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The Role of Nuclear Energy in a Low-Carbon Energy Future
Summary of the OECD/NEA Expert Group Report

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http://www.oecd-nea.org/nsd/reports/2012/nea6887-role-nuclear-low-carbon.pdf

Background of the Study

- World energy demand will increase in particular in developing countries
- Will be mostly met by burning fossil fuel, unless current trends are reversed
- Before the Fukushima Daiichi accident NE was favourably considered
- Since the accident scenarios related to plans to reduced GHG emissions in the power sector still project significant deployment of NPPs, but at a slower rate
- Report provides analysis that confirms contribution of NE to the reduction of greenhouse gas emissions

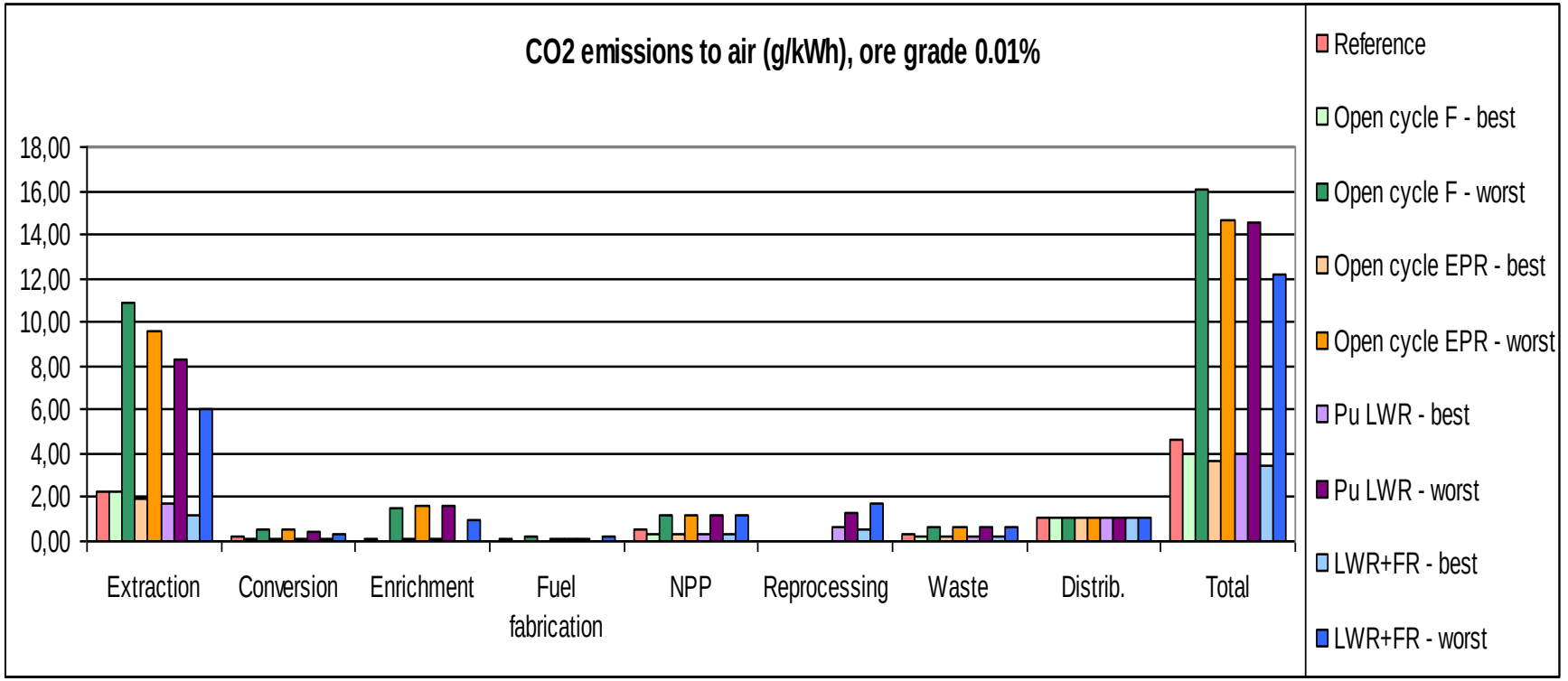
Table of Contents of the Report

1. Greenhouse gas emissions from the nuclear cycle
2. Status of nuclear power and outlook to 2050
3. Economic, technical, societal, institutional and legal factors affecting nuclear expansion
4. Impact of developments in the electricity supply system
5. Longer term perspectives for nuclear energy
6. Summary and conclusions

