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Demand-side Energy Policy as an Alternative Energy Strategy for Pakistan

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1. INTRODUCTION

After the first oil-price shock of 1973, a search for new energy policies was started all over the world. Changing one fundamental concept — that relating to the general development of energy supply and consumption — was, however, out of the question. The pre-1973 trend of development was maintained. The energy elasticities did not change. The old forecasts were still held to be valid and were considered now, as earlier, to be the objectives which a successful energy policy had to achieve. This was considered a prerequisite for high growth rates of GNP and improvements in living conditions, and energy consumption was regarded as an indicator of the level of economic development. Therefore, the focus was shifted to an enlargement of the supply of indigenous energy resources as a substitute for imported energy, so that dependence on foreign countries could be minimized.

It was not before the end of the Seventies, i.e. at the time of the second oil-price increase, and the early Eighties that alternative scenarios with fundamentally changed approaches to energy policy were developed for some industrialized countries.[1] They depicted a future of smaller or even zero growth rates in energy consumption, achieved without any reduction in economic growth or living standards[2] through formulation of an energy policy focusing on energy demand and, therefore, on energy conservation.

Although, so far only a few recommendations of these studies have been introduced into the governmental energy policy of the countries concerned, surprising results have already been achieved. In Germany, for example, energy consumption in 1984 was lower than in 1973, whereas the GNP showed an increase of over 20 percent. A similar development took place in the United Kingdom, Denmark, Belgium and Sweden.

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[1] See, for instance, Krause/Bossel/Mueller-Reissmann [11] and Meyer-Abich [14] for the FRG and Leach [13] for Great Britain.

[2] One study for Germany assumes a doubling of GNP by the year 2030, which will be reached with an energy consumption of only 60 percent of the present value.

It is, therefore, necessary to analyse a possible application of this concept to energy strategy in the developing countries. The following arguments and considerations would seem to show that it could contribute a great deal to the solution of the energy problem which is at present being faced by Pakistan as well as other developing countries.

2. ENERGY POLICY AND EFFICIENT ENERGY ALLOCATION: SOME THEORETICAL CONSIDERATIONS

The traditional energy policy, which still prevails in the developing countries, proceeds from the basic idea that its only task is an expansion of the supply of energy sources. The path of future expansion is regarded as determined by past growth rates of energy consumption or by historic energy elasticities which express the allegedly close link between the growth rate of GNP and primary energy consumption. This energy policy concentrates solely on the supply side of the energy sector and completely neglects the demand side. It can be depicted as in Fig. 1.

This supply side energy policy, however, relies on completely false assumptions. The decisive factor in the energy sector, as shown by recent investigations in connection with the debate on delinking, is, in fact, the variable "energy service" [14; 17]. Energy service means the service which can be realized by using energy sources, e.g. a warm room in winter, heat for cooking meals, transport from point A

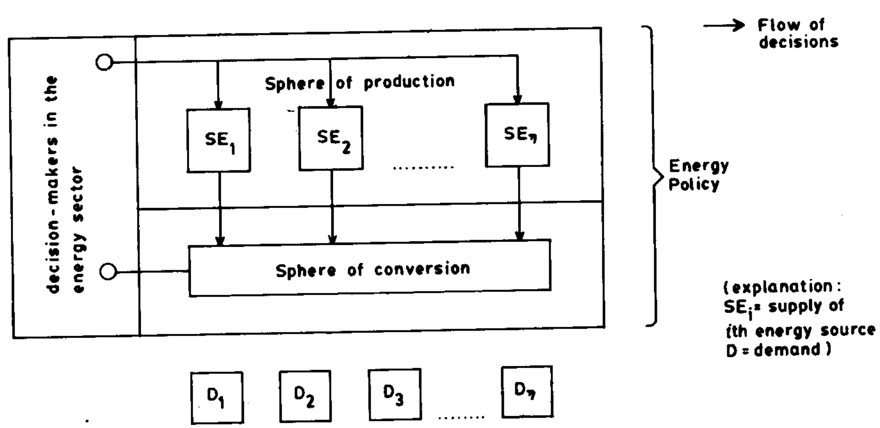

Fig.1

to point B, warm water for a shower, etc. Strictly speaking, nobody demands an energy source for its own sake, but rather for its ability to produce the service desired by the consumer.[3]

It is clear from these remarks that there are several possible levels of energy consumption at any given level of economic production and/or living conditions, depending on the proportion of energy services and energy sources used. This result has strong implications for an efficient energy allocation as well.

