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Does the Future have a constituency?

An Address by the Honourable Donald J. Johnston
Secretary-General of the OECD

To the American Nuclear Society /European Nuclear Society International Meeting

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I accepted your kind invitation to address you here in Washington, as Secretary-General of the OECD, because I consider nuclear energy in a sustainable development perspective to be one of the most important issues of our time. I wish to make it clear at the outset that I am speaking in my personal capacity, and not as a spokesperson for the Members of the OECD. You are aware that there are serious divisions of opinion within the OECD membership with respect to the future of nuclear energy and with two notable exceptions, Japan and Korea, there do not seem to be any plans for expanding nuclear energy capacity through the construction of new reactors.

I also want to underline that I am by no means advocating any particular energy mix in these remarks. I am simply advocating a hard look at reality, and raising questions to which I have sought answers. In fact, one of those questions is the title of these remarks, namely, "Does the future have a constituency?"

I would like to think that it does, and that those who espouse "sustainable development", in particular political leaders, are firmly committed to acting for that constituency. That, after all, is what sustainable development is about. Yet, I worry that reality and the necessity of urgent action may be lost in political rhetoric.

Let me remind you of the definition of sustainable development found in the 1987 Report of the World Commission on Environment and Development, chaired by Gro Harlem Brundtland, and entitled "Our Common Future". It is widely referred to as the Brundtland Report.

The definition is that "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

There have been many attempts to define sustainable development. I find this definition to be as suitable as any because, taken in its broader sense, it combines environmental, social and economic considerations. However, I do not intend today to put it in its broadest context, but rather to look at it in terms of the requirement which is stated in that report: "...at a miminum, sustainable development must not endanger the natural systems that support life on earth: the atmosphere, the waters, the soils and the living beings".

The erosion of any of these elements, and certainly the absence of any of these elements, make any consideration of the social and economic objectives of sustainable development irrelevant. (At the request of Ministers, the OECD will deliver next May a major report on sustainable development. The report will have a very broad overall reach, encompassing economic, social and environmental considerations, but will focus on the health of the biosphere.)

Today, I will address only one element of sustainable development, namely, atmosphere and climate change, and why the current trend in the volume of green house gas emissions, concomitant global warming, combined with population growth outside the OECD area, are putting the world on a fast track to catastrophic global consequences for future generations. I will then examine the role of nuclear energy as part of the solution.

Before returning to specifics, let me say a word about the OECD itself and why it is uniquely equipped to deal with the issue of sustainable development.

The OECD is composed of twenty-nine of the world's most advanced industrialised economies, with Slovakia to bring us to thirty Members when it joins the OECD in December. It has its origins in the administration of the Marshall Plan by its predecessor, the Organisation for European Economic Co-operation. The OEEC, as you may know, played a key role in the rebuilding of post-war Europe. The unique intergovernmental working

procedures developed in the OEEC convinced the member governments to continue these activities under a successor organisation, the OECD. In essence, committees of government officials, treating nearly all areas of public policy, meet to share best practice, to analyse problems of common concern and to negotiate guidelines and codes of conduct for multilateral co-operation. I will not recite the many successes of this intergovernmental process, but, with all modesty, let me say on behalf of the Organisation that it has played a central role in the evolution of the world economy in the last half of the 20th Century.

The OECD is not truly an institution. It might be called a permanent intergovernmental conference with the Secretariat, which I direct, supporting the activities of some 140 committees and working groups. More than 50,000 delegates per year attend those meetings, some of which are, of course, highly specialised. These include meetings of the Nuclear Energy Agency, part of the OECD, or those associated with the International Energy Agency, a member of the OECD family of organisations. Moreover, the membership has now become global, though not universal, and programmes and activities are conducted with approximately 70 other non-member countries. Some of these programmes are quite intensive, such as our programmes with Russia and with China, both countries wishing to draw upon the experiences and best practices of OECD Members as they move to market economies.

