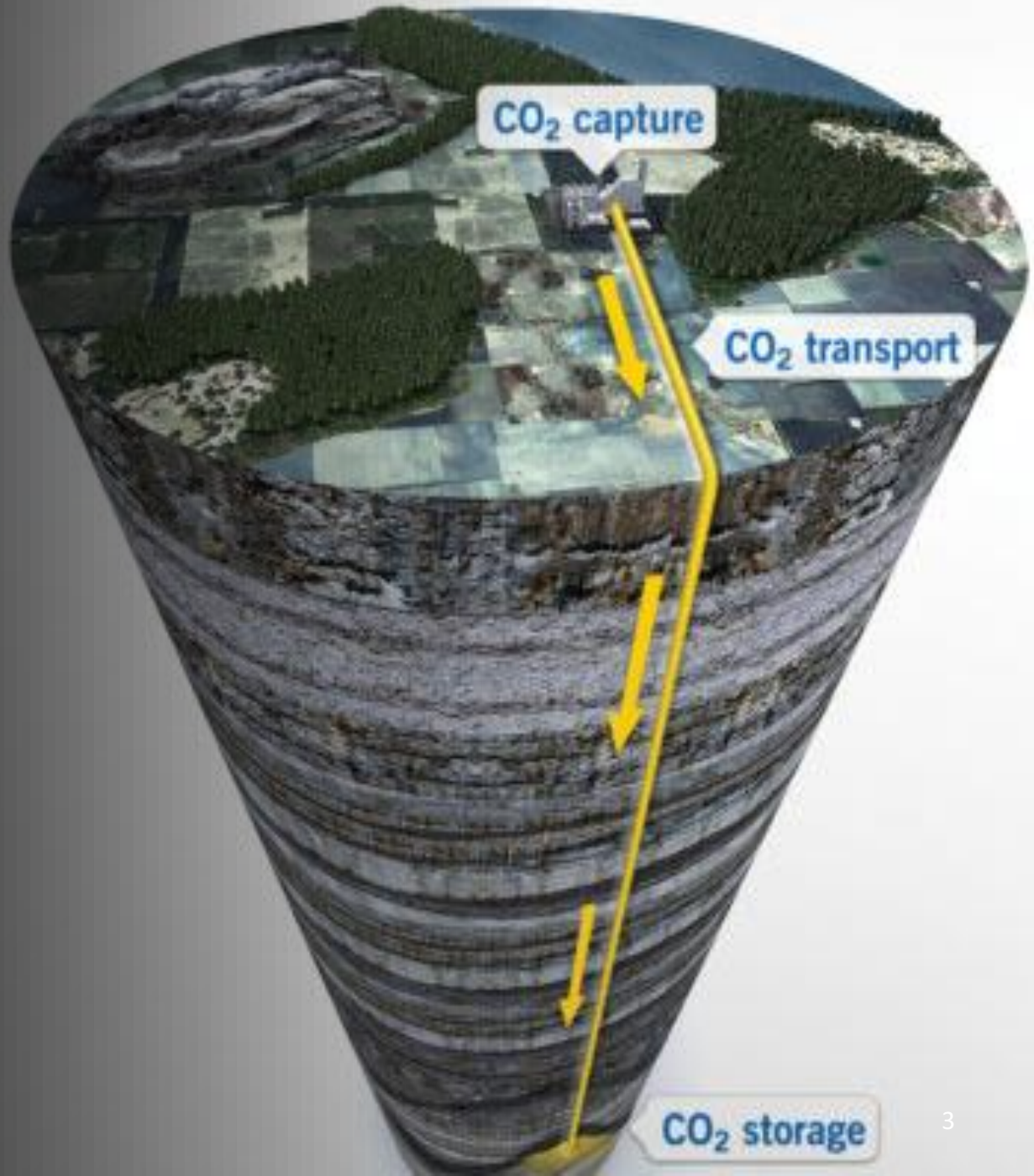
Carbon Capture and Storage (CCS)

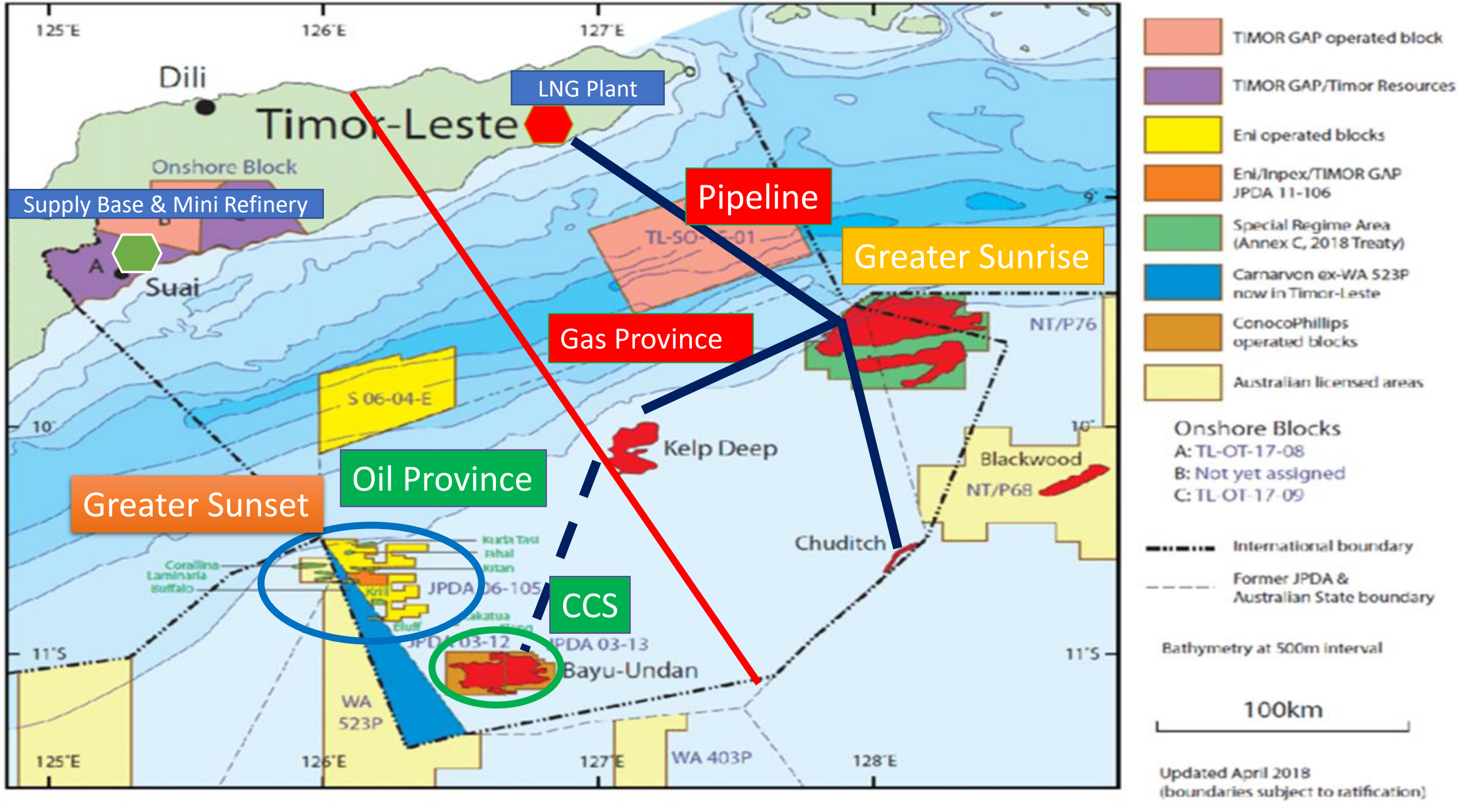
National Authority for Petroleum and Minerals

Agenda

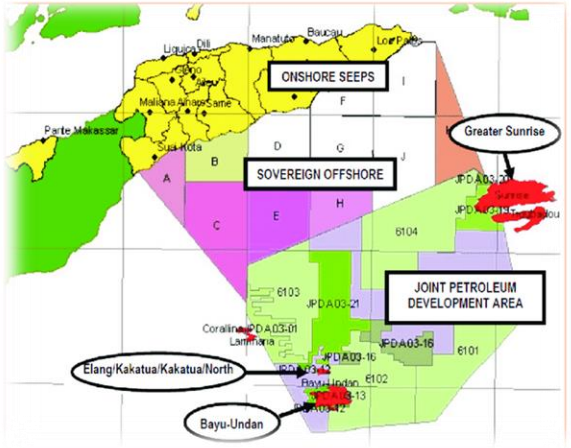
1. Introduction & Current Status of Oil and Gas
2. Carbon Capture and Storage
3. Regulatory & Commercial Frameworks;
4. Local Content

Carbon Capture and Storage (CCS)




125°E
126°E
127°E
Dili
Timor-Leste
LNG Plant
Onshore Block
Supply Base & Mini Refinery
Suai
A
Pipeline
Greater Sunrise
TL-SO-T-01
Gas Province
NT/P76
S 06-04-E
10°
Kelp Deep
Blackwood
NT/P68
Oil Province
Greater Sunset
Chuditch
Corallina
Laminaria
Buffalo
JPDA 06-105
CCS
JPDA 03-12
JPDA 03-13
Bayu-Undan
11°S
WA
523P
WA 403P
128°E
TIMOR GAP operated block
TIMOR GAP/Timor Resources
Eni operated blocks
Eni/Inpex/TIMOR GAP
JPDA 11-106
Special Regime Area
(Annex C, 2018 Treaty)
Carnarvon ex-WA 523P
now in Timor-Leste
ConocoPhillips
operated blocks
Australian licensed areas
Onshore Blocks
A: TL-OT-17-08
B: Not yet assigned
C: TL-OT-17-09
International boundary
Former JPDA &
Australian State boundary
Bathymetry at 500m interval
100km
Updated April 2018
(boundaries subject to ratification)

Our Projects and Showcase



We were entrusted to administer Joint Petroleum Development Area on behalf of Timor-Leste and Australia as the Designated Authority.

2002–2019

Bayu-Undan Production, contributed more than 20 billion in revenue to the state.

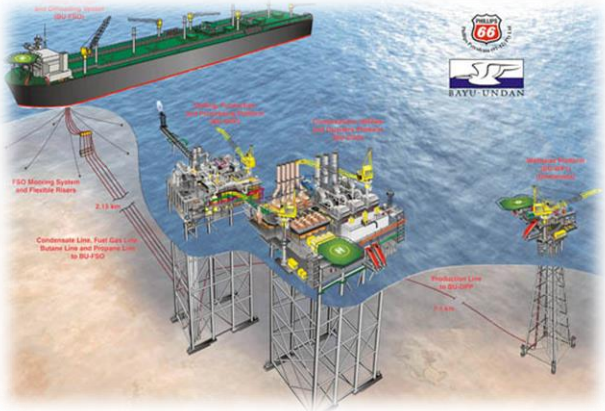
2004 – Present

Kitan Production, lasted only 4 years – also contributed additional revenue to Bayu-Undan.

