



Perspective of CO₂ capture & storage (CCS) development in Vietnam: Results from expert interviews.

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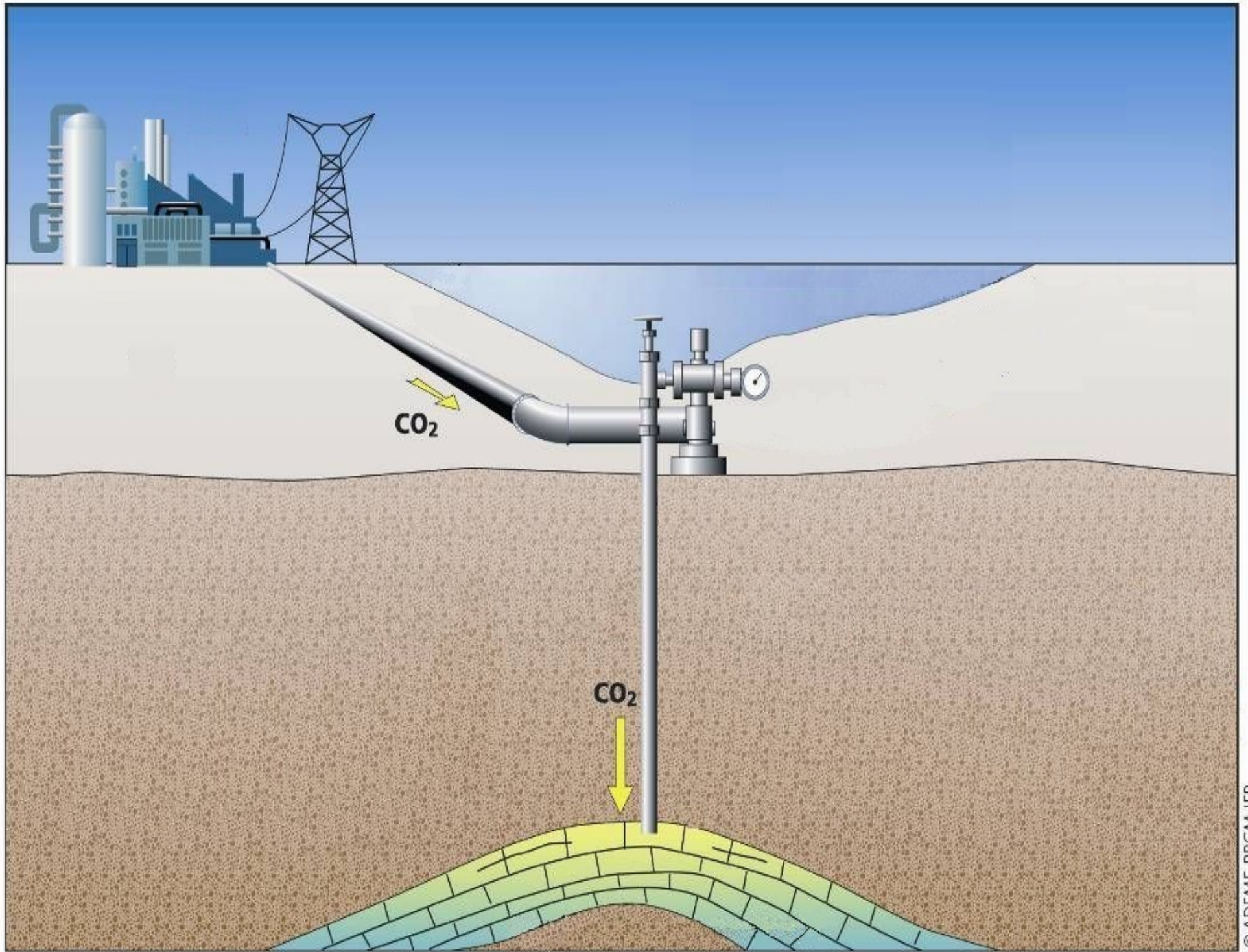


Outline

- CCS : burying the CO₂
- Potentially relevant in Vietnam
- Survey : nobody optimistic



