choice and the policy makers are stuck with the question of 'what to develop?'.

The energy policy established by the end of 1989 did not differ from the former ones in the sense that it kept on projecting the highest value which was still justified by reality. Now we can add that it did not differ from its predecessors either in the sense that it continued to be the policy of continuing energy-production in respect of its aims and concept. Still, due to the fact that it could not go on as the standard-bearer of all sectors in the energy industry any longer, a change arose which, since then, has been dominant in the concept of the energy policy and will remain so in the future.

The moment when the concept can no longer include both coal-based and nuclear based power stations at the same time will force the policy makers to decide to choose between two, more or less equally important groups of interests. Choice means prosperity for one group and decline for the other. The decision will concentrate, for the first time, all the disadvantages into the same energy sector (i.e. lack of investment, development funds, etc.). The policy makers, however, have to face a new risk, investment will be taken from sectors where the consequences are irreversible.

Nevertheless the risks of decision-making have not been accepted, and the following solution has been reached. Up to the turn of the millennium no basic power stations are needed at all, since up to then the construction of modern, more efficient and easy to build power stations with gas-steam combined cycles will be sufficient to meet the requirements. Given this choice, independent of whether or not the concrete decision (power station based on hydrocarbon) is justified, an important step has been taken in the direction that in an insecure, changeable situation energy strategy should depend on investment risks and on the risk to supplies, that is, it seems reasonable to make flexible decisions, easy to alter, instead of committing ourselves to long term engagements with unforeseeable outcomes.

*By the beginning of **1990**, a somehow **renewed energy policy** was formulated, which could be considered traditional in its starting point, but contains tension elements due to the combination of traditional thinking circumstances which are anything but traditional.* These elements always necessitate speedy modifications, as each quarter year brings newer inevitable fundamental changes based on a changing conceptual scenario. The concept cannot stabilize, for the time being it is inappropriate for its purpose, i.e. to be the basis of strategic decisions.

In the meantime, *debates continue.* Each group of interests seeks representation in the elaboration of the program of more significant parties, sometimes to an extremely high level even at the less professional, preparatory stage. It is obvious that they are making efforts to ensure that their interests are taken into consideration in the preliminary, initial concetual phase. The problem is that as opposed to a political management team less prepared for a 'professional' type of reasoning we have a basically intact, professionally well-supported team able to reason self-confidently. Attempts too are sometimes made to balance these teams by replacing the professional elite with 'reliable' members. The real challenge lies in maintaining a professional establishment with a broad perspective. It is helped by surveying and investigating vested interests and making those interests public. In this sense, over and above the primary information, public discussions have the important role of forcing the parties to argue unambiguously, thus not only the facts, but also the reasoning becomes transparent.

In the course of 1990 amidst these struggles another energy policy report of the Ministry of Industry and Commerce was prepared. The report, sent out to different reconciliation forums from the end of the year, and modified several times is characterized by the fact that in its general basic principles it learned from the arguments brought up against previous concepts. Therefore, in fact, no objection can be made to the three basic pillars underlined as the priority of the concept. According to this **the aim of the 1991 energy policy is:**

- *reduce the country's unilateral dependence on imports;*
- to facilitate with all possible means the saving of energy;
- to ease the supply monopolies, help the propagation of production-capacities utilizing local sources, appearing in small, flexibly established decentralized units.

In the period of the change of regime, there was a major common problem for every small Central-European country: **unilateral energy dependence on the** (former) **Soviet Union.**

Hungary also aimed beyond structural shifts, towards a much less energy-consuming industrial structure to loosen the above dependence and, as a next step, to enable the Hungarian electrical energy network to join the (Western) European one.

Neither the presentation of the report, the situation evaluation or general reasoning can be objected to. It is far more ambiguous, how the achievement of basic objectives can consequently be made possible by the described elements of the strategy. Here new solutions are mixed with ideas formulated in former drafts not necessarily compatible with the new basic principles.*

The new concept takes on board the idea that no construction of base power stations is necessary till the end of the turn of the millennium, since up till then the possible extra requirements can be met by the combined gas-steam cycle power stations. The belief that the extra capacities generated this way approx. 800–1,000 MW would be sufficient till the turn of the millennium is based on the constant 0.5 % of increase of total used energies stated in the previous drafts, and within this the predicted 1.5% of annual extra efficiency of electricity.

We saw in *Figure No 2* that the annual extra electricity requirement of 1.5% was forecast in the course of 1989, when it corresponded to the actual figure reached due to the continuously decreasing trend. In 1990 in the 'softer' political situation the electrical industry did not consider it necessary to correct this figure, although the facts showed a decline more abrupt than the previous trend: not only the rate of increase kept on declining, but the increase itself turned into a fall. As a result of this, (as can be seen in *Figure No 2,*) the facts and the trend of this prognosis diverged to a much greater extent by 1990 than in the mid 70s.

The contradiction does not definitely prove that an electricity increase smaller than predicted will be related to future development, but it is obvious that such predictions are unjustified. In the short run, it contradicts the facts to such an extent that even in the case of an eventually well predicted rate of increase, the starting value would be essentially lower than the estimate.

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* *By the end of 1993 a curious situation has occurred: the sharp decrease of industrial output has resulted in the decline of electricity imports from 1,800 MW to 500 MW within the space of five years and the 500 MW electrical energy imports are now coming fifty-fifty from Poland and Ukraine.* **Therefore, the former unilateral dependence is over.** At the same time, *between 1990 and 1993 the Hungarian electricity system/network has begun to join the UCPTE system. The first practical trials successfully taking place in September 1993.*

Realizing this, in 1991 the authors of the report formed a new prognosis. We have seen that since 1973, in the period of decreasing growth the initiators of energy policy endeavoured to acknowledge the measure of actual increase, they only denied the fact of a further decline of rate. In the 1991 situation it could have meant the forecast that requirements would continuously decrease. Instead of this, in compliance with the new theory, decrease is going on only in the temporary period of recession-till 1992. Then suddenly, there is a change, to the rate of growth of the 80's, an annual 3.4%. Even in the most pessimistic scenario it means a value exceeding annually a 2% increase in the electricity requirement. That is the same value, which still justifies the annual continuous growth of 1.5% as per the previous draft. This prognosis can only be inaccurate and is not taken seriously even by its originators.