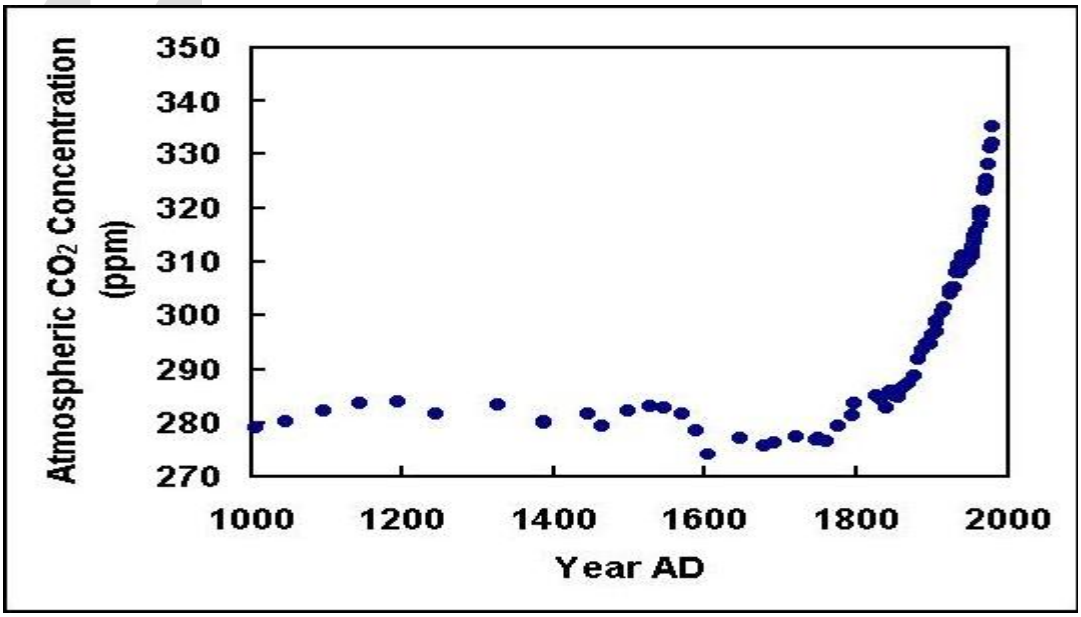
You would deduce from the foregoing, quite correctly, that the OECD has expertise or access to expertise in every area of public policy and, hence, is well placed to address multi-disciplinary issues, such as sustainable development. But I do not wish to wander too far afield, and I will now turn to the important energy questions that must be addressed as part of the sustainable development agenda, especially with respect to the atmosphere and climate change flowing from the greenhouse effect.

How we would like to report to Member countries of the OECD that there are sources of safe, clean energy available to sustain economic growth; to bring up to OECD living standards the four-fifths of humanity which endure various forms of poverty and disease, 1.2 billion of whom live on less than one dollar a day; and to leave a world for future generations with full protection and perhaps enhancement of the air, the water, the soils and living organisms. One day with the right policy approaches and technological innovations we may be able to make such a declaration. But currently the world finds itself on an unsustainable energy path that will produce a very different world for future generations.

One of the most important sets of indicators showing the dangerous direction in which we are headed is that pertaining to the concentration of greenhouse gases in the atmosphere, and the contribution that human activities are making to those concentrations.

The gases that contribute to the greenhouse effect include carbon dioxide (CO2) and a large number of other, often more complex and less common gases. CO2 is not the most powerful of the greenhouse gases, but it is the most abundant -- accounting for the bulk of the human-induced warming effects. And because of its pathways through nature it is the gas for which historical concentrations are the easiest to reconstruct.

