

# Future Cross-Border Trade and ASEAN Power Grid

สัมมนา ร้อยใจผู้ผลิตไฟฟ้าไทย ปี 2558

3 กันยายน 2558

โดย

นายนิทัศน์ วรพนพิพัฒน์

หัวหน้ากลุ่มงานเจรจาและสัญญาต่างประเทศ

ฝ่ายสัญญาซื้อขายไฟฟ้า การไฟฟ้าฝ่ายผลิตแห่งประเทศไทย

# Content

- Existing Cross Border Trade
- ASEAN Power Grid (APG)
- Opportunities and Barriers
- Case Study: LTMS – PIP
- Q&A



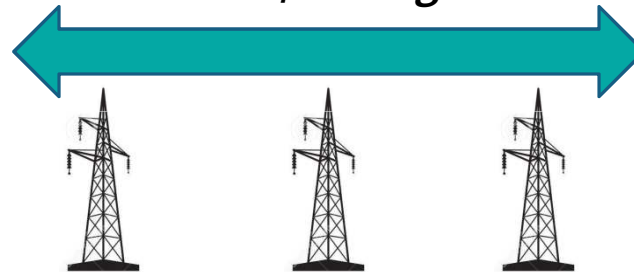
# Existing Cross Border Trade



# Existing Cross Border Trade

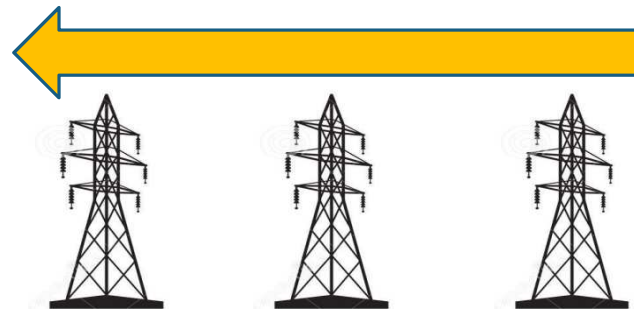
Electricity Generating  
Authority of Thailand  
(EGAT)

Utility to Utility  
Purchase / Sell Agreement



Electricity Utility

Power Purchase Agreement

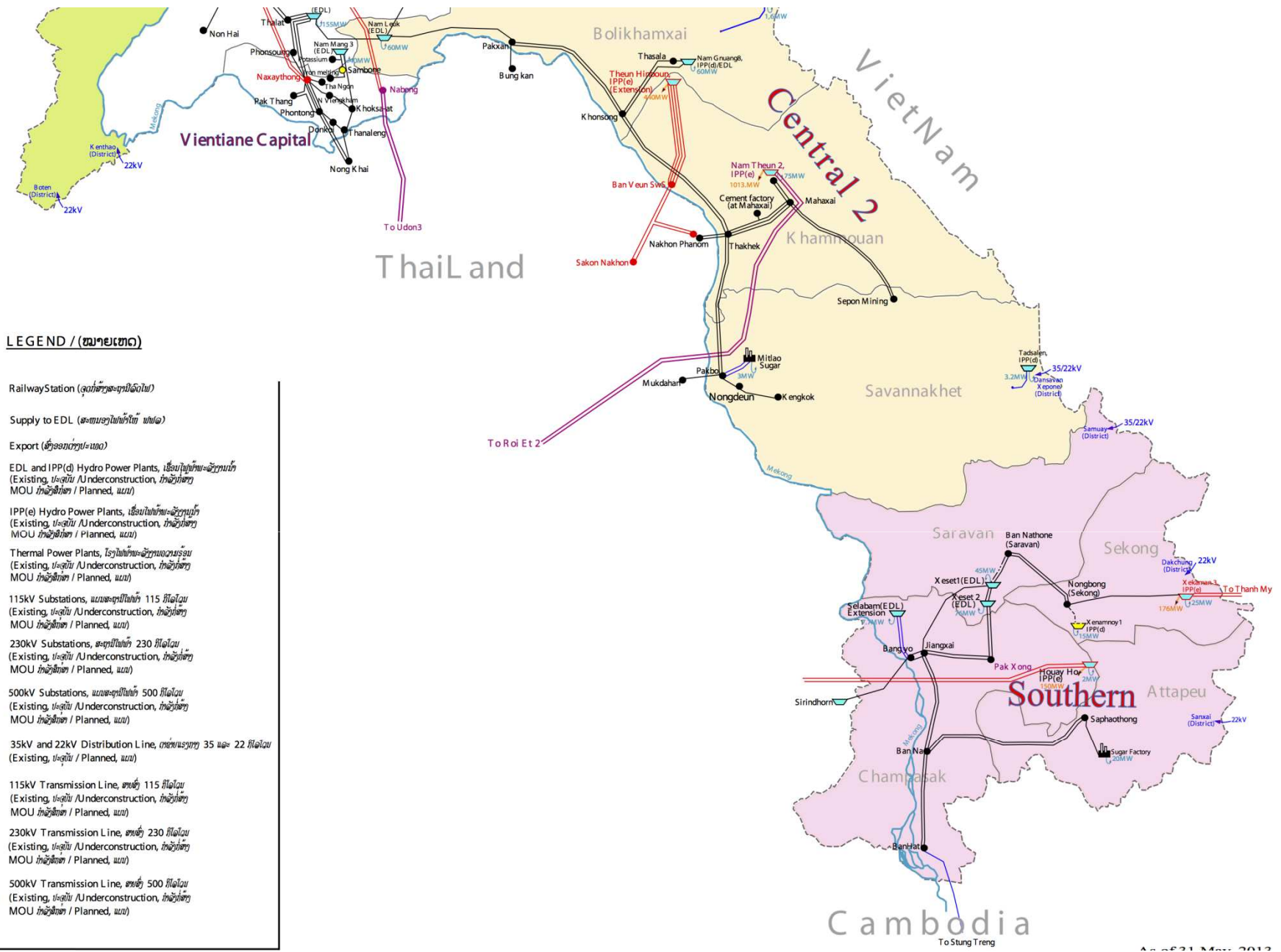


Foreign  
Independent Power  
Producer  
(FIPP)














Import from EGAT during plant shutdown does not included.