In the interest of reducing the unilateral dependence on imports **the infrastructural basis of western imports needs to be ensured for all energy resources.** This requires the **costly construction of networks improving and developing gas, oil pipelines and electric cable networks. The danger of these developments lies in the fact that the western funds and credit lines available for the various networks are coupled with offers which intend to convert Hungary into an exporter of energy.** Thus, the evaluation of these ideas cannot be considered independently from the inevitable review of the overestimation of requirements discussed earlier, since it can only be calculated subsequent to the kind of risks of unjustified capacity generation involved in the various drafts. In other words, the requirement for the energy infrastructure (pipelines, networks etc.) may be overestimated.

The well analyzed chapter of the 'Economy and Energy, Situation Report' points out numerous examples of waste originating from previous, macrostructural and regulation distortions. Based on this, we would rightfully expect that the program chapter dealing with one of the concept's declared basic pillars the saving of energy (and options of increasing efficiency) refers back to this issue. Instead, to promote the conservation of energy in fact, only one concrete argument appears in the program, i.e. the increase in the price of energy resources, although the text, in general, refers to the necessity of preferential treatment in tax and customs. The program fails to attempt the quantification of possible consequences of the macro economic changes. Thus **it is only an abstract**

hope that a structural change will result in the saving of energy, while the program, in its details, is preparing to ensure a growth in energy consumption.

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In the period of the Hungarian social transformation renewed pressure was placed on energy development strategy. At the level of values and declarations, an environment oriented western way of thinking appeared. At the same time, on the level of practical policy making contradictions increased. Lip service was paid to the new values but on an applied level these were rarely implemented. Simultaneously it appeared as if western impetus to encourage change was beginning to dissipate.

3.4. Changes in the International Environment

In the short euphoric phase, when only the advantageous and beneficial nature of eastern European changes was noticed, it seemed natural from both eastern and western perspective that comparisons were important, so that with western assistance the lagging behind of the East could be measured and the correct strategy for achieving a more developed western level would be arrived at.

The comparison, as shown in *Figure No 3*, demonstrated significant differences primarily in the field of energy efficiency between the eastern and western half of Europe. In addition, our analysis pointed out that the neglect in the maintenance of the institutions, the counter-interests in savings, the interest in maintaining monopoly positions and other mechanisms encouraged low efficiency. It seemed logical to adopt, initially at least, the methods, regulations and lessons which the West had already used to resolve important issues. These issues have been, and still are, put forward by western experts at numerous conferences. However, these required changes including the restructuring and modernization of the whole industry cost money even though in the long term an increase in energy efficiency is possible. We also came to the realization that western interest was not necessarily impartial.

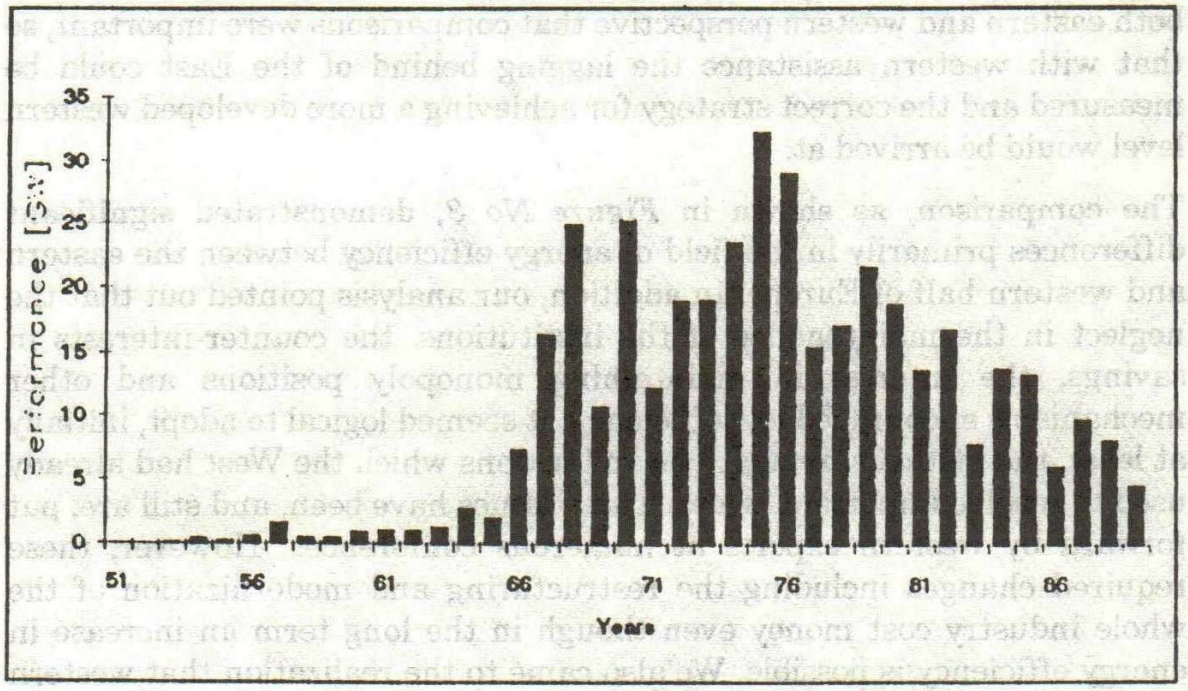
A serious contradiction has materialized. Groups with a vested interest in domestic energy utilization are characterized by the energy-saving 'dialogue' while preparing at the same time for the construction of power stations. Western interests busily promoting themselves as 'assistance' seem to adopt a similar stance.