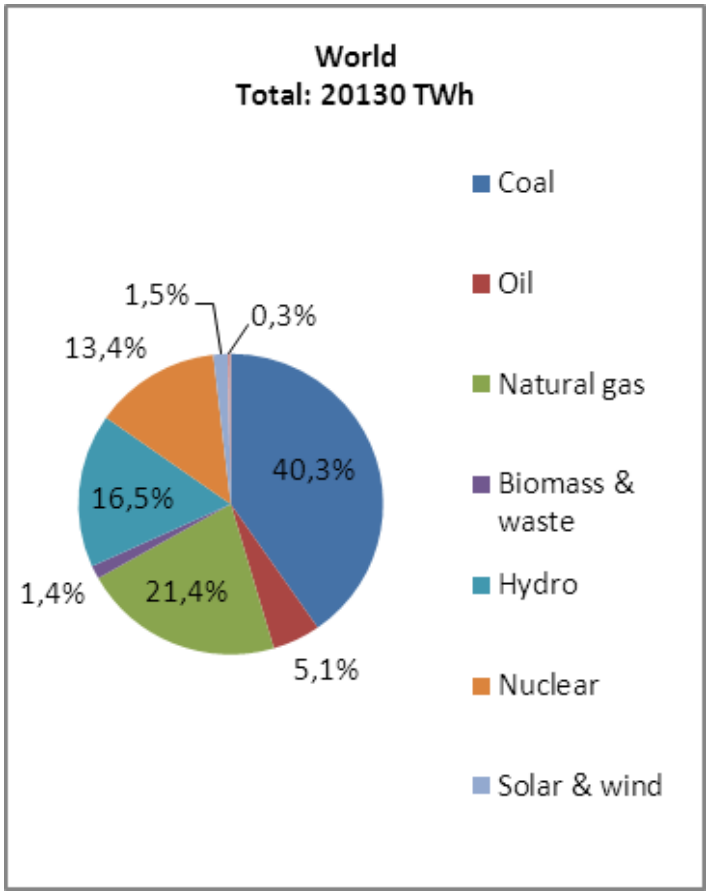
This presentation addresses some chapters of the report

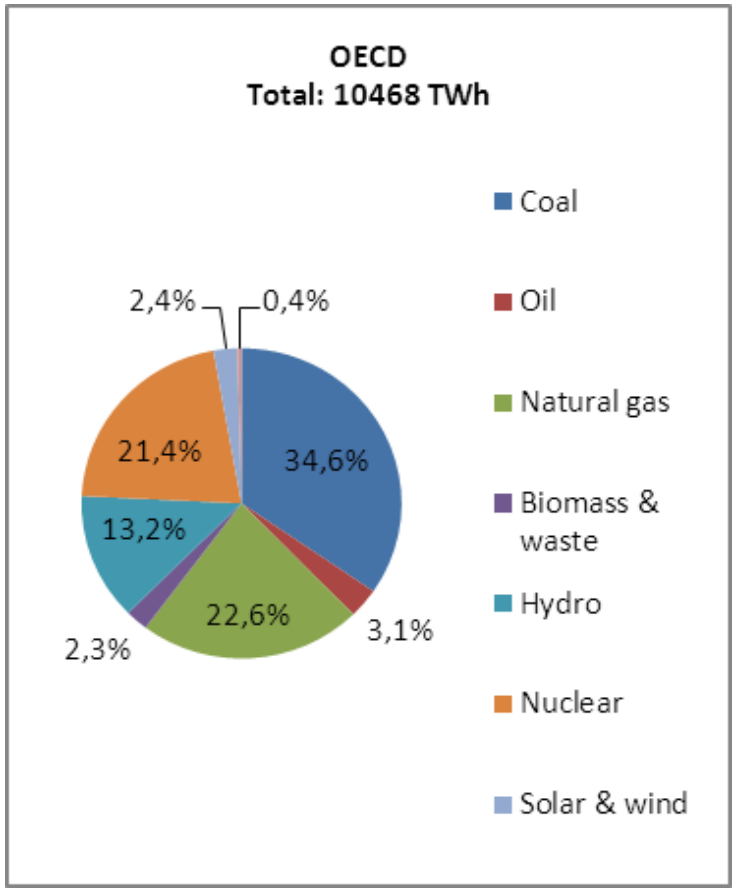
1.) Greenhouse gas emissions fron the nuclear fuel cycle

