THE ENERGY SUPPLY CHAIN: AN ASEAN PERSPECTIVE

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Agenda

- Introduction
- Issues in the ASEAN Energy Supply Chain
  - Inbound Supply Chain: The case of Krabi Power plant (Thailand)
  - Outbound Supply Chain: The ASEAN Grid
- Summary

ASEAN Members

ประเทศ (ASEAN members)	วันที่เข้าร่วม (Timeline)
1) ไทย (Thailand)	2510
2) มาเลเซีย (Malaysia)	2510
3) อินโดนีเซีย (Indonesia)	2510
4) ฟิลิปปินส์ (Philippines)	2510
5) สิงคโปร์ (Singapore)	2510
6) บรูไน (Brunei)	2527
7) เวียดนาม (Vietnam)	2538
8) ลาว (Lao)	2540
9) พม่า (Myanmar)	2540
10) กัมพูชา (Cambodia)	2542

ASEAN Plan of Action for Energy Cooperation 2010-2015 (APAEC)

The objective of APAEC 2010-2015 is to enhance energy security, accessibility and sustainability for the ASEAN region with due consideration to health, safety and environment through accelerated implementation of action plans, including, but not limited to:

- ASEAN Power Grid
- Trans-ASEAN Gas Pipeline
- Coal and Clean Coal Technology
- Renewable Energy
- Energy Efficiency and Conservation
- Regional Energy Policy and Planning
- Civilian Nuclear Energy

ASEAN Energy Supply Chain Issues

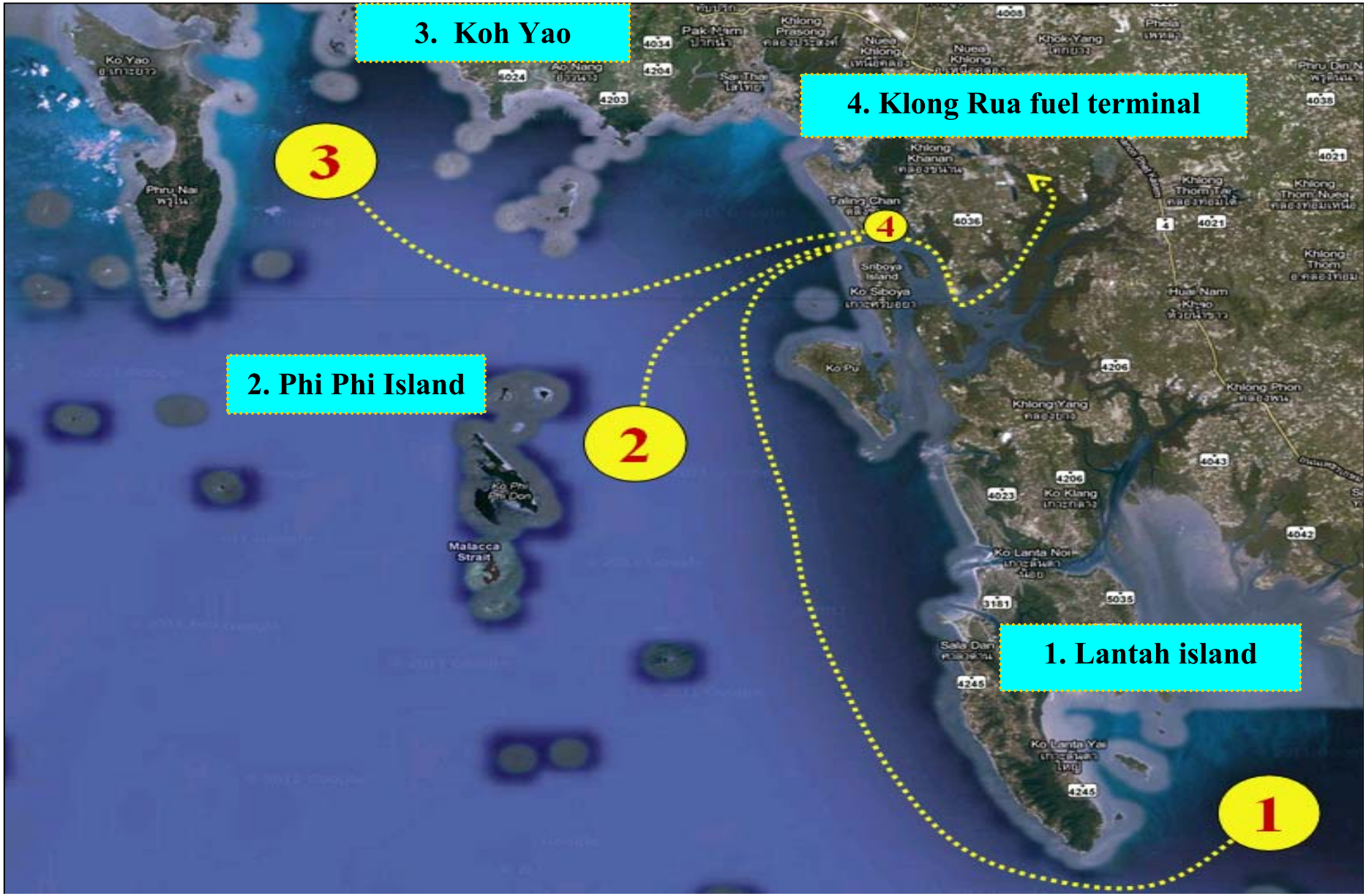
- **Transportation and Distribution**
  - Supply Chain Network Configuration and redesign, including location of production , storage, and distribution sites
  - Sufficiency and reliability of transport, handling equipment, and distribution system
  - Modal choice selection and transport promotion
- **Inbound Supply Chain**
  - Exploration of natural resource
  - Ensuring security of supply to cope with energy scarcity
- **Management issues**
  - Improvement of supply chain efficiency and new production technologies
  - Balancing demand and supply, including policy to storage input and output and inventory policy
  - Liberalization of market access of goods and services
  - Environmental issues

Inbound Supply Chain: The case of Krabi Power Plant

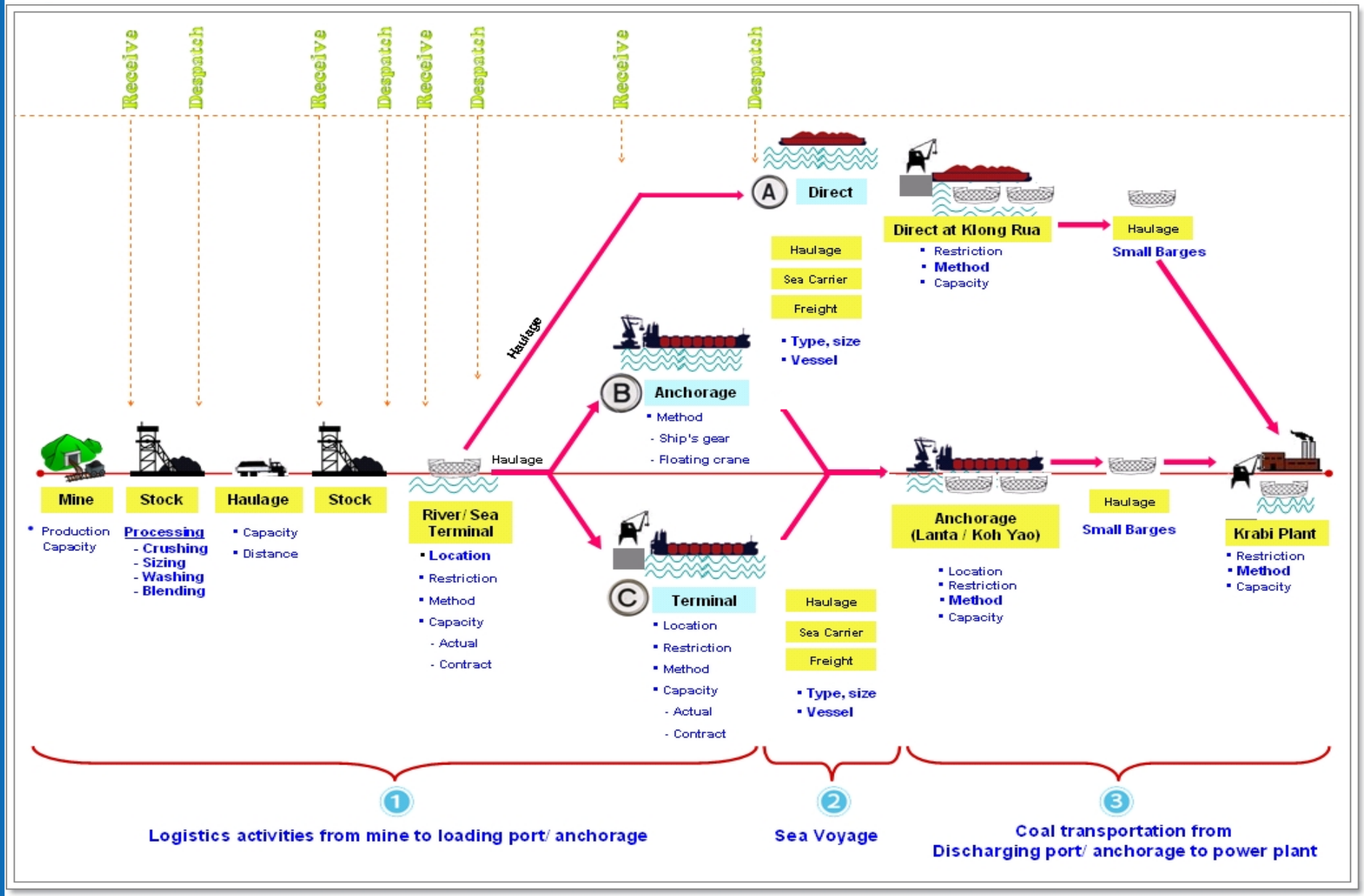
- Electricity generation in Thailand will not be sufficient in the next decade
- New coal power plant is being designated in Krabi province in the South of Thailand (800 MWx2)
- Source of coal: Indonesia
- Issues:
  - inbound supply chain from potential mines to power plant site
  - Design of logistics system appropriate to power plant requirements
  - Environment & Community

Coal Transport from Kalimantan to Krabi

Potential anchorage site(s)



