

# Energy and sustainable development: issues and options

**F**uture development needs to be sustainable in all of its dimensions if it is to continue to fully contribute to human welfare. In the achievement of this objective, the manner in which energy is produced and consumed is of crucial importance. In the wake of these insights, first attempts begin to provide concrete options for steps towards sustainability in the energy sector.<sup>1</sup> Two criteria can be identified for developing sustainable development policies. First, such policies need to strike a balance between the three dimensions of sustainable development – economic, environmental and social – acknowledging that all three are intrinsically linked. Second, policies in the energy sector need to reduce exposure to large-scale risks and improve the resilience of the energy system through active risk management and diversification.

In the energy sector, these two criteria will have to prove themselves in the face of several potential challenges to sustainable development:

- The growing importance of non-OECD countries in global energy consumption has important consequences for global supply security and greenhouse gas emissions. In addition, 2 billion people lack access to electricity.
- Climate change remains a top priority for industrialised countries, while developing countries need to address local and regional pollutants.

- Assuring the security of energy supply is becoming an increasingly difficult challenge as the dependency of OECD countries on a dwindling number of suppliers for their oil and gas imports grows.
- The institutional environment for energy policy making is changing fast. On the one hand, market reform, privatisation and increasingly vocal NGOs decentralise decision-making power; on the other hand, more and more issues require regional or global co-ordination.
- Technical progress – in particular, improvements in energy efficiency and cost reductions of renewable energy sources – holds great potential for making progress in several areas of sustainable development; however, it will not be realised on its own.

A number of initiatives testify that policy makers are responding to these challenges. Both the Ninth Session of the Commission on Sustainable Development (CSD) in New York (April 2001) and the Meeting of IEA Energy Ministers in Paris (May 2001) have energy and sustainable development as their principal theme. The three-year OECD horizontal project on sustainable development provides a reference for a large number of policy efforts aimed at improving sustainability.

The International Energy Agency (IEA) is fully contributing to these efforts. For several years, the IEA has committed itself to an integrated approach to energy policy making. Its Shared Goals of 1993 state:

*Member countries of the IEA seek to create the conditions in which the energy sectors of their communities can make the fullest possible*

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*contribution to sustainable economic development and the well-being of their people and of the environment.<sup>2</sup>*

This orientation is now developing into a full-scale commitment towards sustainable development. The IEA looks forward to participating in the emerging discussion on energy and sustainable development in collaboration with the OECD and the NEA.

### The global energy picture

The quest to assure sustainable development in the energy sector is challenged by a projected fossil fuel future and an increasing concentration of oil and gas suppliers. In the Reference Scenario of the IEA's *World Energy Outlook 2000*, world total primary energy demand for commercial fuels is estimated to increase by more than 57% between 1997 and 2020, or at an average annual rate of 2%.

The bulk of the projected increase in world energy demand over the next 20 years is expected to come from regions outside the OECD. Consequently, the current 54% share of OECD countries declines to 44% by 2020, while that of developing countries rises to 46% from the current 34% share.

