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Mitigation of Climate Change and Role of the IAEA in the Climate Change Dialogue

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IAEA and Mitigation of Climate Change

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International Atomic Energy Agency

IAEA Activities related to climate change

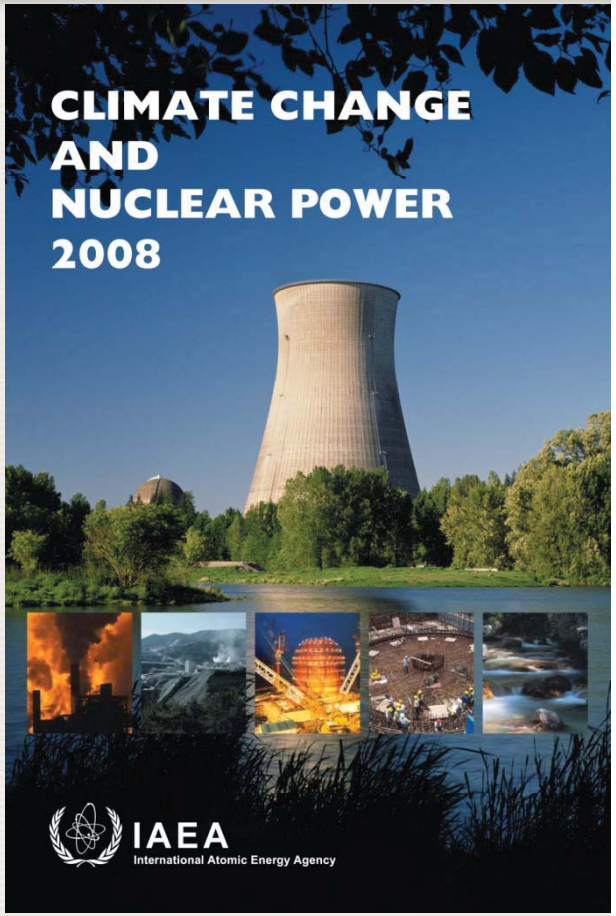
- Disseminating information about the climate change benefits of nuclear energy
- Capacity building in
  - Energy planning and the development of optimal mitigation strategies
  - CDM and JI analysis
- Nuclear applications:
  - Nuclear techniques for carbon uptake by soils (sequestration)
  - Resilient agricultural production
  - Hydrological cycles
  - Carbon cycle

Dissemination

Three take-away messages

- Nuclear power is good for the climate
- Nuclear power is not a quick-fix mitigation option
- Nuclear power can make a substantial mitigation contribution in any serious long-term mitigation strategy

But there must be a (socio-political) will to do so!



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Today's popular climate change mitigation ladder

Efficiency improvements

Renewables

Reducing Emissions from Deforestation and Forest Degradation (REDD)

New and advanced technologies

Clean fossil (coal technology)

Carbon capture & storage (CCS)