The supply side energy policy – and this means the actually realized energy policy in Pakistan – accepts the volume of the energy sector and the level of energy consumption as an exogenous factor. This view inevitably leads to a misallocation of resources, as it means that energy policy is limited to optimizing intrasectoral allocation, i.e. the optimal structure of energy sources at an exogenously given level of energy consumption. Hence, part of the energy supply is delivered at costs higher than those of avoiding the consumption of energy sources at the same level of energy services. Fig. 2 illustrates this.

A correct perception of the allocation problem in the energy sector implies that the volume of energy consumption itself is also a policy variable, i.e. the allocation problem is an intersectoral and not just an intrasectoral one. In this way, it is possible to realize an optimal allocation of the factors of production, i.e. technological know-how, energy, capital and labour in relation to a given level of production and living conditions of a society.

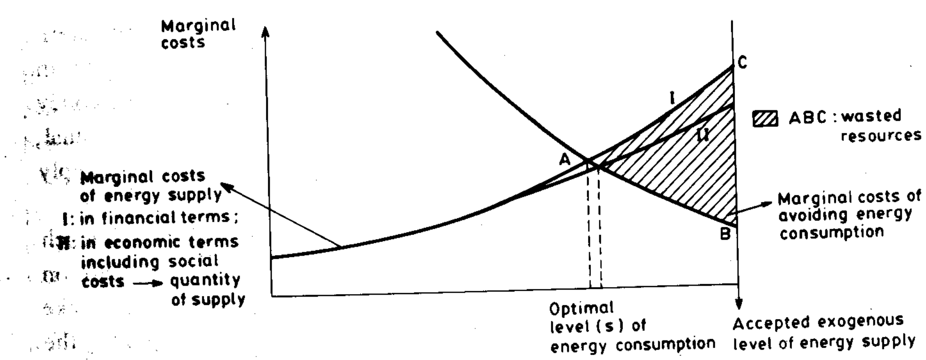

Fig.2

[3]This conceptual framework is, in a way, similar to the consumer theory of Lancester [12]. It is, however, more comprehensive, as it includes the producing sector, too.

Such an alternative perception of the allocation problem implies that the components of the demand side of the energy sector should be seen as a primary parameter of the energy policy. Ultimately, this demand side energy policy represents a policy of energy conservation. The demand side energy policy is shown in Fig. 3, which brings out its basic distinction from the supply side strategy depicted in Fig. 2.

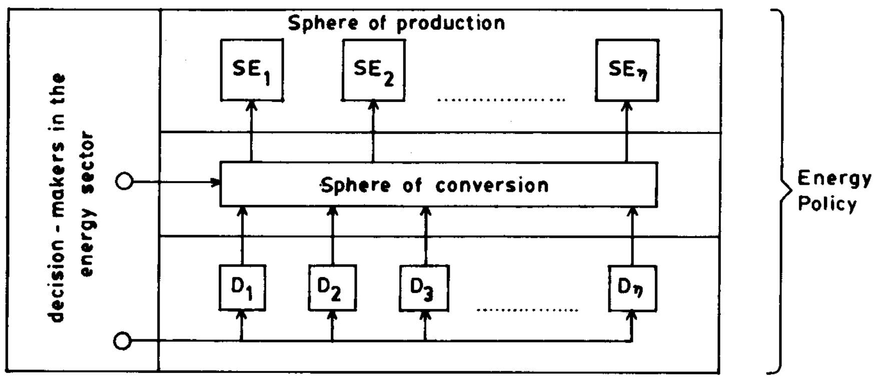

Fig. 3

Here, the demand components are a part of the energy policy. From a theoretical point of view, they are even more important than the supply factors, as, in theory, it is through the application of demand side measures that energy policy determines the volume of energy consumption, i.e. the supply required, as a residual; in practice, however energy policy must control both demand and supply simultaneously.

