

generally recognized that the new commercial nuclear stations are capital cost competitive with conventional fossil fuel plants, and have the lowest cost fuel with the most secure supply. Only the advanced gas turbine plant is superior to all in gross electricity costs because of its very high conversion efficiency and low capital cost, which overcomes the relatively high cost of natural gas. In China the competition between nuclear power and pipeline gas will be slowly played out. In Japan and Korea, it will be nuclear power vs. imported liquefied natural gas. Clearly, these are country specific situations and very technology dependent.

An effective mix of global and regional strategies requires free access to all technologies. I am concerned that suggested government manipulations of such access by fiscal devices, such as taxation and subsidies, would distort the optimal mix that a free technologic competition could sustain over a long-term. For example, a carbon tax intended to reduce CO₂ emissions would obviously distort the free market mix. It would be a self-inflicted harm if limited to the United States. As a R&D technologist, I view selective taxation or selective subsidies as a subtle form of censorship, and as a meddling R&D hindrance in today's rapidly shifting and relatively free market of technologies. This should not be confused with government funding of pre-competitive science and technology, which I support. As an example, research on enhancing nature's terrestrial and oceanic CO₂ sinks appears promising and contributes to a common knowledge base. Commercial competition is a different playing field, best left unfettered.

In view of all this uncertainty, it appears to me that the core of any long-range energy strategy is maintenance of the institutional and technical flexibility needed by a globally dynamic energy structure. As a corollary, the major industrial governments have a global responsibility to sustain the long-term viability of all energy options and advanced technologies. This is beyond the economic time span of the commercial sector. New and improved technologies provide opportunities to beneficially fashion the future, rather than only to remedy unwelcome events. Obviously this is a technologist's "no regret" policy, so I recommend it enthusiastically.

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Energy Efficiency in a World of Abundant, Cheap Energy

By Hans Jørgen Koch*

It is certainly a great honor and pleasure to address you this morning. The message I would like to leave with you is strikingly simple, it is that:

The threat of climate change means that the world, and in particular we energy professionals, must devote much more of our talent and resources to understanding and curtailing the world's burgeoning energy demand.

Some might respond that the energy markets show no evidence of an energy demand problem. I argue that it is precisely this absence of market evidence, this "near silence", that makes the situation dangerous and makes renewed efforts to understand energy demand and to pursue energy efficiency and conservation so necessary. The world's political leadership is coming to recognize the threat of global climate change, and the magnitude of the technical, economic, and political response needed. But thus far, the energy markets have been "quiet" on the issue.

Markets speak through prices and the actions of suppliers and consumers. And frankly, the "quietness" of the energy markets is evident on most, though not all, fronts. In terms of prices, energy markets have been unresponsive. The low energy prices we now enjoy are inhibiting the development, commercialization, and implementation of new energy-efficient technologies. As for energy suppliers, they are only now beginning to really come to terms with the challenge. The declaration by the CEO of BP last May that the greenhouse effect was real and that it merited concerted action was very encouraging. But unfortunately, such attitudes are still rare among energy suppliers. Turning to energy consumers. Here the situation has been mixed. There have been some encouraging actions taken by industrial and commercial consumers, prompted by their recognition of the potential financial and public image liabilities of not making progress soon. Individual consumers, on the other hand, are reacting very little, they are continuing to demand more energy-using goods and services, with only minor regard for the consequences for climate change.

Outside of the energy market, suppliers of some types of appliances and equipment have made impressive improvements in the energy efficiency of their products. This has not, however, been prompted by signals from the energy market. It has been the result of government persuasion and regulation and, as with industrial and commercial enterprises as energy consumers, the recognition of the potential liabilities of inaction.

The relative "quietness" of the markets makes political action all that much more necessary and all that much more difficult. Of course, you recognize the situation as one of an "externality". Well, this is an externality that cannot be ignored. It must be conquered - first by internalizing as much of it as possible through prices, and second by other policy

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measures such as regulation. Both means will require a great amount of political courage and work – based on solid understanding of the technical, economic, and behavioral aspects of energy demand.

Focus on Energy Demand

Thanks to the efforts of the energy industry, and in no small part the brokering work of the IEA, I believe we are not facing a global supply problem.

There are certainly challenges in local supply problems and in energy sector regulatory reform. But there are no strong global resource constraints – there is enough coal for 200 years, and gas for 70 years and oil for 50 years, if not longer. Turning to prices. The era of high-priced oil and panic are over. We find prices lower in real terms than before 1973.

