The challenge for policy makers

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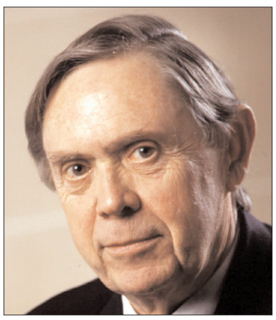

DONALD JOHNSTON holds a law degree from McGill University, Canada. After thirteen years teaching fiscal law he embarked on a career in politics, during the course of which he served in a number of Ministerial roles before being elected President of the Liberal Party of Canada in 1990, a position he held until 1993. He has also had a distinguished career as a lawyer and was a founding partner of the prominent Canadian law firm Heenan Blaikie. Mr. Johnston took office as Secretary-General of the OECD on 1st June 1996.

Governments have at least three reasons to pay particular attention to the energy sector. Firstly, energy systems are essential to meeting basic human needs and supporting economic growth. Secondly, the extraction, conversion and use of energy are responsible for the most important environmental problems - from the local level (such as urban pollution) and globally (climate change). Thirdly, making major changes in energy production and use requires long lead-times, action can not wait until energy problems become obvious.

Europe, like other regions, faces two major challenges namely: ensuring the secure supply of energy in the short and longer term and minimising the harmful environmental effects related to the production, transportation and use of energy.

Governments need to act now to address these issues, for ourselves, and for future generations.

Energy prospects

Superficially, energy supply does not seem to be a problem. Current supplies are ample, cheap and diverse. Since 1976, the real price of oil has trended downward. Expressed in 1976 dollars, oil is about 30 per cent cheaper today ($9 per barrel) than it was in 1976 ($13 per barrel).

Fossil fuel reserves are plentiful. According to the International Energy Agency (IEA), a sister agency to the OECD, proven reserves of fossil fuels are adequate to meet demand well into the 21st century. Proven conventional natural gas reserves amount to about 150 trillion cubic metres or 60 years of production at current rates. Ultimate reserves are probably much higher, perhaps 170-200 years of supply at current levels of consumption. World coal reserves represent at least 200 years of production at current rates.

Proven reserves of conventional oil are relatively less abundant - less than 40 years of production at present rates. But there are ample reserves of non-conventional oil, notably the oil sands in Canada and heavy oil deposits in Venezuela.

So why is energy an urgent issue?

Firstly, even in the short-term there are periodic problems of supply, related to the high concentration of oil production in a few countries. Over the past 3 decades, the price of oil has more than tripled on 4 occasions: in 1973, 1979, 1990 and 1999-2000. Each time a downturn in the world economy followed.

Longer-term supply is also problematic. The IEA has estimated that world primary energy demand would increase by 57 per cent between 1997 and 2020. This represents an average rate of 2 per cent per year, or a pace slightly slower than over the 1971-1997 period (2.2 per cent per year).

Meeting this extra demand from fossil fuels will not be easy - despite plentiful reserves. Massive investments over sustained periods will be required. New technology to improve the efficiency of finding, developing and producing oil will be crucial for reducing supply costs. For instance, estimates of the investment needed in the Middle East to increase production capacity to meet demand by 2010 run to over $300 billion. Meeting the growing demand for gas will call for very large investments in production facilities and infrastructure to transport gas to markets.

Another concern is that reserves of oil and gas, the most widely used forms of energy, are very unevenly distributed across the globe. The Middle East currently provides 26 per cent of global oil production; it has more than half of the world's remaining conventional oil reserves. Roughly one half of natural gas reserves are located in only two countries, Russia and Iran. Hence, OECD and other energy-poor countries will rely on a relatively small group of countries to meet a major part of energy needs from fossil fuels.

Environment

But supply is only one of the important aspects of the energy equation. More worrisome are the IEA projections that by 2020, fossil fuels will still account for 90 per cent of primary energy consumption. "Science" has not come to a full consensus on the atmospheric impacts of carbon emissions and there are still many gaps in our knowledge. But no one maintains that humanity can safely continue to rely on fossil fuels, as we know them today, to meet expanded future energy needs. There is growing consensus that patterns of energy use need to be radically altered.

