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SOVIET ENERGY PROSPECTS AND PROBLEMS: THE ENERGY SECTOR IN THE USSR 1985-1990

by B.P.Pockney

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INTRODUCTION

By the early and middle 1980s the USSR was experiencing simultaneous crises in three areas. There was an economic crisis and a political crisis and in addition foreign policy had run into an impasse. The economic crisis was expressing itself in a decline in the productivity of land, labour and capital. In the countryside, harvest yields were either stagnating or were falling. The flow of labour into the various industries was irrational and the economy was experiencing severe shortages.

Another way in which the economic crisis expressed itself was the backwardness in the technologically advanced industries. Thus the USSR had found it difficult to apply to its economy the benefits of advanced electronics, the computer industry, laser industries and other similar technologically developed spheres in the same way that the economies of Western Europe, North America and Japan had, in the 1970s and 1980s.

The difficulties in Soviet agriculture had compelled the USSR to become the world's largest grain importer and by the middle 1980s the USSR was importing about 40-50 million tonnes of grain each year. This amounted to one quarter or one third of total world trade in grains. The USSR was exporting a considerable volume of oil and the volumes of oil exported had grown through the 1970s and were continuing to grow in the 1980s. But the problem for the USSR was that its outputs of oil and coal and electricity were failing to keep pace with the planned outputs and in the case of oil and coal, the output was actually falling by the years of the middle 1980s. Consequently, the USSR was in the difficult position that it was having to increase its exports of oil a time when its output was beginning to fall.

In the political sphere, there were acute problems in achieving an orderly succession at the highest levels of government. From about 1975-6, Brezhnev, who was both General Secretary of the Communist Party of the Soviet Union and President of the Soviet Union, was physically incapable of discharging his duties. He had suffered a stroke, he found it difficult to speak and very difficult to walk. His ability to concentrate was very limited but for a variety of political and institutional reasons the system was incapable of removing Brezhnev from those positions until he died in November 1982. He was followed by Andropov who at the time of his succession was already a mortally sick man and he functioned in public for less than one year. By July/August 1983, Andropov was no longer seen in public and his speeches were read for him on public

occasions. He died and in 1984 Chernenko was appointed to the post of General Secretary. Chernenko was so ill at the time of his appointment that he found it even more difficult than Brezhnev to walk and to talk and when he died in March 1985, Gorbachev was elected to the post of General Secretary and immediately instituted a series of new initiatives.

The institutional difficulties of removing General Secretaries who were incapable of discharging their responsibilities went much further - the same paralysis extended through the Politburo, the Secretariat and the Central Committee. To a certain extent all the upper levels of the Soviet establishment were in the grip of rigormortis. In the sphere of foreign policy the Soviet Union was experiencing acute difficulties. Its armies were engaged in a hopeless struggle in Afghanistan. Its support for the front line states of South Africa was proving counter productive. Some countries of Eastern Europe, in particular Poland, Hungary and Romania, had incurred very heavy debts with Western banks and governments and the international debt crisis was creating stagnation and difficulties in Eastern Europe for the USSR.

In its relations with the United States the atmosphere was as difficult and as poisoned as at almost any time in the last twenty years and a build-up in Europe of medium range missiles was underway.

In March of 1985 immediately after the election of Gorbachev to the post of General Secretary, there came numerous calls for the renovation and up-dating of Soviet society.

THE REFORM PROGRAMME IS LAUNCHED

The first speeches of Gorbachev in the summer of 1985 focussed upon the problems of concentrating and being selective in the area of capital investments. The age old problem in the Soviet economy of far too many investment projects being launched without a sufficiency of capital to bring them to fruition was one of the expressions of the deeper economic crisis which Gorbachev addressed. In the period between March 1985 and the 27th Congress of the Communist Party of the Soviet Union in February/March 1986, there was a major governmental reshuffle. Most of the government ministers in the industrial ministries were replaced and in the Energy Sector, all of the ministers were replaced. Dinko moved from being Minister of Gas to being Minister of Oil, but he was the only Minister to retain his post from the Brezhnev period. Parallel with the governmental reshuffle, there was a very considerable turnover in the Party apparat, particularly at the level of the oblast. There were a few changes in the Politburo but interestingly the Central Committee remained, by and large, unchanged until April 1989. By 1987, more specific measures were being adopted and in the summer of that year the new Law of the

Enterprises was adopted. This law is of considerable importance and it was implemented in two stages:

a) from January 1988, about 40 per cent of industrial enterprises moved to a new model of taking their orders from customers rather than from Ministries in Moscow, ie they were to move to a horizontal system of stimuli from a vertical system; and

b) in January 1989, most of the remaining enterprises were scheduled to move to the new system of being responsive to orders from their customers.

This was a fundamental change in Soviet economic administration as the system had developed over the last fifty years on the basis of strict Ministerial control over each of the enterprises. In the years of Khrushchev and to a certain extent when Kosygin was Prime Minister, there had been attempts at similar reforms but these were partial and Ministries had reasserted their powerful autarchic control over the enterprises. Consequently when these reforms were introduced in 1987 and began to be implemented in 1988, very considerable opposition was expressed to them. There was very little open opposition, but from the speeches of Gorbachev and a number of his closest associates, it is clear that the Ministries still tried to retain their control over each of the enterprises. Even in 1990 there were strong vestiges of central ministerial control over enterprises.

There is an even more fundamental difficulty in that the State Plan is still imposed from the centre, is still expressed in quantitative terms of output and is still implemented via the Ministries. A further weakening of the new reforms is in the continued imposition of State Orders. The State Orders were intended to be a small category of orders to enterprises to ensure that certain strategic commodities were produced in sufficiency. In fact it was clear even in 1988-90 that the State Orders were being used to retain ministerial control.

The reformers have been arguing for the emergence of 'the Socialist Market' and also for the emergence of a wholesale market so that enterprises might order the equipment that they require via the market, rather than have to request their Ministry for capital allocations and new machinery. However, the achievement of 'the Socialist Market' and a wholesale market requires a viable price system which has a considerable extent of rationality. But the existing price system was wholly irrational and still rests upon the basis of many millions of prices being decided by the State Committee on Prices, rather than by supply and demand. An underlying problem which is little addressed in public, is the priority of the military defence sector. Here there are a number of changes taking place, but in articles in the Soviet press in January and February 1989, it was accepted that

some fifteen ministries are in fact part of the Military Defence Sector and although some of them have been identified in the Soviet press, not all of them have yet been itemised. The problems here are several. For many years the Soviet official data have given a figure of Soviet military expenditure which was clearly meaningless. In 1987, Shevardnadze, the Foreign Minister, promised that the Soviet Union would make clear how much it was actually spending on its military sector. But in the early months of 1989 there were several articles in the press by Deputy Defence Ministers and others indicating that the authorities had not yet been able to unravel what proportion of the expenditure was going to the Military Defence Sector. Towards the end of 1989 some data were released to indicate that the budgetary expenditure on the armed forces was in excess of R70 mlds per annum instead of the fictitious R18-20 mlds previously claimed. Few details accompanied the announcement and the possibility remains that these figures are still minimum estimates. Even so they took circa 20 per cent of budget expenditures. In October 1990 some data were provided to the United Nations, Military expenditure for 1989 was estimated at R77.9 blns but this excluded certain items, e.g. production of nuclear warheads was contained within the budget of the Ministry of Nuclear Power Generation. The burden of financing military expenditure may be much larger than the published data suggest and some Soviet sources have suggested that the military sector may take up to 50 per cent of the State Budget.

Consequently, the Soviet economy is still to a very considerable extent determined by the priority claims of the Military Defence Sector on its scarce resources. The number of men in the armed forces is circa 5,500,000 and the Industrial Defence Sector has to supply them with the military equipment necessary for a modern army. There have been reductions of the demands of the Defence Sector upon the general economy. Gorbachev announced at the United Nations in December 1988 that the armed forces would be reduced by 500,000 men and in April 1989 the first withdrawals began of several tank and artillery divisions from Eastern Europe, There have been reductions in certain categories of weaponry and the signature of the INF Treaty had led to the withdrawal of the intermediate missiles from Europe and to their destruction. These measures have led to the release of some industrial capacity from producing military equipment and some speeches by members of the Politburo have stated that every defence related enterprise must now produce one rouble's worth of civilian consumer goods for each one rouble's worth of military output. Simultaneously with this action the Food Processing Industry was placed under direct military control and administration. The reason given for this is that it was a very backward sector of industry and it needs to be completely reorganised and to have good management techniques introduced. Indeed, large capital sums have been allocated of the renovation of the Food Processing Sector and important large scale

foreign trade deals have been made with West Germany and Italy to provide for the importation of capital goods to produce equipment for the food processing sector. In general, 25 per cent of the imports of capital machinery into the USSR are destined to be for consumer goods.

In the sphere of foreign trade the monopoly by the former Ministry of Foreign Trade has been abolished and the very name of the ministry has been changed from that of Foreign Trade to Ministry of Foreign Economic Links. Many enterprises in the Soviet Union are now free, for the very first time in Soviet history, to make direct links with foreign customers and suppliers. This reform has placed on the agenda the question of the first steps, to a limited degree, of rouble convertibility. In a number of statements from late 1988, it has been indicated that the rouble may be devalued by 50 per cent or more from 1 January 1990.

By November 1989 the first auction for the rouble was held and a selected few Soviet enterprises were allowed to bid for $7.2 mlns of foreign currency. The 'exchange rate' established fluctuated above the level of R15 for £1.00. In auctions in the Spring and Summer of 1990 the 'rate' was established at closer to R30 for £1.00 while the official 'business exchange rate' had remained at £1.00 for R1. In November 1989 the tourist exchange rate was devalued tenfold - from £1.00 for R1 to £1.00 for R10. These prices for the roubles indicated how artificial the official rate of exchange was and that the path to a convertible rouble would be very painful. Some Soviet economists have canvassed the idea of the co-existence of two roubles where one would be 'hard' and convertible against other currencies and may be backed by gold whilst the second would be 'soft', non-convertible against other currencies but would have an exchange rate against the 'hard rouble'. This could be a possible solution to the problem but the idea has not found favour in governing circles. There is a limited experience of such a system as there were two roubles in existence during the years of the New Economic Policy in the mid 1920s when over a thousand foreign firms came into the young Soviet republic and engaged in Joint Ventures. Almost all the Joint Ventures were terminated with the implementation of the first Five Year Plan from 1928 and the convertible rouble ceased to play an active role.

During 1990 the problem of convertibility has remained a key question but has been overshadowed by the collapse of the internal rouble within the USSR. Late in October 1990 a Presidential decree introduced a new 'commercial' exchange rate of circa R3 = £1.00.

Another major reform which has been launched in the sphere of foreign trade is the series of measures to encourage joint ventures by overseas companies in the Soviet economy. By the end of December 1988 about 150 Joint Ventures had reached the stage of legal registration. None of these was related to a large energy project but it is known

that several very large investment projects totalling many billions of dollars are under active consideration and are passing from the protocol stage to that of legal registrations.

During 1989 and 1990 the number of Joint Ventures registered passed 1,000 but relatively few of these had passed from the stage of protocol and legal registration to economic activity.

In addition to the perennial problems of how to earn a return on capital invested whilst the rouble is still inconvertible further complications have arisen in the Summer of 1990 from the published decrees on taxation. In the final set of decisions the taxes levied could be so crippling as to prevent entirely the development of large scale projects and modifications were being sought from the Soviet authorities by Soviet and overseas firms. Even by the Autumn of 1990 Joint Ventures in the sphere of energy were either on a small scale or in the preparatory stages of drafting. Some had reached protocol agreement stage but were awaiting economic and practical implementation.

PROBLEMS FOR THE POPULACE

In the first years of Perestroika from 1985 until early 1989, a number of negative phenomena appeared. The supply of food and goods and services to the populace had become more difficult and in 1988 Pravda reported that food rationing existed in about half of the oblasts of the USSR and in the Spring of 1989, even Moscow had to introduce rationing for sugar. In some of the enterprises, the monetary earnings of workers have been reduced as the enterprises try to become self financing under the new Law of the Enterprises.

By the Summer of 1990 the supply of consumer goods to the shops had worsened dramatically, the most basic items, e.g. salt, soap, were wholly unavailable in some cities and irregular in others. Many regions and cities had introduced local legislation to limit access to shops selling consumer goods to registered local residents only and, quite literally, the national market was fracturing.

In the Summer of 1990 supplies of cigarettes to many cities failed and the newspapers reported "tabachniye bunty", i.e. tobacco riots. One of the worst expressions of this aspect of the crisis was the sudden failure of bread supplies to the shops - even in Moscow and Leningrad in August 1990.

The near collapse of the retail distribution system and the loss of confidence in the rouble led to the emergence of a parallel economy by the Spring and Summer of 1990 where goods and services in scarce supply were available for dollars but not for roubles. The press reported deals between enterprises in the form of barter and not for cash. Petrol and diesel fuel were reported by several major cities to be unobtainable and urban

transport had come to a halt with consequent disruptions to workers reaching their place of employment.