Next generation of nuclear power

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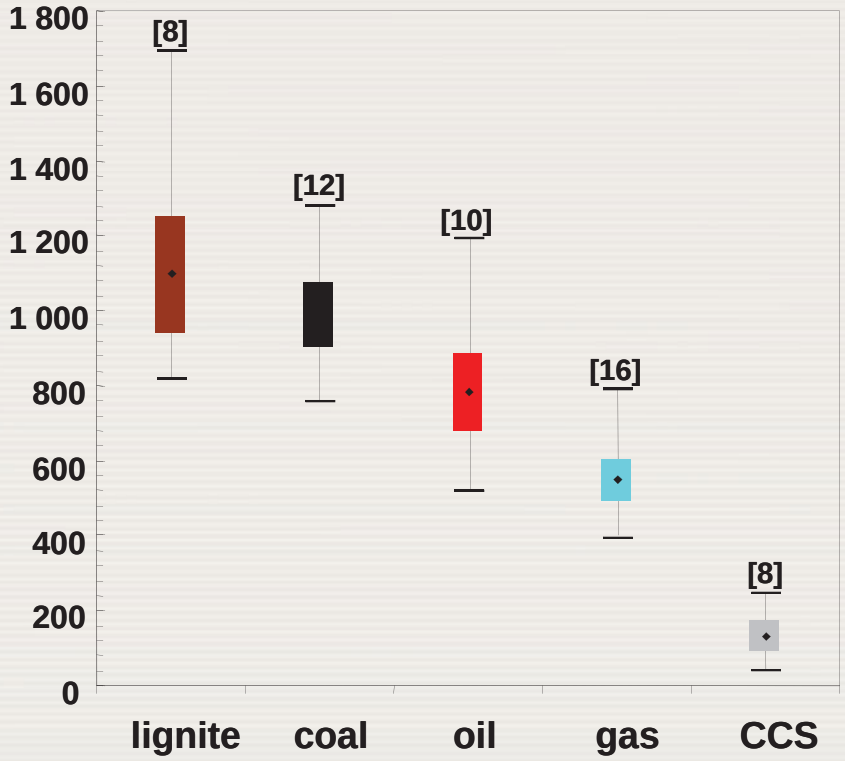
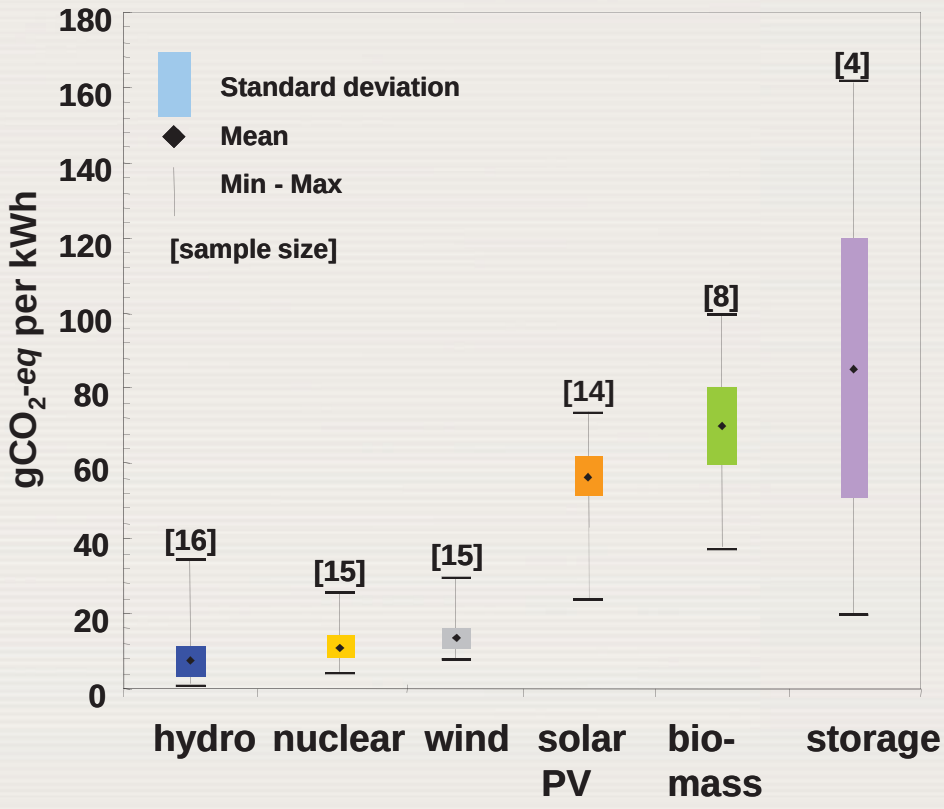
Nuclear power is good for the climate

Life cycle GHG emissions of different electricity generating options





Nuclear power: Very low lifetime GHG emissions make the technology a potent climate change mitigation option