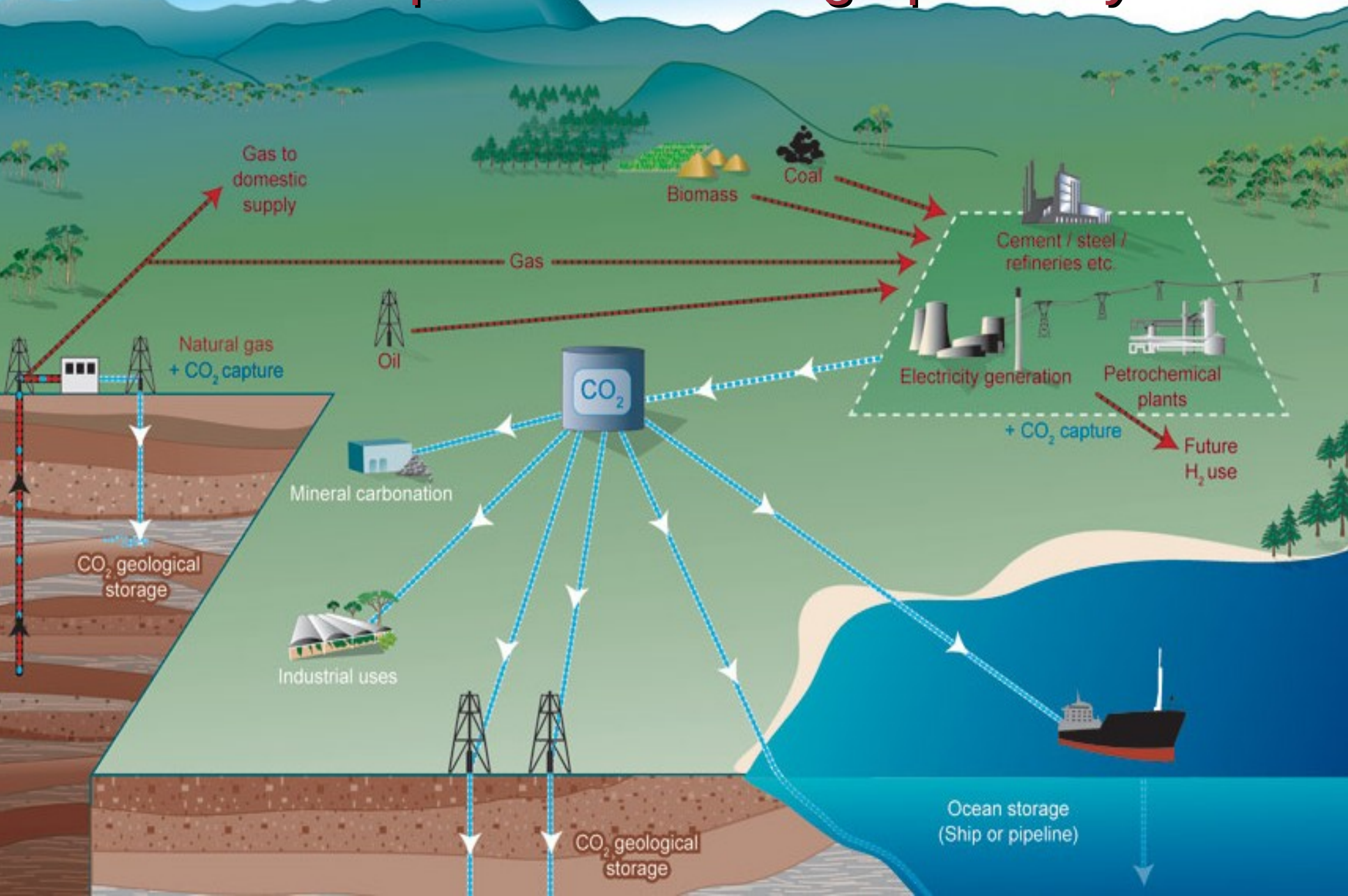
1. A primer on CCS



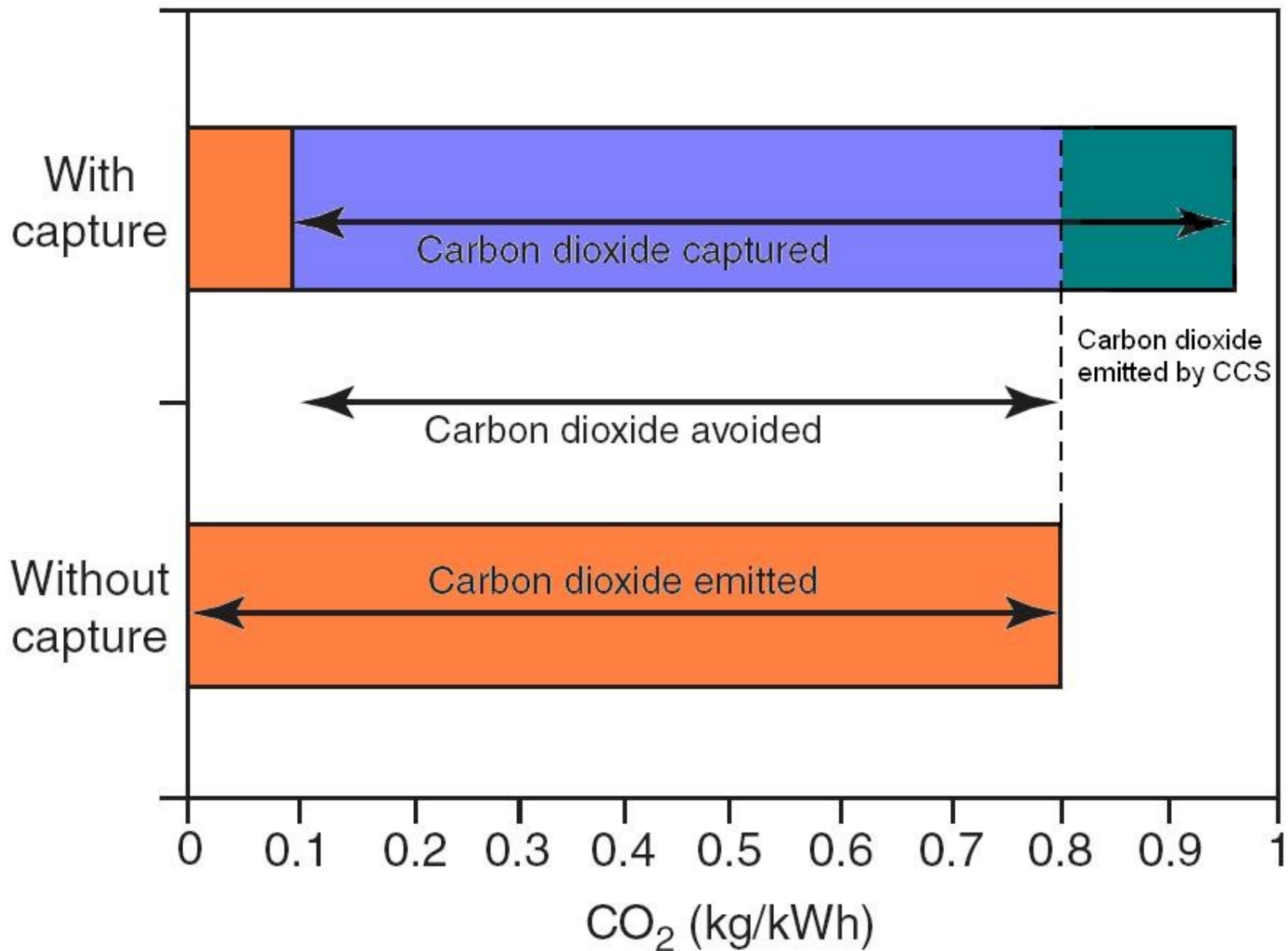
Example: Sleipner natural gas field, Norway



CO₂ capture and storage pathways



CO_2 avoided =
 CO_2 captured - emissions of CCS



Estimated total cost, today

43 - 52 € / tCO₂ avoided for 10 M t/yr



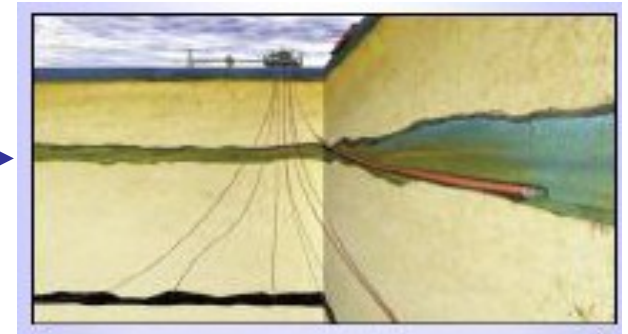
**Capture
compressed to 110 bar**

37-44 €/tCO₂



**Transport
100km**

1-3 €/tCO₂



**Storage
1Mt/yr 10Mt/yr**

15 €/tCO₂

5€/tCO₂

Electricity production cost increases by >30%

- Coal plant:
from 4.3-5.2 c/kWh without
to 6.3-9.9 c/kWh with CCS
400M\$ additional investment
- Natural gas combined cycle:
3.1 - 5.0 c/kWh without
4.3 - 7.7 c/kWh with

