

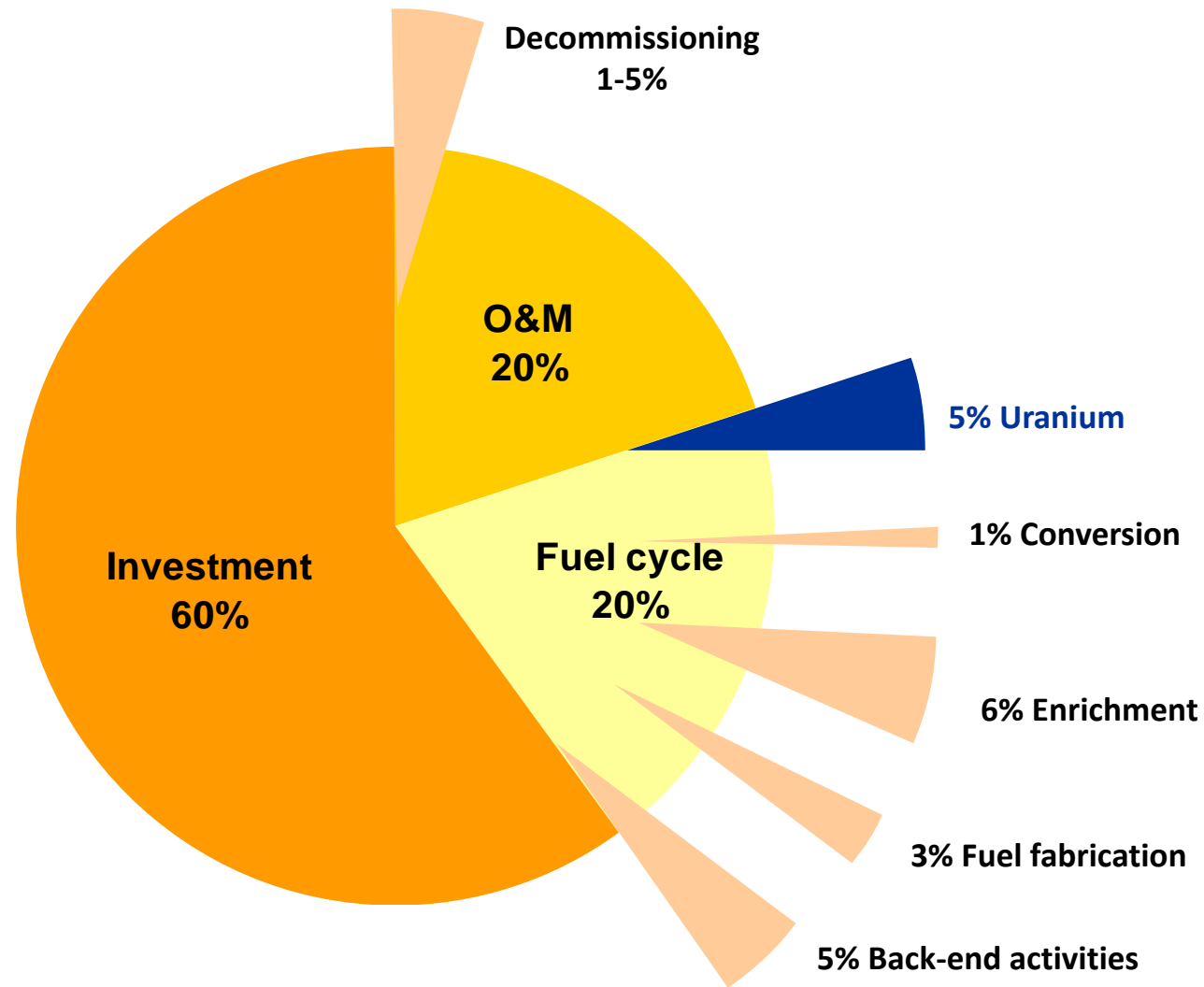
Nuclear Power Option

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Why nuclear power?