2011–2015

Signed Maritime Boundaries Treaty Delimiting our offshore boundaries with Australia; as a consequence, former JPDA is now 100% part of Timor-Leste's Jurisdiction

2018



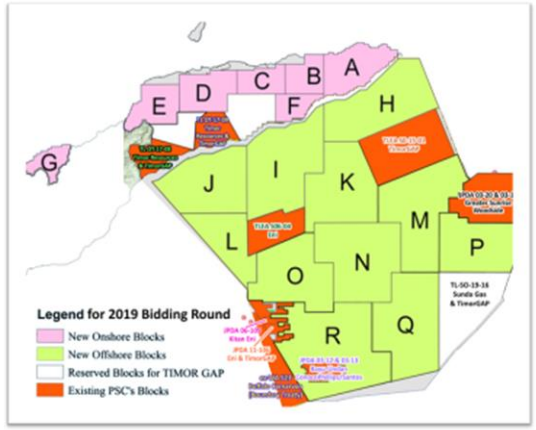
Achievements in oil and gas sector in 2021/2022

- Timor-Leste drilled 6 wells during 2021 – during Covid-19 period;
- Infill well of Bayu-Undan – 3 infills successfully drilled during in 2021 contributed to a revenue around 400 million between 2021-2022;
- The drilling of the exploratory wells for the first time after 50 years of exploration idle in the onshore of Timor-Leste. Two wells have been completed and one proved to be commercial;
- The first exploratory of Buffalo field in the offshore Timor-Leste (dry well);
- The signing of the CCS MoU (Carbon Capture and Storage).
- Successfully held 4th Mining & Energy Summit in Dili hosted around 250 executives;
- Continuous discussion of the legal, fiscal as well as regulatory frameworks for GSSR (Greater Sunrise Special Regime)
- The signing of Pualaca PSC (onshore) with TIMOR GAP, E.P. (7 Dec 2021)

Going Forward

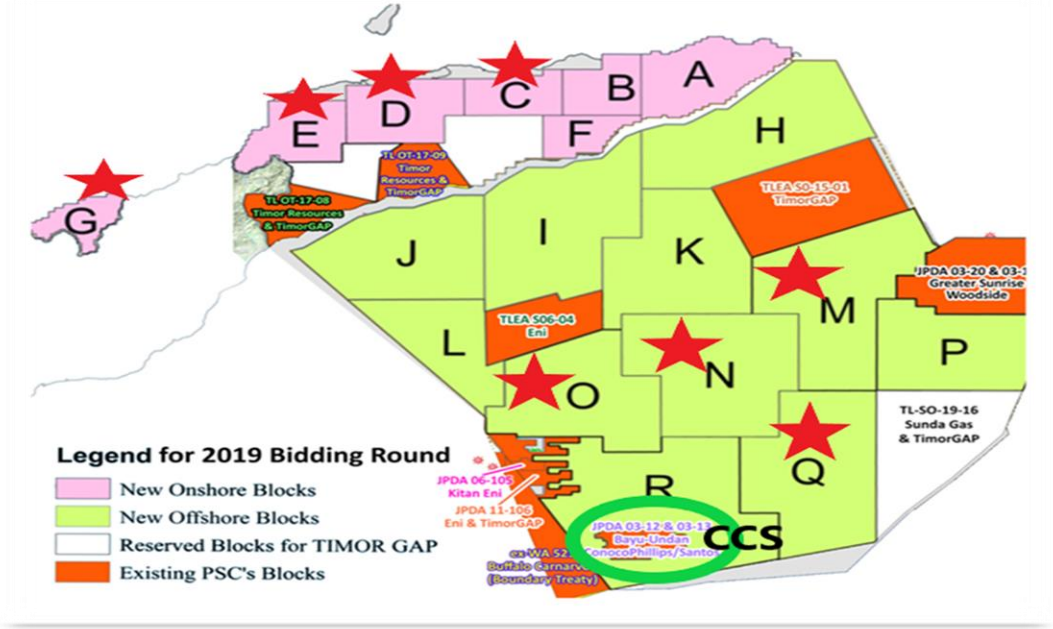
Timor-Leste 2nd Licensing Round (Blocks Promotion)

Timor-Leste 2nd Licensing Round Result



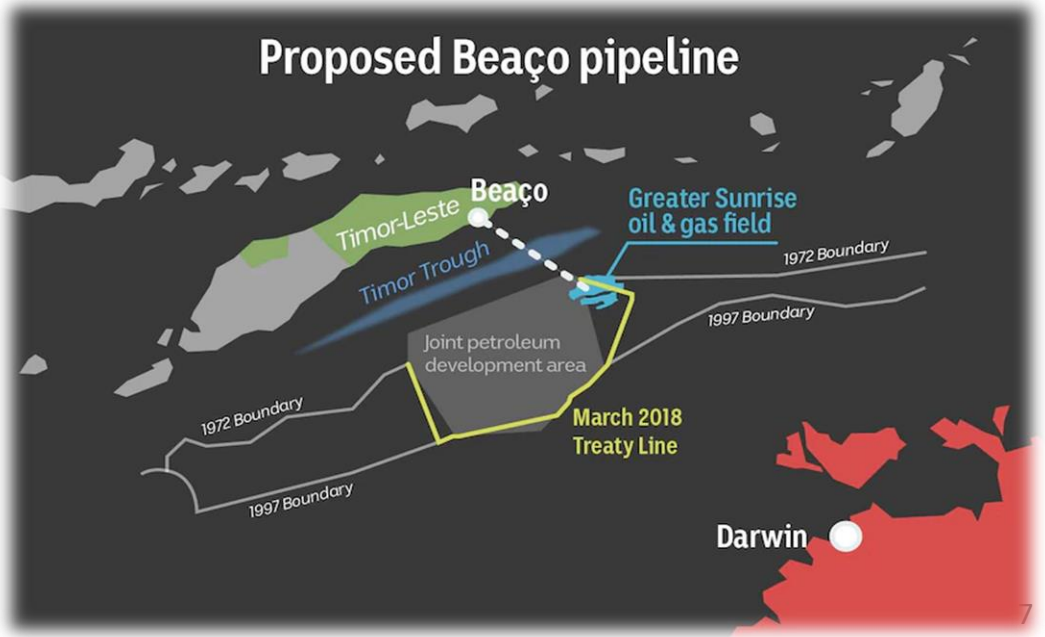
No.	BLOCK	WINNER
1	A	TIMOR GAP E. P.
2	B	ETO Lda
3	F	HTS Exploration Ltd
4	P	ENI Australia B. V.
5	R	Santos NA Timor-Leste Pty Ltd

- *We are currently negotiating 5 PSCs and looking forward to signing these PSCs within this year*
- *With this contribute to a total of 15 oil and gas projects; There are explorations blocks (PSC) in offshore and 6 Blocks onshore.*



Greater Sunrise:

- **Discovered in 1974 (48 years ago)**
- **The Recoverable Reserves: 7.3 tcf (Operator's Mid Case)**
- **Timor-Leste's NOC's share 56.56%.**
- **Government of Timor-Leste and Australia is currently working together to put in place legal, fiscal as well as regulatory frameworks**

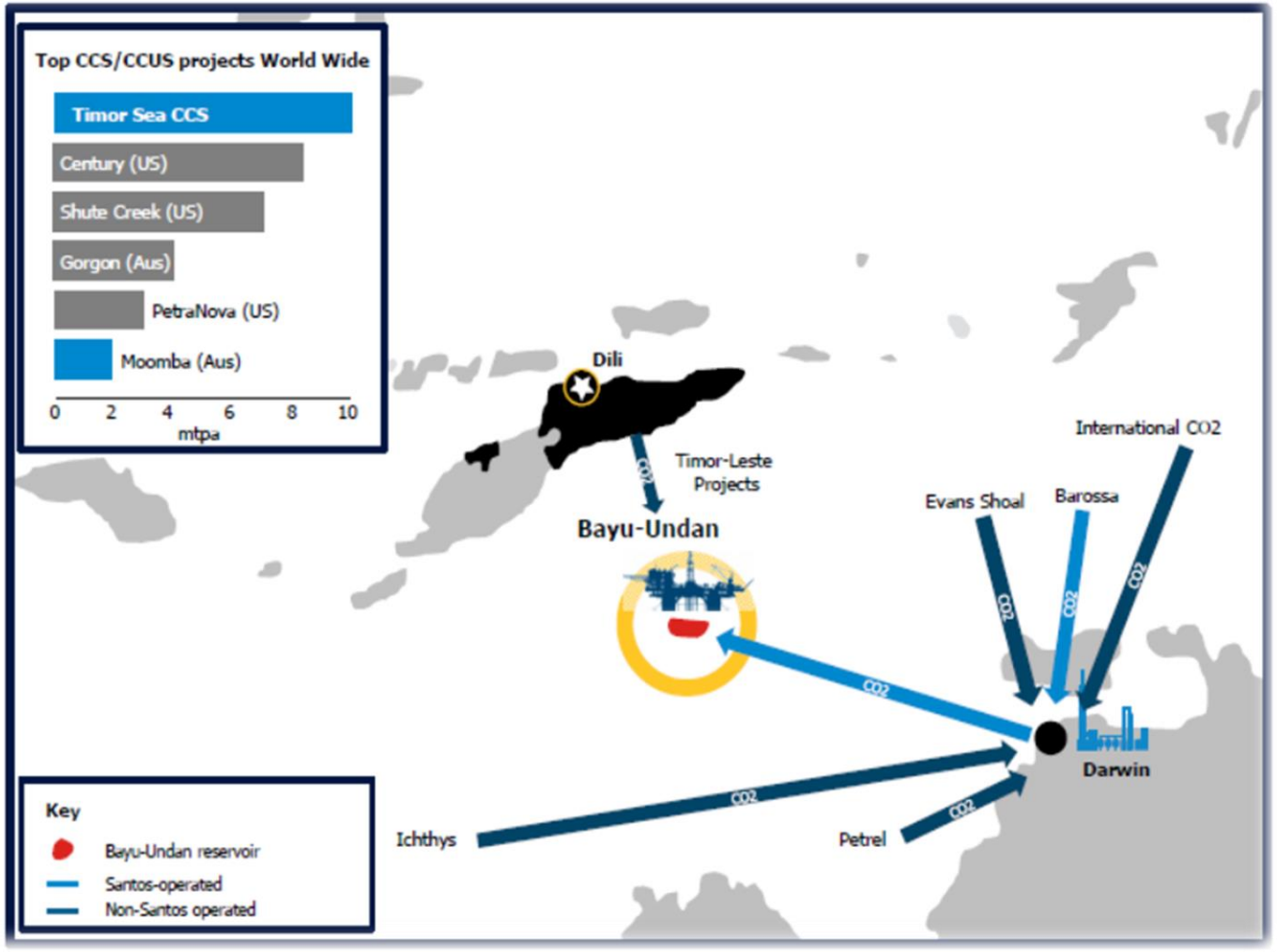


CCS MoU Signing between Timor-Leste and Santos

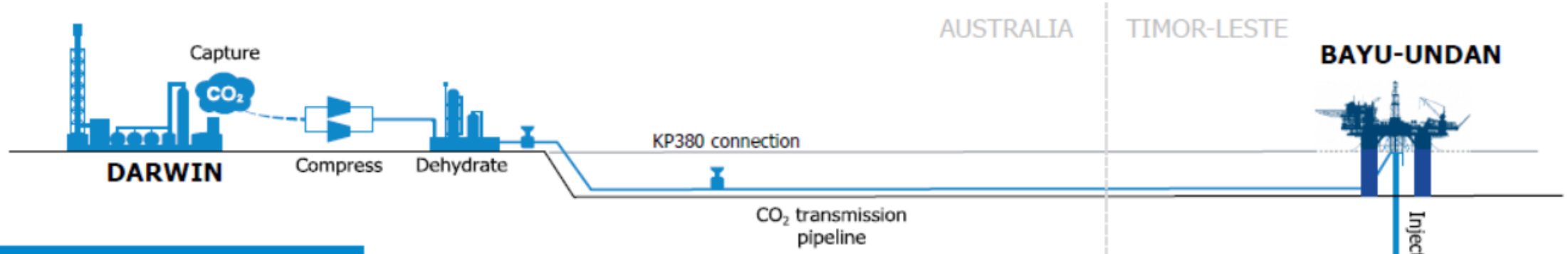
>12 mtpa Potential market for CCS in the region