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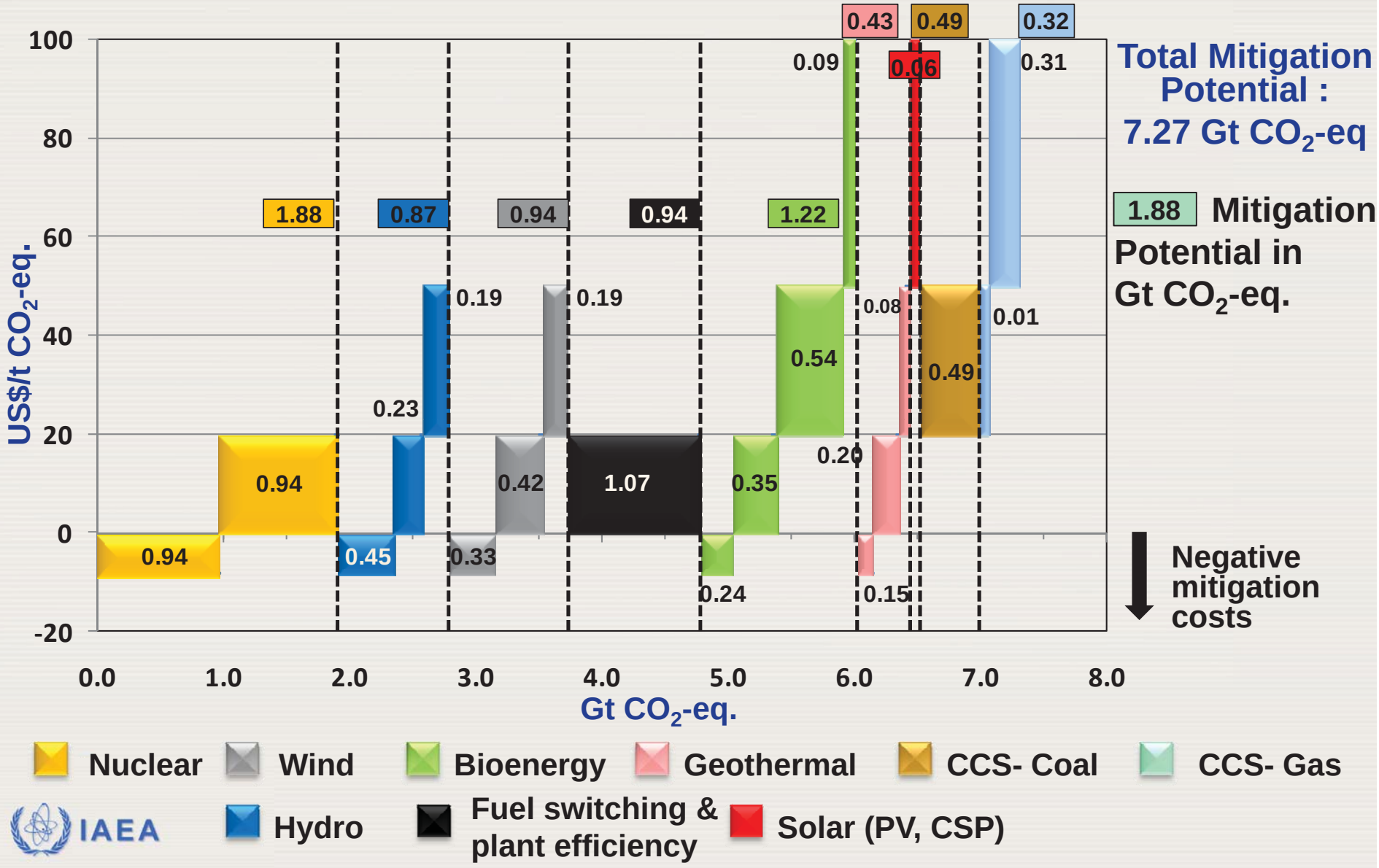
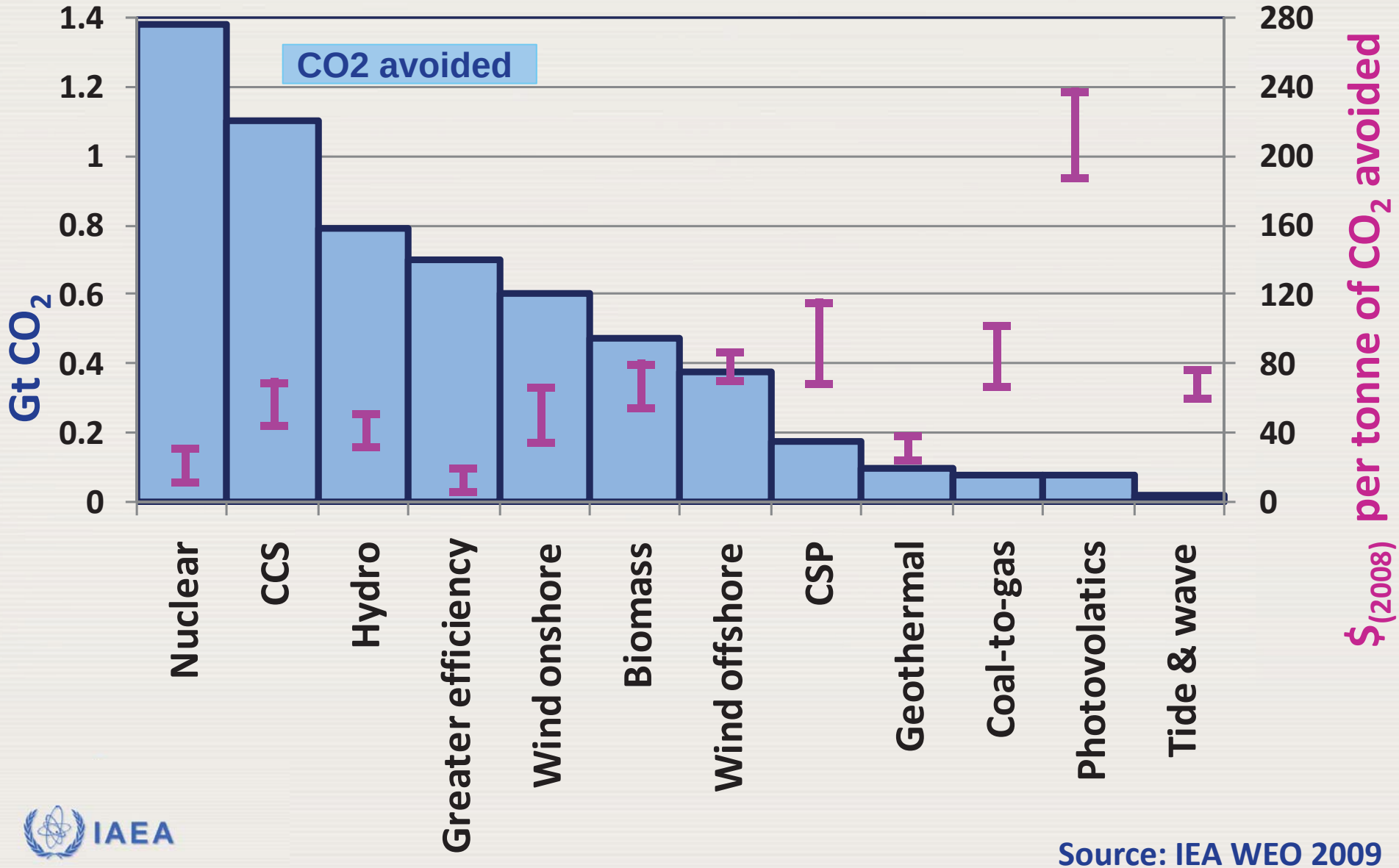
Mitigation potentials by 2030 of selected electricity generation technologies in different cost ranges



