Summary of Discussions
Seventh Meeting of the Planning Working Group (PWG-7)
Eighth Meeting of the Focal Group (FG-8) and
Eighth Meeting of the Regional Power Trade Coordination Committee (RPTCC-8)
Luang Prabang, Lao PDR, 25-27 November 2009

1. **Objectives.** The PWG-7 meeting took stock of the progress of work under regional technical assistance project (RETA) 6440 (Facilitating Regional Power Trading and Environmentally Sustainable Development of Electricity Infrastructure in the GMS), particularly along the RETA's two components: (i) facilitation of development of regional power trade, and (ii) capacity development for environmental impact assessment (EIA) of power projects. Forthcoming RETA 6440 activities were discussed with the presentation of work plan and timetable for the remainder of RETA 6440.

2. The FG-8 meeting discussed the country reports on the progress of power development programs of GMS countries, taking into account the effects of the global financial crisis on power demand and its consequences on planned power generation and transmission investments. The discussions looked at how these developments affect the milestones identified in the MOU on the Road Map for GMS Cross-Border Power Trading (MOU-2) signed during the Third GMS Summit in March 2008 and the status of energy items in the Vientiane Plan of Action (VPOA), 2008-2012. Forthcoming RETA 6440 activities and work plans were to be adjusted for better alignment with MOU-2 milestones.

3. The RPTCC-8 meeting undertook the following: (i) discuss ways to strengthen linkages between RETA 6440 and other subregional programs in promoting environmentally-sustainable regional power trade development; (ii) firm up the objectives, scope and components of proposed projects for advancing regional power trade under the GMS Energy Road Map; (iii) share knowledge and experience that would provide suitable generation and transmission technology options for GMS countries' power development programs; and (iv) share GMS-appropriate practices for promoting renewable energy (RE) and energy efficiency (EE) in the GMS, a continuation of Subregional Energy Forum (SEF) knowledge sharing series.

4. The PWG-7, FG-8 and RPTCC-8 meetings were held in Luang Prabang, Lao PDR on 25-27 November 2009 and co-organized by the Department of Electricity (DOE)- Ministry of Energy and Mines (MEM) of Lao PDR and the Asian Development Bank (ADB). It was attended by RPTCC nominees of the six GMS member countries, as well as by representatives of ADB, Agence Francaise de Developpement (AFD), Australian Agency for International Development (AusAid), Environment Operations Center (EOC), Japan International Cooperation Agency (JICA), World Bank (WB), Alstom Power, Fichtner Stuttgart, RTE International/ Center for Energy Environment Resources Development (CEERD), and Tokyo Electric Power Company (TEPCO). Attached is the agenda and program of the meetings (Annex 1) and the list of PWG-7, FG-8 and RPTCC-8 participants (Annex 2).

5. The PWG-7 meeting was co-chaired by Mr. Boungnong Bouttavong, Deputy Director, Technical Department, Electricite du Laos (EdL), Lao PDR, and Mr. Yongping Zhai, Lead Professional (Energy), Energy and Water Division (SEEW), Southeast Asia Department (SERD), ADB.

6. The FG-8 meeting was co-chaired by Mr. Daovong Phonekeo, Deputy Director General of the Department of Electricity, Ministry of Energy and Mines, Lao PDR, and Mr. Yongping Zhai, ADB.

7. The RPTCC-8 meeting was co-chaired by Mr. Sompol Uthaichalanonta, Assistant Director, System Control and Operations Division, Electricity Generating Authority of Thailand (EGAT), Thailand, and Mr. Yongping Zhai, ADB.

PWG-7 Meeting (Day 1: Whole Day)

Opening Session

8. Mr. Boungnong welcomed everybody to the meeting and thanked the GMS participants, the ADB and the development partners for their support to the RPTCC. He invited everybody to enjoy the sights of Luang Prabang after achieving substantive outputs from the meeting.

9. Mr. Yongping Zhai, SEEW, ADB, welcomed the participants and thanked the host, DOE-MEM, for the hospitality and excellent meeting arrangements. He briefed that the PWG meeting will review the status of work of RETA 6440 particularly along its two main components, on: (i) facilitating power trade development, and (ii) building capacity for environmental impact assessment (EIA) of projects. A work plan and timetable for the remainder of RETA 6440 will then be discussed and firmed up. He announced ADB's approval of its GMS assistance program for 2010-2012, which continued the emphasis on regional power trade development, but reflected the adjusted timing of hydropower and transmission investments while continuing with the software aspects of power trade, such as institution and human capacity building for sustainable power planning and regional power trade operations. He also noted proposed assistance for the promotion of renewable energy and energy efficiency. He called for productive deliberations on the focus and directions of RETA 6440.

Review of Activities of the PWG

10. **Presentation on Main Activities/ Results from Previous Meeting**. Mr. Zhai recalled the history of the RPTCC, FG and PWG and took stock of what has been achieved under these bodies. He noted the limited progress in power infrastructure development since RPTCC's establishment, but asked the countries to report on their infrastructure program and their views on the institutional set up for GMS power trade.

11. **Discussions (Key Issues Arising from the Activities)**. The GMS countries were asked for their views on: (i) progress of country-to-country interconnections; and (ii) the need for a more formal institutional set up. The responses were as follows:

a. Cambodia- Noted the progress in interconnections with Lao PDR, Thailand and Viet Nam and pleased with bilateral cooperation on power projects (transmission and generation), such as with PRC (Sino Hydro) as well as activities under the RPTCC;
b. PRC- Informed of the progress of bilateral cooperation in power with GMS neighbors in terms of interconnections and investment in generation projects (Cambodia, Lao PDR, Myanmar and Viet Nam) and satisfaction with the work under the RPTCC;
c. Lao PDR- Discussed the progress of 115 kV interconnection projects and the delay in the 500 kV line and major hydropower projects due to low demand; noted that the regional database could not be utilized and PRC clarified that there has been change in IP address of the RPTCC website and the problem is being addressed;

d. Myanmar- Informed of plans for hydropower exports to PRC and Thailand (currently experiencing delays) and noted that the current RPTCC structure is useful for promoting interconnections and power trade in the future;
e. Thailand- Advised that demand appears recovering after a flat year in 2009, and will continue imports from Lao PDR; informed of prospective interconnections for import of hydropower from southern Lao PDR and from Myanmar, and expressed satisfaction with the RPTCC set up;
f. Viet Nam- Informed of the existing interconnections with PRC and Cambodia and prospective interconnections to enable import of hydropower from Lao PDR. Viet Nam had no issues to raise regarding RPTCC institutions set up at this point.

12. **Next Steps for the PWG Work.** Mr. Zhai proposed that the consultant build a map of GMS power systems showing all existing interconnections with footnotes on the capacities, power flows and ownership of these lines, which could be updated in subsequent RPTCC meetings. RTE responded that developing this map is feasible and would be ready by January 2010. Mr. Zhai noted that the countries should examine the value added contribution of the RPTCC, in terms of enhancing GMS power cooperation projects.

Review of Status of Activities Under RETA 6440

13. **Component 1 (Facilitation of Development of Regional Power Trade)** (Annex 3). Mr. Michel Caubet, Project Team Leader, RTE, gave a recap of the objectives o RETA 6440, its organization, the objectives of component 1 of the RETA, and the work organization around the components five modules: regional power interconnection master plan, methodology for assessment of benefits, power transmission studies, GMS regulatory framework, and GMS regional database. He outlined the tasks prescribed for each of these modules in relation to the MOU-2 prescribing the steps to fully achieve stage 1 of power trading signed in March 2008. He described the general activities undertaken for component 1, and the specific activities and results for each of the modules, in terms of delivered versus planned outputs. He noted the various obstacles to implementation of component 1 activities, how these were resolved partially by the team, and the proposed next steps for the component.

14. **Discussions (Key Issues)**. Mr. Zhai suggested further discussions during later session focusing on the key issues and messages arising from the outputs under each module. Mr. Bui (ADB) suggested that the key issues/ messages be discussed in relation to the items in the MOU-2 on the power trade road map

15. **Component 2 (Presentation of Project Results in View of Coordination Between Components 1 and 2)** (Annex 3). Mr. Thierry Lefevre, Deputy Team Leader, CEERD, presented the structure, objectives and methodology of component 2 of RETA 6440. He gave the timeline of the activity schedule and the overview of the implemented activities, and provided details of specific activities such as the Regional Stakeholder Consultation Workshop on SEA, EIA and EMP[1] training, Regional EIA on-the-job training (OJT), Regional SEA OJT and 1st/ 2nd PDP[2] Training and Assistance Session in Cambodia. He detailed the various activities under implementation which included EMP OJT cum Field Trip to NamTheun 2 (Lao PDR) and SEA for the Preparation of PDP VII in Viet Nam. He cited other project activities linking with regional stakeholders such as EOC, MRC and AFD, and discussed the completed outputs and

[1] Strategic Environmental Assessment (SEA), Environmental Impact Assessment (EIA), and Environmental Management and Monitoring Assessment (EMP)
[2] Power Development Program (PDP)

those for delivery in the coming months. He discussed the obstacles in implementing capacity building and how these were resolved, and the next steps and alternative priorities for component 2 in the coming months.

16. **Discussions (Key Issues)**. Mr. Zhai asked about the selection of participants to the training programs and how the impacts of these programs were measured. Mr. Lefevre informed that participants were selected on the basis of institutions and individual profiles. While feedback was obtained immediately after the training, only ex-post evaluation 1-2 years after the training could be done to evaluate long-term training impact.

17. **Package 3 (TEPCO) Strengthening the Indochina Power Grid: Interim Project Progress** (Annex 4). Mr. Yasuhiro Yokosawa, Consultant, TEPCO presented the objectives of the study consisting of the 1st stage (master plan study) and 2nd stage (feasibility study on interconnection). He discussed the methodology for the master plan study which involved review of the PDPs of Cambodia, Lao PDR and Viet Nam, study of the interconnection and generation plans based on supply-demand analysis, and selection of appropriate interconnections. For stage 2, pre-FS of selected projects were undertaken through an evaluation of transmission costs, fuel cost reduction and total benefits of three cases: (i) Ban Sok-Strung Treng-Tay Ninh; (ii) Luang Prabang-Nho Quan; and (iii) Strung Treng-Plei Ku-My Phuoc. The evaluation and sensitivity analysis of fuel cost, and costs of transmission and generation, revealed the superiority of hydropower and the (i) Ban Sok-Strung Treng-Tay Ninh as the most feasible line which should be given highest priority.

18. **Discussions (Key Issues)**. The GMS countries' views on the recommendations of the study were as follows:

a. Cambodia- Stressed the need to optimize locations for the 500 kV and 230 kV substations under the proposed line, considering their distances from each other, from hydropower sources and from power demand centers;
b. Viet Nam- Noted that the assumed fuel costs (e.g., gas) were too high, and asked whether Viet Nam's National Power Transmission (NPT) agency is aware of the cases presented; TEPCO replied while NPT was provided a copy of the report, the formal consultation with Viet Nam's agencies would take place later.
c. Lao PDR- Inquired about the extent to which the hydropower potentials of southern Lao PDR were considered in the cases; TEPCO clarified that the simulations took into account the proposed hydro IPP projects in the area.
d. PRC- Asked about the directions of power flows and transmission capacity of case A scenario; TEPCO showed the demand centers and the recommended capacities of the lines serving them.

19. **Next Steps.** TEPCO would re-send the interim report to the three countries after the meeting; the countries were requested to submit their comments on the report by 27 December 2009.

20. **Summary Results from Other Regional Projects in the GMS.** Mr. Bui informed that the project preparatory TAs for the two listed projects below were deferred due to the decline in demand brought about by the financial crisis.

a. Nabong-Udon Thani Interconnection. Thailand informed that power demand is now expected to rise with economic recovery. However, there have been no recent developments in Nam Ngum 3, Nam Theun 1 and Nam Ngiep 1 hydropower

projects, which will supply power to the Nabong substation. Lao PDR also indicated some constraints in financing of the hydro projects due to problems in setting wheeling charges satisfactory to the user. Thailand clarified that the project was deferred due largely to cost increase and financing constraint, instead of reduced power demand. Mr. Bui suggested ADB assistance may be directed toward addressing pricing/ other aspects of interconnection or in developing other priority lines that may be identified.

b. Ban Sok-Pleiku Interconnection. Lao PDR said that the situation for this line is different given the robust growth in power demand from Viet Nam. However, there have been unresolved issues with respect to tariff setting and asked for ADB assistance in tariff and other technical aspects to advance progress of the project. Mr. Bui said the work in this project may be resumed subject to the countries' recommendation.

Discussions on RETA 6440 and Other Projects/ Results and Key Issues

21. **Summary of Key Issues**. Mr. Caubet (RTE France) presented the outputs of RETA 6440 Component 1 versus the requirements of the MOU-2 on the power trade road map, with the view to charting the next steps for Component 1. He stressed that the planned outputs for the various modules, such as performance standards and metering arrangements (module 3: power transmission studies) and review/ assessment of current regulatory framework (module 4: GMS regulatory framework) would meet the milestones specified in MOU-2. He recalled the obstacles to the implementation of component 1 activities and gave his recommendations, such as listing the expected inputs from GMS-PWG members, which would allow common basis for updating the master plan.

22. **Master Plan Study**. Mr. Caubet indicated that the priority would be to ensure the consistency between the PDP targets and the demand/ generation projections in Viet Nam. However, Viet Nam representative indicated that the consultant was provided the revised PDP VI projections, and that the PDP VII preparation is underway, which would come up with a completely new set of projections. It was agreed that RTE would visit Viet Nam in January 2010 to validate the PDP figures. Myanmar representatives agreed to furnish RTE with the needed power sector information requested by RTE by end of December 2009. Mr. Caubet stressed that it would be desirable to have the same set of participants in the various training programs to ensure continuity and institutional retention of knowledge gained.

23. **Database**. Mr. Zhai asked whether there is need to continue with the database as designed. He recalled that in the last RPTCC, it was agreed that RTE will continue with the earlier database developed by Soluziona, but no action had been undertaken so far. The GMS representatives generally noted the usefulness of the database but that there is a need to update it regularly and make it more accessible. PRC noted that the database has not been utilized as much as envisioned, even as country administrators have been briefed on its use. Ms. Gabrielsson (ADB) enjoined the GMS countries to be strongly involved in the remaining RETA 6440 activities. She stressed that the usefulness of the database rests in it being able to provide up-to-date, secure and relevant information to its clients.

Closing Session

24. **Conclusions on Results and Work Plans/ Main Message to FG by PWG Chair**. Mr. Zhai shared that the earlier sessions discussed a number of issues in implementing RETA 6440. He noted that related to component 2, the RPTCC would be discussing an extension of

the work through a new RETA that would undertake a broader scope for the master plan to include social and environmental considerations. Mr. Zhai said this work would affect the results of the master plan modeling simulations, but stressed there is a need to find GMS champions to push work in this area. For component 1, he stressed that the validity of the master plan would depend on the quality of the data inputs. He expressed the need for consistency in the assumptions between RTE's master plan simulation with those used by TEPCO for the Indochina power grid, and both TEPCO and RTE agreed to share information and improve coordination in this regard. He asked TEPCO to revise the report based on comments from the countries to be given by December 2009. In response to Cambodia's comments, Mr. Zhai stressed the importance of SEA analysis in PDP but noted that except for Viet Nam, the other GMS countries do not yet incorporate SEA in PDPs. He noted the need to take action to ensure better utilization and updating of the database. He requested that the consultant develop an action plan to improve the ownership, utilization and maintenance of the database.

25. **Closing Remarks**. Mr. Boungnong thanked the participants for their substantive contributions during the extensive discussions that took place, and noted the hard work ahead for the GMS countries to realize successful power trade arrangements in the GMS region.

FG-8 Meeting (Day 2: AM)

Opening Session

26. Mr. Daovong Phnonekeo welcomed the participants to the FG meeting and hoped everyone had the chance to enjoy the attractions of Luang Prabang. He looked forward to fruitful discussions during the meeting.

27. Mr. Yongping Zhai, welcomed the participants and explained that for the FG meeting, the progress of each GMS country's power development program will be presented, with the discussions focusing on the effect of the global financial crisis on power demand and subsequently the planned power investments in the GMS region.

Country Reports on Power Development and Transmission Interconnection Projects (Annex 5)

28. **Cambodia**. Mr. Heng Kunleang, Director, Ministry of Industry, Mines and Energy (MIME) presented highlights of major achievements in the power sector, and showed the breakdown of generation sources and fuel mixes in 2008. He informed of government's policy targets for rural electrification and generation for export and domestic use, and discussed the generation sources/ expansion plan comprised mostly of hydro and coal plants. He discussed progress in development of the transmission network and presented the transmission expansion plan from 2001 to 2020 and the distribution and rural electrification plan up to 2020.

29. In response to a query from ADB, Mr. Kunleang briefed on the process of negotiation for power projects under BOT and other arrangements, including power purchase agreements (PPAs). Mr. Sodavath (Cambodia) informed of the proposed 220 kV lines to serve hydropower exports to Viet Nam and explained the reasons behind the high growth in domestic power demand. On the issue of power tariffs, Mr. Sodavath noted that tariffs are not expected to decline much due to (i) EDC losses that need to be recovered, (ii) expected reliance on imported coal and (iii) high cost of hydropower production. He discussed the indicative transmission projects that relate to the proposed priority line in the TEPCO study, including the links that will enable power flows from southern Lao PDR to the Phnom Penh area.

30. **PRC**. Ms. Long Qing, Section Chief, China Southern Power Grid Co. (CSG), briefed on the status of CSG in 2008, showing the generation capacity mix, generation growth, transmission capacity, and power exchanges with other regions, among others. She showed the trend in power consumption in China and CSG since 2008, reflecting declines due to the financial crisis. She discussed developments in power grid planning consisting of demand forecasts for 2010-2015, generation capacity additions, elements of the CSG Board resolution, and transmission line development. She discussed the progress in various cooperation projects with GMS countries (Viet Nam, Lao PDR, Cambodia, Thailand and Myanmar).

31. Ms. Long clarified that the projected share of renewable energy (RE) by 2020 remains small (solar, wind and biomass) and informed that there is little progress in the proposed interconnection with Thailand due to persisting tariff differences. She briefed on the Tasang hydropower project which is projected to export power to PRC; Thailand noted its role in the development of Tasang and Hutgyi hydropower in Myanmar. In response to ADB's query, Ms. Long informed that government bears the subsidy for RE use.

32. **Lao PDR**. Mr. Boungnong Bouttavong, EdL, provided an overview of Lao PDR's socio-economic-geographic and energy characteristics. He briefed on the history of Lao power sector development, power sector policy and objectives, primary energy resources, exploitable hydropower potential, and power generation ownership. He discussed the existing power transmission network (2009), demand forecast for 2009-2020, development status of generation projects (22,069 MW), electricity tariffs, and status of power exports to Thailand and Viet Nam. He informed of the progress of planned high voltage interconnections and planned network up to 2020.

33. In response to a query from PRC, Mr. Chansaveng, Department of Electricity (Lao PDR) informed of the sharing arrangements for various IPP projects. Mr. Boungnong discussed the rural electrification targets, the share from off-grid RE sources, and the funding source for these projects. Mr. Daovong informed of timeline for power generation projects for export after Nam Theun 2. Thailand representative provided additional information on future Lao hydropower projects that are being prepared for export to Thailand.

34. **Myanmar**. Dr. Maung Maung Kyaw, Deputy Chief Engineer, Ministry of Electric Power 2 (MOEP-2) discussed the current installed generation projects, fuel generation mix (2008-2009) and the generation cost. He showed the average generation cost versus average retail tariff and the demand growth projection (2010-2020). He presented the policy and projects for new generation capacity and discussed the progress of projects for cross-border power interconnection. He presented the status of cross border power trade and transmission lines in operation, under construction, and planned for 2010-2020. He showed the electrification targets to 2020 and 2025.

35. Mr. Kyaw briefed on case experiences in the negotiation of PPA for Shweli 1 project and the extent to which outputs could be utilized domestically. He clarified that outputs from a hydropower plant are separated in terms of export (to PRC) and for domestic use.

36. **Thailand**. Mr. Suthep Chimklai, Director, System Planning Division, Electricity Generating Authority of Thailand (EGAT), presented the current status of power generation, and showed geographic location of hydro, thermal, and IPP plants, and power purchases. He discussed the demand and load forecasts and the updated PDP for 2009-2021.He explained Thailand's energy policy and the gas, coal and nuclear options and the status of power imports

from GMS neighbors. He discussed efforts to promote RE under the Alternative Energy Development Plan (AEDP) 2008-2022, and efforts at demand side management (DSM). He explained the ASEAN Interconnection Master Plan Study II of the Heads of ASEAN Power Utilities Association (HAPUA).

37. Mr. Chimklai clarified that revised power demand forecasts would be further refined after a more intensive analysis of growth trends is undertaken. He explained the reserve margin targets to ensure energy security. He informed of a study which recommended the maximum percentage of allowable power imports depending on the number of country-sources. He clarified that greater RE use would require more conservative reserve margins given unreliable supplies of certain RE sources (wind, hydro). Thailand clarified the volume of future gas imports from Myanmar for use in power generation. In response to a query from Ms. Isabelle Vincent (AFD), Mr. Chimklai clarified that incentives are given to the private sector in the production of power from RE sources.

38. **Viet Nam**. Ms. Hoang Ha Quynh Giao, Official, Electricity Regulatory Authority of Viet Nam (ERAV), discussed the current power system situation in terms of installed capacity, production by source, generation fuel mix, consumption growth rate, and transmission network status. She informed of major developments such as formation of NPT, increase in power tariffs and operation of 220 kV Takeo-Phnom Penh line. She provided the power demand forecast, recent power plant construction, and revised power generation and transmission development program which includes hydropower projects in Lao PDR and Cambodia, and cross-border interconnections with PRC, Cambodia and Lao PDR. She raised a number of issues related to development of high voltage interconnections with GMS neighbors.

39. Mr. Pham Manh Thang (ERAV) clarified that current RE share in Viet Nam is quite low but noted that nuclear power will be tapped in the future. The GMS delegations were asked to verify and ensure the consistency of their projected interconnections with the ones indicated in the Viet Nam report and preceding country presentations. Mr. Jona (Cambodia) requested that standard definition of RE be adopted, and Mr. Hung (ERAV) noted that in Viet Nam only mini-hydropower (< than 30 MW) is classified as RE. Mr. Hung noted that low tariffs in Viet Nam act as barriers to investment in the power sector and discussed the incentives for RE production.

Closing Session

40. **Vientiane Plan of Action (VPOA), 2008-2012 Energy Status Report** (Annex 6). ADB presented the status report of the VPOA which shows the status (as of June 2009) of the priority energy projects included in the VPOA and endorsed at the Third GMS Summit in Vientiane in March 2008. The table also includes follow up actions required for each project. ADB stressed the need to update the status report for presentation at the 16th GMS Ministerial Conference to be held in Hanoi in March 2010. While the preceding country presentations on power sector developments provided information useful for VPOA updating, ADB will shortly circulate the soft copy of the status report and requested FG members to provide additional inputs, updates and comments to the VPOA by mid-December 2009.

41. **Closing Remarks**. Mr. Zhai thanked the participants and appreciated the participants' contributions during the extensive discussions that took place. He thanked Mr. Daovong for helping steer the discussions during the FG.

RPTCC-8 (Day 2: PM and Day 3: Whole Day)

Opening Session

42. Mr. Sompol thanked everyone for the opportunity to co-chair the RPTCC meeting. He noted that a presentation by a representative from the Thai gas sector will provide an overview of the requirements in the development of gas network and logistics, which is a priority area of cooperation identified in the GMS energy road map.

43. Mr. Yongping Zhai, SEEW, ADB, welcomed the participants and emphasized that while some adjustments were made to the GMS power investment program due to the global financial crisis, the development of GMS power trade remains a priority. This is the basis for the emphasis on strengthening linkages between the RPTCC and other GMS initiatives concerned with sustainable development, which will make more effective efforts to build capacity in environmental impact assessment (EIA) of power projects. He informed that the meeting will discuss broader issues such as energy supply security (e.g. gas) and regional power trade coordination.

Energy Supply Security: Discussions on Enhancing GMS Energy Planning- Strategic Security and Safety of Supply.

44. **Gas Industry Development in Thailand** (Annex 7). Ms. Sriwan Eamrungroj, Executive Vice President, PTT Public Company Ltd., gave an overview of the Thai petroleum and petrochemical supply chain and noted that local natural gas (NG) development has reduced dependence on oil imports. She showed the rapid increase in Thailand's NG demand, with NG serving as major fuel for power generation and increasingly for industry. She noted also the increased use of NG in transport, with currently 150,000 NG vehicles (NGV) served by 357 NGV stations nationwide. She cited the economic multiplier from natural gas and stressed that the increase in NG supply has been driven by continued pipeline expansion. She noted the important role of Liquefied NG (LNG) in complementing domestic and regional supplies.

45. **Comments**. In response to query from ADB, Ms. Sriwan briefed on the regulations affecting the NG industry which included incentives to enhance private investment in NGV stations, and the price subsidy for NG players/ consumers. On the issue of volatility of gas prices raised by Mr. Jie Tang (WB), Ms. Sriwan agreed that this is an area of concern, given that gas is increasingly imported from Myanmar and Cambodia. The meeting noted that gas is a major fuel for the Thai power sector, and this has implications on energy security in the event of interruptions in gas imports. Ms. Sriwan said that this is being addressed by requiring gas concessionaires to maintain higher reserve capacity and maintaining 3-day reserves for fuel oil, which can serve as alternative to gas. Ms. Sriwan noted the concerns for reducing carbon emissions from the industry but pointed out the high cost involved in implementing carbon capture and storage technology in the gas sector.

In-depth Sessions: Discussion on Possible Options for Institutional Structures for GMS Power Trade

46. Mr. Dejan Ostojic, Sector Leader-Energy (World Bank) cited the experience in power market integration in other parts of the world, where the process began by putting in place stronger institutions. He said that in the GMS, interconnections are being developed even in the face of very limited institutional structure. He suggested that the GMS may consider a broader approach through institutional development that could later manage the power integration process, including database maintenance and implementation of the master plan and road map.

47. **RTE Presentation** (Annex 8). Mr. Michel Caubet provided an overview of the objectives of power trade and the rationale for establishing an institutional framework for fostering regional power integration. He presented international experiences in power market development in (i) Europe and (ii) Africa. He presented the next steps proposed for the GMS involving creation of the **GMS Coordination and Information Centre, and prescribing its principles, possible functions and financial/ human resource requirements** (see slides 70 to 73 of Annex 8).

48. **Discussions/ Comments from RPTCC**. The RPTCC meeting discussed the following views on the institutional structure for power trade:

a. Thailand noted that bilateral power exchanges between Thailand and Lao PDR worked well even with only agreements between power developers and transmission system operators. He said that step-by-step development of institutions could be carried out on a needs basis.
b. Viet Nam expressed that strengthening of bilateral arrangements may be suitable for the GMS at present; Myanmar concurred with Viet Nam's position on this issue.
c. Lao PDR noted the various obstacles in developing the regional coordinating body, given the constraints in the regional power infrastructure.
d. PRC noted that it took Europe and Africa a long time to realize their current regional power set up. Agreed that working on better bilateral relationships would be useful at present, and that further discussion on possible institutional set up would be necessary.
e. Cambodia found the cases from Europe and Africa as good examples for long term development of GMS regional power market institutions.

49. Mr. Caubet noted that as long as power exchange involves more than 2 countries, there would be need for an institution to manage the power exchange/ settlement among the parties.

50. Mr. Bui (ADB) noted that MOU-2 provides for milestones for managing power trade arrangements among GMS countries. He stressed the need to assess whether these milestones could be realized given current status of RPTCC/ FG/ PWG work. Ms. Gabrielsson (ADB) discussed the case for a regional institution to oversee power trade arrangements involving more than 2 countries; she noted that the RETA 6440 consultant would solicit and consider the GMS countries' views in formulating the concept for the regional institutional setup.

51. Mr. Ostojic (WB) pointed the need for a deeper understanding of GMS countries' needs with respect to GMS power trading and cited the value of discussions on managing the regional database. Mr. Jie Tang (WB) said the proposed regional institution may consider handling not only the database but also managing the master plan and overseeing the various bilateral trading activities.

In-depth Sessions: Promoting Environmentally-Sustainable Regional Power Trade Planning, Coordination and Development in the GMS

52. **New RETA for Broader Scope of GMS Master Plan to Include Environmental Considerations** (Annex 9). Mr. Carl Bernadac, Infrastructure Project Manager, AFD, briefed on the nature, coverage and scope of work of AFD, and discussed the clean and lean energy strategy AFD promotes. He discussed the energy challenges faced by GMS countries and the key developmental issues in the pursuit of GMS regional power sector development. Mr. Romeo Pacudan (AFD Consultant) presented the proposed new RETA to ensure sustainability in power development, its goals, scoping/ reporting/ capacity building elements, and consideration of

energy security planning alternative scenarios: business as usual, energy security, environmental and social and sensitivity. Energy security scenarios would include more aggressive RE, energy efficiency (EE) and demand side management (DSM) in the power development plans, and consideration of their risks in terms of price volatility, financial crisis and depletion/ supply disruptions. He noted that capacity building would include (i) energy security and electricity planning and (ii) strategic environmental assessment (SEA). He described the RETA's inputs in terms of experts, costs and duration. Mr. Bernadac explained the potential interest of various stakeholders in the RETA's expected outputs involving the utilities, the environment, finance/ planning and energy ministries, and the Prime Minister's office.