- **Economics**
 - Cheap to operate
 - Small resource share in generating costs
 - Stable and predictable generating costs
 - Dispatchable base load technology
 - Long life times
- **Energy security**
 - Small fuel volumes & long refueling cycles
 - Resources are plentiful and geographical widely distributed
- **Environmental and health protection**
 - Low life cycle GHG emissions and other pollution
 - Low externalities (so far no credit applied)
- **Excellent safety record**

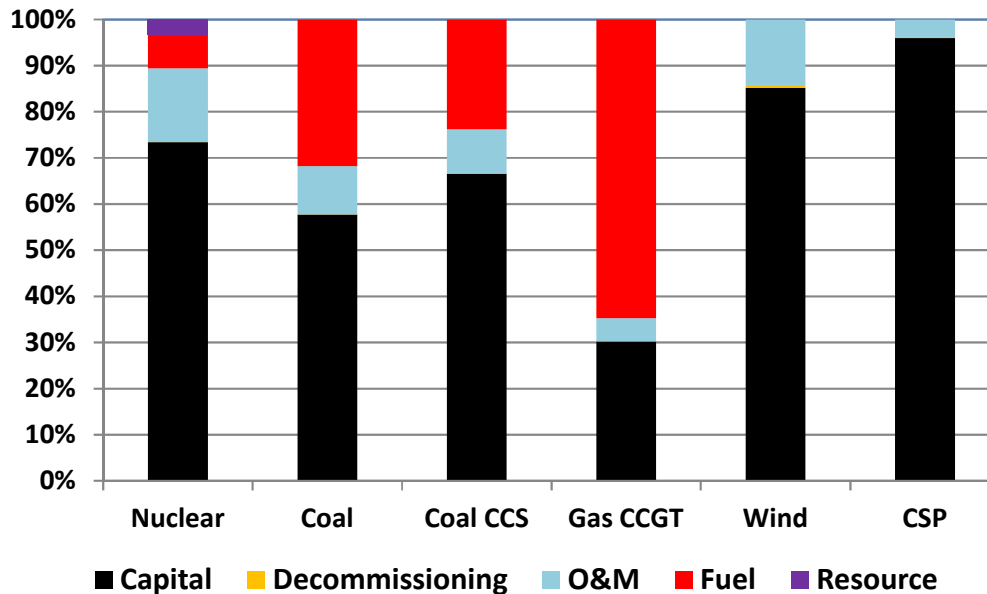
Typical nuclear electricity generation cost breakdown



