

Just burry the stuff?

Lessons from the comparative assessment of the geological disposal of CO₂ and radioactive waste

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Overview

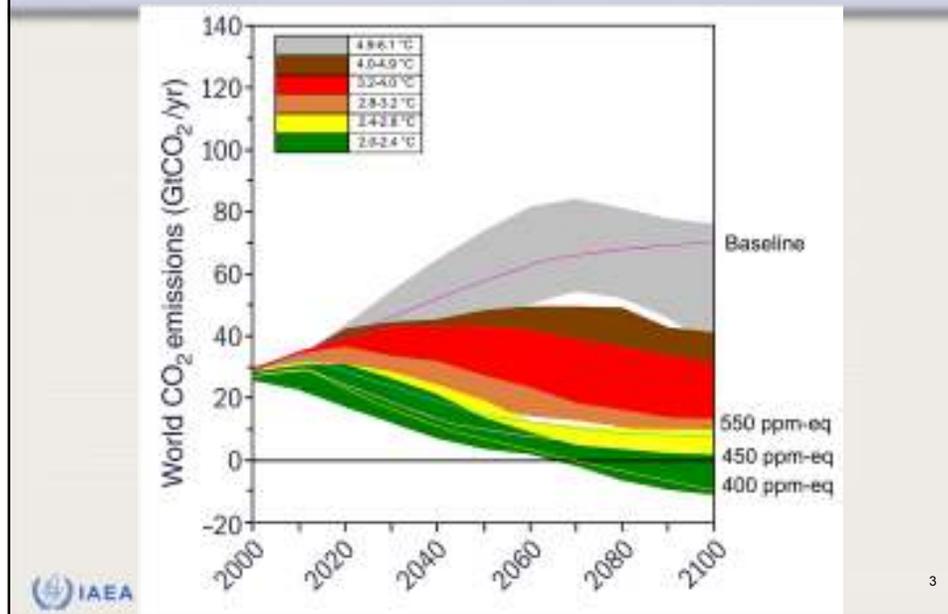
1. Context: CC mitigation
2. Comparison: economic aspects
3. Other socio-economic aspects
4. Summary and conclusions

Note: Part 2 of this presentation partly also draws on the work of Asami Miketa, co-author of the costs/economics chapter in the Geodisposal book

Why on Earth: Many IAEA MSs face the dilemma ...

