IAEA Assistance in Energy and Nuclear Power Planning

H-Holger Rogner

Planning & Economic Studies Section (PESS)

Department of Nuclear Energy

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International Atomic Energy Agency

Why is IAEA involved in system energy planning?

- Many developing countries lack the capability and/or capacity for integrated resource planning
- Sequential stop-gap measures instead of long-term development planning
- Only UN organization which is promoting energy planning and assists Member States since the mid-1970s

Objective is to build planning capacity in developing countries

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Why energy system planning?

- A prerequisite for informed decision making
- Supply and demand side options
- Financial viability and capability
- Social/public/political commitment & acceptance
- Economic development & environmental protection including mitigating climate change
- Regional approaches, infrastructure sharing & energy trade (interconnections)
- Testing effectiveness of policy measures

Capacity building: Energy for Development

- Transfer planning models tailored to developing countries
- Transfer data on technologies, resources and economics
- Train local experts
- Jointly analyze national options
- Help establish continuing local expertise

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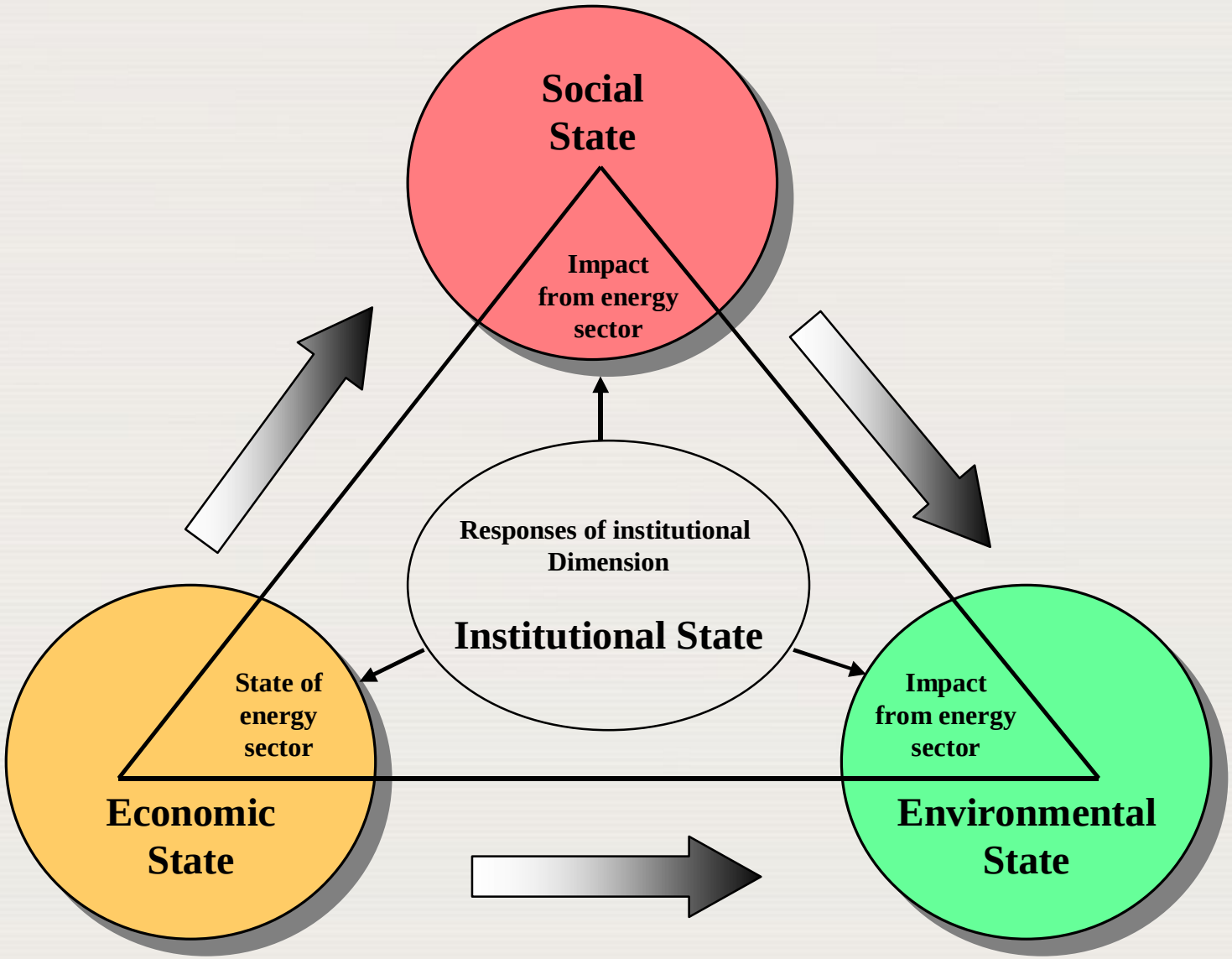
IAEA Analytical Tools for Sustainable Energy Development