53. **Discussions**. ADB (Mr. Zhai) noted that tackling the climate change issue requires a different mindset from the business as usual, least-cost planning method. Mr. Ostojic (WB) stressed the importance of the proposed study and informed of WB's similar work on energy security and sustainability issues in Asia and asked for clarification on whether the RETA covers also energy in transport or confined to the power sector. Mr. Bernadac clarified that the RETA focus is on the power sector, although EE/ DSM measures would look into possibilities across sectors. Mr. Sumit Pokhel (EOC) informed of the ongoing areas of cooperation between the EOC and the GMS energy group and strongly supported the sustainability thrust of the RETA. He suggested that the RETA include an element for channeling benefits to the marginalized communities. Mr. Pacudan explained that this concern is addressed in the detailed RETA paper. Mr. Daovong (Lao PDR) asked whether the study could be piloted in a specific project or area within a country. Mr. Khamso suggested that local and provincial authorities be involved in the RETA implementation. Mr. Bernadac agreed that it is important to include local representatives especially on the matter of channeling local benefits. Mr. Lefevre however cautioned on the trade-offs between greater local participation and the limitations imposed on RETA resources. Mr. Zhai expressed the need to identify a champion that would support coordination among all agencies in the RETA's implementation, in order to ensure ownership and sustainability of the RETA's outcomes.

Coordination with Other Regional Bodies

54. **Heads of ASEAN Power Utilities Association (HAPUA)**. Mr. Zhai raised the issue of how GMS RPTCC work, particularly on the GMS master plan, could be coordinated with the work of the larger ASEAN community such as the ASEAN power interconnection plan of HAPUA. Mr. Sompol noted that GMS RPTCC work is more advanced in terms of the directions for power trade development. Mr. Zhai said it would be interesting to learn how the ASEAN, through HAPUA coordinates planning work and implements programs agreed under its interconnection plan. Mr. Sodavath (Cambodia) suggested it would be useful to take the GMS power work as a subset of the larger ASEAN power plan. Mr. Lefevre (CEERD) proposed that closer working relations be developed with the ASEAN power group. Mr Daovong briefed on the nature of HAPUA cooperation, which largely serves as a platform for networking among utilities, and stressed that the GMS RPTCC provides direct support for the development and financing of priority projects.

Development Partners Perspectives: Updates on Development Partners' Programs/ Views on RPTCC Work Program (Annex 10)

55. **JICA**. Mr. Nobuo Hashimoto, JICA Expert, discussed the target of the JICA Program on the power sector in Lao PDR and the outcomes to be expected from this, namely (i) improvement in power sector management, (ii) power network development, and supply extension in domestic and neighboring countries, and (iii) promotion of rural electrification. He

elaborated on the ongoing and planned JICA projects under each outcome given and showed a map of Lao PDR indicating the various project locations. Mr. Yokosawa (TEPCO) clarified that the development of transmission projects in Lao PDR are being coordinated with Thai power officials for possible interconnection in the future.

56. **AFD**. Ms. Isabelle Vincent, Project Manager, stressed that the output of the proposed AFD RETA aims to come up with alternative power master plan scenarios that carefully take into account social and environmental aspects. She stressed that this exercise should bring about methodologies and results that could be replicated in national PDPs and would build on GMS power initiatives of other partners like the WB, and the SEA work of the EOC.

57. **EOC**. Mr. Sumit Pokhel noted that the EOC had participated in past SEF/ RPTCC meetings and had given sufficient briefs on the work of EOC in integrating environmental considerations in development planning processes. He discussed analytical tools that EOC promotes such as the SEA, which was applied in the PDP exercise in Viet Nam. He stressed the need to address the "climate change fatigue" which looks at environmental sustainability efforts as an additional operational layer, instead of being integrated as an essential element of development planning.

58. **World Bank**. Mr. Jie Tang, Senior Energy Specialist, briefed on the objectives of WB support to GMS power trade and the strategy of WB support consisting of policy/ institutional and investment support. He listed the projects and activities under each type of support; for example, for policy support the WB has provided advice and TA to the RPTCC while for investment support, the WB has financed two cross-border transmission lines between Lao PDR and Cambodia. Other WB activities include the Thailand RE and EE program using clean technology and capacity building for sustainable hydropower development in Lao PDR. He noted that the WB is prepared to provide support for the establishment of the appropriate regional institution to manage power trade arrangements, while continuing to support capacity building in IDA GMS members.

59. **Swedish International Development Cooperation Agency (SIDA)**. On behalf of SIDA, Ms. Gabrielsson noted that Sweden's future involvement in regional power market integration depends largely on the success of RETA 6440, which requires the GMS countries to extensively build capacity for regional power integration, including properly integrating social/ environmental considerations in PDPs. She was pleased that the institutional issue was raised during the meeting and noted that SIDA would offer support for developing the implementing institutions for power system integration in the GMS. She noted that the Indochina interconnection study should provide good guidance on the priority interconnection investments that should be made in the future.

Synthesis of Discussions

60. **Conclusion on RPTCC Work Program**. ADB (Mr. Zhai) stressed that as part of RPTCC meetings, at least one key issue should be discussed and for this meeting, in depth, the appropriate institutional set up for power trade arrangements. He proposed a study trip of RPTCC members to Africa to meet with key players on the African power pools, to get important insights for the GMS brainstorming on institutional arrangements.

61. On the AFD proposal (RETA: Ensuring Sustainability of GMS Power Sector Development), he suggested that AFD consider the comments made during the RPTCC

meeting in refining the proposal which would be submitted to the countries for their endorsement within two weeks.

RPTCC Knowledge Sharing (Annex 11)

62. The meeting extensively discussed various issues raised during the following presentations of the RPTCC knowledge sharing seminar:

a. Promoting Clean Power Solutions and RE for Power Generation- presentation by Alstom Power; and
b. HVDC Cross Border Power Interconnections (with Focus on HVDC Cable Links): Pricing, Technical and Other Issues- presentation by Fichtner Stuttgart.

Subregional Energy Forum (SEF) Knowledge Sharing Seminar (Annex 12)

63. Substantive exchanges also took place on the following presentations on GMS-appropriate practices for promoting RE and EE in the GMS, which continued the SEF knowledge sharing series which began at the SEF-3 meeting in August 2009:

a. Thailand Experience in the Promotion of RE/ EE Promotion: Incentive Schemes; and
b. Myanmar Experience in RE/ EE Promotion: Policy Initiatives.

Closing Session

64. **Consideration and Adoption of Proceedings**. Mr. Zhai announced the distribution of the draft summary of proceedings for review by the participants. After the FG, PWG and RPTCC members reviewed the draft summary of proceedings, and after incorporation of suggested changes, the body therefore approved the minutes of the PWG-7, FG-8 and RPTCC-8 meetings *ad referendum*.

65. The RPTCC members agreed that next year's annual RPTCC meeting (back-to-back with PWG and FG meetings) would be held in Thailand. The venue for the stand-alone PWG/FG meetings next year would be decided separately.

66. **Closing Remarks**. Mr. Sompol and Mr. Zhai both thanked the participants and appreciated the participants' substantive contributions during the discussions that took place, further advancing the progress of GMS cooperation in power trade development.

Greater Mekong Sub-region
Seventh Meeting of the Planning Working Group (PWG-7) of the Regional Power Trade Coordination Committee (RPTCC)
Luangprabang, Lao PDR, 25–27 November 2009

Agenda and Program

24 Nov (Tue.) Arrival of Delegates

25 Nov (Wed.) **Day 1 (am): PWG-7 Meeting**

08:30am- 08:45am Registration

08:45am- 09:00am **Session 1**. Opening Session - ADB

09:00am- 09:45am **Session 2**. Review of activities of the PWG – PWG Chairperson
- PWG presentation on main activities and results following the previous Meeting
- Key issues arising from the activities to be discussed by the Meeting
- Next steps for the PWG work to be discussed by the Meeting

09:45am- 10:30am **Session 3.** Review of Status of Activities under RETA 6440 – RTE International: Facilitating Regional Power Trading and Environmentally Sustainable Development of Electricity Infrastructure in the GMS, Component 1: Facilitation of Development of Regional Power Trade (Modules 1 to 5)
- Presentation of results against the milestones prescribed in the MoU on the Road Map
- Key issues for discussion by the Meeting
- Next steps of the project to be discussed by the Meeting

10:30am- 11:00am **Coffee Break**

11:00am- 11:30am **Session 3. (Continued)**. Review of Status of Activities under RETA 6440 – CEERD: Component 2: Capacity Development for Environmental Impact Assessment (EIA) of Power Projects (Conduct of Strategic Environmental Assessment SEA and EIA)
- Presentation on project results in the view of coordination between Components 1 and 2
- Key issues for discussion
- Next steps on Component for discussion by the Meeting

11:30am- 12:00nn **Session 3. (Continued)** Review of status on RETA 6440 Package 3 – TEPCO: Prioritized interconnection project on strengthening the Indochina power grid
- Presentation on interim project progress
- Key issues for discussion
- Proposed next steps on this Component for discussion by the Meeting

12:00nn-12:30nn **Session 3. (Cont.)** Summary of results from other regional projects in the GMS - ADB
- Nabong - Udon Thani interconnection
- Ban Sok – Pleiku interconnection
- Comments from the PWG

12:30nn-02:00pm **Lunch Break**

02:00pm-03:00pm **Session 4.** Discussions on RETA 6440 sand other projects' results and key issues:
- Summary of the key issues taken up by the previous presentations - ADB
- Discussions – ADB
- Conclusive summary of results and message to be presented to the FG – PWG Chair

03:00pm-03:30pm **Session 5**. Forthcoming RETA 6440 and PWG Activities
- RTE International/ CEERD/ TEPCO: Presentation of Work Plans and Timetables for RETA 6440 (in relation to the Milestones in the MoU and based on the key discussions)
- Forthcoming tentative work plan for the PWG, based on the conclusive summary - PWG Chair

03:30pm-04:00pm **Coffee Break**

04:00pm-04:30pm **Session 6.** Closing Session
- Conclusions on results and work plans – PWG Chair
- Main massage to the FG – PWG Chair
- Considerations and Adoption of Proceedings – PWG Chair
- Closing remarks - ADB

<u>26 Nov (Thur.)</u> **Day 2: FG – 8 Meeting**

08:45am-09:00am **Session 1**. Opening Session - ADB

09:00am- 10:30am **Session 2**. Country Reports on Progress of Power Development Plans and Transmission Interconnection Projects (15 minutes each country) – country representatives

- Cambodia
- People's Republic of China
- Lao PDR
- Myanmar
- Thailand
- Viet Nam

10:30am-11:00am **Coffee Break**

11:00am-11:30am **Session 3.** Review of FG activities and issues – FG Chairperson

- Presentation by FG activities and key results following the 7th FG meeting
- Discussions (Focus on the country presentations and the impact of financial crisis on power demand and its consequences on planned interconnections)

11:30am -12:00nn **Session 4.** Message from the PWG

- Summary of results, main message and planned key activities generated for the PWG – PWG Chairperson
- Discussions and comments from the FG – Chaired by FG Chair

12:00nn-12:30nn **Session 5.** Closing session

- Conclusions – what needs to be done to encourage planned investments – FG Chair
- Message to the RPTCC – FG Chair
- Considerations and Adoption of Proceedings – FG Chair
- Closing Remarks - ADB

12:30nn-02:00pm **Lunch Break**

<u>26 Nov (Thur)</u> **Day 2 (pm): RPTCC-8 Meeting**

02:00pm- 02:15pm **Session 1**. Opening Session - ADB

02:15pm-03:00pmm **Session 2.** Conclusions from the FG Meeting and main massage from the FG – FG Chair person

- Key results and work plans towards the milestones in the Road Map
- Compliance of RETA 6440 and other related projects with the milestones
- Comments from RPTCC and discussions

In-depth sessions

03:00pm-03:45pm **Session 3.** Discussion on Enhancing GMS Energy Planning - strategic security and safety of supply - ADB

- The role of oil, gas, nuclear energy etc. in the regional energy supply illustrated by the ADB consultant on the natural gas survey
- The progress in planned interconnection investments
- ADB's perspective on coming investments

03:45pm-04:00pm **Coffee Break**

04:00pm-04:45pm **Session 3. (Cont.)** Discussion on possible options for institutional structures for regional power trade, including power market operator (pool), power transmission operators and regional regulatory authority – RTE International

- RTE presentation on experiences for regional power trade institutions
- Discussions and comments from RPTCC
- ADB's focus of institutional set-up for future power trade in GMS.

<u>27 Nov (Fri.)</u> **Day 3 (am): RPTCC-8 Meeting (Continued)**

08:45am- 09:30am **Session 3. (Cont.)**. Promoting Environmentally-Sustainable Regional Power Trade Planning, Coordination and Development in the GMS
- Presentation of Strengthening Linkages Between RETA 6440 and the Core Environment Program (CEP) and Mekong River Commission (MRC) Programs - CEERD/ ADB
- New RETA for broader scope of GMS Master Plan to include environmental impact considerations – AFD/Consultant
- Proposed Scope, Objectives, Components and Activities for environmentally sustainable power trade in GMS - ADB
- Discussions (focus on "lead" country for preparation of project, fund sourcing, etc.) – ADB

09:30am-10:00am **Session 4.** Development Partners Perspectives - Updates on development partners programs/ views on RPTCC work program (Sida, AFD, EOC, JICA, MRC, WB)

10:00am-10:30am **Session 5.** Synthesis of Discussions
- Conclusion on RPTCC Work Program - Development of Regional Power - a key concerns for the RPTCC-8 Meeting - RPTCC Chair
- Regional Power Master Plan, Timetable and Financing for Priority Projects – RPTCC Chair

10:30am-11:00am **Coffee Break**

Knowledge Sharing Sessions

11:00am- 11:30am **Session 6**. RPTCC Knowledge Sharing: Promoting Clean Power Solutions (Gas, Coal, Nuclear) and Renewable Energy for Power Generation (Wind, Solar and Hydro)
- Presentation by Alstom Power
- Discussions (Focus on it with the GMS Road Map)

11:30am-12:00nn **Session 6**. **(Cont.)** RPTCC Knowledge Sharing: GMS Cross-Border Power Interconnections - Pricing, Technical and Other Issues
- Presentation by Fichtner
- Discussions

12:00nn- 01:30pm **Lunch Break**

01:30pm-03:00pm **Session 6. (Cont.)** Sub- regional Energy Forum (SEF): Knowledge Sharing Seminar (KSS) -Continuation of SEF Seminar Series: Thailand Experience in the Promotion of Renewable Energy (RE) and Energy Efficiency (EE), Incentive Schemes:
- Presentation by Thailand Delegation
- Discussion with focus on incentive system for EE and RE promotion

03:00pm- 04:15pm **KSS Series. (Cont.)** Myanmar Experience in the Promotion of Renewable Energy (RE) and Energy Efficiency (EE), Policy Initiatives
- Presentation by Myanmar Delegation
- Discussion with focus on policy initiatives for EE and RE promotion

04:15pm- 04:40pm **Session 7**. Closing Session
- Conclusions on forthcoming RPTCC activities - RPTCC Chairperson
- Consideration and Adoption of Proceedings – RPTCC Chairperson
- Closing Remarks - ADB

Greater Mekong Subregion (GMS)
Eighth Meeting of the Regional Power Trade Coordination Committee (RPTCC-8);
Seventh Planning Working Group (PWG-7); and Eighth Focal Group (FG-8)
Luang Prabang, Lao PDR, 25–27 November 2009

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ADB/GMS RETA 6440

Facilitating Regional Power Trading and Environmentally Sustainable Development of Electricity Infrastructure in the Greater Mekong Subregion

Review of Status of Activities under RETA 6440 – Component 1

"Facilitation of Development of Regional Power Trade"

Prepared by : Michel CAUBET, Project Team Leader

Seventh Meeting of the Planning Working Group of the RPTCC

Luang Prabang, Lao PDR, 25–27 November 2009

PRESENTATION OUTLINE

1. RETA 6440 – Objectives
2. RETA 6440 – Organization
3. COMPONENT 1 – *Objectives and Organization*
4. COMPONENT 1 – *Results*
5. CONCLUSIONS

PRESENTATION OUTLINE

1. **RETA 6440 – Objectives**
2. RETA 6440 – Organization
3. COMPONENT 1 – *Objectives and Organization*
4. COMPONENT 1 – *Results*
5. CONCLUSIONS

OBJECTIVES OF RETA 6440:

- **To establish a COMPETITIVE and EFFICIENT REGIONAL POWER MARKET;**
- **To ensure proper CONTROL of ENVIRONMENTAL IMPACTS while developing power projects for Regional Power Interconnection and Trading.**

It is to say:

- ✓ **PLANNING** the **DEVELOPMENT** of Resources for the National Power Systems as part of the Development of Resources for the Regional Electric Power System;
- ✓ Setting up **LEGAL FRAMEWORKS**, **RULES**, **PROTOCOLS** and Regional **MECHANISMS** and **BODIES** responsible for the reliable, secure and cost-effective operation of the Regional Interconnected Network and the introduction of a Regional Electricity Power Market;

OBJECTIVES OF RETA 6440 [cont'd]:

- ✓ Implementing **MECHANISMS** and **STRUCTURE** for the Development and the Operation of Regional Electric Power Projects;
- ✓ Ensuring that Investments and Infrastructure Development toward the RPT are **ENVIRONMENTALLY** and **SOCIALLY SUSTAINABLE**, and that Environmental and Social Aspects are considered at an earlier stage in the Planning Process;
- ✓ Proposing the Various Steps necessary to **SET UP** a **REGIONAL ORGANIZATION** that will be Responsible for the Implementation of these Actions, and for the Operation of the Regional Interconnected Power System.

PRESENTATION OUTLINE

1. RETA 6440 – Objectives
2. **RETA 6440 – Organization**
3. COMPONENT 1 – *Objectives and Organization*
4. COMPONENT 1 – *Results*
5. CONCLUSIONS

ORGANIZATION

- **A strong Association of well-known International Consulting Firms was created under the Leadership of RTE International with:**
  - EDF-CIH, Hydro Engineering Centre – FRANCE;
  - Nord Pool Consulting AS (NPC) – NORWAY;
  - Power Planning Associates (PPA) – UK;
  - Franklin Paris, Legal Firm – FRANCE;
  - Centre for Energy Environment Resources Development (CEERD) – THAILAND;
- **Partnership was established with National Consulting Firms and Independent Consultants in Five GMS Countries.**
- **Two Components:**
  - Component 1: *Facilitating Regional Power Trading*, taken in charge by the Project Team Leader (RTE International)
  - Component 2: *Environmentally Sustainable Development of Infrastructures*, taken in charge by the Deputy Team Leader (CEERD)

2. RETA 6440 – ORGANIZATION

- **COMPONENT 1 is composed of 5 Modules:**
  - Module 1: Regional Power Interconnection Master Plan (EDF-CIH)
  - Module 2: Methodology for Assessment of Benefits (NPC)
  - Module 3: Power Transmission Studies (RTE & PPA)
  - Module 4: GMS Regulatory Framework (RTE, NPC, PPA, Franklin)
  - Module 5: Update of the Structure of the Existing Regional Database (RTE)
- **COMPONENT 2 is composed of:**
  - Strategic Environmental Assessment (SEA) – (CEERD)
  - Environmental Impact Assessment (EIA) – (CEERD)
- **A Project Office:** was set up in Bangkok, under the management of CEERD.
- **A Web Site for the Project:** **www.gms-powertrade.net** was launched on January 2009, to help team members sharing reports and documents with user friendly upload/download tools, and later on to inform the General Public on the developments & outputs of the Project.

PRESENTATION OUTLINE

1. RETA 6440 – Objectives
2. RETA 6440 – Organization
3. **COMPONENT1 – *Objectives and Organization***
4. COMPONENT 1 – *Results*
5. CONCLUSIONS

Objectives of Component 1

- **In continuation of the activities undertaken under RETA 6304:**
  1. Review and update the Regional Power Master Plan in order to identify the Regional Priority Projects for undertaking feasibility studies;
  2. Develop and Demonstrate a Mechanism for Benefit Sharing;
  3. Assess the existing Regulatory Framework of each GMS Country, and define the necessary requirements for establishing an appropriate Institutional, Legal, Commercial and Technical Framework for developing Regional Power Trading;
  4. Review and Update the Road Map for RPT that describes clearly the steps and milestones towards a Regional Power Market;

Objectives of Component 1 [cont'd]

5. Define the activities to be undertaken and resources required to implement these activities;
6. Address its capacity-building needs; and
7. Make the Regional Power Sector Database operational.

Work Organization

- **Around 5 Modules:**
  - **Module 1:** Regional Power Interconnection Master Plan (EDF-CIH)
  - **Module 2:** Methodology for Assessment of Benefits (NPC)
  - **Module 3:** Power Transmission Studies (RTE & PPA)
  - **Module 4:** GMS Regulatory Framework (RTE, NPC, PPA, Franklin)
  - **Module 5:** Update of the Structure of the Existing Regional Database (RTE)

3. COMPONENT 1 – OBJECTIVES & ORGANIZATION

- **MODULE 1: Regional Power Interconnection Master Plan**
  - **Objective:** Update the indicative GMS Regional Master Plan for the 2009-2025 period by simulating the regional power systems with existing and potential interconnections.
  - 5 Tasks:
    - ✓ Task 1 : Review of Previous Studies / Review and Update of Data.
    - ✓ Task 2 : Existing situations and projections in each of the GMS Countries.
    - ✓ Task 3 : Review and Update of National PDPs.
    - ✓ Task 4 : Common Planning Criteria.
    - ✓ Task 5 : Update of the GMS Interconnection Master Plan.
  - A Team of National Experts to assist collecting data and validating scenarios.

3. COMPONENT 1 – OBJECTIVES & ORGANIZATION

- **MODULE 2: Methodology for Assessment of Benefits**
  - **Objective:** to enable the PWG (Planning Work Group) to assess priority projects in the GMS by providing guidelines for an assessment methodology and by training the PWG.
  - 5 Tasks:
    - ✓ Task 1: Review of the Best Practices.
    - ✓ Task 2: Methodology Guidelines for Assessment of Benefits.
    - ✓ Task 3: Assessment of Priority GMS Power Interconnection Projects.
    - ✓ Task 4: On-the-Job Training.
    - ✓ Task 5: Assistance in the Further Assessment of Priority Projects.
  - A Team of National Experts to assist collecting data, reviewing best practices, establishing guidelines and assessing projects.

3. COMPONENT 1 – OBJECTIVES & ORGANIZATION

- **MODULE 3: Power Transmission Studies**
  - **Objective:** to assess the potential capacity of priority interconnection projects between the different GMS countries in terms of specific characteristics of the transmission lines and operating regimes of the networks.
  - 8 Tasks:
    - ✓ Task 1: Review of Previous Studies / Review and Update of Data.
    - ✓ Task 2: Assessment of Candidate Transmission Projects.
    - ✓ Task 3: Assessment of Potential for Synchronous Operation.
    - ✓ Task 4: HVDC vs. AC Interconnection.
    - ✓ Task 5: Training in PDP Methods.
    - ✓ Task 6: Load Flow Studies.
    - ✓ Task 7: Completion of the Performance Standards (PS).
    - ✓ Task 8: Metering Arrangements (MA).
  - A Team of National Experts to provide support to International Experts;

3. COMPONENT 1 – OBJECTIVES & ORGANIZATION

- **MODULE 4: GMS Regulatory Framework**
  - **Objective:** to define principles, develop and put in place mechanisms and regional structure to gradually evolve towards an integrated market structure.
  - 5 Tasks:
    - ✓ Task 1: Data Collection.
    - ✓ Task 2: Review and assessment of the current regulatory framework – Identification of barriers and recommendations.
    - ✓ Task 3: Review of International Experiences.
    - ✓ Task 4: Conceptual Design of the GMS Regional Electricity Market.
    - ✓ Task 5: Completion of the GMS Transmission Regulations.
  - A Team of National Regulatory and Legal Experts to provide support in reviewing, assessing the legal and regulatory frameworks and liaise with country counterparts.

3. COMPONENT 1 – OBJECTIVES & ORGANIZATION

- **MODULE 5: Review and Update of the Structure of the GMS Regional Database**
  - **Objective:** to disseminate the correct information at the right time among all actors of the regional power market without discrimination to evaluate potential power transactions.
  - 3 Tasks:
    - ✓ Task 1: Review the structure of the existing GMS regional database and consult with GMS member countries on the content, format, uses, and requirements of a regional power system database;
    - ✓ Task 2: Draft TORs for a database specialist based on these discussions; and
    - ✓ Task 3: Supervise the updating of the existing database structure.

PRESENTATION OUTLINE

1. RETA 6440 – Objectives
2. RETA 6440 – Organization
3. COMPONENT1 – *Objectives and Organization*
4. **COMPONENT 1 – *Results***
5. CONCLUSIONS

MOU 2 – Signed in Vientiane, Lao PDR, on 31 March 2008, prescribing to fully achieve STAGE 1 during the period 2008-2010:

1. Complete the indicative Power Transmission Master Plan and select priority new interconnection projects for undertaking feasibility studies by 2009;
2. Complete the study on GMS Performance Standards;
3. Complete the study on Transmission Regulations;
4. Complete the study on standard Regional Metering Arrangements and Communications System in grid-to-grid interconnections;
5. Complete the study on a GMS Grid Code (Operational Procedures), which includes performance standards, metering, communication and coordination procedures for regional network interconnections;
6. Complete the study on Power Trade Rules;

General Activities:

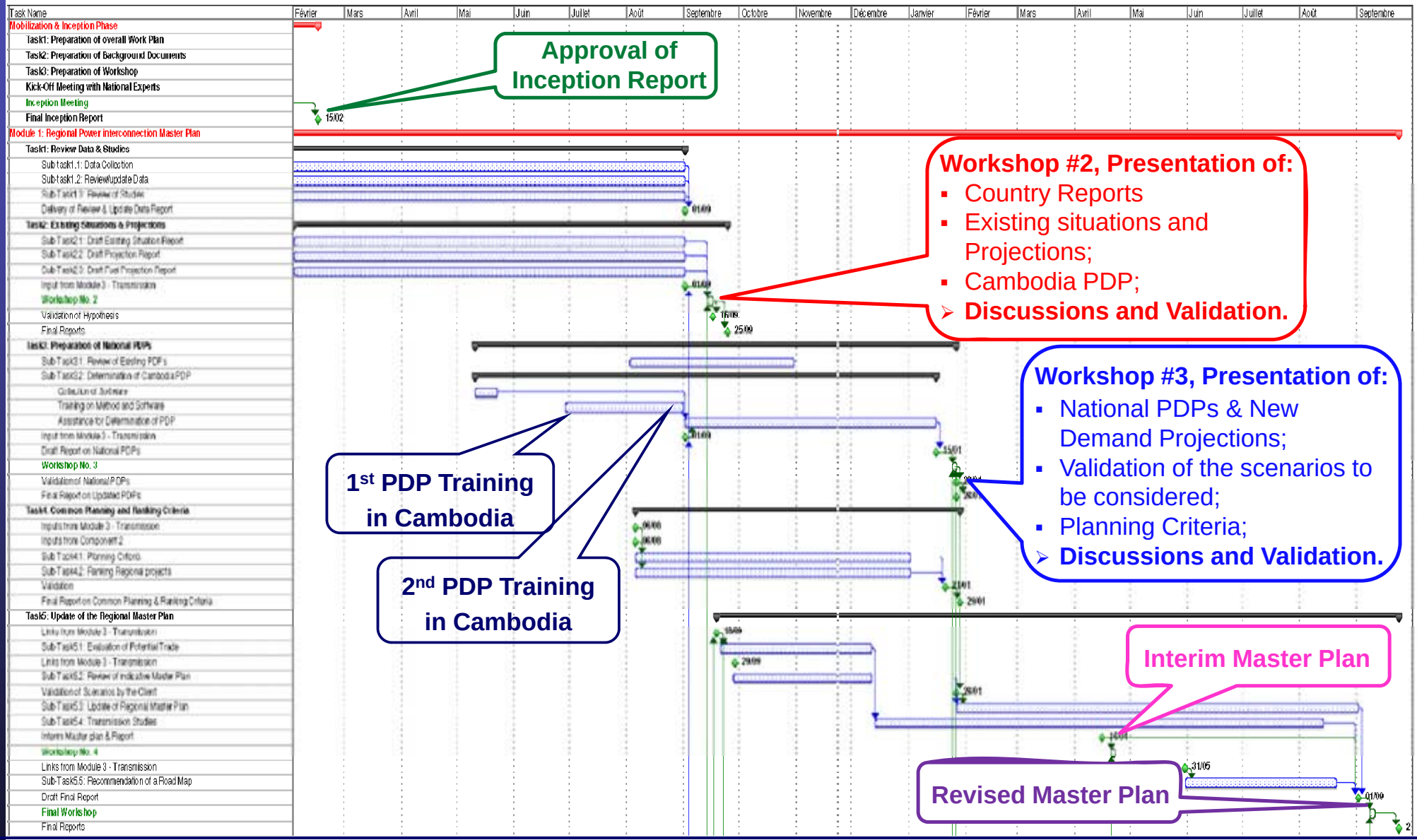
- **Kick-Off Meeting with National Experts**
  Bangkok, 17 and 18 November 2008
- **Inception Meeting**
  Ho Chi Minh City, 20 and 21 November 2008
- **Inception Report**
  approved by ADB,
  early March 2009
- **Consulting Team visit to GMS Countries**
  26 March - 3 April, 2009
  (Thailand, Cambodia,
  Lao PDR, Viet Nam)
  3-4 August 2009 (PR China)

COMPONENT 1:

- **Training course on the "GMS Database and Website“**
  Kunming, March 26-27, 2009
- **1st Training & Assistance Session for the Update of Cambodia PDP**
  Phnom Penh, 29 June to 3 July 2009;
- **2nd Training & Assistance Session**, to Cambodian Experts
  24-28 August 2009;
- **COMP1 – Workshop #2, Part I**, September 14 to 16, 2009;
- **COMP1 – Workshop #2, Part II**, September 17-18, 2009;
- **COMP1 – Workshop #3**, January 20-22, 2010 [To come];
- **COMP1 – Workshop #4**, April 2010 [To come];
- **COMP1 – Final Workshop**, August 2010 [To come].