Inbound Supply Chain: Before production



Option A

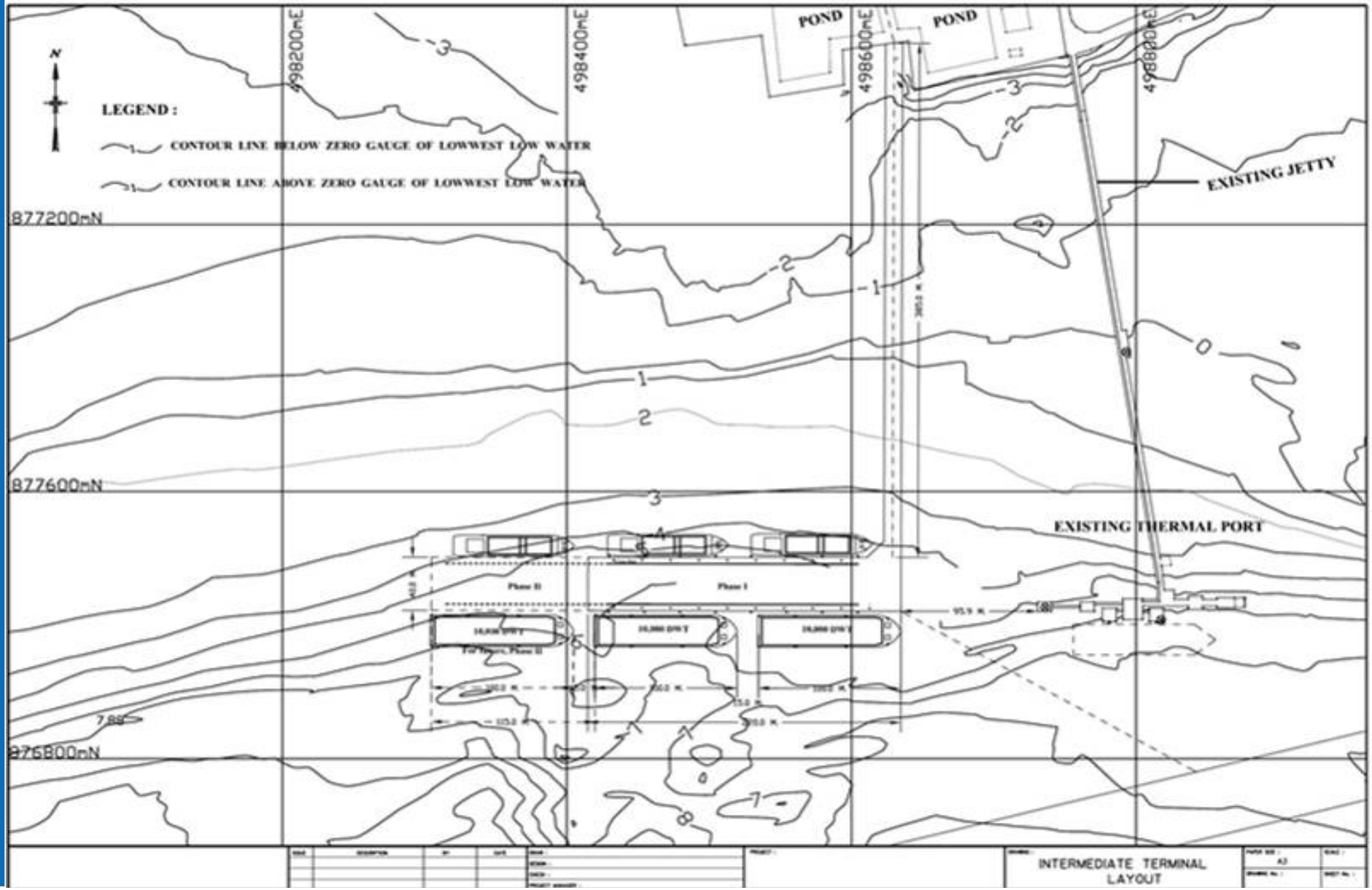
10,000 DWT barge from Indonesia

Option A

10,000 DWT self propelled barges

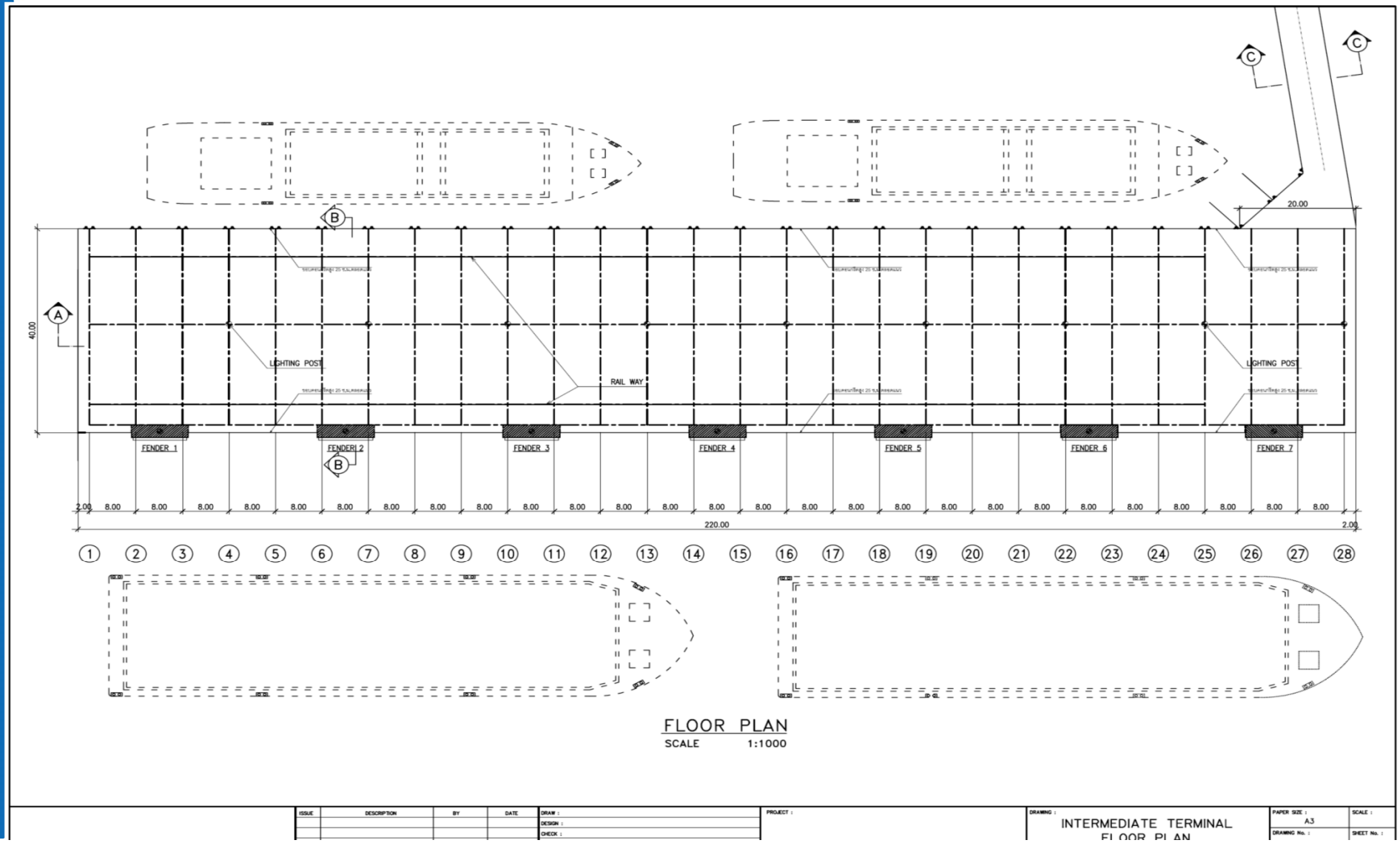
Intermediate coal transfer terminal

Klong Rua Intermediate Coal Terminal

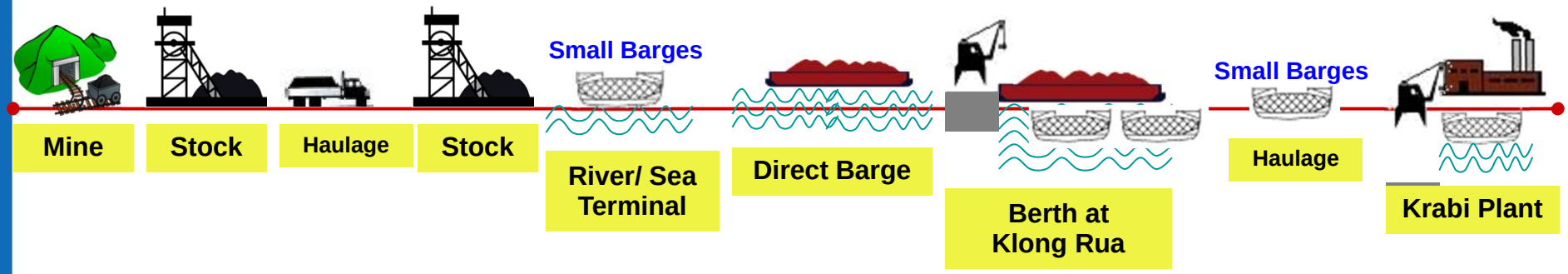


Klong Rua Intermediate Coal Terminal

Intermediate Terminal with Concrete Deck on Piles structure (40m x 220m or 8,800sqm



Option A: inbound supply chain activities



1. Sea Going Barges or SGB (8,000-12,000 DWT) transport coal from Indonesia
2. Intermediate coal terminal
3. Loading equipment to load/unload coal from SGB to River Going Barges (RGB)
4. RGB transport coal to Krabi coal power plant
5. Krabi power plant quay
6. Unload coal from RGB and transfer to stock pile

Intermediate coal terminal capacity

- Coal Discharge capability from SGB and RGB loading
  - 10,000 ton/day for phase 1 x 330 days = 3.3 million ton/year
  - 20,000 ton/day for phase 2 x 330 days = 6.6 million ton/year
- Required coal consumption
  - Phase 1: 2.65 million ton/year
  - Phase 2: 5.3 million ton/year
- Loading equipment capability 1200 tons/hour
  - 2 Traveling Bucket Continuous Self-Unloader (CSU) or
  - 1 CSU and 1 Traveling Crane

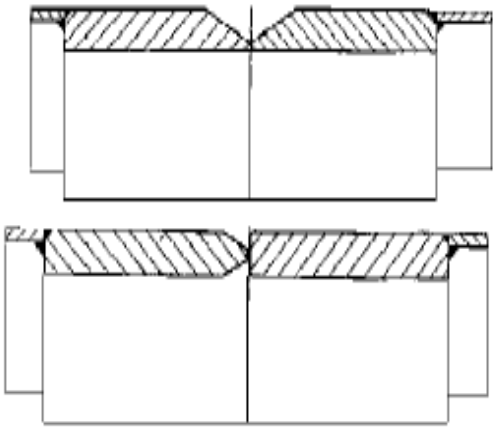
Continuous Unloader

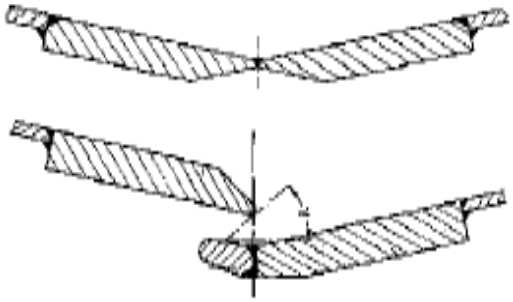
Bucket Wheel Unloader

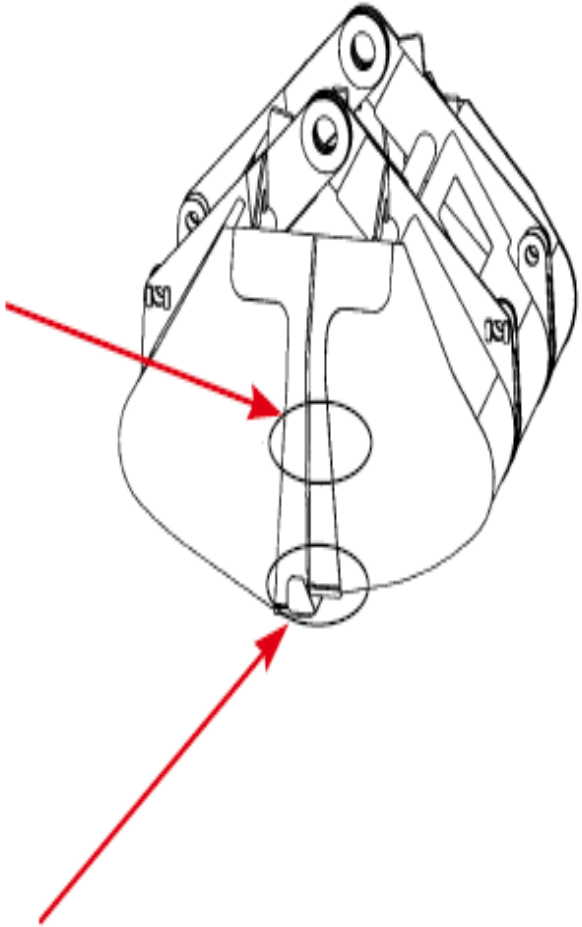
Grab-Type Unloader :