Mitigation costs & associated CO_2 avoidance in 2030 in the 450 Scenario (electricity sector)



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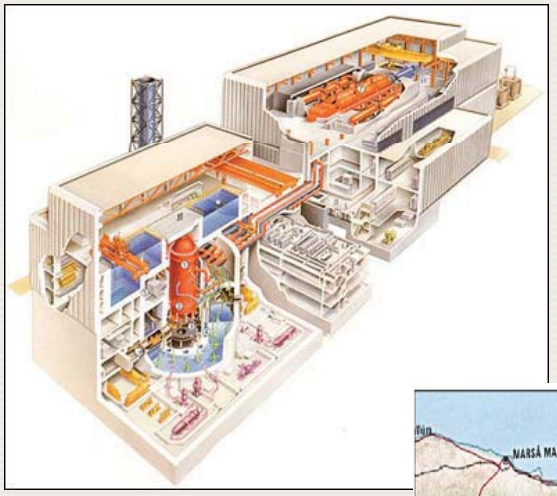
Source: IEA WEO 2009

Nuclear power is not a quick-fix mitigation option

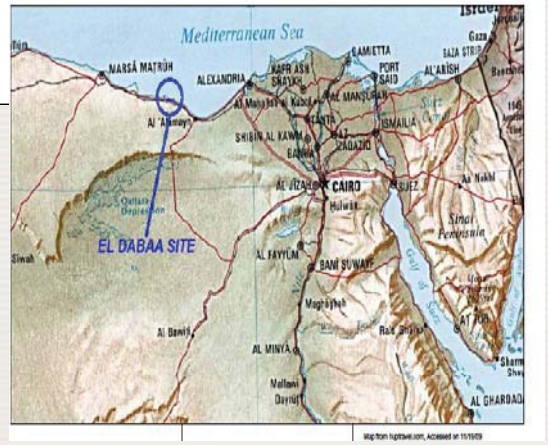
Time

Planning, infrastructure development, design & licensing
15 to 20 years



Construction
4 to 10 years

Operation
4o to 60 years



Site preparation
4 to 10 years

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Flexible mechanisms under the Kyoto Protocol and nuclear energy

- Exclusion inconsequential for the first commitment window 2008 – 2012
- Length of the commitment window of a post-2012 environmental agreement essential
- Possible exclusion from NAMAs
- Some countries call for a reversal of the exclusion
- In many cases nuclear projects would fail the "additionality" condition
- Finance is likely to remain a steep hurdle – but this is a common characteristics of most supply side mitigation options

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IAEA responds to Member State requests

Many developing countries lack the capacity for integrated resource planning, therefore:

- **Energy planning and capacity building**
  - **Mitigation options throughout the energy system**
  - **CDM, JI and emission trading**
- **Infrastructure planning for starting nuclear power programmes**
- **Coordinated research projects (CRPs)**
- **Interregional TC Project on NAMAs (2012-2013)**

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Capacity building: Energy for development and mitigating climate change

- 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 energy analysis models

- **M**odel for the **A**nalysis of **E**nergy **D**emand

- **M**odel for **E**nergy **S**upply **S**ystem **A**lternatives and their **G**eneral **E**nvironmental impacts

- **Fin**ancial Analysis of Electric Sector Expansion **Plan**s

- **Simp**lified Approach for Estimating **Impacts** of Electricity Generation

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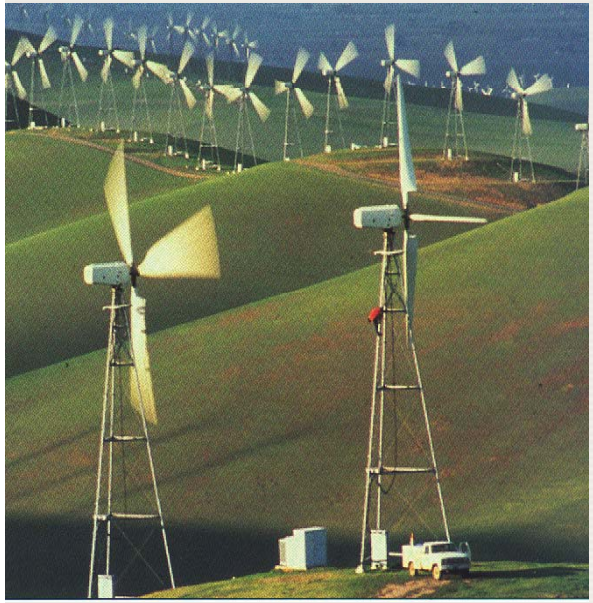
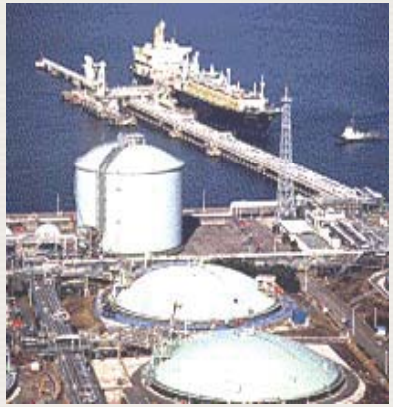
Energy Planning – Mitigating Climate Change