>10 mtpa CO2 storage capacity at Bayu-Undan

2025 Targeted project start-up



Maximise repurposing of existing facilities



CO2 Capture

+ **Build new CO_2 capture/export facilities in Darwin**

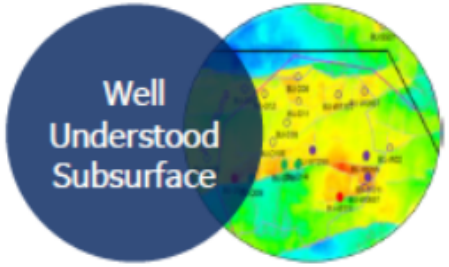
Pipeline

+ **Repurpose available section of Darwin Pipeline, K380 to Bayu-Undan for CO_2**
+ **~120km section of new pipeline will be required**

Bayu-Undan Facilities

+ **Repurpose offshore facilities with modifications for CCS**
+ **Offshore CCS operations transitions to majority TL workforce**
+ **Potential for Timor Gap participation**

Encouraging findings from initial feasibility assessment, but need to act quickly to position BU CCS project as the major CCS hub for this region



+ Estimated storage capacity of >250 Mt CO_2, with potential for >10mtpa
+ 20 years storage modelled, with potential for additional upside
+ Proven reservoir seal and high injectivity

+ Opportunity to re-purpose existing wells and platforms with modifications
+ Provides strong competitive advantage vs. other greenfield projects in region

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+ New pipeline, CO_2 separation, dehydration and compression facilities will be required in Australia to deliver CCS at Bayu-Undan
+ CCS injection could commence in early 2025, but only if the new pipeline is sanctioned in Q1, 2022
+ Delay will substantially increase project costs and project may lose first mover advantage

Depleted hydrocarbon reservoirs like Bayu-Undan are well characterised and understood through decades of exploration, appraisal and production data, making them the ideal storage targets.

CONTAINMENT

- \+ High sealing capability of reservoir cap rock
  - \+ Reservoir seals proven through containment of hydrocarbons for tens of millions of years
- \+ Structural trapping is sufficient mechanism for containing CO_2 plume
- \+ High formation competency & high injectivity ($P_{inj} < P_{frac}$)

CAPACITY

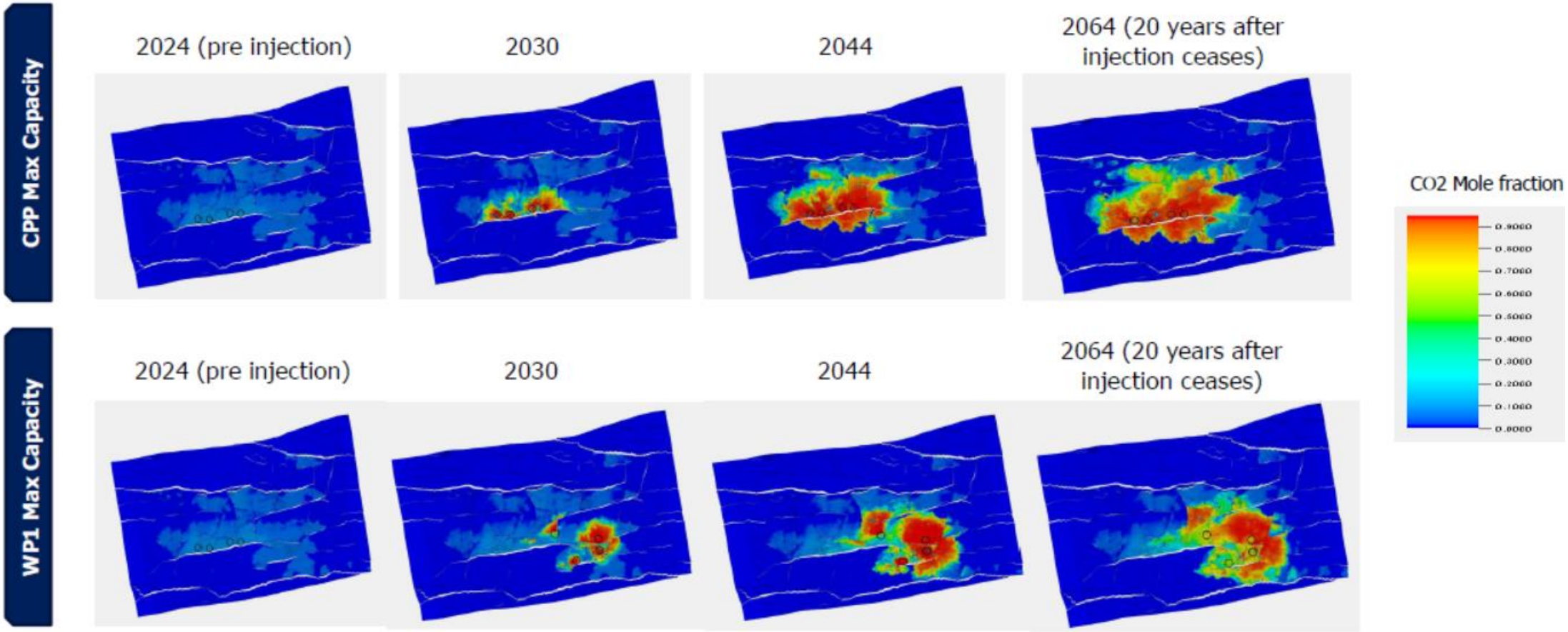
- \+ >3 Tcf of gas withdrawn to EOFL, preliminary estimates 250+ Mt capacity
  - \+ Strong and laterally extensive aquifer acts as pressure sink
  - \+ Potential to sequester high volume
  - \+ Reservoir may only pressurize ~100psi over Pi (20 years injection)

INJECTIVITY

- \+ High permeability available over long depleted column
  - \+ Historic gas injection ~300 MMscf/d with 3 wells
  - \+ High geomechanical competency of the rock allows for 'large pressure window'

Subsurface Reservoir Simulation

CO2 Plume Extent (CO2 Mole Fraction)



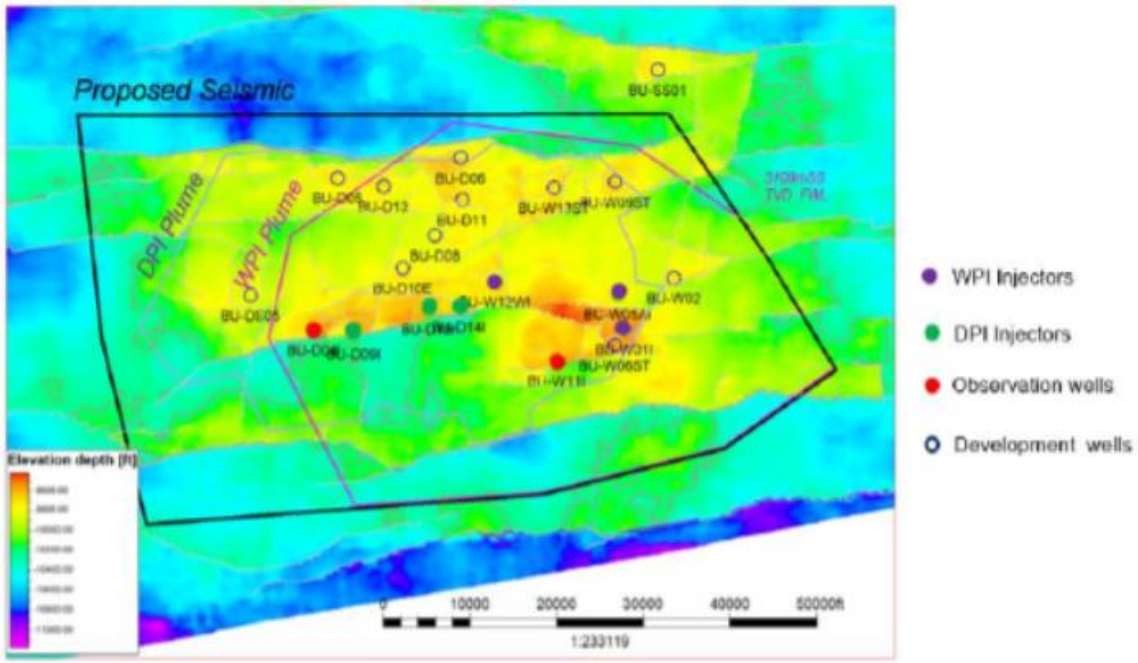
Original gas contains 5.4% CO2 (pale blue colour fill shows areal extent of initial gas column)

Monitoring Concept

Preliminary monitoring concept proposed that aims to determine the movement and fate of CO2, assess integrity of storage complex and wells, detect loss of containment and assess effectiveness of risk control measures…

