

Rothkopf-Concept

GmbH

Carbon Capture and Storage (CCS)

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Political Targets

April 2007

G: Carbon dioxide reduction by 40% until 2020 (Basis: 1990)

EU: Reduction by at least 20 % until 2020

HOW?

Improve share of renewable energies until 2020 (actual in 2005):

Heat:	14 %	(5.4 %)
Electricity:	27 %	(10.2 %)
Fuel:	17 %	(3.4 %)

AND

Further option: Carbon Capture and (underground) Storage (CCS)

Gesetz zur Abscheidung, Transport und unterirdischen Lagerung (KSpG)

Actual

3 000 billion tes of CO₂ (770 billion tes of carbon) are processed within the system „world“

app. 27 billion tes of CO₂ (1%) per year are added by emissions

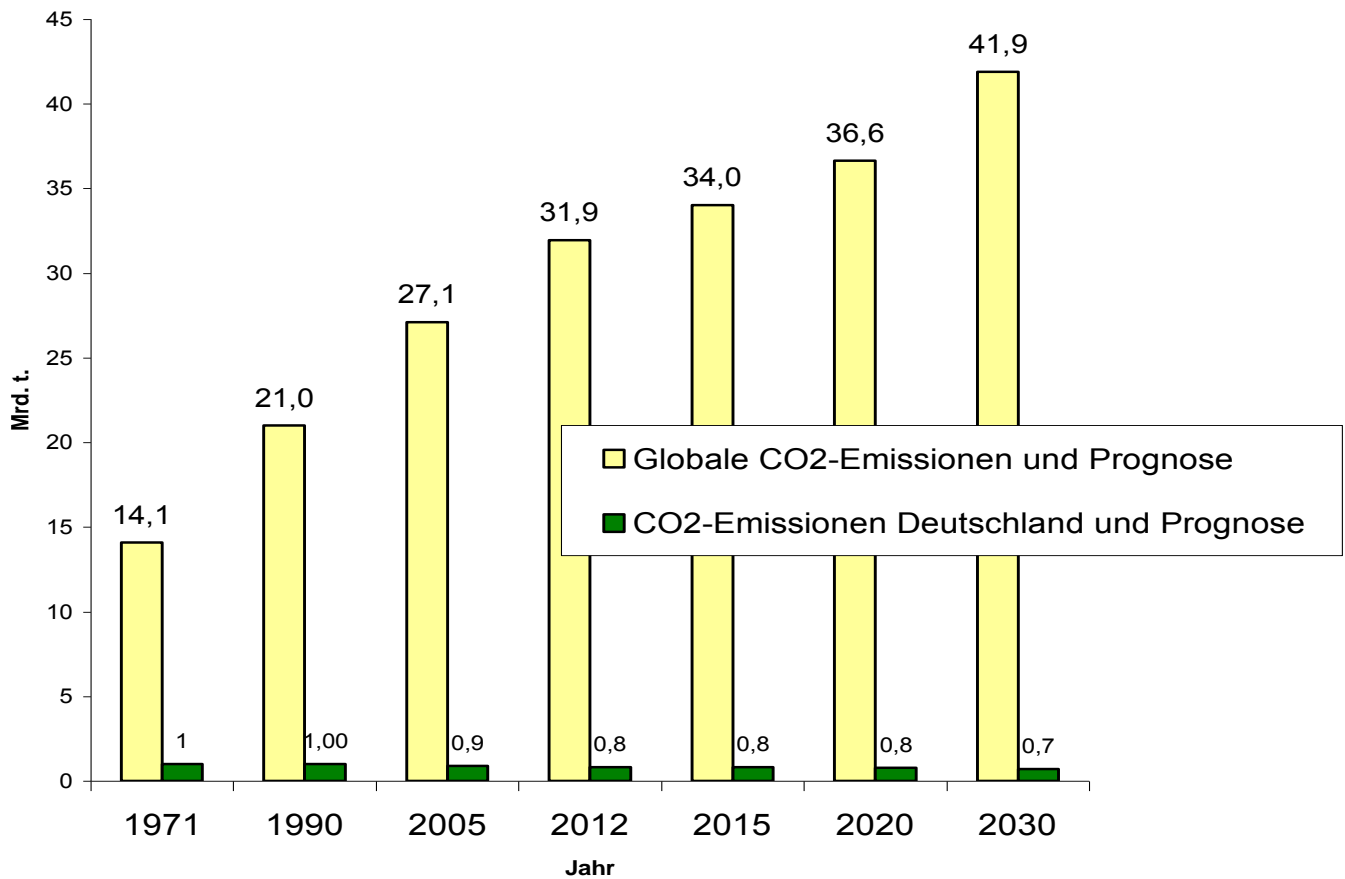
45% remain in atmosphere, 55 % absorbed in natural sinks (sea, biomass)

870 million tes (3.2 %) per year in Germany

480 million tes per year by industry and energy production

Facts and Figures II

Development of CO2-Emissions



Source: Bundesministerium für Wirtschaft und Technologie (MR Werner Ressing)