CO2 Emissions for Different Nuclear Fuel Cycles to Air (g/kWh), Ore Grade 0.01%

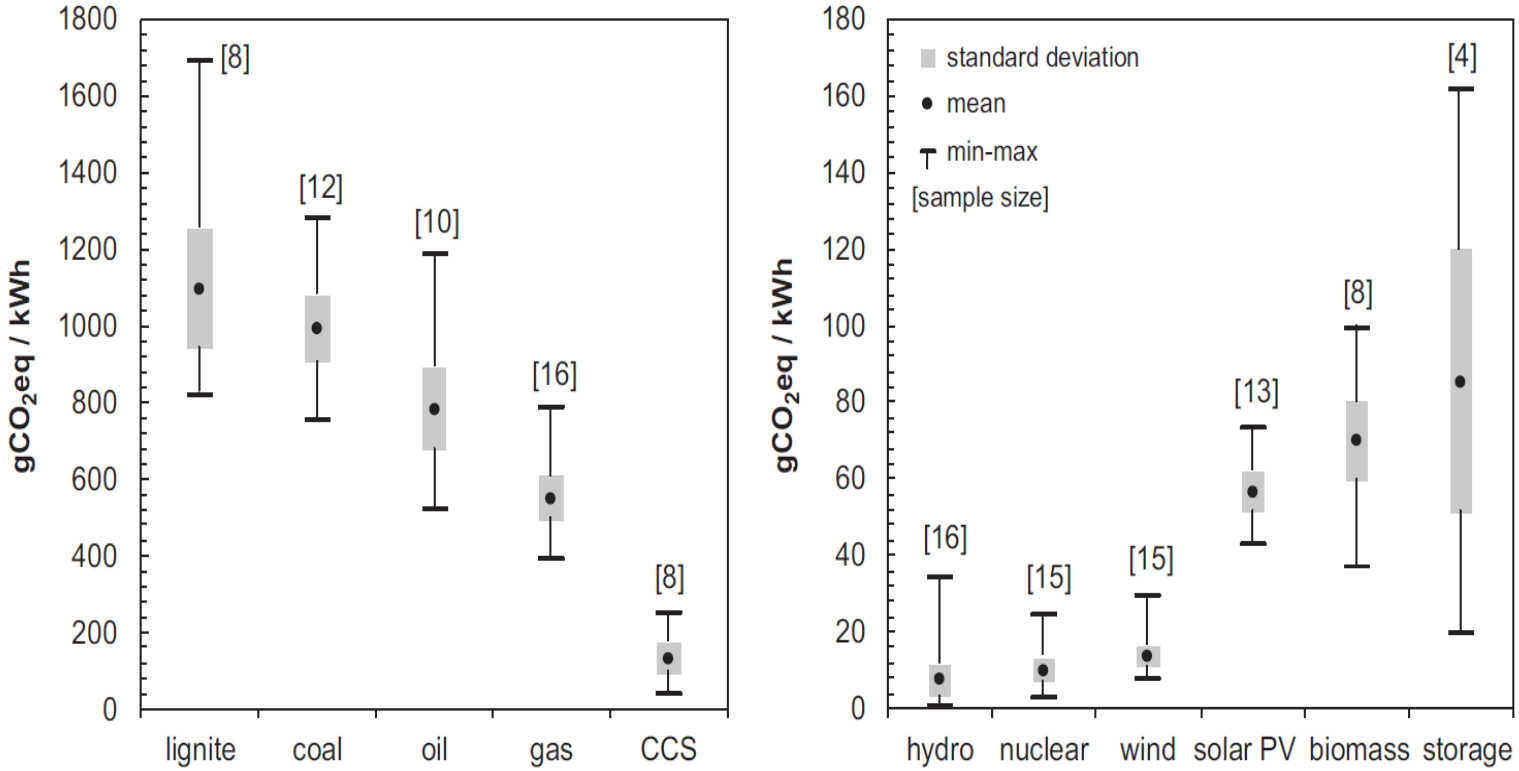


Share of Electricity Production by Technology in 2009





Range of GHG Emissions for Indicated Power Plants



2.) Current Status of nuclear power and outlook to 2050

Current Status of Nuclear Power

435	NUCLEAR POWER REACTORS IN OPERATION
370 003	MW_e TOTAL NET INSTALLED CAPACITY
5	NUCLEAR POWER REACTORS IN LONG-TERM SHUTDOWN
63	NUCLEAR POWER REACTORS UNDER CONSTRUCTION

Source: IAEA PRIS

OECD/IEA Scenarios for Nuclear Expansion

IEA World Energy Outlook (2011) projects an expansion of NE by 2035:

- Current Policy Scenario (CPS) with business as usual: **550 MWe**
- New Policy Scenario (NPS) takes into account announced commitments and plans: **633 MWe**
- 450 Policy Case (CO2 concentr. below 450 ppm by 2050): **865 MWe**