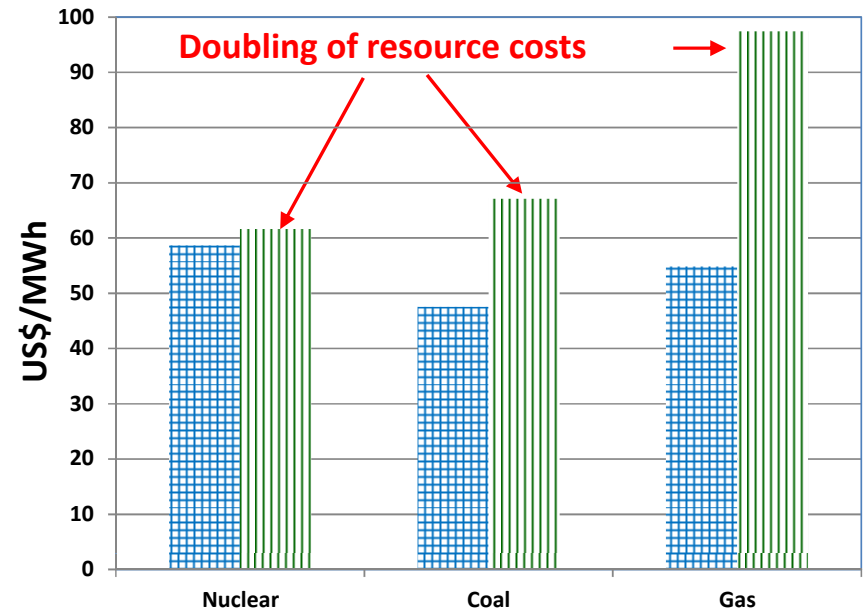
Source: NEA

Impact of doubling resource input costs on generating costs

Cost components in total generating