Evaluation of Nuclear Power as a Cost-Effective Nationally Determined Contribution to Climate Change Mitigation

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Paris Agreement – Targets & Obligations

• Aims at strengthening the global response to the threat of climate change,
  – Holding increase in global average temperature well below 2°C (preferably < 1.5°C)
  – Increasing ability to adapt to adverse impacts of climate change
  – Making finance available

• All Parties take actions to contribute to the global response (NDCs with progression over time)

• Developed country Parties shall provide financial resources to assist developing country Parties for mitigation and adaptation (communicate this information biennially)
Composition of Global GHG Emissions

Source: IPCC 2014
Global GHG Emissions by Sectors

Electricity and Heat Production: 25%
Agriculture, Forestry and Other Land Use: 24%
Industry: 21%
Transportation: 14%
Buildings: 6%
Other Energy: 10%

Source: IPCC 2014
World Electricity Production Mix 2015

Source: RDS-1 2016
Impact of carbon prices

- 30$/t CO2
- 20$/t CO2
- 10$/t CO2

Costs $/MWh:

- Nuclear low
- Nuclear high

Energy sources:
- Coal
- Coal CCS
- Gas CCGT
- CSP

Base costs $/MWh:

- Coal
- Coal CCS
- Gas CCGT
- CSP
CO2 Avoidance Potential and Cost - Power Generation
Capital Intensity of CO2 Avoidance

$ per ton of CO2 Avoided per year.

PESS Estimates
Nuclear Power Contribution to GHG Mitigation

Nuclear power has avoided the release of more than 60 Giga tons of CO$_2$, equivalent to twice the total annual emissions globally.
Nuclear Power
Potential for the Future

Capacity and Generation

- Capacity (GW)
- Generation (TWh)

CO2_if Coal
CO2_if Gas
Global Energy Investments

Source: Energy Investments, IEA 2016
Energy R&D Investments

Source: IEA RDD Factsheet 2016
Energy R&D Investments – OECD Countries

Source: IEA RDD Factsheet 2016
CO2 Emission from Energy Sector

- 1.5 °C case
- "well below 2 °C" case
- 450 Scenario

Cumulative 2015-2100
Carbon Budget and Fossil Fuel Reserves

Global CO₂ emission budget for < 2°C at 66% probability

~900 Gt left until 2100

Source: Adapted from Rogner (2012) and Bauer et.al (2015)
A dynamic agreement and its ratchet mechanism

1. Climate plans submitted
   - Countries submit their first round of climate pledges (INDC)

2. Facilitative dialogue
   - To take stock of collective efforts in relation to the long-term commitment and to inform the preparation of the next round of pledges

3. By 2020
   - Countries with 2025 targets communicate their 2nd round of climate pledges - countries with 2030 targets confirm or update their targets
   - 2020, 2021, 2022, 2023, 2024

4. Global stock take
   - On mitigation, adaptation and finance
   - By 2025
   - 2025, 2026, 2027, 2028, 2029, 2025

5. By 2025
   - Countries submit their 3rd round of climate pledges
   - 2025, 2026, 2027, 2028, 2029, 2025

6. Second stock take
   - 2030

Source: Adapted from CarbonBrief, 2016
Periodic Stock-Take

Review and Assess Adequacy of

- Mitigation Efforts
- Support for Adaptation
- Climate Finance
- Technology Development and Transfer

Ad Hoc Working Group on the Paris Agreement is preparing the “Entry into Force”.
NDC Process & Assessment Tools

- NDC Preparation/Updating
- NDC Monitoring/Assessment
- NDC Submission
- NDC Implementation

- Forward-looking Modelling tools
- Ex-post evaluation of projects/policies Indicators/Metrics for Impacts
- Sectoral Consolidation, National Consensus
- Concrete Actions/Policies, Investments/Taxes, Regulations, etc.

IAEA 60 Years
Atoms for Peace and Development
Modelling tools for NDC evaluation

- Models included here are for mitigation and/or carbon pricing policies primarily in energy-related sectors, for ex-ante analysis and projection (excluding visualization/communication tools, and software)
Possible Options for NDCs

Base Line emissions
Unconditional Reductions
Conditional Reductions
Possible Options for NDCs

Intensity Targets

Reduction in GHG per unit of electricity generation
INPRO Studies and
MESSAGE Modelling Framework

Experience on Modelling Nuclear Energy Systems with MESSAGE: Country Case Studies
Technology Development & Transfer Needs

• What Nuclear Energy Technologies would be needed
• When different technologies should be available
• What RD&D efforts/investments are needed
Thank you!