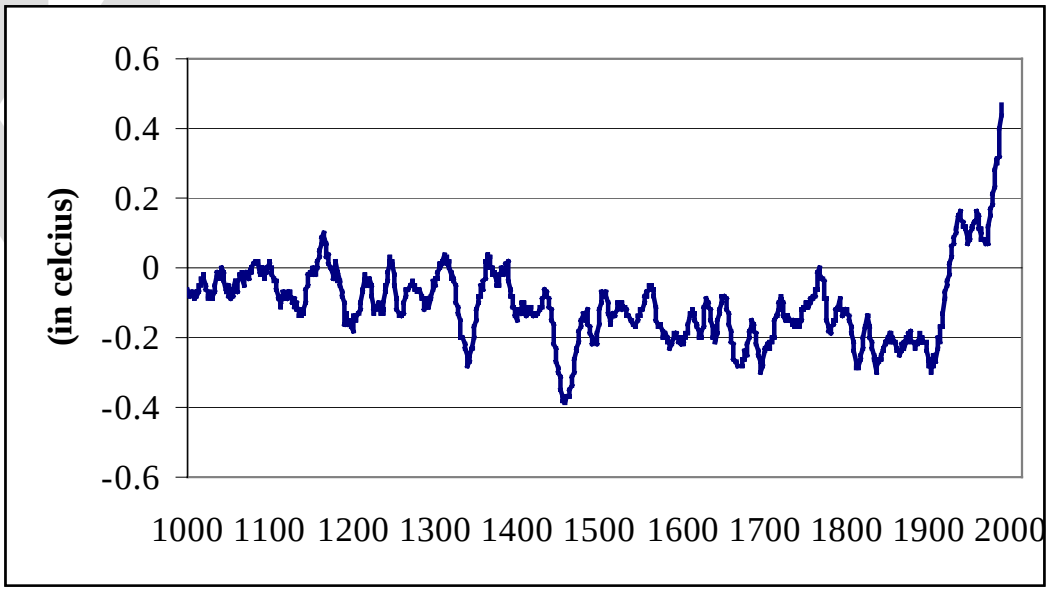
Atmospheric carbon dioxide concentration



(Slide 1) This chart shows average atmospheric concentrations of CO2 since the Middle Ages. Note that for most of the intervening period concentrations have ranged between 270 and 290 parts per million. Since about the middle of the 19th century, however, they have shot up dramatically, and are now close to 360 parts per million -- almost 30% higher than pre-industrial levels.

Emissions of CO2 from the burning of fossil fuels are mainly to blame. These emissions increased by a factor of seven during the 20th century and continue to rise at an accelerating rate.

Climate Change



Surface temperatures of the Northern Hemisphere over the last millennium

(Slide 2) Average temperatures have also risen over the last millennium. The chart shows annual changes in the Northern Hemisphere as a whole. There have been variations, reflecting the relative influence of natural phenomena such as solar intensity and volcanic activity. Viewed over a period of centuries, however, the general trend seems to have been downward until near the end of the 19th century.

Beginning around the year 1900, temperatures started rising steeply. The rate of increase has accelerated over the last 25 years, such that current average temperatures are believed to be close to 0.8ºC -- 1.4ºF -- above the trend.

Some parts of the planet have warmed more than others. Notable is the Antarctic Peninsula, where average temperatures have risen by 2.5ºC over the last 25 years.

These temperature increases might not sound like much, but on a global scale they represent a tremendous cumulative warming. Imagine what it would take to try to heat the earth even a fraction of a degree by turning on all the heating units in all the houses in the world and leaving the windows open. I am advised that we could not achieve it even over the course of a decade. The latest draft report by the Intergovernmental Panel on Climate Change (IPCC) concludes that global temperatures could rise as much as an incredible 6.1ºC over this century. The report projects that my country, Canada, as well as other regions of North America, will experience temperature increases in the range of 40% above the global mean taking into account the projected increases.

We are engaged, in short, in a perilous experiment with nature that is unprecedented in the history of humankind.

