URANIUM AND ENERGY INDEPENDENCE

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U R A N I U M A N D E N E R G Y I N D E P E N D E N C E

1. THE ENERGY DEPENDENCE PROBLEM

The events of the past seven years have clearly shown the disastrous consequences for highly industrialized nations of too high a degree of dependence from foreign countries, for the supply of raw energetic materials.

Too heavy dependence on oil in the course of the last two decades have progressively put our energetic independence in jeopardy.

Slide 1 gives a very clear illustration of this situation, for the nine countries of the European Economic Community, with a degree of dependence close to 60% in 1978. In the USA, this degree of dependence was slightly below 40%.

Slide 2 shows for those countries and Japan the percentage of installed nuclear capacity by 1985 and the degree of energy dependence in 1978.

For a number of Western world countries, especially those with little or no domestic coal and gas, nuclear energy is the only way out, provided however that those countries are not switching from oil dependence towards uranium dependence. However, due to geographical spread of uranium and its ability to be easily stored, uranium dependence is less severe than oil dependence.

Uranium is spread over a fair number of areas and mostly in zones controlled by highly industrialized countries. Unfortunately, Western Europe holds only a very modest share of the reserves on its own territory, amounting to only roughly 10% of the reasonably assured and estimated available reserves.

The situation is quite different for North America which, besides huge coal reserves and substantial future oil and gas potentials, holds a large part of the uranium resources, as shown on slide 3.

Another problem has arisen these last years, when some uranium producing countries tried to impose to consumer countries their views concerning the lack of necessity to reprocess spent fuel and to develop the fast breeder program, which is the only presently conceivable avenue, which may lead in a reasonable time to energy independence for those nations deprived of domestic oil, coal, gas and uranium ore.

The consumer countries which have heavily committing themselves in power reactor programs based on thermal reactors are very concerned for the immediate future with two issues :

- The timely availability of uranium production capabilities in the required quantities
- The assurance of supply of uranium

Both these issues have been the main subjects of discussions between Producers and Consumers members of the Uranium Institute.

The assurance of supply with its very controversial associated issue on "prior consent" has even been the subject of a report published by the Institute in October 1980.

The study of the timely availability of uranium production in the required quantities has been the main concern of a special committee set up within the Institute and named the Supply and Demand Committee (S/D Committee).

Let us now see how we could visualize the U demand taking into consideration the perturbing effects which have plagued the development of power reactor plants in the course of the past recent years.

2. THE NECESSITY OF A REAPPRAISAL OF THE S & D BALANCE

A first report titled "The balance of supply and demand 1978-1990" has been published in the middle of 1979 by the Uranium Institute.

This report highlighted the following conclusions regarding the balance between supply and demand :

" In the short term, until 1985, actual uranium demand is likely to be determined principally by enrichment contracts. During this period uranium production should be able to satisfy all possible demand scenarios.

In the period 1985-1990, the range of uncertainty becomes much larger, but the flexibilities are such that it should be possible to establish a satisfactory supply-demand balance over the period, provided price conditions remain reasonably stable and provided the investment decisions of producers and consumers can be kept reasonably in step.

Within this broadly satisfactory general picture the possibility of short-term imbalances cannot, however, be entirely ruled out.

As regards the level of stockpiles, the estimate given of realistically attainable production capability (the lower supply forecast), together with the lower forecast of nuclear capacity, would indicate a substantial increase in the level of world stockpiles - from the present 100,000 tonnes U to a figure for 1990 nearer 200,000 tonnes. However, given the higher annual rate of consumption anticipated in 1990 this larger figure would still correspond to only about two years' forward requirements."

Since the issue of that report, some important events have occurred which have dictated the necessity to review both the demand and the supply, and consequently the balance between the two components. Those events are mainly :

- The TMI aftermath
- The second petroleum schock of 1979
- The economic world crisis with its financial problems
- The tilt over of the U market into a buyers market
- The growing public awareness of the necessity for nuclear energy
- The coming into office of a new American administration.

TMI came into the picture in March 79. It has had a very negative immediate impact on the nuclear industry. Many orders have been cancelled or delayed and numerous additional constraints have been put on the design of reactor plants. The public at large has been hit by the excessively alarmist reports coming through the media and which reflected ignorance or ill understanding of what was really going on.

After the first shock of TMI, the public at large has slowly and progressively evaluated the situation on a much less emotional basis and it is becoming apparent that, after all, the design of that plant has led to a situation where no one inside or outside the plant has been injured and that no substantial radioactive release has been experienced.

For the US, resumption of licensing occurred only in 1980 with the issuance of one operating license in December last. Four new operating licenses seem to be planned for 1981 and the first new post TMI construction permit is scheduled for mid-82. To show the real impact of TMI, one should just notice that out of 60 US plants which were due for commercial operation in the five years following TMI, two thirds of them have been cancelled or delayed.

The evolution of US and non US orders and cancellations over the past decade is shown on slide 4. One should notice the basic difference between the US and the non US world.

Setting aside the cancellations of export projects in 1978-79 to Iran and Brasil, heavy cutbacks have not been experienced in the major non US WOCA countries. France, Japan and Spain are moving steadily towards achieving a very substantial nuclear program by the end of the century. West Germany and the United Kingdom seem to move progressively out of a long stagnation period and are slowly resuming building new projects.

Other smaller countries are also making good progress although the outlook for the future beyond this present decade is not clear to them. This is the case for Italy, Sweden, Switzerland and Belgium, these last three countries having already for the last three years a production in nuclear electric energy rating between 20 and 25%.

By the end of the seventies, the second petroleum shock started to materialise. It has very quickly developped into the world economic crisis which we are experiencing today.

We find ourselves in the spring of 1981 in a situation :

- where the economic growth is close to zero for the industrialized countries
- where the immediate demand for electricty and energy in general is stagnating
- where the U spot market prices have fallen to 55 % of their 1978 value
- where the necessity of moving as fast as possible away from excessive oil and gas imports is mandatory for our future survival
- where the scarcity of available funds at acceptable costs and the hazardeous financial prospects precludes to make the necessary investments to assure our future survival.

