WP4 : Recommendations and Guidelines for Implementation

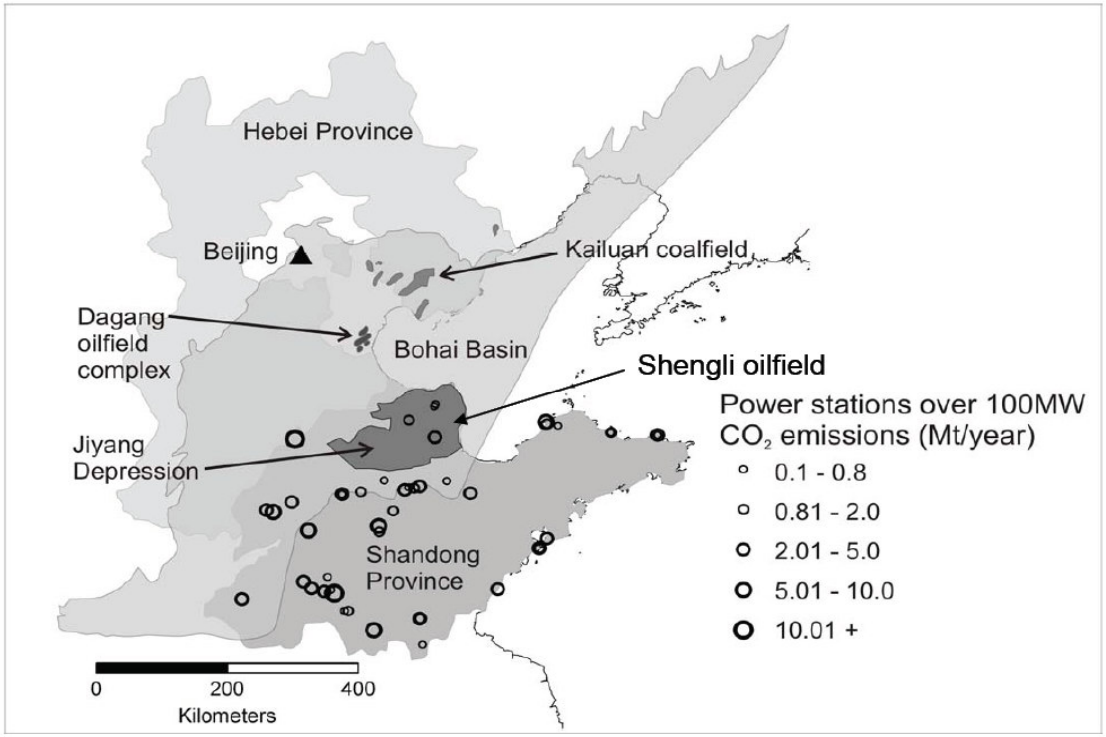
Tony Espie

Selection of scenarios

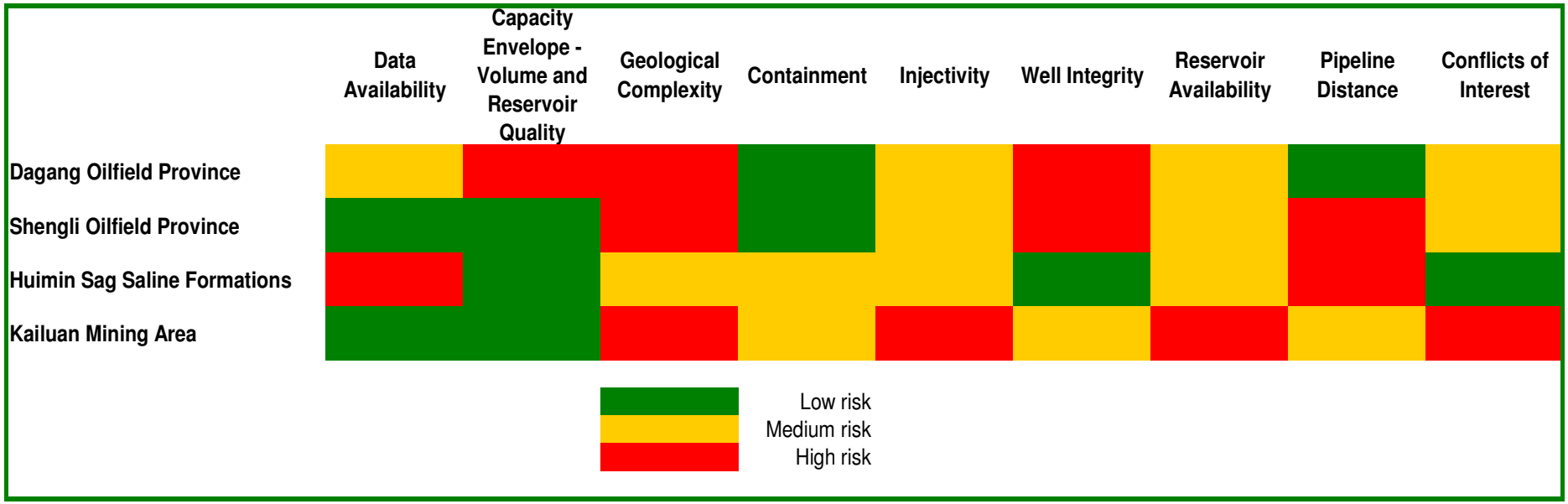
Region	Bohai Basin region in the North East of China	
CO_2 source	3rd phase of GreenGen (Tianjin, 2012-2015)	
Transportation	Pipeline	
Feedstock	Shenhua coal, railway transport from Inner Mongolia	
Gasifier	TPRI / GreenGen	
Products	Only power and methanol (subsequently modified to power only)	
	Scenarios A (Small scale)	**Scenarios B (Full scale)**
CO_2 amount	0.1-1 million ton /yr	2-3 million ton /yr
CO_2 sink	EOR (Dagang or Shengli Oil field)	Shengli Oilfield or Saline aquifer in Huimin Sag