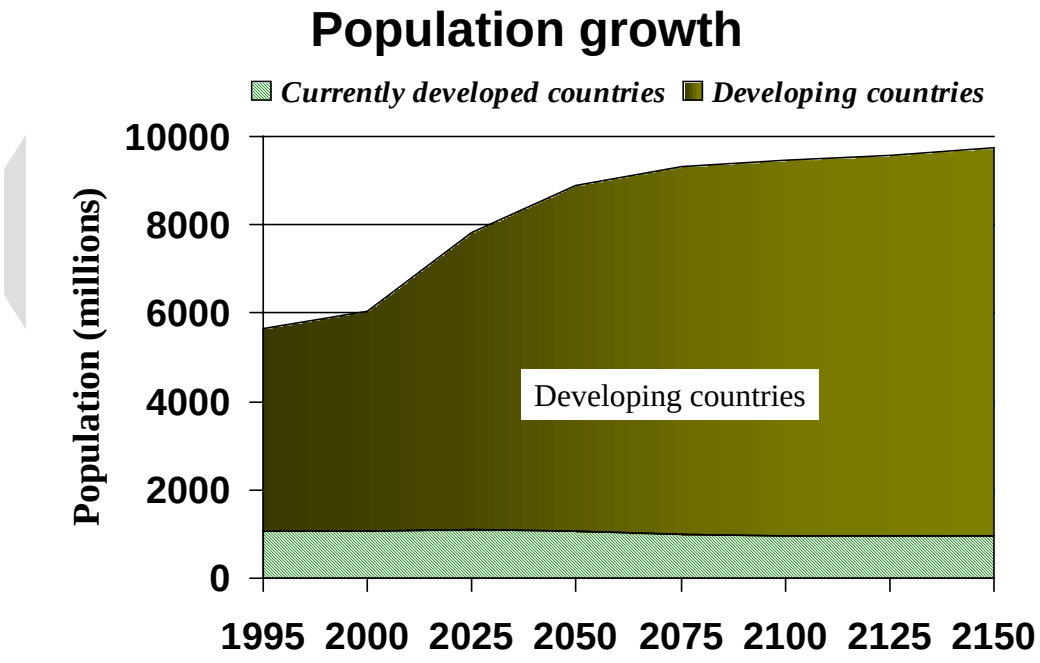
Does it matter? How could anyone shrug it off? If the climatic events we have witnessed following modest temperature increases are an indication, the potential effects of radical climate change are indeed frightening! We already see frequent extreme events –violent storms, periods of extreme heat and intense cold, with concomitant flooding and drought and loss of life. You have felt it: a severe ice storm in North Eastern America; a windstorm that destroyed much of France's forests last December with 140,000 mature trees uprooted just in two Paris parks.

These are but a few examples. Even as we meet here the United Kingdom is faced with some of the heaviest rainfalls and flooding on record. There seem to be unusual weather patterns all over the globe with serious results for the environment and human welfare.

Global warming will no doubt have catastrophic effects on ecosystems and biodiversity. It will certainly have an impact on our economies and on human health. Rising sea levels will render uninhabitable the world's low lying sea coasts. We will have to contend with the broad spread of tropical diseases. There is even serious concern that the Gulf Stream, and the larger "conveyor belt" of ocean currents could come to an abrupt halt, plunging Europe into a new ice age... even while the rest of the world experiences warmer temperatures. If current warming trends continue, serious consequences of this kind could begin within the remaining lifetime of our children, in addition to the weather aberrations we are already experiencing!

Can we do something to turn around the situation? Yes, of course we -- that is, the developed, industrialised countries of the world -- can. After all, our populations have stabilised, and we are probably rich enough and smart enough to develop clean, safe energy technologies that can deliver our current level of material welfare while cutting emissions-- if we rise to the challenge.

But there is a major obstacle to success: poverty and population growth in the rest of the world.



UN projections of world population to 2150 (medium scenario)

