Key Trends and Innovations in Nuclear Power and International Collaboration

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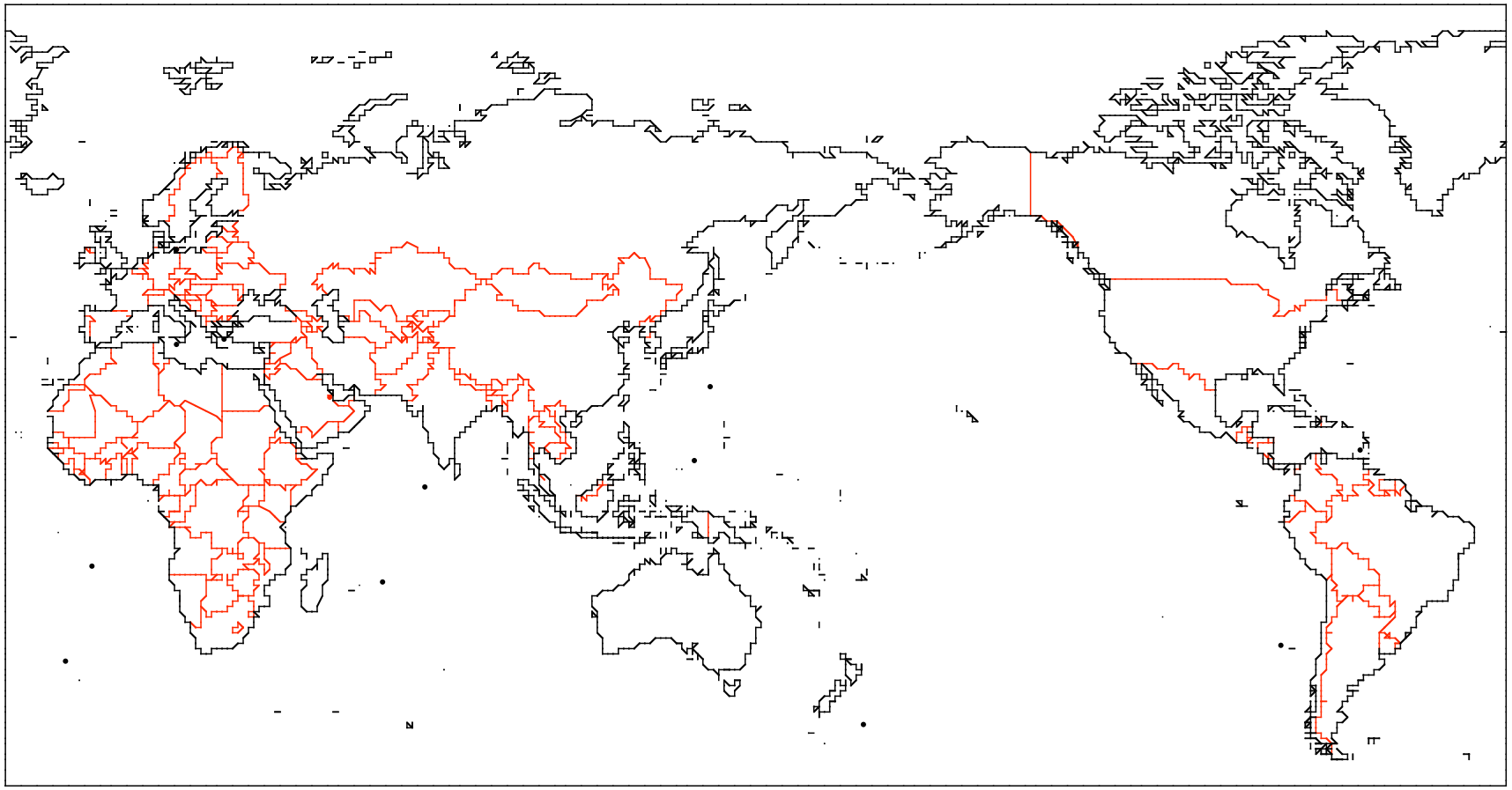