This represents a momentous undertaking. Energy systems are extraordinarily complex and rely on a broad range of complementary technologies. These technologies will take years to develop. Moreover, the current production and distribution systems represent a huge investment; we will not be able to afford to abandon them quickly. Hence, new energy systems can only be introduced gradually over time.

I see two main approaches that could be adopted. Firstly, governments should set the conditions that will promote the development of alternative environment-friendly energy technologies. Secondly, I think it is appropriate, if not urgent, to take a second sober look at the contribution that could be made by nuclear energy.

The uncertain promise of new energy technologies

Among the approaches for replacing existing energy systems, two seem to be the most promising, namely: the development of "clean" fossil fuel technologies or "carbon sequestration" and the development of renewable resources such as hydropower, bio-energy, wind energy or solar energy.

Development of clean fossil fuels or carbon sequestration would permit continued use of fossil fuels, while mitigating their harmful effects on the environment. If feasible, such an approach could give us a "breathing space" for developing alternative solutions. In principle, all power-generation systems fired by fossil fuels can be combined with techniques that capture CO_2 from exhaust gases. The captured CO_2 could then be stored in the ocean depths or in stable geological formations. Oceans already contain large quantities of CO_2, and, it would take a very long time for CO_2 injected into the deep oceans to return to the atmosphere. However, the environmental effects of such ocean storage, for example, change in the pH of the water, are little understood. Depleted oil and gas reservoirs could also be used for carbon sequestration. Here the costs are very uncertain. Even under optimal conditions they could amount to 2 cents per kWh.

The development of renewable resources could theoretically meet current global electricity demand many times over. Progress in this direction is essential for sustainable development in the longer run. It also contributes to security of supply, as renewable energies could help limit import dependence in the future.

Hydropower is the world's largest renewable energy source. Its un-exploited potential is still vast (more than 14,000 terawatt hours per year at the world level), particularly in developing countries (more than 9,000 terawatt hours per year). The IEA expects that installed hydro capacity will increase by 340 gigawatts over the next 20 years (at a rate of 1.8 per cent per year) and roughly 80 per cent of this increase will take place in developing countries.

Although it is an attractive form of energy, hydropower also has problems. It is a capital-intensive option for electricity generation. Second, hydropower is not environmentally benign. Large-scale projects may disturb local ecosystems, reduce biological diversity or modify water quality. Hydropower also emits greenhouse gases on a life-cycle basis (especially methane generated by decaying bio-energy in reservoirs), although far less than the burning of fossil fuels.

The IEA expects the share of non-hydro renewables in electricity generation in OECD countries to increase from 2 per cent today to 4 per cent in 2020.

Bio-energy is a well-established option for electricity and heat production. In 1999, global electricity generation from bio-energy was 160 terawatt hours, or a little more than 1 per cent of the total. Over the next 20 years, output is expected to double, with most of the increase taking place in OECD countries. From an environmental perspective, bio-energy is desirable if the resource is produced and used in a sustainable way. However, while bio-energy plants emit less sulphur dioxide (SO_2), they produce more particulate matter than oil- and gas-fired plants.

Potential wind-power greatly exceeds current electricity demand worldwide. Estimates of onshore potential vary from 20,000 to 50,000 terawatt hours per year. About 40 per cent of this potential is located in OECD countries. Offshore potential could be in the same order of magnitude. By 2010, wind power at the best onshore high wind sites could become competitive with the cheapest fossil fuel resources, while offshore sites could become competitive by 2020.

However, wind-power has a number of limitations. First, it is only an intermittent energy source and this becomes a serious drawback as its market penetration increases. Land requirements are extensive since turbines must be spaced several rotor diameters apart. For instance, it is estimated that Germany would have to put windmills on 2 per cent of its total land to produce 10 per cent of the country's current electricity demand. Wind turbines also create noise, interfere with communication signals and create a hazard for birds, notably migratory species.

The contribution of solar energy to energy supply will remain modest over the next 20 years. In the longer run, solar energy could offer an attractive alternative for heat and power production in buildings, especially for countries where electricity demand peaks in the summer. In the more distant future, solar-power satellites may become a reality. Solar collectors in geo-stationary orbit would not be subject to the day/night cycle or to atmospheric interference and could receive about eight times as much light as a collector on the ground. However, formidable hurdles would have to be faced, including launching costs and the efficiency of microwave transmissions.