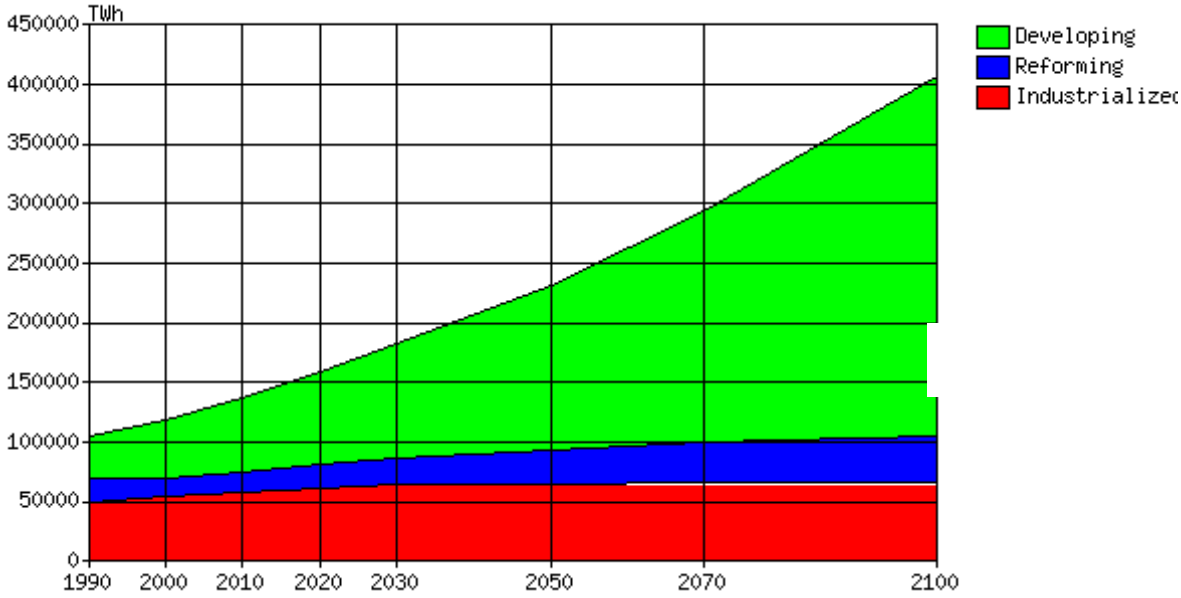
(Slide 3) This chart shows the United Nations' latest central population projections out to the year 2150. Note the differences in population growth rates between the developed and the developing worlds. In total the UN projects a 50% increase in global population by the middle of the century. Virtually all of that growth will occur outside the OECD area.

We hear a lot about globalisation these days, and my Organisation is proud to be an important agent in helping to shape this irreversible process for the benefit of all. We should not forget that globalisation is paving the way for the emergence of a world wide middle income class of 4 to 5 billion people. This will be one of the major benefits of globalisation: a middle income class with the same aspirations for comfortable homes, imported foods, foreign travel and all the other accoutrements of our modern civilisation that depend on one vital input: energy.

If the rest of the world were to have the current energy standard of living of the OECD area, energy production would have to increase by a factor of 30: a factor of 5 to account for the size of the population in the developing world relative to that in OECD; and another factor of 6 to account for high OECD per capita of energy use.

No one expects of course such a jump by a factor of 30 to happen suddenly.

Energy use projections



Total primary energy consumption by region
(IIASA reference projection scenario B in teraWatt-hours)

(Slide 4) The central, reference scenario for primary energy consumption by region as projected out to the year 2100 by the International Institute for Applied Systems Analysis (IIASA) predicts an increase by a factor of 4, almost all of it occurring in the developing world.

How is that demand for energy going to be met?

Let us look at fossil fuels -- the fuels largely responsible for anthropogenic emissions of greenhouse gases. Many experts expect that production of petroleum-based oils will peak some time before mid-century and start to decline thereafter. Coal, which will remain abundant, can easily fill the gap. For geological reasons, natural gas is more abundant than oil and can be expected to increase in absolute terms and then stabilise. Under this "business-as-usual" scenario, IIASA predicts that the use of fossil fuels will double over the next century.

Given the strong links between fossil-fuel combustion and growth in atmospheric CO2 concentrations that we have seen already, can we actually envisage continuing to burn fossil-fuels at current or expanding levels over the next century? The consequences for global warming and climate change would be intolerable.

What about clean renewable sources of energy like solar or wind or harnessing the ocean currents? There is certainly room to further develop wind power and solar panels and perhaps ocean currents and tidal power, but as contributors to basic energy needs they are likely to remain minuscule. For example, I recently read that to provide the City of Toronto with its present power needs, about 40,000 one megawatt wind generators would be required and they would cover an area three times the size of Canada's smallest province, Prince Edward Island, or 5656 square kilometres. And of course the wind does not always blow nor does the sun always shine, so storage of such energy adds another dimension which has only begun to be explored.

