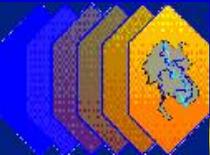


ENERGY DEVELOPMENT IN THE GREATER MEKONG SUBREGION
29 September 2009
Phnom Penh, Cambodia

Roadmap for Energy and Power Integration in the Greater Mekong Subregion (GMS)

Yongping Zhai
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Southeast Asia Department, ADB



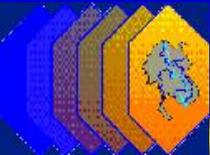


Greater Mekong Subregion

- 5 countries + 2 provinces in PRC
- Area 2.6 mn km²
- Population >313 mn (~5% of world population)
- Per capita GDP \$250-\$2,700; average \$1000
- Per capita PPP GDP \$2000-\$8,300
- Poverty incidence (\$1/day) 0.7% - 33.8%
- Energy use per capita (kgoe): 180 – 1,406
- Fuel wood share: 9% - 88%

The Greater Mekong Subregion (GMS)

- The GMS is one of the world's fastest growing subregions, growing at an average annual rate of over 6%, in spite of a number of adverse internal and external shocks.
- Since 1992, the economies of Cambodia, Lao People's Democratic Republic, Myanmar, Thailand and Vietnam as well as the Yunnan province of the People's Republic of China agreed to pursue a program of regional cooperation to foster their sustained economic and social development. The Guangxi Zhuang Autonomous Region joined the program in 2004.

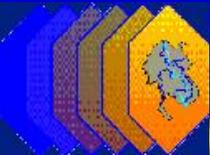


The GMS Program

Initiated by ADB in 1992 after cessation of hostilities in the subregion.

ADB's role

- facilitator,
- catalyst, and
- honest broker assisting the GMS member countries.

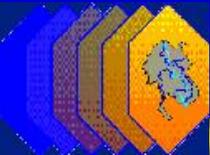


The GMS Program

- **C**onnectivity
- **C**ompetitiveness
- **C**ommunity

National Programs

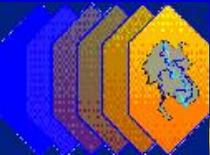
- Aligned with national poverty reduction and growth strategies



ADB's Approach

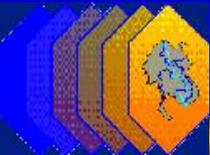
*"Think Regionally,
Invest Nationally"*

Integrate national programs
with GMS Program



GMS Priority Sectors

- Transport
- Telecoms
- **Energy**
- Environment
- Tourism
- Trade facilitation
- Investment
- Human resource development
- Agriculture



Rationale for Energy Cooperation

- Regional Cooperation as an effective way to ensure cost-effective energy supply
 - integrated regional planning and coordination allow for identification of most cost-effective energy projects
 - Cross-border energy supply also allows diversification of sources key to energy security.
- Regional Cooperation as an effective way to mitigate climate change
 - Mitigation measures to addressing climate change needs public policy actions not only at the national level, but also at the regional level.
- The goal of GMS expanded cooperation is to deliver **sustainable, secure, competitive** and **low carbon** energy in the subregion through a cooperative and integrated approach.

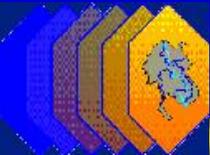


The GMS Road Map for Expanded Energy Cooperation Adopted in June 2009 by GMS Energy Ministers

Goal: An integrated approach to **deliver sustainable, secure and competitive energy** in the GMS

Major Strategic Objectives:

- Enhance **access to modern energy** to all sectors/ communities
- Utilize domestic resources in a more optimal, **environmentally-sound** manner/ reduce oil dependence
- Improve **regional energy security**
- Promote **private participation** in GMS energy development



Medium Term Thrusts and Work Plan (2009-2015)

