



IEA Greenhouse Gas R&D Programme



Oil and Gas Fields: an Opportunity for CO₂ Storage or Not?

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IEA Greenhouse Gas R&D Programme

19th World Petroleum Congress

Madrid

June 29th to July 3rd 2008





IEA Greenhouse Gas R&D Programme (IEA GHG)

- A collaborative research programme founded in 1991
- Main role: to evaluate technologies that can reduce greenhouse gas emissions
- IEA GHG is an implementing agreement of the IEA
- Activities financed by participants contributing to a common fund (US\$2.5m/annum)



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 OPEC ORGANIZATION OF THE PETROLEUM EXPORTING COUNTRIES



ALSTOM



BG GROUP



CEZ GROUP



ConocoPhillips



EniTecnologie



EPRI

ExxonMobil

REPSOL YPF



Schlumberger



Statkraft

StatoilHydro



TOTAL

VATTENFALL



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IEA GHG AIMS

- Objective evaluation of greenhouse gas mitigation options
- Provide a trustworthy source of technical information – studies reviewed by external experts
- Generate information that is policy relevant but NOT policy prescriptive
- Activities include funded studies, organisation of international research networks and GHGT conferences, participation in R&D projects
- Publications: Greenhouse Issues newsletter, International Journal of Greenhouse Gas Control (Elsevier), study reports available on www.ieagreen.org.uk



