Lecture Meeting

25th September 2002

World Energy Outlook 2002

ROBERT PRIDDLE
Executive Director, International Energy Agency

Good morning, ladies and gentlemen. Thank you, Mr. chairman, for your welcome. And thank you all for coming here so early in the morning for an intense period of listening to lectures by three of us.

Welcome, my fellow speakers. And later in the morning I apologize to you that I have to leave to catch a plane for China. And after my presentation I'm afraid I will have to leave. But I'm sure they will have many fascinating things to say to you.

This is actually the second time in five days that Mr. Sakamoto has been my host. As he said, there has been a series of important meetings in Osaka in the past few days. And on Saturday morning he was the host at a symposium preceding the start of the International Energy Forum, that is, the dialogue between oil producing and consuming states.

I'll say more about that if there is time at the end of my presentation. And I'm sure we might hear more about it from our subsequent speakers later in the morning.

It was a very successful occasion, both the symposium and the International Energy Forum meeting. That Forum has reached a new maturity. The dialogue between oil producing and consuming states is now on a much more solid basis than it was even eight years ago, when I came to my position in the International Energy Agency.

And this time there were some concrete results from that meeting, particularly in relation to improved data about what is going on in the oil market, some really concrete achievements, a commitment globally to improve the quality and the timeliness of the data which is collected and made available to operators in the market about what is happening there.

We should not deceive ourselves. Of course there are still important differences of opinion between producers and consumers. Dialogue doesn't mean that all the difficulties melt away. But the fact that there can be such a frank exchange is, I think, extremely important to the security of oil supply, security of supply for those of us who are importers, and indeed security of demand for those who are exporters.

But today I have a different purpose. It's not that immediate question of what is going on today between producers and consumers, what is going on today in the market. It's a much longer-term question, about how the energy scene might develop over the next 30 years.

I think many of you will know that the International Energy Agency produces a forward look, a scenario for the future, updating it every two years, looking at global demand and supply and other questions.

And this year we were due to produce the latest version of that. On an extended time scale, our last version (in the year 2000) looked forward 20 years. This time we have tried to look forward 30 years, to allow for some of those new technologies which are likely to emerge in a more significant way after or around the year 2020.

That new addition was due to come out in November, actually. But the Japanese government particularly requested us to, if possible, bring it forward and to make it available for the Osaka meeting.

And we were able to do that. So this large volume, a 500- page analysis of the future, was published in Osaka last Saturday.

My purpose, therefore, is to introduce to you some of the more important features of our analysis. To try to help you, I have placed outside some copies of the press communique that we released in Osaka, which has some summary information about out findings.

We have also produced a much slimmer book, which is just the highlights of that analysis. And some copies of that are available to the Institute, and could be distributed.

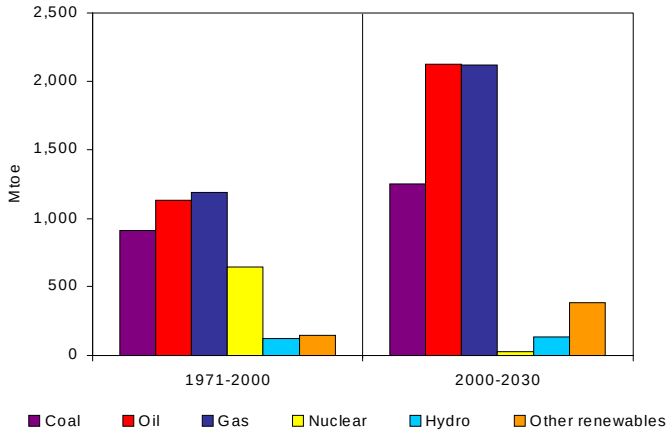
And of course, we would be delighted, for those of you who would like to actually buy our full volume. I gave Mr. Sakamoto the first copy to be given to any recipient in Japan last Friday.

So I need to expound some our findings to you. That, I'm afraid, is going to demand some concentration. I apologize for that. What I will not do, though, is go in detail into the underlying assumptions, the analytical process. That, of course, is described in the full book. But there simply is not time to go into that in a short presentation this morning.

So I'll concentrate on the results, on the lessons, the issues which demand attention and action, indeed, from governments and from others who operate in the energy market.

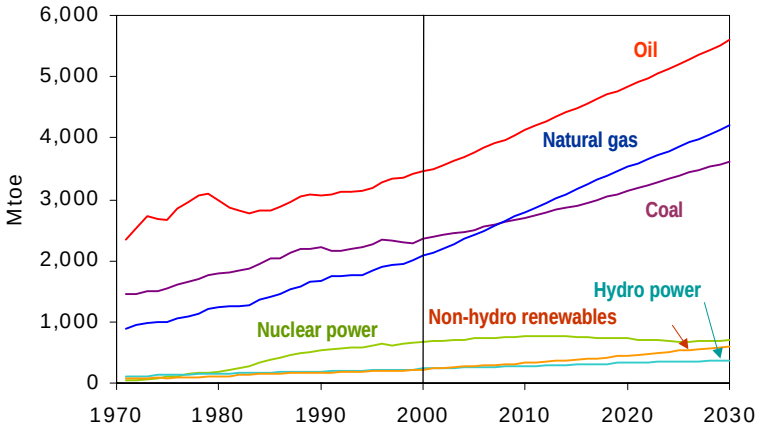
So let's start. Here is the increase which we expect to take place in total primary energy demand over the next 30 years, comparing the 30 years of 1970-2000 with the period 2000-2030(Increase in World Primary Energy Demand by Fuel). And it shows the increase in demand for each of the main fuels(World Primary Energy Demand).

Increase in World Primary Energy Demand by Fuel



Fossil fuels account for more than 90% of the increase in energy demand in 2000-2030 – a bigger share than in the past

World Primary Energy Demand



Gas grows fastest in absolute terms & non-hydro renewables fastest in % terms, but oil remains the dominant fuel in 2030

This is our so-called reference scenario, our central case on central assumptions, which are spelled out in the analysis. And the results show that overall we expect world energy demand to grow at a rate of 1.7% each year over this 30-year period. And the slide shows how that increase is expected to be distributed among the fuels.

The key message here is that in 30 years' time we shall be using

two-thirds as much fuel again as we are today. This rate of growth is slightly lower than the rate of growth of the last 30 years. That is particularly because of technological advances that enable us to get more energy service out of less input, and also partly because of the maturing of the economies in some parts of the world, which makes them less energy intensive.

Here is another way of looking at this. It shows the expected share of each fuel in total demand over this period. Fossil fuels, you will see, remain overwhelmingly dominant. They are expected to meet over 90% of the increase in demand for energy in this 30-year period.

Oil remains the single most important energy source at the end of the period, with almost three-quarters of the increase in oil demand going to the transportation sector.

