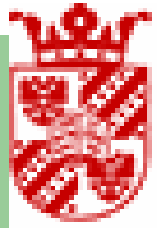
Incentives for Carbon Capture and Storage



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Position of CCS

- Given the goal of the NL Govt. (-30% GHG in 2020) CCS will be necessary as a 3rd option besides energy efficiency and renewables (excl. nuclear)
- Certain elements of CCS tech./processes need improvement or are not (yet) considered proven technology (e.g. IGCC and certain cap. techs) or safe and reliable practice (i.e. geological- and other forms of storage)
- Economics of CCS still unclear

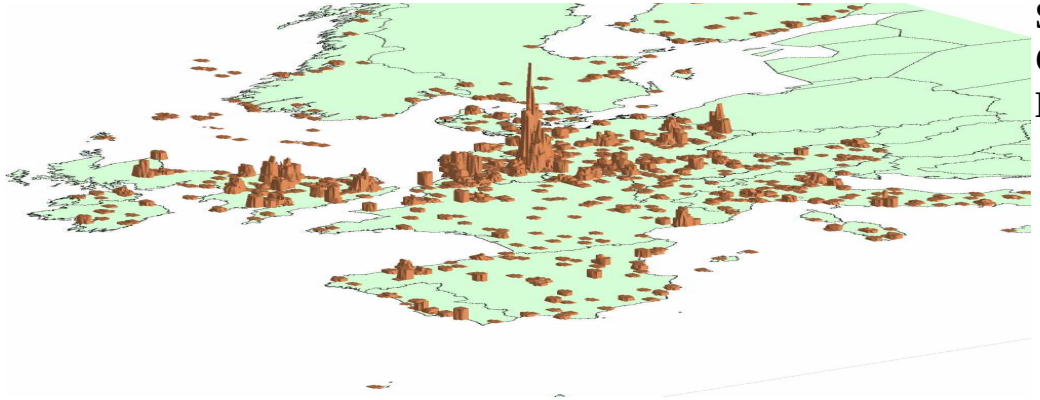
CCS options

Capture	Transport	Storage
• Pre-combustion • Post-combustion • Oxyfuel combustion • Industrial processes	• Pipeline • Ship	• Geological • Ocean • Mineral carbonation • Industrial uses

- Capture; various types of membranes, chemical absorption/looping and other separation techs.
- Transport; pipeline and ship, but also rail and truck can be considered in specific cases.
- Geological storage; empty hydrocarbon reservoirs, EOR, EGR or ECBM, aquifers or other geological cavities such as salt domes and rock formations.

10-12 EU large pilots need to differ!

