Eighth Annual Conference on Carbon Capture & Sequestration

Decision Making Tools/Criteria

A revised estimation of CO2 storage capacity in North American Gas Fields

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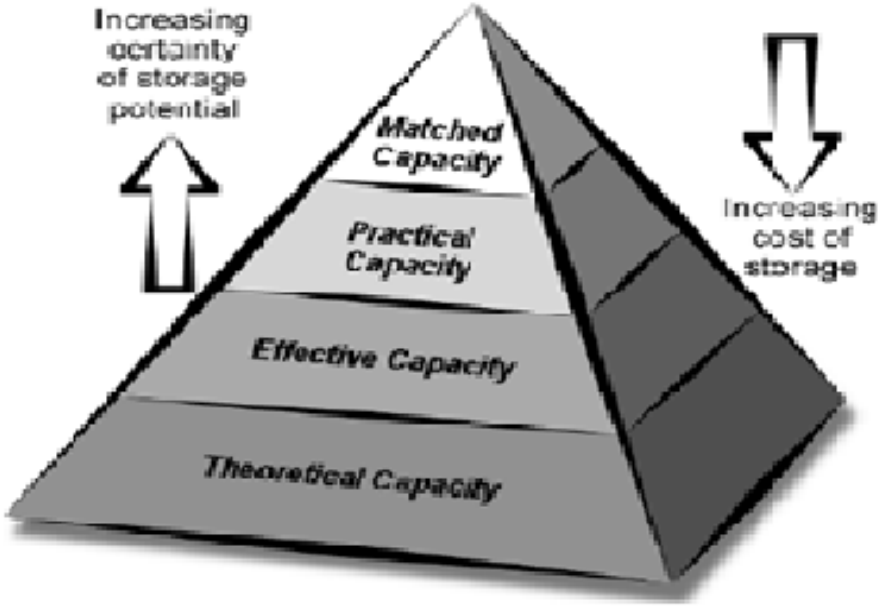
Contracting Parties and Sponsor Organisations of IEA GHG

Background

- Depleted gas fields offer significant potential advantages for CO_2 storage
- Previous IEA GHG studies:
  - in 2000 estimated 797Gt global capacity
  - in 2004 estimated 39Gt effective capacity in USA/Canada
- Study undertaken by Poyry Energy Consulting, in association with Element Energy and BGS, starting in April 2008
- Main aims of the study were twofold:
  - Re-assess global storage capacity of depleted gas fields
  - Derive cost curves for storage in depleted gas fields

CSLF Resource Pyramid



Limitations of Study

- High level data sources due to global context:
  - USGS 1995 world and US petroleum assessments
  - 2008 AAPG Giant Fields Atlas
  - IEA GHG point source emission database
- Study necessitated use of many generic factors and simplifying assumptions
- Regional results must be treated with caution

Basic Storage Capacity Assumptions

- Fields will be refilled to original pre-production pressures, but not above
- Total recoverable gas reserves converted to CO_2 storage capacities using gas expansion factor of 200 and injected CO_2 density of $0.7 t/m^3$
- Global nature of study necessitated many simplifying assumptions and generic factors

Storage Capacities from USGS Data

- USGS national and world datasets from 1995 used to estimate theoretical, effective and practical storage capacities
- USGS data not field-specific
- Allowances made for associated gas in oil fields, reserve growth and undiscovered reserves

Global Storage Capacities from USGS Data

- ***Theoretical capacity*** calculated by simple conversion of total recoverable gas reserves – ***870Gt***
- ***Effective capacity*** estimated as 75% of theoretical, to allow for technical factors – ***650Gt***
- ***Practical capacity*** reduced by 40% from effective to allow for uneconomic field sizes and by a further 1% to allow for unsuitable sites due to probability of leakage – ***390Gt***

Regional Capacities from USGS Data (Gt)

Region	Theoretical	Effective	Practical
N America	**75**	**56**	**33**
Asia-Pacific	100	75	45
South America	60	45	27
Europe	83	62	37
Former Soviet Union	340	260	150
Middle East & Africa	240	180	110
TOTAL	**900**	**680**	**390**

Matched Storage Capacities

- Source data: IEA GHG point source emissions and AAPG Giant Fields Atlas
- Source-sink matching exercise using a GIS-based network connection algorithm
- Assessment made on decade-by-decade basis with estimated close of production (CoP)
- Fields closing after 2050 or shallower than 800m discounted