One of the most fundamental changes to have occurred in the Soviet economy is that in 1988 for the very first time in Soviet history, the number of people classified as 'workers' ceased to grow and there were signs that there was a turn to the development of a service economy. Two factors were at work simultaneously. There is a smaller number of people coming into the labour market than previously and of the reduced total working population, a shift has occurred from work in the manufacturing sector to work in the service sector.

Other problems were revealed in the later 1980s. In the Budget Speech at the end of 1988 the Minister of Finance revealed that a budgetary deficit of 35 billion roubles existed and that this had been hidden in the budgets of the previous decade. However, further examination of Soviet budgetary data reveals that the real deficit is probably closer to 100 billion roubles. A deficit of this size without the corresponding goods and services available to the population is creating not only a very difficult, but indeed, a very dangerous situation for the stability of the Soviet economy. Part of the problem is that the subsidies paid by the budget in order to maintain the prices of food, housing, transport and similar services at a stable level had been rising rapidly in recent years and in 1989 were between 80-100 billion roubles. The internal budgetary deficit has been made more difficult by the unfavourable turn in the terms of trade for the USSR. During the 1980s the price of oil on the world market has fallen steadily (until the Spring of 1989 when there was an up-turn (and again from August 1990).

In the Summer of 1989 it was revealed that the USSR was unable to balance its balance of foreign trade and could not fully service its overseas debts. By early 1990 there were reports that the USSR was, for the first time ever, defaulting on its payments for imports. Although a number of steps were taken and the position was eased it seems likely that this problem had not been fully resolved by the Autumn of 1990.

The general crisis of the Soviet economy worsened rapidly from the Autumn of 1989 and the failure of the 1987 Law of the Enterprises to overcome the systemic problems brought the decision-makers to the point of considering changes and reforms which can only be described as revolutionary, and rejecting almost every tenet on which the Soviet society had been built for seventy years.

The phrase 'the socialist market' was replaced by the euphemism 'the directed market' but this was soon replaced by 'the market'. New words came into existence in the language to describe the process of dismantling the order, e.g. 'razgosudarstvlenniye' the nearest translation of which is 'destatification' and was being used partially as an acceptable synonym for 'privatisation' and partly to describe the process of removing

enterprises from direct ministerial control and allowing them to function independently in response to market forces. There were numerous drafts by the late Autumn of 1989 each with a variation of how to tackle the problems of price reform, the subsidies, the budget deficit, the stifling ministerial control. All the variants had to grapple with the conceptual problems of how to convert an economy which consisted of about 100 vertical industrial-ministerial monopolies, which had grown for sixty years on the basis of physical output planning where monetary measurements were of marginal applicability, into an economy in which the customer would dictate to the producer what should be produced, the variety, the cost and all the other features of a market led economy.

This incredible conversion was to be attempted in an economy with only a very rudimentary banking system and communications infrastructure.

The first attempt to introduce some of these reforms was made by Premier Ryzhkov in the Summer of 1990 but the Supreme Soviet rejected his plans and voted to give powers to President Gorbachev to introduce reform measures by decree.

This action was taken by a Supreme Soviet which, for the first time in all Soviet and Russian history, had several elements of a genuinely elected Parliament. This body had come into existence in 1989 and had shown independence from the beginning. In the Spring of 1990 elections had been held in most of the Union Republics and in the largest of them, the Russian republic, resulted in Yeltsin being elected the President of Russia. As the RSFSR has within its boundaries over half the population of the USSR and circa 75 per cent of the mineral wealth, the resurrection of Yeltsin after his casting out from the Politburo in 1987 had enormous significance. The political crisis of the society had now worsened to the point that Gorbachev, Ryzhkov and the Union authorities could no longer be sure that their writ would run, not just in the far distant corners but in the largest unit of their multi-ethnic, multi-republic society.

The Russian government immediately rejected the Ryzhkov proposals and proposed its own 500-day crash programme to control money supply, end subsidies, 'destate', indeed privatise, many parts of the economy and reach the desired stage of a market economy within two years.

Ryzhkov attempted again in September to introduce a modified variant of his earlier proposals but for political, as much as for economic reasons he was forestalled and President Gorbachev was charged with presenting by mid-October 1990 a blueprint which would outline the best features of the Russian plan (drafted by Shatalin) and the Ryzhkov Plan even though the one point of agreement of all the authors of all the variants was that the Shatalin and Ryzhkov plans are irreconcilable.

Gorbachev presented his ideas to the Supreme Soviet in October 1990 but the 'Basic Directions' lacked clarity and precision. It seems likely that the energy sector will

be considerably shielded from market forces and will be controlled (together with money supply and defence) by a central inter-republican agency. Oil, gas, gold, diamonds and some other goods (yet to be specified) will remain under central control as 'all-union export resources'. The central government will continue to control the prices of fuel.

THE PROBLEMS FOR THE ENERGY SECTOR

It is against this background that the crisis in the energy sector has developed and the role of this sector in the new reformed economy has been one of the areas of fiercest dispute. Before considering the energy crisis, and the various proposals for it a short review of recent developments will help to place these problems in context and a better perspective.

The Long Term Energy Programme

In 1984 Politizdat published the main principles of the long term energy programme. This document charts the course of development of the energy sector well into the 21st century and frequent references have been made to this strategy and a revised, updated version had been promised for publication in 1989 but not realised by 1990.

The programme viewed the development of the energy sector in the general context of the transformation of the economy from an extensive path of development to an intensive mode of operation. It was envisaged that there would be:

a) a very active conservation policy
b) a speed-up of technical progress in the fuel energy complex and in the engineering industries supplying this sector
c) the output of electricity was expected to grow at a faster rate than the extraction and production of primary energy resources
d) a rapid development of the gas industry, both for the internal and foreign markets
e) maintenance of a stable high level of oil extraction
f) an increase in the volume and depth of oil processing
g) reduction in the use of fuel oil (mazut) at the power stations
h) use of compressed natural gas to replace motor fuel
i) development of synthetic motor fuels from gas, coal and combustible shales
j) the forced development of nuclear energy and construction of hydro and accumulator stations (i.e. pumped storage) in the European regions
k) the development of the coal industry mainly by a rapid enhancement of open-cast capacity in the Eastern regions and the building of large coal-fired power stations in the East

l) the building of hydro-electric power stations in the Far East, central Asia and Siberia

m) creation of the basis for a wide use of fast breeder reactors and of thermo nuclear synthesis

n) development of non-traditional renewable energy sources e.g. solar, geo-thermal, tidal, wind, biomass

o) development of optimal means of transport from the fuel deposits in Siberia to the European regions

p) overcoming the problem of unreliable fuel and energy supply by the creation of reserves of capacity in the fuel energy complex

q) ensuring a sufficiency of fuel and electricity for exports both to the Socialist countries and to the rest of the world.

The authors of the programme are aware that its realisation would involve increased expenditure in the fuel energy sector and in the engineering industry supplying it, and also that efforts would have to be made to locate industry closer to the energy sources.

Most importantly the energy programme was envisaged in two main stages:

Stage 1 (to run to circa 1990)

i) maintaining a high level of oil extraction

ii) a rapid increase in the extraction and delivery of Siberian gas to the European regions

iii) a rapid increase in nuclear energy.

Stage 2 (would operate from circa 1990 to 2000 and the first decade of the next century)

i) gas extraction will reach its maximum level

ii) there would be a continued expansion of nuclear power and of open-cast coal and of renewable energy.

Simultaneously with Stage 1 there would be a policy of conserving oil by:

i) rapid application of electricity where it can be substituted for gas and oil

ii) substitution of gas for oil, in particular as the fuel for power stations (the proportion of mazut [i.e. fuel oil] used at the power stations must be halved)

iii) substitution of oil in motor vehicles by diesel fuel and compressed gas

iv) further electrification of railways and urban transport

v) enhanced output of liquid hydrogen from deeper processing of natural gas.

These measures were intended to solve one of the major problems, viz: that of reducing the growth in consumption of fuel oil at the power stations.

In the European regions of the USSR the consumption of oil and gas would be reduced by the rapid development of nuclear energy west of the Urals and by building super high-voltage power lines to transmit the electricity generated from the coal of Ekibastuz and Kansk-Achinsk.

Simultaneously with Stage 2:

i) nuclear energy will be developed to a level which will satisfy the major part of the economy's increased demand for electricity

ii) there would be further rapid development of the gas industry

iii) in an enhanced development of the coal industry and an increase in the proportion of coal in all organic fuels there would also be an increased use of coal at the power stations.

The essence of the long-term energy programme adopted in the early 1980s was to stabilise the output of oil at about the level of 600-630 millions tonnes per annum (although the published programme was careful not to commit itself to a particular target we can deduce that this was the intended level). Wherever possible, oil would be substituted by gas and coal in the first stage and by coal in the later stages.

The oil thus saved would be used more and more as an input to the petrochemical industries instead of being burned in power stations and in vehicles and it would also be used as an export commodity, both within the CMEA bloc and in the hard currency markets. A limited amount of oil was also intended for export to Third World countries.

The rising internal consumption of electricity would be met partially by resource saving but mainly by rapid development of nuclear and hydro power. This was originally expressed in the current Five Year Plan 1986-1990, where the original aim was to generate circa 30 per cent of the electricity by 1990 from nuclear and hydro sources. This aim has been revised since Chernobyl and significantly scaled down. There has also been very considerable discussion in the Soviet specialist journals on the advisability of further development of hydro power.

The problem for the planners and decision makers is that many of the assumptions of the late 1970s and early 1980s have changed. The price of oil has tended to fall since 1980. Three Mile Island and Chernobyl have generated massive doubts about the safety of nuclear power and in addition to the safety factor, there is concern that nuclear electricity may not be cheaper than that produced by conventional methods.

In the case of the USSR it is possible that the cost of nuclear generated electricity may not be known even by the officials of the Ministry of Electrification and of the Ministry of Nuclear Energy. The extent of public anxiety about nuclear power is now an

important political factor in the USSR and in some of the non-Russian republics, e.g. the Ukraine, Lithuania, Armenia, the opposition to atomic energy stations (AES) has fused with strong nationalist sentiments. As a token concession to these feelings, the authorities announced the cancellation of six projected AES in December 1988.

When the Energy Programme was being drafted the wisdom of the rapid development of hydro power was never questioned in public but since a limited degree of glasnost in the press has been allowed there has been some highly polemical discussion of the merits and demerits of hydro power. Whilst this contrasts with the veil of silence drawn over matters nuclear, it has given us a glimpse of some of the processes by which decisions have been reached in the past.

Another assumption which has changed is that of the switch from endlessly striving for gross output measured in physical volumes to that of operating cost-effective, profitable enterprises, and eliminating loss-making enterprises. This poses fundamental questions for the energy sector.

Because the energy exports are the single most important item in its exports the USSR has to pay careful attention to movements in world prices, supply and demand. The fluctuations in oil prices have already been noted. The problems caused by the non convertible rouble have already been noted as have also the former multiplicity of exchange rates between the internal and the foreign trade rouble. As we have also noted, in the last days of October 1990 Gorbachev issued a set of presidential decrees included in which was a new 'commercial' exchange rate of circa R3 = £1.00 and an undertaking that profits could be repatriated.

The aim is to attain a fully convertible rouble sometime in the 1990s. This will be an exceptionally difficult operation after seventy years of strict currency control and it may prove to be a socially very painful operation.

If these measures in relation to the convertibility of the rouble are combined with internal steps leading to the establishment of prices determined by the laws of economics rather than by the decisions of central planners, we may well see a major re-orientation of internal energy policy as well as export policy.

If we take these factors together, plus the problems of the cost of capital investment, labour, infra-structure, etc. we can see that the earlier assumptions of the planners in trying to devise a long-term programme for twenty to thirty years ahead have proved to be based on shifting sands. During the years of 1987, 1988 and 1989 there has been an intense argument within the Soviet corridors of power on future energy policy and the attainment of a consensus is proving to be very difficult. As the economic crisis worsened in 1990 the divisions of opinion deepened and by Summer/Autumn 1990 there

was not only no agreement on a revised energy policy but there was also no agreement on a general strategy for the economy.

These arguments on energy policy rank with those on agriculture, on foreign policy, on arms policy. For the first time since the 1920s there have been limited opportunities for public participation.

The planners now have to pay serious heed to public opinion, particularly since Chernobyl, 1986 and since the March and April 1989 elections for the new style Congress of People's Deputies. The Spring 1990 elections in most of the republics and towns resulted in a variety of 'independent' and 'radical' groups taking control of many town Soviets as well as republic Soviets. By the Summer of 1990 most of the republics had declared their 'independence'.

THE MAIN SECTORS OF THE FUEL ENERGY COMPLEX

Electricity

The current Five Year Plan (1986-1990) envisaged a considerable renovation of existing generating capacity, but halfway through the Plan period there were indications of difficulties in achieving the targets and adequate data here ceased to be published. An interview by Izvestia (05.10.90) with a Deputy Minister of Power and Electrification revealed that "The equipment at most power stations is worn out: it has been used too long and had excessive demands made of it. It should have been replaced long ago. There is no reserve capacity to which we can switch while these plants are being overhauled".