These theoretical conclusions make it evident that regression analyses, which determine the relation between energy consumption and GNP or quality of life on the basis of past data, are of little value for future planning, as they do not take enough account of structural changes and the role of the energy policy.[4] Besides, the existing data and the fact that even today, with a similar basic concept of energy policy in all countries, the volume of energy consumption varies widely within any single level of per capita GNP, imply that energy policy does have a role to play in determining the level of energy consumption.

[4] For further arguments against the use of a regression analysis for this purpose, see Pintz [16].

3. THE POTENTIAL OF ENERGY CONSERVATION IN PAKISTAN

Trying to calculate or estimate the volume of energy conservation for Pakistan, as for other developing countries, is a very difficult task, as the basic data required for this purpose are largely unavailable at present. The most recent study for Pakistan in this area [20] was published in 1985. It concentrates on industry and power sectors; most of the data have been obtained through energy audits. The potential savings range from 14 percent to 40 percent of the present consumption, depending on the specific industry (with the sole exception of the sugar-refining industry). For cement, brick, refining of petrochemicals, inorganic chemicals, fertilizer and pesticides, and textile industries, the potential saving is estimated at 25 percent. The average conservation potential of the 17 industrial subsectors amounts to 21 percent. For transport and domestic/government/agriculture, the corresponding but very rough preliminary estimates are 8.8 percent and 8.5 percent respectively.

These figures, however, clearly understate the actual conservation potential, on account of several reasons. Only conservation measures with a period of amortization of less than 3 years are included. They have, furthermore, been calculated in purely financial terms, using the present market prices of energy sources, which fall short of the actually existing opportunity costs. Sectors other than industry and power are, for the most part, neglected. Finally, the experiences of industrialized countries show that almost all studies on the potential of energy conservation have had to be revised upward almost as soon as they are published.

Other calculations for Pakistan comprise the following results [3; 5]. There is a saving potential of 25–30 percent for the industrial sector, and of 25 percent for the cement industry alone. Gas heaters, instead of electrical heaters, for space heating can save up to 70 percent of the specific energy required. Similarly fluorescent lighting instead of incandescent lamps saves up to 80 percent of energy, and the choice of the most energy-efficient air-conditioner saves about 60 percent as compared with the least efficient. The use of pressure cookers could save about 40 percent of the energy consumed for cooking purposes. The overall conservation potential of the domestic sector is estimated at 6.4 percent.

The following calculations and estimates for other developing countries supplement the data on energy conservation. The potential energy savings of various industries range between 3 percent and 51 percent in Korea and between 6 percent and 33 percent in Turkey [1]. The World Bank estimates savings up to 25 percent for energy-intensive industrial subsectors and from 20–25 percent for the transport sector [21]. An efficient urban transport will conserve between 20 percent and 50 percent of energy [9]. A study on India shows a conservation potential of about 30 percent for private households [18].

In order to show quantitative differences of the various energy strategies, I show in Fig. 4 three scenarios on the basis of the above data. Variant I represents the trend development of the traditional supply-side policy, with the consumption target of the present five-year plan for 1988 and a growth rate of energy consumption of 7.5 percent per annum thereafter. Variant II depicts development, according to the USAID-study [20], up to 1993. Variant III assumes the following potentials of energy conservation within ten years: 25 percent for industry, transport and commercial; 20 percent for agriculture and government; and 30 percent for domestic use.