Cross Cutting Regional Initiatives

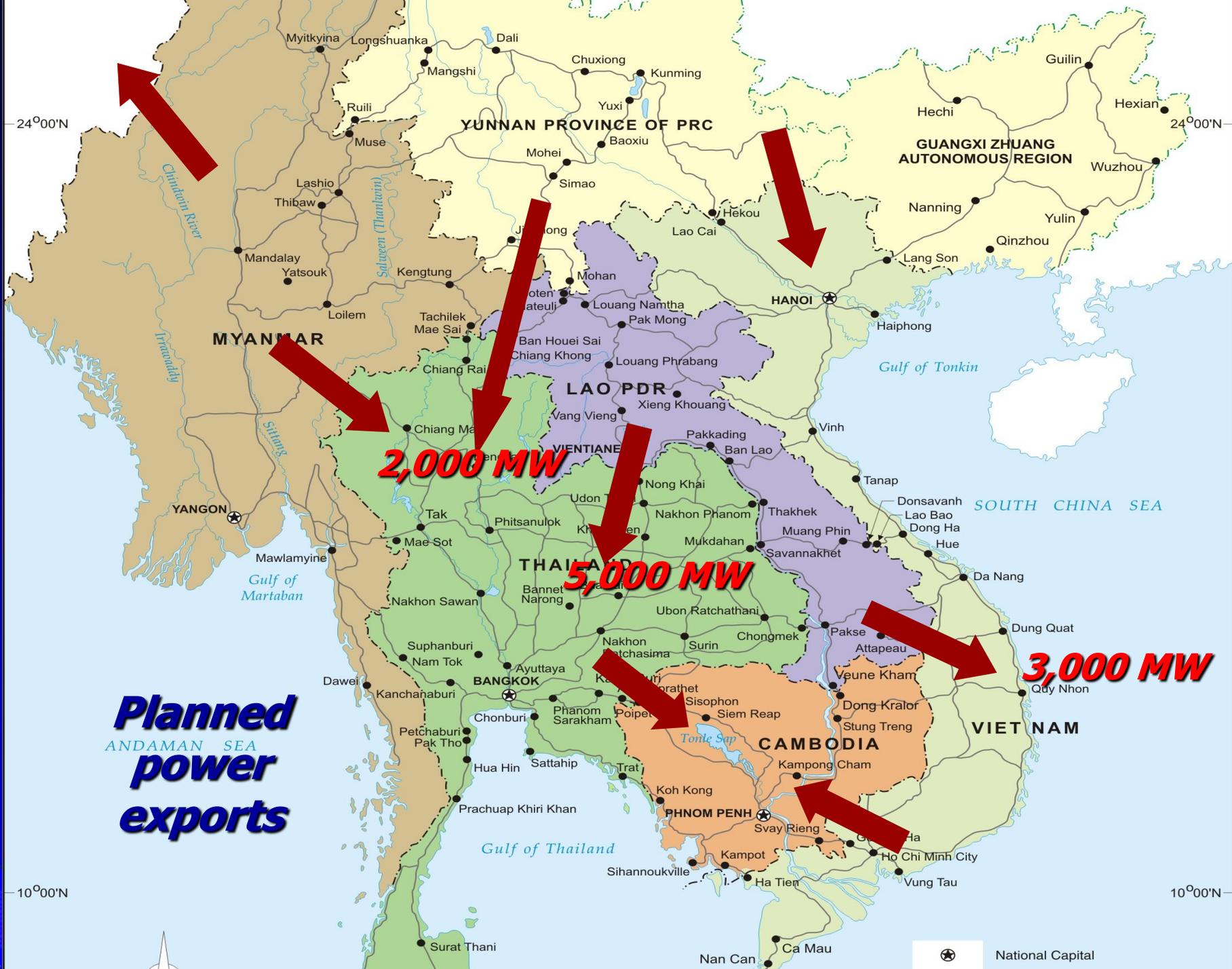
- Promoting Environmentally-Sustainable Regional Power Trade Planning, Coordination and Development in the GMS;
- Improving energy efficiency (EE) Through Demand Side Management (DSM) and Energy Conservation (EC) in the GMS,
- Promoting the Development of Renewable Energy (RE) and Clean Fuels (CF) in the GMS



Rationale for Regional Power Trade (RPT)

- National forecasts see demand for electricity continuing to grow at the rate between 9% and 15% per year for the next decade.
- GMS countries are characterized by uneven load demand and quite different resource bases
 - biggest hydropower resources are in Myanmar, Laos and also in Viet Nam.
 - Thailand has limited mineral as well as hydropower resources.
 - Cambodia has diverse resources including hydropower and natural gas but yet to fully develop.
- Thus, regional cooperation in power trading represents excellent opportunities for efficient utilization of regional energy resources in meeting growing national electricity demand.