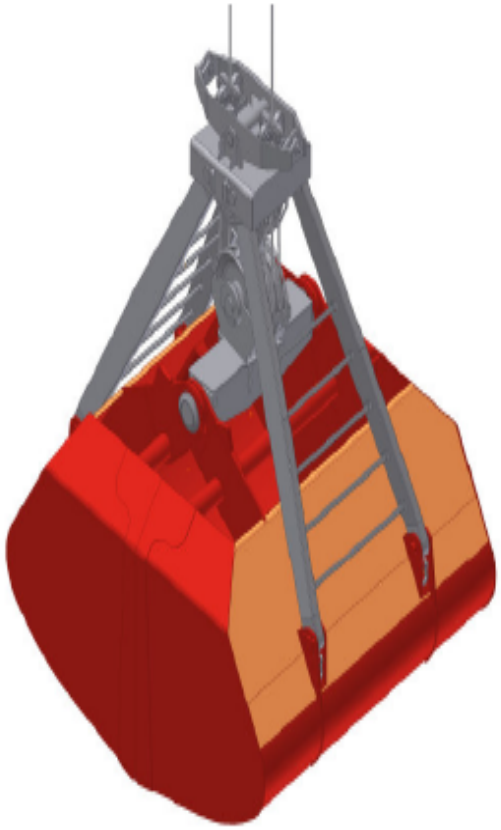
Travelling Cargo Crane in seaport

Grab-type Unloader : Spillage-Free Grab



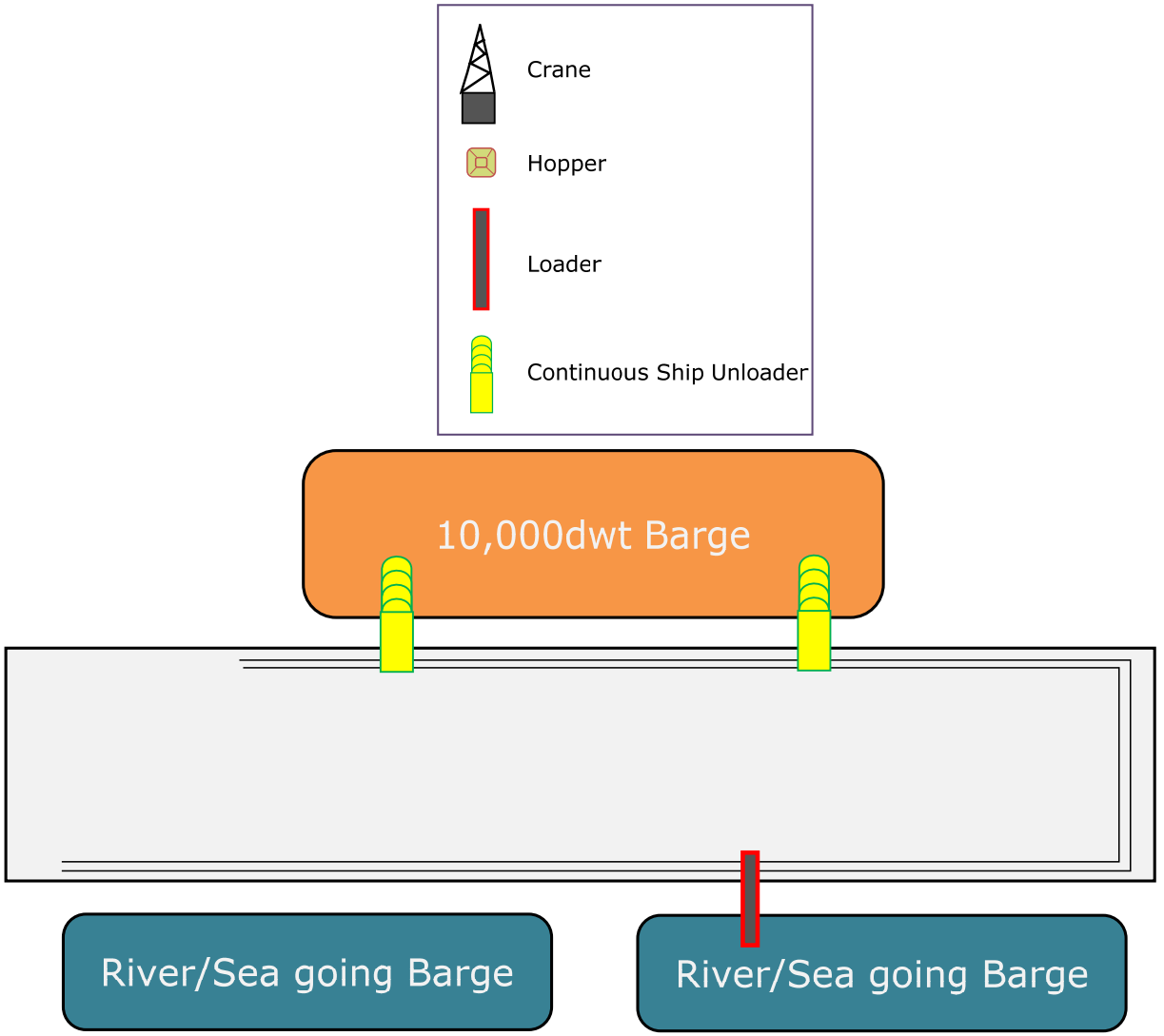






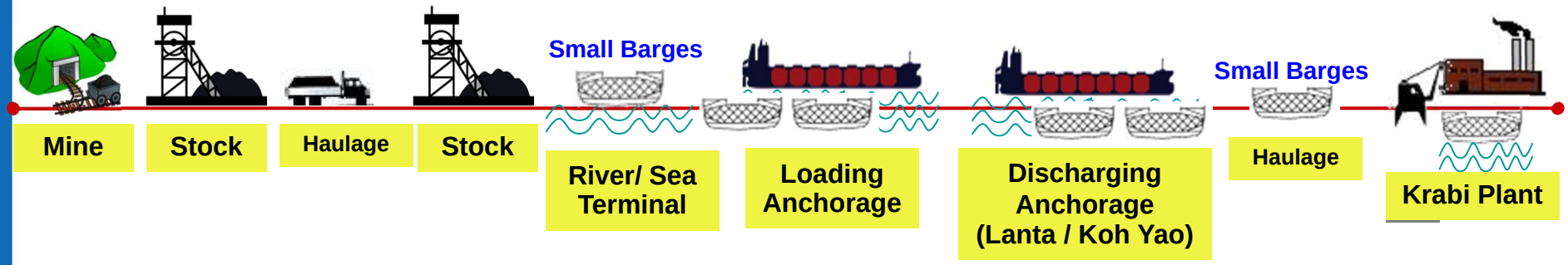
Loader

Equipment Layout@intermediate terminal



Option B: Geared vessels

Option B: Geared vessel inbound supply chain activities



1. 50,000-60,000 DWT vessels from Indonesia
2. Loading/Unloading equipment from vessel to RGB
3. RGB used to transport coal to Krabi power plant
4. Krabi power plant quay
5. Unload coal from RGB and transfer to stock pile

Geared vessel

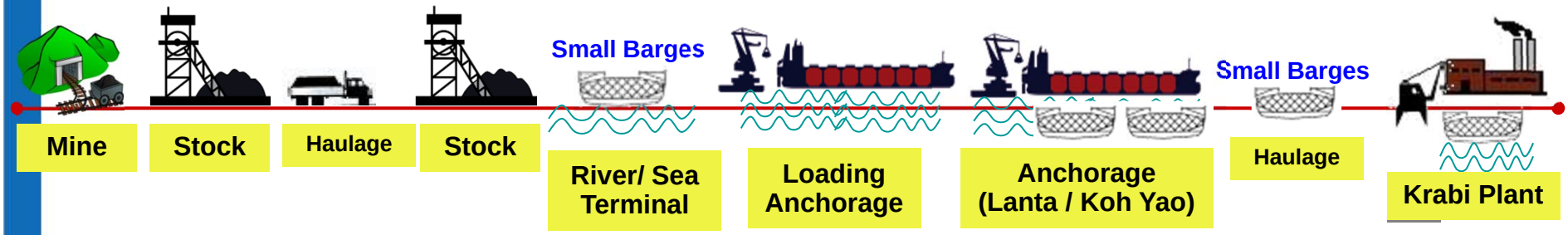
Geared vessel

System capability with geared vessel

- Loading/Unloading equipment
  - ➢Supramax vessel preferred as usually have own gear with 4 25-30 MT cranes
  - ➢10 - 15 CBM Grapple

- Suggested loading/Unloading rate
  - ➢On average 4 cranes can load/unload 560 tons/hour or 13,440 ton/day
  - ➢10,000 ton/day for phase 1 x 330 days = 3.3 million ton/year
  - ➢ 20,000 ton/day for phase 2 x 330 days = 6.6 million ton/year

Option C: Gearless Vessel inbound supply chain activity



1. 100,000-200,000 DWT vessels from Indonesia
2. Loading/Unloading equipment from vessel to RGB
3. RGB used to transport coal to Krabi power plant
4. Krabi power plant quay
5. Unload coal from RGB and transfer to stock pile

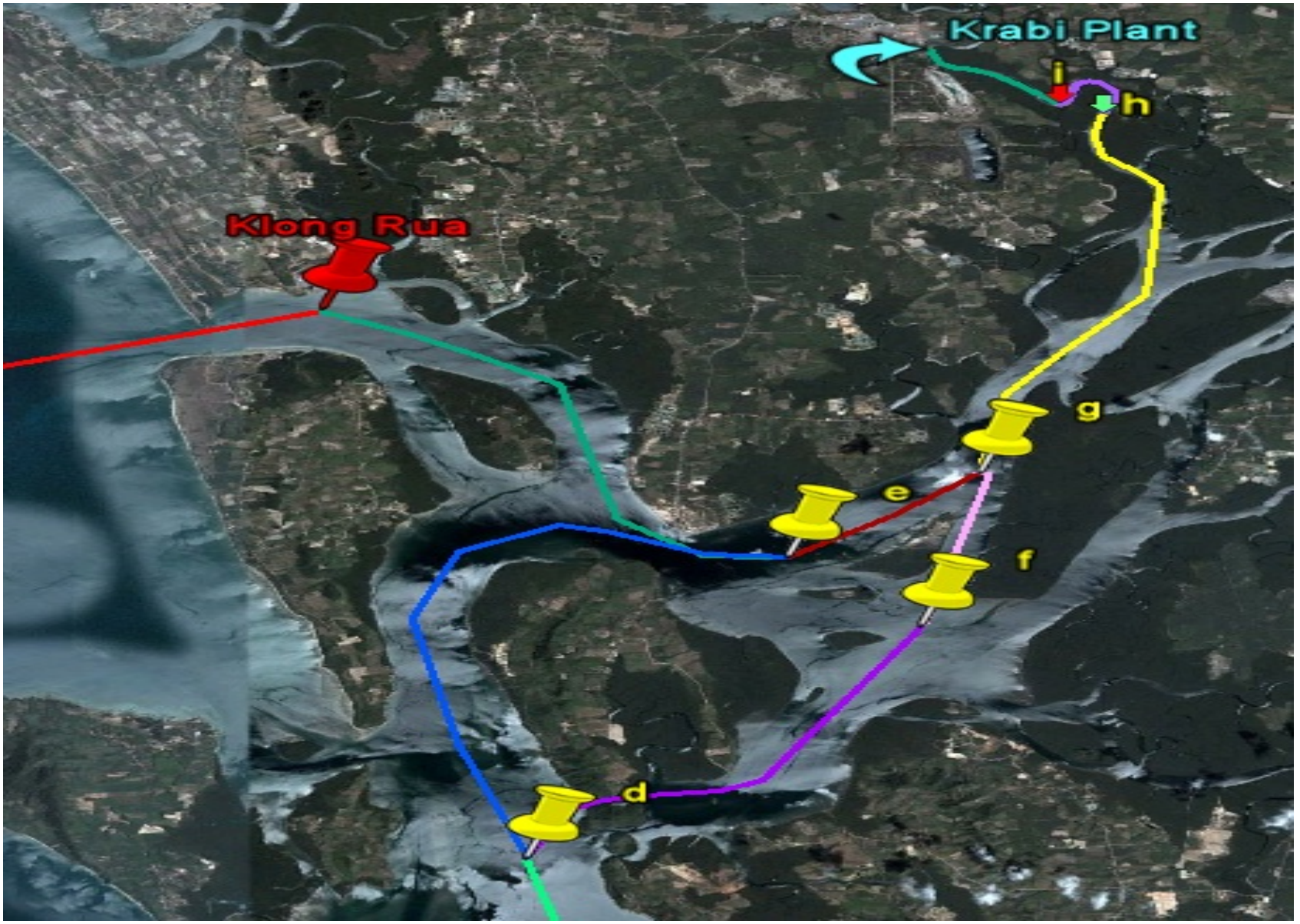
Floating Crane

Cranes on Floating Terminal

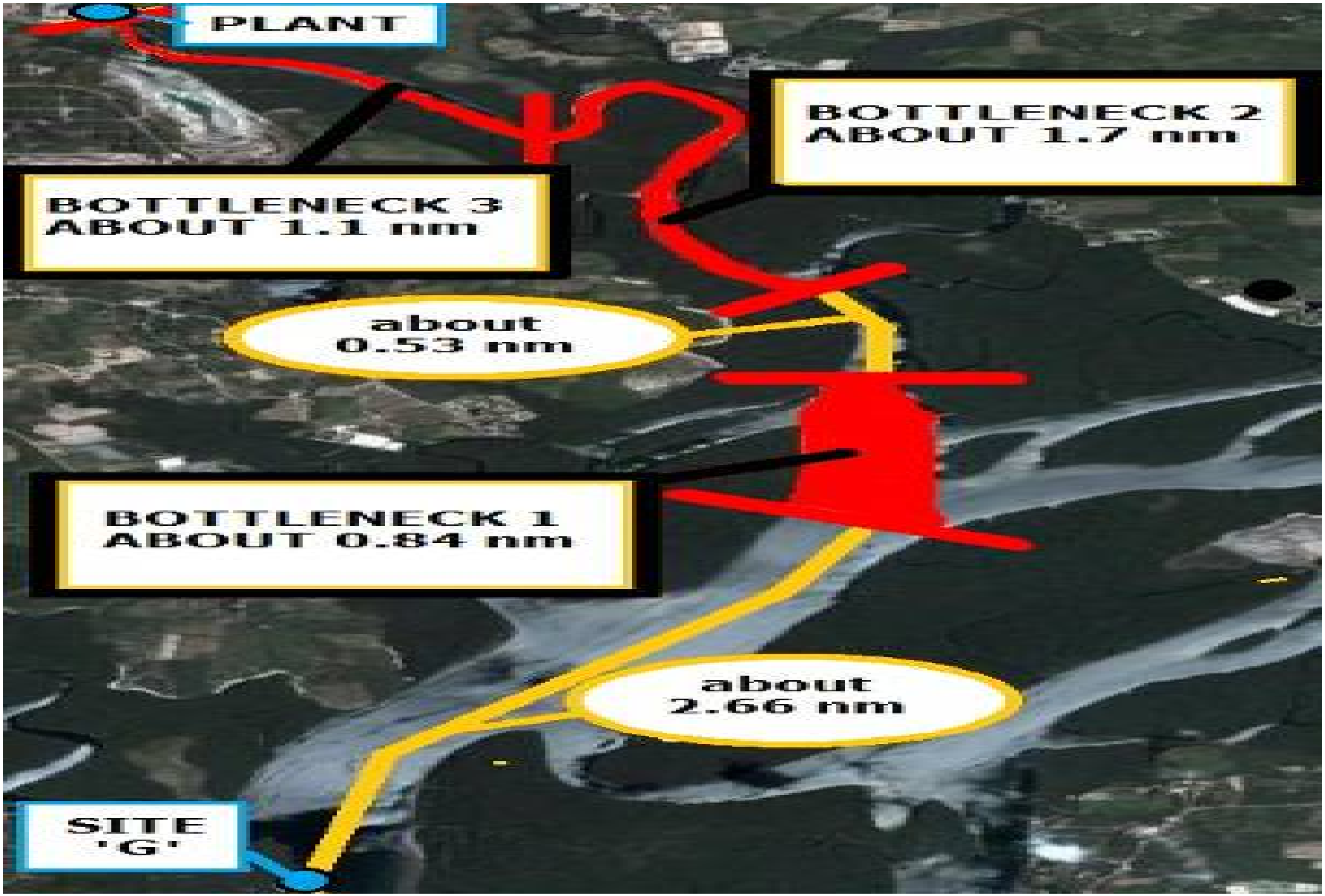
Floating crane capability

- Loading/Unloading Equipment & recommended charge/discharge rate
  - ***Floating Crane***
    - 12 - 15,000 ton/day/crane (500 – 625 ton/hour)
    - if 2 cranes then 24 - 30,000 ton/day