An important contribution to saving fuel, is scheduled to be made by energy conservation measures but there are conflicting reports in the Soviet press on the success of these measures so far and until consumers become price sensitive to energy used there is little likelihood of serious economies in consumption.

The generating sector is experiencing difficulties in ensuring a steady flow of turbines from the engineering industries. The contribution from the nuclear sector has been scaled down since the Cherobyl explosion and there are considerable doubts about the contribution to electricity generation that will be made by the hydro electric stations. The coal supplies for the electricity generating sector are in the remote regions of the country, mainly in the Kuznetsk Basin (Kuzbass), Ekibastuz and Kansk-Achinsk as the coal of the Don field in the European regions is reserved mainly for the iron and steel industry. The two major fields of the USSR, the Donbass and the Kuzbass, which produce nearly 50 per cent of the country's coal, experienced strikes in the Summer of 1989 and throughout 1990 there have been reports of simmering discontent in the Donbass, of breakaway trade unions and the murder of one of the leaders of a breakaway union.

Much depends on the successful introduction of super high voltage transmission lines which will enable the cheap electricity generated at the fields of Kansk-Achinsk and Ekibastuz to be transmitted to the industrial region of the Urals without serious losses in transmission. If this strategy succeeds, it will relieve some of the pressure on electricity supplies to the southern and western regions of the European USSR.

The hoped for breakthrough in the generation of electricity by the Magneto-Hydro-Dynamic (MHD) method has not yet come about and the programme is several years over schedule. Whereas in the 1970s there were frequent announcements expressing the hope that the MHD method would improve the efficiency of electricity generation by fifty-plus per cent, statements in recent years have referred to improvements of twenty to twenty-five per cent. There was an announcement in 1988 in the statistical returns which suggested that the first electricity had been generated by the MHD method but later reports indicated that whilst this electricity was being generated at the Ryazan station, it was not yet a genuinely MHD method of generation.

In most winters there are numerous reports of electricity failures to both domestic consumers and to industry and the unreliability of electricity supplies is an important impediment to the development of an efficient industry.

Oil

In the middle 1980s the oil industry experienced severe difficulties in maintaining its output. It appeared to recover and in the first half of 1988 it seemed to regain some of its earlier momentum but in the late Summer of 1988 the monthly publications of economic data ceased in the usual sources and the annual result for 1988 showed that oil output was identical with that for 1987. As 1988 was a leap year, one would have expected a small increase in the region of 1.7 million tonnes, simply for the one extra day in the year.

In the Spring of 1989 the USSR was conferring with OPEC and NOPEC and some officials have been pronouncing in favour of "a stable level of price for oil".

With the reduction in the nuclear programme and the doubts about hydro power the pressure on oil from domestic demand has increased.

A number of the big western major oil companies have been conferring with the USSR on possible joint ventures in the oil industry and firm decisions may be made in the near future. With the rising cost of oil extraction and the difficulties of maintaining a flow of labour to the oil fields combined with the uncertainty of what should be the optimum size for the oil industry in a restructured cost conscious economy, there are more questions than answers, as the decade of the 1980s comes to a close.

During 1989 the output of oil first faltered and then went into decline. During the first half of 1990 the most serious fall in the whole history of the Soviet economy manifested itself and the USSR was unable to maintain its contracted supplies to the countries of Eastern Europe. Hungary, Czecho-Slovakia and Poland reported shortfalls of circa 20-30 per cent in deliveries of crude and some products. Within the USSR there were numerous reports of towns being left for days at a time with no petrol or diesel for urban transport and during the harvest tens of thousands of harvesters were idle from lack of fuel. By the Summer of 1990 it was very clear that there was no hope of the original target of 635 million tonnes being attained in 1990. Output for the year is almost certain to be below 600 million tonnes and the question being discussed in the Summer and Autumn of 1990 is whether output will be close to 550 million tonnes or 575 million tonnes. 1990 output was at least 5 per cent below the level of 1989.

This breakdown in the volume of oil lifted has occurred at a moment when the USSR could have resolved several of its major problems if it had the oil to sell. From 1 January 1991 sales to other Eastern European countries should be at world prices in convertible currencies but there are doubts if either the USSR can supply the oil or the Eastern Europeans will have the convertible currencies to pay for it. The Iraqi invasion of Kuwait in August 1990 and the consequent rocketing of the international oil price has had a very negative effect on several of the economies of the smaller countries of Eastern Europe whilst the USSR has been unable to take full advantage of the higher oil prices by increasing its exports.

The reasons for the sudden fall in oil output are numerous but only partially discussed in the Soviet sources. The 'easier' fields of W. Siberia have been worked and it is now more difficult and more costly to raise the oil than before.However, too much emphasis should not be placed on this factor as it has been known and discussed for some years and its impact could be anticipated. The more immediate reasons for the decline occurring in 1989 and 1990 are to be found in the dislocations in the ill-considered moves to a 'market economy' and in the ethnic disturbances which have dislocated the flow of essential parts from monopolistic suppliers.

The prices of oil have been directly controlled by the central authorities but the prices of essential components for the rigs have been 'liberated' by the moves to industrial self-financing . In one partially reported incident the Prime Minister, Ryzhkov, had to intervene in a dispute between the engineering ministries and the oil industry for the oilmen wished to buy only spare parts for the existing rigs but the engineering factories had insisted on selling complete rigs.

The conflict between Azerbaidjan and Armenia over Nagorny Karabakh and the resultant imposition of martial law in Baku together with the disruption of the railway

system have interrupted the flow of key parts for the rigs from the Baku factories which occupy a near monopoly position in the manufacture of certain components.

The W. Siberian labour force has always been subject to considerable turnover but during 1989 and 1990 this worsened as supplies of food to the settlements became irregular. By the Spring and Summer of 1990 there were numerous threats of strike action which were narrowly averted by the personal intervention of Prime Minister Ryzhkov, promises of food and the spending of part of the hard currency receipts from oil exports on scarce consumer goods and medicines for the oil regions.

Gas

The rate of expansion of gas extraction is on an unprecedented scale and the very rapid rate has been maintained for a decade. As yet, there are no signs of a serious slowdown, but a few warning voices have been raised that gas is repeating the mistakes of oil in earlier years in extracting the easier deposits and moving onto new deposits to maintain high levels rather than invest in extraction from older deposits.

Gas is still important in the exports of the USSR, but the amounts contracted to be sold in Western Europe have not reached the levels predicted in the early 1980s when the great international furore raged over the Soviet gas pipeline to Western Europe. It is unlikely that the capacity of 40 billion cubic metres per annum of the gas pipeline from the USSR to Western Europe will be fully used for some years to come.

A problem for both oil and gas is the poor quality of the pipelines along which most of these fuels are transported. The problem was dramatised in an horrific fashion in the Summer of 1989 when almost 600 passengers near Ufa were incinerated by a spark from two passing trains which caused gas leaking from a faulty pipe to explode in a fireball. From the materials submitted to the Commission of Enquiry, parts of which have been published in the central press, it has emerged that Soviet pipelines have a life expectancy of only 10 years whereas international experience expects a life-span of circa 30 years even in harsh environments. But of even greater significance is the absence of any 'pigs' from the pipelines to explore them and report possible weaknesses and fractures. The Ufa explosion happened because the gas had been leaking for some time, had accumulated in a depression but nobody in the control systems had either fore-knowledge that a leak might occur or knowledge of it after it had occurred.

The first half of 1990 has seen the publication of more articles in responsible journals of the problems of the pipelines, resulting from the very rapid rate of building in the 1970s and 1980s without due attention to quality, prophylactic investigation or maintenance. Several major oil and gas leaks have been reported in 1990, fortunately without the great loss of life of 1989.

Nuclear

This is a problem sector. Public attention to the health and safety aspects of nuclear power in the USSR has reached unprecedented levels and since the Chernobyl explosion in April 1986, the opposition to nuclear power has grown stronger and stronger.

No data have been published on the costs of construction of a nuclear power station or of the costs of generating nuclear electricity but international experience shows that nuclear stations are expensive to build and run. In the pre-perestroika period the cost was of secondary importance but now it should become the cardinal factor.

Public disquiet over nuclear power has merged with national unrest and the continued lack of reliable data has added to Soviet public worries.

In the late 1970s and early 1980s there were numerous articles in the press on the building of reactors at Atommash on the flow-line principle. However, after a non-nuclear explosion at the factory in the early 1980s little has been heard of this venture except that in the spring of 1989 there was a short report that Atommash was still working well below capacity.

Since Chernobyl the Soviet Authorities have been co-operating with the International Atomic Energy Authority (IAEA) and inspections of Soviet nuclear stations are now a regular feature. In May 1989 a protocol was signed by the main nuclear producing powers establishing a new organisation to render international help in the case of nuclear accidents.

In December 1988 the Soviet authorities announced that six nuclear power stations were to be closed. On closer inspection only one of these - the Armenian AES - was an operating station. The other five, Georgia, Azerbaidjan, Odessa, Minsk and Krasnodar were in various stages of construction. Odessa and Minsk may have been fairly well advanced in construction but little is known of the other three. The closure of the Armenian AES in March 1989 is causing difficulties in electricity supplies in the Caucasus as this station generated 12% of the power consumed in the Transcaucasian republics. The 1990 electricity shortages in the North Caucasus regions have been caused by the temporary shut down of the Rostov nuclear station. The question arises of what alternative plans are being implemented to generate the electricity which the stations would have supplied if they had been completed. By the Summer of 1990 almost complete confusion reigned over the role and future of nuclear power generation. A number of scientists were calling for the continued expansion of this sector whilst local Soviets at town and republic level were declaring for the shut-down of all nuclear stations within their territories. Many of the stations were closed for periods of time whilst post-Chernobyl modifications were made. Yet other new nuclear stations were completed e.g.

the Crimea AES was built but not switched on to provide power for the grid. To confuse matters even more there is a statement from Deputy Minister Petrayev that the Armenia station may be re-opened. He does not address the problem that this station has been built in the seismically active region where the great earthquake of December 1988 killed many thousands of people.

Almost the only certainty about nuclear power in 1990 is that it will not contribute the percentage of electricity envisaged in the 1986-1990 Five Year Plan and the volume generated in 1990 may be less than in 1989.

The problem of electricity supplies from the nuclear stations is of great importance to Eastern Europe. Bulgaria, Hungary and the former East Germany have operating Soviet AES. Czechoslavakia has AES partly of Soviet and partly of Czech construction. Romania is trying to install a Candu reactor and Poland has finally decided not to build an AES of Soviet design.

In varying proportions the countries of Eastern Europe have energy problems and their economic plans have heretofore been built on the basis of Soviet oil and gas plus nuclear electricity.

Economic considerations may well incline the decision makers in one direction but political factors could lead to another. Even after the downward revisions following the Chernobyl explosion, the nuclear power stations are still planned to be the fastest growing sector of the electricity generation.

At the start of the current Five Year Plan in 1986 the AES provided 9% of installed capacity of all power stations and by the end of the Plan the nuclear stations should account for 17.8%. It was planned to install a total of MW85,300 of new generating capacity within the USSR in the years 1986-90 and MW40,500 were intended to be nuclear, i.e. 47.5% of the total. This can be expressed another way by showing that there will be a 21.8% expansion of electricity generating capacity within the current Five Year Plan but within that overall figure the nuclear sector would expand by 240%.

These figures were for the whole of the USSR but when analysed for the European regions of the country, the contribution of the nuclear sector is even more striking. On 1 January 1986 the AES provided 15% of the capacity of the power stations between the Urals and the western frontiers and by 1 January 1991 it was intended they should provide 29%. It is planned to install MW51,500 of new capacity in these regions and MW37,900, i.e. 74%, was planned to be nuclear (see tables in Appendix 1).

The success of the plans for nuclear power installation are crucial for the whole of the generating sector and hence for industry, agriculture, transport and domestic consumers.

The revised schemes of the new energy programme which should have been published in 1989 but which by the Summer of 1990 have still not seen the light of day, will have to clarify the role of nuclear power stations in this post-Chernobyl era.

Hydro

Most of the hydro potential of the European regions has been harnessed and before the reform movement gathered momentum there were grandiose plans to harness the mighty rivers of Siberia. Siberia already has the huge hydro electric station (HES) at Bratsk with MW4,500 capacity and Krasnoyarsk with MW6,000 and plans were announced to build a hydro station of MW20,000 beyond the Arctic Circle.

But now all is in doubt. During 1988 and early 1989 there were sustained attacks in the Soviet journals on the hydro power stations for being expensive to build and for causing great ecological damage.

Hydro stations experience several persistent problems. The big ones can take up to twenty years to build and when built they may be unreliable in operation as they have to compete for the water with agriculture and with shipping: in years of low rainfall some of the HES cannot function at all.