Sources and Sinks



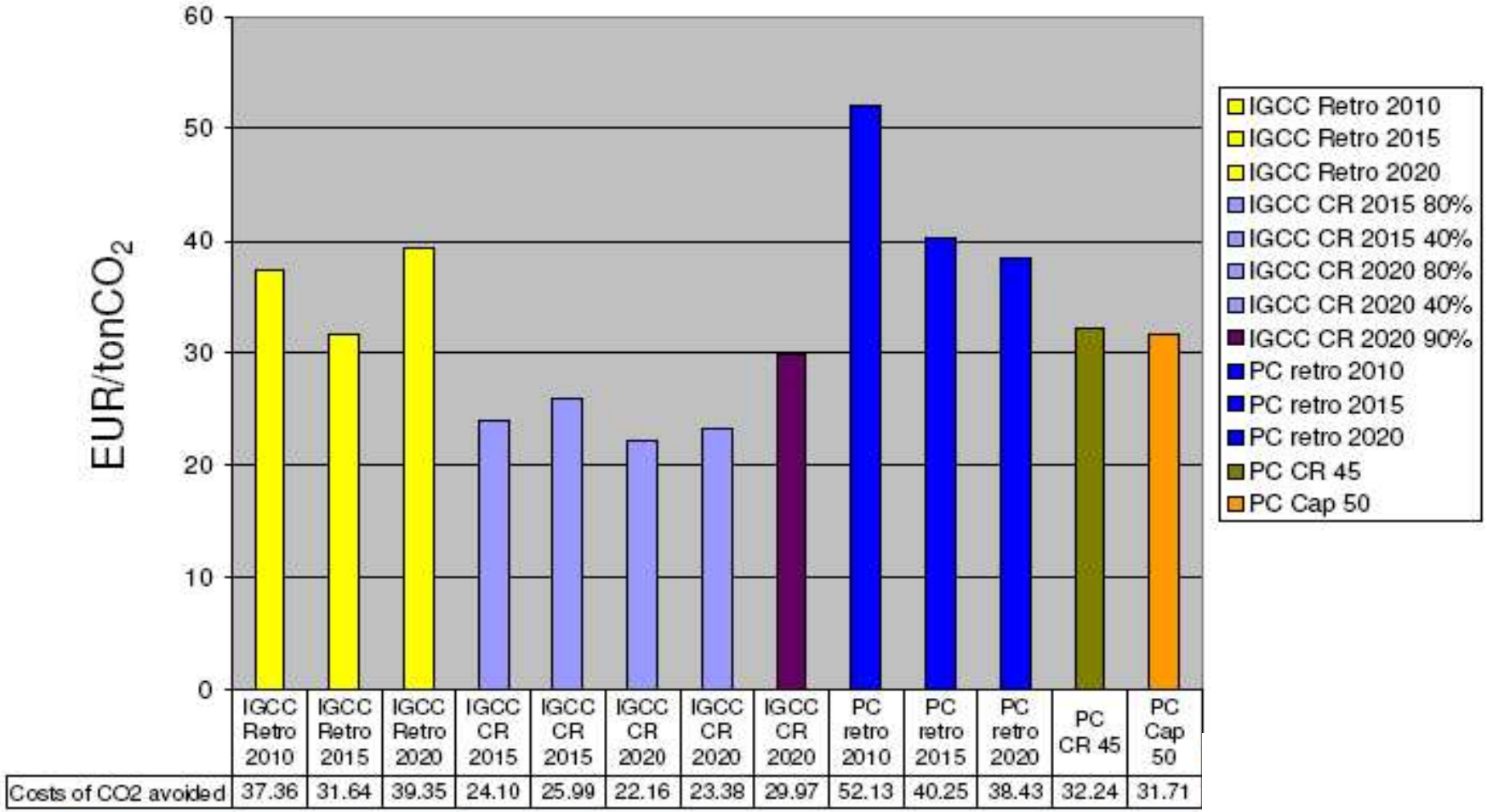
Source: IEA-GHG: Building the Cost Curve for CO_2-storage: European sector, London, 2005

Country	Oil fields	Gas fields	Total capacity	Annual point source	Number of years storage capacity
	(10^6 t CO_2)	(10^6 t CO_2)	(10^6 t CO_2)	(10^6 t CO_2)	(yr)
Denmark	176	452	628	29	17
Germany	103	2.227	2.330	393	5
Netherlands	54	10.907	10.961	96	88
Norway	3.453	9.156	12.609	23	422
UK	3.005	7.451	10.456	218	37
Totals	6.791	30.193	36.984	218	

Source: Gestco-project, summary report november 2004.