- MAED
- WASP
- ENPEP
- MESSAGE
- FINPLAN
- SIMPACTS
- ISED



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IAEA energy analysis models

- Model for the Analysis of Energy Demand

- Model for Energy Supply System Alternatives and their General Environmental impacts

- Financial Analysis of Electric Sector Expansion Plans

- Simplified Approach for Estimating Impacts of Electricity Generation

MAED

Model for the Analysis of Energy Demand

INPUT

- Energy sector data (energy balance)
- Scenario assumptions
  - Demographic
  - Socio-economic
  - Structural change
  - Technological
- Substitutable energy uses
- Process & equipment efficiencies
- Hourly load characteristics

OUTPUT

- Useful or final energy demand by sector/fuel
- Electricity demand by sector
- Degree of electrification
- Urban vs rural demand
- Hourly electric load
- Load duration curves

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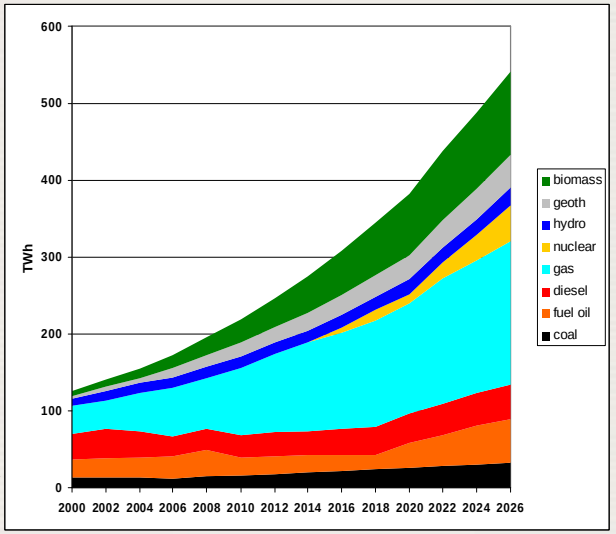
MESSAGE: Model for Energy Supply System
Alternatives and their General Environmental Impacts

INPUT

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

OUTPUT



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

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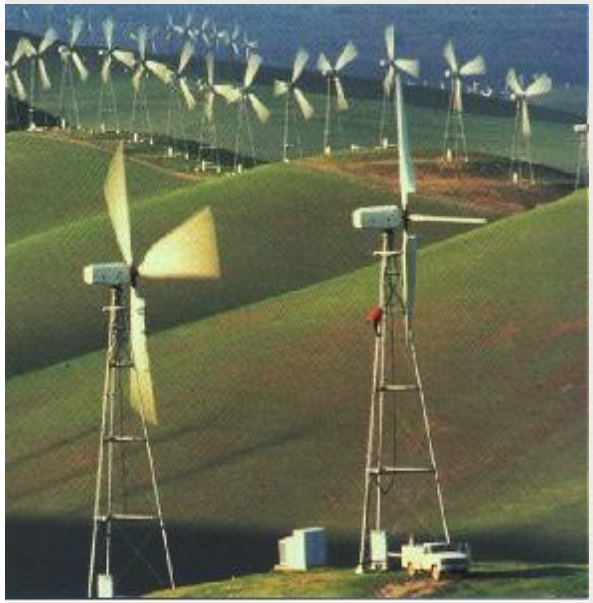
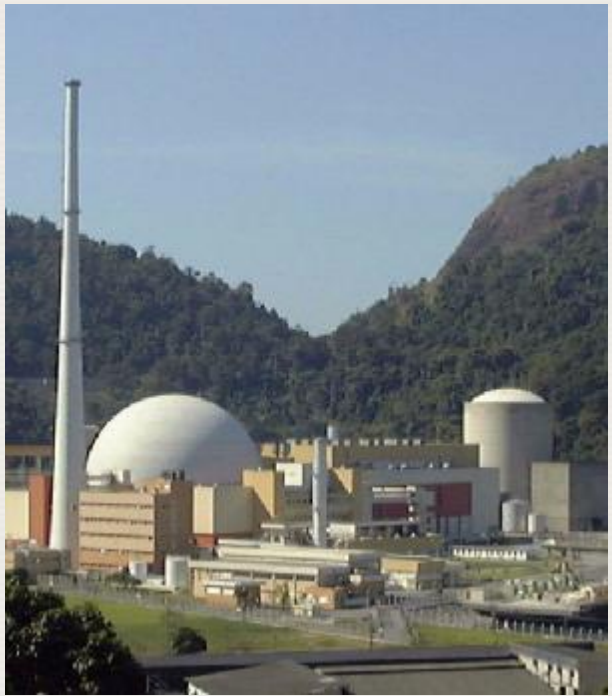
Energy Planning



