

COMPARATIVE ASSESSMENT OF ENERGY SOURCES

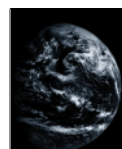
COMPARATIVE ASSESSMENT OF ENERGY SOURCES

PROGRAMME OBJECTIVE

To facilitate national and international assessments of nuclear power in the context of full source-to-service energy chains, with the aim of supporting sustainable energy development in increasingly competitive electricity markets. To explore the role of nuclear power for sustainable energy system development and to assist Member States in making informed policy decisions about their future energy development.

OVERVIEW

The programme on comparative assessment of energy sources developed methodological tools for informed policy and decision making for use in Member States. This included the development of tools for comprehensive comparative assessment of all energy supply options, and economic analysis of issues related to the nuclear fuel cycle and to the supply and use of nuclear power in changing electricity markets. These studies aim to identify: the potential role for nuclear power in achieving sustainable energy development; the relative economics of different electricity generating options; other potential barriers to the future use of nuclear power; and the environmental costs and benefits of nuclear and other options. Capacity building in Member States in these areas was pursued through the dissemination of methodologies and through training. The programme was also restructured in order to: (a) launch a new activity focusing on the role of nuclear power as a greenhouse gas (GHG) mitigation option, especially under the flexible mechanisms of the Kyoto Protocol; and (b) participate proactively in United Nations system-wide activities related to sustainable development.



ENERGY DEMAND ANALYSIS, SUPPLY OPTIONS AND INDICATORS FOR SUSTAINABLE ENERGY DEVELOPMENT

Despite the need for sustainable development, and the fact that energy is a key input for all socioeconomic development activities, indicators for sustainable energy development (ISED) have not been developed anywhere. The need for such indicators has become even more acute since current work in this area has

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focused on *general* sustainable development indicators. In response, the Agency initiated a project, with the help of Member States and other international organizations, to define a comprehensive set of indicators that measure and monitor the development of the energy sector in conformity with the objectives of sustainable development. The availability of ISED would help in: (a) evaluating the role of energy in sustainable development strategies; (b) making necessary modifications to the Agency’s databases and analytical tools so as to make them more responsive to sustainable energy development issues; and (c) rendering assistance to Member States in the formulation of their energy strategies in conformity with the objectives of sustainable development. Following further refinement, these indicators will be submitted to the United Nations Commission on Sustainable Development for consideration during its ninth session (UNCSD-9), to be held in April 2001. This meeting will, for the first time, hold discussions on energy in relation to sustainable development.

Since sustainable development necessarily has a strong economic component, assessing

the economics of nuclear power is essential. A number of studies were completed, some with other organizations, exploring the competitiveness and the economic future of nuclear power in general, as well as the economics of specific aspects of the nuclear power cycle. One such study culminated in the publication of a technical document entitled *Strategies for Competitive Nuclear Power Plants* (IAEA-TECDOC-1123). A number of other studies were also initiated, including one on liability management in the decommissioning and waste disposal phases of the nuclear cycle, and another on the need for cost effective safety approaches in nuclear power plants. In related work, a CRP on the impact of infrastructure requirements on the competitiveness of nuclear power was initiated. The first Research Co-ordination meeting was convened in December.

An example of the Agency’s pursuit of synergy with other international organizations was the completion of a study with the OECD/NEA on long term projections of energy and electricity demand and supply to the year 2100, and adapting them to explore the impact of competitive markets on the future market share of nuclear power, the consequences of any decision to phase out nuclear power on emissions affecting air quality, regional acidification and climate change as well as nuclear power’s potential role in mitigating GHG emissions over the very long run.

NUCLEAR ENERGY IN SUSTAINABLE ENERGY STRATEGIES

The Agency has for many years provided data, information and analytical tools for making informed decisions on how best to meet the energy needs of a country. These tools have been distributed in over one hundred countries and to 12 international organizations. In 1999, model development efforts focused on creating improved versions of the Agency’s most widely used energy planning tools, including DECPAC, MAED, WASP and ENPEP, which are used for the comparative assessment of energy options, analysis of energy and electricity demand, electricity



generating system expansion planning, integrated energy system planning and GHG mitigation assessment.

The restructuring of electricity systems around the world has led to national electric utilities being privatized, independent power producers being allowed access to the system, and bidding based power markets to be opened to stimulate competition. The Agency has launched an effort to redesign its WASP expansion planning methodology to take account of these changes. Specifically, work began on developing electricity system planning tools that will provide information to Member States on how existing nuclear plants can compete in the new electricity market and how new nuclear units might fit into long term development plans.

Development was also completed of software (*B-Glad*) for estimating and valuing external costs associated with electricity generation. Designed for use in developing countries that cannot afford data intensive and costly analyses, the program runs on a PC and requires a minimum of data. It facilitates estimation of the environmental and external costs of electricity generation and helps users chart pollution mitigation strategies. This package of software and background information includes estimation and valuation techniques covering health and non-health damages from air, water and land pollution from fossil and nuclear energy generation technologies. The *B-Glad* package is available on CD-ROM for

teaching purposes. Controlled field testing was begun in June through a CRP; the complete package, including a refined hydropower component, will be available for distribution by the end of 2000.

Peer review of the Reference Technology Database (RTDB), which contains information on technical, economic and environmental aspects of various components of energy chains, was finalized within the framework of the interagency DECADES project. Feedback from Member States using the DECADES tools resulted in two major improvements to the DECPAC software for comparative assessment. Specifically, the enhanced Pollution Control Devices submodule and the interface for the VALORAGUA model were integrated with the DECADES tools to permit better modelling of air pollution mitigation strategies and of electricity systems with an important share of hydropower.