Overall, this means that the demand for oil will rise from 75 million barrels a day at the start of the period to something like 120 million barrels a day in 30 years' time.

The demand for natural gas grows more strongly than does the demand for any other fossil fuel. Gas use, therefore, doubles between now and 2030. And nearly two-thirds of that increase in demand will be dedicated to power generation.

As for coal, consumption is also growing in absolute terms, but more slowly than gas. It's significant that China and India account for two-thirds of the increase in demand for coal. And the increase, in this case again, is concentrated in power generation, where coal remains the dominant fuel for power generation, even at the end of the period.

As for nuclear power, this is more difficult. The whole basis of this reference case is the extension into the future of a scenario which assumes current policies will continue. Of course, that's a false assumption. But it's also false to make a different assumption about what governments might do in the future.

So this is particularly relevant to nuclear power. We have to take the present positions of governments toward nuclear power. And, as you know, many, like Germany for example, have a policy of phasing out nuclear power. And this is reflected in the pale-green line here, which shows nuclear-power output peaking in 2010 and then slowly declining after that, as a result of some nuclear-power stations coming to the end of their lives, and a rather slow addition to the stock of nuclear-power stations in those few countries, including Japan of course and Korea, where there is a policy of expanding or maintaining the nuclear component of supply.

Renewable energy, in terms of its rate of growth, grows faster than any other type of energy. But it starts from such a low base that it is still not a very

significant part of supply, even at the end of this period.

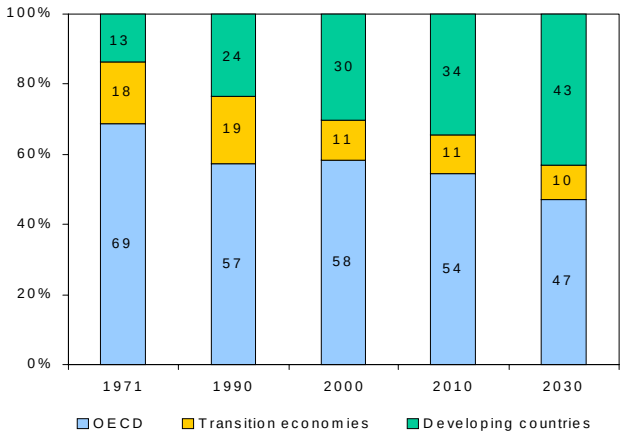
It's very important to face up to this reality. Renewable energy commands support in every country of the International Energy Agency. Every government is intervening in one way or another to increase the proportion of energy coming from renewable sources, but even so we can't expect anything dramatically more than this.

There are alternative scenarios that show a somewhat greater rate of growth, but we are still going to be a fossil-fuel-energy economy. Therefore, in thinking about the issues in energy, we have to deal with the fossil-fuel component, as well as giving support to renewable energy.

There is going to be a major geographical shift in the center of energy demand. Indeed, it is already happening. You see over time here how the proportion of total energy taken by the countries of the OECD is diminishing (Regional Shares in World Primary Energy Demand). And the proportion taken by the transition economies, or the developing economies, is growing. In fact, over 60% of the growth in demand comes from the developing world.

The share of those countries in total demand will rise from 30% in the year 2000 to some 43% by the end of the period.

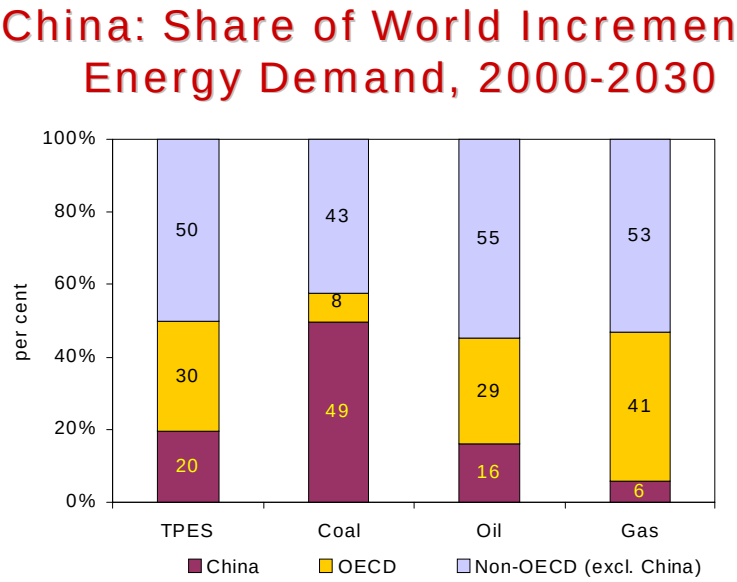
Regional Shares in World Primary Energy Demand



62% of the increase in world demand between 2000 and 2030 comes from developing countries, especially in Asia

I thought that it would be appropriate here, in this part of the world, to give prominence particularly to China (Slide: China: Share of World Incremental Energy Demand, 2000-2023), which is of course a very, very major component of world demand and very, very important in terms of its share of demand growth.

China is already the second largest consumer of energy in the world. And the slide shows China's share of the increase in demand for energy over this period for each of the three main fossil fuels and overall. For example, nearly half of the global increase in demand for coal will be absorbed in China.



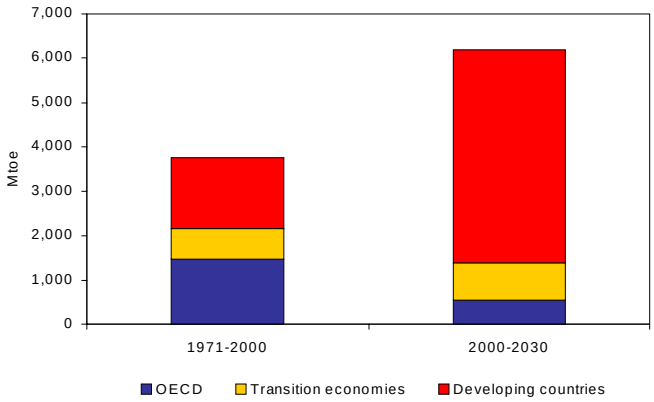
China accounts for a fifth of the increase in world energy use & half of the increase in coal use over the next 3 decades

So where is all this additional supply going to come from? This is what I depict here (Slide: Increase in World Primary Energy Production). It shows the geographical source of the additional supplies among three regional categories, as I used before: the OECD, the transition economies, and the developing world.

This significance is that almost all the increase in supply over this 30-year period is going to come from the developing world, and not from within the OECD. That figure for the past 30 years was something like 60%. So there is a significant geographical shift in the source of energy, as well as in the demand for energy.

