Pugwash Meeting No. 269

51st Pugwash Conference on Science and World Affairs:
Challenges for Peace in the New Millenium
12-16 March 2002, Agra, India

Report on Working Group IV: Natural Resource Issues - And Security

Rapporteur: Adele Buckley
Co-conveners: Waliur Rahman and Venance Journé

Members of the working group were from 16 countries, several of which need much more capacity for electrical power generation, so a key topic for WG4 was the best way to accomplish this. Important issues for energy security include:

Security of supply
Availability at an acceptable price over the long term
Environmental impact

Energy is a major component of economic growth. - facing supply constraints has come into sharper focus since the events of September 11, 2001. Cheap access to oil, facilitated by the U.S. as a major world power, has delayed rapid development of alternate energy sources. Even though oil resources will go into decline in the next decades, Central and Northeast Asia continue to rely on Gulf producers. Manipulation of the oil market has had a destabilizing effect on the economies of large importing countries like India, Japan and South Korea.

Environmental concerns may well be the single most important factor influencing choice of fuels such as natural gas (identified as the least polluting of the hydrocarbons), but vulnerability to terrorist attacks is a deterrent to reliance on pipelines. Future producers and consumers will become increasingly dependent, and at the same time vulnerable to political developments - thus different energy sources such as additional nuclear power plants are receiving attention. A combination of all viable energy sources will be applied by countries such as China and India, but coal is anticipated to be a main source.and oil use will continue to rise in the near future as consumption increases for transportation. Thus, in spite of efforts to the contrary, fossil fuel is anticipated to level out to a steady 40 to 45% of total world energy consumption in 2050.

Pricing is a tool to encourage less use of carbon, the developed world economies can adjust without destroying the economy. However, the effect of the same price increases for fossil fuel could raise "survival" issues for undeveloped countries

There is a niche, perhaps a larger one than presently being considered, for alternates such as off-grid solar photovoltaics, small hydro and wind energy. True price comparison must include distribution costs, which is not a factor for small scale photovoltaics. Nuclear power is capital intensive, and, per kilowatt, is expensive, though it too has the advantage of not emitting greenhouse gases.

Adding Nuclear Energy Capacity

Nuclear energy is a very modest contributor to overall energy of developing countries (2% in India and China) but new nuclear power plants could supply the means of industrialization and rising standards of living. The only alternative for large capacity increase is coal-fired plants, with attendant environmental degradation. Western countries have the latest energy-related technology, but there is no organized program for technology transfer, even though this might be the best means of achieving both safety and economic efficiency. In addition, denial of transfer of nuclear technology to India has been in place since 1974, thus requiring an indigenous development in that country.

There are 38 nuclear reactors in developing countries and 395 in developed countries, all requiring management. For nuclear power generation, there is a degree of risk involved, but this is not necessarily an overwhelming objection as comparable risks exist in our modern technical society. However, an ever-accumulating stream of waste is an issue that some countries can not resolve solely by development of good storage technology. Except for the United States, no country has a permanent site for such a facility. However, the vulnerability is potential access to this nuclear material for weapons, making storage technology as a waste management technique virtually out of question because of high risk associated with it. A considerable alarm has been raised regarding potential terrorist attacks on nuclear power installations. However, a terrorist attack on a chemical plant could cause comparable damage to the civilian population from toxic chemicals, as could the radioactive release from a terrorist-damaged nuclear power plant.

Nuclear energy must be seriously reviewed for its potential to provide base-load energy because the alternative (large scale coal and natural gas electricity) would have catastrophic climate repercussions. Application of CO_2 capture and storage may offer some hope, when and if it is economically viable. To those who oppose further nuclear power plant development, this new pressure to access this energy source is unwelcome. Others take the position that the priority is to serve two billion people who now have no access to electricity. Fulfilling basic human security needs (food, water, energy) is the challenge of the next half century.

When considering further implementation of nuclear energy, the associated production of weapons-useful material is seen as an intractable problem. Thus the

challenges remain to (1) effectively prevent illicit access to material for weapons use, and (2) minimize and safely handle waste.