MODULE 1

4. COMPONENT 1 – RESULTS



IMPLEMENTED ACTIVITIES:

- **1st Training & Assistance Session for the Update of Cambodia PDP,** Phnom Penh, 29 June to 3 July 2009;
- **2nd Training & Assistance Session**, to Cambodian Experts 24-28 August 2009;
- **COMP1 – Workshop #2, Part I**, September 14 to 16, 2009
  - ✓ Country Reports;
  - ✓ Review of previous studies / Review and update of Data;
  - ✓ Existing situations and projections in each of the GMS Countries;
  - ✓ Presentation of the PDP Training and Assistance in Cambodia;
  - ✓ Draft Revised Cambodia PDP 2009;
  - ✓ Fuel price projections.

DELIVERED OUTPUTS:

- **Cambodia**
  - ✓ Report - Task 1 - Data Collection
  - ✓ Report - Task 2.1 - Power Demand projection
  - ✓ Report - Task 2.2 – Power Sector Profile
  - ✓ Report - Task 2.3 – Fuel Price Projections
- **PR China**
  - ✓ Report - Task 1 - Data Collection
  - ✓ Report - Task 2.1 - Power Demand projection
  - ✓ Report - Task 2.2 – Power Sector Profile
  - ✓ Report - Task 2.3 – Fuel Price Projections
  - ✓ Report - Task 2.4 – Summary of Data and Hypotheses
- **Lao PDR**
  - ✓ Report - Task 2 - Data Collection
  - ✓ Report - Task 2.4 - Summary of Data and Hypotheses

DELIVERED OUTPUTS:

- **Thailand**
  - ✓ Report - Task 2.1 - Power Demand projection
  - ✓ Report - Task 2.2 – Power Sector Profile
  - ✓ Report - Task 2.3 – Fuel Price Projections
  - ✓ Report - Task 2.4 – Summary of Data and Hypotheses
- **Vietnam**
  - ✓ Report - Task 1 - Data Collection
  - ✓ Report - Task 2.1 - Power Demand projection
  - ✓ Report - Task 2.2 – Power Sector Profile
  - ✓ Report - Task 2.3 – Fuel Price Projections
  - ✓ Report - Task 2.4 – Summary of Data and Hypotheses

DELIVERED OUTPUTS:

- **Fuel Price Projections**
  - ✓ Report - Fuel Price Projections for the GMS Master Plan Update

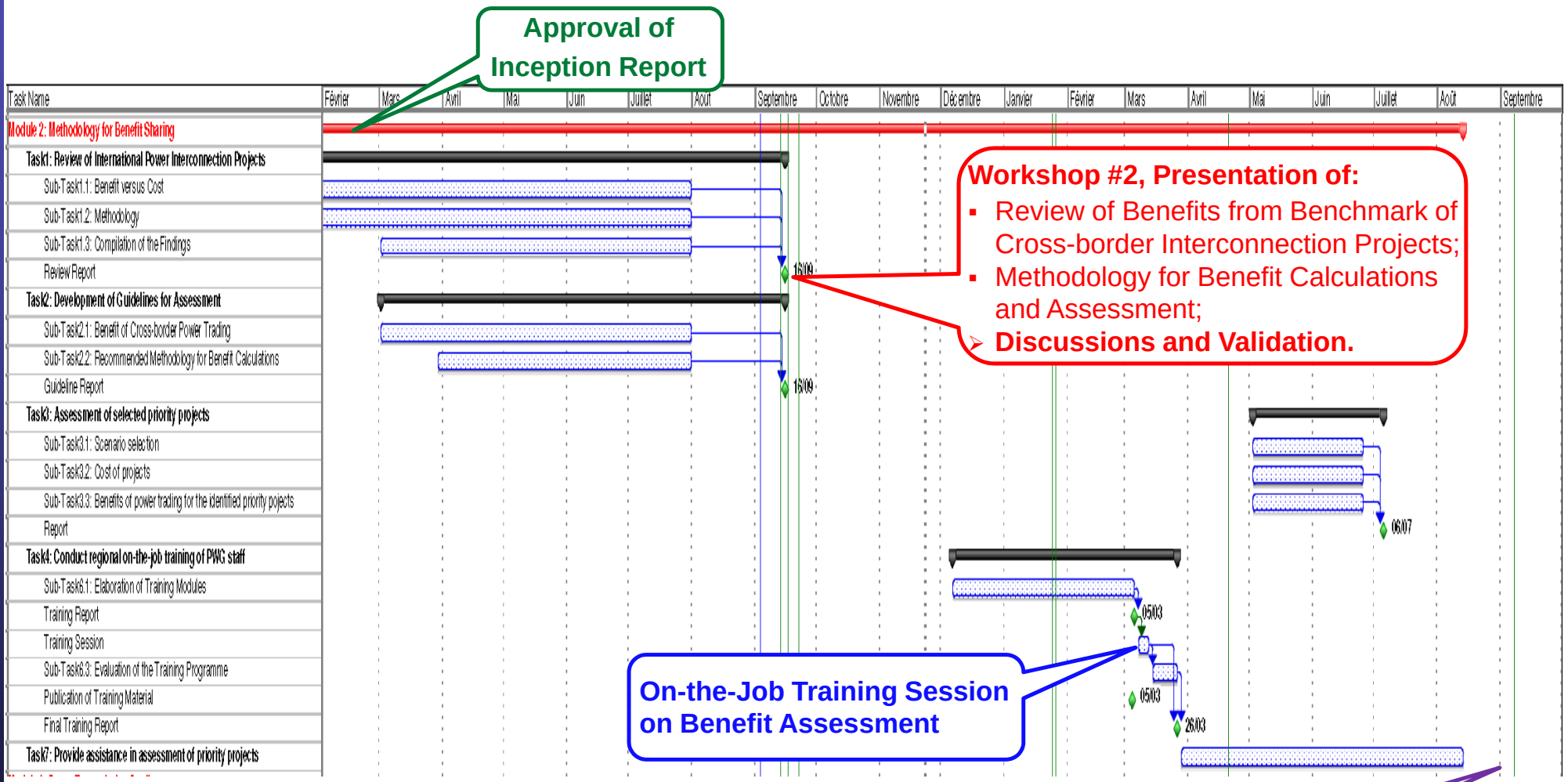
- **Update of Cambodia PDP**
  - ✓ Report - Update of Cambodia PDP
  - ✓ Report - Appendices
  - ✓ Report - Assistance for Updating Cambodia PDP – Working Session I Report
  - ✓ Report - Assistance for Updating Cambodia PDP – Working Session II Report

PLANNED OUTPUTS:

- **COMP1 – Workshop #3,** January 20 to 21, 2010
  - ✓ Review and Update of National Power Developments Plans;
  - ✓ Common Planning Criteria;
  - ✓ Potential Power Trade between the GMS Countries;
  - ✓ Review of the GMS Master Plan 2008 / Proposed Scenarios for GMS Master Plan Update;
- **COMP1 – Workshop #4,** mid April, 2010
  - ✓ Report on the GMS Interim Master Plan;
- **COMP1 – Final Workshop,** beginning of September, 2010
  - ✓ Report on the Revised GMS Master Plan;

MODULE 2

4. COMPONENT 1 – RESULTS



IMPLEMENTED ACTIVITIES:

- **COMP1 – Workshop #2, Part I**, September 14 to 16, 2009
  - ✓ Review of benefits from benchmark of cross-border interconnection projects;
  - ✓ Recommended methodology for benefit calculations and assessment;

DELIVERED OUTPUTS:

- **Lao PDR: Report – Power Economics**
- **Vietnam: Report – Power Interconnection between Vietnam and other GMS Countries**
- **Thailand: Report – Generation Planning and Economic Study**
- **Report on Review of Best Practices (November 2009 – Under finalization)**

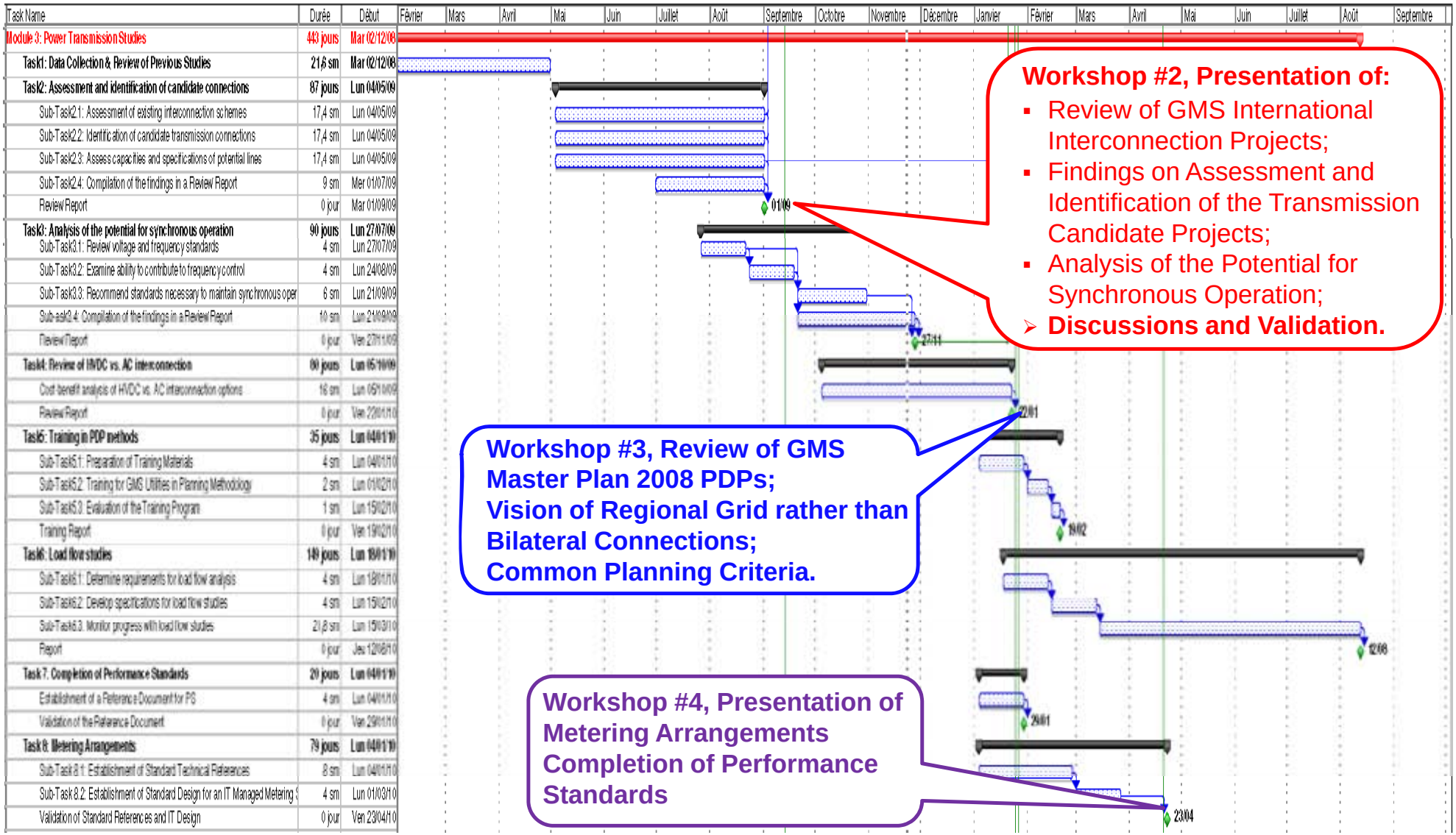
MODULE 2

PLANNED OUTPUTS:

- **Report on the Methodology Guidelines for Assessment of Benefits**
  - ✓ Draft Report ready by February 2010, subject to data from Module 1;
  - ✓ Presentation at Workshop #4, mid April 2010;
- **Assessment of Priority GMS Power Interconnections Projects**
  - ✓ Draft Report ready after final simulation results from Module 1 (July 2010);
  - ✓ Presentation at Final Workshop, beginning of September 2010;
- **On-the-job Training,** to be coordinated with Modules 1 & 3, March 2010;
- **Assistance in further Assessment of Priority Projects,** to be coordinated with other Modules, April to August 2010.

MODULE 3

4. COMPONENT 1 – RESULTS



4. COMPONENT 1 – RESULTS

IMPLEMENTED ACTIVITIES:

- **COMP1 – Workshop #2, Part I**, September 14 to 16, 2009
  - ✓ Review of international power interconnection projects in the GMS - Findings on assessment and identification of the transmission candidate projects;
  - ✓ Analysis of the potential for synchronous operation;

DELIVERED OUTPUTS:

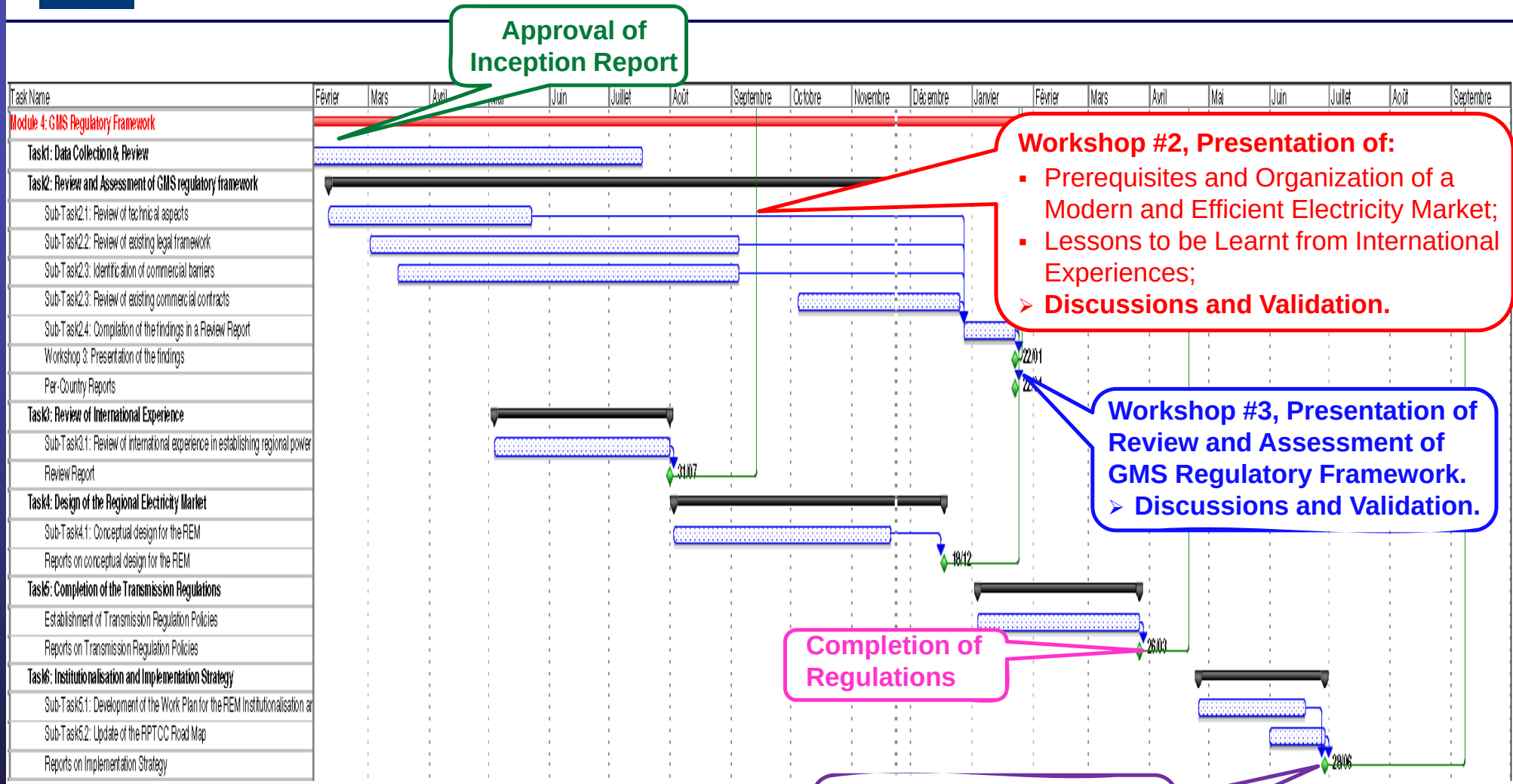
- **Cambodia: Report – Power Transmission Studies**
- **PR China: Report – Report on Transmission Issues of CSG**
- **Lao PDR: Report – Data Collection of Transmission Network**
- **Thailand: Report – Reports and Data required for Transmission Studies**
- **Vietnam: Report – Report for Transmission Studies**
- **Report on Review of International Power Interconnection Projects in the GMS (November 2009 – Under finalization)**

PLANNED OUTPUTS:

- **COMP1 – Workshop #3,** January 20 to 21, 2010
  - ✓ Cost of Transmission Interconnection;
  - ✓ Updated List of Candidate Interconnection Projects;
  - ✓ Review of GMS Master Plan 2008 PDPs;
  - ✓ Vision of Regional Grid rather than Bilateral Connections;
  - ✓ Common Planning Criteria;
- **COMP1 – Workshop #4,** mid April 2010
  - ✓ Assessment of Potential for Synchronous Operation;
  - ✓ HVDC vs. AC Interconnection;
  - ✓ Performance Standards;
  - ✓ Metering Arrangements.

MODULE 4

4. COMPONENT 1 – RESULTS



IMPLEMENTED ACTIVITIES:

- **COMP1 – Workshop #2, Part II**, September 17 to 18, 2009
  - ✓ Prerequisites and organization of a modern and efficient Electricity Market, the "Basic Principles" to be applied;
  - ✓ Lessons to be learnt from International Experiences such as the European Continental Electricity Market, the Nordic Market, the North American Market;
  - ✓ Regional Cooperation and Integration Experiences in Africa: SAPP, WAPP and EAPP;
  - ✓ Towards the GMS Electricity Market.

DELIVERED OUTPUTS:

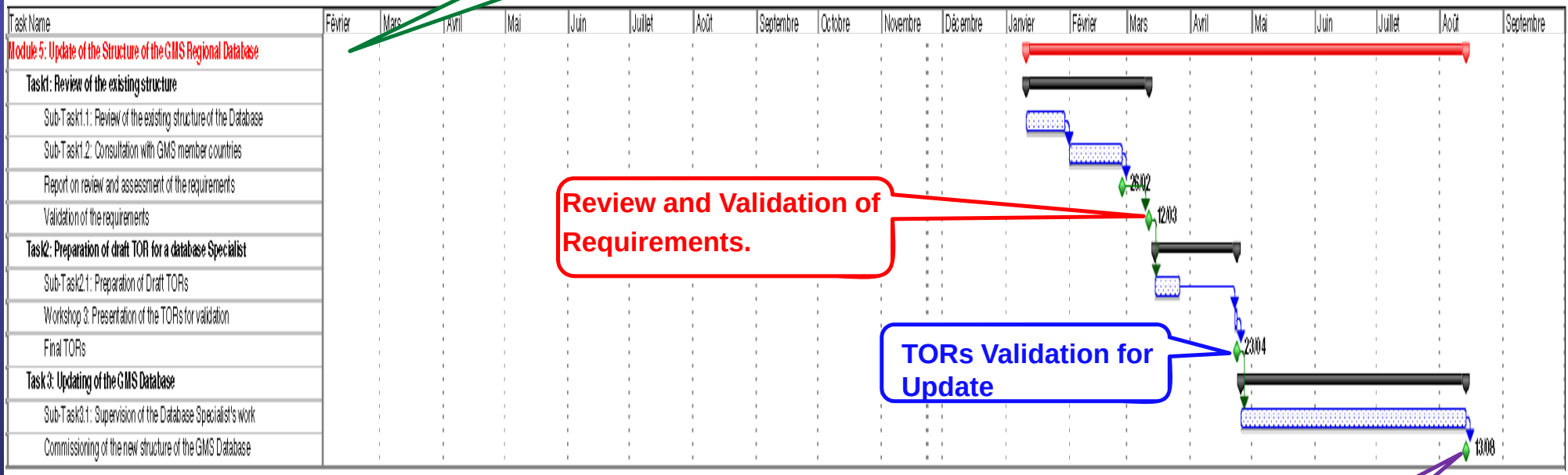
- **Lao PDR:** Report – Institutional, Legal, Regulatory and Commercial Aspects
- **PR China:** Country Report
- **Thailand:** Review and Assessment of the Current Regulatory Framework
- **Vietnam:** Review and Assessment of the Current Regulatory Framework
- **GMS Countries:** DFDL Report on Assessment of the Regulatory Framework of Cambodia, Lao PDR, Thailand and Vietnam
- **Report on Review of International Experience (December 2009 – Under finalization)**
- **Report on Conceptual Design of the GMS Electricity Market (December 2009 – Under finalization)**

PLANNED OUTPUTS:

- **COMP1 – Workshop #3,** January 22, 2010
  - ✓ Review and Assessment of the Current Regulatory Framework in the GMS Countries;
  - ✓ Transmission Capacity, Access and Pricing Options for the GMS Countries;
  - ✓ Conceptual Design of the GMS Electricity Market;
  - ✓ Draft Implementation Strategy - GMS Road Map;
- **COMP1 – Workshop #4,** mid April 2010
  - ✓ Remaining Transmission Regulations;
- **Institutionalization and Implementation Strategy – Revised Road Map, June 2010.**

MODULE 5

Approval of Inception Report



Review and Validation of Requirements.

TORs Validation for Update

New Structure

PLANNED OUTPUTS:

- **Report on Review and Assessment of Requirements,** March 2009;
- **Draft Terms of Reference for the Update of the Structure of the GMS Data Base and Workshop #4 for Validation,** mid April 2010;
- **Commissioning Report of the New Structure,** August 2010.

PRESENTATION OUTLINE

1. RETA 6440 – Objectives
2. RETA 6440 – Organization
3. COMPONENT1 – *Objectives and Organization*
4. COMPONENT 1 – *Results*
5. **CONCLUSIONS**

Obstacles to the Implementation of Component 1 Activities:

- Unavailability and Inconsistency of the RETA 6304 Data Base;
- Current update of the National PDPs in the People Republic of China, Vietnam and Thailand, thus inducing the suspension of the Module 1 activities up to the release of the new demand forecasts of these Countries;
- Inconsistency of the National PDPs of Vietnam and Lao PDR, forcing the Consultant to revise them partially;
- Difficulty in collecting data and information from Myanmar;
- Difficulty to finance participants from Myanmar.

5. CONCLUSIONS

These issues were partially resolved by the Component 1 Team of Experts by:

- Intensive Exchanges with the Countries' Stakeholders during and after Workshop #2;
- It is also propose to make an additional visit to Vietnam to adapt and revise their national PDP;

Next Steps:

- The Issues to be discussed during Workshop #3, in January 2010, will greatly increase the quality of the revised GMS Master Plan, mainly by:
  - ✓ Validating the national PDPs;
  - ✓ Validating the Potential Power Trade between GMS Countries;
  - ✓ Validating the proposed Scenarios.
- Thus allowing the adoption of a common basis for the update of the GMS Master Plan.

5. CONCLUSIONS

- At present, Component 1 – Module 1 Activities have six (6) months of delay involving a delay of the Activities of Modules 2 & 3 and, thus an overall 6 Month Delay of the Project.
- The other Activities of RETA No. 6440 Component 1 have been implemented satisfactorily in particular for Module 4, and so far good evaluations have been received by GMS participants to Component 1 Workshop #2 and the Training Sessions in Cambodia for the update of their national PDP.
- There is no access to the GMS Regional Data Base, hosted by CSG – PR China. There is no Administrator of the Data Base in our knowledge. Only the User Manual has been made available. What are the expectations of the GMS Stakeholders regarding the Regional data Base and Who will be in charge ?

ADB

THANK YOU FOR YOUR ATTENTION

ADB/GMS RETA 6440
Facilitating Regional Power Trading and Environmentally Sustainable Development of Electricity Infrastructure in the Greater Mekong Subregion

7th PWG Meeting - Session 3

"Review of Status of Activities under RETA 6440 Component 2 - Capacity Development for Environmental Impact Assessment of Power Projects"

Prepared by : Prof. Thierry Lefevre, Deputy Team Leader / Coordinator Component 2
Centre for Energy Environment Resources Development (CEERD)

November 25, 2009 – Luangprabang, Lao PDR

PRESENTATION OUTLINE

1. **Component 2 Structure**
2. **Component 2 Objectives**
3. **Component 2 Methodology**
4. **Component 2 Activity Schedule**
5. **Component 2 Implemented Activities**
   - *Overview of Activities*
   - *Detailed Activities*
   - *Linking Components 1+2 Detailed Activities*
6. **Component 2 Activities Under Implementation**
7. **Other Project Activities Linking with Regional Stakeholders**
   - *Linking with EOC and MRC*
   - *Linking with AFD*
8. **Component 2 Outputs**
   - *Outputs Delivered*
   - *Outputs to be Delivered*
9. **Conclusions and the Way Forward**

PRESENTATION OUTLINE

1. **Component 2 Structure**
2. Component 2 Objectives
3. Component 2 Methodology
4. Component 2 Activity Schedule
5. Component 2 Implemented Activities
   - *Overview of Activities*
   - *Detailed Activities*
   - *Linking Components 1+2 Detailed Activities*
6. Component 2 Activities Under Implementation
7. Other Project Activities Linking with Regional Stakeholders
   - *Linking with EOC and MRC*
   - *Linking with AFD*
8. Component 2 Outputs
   - *Outputs Delivered*
   - *Outputs to be Delivered*
9. Conclusions and the Way Forward

1. COMPONENT 2 - STRUCTURE

Capacity Development for Environmental Impact Assessment of Power Projects

Component 2 is composed of two modules:

- *Strategic Environmental Assessment (SEA)*
- *Environmental Impact Assessment (EIA)*

The Project Office in Bangkok, under the Management of CEERD, coordinates all activities related to the implementation of Component 1 ("Facilitation of Development of Regional Power Trade") and Component 2.

PRESENTATION OUTLINE

1. Component 2 Structure
2. **Component 2 Objectives**
3. Component 2 Methodology
4. Component 2 Activity Schedule
5. Component 2 Implemented Activities
   - *Overview of Activities*
   - *Detailed Activities*
   - *Linking Components 1+2 Detailed Activities*
6. Component 2 Activities Under Implementation
7. Other Project Activities Linking with Regional Stakeholders
   - *Linking with EOC and MRC*
   - *Linking with AFD*
8. Component 2 Outputs
   - *Outputs Delivered*
   - *Outputs to be Delivered*
9. Conclusions and the Way Forward

2. COMPONENT 2 - 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 EMP practices;
4. **To build capacity** through EIA case studies and EMP on-the-job activities related to on-going power projects, in cooperation with the GMS Biodiversity Corridors Initiative supported by ADB;
5. **To provide practical training** in preparation and implementation of EMPs, specifically in monitoring of environmental safeguards and regional ambient standards.