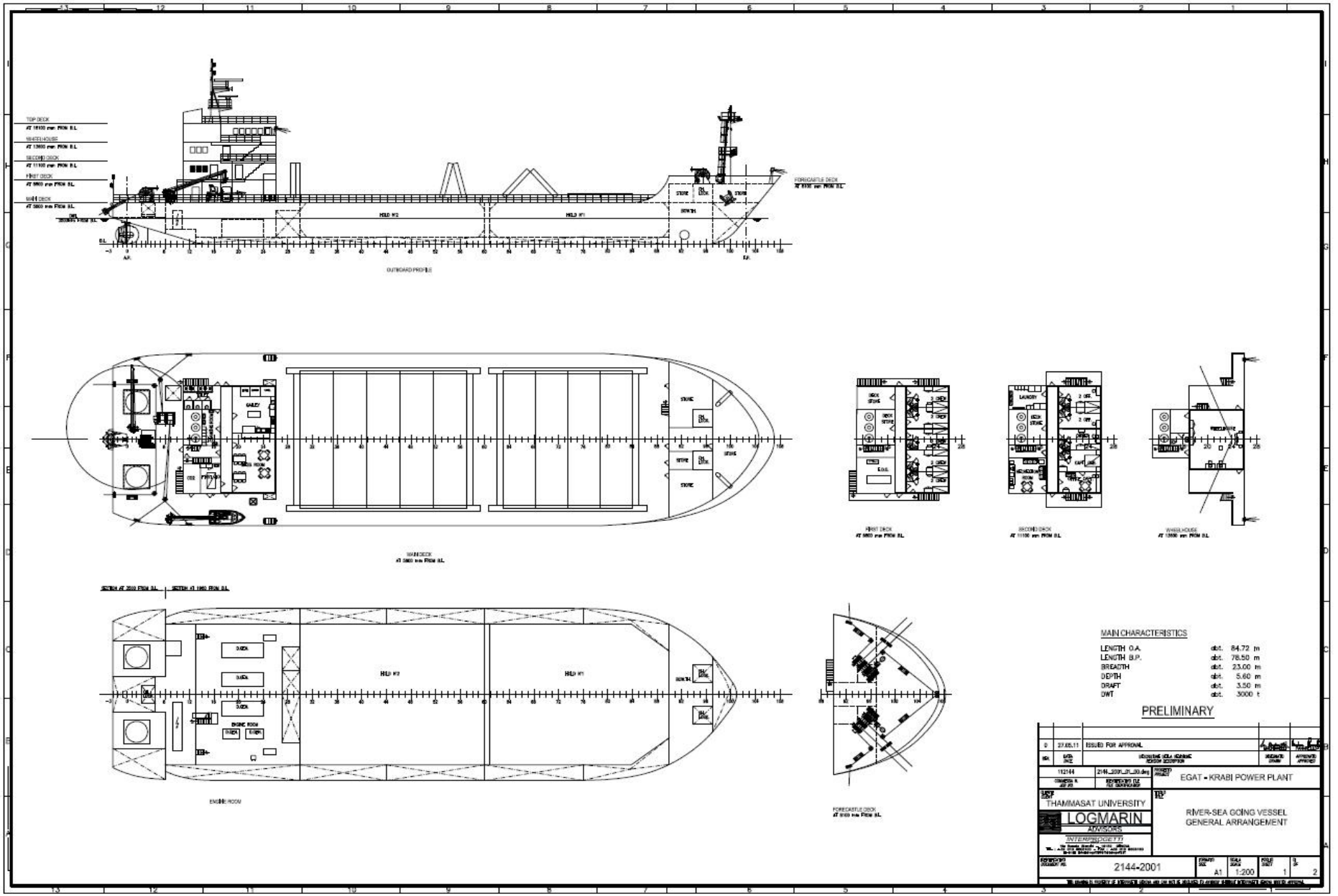
Access to Krabi Power Plant



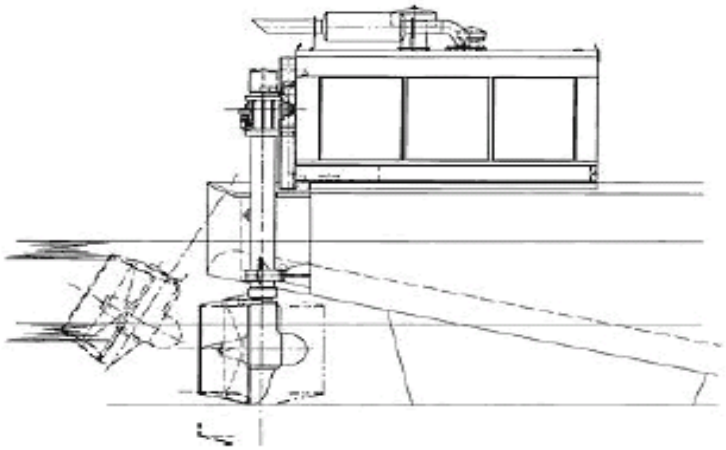
Bottlenecks in the access river



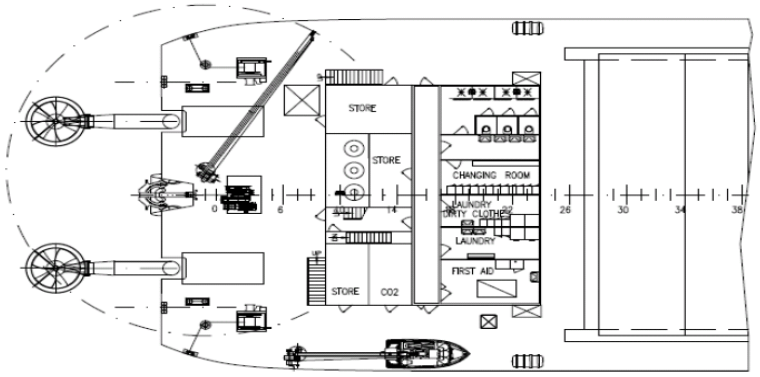
Taylor-made design of river going barges

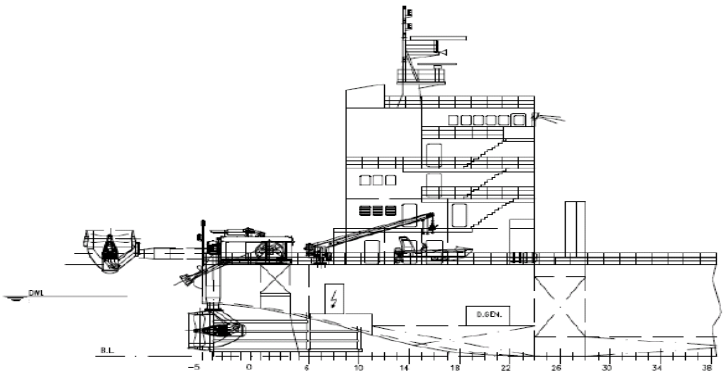


Recommended engines



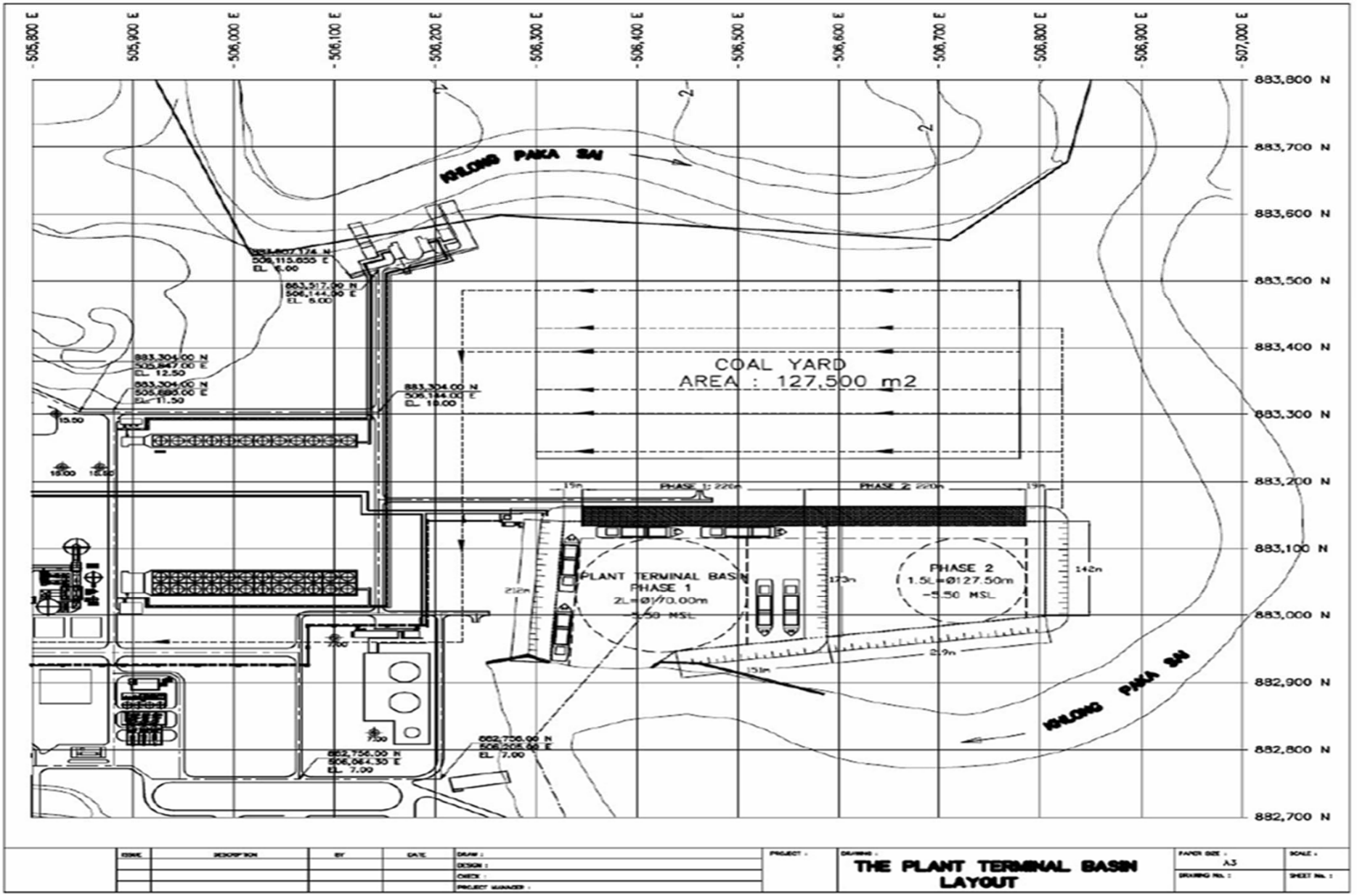
1) deck-mounted navigators Azimuth Thruster