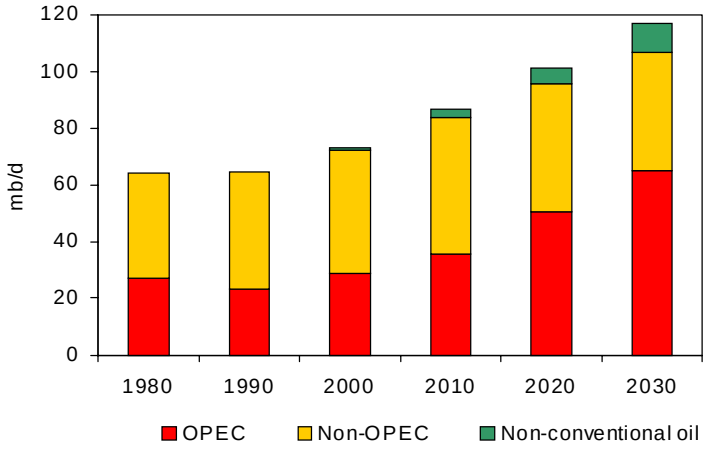
Most of the increase in supply of oil and gas will come from the Middle East or from the countries of the former Soviet Union (Slide: World Oil Production). OPEC Middle East countries will account for most of the increase in oil supply after the year 2010.

Increase in World Primary Energy Production



Almost all the increase in production occurs outside the OECD, up from 60% in 1971-2000

World-Oil Production



Non-conventional oil emerges as a major new source

So that has given you a very brief picture of the results by fuel over this period. In the book we look at the global picture. We then look at the application of these figures by fuel. And then we develop the analysis in several important regions of the world.

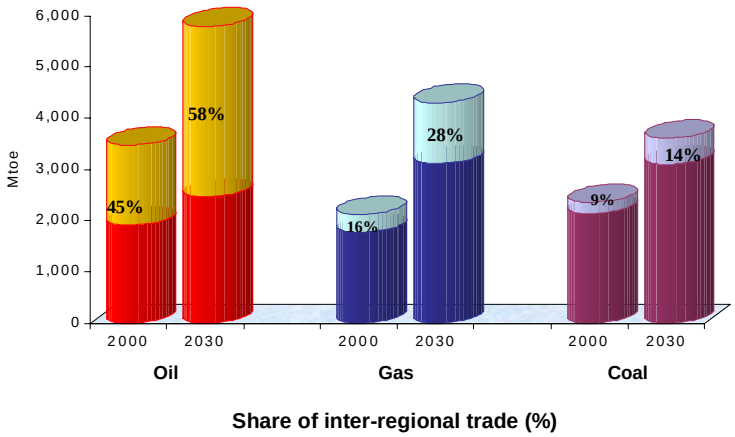
I want to draw some key policy implications from what I have said. First, there is going to be an enormous increase in the international trade in energy.

Trade, especially in fossil fuels, is going to grow dramatically, as shown here(Slide: Share of trade in world fossil fuel production)

Trade between regions, by which I mean among the regions of the OECD and between the OECD and other major regions of the world, is going to more than double in 30 years.

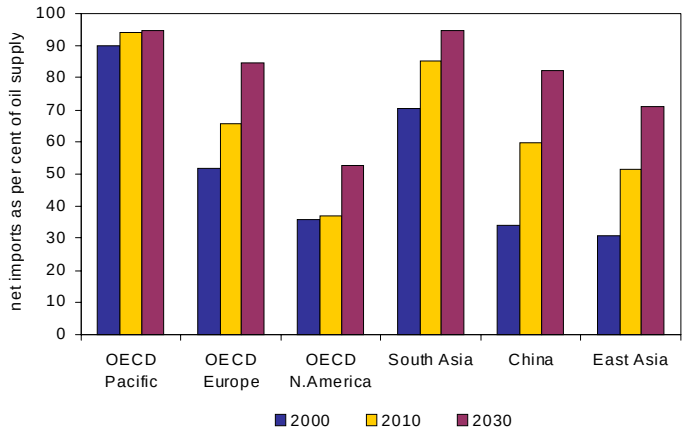
All importing regions, including all three regions of the OECD, are going to import more oil. And all the main gas markets, particularly those of North America, of Europe, and of the Pacific Rim, are going to become much more import- dependent for gas (Slide: Oil Import Dependence).

Share of Trade in World Fossil-Fuel Production



Energy trade between regions more than doubles between now and 2030, most of it in the form of oil

Oil-Import Dependence



Asia sees the biggest jump in import dependence, while OECD imports also continue to rise, especially in Europe

Here is another way of illustrating that growth in import dependence in the case of oil. It's bound to increase our concern for security-of-supply issues. I'll say a bit more about that at the end.

That issue, though, is already back at the top of the agenda. It's a sensitive matter for the oil producers that we in the consuming countries place such emphasis on our concern about security. They feel that we do not hear their assurances.

But the reality is that there are certain situations for which the producers with the best will in the world might not be able to compensate.

There was, indeed, a note of irritation, I thought, in the Saudi oil minister's presentation to the symposium last Saturday morning on this very point.

But, as I say, not every geopolitical situation can be compensated for by even well-disposed oil suppliers. So it is perfectly reasonable that countries such as Japan, indeed all members of the IEA, who are heavily dependent for the most part on oil imports, should have policies directed toward increasing their security of oil supply.

We are bound to maintain our preparedness. We are bound to maintain our policy of holding oil stocks. I think there were significant advances this weekend in terms of the commitment in this part of the world between the ASEAN plus three about the policy of building oil stocks against a potential emergency.

There is going to be new emphasis on safeguarding the sea transit routes.

And there needs to be a lot of it as well on safeguarding gas pipeline routes.

There will be, I suppose, new attention paid again to diversity: Is it possible to broaden the spectrum of our energy supply, so as to become less reliant on one particular form?

And there will be new emphasis on efficiency, efficiency to curb demand, not just for economic efficiency, but also for security.

We have in the book what we call an alternative scenario for the OECD countries. That's actually driven by new policies to curb carbon dioxide emissions.

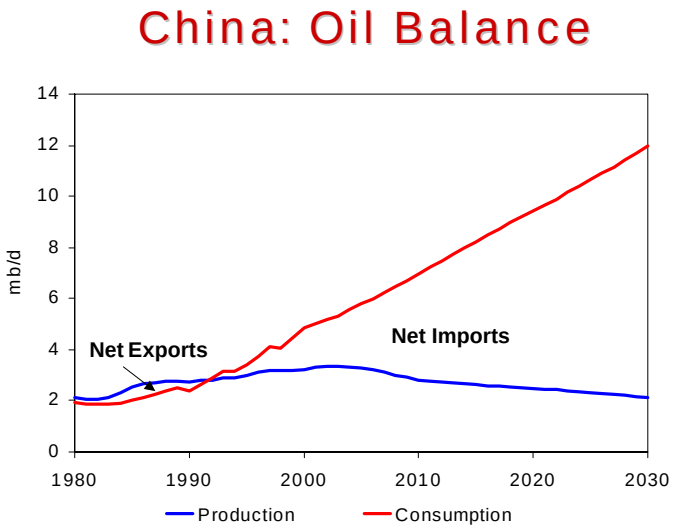
But it is very interesting. No matter what the motivation, it does show what can be done if governments are sufficiently committed to a particular end.