Having examined the best evidence available to me, I have concluded that if we are to hand on to future generations a planet that will meet their needs as we have met ours, it can only be done by incorporating the nuclear energy option. Perhaps I am wrong. Perhaps I will be presented with other evidence that would refute the conclusions I have reached, but I have yet to see such evidence. Nuclear power can be abundant, even unlimited; it produces no greenhouse gases of any consequence.

Let me put to you an apparent paradox: in my youth, despite the horrors of Hiroshima and Nagasaki at the end of World War II, President Eisenhower's initiative of "atoms for peace" was broadly embraced as the way of the future. William Laurence wrote in The New York Times on August 15, 1955, that scientists at a major international conference in Geneva had indicated that thanks to nuclear energy, "for the first time, man is assured of virtually unlimited supply of energy".

At that time, nuclear energy was seen as a godsend for both the developed and the developing world. Fossil fuels were understood to have a finite life, which of course they still do, although it has been modestly extended beyond estimates of that day. But fossil fuels were not seen at the time as harbouring the potential for irreversible damage to the biosphere which we now believe to be the case.

Today, the atmosphere is being choked by greenhouse gas emissions, global temperatures are rising dramatically, and the global population has more than doubled since 1955, most living in poverty in the developing world. Yet we seem to be denying ourselves the nuclear option which was seen over four decades ago as the way forward!

What happened to change public and, hence political, attitudes towards nuclear energy? It seems to be pretty obvious that the incidents of Three Mile Island a little over 21 years ago, and more recently Chernobyl, have had a major negative impact on the evolution of the nuclear industry. The tendency of the nuclear industry to secrecy, probably inherited from national defence orientations of nuclear research, made things worse. As I noted, no new nuclear facilities are currently planned within the OECD countries except in Japan and Korea. In fact others, following Germany's lead, may opt to phase it out.

Recently I had the privilege of being visited by two Nobel Prize winning physicists, Burton Richter and Carlo Rubbia. I discussed the future of nuclear energy with each of them. I also read a speech that Burton Richter was about to deliver in Italy. I will quote generously from it. He said:

"It is our responsibility, both on ethical grounds and on grounds of self interest, to develop technologies that will allow the rest of the world to increase their standard of living without at the same time destroying the environment of the planet. I want to turn aside for a moment and express certain bewilderment that I think almost all scientists feel at the opposition to nuclear power by the green movement."

Today, with you, this will be the crux of my argument. I agree with Richter that we (or you, scientists) have a responsibility to develop the technologies that will allow us to escape from our energy conundrum. But I also think that you, as well as other knowledgeable, concerned leaders, cannot let bewilderment suffice. We must ensure that the nuclear option is the subject of informed public debate.

Let me now briefly look at some considerations concerning nuclear energy that are likely known to scientists -- but probably not to the general public. I will draw on Dr. Richter -- since I myself am not an expert on nuclear energy nor likely to become one.

RADIATION EXPOSURES

Source	Radiation Dose Millirem/year
Natural Radioactivity	240
Natural in Body (75kg)*	40
Medical (average)	60
Nuclear Plant (1GW electric)	0.004
Coal Plant (1GW electric)	0.003
Chernobyl Accident (Austria ~ 1988)	24
Chernobyl Accident (Austria 1996)	7
* Included in the Natural Total	

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In his speech he offered a table (Slide 5) that shows radiation exposures from a number of sources. Speaking about levels of radiation exposure, he points out:

"Natural radioactivity is the largest. Of that total, about a sixth comes from natural radioactivity in the body itself. The natural radioactivity in our bodies gave a dose about a factor of two larger than the Chernobyl accident gave in Austria in the year of the accident. Nuclear power plants and coal fired power plants give about the same average dose for the same power."

Dr. Richter also cites an article by a German group entitled "Health Risks of Energy Systems" which presents extensive data and from which Richter concludes...

" In years of life lost per terawatt hour of plant operation, the only thing better than nuclear power is wind power.

