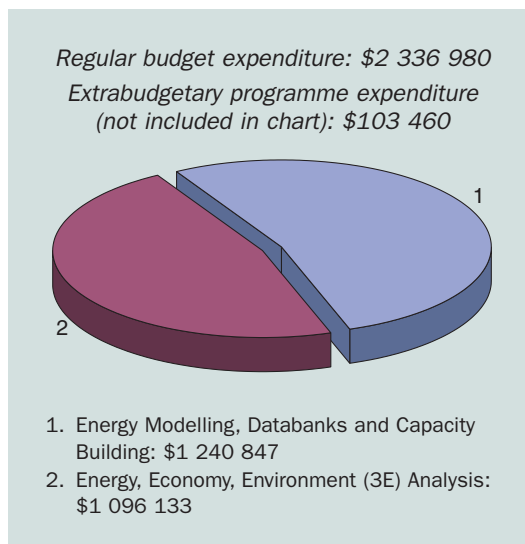


# COMPARATIVE ASSESSMENT FOR SUSTAINABLE ENERGY DEVELOPMENT

## PROGRAMME OBJECTIVE

To facilitate national and international comparative assessments of full energy source to service chains, with the aim of supporting sustainable energy development. 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.



## KEY ISSUES AND HIGHLIGHTS

- New methodological tools to aid in informed decision making were developed and distributed to Member States.
- Analytical reports were completed on the impact of competition on nuclear power, and on the importance of nuclear power for environmental protection and greenhouse gas mitigation.
- Capacity building was promoted through the dissemination of methodologies, provision of training and convening of information seminars for Member States.
- The Agency organized two information seminars at the Commission on Sustainable Development's Ninth Session (CSD-9) (the first to address energy issues) and served as the source of nuclear expertise at UN negotiations on energy, sustainable development and climate change.

**ENERGY MODELLING,  
DATABANKS AND CAPACITY  
BUILDING**

The Agency provides the data, information and analytical tools to support informed decision making by Member States — particularly developing Member States — on sustainable energy development strategies, energy and environmental policies and investment decisions. The Energy and Economic Data Bank (EEDB), for example, is a collection of time-series data for all Member States of the UN system with historical information on energy and electricity production and use, and the status of nuclear power at country, regional and global levels. It also contains medium and long term projections for energy and electricity demand, as well as regional and global projections on nuclear power development. Figure 1 shows the 2001 projections using information from the EEDB. The low projection assumes only the completion of firm plans for new nuclear power plants or the retirement of old ones that have been announced by governments and companies. The high projection reflects additional power plants that are included less firmly in government and company plans, but are judged to be highly plausible by

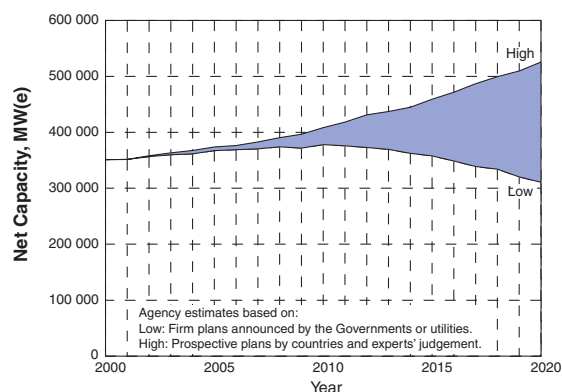


FIG. 1. Outlook for the global development of nuclear power (source: Energy, Electricity and Nuclear Power Estimates for the Period up to 2020, Reference Data Series No. 1, IAEA, Vienna (2001)).

expert meetings convened periodically by the Agency for this purpose.

In addition to data collection, the Agency provides a package of planning models, developed (or adapted from models in industrialized countries) to match the data availability conditions typical in developing Member States. The models are used to analyse alternative approaches to sustainable energy development (Table I). Although the package is very flexible

TABLE I. AGENCY PLANNING MODELS AND THEIR DISTRIBUTION

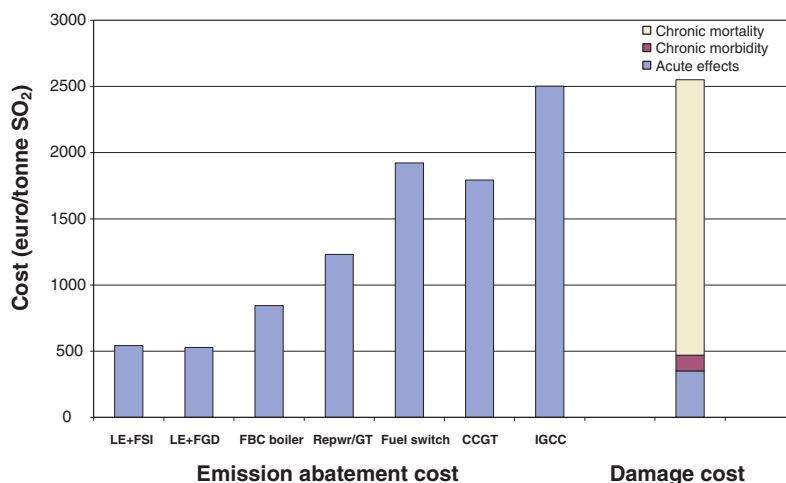
Type of package	Description	Releases to Member States
ENPEP	Evaluates energy system development strategies	43
FINPLAN	Assesses the financial viability of energy proposals, including cash flows and financial ratios	17
MAED <sup>a</sup>	Evaluates future energy needs based on development scenarios in a country or region	41
MESSAGE	Formulates and evaluates alternative energy supply strategies for a country or region	10
Simfacts	Estimates environmental impacts and costs using minimum data input	18
WASP	Identifies the optimal long term expansion plan for a power generating system within constraints defined by the user	49