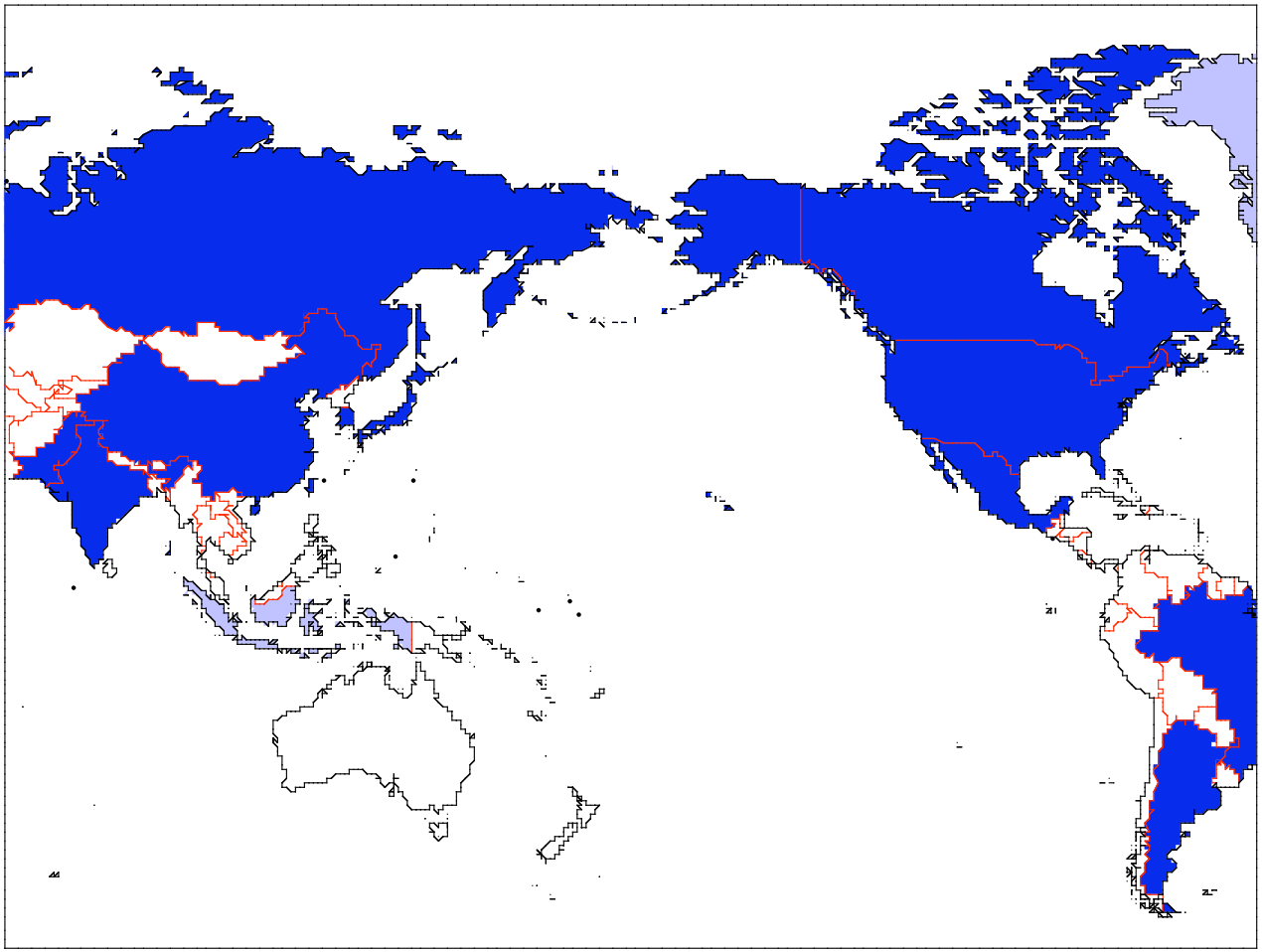
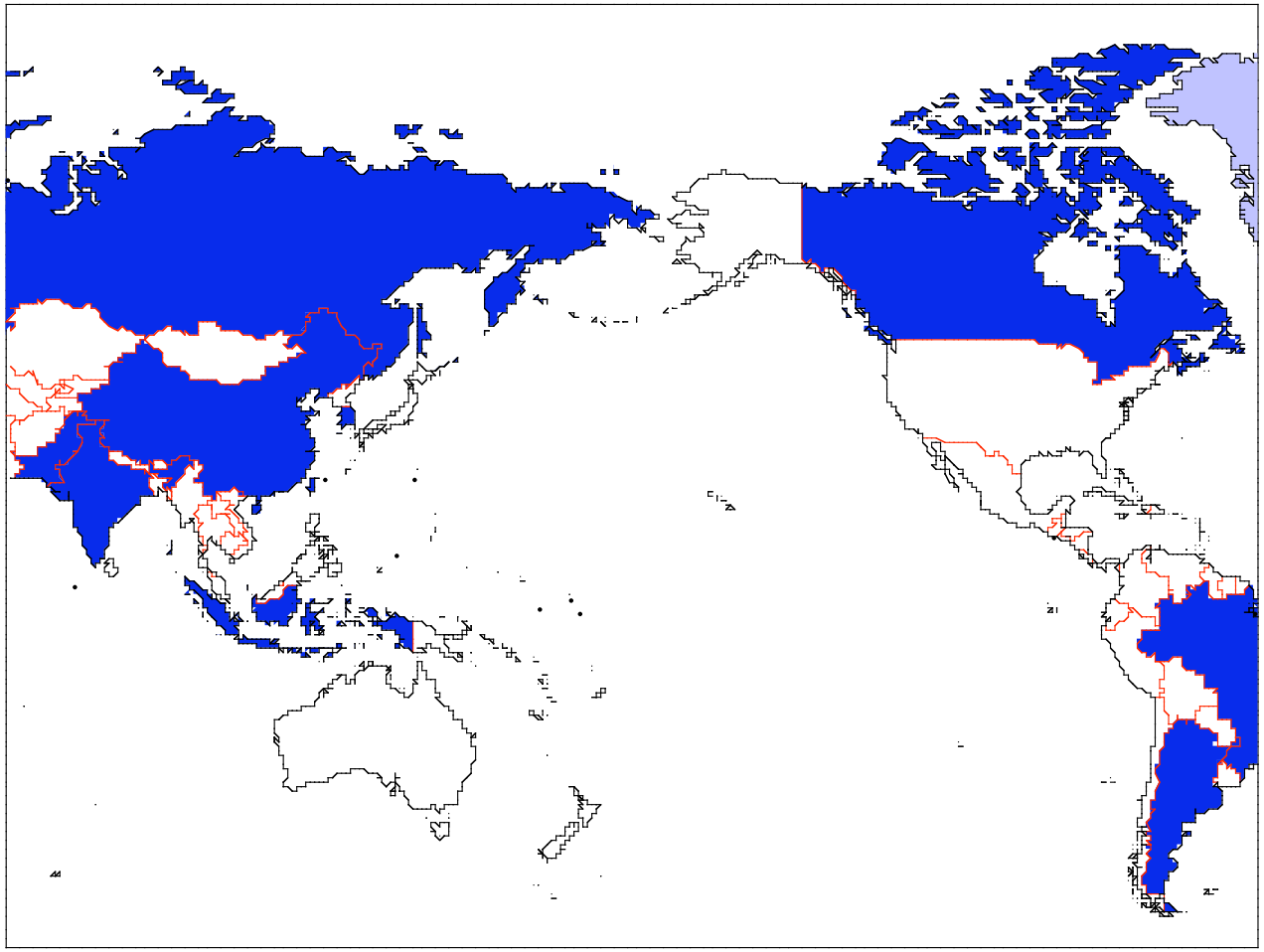
A “Pacific-centric” View