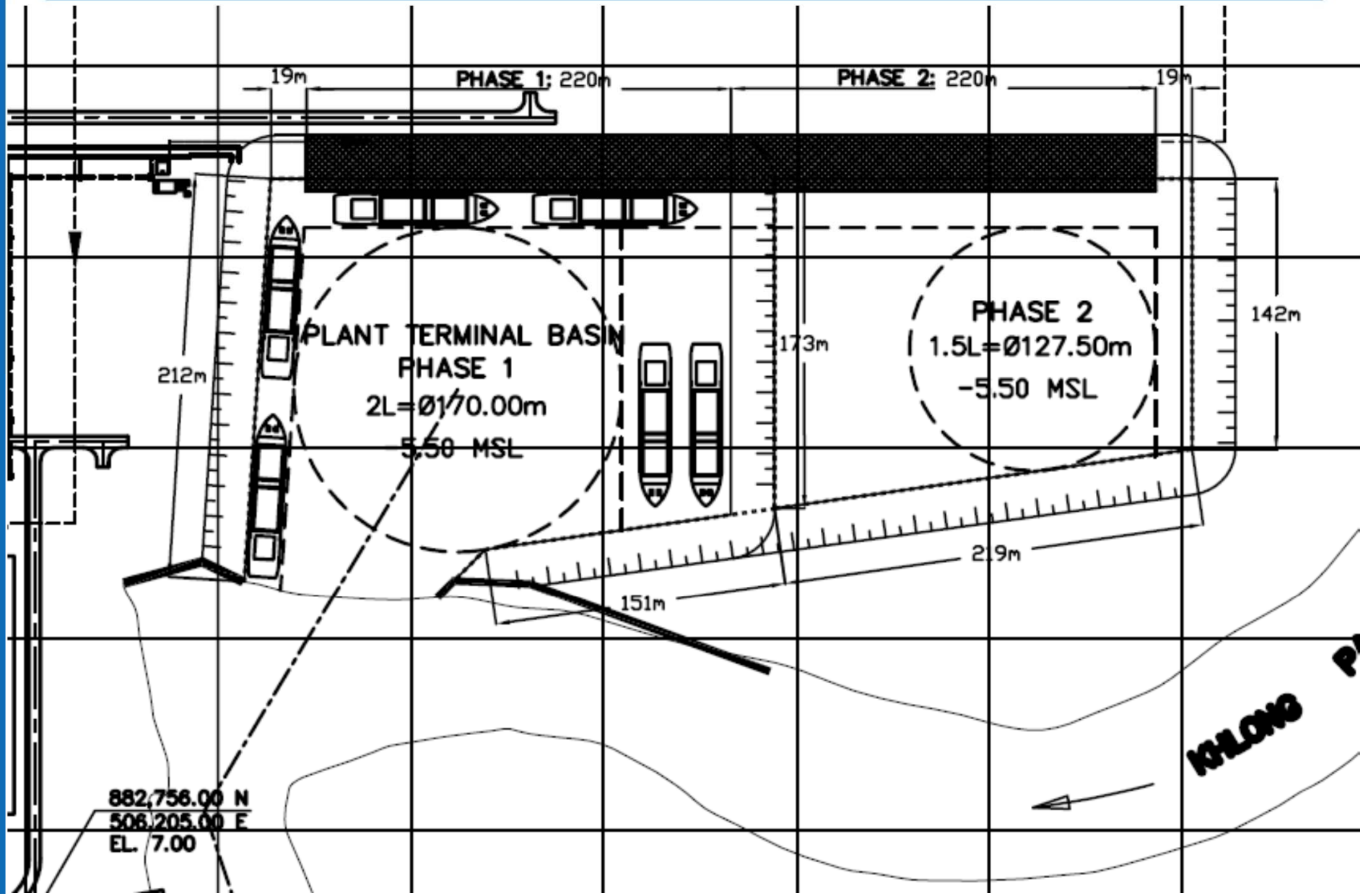


2 Azimuth Thrusters

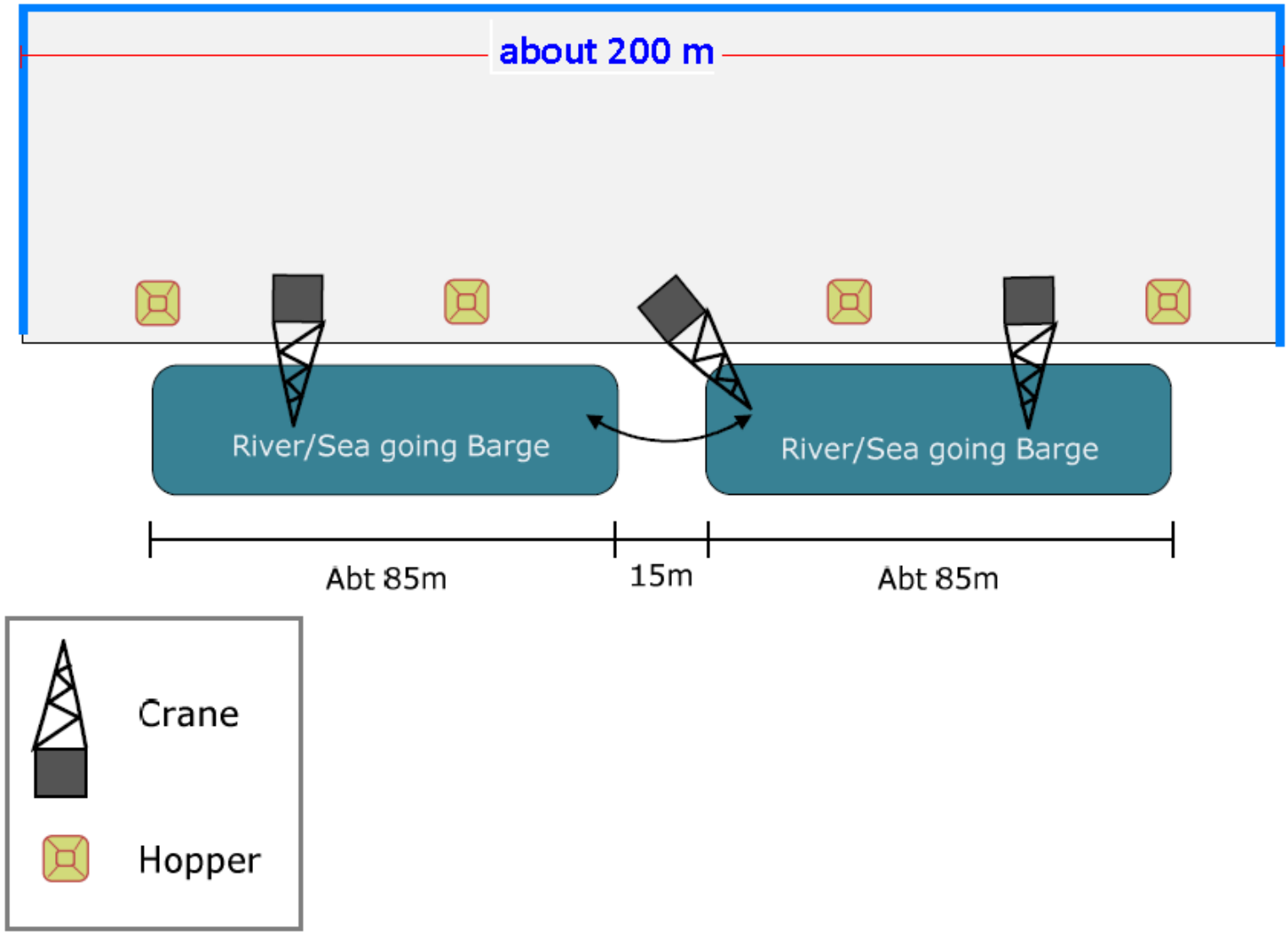
Coal terminal at Krabi Power Plant



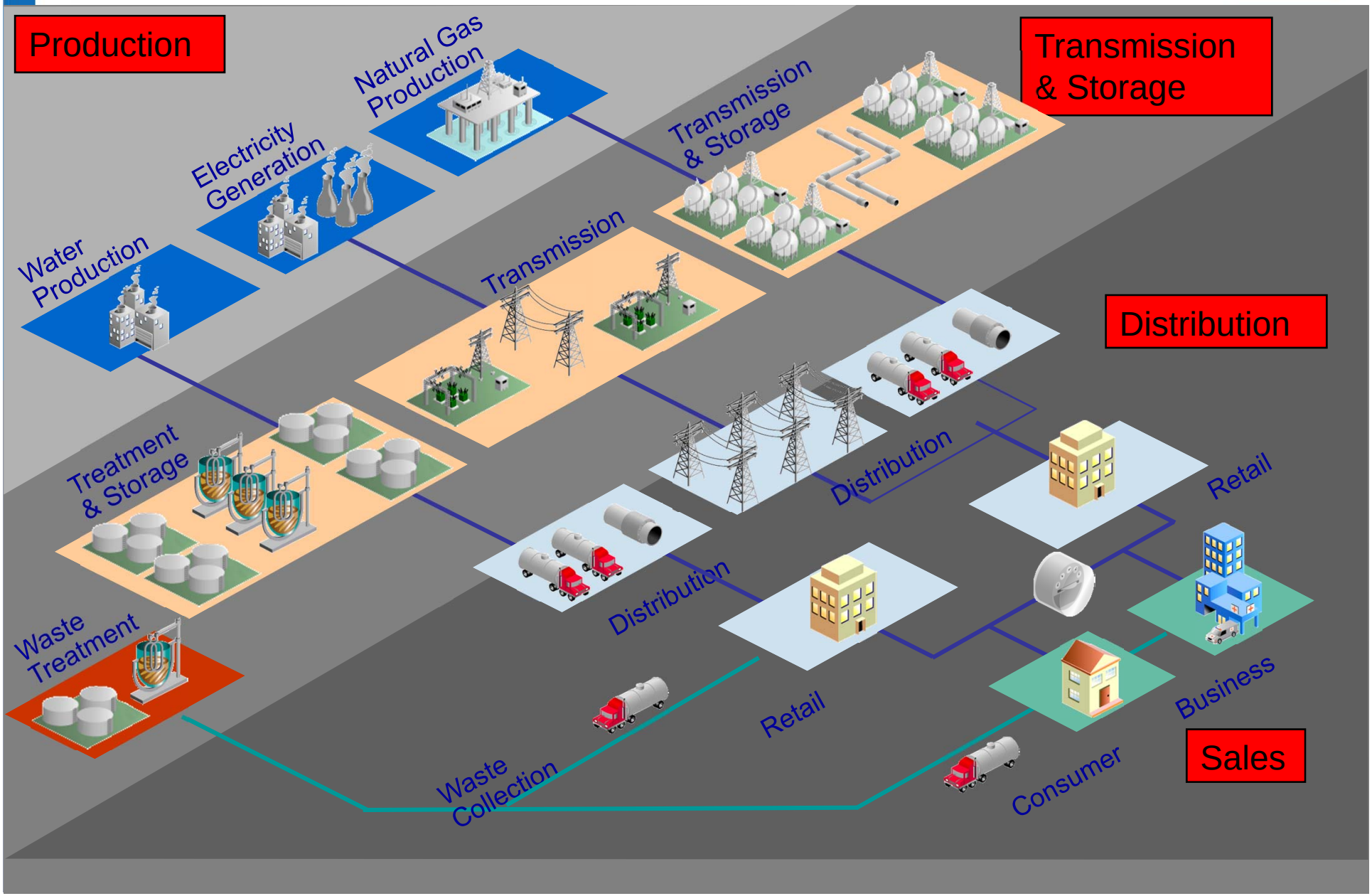
Coal terminal basin



Quay at Krabi Power Plant

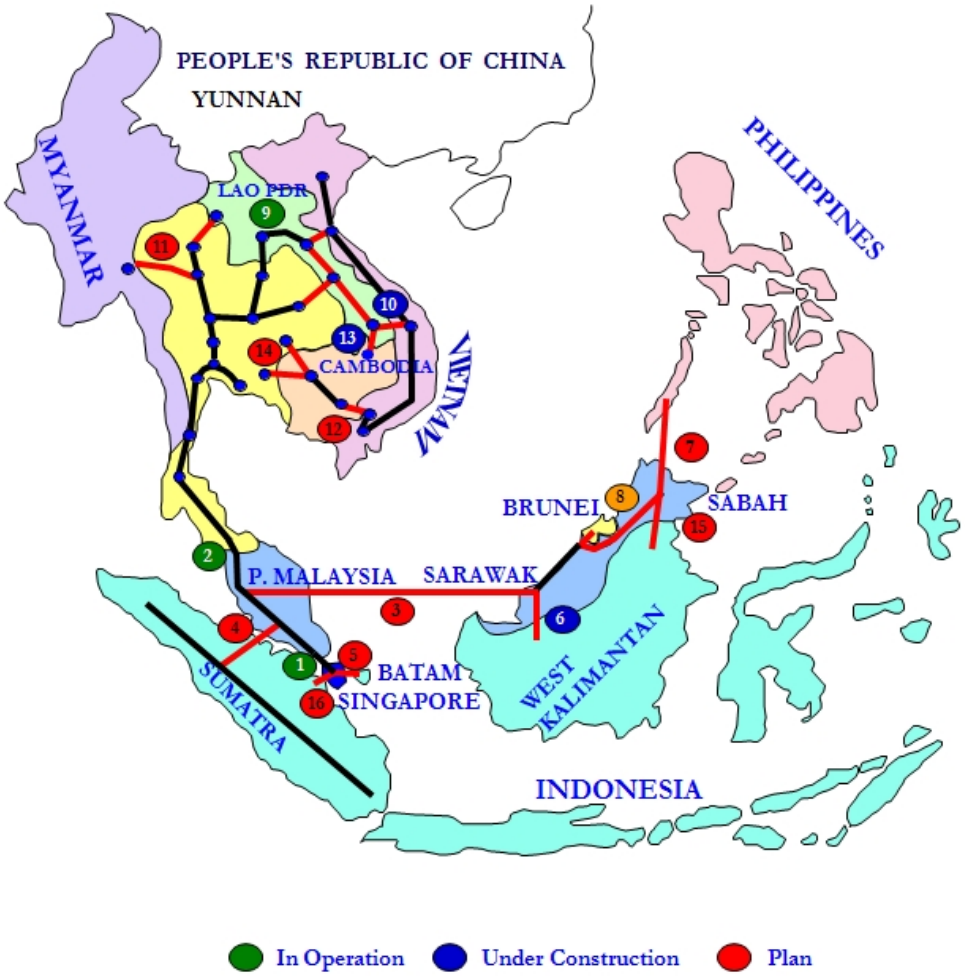


THE OUTBOUND SUPPLY CHAIN



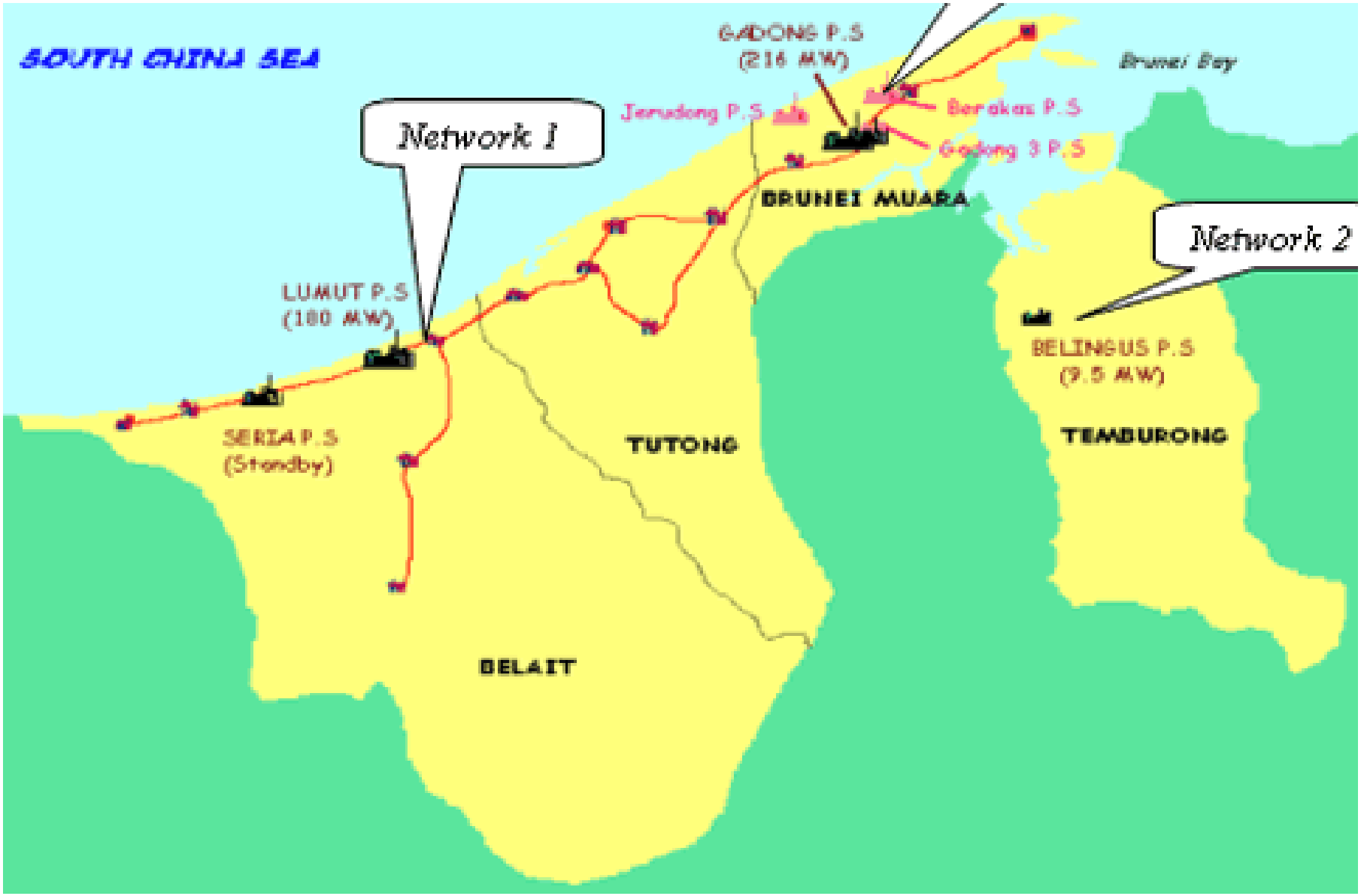
Progress on ASEAN Interconnection Projects