Source: IPCC SRCCS

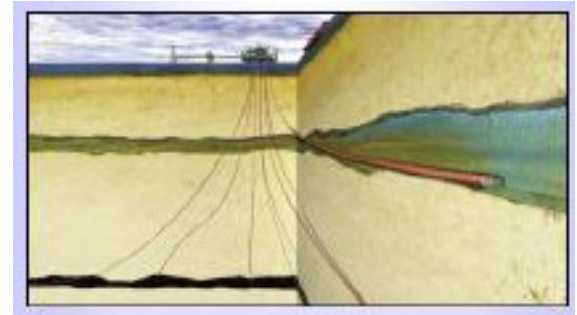
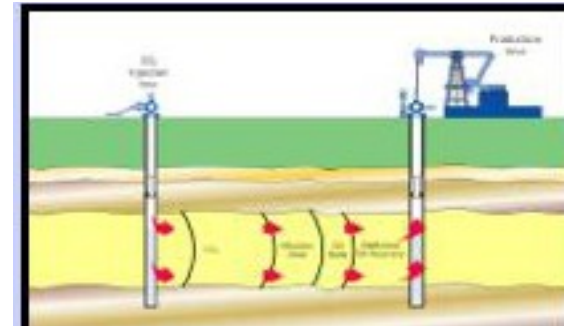
But there are uncertainties

Risks of leakage:

Imply long term monitoring

Economic framework is uncertain (post
Kyoto regulation, ETS...)