This **self-interest** was first made clear in the most obvious way by the *nuclear-lobby* and mainly the *EDF French interest group*. The 40 year history of nuclear power stations can well be seen in *Figure No 4.*

According to *Figure No 4* the demand for nuclear power stations grew from 1951 to 1976, since then the number of orders has been decreasing at the same pace. The period of 'cheap oil' ended in 1973, and the resultant effect is far beyond what could be expected in the case of rigid demand structure, namely, the uncertainty of oil acquisition prospects intensifies

Figure No 4

Since 1976 Order/Demand for Nuclear Power Stations has been Continuously Decreasing



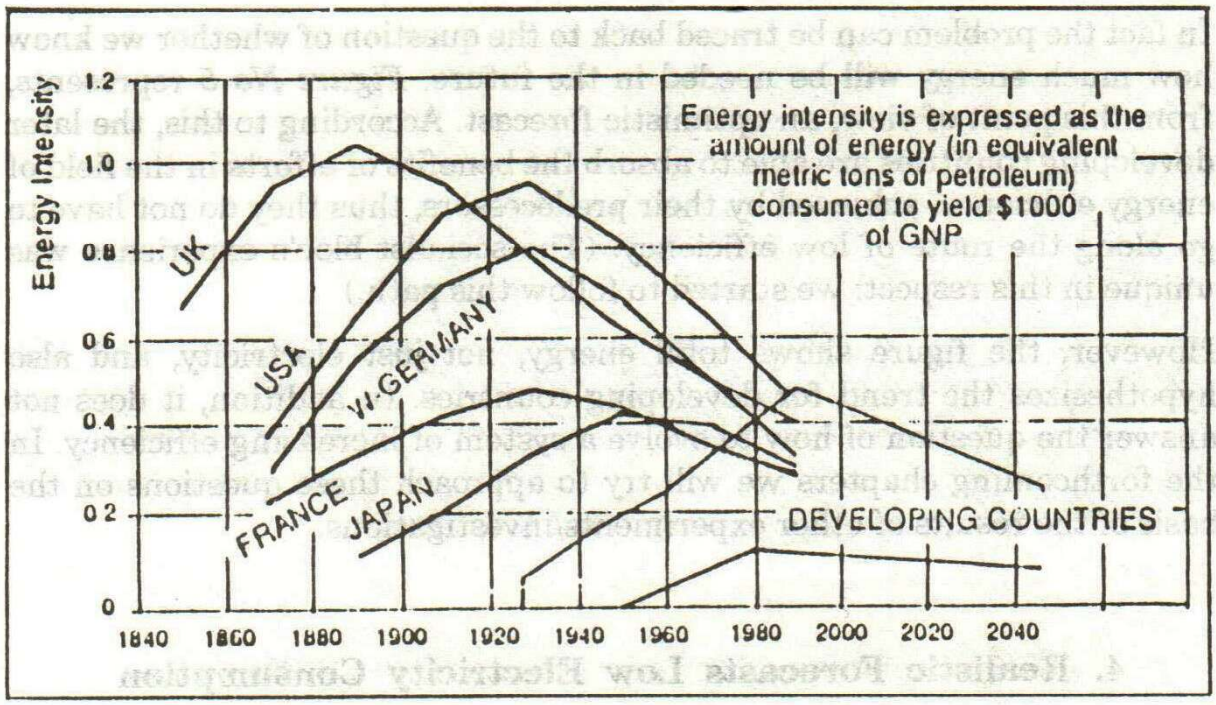
[Source: Char, N. L. Csík, B. J. and IAEA Bulletins]

the demand for replacing projects. On the contrary, a world accustomed to cheap energy had needed large quantities of oil and other energy resources on an increasing scale. The industrialized world then came to the realization that energy needed to be conserved and began to look at levels of consumption and energy requirements, especially nuclear energy. We must remember that 1976 was before Chernobil and the accident on Three Mile Island in 1979. An increased sense of caution was not due to these events.

The graph showing the placement of orders for nuclear power station constructions draws the typical line of a declining cycle of innovations: 25 years of growth is followed by 15 years of permanent decrease of demand. In the case of simpler products a developed country would strive to give

Figure No 5

Showing the Decreasing Energy Intensive Paths of Developed Industrial Countries. Paths not Followed by the Developing Nations.



[Source: Scientific American, Sept. 1990]

away not only the product, but the manufacturing equipment too, so that the final losses are suffered by a less developed country. Here this is not the case, and even greater pressure was put between 1989 and 1991 on those countries, which could be potential buyers. At that time it seemed that westward from the Visegrad countries nobody wanted to buy nuclear power stations, while eastward from this line it was not advisable to sell them. Now, perhaps this latter condition can be reviewed, and pressure has now been extended even further eastward.

The nuclear power station is only one selected example. **The point to be made is that in the interests of safety and security the national dependence on unilateral energy imports from the former Soviet bloc should be rapidly replaced.** Domestic and western experts involved in the dialogue who have a vested interest in the construction of power stations would like to see energy imports especially that of electricity replaced by domestic energy production. At the end of the day security of energy supply relies on flexibility and dependence on any one source with no viable alternatives is an unsound policy. It is important to leave room for manoeuvre.

In fact the problem can be traced back to the question of whether we know how much energy will be needed in the future. *Figure No 5* represents, from this point of view, an optimistic forecast. According to this, the later developing countries are able to absorb the benefits of efforts in the field of energy efficiency, achieved by their predecessors, thus they do not have to go along the route of low efficiency. (The socialist bloc's experience was unique in this respect: we started to follow this path.)