Outputs

- A national plan towards sustainable energy development



- A tool for benchmarking status, defining strategies for, and monitoring progress towards, a sustainable energy future (meeting climate mitigation and adaptation objectives

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Clean Development Mechanism (CDM)

- The Clean Development Mechanism (CDM) is defined by the Kyoto Protocol (Article 12) and is a new cooperative mechanism involving;
  - Developing countries (or so-called non-Annex I parties); and
  - Countries subject to quantified emission limitation and reduction commitments (or so-called Annex I parties).
- Article 12 defines the purpose of CDM as a means
  - to assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention, and
  - to assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments under Article 3.

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Clean Development Mechanism

Under the clean development mechanism:

- **Parties not included in Annex I will benefit from project activities resulting in certified emission reductions (CERs) through foreign investment in sustainable development projects; and**
- **Annex I Parties may use the CERs accruing CDM to contribute to compliance with part of their quantified emission limitation and reduction commitments under Article 3.**

Clean Development Mechanism

- The CDM shall be subject to the authority and guidance of the Conference of the Parties (CoP) to this Protocol and be supervised by an executive board of the CDM
- Emission reductions resulting from each project activity shall be certified by operational entities to be designated by the CoP on the basis of:
  - Voluntary participation approved by each Party involved;
  - Real, measurable, and long-term benefits related to the mitigation of climate change; and
  - Reductions in emissions that are additional to any that would occur in the absence of the certified project activity.

A Simple Generic CDM Example

Non-Annex I country needs additional electricity generating capacity.

The least-cost incremental capacity option is a coal-fired generating unit with specific investment costs of $950/kWe.

Capital, fuel and operating costs combine to total generating costs of $0.042/kWh.

This coal plant has a thermal efficiency of 34% and emits 1.1 kgCO_2/kWh of electricity.

Alternatively, a nuclear power plant (NPP) costs $2,800/kWe and has generating costs of $0.068/kWh.

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A Simple Generic CDM Example

- Annex I partner finances the difference between the coal PP and the NPP ($1,850/kWe) plus a contribution to the adaptation fund and administrative costs.
- In return, the Annex I partner receives CERs of 1.1 kg CO_2/kWh generated, because the coal PPis the baseline and the CDM project meets the additionality as well as the measurable, long-term GHG mitigation benefit criteria.
- Non-Annex I country reaps several benefits ranging from lower operating costs to quasi eliminated local and regional air pollution further fostering economic and sustainable development.
- Project life time (duration), long-term CER distribution and the distribution of other benefits are negotiable.

Nationally Appropriate Mitigation Actions (NAMAs)

- The Bali Action Plan (BAP) of 2007 introduced the concept of NAMAS
  - Paragraph 1 (b) (ii) of the Bali Action Plan (BAP) calls for "Nationally appropriate mitigation actions' by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity building, in a measurable, reportable and verifiable manner..
- At the international climate negotiations at COP-15 in Copenhagen in December 2009, nationally appropriate mitigation actions, NAMA was agreed, in principle, as the solution of many open issues.

NAMAs in the context of Sustainable Development

- Climate change needs international cooperation guided by the UNFCCC Convention and BAP and in accordance with the principle of *common but differentiated responsibilities*.
- Climate change poses great challenge to developing countries in addition to challenges of poverty, hunger, health and education, etc.
- NAMAs by developing countries should be coordinated with the goals of development and poverty eradication.
- Only sustainable development could provide the effective response to climate change.

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NAMAs are distinct from quantified emission reduction commitments & targets by Annex I countries

- NAMAs by Non-Annex I countries are on voluntary basis, distinct from legally-binding obligations by developed countries.
- NAMAs by Non-Annex I countries are concrete actions and project activities, distinct from emission reduction commitments and emission reduction targets of developed countries
- NAMAs should be based on national circumstances, national strategies of sustainable development and priorities of the developing countries.
- NAMAs are dependent on measurable, reportable and verifiable technology, finance and capacity building support provided by developed countries.