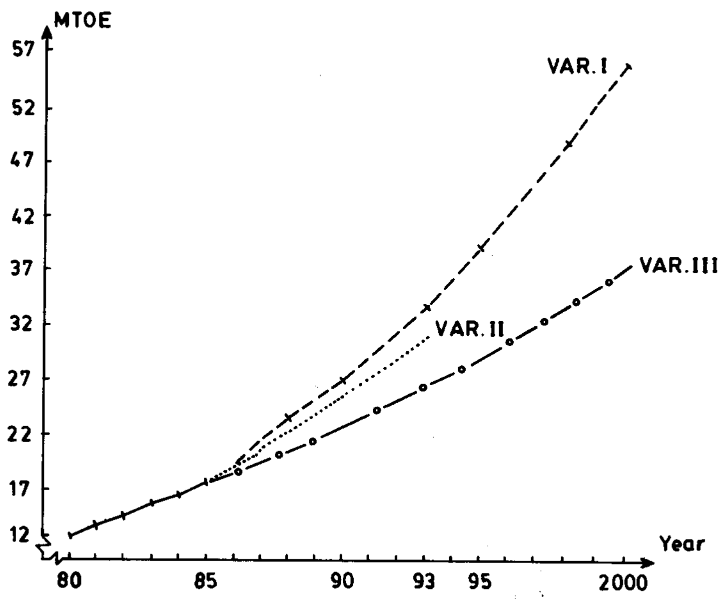

Fig. 4

Variants II and III save 2.54 million tonnes and 7.5 million tonnes of oil equivalent (MTOE) respectively in 1993 compared with the trend of development, and Variant III saves 18.9 MTOE in 2000 (which is slightly higher than the present annual consumption).

4. IMPACTS OF DEMAND SIDE VERSUS SUPPLY SIDE ENERGY POLICY

There is a consensus among energy scientists that energy policy and its results cannot be judged solely unidimensionally, i.e. in purely financial terms, but require a

multidimensional approach, which takes into account economic efficiency, appropriateness in terms of international-political relations, and appropriateness in relation to environment and social relations [14]. These single components may vary slightly in concretization for industrialized and developing countries; each of them, however, is valid for both groups of countries; see [16].

As to economic efficiency, it is obvious that demand-side policy requires less resources, as its basic feature is that it includes only what can be conserved more cost-effectively than the supply of the same quantity of energy sources (as depicted in Fig. 2, where the area ABC reflects the value of resources saved). Thus the above-quoted USAID report calculates that the cost savings of its conservation measures will amount to 3579 million US dollars between 1986 and 1993.[5] As the conservation figures clearly underestimate the actual potential, as shown above, the cost-saving data tend to be underrated, too.

Of equal importance to the capital requirements of an energy policy are the requirements of foreign exchange which are far lower for demand-side policy. Hence, for example, the net foreign-exchange savings through the energy conservation taken into account by USAID add up to 927 million US dollars for the 1985–93 period.

In order to gauge the long-term impacts of reduced foreign-exchange requirements on the balance of payments, Pakistan is here assumed to have realized a demand-side energy policy as long ago as 1974 and to have diminished her oil imports accordingly. On this assumption, it can easily be computed that reduction in commercial-energy consumption by a mere 15 percent[6], compared with actual consumption – a level of conservation already economically feasible with the energy prices prevailing after 1973 – would have resulted in cutting the annual trade deficit by 10–25 percent (depending on the year) and the deficit of the current account by 11–59 percent (with 1982-83 free of any current-account gap).

Reducing the trade deficit would have, of course, implied, other things being equal, decreasing foreign loans. At the hypothetical energy conservation of 15 percent, Pakistan would have realized at the end of 1984-85 a debt volume nearly two-fifths lower than the one actually reached.

These hypothetical figures can, admittedly, give only a rough estimate, as they are calculated under some restrictions and the *ceteris paribus* clause. In the absence of the *ceteris paribus* clause, one must remember that energy-conservation measures require some foreign exchange for investments. On the other hand, it is obvious that had most countries pursued a demand-side energy policy, oil prices would not have soared with the speed they actually did after 1973, as with this energy strategy the

[5] Owing to the recent development in oil prices, the calculations have been made on the basis of a price substantially higher than that now prevailing.

[6] Although it is obvious that not all savings would have been made in the form of oil, we can rely on this simplification for a rough calculation, as oil would have formed the main share.

overall demand pressure on the oil market would have been far lower. This, however, would have led to lower foreign-exchange expenditure for the remaining oil imports.

Demand-side energy policy saves not only capital and foreign exchange but also time. All energy technologies involved in expanding the indigenous energy supply have quite long gestation periods, in some cases more than a decade (e.g. huge water-power and nuclear-power stations). Supply-side energy policy, therefore, cannot solve the present energy problems of the developing countries. Demand-side policy, on the other hand, leads right from the outset to a reduction in energy consumption.

As the environmentally damaging consequences of an increased use of energy sources have, for the most part, been common knowledge for some time, a detailed consideration of this point is not required here. One remark, however, seems to be important. It is obvious that a reduction in energy consumption through a demand-side energy policy leads automatically to a reduction of environmental pollution. The impact, however, not only is proportional to the reduction realized, but will also lead in many cases to a qualitatively enhanced situation, as critical threshold values will not be surpassed.

