



Halfway to the Hydrogen Economy: CO₂ Geological Storage at In Salah (Algeria)

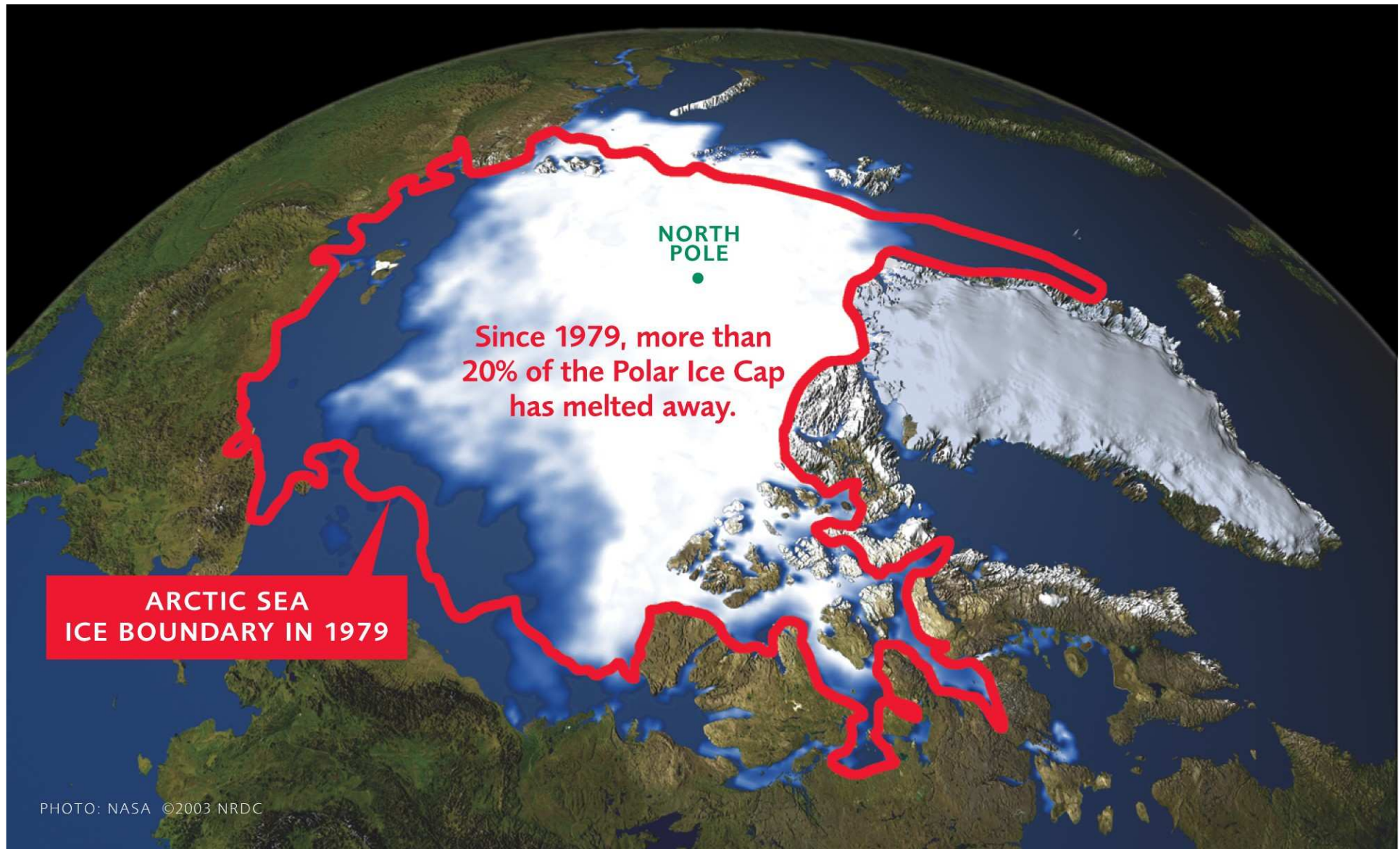
Iain Wright (CO₂ Project Manager, BP Group Technology)
World Gas Conference: Amsterdam June 6th 2006

Agenda



- **Technology Solutions to Climate Change**
- **A Vision of the Hydrogen Economy**
- **CO₂ Capture and Geological Storage**
- **The Three Projects at In Salah (Algeria)**
 - In Salah Gas Development (1bcf/d \$2,000 million)
 - In Salah CO₂ Storage (1mmtpa \$ 100 million)
 - In Salah CO₂ Assurance (R&D \$ 30 million)
- **Summary**