PRESENTATION OUTLINE

1. Component 2 Structure
2. Component 2 Objectives
3. **Component 2 Methodology**
4. Component 2 Activity Schedule
5. Component 2 Implemented Activities
   - *Overview of Activities*
   - *Detailed Activities*
   - *Linking Components 1+2 Detailed Activities*
6. Component 2 Activities Under Implementation
7. Other Project Activities Linking with Regional Stakeholders
   - *Linking with EOC and MRC*
   - *Linking with AFD*
8. Component 2 Outputs
   - *Outputs Delivered*
   - *Outputs to be Delivered*
9. Conclusions and the Way Forward

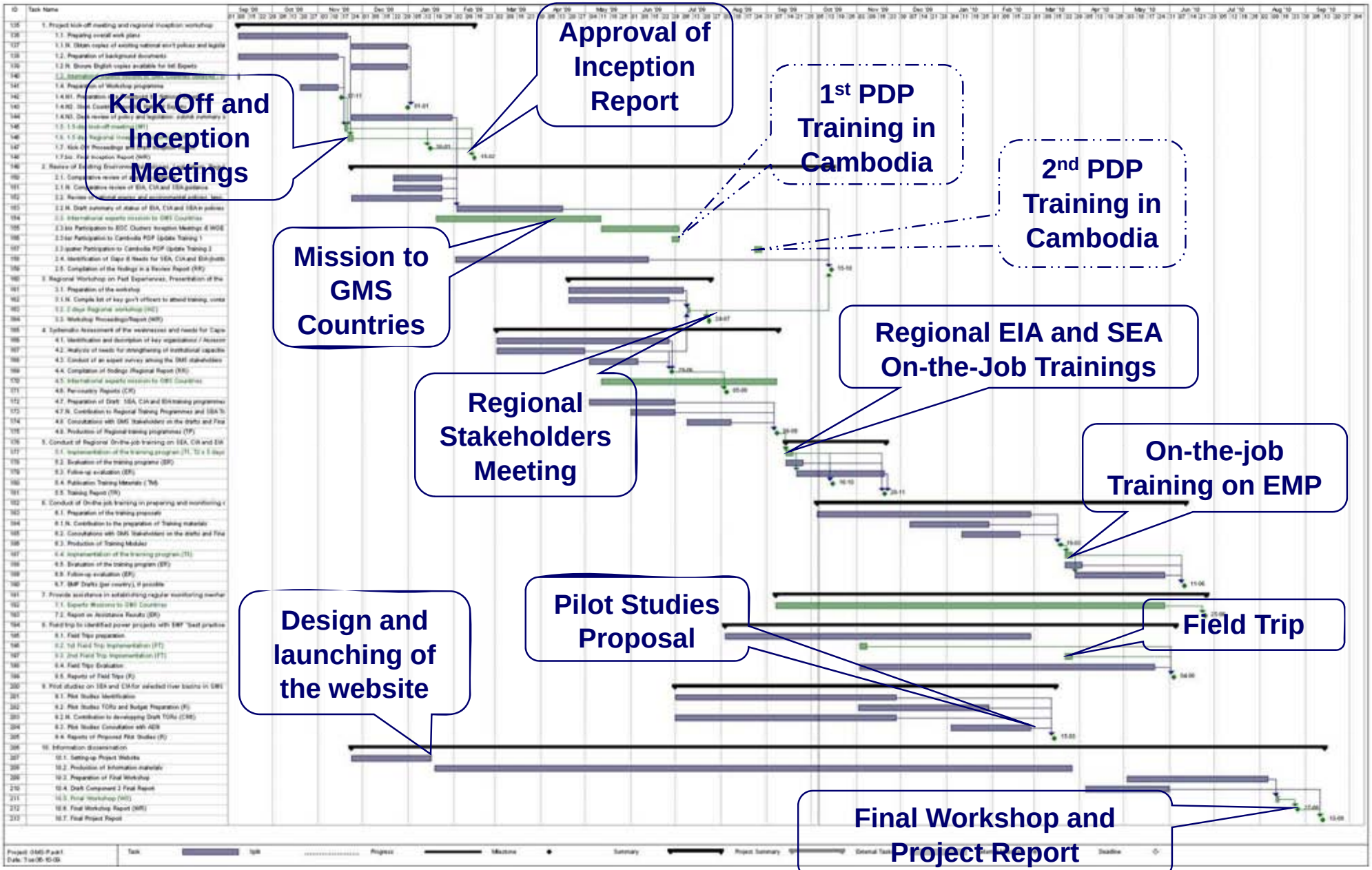
3. COMPONENT 2 - METHODOLOGY

- **Desk Studies** to prepare work plans, reports, trainings and pilot studies proposal;
- **Meetings and interviews** with GMS stakeholders and regional experts;
- **Expert Surveys** to identify and confirm the needs, contents, timing and duration of trainings;
- **Workshops** (inception, regional workshop on past experiences on regional power sector integration and SEA, and final);
- Implementation of **Regional on-the-job trainings on EIA, SEA and EMP**; and
- **Field trips** to identified power projects with EMP "best practices".

PRESENTATION OUTLINE

1. Component 2 Structure
2. Component 2 Objectives
3. Component 2 Methodology
4. **Component 2 Activity Schedule**
5. Component 2 Implemented Activities
   - *Overview of Activities*
   - *Detailed Activities*
   - *Linking Components 1+2 Detailed Activities*
6. Component 2 Activities Under Implementation
7. Other Project Activities Linking with Regional Stakeholders
   - *Linking with EOC and MRC*
   - *Linking with AFD*
8. Component 2 Outputs
   - *Outputs Delivered*
   - *Outputs to be Delivered*
9. Conclusions and the Way Forward

4. COMPONENT 2 - ACTIVITY SCHEDULE



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5. COMPONENT 2 – IMPLEMENTED ACTIVITIES OVERVIEW

- **Kick-Meeting with National Experts,** Bangkok, 17th – 18th Nov. 2008
- **Inception Meeting,** Ho Chi Minh City, 20 – 21st November 2008
- **Inception Report,** Approved by ADB early March, 2009
- **Consulting Team Visits to GMS Countries (Thailand, Cambodia, Lao PDR and Vietnam),** 26 March - 3rd April, 2009
- **1st PDP Training in Cambodia,** 29 June – 3 July, 2009
- **Regional Stakeholder Consultation Workshop (#2),** Bangkok, 9 – 10 July, 2009
- **Consulting Team Visit to PR China,** 4 – 5th August, 2009
- **2nd PDP Training in Cambodia,** 24 – 28 August, 2009
- **Regional SEA and EIA On-the-Job Trainings,** 14 – 18 September, 2009

5. COMPONENT 2 – IMPLEMENTED ACTIVITIES DETAIL (1)

Regional Stakeholder Consultation Workshop #2 on SEA, EIA and EMP Trainings Contents

Bangkok, 9 – 10th July 2009

Regional Stakeholders Consultation Workshop on Past Experiences on Regional Power Sector Integration, Strategic Environmental Assessment (SEA), Environmental Impact Assessment (EIA) and Environmental Management & Monitoring Assessment (EMP) took place on 9th-10th July, 2009 in Bangkok Thailand. Consultants presented the status of on-going Project Environmental Review, and identified weaknesses, gaps & needs in the fields of SEA, EIA and EMP, and of training needs. Detailed discussions were held with GMS Countries' Stakeholders on the contents of the SEA, EIA and EMP Trainings to be implemented in September (SEA & EIA) and November (EMP) 2009.

Attendees of the workshop were consulted further through a national questionnaire which aimed to clarify existing knowledge on EIA, SEA and EMP practices in GMS countries. The questionnaires were filled by the participants at the time of the meeting.

5. COMPONENT 2 – IMPLEMENTED ACTIVITIES DETAIL (2)

Regional EIA On-the-Job Training

Bangkok, 14 – 18th September, 2009

Regional On-the-Job Training on EIA for Power Ministries, Power Generating and Transmission Organizations/Companies and Environmental Authorities in the GMS region was held from 14th-18th Sep 2009 in Bangkok. The training aimed to build capacity within the relevant stakeholders in EIA methodology and practice with emphasis on improved legislation, new performance criteria and analytical techniques, new issues of concern (transboundary and climate change issues), advances in social and health impact assessment, public participation, and worldwide "best practices" for EIA development and implementation.

Regional SEA On-the-Job Training

Bangkok, 14 – 18th September, 2009

Regional SEA On-the-Job Training for Power Companies and Environmental Authorities in the GMS aimed to build capacity of the relevant stakeholders on SEA methodology, with emphasis on new means of analyzing and addressing the environmental effects of policies, plans, programs (PPP) and other proposed strategic actions, and worldwide "best practices" for SEA development and implementation. The training content included the SEA Concept and Implementation; SEA Screening and Scoping Methodology; Scenarios Preparation; Environmental Social and Environmental Impacts; Weighting Assessment; Identifying SEA Recommendations and Reporting.

5. COMPONENT 2 – LINKING COMPONENTS 1 + 2 DETAILED ACTIVITIES

1st PDP Training & Assistance Session in Cambodia

29 June to 3rd July 2009

In the framework of RETA No. 6440, a training of the staff of the main agencies involved with power sector development (MIME, EDC & EAC), and the Ministry of Energy of Cambodia have been conducted. In the framework of this activity, energy and environment experts of Cambodia (14 Trainees) were trained to prepare and update the PDP of Cambodia on a regular basis. A software (OPTGEN) was transferred to these experts to allow them to prepare this PDP. In the framework of this 1st session, a module on SEA has been delivered by Component 2 Expert to sensitize these experts to the environmental and social issues and on how these issues can eventually be integrated in the preparation of the PDP.

2nd PDP Training & Assistance Session in Cambodia

24 – 28 August 2009

This session was dedicated to the preparation of the Cambodia PDP 2009 (baseline and alternative scenarios, of which at least one environmental scenario), and one-and-a-half day was dedicated to go more in-depth on the social and environmental issues linked with the Energy Sector Development and on their integration in the PDP preparation.

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Spatial Planning Software Training in Cambodia

2nd half of January 2010

The hardware/software is provided by RETA No 6440 Project and the training will be implemented by resource persons from ADB-EOC.

This spatial planning system will give to the PDP Team participants from the Ministry of Environment an effective way to effectively cooperate in the framework of the PDP Team set up by MIME.

This activity is part of the linking Component 1 and 2. It is an extension to the PDP Training in which RETA No 6440 - Component 1 focused on the Power Planning aspect with the OPTGEN software, and Component 2 introduced the environment and social components with this spatial planning software as a tool to provide inputs to the Cambodian PDP Team.

The Cambodia PDP Team will have then in its hands the right tools (OPTGEN & Spatial Planning system) to continue in the future the job started with the PDP Training for Cambodia.

EMP On-the-Job Training-Cum-Field Trip to the Nam Theun II Hydropower Project, Lao PDR

March 2010 (probably delayed at the request of NTPC)

Nam Theun 2 (NT2) is the largest hydropower project is the largest hydropower project in the history of Lao PDR, with a generation capacity of 1,070 MW. It is built on the Nam Theun River, a tributary of the Mekong River. The power generated from NT2 will be exported, to Thailand, once it commences operation in October 2009.

Mitigation and environmental management measures for the NT2 power plant have been recognized as a 'global model'. The EIA/EMP reports for the project are comprehensive, and meet the World Bank and ADB's standards. The EMP is drafted in accordance with the IFI Performance Standards and the Equator Principles.

The EMP-on-the-job training cum-Field Trip, to be implemented in March 2010 (?), will provide government authorities an opportunity to study the EIA/EMP documents and understand how environmental and social impacts mitigation measures have been incorporated into the project design. The training will also develop capacity to study the EMP documents and verify compliance, implementation and effectiveness of EMP in practice.

6. COMPONENT 2 – ACTIVITIES UNDER IMPLEMENTATION (3)

Preparation of a pilot project TOR and Budget to be proposed to ADB for implementation

January – March 2010

Several SEA pilot studies were proposed for potential cooperation between GMS Partners:

- SEA on 8 dams on the Mekong Mainstream in Lao PDR (EOC)
- SEA for Developing the Nam Ou Hydropower cascade, Phongsaly Province, Lao PDR (RETA No 6440)
- SEA of Hydropower Development (11 dams) in the LMB (MRC)
- SEA for Preparation of PDP VII in Vietnam (EOC)
- SEA for the Sustainable Regional Power Master Plan

After discussion with Stakeholders, the SEA for Preparation of PDP VII in Vietnam and SEA for the Sustainable Regional Power Master Plan were selected as potential pilot projects.

6. COMPONENT 2 – ACTIVITIES UNDER IMPLEMENTATION (4)

Pilot Projects (cont.)

SEA for the Preparation of PDP VII in Vietnam was selected by Stakeholders and Component 2 International Experts as the best pilot studies to be implemented under the RETA 6440 project, based on the following grounds:

- Requirement for cooperation with the GMS EOC under the framework of ADB RETA 6440;
- EOC does not have sufficient funds to carry out a full SEA study;
- All legal, institutional arrangements are in place in Vietnam for this SEA (SEA Decree has been passed);
- Preparation work for the SEA has already been initiated by the EOC;
- This SEA will be most relevant to the rest of the GMS countries in the context of power development planning.

6. COMPONENT 2 – ACTIVITIES UNDER IMPLEMENTATION (5)

Pilot Projects (cont.)

SEA for the Preparation of PDP VII in Vietnam

The Ministry of Industry and Trade (MoIT) in Vietnam, with the assistance from the Stockholm Environment Institute (SEI) and the ADB Core Environmental Program completed a Pilot Strategic Environmental Assessment (SEA) of hydropower development in the context of Power Development Plan (PDP) VI.

Based on the recommendations and capacity developed from the PDP VI Pilot SEA, **a SEA for PDP VII** (to be implemented in 2009-2010) will serve as a 'learning by doing' activity. The ADB/EOC will be responsible for overall planning, training and technical quality control, while MoIT (IEV) will be responsible for developing the PDP VII and the associated SEA process in Vietnam.

A detailed TOR and Budget for the Implementation of this SEA will be prepared under RETA 6440 by March 2010. This proposal will be developed in close cooperation with the GMS-EOC and Vietnamese counterparts.

Pilot Projects (cont.)

SEA for the Preparation of a Sustainable Regional Power Master Plan

Following Agence Française de Développement (AFD) proposal of linking RETA No. 6440 (Pack 1) Component 1 and 2 (at the Inception Meeting in Ho Chi Minh City, Vietnam in November 2008), an SEA for the Preparation of a Sustainable Regional Power Master Plan integrating environmental and social sustainability issues into technical and financial issues, for the preparation of a Sustainable GMS Power Master Plan. This pilot project was initially selected by Component 2 Experts in discussion with GMS Stakeholders at the Regional Stakeholders Consultation Workshop (Bangkok, 9-10 July 2009).

It seems now that AFD has secured the funding for the implementation of this SEA, and AFD is preparing a RETA for the implementation of this SEA, therefore, this task will not be undertaken under RETA 6440.

However, Component 1 and component 2 Experts have cooperated with AFD in providing all necessary information related to RETA No 6440 implementation to facilitate its preparation and to avoid duplications.

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7. OTHER PROJECT ACTIVITIES LINKING WITH REGIONAL STAKEHOLDERS: EOC AND MRC

- Participation to the **Special Subregional ADB-GMS Energy Forum** (2nd SEF) (Bangkok, 18-19 March, 2009)
- Participation to the **EOC Clusters Inception Meetings** in Vientiane (12-13 May 2009)
- Participation to the **EOC Clusters Inception Meetings** in Phnom Penh (28 May 2009)
- Participation to the **GMS WGE 15th Annual Meeting** (Bangkok, 2-3 July, 2009)
- **Intern co-contracted by EOC and CEERD** in the framework of RETA 6440 to carry out an analysis of SEA and EIA practices, gaps, weaknesses and needs for capacity development in the GMS
- **GMS WGE Meeting** (25-26 November 2009) – SEA Report distributed

7. OTHER PROJECT ACTIVITIES LINKING WITH REGIONAL STAKEHOLDERS: EOC AND MRC (2)

- EOC and MRC Participation to the RETA No. 6440 **Regional Stakeholders Consultation Workshop** (Bangkok, 9-10 July, 2009)
- Participation to the 3rd **Subregional Energy Forum** (SEF) in Phnom Penh (20-21 August 2009)
- EOC and MRC Participation to Component 1 - 2nd **PDP Training Session in Cambodia** (24-28 August 2009)
- EOC and MRC Participation to Component 2 – **SEA and EIA Trainings** in Bangkok (14-18 September 2009)
- EOC Participation to the **Spatial Planning Software Training** in Cambodia (2nd half January 2010)

7. OTHER PROJECT ACTIVITIES LINKING WITH REGIONAL STAKEHOLDERS: AFD

SEA for the Preparation of a Sustainable Regional Power Master Plan

- The Agence Française de Développement (AFD) has initiated the preparation of arrangements for conducting an SEA of the Regional Power Master Plan for the GMS, which will serve as a linkage between Components 1 and 2 under RETA No. 6440. The new RETA is to be implemented by the Infrastructure Division of the Southeast Asia Regional Department (SERD) and coordinated by AFD. The new RETA will,

    1) **Integrate environmental, social, energy security and economic pricing considerations into the regional power planning process**
    2) **Strengthen regional capacities to manage environmental and social impacts of power projects, and**
    3) **Integrate energy security concerns in national and regional power development plans through capacity building activities at national levels.**

- RETA No 6440 Experts have cooperated with AFD in providing all necessary inputs related to RETA No 6440, to avoid duplications and time loss in the framework of the implementation of this new AFD RETA.

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8. COMPONENT 2 – DELIVERED OUTPUTS

Component 2 National Experts have delivered several **Country Reports** as stated in their respective STORs. These reports consist of:

- Desk Review of Policy and Legislation;
- Status of Environmental Impact Assessment Tools in Environmental Policies and Legislations;
- Capacity Building Needs of National Utilities, Agencies and Government Ministries for EIA/EMP/SEA Implementation;
- Key Strategic Issues for Power Sector Development;
- Training Materials, Guidelines, Policies and References to SEA.

These Reports are still under development

8. COMPONENT 2 – DELIVERED OUTPUTS (2)

- **Regional Review Report** of Existing Environmental Policies, Legislation, Regulations on SEA, and Systematic Assessment of the Weaknesses and Needs for Capacity Development has been completed by an intern co-contracted by CEERD and EOC under the framework of RETA 6440.
- **Workshop Proceedings** of the Regional Stakeholders Consultation Workshop (9 – 10th July 2009)
- **Training Report and Training Materials** of the Regional EIA On-the-Job Training (14 – 18 September, 2009)
- **Training Report and Training Materials** of the Regional SEA On-the-Job Training (14 – 18 September, 2009)

8. COMPONENT 2 – OUTPUTS TO BE DELIVERED

A number of Component 2 outputs are to be completed in the coming months including:

- **Regional Review Report** of Existing Environmental Policies, Legislation, Regulations on EIA/EMP, and Systematic Assessment of the Weaknesses and Needs for Capacity Development
- **Reports on a Proposed Pilot Study** on the SEA of PDP VII in SR Vietnam
- **Training Report and Training Materials** of the On-the-Job Training Cum Field Trip on EMP
- **Proposal of an EMP Guideline** to assist GMS Countries in establishing regular monitoring mechanisms.

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9. COMPONENT 2 – CONCLUSIONS AND THE WAY FORWARD

Obstacles to the implementation of capacity building efforts for GMS institutions included:

- Insufficient funding to conduct national-level trainings on EIA and SEA for GMS institutions;
- Limited Number of Regional Travels for Comp. 2 (mostly used by Comp. 1);
- Unavailability of the NT2 Power Project Team at the period proposed for the EMP Training (November – December 2009);
- No link between Component 1 and 2 being drafted in the TORs;
- Difficulty to finance participants from Myanmar.

These issues were resolved by the Component 2 Team by:

- Inviting a greater number of participants (6) to SEA and EIA trainings from each country;
- Postponing the EMP Training to March 2010 (**?**) in agreement with NTPC;
- Environmental & Social considerations were integrated to Comp. 1 organized PDP Trainings in Cambodia. An extension would be the Spatial Planning Software Training.

Next Steps and Alternative Priorities:

- Organization and Conduct of Regional On-the-Job EMP Training-Cum-Field Trip;
- Pilot Study Proposal for an SEA for the Preparation of PDP VII in Vietnam.

9. COMPONENT 2 – CONCLUSIONS AND THE WAY FORWARD (Cont.)

- RETA No. 6440 Component 2 Activities have been implemented satisfactorily, and good evaluations have been received by GMS participants to Component 2 workshop and training programs.
- At present, Component 2 activities are well in line with the initial implementation schedule, except for the EMP On-the-Job Training activity, which has been delayed (without any impact on the overall project schedule) due to the un-availability of Nam Theun 2 NTPC Experts for the initially scheduled period (Nov-Dec 2009).
- So, up-to now, there have been no fundamental obstacles for the capacity building activities with GMS institution, apart a delay in the EMP Training implementation.
- The Component 2 Team has been systematically developing synergies with Component 1 and with other regional institutions working in energy and environmental fields in the GMS, such as ADB-EOC and MRC, within the limits of our TOR! So, we think that up-to now, both Components have been well coordinated.
- Several of the project activities and outputs are to be implemented during the coming months, including the preparation and conduction of EMP On-the-Job Training-Cum-Field Trip and the corresponding reports, and the preparation of a detailed TOR and proposed budget for SEA for PDP VII in Vietnam in close cooperation with ADB-EOC and the Vietnamese counterparts.

10. COMPONENT 2 – FINAL RECOMMENDATIONS

- Our main final recommendations to PWG, the RPTCC and the GMS Countries would be to systematically include Environmental and Social issues when planning their National Power Systems, as well as in the framework of the preparation of the Regional Master Plans;
- Up-to now only Vietnam has included in its legislation the obligation of preparing an SEA for the PDP VII which has recently started;
- The SEA on PDP VII will be crucial for all the GMS Countries, as it will serve as a Pilot Guideline for all GMS Countries, as barriers will be analyzed as well as the way to solve them;
- EMP is stated in most of the GMS Countries legislations, but at present EMP is not really implemented in these Countries, and a recommendation would be for the Countries to give particular attention to this process. The EMP Training and Field Trip will be fundamental to raise Countries' awareness and to enhance their capacity to apply EMP processes.

ADB

Thank you for your attention

Greater Mekong Sub-region (GMS)
Eight Meeting of the Focal Group *(FG-8)*

Progress of Cambodia Power Development Plans & Transmission Interconnection Projects

Ministry of Industry, Mines and Energy
Electricité du Cambodge

Luangprabang, Lao PDR, 26 November, 2009

CONTENT

- ✓ Current Development of Power Sector
- ✓ Outlook of Power Development Plan

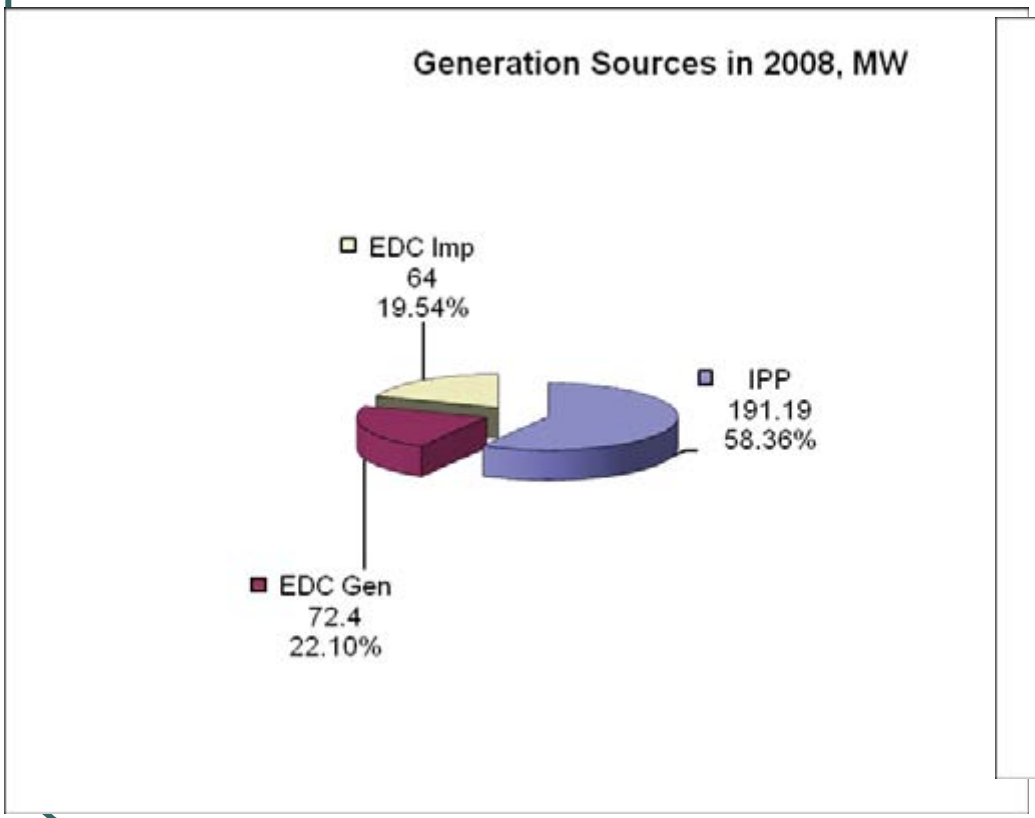
Current Development of Cambodia Power Sector

Highlights on major achievements

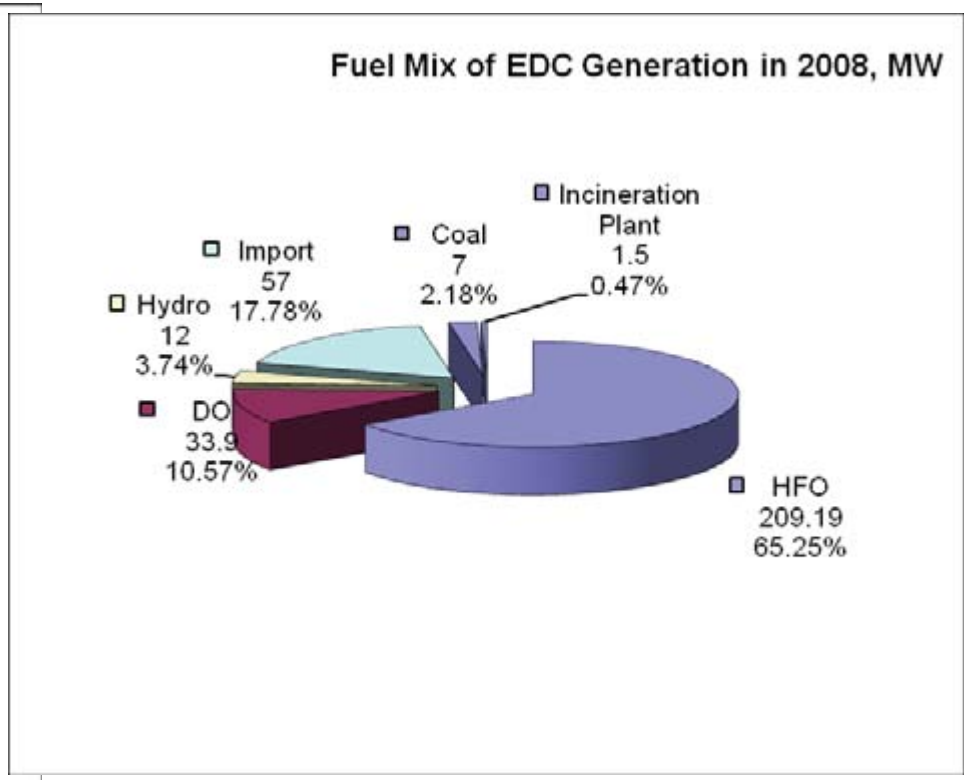
Year	2002	2003	2004	2005	2006	2007	2008
Generation							
Installed Capacity,? MW	157.4	158.4	182.2	223.25	276.36	390.01	390.01
Max generation,? MW	123	124	158.3	173.22	241.26	358.06	358.06
Energy Generation,? GWh	547.92	632.1	761.13	905.94	1,106.47	1,378.117	1,620.206
Peak Demand,? MW	99.29	118.52	140.5	168.89	207.87	262.165	306.00
Sales, GWh	464.2	540.6	644.5	872.23	974.62	1222.52	1,448.101
Total System Loss, %	13.10%	12.70%	13.00%	11.35%	10.69%	10.37%	10.03%
# Customers			201,215	217,453	263,730	286,660	318,475
HV Cct-km	129	129	129	129	129	333	333
# HV Substation	4	4	4	4	4	7	7