As of June 2011

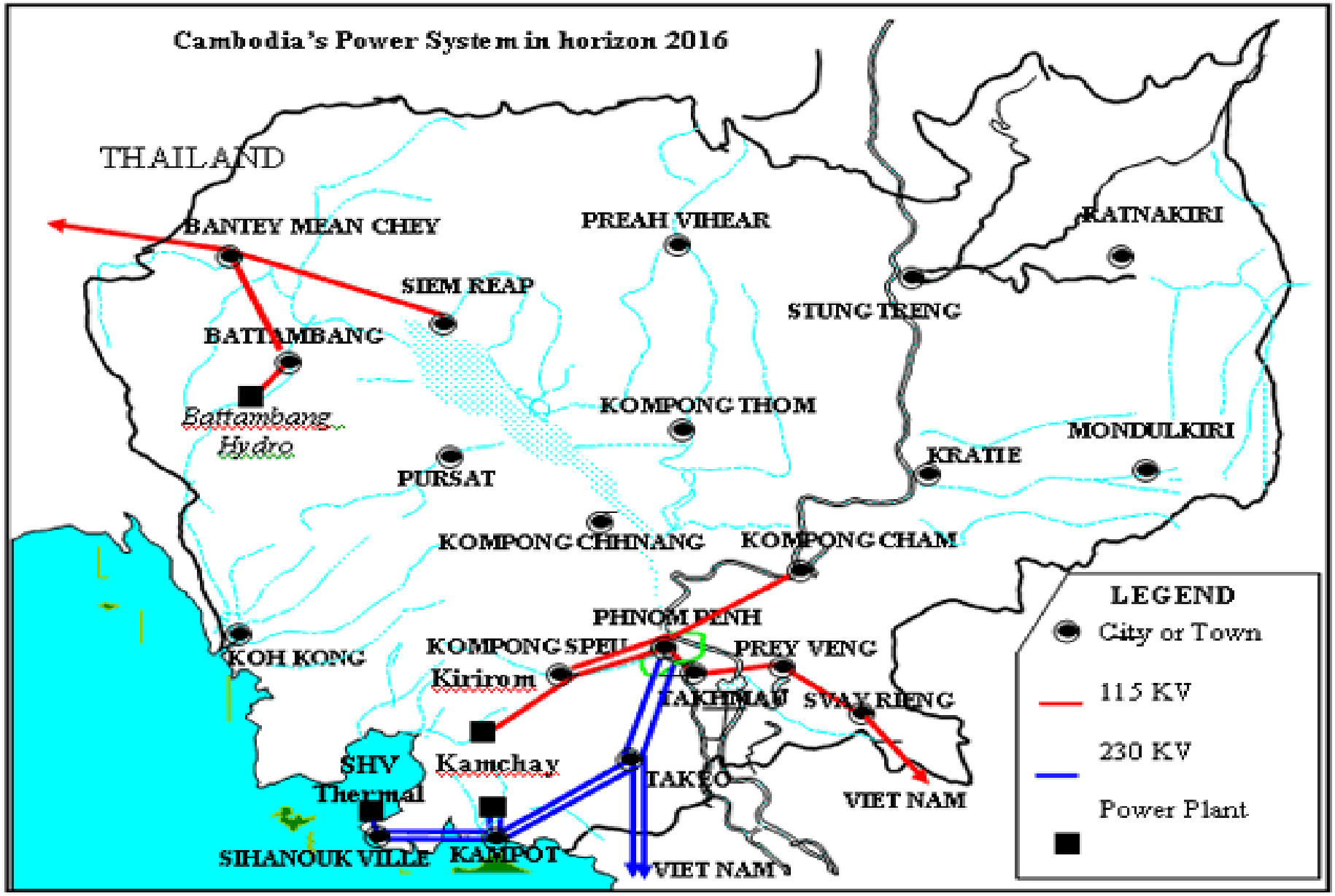


		Earliest COD
1)	P.Malaysia - Singapore (New)	2018
2)	Thailand - P.Malaysia	
	• Sadao - Bukit Keteri	Existing
	• Khlong Ngae - Gurun	Existing
	• Su Ngai Kolok - Rantau Panjang	2014
	• Khlong Ngae – Gurun (2nd Phase, 300MW)	2016
3)	Sarawak - P. Malaysia	2015-2021
4)	P.Malaysia - Sumatra	2017
5)	Batam - Singapore	2015-2017
6)	Sarawak - West Kalimantan	2015
7)	Philippines - Sabah	2020
8)	Sarawak - Sabah – Brunei	
	• Sarawak –Sabah	2020
	• Sabah – Brunei	Not Selected
	• Sarawak – Brunei	2012-2016
9)	Thailand - Lao PDR	
	• Roi Et 2 - Nam Theun 2	Existing
	• Sakon Nakhon 2 – Thakhek – Then Hinboun (Exp.)	2012
	• Mae Moh 3 - Nan - Hong Sa	2015
	• Udon Thani 3- Nabong (converted to 500KV)	2017
	• Ubon Ratchathani 3 – Pakse – Xe Pian Xe Namnoy	2018
	• Khon Kaen 4 – Loei 2 – Xayaburi	2019
	• Thailand – Lao PDR (New)	2015-2023
10)	Lao PDR - Vietnam	2011-2016
11)	Thailand - Myanmar	2016-2025
12)	Vietnam - Cambodia (New)	2017
13)	Lao PDR - Cambodia	2013-2014
14)	Thailand - Cambodia (New)	2015-2017
15)	East Sabah - East Kalimantan	Newly Proposed
16)	Singapore – Sumatra	2020

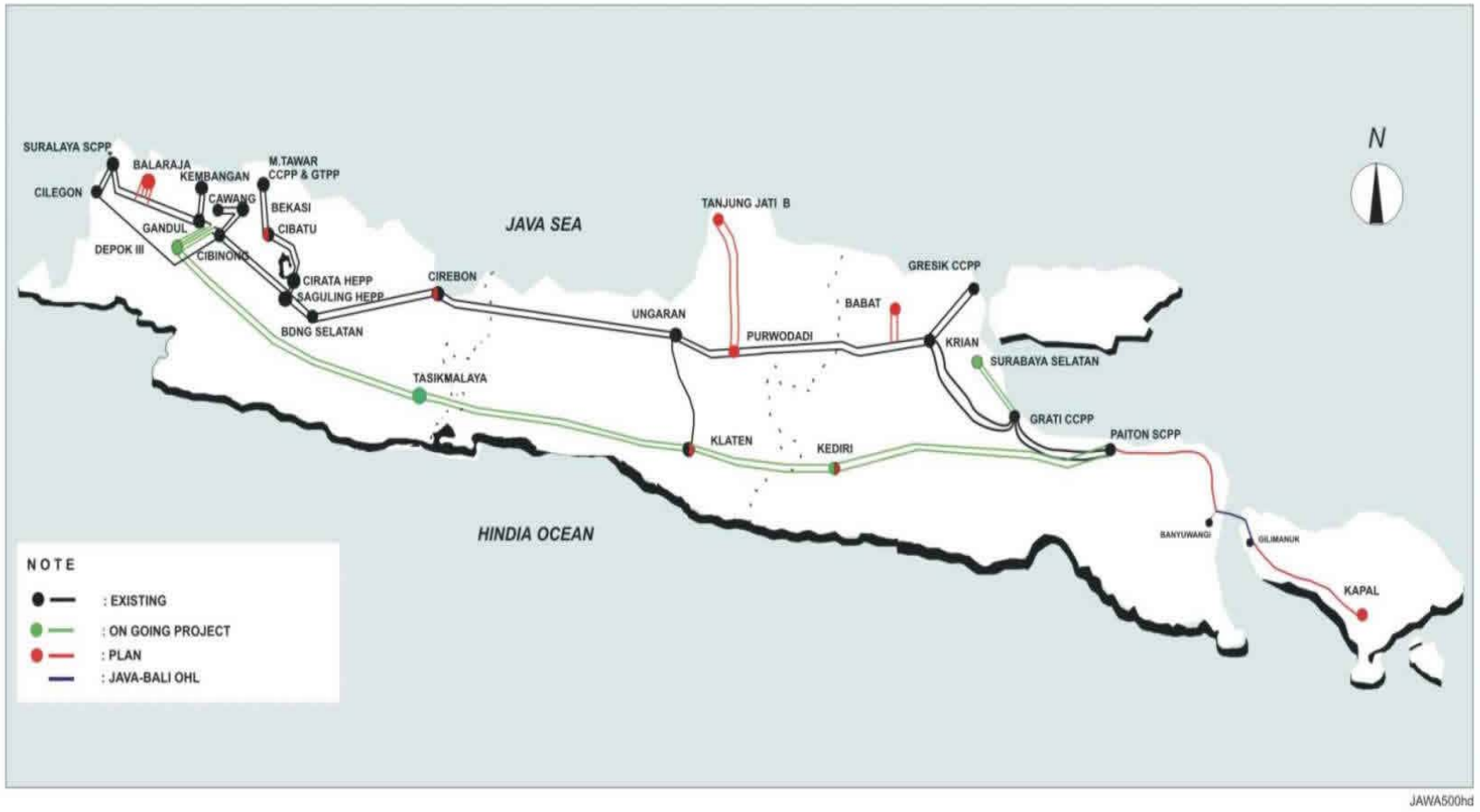
Brunei grid


SOUTH CHINA SEA
GADONG P.S
(216 MW)
Brunei Bay
Jerudong P.S
Berakas P.S
Gadong 3 P.S
Network 1
BRUNEI MUARA
Network 2
LUMUT P.S
(180 MW)
BELINGUS P.S
(9.5 MW)
SERIA P.S
(Standby)
TUTONG
TEMBURONG
BELAIT