Outputs

- A national plan towards sustainable energy development

- A tool for benchmarking status, defining strategies for, and monitoring progress towards, a sustainable energy future



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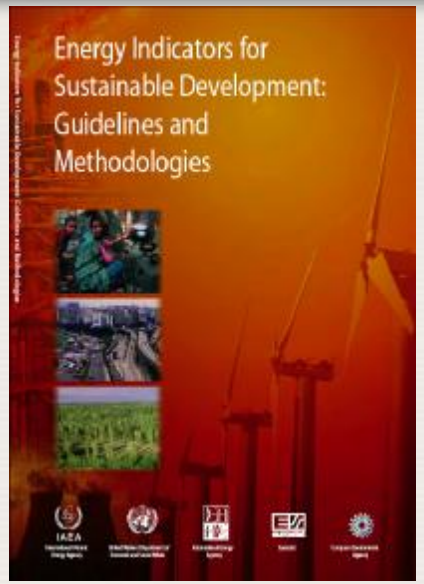
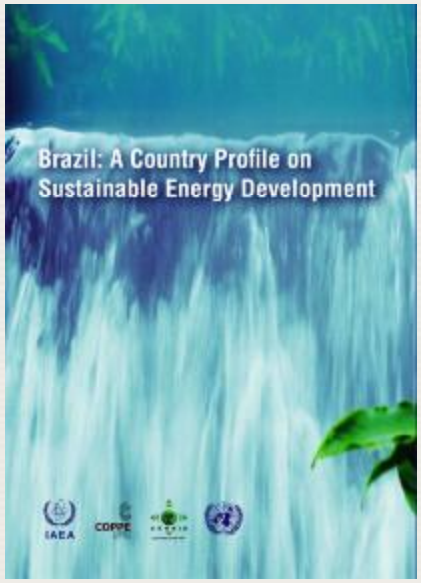
WSSD partnerships

- Indicators for Sustainable Energy Development



- Designing Country Profiles on Sustainable Development



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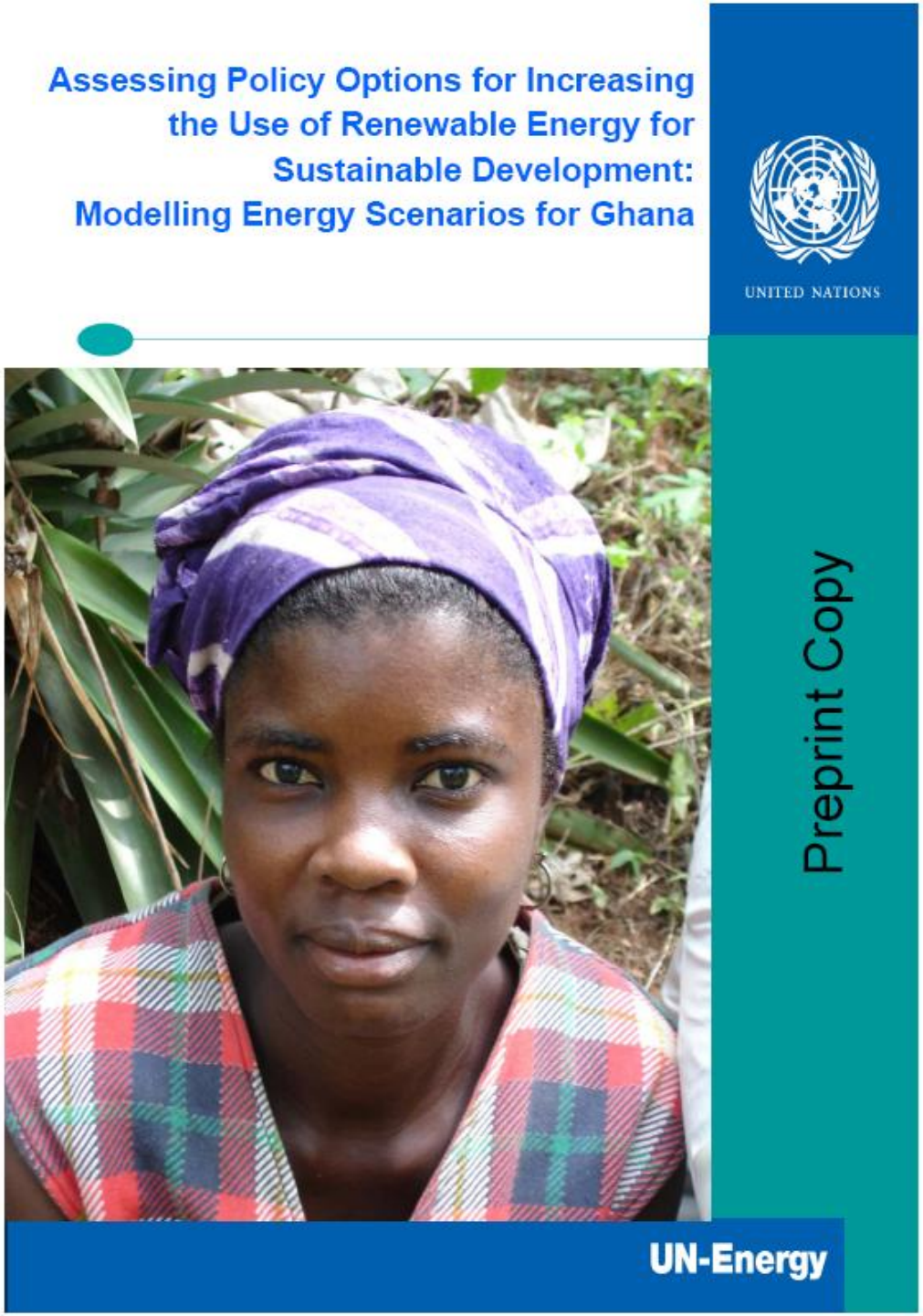