In that case, to take an example, because of the new policies that are assumed (those are all policies that are under consideration in OECD countries at the moment but not yet adopted), if that full range of policies were adopted, for example, gas imports into the European Union by volume would be cut by a volume equivalent to the total imports now into Europe from both Norway and Russia.

To focus on this region again, here is China's prospective oil balance (Slide: China: Oil Balance). Oil consumption, on our analysis, will rise to some 12 million barrels a day by 2030. From being a small net exporter, China has already become a net importer of some 2 million barrels a day. And by 2030 we think that figure could be nearly 10 million barrels a day of net imports into China. That is to say, China would then be an oil importer on the same scale as the United States is today.

China's reliance on imports, if those figures are right, would rise from some 34% today to 82% at the end of this period.

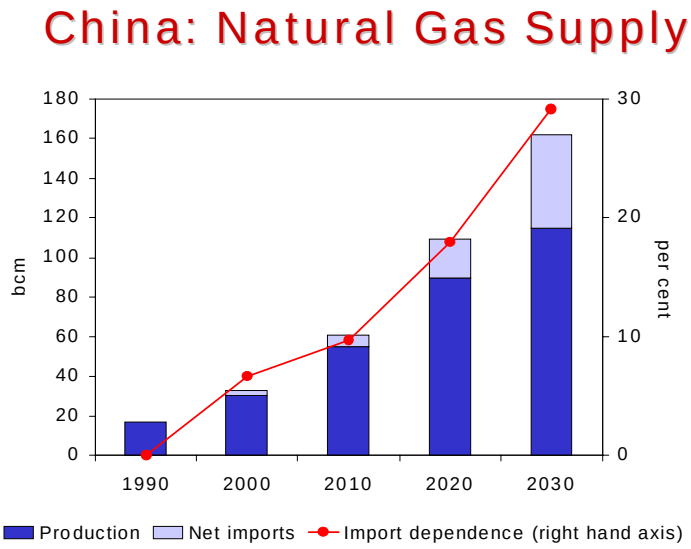
Clearly, China is going to be a major strategic buyer on the oil market in an increasing way over this period.



Net oil imports surge from 1.7mb/d in 2001 to 9.8mb/d in 2030

Here's a similar picture for China's gas import dependency. We expect China's gas consumption to rise nearly fivefold over 30 years. Import dependence, in this case, is not so marked (Slide: China: Natural Gas Supply). But it still makes China a major gas buyer from abroad.

We are assuming here that the West-East Pipeline is built and the other major Chinese domestic projects do go ahead. But still China becomes a growing importer of gas, in the early years particularly from Australia, from Southeast Asia, from the Middle East--later probably from Russia, and perhaps from some of the Central Asian countries now in transition.



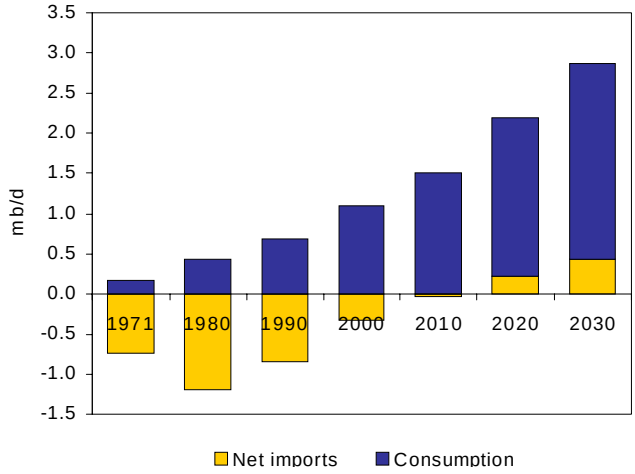
Gas demand, increasingly met by imports, jumps from 32 bcm in 2000 to 162 bcm in 2030

Just to shift the geographical focus a little, while remaining in this region, here's a picture of the Indonesian net oil export-and-import position as we expect it to develop (Slide: Indonesia: Oil Balance).

Recent exploration has failed to find new reserves sufficient to keep pace with the depletion of existing fields. In the short-to-medium term there is a prospect of new production sufficient to offset the decline of mature fields, but not more than that.

So over this period, we expect Indonesia to switch from being a net oil exporter to being a net oil importer. And I could show a similar picture for Malaysia.

Indonesia: Oil Balance



By 2010, Indonesia's oil production begins to decline & the country becomes a net oil importer

Just finally on this point about the growth in world trade, here's a picture of what we expect by way of trade in oil at the end of the period (Slide: Net Oil Trade).

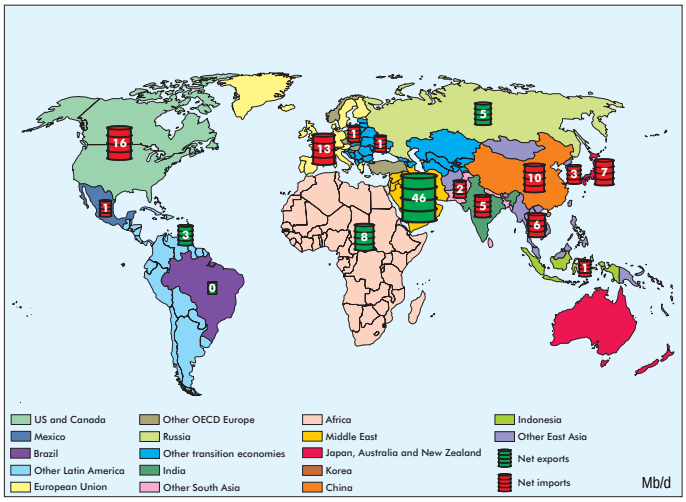
You see that the Middle East OPEC countries are overwhelmingly dominant as exporters. That's the green barrel there. There are large-scale imports required globally, particularly in the United States, in Europe, in China, in Japan, elsewhere in Asia, and indeed beyond.

And similarly for gas (Slide: Net Gas Trade Flows, 2030). Here are the trade flows that we expect in the year 2030 in the gas business, most of it coming out of the Middle East, Africa, Latin America, Southeast Asia, and Australia.

Europe, in this case, is the dominant customer. But substantial import demands exist in other countries, too.