Cambodia Grid

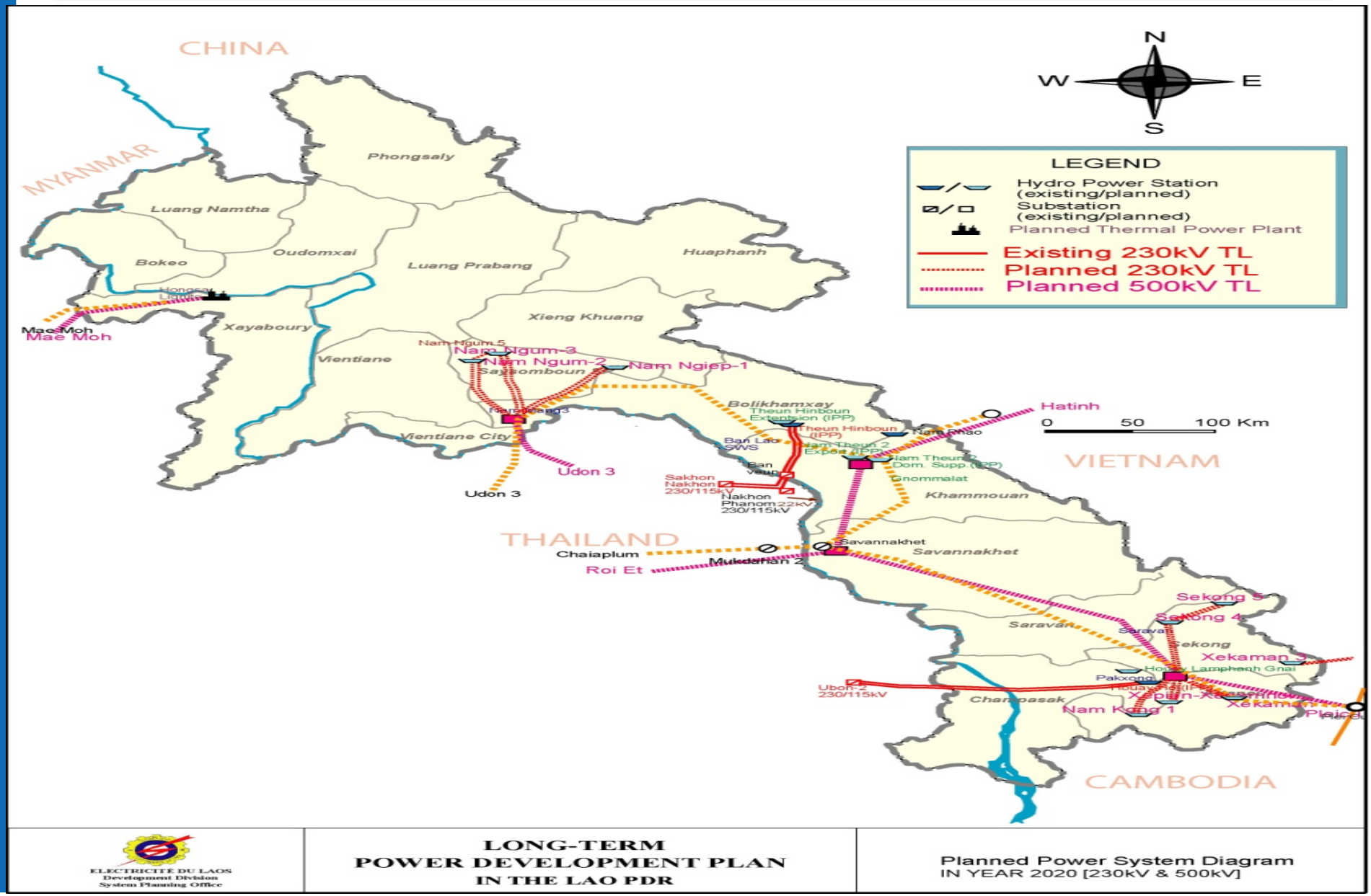


Indonesian National Grid



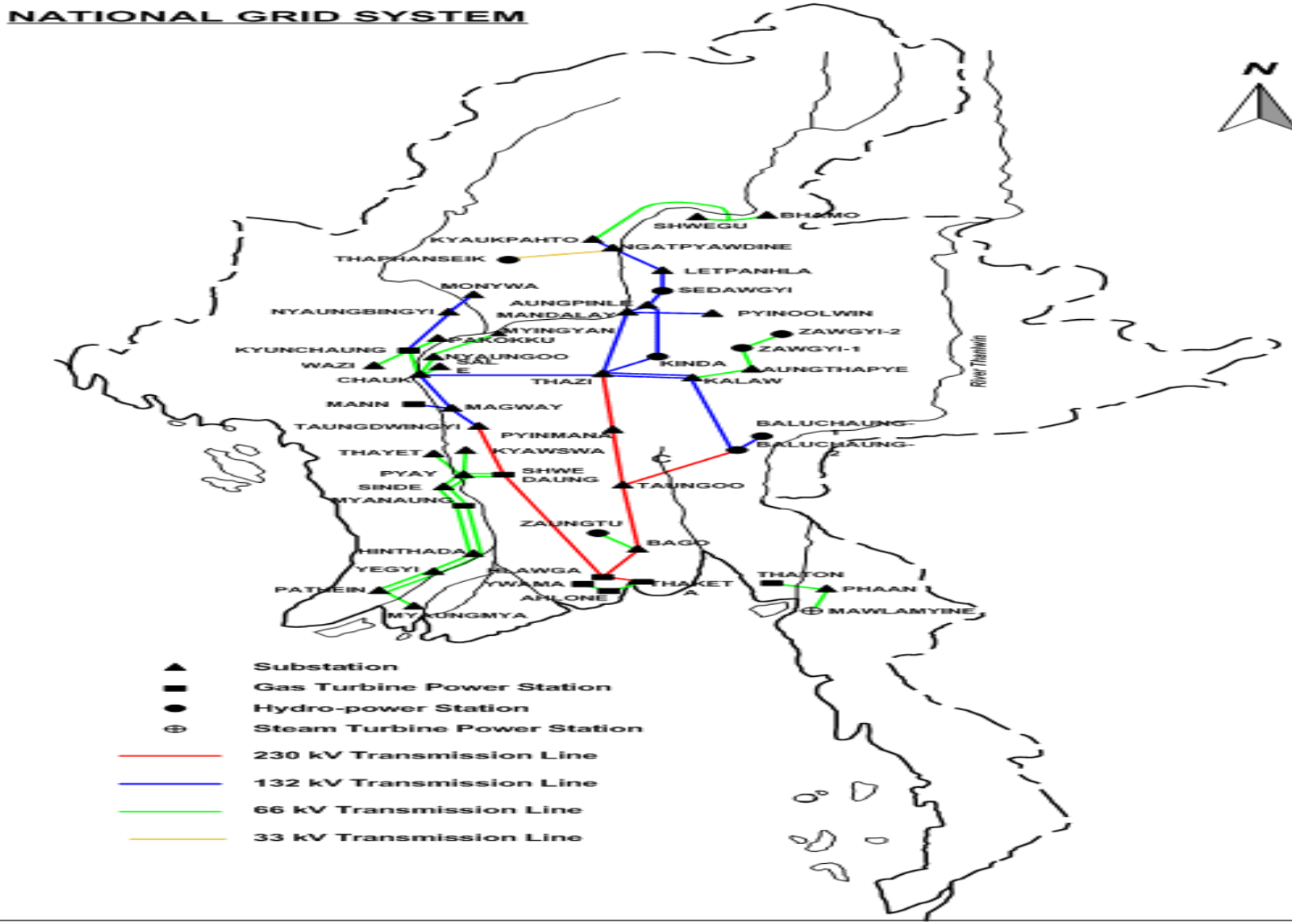
DEVELOPMENT PROGRAM OF JAVA 500 KV
2001 - 2005

Lao PDR electricity grid

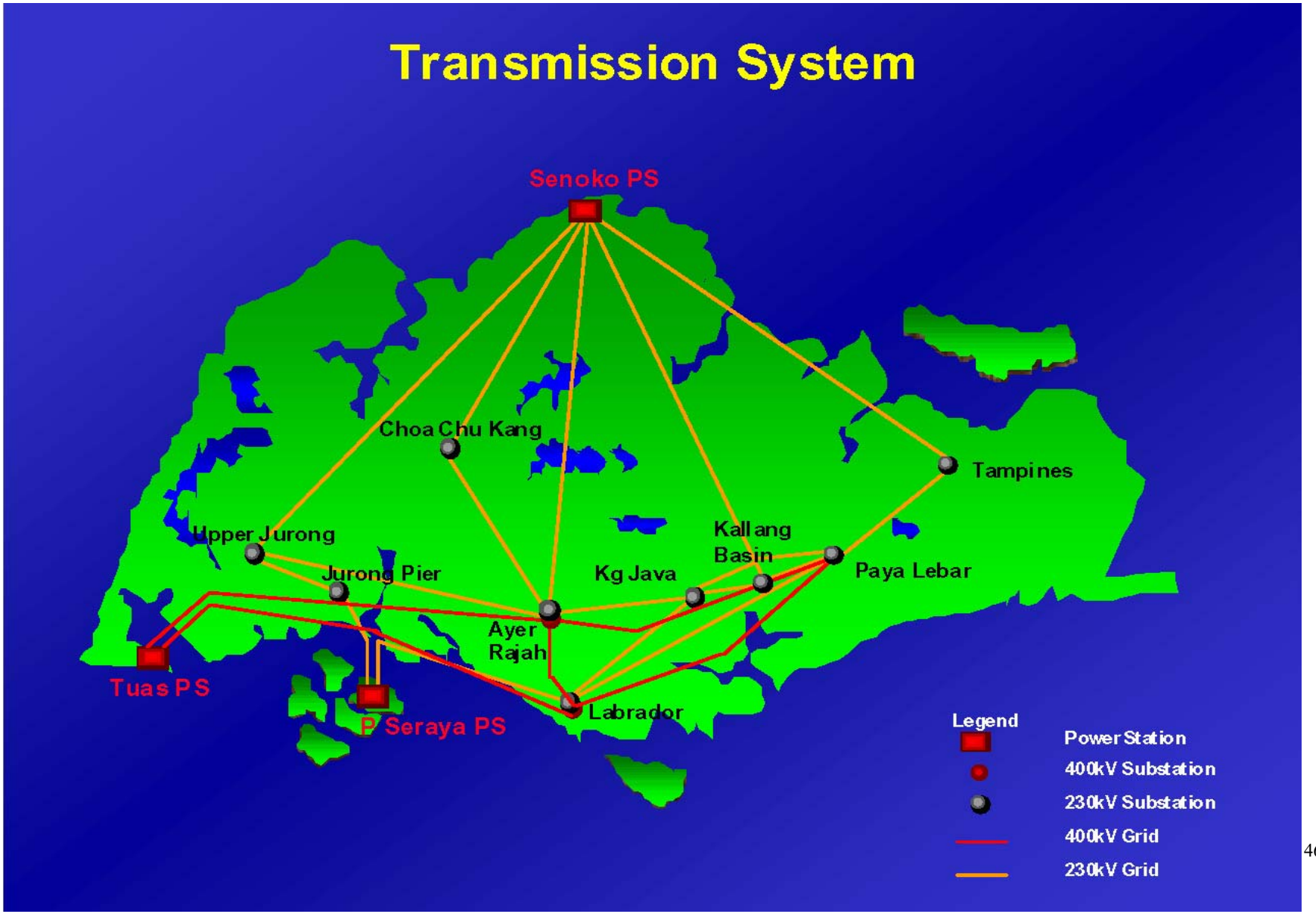


GRID SYSTEM IN PENINSULAR MALAYSIA

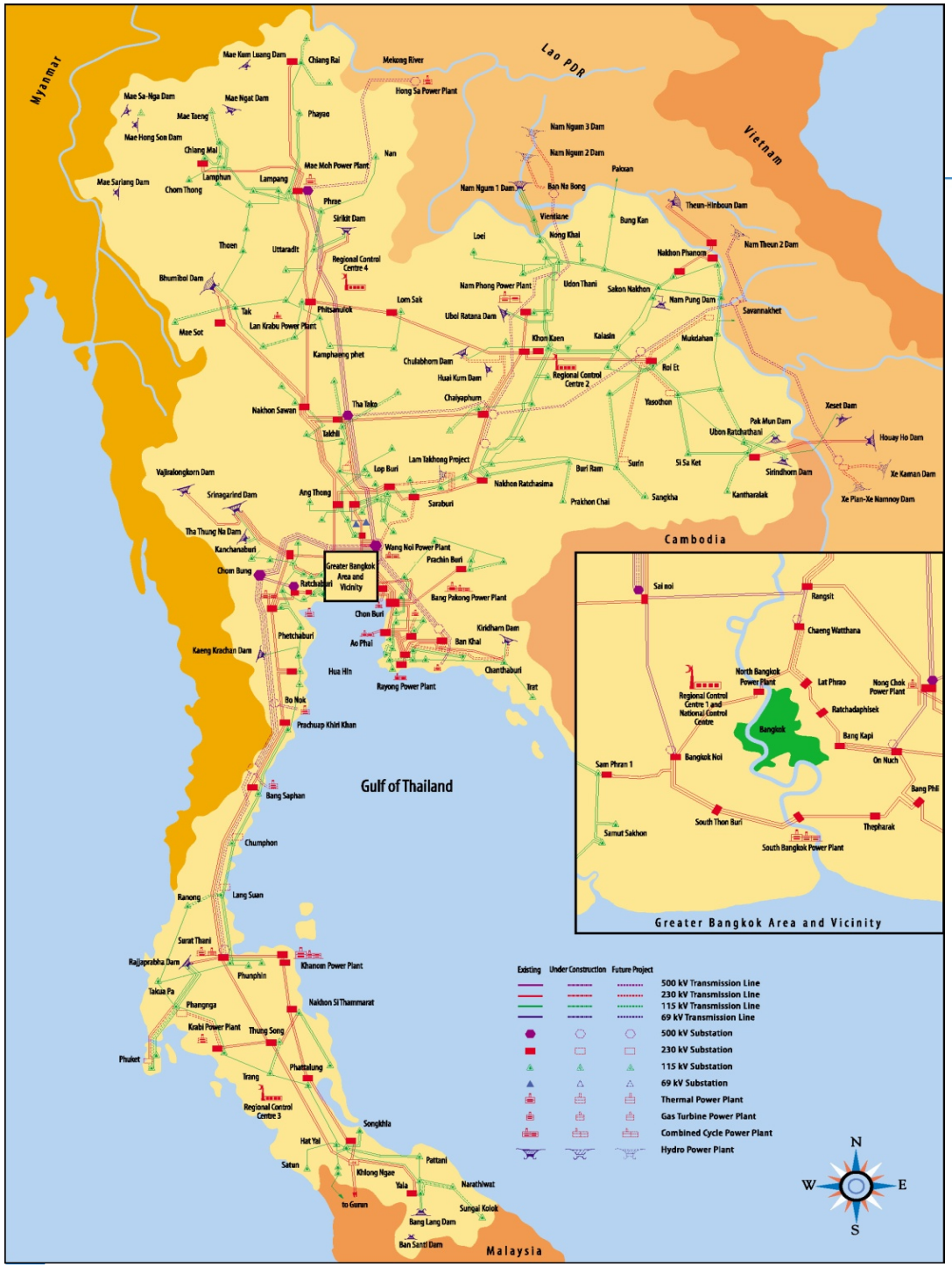
Myanmar

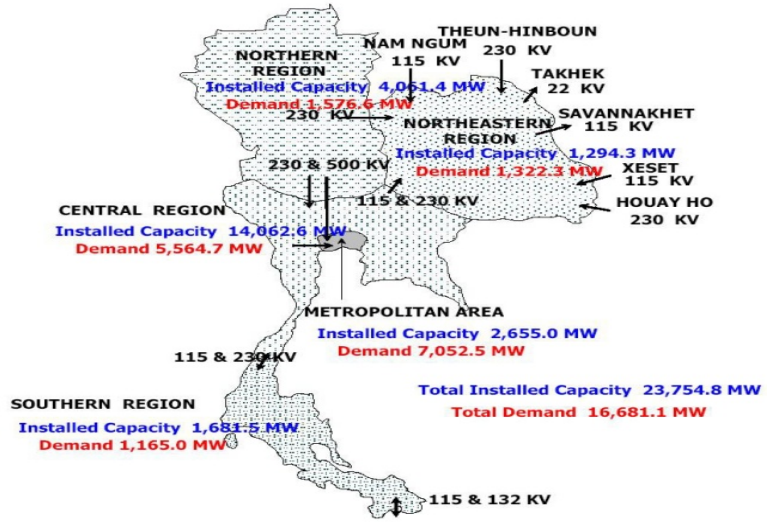

NATIONAL GRID SYSTEM
N
BHAMO
SHWEGU
KYAUKPAHTO
NGATPYAWDINE
THAPHANSEIK
LETPANHLA
SEDAWGYI
MONYWA
AUNGPINLE
MANDALAY
PYINOOLWIN
NYAUNGBINGYI
MYINGYAN
ZAWGYI-2
KYUNCHAUNG
AKOKKU
ZAWGYI-1
NYAUNGOO
WAZI
SAL
E
KINDA
AUNGTHAPYE
CHAUK
THAZI
KALAW
River Thanlwin
MANN
MAGWAY
TAUNGDWINGYI
PYINMANA
BALUCHAUNG-
BALUCHAUNG-
THAYET
KYAWSWA
PYAY
SHWE
DAUNG
TAUNGOO
SINDE
MYANAUNG
ZAUNGTU
BAGO
HINTHADA
YEGYI
LAWGA
THATON
PATHEIN
YWAMA
THAKETA
PHAAN
AHLONE
MAWLAMYINE
MYAUNGMYA
Substation
Gas Turbine Power Station
Hydro-power Station
Steam Turbine Power Station
230 kV Transmission Line
132 kV Transmission Line
66 kV Transmission Line
33 kV Transmission Line