However, the figure shows total energy, not just electricity, and also hypothesizes the trend for developing countries. In addition, it does not answer the question of how to evolve a system of increasing efficiency. In the forthcoming chapters we will try to approach these questions on the basis of the results of other experiments/investigations.

4. Realistic Forecasts Low Electricity Consumption

On the subject of forecasts the domestic environment-friendly scenarios are generally attacked due to the fact that even some of the experts who accept the decrease in general demand for energy argue that it will be true

for electricity as well and that in the long run the demand for that too might decline. We intend to indicate some relevant trends from a survey as follows.

In forecasts relating to electricity consumption the demand for electrical energy is regularly mixed up with services generated through electricity. In reality, the consumer does not need the *energy,* but the various services. However the interests involved in energy supply endeavour to mix the two and translate them as a direct demand for energy. Two important questions are raised here: one is how the two interests can be divided with the help of economic regulations, more exactly, to achieve the position whereby the suppliers of electricity become interested directly in the performance of the services. This in such a way that the decrease of energy used to supply these services means a reduction of costs for the servicing company and not a loss of income, i.e. it has to be in the company's interest to save energy. Practical examples for the implementation of such regulations are provided in California, U.S.A.

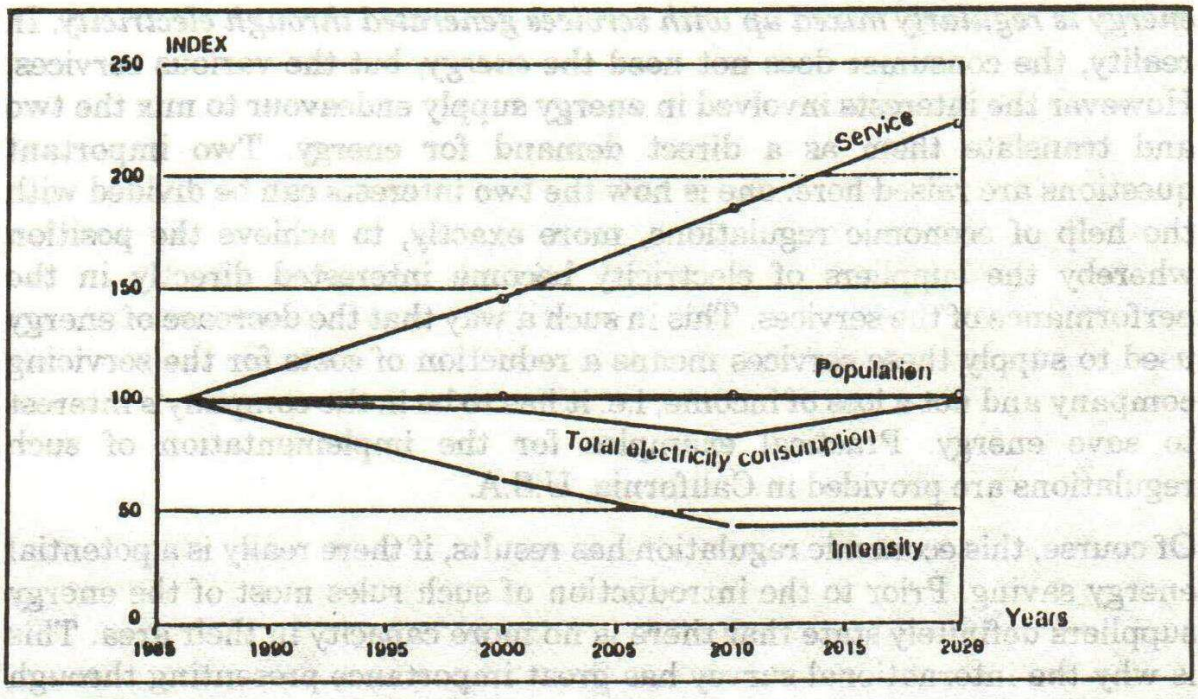
Of course, this economic regulation has results, if there really is a potential energy saving. Prior to the introduction of such rules most of the energy suppliers definitely state that there is no more capacity in their area. This is why the international survey has great importance presenting through European comparisons the kind of potential saving which might be achieved in the most developed countries with the help of already marketed available technologies.

The survey conducted in 15 Western European countries infers those countries' future demands for electricity from three components. These are the demands per capita for services effected by electrical energy, the actual electricity intensity (that is the ratio of electricity consumption and GDP) and the level of population.

The calculation took into consideration two scenarios for the future change of services: a growth scenario, where the demands are continuously expanding between 1986 the base year, and 2020, in each country at the same pace, (by 34%). A saturation scenario, where the most developed countries will slow down their demands for increase in the near future, the less developed ones doing the same only by the end of the period under study, on a level exceeding the actual European standard by 25%. (Even in the case of the least developed country, Portugal, it meant a 160%, improvement.)