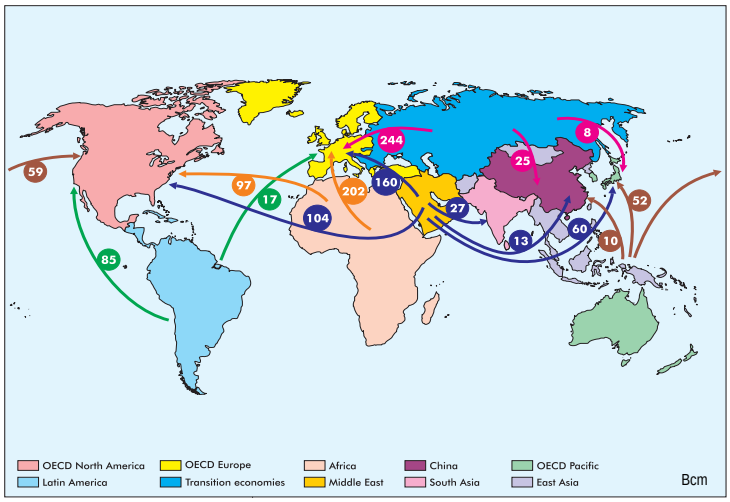
I have emphasized trade development, because I think it is very significant, but I want to move now to a different issue. And this is the question of the funding of the infrastructure needed in order to meet this demand for energy, to supply this potential increase in demand for energy.

Net Oil Trade, 2030



The Middle East strengthens its position as the world's largest oil exporter

Net Gas-Trade Flows, 2030



The Middle East overtakes the transition economies as the world's biggest gas-exporting region

This is work that we are going to take further in the course of the next year. And in a year's time we will publish a much more detailed analysis of investment in this area.

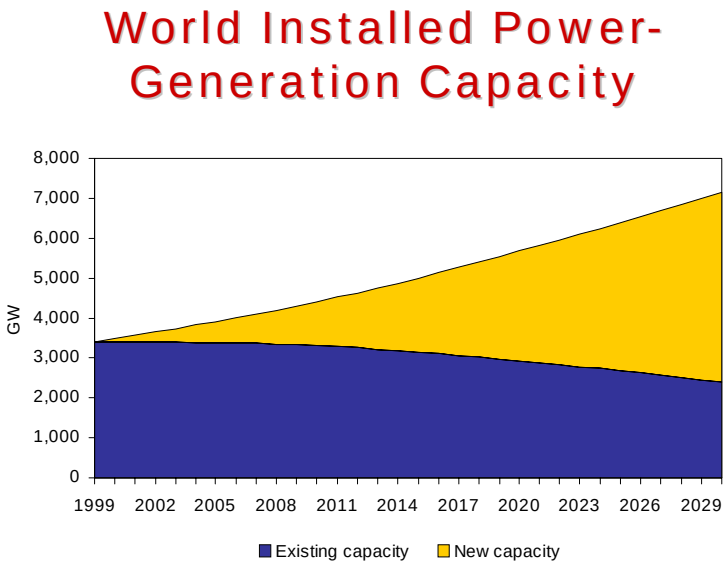
But here is an illustration, in this case, related to the power-generation sector alone (Slide: World Installed Power Generation Capacity). Of course,

there is nothing unexpected about this slide. Power-generation demand goes up. Supply from existing power stations declines over time, as they come to the end of their useful lives.

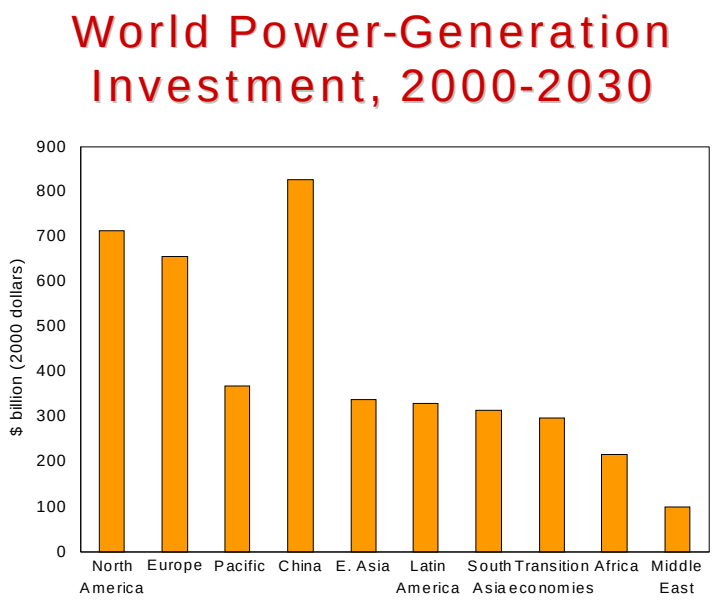
What we have to do, though, of course, is to provide for the capacity decline. That has to be made good. And we have got to provide for the expansion in demand.

And this shows, for power generation alone, that in our estimate the capital requirement will be some $4.2 trillion (Slide: World Power Generation Investment, 2000-2030).

The developing countries share of that is about half: $2.1 trillion, over twice the investment those countries have made in power generation in the last 30 years.



Nearly 5,000 GW of capacity is built in 2000-2030, almost half in developing countries



Cumulative worldwide investment in new power plants amounts to $ 4.2 trillion, more than half in developing countries

The realization of such capital flows first is obviously going to depend upon capital flowing from the industrialized world to the developing countries. And second, it is going to depend on market barriers, regulatory barriers, being lowered to a sufficient extent to attract that capital.

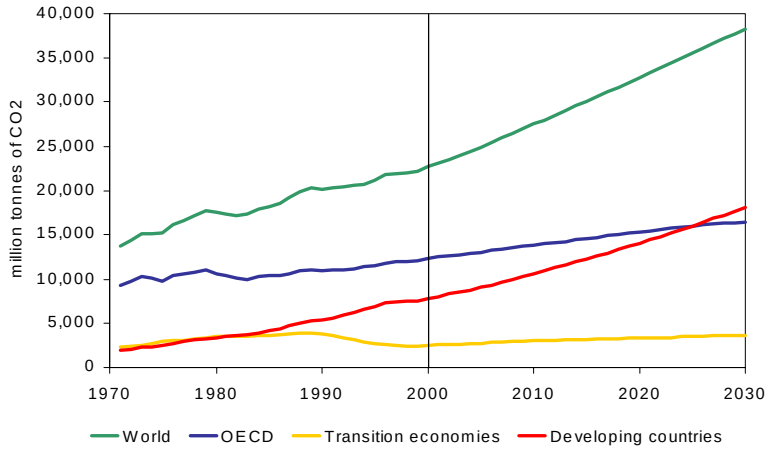
The right investment climate has to be created if this demand is going to be met, if this is going to appeal to investors in preference to their choice to place their capital in other markets.

