



Global CO₂ Geological Storage Capacity in Hydrocarbon Fields

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Content of Presentation

- Introduction to IEA GHG
- Global geological storage capacity for CO₂
- Storage in depleted gas fields
- Storage associated with CO₂-EOR



IEA Greenhouse Gas R&D Programme



IEA GHG Contracting Parties and Sponsors

A world map is centered on the slide, surrounded by various logos and national flags of contracting parties and sponsors. The logos include:

- ALSTOM**
- B&W** (power generation group)
- BG GROUP**
- bp**
- CEZ GROUP**
- Chevron**
- CIAB**
- ConocoPhillips**
- eni**
- e.on**
- EPRI**
- ExxonMobil**
- JGC**
- REPSOL YPF**
- RWE** (The energy to lead)
- Schlumberger**
- Shell**
- Statkraft**
- StatoilHydro**
- TOTAL**
- VATTENFALL**

National flags are placed around the map, representing countries such as Switzerland, United Kingdom, USA, Australia, Austria, Canada, Denmark, EU, Finland, France, Germany, India, Japan, Korea, and Norway.

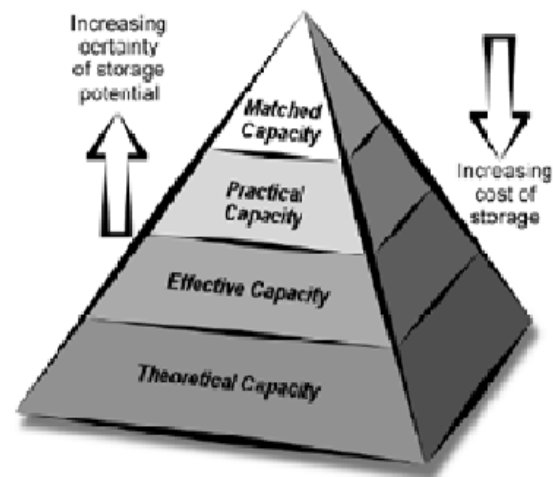


Global CO₂ Storage Capacity

IPCC 2005 estimates

- 1,000 to 10,000Gt in saline aquifers
- 675 to 900Gt in depleted oil and gas fields
- 3 to 200Gt in coal beds

CSLF Resource Pyramid





Depleted Gas Fields Study

- IEA GHG study undertaken in 2008 by Poyry Consulting, Element Energy and BGS
- Regional theoretical, effective and practical capacities calculated using USGS petroleum assessments
- Regional matched capacities calculated using AAPG Giant Fields database and GIS based source-sink matching



Simplifying Assumptions

- Many made, due to nature of study, e.g.
 - Total recoverable gas reserves converted to equivalent CO₂ capacities (0.7t/m³, GEF 200)
 - Reservoirs re-filled to original pre-production pressure
 - Minimum depth 800m
 - Minimum economic storage capacity of 50Mt onshore/100Mt offshore
 - Estimated dates for close of gas production