Figure No 6/A

Parameters of 15 Western Countries in the Growth Scenario



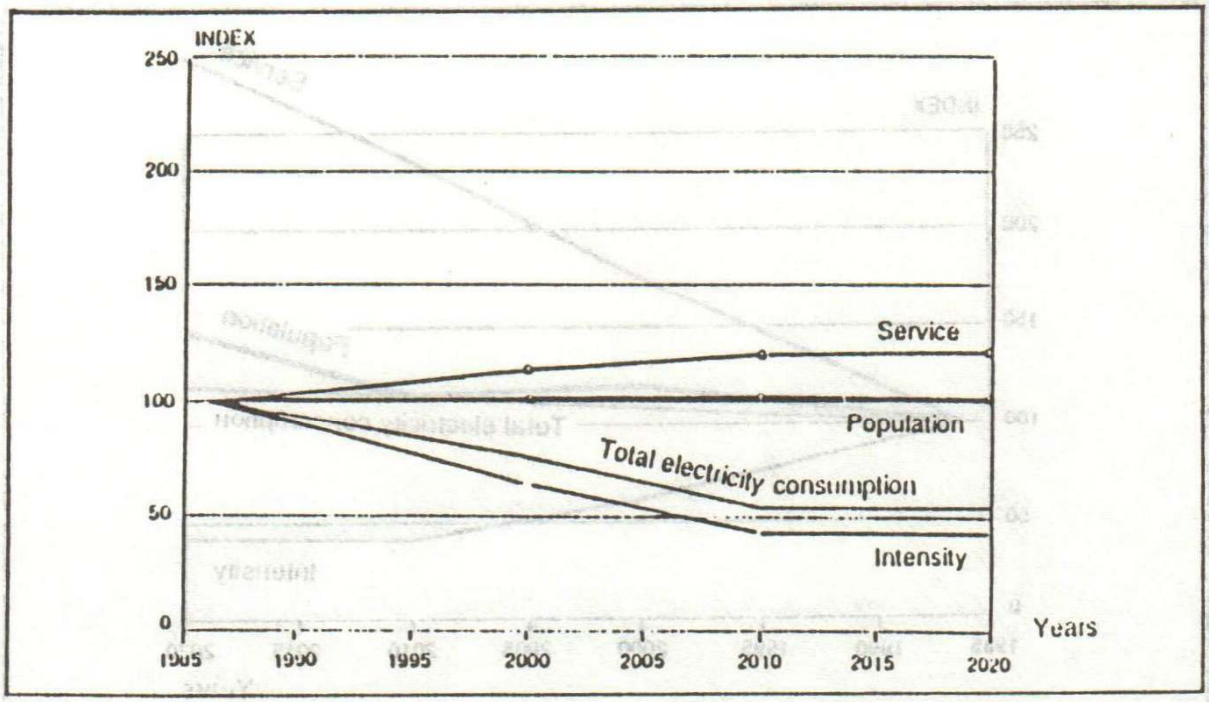
[Source: Norgard, Jorgen S; Viegand, Jan: Op.cit.]

The most revealing part of the survey is that future estimates of changes in electricity intensity are the reciprocal value of electricity utilization efficiency. By country it is divided into 16 sectors and 10 different end users' categories. The survey was based on the situation in 1986, where, as a base the electricity used in the Danish wood industry for pumping represented one unit. The surveyors assumed that in the case of electricity consumption 15 years hence (i.e. around the turn of the millennium), the average efficiency of the equipment of this sector would reach the level of the best technology available in 1986. Between 2000 and 2010 the researchers counted on another similar technological development, but did not assume another improvement in equipment efficiency before 2020.

The results of model calculations for the whole of Western Europe are shown in *Figures Nos. 6/A and 6/B* In the case of the growth scenario the 35 year' growth of services, an approximate 2.25 fold increase will

Figure No 6/B

Parameters of 15 Western Countries in the Saturation Scenario



[Source: Norgard, Jorgen S; Viegand, Jan: Low Electricity Europe Sustainable Options]

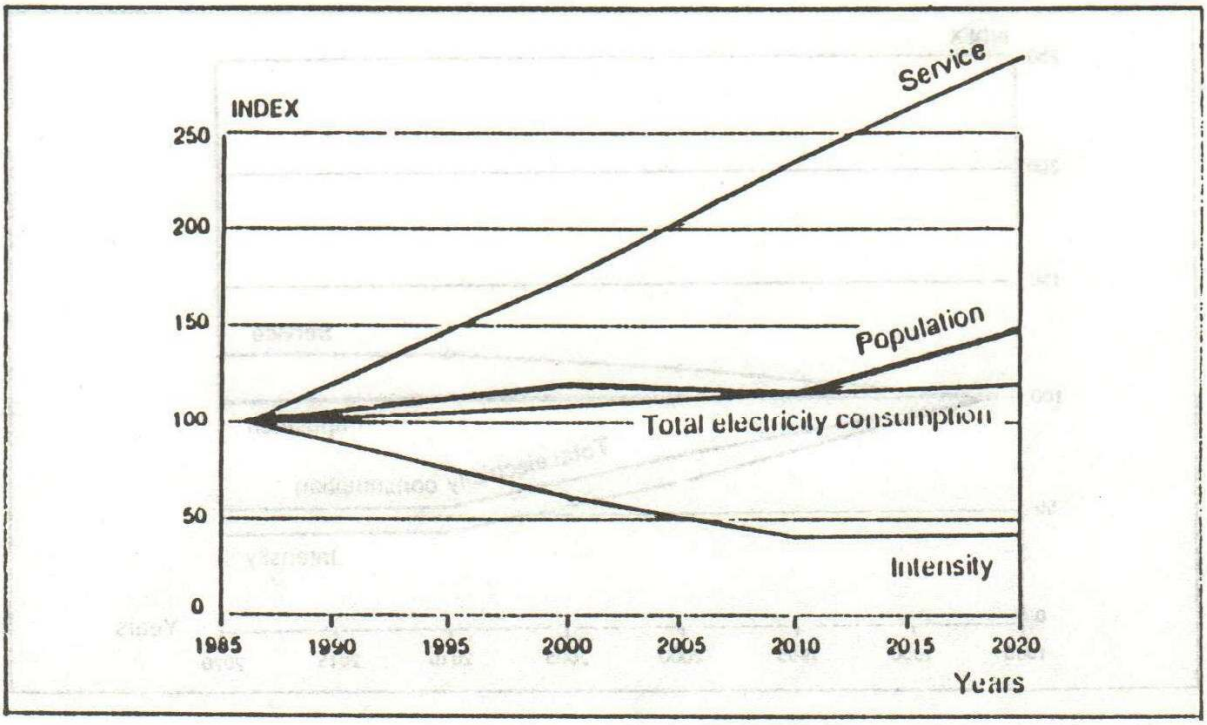
complement a 25% decrease in total electricity consumption up to 2010. However, in the last ten years, when the authors did not take into consideration the further improvement of energy efficiency, this decline in consumption collapses, and the 1986 total consumption level will be restored. In the case of the saturation scenario as compared to the 1986 base level the 20% increase in services will complement a decrease of nearly 50% in total electricity consumption.