<sup>a</sup> MAED: Model for Analysis of Energy Demand.

and has been used in countries as diverse in size as Armenia and China, it needs regular updating to remain abreast of both technological and institutional changes, including energy market liberalization and stricter environmental controls. An Advisory Group meeting at Argonne National Laboratory, USA, recommended upgrades to the user interfaces of ENPEP (Energy and Power Evaluation Program), FINPLAN (Model for Financial Analysis of Electric Sector Expansion Plans) and MESSAGE (Model of Energy Supply Systems and General Environmental Impacts), extending ENPEP to include infrastructure costs and adding features to FINPLAN to deal with new high priority issues such as electricity imports and exports, and combined heat and power plants. The improvements to ENPEP and FINPLAN were completed in 2001, as was phase I of the MESSAGE improvements. An updated version of the WASP-IV (Wien Automatic System Planning Package) user's manual was also published.

During the year SIMPACTS — Simplified Approach for Estimating Environmental

Impacts and External Costs of Electricity Generation — was added to the Agency's planning model package. Developed principally for developing Member States, SIMPACTS allows decision makers to make reasonable estimates of environmental impacts and costs using a minimum amount of input data. The analysis is simple, transparent and user friendly. While not intended as a replacement for a detailed environmental impact assessment, SIMPACTS is capable of producing results that are similar to those obtained through such methods. Currently, there are four modules in SIMPACTS: AIRPACTS for quantifying the impacts and costs of damage due to atmospheric emissions (Fig. 2); NUKPACTS for assessing the collective doses and latent health effects from the routine operation of nuclear facilities and the external costs due to accidents and waste disposal; HYDROPACTS for calculating the damage costs of hydropower dams resulting from resettling people due to flooding and lost land use; and 'DAM', a decision aiding model permitting multi-criteria policy analysis. All four modules were externally peer reviewed in 2001. A CRP was also completed that success-



- LE +FSI: life extension + retrofitting of furnace sorbent injection SO<sub>2</sub> control.
- LE+FGD: life extension + flue gas desulphurization + low NO<sub>x</sub> burners.
- FBC boiler: fluidized bed combustion boilers.
- Repwr/GT: repowering with gas turbine.
- Fuel switch: coal → coal+gas.
- CCGT: combined cycle gas turbine.
- IGCC: integrated gasification combined cycle.

FIG. 2. Comparison, using AIRPACTS, of the costs of different emission abatement options and health damage costs per tonne of SO<sub>2</sub> for the Ostrołęka power plant in Poland.

fully field tested SIMPACTS for applicability over a wide range of external cost questions. The Agency has begun to use SIMPACTS in its own analytical work. For example, in co-operation with the World Bank, the Agency completed a preliminary assessment in Belarus of the external costs due to environmental damages from the Chernobyl accident. The project focused primarily on assessing the agricultural, forest and water resource sectors, the need for additional monitoring, and especially the effects of agricultural countermeasures on the health and environmental impacts of exposure to caesium-137 from the 1986 Chernobyl accident.

*Agenda 21*, which was agreed at the 1992 'Earth Summit' in Rio de Janeiro and is the subject of the August 2002 World Summit on Sustainable Development (WSSD) in Johannesburg, calls on "Countries at the national level and international governmental and non-governmental organizations at the international level [to] develop the concept of indicators of sustainable development..." The Indicators for Sustainable Energy Development (ISED) that the Agency has subsequently developed are designed to help national policy makers assess and monitor the contribution of energy to sustainable development in their countries, the impacts of energy on environment, economic and social development, and the inter-relationship between these issues. Other agencies that have formally affiliated themselves with ISED include the OECD International Energy Agency, the UN Department of Economic and Social Affairs and the UN Economic Commission for Europe. In April 2001, the Agency reported on phase I of this project at CSD-9, in New York. Phase I involved a review of the indicator sets and statistics in the energy field, development of a set of 41 indicators and field testing of these indicators. Phase II, starting in 2002, involves streamlining the ISED package and its introduction into the statistical regimes of the Member States of the various sponsoring agencies. Part of this effort will take place under the aegis of a CRP.