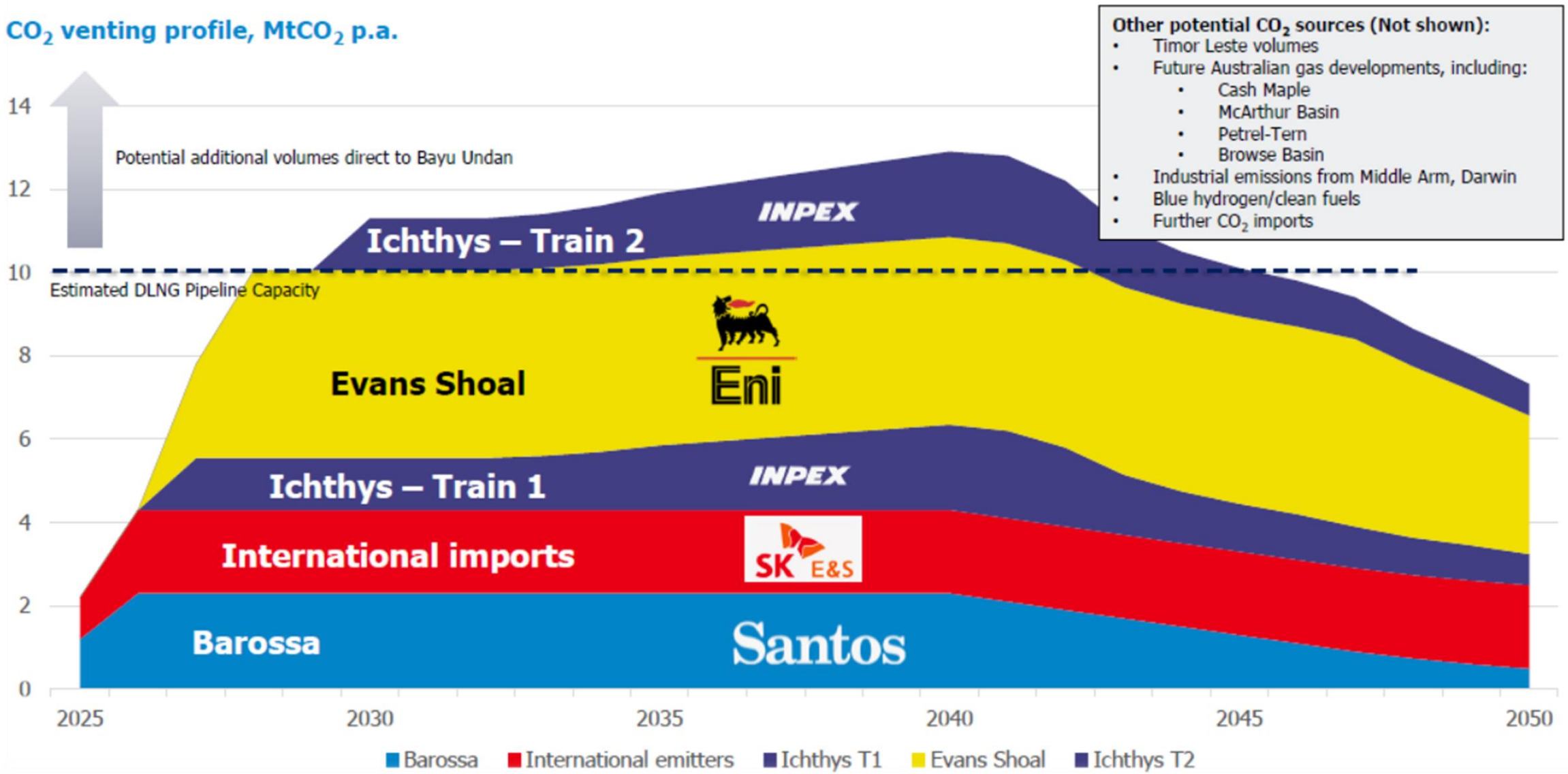
- **Monitoring Objectives**:
  - Predict CO2 front and pressure response
  - Confirm CO2 containment within structure
- **Well Monitoring**: utilise saturation logging, well integrity monitoring, injectivity telemetry and pressure/temperature gauges
  - One monitoring well within reservoir (i.e. D04/W11)
  - One monitoring well in overburden (i.e. D07/D16)
- **Seismic Monitoring**: Time lapse 4D seismic to monitor extent of plume via saturation changes
  - ~300 km^2 3D seismic area based on plume size modelling
  - Tentatively, four surveys proposed: Year 1 (prior to injection commencing), Year 5, Year 20 (after injection ceased), Year 40 (20 years after)

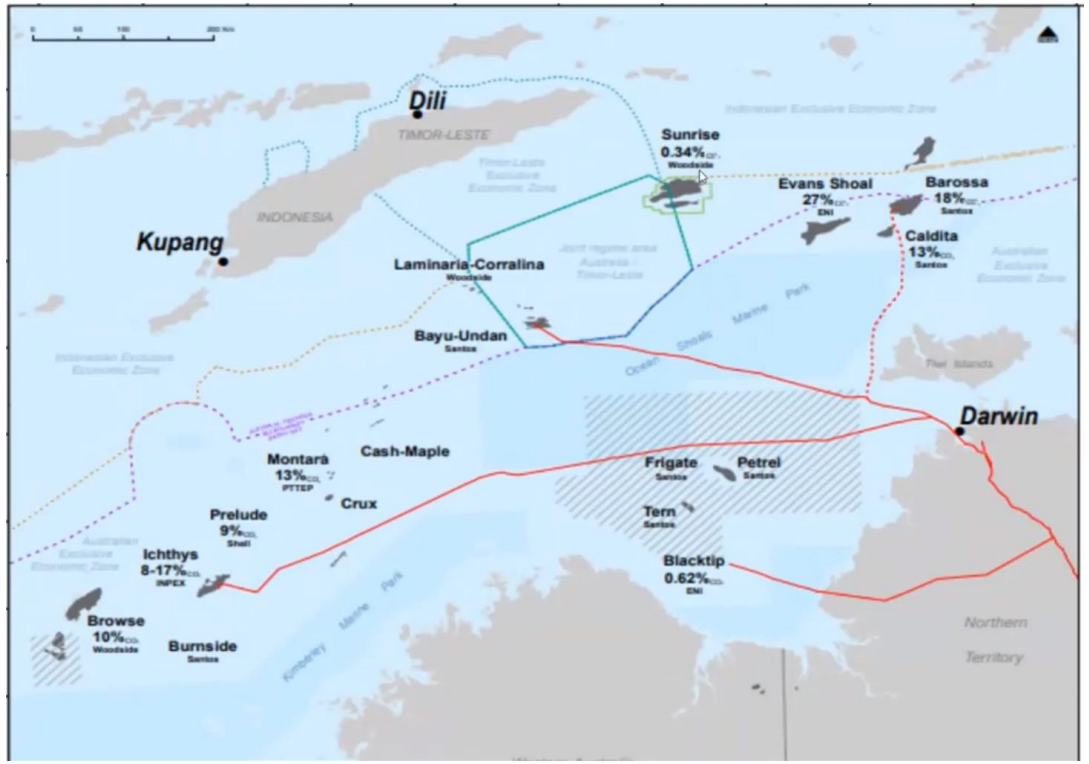
Top Reservoir Depth Map



>12mpta of potential demand for Bayu-Undan CCS

Santos





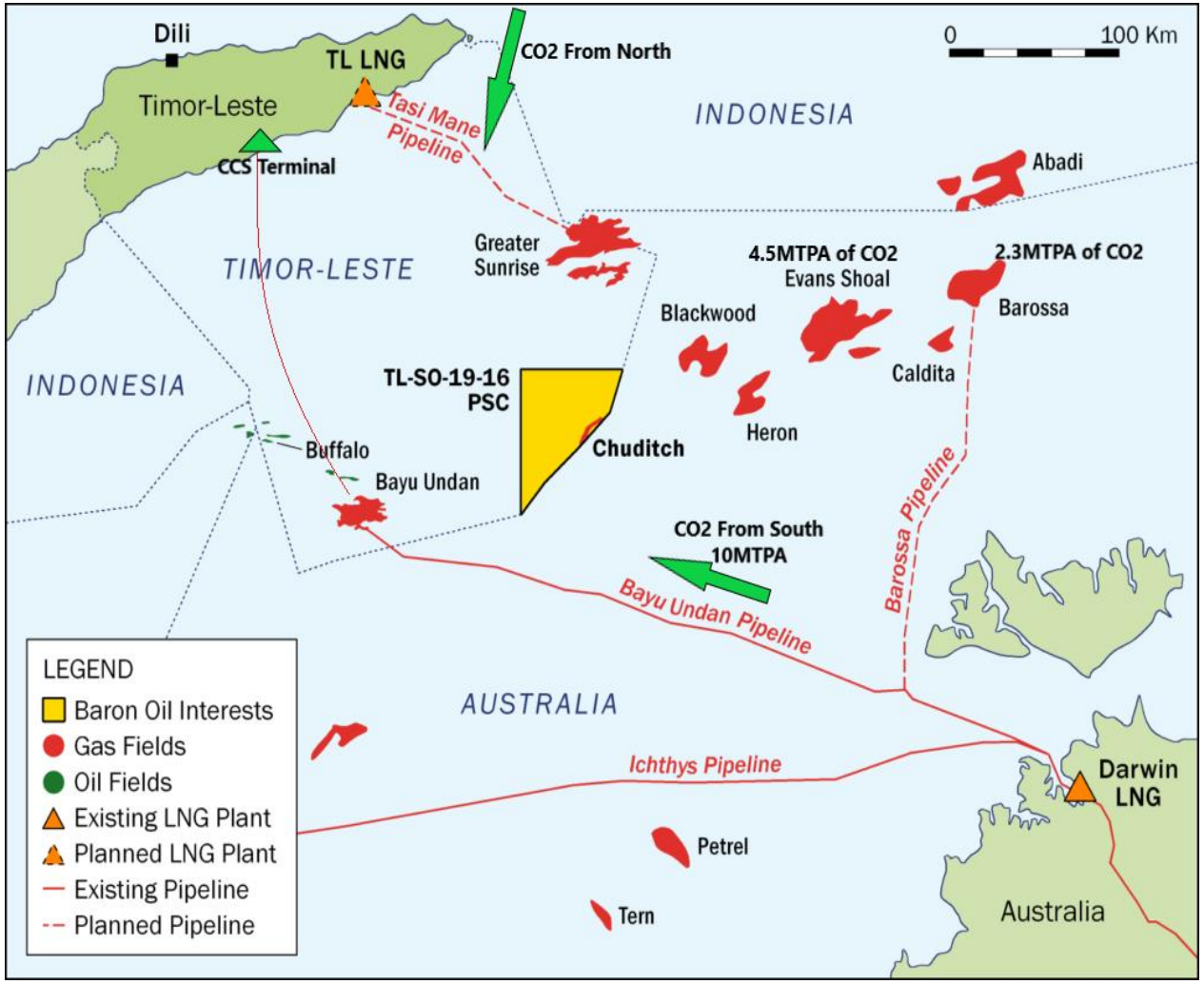
State	Field	Operator	Status	Sales Gas (TCF)[1]	% CO_2	CO_2 (TCF / MMt)
Timor-Leste	Bayu Undan	Santos	Future CCS hub	0.6 [2]	6%	-
	Greater Sunrise	Woodside	Development and LNG studies ongoing	5.1	5%	0.3 / 14
	Chuditch	SundaGas	Upside >6TCF, to be drilled 2023	3.4 [3]	18%	0.7 / 39
	Kelp Deep	n/a	Sour gas, tight reservoirs. Appraisal sidetrack failed	-	28-34%	-
Australia	Evans Shoal	ENI	Development studies	5.5	30%	2.4 / 122
	Barossa	Santos	FID taken in 2021	4.6	18%	1.0 / 52
	Blackwood	ENI	Low relief, limited upside	-	29-37%	-
	Heron	n/a	Deep; small; no flow on DST	-	28-35%	-
Indo-nesia	Abadi	INPEX	Development deferred	5.0	8%	0.4 / 23
			TOTALS (expected developments) =	**24.2**		**4.8 / 250**