costs at a 10% discount rate

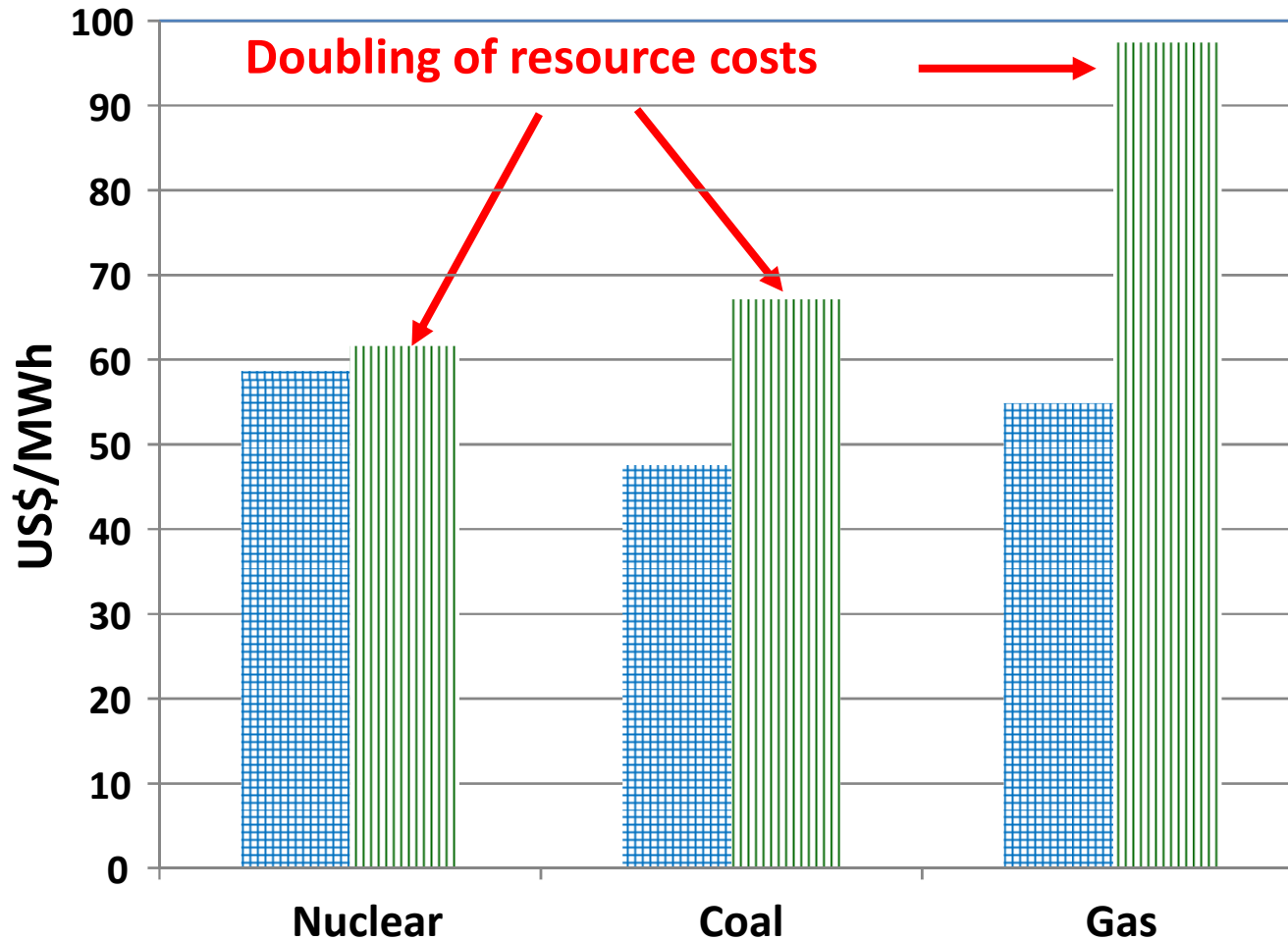


Doubling of resource costs



Adapted from IEA/NEA 2010 and NEA 2003

