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Joint ICTP-IAEA Workshop on Sustainable Energy Development: Pathways and Strategies after Rio+20

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IAEA Support and the role of nuclear energy

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Sustainable energy development after Rio+20: IAEA Support and the role of nuclear energy

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IAEA-ICTP Workshop on

"Sustainable Energy Development: Pathways and Strategies after Rio+20"

ICTP, Trieste, Italy, October 1-5, 2012

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International Atomic Energy Agency

Overview

1. Context: Rio+20 and energy concerns
2. Energy security and environment
3. Energy modelling and capacity building
4. Energy-economy-environment analysis
5. Main messages

1. Context: Rio+20 and energy concerns

SD history: notoriously missing – Energy

[Stockholm 1972 – Brundtland 1987]

Rio 1992: Agenda 21: 40 areas, no energy

→ UNCSD

→ Millennium Summit 2000

→ WSSD Jo'burg 2002

→ UNCSD (esp. #9): Parties agreed to disagree

→ run up to – negotiations for:

→ Rio+20: Green growth – constraint for development?

1. Context: Rio+20 and energy concerns

Rio+20 – Outcome document

- General statements

Rio+20 – Follow-up: UN system

- Little attention to energy

1. Context: Rio+20 and energy concerns

Recent years: many concerns relaetd to SED *worldwide*:

- fast growing energy and electricity demand (dev'ing)
- limited domestic fossil sources or export opportunities
- fossil fuel price level and volatility
- development, food, water security (mainly developing)
- energy supply security and diversification (all)
- economic efficiency and competitiveness (mainly dev'd)
- climate change mitigation (Durban Platform – all)
- local/regional air pollution (East + Southeast Asia)
- sustainable development
- non-fossil alternatives yet to improve (cost, performance)
- … many others

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2. Energy security and environment

Energy security: growing concern worldwide

- *long term*: availability and price trends

- *short term*: disruptions and price volatility

Robust energy strategies have to

- *balance* supply security, economic efficiency, environmental protection:

complex linkages: trade-offs and synergies

- *be valid* under a broad range of future conditions: technology options, energy prices, political situations, environmental targets

2. Energy security and environment

Energy supply security: many definitions and targets; depending on national/regional conditions:

- *Adequate supply* to meet basic needs and development aspirations
- *Self-sufficiency*: share of imported primary energy
- Protection against supply *disruptions*
- Protection against *price volatility*
- Physical plant and infrastructure *reliability*
- *Diversity* of technologies and sources

2. Energy security and environment

- *Threats* to and/or from neighbouring states
- Well functioning energy *markets*
- Economic sustainability of supply (*profitability*)
- *Environmentally benign* resources and technologies

…

→ Elements of sustainable (energy) development

Nuclear energy can enhance energy security

2. Energy security and environment

Most aspects of supply security: “public good”
(non-rivaled, non-excludable)

Underprovided by markets →

need for public (government) *policies* to provide it;
various *instruments*: tax, quota, minimum standards

→ Need for solid analyses to underpin these policies:
models, indicators,
technoeconomic and policy analysis

2. Energy security and environment

Environmental impacts of energy production and use:
Multitude – from local to global pollutants;
direct emissions (from energy facilities)
vs *life-cycle* emissions (all related activities)

Land: use, soil pollution, landscape …

Water: use, physical/chemical pollution …

Air: local/regional air pollution (SOx, NOx) and
GHG emissions → *climate change*

→ Elements of sustainable (energy) development

Nuclear energy can reduce harmful emissions and
contribute to GHG mitigation

2. Energy security and environment

Most aspects of *environmental* impacts: “externalities”

(non-compensated, unpriced transactions)

energy-related externalities: negative

Overprovided by markets →

need for public (government) *policies* to reduce them;

various *instruments*: tax, quota, environmental standards

→ Need for solid analyses to underpin these policies:

models, indicators,

technoeconomic and policy analysis

2. Energy security and environment

Combining supply security and climate change:

- coal: SS+ (if domestic); CC– (even with CCS)
- gas: SS +/- (dom/imp); CC +/- (replace coal/oil)
- nuclear: SS+ ; CC +

➔ Complex linkages: trade-offs & synergies across supply security, economic, environmental, social, …

Subprogrammes 3.1 and 3.2 (PESS) address:

- Need for tools to assess options in a consistent framework – Area 1
- Need for in-depth analyses of techno-economic characteristics and contribution to UN and other international activities – Area 2

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3. Energy modelling and capacity building

PESS – Area 1:

Energy modeling & capacity building

- develop energy planning tools
- build capacity for applications
- training and technical support

For:

- Energy system modeling
- Economic, financial and environmental assessments
- Analysis of options for energy strategies

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3. Energy modelling and capacity building