Energy Security for Developing Countries

For Bangladesh, low cost energy, with long term availability, is a critical security issue. Vulnerability of developing countries to dramatic rise of oil prices, as in 1973 and 2000/2001, was recognized by the group. This situation is typical of developing countries where a majority (e.g. 65%) of foreign purchases relate directly to import of energy sources. In contrast, goods and services in developed countries may have an average energy import content of, say, 10%, and thus a price increase can be absorbed in the normal course. Success in maintaining energy security for Bangladesh is based on devising an optimal energy strategy for their to-be-developed natural gas fields. Capital must come from external sources and provide the investor, whether it be a international developer or an institutional lender such as World Bank, with virtual assurance of clear prospects for commercially viable discoveries, a ready market, viable pricing, reliable payment and patriation of profits to satisfy returns due to shareholders. This energy supply situation must fit well into the fundamental and ever-changing energy dynamics of South Asia, at the same time as delivering a long term sustainable, but exploitable, resource to Bangladesh. Selective use of renewal energy could add flexibility.

A debate is ongoing in Bangladesh on the question of export to India, potentially by pipeline. The Government of Bangladesh has set up two committees to study the options for making the best use of the gas. A regional grid including India, Bangladesh, Nepal, Bhutan, Myanmar, Thailand, Sri Lanka is being discussed. A good example of a successful strategy, admired in Bangladesh, is the analogous situation of Canadian natural gas exportation to the U.S over the past period of 50 years. For security of supply desired by the U.S., Canada is now the key to at least one good pipeline route from the Arctic. Other fuel transport technologies (e.g. underwater tankers) could also be applied in the Arctic. All of these are costly in comparison to conventional supplies, but security of energy supply is an asset that warrants the premium price. Trade is usually a successful strategy to maintain peaceful relations as nations that trade with each other are less likely to go to war against one another.

Future Trends in Energy Sources and Energy Demand

During the last century, when population increased nearly 4X, energy usage increased 10X. In developing countries, food production is the sector with the highest demand for energy. In industrialised countries, the energy demand is shared more or less equally between food, fuel, electricity, heating and high temperature process heating. To bridge the gap between rich and poor, much more capacity must be added to the developing countries, and a responsible, reduced

energy usage must be adopted by the rich. A dynamic mix of energy should be applied, depending on local conditions. There is *no ideal energy source*. Hydrocarbons produce greenhouse gases, nuclear energy produces toxic, long-lived waste. Photovoltaics need safe grid connection technology that integrates smoothly without unbalancing the grid. Means of hydrogen transport, so far, are all high-loss, high cost, or requiring further development before commercializing. Hydroelectric dams cause environmental damage and displace populations and land acreage.

Hydrocarbons are irreplaceable as feedstock - what happens when/if hydrocarbons are totally depleted? A world energy crisis is anticipated - historically these dire predictions have been wrong. Exploration for new hydrocarbons have, historically, kept a favourable balance between reserves and demand, but this situation will not continue. However, economically exploitable hydrocarbon reserves increase dramatically (e.g. oil sands) as energy prices rise. Uranium resources could be available for 2000 years in the price range $US 100/kg. Population growth will continue, but level to 8 - 10 billion by 2050; energy use may follow a parallel pattern. Year 2000 total usage was 400 exajoules (86% fossil); year 2050 total usage will be 800 exajoules (45% fossil).

It would be a worthy goal to begin today to lay the groundwork for making the world a pleasant and secure place to live (for our grandchildren's grandchildren). The key to this would be that the developed world had learned to reduce its per capita production of carbon dioxide, Energy and other resources would be distributed so that all the world's population could be sustained a in a reasonable degree of comfort.

The most important tool available to any country is review of energy strategy at frequent intervals, taking a wide, long-term perspective. The energy situation is constantly changing, and requires an integrated strategy that can maintain or increase capacity with a flexible, dynamic mix of energy sources. Two recent examples of countries that suffered loss of energy security are Brazil (lack of investment for 20 years in the electrical sector, which led to a shortage of electrical supply and withdrawal of electrical service to 20% of its consumers) and California, USA (vulnerable to widespread brownouts by failure to plan for all demand scenarios). Governments can avoid "foolish" mistakes, by avoiding short sighted cost saving measures that have a high true cost, such as building codes that produce structures that are incapable of adding low cost energy saving measures.