Let us hope that the Western world will wake up before it is too late and decide to do what it takes to overcome our common present difficulties. Let us also hope that the new American administration will lead the free world in this direction.

3. THE URANIUM DEMAND TREND UP TO THE END OF THE CENTURY

Let us now look at the trend of the uranium demand over the next 20 years.

The uranium consumption for reactor first loads and reloads and for feeding the enrichment plants in execution of existing enrichment contracts is well defined over the coming ten years because of the long lead times for reactor commercial operation.

What will happen over the last decade of the present century is somewhat more difficult to portray, the more so that all the demand forecasts, made since 1972, have been regularly downgraded as shown on slide 5.

This diagram shows 3 curves giving as a function of the date of the forecast, the downfall of the nuclear capacity prognosed for commercial operation in 1980, 1985 and 1990. The vertical lines show the high-low range given at a certain time by institutions such as OECD, AIF, EPRI, DOE, Uranium Institute, etc.

In the new study of the Institute, three cases have been considered for the demand of uranium. They are shown graphically on slide 6.

The lower case corresponds to the requirements of the operating and the presently committed reactors. The middle curve called Forecast Capacity is the result of a wide consultation of the consumers, leading to figures which have been analyzed and used to establish the forecast. The upper curve called High Growth Scenario introduces in the forecast a prudent increase in operating capacity which may materialize if the new policies being implemented in the US as a result of the last elections bring about a revigoration of the US reactor program with the effects this may invariably have on the programs in other countries. This curve matches fairly well with the OCDE December 1979 Low Uranium Requirements curve, as shown by superposition on the graph.

The Supply and Demand Committee is well aware of the difficulty of establishing forecasts for after 1990.

It is not easy to foresee what will be the change in the nuclear program development which may occur in the next few years in the USA with the coming into power of the new administration and even more so, what will be the entrainment effect on the other industrialized countries.

The new forecasts of the Institute are considerably lower than those made in 1979. To illustrate this, we now show for 1990 a 58,000 TU/year Forecast demand value and a 67,000 TU/year High Growth demand value, against roughly 75,000 TU/year as low demand forecast in the report of February 1979. This is a substantial reduction.

The figures given above are based on 0.20% tails assay. To illustrate the infuence of tails assay, let us note that a reduction of tails assay from 0.20 to 0.16% would permit a saving of round 6% in the natural U demand per unit enriched uranium produced. This percentage is almost tripled if the saving is expressed per unit separative work. This is most important for the period where the enrichment plants requirements will be governing the demand.

This feature combined with drawing on the estimated 120,000 TU stockpile presently available, gives in our view, a fair amount of flexibility in the demand of uranium.

Before leaving the demand, it should be stressed, as shown on slide 6, that between now and 1987 the demand will be set by the committed enrichment contracts which override by roughly 10,000 TU per year the net requirements of the reactors in operation or in construction.

4. THE RESOURCES AND THE PRODUCTION EXPECTATIONS UP TO THE END OF THE CENTURY

The uncertainties involved in projecting future uranium supply over the medium-long term range are as great as those tied to demand projections.

In the past, the uranium industry has demonstrated its ability to respond to increases in demand by producing timely the additional required amounts of uranium.

Since the mid 50's to the present time, a situation of oversupply has virtually existed through the whole period extending up till now. This was so even through the first half of the seventies, characterized by a fast expanding nuclear program in the US and abroad.

This period of vigourous nuclear programs has been followed by four years of various impediments to the development of these programs by way of bureaucratic hurdles resulting from legal actions and political slow down, if not complete stagnation attitudes towards the nuclear industry development. I refer here more specifically to the situation in North America. The TMI mishap and the non proliferation concerns have been major catalysts to this degradation.

The result of all this is that the nuclear industry and mostly the uranium mining industry has and is still living difficult times with a market undergoing the type of price fluctuations we have experienced over the last 10 years.

On slide 7, we have shown a series of uranium supply estimates over the next 15 years. Curve 1 gives the supply capability computed for the facilities presently existing or under construction. Curve 2 takes into account the mine clossures recently announced and curve 3 assumes that all the projects under evaluation in 1980 are producing at the date and with the maximum production rate as considered in 1980. This additional capacity amounts to a little over 40,000 TU/year in increments spread from 1986 to 1992, most of it coming from Australia, the USA, Central Africa and Canada. Curve 3 does not take into account the reopening of the mines whose closures have led to curve 2.

On the slide, these three estimates are compared with estimates made in 1979. Curve 4 gives the realistic production forecast made by the Institute just 2 years ago, whereas curve 5 gives the effective maximum production capability that could be achieved, if conditions were sufficiently favorable for all projected expansion programs and new and developing operations to be brought into production with minimum delay.

Curve 6 shows the theoretical maximum supply capability which could be derived if all known economically workable resources were put, without undue delay, into exploitation. This last curve has been established by OCDE in December 1979.

The U production capabilities can also be subject to short term flexibilities, though maybe in a smaller amount, than the demand requirements. Ore grade cutoffs, mill recovery rates, capacity increase by overtime work, etc. are short term flexibilities which may momentarily permit production variations in the range of 10 to 15%, but at the cost of inconveniences such as loss in the final total output, risk of equipment breakdown, etc. There is of course always the possibility of closing down mine operations, but quite often this may entail the abandonment of the deposit if economic conditions cannot warrant the reopening of the works at a later date.

The High Growth Scenario demand curve shows that by the end of the century the yearly U demand would be around 120,000 TU/year. With a doubling time of 10 years, the 5 million tons of U corresponding to the Reasonably Assured Resources, plus the Estimated Available Resources, would not carry us very far within the next century.

Of course, some instances such as some participants in INFCE have claimed that the 5 million TU figure could be raised to 15 millions, but this is high speculation and would only bring us a few decades further along the next century.

The point which should be made here is that uranium must be considered the same way as oil. This means that it is an energetic raw material, which if used in thermal reactors will only carry us for some decades, and this provided exploration programs are diligently pursued without interruption, even when the U market conditions are momentarily unfavorable, as it is the case today.