- **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**

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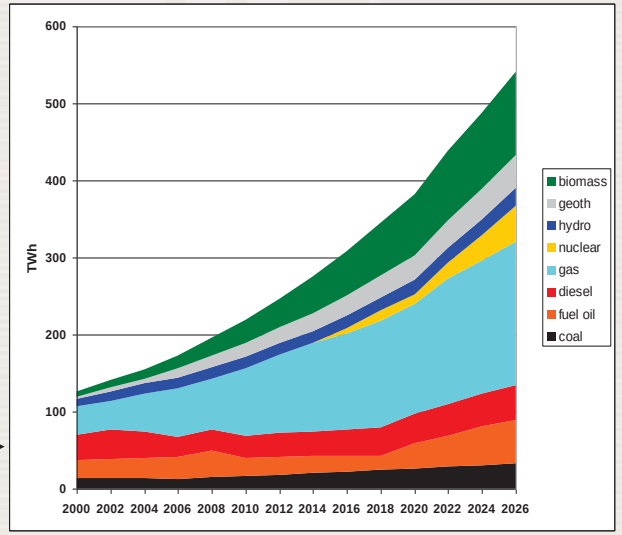
MESSAGE: Model for Energy Supply System
Alternatives and their General Environmental Impacts

INPUT

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

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4. Energy-economy-environment analysis

PESS – Area 2: Economics and

Energy-economy-environment (3E) analysis

- Techno-economic analysis
- Analysis of NE-development-environment linkages:
  role of NE, energy security, CC mitigation, SED
- Contribution to related international efforts: UNCSD, UNFCCC, IPCC, many others
- Developing tools:
  Energy Indicators for Sustainable Development;
  Indicators for Nuclear Power Development;
  Sustainability Indicators for the Power Sector

4. 3E Analyses and services to MSs

World in the early 2010s – diverse 3E problems:
Socecon development; *Energy*: poverty, economics, technologies, costs, financing; CC, SED, …

Dynamic fields: New developments in science & policy

Mandate 1: provide balanced, objective, up-to-date information to MSs; methods and training to adopt them

Mandate 2: cooperate with and contribute to the work of UN and other international organizations (IEA, NEA)

Action: traditional and innovative products and services: external and Agency publications, lectures, CRPs

4a. Technoeconomic analysis

Example 1: Technoeconomic comparison of the geological disposal of CO2 and RW

Example 2: Energy for development

4a. Example 1: Geological disposal

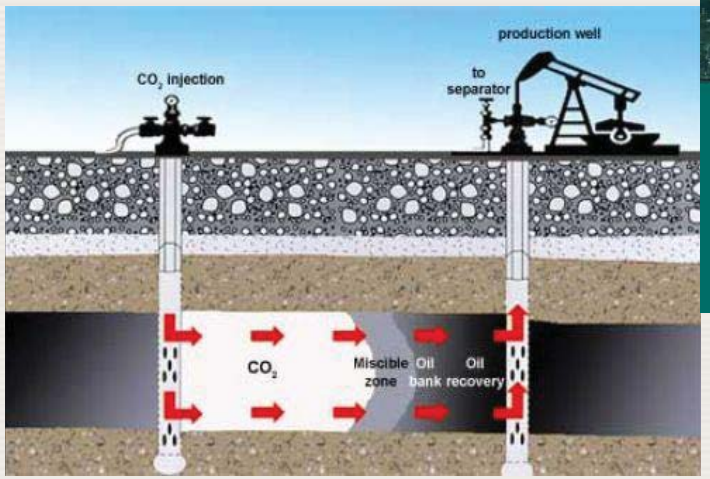
Reason: MSs' dilemma:

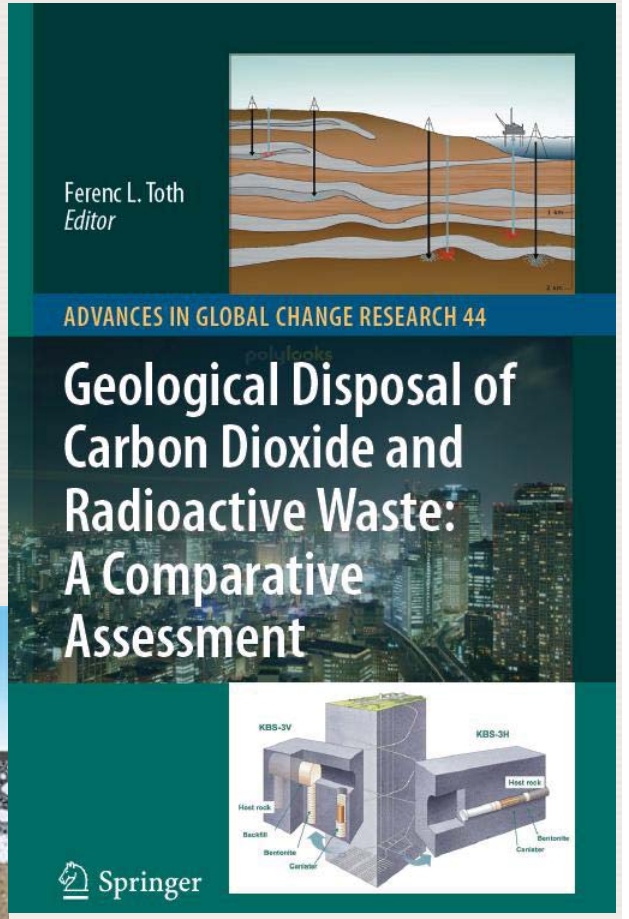
Nuclear (RW disposal)

or coal (CO_2 disposal)