# Existing Cross Border Trade

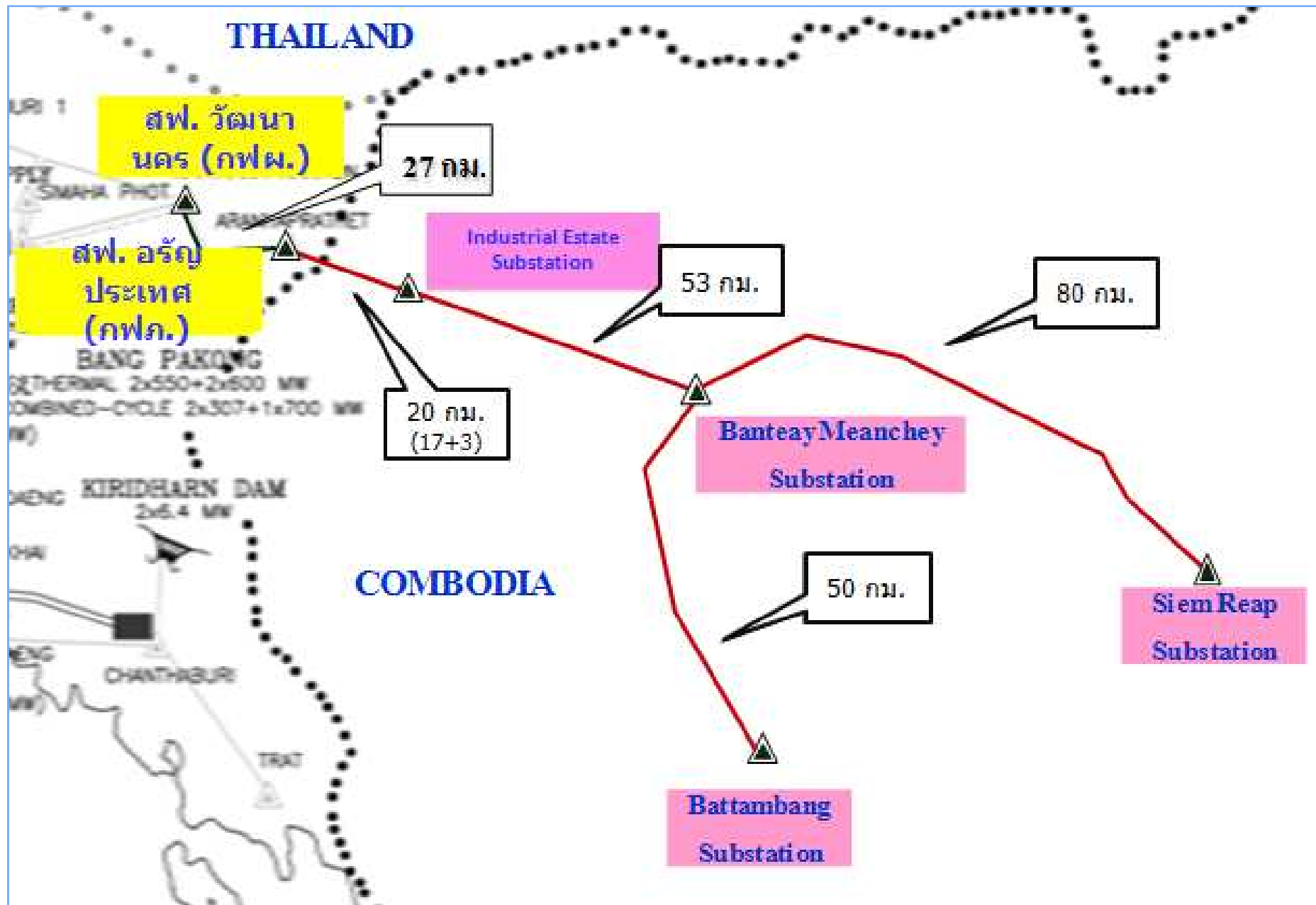


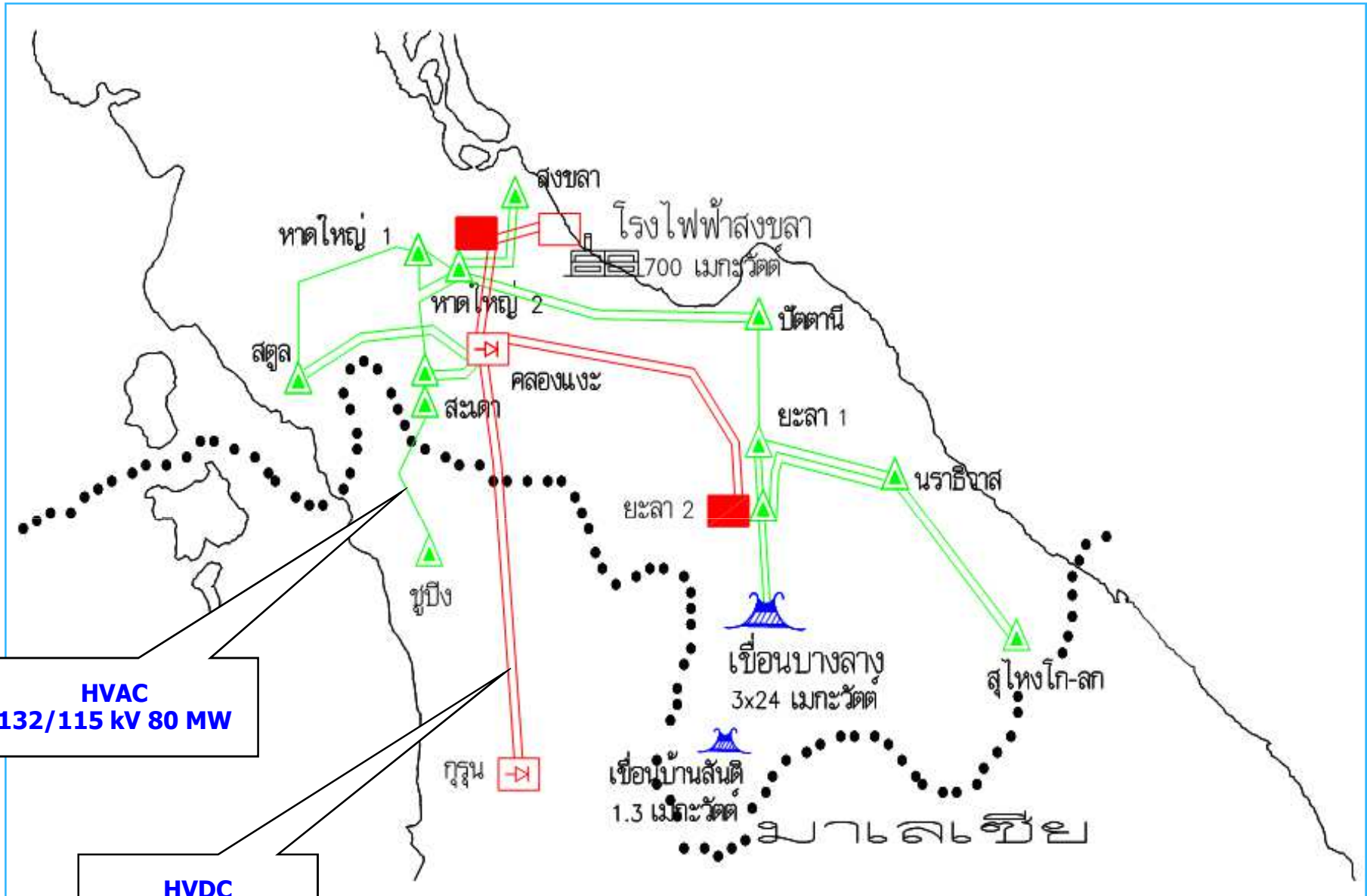


**LEGEND / (ໝາຍເຫດ)**

-  Railway Station (ສູນກຳລັງສະຖານີລົດໄຟ)
-  Supply to EDL (ສະໜອງໄຟຟ້າໃຫ້ ພຣ໌ເວດ)
-  Export (ສົ່ງອອກຕ່າງປະເທດ)
-  EDL and IPP(d) Hydro Power Plants, ເຮືອນໄຟຟ້າພະລັງງານນ້ຳ (Existing, ປະຈຸບັນ / Underconstruction, ກຳລັງກໍ່ສ້າງ / MOU ກຳລັງສຶກສາ / Planned, ແບບ)
-  IPP(e) Hydro Power Plants, ເຮືອນໄຟຟ້າພະລັງງານນ້ຳ (Existing, ປະຈຸບັນ / Underconstruction, ກຳລັງກໍ່ສ້າງ / MOU ກຳລັງສຶກສາ / Planned, ແບບ)
-  Thermal Power Plants, ໂຮງໄຟຟ້າພະລັງງານຄວາມຮູນ (Existing, ປະຈຸບັນ / Underconstruction, ກຳລັງກໍ່ສ້າງ / MOU ກຳລັງສຶກສາ / Planned, ແບບ)
-  115kV Substations, ແບບສະຖານີໄຟຟ້າ 115 ກິໂລເວດ (Existing, ປະຈຸບັນ / Underconstruction, ກຳລັງກໍ່ສ້າງ / MOU ກຳລັງສຶກສາ / Planned, ແບບ)
-  230kV Substations, ສະຖານີໄຟຟ້າ 230 ກິໂລເວດ (Existing, ປະຈຸບັນ / Underconstruction, ກຳລັງກໍ່ສ້າງ / MOU ກຳລັງສຶກສາ / Planned, ແບບ)
-  500kV Substations, ແບບສະຖານີໄຟຟ້າ 500 ກິໂລເວດ (Existing, ປະຈຸບັນ / Underconstruction, ກຳລັງກໍ່ສ້າງ / MOU ກຳລັງສຶກສາ / Planned, ແບບ)
-  35kV and 22kV Distribution Line, ເສັ້ນສົ່ງແຮງກາງ 35 ແລະ 22 ກິໂລເວດ (Existing, ປະຈຸບັນ / Planned, ແບບ)
-  115kV Transmission Line, ສາຍສົ່ງ 115 ກິໂລເວດ (Existing, ປະຈຸບັນ / Underconstruction, ກຳລັງກໍ່ສ້າງ / MOU ກຳລັງສຶກສາ / Planned, ແບບ)
-  230kV Transmission Line, ສາຍສົ່ງ 230 ກິໂລເວດ (Existing, ປະຈຸບັນ / Underconstruction, ກຳລັງກໍ່ສ້າງ / MOU ກຳລັງສຶກສາ / Planned, ແບບ)
-  500kV Transmission Line, ສາຍສົ່ງ 500 ກິໂລເວດ (Existing, ປະຈຸບັນ / Underconstruction, ກຳລັງກໍ່ສ້າງ / MOU ກຳລັງສຶກສາ / Planned, ແບບ)