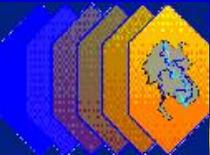


Planned
ANDAMAN SEA
power
exports

 National Capital

Developing the GMS Power Trade A Two-Pronged Approach

1. **Providing the Policy and Institutional Framework** for increasing cooperation in power trade
2. **Developing the Grid Interconnection Infrastructure** through a building block approach allowing cross-border dispatch of power



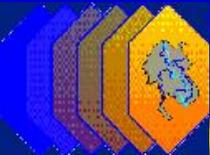
Institutional Development for RPT

- GMS Electric Power Forum (EPF) in 1995
- Experts' Group on Power Interconnection and Trade (EGP) in 1998
- In 2002, at the first GMS summit, the Inter-Governmental Agreement on Regional Power Trade was signed by the leaders of six GMS countries.
- A Regional Power Trade Coordination Committee (RPTCC) tasked with coordinating and implementing activities was created in 2002 consisting of representatives from power utilities and energy ministries in each GMS country.
- a Memorandum of Understanding on the Guidelines for the Implementation of the Regional Power Trade Agreement in 2005.
 - Focal Group (FG) of RPTCC tasked with coordinating priority RPTCC activities in each country
 - Planning Working Group (PWG), tasked to undertake planning and system operation studies that would help the GMS countries move towards common power trading guidelines.
- A Memorandum of Understanding on the Roadmap of RPT was signed in March 2008.



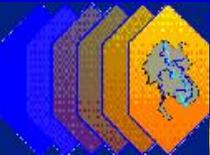
Roadmap for Cross Border Power Trading Stage 1

- Stage 1: the existing cross border transmission lines are mostly associated with Power Purchase Agreements (PPAs) between a power utility and Independent Power Producer (IPP) located in one GMS country selling power to a power utility in another GMS country.



Roadmap for Cross Border Power Trading Stage 2

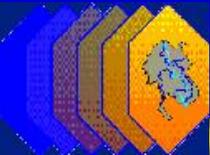
- Stage 2 corresponds to the moment when trading will be possible between any pair of GMS countries, eventually using transmission facilities of a third regional country. However in this stage the available cross border transmission capacity is limited and based on surplus capacity of lines linked to PPAs.



Roadmap for Cross Border Power Trading

Stage 3

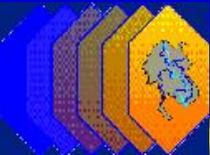
- Stage 3 will be linked to the development of transmission links specifically dedicated to cross border trading. During this Stage some GMS countries may have completed a transition to competitive markets, where multiple buyers-sellers are allowed to enter in cross border transactions.



Roadmap for Cross Border Power Trading

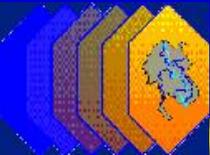
Stage 4

- Stage 4 corresponds to the situation when most of GMS countries have moved to a multiple sellers-buyers regulatory frameworks, so a regional wholly competitive market can be implemented.



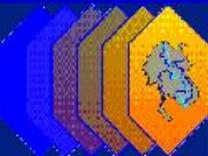
Existing Power Trading in GMS

- Power trading in the GMS started in 1971 with Lao PDR's power export from its Nam Ngum hydropower plant to the northeastern portion of Thailand.
- Modest cross-border exchanges have been engaged in by the GMS countries which resulted in the electrification of remote areas of one country from the nearby system of another.
- Bilateral agreements, one way power flow:
 - China to Vietnam (220-kilovolt line linking Wenshan in southwest China's Yunnan Province with Ha Giang in Vietnam)
 - Hydropower exports from Laos to Thailand (e.g. 210 MW Theun Hinboun, 150 MW Houay Ho, 150 MW Nam Ngum 1, 40 MW Xeset)
 - Various border power trade between countries (e.g. Malaysia-Thailand, Thailand-Cambodia, Laos-Viet Nam, China-Myanmar)