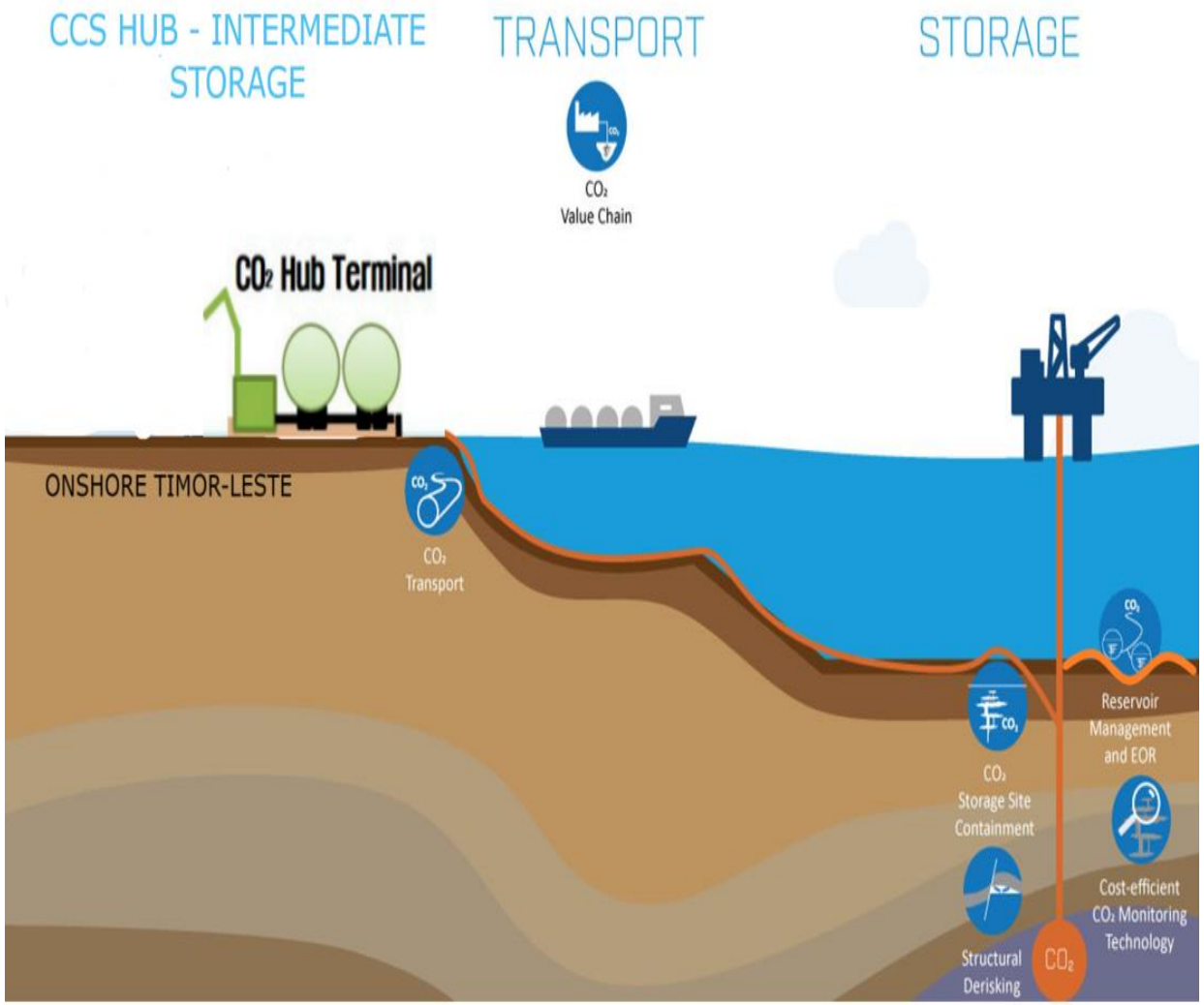
Other Potential Suppliers of CO2

Level	Name	Status	Potential Market	Transportation	Remarks
1	Icthys LNG	Current Emitter	4 mtpa	Pipeline to Bayu-Undan	
1	NT Power and Water	Current Emitter	2 mtpa	Pipeline to Bayu-Undan	
2	Darwin LNG	Under development	3 mtpa	Pipeline to Bayu-Undan	2025 start
2	Singapore Industrial			Maritime Shipping	2026 est.
	Korea Industrial			Maritime Shipping	2026 est.
	Japan Industrial			Maritime Shipping	2026 est
	DACC			Onshore Timor-Leste	Demo plant to start in 2024

Why does a small country want to commit to net-zero carbon?

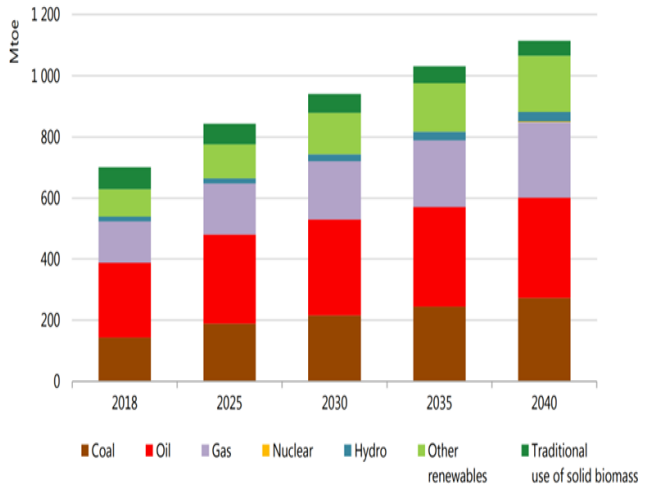
TIMOR-LESTE CCS TERMINAL HUB





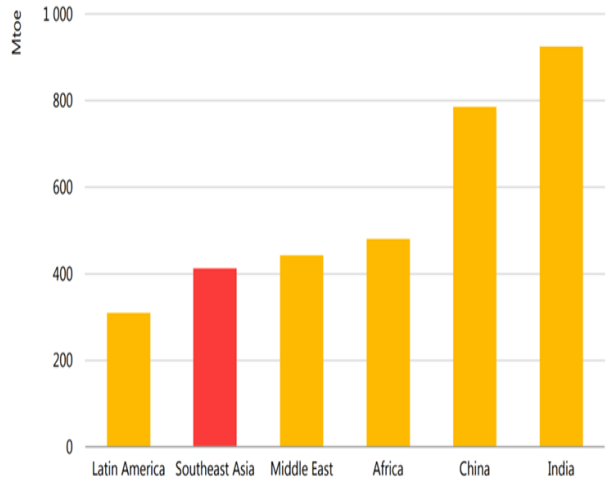
SEA Energy Demands & Timor-Leste's Contribution to the region and beyond

Primary energy demand in Southeast Asia in the Stated Policies Scenario

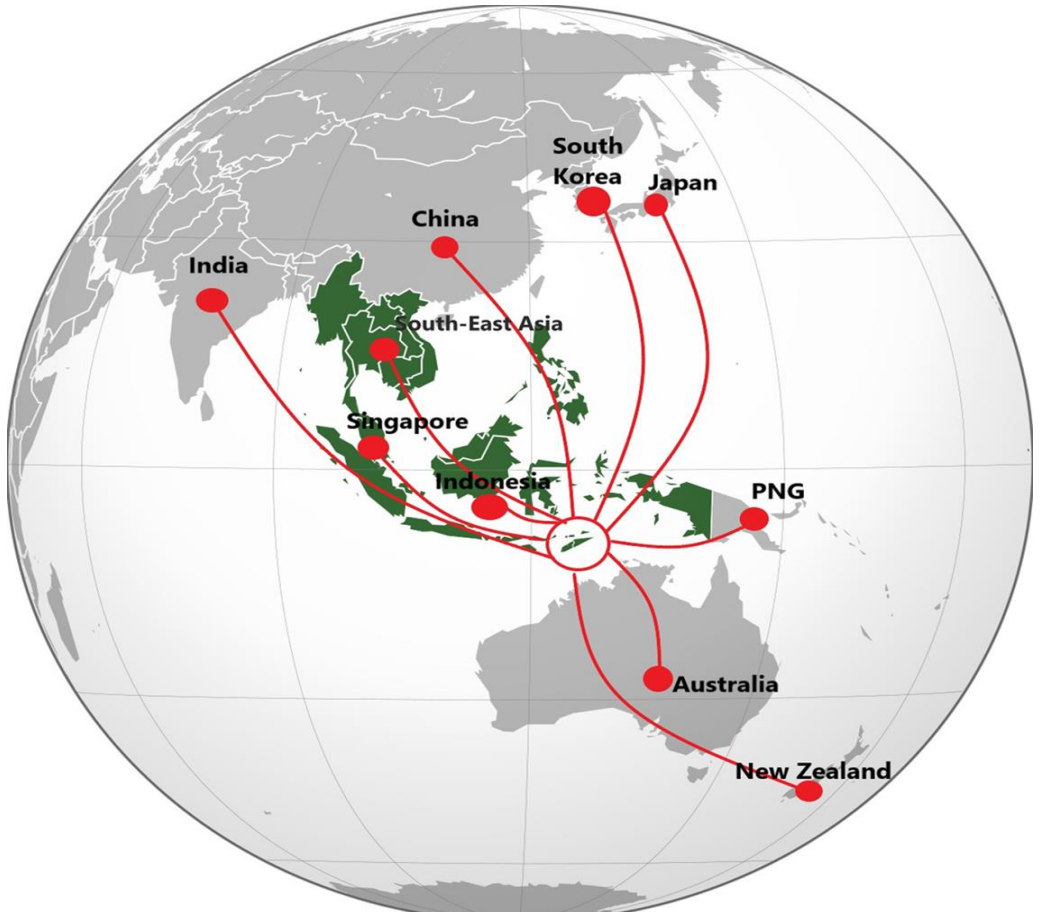


Notes: Mtoe = million tonnes of oil equivalent. Other renewables include solar PV, wind, geothermal and modern use of bioenergy.

Change in total primary energy demand in selected regions in the Stated Policies Scenario



Note: Mtoe = million tonnes of oil equivalent.