Some of the articles in the public argument in the press have alleged that no account is taken of the cost of the agricultural land flooded by the HES, nor of the historic villages lost in the waters of the big reservoirs. The antagonists and the protagonists in the dispute have not been able to agree even on the areas of land flooded.

The ecological accusations against the HES are not only that they have flooded millions of hectares of good agricultural land but that they have also destroyed valuable fish resources and their reservoirs distort the local micro-climate. From the viewpoint of the planners of the Fuel-Energy Complex the HES have provided a substantial source of power and if their development is to be halted or seriously scaled down, then the question again arises of what will be the alternative sources for generating electricity.

A possible solution of the argument over HES is to continue building smaller HES on the big rivers. The revised Long Term Energy Plan may contain some indications of the resolution of this dispute.

LOCATION OF RESOURCES

The USSR covers one-sixth of the world's land surface and within that mighty expanse there are some of the world's greatest deposits of oil, gas and coal. The USSR authorities have not published reliable data on the extent of reserves for some fifty-plus years but we can estimate that about forty-plus per cent of the world's gas is within the USSR and about 20-25 per cent of the world's oil and coal.

However, despite these impressive figures of resources, the USSR has a persistent problem in that these massive energy resources are remote from their consumers (both internal and abroad). Of the total population of nearly 290 million, circa 200 million live and work in the regions between the Ural mountains and the western frontiers but the oil, gas and coal reserves of West Siberia, Ekibastuz, Kansk-Archinsk, Yakutia, etc., are in remote and climatically hostile regions to the east of the Ural mountains.

This imposes very heavy transport and other infrastructure costs on the fuel energy complex, e.g. Soviet sources estimate that 40 per cent of the railway capacity of the country is engaged in moving fuel (mainly coal). For most of the post-war period, the main oilfield was the Volga-Urals field but this field reached its peak in the middle 1970s and is now in decline. In the early 1960s, development of the West Siberian fields started and by the late 1970s it was the premier field of the USSR, indeed of the world. It is now producing over 60 per cent of the USSR's oil output. Its difficulties in maintaining its output of more than 300 million tonnes per annum in the middle 1980s appeared to have been resolved after the much publicised visit to West Siberia in the autumn of 1985 by Gorbachev but the unexplained erratic publication of energy data for several months starting in 1988 and the final output figure of oil for 1988 being identical with that for 1987, raised queries in the mind of the observer, about the current performance of this major field.

During 1989 the publication of data was still erratic but it became clear that output was again beginning to decline and the year end output of 607 million tonnes showed that the second half of the year had performed worse than the first half.

The decline continued during 1990 and the results for January to September, suggested that the final output figure for the year of 1990 would be circa 550 to 570 million tonnes, which would bring output close to the level of 1980. Most of the problems of maintaining oil output were in the West Siberian field.

This super-giant West Siberian Oil and Gas Complex functions with a very limited infrastructure of roads of railways and it has been possible to develop this field only through large helicopters which bring in the men in shifts and convey the engineering materials from the riverbanks where the ro-ro ships have brought it in during the ninety or so days that the Arctic Ocean is navigable. Winter temperatures of -50° impose exceptional burdens on men and machinery as well as considerably adding to costs.

The coal fields of Kansk-Achinsk and Ekibastuz are much further to the south but they also experience the extremes of climate associated with the central continental land mass. Similar problems pertain to Yakutia.

The problems of this dislocation of resources and consumers are compounded by the very underdeveloped infrastructure of roads and railways. The solution envisaged by

the authorities is the dual one of encouraging the location of industry in the eastern regions and simultaneously trying to develop more efficient and cheaper ways of transmitting coal, oil and gas to the consumers in the West. The USSR is very active in developing Super High Voltage Transmission lines for electricity, slurry forms for moving coal and a large network of oil and gas pipelines traversing Siberia and Europe.

It is this internal energy deficit in the more developed European regions which is a prime spur to the rapid development of Nuclear Power Stations in the European regions.

The Don coalfield is located in the European region of the country and with an output of circa 200 million tonnes per annum it is the premier field in the USSR. Its coal is of high quality and is, in general, reserved for the iron and steel industry rather than for use at power stations. The field has been operated for over 200 years and unlike most of the other Soviet coalfields it has very narrow seams and fractured structures which make the application of mechanised mining methods difficult. The coal from the Moscow field is of poor quality and is not of a significant quantity. The Kuzbas coalfield in the Kuznetsk basin is the second largest producer of coal and is currently yielding circa 150 million tonnes per annum. This coal is of reasonably good quality and easier of access than the coal in the Don field. In the early and middle 1980s there was a big public dispute between the Kuzbas field and the Donbas, for the Kuzbas field argued that the Don field was receiving a disproportionately large amount of the capital investment allocated to the coal industry and that it would be wiser to divert the investment to the Kuzbas field where per rouble invested the return in coal would be greater. To the east of the Kuzbas field lie Kansk-Achinsk and Ekibastuz. Both have vast deposits which can be calculated in thousands of millions of tonnes of coal and both can be worked by the open cast method. However, the problems with both of these fields lie in the quality of their coals. Both fields yield low quality coal with a high content of noxious chemicals which make if difficult to burn in the power stations. Some of the coal is self-igniting and possibilities of transporting it are limited. Since 1988 there have been repeated claims in the Soviet press that a transmission line with a capacity of 1,150 KV has been built and is bringing electricity from the Ekibastuz field the 700 kilometres to Barnaul. It is claimed that this line completes the unification of the European USSR, the Central Asian and the Siberian grids. Interestingly, the annual volumes of economic data have not yet begun to include this transmission line of 1,150 KV and in the autumn of 1990 its exact status is still uncertain.

INVESTMENT

The Fuel Energy Complex is one of the main recipients of capital allocations in the USSR economy. In most years only the agriculture, transport and communications, housing and the conglomerate category of trade, communal economy, timber, procurement, science, culture, art, education, health, sectors receive more than the Fuel Energy Complex.

It is very important to note that the Fuel Energy Sector is not only the biggest recipient of industrial investment (receiving more than either engineering or the chemical-timber complexes) and that the amounts invested have almost doubled from 1971/75 to 1981/85 but also that it is receiving a growing proportion of the total invested in industry.

Until the changes in policy towards foreign capital in 1988-90 and the invitation to the Western oil majors to participate either in Joint Ventures or to invest in wholly owned subsidiaries the USSR had virtually no access to outside sources of capital for industrial investment and it all had to be generated from internal sources. A persistent and fundamental problem has been the difficulties experienced in generating a sufficiency of capital to achieve all the objectives set by the planners in physical terms. The volumes of incomplete capital construction have been highlighted by Gorbachev and his fellow reformers as one of the most urgent asks needing resolution. Hence capital investment is a crucial indicator of the relative importance of the Fuel Energy Complex in the Soviet economy.

From Table 1 (see Appendix 2) it will be seen that in the years 1971-75 the Fuel Energy Complex received 10.1 per cent of the total capital invested. In 1976-80 it received 10.5 per cent of the total capital invested and in 1981-85 12.9 per cent of the total.

Table 2 gives the breakdown of the direction of investment into each of the main sectors of the Fuel Energy Complex, ie for electricity, coal, oil and gas. Since 1985 the volumes of economic data have amalgamated the information on capital investment and we can no longer follow the amounts invested into the sub-categories of electricity, oil, gas, coal, but from Table 2 we can see there has been a very marked rise in recent years. Table 2 illustrates that it was the oil sector which had the most rapidly increasing volumes of investment allocated to it, viz: from 17.9 milliard[1] roubles in 1971-75 to 50.3 milliard roubles in 1981-85, we may reasonable assume that it is the oil sector which is still taking an increasing proportion of the enhanced amounts of capital allocated to this sector.

However, the output of energy did not rise in the same fashion and in the coal and oil sectors there were some periods of a down turn in output (see tables of output for coal,

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[1] Milliard = billion

oil, gas and electricity). The electricity generating sector also experienced severe difficulties in these years particularly in the nuclear power division.

Tables 3 and 4 show the output of oil, gas and coal in physical volumes and converted to conventional fuel compared with the amounts invested. More and more milliards of roubles have to be invested to reverse the decline in output.

LABOUR IN ENERGY

For many years the Soviet Authorities published no data on the labour force in various industries but some data have been released in the later 1980s and selections from these are given in tables 5 and 6. The USSR is experiencing a critical shortage in the numbers of young people entering the labour force compared with earlier years. Whereas in the past the labour force grew by several millions in each plan period the middle years of the 1980s have seen a slowdown in the growth of numbers available to, and employed in, industry. In 1988 the Statistical Authorities reported the first peacetime decline in the numbers employed in industry. There is also a small shift of employees away from the manufacturing industries to service industries.

The labour problem for the fuel energy sector is that its requirements are mainly for young male workers to go and work in areas of very hostile climate where the infrastructure is underdeveloped. Premium wages are paid but there is a general shortage of goods and services to purchase. The shortages of food and consumer goods have provoked labour disturbances in the coalfields. In the summer of 1989 most of the pits in the Kuzbas and Donbas fields struck for several days. The thrust of their demands was not primarily for more money but for guaranteed supplies of food, soap, medicines and other basic commodities. Although no comprehensive data have been published we know from press reports that labour turnover in these industries is an acute problem. In many respects the problems for the USSR are similar to those of the North Sea and Alaska but on a much greater scale.

Table 6 shows the annual average numbers of industrial production personnel in the Fuel Energy Complex. The sources offer no definition of industrial production personnel but the figures give us some notion of the numbers employed. There are some discrepancies in the numbers and these are discussed in the footnote. The discrepancy diminishes over the years and it may be connected with the decline in production and consumption of peat. It is not significant.

Table 7 attempts an elementary calculation of the calorific value raised by oil, gas coal workers. There are no data published to show the value of output in roubles and these calculations are intended to give some idea of the value created per worker.

However, care should be taken in drawing too many conclusions as we lack precise definitions of the workers counted in these tables.

Very little data have been published by the Soviet Authorities on their refining capacity but some recently released data gives us some indication of the number of workers in the refining complex. The problem with interpreting these data is that these are large amalgamated groups, thus Chemical and Petro-chemical Industry into which Chemical industry and Petro-chemical are sub-divided. There is a discrepancy in the figures of Table 8 which is not explained by the compilers of the volume Trud V SSSR, viz the additions of the data for the Chemical and Petro-chemical Industry do not agree with the totals given in the Chemical and Petro-chemical Industry entry.

We have seen from the data on investment that the volumes of capital invested in the energy sector have grown at much faster rates than the capital invested in industry overall or in the whole economy and from the output data we have observed that, apart from gas, the output has not increased at the same rate as the investment of capital.

Consideration should be given by the outside observer to the possibility that increased capital investment has facilitated a reduction in the number of personnel and has increased productivity per worker. The data in Table 9 - Energy Output in Physical Terms and Numbers of Workers - examines the changes in output per worker from 1950 to 1987.

From these data it can be seen that the number of workers in the fuel energy complex does not rise at the same rate as the increase in capital investment.

The tables on the calorific value of the fuel obtained by the workers in the different sectors and the table showing the output produced in physical units gives some idea of the problems which the planners in Gosplan, the Central Committee and the Politburo have to take into consideration when making judgements on capital investments and on export policy for the various fuels. It could be seen that the oil workers were contributing 36,000 kilocalories per worker by 1986 and this compares with 150,000 kilocalories in the Gas Industry and a mere 2,480 kilocalories per coal miners.

By combining the data showing the increased investment in oil, gas, coal with the calculations derived from the data in Table 7 it can be shown that:

<u>Oil</u>

1975-80	Capital invested in oil increased by 79%
"	Labour employed in oil increased by 24%
"	Output of Oil increased by 23%
1980-85	Capital invested in oil increased by 53%
"	Labour employed in oil increased by 18%
"	Output of oil decreased by 1%

Gas

1975-80	Capital invested in gas increased by 15%
"	Labour employed in gas increased by 21%
"	Output of gas increased by 50%
1980-85	Capital invested in gas increased by 82%
"	Labour employed in gas increased by 6%
"	Output of gas increased by 48%

Coal

1975-80	Capital invested in coal increased by 79%
"	Labour employed in coal increased by 7%
"	Output of coal increased by 2%
1980-85	Capital invested in coal increased by 53%
"	Labour employed in coal increased by 8%
"	Output of coal increased by 1%

EXPORTS OF ENERGY

The USSR has been one of the world's major energy exporters and in 1988 exported 205 million tonnes of oil but since then the overseas sales of oil have fallen as the industry ran into greater and greater difficulties in lifting oil. By 1990 several countries of Eastern Europe were reporting that the USSR had failed to deliver the amounts contracted and in the autumn of 1990 there were unconfirmed reports of the USSR importing petrol from some Western European countries. Gas is being sold in substantial and increasing quantities but whilst sales of coal and electricity are a relatively low proportion of total output, the export of electricity continues to grow.

The rate of increase of electricity sales is worth noticing and in the years to the end of the century we may well observe electricity sales rising to substantial levels.