I'll move on again, this time to the question of carbon dioxide emissions (Slide: Energy Related CO2 Emissions), both carbon dioxide emissions and in many cases local environmental effects associated with this great increase in energy demand and supply.

Carbon dioxide emissions are set to grow even faster than energy use is going to grow over this period, particularly because of our assumption about a declining nuclear component.

Global carbon dioxide emissions by the year 2030 will be 38 billion tons, compared with 22 billion tons today. That is a 70% increase.

Energy-Related CO_2 Emissions



World emissions increase by 1.8 % per year to 38 billion tonnes in 2030 – 70% above 2000 levels

That count of the actions and commitments made by our governments so far. But, of course, a large part of this increase is coming in the developing countries. Indeed, two-thirds of it arises in the developing world.

China alone will account for one-quarter of the increase in carbon dioxide emissions. But I should say that total Chinese emissions in 2030 will still be below those of the United States.

In the reference scenario, the basic scenario for the OECD countries, which is shown in blue here, you see our expectation of a rising level of carbon dioxide emissions from the OECD countries, too.

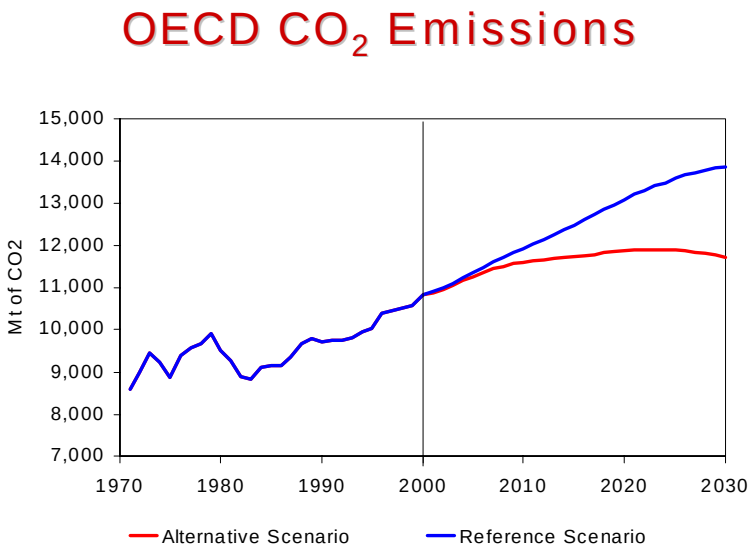
The only way in which the OECD countries could meet their Kyoto commitments would be by relying very heavily on the purchase of carbon emission credits from those countries that have them, particularly from the countries of the former Soviet Union. And even then, it's going to be a great struggle to meet those commitments.

What the alternative scenario looks at (Slide: OECD CO2 Emissions), as I told you, is what might be achieved if all the policies now in contemplation in our member states were adopted, with the objective of reducing carbon dioxide emissions.

And what this picture shows in the red line is that there could be cuts in emissions over this period. But our countries would still be dependent on the purchase of carbon emission credits in order to meet their Kyoto commitments.

However, there would be enough credits for them to do that, assuming that the United States is not in the market, is not a trader in the emissions credit

market.



Emissions in the Alternative Scenario stabilise towards the end of the projection period

I'm turning now to my final issue. And this is energy poverty. What this map shows is the number of people globally who are suffering from energy poverty today (Slide: 1.6 Map of Global Energy poverty).

What I mean by energy poverty that energy poverty takes two forms: absence of access to electricity (those are the figures in yellow here) and reliance on traditional biomass for cooking and heating (which are the gray-green figures here).

These are distinct but complementary issues. The transition is not from traditional biomass straight to an electrical economy. There is a transitional phase, during which when electricity becomes available it is used for very limited purpose, for one light, perhaps, for one communication system, perhaps for a pump. But there is continued reliance on other forms, like kerosene and the traditional biomass.

But electricity itself, of course, is essential to economic takeoff. It creates the motive power, the drive, for local enterprise, which creates income and creates employment.

In relation to electricity, the picture is grim. But much is being done. What this slide shows is that we expect a continuance of an average rate over this period of some 75 million new people globally connected to the electricity system, either locally by distributed generation or connected to the main-grid network (Slide: Average Number of Electricity Connections per Year).

Today there are 1.6 billion people in the world with no electricity. This

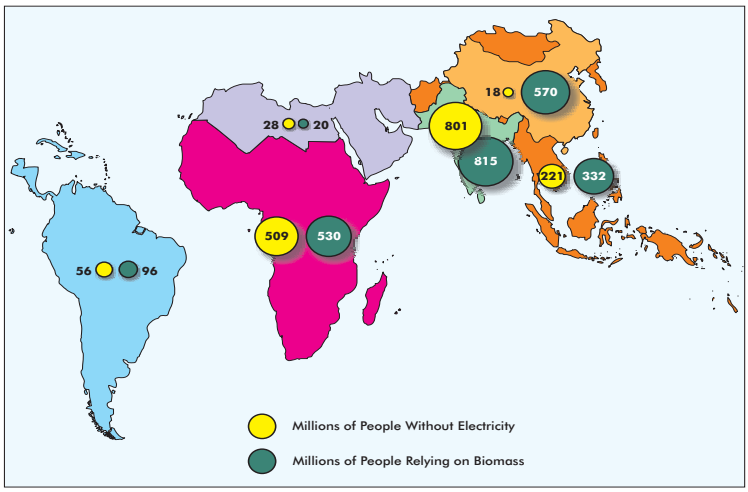
is a detailed analysis we have done to underpin these figures country by country.

Even if we have 75 million new connections every year, this is still going to remain a major problem in 30 years' time.

The numbers without electricity decline in China, in the rest of East Asia, in North Africa, in Latin America, and in the Middle East. But it is still a major issue, because world population is growing at the same time (Slide: Population Increase in Developing Countries).