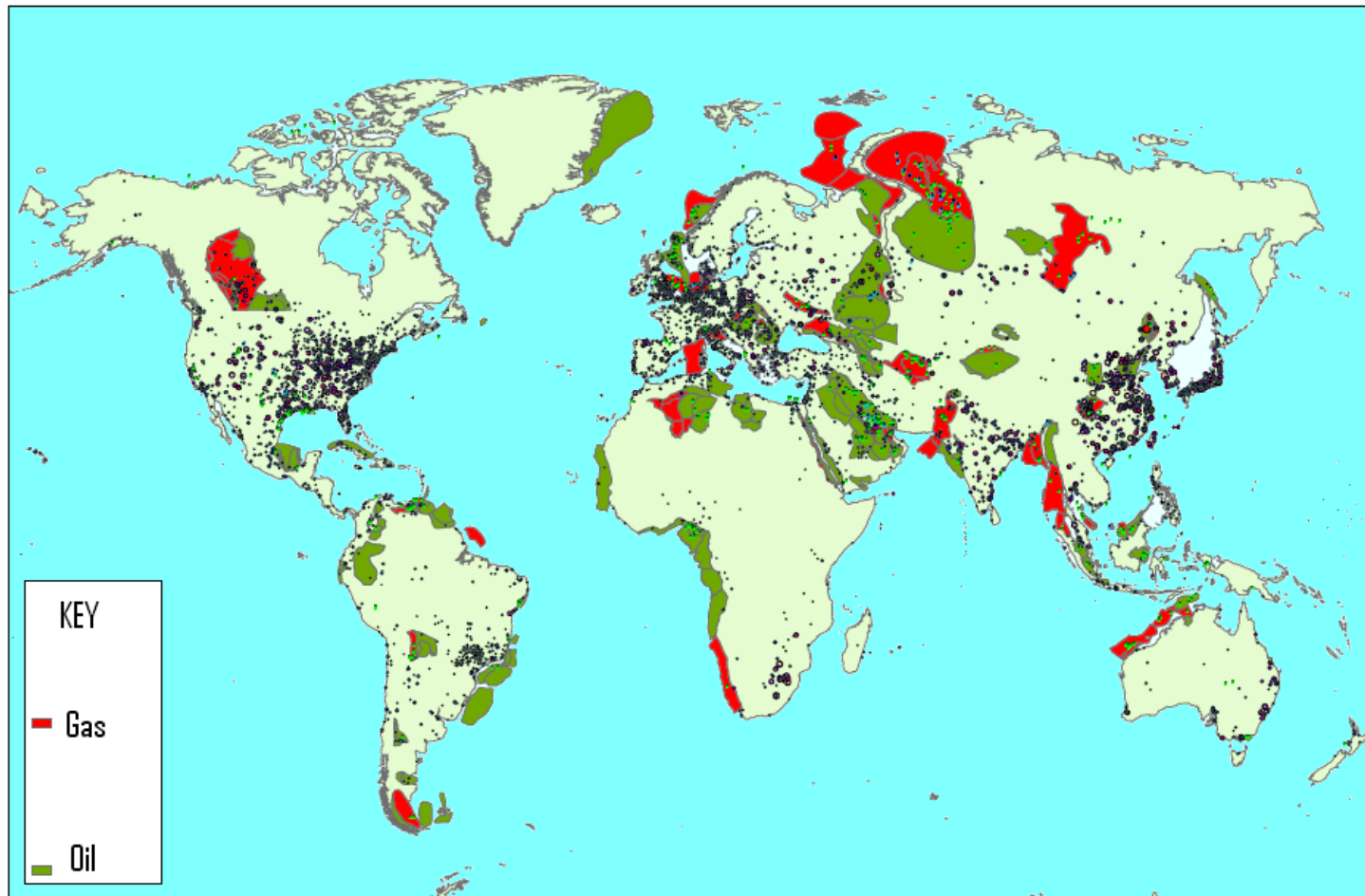
Worldwide Storage Potential

- IPCC Special Report on CCS
- Saline Aquifers – 1,000Gt to 10,000Gt CO₂
- Oil and gas fields – 675Gt to 900Gt CO₂

- IEA GHG Estimates
- Gas fields up to 1,000Gt CO₂
- Oil fields – average of previous estimates about 120Gt CO₂