Generation

Generation Sources

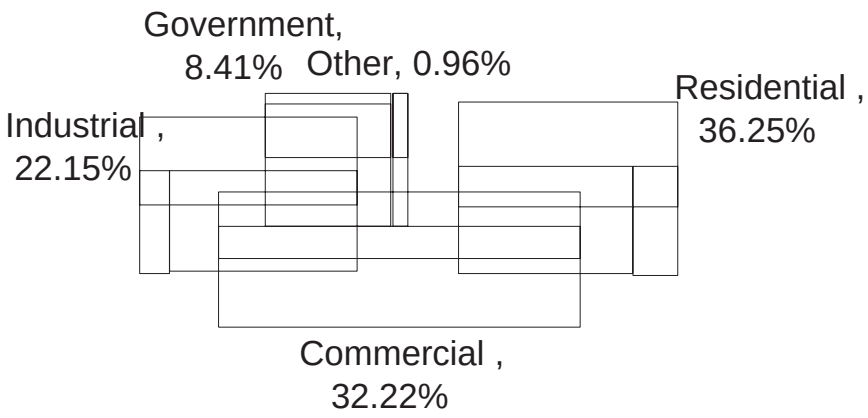


Fuel Mixes

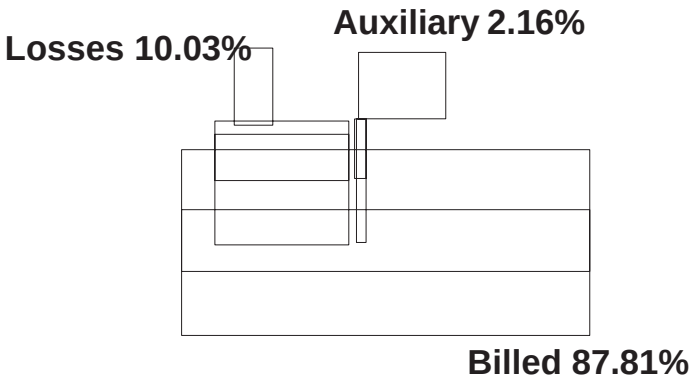


Business 2008 (EDC's Phnom Penh only)

Customer by sector



Energy sale vs. losses



Customers

EDC	# of Customers					Growth, %			
	2004	2005	2006	2007	2008	2005-2004	2006-2005	2007-2006	2008-2007
Phnom Penh	150,726	162,605	177,172	192,697	211,680	7.31	8.22	8.05	9.67
Provinces	50,489	54,835	86,561	93,963	103,825	7.92	33.65	7.88	10.63
Total	**201,215**	**217,440**	**263,733**	**286,660**	**315,505**	**7.46%**	**17.55%**	**8.00%**	**9.14%**

Outlook of Power Development Plan

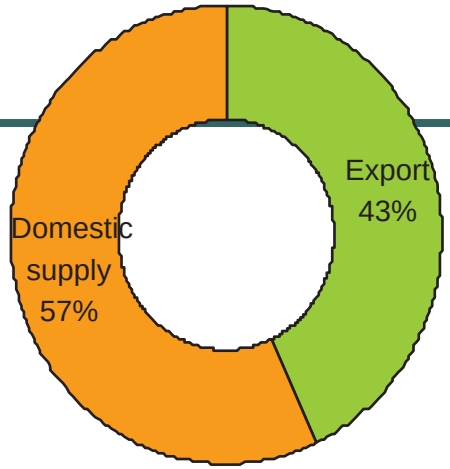
Policy Targets

- 100% of villages have access to electricity services by 2020
- 70% of rural households have access to quality electricity services by 2030

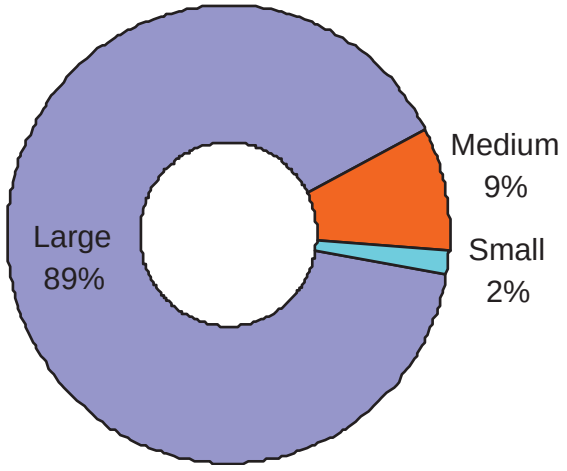
Policy (Cont')

- Projection in 2020, the Electricity supply about 6,000 MW.
- Domestic Supply about 3,500 MW and 18,597 GWh,
- Export more than 2,500 MW
- High potential of hydro source about 10,000 MW

Projection of Electricity Supply in year 2020
6,000 MW



Share of Hydro Power Potential 7,600 MW



Generation Sources Plan

A1- Project Existing

No.	Power-Project	Install Capa.MW	IA/PPA/LA	Company	Country	COD
1	Kirirom I	12	BOT	CETIC	China	2002
2	Ochum	1		EDC	Cambodia	1993
3	Oromis-Omleng	0.37		J-Power	Japan	2009

A2- Project Under Implementation

No.	Power-Project	Install Capa.MW	IA/PPA/LA	Company	Country	COD
1	Kamchay Hydro	193	BOT	Synohydro	China	2011
2	Coal Power Plant I	100	BOO	Leader	Cambodia	2011
3	Kirirom III	18	BOT	CETIC	China	2012
4	Atay Hydro	110	BOT	CYC	China	2012
5	Coal Power Plant II	100	BOO	MKCSS	Cambodia	2012
6	Tatay Hydro	246	BOT	Chinese	China	2013
7	LSt. Russei Chhrum	338	BOT	Chinese	China	2013

Generation sources plan (Con't)

A3- Project Under MOU Study

No.	Hydro-Project	Install Capa.MW	IA/PPA/LA	Company	Country	Plan
1	Sambor Hydro	2,600	F/S	--	China	2019
2	Lower Sesan II & Lower Srepok II	420	PFS	--	Vietnam	2016
3	Lower Sesan III	375	F/S	--	Korea	
4	Lower Srepok III	330	F/S	--	China	
5	Lower Srepok IV	235	F/S	--	China	
6	Battambong I	24	F/S	--	Korea	
7	Battambong II	36	F/S	--	Korea	
8	Stung Pursat I	75	F/S	--	China	
9	Stung Pursat II	17	F/S	--	China	
10	Prek Liang I	64	F/S	--	Korea	
11	Prek Liang II	64	F/S	--	Korea	
12	Stung Sen	40	F/S	--	Korea	
13	Stung Treng	980	F/S	--	Russia	

Hydro Power Site

-The rest of hydro potential around 3000 MW.

72%

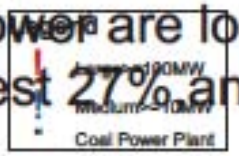
MOU
Over 6000 MW

1%

- Cambodia has a huge of hydro potential about 10,000 MW
- The existing data for the Master Plan Study on Hydropower in Cambodia is around 7,500 MW. (75%). within the 29 sites of Hydropower sources.
- Currently the huge of hydro power are located in the North-East 72% and North-West 27% and Others 1% only.

27%

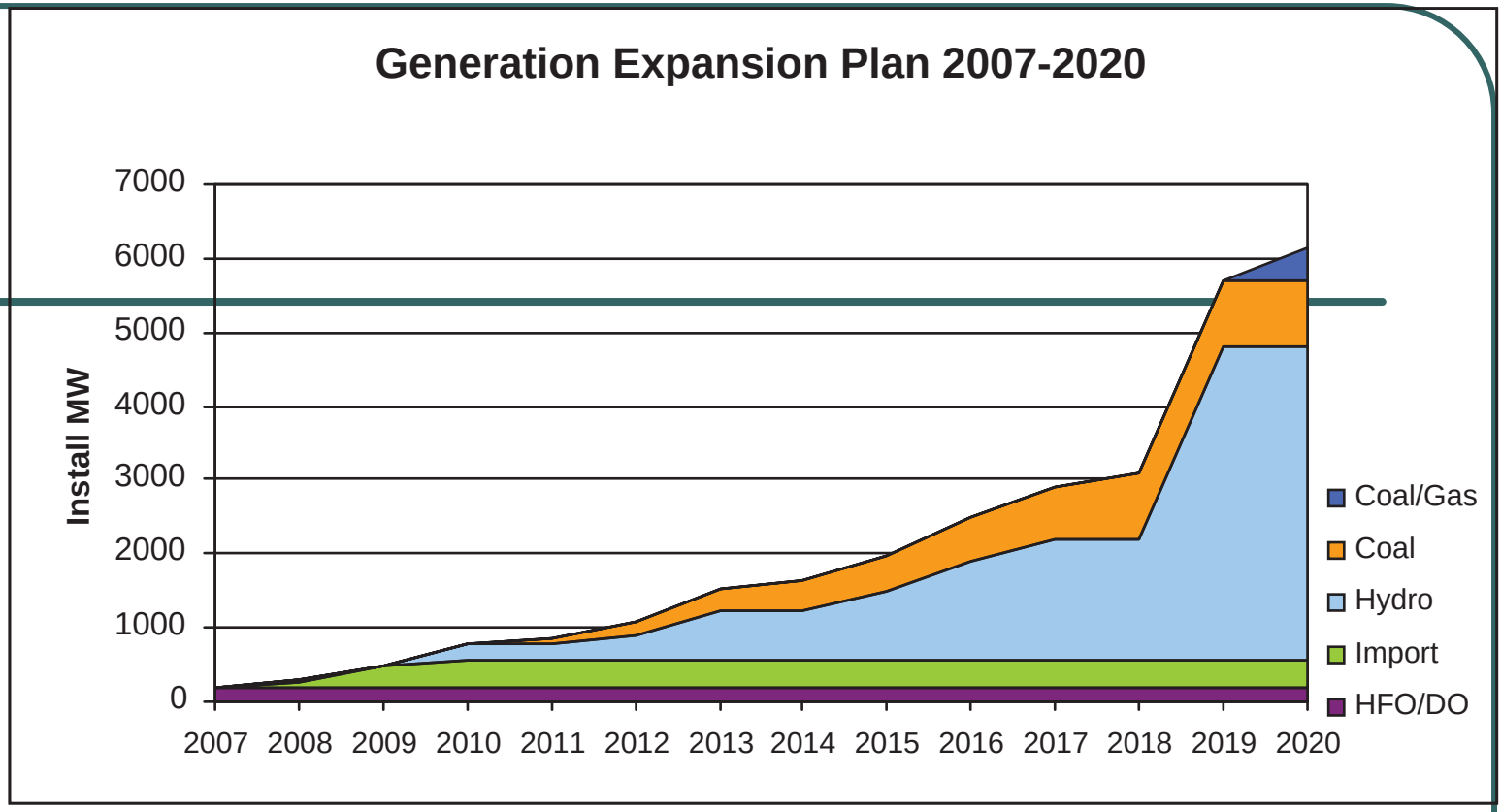
Under Construction
about 1000 MW



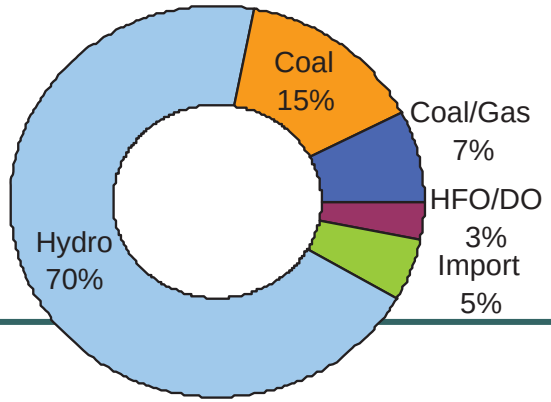
Generation Expansion Plan (2007-2020)

No.	Domestics Generation Expansion Plan	Fuel Type	Install Capa.MW	Year
1	Kamchay Hydro Power Plant	Hydro	193	2011
2	Kirirom III Hydro power Plant	Hydro	18	2012
3	200 MW Coal Power Plant (I) in Sihanouk Ville - Phase 1	Coal	100	2011
4	Atay Hydro Power Plant	Hydro	110	2012
5	200 MW Coal Power Plant (I) in Sihanouk Ville - Phase 2	Coal	100	2012
6	700 MW Coal Power Plant (II) -Phase 1	Coal	100	2013
7	Lower Stung Russei Chhrum Hydro Power Plant	Hydro	338	2013
8	Tatay Hydro Power Plant	Hydro	246	2013
9	700 MW Coal Power Plant (II) -Phase 2	Coal	100	2014
10	700 MW Coal Power Plant (II) -Phase 3	Coal	100	2015
11	700 MW Coal Power Plant (II) -Phase 4	Coal	100	2016
12	Lower Sesan II + Lower Srepok II	Hydro	420	2016
13	Stung Chay Areng Hydro Power Plant	Hydro	260	2017
14	700 MW Coal Power Plant (II) -Phase 5	Coal	100	2017
15	Add 700 MW Coal Power Plant at Offshore	Coal	200	2018
16	Sambor Hydro Power Plant	Hydro	450	2019
17	Coal Power Plant (III) or Gas Power Plant	Coal/Natural Gas	400	2020
Total			**3,345**	

Cont'...



Projection of Electricity Generation by Fuel in 2020, 6000 MW



The Projection 2020:

-Domestics Supply 3,500 MW (57%)

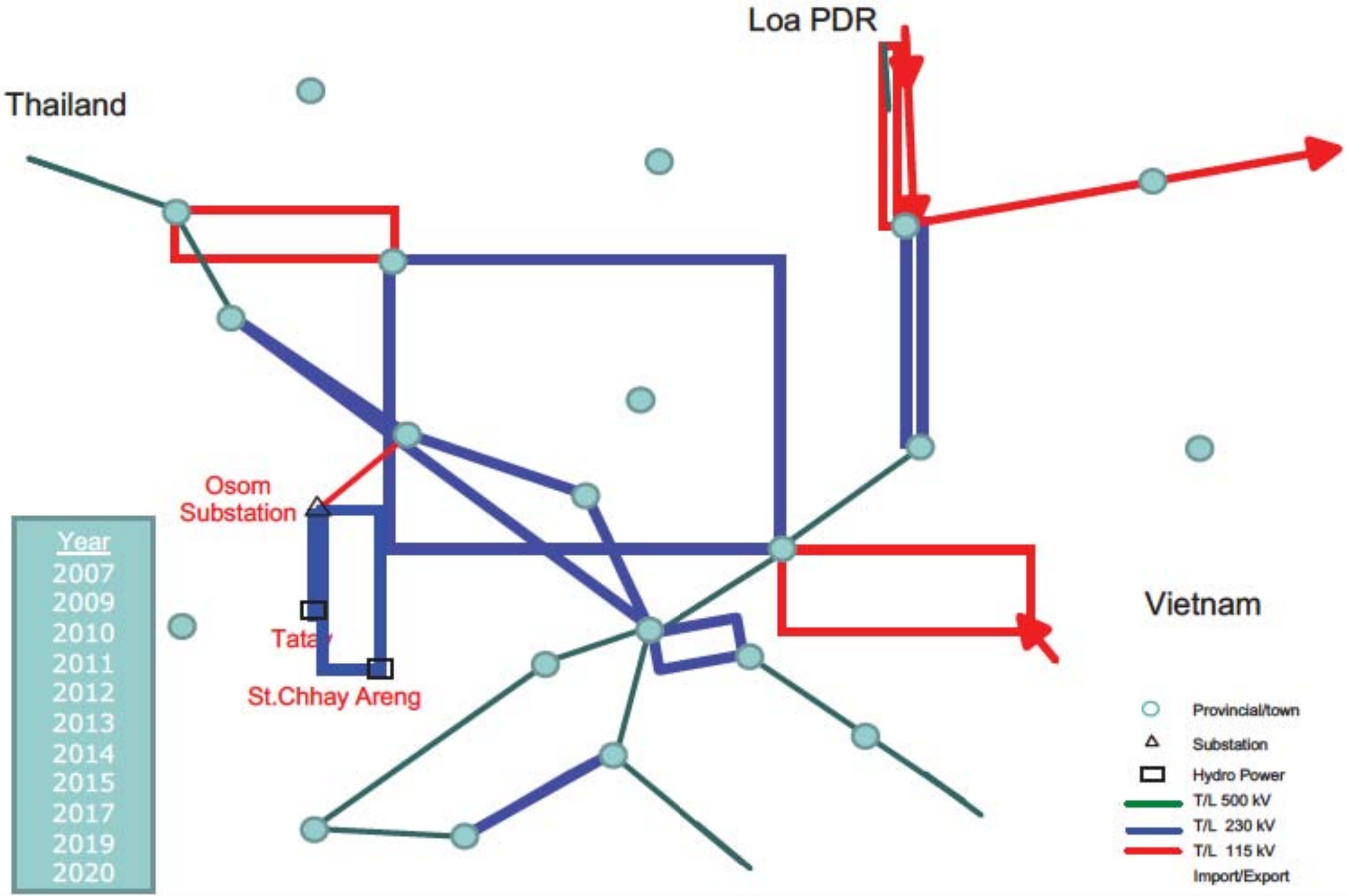
-Export more than 2,500 MW (43%)

Development of Transmission

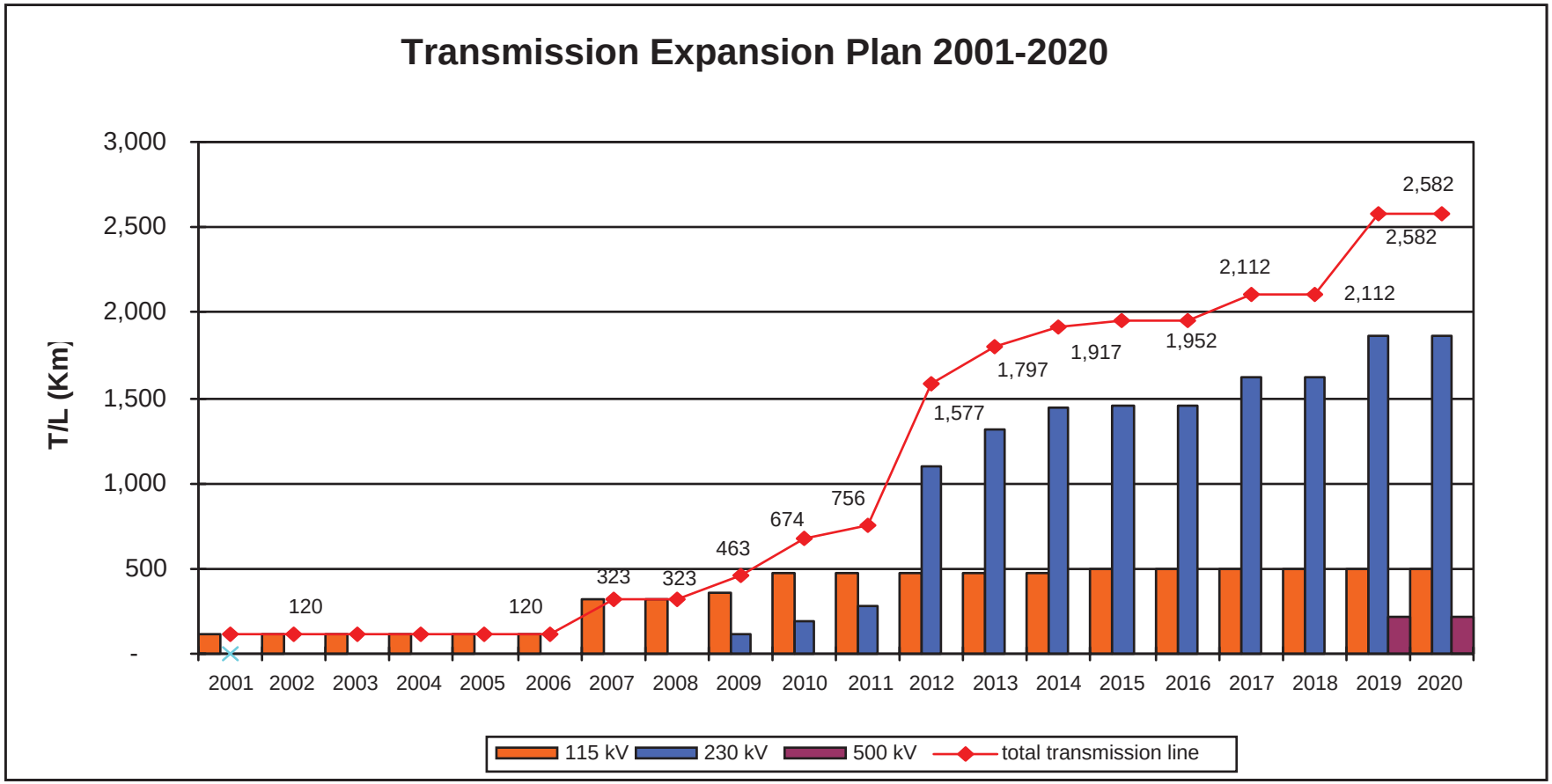
No.	Transmission Expansion Plan	Distance (Km)	Grant/ Invest	Year
1	115 kV, Kirirom I - Phnom Penh	120	CETIC	2001
2	115 kV, Thailand - Bantey Meanchey - Siem Reap - Battambong	203	CPTL	2007
3	220 kV, Phnom Penh - Takeo - Viet Nam, (construct the substation in Takeo),	110	ADB & NFD	2009
4	115 kV, Reinforcement of transmission line and construct substation at WPP (West Phnom Penh),	30	WB	2009
5	230 kV, Takeo - Kompot, (construct substation in Kompot),	87	KFW	2010
6	115 kV, Steung Treng - Loa PDR, (construct substation in Steung Treng),	56	WB	2010
7	110 kV, Kampong Cham - Viet Nam, (construct 3 substations: - Kampong Cham, - Soung, - Pongnearkreak),	68	WB	2010
8	230 kV, Kampot - Sihanouk Ville, (construct 2 substations: - Vealrinh - Sihanouk Ville),	82	ADB & JBIC	2011
9	230 kV, Phnom Penh - Kompong Chhnang - Pursat - Battambong, (construct 3 substations: - Kompong Chhnang, - Pursat, - Battambong),	310	CYC	2012
10	230 kV, Pursat - Osom, (construct 1 substation in Osom Commune),	175	CYC	2012
11	230 kV, Kampong Cham – Kratie,	110	CUPL	2012
12	230 kV, Kratie – Stung Treng,	126	INDIA	2012
13	230 kV, Phnom Penh – Kampong Cham,	100	CUPL	2012
14	220 kV, Phnom Penh – Sihanoukville, along national road 4,	220	CHMC	2013

Development of Transmission (Cont'...)

No.	Transmission Expansion Plan	Distance Km	Grant/ Invest	Year
15	230 kV, East Phnom Penh – Neakleung – Svay Rieng, (construct 2 substations: - Neakleung, - Svay Rieng)	120	CHMC	2014
16	230 kV, Stung Tatay Hydro – Osom substation,	15	CHMC	2015
17	115 kV, West Phnom Penh – East Phnom Penh (construct substation GS4 at South Phnom Penh)	20	WB	2015
18	230 kV, Reinforcement of transmission line on the existing pole, Phnom Penh – Kampong Cham (transmit power from Lower Sesan II + Lower Srepok II)	100	CUPL	2017
19	230 kV, Stung Chay Areng - Osom substation	60	CSG	2017
20	230 kV, Kampong Cham - Kampong Thom - Siem Reap, (construct 1 substation in Kampong Thom)	250	KTC	2019
21	500 kV, Loa PDR (Ban Sok)- Steung Treng – Vietnam (Tay Ninh), (construct substation in Steung Treng)	220	ADB	2019
	Total Transmission Line	**2,582.0**		


Loa PDR
Thailand
Osom
Substation
St.Chhay Areng
Vietnam
Year
2007
2009
2010
2011
2012
2013
2014
2015
2017
2019
2020
Provincial/town
Substation
Hydro Power
T/L 500 kV
T/L 230 kV
T/L 115 kV
Import/Export

Transmission Expansion Plan (2001 – 2020)



Distribution and Rural Electrification Plan up to 2020

Electrification plan:

- Grid electrification with government initiative and off-grid electrification with private sector initiatives.
- Electrification and financial demand:

Type of electrification	# of villages	Newly electrified h/h	Total cost, M$
Grid electrification	6,411	600,000	308
Off-grid electrification	5,320	272,000	147
Total	11,731	872,000	455

Distribution and Rural Electrification Plan up to 2020 (con't)

Financial Demand by type of materials:

Type of materials	EDC's Zone	Other Zone	Total
New MV system, US$	33,984,844	201,205,684	235,190,528
Transformers, US$	1,669,500	0	1,669,500
New LV system, US$	2,024,769	57,974,957	59,999,726
LV Metering systems, US$	4,233,253	48,962,993	53,196,247
Total	41,912,366	308,143,630	350,056,001

Thank you for your attention

中国南方电网
CHINA SOUTHERN POWER GRID

Update For CSG Power Grid Planning & GMS Cooperation Projects

China Southern Power Grid Co., LTD

November, 2009

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CHINA SOUTHERN POWER GRID

Contents :

- ✓ Status of CSG in 2008
- ✓ Power Grid Planning
- ✓ GMS Cooperation Projects

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Status of CSG in 2008

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CSG : Status in 2008

Area :

1,000,000km^2

GDP 5.34 Trillion Yuan
RMB 17.7% of China

Population :

236 Million

17.7% of China

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CHINA SOUTHERN POWER GRID

CSG : Status in 2008

Total Capacity: 140GW ▲9.24%

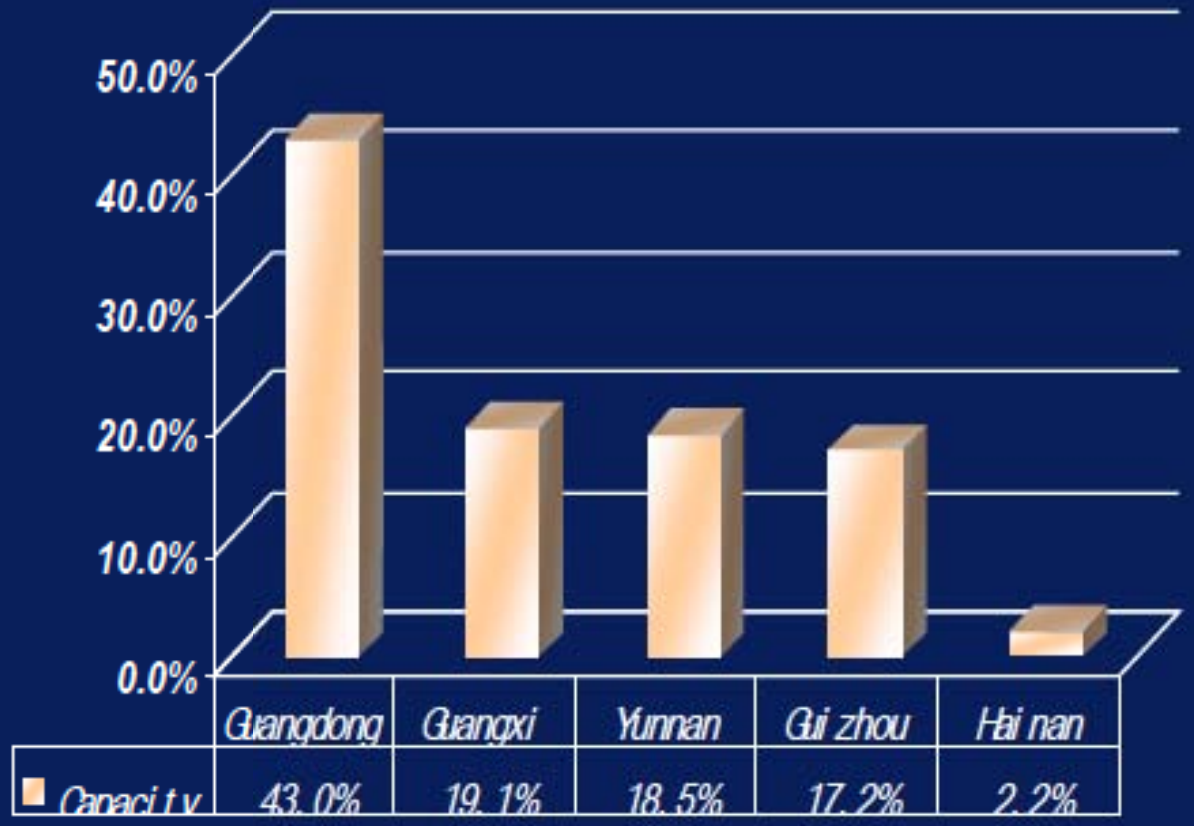
Hydro : 47.7GW

Thermal: 85.6GW

Nuclear: 3.8GW

Renewable : 0.43GW

(Renewable refers to wind, solar and bio-mass)