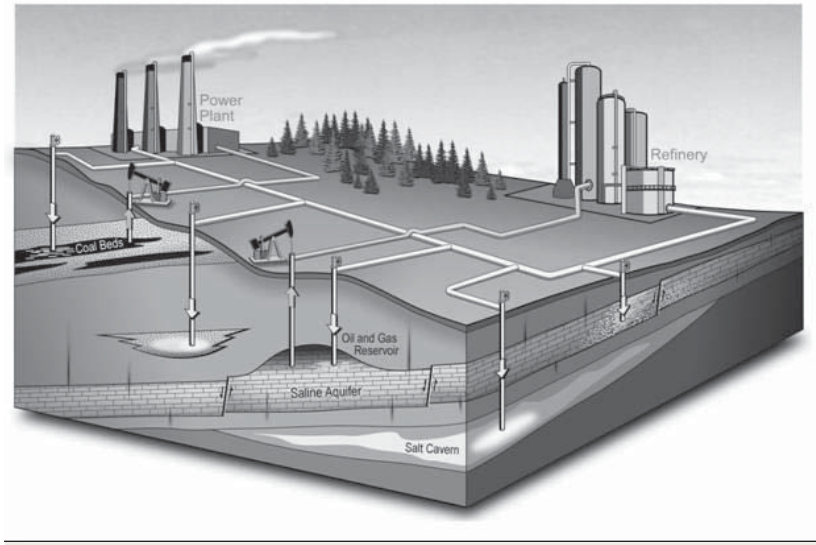
Our response:

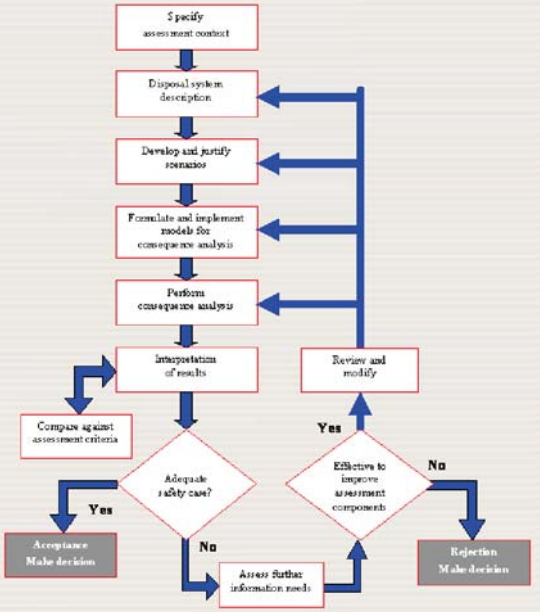
Comparative assessment of geological disposal of CO2 and radioactive waste:





4a. Example 1: Geological disposal





4a. Example 1: Geological disposal

Book: well received: positive reviews in journals

Increasing interest: follow-up workshop in 2010

Immediate use: IAEA CRP teams

- build on insights
- extend and deepen comparative assmts
- focus on national/regional contexts, features

CRP: 3+years, ~10 teams, publications underway

Ultimate objective: provide input for PMs:

- pros and cons of fossil-CCD and NP-RWD

4a. Example 2: Energy for development

IAEA Scientific forum – PESS

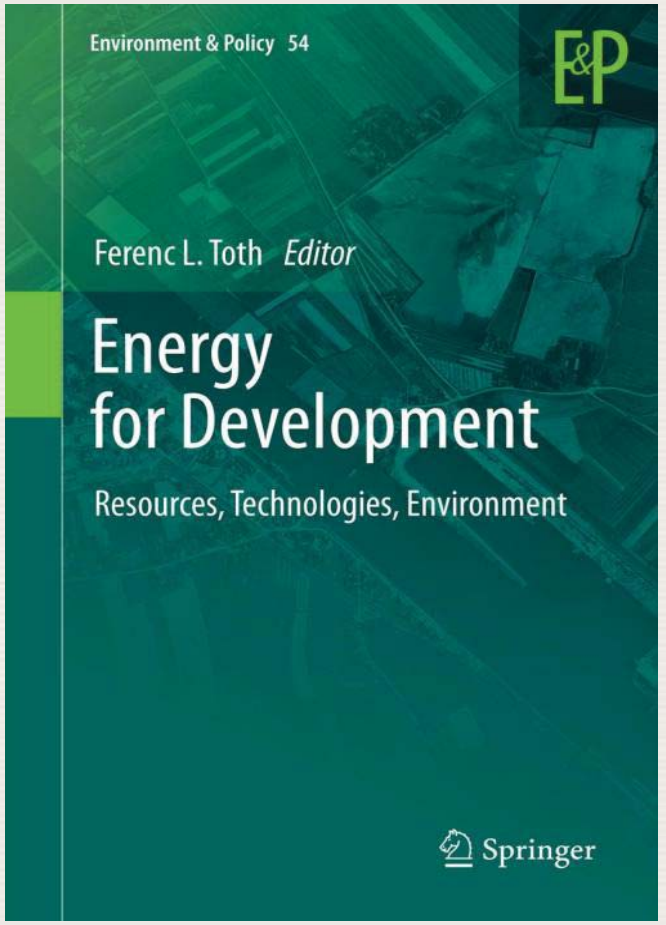
Senior lecturers – diverse insights

- International institutions
- Energy demand
- Energy supply

Extended lectures – Book in 2012

Broad technology-neutral overview

Great interest at Rio+20



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4b. Sustainable energy development (SED)