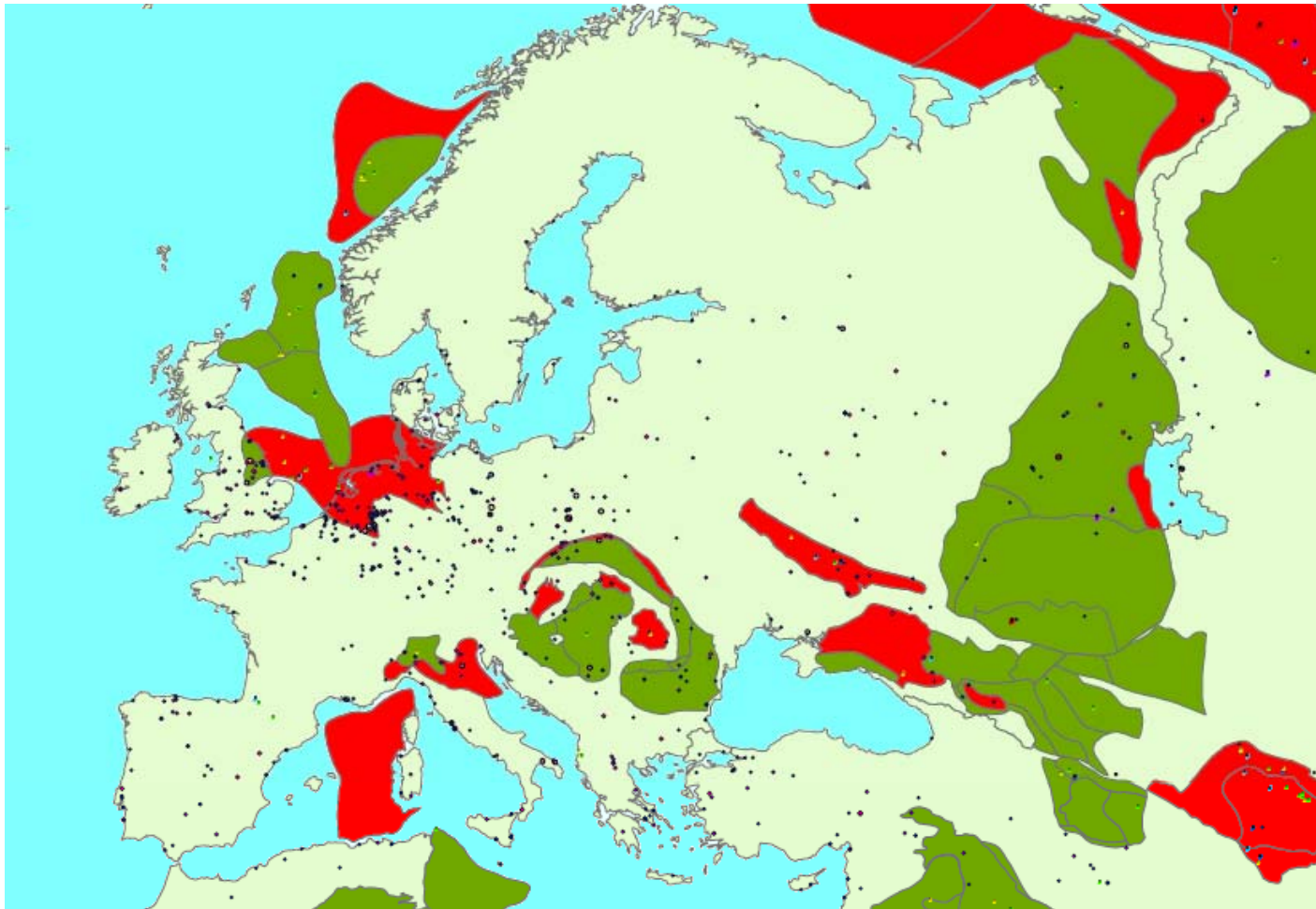


Major Petroleum Provinces





European Petroleum Provinces





Gas Fields – Major Issues

- Future increase in gas production from fields with high CO₂ content
- Relative distances from major point sources to many large gas fields
- Re-use of existing infrastructure
- Low potential of EGR, timing/availability issues
- Potential leakage mechanisms – caprock failures, old wells



Oil Fields and EOR – Major Issues

- High levels of EOR activity in Texas, Alberta
- Low levels of EOR application elsewhere
- Problems of matching CO₂ sources with EOR timing requirements
- Requirements for ‘buffer’ storage
- Infrastructure modifications
- Risks associated with leakage from old wells



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Monitoring CO₂ Storage in EOR Fields: IEA GHG Weyburn CO₂ Project, Phase 1



IEA GHG
WEYBURN-MIDALE
CO₂ MONITORING
AND STORAGE PROJECT

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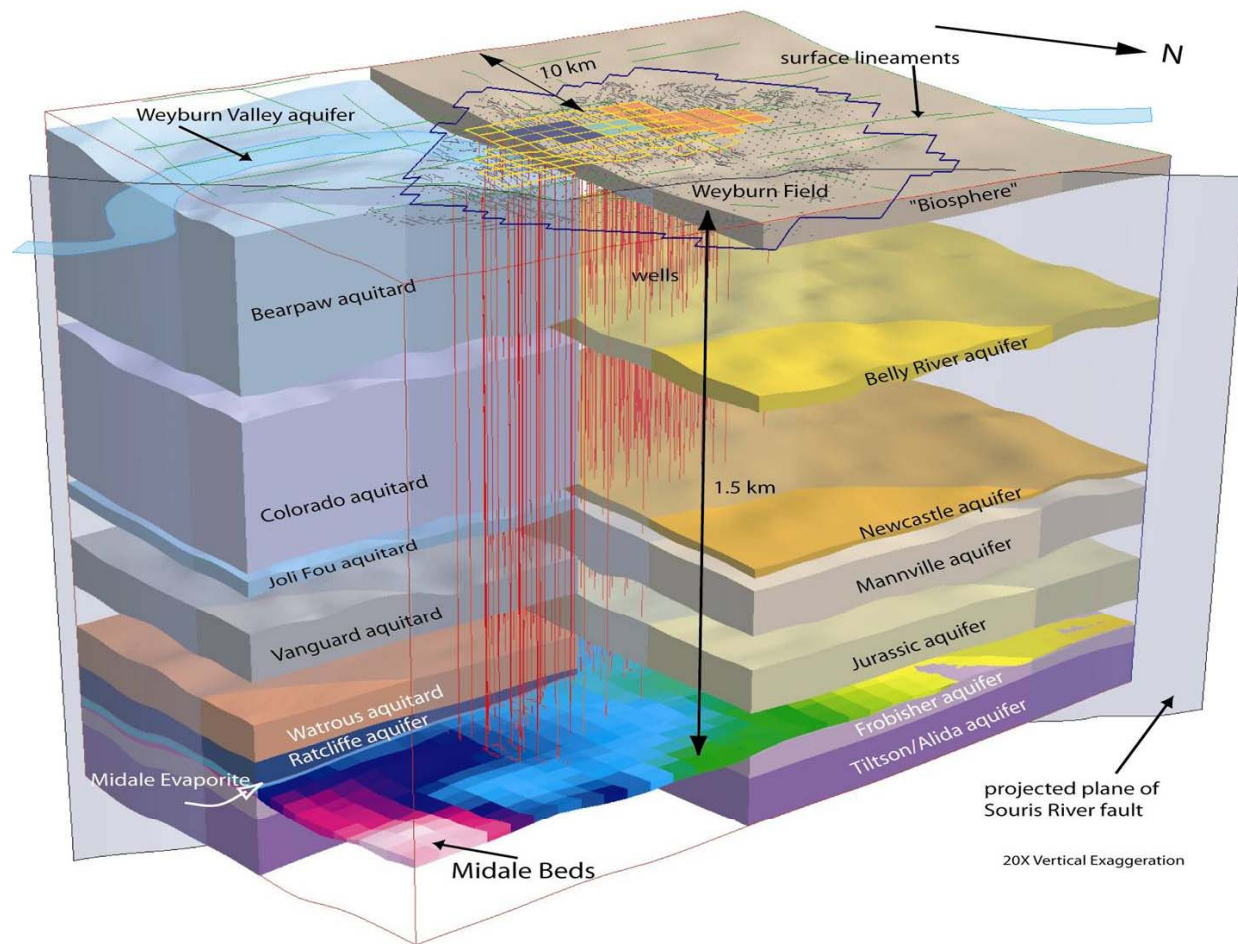