In the sphere of international relations, one of the main effects achievable by a demand-side policy is an ease of the structural dependence of energy importers on foreign suppliers. This dependence is especially valid for the oil and the nuclear energy markets.

Although at present there is little threat of a supply interruption in the oil market, this problem can easily recur in some years, as it is clear that the present oil-glut is only a short-time phenomenon and will be exacerbated by dwindling reserves. This menace is especially serious in such countries as Pakistan, which rely solely upon two or three supplying countries. The fact that Pakistan's dependence on oil imports has hardly declined in relative importance and has even increased in absolute figures since 1973 is especially relevant here.

The threat of an interruption of supply is greater in the case of nuclear energy. This is because of highly oligopolistic markets in all stages of nuclear technology. Only eleven countries have the expertise to supply commercial reactors, out of which only seven have developed their own reactor types. Four-fifths of the world uranium reserves outside the Eastern bloc and almost the entire uranium market are shared by five countries. Enrichment of uranium is offered by four operators only, two-thirds of the capacities being concentrated in the USA. For the reprocessing of nuclear fuels, there are actually only two plants available.

The KANUPP reactor, for example, shows the consequences of the with-drawal of foreign supply: after Canada had abrogated co-operation agreements, the produced quantity of power diminished rapidly from 1977-78 onwards, and in 1979-80 reached a mere 0.2 percent of the potential capacity.

It is relevant to mention here that a reduction in energy consumption and, hence, in the importation of energy sources and technologies (which can include the abandonment of nuclear energy) not only increases supply security and sovereignty in foreign affairs proportionally to the extent of import reduction, but also results in a qualitative change.

With respect to dislocations in social relations, only one aspect is pointed out here.[7] Supply-side orientation leads to a rapid exhaustion of energy sources, so that the security of supply for the coming generations of a country may be threatened. Calculations for Pakistan show that the life span of the indigenous energy-sources can be increased substantially only by a demand-side energy policy with a low energy-elasticity, as shown in Table 1.

Table 1

Changes in the Life Span of Indigenous Energy-Resources due to Demand-side Energy Policy with Low Energy-elasticity

Energy Source	Reserves/ Potential	Life Span (years) at a 5% Growth Rate p.a. of GDP				Percent Increase of Highest over Lowest Life Span
		$\epsilon = 1,5$	$\epsilon = 1,2$	$\epsilon = 0,5$	$\epsilon = 0,2$	
Gas	16 mill. cu. ft.	19	21	29,4	36	89
Oil	140 mill. barrels	8	8,4	10	11	38
Coal	100 mill. tons	26	29,5	44	59	127
Hydro Power	20.000 MW	27	33	78	194	619

5. ECONOMIC AND POLITICAL MEASURES FOR THE REALIZATION OF DEMAND-SIDE ENERGY POLICY

The crucial question now is by which means the technically feasible and financially profitable conservation potential could be best implemented.

[7] For further aspects, see Pintz [16].

As the low level and wrong structure of energy prices are important elements in supply orientation,[8] I will first analyse the price mechanism as a measure of energy policy. Both static and dynamic analyses lead to the result that price increases and a price level equivalent to the long-run marginal costs of the various energy sources will contribute to the realization of energy conservation and, hence, to an approximation of an intersectoral optimum of allocation.

There are, however, some deficiencies in the price mechanism, which can also account for the low price-elasticities of energy demand found in various empirical studies [6; 10; 15].

A large proportion of energy consumers are not affected by price increases, as they rely primarily on non-commercial energy sources. Owing to cultural, sociological and religious factors, prices and price increases are only incompletely included in consumption decisions. Perceptions of price changes may be delayed and unrealistically low prices assumed for the future.

In some cases, a comparison of energy supply and conservation will not give an unequivocal advantage to any of the two options due to (almost) identical costs. Hence, the consumer may choose the option with lower energy-efficiency [8]. An energy policy which takes into account the external and intangible effects of energy consumption, must, however, make sure that the energy-efficient option is realized – a result which price mechanism can not achieve.