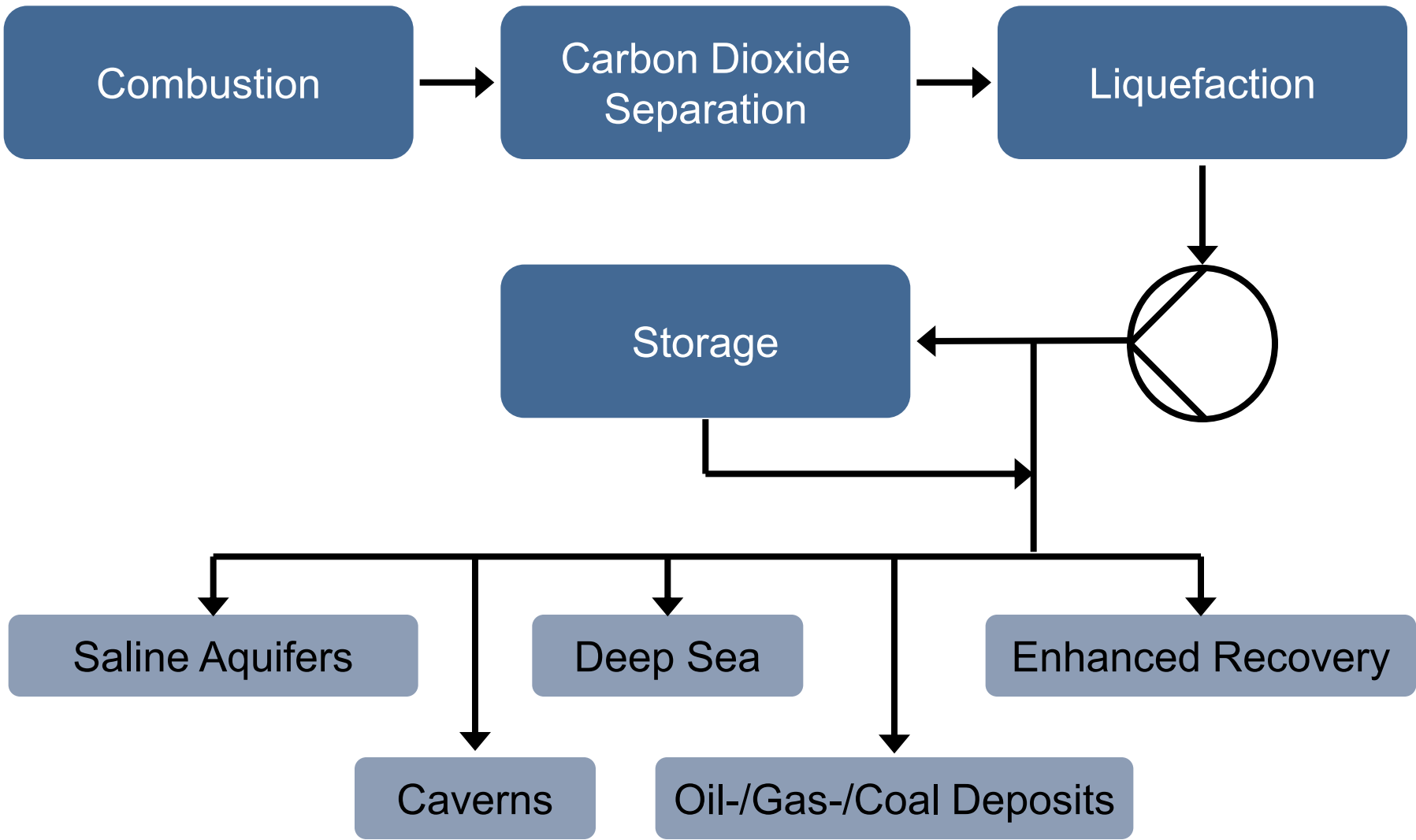
In summation

CO₂ - increase is a global issue and cannot be solved locally

Any achievement on the reduction targets for Germany or EU will be compensated within some weeks!

Responsible allocation of resources should maximise their return!

Sequestration



Carbon Capture and Storage

1.4.2009

Deals with: Separation, Transport und Storage of Carbon dioxide

Political Targets:

- Comply with European legislation (CCS-RL Jan. 2008)
- Test / demonstration of the necessary technical issues in pilot plants
- Exploration of suitable (geological) deposits
- Secure improvement/revamp of existing energy plants (coal / lignite)
- Secure environmental friendly energy supply based on coal / lignite
- Reduce dependency from foreign energy suppliers
- Secure technological leadership for future engineering demands
- Clarification of future responsibilities / liabilities for the safety of the storage facilities

Target

Improvement of climate change by reducing carbon dioxide in atmosphere

Issues of Sequestration

Carbon dioxide transportation (ship, pipeline, lorry, intermediate storage)