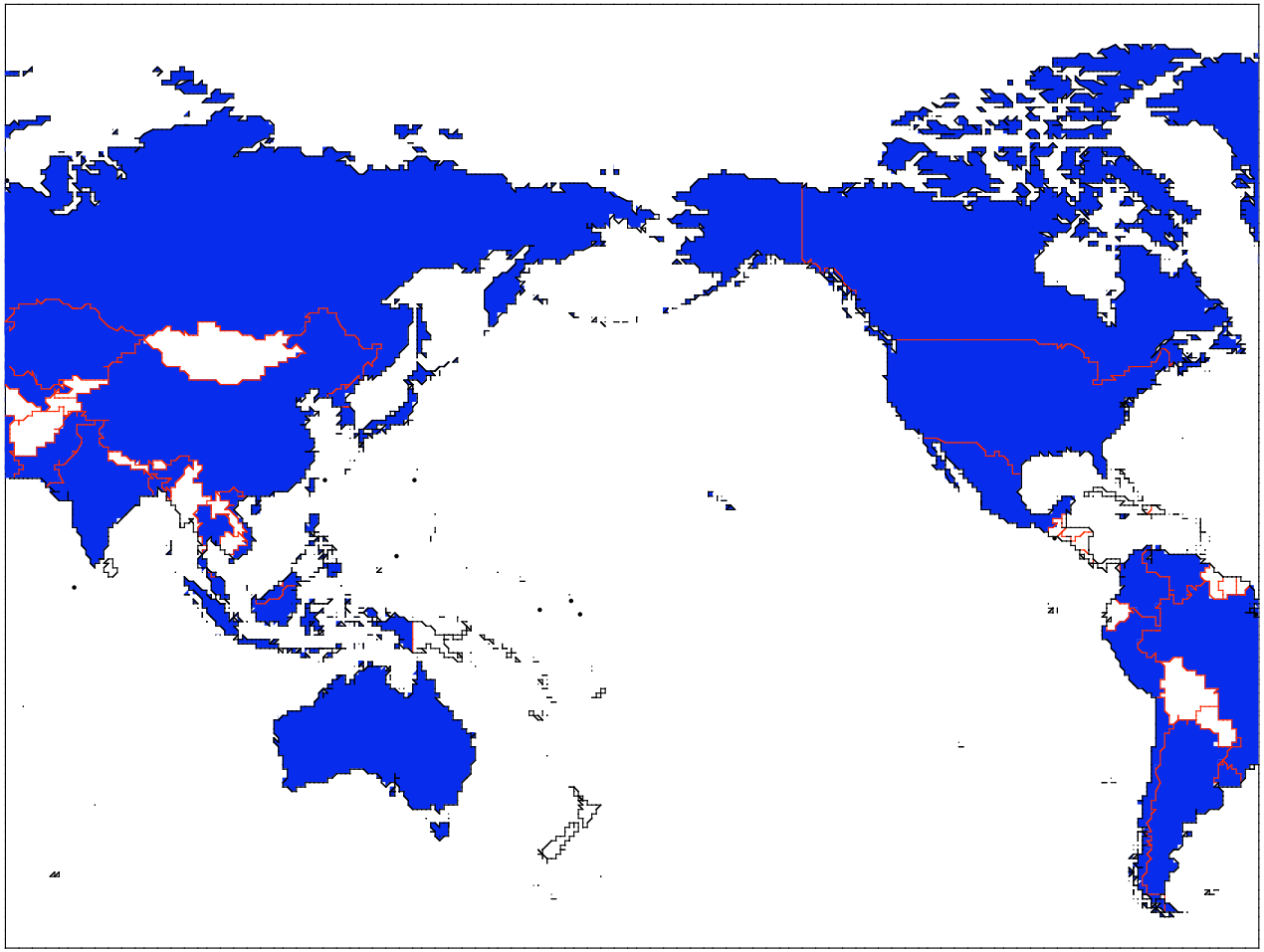
Countries with Nuclear Power Plants



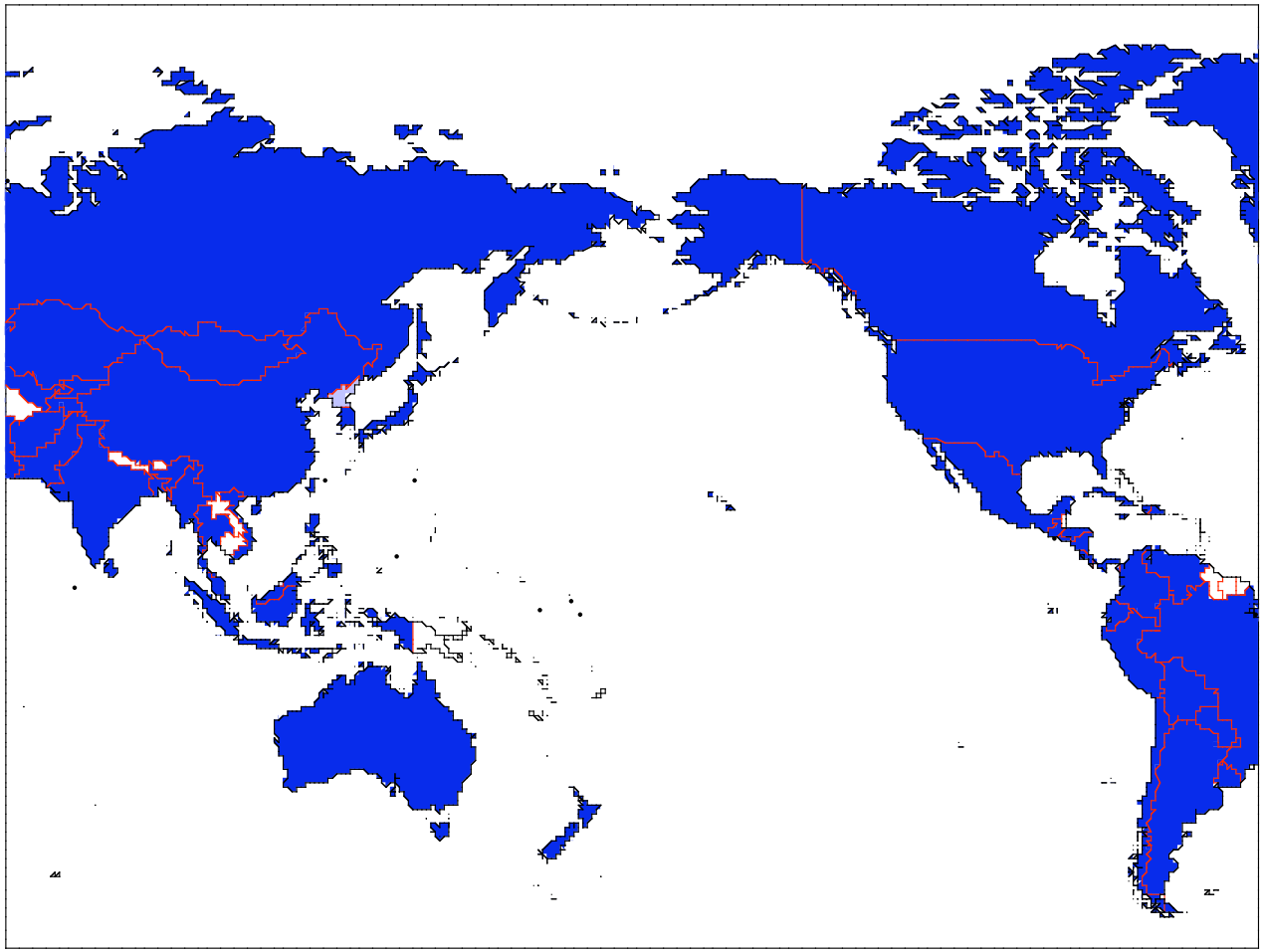
INPRO



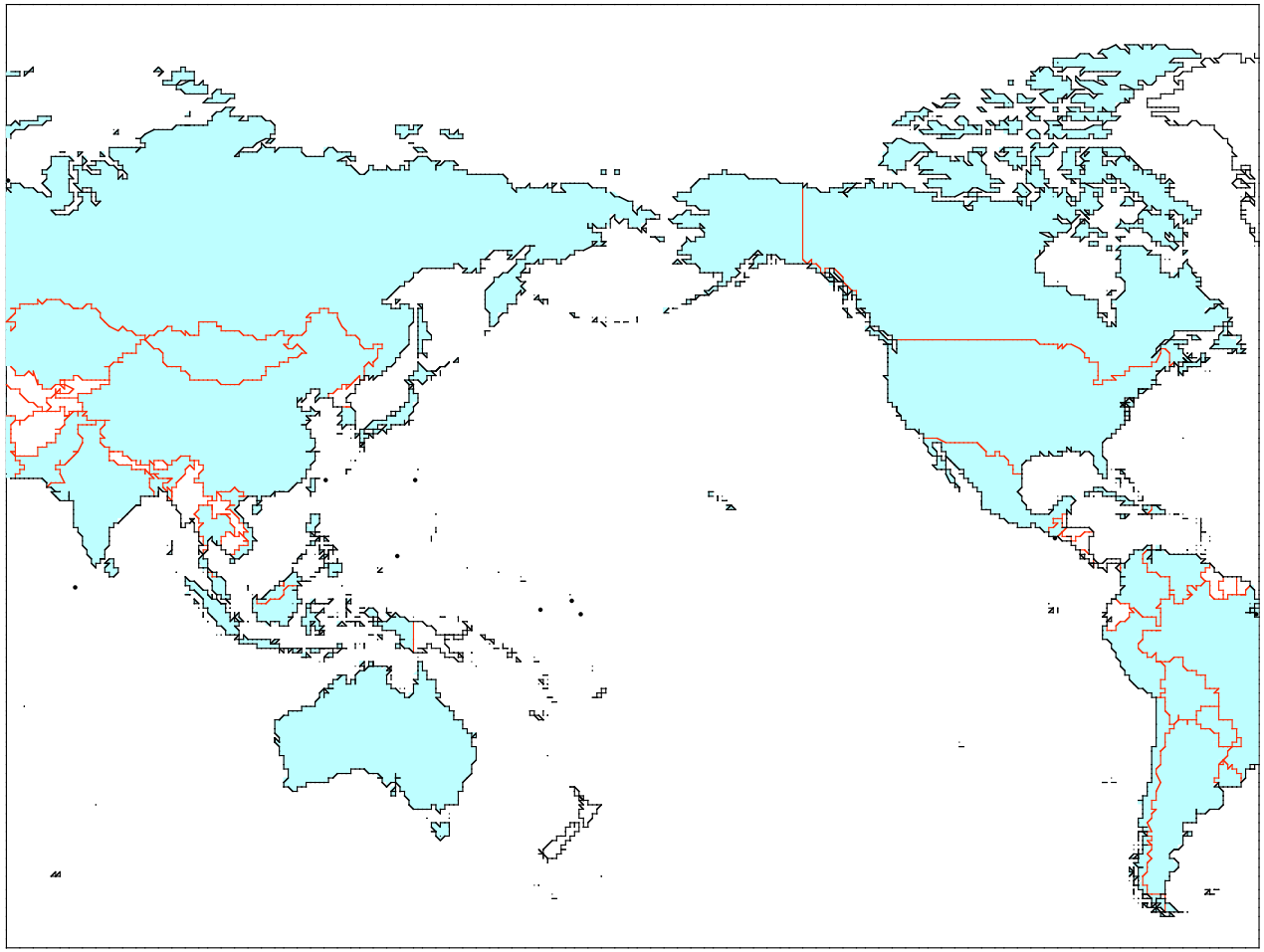
Research Reactors



Radiation Sources



IAEA Models – Clients & Partners



Key Trends

- Continuing expansion of energy demand
- Growing requirements for a nuclear role
- Expanded nuclear role in some national energy strategies

Key Trends

- Availability factor: **1% per year**
- Success of existing NP plants in liberalized markets
- Licensed life extension: up to 60 years
- Cost reduction, shortened construction times

Key Trends

- Ageing nuclear infrastructures and personnel
- Accumulation of spent fuel and high-level waste
- Storage capacity need
- Deregulation of the utility business
- Development of evolutionary NPP designs
- Need for innovation
  - an integrated holistic approach encompassing economics, safety, waste management, non-proliferation, environment, management innovation, the full fuel cycle, and full facility life cycles

INPRO

- INPRO : International Project on Innovative Nuclear Reactors and Fuel Cycles
- INPRO Goals:
  1. To help to ensure that nuclear energy is available to contribute in fulfilling energy needs in the 21st century in a sustainable manner
  2. To bring together both technology holders and technology users to consider jointly the actions required to achieve desired innovations in nuclear reactors and fuel cycles

INPRO

- 18 Participants in INPRO (March 2004)