Beyond Kyoto

The cost (to society, and to the planet) of supplying the energy needs of the developing world is an additional very large emission of greenhouse gases, leading to global warming. At the same time, there is hope that, after the next decade, the

developed world will have worked out a suite of methods to reduce energy consumption and/or polluting emissions. North America and Europe will no longer be the world's leading energy consumers; instead Asia generally, and India and China particularly, will take the lead and thus produce the bulk of greenhouse gases. Climate change, however, poses a risk of moderate to severe disturbance. The Kyoto Protocol is insufficient in both goals and methodology to be viewed as the only means of curbing climate change. A new vision is needed - to be developed and implemented as a successor to Kyoto.

Development of new ideas on institutional infrastructure is needed to guide the next stage of adapting to and diminishing the degree of climate change. One must bring together people with

technical and scientific competence
economic, social and legal competence
from a wide range of countries, in a setting conducive to creating new ideas.

Pugwash is a group that has a combined high level of competence in those disciplines (with the possible exception of economics). Therefore, Pugwash could accept a challenge to lead in developing an idea base from which a new institution could arise. Accepting this challenge implies that Pugwash would act as a catalyst to initiate a process, and would contribute the foundation of ideas from which others could build an international institution that would guide the post-Kyoto era.

Global Urbanization

In contrast to the past, ¾ of the world's megacities are in developing countries. Urban and suburban life has been radically changed by two drivers that have produced global urbanization. These are:

- the green revolution - the number of agricultural workers per unit food production has decreased dramatically, causing a migration to the cities
- the information society - computer and internet technology have made a complete change in business and government operations and personal lifestyles. A significant proportion of work is performed in a virtual work group, from computer connected but physically disconnected locations.

Urban planners and their governments have not fully recognized this new regime, and thus environmental degradation is a result. Food distribution is an ongoing challenge. Thus, science alone (the foundation of the two drivers) is not enough to support sustainable cities. Economic and social changes are needed too.

Water Security

Water security issues are mainly analogous to those of energy security. However, the planet's water resources have suffered through environmental degradation (in contrast, energy supplies have contributed to the degradation). The planet's water resources are finite, and presently over-used, resulting, for example, in rapid depletion of aquifers throughout the world, with no planning for sustainability. There is, or will be, competition for water between food production, industry and direct use by the population. The productivity of the planet's water resources needs to be managed for maximum productivity. Instead, global water problem areas are on the increase - contaminated drinking water, insufficient treatment of municipal wastewater, obsolete/decaying water infrastructure, water wastage (leakage, evaporation), depletion of groundwater, lack protection of watersheds from agricultural waste, and habitat and ecosystem damage. Climate change produces additional stress on water supplies. Serious concern was expressed about the widespread presence of arsenic in the drinking water of fourteen Asian countries.

The basic premise for water security is that access to water is a human right. The trend to privatization introduces a profit imperative that is likely to compromise access to water at an acceptable price. Nevertheless, correct pricing is a key tool for conservation and protection. Enforced regulations are another key tool. There is concern in some countries (e.g. Canada) that trade agreements might force water exports. Water security is a local and regional concern, by its nature. Reliance on water imports actually delays achievement of true water security. The solutions to water security require conservation and protection, new technology and political and organizational vision and action. At present, there are few indicators that nations generally are engaging in sustainable exploitation of water resources. Therefore, water insecurity is the reigning condition.

While water security is recognized by WG4 as very important, there was virtually no discussion on this topic due to time limitations.

Including the Public and Gaining Their Trust

Pugwash has never had a role of addressing its message to the public, and this report is fully supportive of continuation of that existing mandate. Nevertheless, it is recognized that many of the developments discussed in WG4 will not be possible without the active cooperation of the population. Understanding the needs of all and rights of all may be advanced through appropriate training. However, the public is skeptical, and rightly so, because the leaders (of many countries and institutions) have often failed to be truthful. Since every option for natural resource use has associated risk, informed decision makers must chart the right path. Trust of the public must be gained, as they, publicly and privately, are users of those natural resources that must be secured sustainably. Therefore the public must "own" the new path and subscribe fully to the sacrifices and lifestyle changes that the energy reduction and economic reconfiguration will bring.