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NAMAs should be enabled by technology, financing and capacity building

- Article 4.7 of the Convention states that Non-Annex I Parties implementation of their commitments under the Convention will depend on the full implementation by Annex I Parties of their commitments under the Convention related to financial resources and transfer of technology.
- The provision of technology, financing and capacity building support by Annex I Parties is a compensation for the excessive occupation of emission space due to their high per capita cumulative emissions.
- Industrialization and urbanization in developing countries mean large-scale infrastructure construction, urgent technology, financial and capacity building support are needed to avoid lock in effect in GHG-intensive infrastructures

NAMAs should be enabled by technology, financing and capacity building

- Non-Annex I Parties propose lists of NAMAs together with the required technology, finance and capacity building support.
- Annex I Parties provide technology, finance and capacity building support in a manner of MRV to match needs of NAMAs.
- Appropriate mechanisms to match NAMAs with technology, finance and capacity building support.
- Proposal of G77 and China offers a good basis for the establishment of such mechanisms.
- The emission reduction generated from NAMAs should not be used to offset quantified emission targets of developed countries.

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Nationally Appropriate Mitigation Actions (NAMAs)

- The negotiations have so far failed to define precisely what NAMAs actually are
- Views also differ on the institutional structure needed for providing support to NAMAs as well as ways to measure, report and verify actions.
- Due to this vague approach, the negotiations surrounding NAMAs are still very generalised, making it difficult to work on concrete implementation issues.

Nuclear Power and Climate Change

- Clearly, there are issues surrounding the technology that need continued attention
  - Finance
  - Maintaining and improving safety performance standards
  - Waste disposal / spent fuel management
  - Non-proliferation and physical security
- BUT: If you are serious about protecting the climate – you cannot ignore nuclear energy
- Nuclear energy needs public tolerance and political support

IAEA is more than nuclear power

- **Department of Nuclear Sciences and Applications**
  - **Agriculture**
  - **Health**
  - **Hydrology**
  - **Marine monitoring (carbon cycle)**

Carbon Capture and Storage (CCS) in Agriculture

- Carbon in soils provides additional nutrients and enhances water storage of crops
- Soil carbon also enhances soil resilience against desertification and degradation and promotes soil biodiversity
- The Agency is developing and evaluating land management practices to mitigate GHG emissions by capturing carbon and nitrogen in soils as sources of organic matter and nutrients for crop growth
- Also, through plant mutation breeding, the Agency is working to develop crop varieties able to absorb additional carbon from the atmosphere and to effectively utilise soil nitrogen

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CCS in Agriculture – Turning GHGs into fertilizers

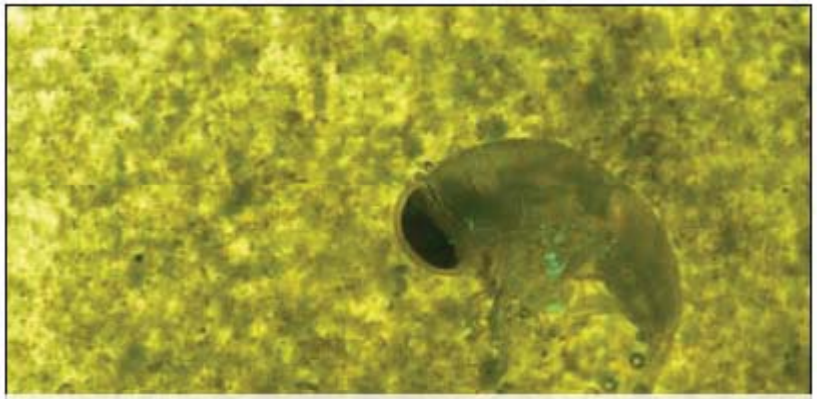
- Agency-funded studies in Brazil indicate that zero-tillage agriculture and adequate soil fertility result in the capture of 1000 kg more carbon per hectare than with conventional tillage practices
- Soil carbon sequestration was also demonstrated to increase by including nitrogen-fixing practices in addition to crop rotation

Agriculture

Nuclear techniques can also make valuable contributions to the development of new crop varieties able to provide higher yields and to tolerate drought, reduced soil quality and the harsher weather patterns wrought by climate change.