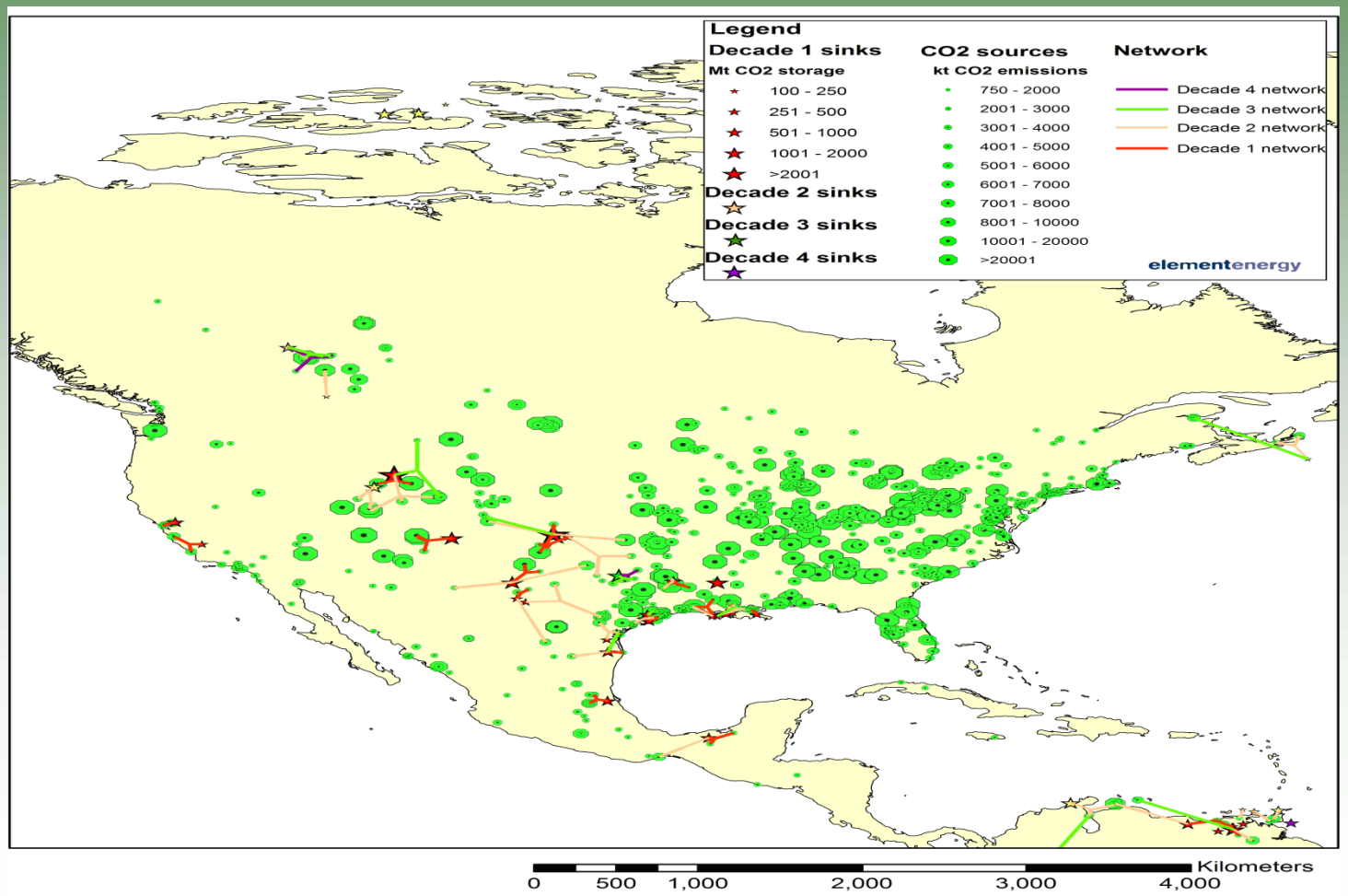
Source-sink matching

- GIS-based algorithm used to undertake source-sink matching exercise
- Sinks allocated by decade according to estimated CoP
- Up to 3 sources allowed to connect to each sink per decade, provided capacity sufficient
- Matching based on technical/economic factors, not geopolitical

Matched Regional Capacities (Gt)

Region	By 2020	By 2030	By 2040	By 2050
N America	**11**	**15**	**17**	**17**
S America	2	5	6	8
W Europe	4	9	11	11
E Europe	7	21	38	47
Middle East	6	25	32	33
Africa	1	11	13	13
Asia/Oceania	2	5	19	28
TOTAL	**33**	**89**	**140**	**160**