5. THE BALANCE OF SUPPLY AND DEMAND 1981-1995

Slide 8 shows the comparison of the U supply from the mines existing at present and under construction, curve 1 and the same augmented with the potentialities of the projects at present under evaluation but reduced by the recent production cutbacks, curve 3, with two U demand projections referred to previously as Forecast, curve 4, and High Growth scenario, curve 5.

The requirements to satisfy the presently concluded enrichment contracts and the feed requirements of the existing natural uranium reactors are also shown on the graph, in curve 6.

These curves tend to confirm the findings of the previous study of the Uranium Institute published in mid-1979 :

- The demand up to around 1987 will be governed by the committed enrichment contracts over and above the requirements of the reactors.
- This will bring about a further increase of the uranium stockpiling held by the utilities and which can be estimated at 120,000 TU at the beginning of 1981.
- Such a stockpile will soon represent something like 2 to 3 years forward requirements of the reactors and make thus available a considerable flexibility for helping the supply to be able to meet the demand.
- Over the period considered, i.e. from today onwards up to 1995, the U supply should be capable to meet the demand.

This stems from the analysis of the Supply and Demand curves shown on slide 8, bearing in mind the conservation built into them. For instance, the lost capacity resulting from recent mine shutdowns has not been reintroduced later and new production potential is limited to the amounts recoverable from the projects under investigation in 1980, without any account for findings occurring after the end of 1980.

Furthermore, the demand curves being established for 0.20% tails assay, they allow for some flexibility. Also the large accumulated stockpile may permit coping with momentarily unbalances resulting from unforeseen events.

The past history of the uranium market with its recessions in 1963-66 and 1971-73 has shown an astonishing ability to recover and to adapt to the changing production requirements. Taking into account the long and comparable lead times to get new mines and new nuclear plants on line, there is room to take administrative action if the political will is there to do so under the pressure of the events in order to remove the unnecessary impediments which may jeopardize the capability of the supply meeting the demand.

Concerning the demand curves, the High Growth scenario has been defined without indulging in too much optimism concerning the impact over the period of the changes which may occur in some major countries such as the US, the UK and Germany, where the nuclear development programs after swift progress in the first half of the seventies have been stalling during the latter part of the period.

The uncertainties over the demand curves lay mostly at the very end of the period considered, i.e. around 1995.

6. THE FUELING OF A LONG RANGE NUCLEAR PROGRAM

Developing a new technology such as the nuclear technology is a very long and costly process. Since 1950, when it was first demonstrated that electricity could be produced from atomic fission, around $ 20 billion in 1979 US $ have been spent in US federal subsidies for nuclear development according to a recent DOE estimate. To this amount one should add the contributions of the industry. Considerable amounts have also been spent outside the US.

Such efforts in time and money can only be justified to promote a durable solution to the problem of the intolerable present foreign energy dependence plaguing the Western Free World, by securing a new, abundant and readily available source of energy.

Nuclear energy may be the answer, but thermal reactors are only a transient solution to this problem.

Whatever the degree of optimism one may lay in the future availability of U production, the period over which such availability will materialize has to be counted in terms of a few decades. Increased reactor performances with burnup extension for instance will not change the picture substantially.

Therefore to any decision maker, who is conscious about the future welfare of his children and grandchildren, it must become obvious that the breeder system is probably the only valid and presently available answer to our long term energy problem and that, without making any "a priori" commitments, this avenue should be explored in all its details up to full size reactor plants, with its associated completely closed fuel cycle including its waste handling and storage solutions. Such a program should be implemented starting right now if we want to be ready on time.

Big efforts in this direction are well in progress in Western Europe with the French, the British and the Germand-Dutch-Belgian programs. Our continent being almost deprived of energetic raw materials, the success of this program by the turn of the century is the only possible relief from our present preoccupying energy dependence.

In North America, you are lucky to have large potentialities in conventional energetic resources, this may give you some time relief, but sooner or later you will need more and more nuclear energy, first to complement these other resources and later to replace them, when hydrocarbons and coal will be in increasing quantities allocated to the chemical industry as raw material.

I wish to quote here a recent statement made by the International Institute for Applied Systems Analysis :
"During the next fifty years, worldwide population will double to 8 billion, even with modest economic growth and extensive conservation, global energy demand is likely to expand to 3 or 4 times today's level. Nuclear primary energy will not remain restricted to its exclusive use as a source of our form of secondary energy, i.e. electricity. By then it should in principle be able to satisfy all of the energy requirements of a global society on an unexhaustible basis".
The National Academy of Sciences seems to concur with these views.

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I have jumped from the near future, i.e. the 1981-1995 period, towards the far away future, i.e. the first decades of the next century. The period of real concern is the in-between period.

It is difficult to foresee what will be the U demand around 1995 since this will depend so heavily on an improvement of the public acceptance of nuclear power and on the courage of the political class which should lead the public towards the right energetic choices, instead of following and acknowledging the sometimes irresponsive moods of the public opinion.

A recent Harris survey (end of January 1981) shows a 52 to 39 support in the US public for building more nuclear plants when this ratio was 42 to 47 in November 1979.

Whatever the U demand around the turn of the century turns out to be, it will be around twice or three times the present production capacity. This means that new mines will have to come into operations and new deposits will have to be found. Taking into account the long lead times, it implies that the exploration programs presently under way must be pursued and amplified. This, in the present economic recession and with the nowadays weak U market, is a real challenge to the uranium producers, especially for those operating a single project with high production cost.