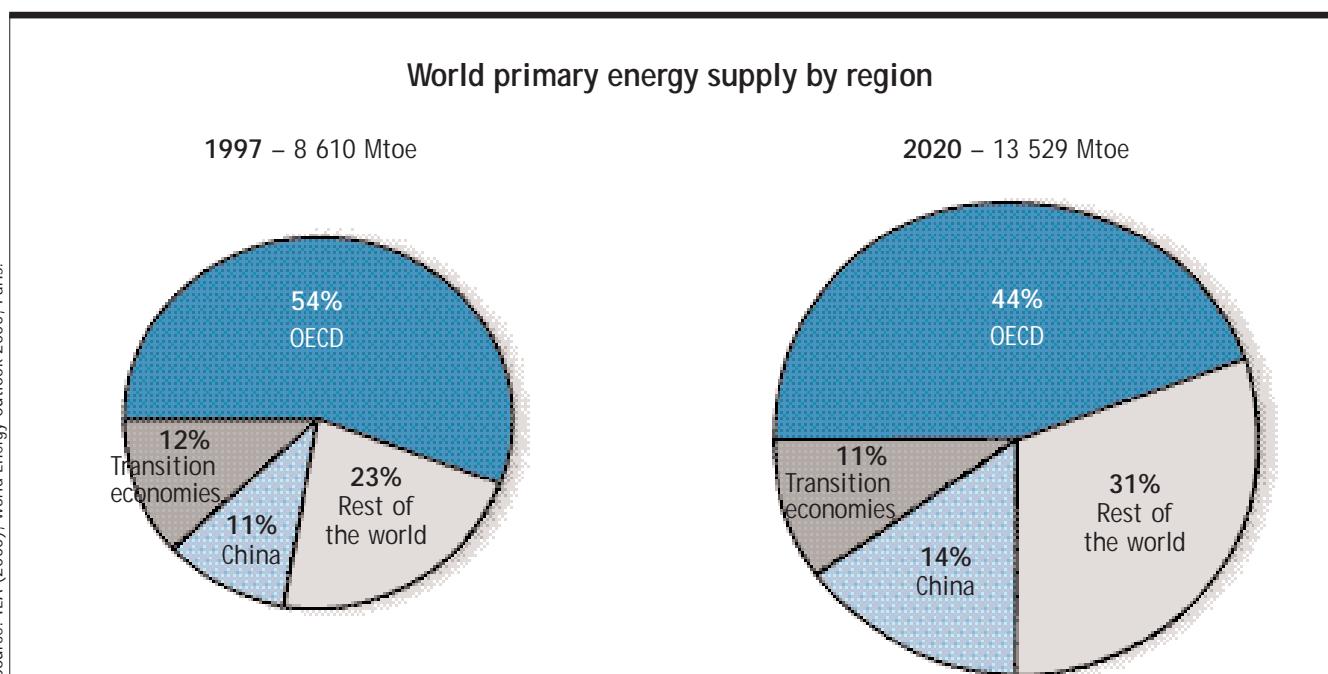
Oil remains the dominant fuel with a share of almost 40% in 2020, increasing with total energy demand at an annual 2% growth rate. Oil demand growth is driven by the transportation sector, which increases by 2.4% per annum. Natural gas is the second fastest growing energy source after non-hydro renewable energies with 2.7% per

annum over the projection period. As a result, its share in world primary energy demand increases from 22% today to 26% in 2020. The expected demand increase for gas, however, has raised the issue of gas security.

Over the outlook period, world coal demand is projected to increase by only 1.7% per annum, thus reducing its share of total primary energy supply. China and India, countries with rich coal bases and high electricity demand growth prospects, are expected to contribute more than two-thirds to the increment in world coal demand over the projection period.

Nuclear power, which accounted for 17% of the world's electricity in 1997, is projected to decline by the end of the outlook period after 2010 to 9% in 2020. Nuclear power output increases only in developing countries, while a significant number of the currently operating reactors in the OECD are expected to be decommissioned.

Hydropower is, with 18% of global electricity production, the world's second largest source of electricity after coal and contributes approximately 3% to the global energy supply – a share that is anticipated to remain stable. Non-hydro renewable energies are expected to be the fastest growing energy source in the global energy mix, with an annual growth rate averaging 2.8% until 2020. Despite this rapid growth, their share will only reach 3% by 2020. This projection is raising a fundamental question: Are we on a sustainable energy path? The obvious answer is no unless there are considerable changes.



## Elements of sustainable development in the energy sector

Sustainable development contains a strong future orientation. The Brundtland Report of 1987 defines it as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The concern over the long term is particularly relevant for the energy sector, as impacts from energy production and consumption can reach into the future for many generations to come.