No public opinion exists yet





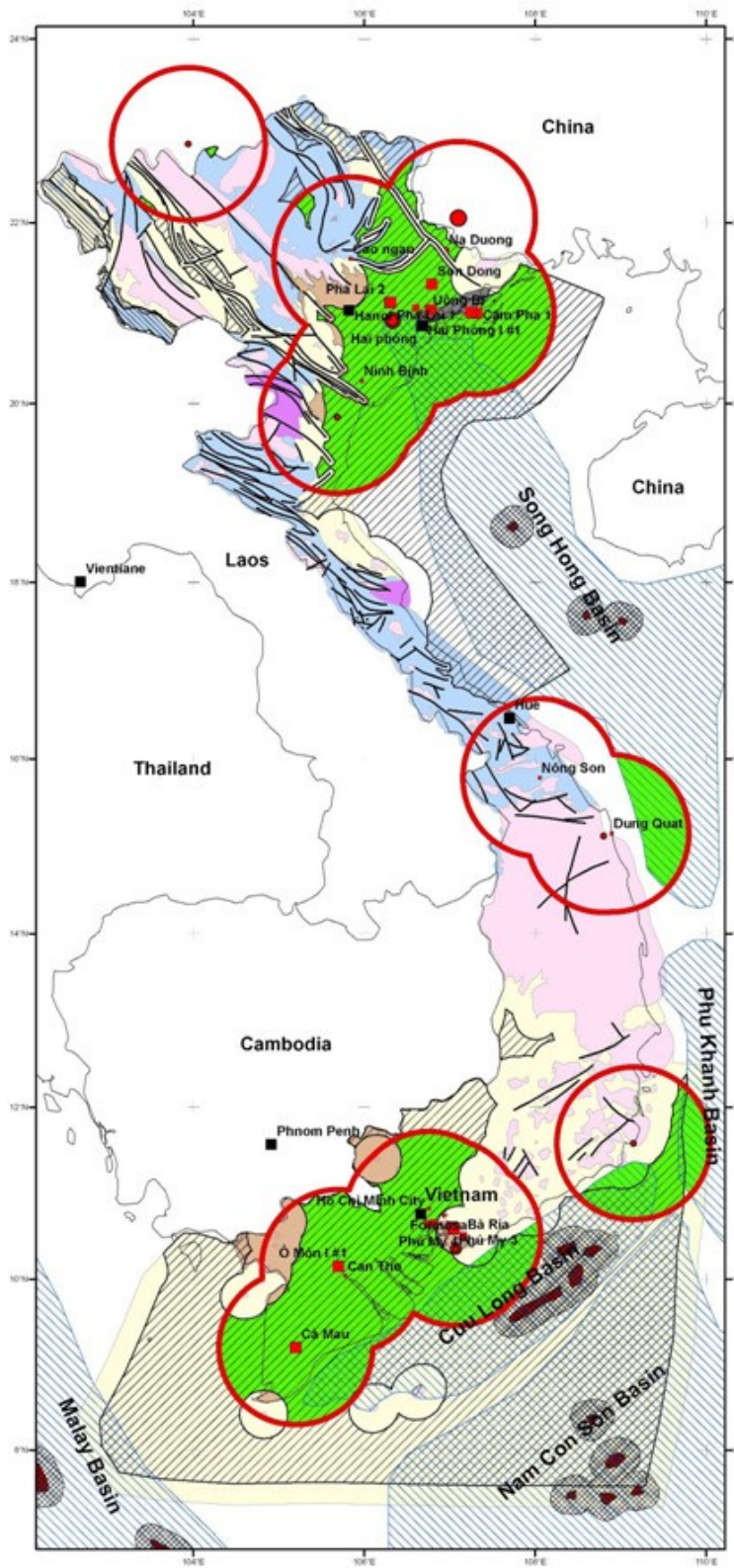
2. CCS potentially relevant in Vietnam

Many power plants >2.5 Mt CO₂ / yr

Existing and future coal-fired/natural gas combined cycle power plants (Pha Lai, Uong Bi, Hai Phong, Cam Pha, Quang Ninh, TBKHH Mien Trung, Coal