Geological Storage Capacity Assessment at a Country Level

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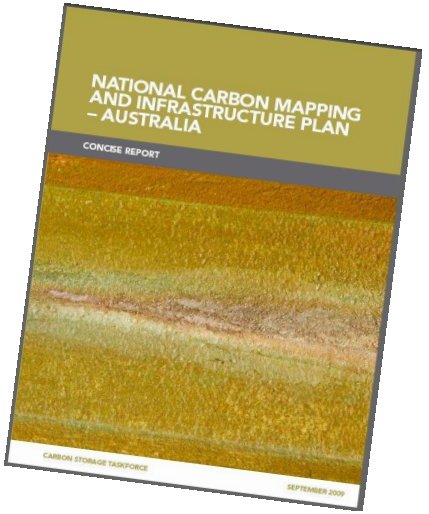
High Level Country Scale Assessments

- Conducting a detailed assessment of a country's storage potential is the first step in moving to a an efficient and coherent CCS or BECCS strategy.
- Around 30 countries have carried out and published such assessments including:
- Brazil, South Africa, Japan, Mexico, Australia, South Korea, USA, Canada, Netherlands etc



Qualitative versus Quantitative Assessments

- The first stage in making in making a country wide assessment is to make a qualitative assessment of the sedimentary basins within a country's borders., that's which are assessed as good for storage versus which are seen as being poor – generally done by expert assessment.
- The second , very important stage is to attempt a quanitative assessment – that is how much carbon dioxide do we think the good basins can store – must be done by detailed analysis.

The storage Potential Of Indonesia

Studies that include Indonesia as part of South-Eastern Asia as a whole.

1. APEC 2009 – CO2 Storage Prospectivity of Selected Sedimentary Basins in the Region of China and South East Asia
2. GEOGREEN 2010 – UNIDO CCS Technology Roadmap on CCS in Industry

Study focussed specifically on Indonesia

1. Indonesia CCS Study Group – Understanding Carbon Capture and storage Potential in Indonesia

These studies briefly discuss the quality of some of Indonesia's sedimentary basins for geological storage – but none of them address the storage potential of the deep saline aquifers quantitatively.