From Hungary's point of view it is worth selecting the parameters of the least developed country, Portugal from the comparison *[Figures Nos. 7/A and 7/B]*

In the case of the growth scenario in Portugal the expansion of services to 300% is accompanied by the rise of total energy consumption to 150%, but we need to take into consideration the fact that of nearly half of the 50%

Figure No 7/A

Parameters of Portugal in the Growth Scenario



[Source: Norgard, Jorgen S; Viegand, Jan: Low Electricity Europe Sustainable Options]

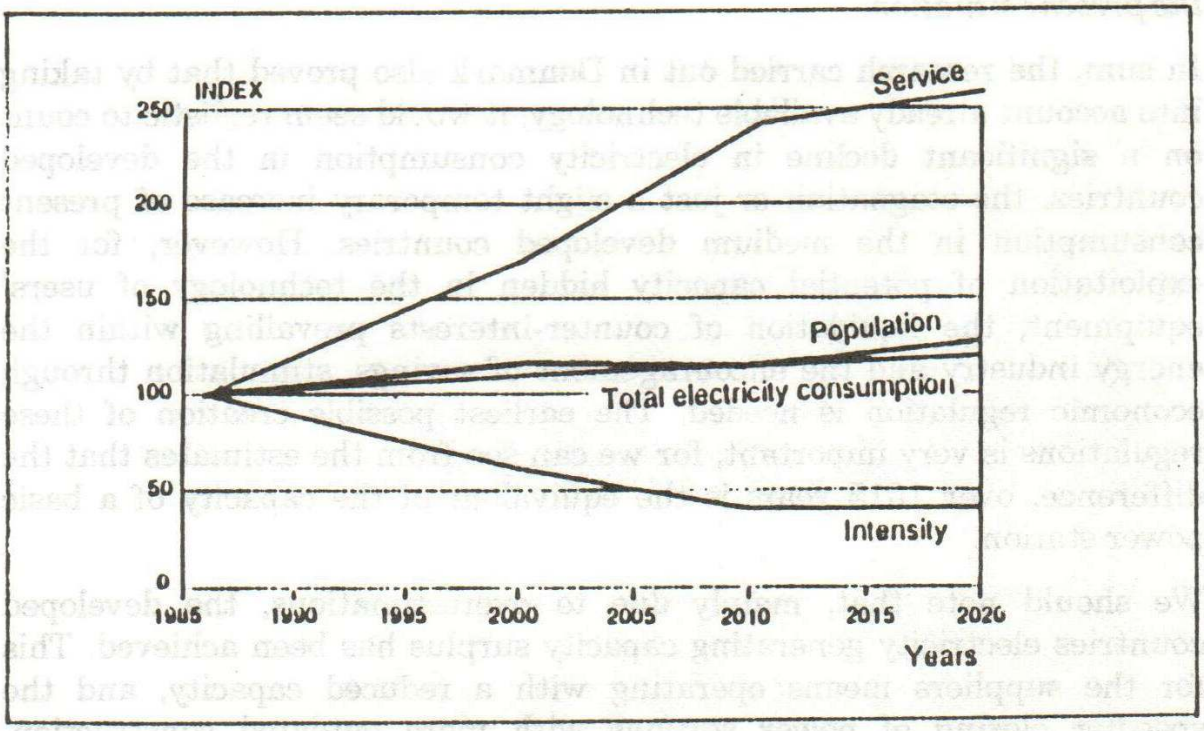
growth, almost 20% is caused by the growth of the population, i.e the increase in the electricity consumption per capita will be 30% in 2020 compared to 1986, while zero in 2010.

In Portugal even in the case of the saturation scenario the services will grow to 260%, which will be accompanied by a 25% growth in total energy consumption, more or less in conformity with the growth of the population. This means that the electricity consumption per capita, in fact, remains on the 1986 level.

As a matter of fact, an accurate comparison could be drawn with Hungary, if we were in a position to complete the total calculation with detailed data and forecasts of service demands for the individual domestic sectors. As a preliminary estimate, some differences can be found in comparisons with

Figure No 7/B

Parameters of Portugal in the Saturation Scenario



Portugal. In the period under study a decrease in population can be forecast in Hungary instead of an increase, which is a consumption reducing factor in the future. It can be assumed that, taking 1986 as the basis, greater potential capacity can be found in Hungary in the industrial sector of electricity consumption than in Portugal, for example in aluminium processing, also in the mining and the chemical industries. However, the global comparison of statistics might be confusing - Hungary has used about 40% more electricity compared to GDP – partly because the comparison of GDP is disputable, partly because of differences in climate and heating demands.

As a comparison it is worth mentioning that the Hungarian energy policy elaborated in 1992 started from estimates similar to the growth scenario, discussed above, that is an expected 3–4% of GDP growth. The concept

however fails to make the necessary differentiation between the demand for services and the demand for electricity. Thus, instead of a stagnation in the level of total consumption demand it counts on a 2.0–2.5% increase in the demand for electricity, which would grow to 20–25% by 2000 compared to the present situation.

In sum, the research carried out in Denmark also proved that by taking into account already available technology, it would seem realistic to count on a significant decline in electricity consumption in the developed countries, the stagnation or just a slight temporary increase of present consumption in the medium developed countries. However, for the exploitation of potential capacity hidden in the technology of users' equipment, the liquidation of counter-interests prevailing within the energy industry and the encouragement of savings, stimulation through economic regulation is needed. The earliest possible creation of these regulations is very important, for we can see from the estimates that the difference, over 1015 years is the equivalent of the capacity of a basic power station.