Reference: EDL PDP 2013



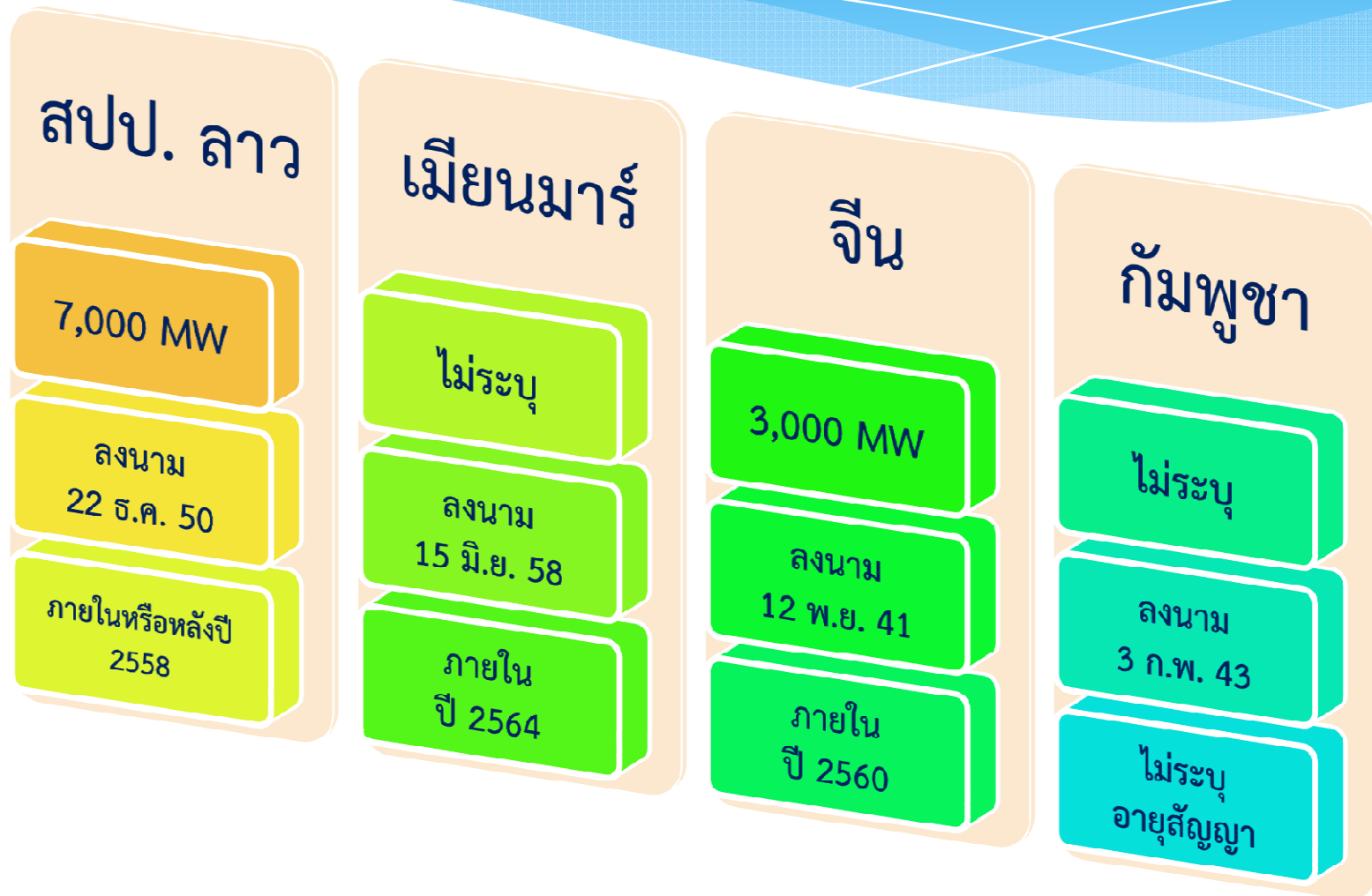


**HVAC**  
132/115 kV 80 MW

**HVDC**  
300 kV 300 MW



# MOU between Thailand and neighboring countries



**Pak Beng \***  
 (Run-of-River on mainstream of the Mekong basin)  
 798 MW  
 Under Tariff MOU negotiations

**Nam Ngiep 1 (Reservoir)**  
 269 MW  
 Under constructions 10.8%  
 SCOD : 12 Feb 2019

**Nam Theun 1 (Reservoir)**  
 520 MW  
 Under Tariff MOU negotiations

**Hongsa Lignite (Thermal)**  
 1,473 MW  
 Under constructions 95.20%  
 SCOD : 2 Mar 2016

**Theun Hin Boun – Expansion (Reservoir)**  
 434 MW  
 COD : 1 Dec 2012

**Xayaburi**  
 (Run-of-River on mainstream of the Mekong basin)  
 1,220 MW  
 Under constructions 42.76%  
 SCOD : 29 Oct 2019

**Nam Theun 2 (Reservoir)**  
 948 MW  
 COD : 30 April 2010

**Nam Ngum 2 (Reservoir)**  
 596.6 MW  
 COD : 1 Jan 2013




**Houay Ho (Reservoir)**  
 126 MW  
 COD : 3 Sep 1999

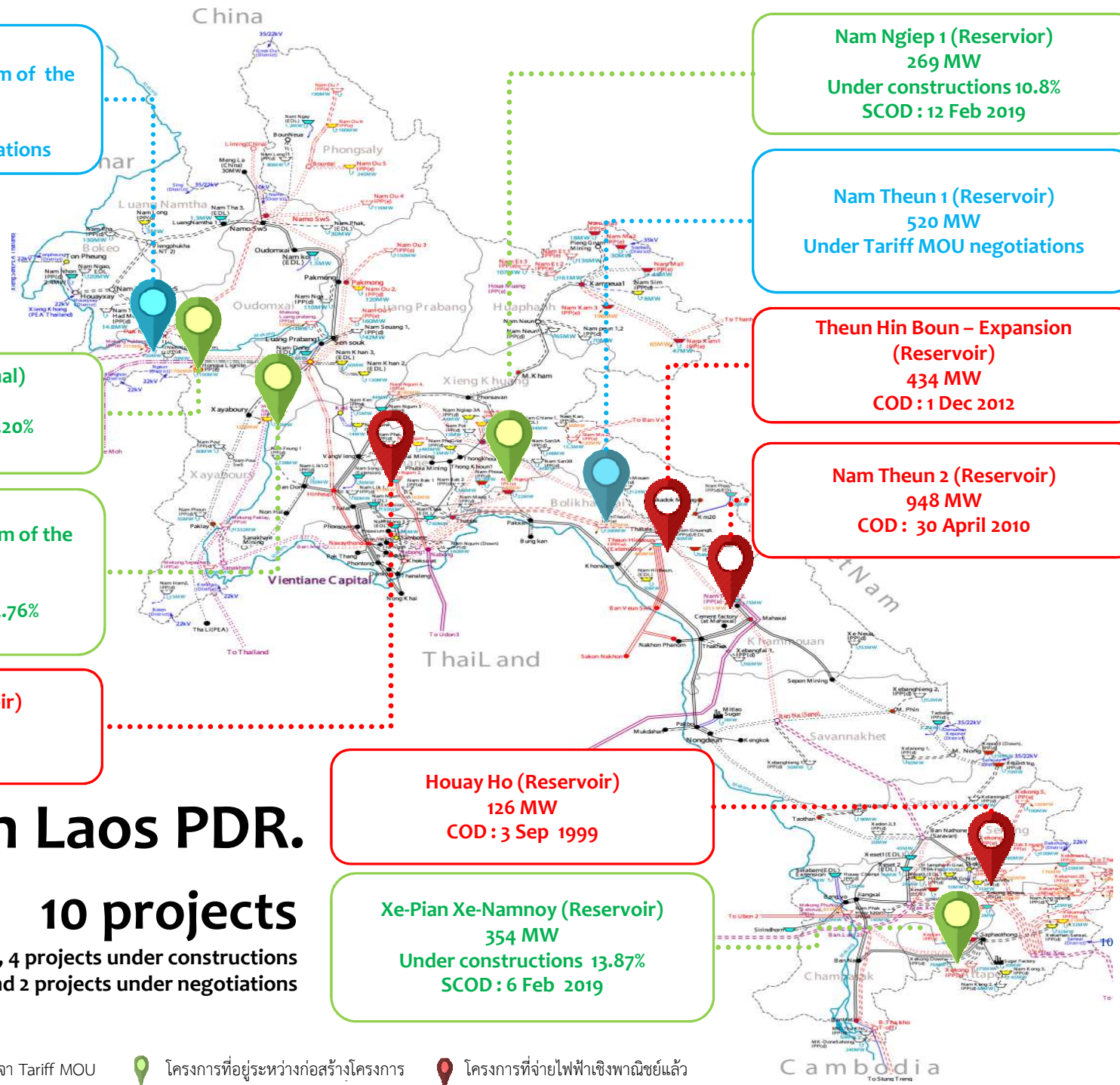
**Xe-Pian Xe-Namnoy (Reservoir)**  
 354 MW  
 Under constructions 13.87%  
 SCOD : 6 Feb 2019