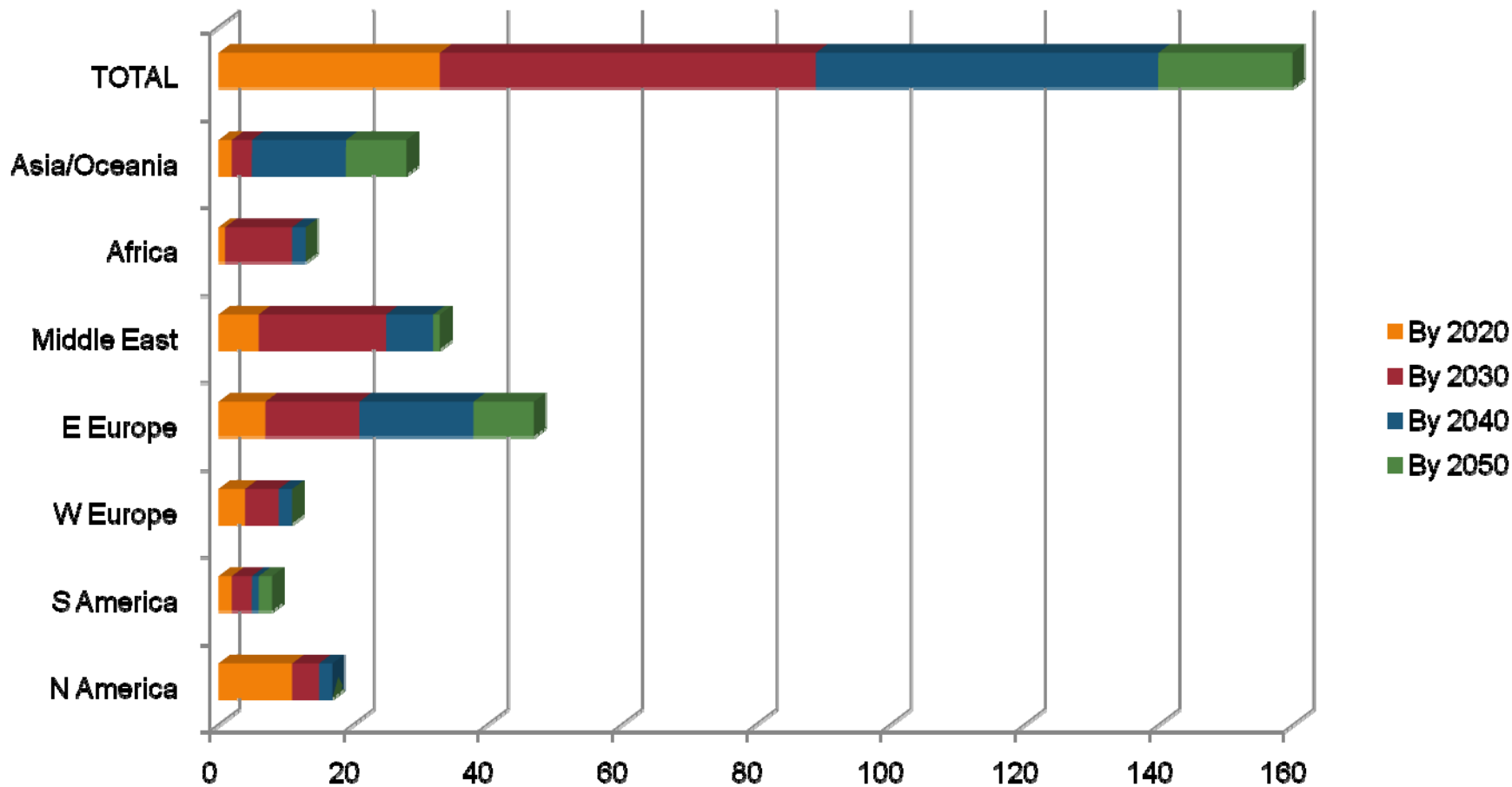


Global Gas Field Capacities from USGS Dataset

- **Theoretical** – *assuming all available pore space through gas production utilised* – **900Gt**
- **Effective** – *assumed 75% of theoretical to allow for geological & technical factors* – **680Gt**
- **Practical** – *discounting effective capacity by 40% to allow for sub-economic field size, and 1% of sites to be rejected due to risk assessment (leakage)* – **390Gt**



Matched Capacities (Gt) for Gas Fields





CO₂-EOR Study

- Undertaken by Advanced Resources International, based in the USA
- Global study involving:
 - Characterisation of hydrocarbon basins
 - Estimation of OOIP
 - Judgement of CO₂-EOR potential
 - Estimation of CO₂ storage potential
- Preliminary Results