There is concern about the disposition of radioactive waste. I think virtually all scientists would say that this is not a problem. It can be disposed of geologically in many ways. Not all countries have the proper geological formations to do such disposal, but international burial sites could be developed to handle the radioactive waste of the entire world without any difficulty. The worst scenarios dreamed up by the opponents of nuclear power for radiation release from long term storage give negligible years of life lost compared to the continued use of our conventional

sources of energy. It is difficult to understand the opposition to nuclear power. No energy source is free from risk and a proper analysis has to balance risks and benefits. On such a balance, nuclear power comes out better than most".

Here I end my citation of Dr. Richter.

Risks are an inherent part of decision-making in public policy. But the risks must be identified, the risks must be assessed, there must be an application of a cost benefit analysis to the risks and, of course, the risks must be managed. So when we look at nuclear, it is not a question of saying there is a risk. There are obviously risks, but compared to what alternatives? Are we to abandon nuclear on the strength of a few accidents? Dams are frequently located upstream from population centres: between 1918 and 1958, 33 major dam failures with much loss of life. Between 1959 and 1965, 9 major dams failed. Did we stop building dams as a result? Did we abandon coal because of the high risks associated with coal mining? No. We worked at making technologies more reliable and safety measures stricter.

But much of the public seems either unaware or unconvinced of the facts. I would go even farther. The nuclear question, like genetically modified food (another issue we are grappling with at the OECD), finds itself in a period where the public is increasingly sceptical of science and of the capacity of governments to create and apply adequate regulatory frameworks for their safety and security. In a recent editorial on mad cow disease, The Economist wrote: "The political and cultural legacy of BSE is enormous. Because of it, public trust in science and government's ability to regulate it has plummeted."

Perhaps understandably, the public tends to lump all controversial issues involving science into the same basket of suspicion and doubt. Failures to deal adequately with concerns in one area, such as mad cow disease, cascade quickly into others, with the result that facts and sound scientific analysis are often lost in a flood of misperceptions and fears. It is not surprising that politicians give way to these fears, or simply refuse to deal with an issue. I would say the latter attitude -- refusal to deal with the issue -- characterises the nuclear debate in many countries.

I conclude that those of us who do believe that the future has a constituency must prove it by urgent action. We must have a public education campaign to lay out facts and dispel myths and fears about nuclear energy. Ideally, this campaign should be lead by political and civic leaders who have no vested interests in any particular energy option. If they abdicate this responsibility, you in the nuclear field must take it up, eventually to be joined by a broader group of respected spokes persons who wish to be part of that constituency for future generations.

This campaign should be based on an honest assessment of the risks and benefits of nuclear, and solutions to solve problems. I take our recent NEA Study "Nuclear Energy and Sustainable Development" as a very positive step in this direction.

Fears and questions about nuclear energy abound: the safety issue, including radiation from operating plants; the relationship between nuclear reactors and the proliferation of nuclear weapons; and the dangers of nuclear waste. The latter is probably the major fear because of its longevity and the concerns for geological stability over many thousands of years.

Carlo Rubbia discussed this issue with me. He raised the Accelerator Driven Systems, and the prospect of reducing radioactive waste to harmless ash while co-generating electrical power. As you might expect, I was unable to comment on the science, but I was struck by the importance of moving ahead as quickly as possible with technological innovations in the nuclear field. Proof of further progress on safety and cost will be necessary to bring public opinion and hence political support behind the importance of nuclear energy once again. For example, the objectives for Generation IV nuclear reactors are impressive: highly economical; proliferation resistant; enhanced safety and minimal waste. Moving ahead on these fronts could contribute to restoring confidence.

I would also like to see the OECD membership use our Global Science Forum in order to mobilise significant resources and scientific expertise behind accelerated energy research in all areas, including fusion and Generation IV. Non-OECD countries such as Russia, China, India and others should equally participate.

The future of energy is not the future of any one part of the globe, it is the future of the fragile planet earth, the pale blue dot travelling alone through dark uninhabited space. As Burton Richter reminds us.. Our solar system appears to be empty of life except for us. We live in a closed system which will survive whatever we do to it, but it may not survive in a condition that is hospitable to human life."

So let us together from each corner of the global village join forces to ensure that it does survive in a condition hospitable to human life. That must be our promise to future generations.