This leaves the demand side. I believe, it is demand that is the principal threat to the energy supply-demand balance and to the environment at the moment. We have strong environmental constraints on energy demand. And in the longer term, the comfortable supply-demand balance might change in Asia, if China and India grow as expected.

I can assure you that we in the IEA will be vigilant in our efforts on energy supply issues. But I believe that we – the IEA, the community of energy professionals, and the world at large – must focus much more on energy use and energy users, at a level of detail sufficient to:

- See how energy is really used, and where our problems might arise in the future,
- Understand better how to effectively influence energy use with public policy, and
- Discuss and negotiate responsibilities for addressing the climate change problem. We all recognize that we have responsibilities and that sooner, rather than later, we are going to have to accept and act on them.

The need to understand energy demand, and energy efficiency, has never been greater. Energy use is the principal threat to energy market stability and environmental sustainability, and, therefore, it should be the main concern of policymakers.

Energy Efficiency a Concern of the Present and Future

At the moment, energy efficiency is not improving as rapidly as growth in levels of GDP per capita, population, and various energy services – floor area heated, distances traveled, etc. So, not surprisingly, energy consumption is rising. This growth in consumption, coupled with the continued reliance on fossil fuels, makes cutting CO₂ emissions extremely difficult.

There are several major ways to mitigate emissions of CO₂ and greenhouse gases – energy efficiency is one way, switching away from CO₂-intensive fuels another, and CO₂ sequestration another. However, only energy efficiency and fuel switching can give results in the near term. The timeframe for development, commercialization, and implementation of viable CO₂ capture and disposal methods is considerably longer.

Brief Review of IEA Trends in Energy Use

Energy/GDP ratios are widely recognized as overly simplistic, misleading, and insufficient to describe how energy is used or how well energy is used. Lifestyle changes

and structural changes within the productive economy have opposing effects, with lifestyles became more energy intensive, thus raising energy demand, while structural changes (both within manufacturing in a few countries and between sectors in others) restrained demand growth, all relative to GDP.

Energy savings in IEA countries were significant between 1973 and 1993. Approximately 20 percent reduction in energy intensities occurred in some IEA countries (United States, West Germany, Japan, Denmark). The most important savings were in air travel (55 percent less fuel per passenger-km flown), manufacturing (25-35 percent less energy use per unit of activity), space heating (25-50 percent less heat per square meter of home or building area), the main spark was higher fuel prices and long term technological changes, with some help from energy efficiency programs where they were applied, such as thermal protection requirement on new homes. Savings were somewhat less in countries where alternative supplies exist (cheap electricity, etc.) or in sectors where high user-taxes blunted the impacts of higher crude prices. The real reduction in fuel use per kilometer for cars in Europe was less than 10 percent, for example, although more is now being promised by major manufacturers in Germany, France, Sweden, and Italy.

Improvements in efficiency are clearly slowing down, but still restraining demand relative to GDP. In some markets, such as cars, the real fuel economy is stagnant, and there is some evidence of a slight reversal in manufacturing, but in other markets (heating, home appliances), efficiency continues to improve. Most of the 1973-1990 savings have persisted. There were only small rebounds in energy use from greater efficiency after oil prices fell. And there was little unexpected growth in car use or heating.

At the end of the day, IEA energy demand is considerably lower than it would have been had individuals and companies not discovered and implemented more efficient ways of using energy. Few doubt that as equipment turns over another 20-33 percent reduction will occur. The reason is that new aircraft, homes, appliances, and industrial equipment uses much less energy than what is being replaced. But this was also true in 1973, and that “gap” then increased when fuel prices rose! In other words, we keep discovering new ways to save energy, just as we never seem to run out of reserves of oil and gas. What is uncertain is the time it takes for each step of improvement to occur, and what the real net reduction will be.

One important result of the last twenty years is the overall shift in the structure of energy use, towards services and final consumers (passenger transport, households) and away from industry.

The past notwithstanding, the challenge today is that the combined impacts of slow improvements in efficiency and shifts to lower carbon fuels is not reducing emissions as rapidly as economic growth is raising emissions.

How Can Governments Encourage Improving Energy Efficiency?

The policy impasse over what to do about CO₂ emissions is real. We can see its effects on the upcoming Kyoto negotiations as countries and industries step up their propaganda for or against action. At the same time there are a

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number of ways that can be used to further the exploitation of the energy efficiency potential. The most potent methods involve pricing, particularly eliminating subsidies and trying to include externalities (such as CO₂) in prices as well. Efficiency standards, where implemented, have had a proven economic effect on improvements in home heating and equipment. Voluntary agreements seem to spur both technological progress and the take-up of efficiency improvements. Some of these strategies do not need to wait for broad agreement on the "right" carbon tax or other long-range strategies.