USGS World Petroleum Assessment



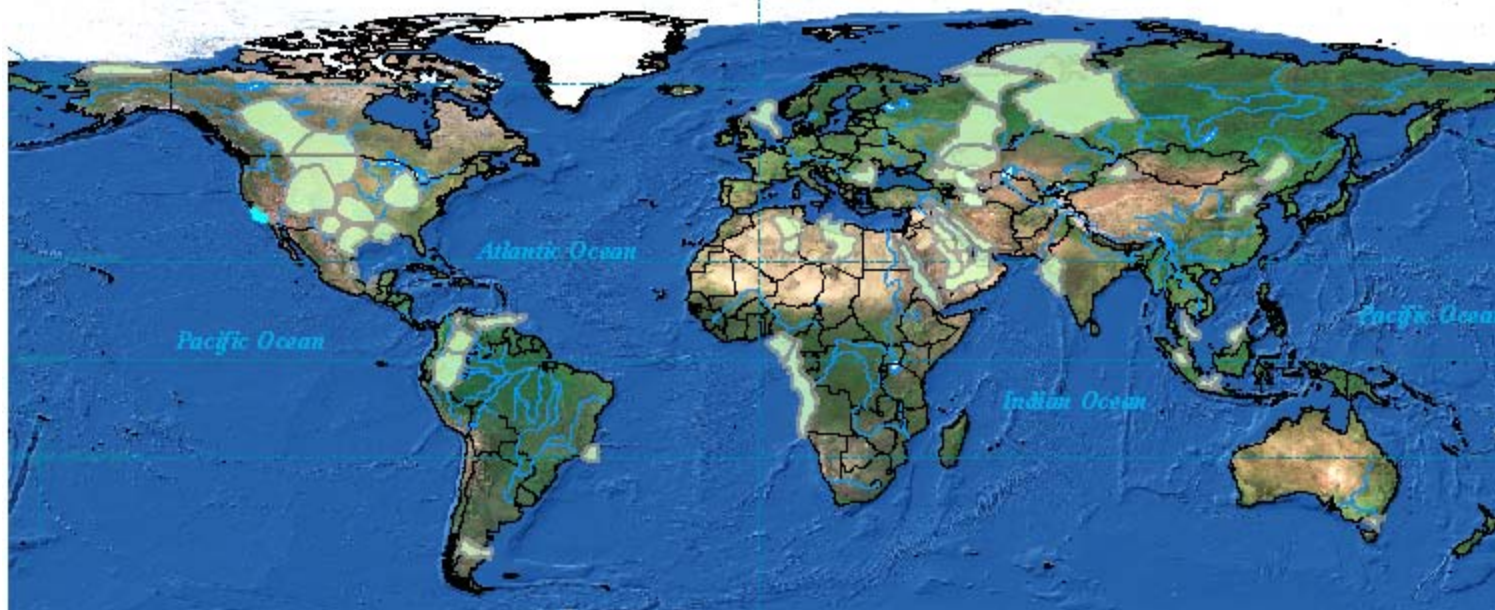


Identification of World Basins

- **The top 40 basins from the USGS assessment were selected, as ranked by volume of oil produced and booked as reserves, for further study.**
 - **Contain 96% of the “Known Oil” identified**
 - **Spread over every continent, but concentrated in the Middle East and Eastern Europe/Russia**
- **Also included 12 U.S basins with large volumes of “Known Oil”**



IEA Greenhouse Gas R&D Programme



Asia & Pacific	9
Central and S America	7
Europe	2
Former Soviet Union	6
Middle East and Africa	13
North America	15