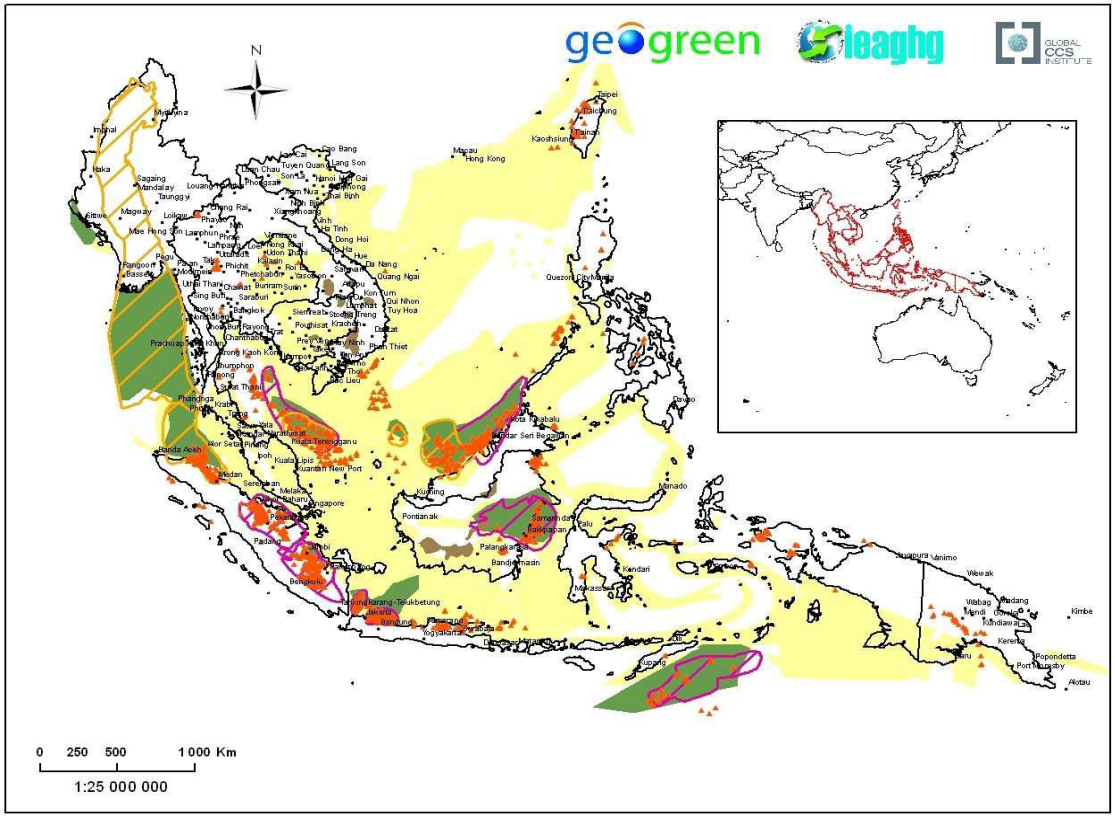
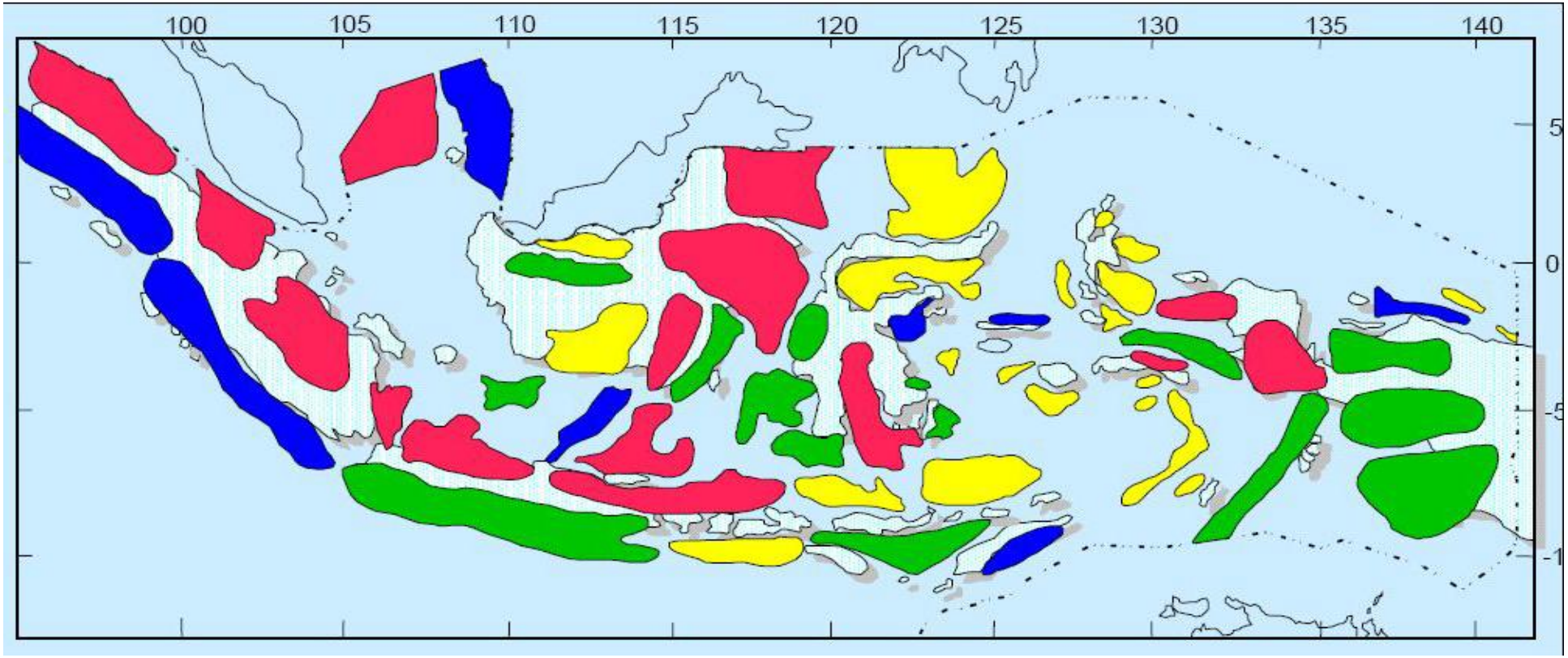