Mien Trung, etc) in the river basin area of Song Hong and the North end.

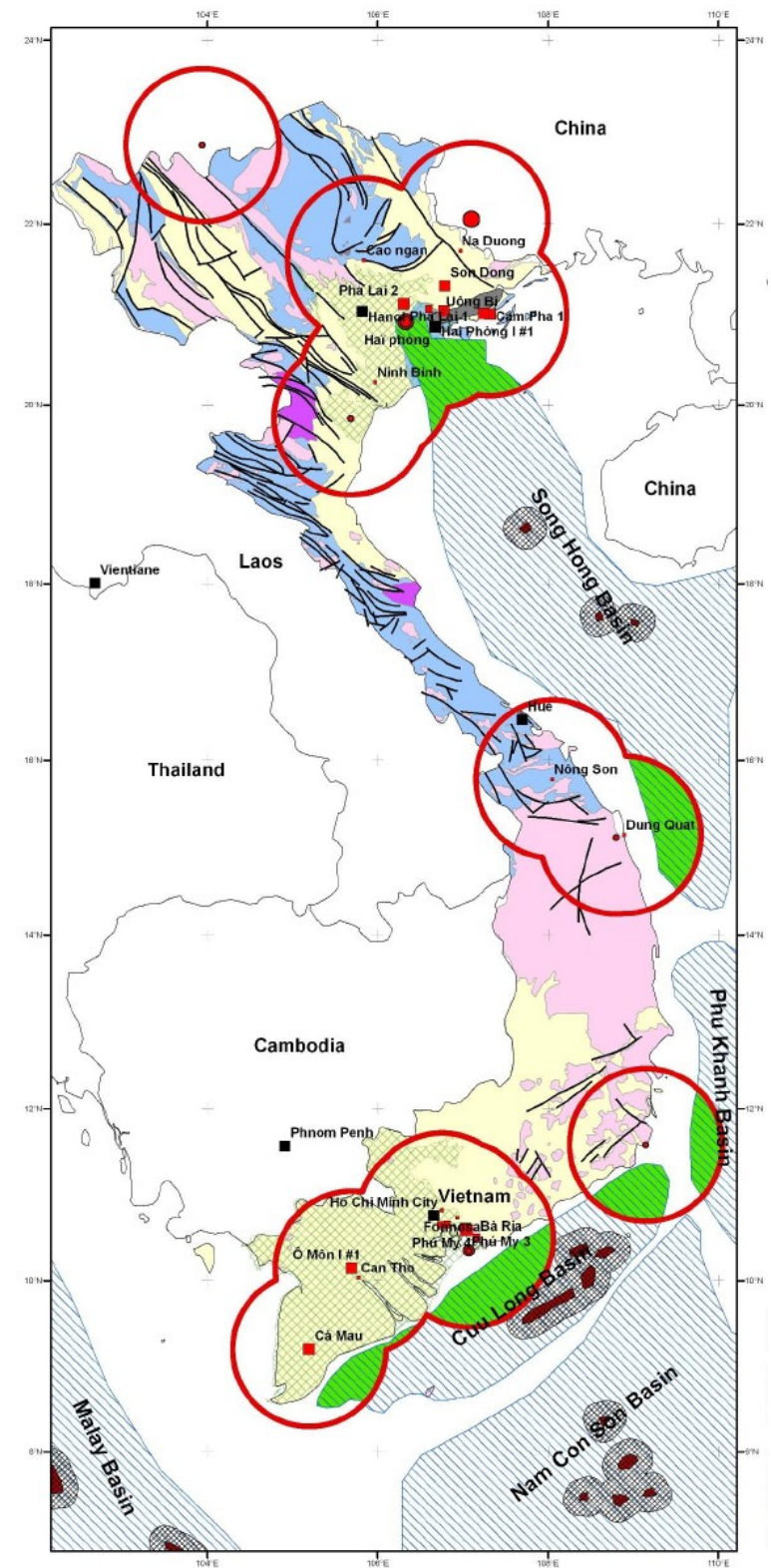
Existing and future natural gas combined cycle/coal-fired power plants (Phu My, Ca Mau, TBKHH Mien Nam, Tra Vinh, Kien Giang, Coal Mien Nam, etc) in the river basin area of Cuu Long.