There are other policies, too, which we cannot ignore:

- Speeding up technological progress by makers of key-energy using capital – R/D and energy price signals;
- Improving markets for energy-saving capital through information, demonstration, testing;
- Speeding up capital stock turnover where justified: scrapping some old appliances and vehicles (aircraft, trucks, some cars, as has been tried for reasons of air pollution); and
- Recognizing and addressing true market failures and barriers (as opposed to sluggish markets, weak consumer interest caused by stable or low energy prices). We think that household appliances and insulation levels and automobile technology would be sub-optimal without some prodding from authorities.

We recognize that today, energy efficiency is not interesting, not selling itself today at the maximum "cost effective" rate. Consumers and industries have other things on their minds. Consumers have, by and large, accepted the present levels of expenditures for energy and are happy with the present slow pace of improvements, however they might measure these improvements. Since energy pricing and price expectations do play a role in the offering of efficiency technology by manufacturers and its take-up by all energy-consumers, it seems that even modest price increases justified by CO₂ and other externalities may have a surprising effect. Fortunately, some nations – the Nordic Countries, the U.K., and Holland – have moved towards this internalization, for a variety of purposes, and announced their intention to keep some of new the taxes at least constant in real terms.

This prescription acknowledges the importance of market forces in stimulating the rate of efficiency improvements. Nevertheless, as suggested earlier, certain interventions by authorities are still justified: efficiency standards on new homes and some equipment, because individual consumers cannot make complex cost benefit or technology calculations, and they do not have the market power of large companies that make equipment. At the same time, we recognize that some interventions are labor intensive (large scale programs, subsidies, etc.) and have been of mixed value. Some succeeded, some did not. It is time to call the winners "winners" and build on them, and jettison the losers. In this regard the United States has undertaken the most elaborate research to evaluate the real impacts of various energy efficiency strategies (and technologies themselves); we call on other IEA members to improve their own efforts at evaluation, to be able to know soon whether the present proposals to restrain CO₂ emissions through improving efficiency are effective.

Need for a New Paradigm: a Sectoral Strategy

Though these traditional methods of encouraging efficiency still offer great potential, I believe we must augment these efforts through sectoral policies. In other words, we should address building and appliance energy use in the context of housing policy, industrial energy use through competitiveness and environmental policy, automobile efficiency and trucking through transport policies, and so forth. The reason is clear: for all but a few activities, energy is a minor input to overall activity.

The sectoral strategy for energy efficiency works in a natural way. The key step is to embed efficient use of energy in normal workings of sectors: this reduces costs of efficiency per se. Otherwise the costs of just "making energy use more efficient" rise because efficiency investments are seen in a vacuum without other reasons to disturb a building, a factory, or a vehicle. Taking a wing of a building or an entire factory out of use to tune up energy-systems hardly seems justified. Improving energy use when major process or structural overhaul is imminent makes much more sense and costs less. (This is particularly important in Eastern Europe, where most of the building stock will have to undergo expensive renovation sooner or later, at which time making efficiency improvements will cost very little.) Use collective sectoral resources to improve expertise among the experts. California, for example, provided a great deal of guidance to home builders, architects, and engineers so they could follow the relatively stringent requirements for new housing.

Certainly there will be differences of opinion over what is "optimal". An open policy process helps to narrow these differences. But the major bearers of technology are the manufacturers and they must be included in this process.

For industry, voluntary agreements, to the extent that they push technology in a cost-effective way (rather than simply validating existing trends) create a useful framework for experts in industry to solve problems to accelerate efficiency improvements and reduce CO₂ emissions. We have to be careful, however, to not expect too much from the voluntary agreements as some energy savings and CO₂ reductions may have been obtained anyway.

For cars, automobile companies in Europe and Japan have become very aggressive at reducing fuel consumption/kilometer in new cars even as the average car becomes more powerful and better equipped. In freight, trucks and trucking are also sensitive to many other larger costs besides those of fuels, and trucking is still rigidly regulated in many countries. Policy reforms in Germany and other European countries may lead to some restraint in fuel use by trucks without impeding the economic flow of materials in the economy, certainly a good example of a how a sectoral policy not even connected to energy could nevertheless reduce energy needs.