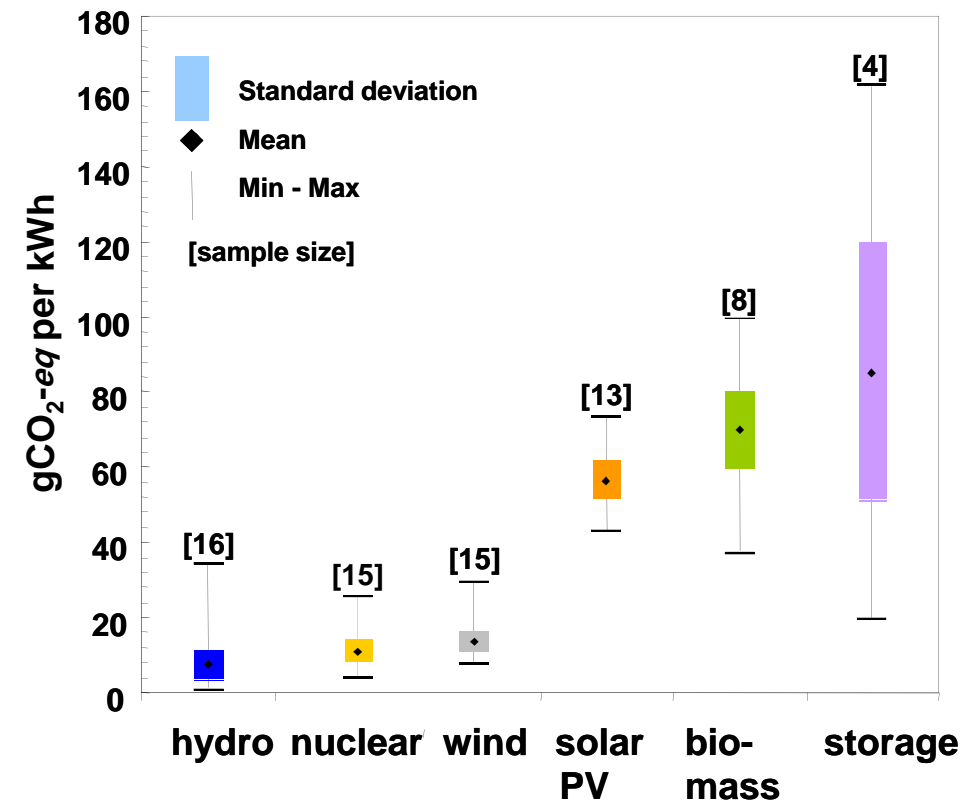
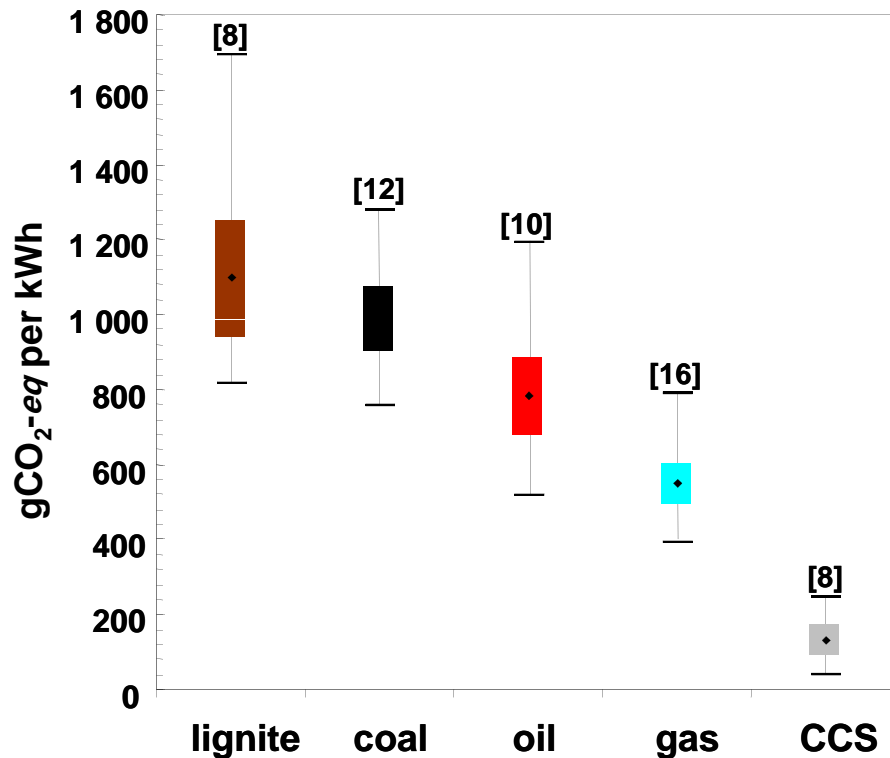
Impact of doubling resource input costs on generating costs