Favorable storage geology & proximity

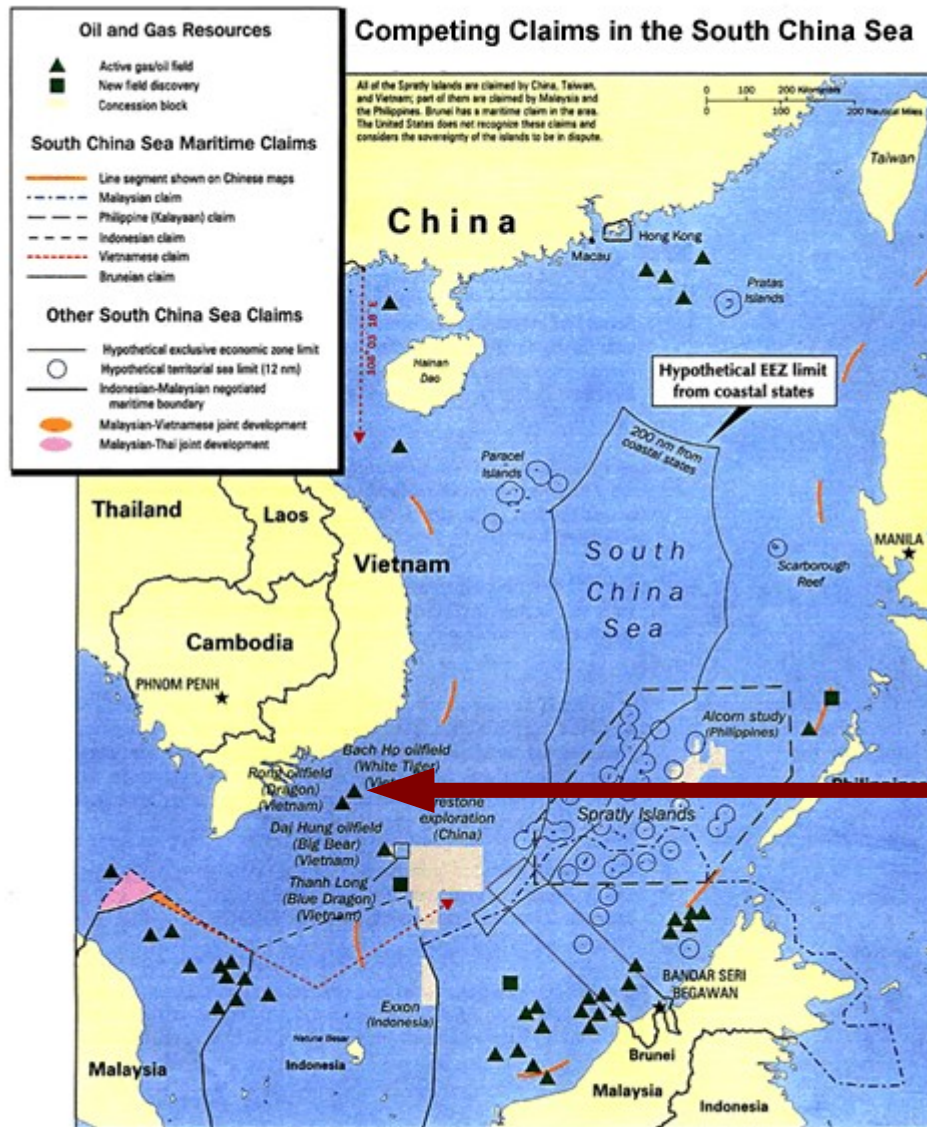


Source : BRGM

Storage potential
even if restricted
to near offshore



CCS at White Tiger field (Bach Ho)



- CO2 capture from gas power plants
- pipeline transport
- storage in oil fields
- enhanced oil recovery (EOR)

White Tiger missed goals

Emission reduction of
7.7 million tCO₂ per year

Recovery of
50 000 barrels of crude
oil per day

Clean Development
Mechanism





3. Experts are pessimistic



The survey

- Face to face interviews
- 16 experts
- 2013, in Vietnam

Table 1: The organizations of experts and their functions

Sector	Organization	Function
Government	Ministry of Industry and Trade (MOIT)	Energy policy and project investment for CCS in the national energy development
	Ministry of Environmental and Natural resources (MONRE)	Environmental and natural resources protection and management
	Electricity Regulatory Authority of Vietnam (ERAV)	Issuing regulations for the power system operation in Vietnam
	Ministry of Science and Technology (MOST)	Scientific policy and research investment for the new technologies
Industrial sectors	Electricity of Vietnam (EVN)	Invest in and regulate the largest share of the power generation sector, all transmission and distribution systems
	National Load Dispatch Center (NLDC - AO)	Dispatch the whole power generation and transmission systems
	Coal power plants	Investing in or operating coal power plants
Scientific institutes	Institute of Energy (IE)	Research on CCS potential and deployment in Vietnam
	Institute of Energy Science (IES)	Research on new and clean energy technologies, implement renewable energy projects
	Electric Power University (EPU)	Research on electric power systems

Table 2: Interview themes

Theme	Key points	Objectives
Necessity of CCS & Capture-Readiness (CR) in Vietnam	<p>Is it a necessary technology in Vietnam for mitigating climate change</p> <p>Is it possible to deploy CCS/CR in Vietnam now</p> <p>Could it be an effective low carbon technology in short- or long-term?</p>	To examine advantages and position of CCS/CR in Vietnam' energy development strategy
Potential risk of CCS projects and the corresponding risk control	<p>What kind of potential risks of CCS/CR exist in Vietnam</p> <p>Is it preventing CCS/CR from deployment</p> <p>How to control risks effectively</p>	To prepare solutions to deal with potential risks
Influencing factors and incentives for CCS/CR deployment in Vietnam	What are the main influencing factors in CCS/CR deployment in Vietnam	To provide policy-making recommendations for CCS/CR development



▣ Views on necessity of CCS

- ▶ Coal : will increase
- ▶ Integration with existing system : relatively easy
- ▶ Competitiveness with efficiency & renewables :
in doubt



▣ Views on barriers

- ▶ Technical risk: novelty, Bach Ho failed EOR
- ▶ Environmental risk of leakage
- ▶ Degrades energy security : need more coal
- ▶ Financial risk : CO2 market unreliable
- ▶ Political risk : no mandate for Capture Ready



☰ Views on solutions

- ▶ Policy : MoIT, MoNRE, MoST joint board
- ▶ Financial incentives needed but not believed
- ▶ More studies : geology, technology, economics
- ▶ Awareness : demonstration (someone else pay)
- ▶ Power sector development strategy



▣ Conclusions

- ▶ All experts : CCS not a first choice for reduction
- ▶ Developing CCS needed, but not our problem
- ▶ Reusing CO₂ is preferred
- ▶ Internalize the costs of CO₂ emissions first
- ▶ No new coal plants without carbon capture built in or funded by Europe