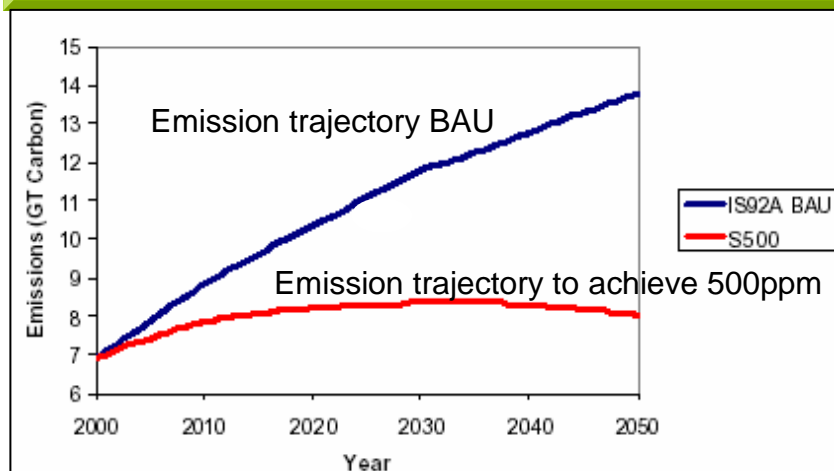
Climate Change



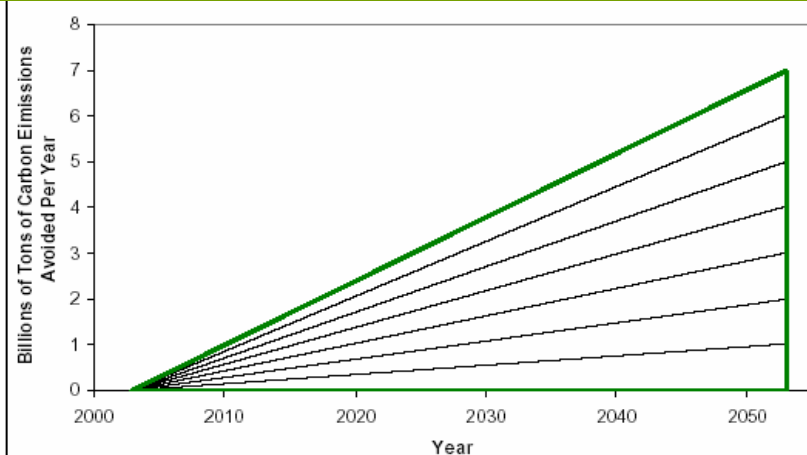
Technology Options for GreenHouse Gas Stabilization



The Stabilisation Wedge



1 GtC Slices of the Stabilisation Wedge

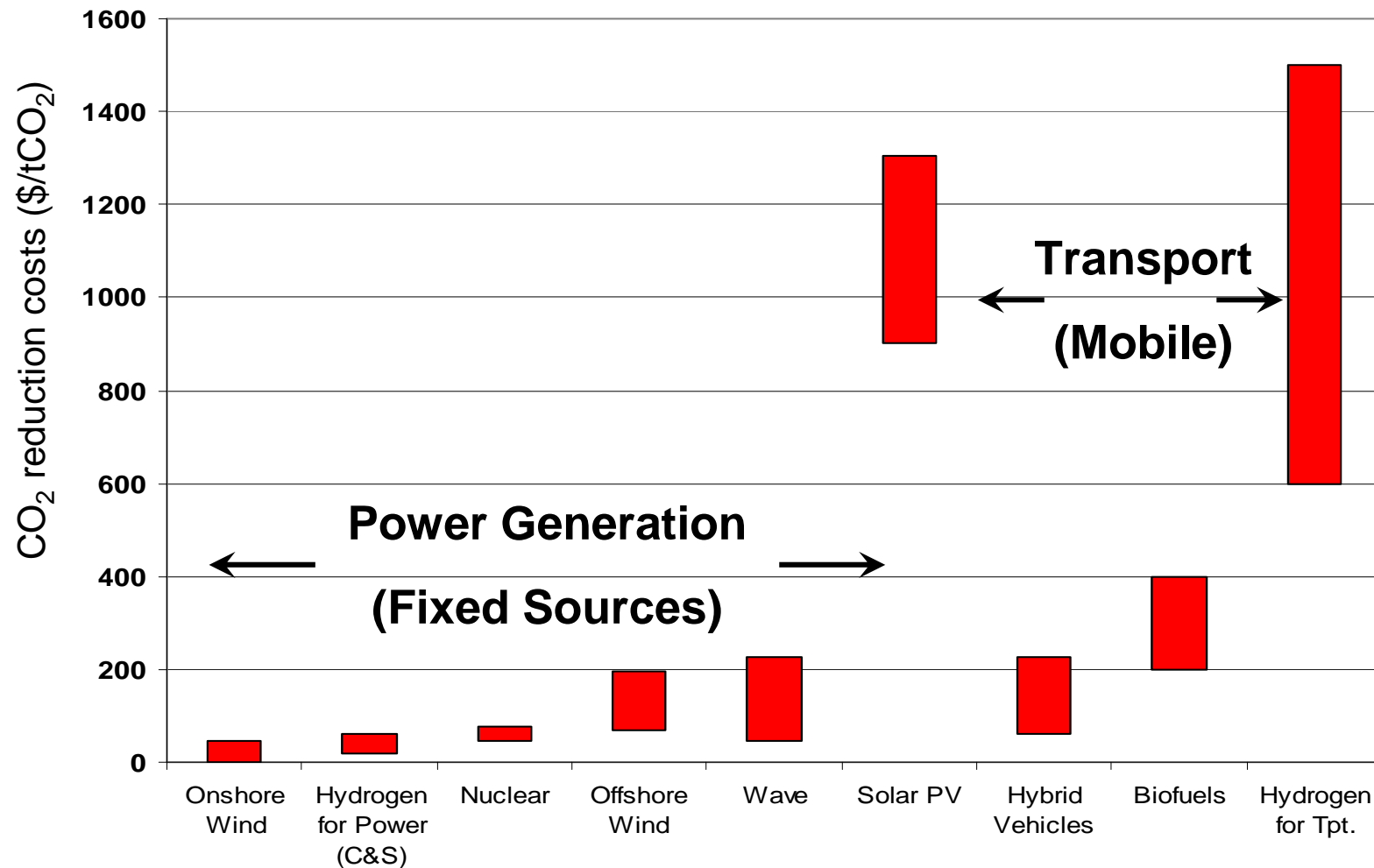


Examples of Lower Carbon Slices	Scale for 1 GtC Reduction by 2050
Increased energy efficiency across the economy	'Emissions/\$GDP' increased
Increased energy efficiency (e.g. vehicles only)	2 billion gasoline/diesel cars achieving 60mpg
Fuel switching natural gas displacing coal for power	1400GW fuelled by gas instead of coal
Solar PV or wind replaces coal for power	1000x scale up PV; 70x scale up for wind
Biofuels to replace petroleum based fuels	200x10 ⁶ ha growing area (equals US agricultural land)
Carbon Capture and Geological Storage	CO ₂ captured from 700 1 GW coal plants; storage = 3,500x In Salah/Sleipner
Carbon Free Hydrogen for Transport	1 billion H ₂ carbon free cars; H ₂ from fossil fuels with CO ₂ capture & storage or from renewables or nuclear
Nuclear displaces coal for power	700 1GW plants (2x current)
Biosequestration in forests and soil	Increase planted area and/or reduce deforestation

CO₂ Reduction Options (\$/te)