Oil

At the end of the 1970s serious doubts were expressed about the ability of the USSR to maintain the level of oil output and some forecasts were made that oil exports would fade in the decade of the 1980s. There was substance in these forecasts in the sense that it was providing more difficult and more expensive to maintain and increase the level of output of oil but apart from difficulties in 1984 and 1985 and again from the second half of 1988 the flow of oil was maintained and the volume of oil exported has risen until 1988.

Table 10, USSR Exports of Energy, shows 67 million tonnes of crude oil exported in 1970, 119 million tonnes in 1980 and 144 million tonnes in 1988 but the volume exported in 1989 fell to 127.3 million of crude and 57.4 million tonnes of products (down

from 61 million tonnes in 1988). The 1990 level of exports is likely to be lower in volume but may earn more dollars as a result of the violent price fluctuations in the autumn of 1990. There have been unsubstantiated rumours that the USSR has imported petrol from Western Europe during the second half of 1990. The Soviet source for these reports was an article in Kommersant No 42, p26 of 22-29 October but it did not quote with precision the origin of its data.

The overall figures are impressive when set against the background of the problems in the world oil business since the first and second price rises in the early and late 1970s and the collapse of the oil price for most of the 1980s.

But the analysis of Soviet oil exports can be taken further. In the late 1970s decisions were taken in the USSR that Soviet oil exports to Eastern Europe would be stabilised and then reduced and that the East European countries would introduce nuclear capacity to generate a substantial part of their electricity as well as taking other measures to diversify their economies away from Soviet oil. In the event the sale of Soviet oil to Eastern Europe has stabilised but a marked reduction and then decline has occurred in 1990. This has not come about as the result of a planned phase-out of oil in favour of nuclear power but, as a result of the decline in output and the simultaneous disintegration of the East Europe trading bloc, COMECON. In January 1990 it was decided that from 1 January 1991 the trade amongst its members would no longer be in the Transferable Roubles used as accounting devices but would be in convertible currencies at world prices. The political changes in East Europe of 1989 and 1990 have brought in their train a major restructuring of the economic and trade systems which had developed over the 45 post war years and at the centre of these changes in the sphere of foreign trade was the switch from subsidised Soviet oil and its tenuous relationship to world prices through the five year sliding average to a market system at world price levels.

The stabilisation and then decline of the volume of sales to Eastern Europe should have resulted in a greater volume of oil becoming available for export to the hard currency countries.

If the OECD/IEA data on oil imports and exports are analysed it can be seen that between 1975 and 1985 the USSR noticeably increased its market share.

From Table 11 it will be seen that Soviet crude oil exports to OECD countries rose from 6 million tonnes in 1976 to almost 50 million tonnes in 1984. There was a fall back in 1985 (but a recovery in 1986). As a percentage of OECD imports from all regions, these sales of oil from centrally planned countries rose from 1 per cent in 1976 to 8 per cent in 1984, 7 per cent in 1985 and for the USSR alone its market share rose from less than 1 per cent in 1976 to 5 per cent in 1985-86.

In the case of OECD category B2 ie Products, the USSR's 'market share' rose from 3 per cent in 1976 to 10 per cent in 1985. Thus Soviet exports to the developed countries of the world grouped in OECD represent a very successful achievement in the years later characterised as the 'era of stagnation'.

The long-term strategy which these figures reveal also has its downside in that whilst there have been two dramatic leaps in oil prices in the last 20 years there has been a steady slide downwards in price - particularly from 1980 to 1988.

The journal Ekonomicheskaya Gazeta, No. 43. p4 of 1988 expressed the Soviet dilemma neatly when it wrote that:

> "The policy of fixed prices is in defiance of economic laws and the 'oil boom' concealed the need for reform. For years the problem was ignored and now it presents itself as an accumulated and aggravated problem. Income from liquor sales also concealed the problem.
> Previously 1 tonne of oil bought 2 tonnes of grain, now the position is reversed."

The decisions which Soviet planners have to take on oil raising and oil exports are very difficult ones but there is one factor which has been constant and will remain so for some years to come. Oil is the only commodity which the USSR can sell in substantial quantities on the world markets which is capable of generating large volumes of hard currency.

Whilst sales of gold, arms, diamonds and some other minerals are important none has the earning capacity of oil and the world markets for these items have limited abilities to expand. Until the USSR can develop a more varied export capacity it is likely that they will attempt to persist with the oil export policy.

The earnings of the USSR from oil are perhaps a little larger than the figures suggest for countries such as Libya, Iraq and some others are recorded as exporting oil to the USSR but much of this oil is in fact sold on hard currency markets.

USSR exports to Third World countries are not big in quantity or in value but they are important in the context of the energy and debt problems of some of these countries.

Gas

Table 10 on 'USSR Exports of Energy' shows the amounts of gas exported rising from 3 mld cu m in 1970 to 54 mld cu m in 1980, 84 mld cu m in 1987 and 88 mld cu m in 1988 but after this date the publication of the volume of gas exported ceases in the foreign trade sources.

As already noted the output of gas is still rising at a spectacular rate per annum and there would not appear to be supply constrictions on maintaining and expanding gas exports. The hesitations and restrictions are on the side of the customers, particularly in Western Europe.

The great sales of Soviet gas to West Europe which were anticipated in the early 1980s have only partially materialised and breakdowns in regular supply have been caused more by technical malfunctions than by political embargoes. The gas pipeline is still being extended and it is likely that sales will commence to Greece and parts of Asia Minor. The price at which the gas is sold is a closely guarded secret but it may be deduced that it is linked to the price of oil and a basket of currencies.

Within the USSR voices are sometimes raised against the policy of 'selling our gas to the West. It would be better to preserve it for the future' but so far the views of these economic dissidents have not prevailed.

Electricity

The East European countries are integrated with the Soviet grid and a substantial part of the electricity to be generated in the AES of the Western regions of the USSR is scheduled for Eastern Europe. A 750 kV power line is operating between Hungary and the USSR and there were plans to extend these high voltage lines further. The USSR has supplied Finland and Turkey with electricity for some years and there were reports that Austria was to take Soviet electricity from January 1985. Mongolia has bought modest amounts of electricity and in March 1989 it was announced that North Korea would become a customer.

A development which may become important in the future is that several links have been made between the grids of East and West Europe. In addition to the power lines between Finland and the USSR there are links between East and West Germany. The development of the links between the grids of East and West Germany have been overtaken by political events. In the late autumn of 1989 the East German government collapsed and on 1 July 1990 the West German mark became the sole currency. On 3 October the two Germanies were re-united into one state and negotiations immediately began to sell the East German electricity generating industry to a consortium of companies from Germany, France, Italy and Britain. As the grids of the former East and West Germanies are brought together in a fully integrated system Germany will occupy an interesting position as the one country fully integrated into the grids of East and West Europe.

Another feature which has been worthy of note, at least until 1989, has been that4 the exports of electricity have grown steadily and by 1989 had reached 39 bln kW hours.

Coal

As will be seen from Table 12, giving data on the Proportion of Total Energy Exported, the amount of coal sold abroad is not significant and this is unlikely to change in the near future.

The major coal fields, apart from Donbas, are remote from possible export markets and the cost of transport would be prohibitive - particularly as, apart from the Donbas, the coal is of low calorific value. An exception to this generalisation is the export of circa 5 mln t of coal per annum to Japan on a long term contract of 20 years in repayment of Japanese investment in the Baikal-Amur railway.

A PROVISIONAL CONCLUSION

By the summer and autumn of 1990 the whole Soviet economy was in a state of profound crisis and the energy sector was suffering from particular problems as well as the general malaise.

Output of oil and coal were falling and the rate of increase in gas extraction was slowing noticeably and the output targets for the Five Year Plan set in 1986 for December 1990 could not be achieved. Whilst output was falling and export contracts to countries of East Europe for oil were being violated there was considerable argument within the upper echelons of the USSR administration over whether or not the energy sector was to be released into the 'market' sector of the economy or would be retained under central control and work to State Orders. The resolution of this question is of fundamental importance not only to the Soviet energy sector and the Soviet economy but also to the world economy as Soviet exports of oil (and to a lesser degree, gas) are an important element and any sizeable reduction or increase in exports will have an effect on the pattern of world trade in energy.

The question of whether the energy sector stays within the 'State Orders Sector' operating at prices fixed by State Committees and not formed by supply and demand or whether it 'marketises' and its prices approach those of world levels is central to the fate of the marketising reforms and world energy trade. This question has close links with the attempts to make the rouble into a convertible currency. By early November 1990 there are several operative exchange rates for the rouble, most of which are determined by administrative fiat and only one has a tenuous link with the forces of supply and demand. These rates are:

R1 = £1	is the Official rate
R3 = £1	is the Commercial rate
R10 = £1	is the Tourist rate
R30 = £1	is the Auction rate

It would, at first sight, appear to be a simple matter to compare these exchange rates with the known data about energy prices within the USSR but this is, in fact, very misleading. The State pays R25 per tonne for oil lifted (R23 in the main West Siberia field) and sells it, within the USSR, for R30 per tonne, whilst in the world market oil has been sold in 1990 at prices ranging from $750 to $2,000 per tonne. The conversion of any of the four officially sanctioned rates given into world prices is complicated further by the system operative within the USSR until November 1990 of 2,000 coefficients to convert the internal rouble into the foreign trade rouble. The present and future of the energy sector is complicated further by the constitutional crisis within the USSR over the rights and authority of the All Union government of the USSR and the government of the republics, for a result of the relatively free elections to republic Supreme Soviets has been the election of republic governments claiming sovereignty over all the mineral resources within their boundaries and resolving that all Union law has validity only if approved by the Supreme Soviet of the republic. The clearest example of this conflict was in October 1990 when the Supreme Soviet of the Russian republic and the Supreme Soviet of the USSR simultaneously declared that each had primacy over the other but neither was in a position or condition to enforce its will. As circa 75 per cent of the USSR's energy deposits are located within the Russian republic this conflict threatened not only the stability of the Union but also any decisions that might be made about investment, pricing, privatisation or any other aspect of policy.

The fate and role of the energy sector are further complicated by the inability of either the Union government or the republic governments to devise and implement a coherent programme of economic reform. Since the autumn of 1989 various projects have been drafted, revised and rejected. The Union Supreme Soviet rejected Ryzhkov's plans in the mid-summer. The Russian republic produced its own 500 Day Version, a Joint Commission of the Union and Russian Supreme Soviets failed to produce an agreed and acceptable version by early October. Finally President Gorbachev produced his own 'compromise' version which was accepted by the Union Supreme Soviet. Meanwhile the Russian republic has made declaratory proclamations that it is, is not, going ahead with the 500 Day Programme. A close reading of Gorbachev's 'Main Directions' fails to reveal any clear ideas on the solutions to the numerous problems besetting the country but the President has been voted unprecedented powers to rule by decree and introduce the reforms.

The USSR has been experiencing a profound political, economic , constitutional and moral crisis which has been gathering pace during the 1980s. The very existence of the Union is now open to question and the chances and possibilities of civil war are openly discussed. The old centrally planned economy (administrative-command in the current

jargon) has long outlived its usefulness, even though it transformed a backward peasant economy into a military super-power at a terrifying and incalculable human cost, but there is no understanding of what it should become or how to proceed if the destination were known. There is a mass popular rejection of the old system but equally there is massive opposition to the introduction of the market, private property, an end to subsidies and other measures associated with the present proposals. A profound tragedy of the late 1980s and early 1990s is that neither the proponents nor the opponents of 'the market' understand either the benefit it can bring nor the problems and difficulties associated with it.

We are witnessing the collapse and disintegration of an economy (and perhaps the society) but as yet there is no clear sight of what will emerge.

APPENDIX 1

TABLE A - CAPACITY OF ELECTRIC POWER STATIONS AND OUTPUT OF ELECTRICITY

	Output from all Power Stations		From HES				From AES			
	Capacity in MW	Output of electricity in blns kWt hrs	Capacity In MW	Capacity As % of total	Output In blns kWt hrs	Output As % of total	Capacity In MW	Capacity As % of total	Output In blns kWt hrs	Output As % of total
1940	11.2	48.6	1.6	14.3	5.1	10.7				
1960	66.7	292.0	14.8	22.2	50.9	17.4				
1970	166.0	741.0	31.4	18.9	124	16.7	0.9	0.5	3.5	0.5
1980	267.0	1,294.0	52.3	19.6	184	14.2	12.5	4.7	72.9	5.6
1985	315.0	1,544.0	61.7	19.6	215	13.9	28.1	8.9	167	10.8
1986	322.0	1,599.0	62.1	19.3	216	13.5	30.1	9.3	161	10.1
1987(Plan)	338.0	1,665.0	64.1	19.0	218	13.1	d n y.p	d n y.p	d n y.p	d n y.p
1987	332.0	1,665.0	62.7	18.9	220	13.2	34.4	10.4	187	11.2
1988	339.0	1,705.0	63.8	18.8	231	13.5	35.4	10.4	216	12.7

Source: N Kh SSSR za 70 let p161 Cols 1, 2, 3, 5, 7, 9. Cols 4, 6, 8, 20 by calculation.
N Kh 1988 p379.
d n y.p - Data not yet published.