  - Argentina, Brazil, Bulgaria, Canada, China, France, Germany, India, Indonesia, Republic of Korea, Pakistan, Russia, South Africa, Spain, Switzerland, The Netherlands, Turkey and the European Commission
  - Number of participants is growing
- Several Observers in INPRO (e.g. Australia, Belgium, Chile, Croatia, Czech Republic, Japan, UK, USA, OECD/NEA, etc.)
- INPRO time horizon is 50 years into the future

Conclusion of Phase-IA

- INPRO Phase-IA finished in June 2003
- Formulation by INPRO in Phase-IA of Basic Principles, User Requirements and Criteria for assessment of INS in all areas (economics, environment, safety, waste management, proliferation resistance) and recommendations on cross cutting issues
- Documentation of results of Phase-IA in an IAEA report (TECDOC-1362)

Ongoing Activities in Phase-IB

- INPRO Phase-IB started in July 2003
  Validation of INPRO Methodology via
  - National Case Studies performed by Member States:
    - Argentina with CAREM-X
    - India with AHWR
    - Korea with DUPIC
    - Russia with BN family
    - China with PBR
  - Results of all Case Studies are due June 2004
  - Consultancies with industry and regulators

INPRO-GIF Interactions

- Continuous participation of IAEA in GIF policy and expert groups
- GIF participated in last INPRO Steering Committee
- Ongoing discussion by GIF and INPRO secretariats about options of general cooperation
- Cooperation between INPRO and GIF in analysis of sustainability, globalisation and safety