# IPP in Laos PDR.

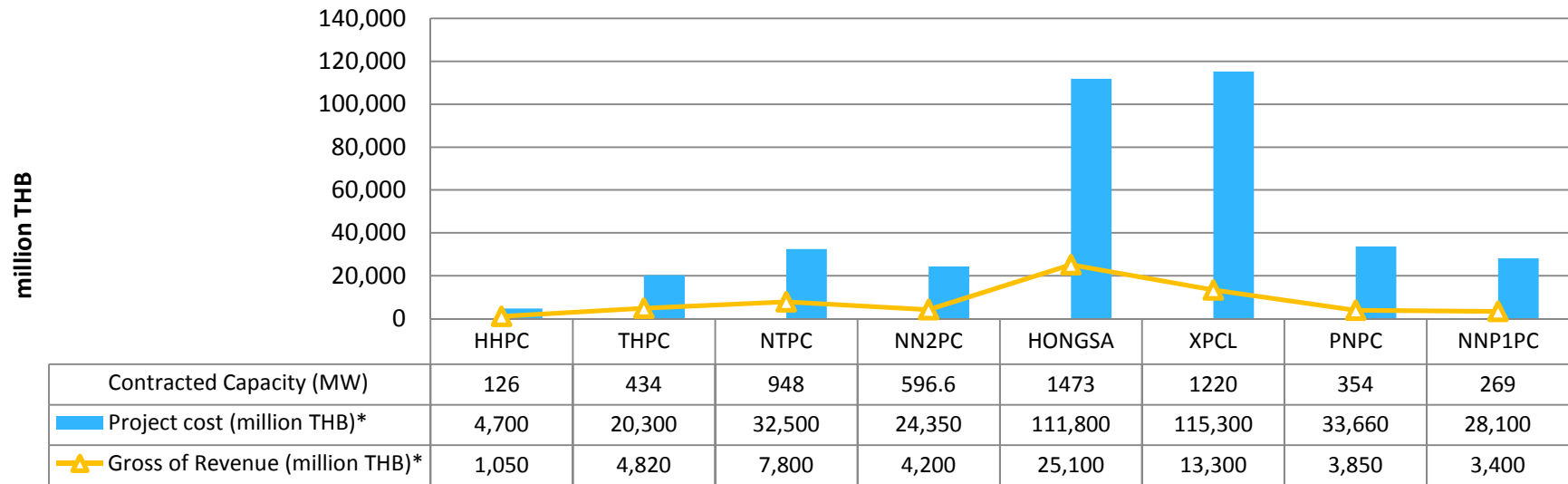
## 10 projects

4 projects in operations, 4 projects under constructions and 2 projects under negotiations

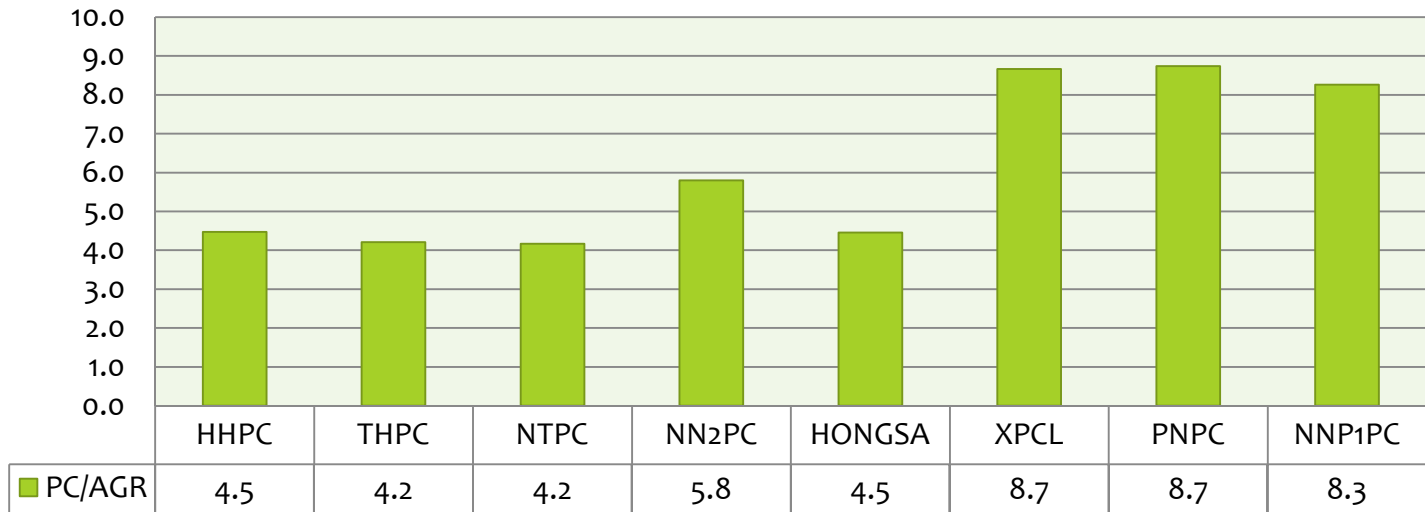
 โครงการที่อยู่ระหว่างเจรจา Tariff MOU
  โครงการที่อยู่ระหว่างก่อสร้างโครงการ
  โครงการที่จ่ายไฟฟ้าเชิงพาณิชย์แล้ว