Energy authorities are still crucial to link efforts across sectors, join efforts to environmental policy, and to balance overall supply/demand concerns. There is a big role for energy economists, too. No one would argue that all the basic or applied energy economics problems have been solved. Like climate models, economic models have big holes too! But whereas the price of oil was on everyone's mind when the IAEE became active, it has very much faded from the headlines. In that sense, energy economists are themselves less in demand than a decade ago, and planning and analysis in both government and the energy industry has been cut back

drastically. Yet there remains an enormous task. More needs to be done, and my organization, the IEA, expects to play a major role in that process. I suggest that the IAEE do likewise.

Conclusions

This past June at the United Nations in New York, world leaders met and discussed their progress on climate change issues. I don't think it is mischaracterizing the situation to say that the heads of state of the major developed economies were "embarrassed" to have to admit that they would not attain the greenhouse gas emissions goals they had set for themselves in Rio de Janeiro. They will no doubt be "embarrassed" further, if - as many observers fear - the COP HI meeting in Kyoto fails to reach agreement on goals for the early decades of the next century. This would indeed be disappointing given the no-regrets potential for energy efficiency that exists in OECD countries. There is a potential no-regrets savings of perhaps 20-30 percent. Unfortunately, there are no "silver bullet" technologies or policies that can yield all of these savings. The potential is spread throughout our economies, and must be pursued on many fronts. Nonetheless, it is obvious that some of the largest potential savings exist in personal transport, electricity generation, industrial motor systems, building lighting.

To my mind, energy efficiency is a resource every bit as valuable as oil, gas, and coal. And I believe we must pursue this potential with all the tenacity with which we exploit other energy resources. For this to happen, we energy professionals must do our part. We must develop and communicate effectively a solid understanding of the technical, economic, and behavioral aspects of energy demand and the role of energy efficiency.

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BIEE/UNIVERSITY OF WARWICK CONFERENCE

THE INTERNATIONAL ENERGY EXPERIENCE: MARKETS, REGULATION AND ENVIRONMENT

8-9 December 1997, University of Warwick, Coventry, UK

This academic energy conference, convened by the British Institute of Energy Economics (BIEE), and by the Centre for Management under Regulation (directed by Catherine Waddams) and the Department of Economics at University of Warwick, follows the December 1995 conference on *The UK Energy Experience: A Model or a Warning?* This second conference will provide a unique opportunity to review UK and international energy experience in the light of recent progress in energy, environmental and regulatory economics. The conference will bring together, from the UK and elsewhere, university economists and others with specializations in energy issues, postgraduate students and also economists and policy makers working on energy issues in industry, government and related organizations. John Battle, UK Minister for Science, Energy and Industry, has agreed to address the conference as opening speaker.

Other speakers confirmed include: Professor David Newbery, University of Cambridge; Professor Peter Davies, Chief Economist BP; Professor Colin Robinson, University of Surrey and Institute of Economic Affairs; Professor Luigi da Paoli, Milan; Professor Catherine Waddams, University of Warwick; Professor Alex Kemp, University of Aberdeen. Peter Oppenheimer, Christchurch, Oxford and will address the conference dinner, which will be presided over by Lord Nigel Lawson of Braby, President of the BIEE.

CONFERENCE ORGANIZATION AND PROCEEDINGS

Nearly 50 abstracts have been accepted and over 50 papers will be delivered, the majority of which will be published in the conference proceedings (subject to receipt by the end of October).

It is anticipated that, as with *The UK Energy Experience: A Model or a Warning?* (edited by Gordon MacKerron and Peter Pearson, and published in March 1996 by Imperial College Press), papers presented at the conference will be considered for inclusion in an edited volume from a major publisher.

LOCATION AND COSTS

The conference will be held at the University of Warwick Conference Park. Campus accommodation is offered. Fee, to cover the cost of the conference, including accommodation on the night of Monday 8 December, meals, VAT and conference proceedings: £80 (academic participants, paper presenters and BIEE members), £150 (nonacademics). It is intended to offer reduced rates for postgraduate students.

Registration: Monday 8 December from 10.00 hrs.; conference starts 11.30 hrs. Monday 8 December; conference ends approximately 16.00 hrs. on 9 December.

FURTHER INFORMATION

Please address any inquiries and send abstracts to Mary Scanlan, Administrative Office, BIEE, 37 Woodville Gardens, Ealing, London W5 2LL. Tel: +44-(0)181-997-3707; fax: +44-(0)181-566-7674.

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