Figure 59: Storage resource in South–East Asia: deep saline formations and oil and gas fields

Qualitative Storage as described in Geogreen Report



Distribution of Indonesia's Oil and Gas Basins in the Indonesia CCS Study Group Report

Indonesia CCS Study Group 2009

Capacity assessment in 6 basic steps

1. Identify all the sedimentary basins within the region to be assessed.
2. Rank basin in terms of perceived prospectivity (expert panel)
3. Estimate the volume of the formation to be used as the reservoir.
4. Estimate the average pore volume of the formation.
5. Estimate the density of the CO_2 at formation depth.
6. Estimate the percentage of the pore volume that the CO_2 will pass through when it is migrating or occupy
when it becomes stationery.

The Need for International Consistency and Intercomparability.

- A 2007 study of storage reserve estimates (Bradshaw et al 2007) showed that because of inconsistencies in the calculation methodologies adopted the reserve estimates arrived at varied wide so widely that some world estimates were smaller that some regional estimates.

- Although a number of methodologies have been published since then there is no global agreement on the most suitable one to use.

- The IEA is working to prepare a set of Guidelines on Storage Assessment to guide Nations who are coming new to this issue

Deterministic or probabilistic estimation

- Deterministic assessment multiplies single values for the storage parameters and presents the result as a best estimate.
- Probabilistic assessment multiplies ranges of values and presents the result as statistical distribution:

  P10-P50-P90

- Probabilistic assessment best presents the uncertainties inherent in the assessment.

Key recently published methodologies

DOE 2006	**USDOE Capacity and Fairways Sub-group – Regional Carbon Sequestration Partnerships**
CSLF 2007	**CSLF Task Force for Review and Development of Standard Methodologies for Storage Capacity Estimation**
CO2CRC 2008	**Generally based on the DOE methodology**
USGS 2003/2006	**Specific sequestration Volumes. A useful tool for CO_2 Storage Capacity Assessment**
IEA/EERC 2009	**Summary and overview of CSLF, DOE and other methodologies, Calculation of storage coefficients in the context of the resource pyramid.**
CGSS 2010	**Methodology developed for the 2009 Queensland CO_2 Geological Storage Atlas. Requires depth of data from Basin**
USGS 2010	**A probabilistic Assessment methodology for the Evaluation of Geologic Carbon Dioxide Storage.**

DETERMINISTIC

PROBABILISTIC

The Need for a Consistent Approach

The need for a internationally consistent approach was recognised in the IEA CCS Technology Roadmap 2009

In 2010 the IEA held two expert workshops bringing together CCS experts from a number of geological surveys with observers from institutions such as EC, UNFC, OPEC, GCCSI etc to agree on a methodology to be proposed as the International standard.

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Objectives of IEA work

Stimulate and facilitate the international discussion

1. **A common estimation framework for countries**
2. **A sound methodology for arriving at a national-scale CO2 storage resource assessment that could be applied globally**
3. **A way forward to quantify what proportion of the resource is technically accessible at any particular cost**

Deliverable: Guidelines for storage capacity estimation

IEA Approach

- Geologically-based
  - Geological model
  - Trapping modes
    - Buoyant and residual trapping
- Transparent – methodology, assumptions
- Probabilistic – range of values to reflect uncertainty
- Regional estimates - not project site specific
- Based on USGS methodology

Schedule for report

- August 2012: Draft Guideline
- September 2012: Review and revision Guideline
- October 2012: Final version
- November 2012: Publication and presentation at GHGT-11 in Kyoto