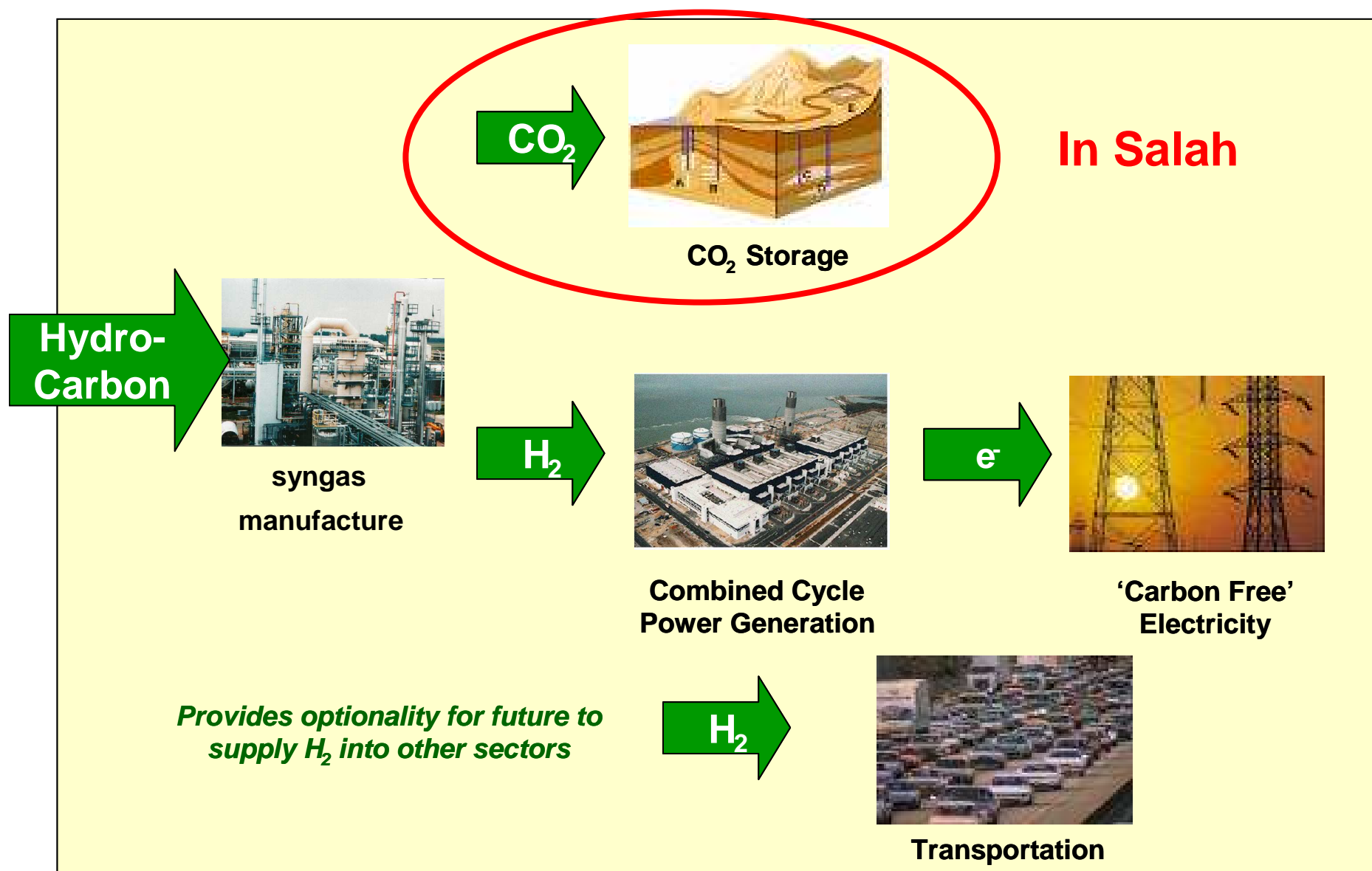


- **Cost of CO₂ mitigation (above today's economics)**

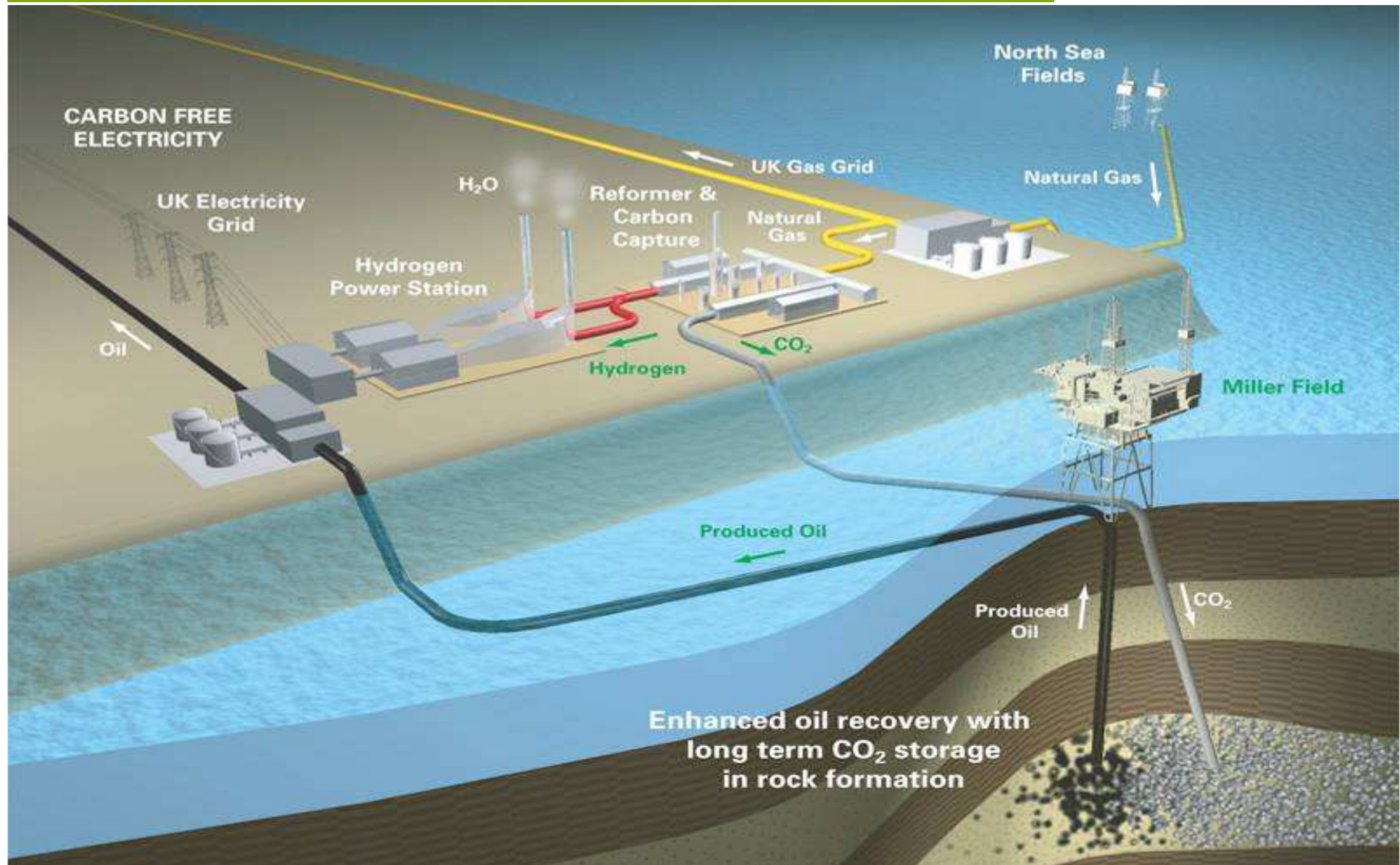


Source: European Commission Report (Jan 2004) , DoT, DTi (2003) , BP Analysis

How to Start the Hydrogen Economy



Peterhead & Miller (Scotland): 2010



CCS 2006: Key Challenges



1. Reducing the Costs