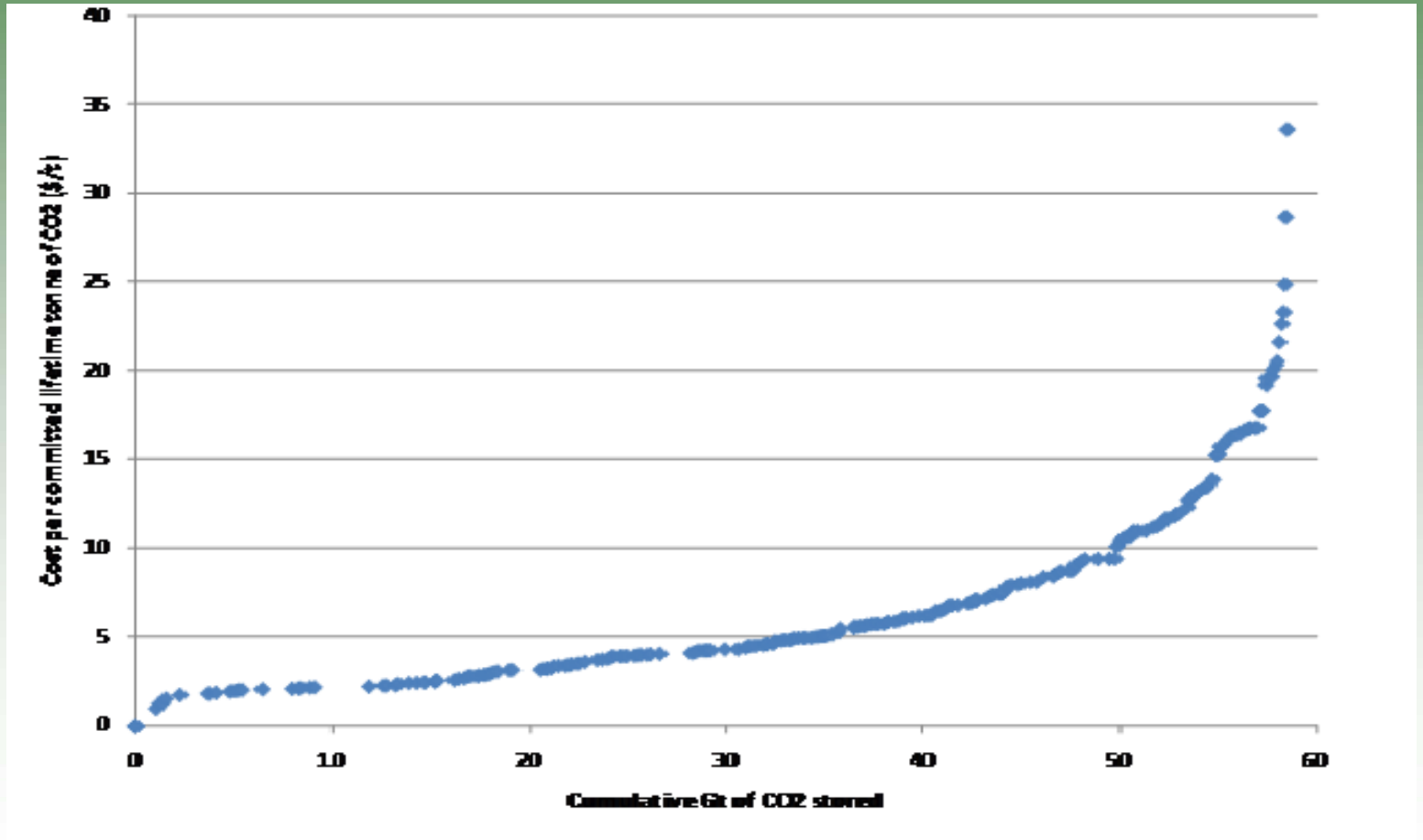
North American Source-Sink Matching



Storage Costs

- Matched source-sink connections used to estimate transport and storage costs
- New infrastructure assumed
- Pipelines mapped as straight lines but costs estimated on 1.25x route length
- Geopolitical factors not considered
- North America: 8Gt capacity <$5/t by 2050

Cost Abatement Curve



North American Capacity and Costs

- Matched capacity 17Gt by 2050, costs under $10/t (under $5/t for first 8Gt)
- Study could be refined with better data and assumptions:
  - Gas production and remaining reserves
  - Forecast reserve growth
  - Undiscovered gas resources
  - Appropriate field capacity cut-off

Conclusions

- Study has provided fresh perspective on storage potential of depleted gas fields and use of resource classification schemes
- Matched global capacity of 160Gt may be more realistic than previous estimates
- Some assumptions conservative, so 50Gt capacity <$10/t emphasises important economic potential of CO_2 storage in gas fields

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