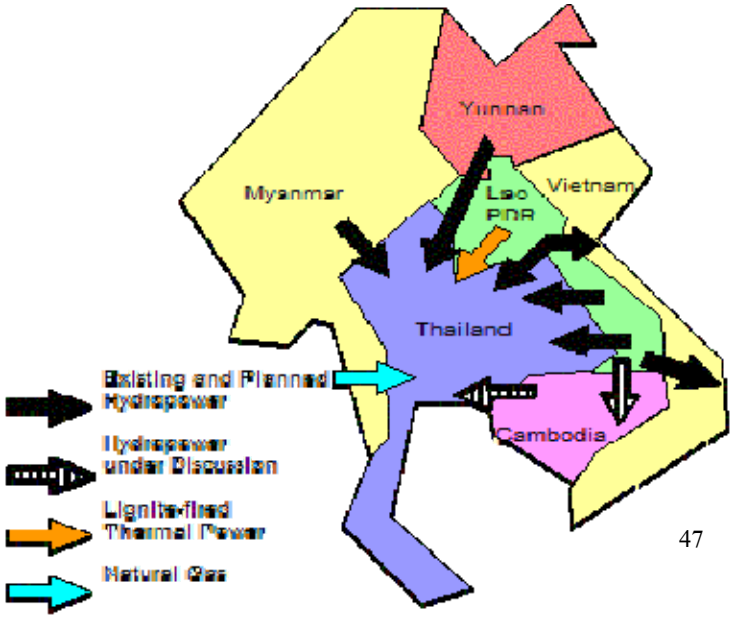
Singapore


Transmission System
Senoko PS
Choa Chu Kang
Tampines
Upper Jurong
Jurong Pier
Kg Java
Kallang Basin
Paya Lebar
Ayer Rajah
Tuas PS
P Seraya PS
Labrador
Legend
Power Station
400kV Substation
230kV Substation
400kV Grid
230kV Grid

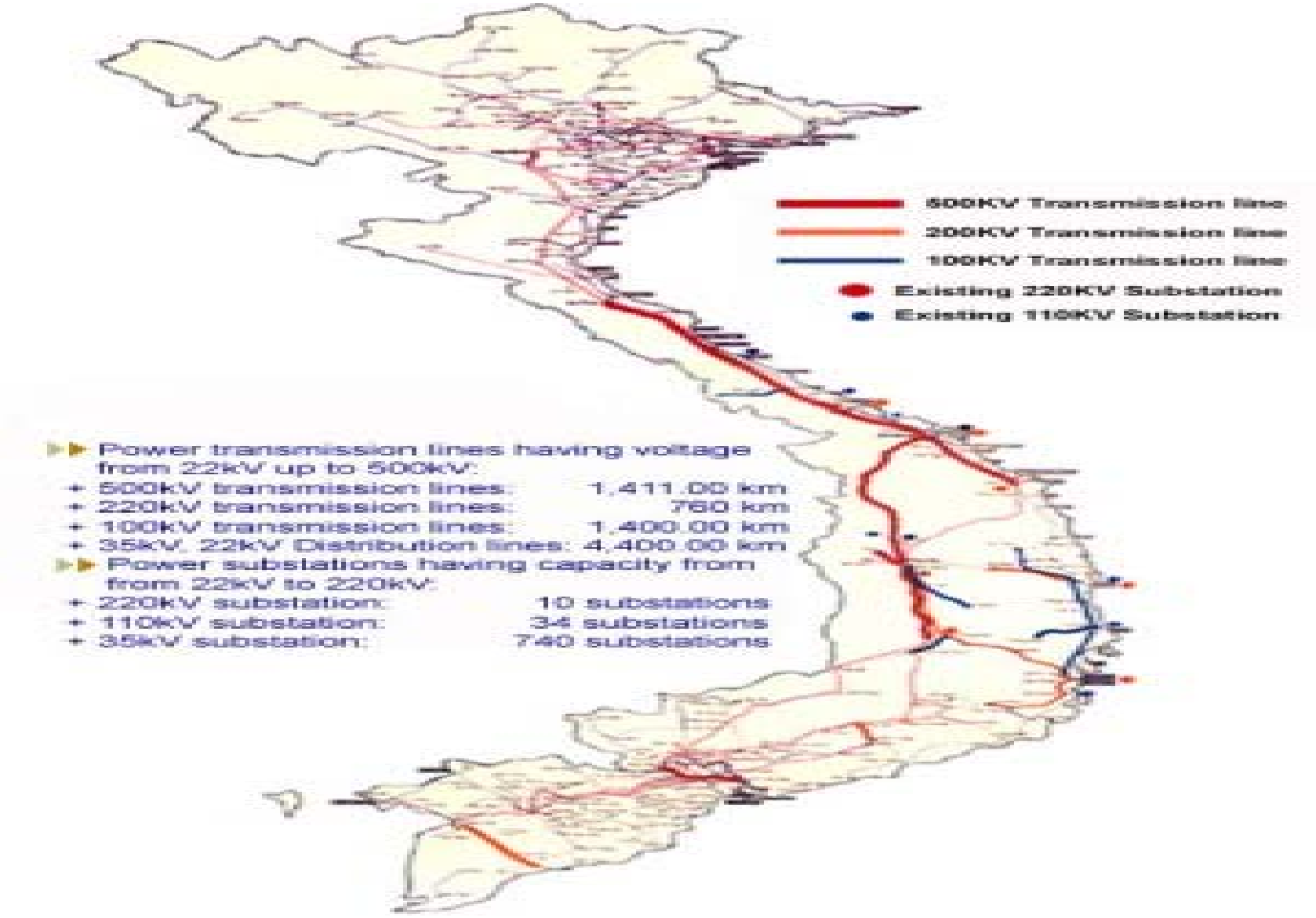
Thai National Grid





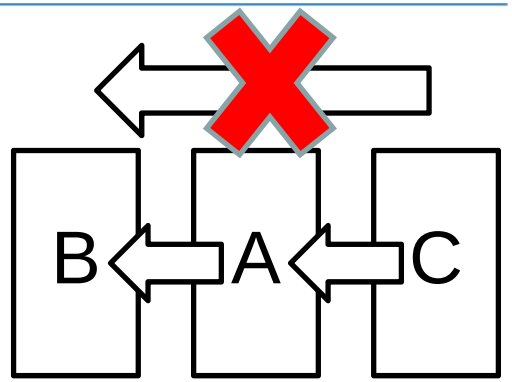


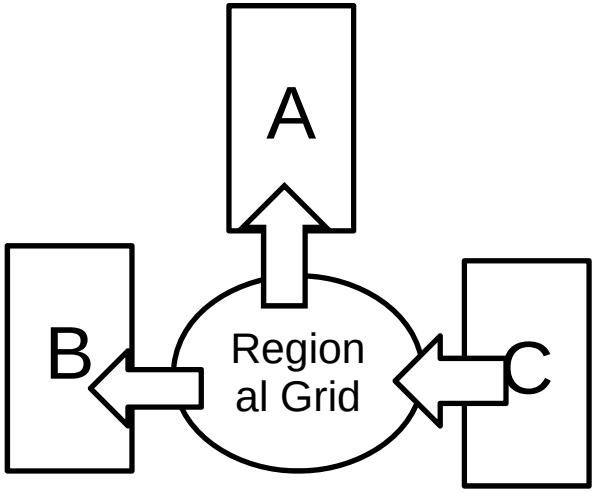
Vietnam


500KV Transmission line
200KV Transmission line
100KV Transmission line
Existing 220KV Substation
Existing 110KV Substation
Power transmission lines having voltage from 22kV up to 500kV:
500kV transmission lines: 1,411.00 km
220kV transmission lines: 760 km
100kV transmission lines: 1,400.00 km
35kV, 22kV Distribution lines: 4,400.00 km
Power substations having capacity from from 22kV to 220kV:
220kV substation: 10 substations
110kV substation: 34 substations
35kV substation: 740 substations

International Grid Connection

- **Neighbour to Neighbour Link**
  - Direct connection between neighbouring countries such as Thailand buying electricity from Lao PDR
- **Linkage through Common Backbone**
  - Establishment of a regional grid, electricity can be bought from other connected countries without being neighbour (Singapore buying electricity from Lao PDR)
  - Each country sell excess electricity to neighbouring countries as it is a commodity that cannot be stored thus reducing the need for new power plants and reducing environmental impact.

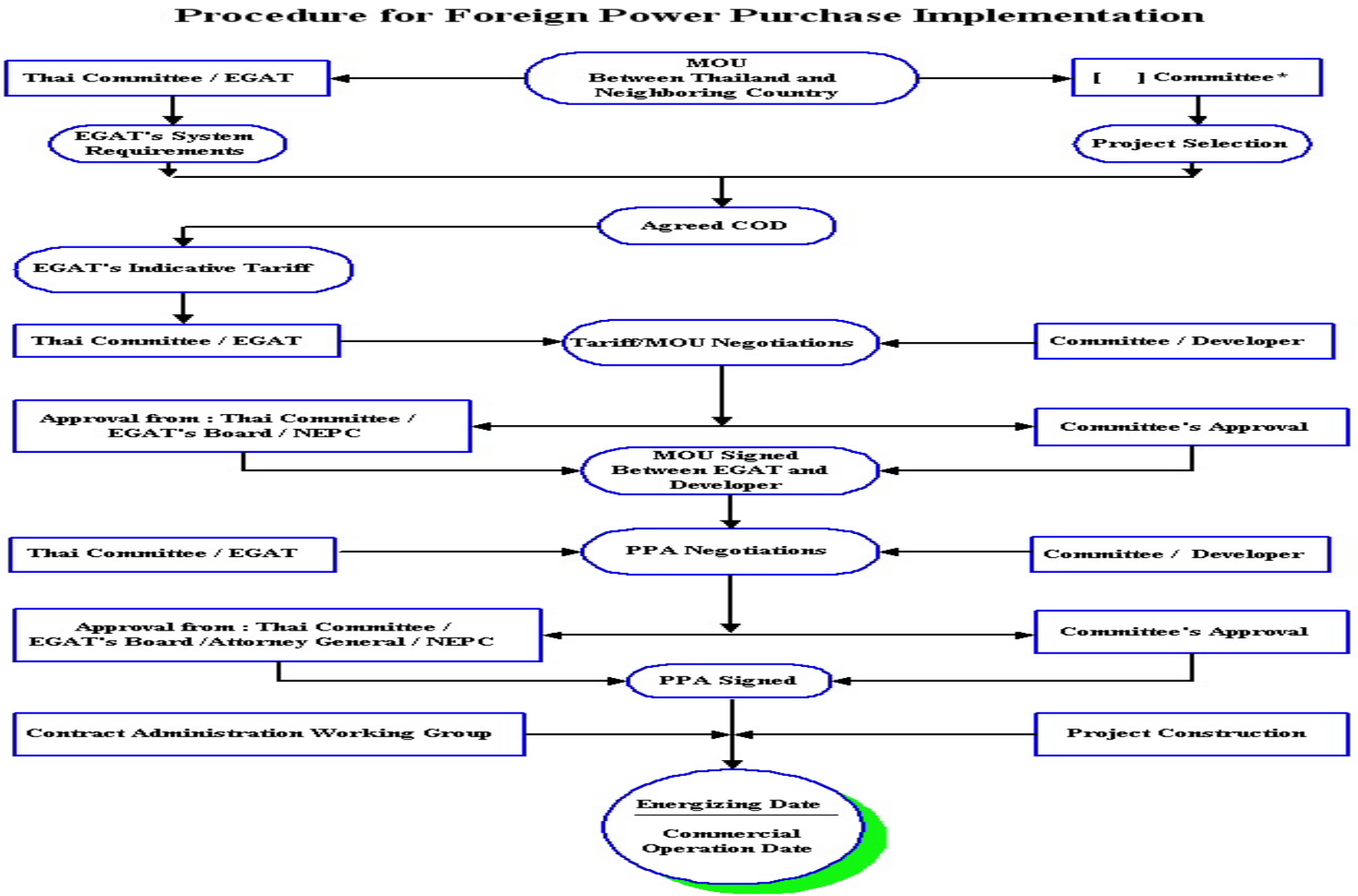




Buying Electricity…

- Traditionally electricity could be bought through a power purchase agreement (PPA). This is where the buyer would agree on the volume (MW) to be bought, the date of buying as well as the agreed upon buying rate.
- The other type of buying agreement are based upon on "Future Trading" where a control centre need to be established in order to arrange for the distribution and settlements of electricity within and between countries.
- This type of buying agreement does not exist yet within ASEAN

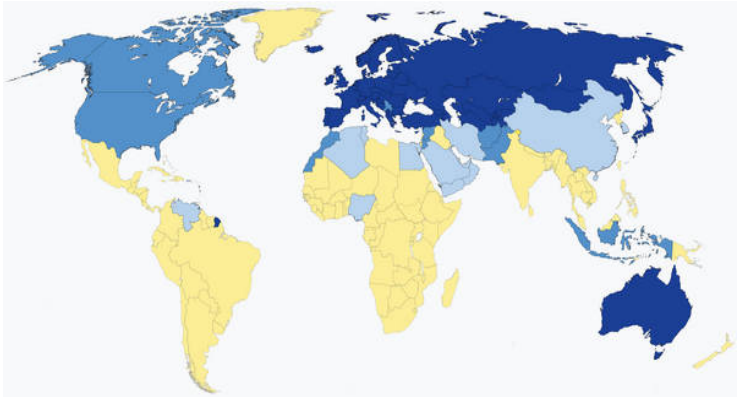
Buying Electricity in Thailand



** A Committee appointed by the Government of each neighbouring country to coordinate with the Thai Committee*

The Energy Charter

- The energy charter is a multilateral agreement focusing on enhancing energy security, guarantee investment in energy projects, developing gridline, etc.
- Countries that are involved in energy trade are signatory to the charter.
- ASEAN member countries are not signatories to this charter.
- The concept of regional gridline cannot therefore be implemented in ASEAN.
- Only physical connections between neighbouring countries will exist.



Summary

1) ASEAN countries need to consider becoming signatories to the “energy charter” in order to be able to trade electricity according to international standards
2) Each ASEAN country should establish a “National Grid Company” in order to develop the business of power trading under a liberalised environment.
3) Each ASEAN countries should support the “National Grid Company” or the National Transmission System Operator in each ASEAN country to establish an ASEAN level related institution.
4) If ASEAN is serious about the regional grid then the PPA should be abolished in order to establish a real ASEAN energy market with “spot” and “future” prices under the tutelage of an ASEAN Regional Grid Control Centre responsible for the distribution of electricity in ASEAN