“To predict and verify the ability of an oil reservoir to securely and economically contain CO₂ (geologically)... to address the long-term migration and fate of CO₂ in a specific environment (EnCana’s Weyburn, Saskatchewan EOR operation)”

- Sponsors:
 - 5 governments (NRCan, US DOE, SIR, AERI, EU)
 - 10 industry sponsors (Canada, USA, EU, Japan) – energy-based
 - Endorsed by IEA GHG R&D Programme
 - \$40 million (50:50 cash : in-kind)
- Research Management:
 - Overall project management by PTRC, based in Regina
 - 22 S&T organizations in 6 countries
 - 80+ researchers



Weyburn EOR Geological Model





WEYBURN FINAL PHASE R&D

- OBJECTIVE – BEST PRACTICE MANUAL FOR CO₂-EOR STORAGE PROJECTS
- TECHNICAL COMPONENTS: SITE CHARACTERISATION, MONITORING AND VERIFICATION, WELLBORE INTEGRITY AND RISK ASSESSMENT
- POLICY ISSUES: REGULATION, COMMUNICATION, BUSINESS ENVIRONMENT
- PROJECT AGAIN MANAGED BY PTRC
- STRONG EMPHASIS ON INTEGRATION OF TECHNICAL AND POLICY COMPONENTS



IEAGHG Studies

- 2 projects commissioned in 2008 to understand the potential for CO₂ in oil and gas fields:
- CO₂ storage in depleted gas fields (Poyry)
- Global Application Study for CO₂ EOR (contract to be awarded)



Gas Field Study - Objectives

- Assess future potential storage associated with high-CO₂ natural gas production
- Produce global atlas of storage capacity in existing fields with reference to CO₂ sources
- Create screening methodology for storage potential
- Examine potential infrastructure issues
- Derive cost curves for storage capacity
- Assess leakage mechanisms