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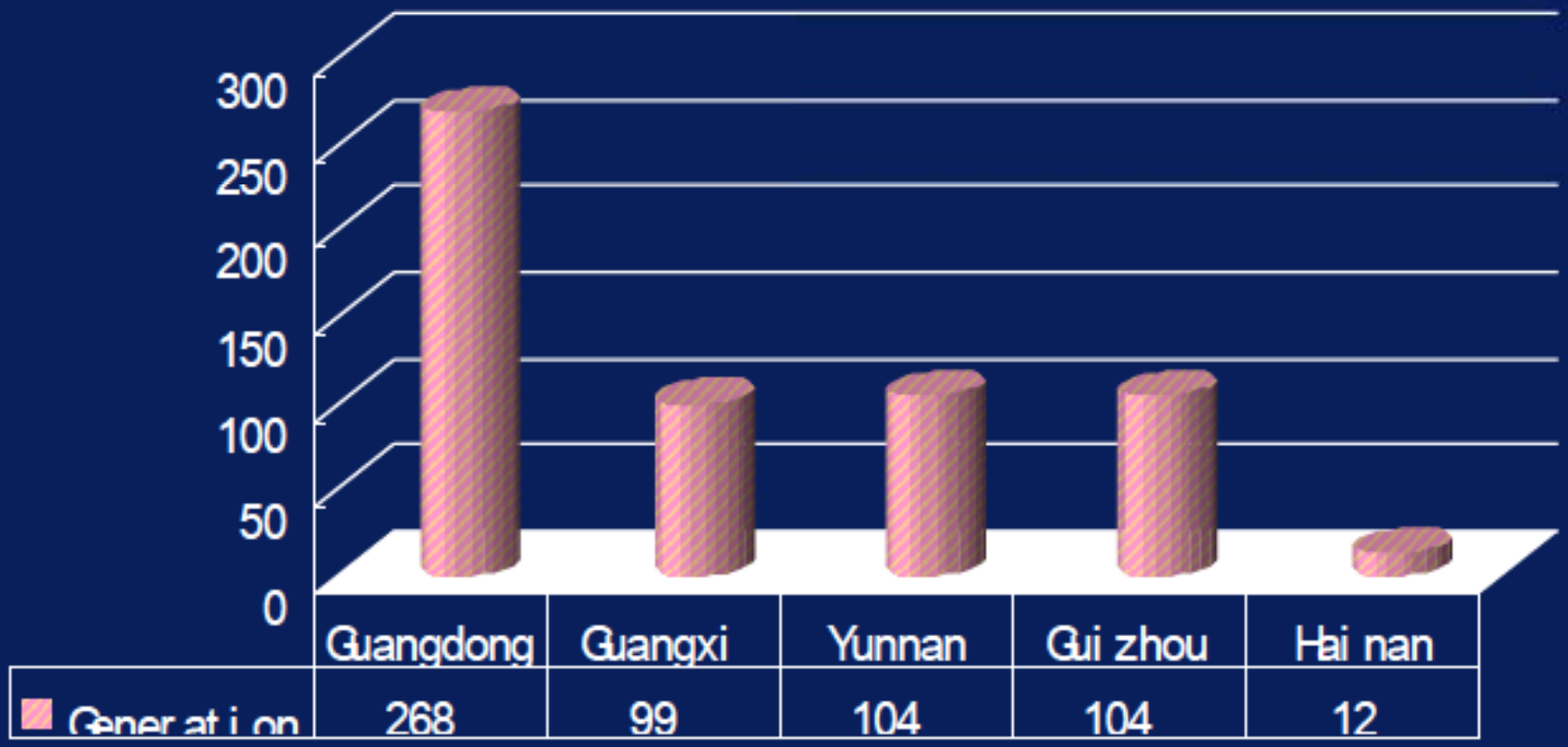
CSG : Status in 2008

Generation: **588 TWh** ▲ **6.22%**



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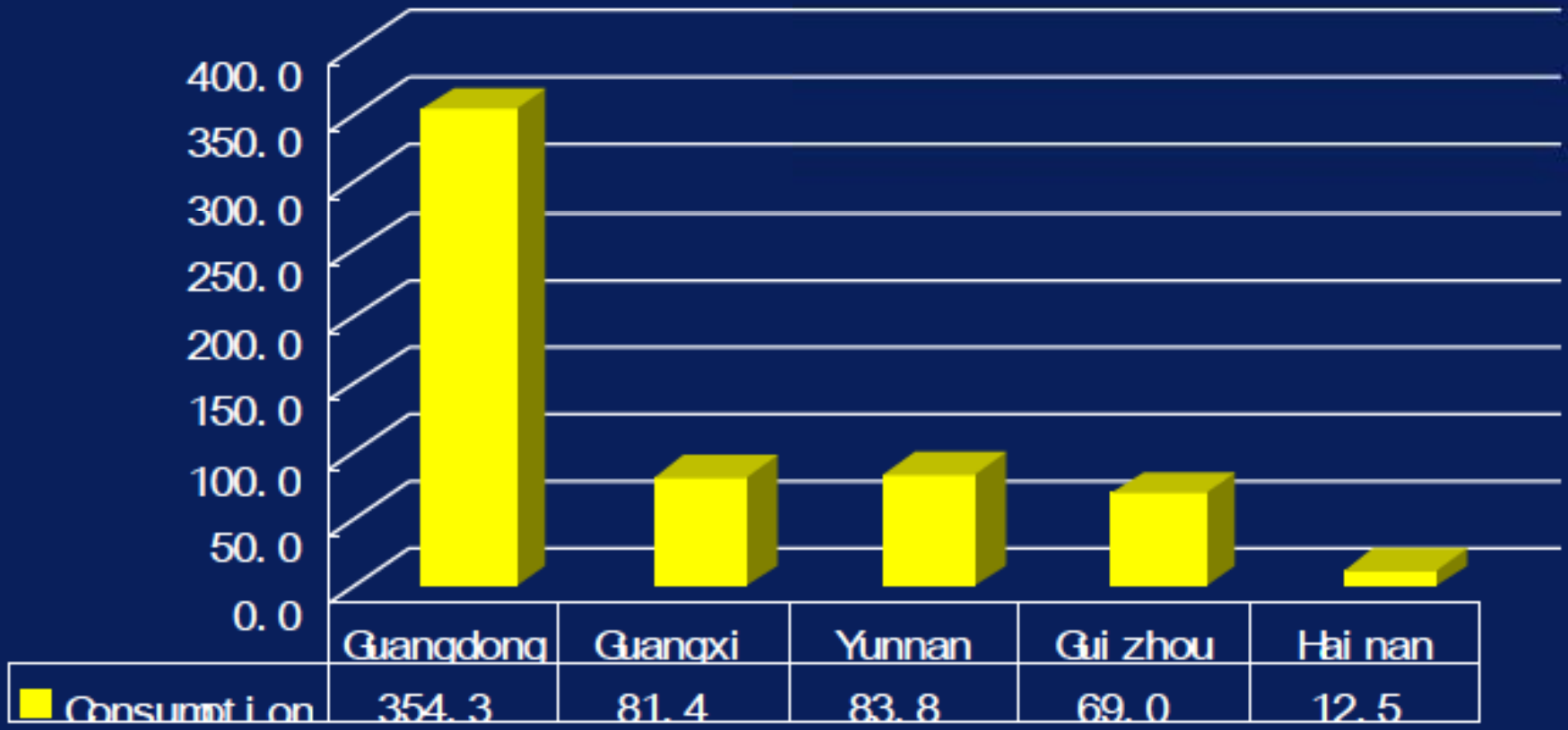
CSG : Status in 2008

Consumption: 594TWh ▲ 5.37%



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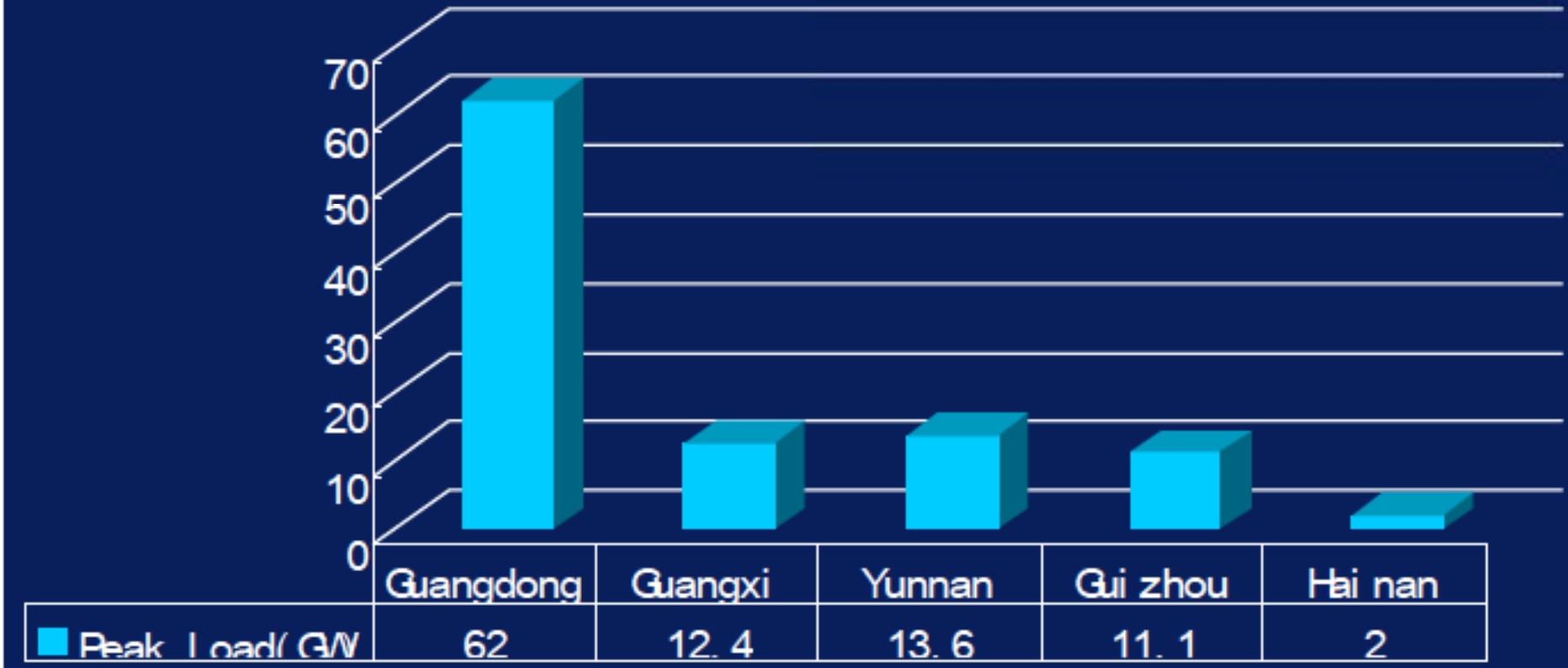
CSG : Status in 2008

Peak Load: **99.2GW** ▲ **13.6%**



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CSG : Status in 2008

Capacity of 500kV Transformers	**99.3 GVA**
Capacity of 220kV Transformers	**151 GVA**
Capacity of HVDC	**7.8 GW**

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CSG： Status in 2008

Length of 500kV AC Transmission Lines 26k km

Length of 220kV Transmission Lines 41k km

Length of HVDC Transmission Line 3k km

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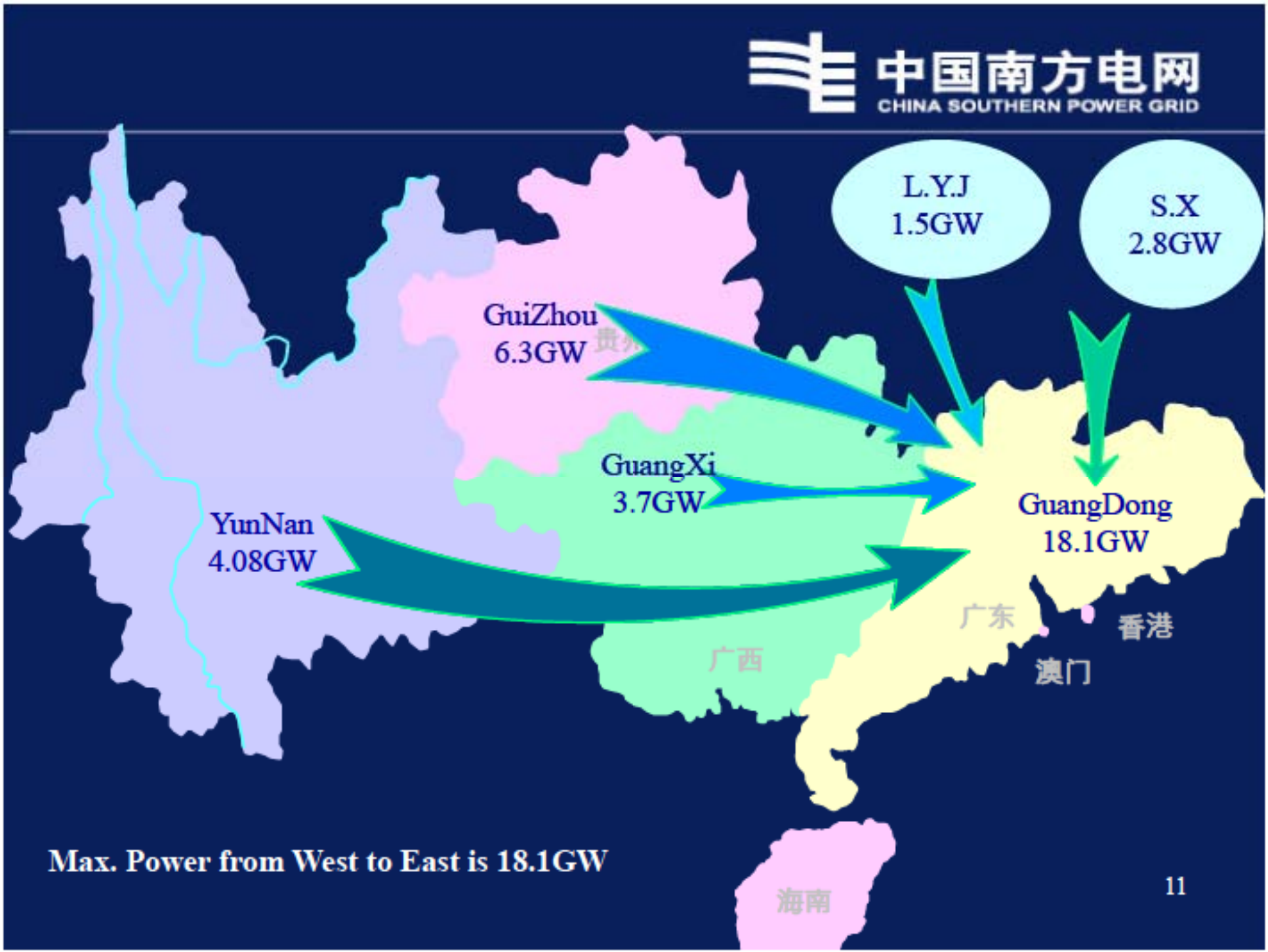

Max. Power from West to East is 18.1GW

CSG : Status in 2008

Power exchange between regions

Hongkong	7.7TWh
Macau	2.3TWh
Chongqing	2.3TWh
Hunan	3.3TWh
Vietnam	3.3TWh

CSG : Status in 2008

Average generation cost (thermal power)	447 yuan / MWh
Average consumption price	609 yuan / MWh

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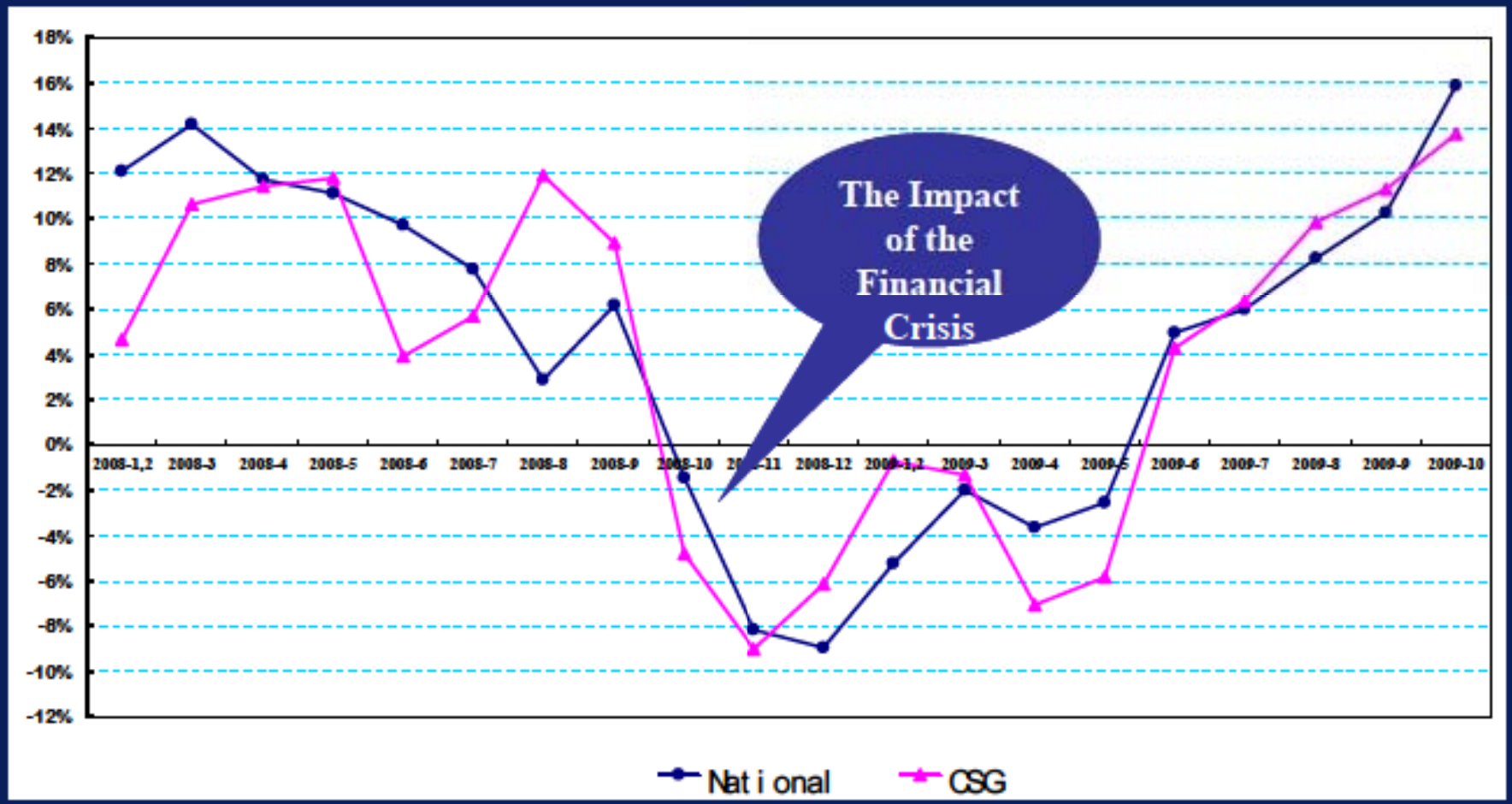
Growth rate of electricity consumption in China and CSG since 2008



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Power Grid Planning

中国南方电网 CHINA SOUTHERN POWER GRID

Demand Forecast from 2010 to 2015

- ✓ **GDP** **Increase rate 9.1%～11.4%/year**
- ✓ **Consumption** **1082TWh in 2015 Increase rate 8.6%/year**
- ✓ **Peak load** **176GW in 2015 Increase rate 8.7% /year**

	2008	2010	2015	2008-2010	2010-2015
Consumption（TWh）	594.4	717.0	1082	10.2%	8.6%
Peak（GW）	100.2	116.1	176.3	7.6%	8.7%

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Increased Capacity of Power (2010-2015)

Hydro	43,450MW
Thermal	34,240MW
Nuclear	10,150MW
Renewable	1,430MW
Total	89, 270MW

Capacity of Power in 2015

Total Capacity: 258,070 MW

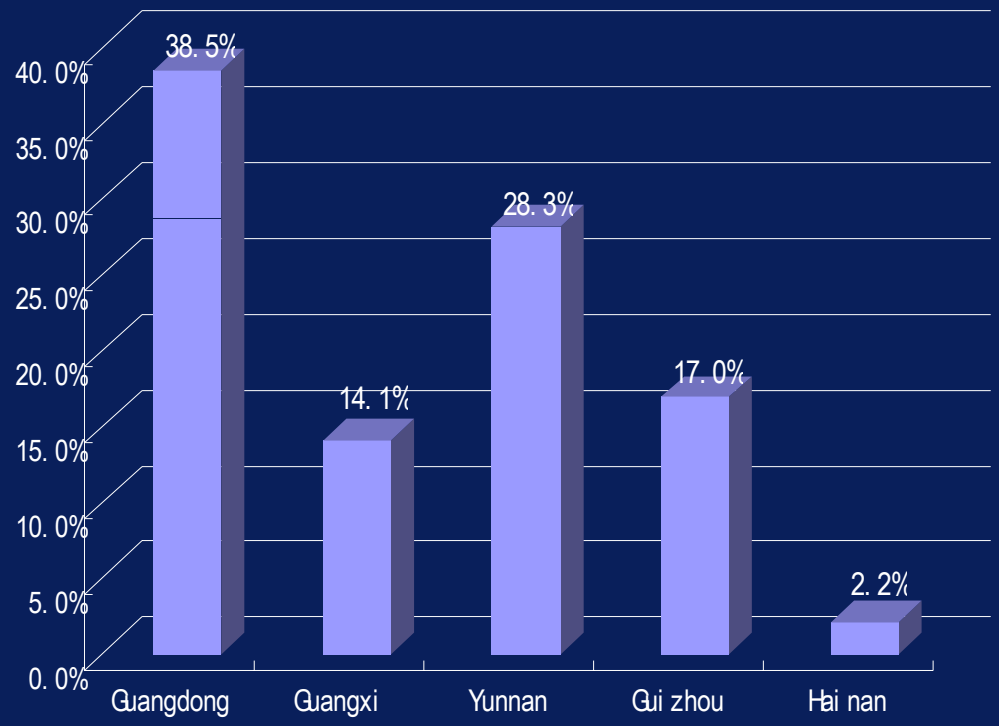
Hydro : 106,330 MW

Thermal: 127,670 MW

Nuclear: 14,930 MW

Gas: 6,510 MW

Renewable: 2,630 MW



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Resolution of the Board

After the 2008 snow, a project for strengthening the transmission network has been proceeded for:

- ✓ **Improve the transmission capacity of major transmission network**
- ✓ **Reduce unit cost of transmission capacity investment**
- ✓ **Improve the margin of transient stability**
- ✓ **Decrease the net lose of power transmission from the west to the east**
- ✓ **Improve the reliability of power supply**

The project has been implemented as planned without any adjustment in spite of the economic crisis.

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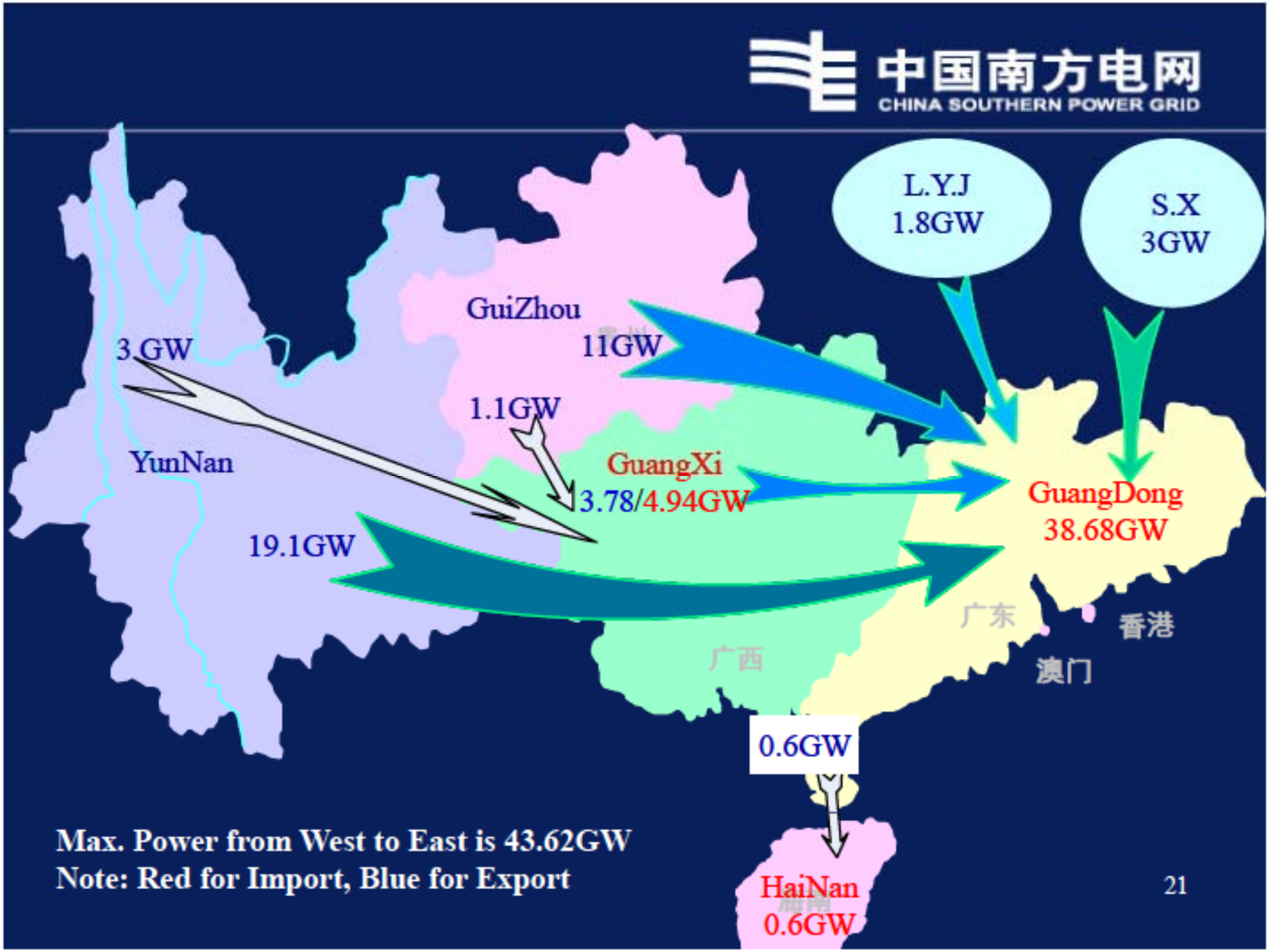
CHINA SOUTHERN POWER GRID

Resolution of the Board

A special work for improving of distribution networks rapidly in city and countryside which will be lasted for 5 years has been proceeded for:

- ✓ **Providing reliable power supply for customer**
- ✓ **Prepare enough power supply in advance for economic development in the next cycle**
- ✓ **customer interrupt time per year in major city ≤ 5 hours**
- ✓ **rate of statistical net loss in major city ≤ 4.5%**
- ✓ **30 billion RMB will be invested for this work in each year of 2009 and 2010 and more than 100 billion RMB will be invested into strengthening the transmission network and distribution network of CSG.**

A special leading group and working group has been established for this work.