- Costs must be less than Benefits
- Mainly Capture Cost and Efficiency

2. Is it Legal?

- Long-term Storage Integrity
- Legal & Regulatory Frameworks

3. Can you get Paid?

- Policy Frameworks
- Market Eligibility (CDM, ETS)

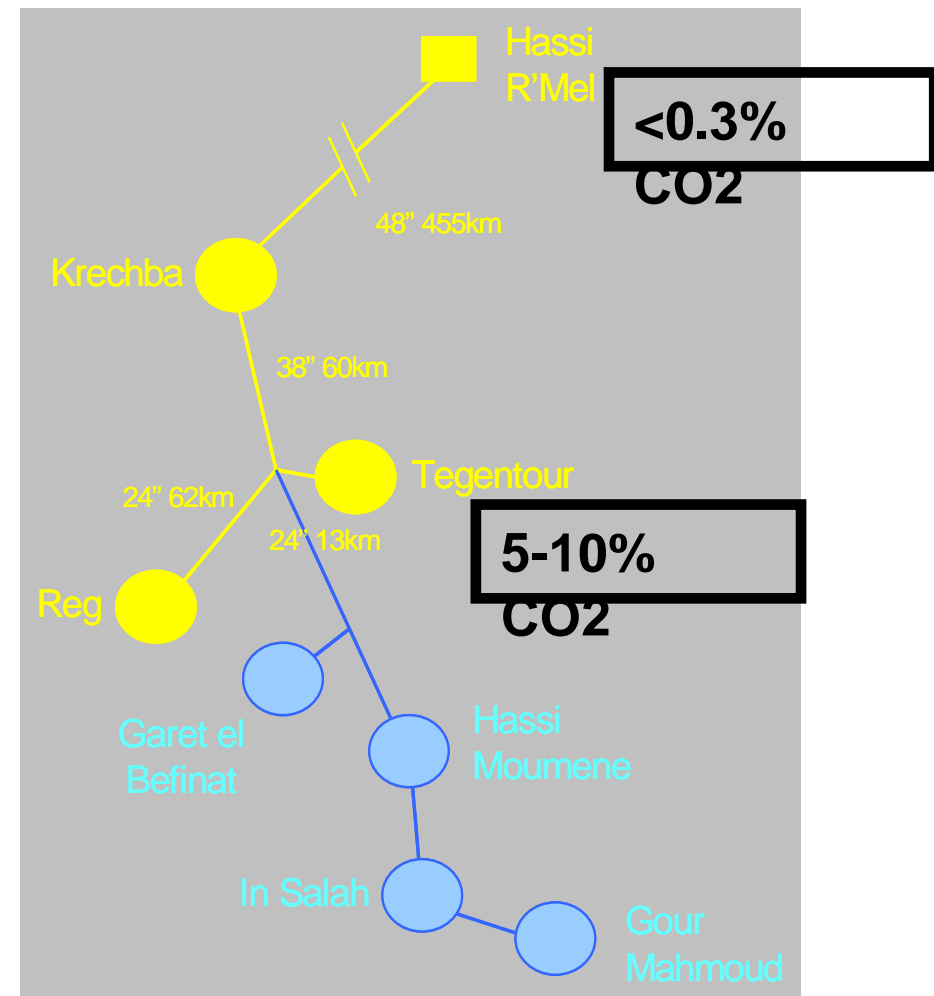
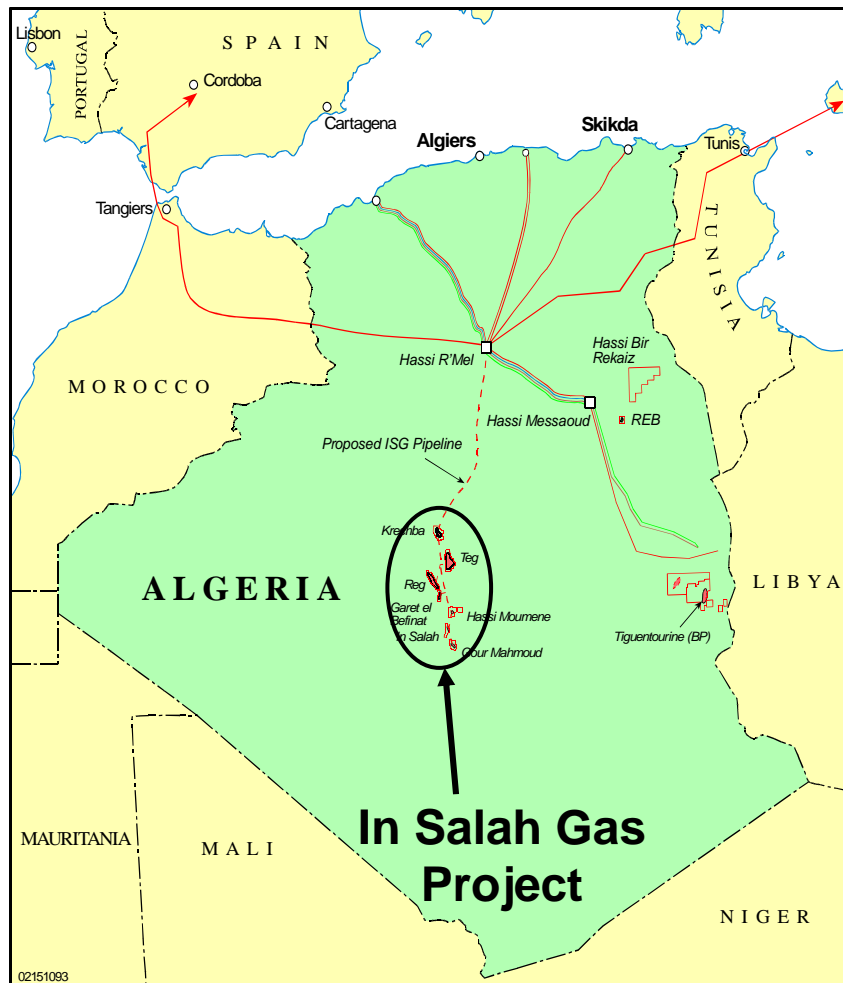
4. Public Acceptance