TABLE B - THE CONTRIBUTION TO ELECTRICITY GENERATION MADE BY THE HES AND AES - Part 1

	Blns of kWt hours	As % of Total Output	Balance from Thermal and other Power Stations
1970	124+ 3.5 =127.5	16.7+ 0.5= 17.2	613.5 bln kWt hrs 82.8%
1980	184+ 72.9 =256.9	14.2+ 5.6= 19.8	1,037.0 bln kWt hrs 80.1%
1985	215+ 167 =382.U	3.9+ 10.8= 24.7	1,162.0 bln kWt hrs 75.3%
1986	216+ 161 =377.U	13.5+ 10.1= 23.6	1,222.0 bln kWt hrs 76.4%
1987	220+ 187 =407.0	13.2+ 11.2= 24.4	1,258.0 bln kWt hrs 75.6%
1988	231+ 216 =447.0	13.5+ 12.7= 26.2	1,258.0 bln kWt hrs 73.8%

TABLE B - THE CONTRIBUTION TO ELECTRICITY GENERATION MADE BY THE HES AND AES - Part 2

	Installed Capacity of HES and AES	As % of Total capacity	Balance of Thermal and other power stations	
1970	31.4 +00.9 =32.3	18.9+00.5 =19.4	133.7	80.5%
1980	52.3 +12.5 =64.8	19.6+04.7 =24.3	202.2	75.7%
1985	61.7 +28.1 =89.8	19.6+08.9 =28.5	225.2	71.5%
1986	62.1 +30.1 =92.2	19.3+09.3= 28.6	229.8	71.4%
1987	62.7 +34.4 =97.1	18.9+10.4 =29.3	234.9	70.7%
1988	63.8 +35.4 =99.2	18.8+10.4 =29.2	239.8	70.7%

Source: By calculation

APPENDIX 2

TABLE 1 - CAPITAL INVESTMENTS IN THE ECONOMIC COMPLEXES
(in comparable prices, mlds of R)

	1971-75		of which 1975	
Capital Investments in the Economy - Total	562.8	100.0%	128.5	100.0%
of which:				
Fuel Energy Complex	56.8	10.1%	12.7	9.9%
Metallurgical Complex	23.7	4.2%	5.3	4.1%
Machine-building Complex	43.1	7.6%	10.8	8.4%
Chemical Timber Complex	28.3	5.0%	6.6	5.2%
Building Complex	31.4	5.6%	7.0	5.4%

	1976-80		of which 1980	
Capital Investments in the Economy - Total	717.7	100.0%	150.9	100.0%
of which:				
Fuel Energy Complex	75.7	10.5%	17.6	11.7%
Metallurgical Complex	28.9	4.0%	5.8	3.9%
Machine-building Complex	60.9	8.5%	13.1	8.7%
Chemical Timber Complex	37.2	5.2%	6.8	4.5%
Building Complex	39.2	5.5%	8.1	5.4%

	1981-85		of which 1985	
Capital Investments in the Economy - Total	843.2	100.0%	179.5	100.0%
of which:				
Fuel Energy Complex	108.9	12.9%	25.4	14.1%
Metallurgical Complex	30.0	3.6%	5.9	3.3%
Machine-building Complex	73.00	8.7%	15.9	8.9%
Chemical Timber Complex	34.9	4.1%	7.0	3.9%
Building Complex	41.5	4.9%	8.4	4.7%

The footnote on p328 of the N. Kh. za 70 let explains that the data refer only to items of productive classification. Non productive items (housing, communal, cultural and other non-productive categories) are not included but are shown in other tables for their corresponding sectors.
Source: N. Kh za 70 let p330

TABLE 2 - CAPITAL INVESTMENTS IN THE FUEL ENERGY COMPLEX
(mlds of R., Comparable Prices)

	1971-1975	1976-1980	1981-1985
Electricity	20.0	22.9	28.7
Coal	9.9	11.4	13.5
Oil	17.9	29.3	50.3
Gas	8.2	11.3	15.9
Fuel Energy	56.0	74.9	108.4

Source: N. Kh 1985 p368.

In later volumes the figures were amended to:

Total for the Fuel-Energy Complex	56.8	75.7	108.9

Source: N. Kh 1986 p330; 1987 p296.

By calculation:

Investment in Electricity rose by:
14.5% from 1971/75 to 1976/80
25.3% from 1976/80 to 1981/85
43.5% from 1971/75 to 1981/85

Investment in Coal rose by:
15.2% from 1971/75 to 1976/80
18.4% from 1976/80 to 1981/85
36.4% from 1971/75 to 1981/85

Investment in Oil rose by:
63.7% from 1971/75 to 1976/80
71.7% from 1976/80 to 1981/85
181.0% from 1971/75 to 1981/85

Investment in Gas rose by:
37.8% from 1971/1975 to 1976/80
40.7% from 1976/1980 to 1981/85
93.9% from 1971/1975 to 1981/85

(Table 2 contd)

TOTAL INVESTMENT IN INDUSTRY (in mlds)

1971-1975	1976-1980	1981-1985
196.0	251.4	300.7

From these data we can calculate that:

From 1971-75 investment in the energy sector was R56 mld, 28.6% of investment in industry.

From 1976/80 investment in the energy sector was R74.9 mld, 29.8% of investment in industry.

From 1981-85 investment in the energy sector was R108.4 mld, 36% of investment in industry.

Of the total investments in the Fuel-Energy Complex:

Oil took: 32% in 1971/75
39% in 1976/80
46% in 1981/85

If we compare the amounts invested with output then the following picture emerges:

TABLE 3 - PRODUCTION OF OIL, GAS AND COAL IN PHYSICAL UNITS AND CONVENTIONAL FUEL

(in physical units)

	Oil (mlns t)	Gas (mlds cu m)	Coal (mlns t)
1975	491	289	701
1976	520	321	712
1977	546	346	722
1978	572	372	724
1979	586	407	719
1980	603	435	716
1981	609	465	704
1982	613	501	718
1983	616	536	716
1984	613	587	712
1985	595	643	726
1986	615	686	751
1987	624	727	760
1988	624	770	772
1989	607	796	740

CONVENTIONAL FUEL - 7,000 kilocalories

	Total	Oil	Gas	Coal
1975	1,571.3	701.9	342.9	471.8
1976	1,649.3	743.1	380.3	479.0
1977	1,726.5	780.5	410.0	486.0
1978	1,790.3	817.3	441.1	487.0
1979	1,852.7	837.4	481.8	483.9
1980	1,895.6	862.6	514.2	476.9
1981	1,938.2	870.6	549.9	470.5
1982	1,990.2	876.0	591.9	479.5
1983	2,036.2	881.4	633.2	479.4
1984	2,086.4	876.2	694.3	476.8
1985	2,073.1	851.3	742.9	439.8
1986	2,165.7	879.1	792.7	454.8
1987	2,230.1	892.6	840.1	459.7
1988	2,286.9	892.8	889.4	467.0

TABLE 4 - INVESTMENTS IN BILLIONS OF ROUBLES

	Oil	Gas	Coal	Electricity
1975	3.8 (4.2)	1.8 (2.0)	3.6 (2.0)	3.6 (4.3)
1970	4.0	1.8	1.7	3.8
1977	4.5	2.0	1.9	3.8
1978	5.3	2.2	2.0	3.9
1979	5.9	2.0	2.0	3.9
1980	7.5	2.3	2.4	5.2
1981	8.1	2.0	2.0	4.5
1982	8.7	2.3	2.2	4.5
1983	9.1	2.7	2.3	4.6
1984	9.9	3.7	2.8	5.8
1985	11.5	4.2	2.9	6.7
1986	n.d	n.d	n.d	n.d
1987	n.d	n.d	n.d	n.d

NB:

1. The data for the amounts invested are revised upwards in the later volumes.
   Where varying data have been published the later figure is given in brackets.

2. In the 1987 volume of Narodnoye Khozyaistvo, there are serious downward revisions of the calorific values of gas and coal. The reductions can be represented thus:

	Total	Oil	Gas	Coal
per 1985 volume	2,137.3	851.3	759.9	486.9
per 1987 volume	2,073.1	851.3	742.9	439.8
Discrepancy	64.2	-	17.0	47.1

The authors of the Narodnoye Khozyaistvo do not offer any explanation of these retrospective revisions of the data. The later data are used on the assumption that they are likely to be more accurate.

Sources: N.Kh 1976 p438
1977 p356
1979 pp170-171
1984 p381
1985 p368, p157
1986 p163
1987 p296

TABLE 4 (contd.)

From these data we can calculate that an increased investment in oil from R3.3 bln from 1975 to 1980, an increase of 79%, resulted in an increased output of 113 mln t, an increase of 23%. Using this approach it can be shown that:

1975-80 a 79% increase in capital invested in oil increased output by 23%
1980-85 a 53% increase in capital invested in oil decreased output by 1%.

1975-80 a 15% increase in capital invested in gas increased output by 50%
1980-85 an 82% increase in capital invested in gas increased output by 48%.

1975-80 a 79% increase in capital invested in coal increased output by 2%
1980-85 a 53% increase in capital invested in coal increased output by 1%.

The above table uses the the physical putput data. For gas there is a difference if the measurement is made using the output of gas expressed in conventional fuel. The data then read:

1975-80 a 15% increase in capital invested in gas increased output by 54%
1980-85 an 82% increase in capital invested in gas increased output by 44%.

In the case of coal output rises by only 1% from 1975-80 when measured in tonnes but when calculated in conventional fuel it falls by 8% from 1980-85.

These data illustrate the sensitivity of the energy producing sectors to the volumes of capital invested in them.

TABLE 5 - ANNUAL AVERAGE NUMBER OF WORKERS ENGAGED IN ECONOMIC ACTIVITY (in mlns)

	Total of Workers and Employees	Increase per Annum	Increase per 5 Year Plan	Workers and Employees as a % of the Population
1945	28.6			
1950	40.4		+11.8	22.63
1955	50.3		+9.9	25.87
1960	62.0		+11.7	29.19
1965	76.9		+14.9	33.49
1970	90.2		+13.3	37.32
1975	102.2		+12.0	40.35
1976	104.4	+2.0		
1977	106.4	+2.2		
1978	108.6	+2.2		
1979	110.6	+2.0		
1980	112.5	+1.9	+10.3	42.53
1981	114.0	+1.5		
1982	115.2	+1.2		
1983	116.1	+0.9		
1984	116.8	+0.7		
1985	117.8	+1.0	+3.8	42.74
1986	118.5	+0.7		
1987	118.6	+0.1		

Provisional data from 1988 suggest a decline of circa 1 mln in the labour force.

Source: N.Kh of various years.

TABLE 6 - THE ANNUAL AVERAGE NUMBER OF INDUSTRIAL-PRODUCTION PERSONNEL IN THE FUEL-ENERGY COMPLEX (in thous)

	1950	1960	1970	1975	1980	1985	1986	1987
Fuel Energy-Complex	1,427	1,965	2,175	2,120	2,418	2,629	2,648	2,616
of which:								
Electricity	184	397	633	686	770	858	870	873
Fuel Industry	1,243	1,568	1,542	1,434	1,648	1,771	1,778	1,743
of which:								
Oil Lifting	77	85	111	113	140	165	170	164
Oil Processing	49	93	161	161	176	179	177	169
Gas	3	18	22	28	34	36	37	36
Coal	858	1,196	1,120	1,009	1,178	1,276	1,282	1,273

Source: Trud v SSSR - Finansy i Statistika 1988 pp49-50.

NB. Electricity plus Fuel Industry equals the Fuel-Energy Complex. But Oil Lifting + Processing + Gas + Coal total only:

987,000 in 1950, a difference of 256,000 from 1,243,000 in the Fuel Industry
1,392,000 in 1960, a difference of 176,000 from 1,568,000 in the Fuel Industry
1,414,000 in 1970, a difference of 128,000 from 1,542,000 in the Fuel Industry
1,311,000 in 1975, a difference of 123,000 from 1,434,000 in the Fuel Industry
1,528,000 in 1980, a difference of 120,000 from 1,648,000 in the Fuel Industry
1,656,000 in 1985, a difference of 115,000 from 1,771,000 in the Fuel Industry
1,666,000 in 1986, a difference of 112,000 from 1,778,000 in the Fuel Industry
1,642,000 in 1987, a difference of 101,000 from 1,743,000 in the Fuel Industry

This discrepancy may be partially explained by the omission of shale workers (unless they are included in the Oil Lifting category) and/or by omission of turf and timber workers. Workers on hydro-electric and in nuclear power stations are presumably included in the figures for electricity.

The 1975 data shows a decline of 103,000 workers from 1970 which is mostly accounted for by a fall in the number of miners.