Adapted from IEA/NEA 2010 and NEA 2003

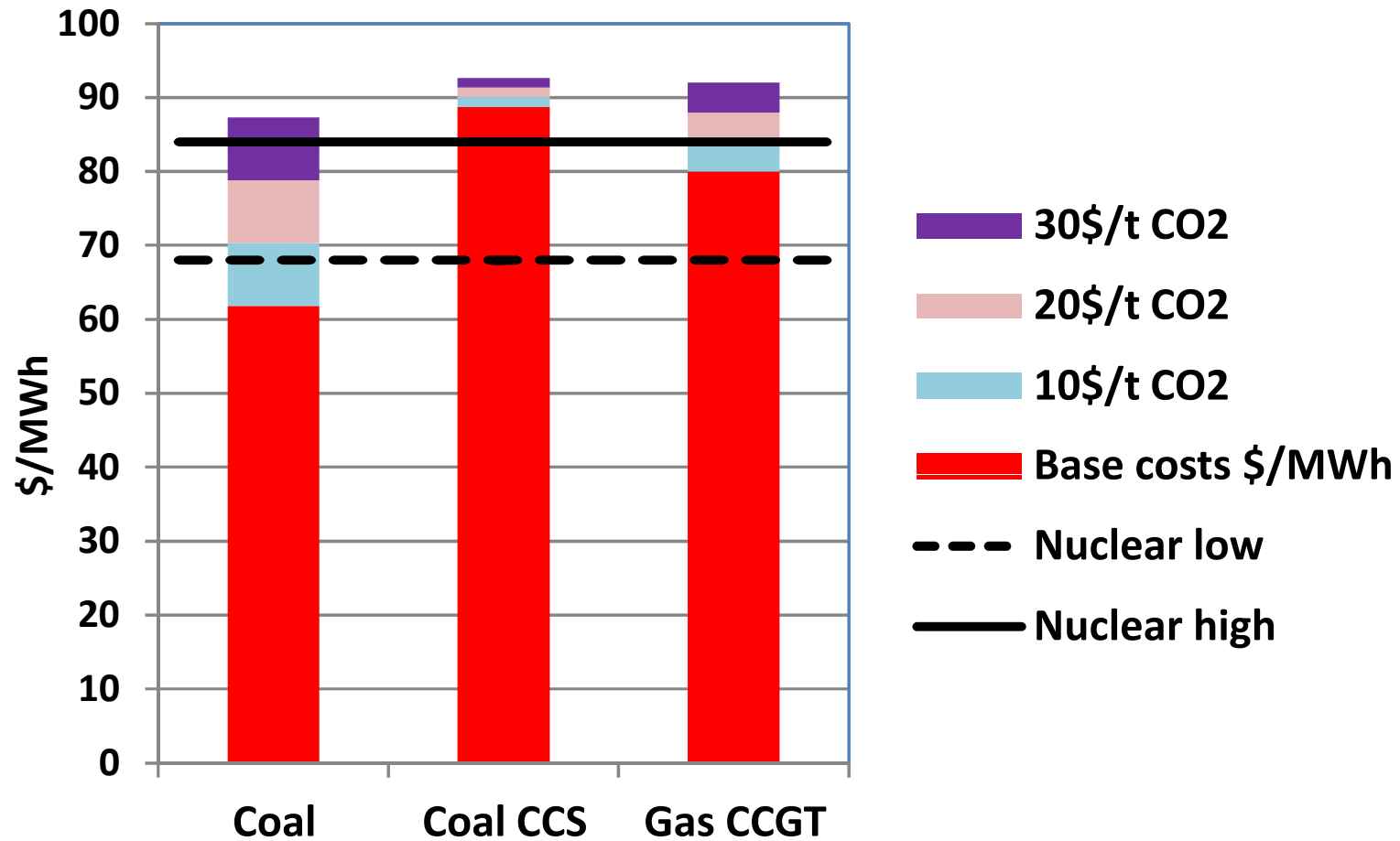
Mitigation – Role of nuclear power

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

Impact of carbon prices



Arab world

- **For the oil and gas rich countries – a back-of-the-envelope rationale**
 - Nuclear power plant investment costs including IDC (5%) of US\$6500 per kW - generating cost 72 \$/MWh
 - To break even a high efficient CCGT plant at 1150 US\$/kW would require
 - an oil price of 50 US\$/bbl or
 - a natural gas price of 8 US\$/GJ
 - Prices significantly higher than the subsidized oil & gas prices in most countries in the region: → nuclear power is not competitive
 - But light oil and LNG currently trade at much higher than these break-even prices: Futures for light oil ~ 100 US\$/bbl and LNG ~11 - 13 US\$/GJ
 - Nuclear power releases oil and gas volumes for export earnings
 - Extra revenues pay for costs of a nuclear power plant at a profit
 - In short, nuclear power is competitive with CCGT as long as average oil export prices are above 50 US\$/bbl and LNG above 8 US\$/GJ

Why not

■ Economics

- High upfront investment cost
- Sensitive to interest rates
- Long amortization periods
- Risks of cost overruns incl. completion & market risks
- Regulatory risks
- Escrow funds for HLW management and decommissioning

■ Energy security

- Access to proliferation sensitive parts of the fuel cycles
- Multi-national approaches

■ Environmental health protection

- HLW
- Radiation impacts of severe accidents

Arab world

- **Lack of nuclear infrastructure in an oil and gas rich region**
 - Human resources
 - Safety and maintenance culture
 - Independent regulation/oversight
 - Technology and fuel recipient
 - Waste management
- **Fast track and outsourcing not longer term options**
- **Enormous solar potential (hybrid options)**
- **Efficiency improvements throughout the energy system – the real low-hanging fruit**
 - Subsidy issue

One size does not fit all

- **Countries differ with respect to**
 - energy demand growth
 - alternatives
 - financing options
- **Weighing risks and preferences**
 - accident risks (nuclear, mining, oil spills, LNG...), cheap electricity, air pollution, jobs, import dependence, climate change
 - There is no technology without risks (“no-silver bullet”)
- **Benefits > risks or risks > benefits (perceived or real)**
- **All countries use a mix. All are different.**
- **Local conditions determine the optimal supply and technology mix**

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Thank You