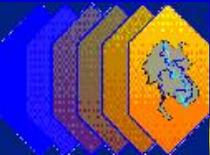
ADB financed Regional Power Projects in GMS

Country	Project Name	Year of Approval	Approved Amount (\$ million)
LAO	Theun-Hinboun Hydropower	1994	270.0
LAO	Nam Leuk Hydropower Development	1996	112.6
CAM	Cambodia: GMS Transmission	2003	95.0
LAO	Nam Theun 2 Hydropower	2005	1,250.0



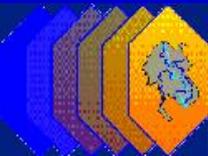
ADB Technical Assistance

- *TA5920-REG: Regional Indicative Master Plan on Power Interconnection in the Greater Mekong Subregion (2000)*
- *TA 6100-REG: Study for a Regional Power Trade Operating Agreement in GMS (2003)*
- *TA6147-REG: GMS Power Interconnection Project Phase I*
- *TA 6304-REG: GMS Power Trade Coordination and Development (2006)*
- **TA 6440-REG: Facilitating Regional Power Trading and Environmentally Sustainable Development of Electricity Infrastructure in the Greater Mekong Subregion (2008)**



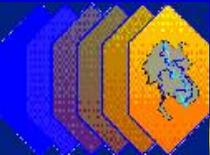
TA 6440-REG: Facilitating Regional Power Trading and Environmentally Sustainable Development of Electricity Infrastructure in GMS

- COMPONENT 1 is composed of 5 Modules:
 - Module 1: Regional Power Interconnection Master Plan
 - Module 2: Methodology for Assessment of Benefits
 - Module 3: Power Transmission Studies
 - Module 4: GMS Regulatory Framework
 - Module 5: Update of the Structure of the Existing Regional Database
- COMPONENT 2 is composed of:
 - Strategic Environmental Assessment (SEA)
 - Environmental Impact Assessment (IEA)



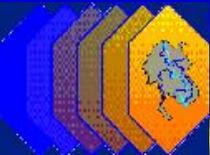
Component 1 - General Objectives:

1. To Review and update **the Regional Power Master Plan in order to identify the regional priority projects for undertaking feasibility studies;**
2. To Make **the Regional Power Sector Database operational;**
3. To Develop and demonstrate **a mechanism for benefit sharing;**
4. To Plan **for a Regional Power System;**
5. To Assess **the existing regulatory framework of each GMS country, and define the necessary requirements for establishing an appropriate institutional, legal, commercial and technical framework;**
6. To Review and update **the Road Map for RPT that describes clearly the steps and milestones towards a regional power market;**
7. To Define **the activities to be undertaken and resources required to implement these activities; and**
8. To Address **its capacity-building needs.**



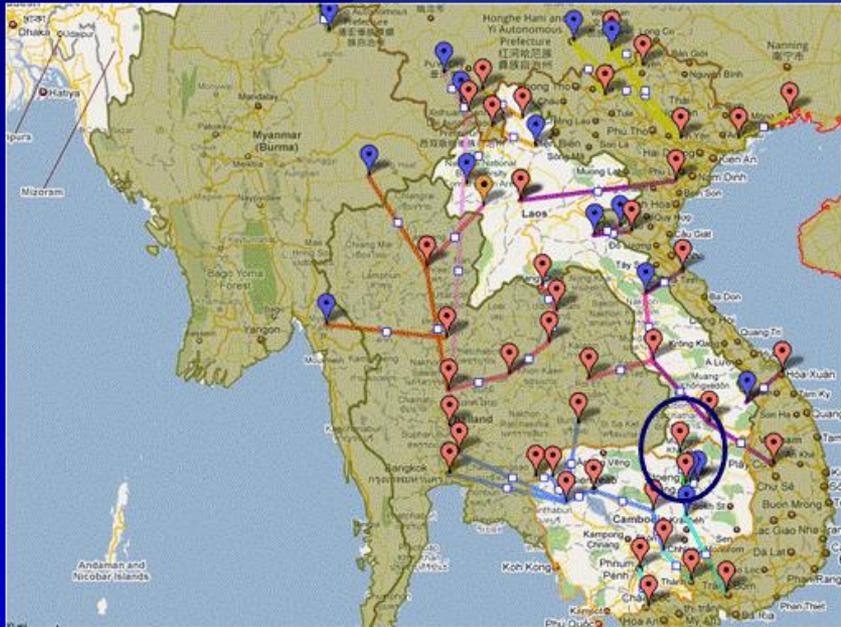
Component 2 - General Objectives:

1. To assess the capacity **of the environmental authorities and power companies in GMS countries** for environmental planning and preparation of environmental management documents.
2. To provide training **to environment ministries and power companies in environmental planning and management.**
3. To provide capacity development **in establishing regular monitoring mechanisms within the power utilities to standardize environmental management plans (EMP) practices.**
4. To build capacity **through proposed pilot EIAs and implementation of EMPs for power projects, in cooperation with the GMS Biodiversity Corridors Initiative (EOC) supported by ADB.**
5. To provide practical training **in preparation and implementation of EMPs, specifically in monitoring of environmental safeguards and regional ambient standards.**



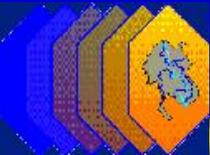
Power Interconnection Projects in the GMS

- CAMBODIA – LAOS



Ban Hat, Laos – Stung Treng, Cambodia
(115 KV, 80MW, 56 KM)

The blue markers on the map represent Hydro Power Projects (HPPs), the orange markers represent Thermal Power Plants (TPPs) and the red markers are locations such as substations



Power Interconnection Projects in the GMS

- CAMBODIA – THAILAND



East Thailand – North West
Cambodia
(250 KV, 300MW, 290 KM)

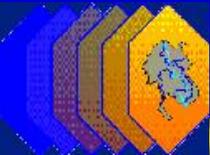


Power Interconnection Projects in the GMS

- CAMBODIA – VIET NAM



- 1) HPPs e.g. Sambor, Sre Pok, Sre San, Cambodia – Tan Dinh, Vietnam (230 KV, 90 KM)
- 2) Kampong Cham, Cambodia – Tai Ninh, Vietnam (115 KV, 80MW, 64 KM)
- 3) Phnom Penh, Cambodia – Chau Doc, Vietnam (230 KV, 300 MW, 110 KM)

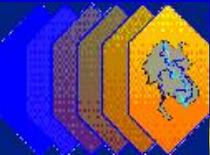


Power Interconnection Projects in the GMS

- CHINA – MYANMAR



Yunnan, China – Ta Pein and Shweli HPPs,
Myanmar (500 KV, 2000 MW, 880 KM)