Maintaining the level of energy services with reduced energy sources quite often requires employment of capital or knowledge of energy-conserving devices, technical processes or possible changes of behaviour. None of these requirements can be met by price increases. If these conditions are not fulfilled, higher prices will either lead to a reduced level of energy services[9] or will cause no reaction at all, as, despite price increases, energy consumers feel compelled to produce the required energy services in an unchanged manner.

The fact that a homogeneous energy market does not exist, and, instead, there is a split between energy supply and energy consumption is also of great significance. Since in each market, decisions on investment are taken with totally differing periods of amortization (in the energy industry up to several decades, on the consumer side only a few years), there must be a significantly higher return on investment for the rational use of energy than for the supplying industries in order to realise the same amount of investment [19]. This distortion can not be eliminated by higher energy prices.

[8] In Pakistan, for example, the average tariff of WAPDA's power supply in 1979 covered only one-third (!) of the long-run marginal cost. See Gellerson [7].

[9] This impact is often used as a counter-argument against higher energy prices and energy conservation. It shows, however, that the concept of an energy-conservation policy has been completely misunderstood, as this reaction means only a maladjustment due to the mentioned deficiencies.

In addition to the deficiencies there are other reasons why price increases seem either unfavourable or unenforceable. They include ecological grounds (e.g. due to substitution of firewood for kerosene), social grounds (e.g. higher burden for low-income classes, which, however, can be abolished by appropriate measures) and political grounds (popular riots after energy-price increases).[10]

It is a definite inference from the previous considerations that, although energy prices must be brought as close as possible to their real cost, demand-side policy cannot rely on price mechanism alone, but rather must be supplemented by indirect public-interventions. Some of these measures are evident from the mentioned deficiencies.

The first measure involves dissemination of information and applicable knowledge about energy conservation. Its presentation must be worked out according to the specific consumer group to be reached. In industry and power generation, this can be done by energy audit groups. For rural areas, it can best take place within a broad agricultural advising or development programme with demonstration units. In urban areas, the media can be employed; this, however, must happen with specified instructions, which everyone can use directly to change technical processes or energy-related consumption behaviour. Special information and education are required for workmen and architects regarding energy-efficient construction of buildings.

Another measure calls for the provision of capital for energy conservation to people lacking in own funds and with limited access to credit, as a lack of resources is often a crucial obstacle to conservation. This can happen through public credits or public guarantees for people or enterprises lacking the necessary security and should be effected without excessive bureaucracy. In many cases, a loan in kind is preferable to one in cash. Increasing credit in this area does not increase the overall credit-requirements of the energy sector, as there is a decrease in the area of energy supply.

Indirect public-intervention also carries measures to realise the financial profitability of demand-side technologies in a situation in which energy prices are well below costs. These include financial incentives, especially subsidies. This policy may be more cost-effective than the more common policies of subsidized energy prices. Additional measures are tax relief, accelerated depreciation, etc.

The shaping of the development strategy can also help to attain the targets of a demand-side energy policy. This includes the employment of intermediate and appropriate technologies in industry and agriculture, a structural policy which favours those sectors which have a low energy profile, a transport system which gives priority to public transportation, bicycles and improved animal-power in rural areas, and a change in consumer preferences away from energy-intensive products.

In addition to indirect measures, direct public-interventions are required in some cases. They mainly include regulations and standards which induce energy

[10] This is true for Pakistan, too. See Ebinger [4].

consumers to realize the technically feasible and economical conservation potential.[11] Direct policy-making cannot enforce one universal measure; it has to suit the standards according to the specific technical properties of every single consumption process.

The main problem of direct intervention lies in its limited ability to enforce recommendations and prohibitions. This is especially due to a lack of functional and organizational efficiency of public administration in most of the developing countries. Thus, direct interventions are solely efficient only when a small group is affected by them, e.g. big industrial units, producers of energy-consuming devices and importers of goods.[12] This means that direct interventions are of limited use in a demand-side energy policy, and should only be employed in areas in which they prove efficient.

6. OBSTACLES TO THE REALIZATION OF A DEMAND-SIDE ENERGY POLICY

When the above theoretical considerations and the advantages of a demand-side energy policy are taken into account, the question really is why energy policy in the developing countries has hitherto neglected energy conservation and demand-side orientation. There are, however, a number of structural and institutional obstacles which may explain this situation.