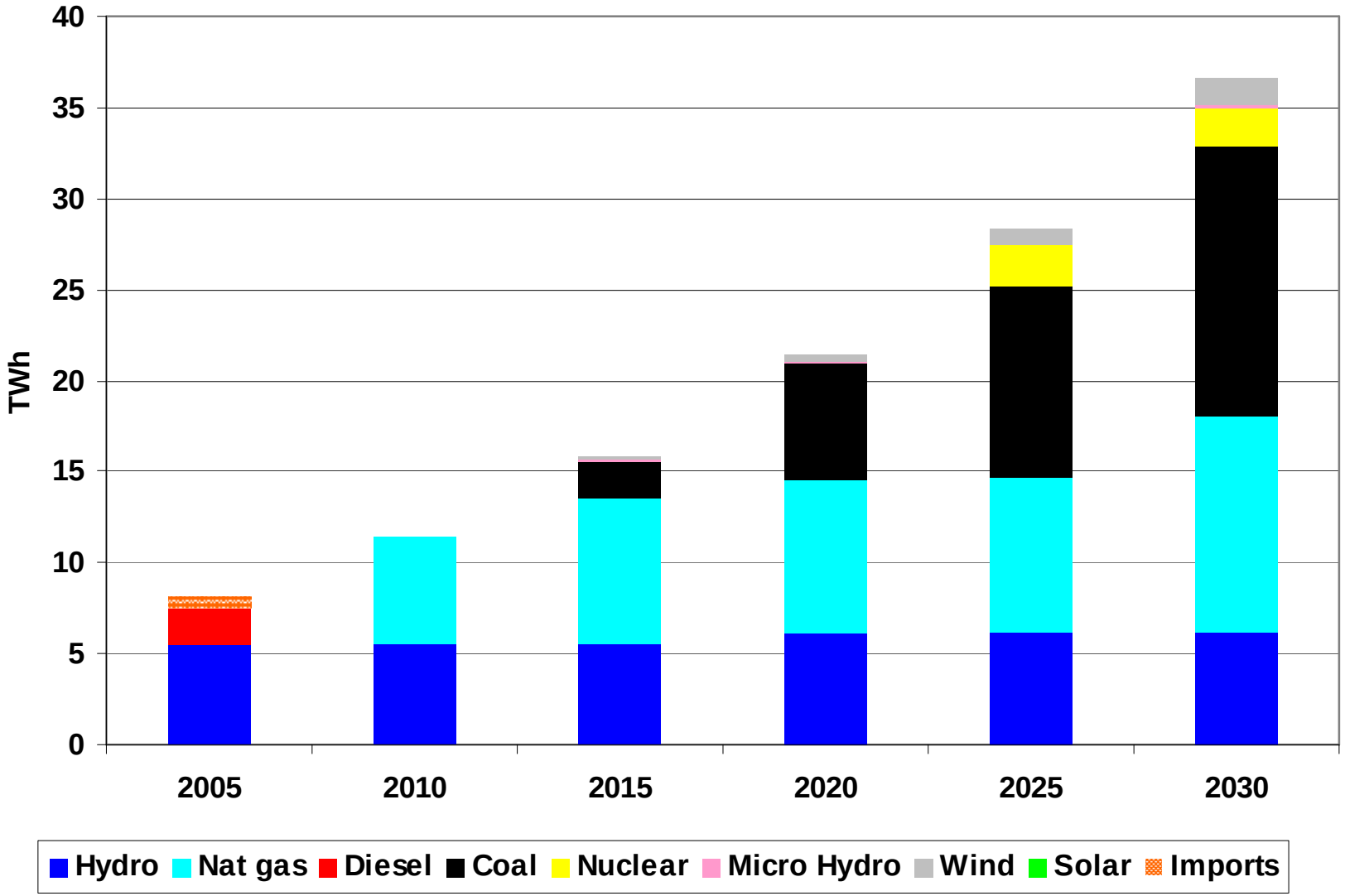
A UN-ENERGY Demonstration Study

conducted by

- **Department of Economic and Social Affairs (DESA)**
- **Food and Agriculture Organization (FAO)**
- **International Atomic Energy Agency (IAEA)**
- **United Nations Environment Programme (UNEP)**
- **United Nations Industrial Development Organization (UNIDO)**

with assistance form the Ghana Energy Commission