All these new technologies are promising, but they also have drawbacks and considerable technological

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uncertainty. Their development will require enormous investments. For instance, doubling the share of non-hydro renewables from 2 per cent to a mere 4 per cent over the next 20 years will require an investment of $90 billion, or 10 per cent of total power sector investment over the period. An increase to 9 per cent would cost much more: $228 billion or almost a quarter of OECD investment in new power generation capacity over the same period!

The investment requirements for renewables will be enormous. And it will take a very, very long time to make a significant impact on overall emissions of greenhouse gases.

The nuclear advantage

For these reasons I believe it is time to take another sober look at nuclear energy. Nuclear energy is plentiful and produces only negligible amounts of greenhouse gases. I want to emphasise, however, that this is a personal view and I do not speak for the Member countries of the OECD.

Uranium is plentiful. Current estimates show that uranium reserves that can be recovered at a cost of $130 per kilogram or less, are equivalent to 70 years of current consumption. Using uranium stockpiles or low-concentration sources, or reprocessing fuel from existing reactors could extent the 70-year figure to several centuries. Long-term increases in nuclear electricity energy generation would require the mining of more costly reserves. However this would not greatly affect the economics of nuclear production, as fuel costs represent a small proportion of total cost. Nuclear energy is also attractive from a security of supply perspective. Costs are largely indigenous. The small component, secured on international markets, primarily uranium ore, originates predominantly from stable OECD countries.

The problem with nuclear energy is that it is often socially contested, due to perceptions about long-term risks stemming from radioactive waste management and disposal, and potential accidents in operating plants, or during the transportation of radioactive waste. Nuclear energy clearly involves some risks. All energy sources involve risks. The risks of nuclear energy need to be balanced against the benefits and compared to the risks of alternatives.

The operational and waste storage risks of nuclear energy may be much lower than perceived by the general public. For instance, Dr. Burton Richter, a Nobel Prize winning physicist, made two important points on this question in a recent speech:

- First, with respect to health risks of energy systems, "…in years of life lost per terawatt hour of plant operation, the only thing better than nuclear power is wind power".
- Second, the risks from accidental release of radiation from long term storage give negligible years of life lost compared to the continuing use of our conventional sources of energy.

Several initiatives are currently under way to cut costs and improve safety of nuclear energy. These include the development of new plant designs that will permit lower construction costs, shorter construction time, reduced operating and maintenance costs, and improved safety.

The need for an abundant clean energy source is pressing. In my view, governments, scientists, the scientific media, and international organisations must launch an extensive, inclusive, dispassionate consultation on nuclear energy. The responsible persons and institutions in our societies must help the public weigh the options and risks of pursuing development with each energy source or mix. This debate has to include reference to the effects of continuing to rely on fossil fuel for the bulk of our energy needs. It must also explore ways to address public concerns with nuclear energy, including waste management and disposal.

Time is important. Most of today's nuclear plants will reach the end of their life some time beyond 2020. Policies about how to replace the existing capacity will be of crucial importance to the energy-supply picture after 2020. Given the lead-time to bring projects into operation, such decisions need to be taken soon, as decisions made today will not have a significant impact on production before 2015 or 2020.

Conclusions

Policy makers face a major challenge over the coming years: how to fuel worldwide economic growth with a secure and reliable energy supply, without despoiling our environment. For this to occur, energy supply needs to be further de-carbonised and diversified and the energy intensity of economic growth needs to be reduced. The transition to a sustainable energy future will be complex and will take time.

Governments will need to ensure that the price signals that private actors use for decision-making truly take into account public policy objectives. Notably the prices of fossil fuels should reflect the damage that their exploitation causes to the environment. Attributing a cost to the emission of carbon to the environment could go a long way in improving the competitiveness of renewables and nuclear energy. Energy decisions have to reflect real technical possibilities, not theoretical or unproven possibilities. In any case, as argued above, it would be unwise, to reject the nuclear option without a fair hearing, since it provides such a powerful response to many of today's energy problems. F