In all four sectors there is an increase in the number of workers until 1986/87 (apart from the decline in 1975 of coal miners already noted) when there is a decrease in each sector. This is a first result of the policy of intensive development replacing extensive development.

If we compare these data with those of the calorific value of each of the fuels we can note the following:

TABLE 7 - EXTRACTION OF FUEL
(conventional fuel - 7,000 kilocalories)

	Oil	Gas	Coal	Turf	Shale	Wood	Total
1950	54.2	7.3	205.7	14.8	1.3	27.9	311.2
1960	211.4	54.4	373.1	20.4	4.8	28.7	692.8
1970	502.5	233.5	432.7	17.7	8.8	26.6	1,221.8
1975	701.9	342.9	471.8	18.5	10.8	25.4	1,571.3
1980	862.6	514.2	476.9	7.3	11.8	22.8	1,895.6
1985	851.3	742.9	439.8	5.5	10.2	23.4	2,073.1
1986	879.1	792.7	454.8	6.6	9.6	22.9	2,165.7

N. Kh 1965 p174; N Kh 1985 p157; N Kh za 70 let p163.

In oil extraction the following calculations can be made:

1950 77,000 oil workers lifted (54.2 x 7,000 kilocalories) 349,000 kilocalories ie. 4,920 kilocalories per worker.

1960 85,000 oil workers lifted (211.4 x 7,000 kilocalories) 1,479,800 kilocalories ie. 17,400 kilocalories per worker.

1970 111,000 oil workers lifted (502.5 x 7,000 kilocalories) 3,517,800 kilocalories ie. 31,680 kilocalories per worker.

1975 113,000 oil workers lifted (701.9 x 7,000 kilocalories) 4,913,300 kilocalories ie. 43,480 kilocalories per worker.

1980 140,000 oil workers lifted (862.6 x 7,000 kilocalories) 6,038,200 kilocalories ie 43,130 kilocalories per worker.

1985 165,000 oil workers lifted (851.3 x 7,000 kilocalories) 5,959,100 kilocalories ie. 36,110 kilocalories per worker.

1986 170,000 oil workers lifted (879.1 x 7,000 kilocalories) 6,153,700 kilocalories ie. 36,190 kilocalories per worker.

These calculations show that the energy in the oil lifted per worker was rising at a rapid rate in the years from 1950 to 1975 (almost a ninefold increase) but from 1975 to 1985 there is a decline followed by a slight improvement in 1986.

(Table 7 contd.)

In gas extraction the following calculations can be made:

1950 3,000 gas workers lifted (7.3 x 7,000 kilocalories) 51,100 kilocalories ie. 17,030 kilocalories per worker.

1960 18,000 gas workers lifted (54.4 x 7,000 kilocalories) 380,000 kilocalories ie. 21,150 kilocalories per worker.

1970 22,000 gas workers lifted (233.5 x 7,000 kilocalories) 1,634,500 kilocalories ie. 74,290 kilocalories per worker.

1975 28,000 gas workers lifted (342.9 x 7,000 kilocalories) 2,400,300 kilocalories ie. 85,720 kilocalories per worker.

1980 34,000 gas workers lifted (514.2 x 7,000 kilocalories) 3,599,400 kilocalories ie. 105,860 kilocalories per worker.

1985 36,000 gas workers lifted (742.9 x 7,000 kilocalories) 5,200,300 kilocalories ie. 144,450 kilocalories per worker.

1986 37,000 gas workers lifted (792.7 x 7,000 kilocalories) 5,548,900 kilocalories ie. 149,970 kilocalories per worker.

In coal extraction the following calculations can be made:

1950 858,000 miners lifted (205.7 x 7,000) 1,439,800 kilocalories ie. 1,670 kilocalories per miner.

1960 1,196,000 miners lifted (373.1 x 7,000) 2,611,700 kilocalories ie. 2,180 kilocalories per miner.

1970 1,120,000 miners lifted (432.7 x 7,000) 3,028,900 kilocalories ie. 2,700 kilocalories per miner.

1975 1,009,000 miners lifted (471.8 x 7,000) 3,302,600 kilocalories ie. 3,270 kilocalories per miner.

1980 1,178,000 miners lifted (476.9 x 7,000) 3,338,300 kilocalories ie. 2,830 kilocalories per miner.

1985 1,276,000 miners lifted (439.8 x 7,000) 3,078,600 kilocalories ie. 2,410 kilocalories per miner.

1986 1,282,000 miners lifted (454.8 x 7,000) 3,813,600 kilocalories ie. 2,480 kilocalories per miner.

As with oil the calorific value of the coal lifted per miner per annum improved from 1950 to 1975 but declined from 1975 to 1985 and showed a small improvement in 1986.

TABLE 8 - WORKERS IN THE REFINING COMPLEX

The data for the numbers employed in the refining industries are shown (in thousands)

	1950	1969	1970	1975	1980	1985	1986	1987
Chemical - Timber Complex	2,670	3,476	4,416	4,548	4,661	4,707	4,710	4,676
of which:								
Chemical and Petrochemical Industry	469	792	1,568	1,753	1,924	1,983	1,984	1,972
of these:								
Chemical Industry	...	...	1,100	1,226	1,352	1,414	1,415	1,409
Petrochemical	...	...	365	414	456	451	449	446

NB. There is a discrepancy in these figures which is not explained by the compilers of the volume Trud v SSSR, viz: the additions of the data for the chemical and petrochemical industries do not agree with the totals given in the Chemical and Petro-Chemical Industry entry. Thus in 1970: 1,100 + 365 = 1,465 whereas the entry is for 1,568 and similarly for other years.

TABLE 9 - ENERGY OUTPUT (IN PHYSICAL UNITS) AND NUMBERS OF WORKERS

	1950	1960	1970	1975	1980	1985	1986	1987
Electricity Mlds kWt hrs	91.2	292	741	1,039	1,294	1,544	1,599	1,665
Numbers of Workers in thousands.	184	397	633	686	770	858	870	873
Output per Worker thous kWt hrs	496	736	1,171	1,515	1,681	1,800	1,838	1,907
Oil mlns of tonnes	38	148	353	491	603	595	615	624
Number of Workers in thousands	77	85	11	113	140	165	170	164
Output per worker in tonnes	494	1,741	3,180	4,345	4,307	3,606	3,618	3,804
Gas mlds cu m	5.8	45.3	198	289	435	643	686	727
Numbers of Workers in thousands	3	18	22	28	34	36	37	36
Output per Worker mlns of cu m	1.9	2.5	9.0	10.3	12.8	17.9	18.5	20.2
Coal mlns of tonnes	261	510	624	701	716	726	751	760
Numbers of Workers in thousands	858	1,196	1,120	1,009	1,178	1,276	1,282	1,273
Output per Worker tonnes	304	426	557	695	608	569	586	597

These data illustrate that the rapid growth in productivity is in the earlier post-war years and a slow down, even decline, occurs in later years.

Electricity improves:
From 496 thous kWt hrs in 1950 to 736 thous kWt hrs in 1960 ie +240 thous KWt hrs.
From 736 thous kWt hrs in 1960 to 1,171 thous kWt hrs in 1970 ie. +425 thous KWt hrs.
From 1,171 thous kWt hrs in 1970 to 1,681 thous kWt hrs in 1980 ie +510 thous kWt hrs.

But Oil rises and falls:
From 494 t in 1950 to 1,741 t in 1960 ie +1,247 t
From 1,741 t in 1960 to 3,180 t in 1970 ie. +1,439 t
From 3,180 t in 1970 to 4,307 t in 1980 ie +1,127 t
But from 4,345 t in 1975 to 3,606 t in 1985 ie. -739 t

Coal has a tendency similar to Oil.

TABLE 10 - USSR EXPORTS OF ENERGY

		1960	1970	1980	1985
Coal	mln t	12.3	24.5	25.3	28.3
Coke	mln t	2.6	4.2	3.8	2.9
Crude Oil	mln t	17.8	66.8	119	117
Oil Products	mln t	15.4	29.0	41.3	49.7
Gas	mlds of cu m	0.2	3.3	54.2	68.7
Electricity	mlds kWt hrs	0.0	5.3	19.9	29.3

		1986	1987	1988	1989
Coal	mln t	33.5	35.5	39.4	37.5
Coke	mln t	2.6	2.2	2.3	2.3
Crude Oil	mln t	129	137	144	127.3
Oil Products	mln t	56.8	59.2	61	57.4
Gas	mlds of cu m	79.2	84.4	88	n.d
Electricity	mlds kWt hrs	30.2	34.9	38.9	39.3

Source: N.Kh 1987 p603
N.Kh 1988 p637
Vnesh Terg 1989 p28

TABLE 11 - EXPORTS OF OIL AND OIL PRODUCTS TO OECD AND EEC COUNTRIES 1976-85 (thousands of t.)

	1976	1977	1978	1979	1980
OECD Imports of B1* from USSR	5,985	34,952	36,269	36,870	33,468
Total OECD Imports of B1	1,230,013	1,269,509	1,230,179	1,290,114	1,124,189
Imports from USSR as % of total	0.5	2.8	2.9	2.9	3.0
EEC Imports of B1 from USSR	4,329	20,768	21,687	22,982	21,074
Total EEC Imports of B1	519,285	501,423	495,568	522,892	446,724
Imports from USSR as % of total	0.8	4.1	4.4	4.4	4.7
OECD Imports of B2** from USSR	8,268	22,036	24,173	22,019	22,531
Total OECD Imports of B2	245,412	248,504	251,148	259,451	249,307
Imports from USSR as % of total	2.4	8.9	9.6	8.5	9.0
EEC Imports of B2 from USSR	2,741	11,215	14,312	12,536	14,316
Total EEC Imports of B2	104,501	100,816	104,430	115,562	121,537
Imports from USSR as % of total	2.4	11.1	13.7	10.8	11.8

*B1 = Crude + Natural Gas Liquids + Refinery Feedstocks.
**B2 = Total Products.
Source: OECD Quarterly Oil and Gas Statistics for the relevant years for lines 1 and 2; line 3 by calculation.

Table 11 (Contd)

	1981	1982	1983	1984	1985
OECD Imports of B1* from USSR	29,395	36,777	44,635	49,629	37,683
Total OECD Imports of B1	985,398	877,603	824,242	846,967	810,496
Imports from USSR as % of total	3.0	4.2	5.4	5.9	4.6
EEC Imports of B1 from USSR	17,317	25,399	30,366	37,179	26,381
Total EEC Imports of B1	394,657	355,217	326,278	335,345	324,859
Imports from USSR as % of total	4.4	7.2	9.3	1.1	8.1
OECD Imports of B2** from USSR	24,124	32,189	33,304	31,815	29,834
Total OECD Imports of B2	249,240	274,719	289,372	310,013	299,238
Imports from USSR as % of total	9.7	11.7	11.5	10.3	10.0
EEC Imports of B2 from USSR	16,813	23,917	24,486	22,985	22,451
Total EEC Imports of B2	131,989	151,749	153,617	161,020	159,960
Imports from USSR as % of total	12.7	15.8	15.9	14.3	14.0

*B1 = Crude + Natural Gas Liquids + Refinery Feedstocks.
**B2 = Total Products.
Source: OECD Quarterly Oil and Gas Statistics for relevant years for lines 1 and 2; line 3 by calculation.

TABLE 12 - THE PROPORTION OF TOTAL ENERGY OUTPUT EXPORTED
(as a percentage of the total output in physical units)

	1960	1970	1980	1985	1986	1987	1988
Coal	3.3	5.1	4.6	5.0	5.7	6.0	6.6
Oil	12.1	18.9	19.7	19.7	21.1	21.9	23.1
Gas	0.5	1.7	12.5	10.7	11.5	11.6	11.4

Source: N.Kh 1987 p605
N.Kh 1988 p639

NB. The source excludes an entry for Refined Products.

TABLE 13 - USSR IMPORTS OF ENERGY

	1960	1970	1980	1985	1986	1987	1988
Coal (mln of t)	4.8	7.1	6.7	10.3	11.8	9.6	11.9
Coke (mln of t)	0.7	0.7	0.6	1.0	0.7	1.3	1.8
Crude Oil (mln of t)	1.2	3.5	3.5	12.4	14.6	14.0	19.8
Oil Products (mln of t)	3.2	1.0	1.4	2.0	2.0	2.2	1.9
Gas (mlds cu m)	-	3.6	2.7	2.4	2.2	1.7	1.0

Source: N.Kh 1987 p606
N.Kh 1988 p641

TABLE 14 - THE PROPORTION OF FUEL AND ELECTRICITY IN THE STRUCTURE OF USSR EXPORTS

	1970	1980	1985	1987	1988
Fuel and Electricity as a proportion of total exports	15.6	46.9	52.7	46.5	42.1
Fuel and Electricity as a proportion of exports to Socialist Countries	14.6	39.7	49.8	47.9	43.6

Sources: N.Kh 1987 pp612-613
N.Kh 1988 p647

TABLE 15 - CONTRUCTION BY THE USSR OF ENERGY-RELATED ENTERPRISES ABROAD (as at 1 January 1989)

	Total	
	Per Contract	of which already operating
Electricity Industry	504	364
Oil Processing	79	56
Coal Industry	131	79

of which:

	To Socialist States		To Developing Countries	
	per contract:	of which already operating	per contract:	of which already operating
Electricity Industry	360	277	134	88
Oil Processing	67	46	12	10
Coal Industry	87	62	44	17

Source: N.Kh 1988 p655

TABLE 16 - THE PROPORTION CONTRIBUTED BY THE SOCIALIST COUNTRIES IN WORLD OUTPUT OF ENERGY (in %)

	1960	1970	1980	1986	1987
Electricity	21	23	26	27	27
Oil (incl. Gas Condensate)	16	18	25	n.d	28
Natural Gas	12	22	32	42	43
Coal (Commercial)	54	55	56	57	57

n.d. = no data.