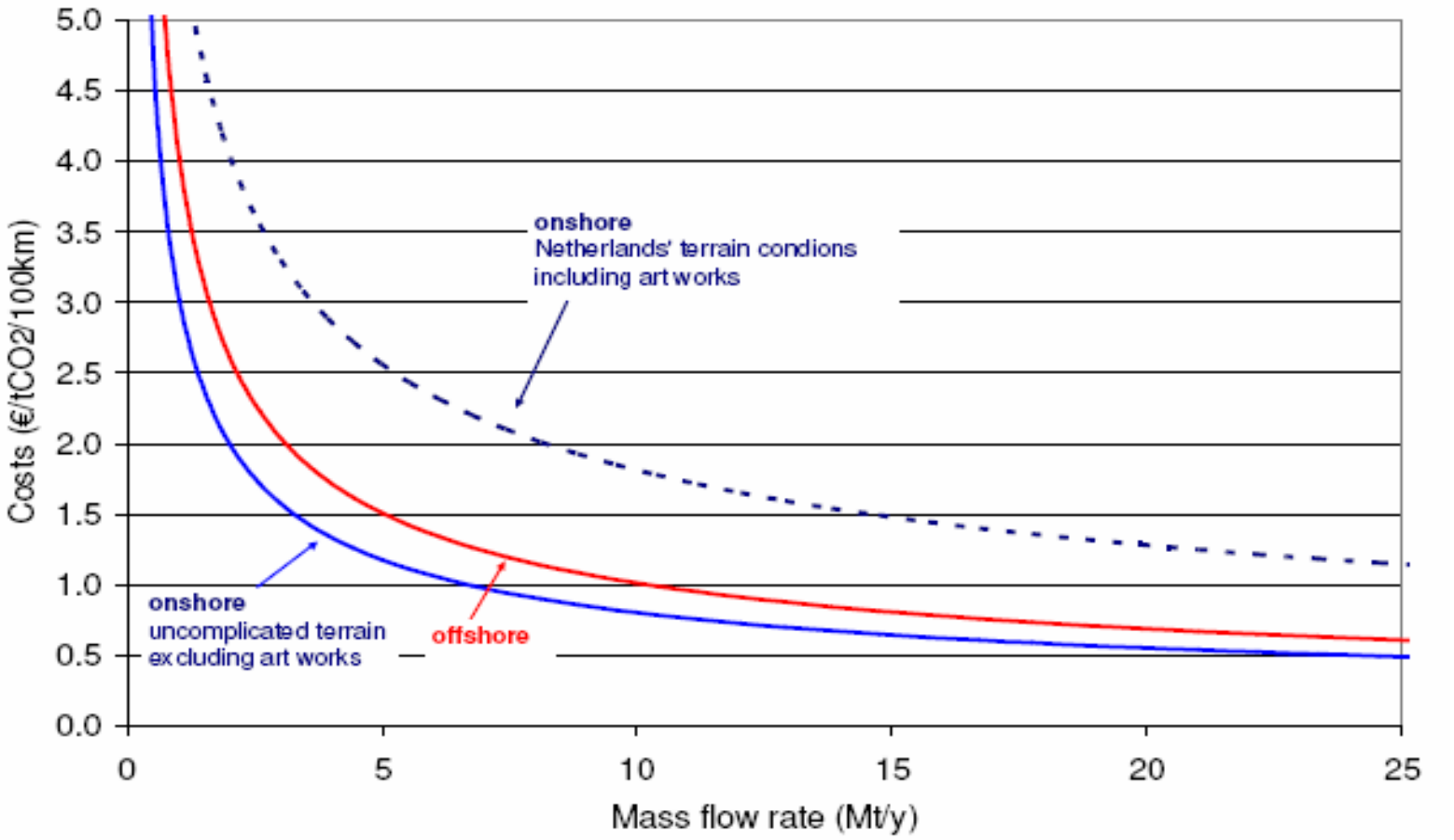
(Note excl. Aquifers → Utsira formation; Sleipner)

Costs of CO_2 avoided (Kema, 2006)



	IGCC Retro 2010	IGCC Retro 2015	IGCC Retro 2020	IGCC CR 2015	IGCC CR 2015	IGCC CR 2020	IGCC CR 2020	IGCC CR 2020	PC retro 2010	PC retro 2015	PC retro 2020	PC CR 45	PC Cap 50
Costs of CO2 avoided	37.36	31.64	39.35	24.10	25.99	22.16	23.38	29.97	52.13	40.25	38.43	32.24	31.71

Costs of CO_2-pipeline transport



Source: Ecofys, 2006

Some CCS aspects

- Incentives
  - Crediting; EU-ETS/CDM and CCS *(may CCS installation receive additional allowances?)*
  - Taxes and subsidy schemes
  - Non-tariff measures (Environmental Impact Assessment and streamlining of other procedures)
  - R&D funding/schemes)