Most of the decision-makers in the energy sector take an incorrect view of the role and essence of the demand-side orientation. It is, falsely, regarded as linked to compulsion, restriction of consumption and reduced prosperity, whereas the extension of energy supply is, again falsely, accepted as inherently positive. The neglect is intensified because of a sociologically explicable insistence on keeping the process of explanation and decision-making within the bounds of familiar patterns of supply-side energy policy.

The heterogeneity of the various energy-conserving measures and techniques make them more difficult to comprehend. Moreover, public administrations in the developing countries, including Pakistan, mostly prefer a few large-investment projects to a great number of small projects. This can be explained by the greater possibilities and ease of economic and political control in the former case. As demand-side energy policy consists of a multitude of measures, each of which contributes a small share to the overall volume of energy conservation, while supply-side orientation concentrates on a few huge projects, the latter is automatically preferred.

[11] Rationing of energy and load shedding, however, are no measures of demand-side energy policy.

[12] Efficiency in this sector, however, can be hampered by smuggling.

Finally, important domestic and foreign pressure-groups, such as the suppliers of energy sources and of equipment for the exploration, conversion and generation of energy, are obviously in favour of a supply-side energy policy. The demand-side orientation, on the other hand, cannot count on the support of pressure groups. This means that there is a structural imbalance in decision-making competence which discriminates against and, thereby, neglects a demand-side energy policy.

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Comments on "Demand-side Energy Policy as an Alternative Energy Strategy for Pakistan"

This is an interesting and well-written paper with a relatively novel and thought-provoking approach. Several industrialized countries have recently utilized new scenarios based on energy demand, energy service and energy conservation, rather than simply increasing energy-supply policies, which has shown some startling results: energy consumption in 1984 in Germany was lower than in 1973, whereas the G.N.P. showed an increase of over 20 percent, although it is not clear if a part of this may reflect the increasing cost of living. The basic thesis is that we ought to consider the volume of energy consumption itself as a policy variable, so that the problem of energy allocation becomes an intersectoral one and therefore *the focus is* on the optimal, i.e. *most economic and efficient, use* of energy resources.

This thesis naturally makes the problem considerably more complicated than a mere forward projection from the simple regression analysis to determine the relation between energy consumption and G.N.P. or other indicators for quality of life, on the basis of data from the recent past. Such data had shown, for instance that, in the case of Pakistan, the regression relation between per capita energy consumption and per capita G.D.P. is given by: log (per cap Energy) = 1.2274 log (per capita G.D.P.) – 0.3697, showing that energy consumption has been increasing as nearly (per capita G.D.P.)$^{1.23}$ (See T. Riaz's article in Vol. XXIII of this *Review.*) A similar behaviour is to be found in the case of several other countries.

The strategy proposed in the paper under discussion seeks to diminish this *faster-than-linear increase* through a combination of thrusts, which include energy conservation, economic efficiency of energy and appropriateness in terms of environment and society. Estimates are presented from cases of several developing countries and USAID studies up to 1993, to show that there is a real potential in Pakistan for ultimate savings of the order of 20 percent to 30 percent, even on a conservative basis. Comparison is possible with Korea and Turkey, where the potential savings for various industries range from 3 percent to 51 percent and 6 percent to 33 percent in Turkey. But it needs to be studied, how much of this effect is going to be offset by the continually increasing costs of energy sources.

Three graphical projections for energy consumption based on three policy variants lead to an almost linear instead of exponential increase in energy consumption from 1986 up to 2000 for the most optimistic case i.e. variant III, which assumes 20 percent to 30 percent energy conservation potential within 10 years for various sectors, optimum conservation in various processes being fixed by a compromise between added costs and the energy saved. So far, so good. But what happens thereafter? Being primarily a physicist, my view of this future is naturally coloured accordingly.