Electricity generation: Base case



Impact of different policies

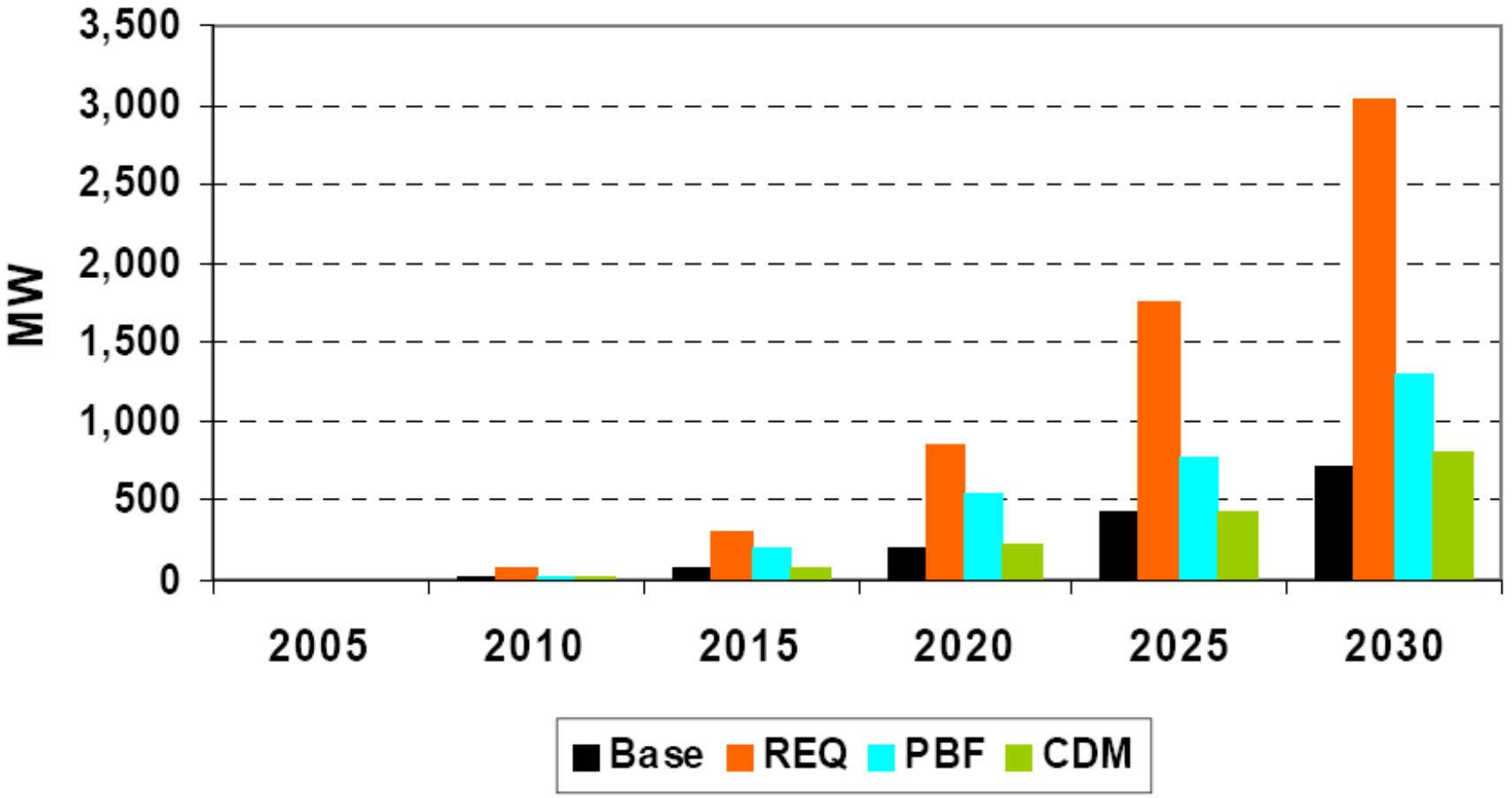


Figure 10: Electricity generating capacity by renewable technologies under different scenarios

Energy Planning – An ongoing process

- No analysis is perfect
- Many more “what if” questions need to be explored
- New information
- Previously plausible assumptions no longer stand the test of time
- Energy planning never ends…..