- Comparison of both assessment methodologies in January 2004, based on GIF peer review of INPRO Methodology

Outlook

- Planning of Phase-II
  - Start possible in 2005 (after finishing Phase-IB)
- Possible Scope of Phase-II:
  - System analysis of global nuclear power role
  - Examination of feasibility of MS beginning joint (international) R&D programmes for INS
  - Establishment of joint R&D projects
  - Provision of IAEA expertise to these programmes (e.g. safety, proliferation resistance, etc.)

RR in the Pacific Basin Countries: Issues and Challenges

- Many RRs are under-utilized and/or inadequately funded
- Strategic planning for these RRs is a necessity
- Regional cooperation for utilization and back-end options
- Best Scenario: regional, state-of-the-art, high flux, multipurpose RRs with integrated interim storage and final disposition facilities
- Needs a high-density, reprocessable LEU fuel
- Extension of the “take-back” programmes

IAEA Assistance On Radioactive Waste Disposal

- **Near-surface disposal**
  - Technical Cooperation Projects (Upgrading, Sitting/Planning)
  - Management of disused sealed sources
    - **On site conditioning** (Bangladesh, Chile, China, Columbia, Malaysia, Myanmar, Pakistan, Peru, Philippines, Thailand, Vietnam)
    - **Regional cooperation on borehole concept**
  - Geological disposal
    - IAEA Network of **Centres of Excellence** (10 Pacific Basin countries participating)