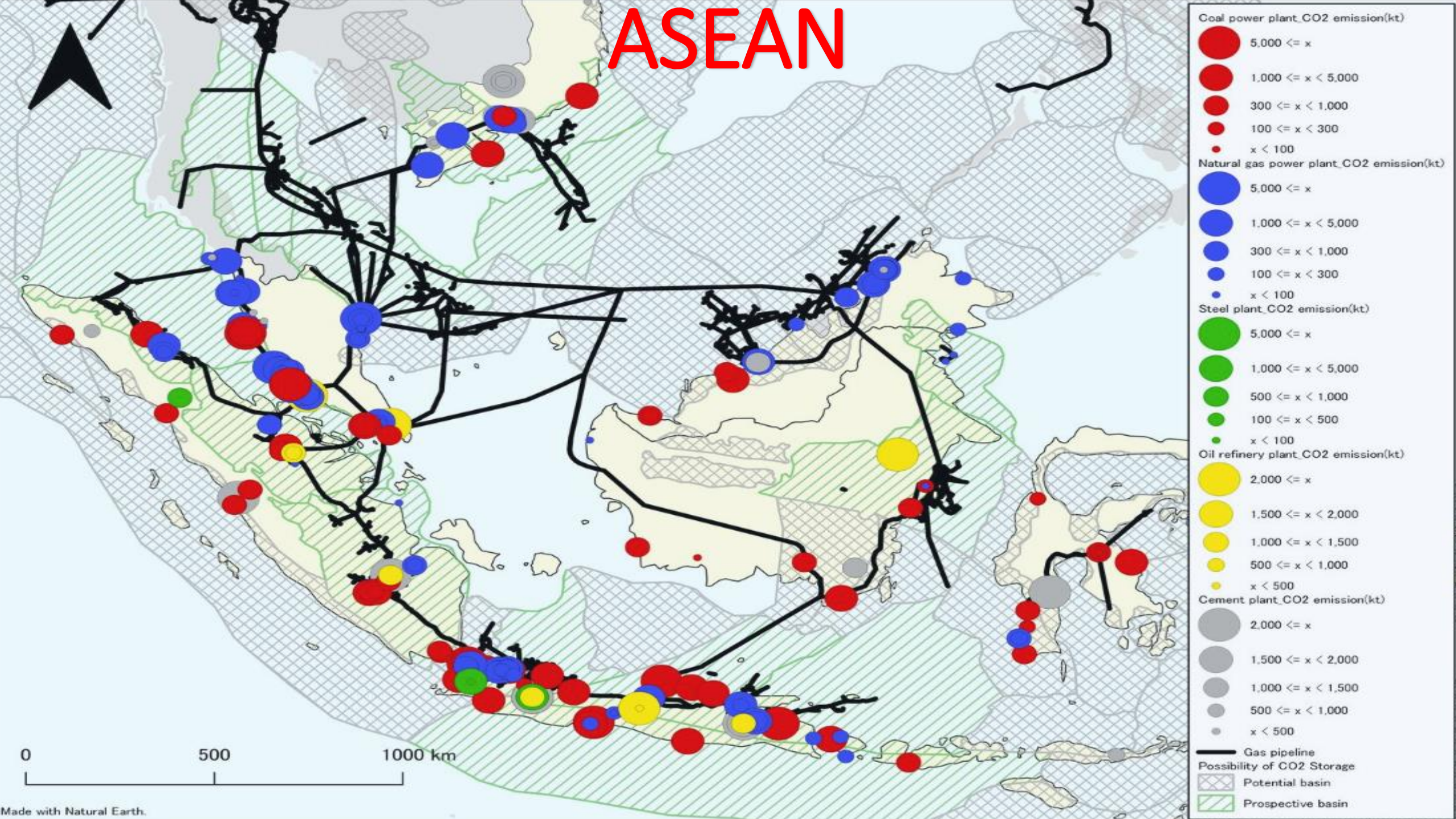


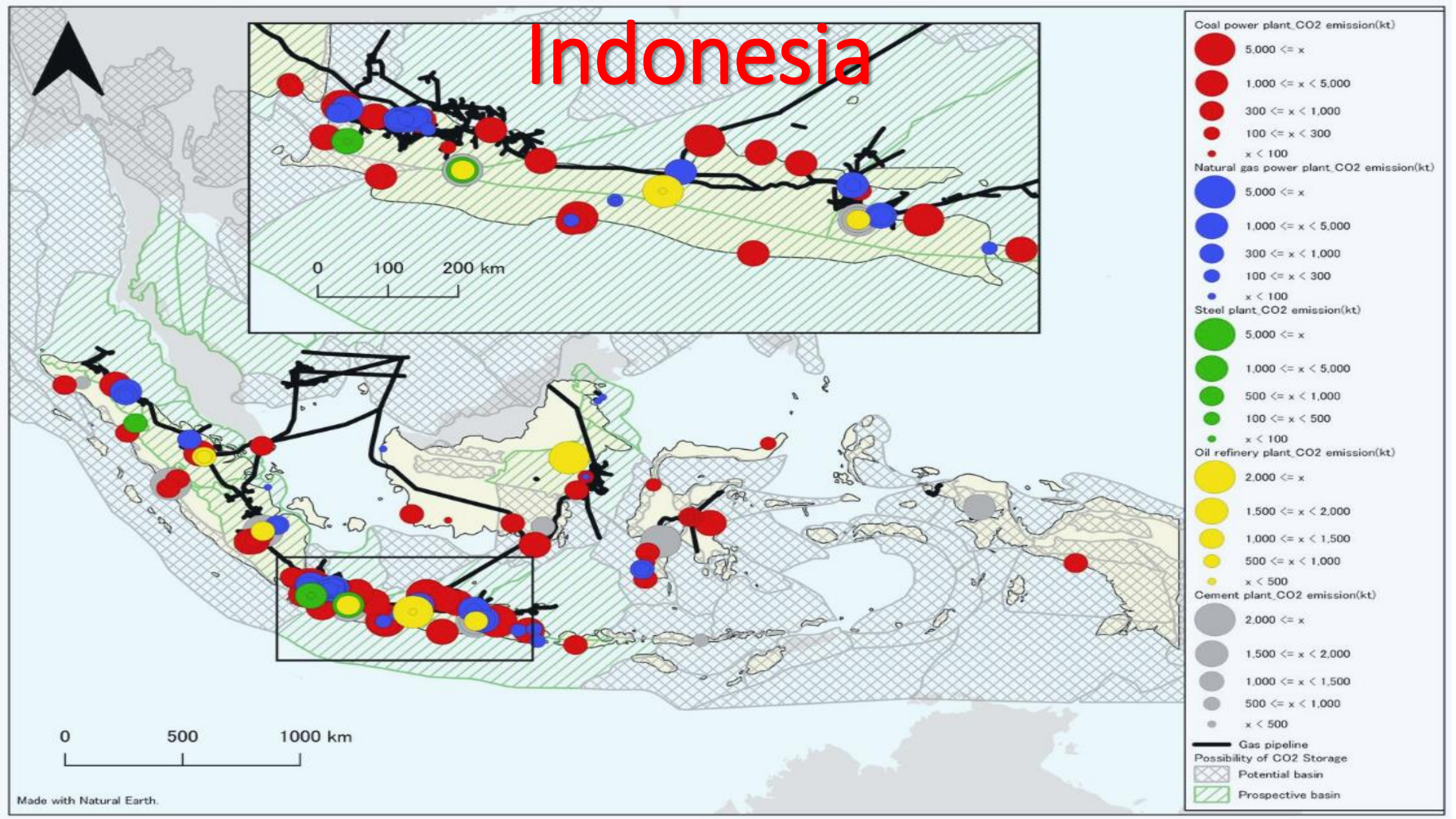
Note:

- Asia-Pacific accounts for > 60% of the world population (4.6 – 4.7 billions)
- The asean energy outlook predicted that south-east asia energy demands are expected to rise by 60% by 2040, yet over 40% of the energy are imported
- China accounts for 25% world energy demand; 67.3% of China's crude oil supply in 2019 came from imports.
- Timor-Leste + Indonesia + Australia has more than 50 TCF ready to be tapped into CCS is the best catalyst to unlocking this resources;
- We have huge potential sites for hydrogen storage and located strategically to transport the hydrogen to Asia-Pacific markets.

- First mover in the region;
- Solution to blue hydrogen + increase supply of gas in the region;
- A player in the ASEAN Carbon Cooperation;
- solution to the industrial CO2 to the countries in the region (Japan, South Korea, Singapore and the region).

The World is in a competition


ASEAN
Coal power plant_CO2 emission(kt)
5,000 <= x
1,000 <= x < 5,000
300 <= x < 1,000
100 <= x < 300
x < 100
Natural gas power plant_CO2 emission(kt)
5,000 <= x
1,000 <= x < 5,000
300 <= x < 1,000
100 <= x < 300
x < 100
Steel plant_CO2 emission(kt)
5,000 <= x
1,000 <= x < 5,000
500 <= x < 1,000
100 <= x < 500
x < 100
Oil refinery plant_CO2 emission(kt)
2,000 <= x
1,500 <= x < 2,000
1,000 <= x < 1,500
500 <= x < 1,000
x < 500
Cement plant_CO2 emission(kt)
2,000 <= x
1,500 <= x < 2,000
1,000 <= x < 1,500
500 <= x < 1,000
x < 500
Gas pipeline
Possibility of CO2 Storage
Potential basin
Prospective basin
0
500
1000 km
Made with Natural Earth.