Thank You For Your Attention

Some world estimates are smaller than some regional estimates

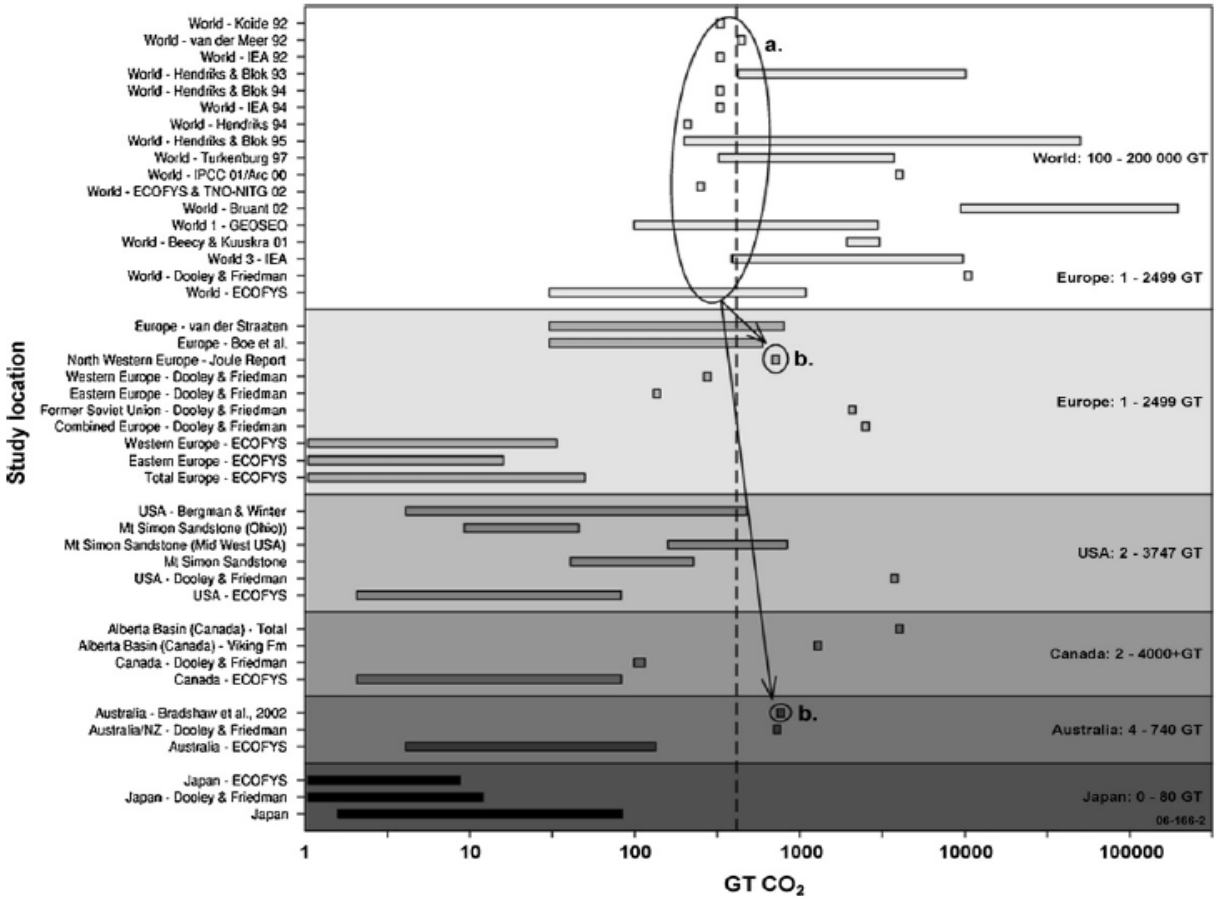


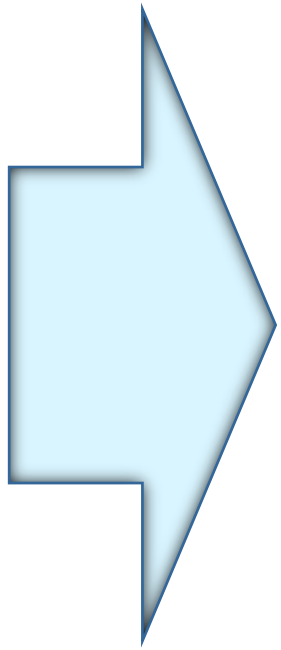
Fig. 1 – A listing of various estimates for CO_2 storage capacity for the world and regions of the world. Estimates are listed by region, and ordered internally by date of completion of the estimates. Note there are world estimates (a) that are smaller than some more "robu

From Bradshaw et al., 2007

Working towards an International standard

IEA CCS Technology Roadmap 2009

- Currently there is no uniform methodology to estimate geological CO2 storage capacity
- Each country or organization uses its own evaluation and estimation method



Recommendations

- Agree on a common global methodology for CO2 storage capacity estimation
- Perform a comprehensive assessment of worldwide capacity for CO2 storage