Economic Methods and Activities
Planning & Economic Studies Section (PES)}

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Two complementary areas

1. Energy Modeling and Techno-Economic Analysis (PESS)

2. NESAs and Nuclear Cost Analysis (INPRO)

Jointly, we support Feasibility Study Workshops, training courses, and benchmarking of nuclear cost models with GenIV EMWG.
Scope of PESS Capacity Building

• Help build capabilities in Member States for energy assessment studies to:
  • Develop sustainable energy strategies;
  • Identify the potential contribution of different technologies, including nuclear power, in meeting future energy needs.
Capacity Building Activities

- Provide training on energy planning tools and nuclear financing options.
- Provide capacity building for energy and nuclear power planning at Regional and Sub-regional levels (AFRA, ECOWAS).
- Support “new comers” by conducting Pre-feasibility & Feasibility studies.
- Model the Socio and Macro-Economic impacts of nuclear.
Energy Planning Tools are used to balance energy resources sustainably

- Analysis of Energy Demand
- Supply Side Planning
- Economic Comparisons
- Environmental and Social Impacts
Energy Planning is key to managing a changing the energy mix (>>Renewables)
Energy Modelling Activities

Developing enhanced versions of energy models:

- MAED-D
- MAED-EL
- SIMPACTS

IAEA
Model for the Analysis of Energy Demand (MAED)

**INPUT**
- Energy sector data (energy balance)
- Scenario assumptions
  - Socio-economic
  - Technological
- Substitutable energy uses
- Process efficiencies
- Hourly load characteristics

**MAED**

**OUTPUT**
- Useful or final energy demand by sector/fuel
- Electricity demand
- Degree of electrification
- Hourly electric load
- Load duration curves
Wien Automatic System Planning Package (WASP)

**INPUT**
- Load forecast
- Existing system
- Candidates
- Constraints:
  - Reliability
  - Implementation
  - Fuel
  - Generation
  - Emissions

**OUTPUT**
- Build schedule
- Generation
- Costs
- Fuel consumption
- Emissions
Model for Energy Supply System Alternatives and their General Environmental impacts (MESSAGE)

**INPUT**
- Energy system structure (including vintage of plant and equipment)
- Base year energy flows and prices
- Energy demand projections (MAED)
- Technology and resource options & their techno-economic performance profiles
- Technical and policy constraints

**OUTPUT**
- Primary and final energy mix
- Emissions and waste streams
- Health and environmental impacts (externalities)
- Resource use
- Land use
- Import dependence
- Investment requirements

[Diagram showing energy flows from 2000 to 2026 for biomass, geothermal, nuclear, gas, diesel, fuel oil, and coal.]
Financial Analysis of Electric Sector Expansion Plans (FINPLAN)

**INPUT**

- Investment programme (= capacity additions) & operating expenses
- Economic and fiscal parameters (inflation, escalation, exchange rates, taxes)
- Financial parameters (credits, bonds…)

**OUTPUT**

For each year:

- Cash flows
- Balance Sheet, Statement of Sources, Applications of Funds
- Financial Ratios:
  - Working Capital Ratio
  - Leverage ratio
  - Debt Repayment Ratio
  - …
  - Global Ratio
Simplified Approach for Estimating Impacts of Electricity Generation (SIMPACTS)

**INPUT**

**Case 1 (minimum data requirements):**
- pollutant emission rates
- regional population density (< 1000 km)
- source location (urban/rural)

**Case 2 (some more data):**
- stack characteristics
- local population (<50 km)

**Case 3 (even more data):**
- local metrological data (wind directions & speed)
- population around the source (10x10 km)

**OUTPUT**

**Case 1 (minimal results):**
- uniform world model (UWM) estimate for total exposure
- quantification of health impacts
- monetisation of impacts

**Case 2 (more output):**
- estimates 1 adjusted for effective stack height (including H+Vexit+Texit)

**Case 3 (even more output):**
- Gaussian plume used for local exposure and impact estimate
- estimates 2 adjusted for more accurate pollutant & receptor distribution
Model for Analysis of Water Demand (MAWD)

**INPUT**

- Demography and Economy, Sectoral Break-down.
- Agriculture land area, cropping pattern
- Climatic conditions and possible future changes
- Urban-rural composition
- Water Intensity for various end-uses
- Technological and policy options for end-use improvements

**OUTPUT**

- End-use water demand for different sectors
- Water Demand by quality (irrigation water, industrial water, domestic use water, etc.)
- Urban-rural split of water demand
- Seasonal variation of water demand.

Water Demand (million m³)
PESS Energy, Economics, and Environment (3E) Activities

- Assess financing and macroeconomic impacts of nuclear power programmes.
- Prepare special reports:
  - 2014 Climate Change and Nuclear Power
  - 2014 Nuclear Power and Sustainable Development
- Create understanding of the interdependencies between Climate change, Land-use, Energy, and Water (CLEW).
• Prepare briefing sheets on nuclear power myth busting, implication of integration of nuclear and renewables, implications of nuclear energy phase-out.

• Collaborate on economic data and analysis with OECD-NEA/IEA, European Commission-Joint Research Centre, and GenIV International Forum.
Macro-economic analysis quantifies benefits from a nuclear programme

- Crucial that MSs understand the challenges and opportunities provided by a nuclear energy projects
  - National income, employment, balance of payments, etc.

- Key to development of a national position, and to public information sharing.

- Agency advances include:
  - Developing and validating state-of-the-art economic modelling techniques and databases.
  - Aiding the preparation of customized studies assessing macroeconomic impacts (GDP, jobs etc.) at the MS level.
Macroeconomic assessments extend from past, present, to future

From 2004-2009 IAEA & ROK studied benefits to date of nuclear technologies to the economy of ROK

CS on Macroeconomic Impacts of a Nuclear Power Programme in Southeast Asia, held in Malaysia from 2 to 6 December 2013.

CRP (2014-2017): To apply (validate) the newly developed modelling tool to selected case studies
Data Support Activities

- 2014 Reference Data Series #1
- Energy-Economy Databank (EEDB) Updates
- International Energy Statistics
- 2014 Nuclear Technology Review
- DG Briefs

Example

In 2011, Cameroon’s total primary energy supply mix was: Nuclear 0%, Oil 23.3 %, Gas 3.5%, Hydro 5.6 % and Other Sources 67.6 %. Total electricity generation amounted to 6.0 TWh, with an electricity consumption rate of 238 kWh per capita (Ranking 88 out of 105 in Non-OECD countries).
Summary

- PESS collaborates closely with INPRO in many areas of nuclear energy planning and economics

- IAEA develops and refines the economic tools and analysis capabilities to meet the needs of our MS.
Thank you