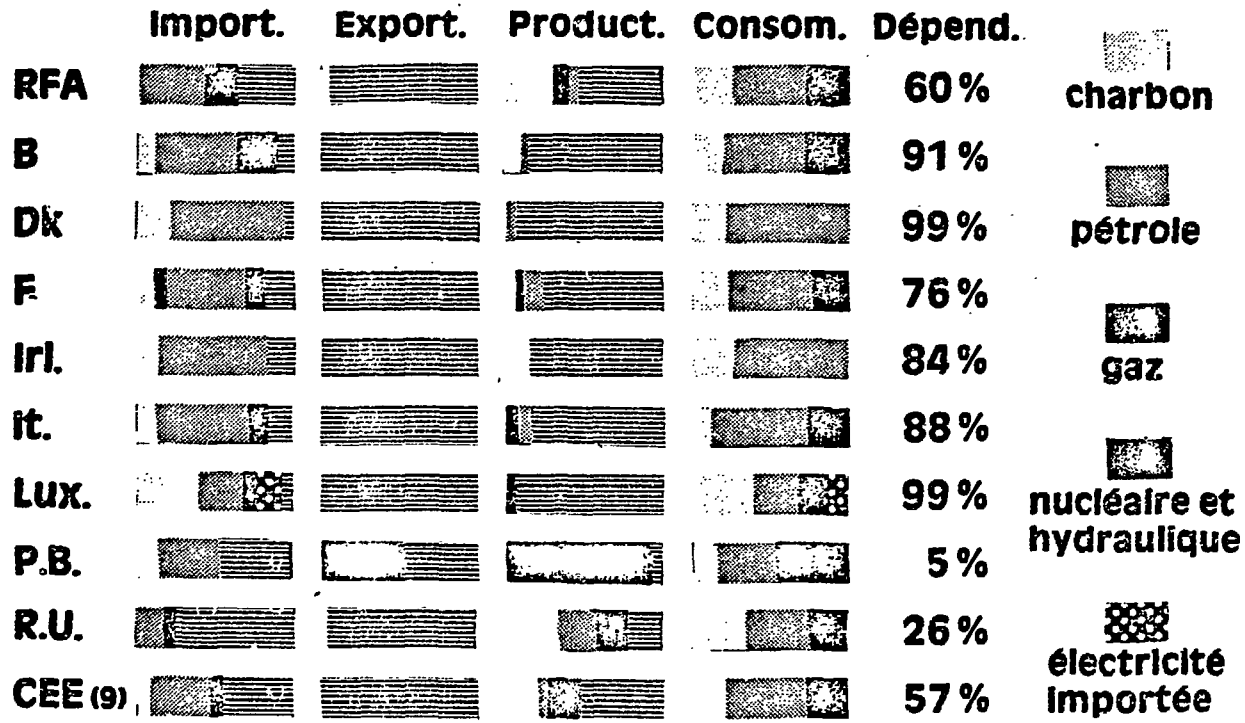
If the producers are having a hard time nowadays, the consumers are not better off since they are faced with the hasardous financial conditions recalled hereabove to build the new nuclear installations and with the uncertainties of the assurance of uranium supply.

I believe that long term supply contracts with yearly price fixing negotiations within the frame of a floor price and a ceiling price, or with other appropriate escape rules, is probably the only way to give a better basis to both producers and consumers for their future financial commitments.

A prerequisite for this is that such long term contracts be strictly implemented within the internationally agreed upon safeguards rules and be free from any such restraints as "case by case prior consent" requirements from governmental authorities of the supplier country in relation with reprocessing and retransfer which is an unacceptable disguised interference with the sovereignty of the receiving country.

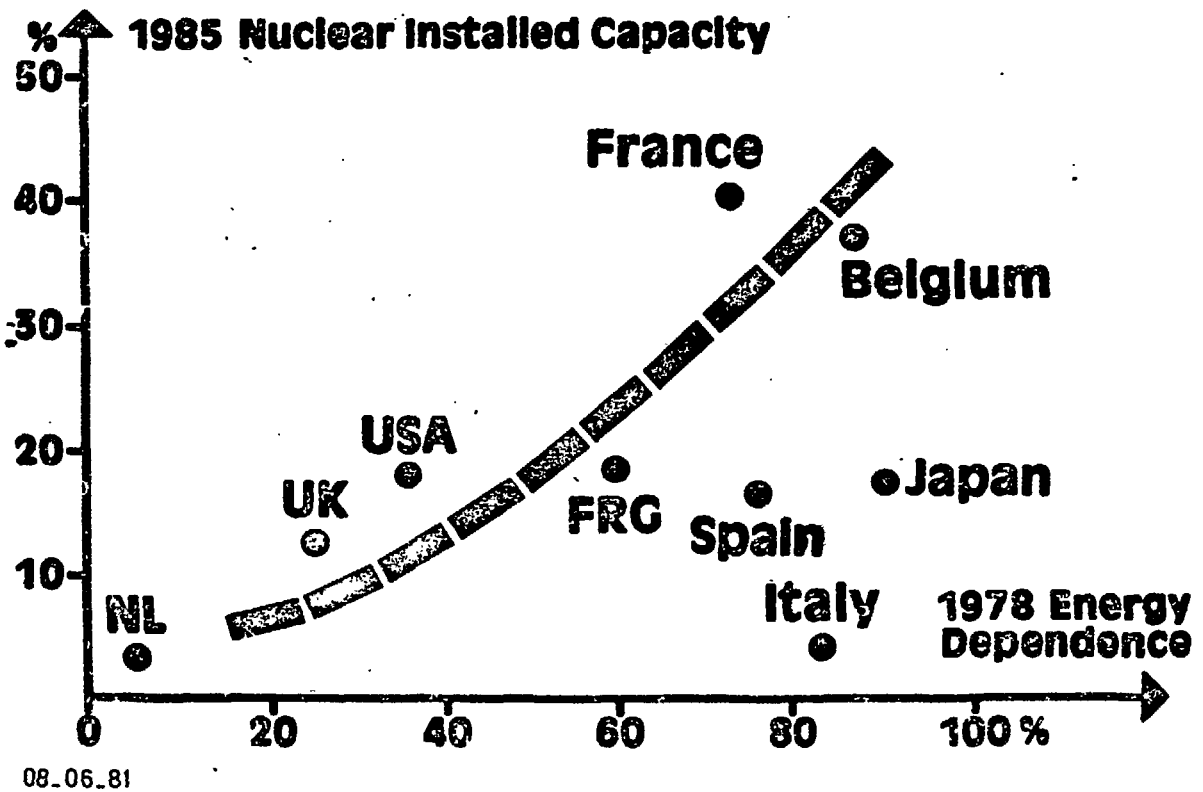
ACKNOWLEDGMENT

This paper refers to some data developed recently by the Uranium Institute and which will be contained in the new Supply and Demand Report to be published in the course of the summer.