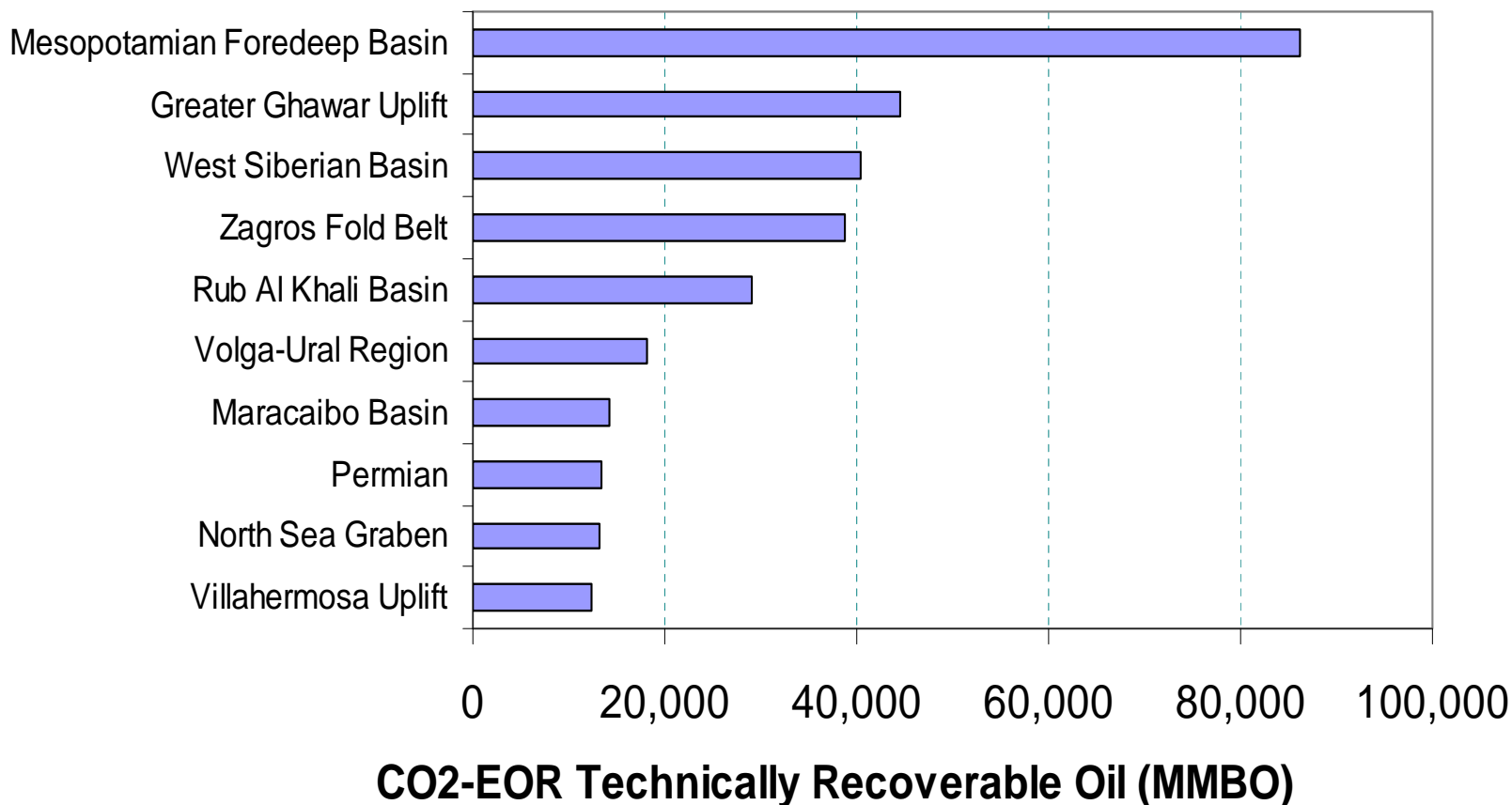
EOR Target

Rationale

Volume (Billion Barrels of oil)	% of OOIP		
2,156	48%	Oil Amenable for CO ₂ -EOR	Certain fields within a basin may be too shallow or contain oil too heavy for miscible CO ₂ -EOR operations
3,213	72%	Oil in Fields Accessible to CO ₂ -EOR Operations	Some reservoirs are too small, or otherwise inaccessible to CO ₂ -EOR operations
4,368	98%	OOIP in basins with favorable characteristics for CO ₂ -EOR operations	Five basins did not meet criteria for Miscible CO ₂ -EOR
4,465	100%	Total OOIP	The total volume of OOIP in the 52 basins will not be available for CO ₂ -EOR