Globalisation, regulatory change, new technical developments, increased awareness of environmental issues and the availability of new information and communication technologies constantly change the complex context in which the energy sector evolves over time. In some cases, such structural change permits progress in all three dimensions of sustainable development at once. For instance, the advent of the combined-cycle gas turbine (CCGT) has allowed several OECD countries to combine economic efficiency gains with reductions or limitations in greenhouse gases.

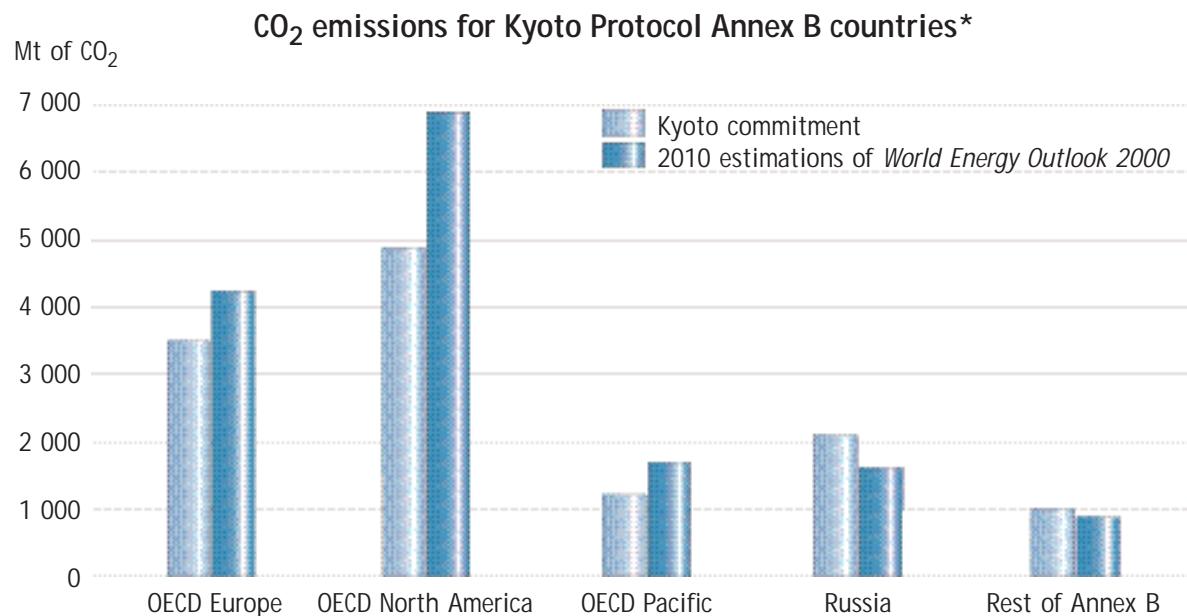
As long as such win-win opportunities do not arise in sufficient quantities in the short term, progress towards sustainability in the energy sector requires careful trade-offs between the different dimensions of sustainable development; for example, when maintaining per capita welfare for future generations. As long as the substitutability between different dimensions is guaranteed, this implies that losses in one dimension – say the environ-

mental one – shall be substituted by at least equivalent progress in another one – say the economic one.

Often trade-offs cannot be made and institutional processes need to determine quantitative thresholds. Environmental regulations primarily aimed at local and regional airborne emissions such as particulates and sulphur dioxide ( $\text{SO}_2$ ) have achieved considerable success in OECD countries. Unfortunately, the same progress has not yet been made in developing countries where the impacts of solid fuel use (coal, dung and biomass) is responsible for about 2 million premature deaths a year.<sup>3</sup>

One of the most challenging policy efforts towards sustainable development in the energy sector is constituted by the efforts of the Kyoto Protocol Annex B countries to reduce greenhouse gas emissions, approximately four-fifths of which result from the combustion of fossil fuels. The graph below indicates the magnitude of this challenge by setting the commitments of Annex B countries against the emissions projected in the Reference Scenario of the IEA World Energy Outlook 2000.