Storage Areas Considered

- The sites considered were :
- The Dagang oilfield province
- The Shengli oilfield province
- The Huimin Sag saline formations (Jiyang Depression area)
- The Kailuan mining area



Qualitative Risk Assessment of Storage Options



Integrated System

	Distance	Capture	Transport	Site Appraisal	Wells	Monitoring	**Total**
	km	€/t	€/t	€/t	€/t	€/t	€/t
Dagang	70	22.50	0.24	0	2.84–3.42–4.67	0.83	**26.41 - 26.99 - 28.24**
Gudao	200	22.50	0.68	0	2.84–3.42–4.67	0.83	**26.85 - 27.43 - 28.68**
Huimin Sag	250	22.50	0.85	0.83	0.67–1.25–2.50	0.83	**25.68 - 26.26 - 27.51**
Kailuan	170	22.50	0.58	0.83	0.67–1.25–2.50	0.83	**25.41 - 25.99 - 27.24**

Conclusions 1

- The Jin-Jing-Ji region of NE China is a material GHG emissions area. However, this region has technical potential for CCS to make a significant reduction in emissions in the event that global dialogues continue to show that this is necessary.
- Two scenarios have been used to focus this study to screen options for a possible CCS demonstration project. These have considered capture of CO_2 from the gasification of coal and storage in one or more geological formations in the Bohai Bay geological basin.
- Storage for the smaller scale scenario (0.1 – 1 million tonnes/year) could be accommodated in the Dagang or Shengli oilfields. Storage for the larger scale scenario (2 – 3 million tonnes/year) could be accommodated in the Shengli oilfield complex (in a number of fields) or potentially in the saline formations in the Huimin Sag area.
- The assessment of geological storage options is at a scoping level only. Large uncertainties remain including :
  - Only public domain data has been used
  - Very limited data available to describe the saline formations of the Huimin Sag.
  - Estimates of storage capacity have been made using analytic approaches
  - Well numbers for CO_2 injection are a major uncertainty. Estimated well numbers could easily be in error by a factor of two.
  - When considering storage options in existing oilfields, the large number of wells gives rise to concerns over well integrity. This has not been reviewed in the current study.

Conclusions 2

- **Costs for CCS for the larger scale scenario have been estimated as :**
  Capture, conditioning and compression :
  €22.50 / tonne CO2 avoided
  Transport, storage and monitoring :
  €3 – 6 / tonne CO_2 stored (depending on the number of injection wells required)

  This yields an integrated cost for CCS for the larger scale scenario of :

  CCS cost = €25.41 - €28.68 / tonne CO_2 avoided

  254 – 287 RMB / tonne CO_2 avoided

- **In common with most other countries, China does not yet have a functioning regulatory framework for CCS (geological storage of CO_2 in particular). Substantial progress has been made in the last two years in clarifying issues and initiating activities leading to the formation of a regulatory framework.**

Questions ?

Recommendations 1

1. Work on capture cost benchmarking should be extended to consider the impact of having both methanol and electricity as product streams.
2. A sustained campaign of geological assessment is required to progress from the current high-level scoping study to a point where selection of a storage site will be possible.
3. It is recommended that further storage site work should focus upon the Dagang oilfield complex, the Shengli oilfield complex and the saline formations of the Huimin Sag. Further work on the Kailuan mining area should wait until there is a further assessment of the implications of CO_2 storage on the economic value of the coal.
4. Dagang is the closest storage site to the Tianjin site but also the smallest. A pilot test of EOR is an option but could not be scaled up further. However, consideration should be given to whether the geology in the Dagang complex is sufficiently similar to that in the Huimin Sag to enable early data to be gathered on injectivity and compartmentalisation.
5. A basin charge study would be useful to consider why the distribution of hydrocarbons is as it is. This could increase confidence in the sealing capacity of potential caprocks in the Huimin Sag area.

Recommendations 2

6. Detailed geological models are required to enable further assessment of the storage sites. This will require access to existing original data or acquisition of new data.
7. Dynamic modelling of CO_2 injection should be performed using development scenarios to enable estimates of storage capacity to be refined.
8. A combination of analogue data and modelling studies should be used to better constrain the projected injection well count.
9. Well integrity studies are required to better understand the leakage risk posed by existing wellbores in producing oilfields
10. In future work attention should be given to identifying and avoiding potential conflicts of interest