Source: N.Kh 1987 p621
N.Kh 1988 p657.

SURREY ENERGY ECONOMICS CENTRE

DISCUSSION PAPER SERIES

SOVIET ENERGY PROSPECTS AND PROBLEMS:
THE ENERGY SECTOR IN THE USSR 1985-1990

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A POSTSCRIPT -
A NOTE ON THE ACHIEVEMENTS IN THE 5 YEAR PLAN 1986 - 1990.

When the preliminary results of the achievements of the economy were published in January 1991 it was clear that very few, if any, of the targets adopted at the start of the 5 Year Plan had been achieved.

THE ENERGY SECTOR IN 1985 - 1990.

In June 1986 the Supreme Soviet adopted a target for 1990 of 635 mln t of oil. The result achieved was 570 mln t (crude + oil condensate), a shortfall of 65 mln tonnes (10%). The target for electricity output was 1,840 - 1,880 bln kWt hours and the level attained in 1990 was 1,728 bln kWt hours, a shortfall of 112 bln kWt hours (6%).

It was planned to raise 850 cu.m. of gas but the level achieved was 815 bln cu.m. i.e. 95.88% of target. Coal output should have been 795 mln t but the 703 mln t raised were only 88.43% of the intended level.

Gas output was 2% and electricity generation 0.3% better than in 1989 whilst oil was 6% and coal 5% worse than in 1989.

The presentation of the data in this form reveals one aspect of the problem but we can examine these figures from another viewpoint. For the first three years of this plan period 1986-1988, the output of oil, gas, coal was on an ascending curve and it was reasonable to assume that if this rate of progress was maintained, the overall targets for the 5 Year Plan would be achieved by 1990 but in 1989 and 1990 there was a failure to achieve any of the targets and the rate of decline gathered speed. Whereas oil output was 27 mln t below target in 1989, it was 65 mln t behind by December 31st 1990. Similarly coal output had been ahead of target in 1986, 1987 and 1988, but was lagging by 41 mln t in 1989 and 92 mln t in 1990. A

shortfall of this size is close to the total output of coal in Great Britain in any one year.

The factors causing the failure to achieve the original plan target for oil had been observed by the planners and the original target was scaled down from 632 to 602 mln t in the middle of the plan period. However the decline is now so steep that even the revised target was unattainable and unless the trend is reversed, we may see total output fall to a figure around 500 mln t in 1991.

Several authoritative sources within the Soviet oil industry have spoken of a further decline of 30 to 40 mln t in output in 1991 and a halving of oil exports but it is possible that output could fall faster than is presently anticipated. Whilst 1991 is forecast as the year in which there will be a reduction of 50% in exports, some of the Soviet spokesmen are forecasting that the USSR will be an oil importer within two to three years.

The last time that Soviet oil output was as low as 570 mln t was 1978 when 571,531,000 t (inc. gas condensate) were lifted.

The output of coal has collapsed in 1989 and 1990 to such an extent that it is impossible to maintain a guaranteed output of electricity from the power stations and the centralised urban heating systems frequently fail from lack of fuel (coal or diesel) as well as breakdowns in machinery.

During 1989 we witnessed large-scale strikes in the two main coal fields of Kuzbass and Donbass as well as in some of the smaller fields. None of the deep problems provoking these strikes have been solved and we may anticipate that more strikes will occur. The daily rations for coal miners in Novokuznetsk in January 1991 were based on 20 grammes of groats, 10 grammes of vegetable fat, one egg every three days.

The average life expectancy of a Soviet coal miner is now 48 years and only 5% live to a pensionable age. Circa 800 die each year in the coal mines.

The mines desperately lack capital investment, modern and safe machinery, as well as adequate food, housing, medical equipment for the miners and their families.

Even when the coal has been raised from the pits, there are continual reports of breakdowns in the transport of coal from pit to customer. Circa 40% of the railway system is engaged in carrying the coal. About 300 mln tonnes of coal per annum are needed by the power stations but the build up of stocks during summer and autumn is often retarded by transport bottlenecks.

The collapse of coal output to 703 mln tonnes is the lowest annual output figure since 1975 when 701 mln tonnes were raised.

The collapse of the coal and oil output will have stranglehold effects on the whole economy in 1991. The output of gas, although greater in volume each year than the preceding year, failed to achieve the 5 Year Plan Target. The reasons are familiar from the experiences with oil lifting. Extraction has moved from one "easy location" to another and inadequate capital has been invested in the infrastructure of the regions and in the apparatus.

Vast amounts of associated gas are flared off and, although the Surgut electric power station is powered by gas, the availability of electricity in the fields is still inadequate and a proportion of the electricity consumed in the oil and gas fields is generated from coal and oil.

The problems of the weak and faulty gas pipelines and the Ufa explosion have already been discussed. The nuclear explosion at Chernobyl in 1986 and Ufa in 1989 were loud and clear warnings of

the results of the past policy of the relentless drive for quantity at the expense of quality, of basing an economy on quantitative indices and not cost, loss and profit criteria with strong social and political control.

The output of electricity is suffering from two crucial bottlenecks. We have already noted the shortfalls in the supply of the fuels, oil, gas, coal. The power engineering industry has failed to supply and equip the generating stations with the renovated and new generating equipment it needs.

The 5 Year Plan for 1986 - 1990 (as outlined in Pravda of 9/11/85) set a target of dismantling 10,000 MW of obsolete equipment and modernising at least 25,000 MW of generating capacity. 75-80% of the increased demand for electricity should be satisfied from improved efficiency and saving of fuel. In the event the electricity generating sector has added <u>less</u> generating capacity in the 5 years of perestroika than in any 5 year period since 1956-1960.

Electricity Generating Capacity Installed 1986-1990

1985 - 1986	7,000 MW
1986 - 1987	11,000 MW
1987 - 1988	7,000 MW
1988 - 1989	2,000 MW
1989 - 1990	6,600 MW
Total	33,600 MW

In the post war period generating capacity has been added at the following rates.

1946 - 1950	8,490 MW
1951 - 1955	17,632 MW
1956 - 1960	29,475 MW
1961 - 1965	48,312 MW
1966 - 1970	51,117 MW
1971 - 1975	51,334 MW
1976 - 1980	49,273 MW
1980 - 1985	48,243 MW
1986 - 1990	33,600 MW

In an interview in Ekonomika i Zhizn No.52 of 1990, p.13, the Deputy Minister of Energy Petrayev said "I can say with full responsibility that we have achieved nothing in reducing energy consumption. This potential is completely untouched."

These problems in power generation result in a position where the USSR was entering the winter of 1990-1991 with only 3 to 4% of spare generating capacity, whereas in the USA and W.Europe the reserve capacity is circa 30%. In the USSR a one degree drop in temperature usually results in a 0.5% increase in electricity consumption and a 2% increase in heat consumption.

The problem is even more acute than these data suggest. Izvestia of 26/1/91 p.1 reported that only 6,600 MW of generating capacity were added in 1990, whilst the report from Goskamstat in Ekonomika i Zhizn No.5 1991, p.12 reports that 60% of the generating capacity ordered and included in the plan was <u>not</u> delivered. The shortfall was in 3,600 MW of thermal capacity and 4,000 MW of nuclear capacity. Hence we can calculate that the planned amount was circa 16,500 MW which is a volume not achieved in any year of the 5 Year Plan. The sources are completely silent on the introduction of new hydro electric capacity in 1990 and no data have yet been released by Goskamstat on the new nuclear capacity installed in 1990. From

earlier data we can construct the table on generation of electricit by thermal, nuclear and hydro stations for the year to 1989.

OUTPUT OF ELECTRICITY (in blns of kWt hrs)

	1980	1985	1986	1987	1988	1989	1990
From all Power Stations	1,294	1,544	1,599	1,665	1,705	1,722	1,728
of which from Nuclear Power Stn.	72.9	167	161	187	216	213	dnyp
Hydro " "	184	215	216	220	231	223	dnyp
Total of non-thermal " "	256.9	382	377	407	447	436	
Hence from Thermal Power Stn.	1,037.1	1,162	1,222	1,258	1,258	1,286	

From these calculations we can see that despite the great setback of the Chernobyl disaster in 1986 it is the nuclear sector which has expanded at the fastest rate, 27.5% in the years from 1985 to 1989 whilst the thermal stations increased their output by 10.7%.

By analysing the newly installed capacity we can establish that it changed in the following fashion.

CAPACITY OF ELECTRIC GENERATING STATIONS (thous of MW)

	1980	1985	1986	1987	1988	1989	1990
Capacity of all Power Stations	267	315	322	332	339	341	
of which Nuclear Power Stn.	12.5	28.1	30.1	34.4	35.4	37.4	
Hydro " "	52.3	61.7	62.1	62.7	63.8	64.4	
Total of non-thermal " "	64.8	89.8	92.2	97.1	99.2	101.8	
Hence capacity of Thermal Power Stn.	202.2	225.2	229.8	234.9	239.8	239.2	

	Nuclear	Hydro	Thermal
1985-1986	+2	+0.4	+4.6
1986-1987	+4.3	+0.6	+5.1
1987-1988	+1	+1.1	+4.9
1988-1989	+2	+0.6	-0.6

These calculations illustrate the pressures on the electricity sector. It is failing to grow at the required rate and its 'generating capacity is not being modernised at the essential rate. Indeed there is a reduction in thermal generating capacity and the total grows only as a result of the expansion of nuclear and hydro capacity. Taken in conjunction with the output figures for oil and coal the reasons for the frequent breakdowns become apparent. By the end of the 5 Year Plan the generating sector was on the edge of a catastrophic breakdown and supplies of power could not be guaranteed through the winter.

We have seen that a key problem for the energy sector is the total volume of capital invested in it and within that overall total the proportions going to oil, coal, gas, electricity. In the last year of the 5 Year Plan the disputes between the republics and the central authorities had grown so acute that it was impossible to agree the Union budget for 1991 before the year began and negotiations dragged on into January 1991.

One of the major tensions delaying the formation of the budget was the dispute between the republics and the all-Union government on the lines of demarcation between them in relation to the ownership of mineral wealth in the ground, ownership of industrial assets, division of subsidies, industrial profits, income tax etc. and this complicated network of disputes (which were a mixture of principle, personal ambition and nationalist hostility) had serious effects on the amount of money allocated to the industrial sector for investment.

Izvestia (16/1/91) published what is claimed to be the Union budget for 1991 and comments that for the first time the Union budget is separate from the budgets of the republics but does not enlighten us further on this crucial redistribution of functions. The total amount allocated "for the National Economy" is R45.742 blns. This is a very small proportion of the sum allocated under similar headings in previous years e.g. R179.5 blns in 1985 and R218.2 blns in 1988. If the republics are expected to find the difference, this has not been stated.

Further confusion is spread by an article in the main economic journal Ekonomika i Zhizn (No.3 of 1991, p.4) where the authoritative official, A.Fedchenko,Head of the Summary Department of Investment and Balances of Production Capacities of Gosplan, commented that in 1991 the volume of capital investment in the Fuel-Energy Complex will be halved. Fedchenko gave no figures to illustrate or support his contention, but even without knowing the detail we can begin to see that the profound crisis in oil extraction, which has been postponed by desperate investments in recent years, may turn into catastrophe in the years of 1991 and 1992 for we know from previous experience that if the experienced labour forces of regions such as West Siberia are weakened or dispersed by cutbacks in capital investments then it is very difficult to re-assemble them in future years.

The implications and application of such decisions clearly have to be considered not only by the republics but also by foreign firms considering large scale investment.

Thus the disputes over the budget, sovereignty, ownership, forms of transition to the market are arguments about the most fundamental features of Russian and Soviet society and history and as energy is one of the major sectors of the economy, it is closely affected by the course of these disputes.

Some changes have been made in recent months. Wholesale prices of energy, but not yet retail, were doubled on January 1st, 1991 and some changes were made in the distribution of receipts from overseas sales of oil and gas in November 1990 but, important though these are, they pale into insignificance against the fundamental questions being currently argued.

The proposed new taxes have created considerable unease amongst Western firms wishing to invest and the sooner this question is resolved the better. There is still lack of defined intent on the convertibility of the rouble and possibilities for exports of all (or part) of profits.