Once abandoned fields are brought back to life with the IAEA help. Credit: L. Wedekind / IAEA

The IAEA supports scientists in Colombia and other countries to use isotopic and nuclear techniques to study underground aquifers. Credit: A. Gabarick



"Marine snow" is an aggregate mixture of microscopic biota and other particles suspended in the ocean. This snow can be used to study the biological processes in the ocean, particularly the processing of carbon dioxide (CO_2) Credit: PhotoDisk

Isotopes are tools for understanding and monitoring key phenomena that help regulate today's climate and that offer important information about ongoing climatic shifts.

Scientists are collecting radionuclide, stable isotope and trace element records in corals and ocean sediments in order to reconstruct the patterns left by past El Niños going back several hundred years. Credit: D. Calma / IAEA

CRPs related to climate change

- **Greenhouse Gas (GHG) mitigation strategies and energy options**
  - To collect and disseminate up-to-date information on plausible post-Kyoto international climate protection regimes and the potential role of different energy options under different agreement designs and implementation mechanisms.
  - To develop and analyze/compare various energy supply response options, including nuclear power, to different future international environmental agreements.

Greenhouse Gas (GHG) mitigation strategies

- **The research teams developed country case studies on energy/electricity scenarios and estimated the associated GHG emissions. The case studies covered:**
  - Review of alternative post-Kyoto approaches and assessment of the applicability of these potential regimes regarding the national circumstances of each country.
  - Comprehensive review of the ongoing debate on climate change.
  - Assessment of national greenhouse gas emissions focusing on CO2 emission from the energy sector.
  - Review of national policies and measures on greenhouse gas mitigation.
  - Development of energy/electricity scenarios and CO2 emission and evaluation of different mitigation options.
  - Assessment of the role of nuclear power and other carbon free and carbon neutral technologies in each regime.
  - Two research papers in peer-reviewed journals. Additionally several papers were contributed to international conferences /symposia.
- **Outcome: Educated climate negotiations**

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CRPs related to climate change

- **Techno-economic Comparison of Ultimate Disposal Facilities for CO_2 and Nuclear Waste**
  - **To support the development of national energy strategies concerning the dilemma in many Member States whether:**
    - **to expand fossil-based electricity generation with adding CO_2 capture and disposal or**
    - **to introduce/expand nuclear energy as a low-carbon electricity source with radioactive waste disposal**

Techno-economic comparison of ultimate disposal facilities

Outcome:

- Improved understanding of the options, pros and cons in the numerous aspects of the geological disposal of CO_2 and RadWaste

- Better information for making informed choices in national energy strategies about the directions to expand power generationsource with radioactive waste disposal

Water - Energy - Land Use Planning: A fragmented approach

- Water, energy and land-use are intimately interlinked
- All affect the climate
- Therefore, issues related to water, energy or land use
  - cannot be dealt with in isolation
  - cannot be met sustainably without trade-offs between them.
- Still, most water, energy and land-use planning, decision and policy making occurs in separate and disconnected institutional entities.

Water - Energy - Land Use: Some issues

- 1.5 billion people have no access to electricity
- 1.1 billion people have no access to safe water
- Food shortages, land-use competition, skyrocketing prices and stresses on arable land (urbanization)
- Assessments, planning, policy and decision making are usually isolated
- Needs an integrated interdisciplinary approach

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Climate, Land-use, Energy, Water (CLEW)

- **Objective**
  - To develop case studies that will be used to test and implement a framework illustrating:
    - The interactions within the CLEW system
    - How those interactions can be harmonised and conflicts reconciled.
  - Of particular interest is:
    - how reduced forms of the results of specialized modelling and analysis efforts can be integrated or linked
    - how the underlying cost, energy and mass balances, as well as other dynamics can be harmonised
  - Demonstrate specific policy considerations that benefit from an integrated approach

Other IAEA Climate Relevant Activities

- Mapping of climate change relevant activities at IAEA
- Comprehensive information brochure on IAEA climate relevant activities
- Contributions to UN-Energy and UN climate activities (AGECC)
- CoP/MoP
- IPCC

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And remember

"… when nature goes bankrupt,

there won't be a bailout".

WWF: Cracking the Climate Nut at COP 14,

Global Climate Policy Position Paper, December 2008.

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…atoms for peace.

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