IAEA Initiative

- Three concepts
  - Limiting weapon-usable nuclear material in civilian programmes to facilities under multinational control
  - New systems that avoid weapon-usable materials
  - Multinational approaches to spent fuel and radioactive waste
- Potential to provide enhanced assurance against vulnerability to misuse and facilitate nuclear growth
- DG to appoint group of experts

Capacity Building

- Assist interested Member States (n.b. developing countries) to improve energy planning and analysis capabilities
  - transfer modern planning methods, tools and databanks
- Energy Planning tools
  - MAED, WASP, ENPEP, MESSAGE, FINPLAN, SIMPACTS

MAED

Model for the Analysis of Energy Demand

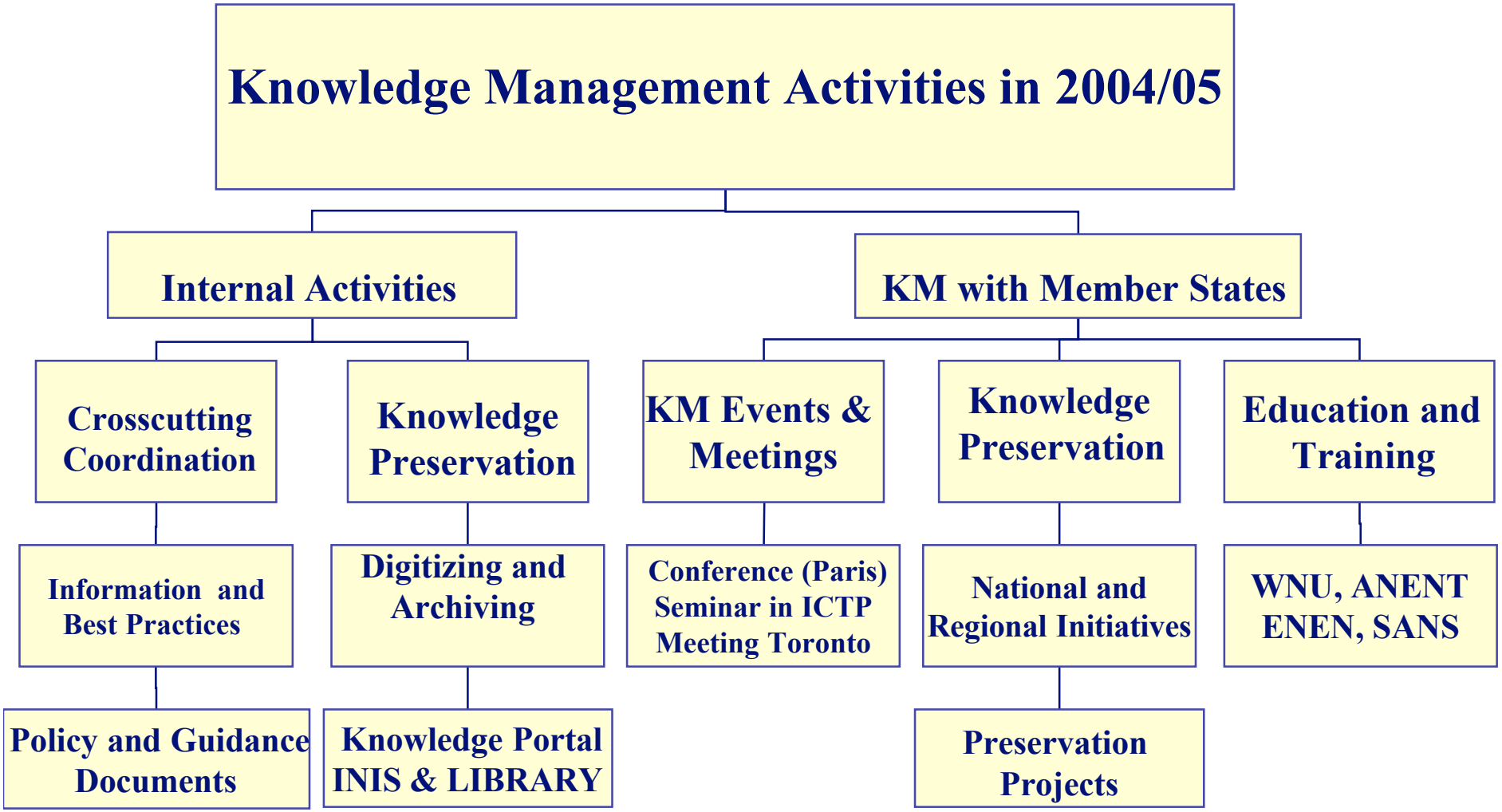
INPUT

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

OUTPUT

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

Knowledge Management Activities in 2004/05



Conclusions

- Maintain a high level of science competence in the Agency to remain a global authoritative and independent source of quality information, knowledge maintenance, expertise, capacity building and analysis