Mandate 2: SED – work + cooperation

Diverse range of activities and products

Sustainable Energy Development: Key issue

access, afford, clean, sustainable (resource+environ)

Climate change: top international env issue

Again: serve MSs: info, lectures, publications

AND:

Agency's link to UN and other SD and CC activities:

UNDESA, UNCSD, UNFCCC, IPCC, UN-Energy …

Prerequisite: recognized as unbiased experts

Evidence: publications

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4b. Example 1: Booklet ‘CC and NP’

Climate Change and Nuclear Power: Bonn-Marrakesh

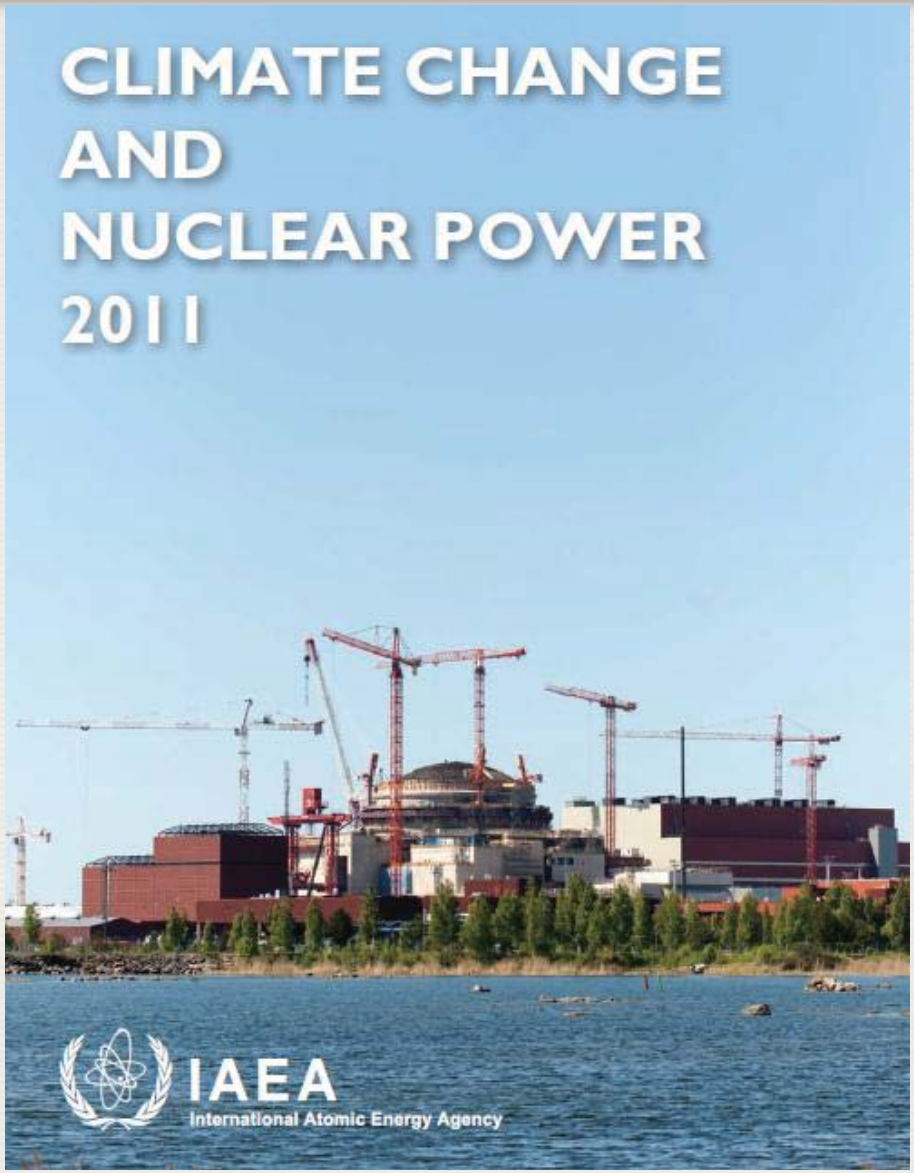
Our response:

- Booklet for UNFCCC COPs

  updated annually

- Side events at COPs

- Presentations, papers, book chapter, etc.