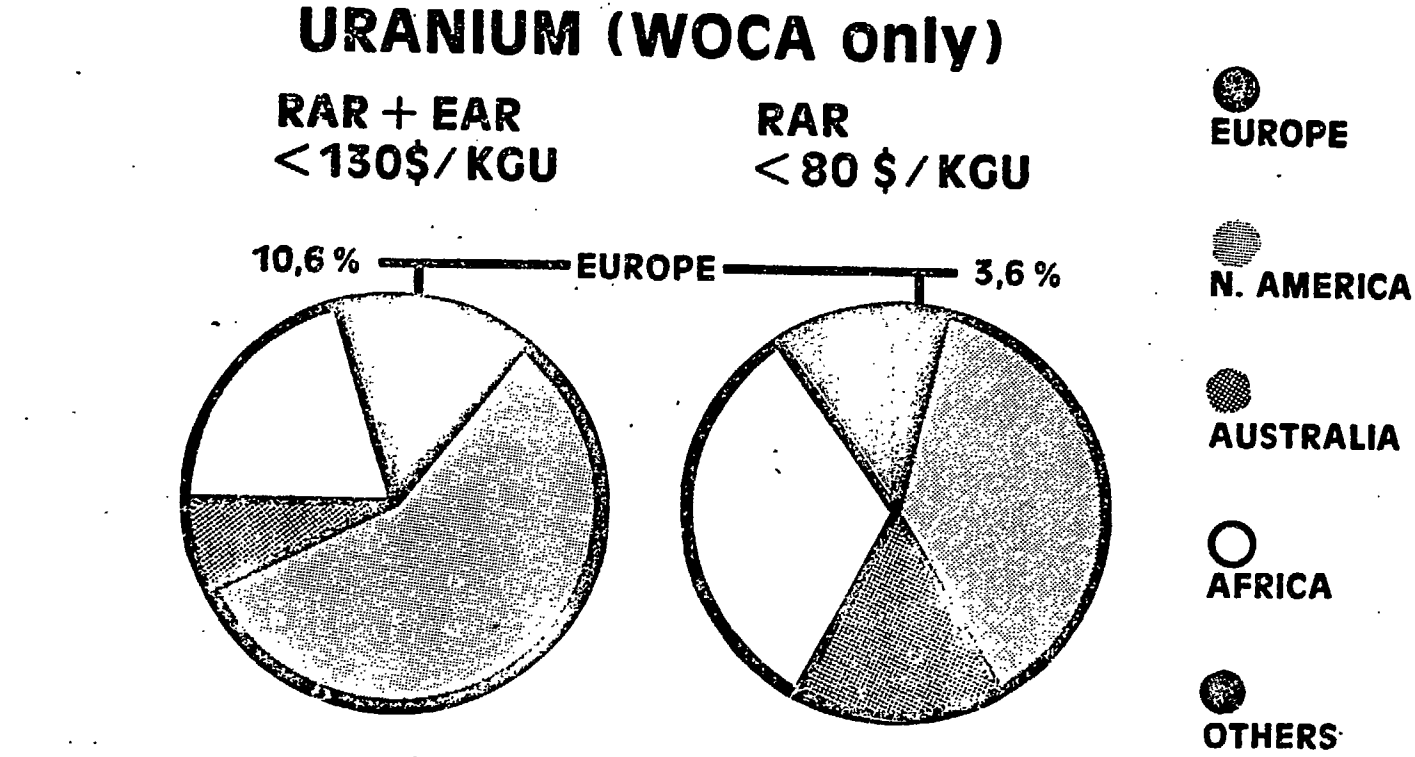
ENERGY DEPENDENCE OF CEE COUNTRIES

SLIDE 1



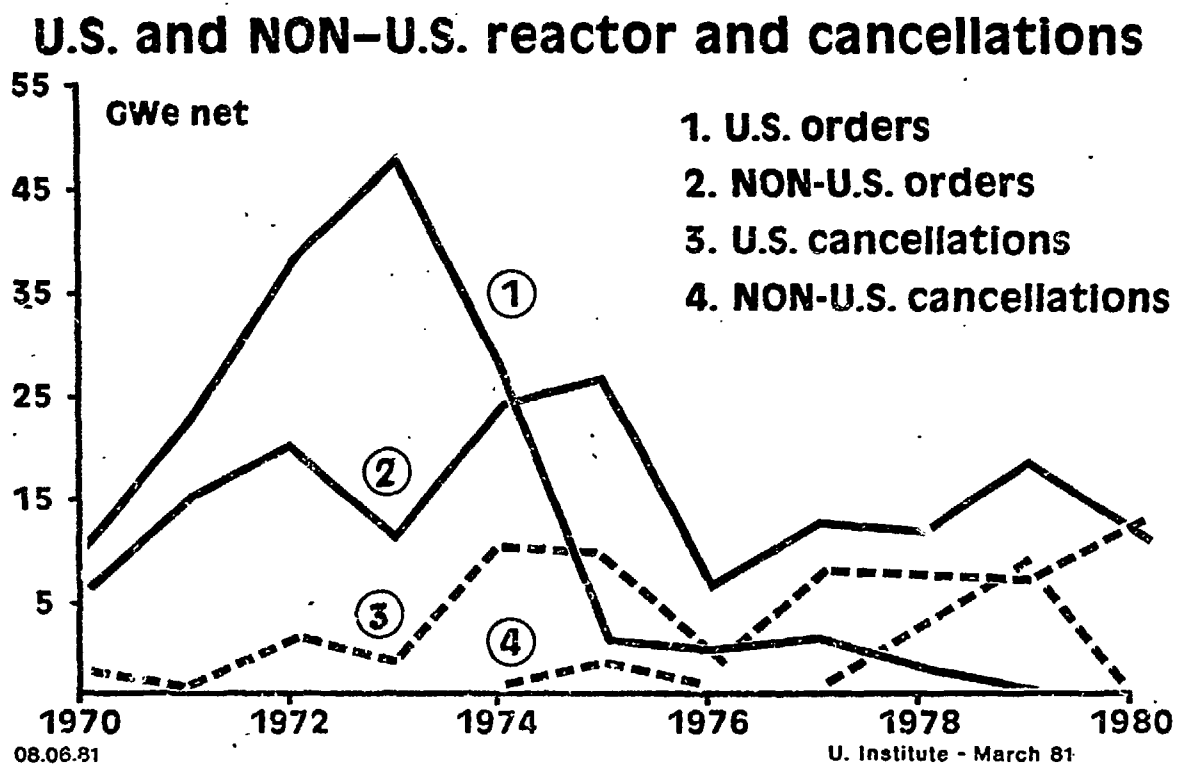
1985 NUCLEAR CAPACITY VERSUS 1978 ENERGY DEPENDENCE