Energy planning and nuclear power

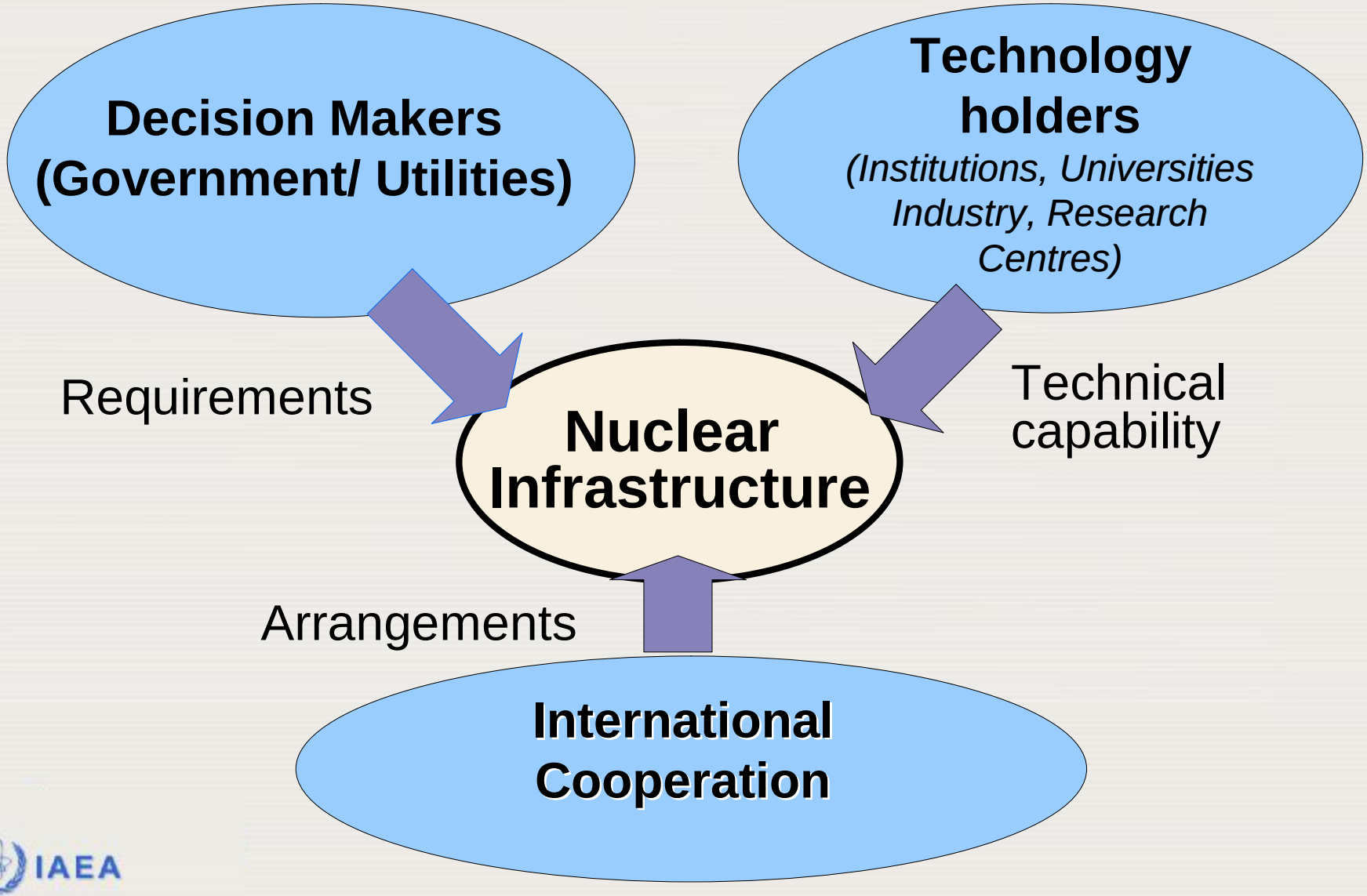
- Nuclear power planning must not occur in isolation
- There is no technology without risks and interaction with the environment
- Integrated energy systems approach
- Demand and supply – technology neutral
- If nuclear power is integral part of the optimal supply mix under several potential futures (scenarios), the next logic step concerns