### Project Cost and Annual Gross of Revenue



### Project Cost / Annual Gross Revenue

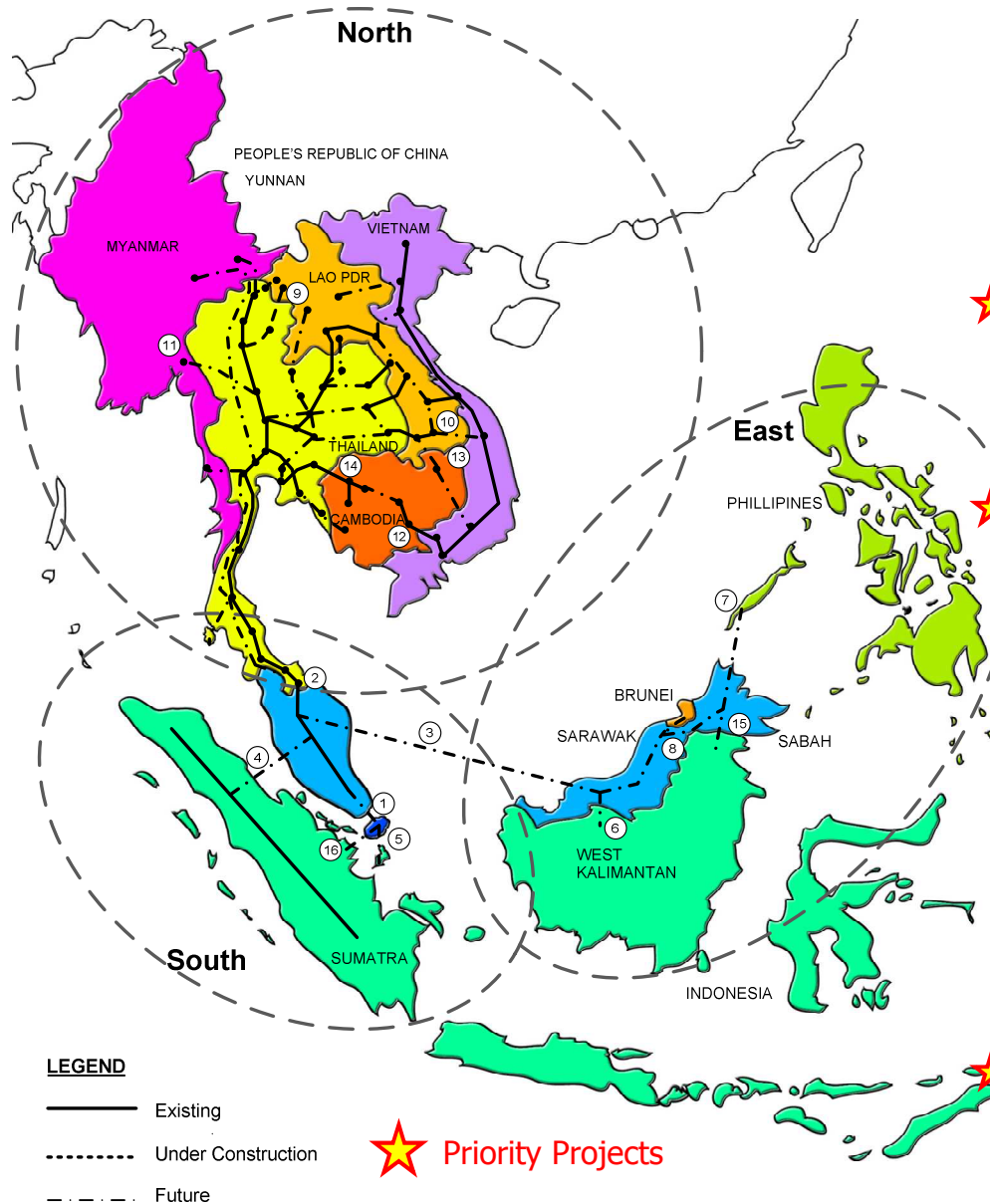


\* Based on approximate information

# ASEAN Power Grid



# ASEAN Interconnection Projects (Updated in May 2015)



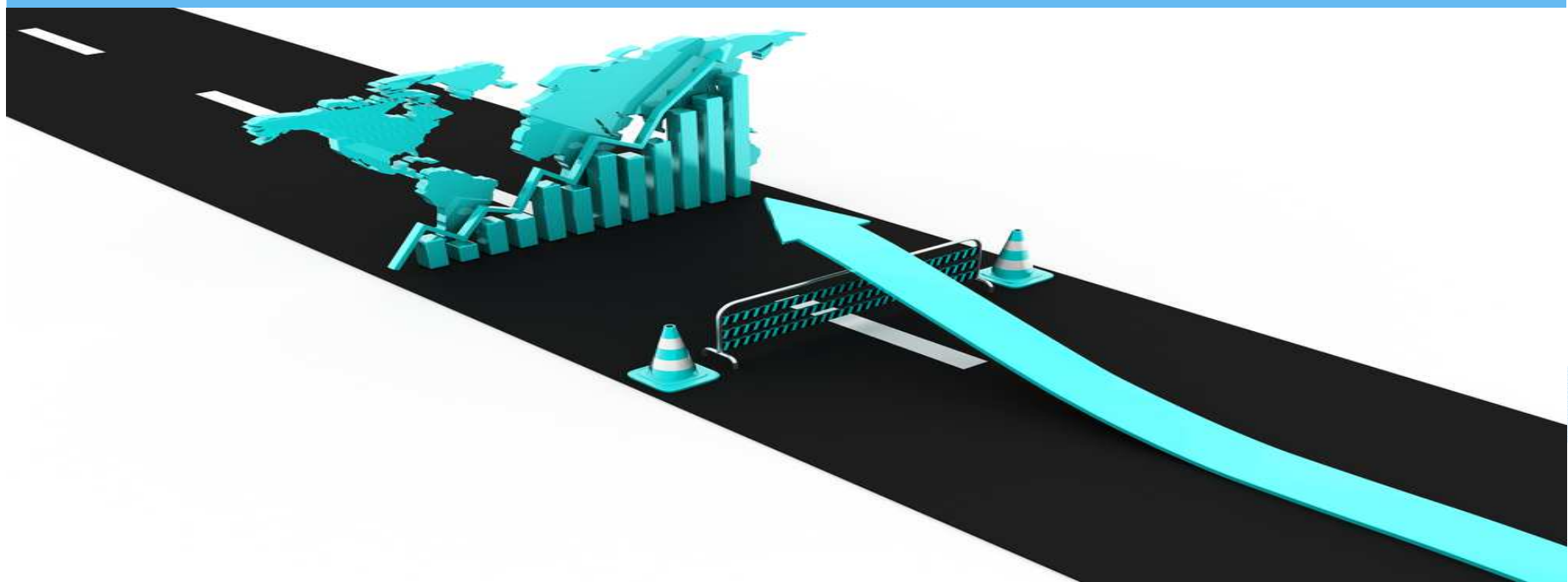
## Earliest COD

- 1) **P.Malaysia - Singapore**
  - Plentong - Woodlands Existing
  - P.Malaysia - Singapore post 2020
- 2) **Thailand - P.Malaysia**
  - Sadao - Bukit Keteri Existing
  - Khlong Ngae - Gurun Existing
  - Su Ngai Kolok - Rantau Panjang TBC
  - Khlong Ngae - Gurun (2<sup>nd</sup> Phase, 300MW) TBC
- 3) **Sarawak - P. Malaysia** **2025**
- ★ 4) **P.Malaysia - Sumatra** **2020**
- 5) **Batam - Singapore** **2020**
- 6) **Sarawak - West Kalimantan** **2015**
- 7) **Philippines - Sabah** **2020**
- 8) **Sarawak - Sabah - Brunei**
  - Sarawak - Sabah 2020
  - Sarawak - Brunei 2018
- ★ 9) **Thailand - Lao PDR**
  - Roi Et 2 - Nam Theun 2 Existing
  - Sakon Nakhon 2 - Thakhek - Then Hinboun (Exp.) Existing
  - Mae Moh 3 - Nan - Hong Sa 2015
  - Udon Thani 3 - Nabong (converted to 500KV) 2019
  - Ubon Ratchathani 3 - Pakse - Xe Pian Xe Namnoy 2019
  - Khon Kaen 4 - Loei 2 - Xayaburi 2019
  - Nakhon Phanom - Thakhek 2015
  - Thailand - Lao PDR (New) 2019-2023
- 10) **Lao PDR - Vietnam**
  - Xekaman 3 - Tranhmy Existing
  - Xekaman 1 - Pleiku 2 2016
- 11) **Thailand - Myanmar** **2018-2026**
- 12) **Vietnam - Cambodia (New)**
  - Chau Doc - Takeo - Phnom Penh Existing
  - Tay Ninh - Stung Treng TBC
- 13) **Lao PDR - Cambodia** **2017**
- ★ 14) **Thailand - Cambodia (New)** **post 2020**
  - Aranyaprathet - Banteay Meanchey Existing
  - Thailand - Cambodia post 2020
- 15) **East Sabah - East Kalimantan** **post 2020**
- 16) **Singapore - Sumatra** **post 2020**