SLIDE 2



REASONABLY ASSURED RESERVES AND ESTIMATED ADDITIONAL RESERVES FOR WORLD OUTSIDE COMMUNIST AREA.

SLIDE 3


U.S. and NON–U.S. reactor and cancellations
GWe net
55
45
35
25
15
5
1. U.S. orders
2. NON-U.S. orders
3. U.S. cancellations
4. NON-U.S. cancellations
1
2
3
4
1970
1972
1974
1976
1978
1980
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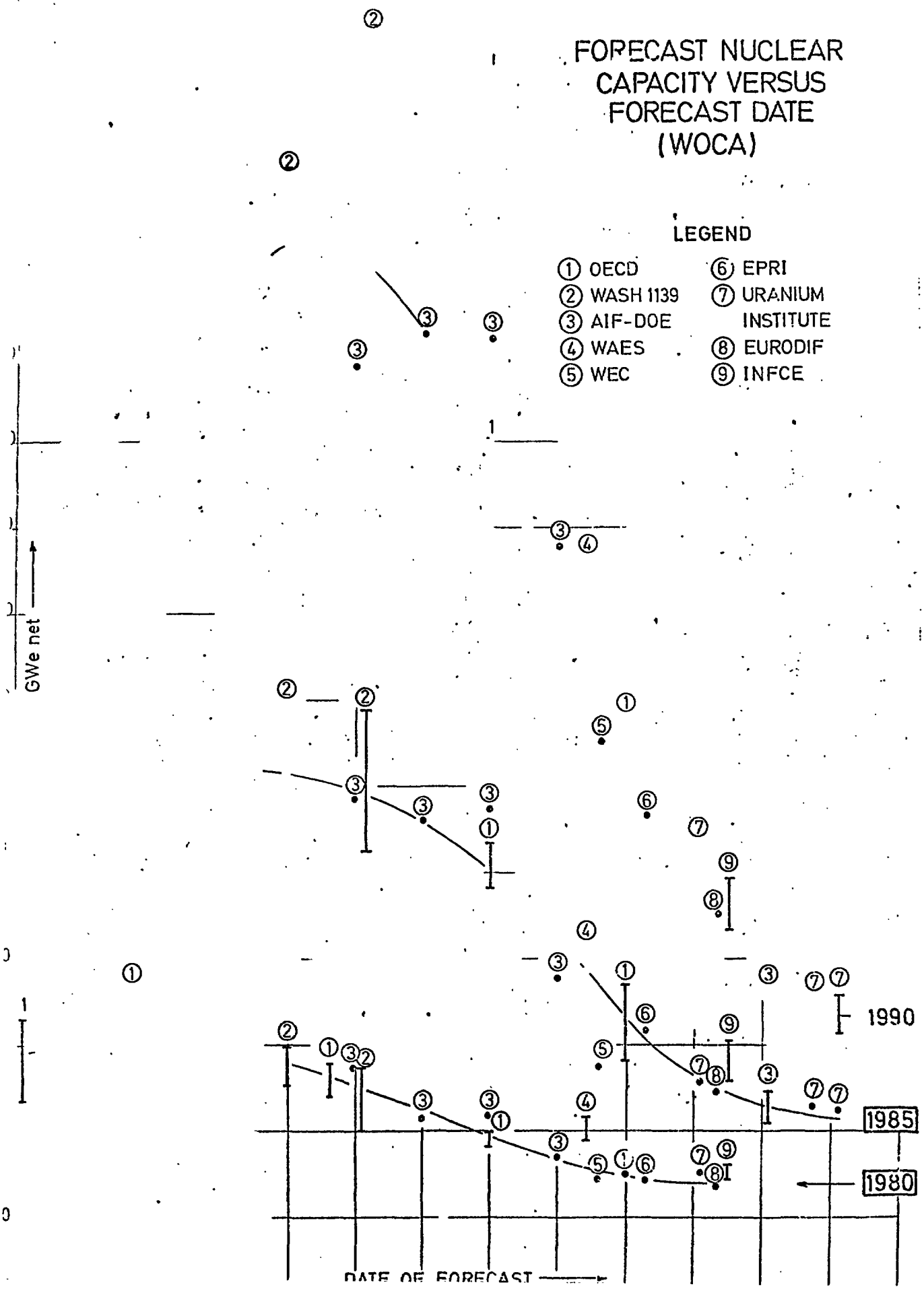
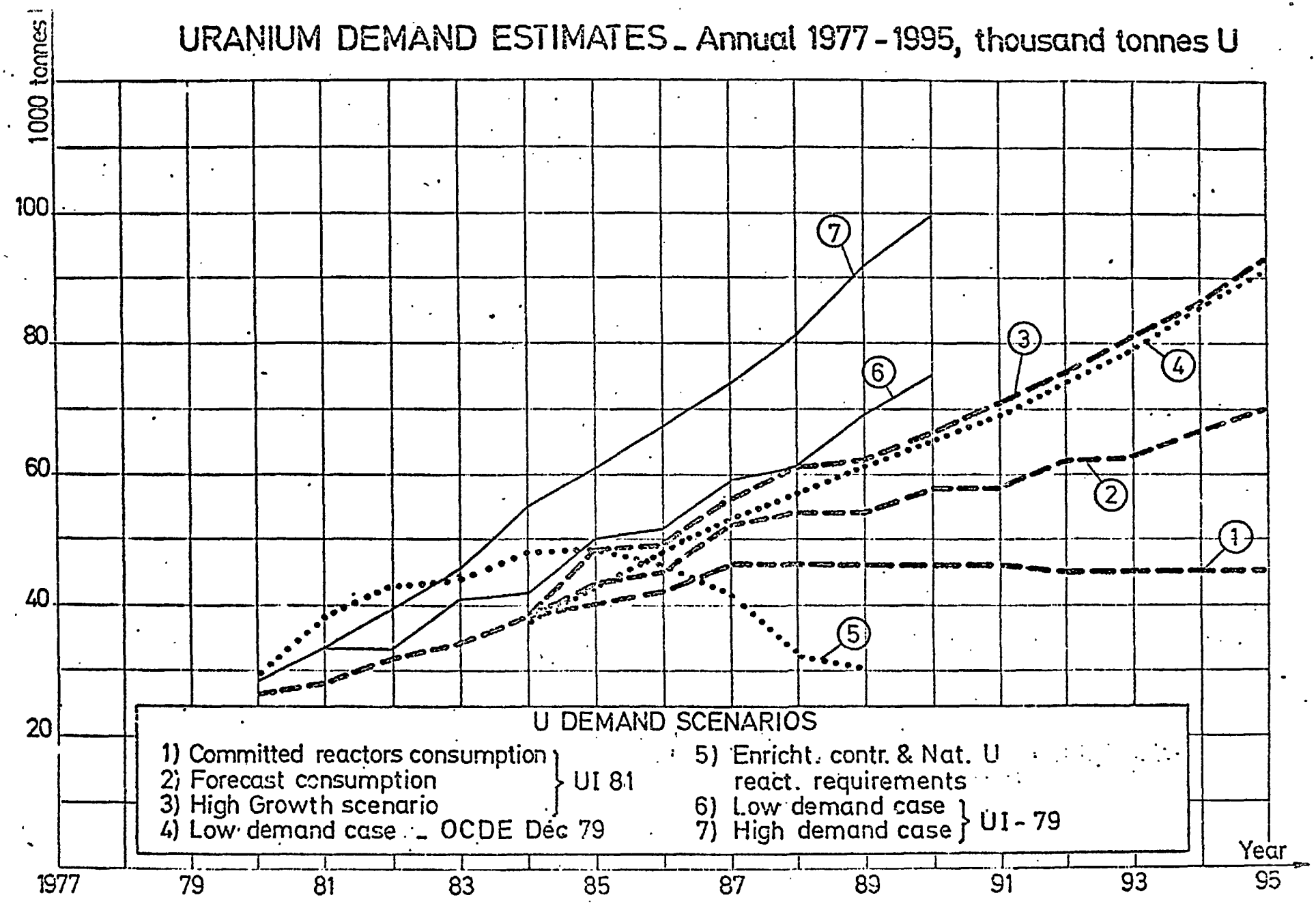
U. Institute - March 81