We should note that, mainly due to overestimations, the developed countries electricity generating capacity surplus has been achieved. This for the suppliers means operating with a reduced capacity, and the speedier closing of power stations with more outdated construction. However, for the power station construction companies the market has immediately and totally been blocked. Therefore, there is a greater and intensified pressure being exercised, on their behalf in the Eastern European and Third World market. All this entails the additional environmental consequences inevitable in the case of energy generation. Due to this, the developed countries are not willing to supply electricity for less developed countries in spite of the momentary surplus capacity. They would prefer rather the opposite. However, with the decline in the potential for power station construction two conclusions can be reached: on the one hand, blocked production capacities will have to be exported, so that the final bankruptcy appears elsewhere. Additionally it is possible to postpone liquidation by the expedient of securing government loans or guarantees for exports to the Third World. Even if the developing country fails to pay, the government guarantee ensures payment to the industry involved.

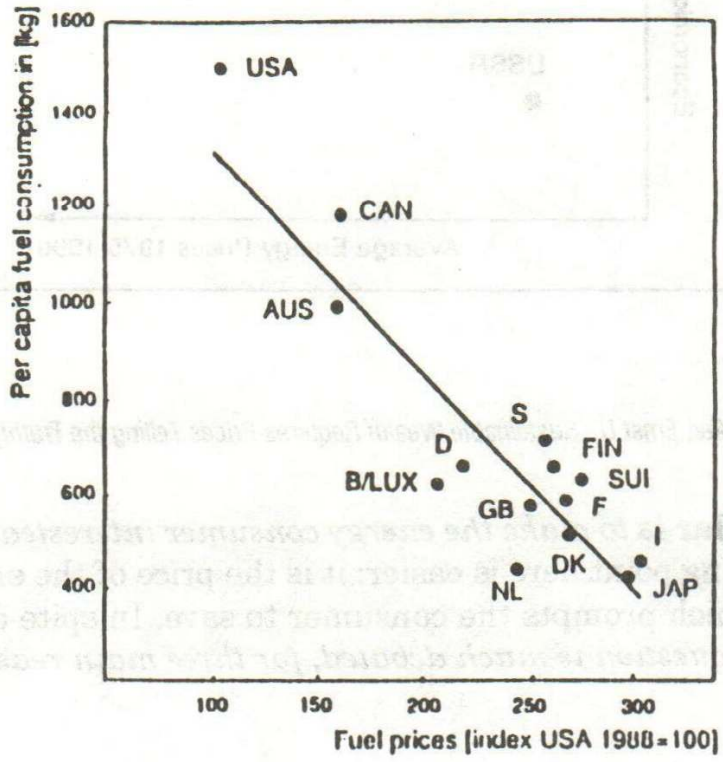
5. Do the Regulations Work?

Two basic pillars of the economic regulation of sustainable energy utilization are to be emphasized.

One is the regulation related to energy producers *which is intended to prevent the energy production-power station constructor interests from operating contrary to energy saving ideas.* In the situation of companies dealing with energy distribution we have already mentioned the Californian regulations, whereby public utility companies do not sell the energy, but the services generated by it (heating, hot water, lighting, etc.). This interest might be projected to the level of energy producers, but it is

Figure No 8

Shows there is a Definite Negative Correlation Between the Price of Fuel and the Fuel Consumption per capita of a Given Country (1988)

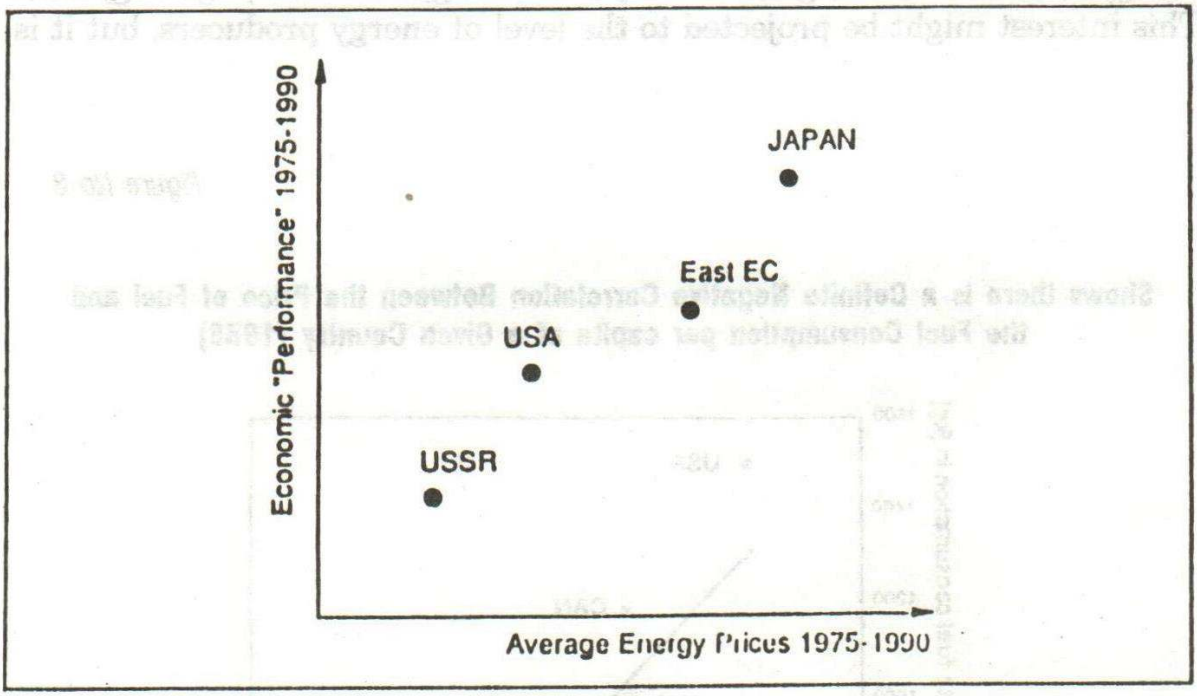


[Source: von Weizsäcker, Ernst U.: Op.cit.]

unthinkable that investors in the energy sector would have as much interest in the generation of energy or services as they would in construction.