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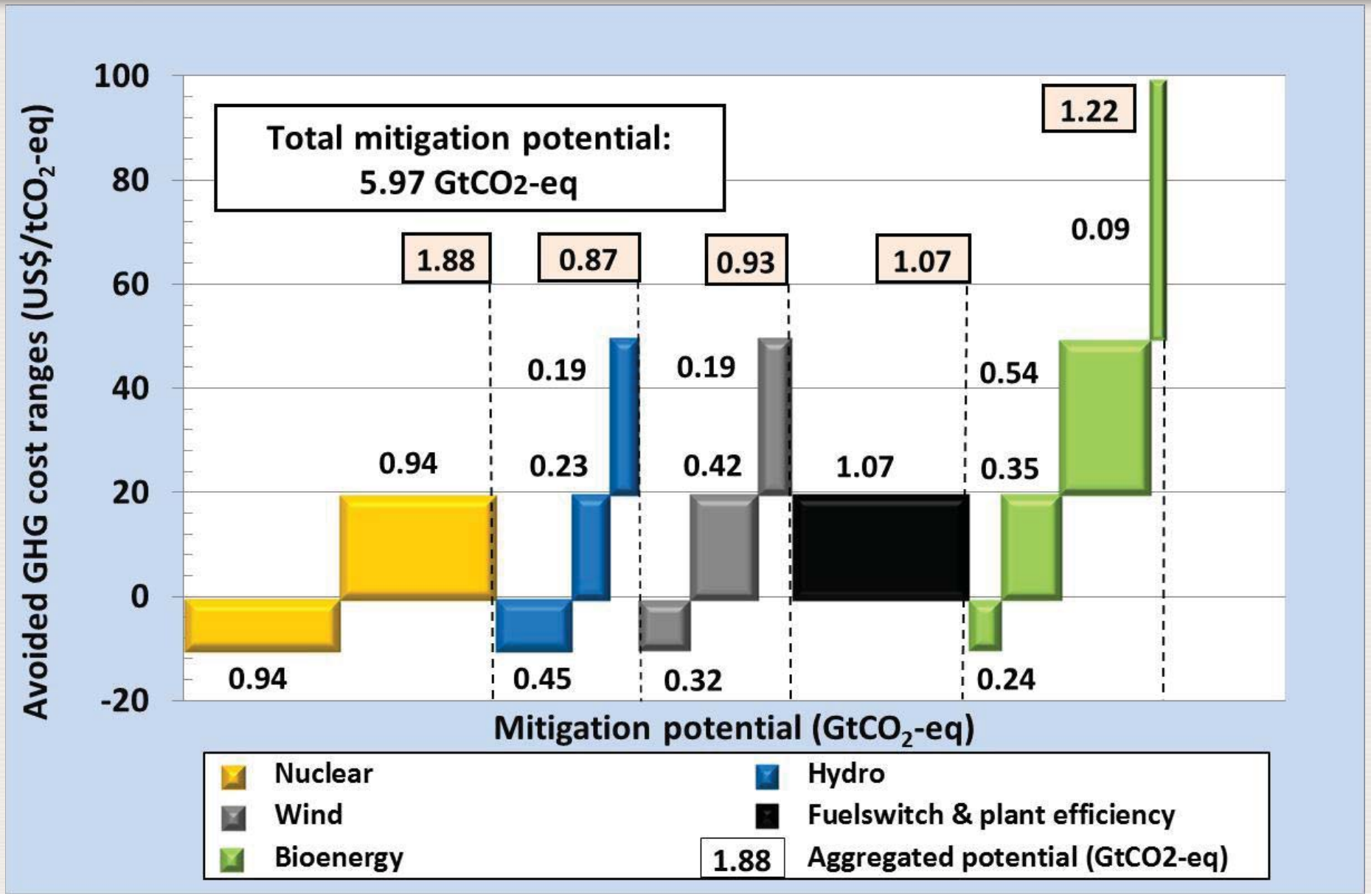
4b Example 1: Booklet ‘CC and NP’



4b. Example 2: Impacts of CC on Energy Systems

MS concern – especially developing:

Energy installations & infrastructure, including NPPs:
vulnerable to CC and EWEs

Our response: series of activities with objectives to:

- inform about relevant CC and EWE patterns
- review vulnerability and adaptation options
- assess potential damage, adaptation costs,
- adopt suitable methods: RA, CBA, CEA, portfolio

IAEA/ICTP workshop; work in progress on journal SI;
to start: CRP

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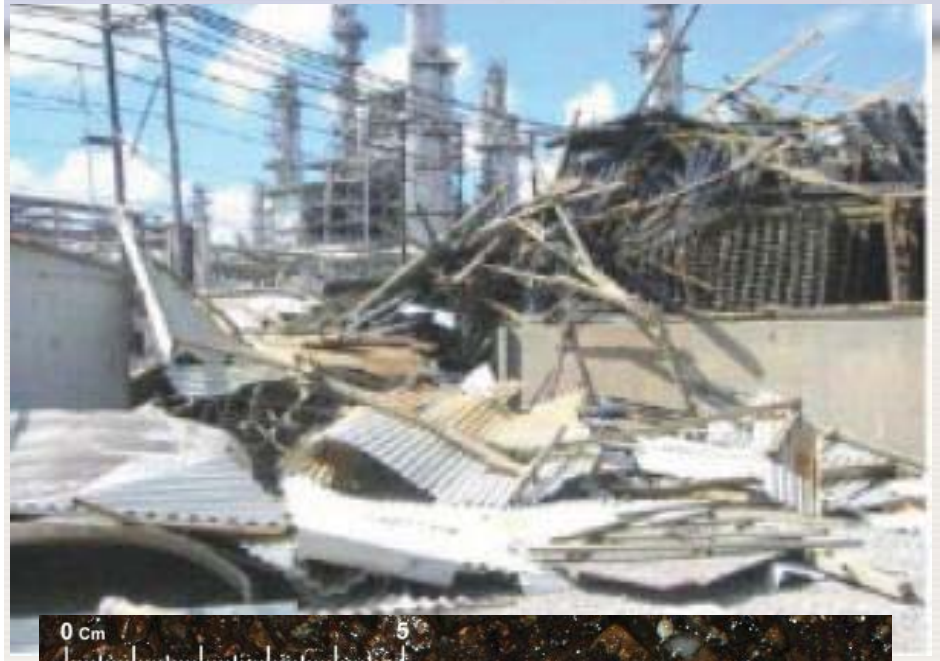
4b. Selected energy sources/technologies