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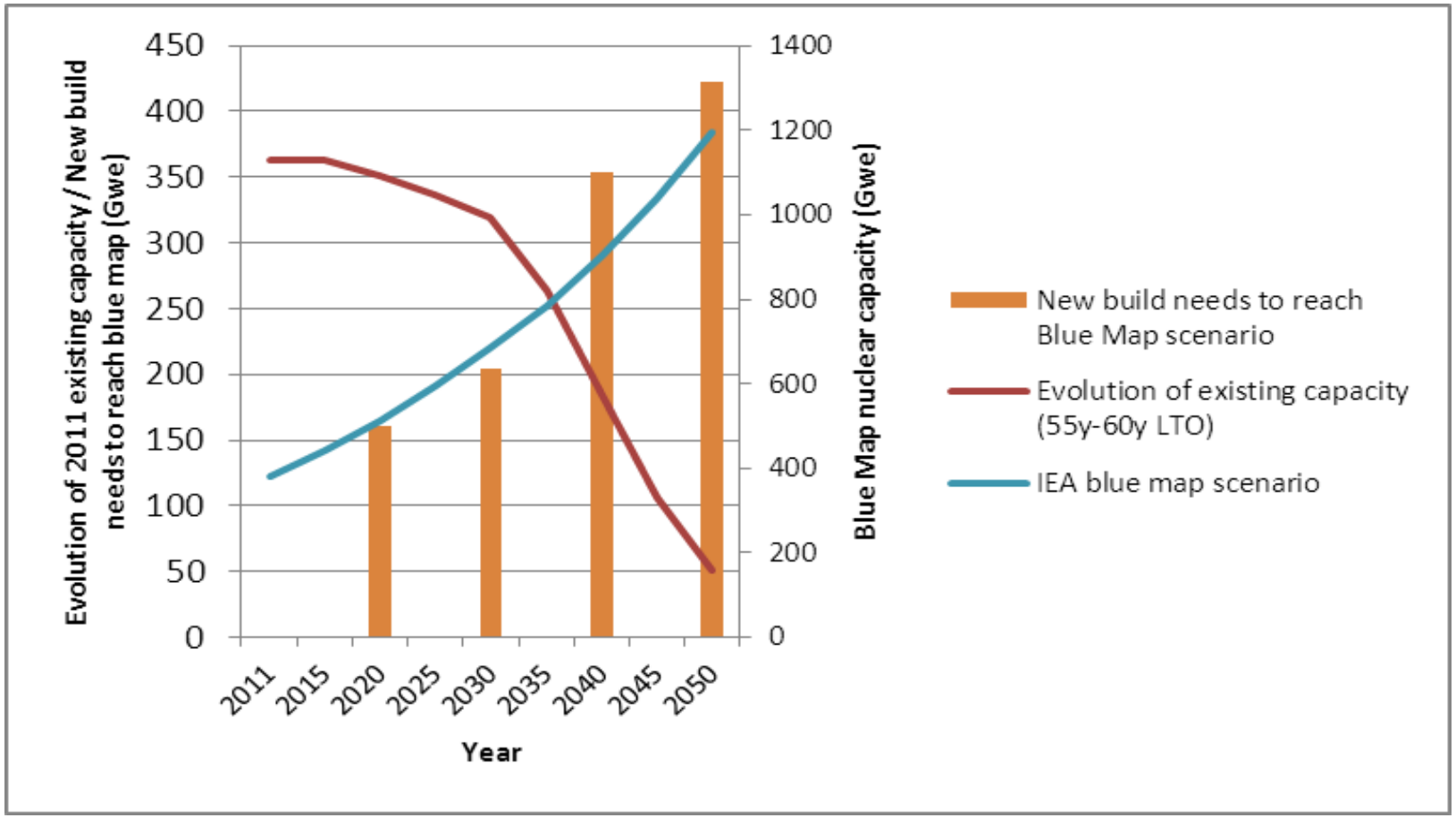
OECD/IEA Energy Technology Perspectives

- Builds on WEO scenarios with extension to 2050
- „Blue Map Scenario“ with 50% cut in energy related CO2 emissions and concentration of 450 ppm by 2050 is reference for this report
  - NP would become the single largest source of electricity (24% of worldwide electricity)
  - Projects installed nuclear capacity of 1200 GWe in 2050
  - Requires average nuclear capacity additions of 30 GWe per year

New Build Rates to Reach ETP 2010 Blue Map Scenario



New Build Rates for Different LTO Assumptions to Reach Blue Map Scenario

Long Term Operation assumptions	Remaining capacity by 2050 (GWe)	New build capacity required to reach Blue Map target (GWe)			
		2011-2020	2020-2030	2030-2040	2040-2050
40 years for all reactors (except 60 years in the US)	7	197	309	301	379
55 years for all reactors (except 60 years in the US)	51	161	205	354	423
60 years for all reactors	75	161	196	298	464

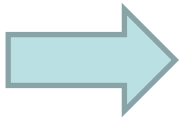
Experience from the 70 – 80ies

- Max 40 NPP construction starts per year in the 70ies
- Max 30 GWe per year connected to the grid in the 80ies

3.Economic, institutional and technical factors affecting the expansion of nuclear power

Investment Needs for Nuclear to Reach Blue Map Scenario

Region	Investment needs to 2050
OECD Europe	586 USD bn
OECD Pacific	615 USD bn
United States and Canada	883 USD bn
China	893 USD bn
India	389 USD bn
Others	609 USD bn
Total	3975 USD bn



High investment costs, but may be comparable with other energy and emission reduction technologies.

Principal Challenges

- Financing of high capital costs
- Overcoming current constraints on industrial capacities and human resources
- Recovering pre-Fukushima levels of public acceptance of nuclear energy
- Demonstrating the safe management of radioactive wastes, and implementing plans for the disposal of long-lived high level waste.
- Introducing nuclear capacity into additional countries.
- Increasing the supply of nuclear fuel in line with the expansion of nuclear capacity, and ensuring reliable fuel supplies during reactor lifetimes of 60 years.