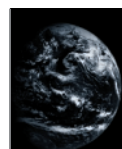
A 'multi source' version of the *EcoSense* model was developed to estimate pollution related health and environmental impacts and associated external costs using the extended pathway methodology. This approach takes account of all sources of pollution for a country or region in one model run. The model was integrated with the Agency's DECADES tools to permit extended analysis of different strategies for electricity generation.

It is important that nuclear power receives fair consideration in the international debate

Distribution of Agency Computer Models in 1999

	Number of releases of planning model or package					
	DECADES	MAED	WASP	ENPEP	FINPLAN	VALORAGUA
Member States	45	68	97	59	22	44
International organizations	8	7	12	6	—	3
Totals	53	75	109	65	22	47

DECADES: Databases and Methodologies for Comparative Assessment of Energy Sources; **ENPEP:** Energy and Power Evaluation Package; **FINPLAN:** Financial Planning model; **MAED:** Model for Analysis of Energy Demand; **VALORAGUA:** 'Valor Agua' (value of water); **WASP:** Wien Automatic System Planning Package. ■



on climate change, given its advantage of minimal GHG emissions. A CRP was initiated to study the role of nuclear power and other energy options in meeting international goals on GHG emission reductions, with three specific objectives: to enhance the Agency's tools for energy planning and comparative assessment so as to make them better suited for analysing issues related to GHG mitigation assessment; to develop methodological guidelines; and to provide the framework to conduct studies on the potential role of nuclear power in meeting international GHG emission reduction targets.

“The scientific forum at the 43rd General Conference explored the compatibility of nuclear power with sustainable development objectives.”

The scientific forum at the 43rd General Conference session in September was entitled ‘Sustainable Development: A Role for Nuclear Power?’ The forum explored the key question of the compatibility of nuclear power with sustainable development objectives. Views differed on what is meant by ‘sustainability’, with no conclusion being reached on the bases for judging nuclear power in this context; there was a strong sentiment in favour of developing a common set of criteria (e.g. emission levels, economics) for all energy generation systems. The question of the inevitable trade-offs between these criteria was raised, but was not resolved. The issue of global climate change was extensively discussed, and there were significant disagreements as to whether this would become the justification for nuclear power's expansion, or whether it would have any material impact on the predominantly economic criteria currently being used. As regards the economics of nuclear power, existing plants fare generally well even in deregulated and liberalized markets. In contrast, new nuclear plants face stiff competition from natural gas and coal and their competitiveness is limited to locations without easy access to gas or coal. What emerged from the various

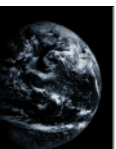
presentations was a common view that electricity use would expand greatly. However, there were vastly divergent views on the role nuclear power would (or should) play in meeting this growth. Fundamental to the entire debate, as pointed out by a number of speakers, is that nuclear power has to become competitive in its own right and must not rely on the introduction of environmental taxes or GHG emission constraints. This and the continued maintenance of the highest level of safety were seen as the most important ingredients for nuclear power to contribute to sustainable energy development.

Preparation of Part 1 of the *Nuclear Technology Review*, suggested at the March meeting of the Board of Governors, was completed. In addition to a brief summary covering the major nuclear energy events of 1999, the review explores the prospects of nuclear power in the years and decades ahead. The issues examined include cost and competitiveness, public confidence and acceptance, and sustainable energy development.

The Agency continued its analytical efforts in relation to the work of the Intergovernmental Panel on Climate Change, the United Nations Framework Convention on Climate Change and the World Energy Assessment — a joint effort of UNDP, the United Nations Department of Economic and Social Affairs and the World Energy Council. This assessment will be an important United Nations input to UNCED-9 in 2001. The Agency's contribution to this assessment was the preparation of a chapter on energy resources.

SUPPORT TO MEMBER STATES

Capacity building activities in developing countries are an integral part of sustainable energy development. In this regard, the Agency seeks to enhance the capabilities of Member States to assess their energy and electricity expansion options by providing state-of-the-art methodologies and decision making tools. It has also had to respond flexibly in terms of its decision aiding tools and its training curricula to the new realities brought



about by market liberalization, deregulation and shrinking government budgets. Such assistance was provided through national technical co-operation projects in Brazil, Bulgaria, Croatia, Egypt, Lithuania, Mexico, Moldova, Poland, Slovenia, Sudan and Viet Nam. In all these countries, the focus was on assessing the role of nuclear power and other energy options in the future expansion of the electricity supply systems in these countries.

Regional projects in Europe, Asia and the South Pacific also addressed needs of Member States in the area of comparative assessment for sustainable energy development. An example is a technical co-operation Model Project that was initiated in Poland to establish a clearly defined energy planning framework and to assess the economic competitiveness and environmental impact of different energy options, including nuclear power and natural gas. The goal is to help build a national team

of experts capable of assessing different energy options. Various scenarios of energy system development will be compared in order to identify those which meet national objectives related to energy diversification, costs, reliability and environmental impact.

Another example is a national technical co-operation project on a pre-feasibility study on the introduction of nuclear power. Two national working groups were formed under the project, the first being responsible for utilizing the Agency's energy planning tools (MAED, WASP and ENPEP) to forecast energy/electricity demand, develop economically optimal expansion plans for the electricity system, and quantify environmental burdens associated with alternative electricity system expansion plans. The second group is investigating technical, safety and infrastructure development issues related to the introduction of nuclear power.