Exploration of suitable and safe deposits

Sequestration will not be ready for industrial use within the next 10 – 15 years

Capacity of geological deposits in Germany is limited (app. 80 years)

Unknown (long term) behaviour of carbon dioxide in the deposits

Long term tightness of storage facilities needs to be secured

Further intense research work necessary

Consequences

Loss of efficiency of the energy production units: 6 -15 %

Additional coal input (up to 20%) to maintain output

Costs for sequestration: 40 – 90 €/t Carbon dioxide

Subsidies available from EU / G: app. 1 billion €

Long term responsibilities / Costs for the deposits („Ewigkeitsproblem“)

Obstruction of storage capacities/ different usages for future / other purposes

Acceptance (and KNOWLEDGE about costs involved) by the population



Consequences

Billions of € spent for the burial of waste

Billions of € spent in Germany and in EU for no significant reduction

End-of-pipe technology

Limited lifetime of deposits

Wrong allocation of resources and
wrong investment into obsolete infrastructure

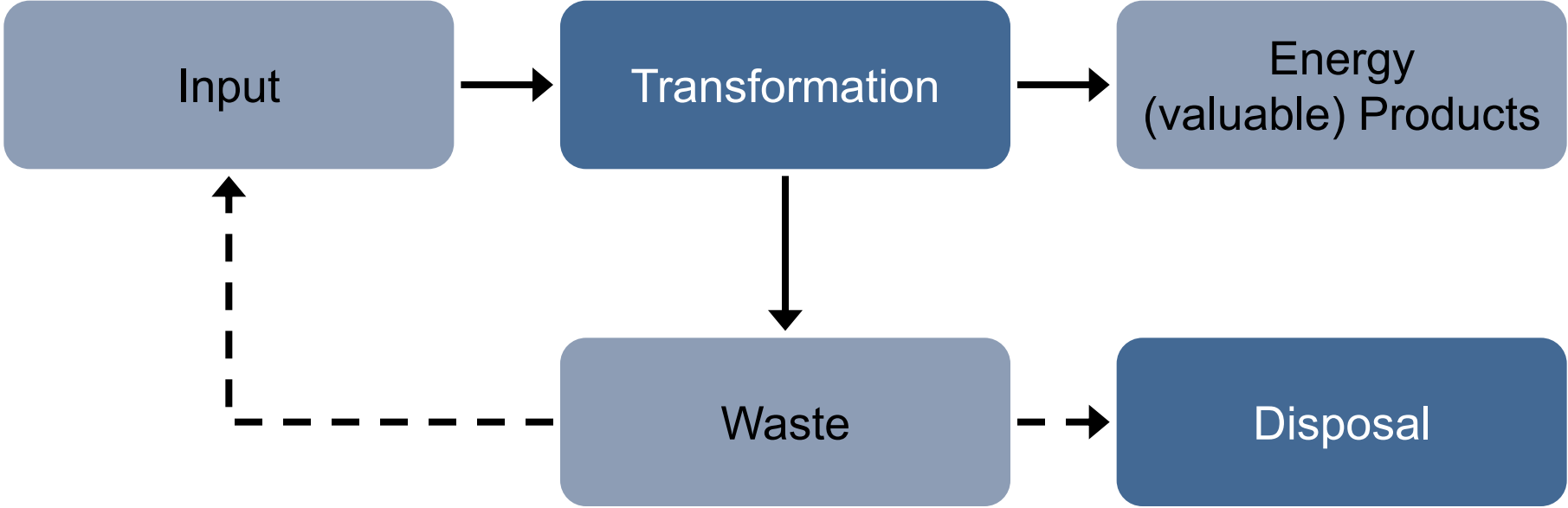
Wrong allocation of perception and attitude

CCS is economically not feasible and no sustainable solution!

Pragmatic perspective

Very cold economic reasons are recommending the reduction of CO₂ – emissions

By processes which add value



1 Intelligent usage of carbon dioxide for the production of value added products

Utilisation by

- Chemical processes
- Biochemical processes
- (Artificial) photosynthesis
- Polymerisation



- Fine chemicals
- Bulk material
- Polymers
- Fuel
- Biogas

2 Reduce carbon input into energy production systems More sustainable use of carbon containing resources (oil, gas, coal)

Present energy mix:

- Fossile materials 77 %
- Biomass 11 %
- Other renewable energies 5 %
- Nuclear 7 %

Reserves:

- Oil 50 years
- Ressources: 70 years
- Gas 65 years
- Coal 200 years
- Uranium 45 years

Conflicting area

- Carbon Capture and Storage in Germany and Europe is a burial of money
- CCS supports a wrong allocation of resources
- CCS is not sustainable


However, CO₂ – emissions must be reduced because

- the availability of fossil raw materials will be limited in the future
- these raw materials will be needed for „non energy processes“
- Carbon dioxide should not be regarded as „waste“ but as valuable input material:

Think out of the box:
Carbon Capture and Utilisation (CCU)

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Thank You For Your Attention

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