4b. Example 3: IPCC

Contribution:

AR-5 (-2014): WGII (Impacts) LA,
WGIII (Mitigation) LA

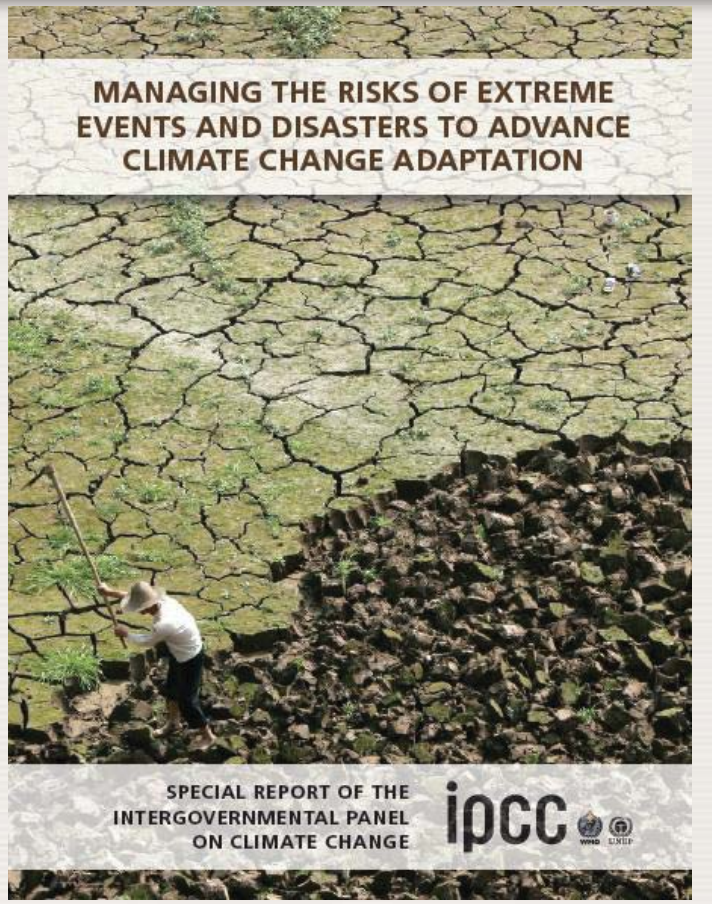
SREX (2008-2012): LA

New Socecon-CC scenarios; AR-5: Scoping Meetings

Reasons:

Contribution to UN activity is 1.3.2 mandate

Forefront of CC science & policy: better service to MSs



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5. Main messages

Supply security & environmental impacts:
many aspects and targets → important issues in SED

Many other concers require attention for SED :
fast growing demand, domestic resources, import prices and current account balance, competitiveness, climate change, sustainability...

→ Need for energy planning tools and 3E analyses to explore the role and prospects for various technologies (including NE) in national energy strategies

4. Main messages

Supply security & environmental problems:

No resource or technology is *a magic cure*

but:

Many could be *part of the remedy*

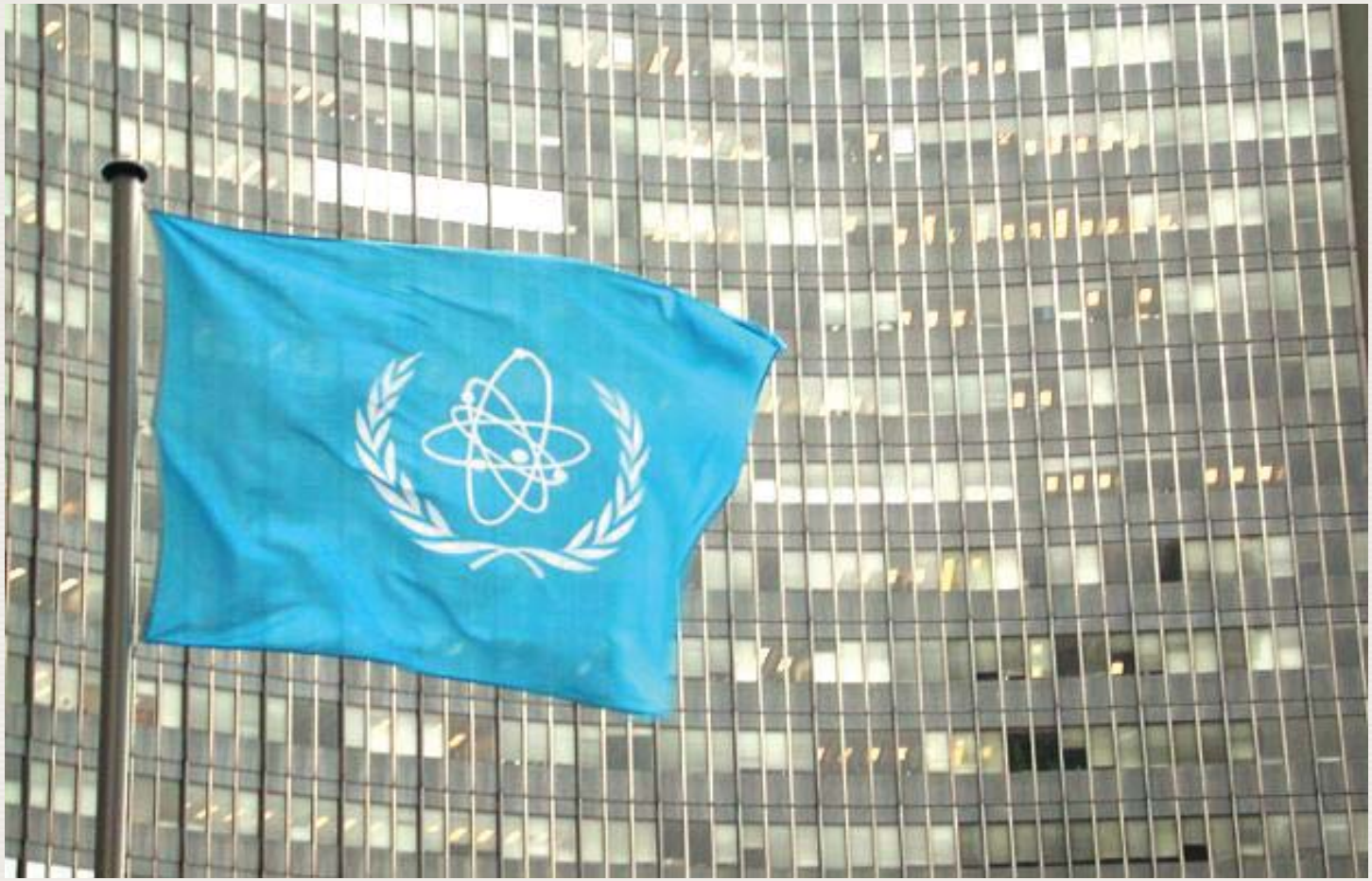
Which one, where, when, how much, what arrangements, NE part of it?:

depends on *national* circumstances and

priorities → *decision of sovereign states*

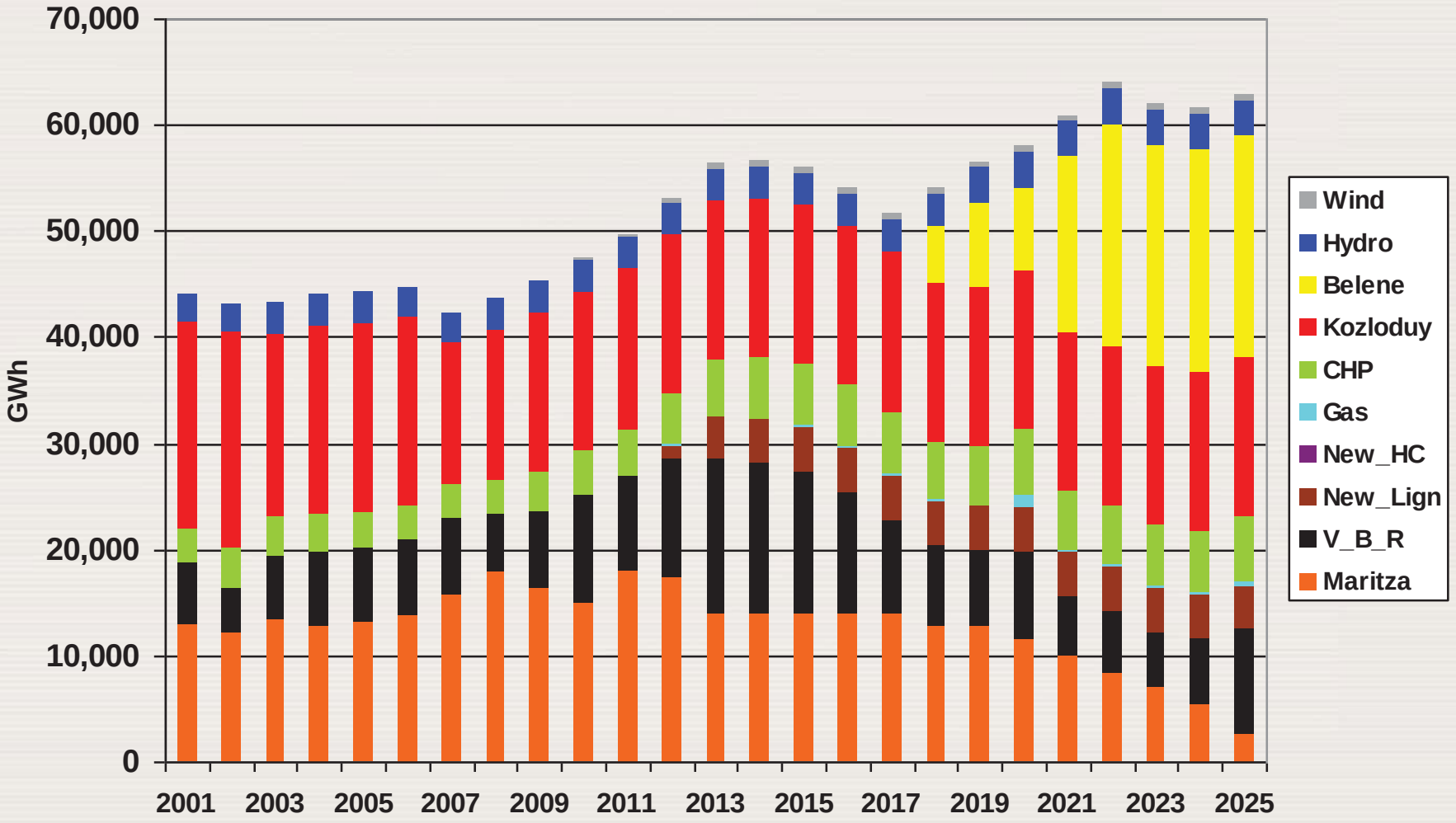
IAEA mandate: support, tools, capacity building, expertise, analysis, publications