It would seem to an observer looking at the various systems from "outside" that, unless some definite and clear scope is available for continually switching from energy-intensive technologies to never less-energy consuming ones, once the above-noted energy-conservation potentials of 20 percent to 30 percent have been fully realized, *further growth* in energy usage would again tend to revert to the previous patterns. A more thorough investigation of this would be desirable. Possibly, a pointer in this direction may be found in taking a look at the Energy versus G.D.P. graph for various countries *at any one time* on a log-log plot. Those who have made such a plot will know that it mostly shows a slope of about 1.8 at the low energy end i.e. for developing and industrializing countries, and a slope of 0.8 for the developed ones (refer to Fig. 1). This may have its roots in the genuinely greater energy needs at the developing stage, due to the very *nature* of the development process and the particular industries being developed, and only partly because of the lack of attention to the energy conservation aspects, I personally would have liked to see a quantitative attack on this facet of the problem.

Finally, the discussion of the economic and political measures, in Section 5, for realization of demand-side energy policy is *illuminating*, and one cannot but agree with the view that for a demand-side policy, the price mechanism must be supplemented by direct and indirect public intervention such as regulations and standards, public motivation and financial incentives for energy usage with a favourable conservation and environmental impact. The use of intermediate and appropriate technologies as an instrument of energy policy for energy savings *needs a word of caution:* while such technologies use less energy per person employed, they are *not always* "energy saving" when considered on the basis of *energy per unit of product* manufactured. This aspect needs to be carefully examined on a case-by-case basis. The last two paragraphs of the paper (Section 6) are certainly thought-provoking and bring out the need for *educating* the public as well as the policy-makers with regard to the crucial importance of energy conservation and long-term energy planning. How we are to do this sort of educating effectively is perhaps a question for debate.

In conclusion, I must thank the organizers of this conference for giving me the opportunity to discuss this interesting paper.

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(1972 Data)

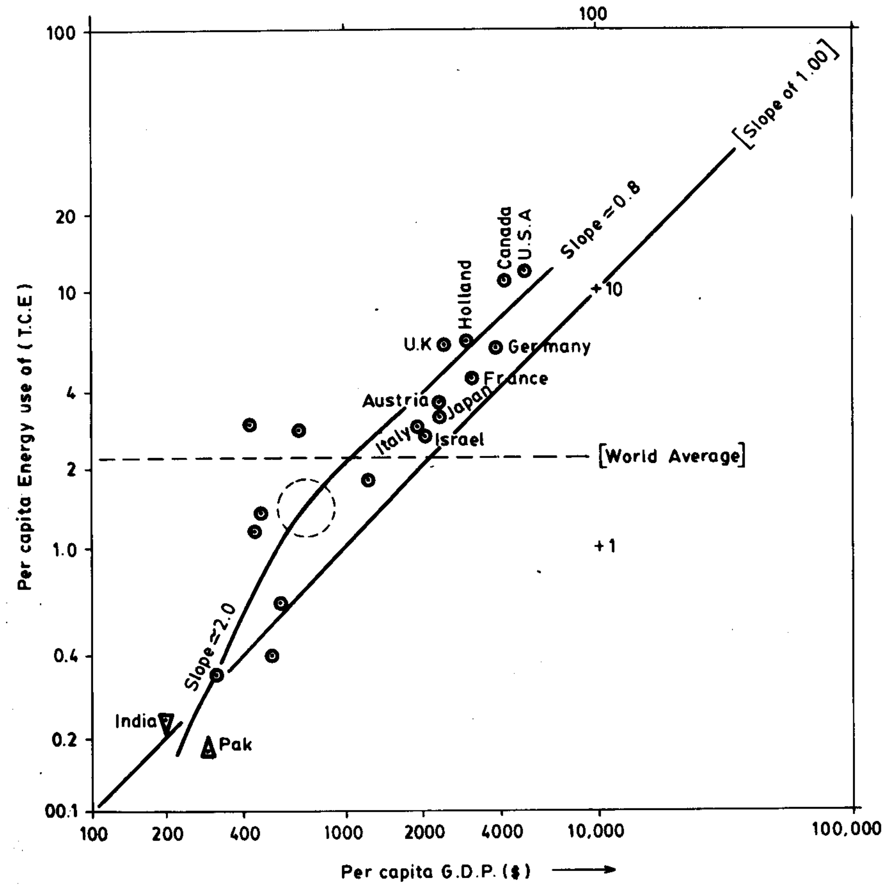

Fig.1