Figure No 9

Demonstrates that there was a Definite Positive Correlation Between 1975 and 1980 in Certain Countries, Between the Price of Petrol and the Capacity of the Given Economy



[Source: von Weizsäcker, Ernst U.: Sustainable Wealth Requires Prices Telling the Truth!]

The other pillar is *to make the energy consumer interested in consuming less*. The starting point here is easier: it is the price of the energy (and not the service) which prompts the consumer to save. In spite of its apparent simplicity, *the question is much debated, for three main reasons*.

The first is in relation to the producer's counter-interest: the seller of energy wishes to intensify sales, for him the optimal price is the one at which he is able to realize the highest profit for a certain period, this price, however, is not necessarily compatible with a price increase engineered to reduce consumption.

The second aspect relates to social considerations. The starting point here is created by current prices and habits. It is not judicious to alter these suddenly, and for those who are not able to adapt themselves to the changes (e.g. pensioners, the unemployed) it is not socially acceptable.

The third aspect is a combination of short- and long-term effects. It is frequently stated that the price of energy is not flexible, since changes in the short run have relatively few effects. *Even in the case of a considerable price increase, the existing equipment and machinery can continue to operate, because within the complete production process the price of utilized energy resources is marginal.* More significant effects take place, when the equipment, the machines and the production line are to be replaced. Then operational efficiency becomes a very important factor, since as an aspect consumption becomes suddenly relevant, especially when we take into consideration the projected life-span of the machinery.

After an increase in fuel prices, people generally do not replace their cars, but whenever they buy a new one, they pay more attention to the question of fuel consumption.

The kind of elasticity effects long-term fuel prices have are shown in *Figures No 8–11.* According to this, the petrol consumption per capita of various OECD countries corresponds closely to the price of fuel, compared to the prices in the USA.

It is frequently argued that the development of an economy is hindered when energy prices are high. In relation to this, it is worth looking at *Figure No 9* which supports the opposite argument. From 19751980 the capacity of certain economies was in proportion to the average energy prices of the given country.

Above we examined a framework for a functioning regulatory system. Planning of the regulation, rather than introducing it in a sudden and ad hoc manner, and gradual implementation over a period of years is part of the *sustainability of a regulation.*

6. Summary

In the course of the discussion of the conditions for sustainable energy utilization, we first examined the external limits of sustainability and within this the exhaustion of certain resources as well as mean utilization per threshold. We also focused on problems caused by contaminating wastes, especially those decomposing over a longer period. Renewable energy resources deserve special attention from the point of view of the external limits of sustainability, but this question was not addressed in this paper.

Compared to the realization of external limits which carry new value principles, in general less attention is paid to the internal limits/burdens of sustainability the focus of this paper. I have reviewed the internal relations of energy utilization with the help of some characteristic mechanisms, formulated in the past decades. These mechanisms include the dominance of production-centred, operational aspects over the servicing side; rigid, hierarchical sector management built on monopolies and closely linked with the government; neglected maintenance and threatened bankruptcy in the fight over distribution of funds; long-term development based on the deficiencies of the existing structure, i.e., its conservation only; interest in wasteful energy usage, the philosophy of unilateral supply-security based on this; mystification of planning on the basis of demands, interest in the overestimating of future demands; and finally, interest in maintaining a mistaken economic policy throughout.

These mechanisms can be created not only under circumstances of the state socialist redistribution, but many similar peculiarities also characterize western energy production and distribution systems. As a consequence, the formation of a market economy in itself, or the appearance of western investors does not solve these problems and does not make the sector sustainable. On the contrary: many signs point to the fact that as the demand for the construction of power stations in western countries is decreasing due to more efficient use of energy, the losers in this process the construction companies try to compensate for this by taking advantage of (domestic) credit lines in Europe, among others.

An important condition of sustainable energy utilization is the decrease of the demand side. On the basis of the results of international research, I have shown that in the case of estimates based on the use of already available energy saving technology during the next 15 years and in the case of continued technological development over a similar period of time, it

seems realistic to suppose that the energy consumption level will be maintained. The only necessary condition for this is that an efficient regulation system be ensured as well. These regulations are needed to control and counter vested interests in energy production and a few examples of these regulations do exist. Another study deals with the effect of higher prices on consumption. On the basis of this we risk the statement that lower prices in reality defend the interests of the energy industry and not those of the consumer.

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INSTITUTE FOR WORLD ECONOMICS
OF THE HUNGARIAN ACADEMY OF SCIENCES

TRANSITION – INFRASTRUCTURE

Edited by: György Csáki

Language editor: Stewart Oldham

Budapest, August 1994.

CONTENTS

The studies were prepared as part of the research project led by ***Professor Éva Ehrlich:*** "The role of infrastructure and services in the modernization of the economy" – sponsored by the National Research Priorities in Social Sciences (OKTK).

ISSN 0133-7769
ISBN 963 301 232 5

INSTITUTE FOR WORLD ECONOMICS
Budapest, XII., Kálló esperes u. 15.
P.O.Box 36, Budapest, Hungary
H-1531

TRENDS IN WORLD ECONOMY

No. 74.

TRANSITION – INFRASTRUCTURE

Budapest, August 1994.

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