SLIDE 4

FORECAST NUCLEAR CAPACITY VERSUS FORECAST DATE (WOCA)



URANIUM DEMAND ESTIMATES _ Annual 1977 - 1995, thousand tonnes U



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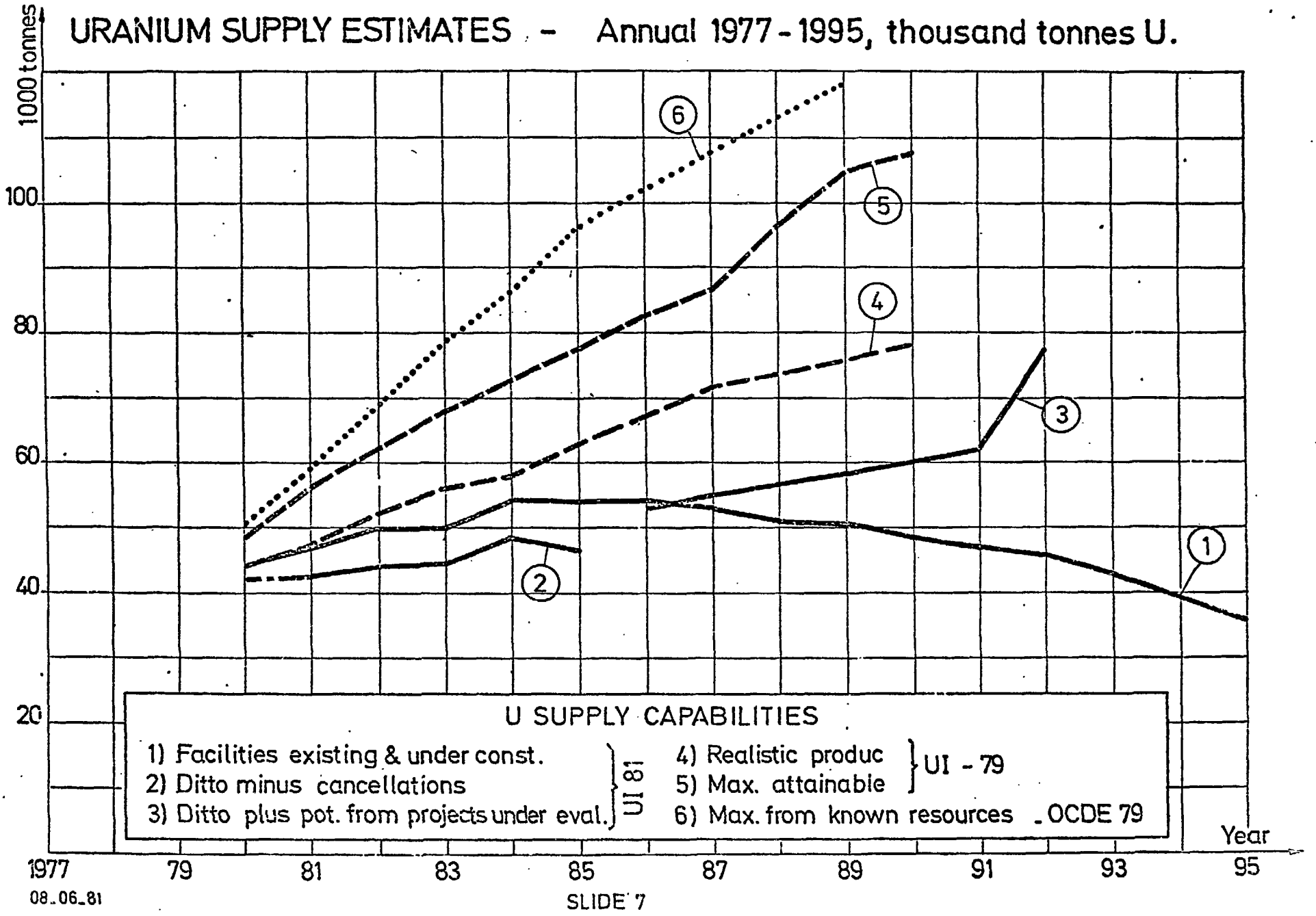
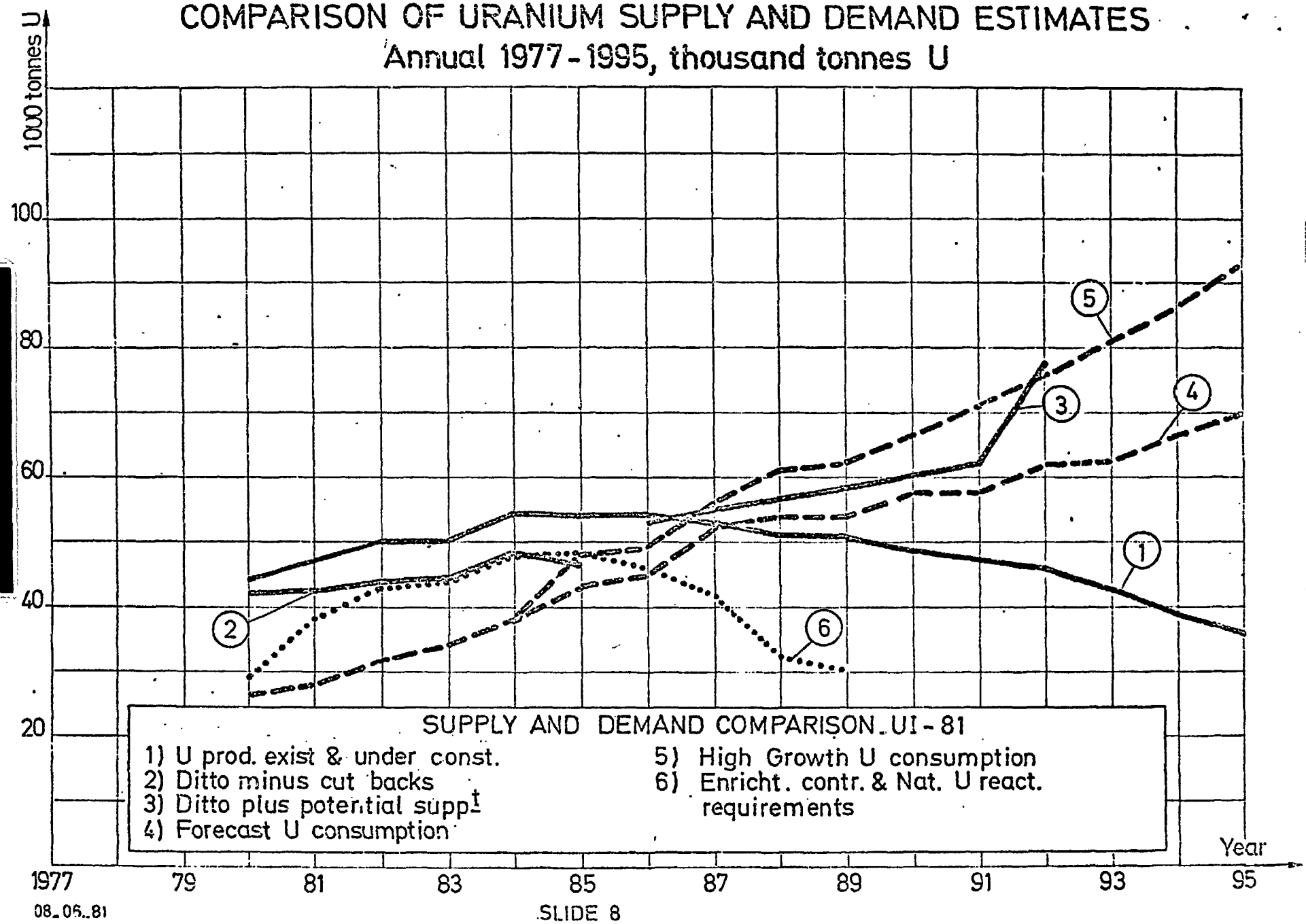
SLIDE. 6


URANIUM SUPPLY ESTIMATES - Annual 1977 - 1995, thousand tonnes U.
1000 tonnes
100
80
60
40
20
6
5
4
3
2
1
U SUPPLY CAPABILITIES
1) Facilities existing & under const.
2) Ditto minus cancellations
3) Ditto plus pot. from projects under eval.
UI 80
4) Realistic produc
5) Max. attainable
UI - 79
6) Max. from known resources
OCDE 79
Year
1977
79
81
83
85
87
89
91
93
95
08.06.81
SLIDE 7

COMPARISON OF URANIUM SUPPLY AND DEMAND ESTIMATES

Annual 1977 - 1995, thousand tonnes U



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SLIDE 8