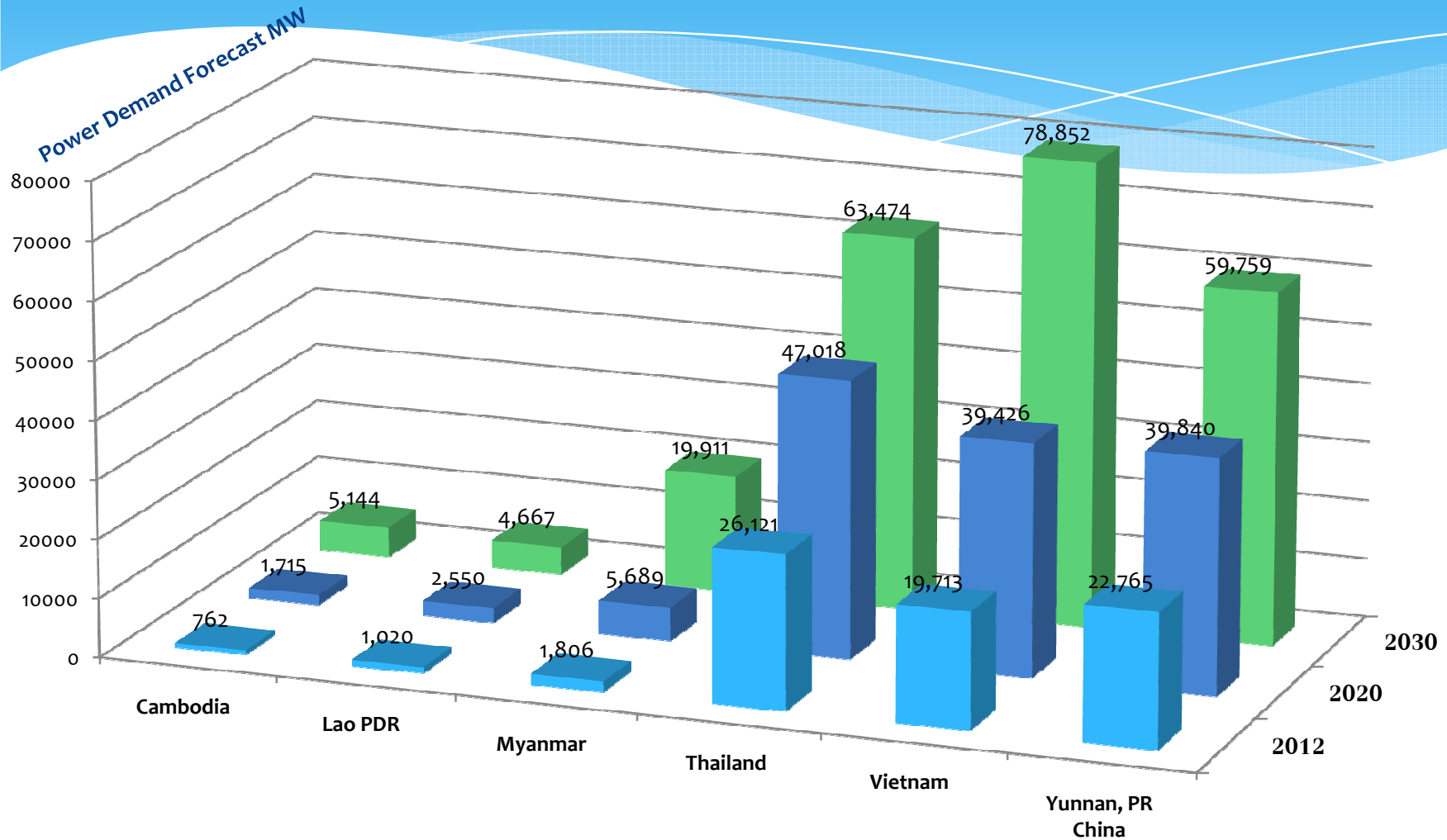
<b>Country</b>	<b>Utility Serves</b>	<b>Electricity Supply Industry Structure</b>	<b>Installed Capacity (MW)</b>
<b>Brunei Darussalam</b>	Departement of Electrical Services (DES)	<i>Vertical Integrated Utility</i>	827
<b>Cambodia</b>	Electricite Du Cambodge (EDC)	<i>Vertical Integrated Utility</i>	732
<b>Indonesia</b>	PT PLN (persero)	<i>Vertical Integrated Utility</i>	40,524
<b>Lao PDR</b>	Electricite Du Laos	<i>Vertical Integrated Utility</i>	2,978
<b>Malaysia</b>	Tenaga Berhad (TNB)	<i>VIU Penisular Malaysia</i>	27,179
	SESCO	<i>VIU Serawak State</i>	
	SESB	<i>VIU Sabah</i>	
<b>Myanmar</b>	Ministry of Electric Power MEPE 1 MEPE 2	<i>Transmission and Distribution Hydro Power Generation</i>	3,494
<b>Philippines</b>	National Power Corporation Trans Co	<i>Power Generation Company Transmission Company</i>	16,924
<b>Singapore</b>	SP Power Grid	<i>Gencos, T &amp; D</i>	9,951
<b>Thailand</b>	EGAT	<i>Generation, SO &amp; Transmission</i>	34,335
	MEA & PEA	<i>Distribution/Retail Supply</i>	
<b>Vietnam</b>	Electricity of Vietnam (EVN)	<i>Vertical Integrated Utility</i>	26,926

Reference: ASEAN POWER MARKET INTEGRATION FOR ELECTRICITY SUPPLY SECURITY by Syaiful B Ibrahim Secretary in Charge HAPUA  
Oil & Gas Security Network Forum April 23, 2015 Kitakyushu City Japan

# Opportunities and Barriers



# Opportunities



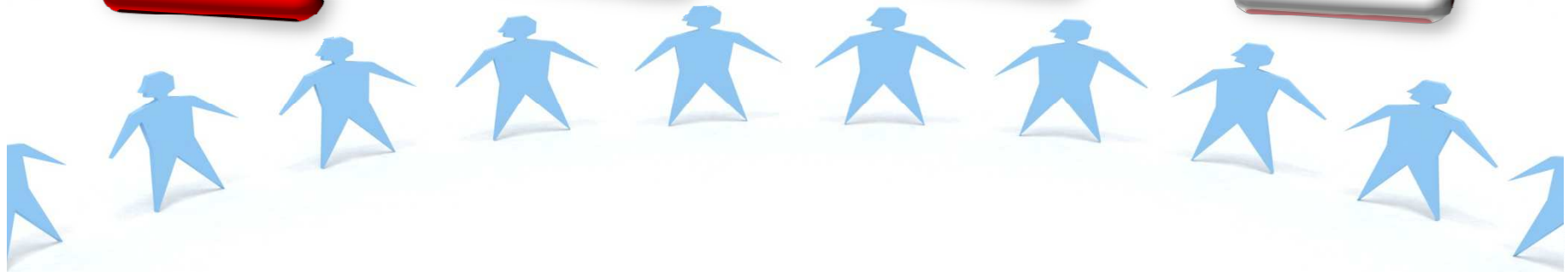
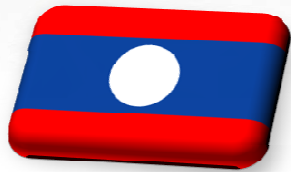
Reference: IFC Workshop on Sustainable Hydropower & Regional Cooperation “Moving from bilateral connections to system-to-system approaches – the experience of Lao PDR” By Viraphonh Viravong Vice Minister, Ministry of Energy & Mines, Lao PDR 19-20 January 2015, Nay Pyi Taw, Myanmar



# Barriers

- legal and regulatory framework for bilateral and cross – border power interconnection and trade
- Technical standards codes or guidelines in the areas of Planning and Design, System Operation and Maintenance
- Formulation of institutional and contractual arrangements for cross-border electricity trade to include Taxation, Tariff and Third Party Access (Wheeling Charge)
- Financing Modalities for realizing the APG

# Case Study: LTMS – PIP



# WORLD NEWS REPORT

THURSDAY, MAY 28, 2015

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## Malaysia hopes for major breakthrough on Laos, Thailand, Malaysia and Singapore Power Integration Project (LTMS-PIP)

May 28, 2015

KOTA-KINABALU: Malaysia hopes to see some major breakthrough in discussions on the Laos, Thailand, Malaysia and Singapore Power Integration Project (LTMS-PIP) however, Energy, Green 1

ENGLISH

## ไทย-ลาว-มาเลเซีย-สิงคโปร์เห็นพ้องแผนเชื่อมโครงข่ายส่งไฟฟ้า

written by: นาย สก. ต. ส. ส. ส. ส. ส.

2015/05/28 10:39 AM



กรุงเทพฯ, 28 พ.ค. - ไทย-ลาว-มาเลเซีย-สิงคโปร์เห็นพ้องแผนเชื่อมโครงข่ายส่งไฟฟ้า เพื่อลดต้นทุนและโครงการนำร่องการบูรณาการพลังงานของอาเซียน

กรุงเทพฯ (รอยเตอร์) - ไทย-ลาว-มาเลเซีย-สิงคโปร์เห็นพ้องแผนเชื่อมโครงข่ายส่งไฟฟ้าเพื่อลดต้นทุนและโครงการนำร่องการบูรณาการพลังงานของอาเซียน (33rd Senior Officials Meeting on Energy (SOME)) ที่เมืองKota Kinabalu, ประเทศมาเลเซีย ระหว่างวันที่ 25-30 พ.ค. นี้

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Archived News (28/05/2015) : Malaysia Hopes For Major Breakthrough On LTMS-PIP At 33rd SOME