IAEA - http://www.iaea.org/OurWork/ST/NE/index.html



…atoms for peace.

3. MESSAGE: Electricity supply expansion



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3. MESSAGE results: scenario comparison

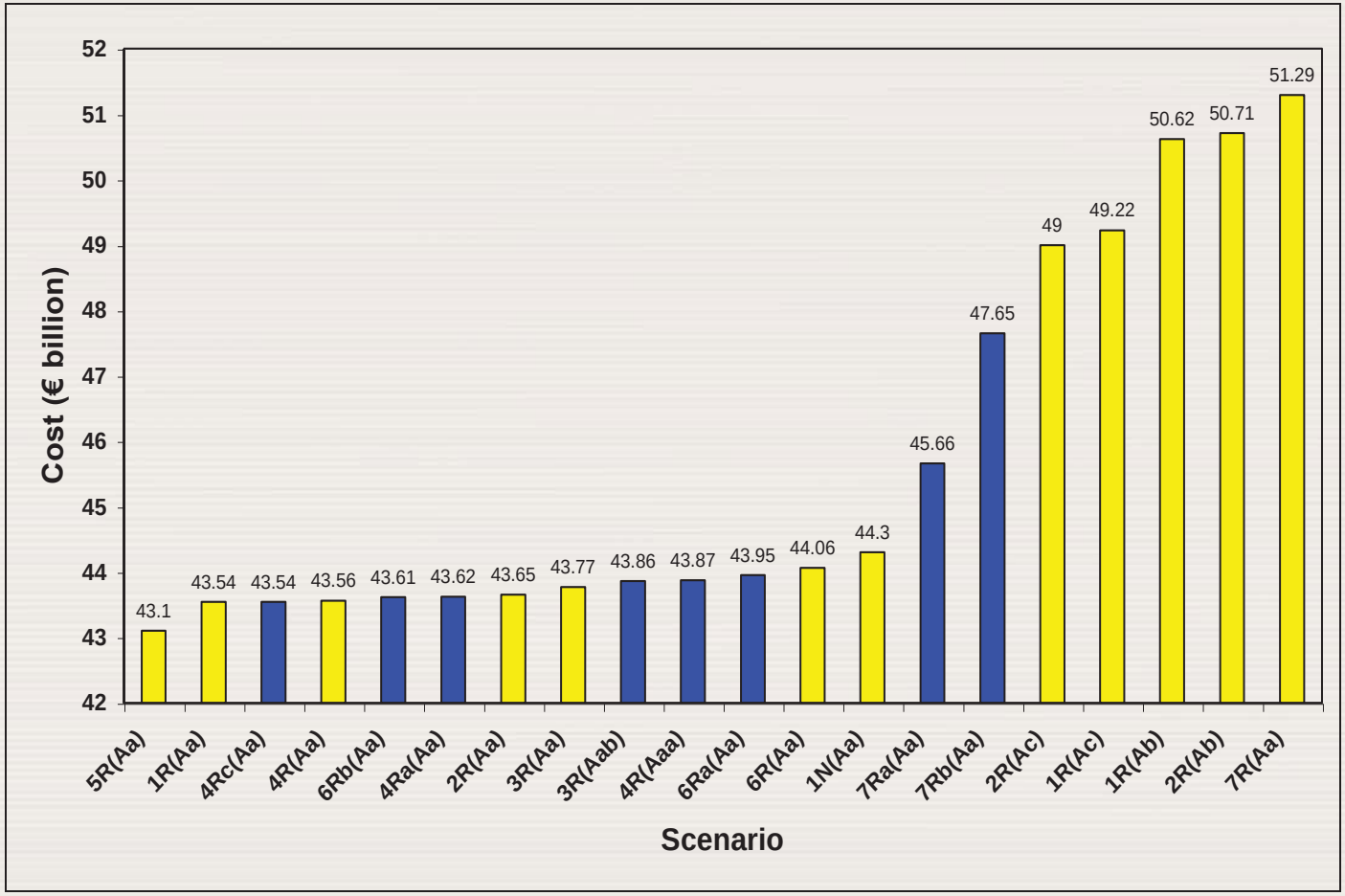

Figure 8.1. Cost comparison of the main scenarios and the sensitivity cases.

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