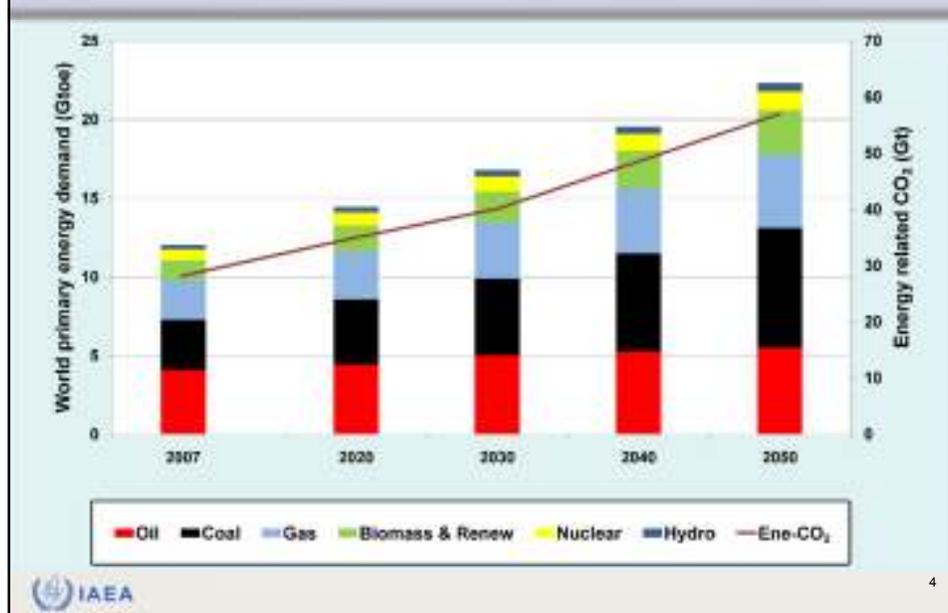


1. Context: CC mitigation



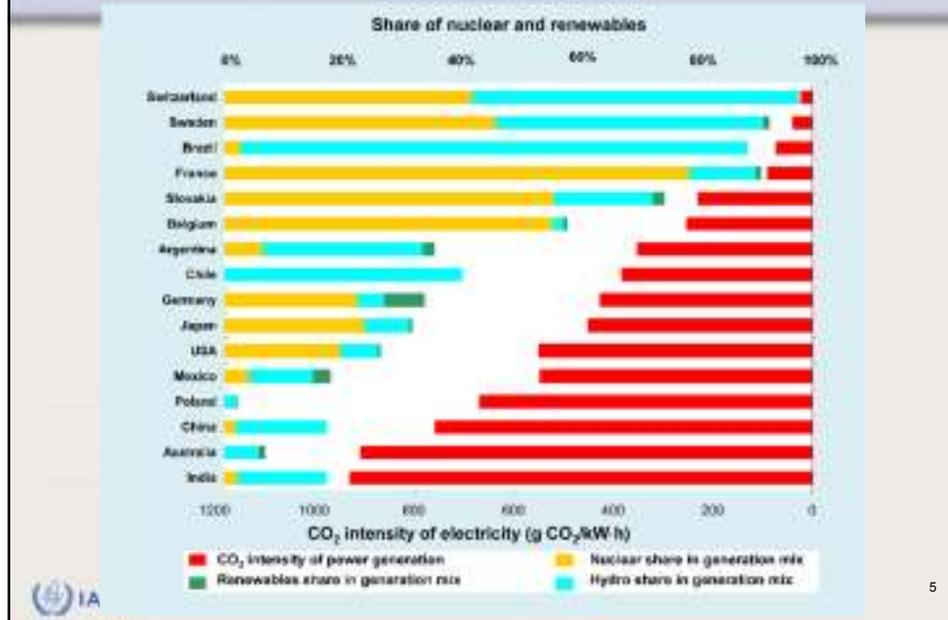
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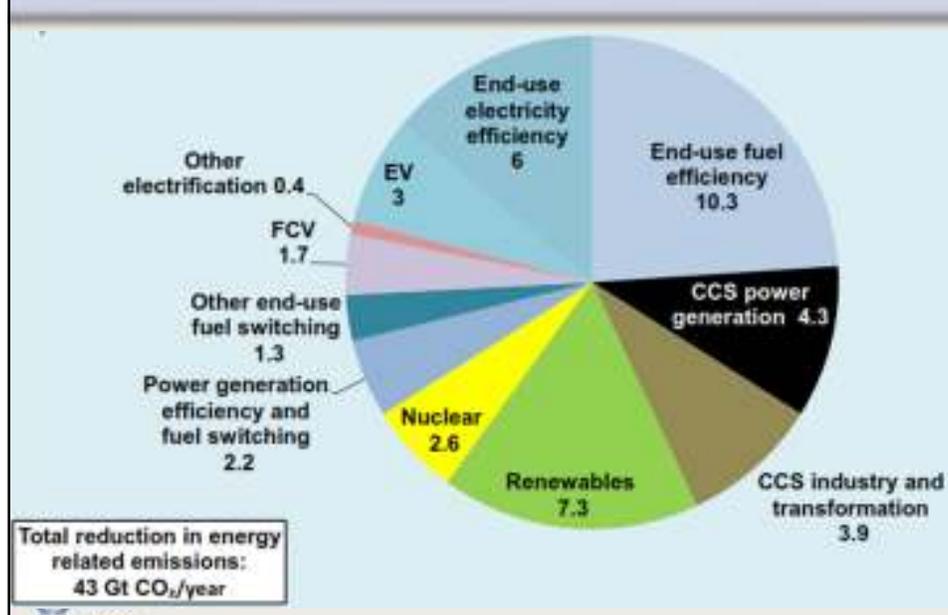
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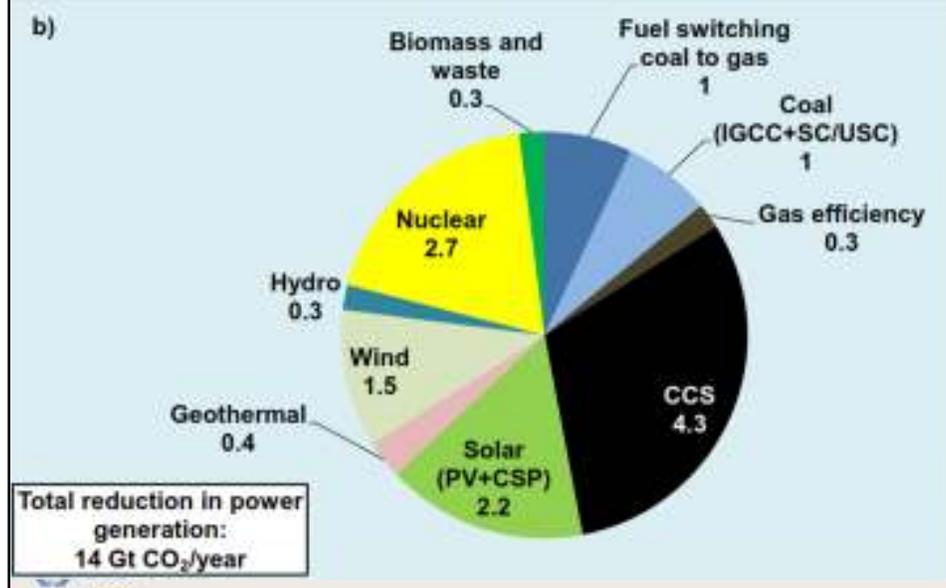