} In Salah CO₂
Joint
Industry
Project (JIP)



- **In Salah Gas Development**
- **(1bcf/d \$2,000 million)**

In Salah Gas Project



In Salah Gas Processing Plant



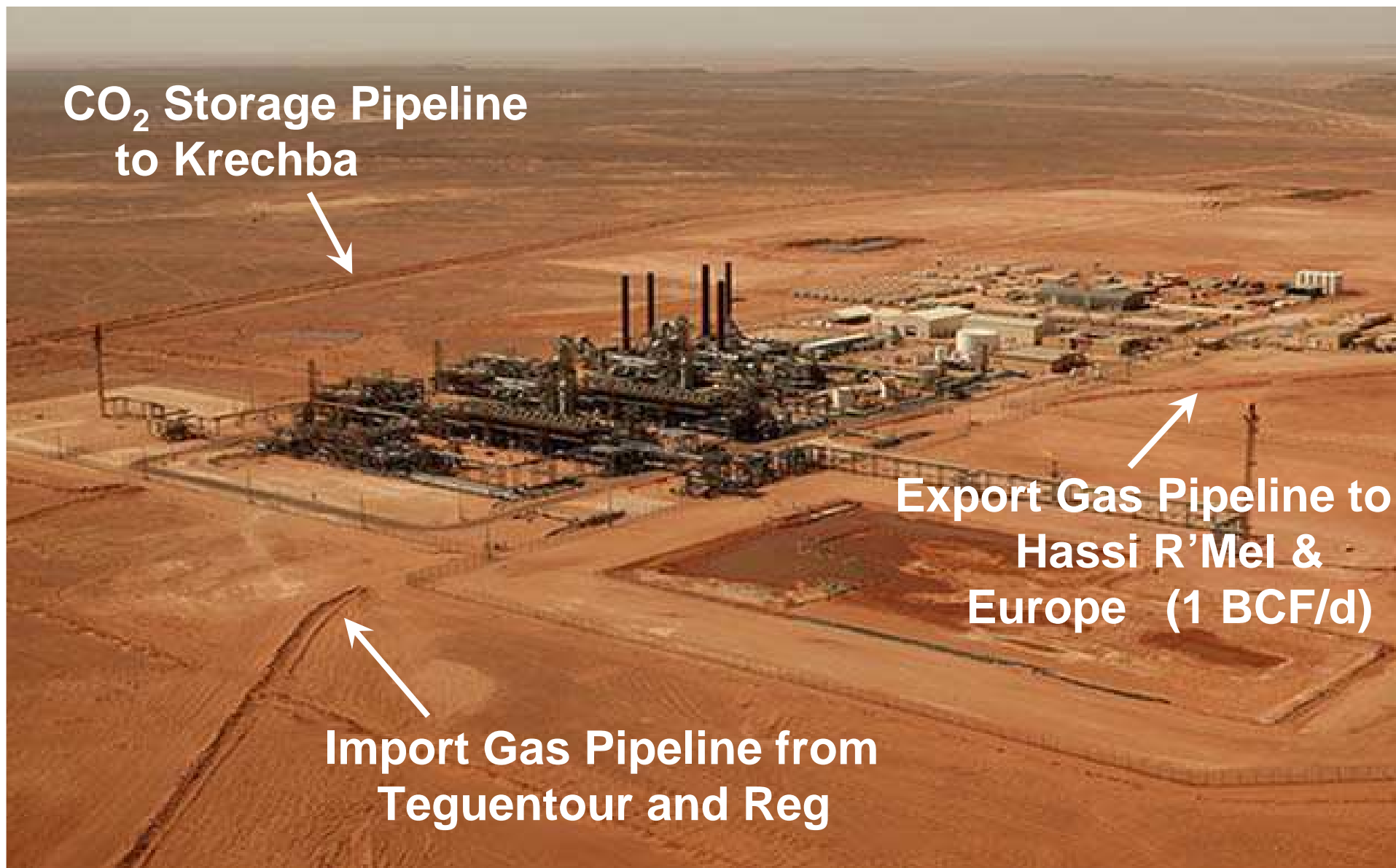
**CO₂ Storage Pipeline
to Krechba**



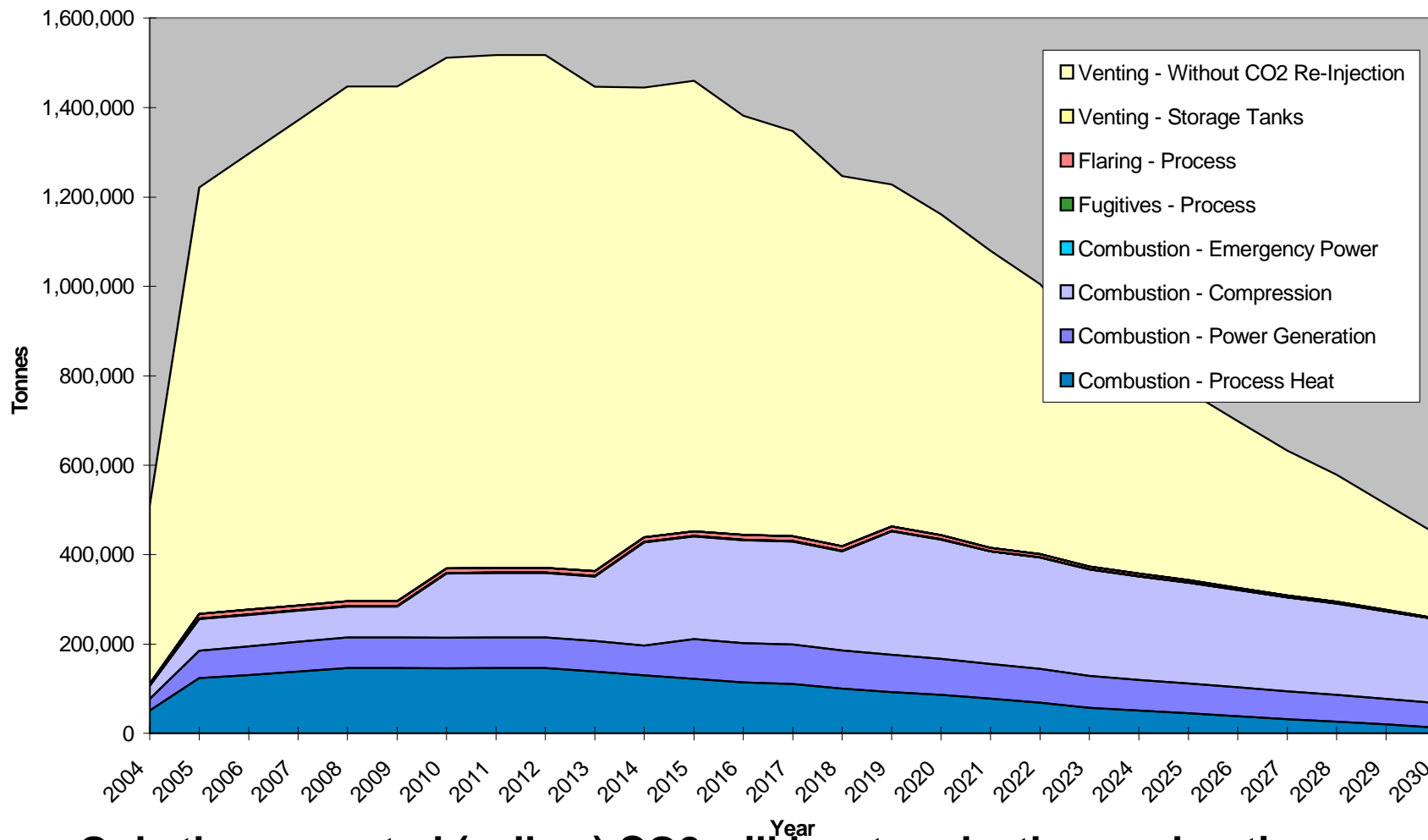
**Export Gas Pipeline to
Hassi R'Mel &
Europe (1 BCF/d)**



**Import Gas Pipeline from
Teguentour and Reg**



In Salah: 25-Year CO₂ Profile