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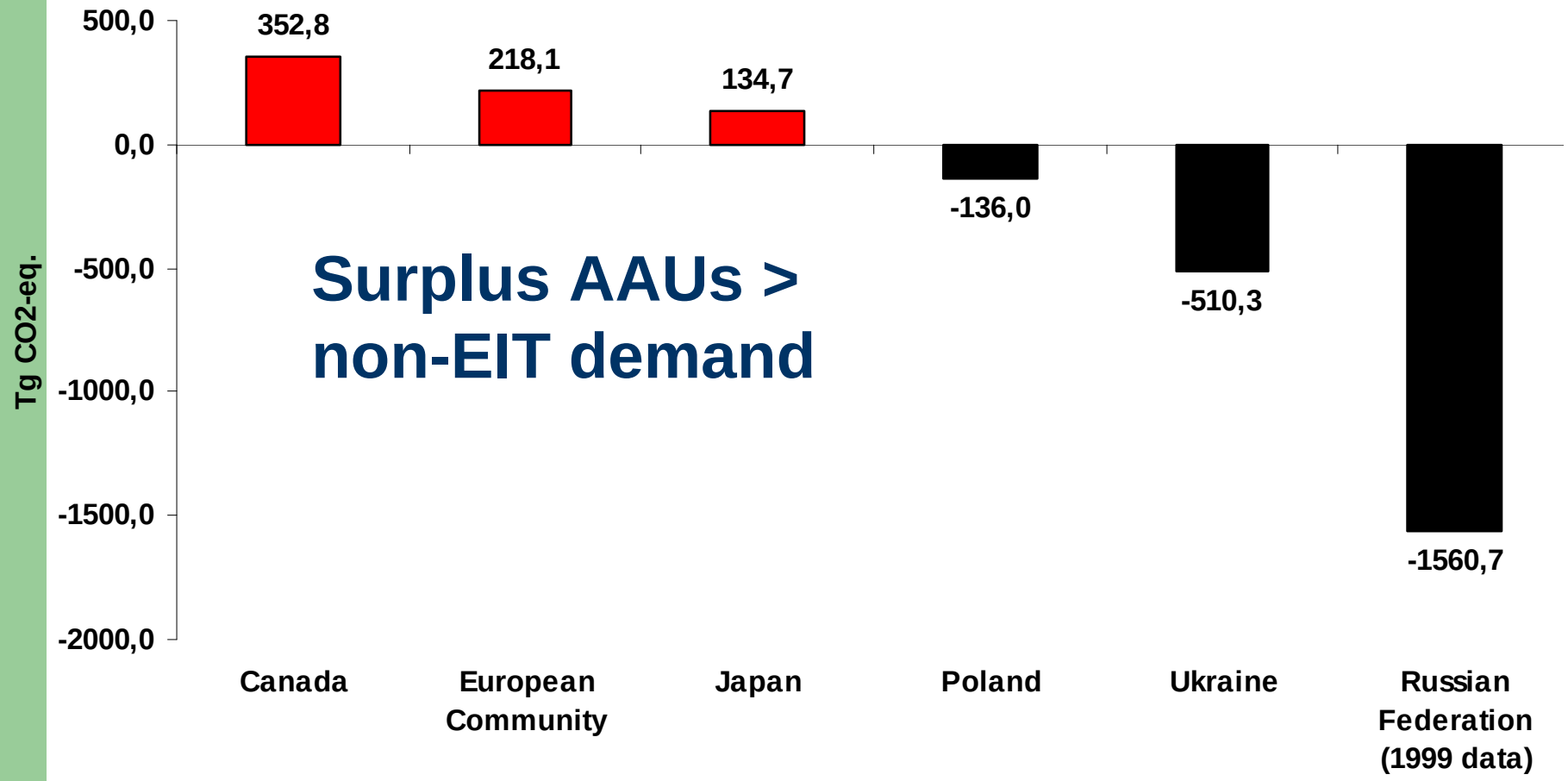
Change in GHG emissions
Selection (LULUCF included, 1990-2004)



Surplus AAUs > non-EIT demand

Source: Based on UNFCCC, 1990-2004.

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Balancing supply & demand

Projected supply, CDM	3.0 billion CERs
Projected supply, JI*	0.1 billion ERUs
AAUs**	2.7 billion AAUs
GIS	?
Total projected supply	**5,8** billion

Proj. CER demand (Haites, 2004)	1,25 billion CERs
Max. EU Demand (estimate)	*1,70 billion CERs*
Total demand (as per 2004)	**3.6** billion

* **Based on 100% registration/issuance of JI projects currently in the pipeline.**

** **Based on restricted sale of AAUs to increase revenues (Haites, 2004).**

Future EU-ETS

- Information asymmetry allocation problem remains
- Risk of lasting credit market volatility
- No clear direction of credit price trend
- Credit prices perceived by industry as politically rather than market driven
- Risk of postponing investment in sustainability

Conclusion

- For speedy introduction of CCS, the EU-ETS may not be the best instrument
- Alternatives are a combination of taxation and subsidies, possibly combined with command and control based on benchmarking