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1. Context: CC mitigation



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2. Comparison: economic aspects

Many differences:

- Quantities ($10^9 - 10^{10}$ t CO₂; 10^6 t RW)
- Hazardous features (modest vs high)
- Timescales ($10^2 - 10^3$ vs $10^5 - 10^6$ years)
- Geological media (sedimental vs hard rock)
- Site engineering (oil/gas well vs mining)

2. Comparison: economic aspects

Many similarities:

- Exploration
- Safety concerns
- Monitoring needs
- Regulation
- Liability
- Public acceptance

Learning from both differences and similarities

2. Comparison: economic aspects

Economics:

CO₂: Bringing home a global externality: cost + close

RW: Storage and disposal internalized

Leakage:

CO₂: CC: even a few %/year OK (vdZwaan-Gerlagh)
some local risks

RW: no leakage tolerated (rare: sufficient dilution)

cost jump: near perfect to perfect containment

2. Comparison: economic aspects

Space ownership: same as surface area or different

CO₂: disperses to large distances from injection

RW: small, well-known extent

Space constraint – scarcity rent

CO₂: few decades, century: Hotelling rent

RW: small quantities/large suitable space: non-issue

Backstop technologies:

CO₂: mineralization – expensive

RW: closing the fuel cycle: fast reactors

Both: efficiency, renewables



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2. Comparison: economic aspects

Costs: Timing of disposal investments

CO₂: invest before, recover from avoided carbon costs

RW: set aside during operation, store for decades, invest in R&D + construction

Costs: Estimates disposal only - published sources

CO₂: 0.105 US¢/kWh (Dooley et al. – LDC) to
2.716 US¢/kWh (Pöyry – oil/gas fields)

RW: 0.036 (Rep) – 0.092 (Dir) US¢/kWh (Belgium) to
0.298 US¢/kWh (USA)

Accounting and cost classifications often unclear



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2. Comparison: economic aspects

Costs: Estimates back end of fuel cycle

CO₂: +++ capture costs are key, transport costs vary
 RW: disposal costs dominate (search, URL, safety case, site engineering), temp storage: minor

Costs: Uncertainties

CO₂: few pilot sites, small quantities → estimates
 RW: decades of experience, URLs → good basis

Costs: Unrecognized

Both: enhanced supply security → public good

2. Comparison: economic aspects

Costs: resource options

CO₂: indirect: EOR, EGR, CBMR – small fraction
 RW: resource itself; retrievability – potentially all

Regulatory issues:

CO₂: carbon tax, permit trade, tech. standards, C&C
 RW: strict technology standards

Key for both:

clear and comprehensive policies
 stability of regulatory system

2. Comparison: economic aspects

ΣΣ: many factors influence relative costs of
CCD and RWD
balance depends on local/regional conditions

Feasible strategy will also depend on other aspects

3. Other socio-economic aspects

Legal issues, here: liability

Public perception/acceptance

Ethical issues

Psychological perspectives

Managing Liability: Comparing Radioactive Waste Disposal and Carbon Dioxide Storage

**Long time horizons:
public/government liability**

Public Acceptance of Geological Disposal of Carbon Dioxide and Radioactive Waste: Similarities and Differences; DADA, BANANA

Comparative Ethical Issues Entailed in the Geological Disposal of Radioactive Waste and Carbon Dioxide in the Light of Climate Change

Intergenerational equity;
- Risks inherited
- Uncertainties involved

Psychological Perspectives on the Geological Disposal of Radioactive Waste and Carbon Dioxide

Risk perception and acceptance

4. Summary and conclusions

CO2 disposal: only motivation: CC mitigation

Immense volumes: IEA/ETP by 2050: 8.2 Gt Ene-related
>50% (4.3 Gt) from the power sector

RW disposal: same motivation: separate from biosphere

Smaller quantities: < 1 Mt of HLW

Disposal options CO2:

- with revenue to reduce costs: EOR, EGR, ECBMR
- largest potential: deep saline formations (off/onshore)
- depleted oil and gas fields: capacity limited

Disposal options RW: - potential resource

 sedimentary (soft) and hard rock: large capacities

4. Summary and conclusions

CO2 economics:

internalizing a global externality → new cost item

RW economics:

never considered an externality → part of costs

CO2 timing:

up front investments, returns from operation

RW timing:

funds from operation, disposal later

Key for both:

Clear and comprehensive policies → stable regulation