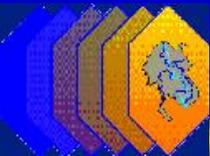


Power Interconnection Projects in the GMS

- CHINA – LAOS

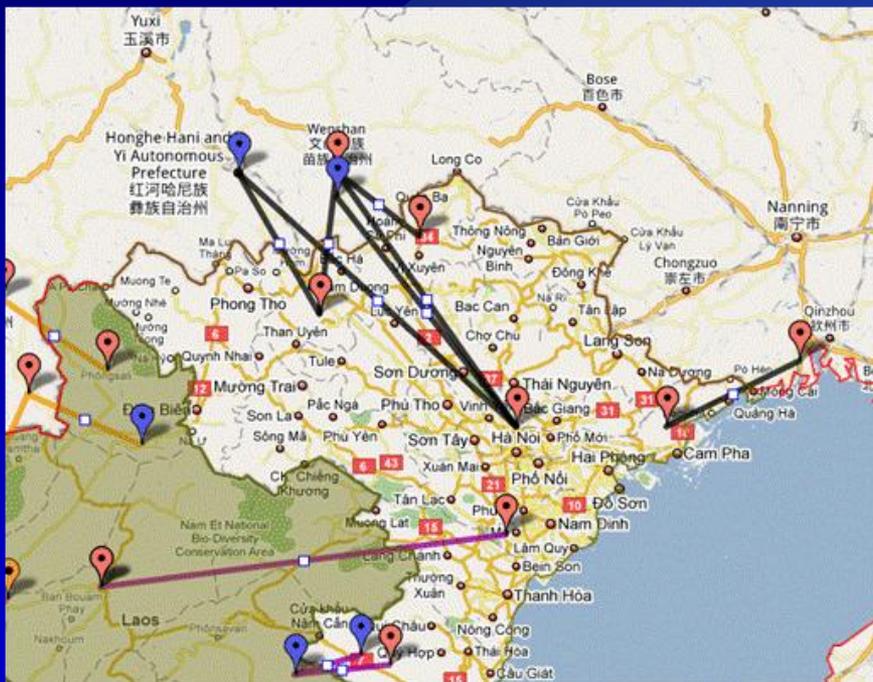


- 1) China – North Laos (500 KV, 3000 MW, 600 KM)
- 2) China border – HPPs in north Laos (115 KV, 33 KM)

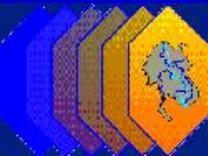


Power Interconnection Projects in the GMS

- CHINA – VIETNAM



- 1) HongHe HPP, China – north Vietnam (500 KV, 1500 MW, 450 KM)
- 2) Wenshan, Yunnan, China – north Vietnam (500 KV, 1500 MW, 400 KM)
- 3) Malutang HPP, Yunnan, China – Soc Son, Vietnam (500 KV, 460 MW, 270 KM)
- 4) Guangxi or Yunnan, China – Quang Ninh, Vietnam (500 KV, 5000 MW, 600 KM)

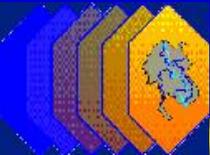


Power Interconnection Projects in the GMS

- MYANMAR - THAILAND

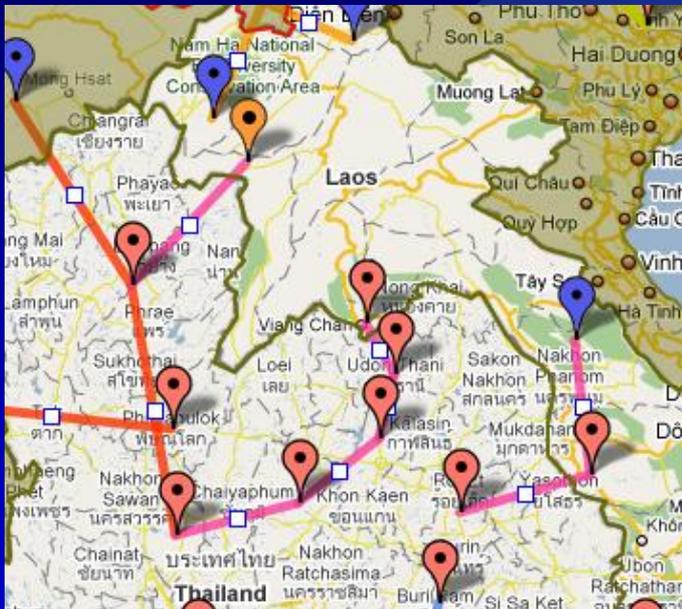


- 1) Ta Sang HPP, Myanmar – Mae Moh and Tha Tako, Thailand (500 KV, 1500 MW, 600 KM)
- 2) HPP in Thanlwin basin, Myanmar – Phitsanulok, Thailand (500KV, 1500 MW, 300 KM)