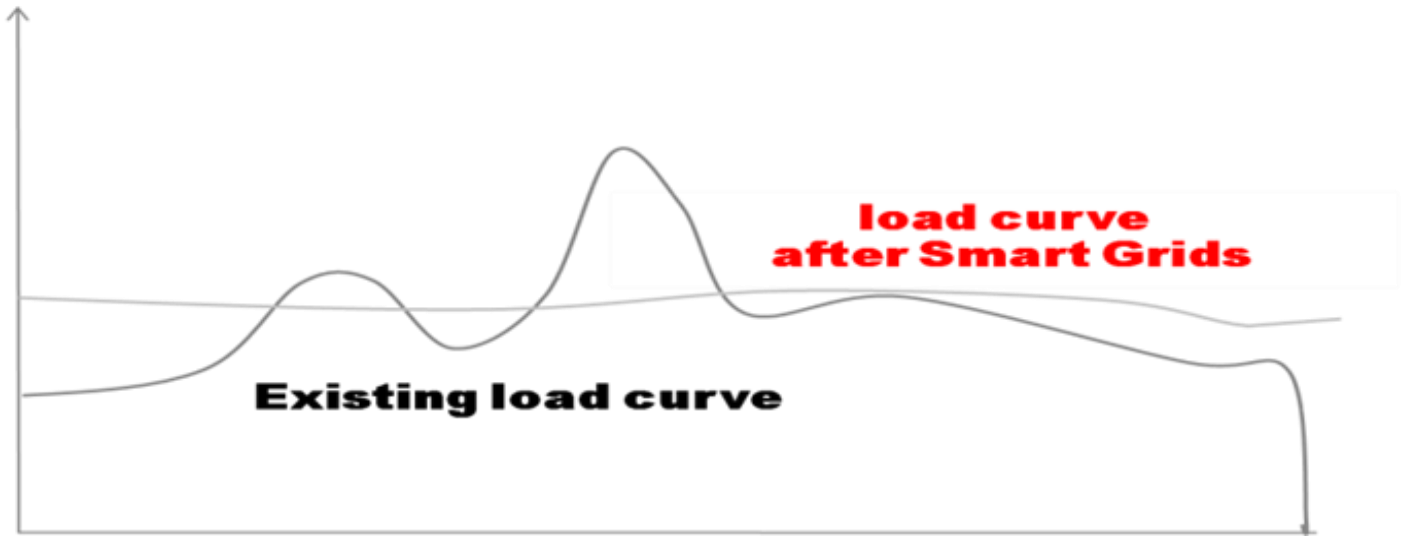
4.) Impacts of Developments in the Electricity Supply System

1. Load following due to
   - response to variations in consumption
   - intermittency in electricity production from renewable sources

Experience shows (e.g. in France, Germany) that current NPPs are capable of load-following

Some utilities already require load following, e.g. EPRI-URD, EUR, but impacts on operational lifetime and economics?
Construction of storage options?

Nuclear Power and Smart Grids



Smart Grids flatten Load Curve

More Baseload

5.) Summary and Conlusions

OECD/NEA Study did not identify any insurmountable barriers to a large expansion of nuclear power

But several challenges:

- Financing the high capital costs
- Industrial infrastructure needs to be expanded (e.g. large steel forgings)
- Skilled labour is required in nuclear industry, utilities, regulators and governmental agencies
- Increased production of Uranium, greater capacity in NFC facilities and -in the longer term – increased use of recycling and introduction of advanced fuels
- Final disposal of radioactive waste has to be implemented
- Institutional and legal frameworks have to be implemented or strenghened, e.g. policy support from governments with long-term settled strategy and availability of regulatory framework
- Recovering pre- Fukushima levels of public acceptance