Indonesia
0 100 200 km
0 500 1000 km
Made with Natural Earth.
Coal power plant_CO2 emission(kt)
5,000 <= x
1,000 <= x < 5,000
300 <= x < 1,000
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x < 100
Natural gas power plant_CO2 emission(kt)
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x < 100
Steel plant_CO2 emission(kt)
5,000 <= x
1,000 <= x < 5,000
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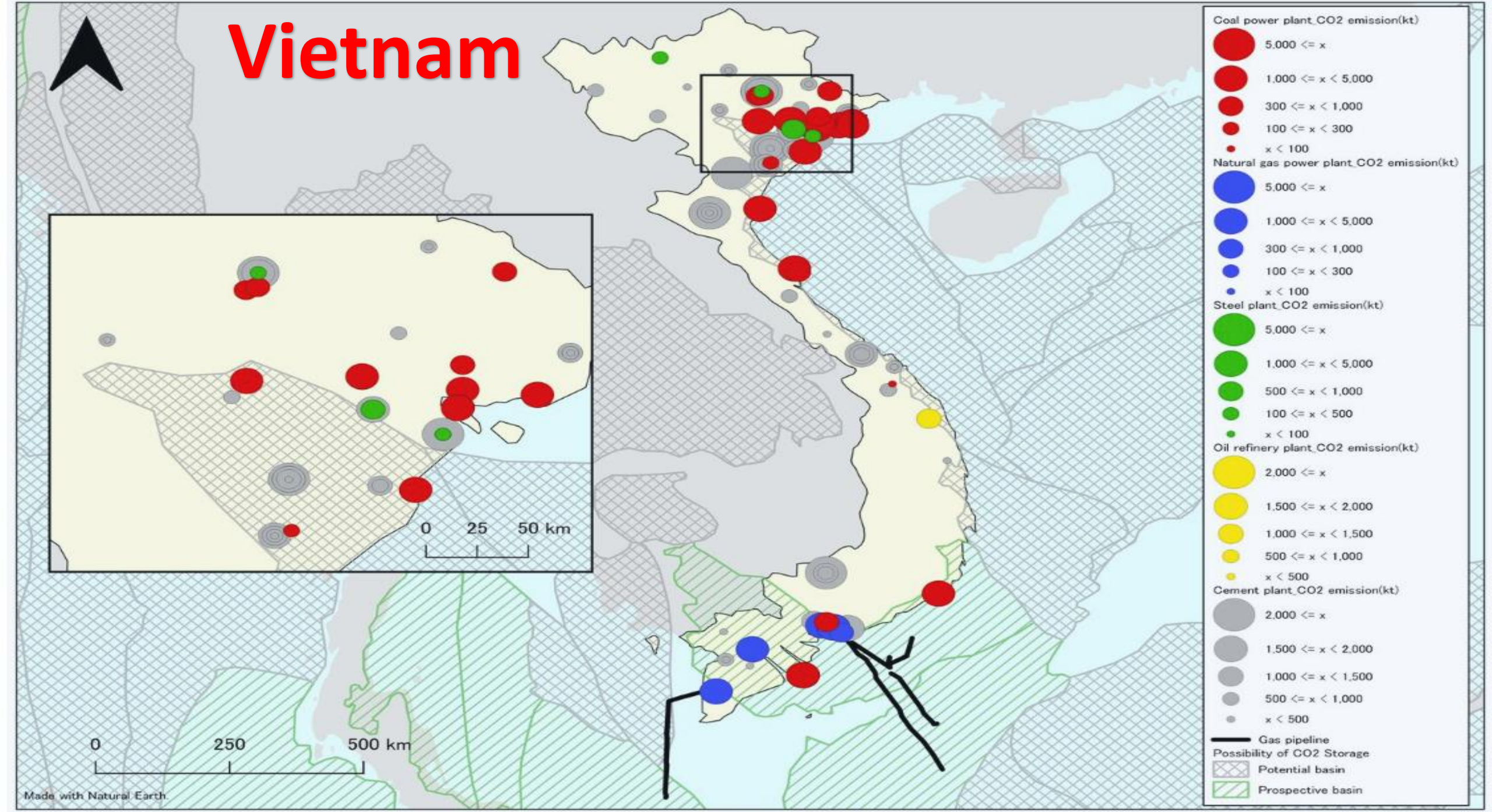
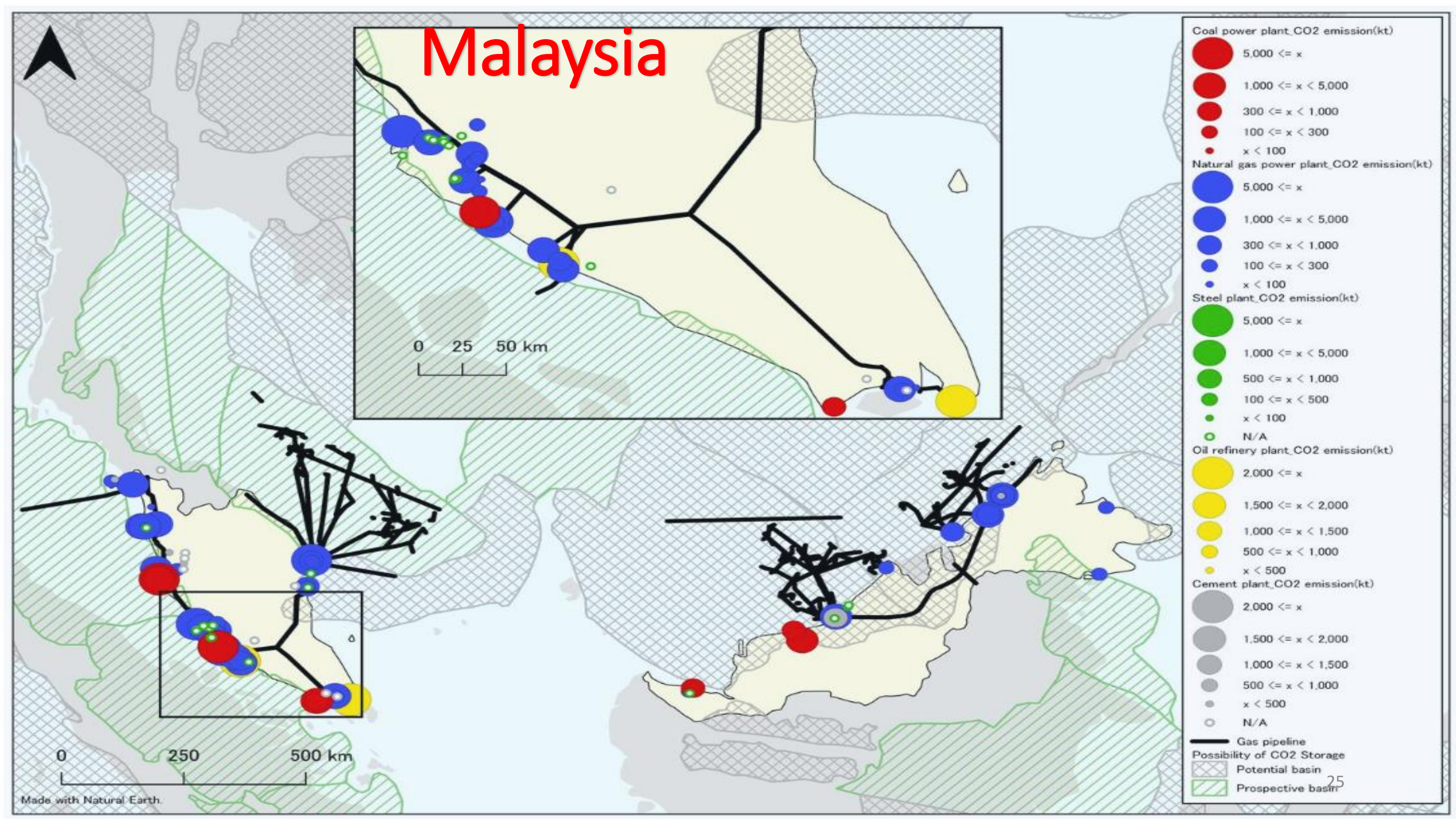
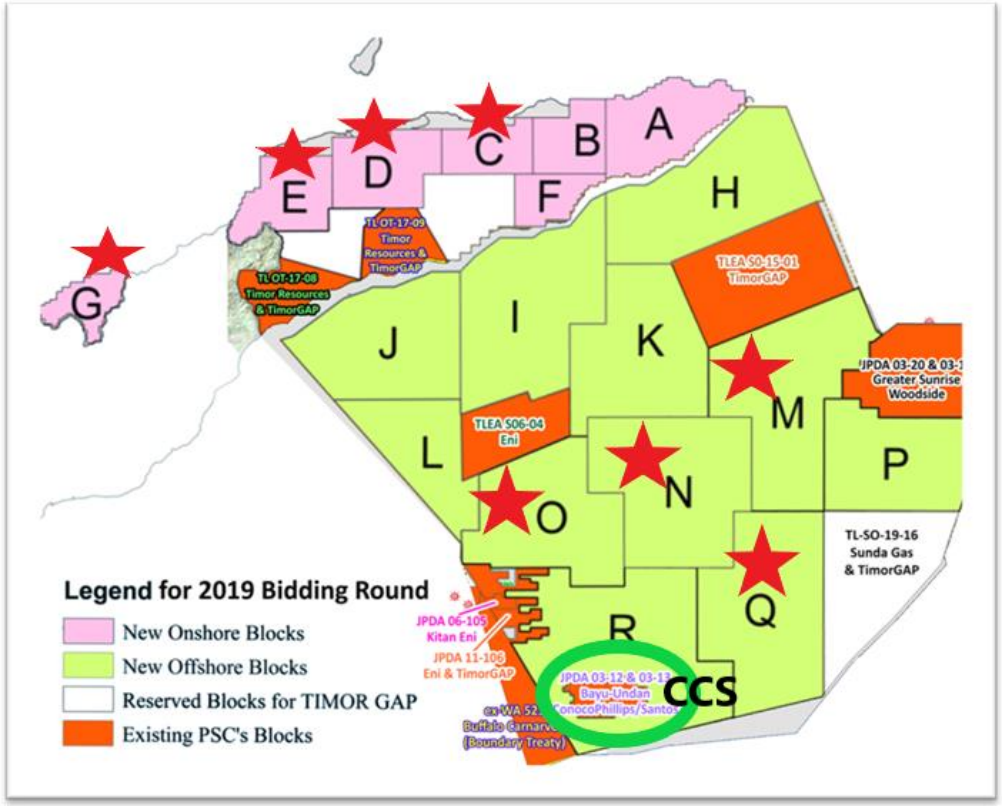
100 <= x < 500
x < 100
Oil refinery plant_CO2 emission(kt)
2,000 <= x
1,500 <= x < 2,000
1,000 <= x < 1,500
500 <= x < 1,000
x < 500
Cement plant_CO2 emission(kt)
2,000 <= x
1,500 <= x < 2,000
1,000 <= x < 1,500
500 <= x < 1,000
x < 500
Gas pipeline
Possibility of CO2 Storage
Potential basin
Prospective basin


Vietnam
Coal power plant_CO2 emission(kt)
5,000 <= x
1,000 <= x < 5,000
300 <= x < 1,000
100 <= x < 300
x < 100
Natural gas power plant_CO2 emission(kt)
5,000 <= x
1,000 <= x < 5,000
300 <= x < 1,000
100 <= x < 300
x < 100
Steel plant_CO2 emission(kt)
5,000 <= x
1,000 <= x < 5,000
500 <= x < 1,000
100 <= x < 500
x < 100
Oil refinery plant_CO2 emission(kt)
2,000 <= x
1,500 <= x < 2,000
1,000 <= x < 1,500
500 <= x < 1,000
x < 500
Cement plant_CO2 emission(kt)
2,000 <= x
1,500 <= x < 2,000
1,000 <= x < 1,500
500 <= x < 1,000
x < 500
Gas pipeline
Possibility of CO2 Storage
Potential basin
Prospective basin
0 25 50 km
0 250 500 km
Made with Natural Earth.

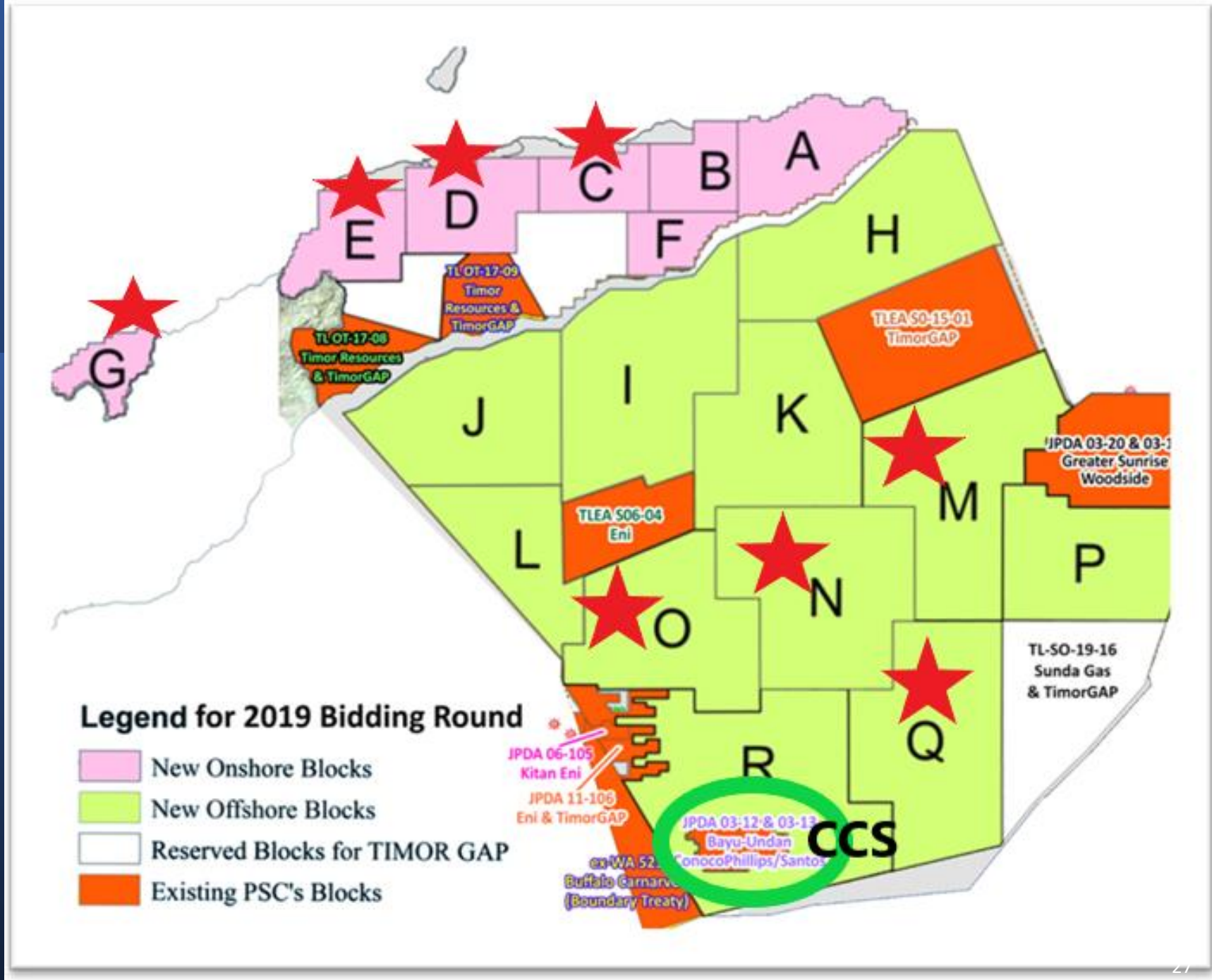

Malaysia
0 25 50 km
0 250 500 km
Made with Natural Earth
Coal power plant_CO2 emission(kt)
5,000 <= x
1,000 <= x < 5,000
300 <= x < 1,000
100 <= x < 300
x < 100
Natural gas power plant_CO2 emission(kt)
5,000 <= x
1,000 <= x < 5,000
300 <= x < 1,000
100 <= x < 300
x < 100
Steel plant_CO2 emission(kt)
5,000 <= x
1,000 <= x < 5,000
500 <= x < 1,000
100 <= x < 500
x < 100
N/A
Oil refinery plant_CO2 emission(kt)
2,000 <= x
1,500 <= x < 2,000
1,000 <= x < 1,500
500 <= x < 1,000
x < 500
Cement plant_CO2 emission(kt)
2,000 <= x
1,500 <= x < 2,000
1,000 <= x < 1,500
500 <= x < 1,000
x < 500
N/A
Gas pipeline
Possibility of CO2 Storage
Potential basin
Prospective basin