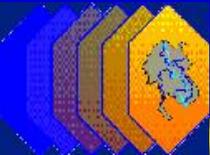


Power Interconnection Projects in the GMS

- LAOS - THAILAND



- 1) Hong Sa TPP, Laos – Mae Moh, Thailand (500 KV, 1400 MW, 200 KM)
- 2) Na Bong, Laos – Udon Thani, Thailand (500 KV, 1000 MW, 220 KM)
- 3) Nam Theun 2 HPP, Laos – Roi Et 2, Thailand (via Savannakhet, Laos) (500 KV, 1000 MW, 220 KM)

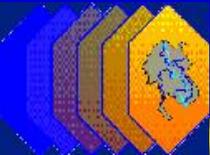


Power Interconnection Projects in the GMS

- LAOS – VIET NAM

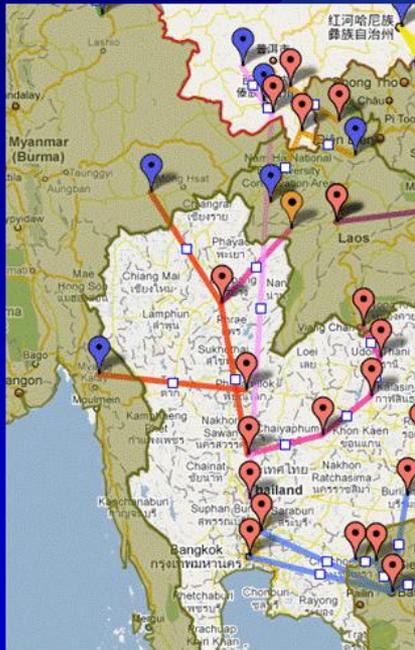


- 1) Luang Prabang HPP, Laos – Nho Quan, Vietnam (500 KV, 400 KM)
- 2) Nam Mo HPP, Laos – Ban Ma HPP or Ban Mai, Vietnam (230 KV, 100 MW, 90 KM)
- 3) Nam Theun 2 HPP, Laos – Ha Tinh, Vietnam (500 KV, 190 KM)
- 4) Xe Kaman 3 HPP, Laos – Da Nang, Vietnam (220 KV, 150 MW, 115 KM)
- 5) Savannakhet, Laos – Pleiku, Vietnam (500 KV, 1000 MW, 165 KM)

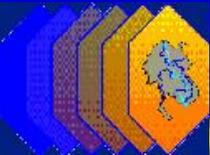


Power Interconnection Projects in the GMS

- CHINA – THAILAND



Yunnan (Jinghong and Nuozhadu HPPs) China –
Tha Wung, Thailand (500 KV, 3000 MW,
1300 KM)