- Only the separated (yellow) CO₂ will be stored – the combustion CO₂ (blue) will be vented



- In Salah CO₂ Storage
- 1mmtpa \$100 million

In Salah CO₂ Storage

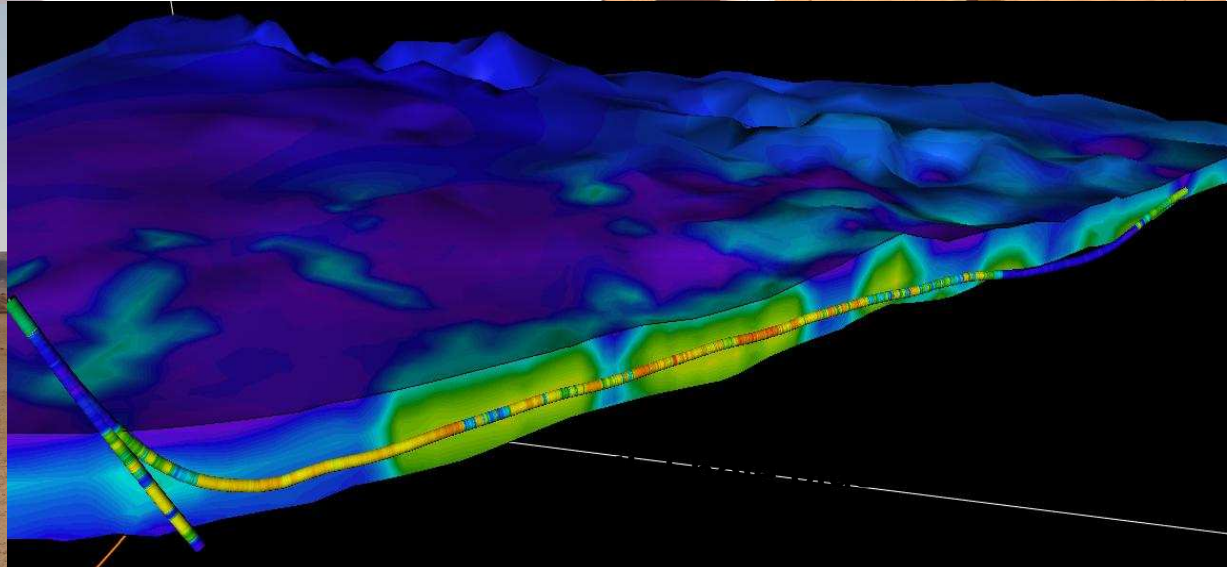


- **Industrial Scale Demonstration of CO₂ Geological Storage (Conventional Capture)**
- **Started Storage in August 2004**
- **Storing 1mmtpa CO₂ (17mm tonnes lifetime)**
 - ~ ¼ million cars off the road
 - ~ Currently installed UK wind power
- **\$100mm Incremental Cost (\$6/tCO₂)**
 - **No Commercial Benefit**