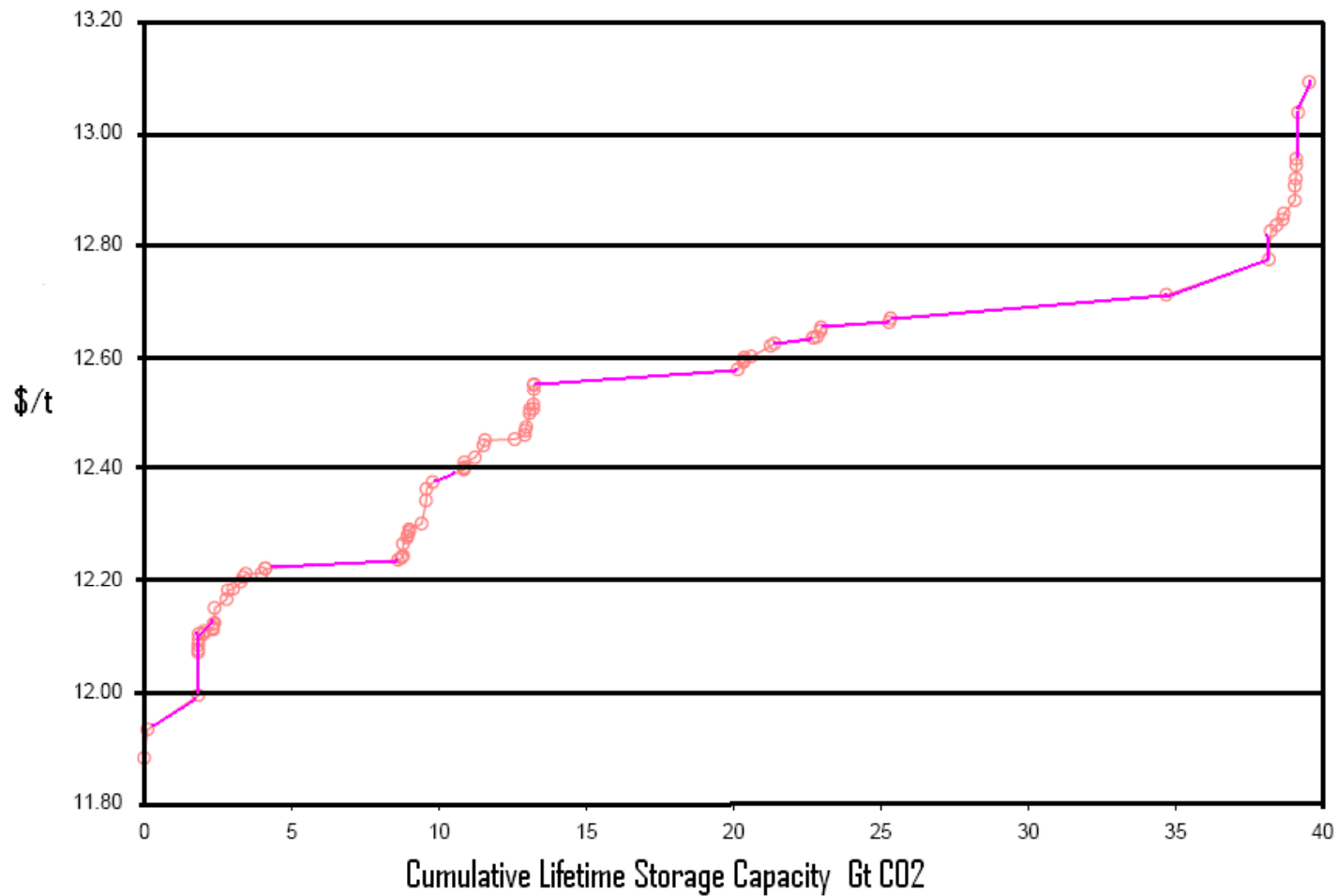


Screening Methodology for Gas Fields

- Methodology to consider factors including capacity, availability, injectivity, geomechanical and wellbore integrity etc
- Development of analytical screening tool to allow ranking of storage opportunities
- Derivation of capacity versus time – graphical presentation
- Screening tool availability for online use



Cost Curves for Gas Field Storage





Gas Field Study – Initial Work

- Project work commenced April 2008, consultants Poyry plus Element Energy and BGS
- Early challenges identified:
 - Regional variation in data availability
 - Timing: field availability for storage
 - Leakage: drawing wider conclusions from limited dataset



EOR Study

- Aim: ‘high level’ report to identify technical and economic barriers that have to date, prevented the widespread utilisation of EOR
- Review of existing projects, literature, relevant research
- Comparison between areas of EOR implementation and other assessed regions e.g. North Sea
- Feasibility study for other regions



Regulatory Frameworks

- Rapid recent developments to allow CO₂ storage including oil and gas reservoirs
- London and OSPAR conventions amended
- Development of regulations in both the EU and US, Australia and Canada
- Note likely requirements for risk assessment, management practices and monitoring
- Compliance of existing EOR schemes



Conclusions

- Global estimates of $>1,000$ GtCO₂ storage in depleted oil and gas fields
- Technical and economic constraints on development
- Gas field issues include location and availability
- Geographical extent of EOR still limited
- IEA GHG studies aim to better understand the realistic potential for storage in these fields



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Thanks for your attention



**GHGT-9:
9th International
Conference on Greenhouse
Gas Technologies**

**16 - 20 November 2008
The Omni Shoreham Hotel;
Washington DC**