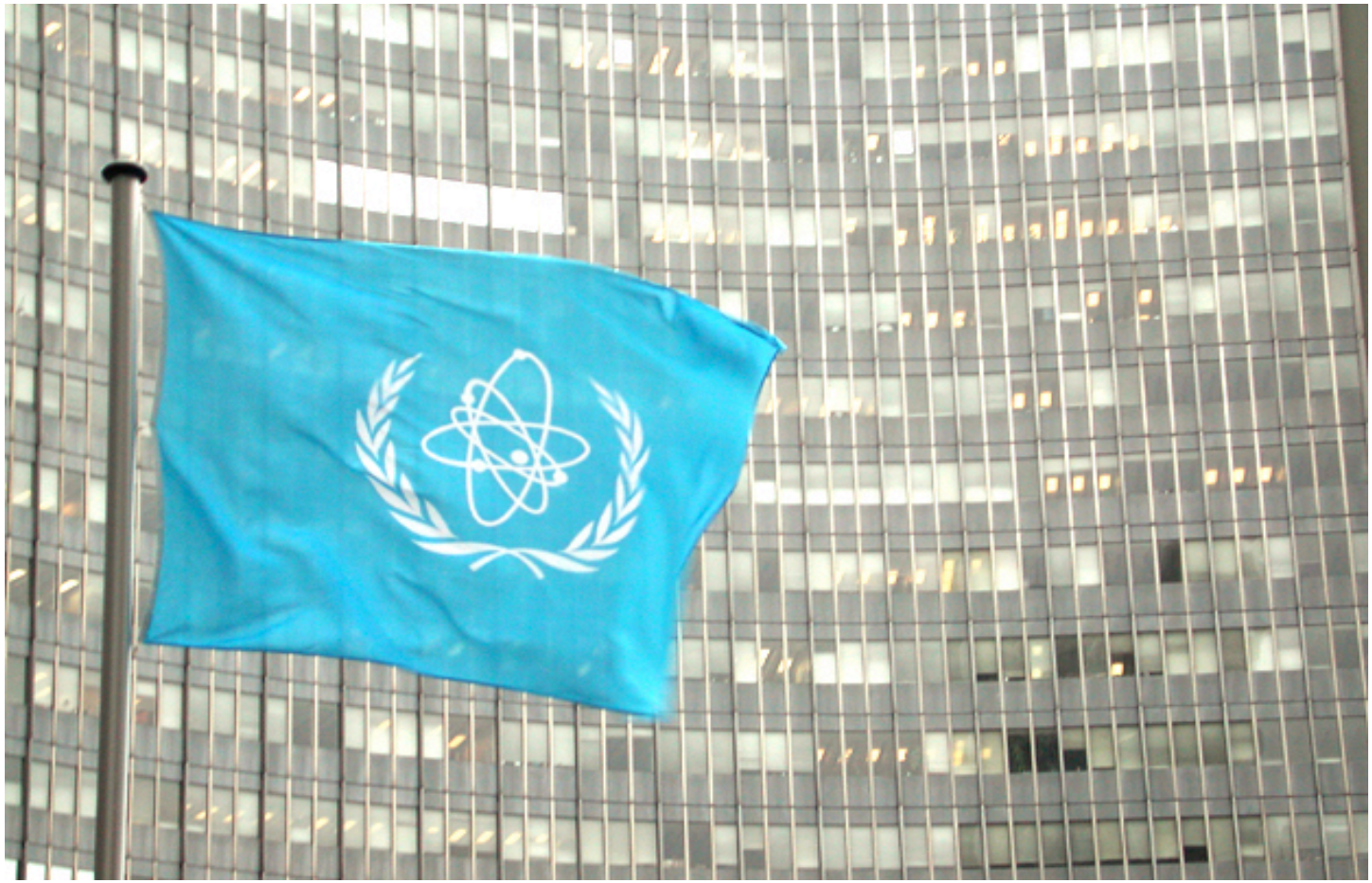
Conclusions

- Expand partnerships and exchanges of information to facilitate the beneficial use of nuclear energy, including non-power applications
- Sustain the nuclear experience and knowledge base to support nuclear expansion, research, new applications and phase-outs

Conclusions

- To assist interested MS in expanding capabilities for innovation, integrated nuclear energy assessment, energy planning, system analysis and applications
- Expand partnerships to speed innovation by connecting centres of nuclear expertise for innovation with centres of high growth

IAEA



…atoms for peace.