Understanding the issues involved with the implementation of a nuclear power programme

Unlike many large industrial projects, nuclear power has certain unique characteristics

- Risk of severe accidents and possible target of sabotage, i.e. concerns inherent with nuclear material and radiation
- Public awareness of nuclear risks seems to outweigh its awareness of the benefits, e.g. climate change
- Importance of public trust
- Safety, security and quality needs
- Start up phase is significant in length and effort, some 10-15 years before the shovel hits the ground
- Requires a “100 year +” commitment
- Long term waste issues

Infrastructure requirements



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Issues: Expected preparedness and competency in key areas of

1. National position
2. Legislative framework
3. Nuclear safety
4. Regulatory framework
5. Human resource development
6. Safeguards
7. Security and physical protection
8. Management
9. Financing
10. Stakeholder involvement
11. Emergency planning
12. Radiation protection
13. Nuclear fuel cycle
14. Nuclear waste
15. Environmental protection
16. Site and supporting facilities
17. Industrial involvement
18. Procurement

ISSUES	MILE-STONE 1	MILE-STONE 2	MILE-STONE 3
1. National position			
2. Legislative framework			
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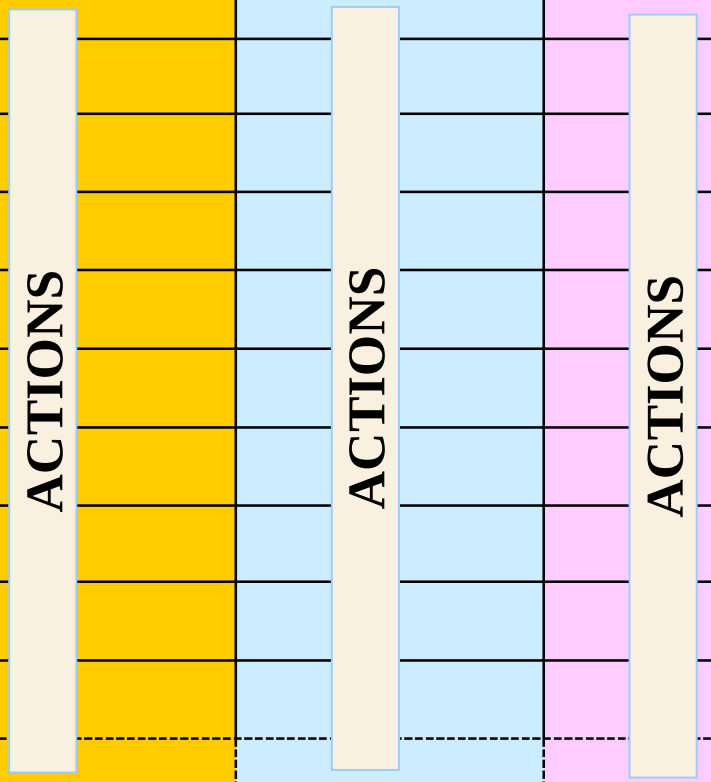

Nuclear Safety Infrastructure

Nuclear Safety is integral part of all aspects of a nuclear power programme

- Legal Framework, regulators, operators
- Technical competence, skills and attitudes
- Leadership and management, and safety culture
- Financial strength and stability for the entire programme
- Life cycle: pre-operation, operation, decommissioning and waste management
- Openness and transparency
- Emergency preparedness and response capabilities
- International connectivity

Reference: Considerations Document - GOV/INF/2007/2

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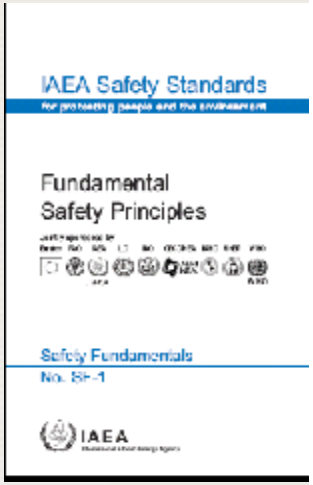
Safety Considerations

- The fundamental safety objective is to protect people and the environment from harmful effects of ionizing radiation
- The prime responsibility for safety rests with the organization responsible for facilities and activities that give rise to radiation risks (Operator and National Government)
  - Resources, skills and safety culture
- Of particular importance is
  - an effective legal and governmental framework for safety, and
  - a competent, independent nuclear safety regulatory body with sufficient authority to ensure compliance.
- The regulatory body needs to be established and maintained during ALL phases of the nuclear programme from cradle to grave.