Building capacity in Member States and providing technical assistance are two major objectives of the Agency's programme in Comparative Assessment for Sustainable Energy Development. And technical co-operation projects are one of the means for achieving these goals. In a

regional project for Asia, 11 Member States received assistance in carrying out studies on the role for nuclear power and other energy options in their countries. Similar projects in Sub-Saharan Africa and in Eastern Europe are helping to build local capabilities for addressing sustainable development issues in national energy policies, thereby contributing to progress on *Agenda 21*.

### ENERGY, ECONOMY, ENVIRONMENT (3E) ANALYSIS

To supplement assistance to Member States and to support the studies they may carry out independently, the Agency provides analyses of current topics and concerns, with a strong focus on issues relating to economics and competition, environment and climate change, and sustainable development. As part of this work it seeks to reach out to a broad international audience on the role for nuclear energy in increasingly competitive markets, in mitigating potential climate change and in helping to achieve sustainable development. In this regard, a CRP that ended in 2001 focused on establishing appropriate methodologies and developing suitable analytical tools for Member States analysing the potential contributions of various energy technologies to greenhouse gas (GHG) reductions. Country studies were carried out, each examining a wide range of reduction possibilities at both the national and regional levels. Figure 3, for example, shows the projected extent of avoidance of GHG emissions by nuclear power in the USA for three scenarios with different assumptions about the retirement, life extension and new additions of nuclear power plants. The results of these national studies were also used by some countries directly in official communications to the United Nations Framework Convention on Climate Change (UNFCCC).

The Agency also participated in several key UN activities in 2001 in the fields of sustainable development, environment and climate change. In the 'Third Assessment Report', published in 2001 by the Intergovernmental Panel on Climate Change (IPCC), the Agency contributed to the report of Working Group III, 'Mitigation', which concluded that nuclear power plants have

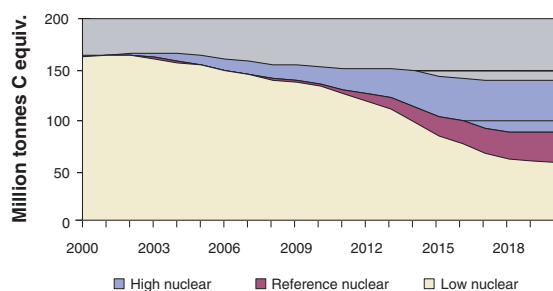


FIG. 3. Projected GHG offsets by nuclear power in the USA.

the highest potential for GHG mitigation in the energy sector, and abatement costs that are among the lowest (see Tables A4–A7 in the Annex).

In addition, as the expert body on nuclear science and technology within the UN family, the Agency has an important role as an information source on nuclear energy for Member States involved in ongoing UN negotiations in the CSD and the Conference of the Parties (COP) to the UNFCCC. CSD-9 was the first session of the CSD to specifically focus on energy. The Agency prepared background information on nuclear energy and organized two information events — one on ISED (described above) and the other on issues central to the debate surrounding nuclear energy's role in sustainable development.

Two outcomes from CSD-9 are significant for nuclear energy. First, the parties agreed to disagree on nuclear energy's role in sustainable development. The final text noted that some countries see nuclear energy as a substantial contributor to sustainable development, while others consider the two to be fundamentally inconsistent. The second significant outcome was unanimous agreement that, “the choice of nuclear energy rests with countries”.

The Agency was also present at the 2001 meetings of the UNFCCC COP — COP-6 Part 2, in

Bonn in July, and COP-7, in Marrakesh in November. The latter meeting (dubbed the “Marrakesh Accords”) was successful in reaching agreement on implementation rules for the Kyoto Protocol. For nuclear energy this was an important step forward since it produces virtually no GHGs and currently avoids 7–8% of global GHG emissions. However, except for a very few instances, there have been no restrictions or taxes on GHG emissions and thus no economic value to their avoidance. The Kyoto Protocol is the world's only currently operative route towards widespread, co-ordinated restrictions on GHG emissions. Thus, the Marrakesh Accords represent a significant step towards attaching a tangible economic value to nuclear power's avoidance of such emissions. However, much of the nuclear industry and the press focused on the Marrakesh Accords' exclusion of nuclear projects from two of the three flexible mechanisms in the Kyoto Protocol, namely joint implementation and the clean development mechanism (the third mechanism is emissions trading). This exclusion reduces cost effectiveness and does not advance the essential UNFCCC objective of stabilizing “greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system”.

In order to ensure that nuclear power is given a full and fair hearing in the sustainable energy debate, the Agency conducts studies comparing nuclear power with non-nuclear alternatives. In 2001, the Agency's analyses of the economic future of nuclear power in competitive markets covered an assessment of technology learning needs and experience in the nuclear industry, and the implications for future market growth. This work included an overview of future energy markets, including alternative scenarios for development and niche markets for nuclear power. It also included an assessment of the potential contribution of nuclear energy in a future hydrogen economy.