Potential Projects in Timor-Leste

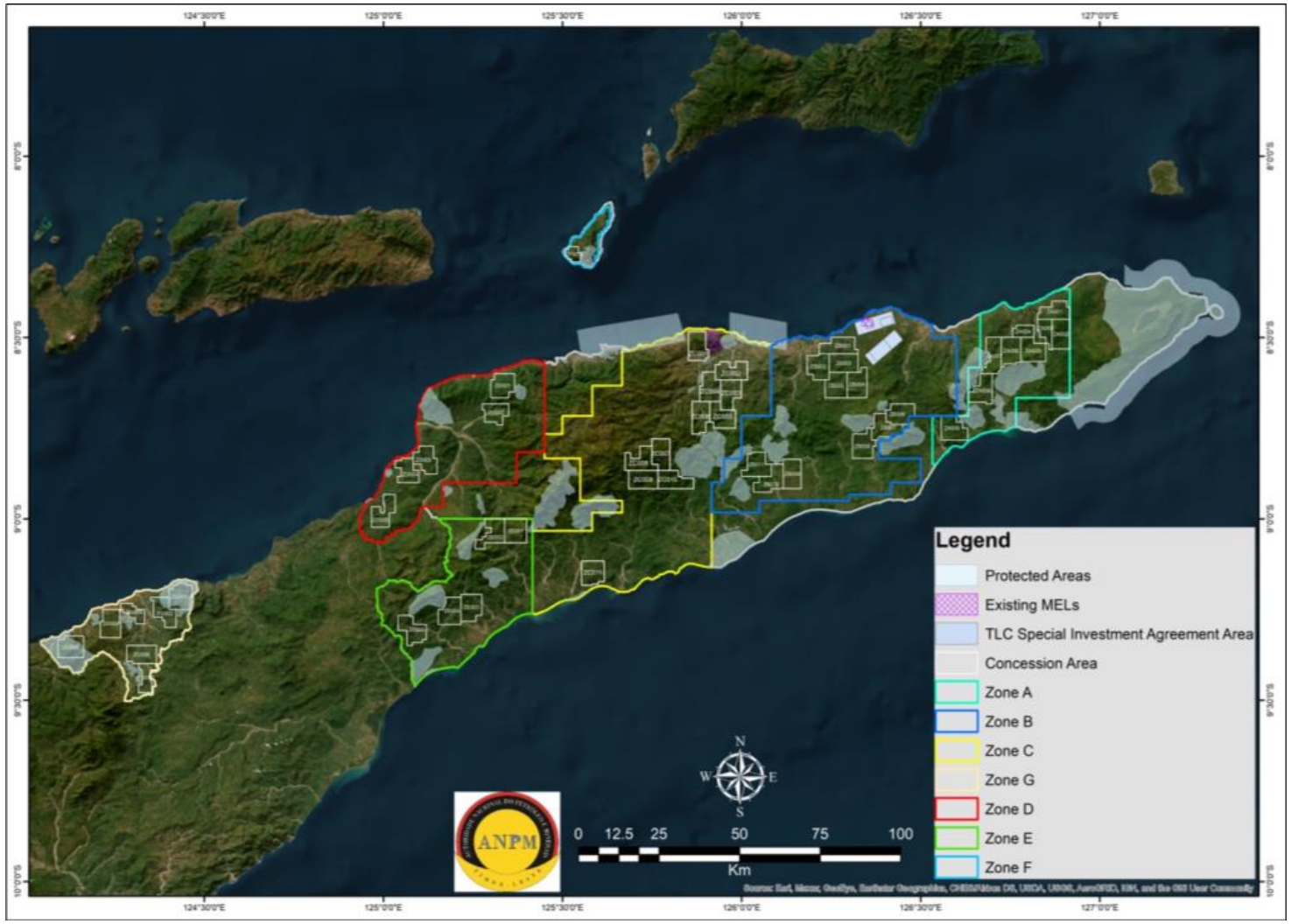
Carbon Credits
French-Bouquet



The Potential Projects in Oil and Gas



Zones and Concession Areas to be opened



- **Total Zones :**

  7 Zones for Mining Activities

- **Total Concession Areas:**

  49 Concession Areas

- **Prospect potentials:**

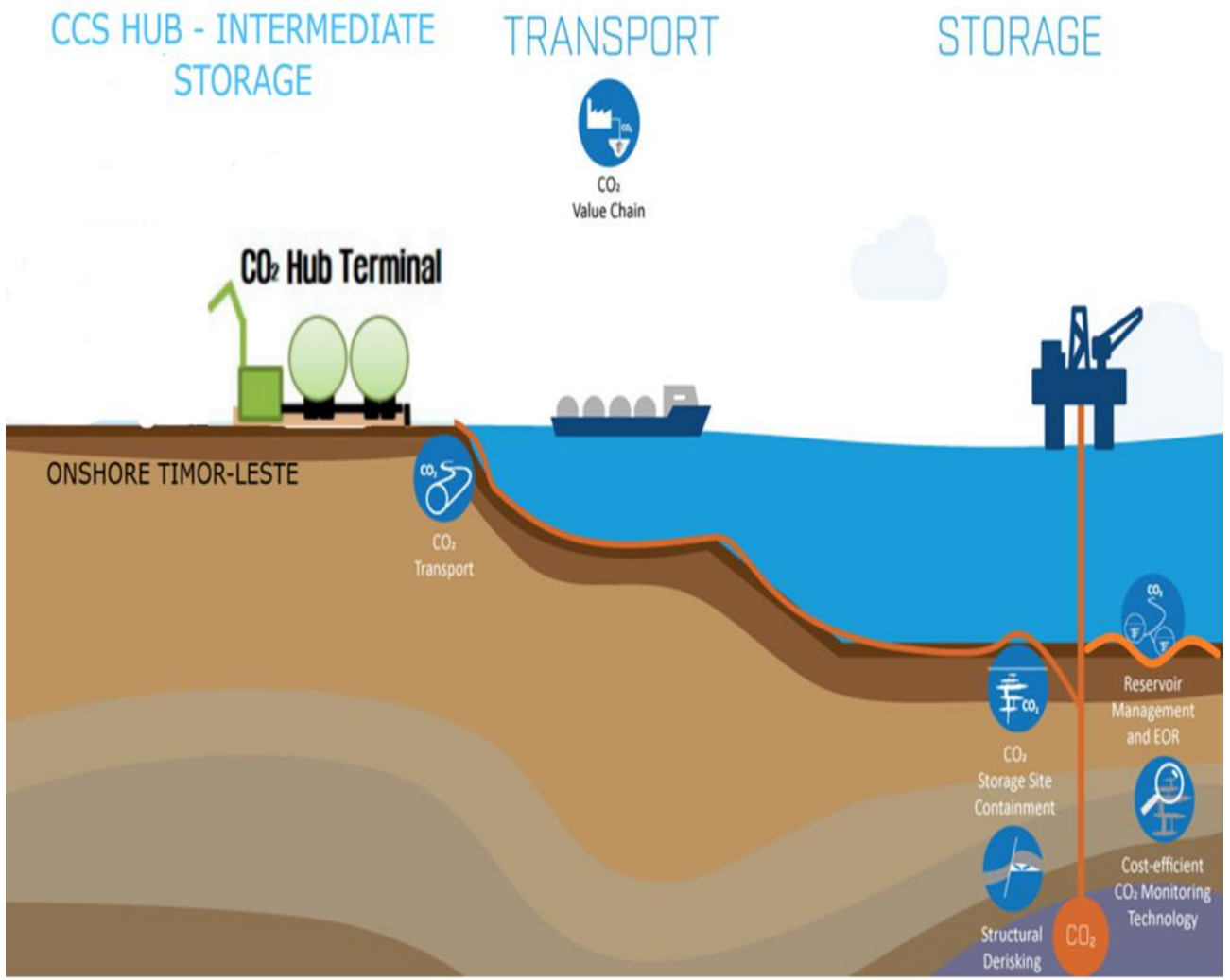
  Au, Cu, Ag, Mn, Fe,Cr and other non-metallic minerals including, limestone, kaolin, bentonite, marble, and various ornamental stones.

Where are we today in terms of Bayu-Undan CCS?

- Establishing CCS Core team to oversee the works on CCS
- Sign a Cooperation Agreement with IFC on exploring the regulatory & fiscal frameworks for Bayu-Undan TL CCS Hub
- Participating in conferences, trainings and summer schools of CCS worldwide to obtain knowledge and skills on CCS
- Actively promoting Timor-Leste CCS hub to investors and potential CO2 markets in the region
- Currently developing regulatory & fiscal frameworks of Timor-Leste CCS Hub

LOCAL CONTENT

- **Potential building of infrastructure (such as port, intermediate storage hub, etc.)**
- **Employment opportunities:**
  - **Timorese employees at BU could continue retain their jobs;**
  - **New potential job opportunities in onshore Timor-Leste as well as in the logistical or transportation;**
- **Training Opportunities for Timorese in this industry;**
- **Provision of goods and services (promote participation of Timor-Leste Local Suppliers);**
- **Other multiplier economic effects**
- **Promoting other investment as part of Carbon Credits incentive to offset projects to become carbon neutral projects.**



In Summary…

- **ANPM is currently negotiating around 5 more PSCs; This will add Timor-Leste's total Oil and Gas contracts to 16 projects;**
- **There are 7 onshore projects and 9 offshore projects;**
- **We have also secured Bayu-Undan for CCS project once production is ceased;**
- **Bayu-Undan will continue generate revenue for the country for at least 25 years from the largest CCS in the world and generating revenue and Carbon Credits;**
- **Timor-Leste is going to attract more investors in mining sector once we open up our mining area for tender (Several interests in Gold, Copper, Manganese, silver, platinum) – Marble is currently undergoing exploration);**
- **Timor-Leste will play a crucial role in the region and beyond – our accession to ASEAN would give us more opportunities to contribute to the regional energy sector;**
- **Our CPLP membership is crucial for APAC region;**

Thank You