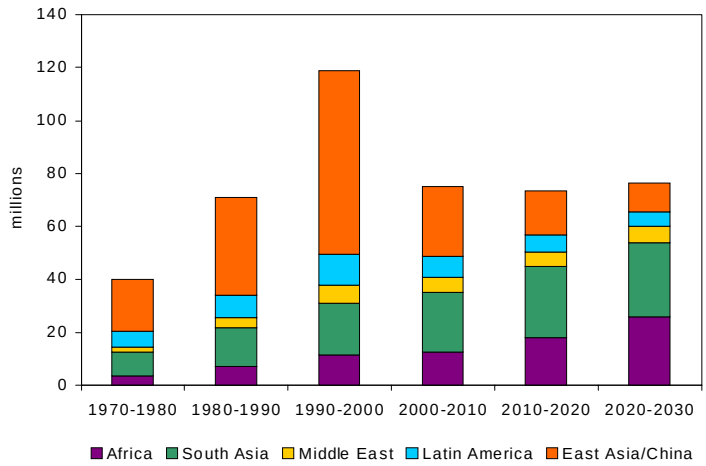
Indeed, world population is growing at nearly the same rate as the number of new connections. So that figure of 1.6 billion people without electricity is still 1.4 billion at the end of this period. That figure, therefore, hardly changes over 30 years

Map of Global Energy Poverty



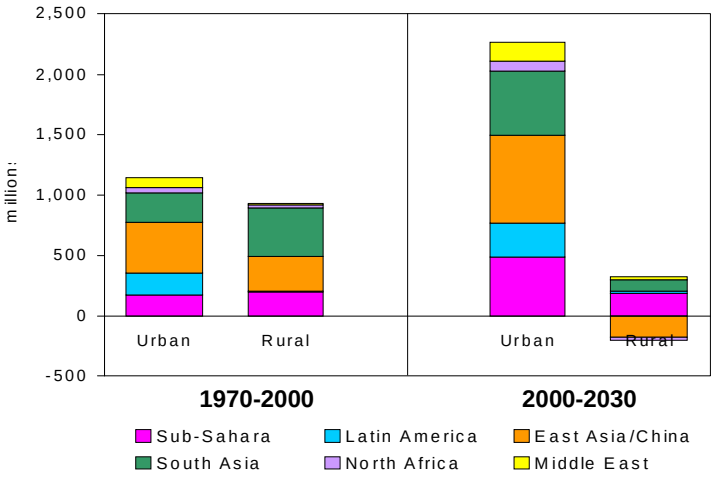
1.6 billion people have no access to electricity,
80% of them in South Asia and sub-Saharan Africa

Average Number of Electricity Connections per Year



The rate of electrification falls sharply in East Asia, as most households are already connected and population slows

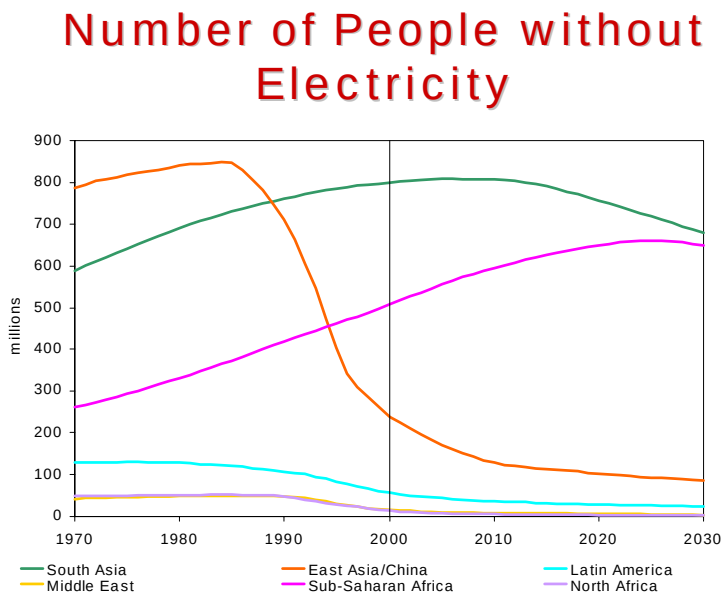
Population Increase in Developing Countries



Providing energy to the urban poor will be the primary challenge

Here is that picture over time (Slide: Number of People without Electricity): 1.4 billion in 2030, most of them in sub-Saharan Africa but an equal number in South Asia, meaning India.

Very interesting here is what has been achieved in China (the orange line, which dips so sharply), a great expansion of the electricity network in China in the last 10 years.



The number of electricity-deprived drops only slightly to 1.4 billion in 2030 & the problem worsens in sub-Saharan Africa

But add to this the situation on biomass. For biomass, we have now 2.4 billion people in the world who are predominantly reliant on biomass, traditional forms of biomass (wood, dung, charcoal) for their cooking and heating at home.

I think that figure, I'm afraid, is going to increase, and not diminish. We believe that at the end of this period the number will be 2.6 billion still wholly reliant on traditional biomass forms for cooking and heating.

These are projections based on today's policies. I think there is hope that the new commitments expressed after the World Summit on Sustainable Development might lead to new policies that could change that. But let's start from the facts. And this is our calculation of what the future will hold without those new policies.

I think the energy community, most of us, are obviously concerned with our local preoccupations, estimating local demand, meeting local demand, in economic and efficient ways.

But the energy community has got to make a contribution to the solution of this global problem.

And the best solution, the first thing that we can do, is to define the issue properly. I found in Johannesburg that there was very, very loose talk amongst the development community, the aid workers, about "What is the problem," failing to make this distinction between electricity on the one hand and biomass on the other.

And we, the energy community, can understand these things. And we

have to contribute to the understanding of those who are, with all seriousness, trying to do something about poverty issues in their broadest definition.

I'm going to conclude there. I brought to your attention four key issues:
(1) The enormous growth in international energy trade and therefore implied additional supply vulnerability of the world in that situation. But of course, you can look at that in a different way. You could say that trade binds the world, that there is mutual dependence in trade.
(2) I've pointed to the enormity of the investment challenge, how to mobilize the finance to meet particularly the infrastructure demands of the developing world.
(3) I've talked about the environmental challenge, in particular in relation to carbon dioxide.
(4) And finally, I've talked about energy and poverty.

If I look at the preoccupations I have seen in governments' attention to energy policy, of course in the 1970s supply security was absolutely dominant, after the oil disruption.

In the 1990s the environmental question became a very, very strong influence on energy policy making. And, as we moved through the decade, economic efficiency in terms of improving the competitiveness of our internal markets as a motivation for higher efficiency also become a very major preoccupation.

I think security has come back onto at least a level basis both the environment and economic efficiency in the last couple of years, partly as a result of the oil-price experience from very low to very high over the period of 1998-2000, partly as a natural concomitant of our increased consciousness of broader security risks in the world at present.

I think what the world must decide now is whether the battle for poverty, or with poverty, including energy poverty, has equal precedence with those other concerns--indeed, whether we can be secure globally, in the widest sense, while such inequalities continue to exist globally.

Thank you very much. I'll be pleased to try and answer any questions that arise from that or from other issues.

Q: My name is Fukushima. Today your presentation was very fruitful, the outlook for the next 30 years. It's very interesting. I'm looking forward to reading that paper from the IEA.

Talking about the relations with the developing countries, technological development is going to be extremely important in the next 30 years.

This may be a model-based analysis. What is the presumption? Can you tell me about the scenario and the preconditions for that outlook?