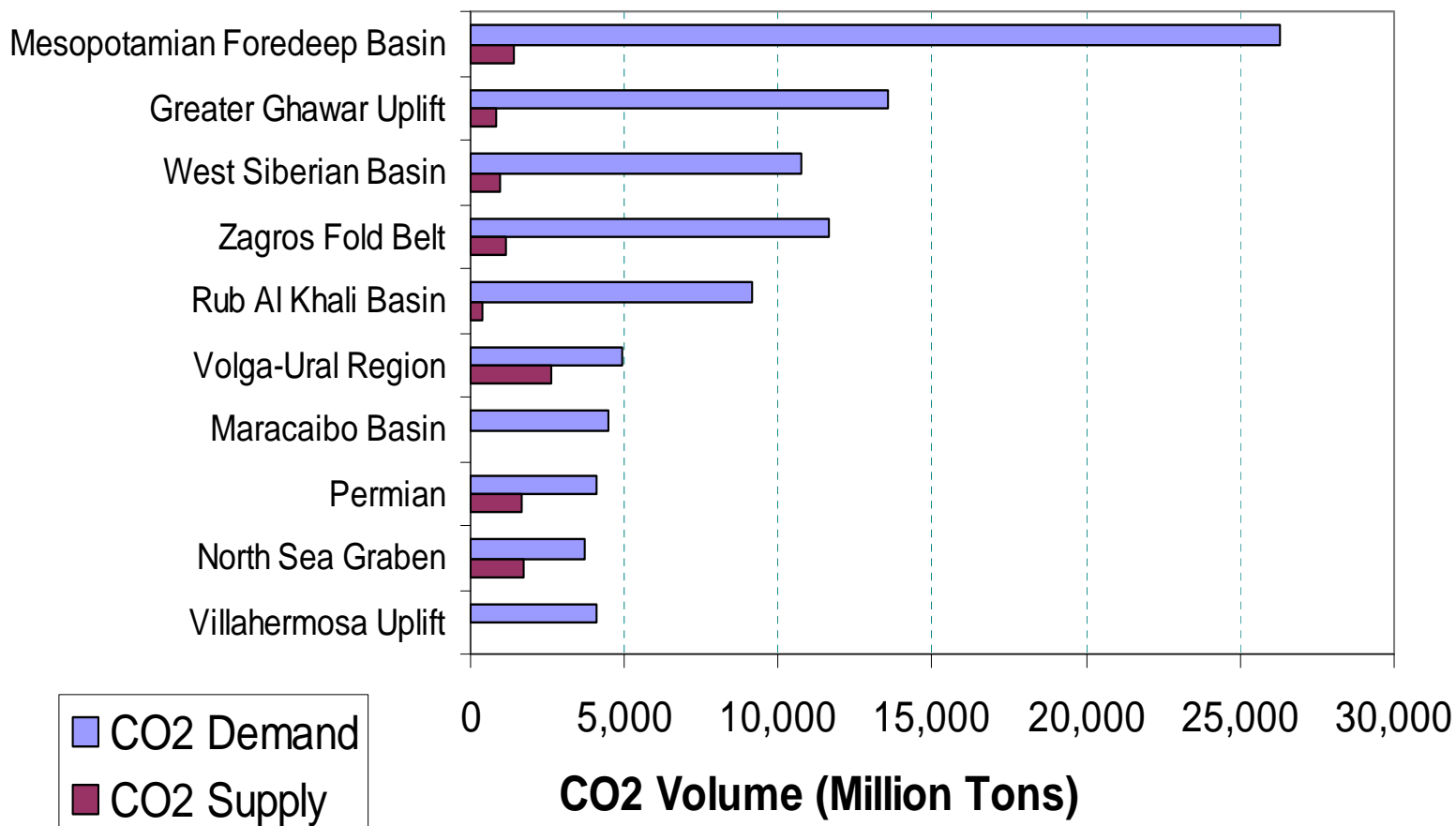


Top 10 World Basins for CO₂-EOR Potential





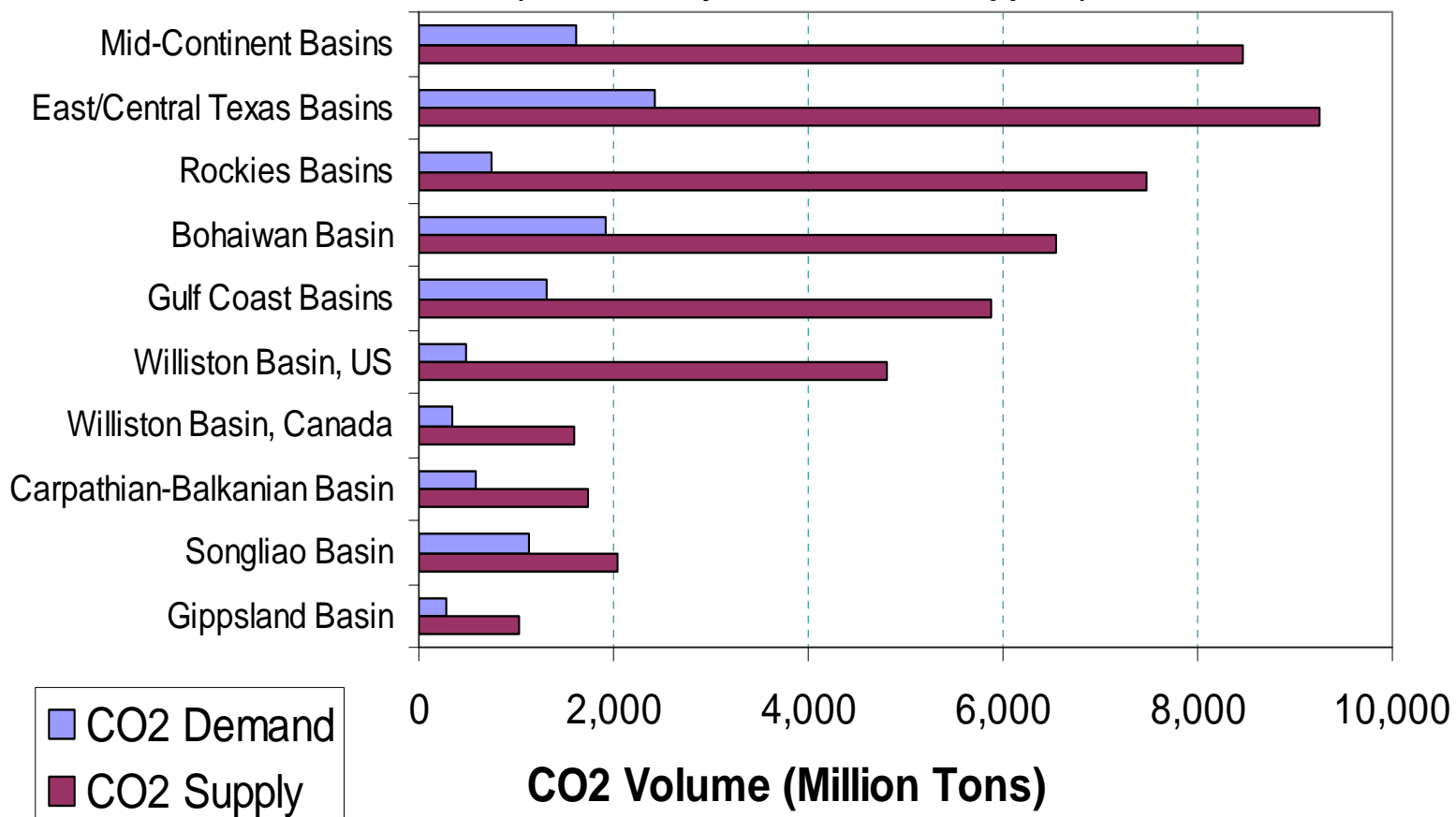
Top 10 World Basins for CO2-EOR





Top 10 World Basins for CO₂-EOR

(As ranked by access to CO₂ supplies)





Revised CO₂ Storage Capacities

Storage Type	IPCC Estimated Global Capacity (Gt)	IEA GHG Estimated Global Capacity (Gt)
Saline Formations	1,000 to 10,000	
Depleted Gas Fields		160 to 390
CO ₂ -EOR	675 to 900	11 to 130
Coal Beds	3 to 200	



IEA Greenhouse Gas R&D Programme

- General - www.ieagreen.org.uk
- CCS - www.co2captureandstorage.info