Power Interconnection Projects in the GMS

- THAILAND - VIETNAM

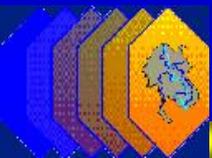


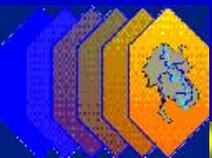
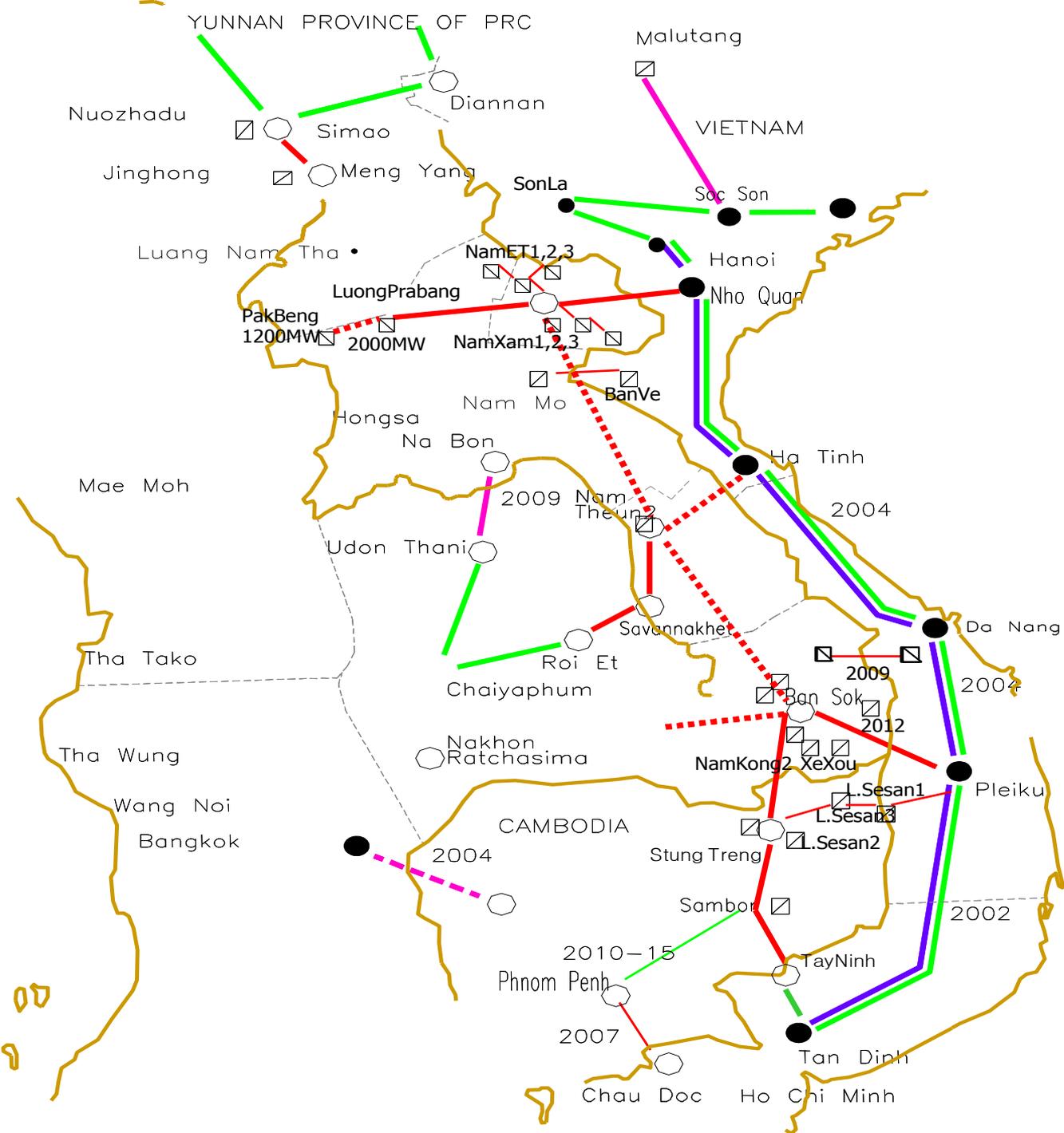
Combination of

Pleiku (Vietnam) – Ban Sok (Laos) – Savannakhet (Laos) with Savannakhet (Laos) – Roi Et (Thailand)

And

Ha Tinh (Vietnam) – Nam Theun 2 (Laos) with Nam Theun 2 (Laos) – Savannakhet (Laos) – Roi Et (Thailand)

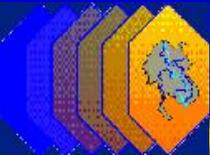




ADB Financing

The Na Bon – Udon Thani Project

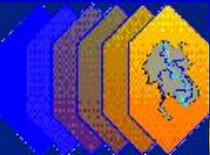
- Four Hydropower projects in Lao PDR exporting to Thailand through a single common transmission facilities (Nam Ngum 2, Nam Ngum 3, Nam Ngiep 1 and Nam Theun 1).
- 500kV transmission line being constructed by the Nam Ngum 2 developer. ADB will finance the substation in Laos.



ADB Financing

The Ban Sok - Pleiku Project

- South Lao PDR: Dak Emeule (138MW)
Sekong 3A&3B(152+96MW); Sekong
5(253MW); Sekong 4(440MW); Xe
Kaman 1 (468MW); Nam Kong
1(240MW)
- All hydropower schemes to be exported
through common transmission facilities
(one single transmission line 500kV)
from Ban Sok 500/230kV substation in
Laos to Pleiku substation in Vietnam.



Thank you

For ADB

www.adb.org

For the GMS

www.adb.org/GMS/