IAEA "Assistance" in Nuclear Safety

- A key to success is to acquire the necessary technical knowledge, skills and experience through training
  - Basic professional training course
  - Identification of training needs
  - Specific tailor-made training
  - IAEA maintains expert networks
- The IAEA develops and maintains a comprehensive set of safety standards
  - Assistance and training is provided
- The IAEA provides for the application of the safety standards through safety review services and expert missions

International Connectivity

- **Global Nuclear Safety Regime is build on:**
  - **National (and operator) responsibility for safety and security**
  - **International obligations**
  - **International non-binding instruments**
  - **Sharing of experience**

International instruments listed in GOV/INF/2007/2

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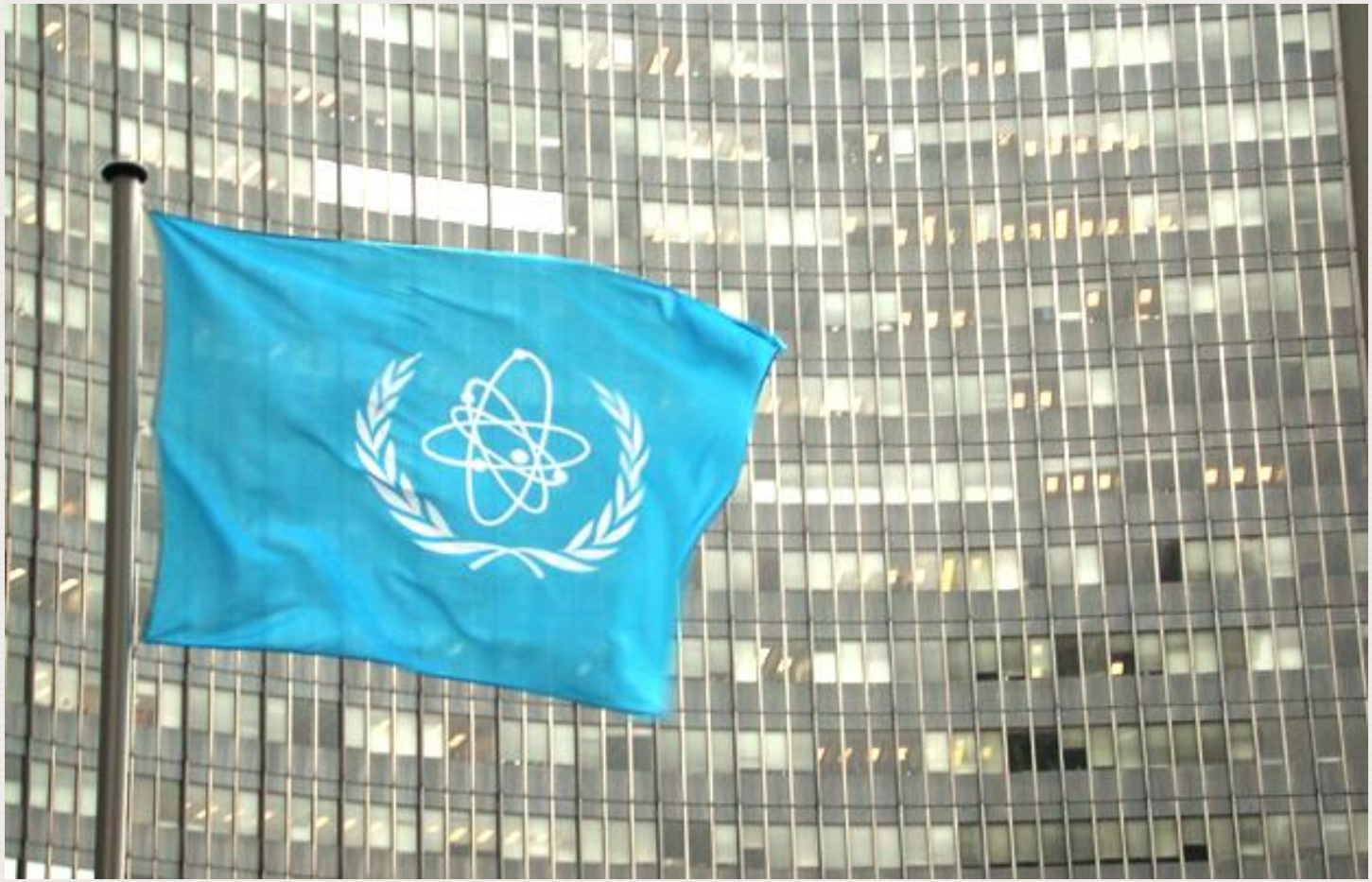

…atoms for peace.