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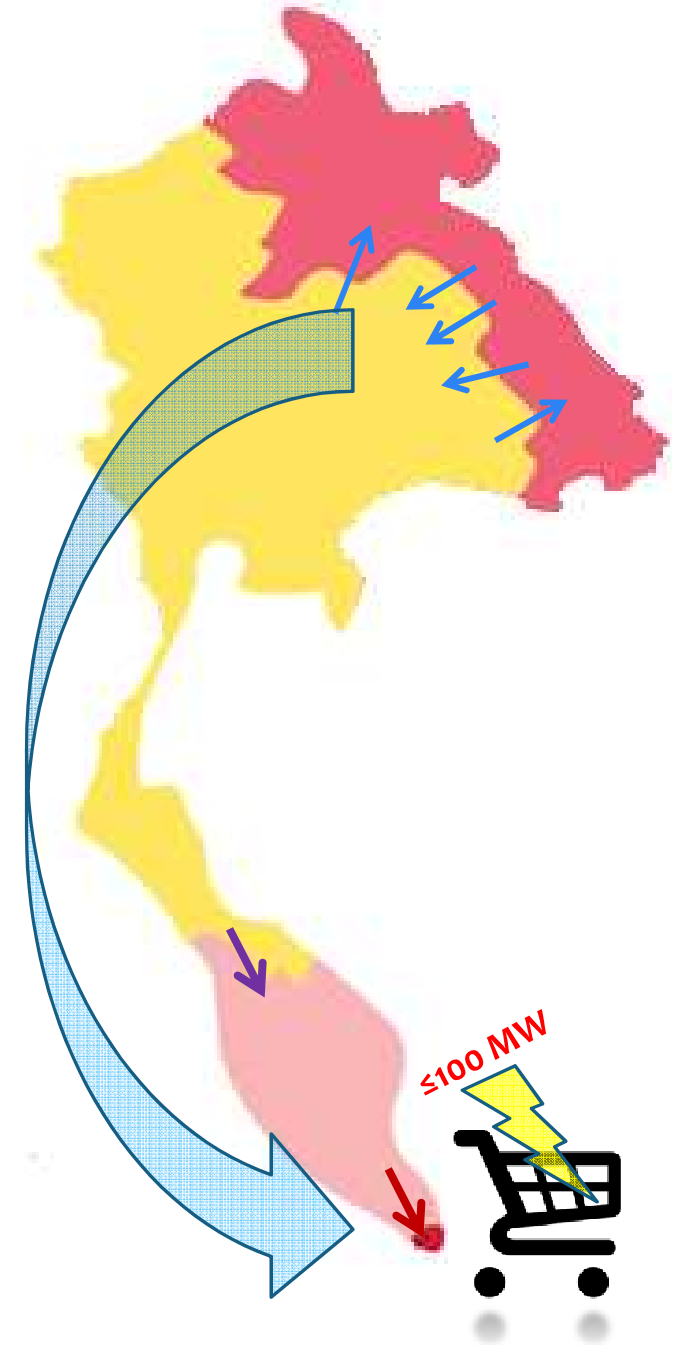
# Joint Statement of the Lao PDR, Thailand, Malaysia and Singapore

## Power Integration Project (LTMS PIP)

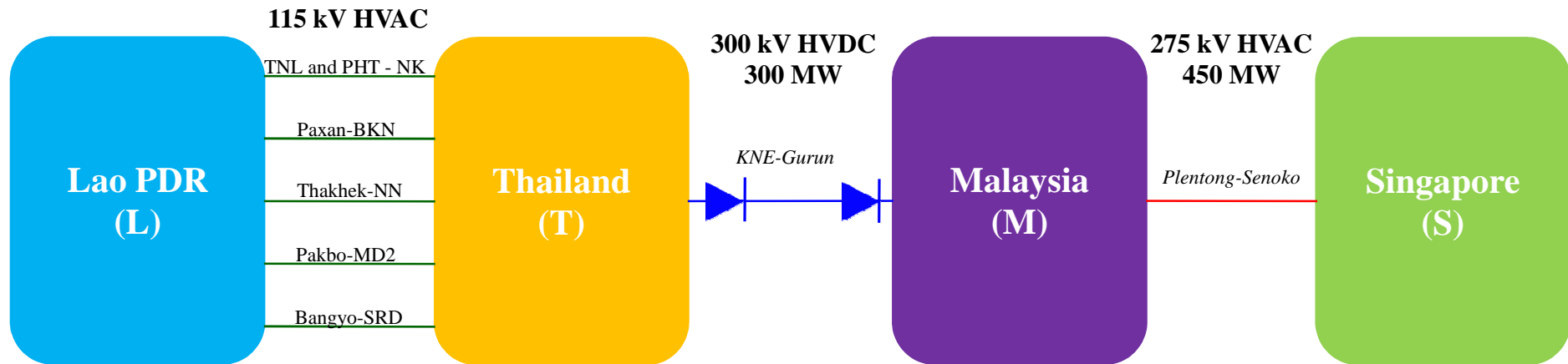
23 September 2014

Vientiane, Lao PDR

“ The Ministry of Energy and Mines of the Lao People’s Democratic Republic, Ministry of Energy of the Kingdom of Thailand, Ministry of Energy, Green Technology and Water of Malaysia, and Ministry of Trade and Industry of the Republic of Singapore agreed today on a pilot project entitled “**Lao PDR, Thailand, Malaysia, Singapore (LTMS) Power Integration Project (PIP)**” to study cross border power trade from Lao PDR to Singapore. “



# Existing Interconnection and Physical Flow



## Power Flow Control through interconnection:

Between Lao-Thailand: without power flow control (without ACE)

Between Thailand – Malaysia: controlled by pole control of HVDC

Between Malaysia – Singapore: AGC setting of Area Control Error (ACE)

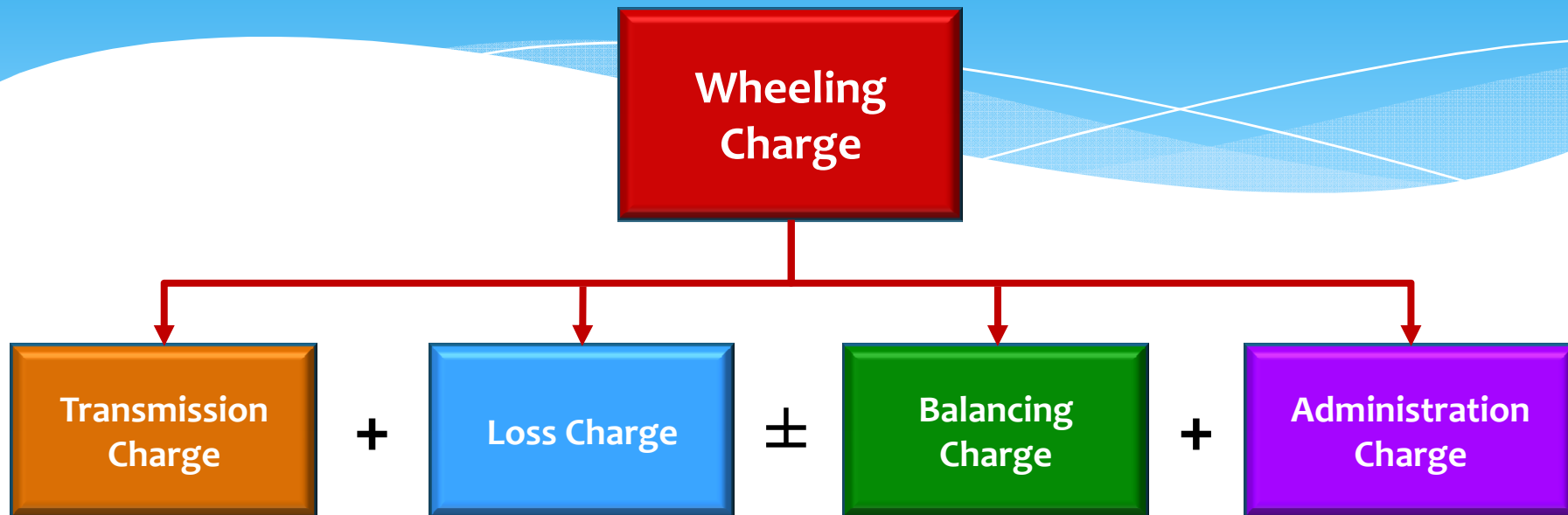
## Note:

Lao-Thailand: TNL and PHT to NK, Paxan-BKN, Thakhek-NN, Pakbo-MD2, Bangyo-SRD all are 115 kV

Thailand – Malaysia: KNE-Gurun 300 kV 300 MW HVDC

Between Malaysia – Singapore: Plentong-Senoko 275 kV HVAC

# EGAT's Wheeling Charge Concept for LTMS-PIP



- Cost of transmission system usage, which is based on MW-Mile concept

- Cost per MWh of transferred energy
- Estimated from simulated losses from importing and exporting 100 MW and forecasted system marginal cost

- Cost per MWh for difference energy between imported energy from Laos and exported energy from Thailand to Malaysia