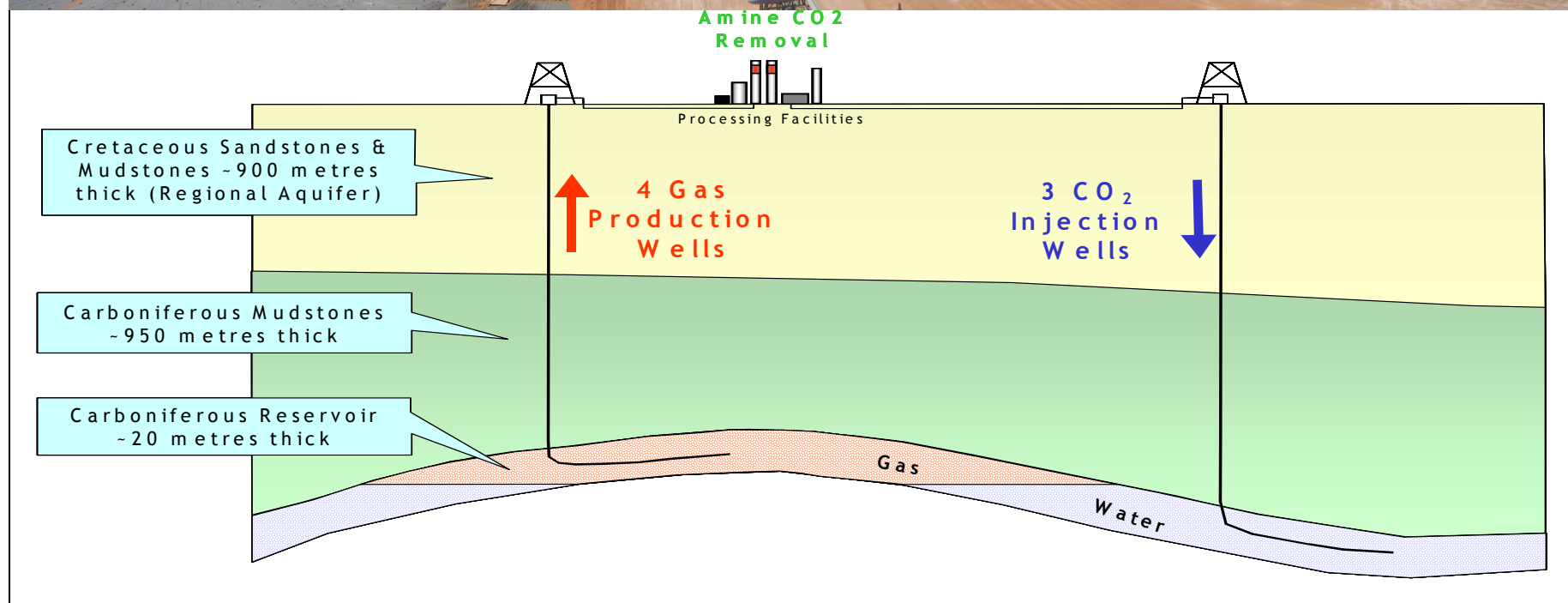
CO₂ Storage Infrastructure



50mmscf/d CO₂
(1mmtpa)
Compression
Transportation
Injection
Storage



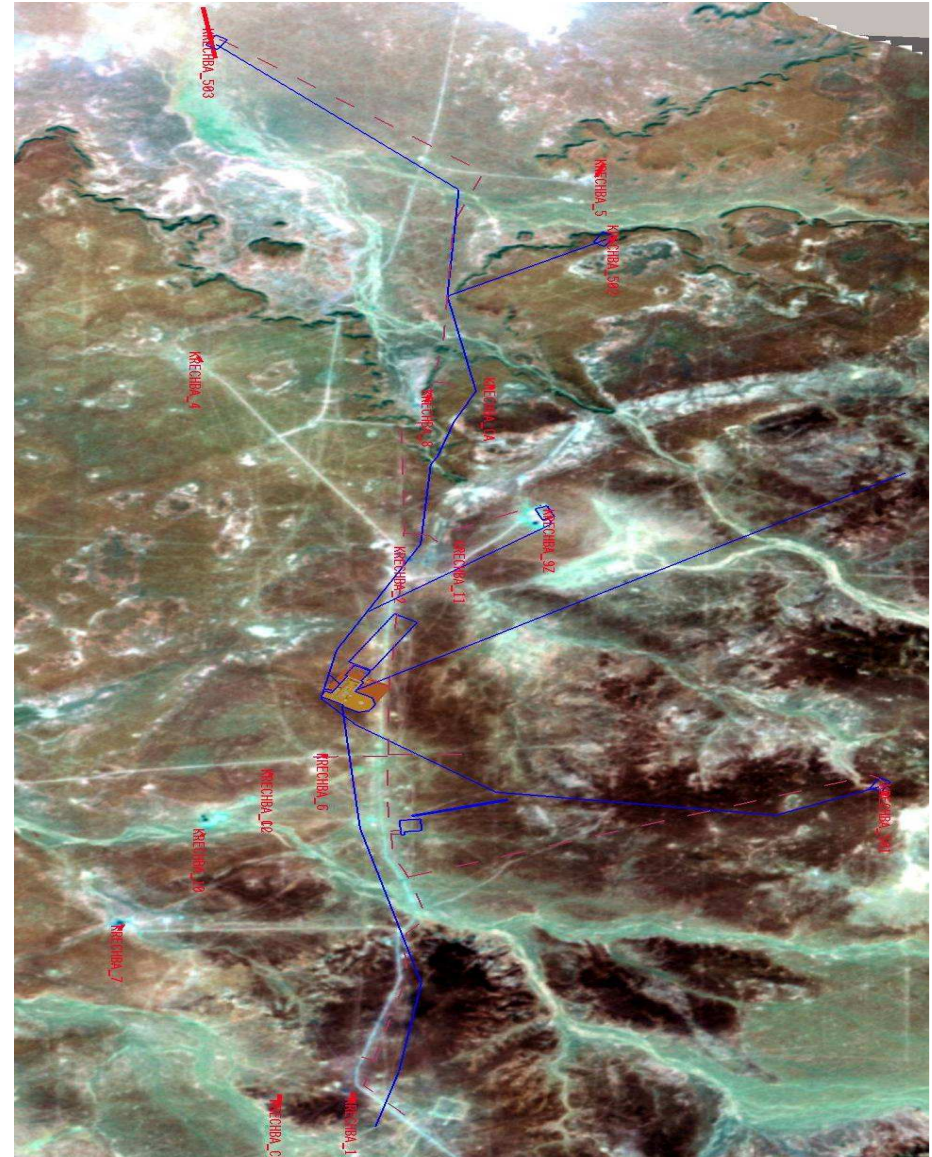
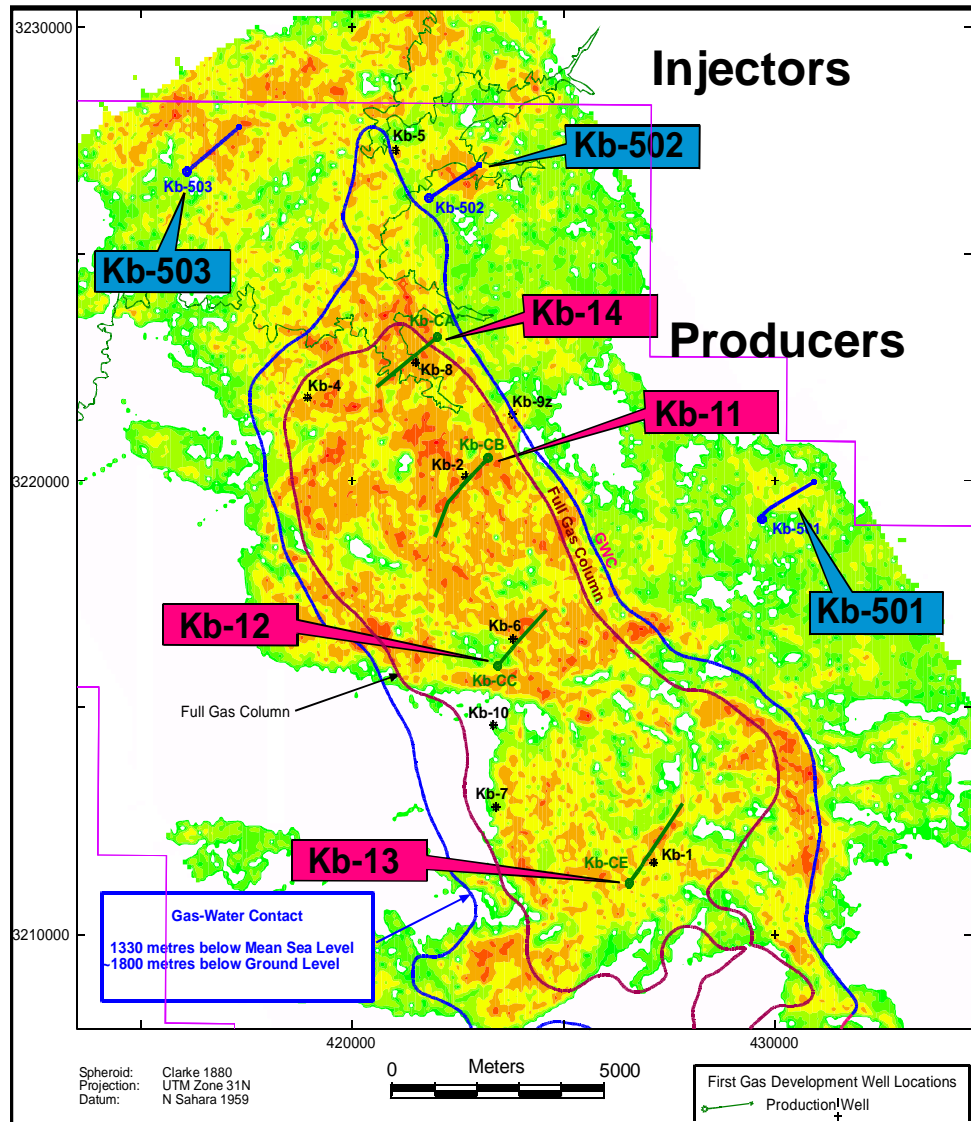
In Salah CO₂ Storage Operation



Krechba Field

Reservoir

Surface





- **In Salah CO₂ Assurance**
 - **R&D (CSLF & EU \$30 million)**

Joint Industry R&D Project



Objectives (2004-09)

- 1. Provide assurance that secure geological storage of CO₂ can be cost-effectively verified and that long-term assurance can be provided by short-term monitoring.**
- 2. Demonstrate to stakeholders that industrial-scale geological storage of CO₂ is a viable GHG mitigation option.**
- 3. Set precedents for the regulation and verification of the geological storage of CO₂, allowing eligibility for GHG credits**

In Salah CO₂ Summary



- **Industrial-Scale Demonstration of CO₂ Geological Storage (Conventional Capture)**
- **Started CO₂ Storage in August 2004**
- **Storing 1mmtpa CO₂ (17mm tonnes over Project Life)**
- **\$100mm Incremental Cost for Storage**
 - **(\$6/tCO₂): No commercial benefit**
- **Green Credit will require Site Certification and Monitoring**
- **In Salah is a Test-bed for CO₂ Monitoring**
 - **\$30mm Research Project**



Thank You!

Questions?