A: Yes. Of course, technological forecasting is a very hazardous business. But we have to do some of it for this sort of analysis. And if I can just draw

attention to two features of the analysis in this sense, we have fuel cells entering the supply picture during this period, predominantly after 2020, and predominantly in static applications, not in mobile applications. That's the best judgment we could make of the probabilities at the moment.

Another significant technological development is the increase in the use of nonconventional forms of oil. It becomes not by any means a dominant or even major part of supply over the period.

But there is an increasing element of supply from nonconventional oils, some of which are already being produced commercially. And we expect that to increase over the period. And that is very significant, because if that supply can be made available economically in competition with conventional oil, the geographical sources are very different. And indeed, the volumes are huge. They exceed the volumes of conventional oil in the Middle East.

In terms of the developing world, I think what is more important than these new technologies is actually the deployment of the technologies that we have.

And as a very, very basic example, we really ought to be making simple but efficient stoves available to people in the developing world so that they can use the fuel that they are consuming more efficiently and more safely in terms of the health effects.

At the moment, women particularly, in the developing world spend many hours a day gathering fuel. And then it is burned often very inefficiently, sometimes in a closed, confined situation. It gives off noxious emission that are damaging to the health of the same women, and their children particularly. And really, we must tackle that.

Thank you.

Q: I have one question. During your presentation, you talked about the next 30 years and said the role of the developing world in energy consumption would become bigger, particularly the developing countries of Asia, that they would have a greater share in energy consumption.

The IEA membership is composed of developed countries. And as we look forward to the future energy consumption, the role of the developing countries will be bigger. And then the functionality of the IEA needed to be reviewed in view of that change. As the Secretary-General of the IEA, do you have any comments on the future direction and role to be played by the IEA?

A: Thank you very much for that question. I would distinguish between membership and influence. It is true that the membership of the International Energy Agency is confined to the countries of the industrialized world, 26 countries at the moment.

It is simply a fact of the constitution of the IEA as it is at the moment

that a country must first be a member of the OECD before it can become a member of the IEA. And to become a member of the IEA, it has to meet certain additional obligations, like oil stock holding, which is expensive and quite a barrier to developing countries in any case.

That doesn't mean that we do not have very close relationships with a number of countries, particularly the big oil producers or consumers. We have formal arrangements with China, with India, and with Russia. I'm going to China this morning after I leave here.

We have extensive contacts, of course, with the oil- producing countries. And I would just cite our work on energy and poverty as an example of our serious identification and concern with the problems of the developing world.

So I don't think that one has to think of the IEA's necessarily changing its membership, provided its scope embraces these issues on a global basis.

Q: Yegen Wasuchikof, Trade Representative of the Russian Federation. Mr. Priddle, when speaking about the possible decline in atomic energy consumption in the world to 2030, you mentioned that it's not a question with Japan and Korea. Can you make some projections about the atomic energy consumption in these countries?

Thank you.

A: I can. And I do. But I can't remember the figures offhand, I'm afraid. The figures are in the analysis. We give the indications of how nuclear supply is likely to expand in both Korea and Japan. That's a significant part of growing nuclear output over this period.

I just can't remember the figures offhand, I'm afraid. But certainly, despite, for example, current difficulties in Japan about safety regulation, the government's policy remains quite clear that the nuclear component of supply must be maintained, and that they are determined to take the steps necessary to make sure that is done safely in order to enable that policy to be realized.

I'm sorry I can't give you a precise figure.

Q: My name is Aaron Wong, from Japan Drilling Company. What is your outlook on world exploration activities, and where do you think the largest increase or the greatest concentration of exploration activities will be in the world?

A: You question relates to oil, does it?

Q: Yes. Oil and gas.

A: As you know, two-thirds of the world's resources of conventional oil lie in the Middle East. So our expectation is that that is where the predominant source of additional supply will lie over this period.

Nonetheless, there are some very important additional areas, notably in the Caspian Sea region. Again, I can't remember exactly the quantity we assume

out of that area, but it's a significant addition to supply, something on the order of output from the North Sea by about 2010.

Nonconventional oil, as I say, is a source of significant additional supply, not a huge proportion but a significant volume. Already there is commercial supply, quite a significant volume by the end of 30 years.

As for gas, this is dominated by Russia and a few countries in the Middle East. And we certainly expect to see great expansion of the supply of gas out of Russia and out of some Middle East countries into the markets that are demanding that import.

Q: In Osaka there was a meeting of OPEC and also a forum of the IEA. After this we are going to have a lecture by Mr. Mabro on the oil situation. Oil supplies are now being threatened. In an era of uncertainty, is the IEA prepared for this kind of threat? Can you tell us about the preparation the IEA is undertaking?

A: Yes. Thank you. Of course, the original function of the International Energy Agency was to contribute to oil-supply security. We were founded after the experience of 1973-74, when the countries of the OECD did not cooperate effectively in responding to that oil-supply crisis.

Therefore, the decision was made to create a dedicated institute that had that as its first purpose. And that remains our first purpose.

And we found over the years that that meant, of course, that we had to understand global oil supply. To understand that we had to understand global energy supply. And we had to have good information.

So over time we have built what I think is one of the best sets of energy statistics in the world. And we publish that freely so that everybody can share in the results of it.

And of course we have developed our relationships with the producing countries. And the meeting in Osaka last week really was an example of that. As I said in Osaka, when I became the Executive Director of the IEA the suspicion and tension between the producers and the consumers was such that I thought a natural thing for me to do would be to go and meet Dr. Lukman, who was then the Secretary-General of OPEC.

But there was such reservation on both sides that, although he agreed (and I compliment him for that) that we should meet (and I went to Vienna for that purpose), we met in a hotel, not in his office, and we have no publicity to that meeting, because there was such sensitivity about the idea that producers and consumers might talk to each other.

That has completely changed. And this process of dialogue, as it has been called, which became the International Energy Forum in Riyadh in the year 2000, driven I think particularly by the experience of 1998-2000, where the

price had gone so low and so high that both sides thought this was intolerable, that dialogue process, that willingness to listen to each other, to try to understand the other point of view, even if we do not yet agree, has really taken a significant step forward.

And that is symbolized by the decision taken in Osaka to create a small permanent secretariat to ensure that that dialog process continues.

So that's a general answer to your question. As to our specific readiness for any eminent loss of supply, we are ready. We have extensive, large-scale stocks held in our membership. We have agreed arrangements as to what actions should be taken in different supply-loss situations. We can act quickly. We can put large volumes of oil onto the market if necessary.

But the first thing we would do would be to go to the producers, to talk to them again, to those who are not directly constrained, and say, "This is your market. Can you meet the additional demand that arises because of the loss of supply from x or y?"

We would ask the producers first, to see if they could supply their customers. Only if they could not would we put our oil on the market.

Contact: ieej-info@tky.ieej.or.jp