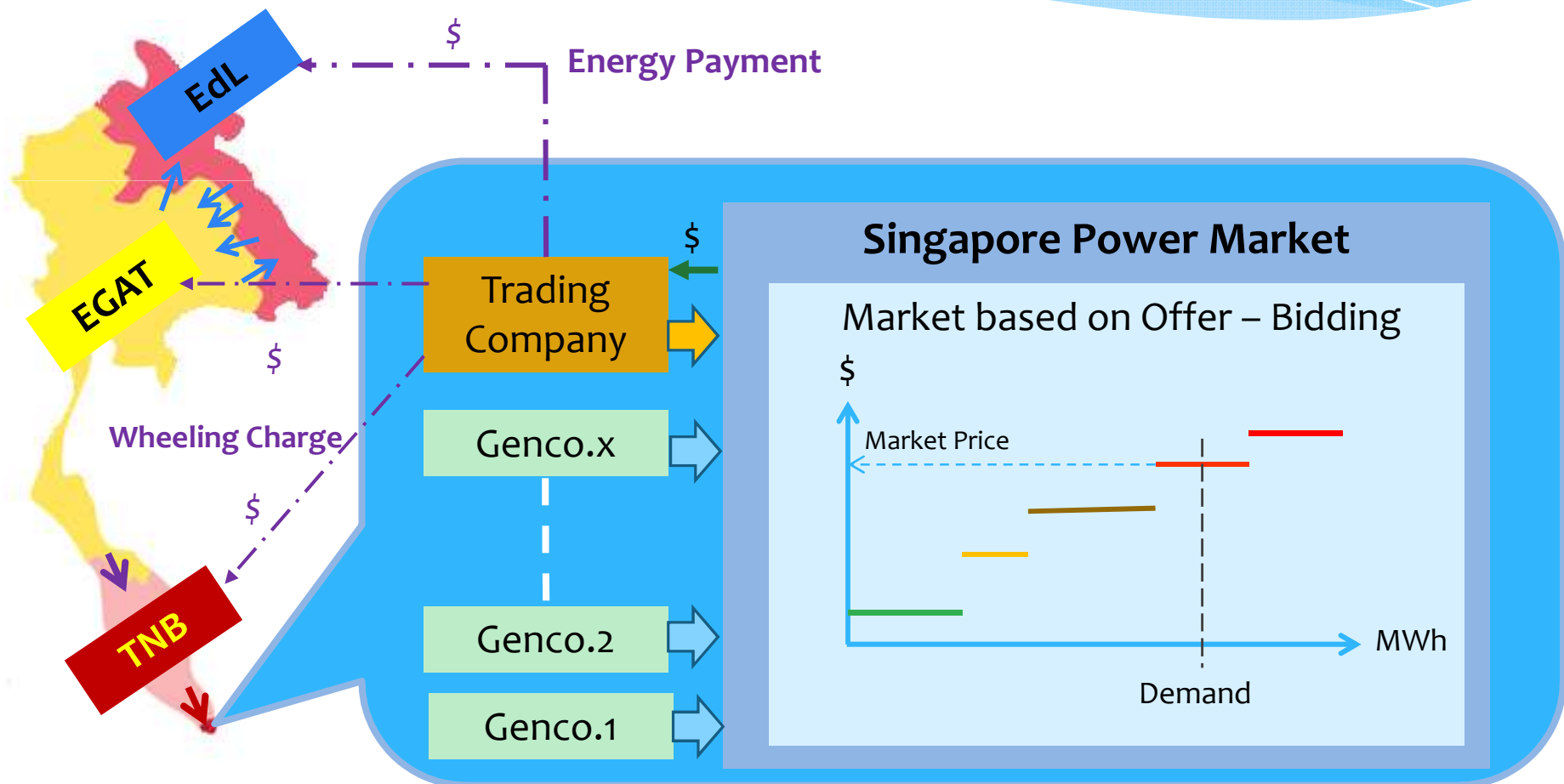
- General costs including scheduling, system control, coordination services, and billing

## EGAT and TNB Wheeling Charge Comparison

TNB's component	remark	<i>EGAT's Structure</i>
1. Single Buyer Operations	To recover the costs of billing, meter reading and administering of power purchase and power transfer contracts.	<i>Administration Charge</i>
2. System Operations and Admin.	To recover the costs of operating the power system and administering the safe and secure operation of the power system including but not limited to the cost of ancillary services.	<i>Administration Charge and Balancing Charge</i>
3. Grid Charge	To recover the cost of transporting electricity through the power grid i.e. CAPEX, congestion cost, losses etc.	<i>Transmission Charge and Loss Charge</i> <i>Note: if there is a congestion, the transaction should not occur.</i>
4. Tax & Tariff	Applicable tax and tariff	<i>Agreed</i>

# LTMS-PIP (continues)

## Business Model





# Real-time Prices



View 5 Periods

View 72 Periods

Disclaimer

Past

Current

Future

Download as CSV

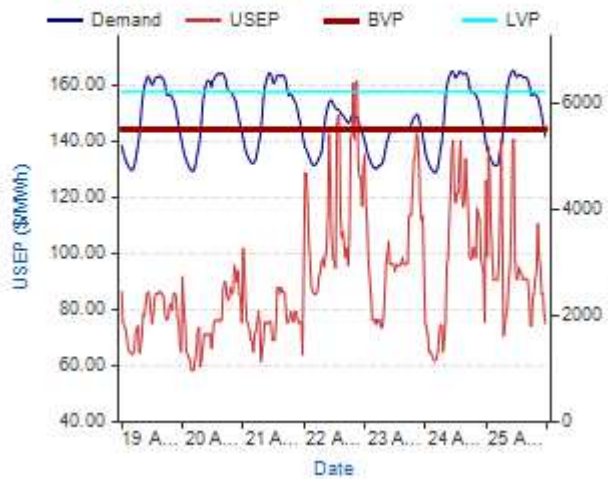
Date	Period	Demand (MW)	USEP (\$/MWh)	Regulation (\$/MWh)	Primary (\$/MWh)	Secondary (\$/MWh)	Contingency (\$/MWh)
26 Aug 2015	15:00-15:30	6512.365	73.97	3.33	0.02	0.02	8.24
26 Aug 2015	15:30-16:00	6457.506	67.63	0.33	0.02	0.02	3.00
26 Aug 2015	16:00-16:30	6424.391	67.62	0.33	0.02	0.02	3.00
26 Aug 2015	16:30-17:00	6406.733	67.74	0.33	0.02	0.02	3.00
26 Aug 2015	17:00-17:30	6342.048	67.66	0.85	0.01	0.02	3.00

Real-time Prices displayed are provisional

Last updated: Wednesday, August 26, 2015 04:01:30 PM

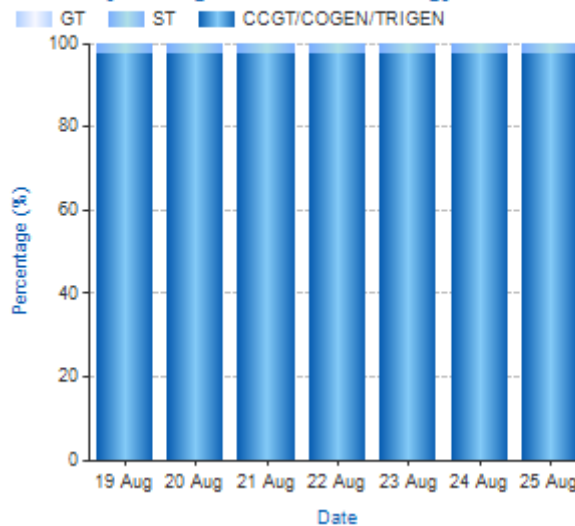
## Energy Statistics

### 7 Day Prices and Demand



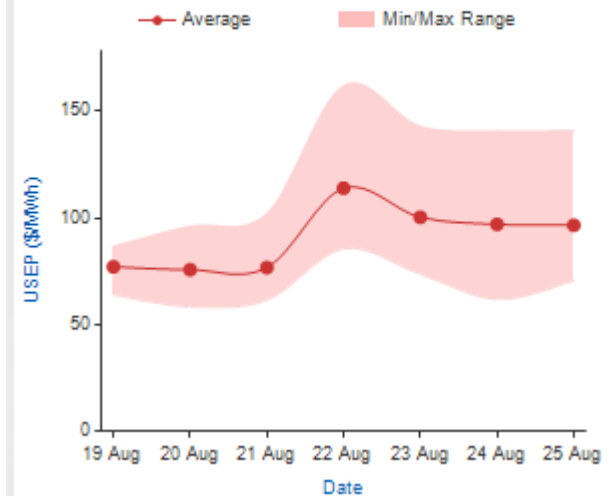
## Energy Statistics

### 7 Day Average Generation - Energy



## Energy Statistics

### 7 Day Prices (Average-Min-Max) - Energy



Thank you



ผลิตไฟฟ้าเพื่อความสุขของคนไทย