While much of the debate on sustainable development has focused on the interplay between economics and the environment, there is a social dimension that must be included. In the case of energy, the social dimension is multifaceted: it includes not only energy security but also the issue of access to energy services, employment issues in the energy sector, disruption to societies that can



Source: IEA (2000), World Energy Outlook 2000, Paris

\* Annex B countries are those countries that have committed to quantified greenhouse gas emission limitations and reductions.

result from price shifts in the energy sector and issues such as the social implications of energy-related land use. None of these factors can be considered individually – each has links to the economic dimension, and many also have links to the environmental dimension.

Other than the pursuit of clearly defined public goods such as in the environmental or the social areas, governments also have an obligation to create the appropriate framework conditions for well functioning and competitive markets. Regulatory reform offers significant potential benefits in terms of improved economic efficiency, lower prices for consumers, improved risk allocation and stimulus to economic growth and competitiveness.

Finally, all three dimensions of sustainable development will require the absence of disruptions that could pose systemic risks. Only by avoiding irreversible breakdowns can economic, social and environmental options of future generations be preserved. Risk management is particularly important in the energy sector due to two factors. First, energy sources such as electricity or oil only have limited substitutability – their absence would imply large burdens on society. Second, the energy sector is characterised by long timeframes of planning, operation and decommissioning of energy installations and infrastructures. The inertia and rigidity that result from these factors limit the flexibility of energy systems and expose them to shocks.

### Towards sustainable energy policies

Energy policy makers have the choice either to be leaders or followers in the discussions about sustainable development. The choice to participate or not no longer exists. Future-oriented policy integration of different dimensions and risk management have been identified as the principal features of a coherent approach to sustainable development in the energy sector. Given that unexpected shocks will certainly arrive and that there is no such thing as “zero risk”, sustainable energy policies will also need to maintain response options when such shocks do arrive in order to ensure sustainable development.

In light of the issues mentioned earlier, a number of policies can be identified that enable progress towards sustainable development. While their implementation may vary from country to country, their combined thrust is common to all countries interested in developing comprehensive energy policies towards sustainable development:

- safeguarding energy supplies through diversification of energy sources and the co-ordination of flexible response mechanisms in the face of unexpected supply shortages;
- balancing climate change risk and the risk to interrupt economic growth through the setting up of appropriate targets and the creation of economically least-cost, market-based instruments;
- promoting the internalisation of environmental externalities of energy production and consumption through the clear assignment of responsibilities as well as the removal of energy subsidies that are detrimental to public-good objectives;
- ensuring the operation of energy equipment, plants and infrastructures under the highest safety standards and the creation and maintenance of appropriate emergency response mechanisms to ensure against accidental risk;
- promoting the research and development of new energy technologies in areas which have the clearly identified potential to contribute to sustainability objectives;
- continuing the liberalisation of energy markets with stable and predictable frameworks concerning environmental performance and social compatibility;
- creating appropriate conditions for the involvement of the private sector to participate in the effort to provide electricity for the 2 billion people currently without access through investment and technology transfer;
- sponsoring research, learning and information dissemination on issues related to sustainable development, thus acknowledging the need to address the intrinsic complexity of sustainable development;
- creating broad and transparent decision-making processes that allow the involvement of all stakeholders and reflect societal changes in order to foster policy integration and the achievement of balance between the three dimensions of sustainable development.

These are guidelines for moving in the right direction. It is inevitable that it will be an immense challenge to reach a sustainable development path, and that strong political determination will be necessary. ■

### Notes and references

1. See, for instance, IEA (2001 forthcoming), *Working Towards a Sustainable Energy Future*, Paris.
2. IEA (1995), *The History of the International Energy Agency*, Volume III, Paris.
3. UNDP, UNDESA and WEC (2000), *World Energy Assessment*, Vienna.