中国南方电网
CHINA SOUTHERN POWER GRID
L.Y.J
1.8GW
S.X
3GW
GuiZhou
11GW
3 GW
1.1GW
YunNan
GuangXi
3.78/4.94GW
GuangDong
38.68GW
19.1GW
广东
香港
广西
澳门
0.6GW
HaiNan
0.6GW
Max. Power from West to East is 43.62GW
Note: Red for Import, Blue for Export

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UHVDC Voltage：±800kV
Current：3.125kA
T/L:1412km
Capability:5GW

Chuxiong UHVDC Substation

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CHINA SOUTHERN POWER GRID

Area：0.3km^2

Shuidong UHVDC Substation

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Area：0.3km^2

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Sea Cable
2 lines
HVAC Voltage：500kV
T/L:31km of each line
Capability: 2×600MW

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CHINA SOUTHERN POWER GRID

GMS Cooperation Projects

International Cooperation Projects

- ☆ Sino-Vietnam Cooperation
- ☆ Sino-Laos Cooperation
- ☆ Sino-Cambodia Cooperation
- ☆ Sino-Thailand Cooperation
- ☆ Sino-Myanmar Cooperation

Sino-Vietnam Cooperation

1. Power Supply to Vietnam

3 220kV + 4 110kV lines

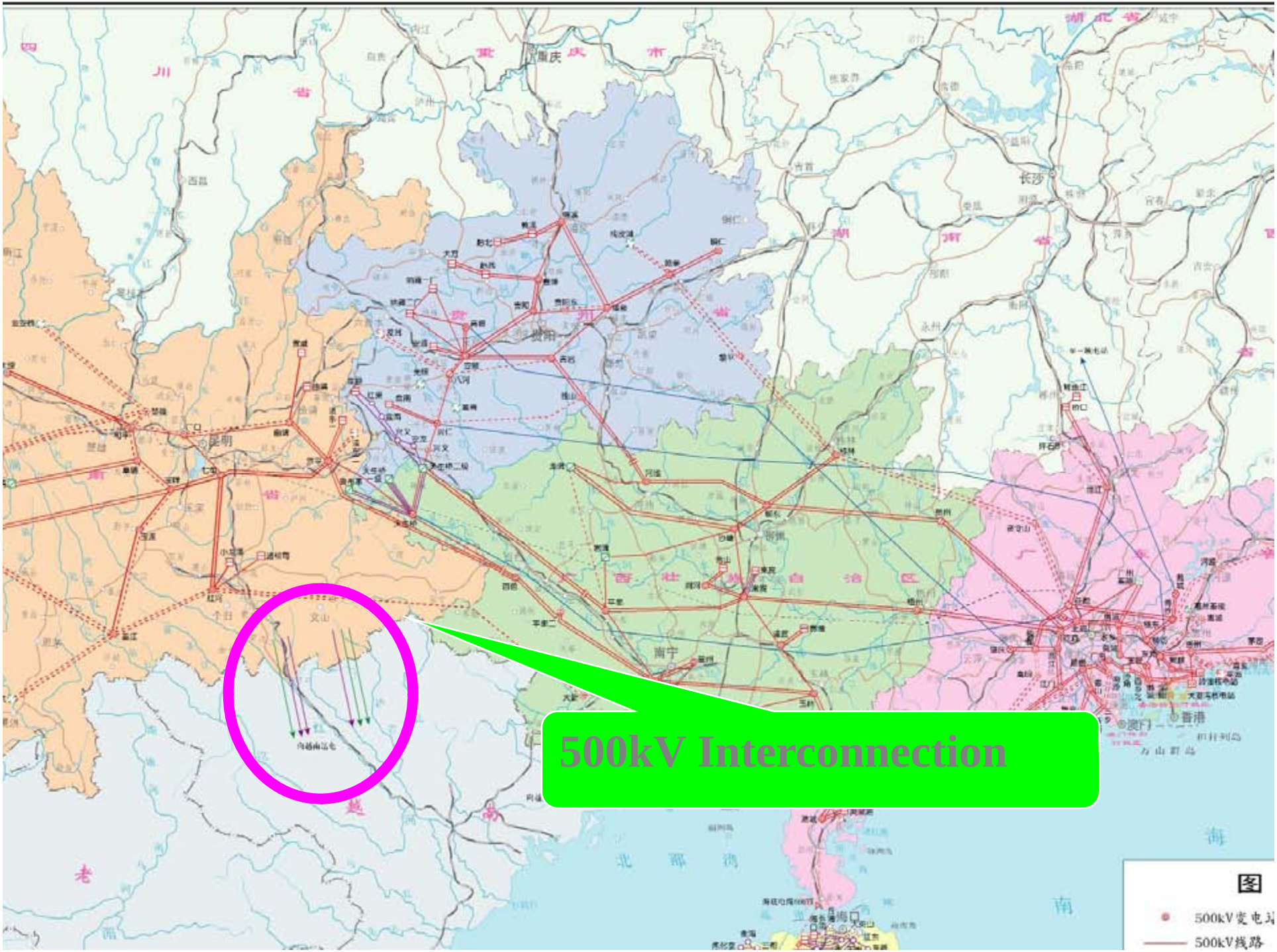
Total by the end of June, 2009: 9.254 TWh

2. Vinh Tan 1 BOT Coal-fired Power Plant Project (2×600MW)

BOT contract is under negotiation

3.500kV Interconnection Project

It has been over four years since the study for the EHV interconnection project was initiated. We hope that the contract could be signed and the Study could be started soon.


500kV Interconnection
图
500kV变电
500kV线路

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Sino-Laos Cooperation

1. Laos' Master Plan on Electric Power Industry

Finished by the end of 2007 and submitted to Laos on Jan.16, 2008.

2. Nam Tha 1 Hydro-Electric Power Project (3×56MW)

BOT contract is under negotiation

3. Nam Ou Hydropower Station Project (about 1000MW)

Initiated by Sinohydro Corporation

4. Northern Grid Construction Project

Under construction

Sino-Cambodia Cooperation

1. Sambor Hydro-Electric Power Project (2600MW)

FS is undertaking according to Cambodia government's comments on the Initial Feasibility Study.

2. Stung Cheay Areng Hydro-Electric Power Project (108MW)

BOT contract is under negotiation

Sino-Thailand Cooperation

1. China-Laos-Thailand 500kV Transmission Project

Suspended.

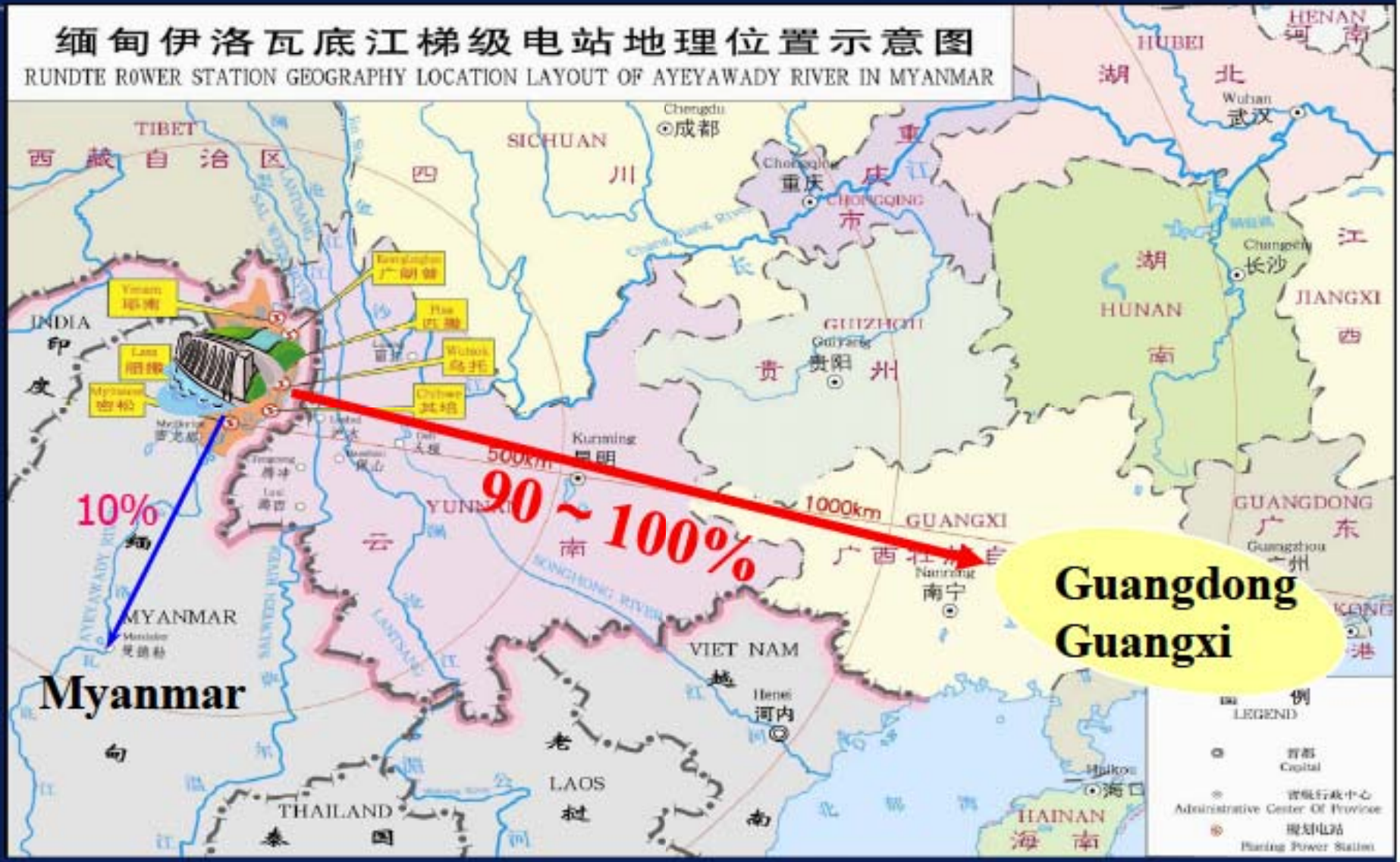
Sino-Myanmar Cooperation

1. Ta Sang Hydro-Electric Power Plant Project (10×711MW)

Myanmar, Thailand and China has signed Frame Agreement to develop in Thalwan River

2. Development of the Myanmar Northern Hydropower Projects (the total is about 21500MW)

Initiated by China Power Investment Corporation


缅甸伊洛瓦底江梯级电站地理位置示意图
RUNDTE R0WER STATION GEOGRAPHY LOCATION LAYOUT OF AYEYAWADY RIVER IN MYANMAR
TIBET
西藏自治区
SICHUAN
四川
Chengdu
成都
Chongqing
重庆
CHONGQING
HUBEI
湖北
Wuhan
武汉
HENAN
河南
HUNAN
湖南
Changsha
长沙
JIANGXI
江西
GUIZHOU
贵州
Guiyang
贵阳
INDIA
印度
Yingjiang
瑞丽
Lasa
腊撒
Myitsone
密松
Mujikrin
Wutuck
乌托
Chybwe
其培
Kunming
昆明
500km
1000km
90~100%
10%
YUNNAN
云南
GUANGXI
广西
Nanning
南宁
GUANGDONG
广东
Guangzhou
广州
HONG KONG
香港
MYANMAR
缅甸
Myitkyina
VIET NAM
越南
Hanoi
河内
LAOS
老挝
THAILAND
泰国
HAINAN
海南
Haikou
海口
Myanmar
Guangdong
Guangxi
LEGEND
Capital
Administrative Center Of Province
Planing Power Station

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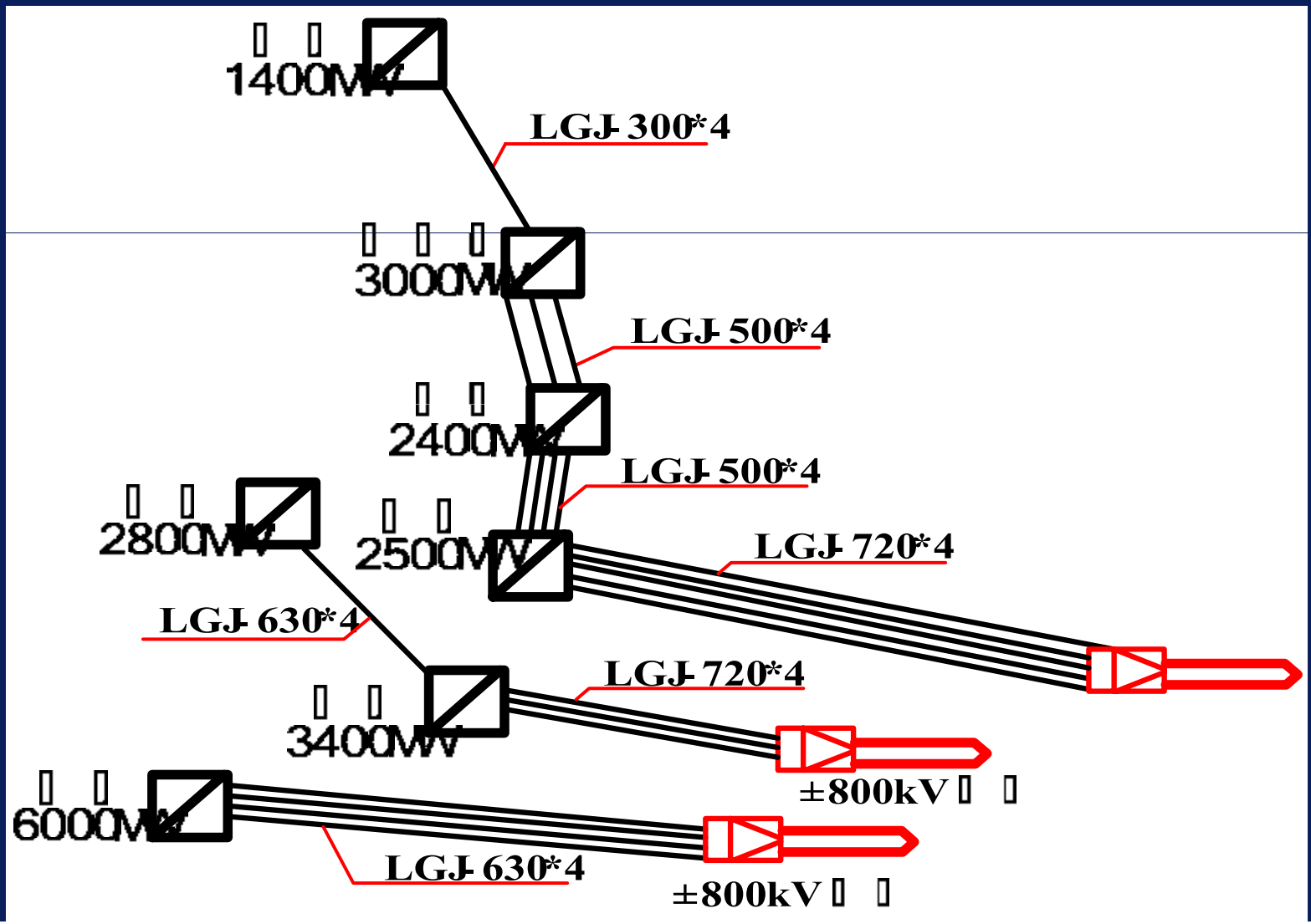
Primary layout



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CHINA SOUTHERN POWER GRID

Thank You !

Country Reports
on
Progress of Power Development Plans

Lao PDR

8th Meeting of the Focal Group (FG-8) of the Regional Power Trade Coordination Committee (RPTCC)

Luang Prabang, Lao PDR 25-27 November 2009

BACKGROUND OF LAO PDR

- Area of 236,800 sq km;
- 16 Provinces + Capital and 139 districts;
- Population of 5.8 million (2007);
- GDP of USD 4.1 billion (2007);
- GDP per Capita of USD 701 (2007);
- Mountainous area with major tributaries of the Mekong River covering 35% of total Mekong River basin.
- Relatively high annual rainfall.
- Hydropower potential: 23,000 MW
- Existing installed capacity of 1826 MW (7.9%)
- Produced energy of 9,500 GWh/Y
- Produced energy per capita of 1,570 kWh/Y
- Exported energy per capita of 1360 kWh/Y

HISTORY OF POWER SECTOR DEVELOPMENT

- Memorandum of Understanding on the power exchange program was signed with the Royal Thai Government in 1996 and 2006 under which 3,000 MW is to be supplied to Thailand and subsequently increased 7,000 MW is agreed;

- In 1998 and 2006 MOUs were signed with the Government of Vietnam for 3000 MW and subsequently 5000 MW is agreed;

- In 1999 Agreement on Cooperation in Power Sector was signed with Cambodia;
- Power Sector Strategy is being developed and updated from time to time;
- Power sector opened to private foreign direct investments;
- Legal framework has been improved from time to time to meet international financing requirements.

POWER SECTOR POLICY

- Maintain and expand affordable, reliable and sustainable electricity supply to promote economic and social development;
- Promote power exports as well as domestic power supply to earn revenues to meet Government development objectives with particular emphasis on poverty eradication;
- Develop and enhance the legal and regulatory framework to facilitate power sector development by either public, private or public private partnership;
- Gain capacity building through international technical know-how and expertise;
- Ensure accountability and transparency of environmental and social impacts and thereby achieve sustainable development

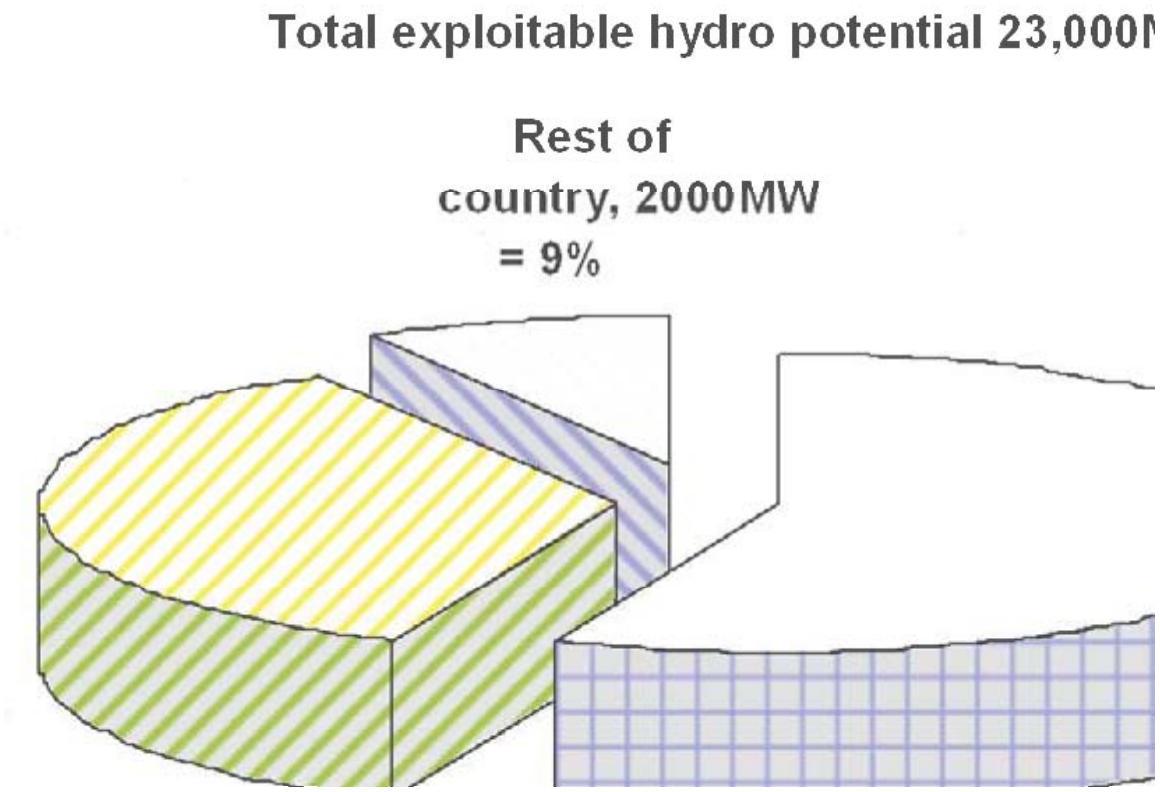
OBJECTIVES OF POWER SECTOR DEVELOPMENT

- Provide a source of foreign exchange to fund economic and social development and alleviate poverty;
- Meet the commitments under intergovernmental MOUs and Agreements with Thailand, Vietnam and others;
- Extend rural electrification to promote better socio-economic development and reach the government target of 70% and 90% by year 2010 and 2020 respectively;
- Integrate power sector and maintain its economic development as a whole with international communities trough its power exchange programs and foreign direct investment.

Primary Energy Resources of Lao PDR

Resource	Reserves	Potential for Use in Power Generation
Oil and Gas	Two exploration concessions in central and southern Lao PDR. Mapping and geophysical investigations are being carried out, including deep hole drill (2,560 m). Results are being evaluated	Possibly in the longer term (10-15 years), if sufficient reserves found
Coal (Lignite)	Major resource located at Hongsa in north-west Lao PDR. About 810 million tons proven reserve, of which over 530 million tons is deemed economically recoverable. Energy content 8-10 MJ/kg, relatively low sulfur content of 0.7-1.1%	Sufficient reserves for about 2,000 MW installed capacity
Coal (Bituminous and Anthracite)	Reserves, mainly anthracite, dispersed in various fields throughout Lao PDR. Exploration ongoing. Total proven reserve to date about 100 million tons. Energy contents 23-35 MJ/kg.	Current annual production of 130,000 tons, used for local factories or export. Possible longer-term option for around 500 MW installed capacity, depending on results of exploration.
Solar	Annual solar radiation received in Lao PDR about 1800 kWh/m^2, possibly less in mountain areas. Corresponds to conditions in southern Europe (Italy, Spain).	Photovoltaic modules already used for small-scale (e.g. 100 W) remote applications.
Wind	Mean wind speeds at Luang Prabang and Vientiane around 1 m/s, in mountain areas likely to be somewhat higher.	Costs in areas of less than 4 m/s likely to be in upper end of range US$ 0.05-0.25 per kWh, hence limited potential
Geothermal	No significant known reserves.	Limited potential for power generation
Biomass (agriculture waste)	Biomass resources dispersed throughout the country.	Current share of biomass (mainly wood fuel) in total energy consumption about 88%. Wood-fired cogeneration (heat and power) plants could be economic for self-supply in wood processing facilities
Hydropower	Average annual precipitation about 2,000 mm. Total runoff around 240,000 million m^3. Theoretical hydropower potential of 26,000 MW (excluding mainstream Mekong).	Exploitable hydropower potential, including share of mainstream Mekong, around 23,000 MW.

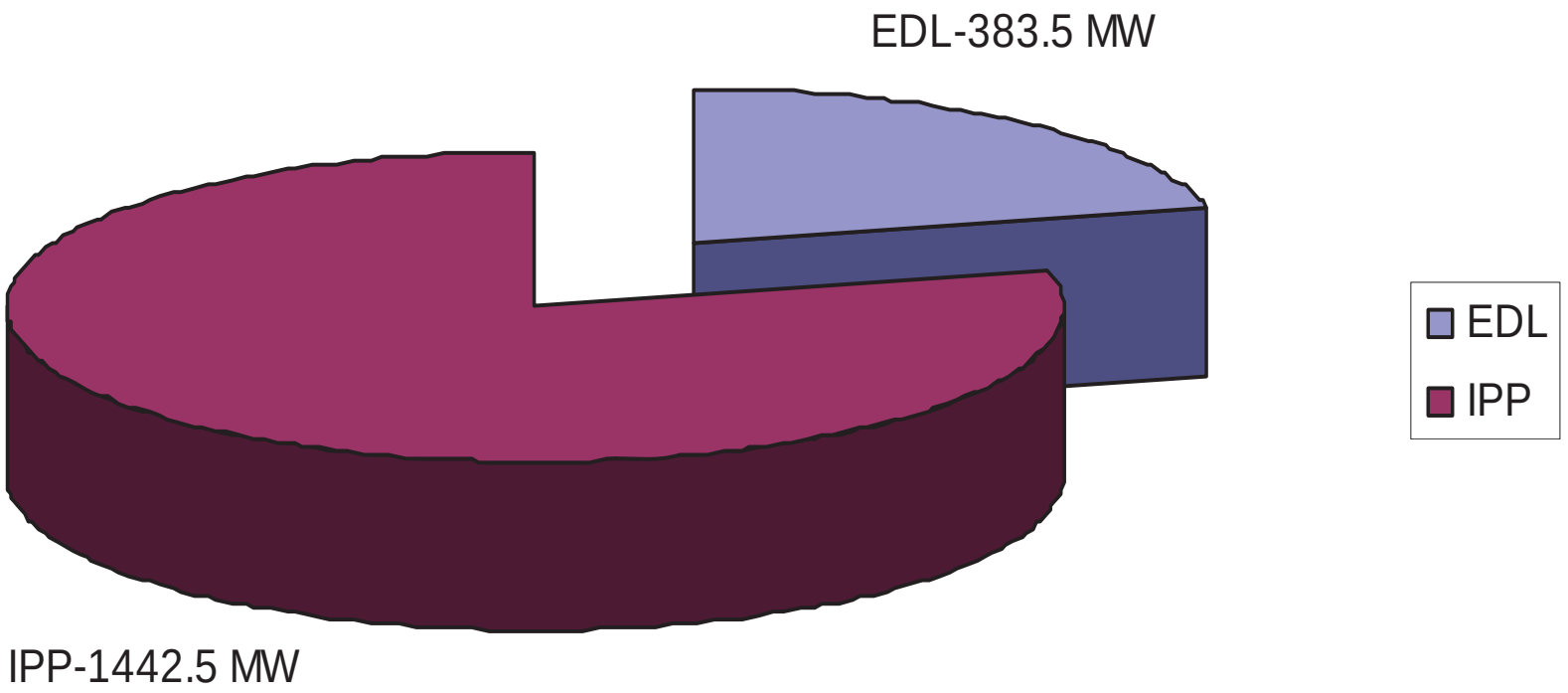
Exploitable Hydropower Potential of Lao PDR



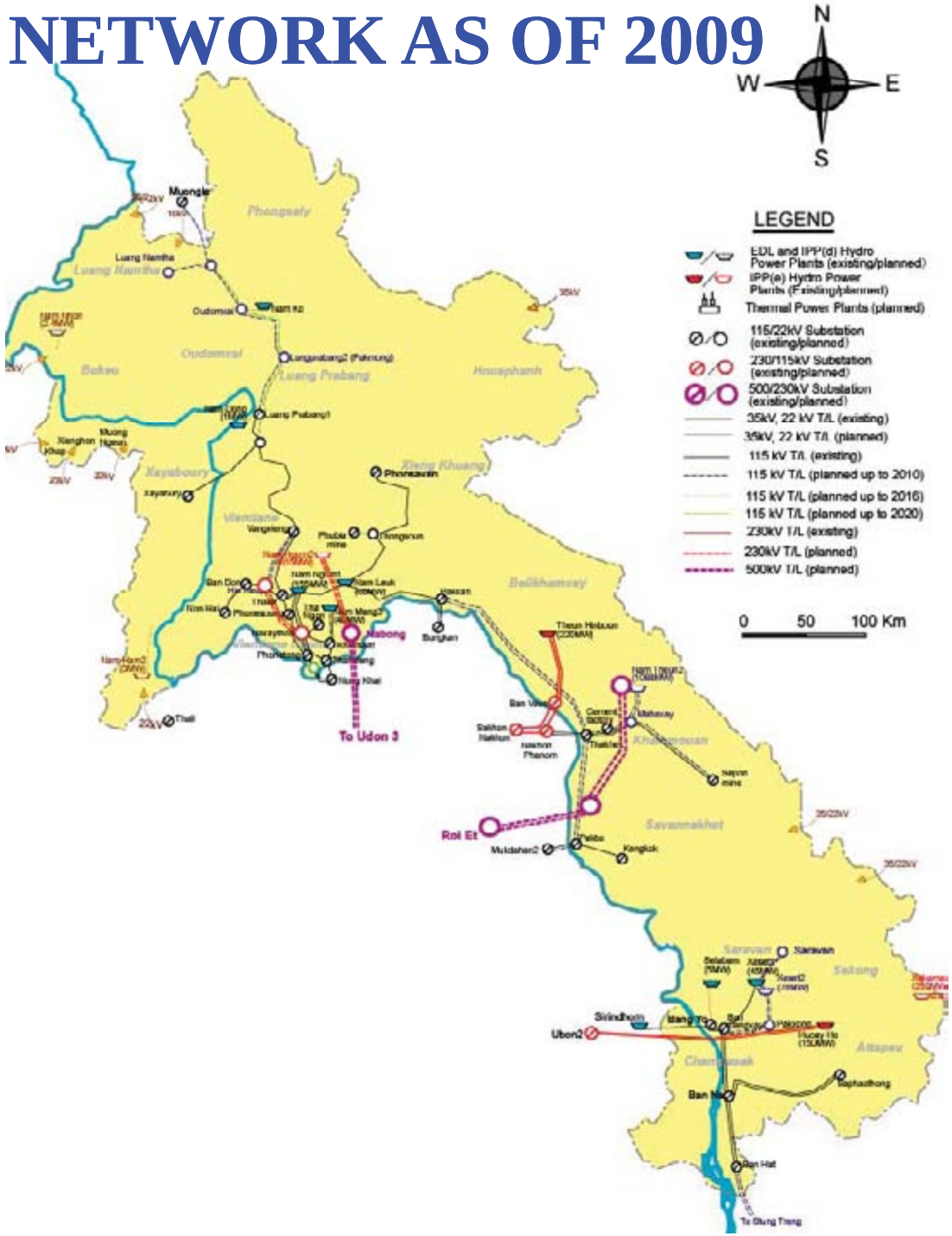
OWNERSHIP OF POWER GENERATION

The country's total installed Capacity: 1826 MW:

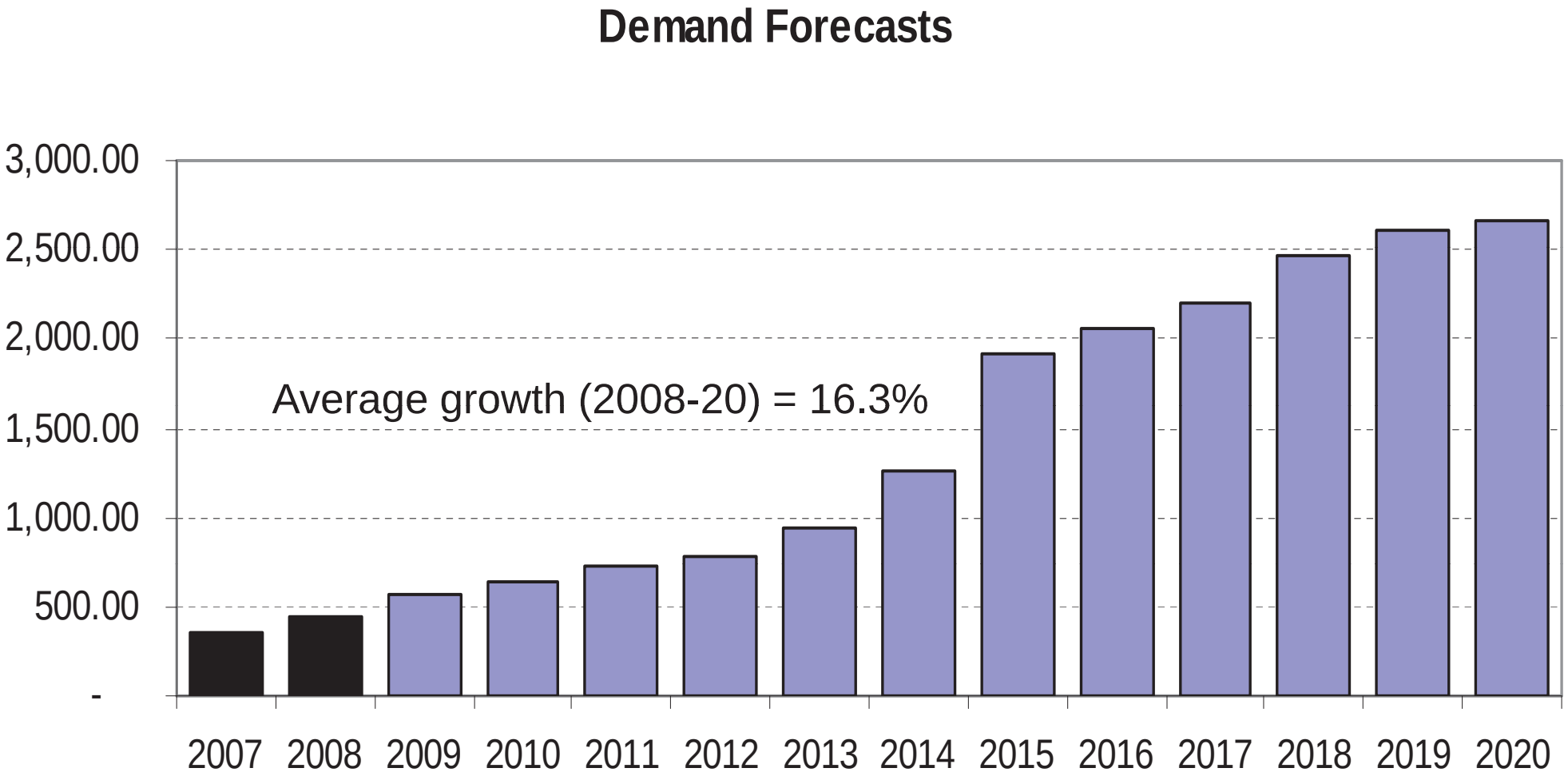
EdL 383.5 MW, IPP: 1442.5 MW



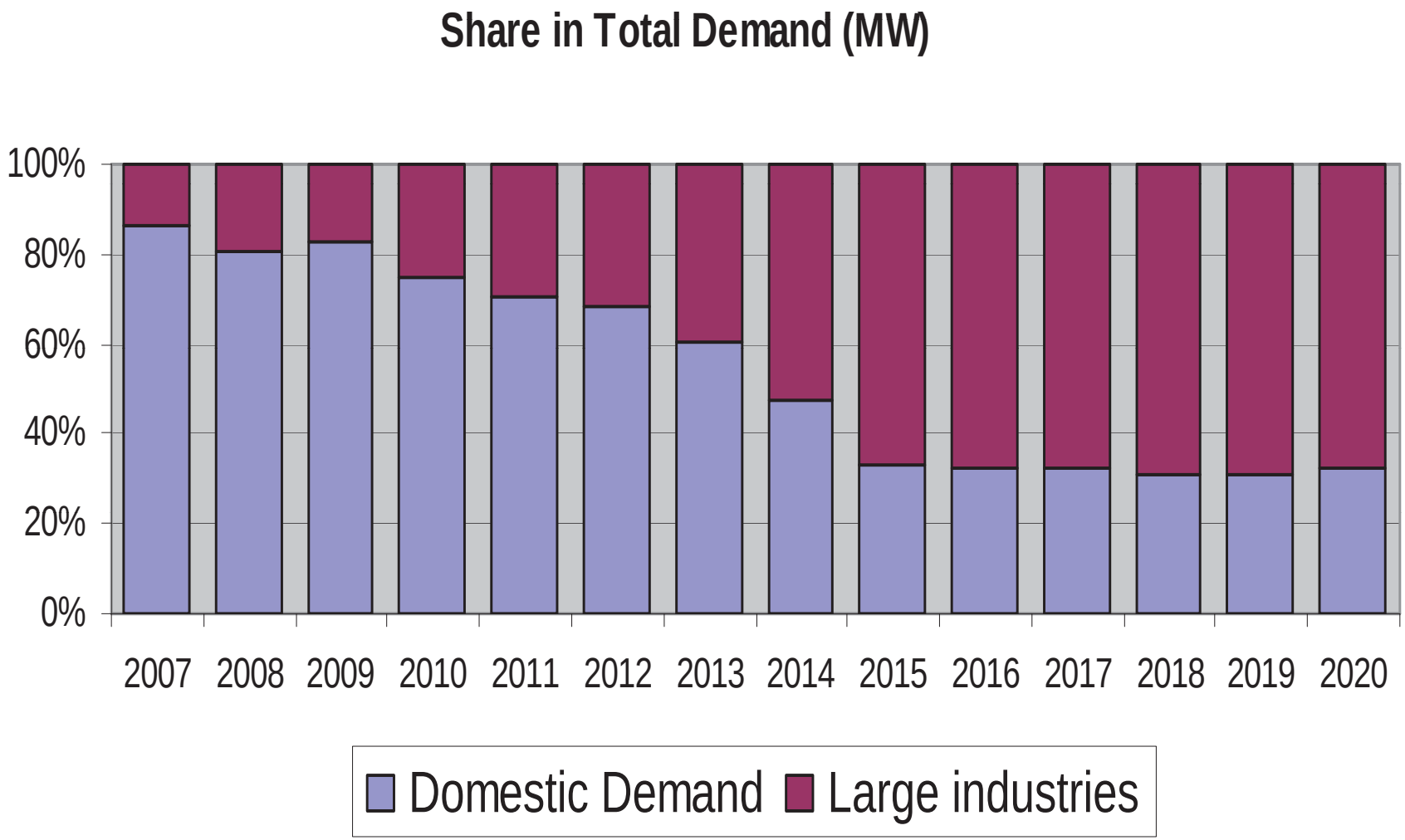
EXISTING NETWORK AS OF 2009



DEMAND FORECASTS



DEMAND FORECASTS (CONT.)



DEVELOPMENT STATUS

68 Projects with estimated installed capacity of 22,069 MW:

- Projects at Feasibility Study stages/with Memorandum of Understanding (MOU): 43 Projects with estimated installed capacity of 12,373.5 MW
- Projects at Preparation stage/with Project Development Agreement (PDA): 17 projects with estimated installed capacity of 7,245 MW
- Projects under Construction/with Concession Agreement (CA): 8 Projects with installed capacity of 2,450.6 MW

Electricity Tariff in Lao PDR

Month, Year		Lao Kip/kWh	Jan-08	Jan-09	Jan-10	Jan-11
Residential						
0-Œ25 kWh		Lao Kip/kWh	175	201	231	266
26Œ-150kWh		Lao Kip/kWh	290	298	307	316
>150 kWh-		Lao Kip/kWh	765	765	765	765
Business	Low Volt.	Lao Kip/kWh	826	826	826	826
	Med. Volt.	Lao Kip/kWh	702	702	702	702
Intertratement		Lao Kip/kWh	1,095	1,095	1,095	1,095
Government	Low Volt.	Lao Kip/kWh	677	667	658	649
	Med. Volt.	Lao Kip/kWh	575	567	559	551
Inter. Organization		Lao Kip/kWh	1,066	1,066	1,066	1,066
Industry	Low Volt.	Lao Kip/kWh	610	601	593	584
	Med. Volt.	Lao Kip/kWh	518	511	504	497
Irrigation	Low Volt.	Lao Kip/kWh	341	359	377	395
	Med. Volt.	Lao Kip/kWh	290	305	320	336

Exchange Rate 1$=8450 Kip

Export to Thailand

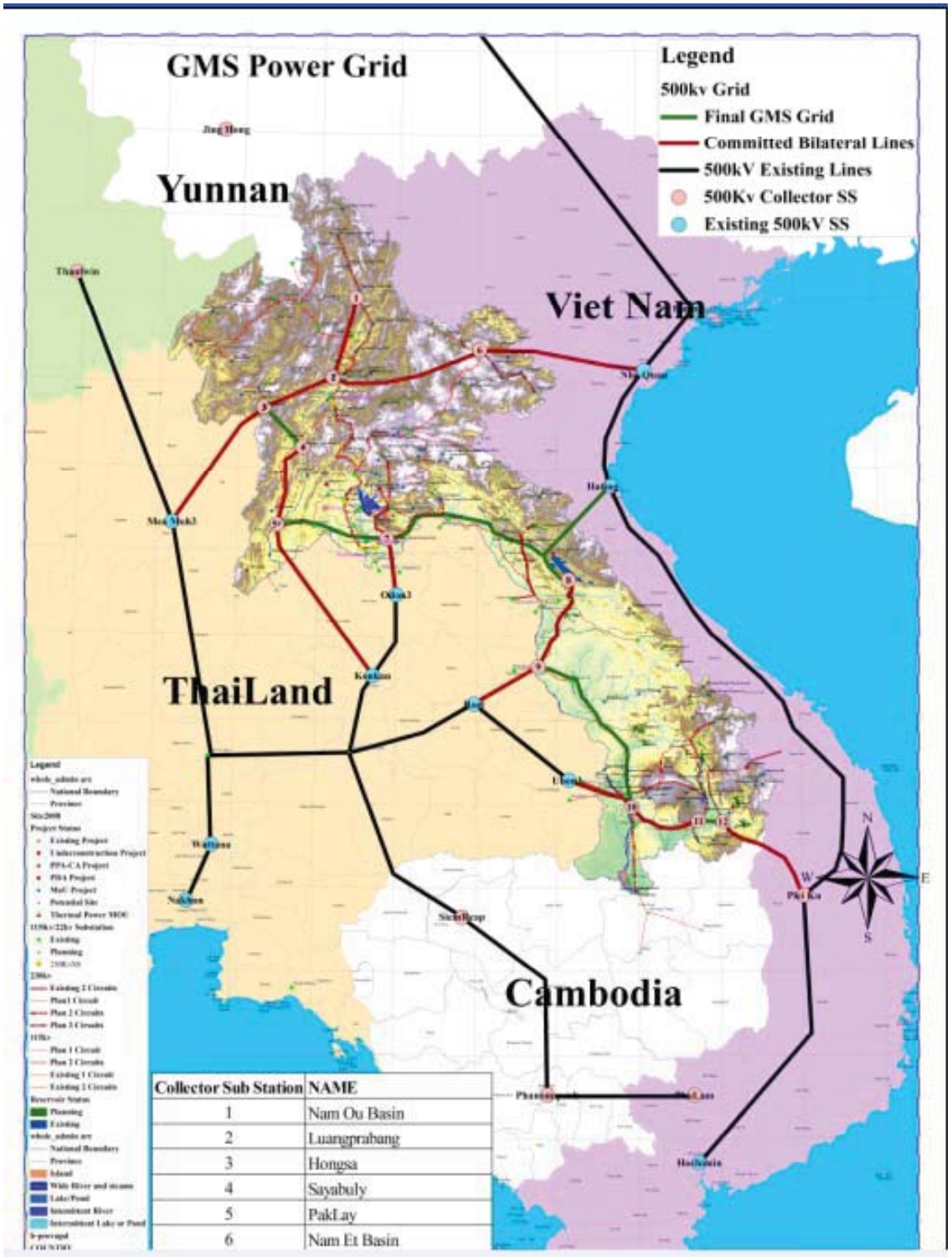
No	Name of Project	Install MW	Energ GWh	Status of the project	Tariff	COD
1	Nam Theun 2	1088	5936	Under testing	Yes	Dec-09
2	Nam Ngum 2	615	1976	under construction	Yes	2010
3	Nam Bak 1	80	240	FS Completed	No	
4	Theun Hinboun Exp	220	1395	under construction	Yes	2012
5	Nam Ngum 3	460	2077	FS Completed	No	??
6	Nam Theun 1	523	1840	FS Completed	No	??
7	Nam Ngiep 1	268	1327	FS Completed	No	??
8	Hongsa Lignite	1800	12200	under construction	Yes	2014
9	Nam Ou	1143	4977	FS on going	No	??
10	Donsahong (Mainstream)	240	2375	FS Completed	No	??
11	Sepian Xenamnoi	390	1748	FS Completed	No	??
12	Sekong 4	300	1901	FS Completed	No	??
13	Sekong 5	330	1200	FS Completed	No	??
14	Nam Kong 1	75	469	FS Completed	No	??
15	Xayabouly (Mainstream)	1260	5602	FS Completed	No	??
16	Pak Beng (Mainstream)	1012	4722	FS Completed	No	??
17	Pak Lay (Mainstream)	1002	4369	FS on going	No	??
18	Sanakham (Mainstream)	692	3202	FS on going	No	??
19	Lat sua (Mainstream)	686	2750	FS Completed	No	??
		12184	60306			

Export to Vietnam

No	Name of Project	Install Capacity MW	Energy GWh	Status of the project	Tariff	COD
1	Xekaman 1	290	1096	under construction	No	2012
2	Xekaman 2A	64	241	FS on going	No	??
3	Xekaman 2B	100	380	FS on going	No	??
4	Xekaman 3	250	982	under construction	Yes	2010
5	Xekaman 4A	96	375	FS on going	No	??
6	Xekaman 4B	74	301	FS on going	No	??
7	Sekong 3Up.	145	598	FS on going	No	??
8	Sekong 3dow.	90	375	FS on going	No	??
9	Nam Ngum 4	220	813	FS Completed	No	??
10	Nam Sam 1	94	323	FS Completed	No	??
11	Nam Sam 3	196	635	FS Completed	No	??
12	Nam Mo2	105	496	FS Completed	No	??
13	Nam Mo1	66	280	FS on going	No	??
14	Nam Ma-1,2,3	175	820	FS on going	No	??
15	Luangprabang (Mekong)	1288	5602	FS on going	No	??
16	Dak E Mule	105	506	FS on going	No	??
17	Nam Kong 2	75	310	FS on going	No	??
18	Nam Kong 3	30	126	FS on going	No	??
		3463	14259			

Domestic Supply

No	Name of Project	Install Capacity MW	Energy GWh	Status of the project	Owner	Tariff	COD
1	Nam Lik 2	100	460	under construction	IPP	Yes	2010
2	Nam Ngum 5	120	507	under construction	IPP	Yes	2011
3	Nam Ngon	2.4	11	under construction	IPP	Yes	2011
4	Tad salen	3.2	15	under construction	IPP	Yes	2010
5	Nam Sim	8	34	FS Completed	IPP	Yes	2013
6	Nam Ham	3.7	12	FS Completed	IPP	Yes	2012
7	Nam Long	5	37	FS Completed	IPP	Yes	2012
8	Nam Lik 1	54	255	FS Completed	IPP	Yes	2013
9	NG-8	60	294	under construction	IPP	Yes	2012
10	Nam Tha 1	158	759	FS Completed	IPP	Yes	2013
11	Xekaman-sanxay	32	123	FS Completed	IPP	No	2013
12	Nam Khan 2	145	578	FS on going	EDL	No	??
13	Nam Khan 3	66	222	FS on going	EDL	No	??
14	H. Lamphan	85	264	FS Completed	EDL	No	??
15	Xe lanong 2	20	103	FS Completed	IPP	No	??
16	Nam San 3	48	366	FS Completed	IPP	No	??
17	Xe Katam	60	380	FS Completed	IPP	No	??
18	Nam Pak	75	307	FS Completed	IPP	No	??
19	Tha kho	30	178	FS on going	IPP	No	??
20	Nam Pay	60	283	FS on going	IPP	No	??
21	Nam Ngiep 2	155	730	FS on going	IPP	No	??
		1290.3	5918				



1. Nabong (Laos) - Oudon (Thailand)

2. Ban Sok (Laos) – Pleiku (Vietnam)

3. Ban Sok (Laos) - Oubon (Thailand)

4. Hongsa (Laos) - Thailand

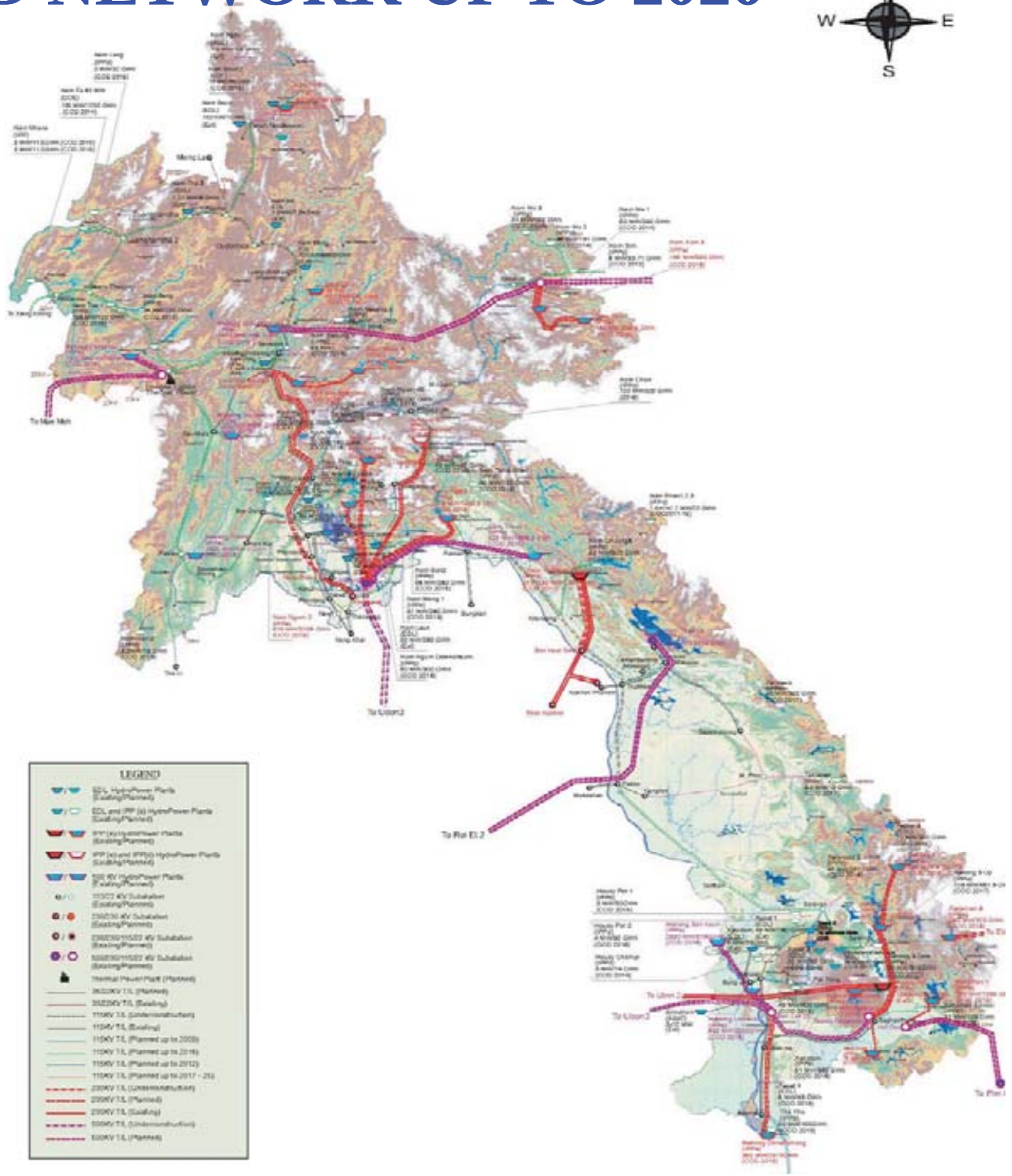
5. Nam Ou (Laos) - Thailand

6. Luangphabang (Laos) - Nho Quan or Than Hoa Vietnam

7. Xayabouli (Laos) – Khon Ken (Thailand)

8. Pakbeng (Laos)-Thailand

PLANNED NETWORK UP TO 2020



Thank You

Greater Mekong Sub-region

Eighth Meeting of Regional Power Trade Coordination Committee (RPTCC-8)
Eighth Meeting of Focal Group (FG-8)
Seventh Meeting of Planning Working Group (PWG-7)

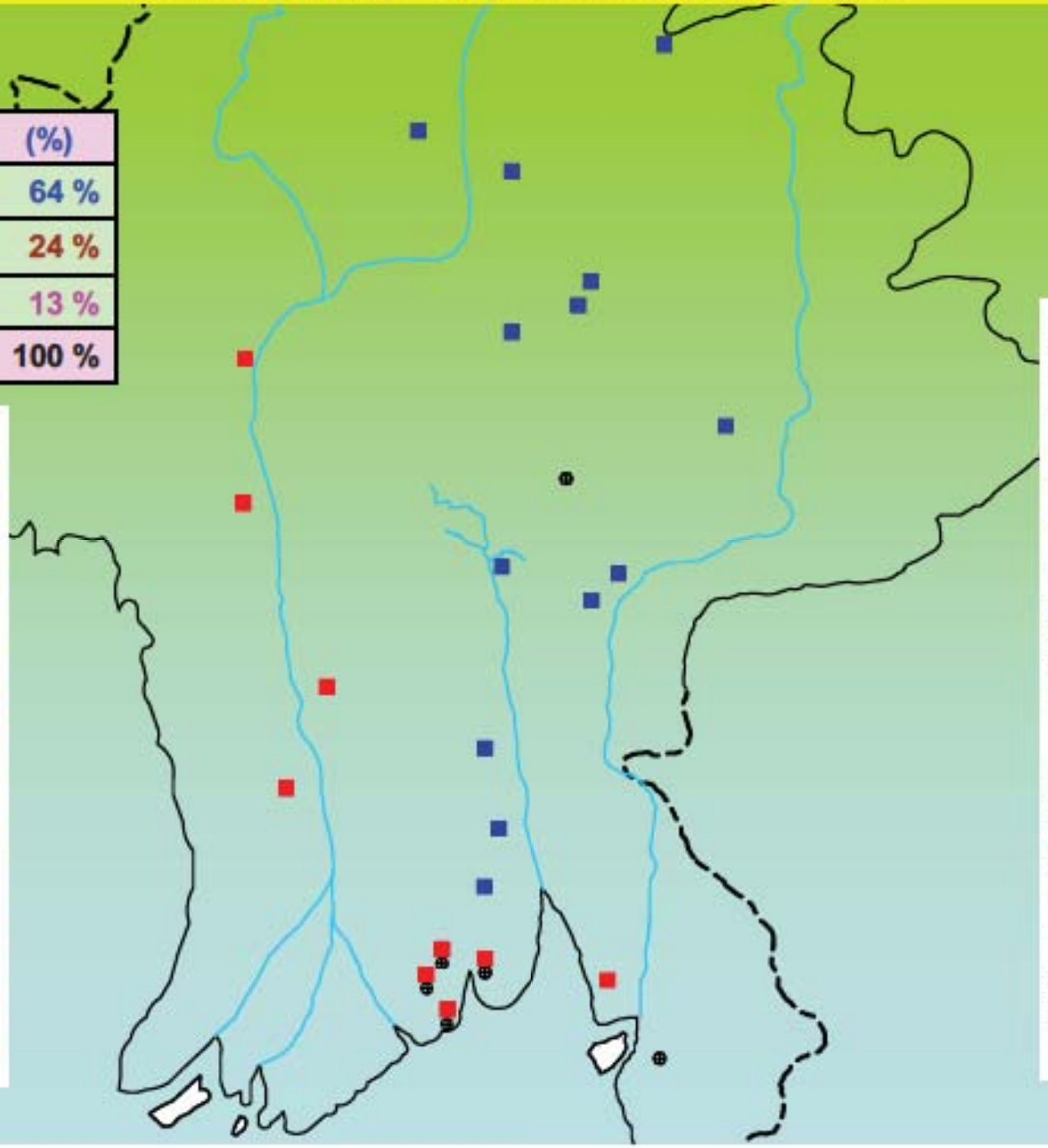
Country Report
on
Progress of Power Development Plans and Transmission Interconnection Projects

MYANMAR

25th ~ 27th November, 2008 **Luang Prabang, Lao PDR**

Current Installed Generation Plants

Type	MW	(%)
Hydro ■	1421.0	64 %
Gas ■	549.9	24 %
Steam ⊕	284.9	13 %
Total	2255.8	100 %



Hydro Power Stations

1. BHP(2)	168 MW
2. BHP(1)	28 MW
3. Kinda	56 MW
4. Sedawgyi	25 MW
5. Zawgyi(1)	18 MW
6. Zawgyi(2)	12 MW
7. Zaungtu	20 MW
8. Thaphanseik	30 MW
9. Paunglaung	280 MW
10.Mone	75 MW
11.Ye`nwe	25 MW
12. Khabaung	30 MW
13. Shwe Li	600 MW
14. KengTawn	54 MW
Total	1421 MW

Gas Turbine P/S

14. Kyunchaung ■	54.3 MW
15. Mann	36.9 MW
16. Myanaung	34.7 MW
17. Shwedaung	55.35 MW
18. Ywama	60.9 MW
19. Thaketa	57 MW
20. Ahlone	99.9 MW
21. Hlawga	99.9 MW
22. Thaton	50.95 MW
Total	549.9 MW

Steam Turbine P/S

23. Thaketa ⊕	90 MW
24. Hlawga	54.30 MW
25. Ahlone	54.30 MW
26. Mawlamyaing	12.00 MW
27. Ywama	9.40 MW
28. Tigyit	120 MW
Total	284.9 MW

Current Installed Generation Plants (Continued)

Existing Hydropower Station

Sr.	Name of Station	Location	Installed Capacity (MW)	Annual Energy (GWh)	Type of Turbine	Commi-ssioned Year	Project Cost	
							Local (million)	Foreign (million)
1	Baluchaung.1	Loikaw, Kayah State	(14MWx2Nos) 28MW	200	Francis	9-8-92	K 402	J¥ 16,000
2	Baluchaung.2	Loikaw, Kayah State	(28MWx6Nos) 168MW	1190	Pelton	2-3-74	K 321.1	-
3	Kinda	Myittha, Mandalay Division	(28MWx2Nos) 56MW	165	Francis	4-12-85	K 180.0	DM 127.6
4	Sedawgyi	Madayar, Mandalay Division	(12.5MWx2Nos) 25MW	134	Kaplan	6-6-89	K 98.77	US$ 16.6
5	Zawgyi.1	Yatsauk, Shan (S) State	(6MWx3Nos) 18MW	35	Francis	28-7-95	K 94.27	US$ 9.975
6	Zawgyi.2	Yatsauk, Shan (S) State	(6MWx2Nos) 12MW	30	Francis	16-3-2000	K 450	US$ 18

Current Installed Generation Plants (Continued)

Existing Hydropower Station

Sr.	Name of Station	Location	Installed Capacity (MW)	Annual Energy (GWh)	Type of Turbine	Commi-ssioned Year	Project Cost	
							Local (million)	Foreign (million)
7	Thaphanzeik	Kyunhla, Sagain Division	(10MWx3Nos) 30MW	117.2	Kaplan	18-6-02	K 1155	US$ 20
8	Zaungtu	N-W of Bago Division	(10MWx2Nos) 20MW	76.3	Kaplan	22-3-2000	K 3800	-
9	Mone	Sidoktaya Magwe Division	(25MWx3Nos) 75MW	330	Francis	27-11-04	K 1680	US$ 32
10	Paunglaung	N-E of Pyinmana	(70MWx4Nos) 280MW	911	Francis	25-3-05	K 4228.53	US$ 170 J¥ 1724
11	Yenwe	Kyauktaka Bago Division	(12.5MWx2Nos) 25MW	123	Francis	10-2-07	K 7249.084	US$ 8.478
12	Kabaung	Oaktwin, Bago Division	(15MWx2Nos) 30MW	120	Francis	23-3-08	K 8862.225	US$ 8.92

Current Installed Generation Plants (Continued)

Existing Hydropower Station

Sr.	Name of Station	Location	Installed Capacity (MW)	Annual Energy (GWh)	Type of Turbine	Commi-ssioned Year	Project Cost	
							Local (million)	Foreign (million)
13	Kengtawng	Moene, Shan (S) State	(18MWx3Nos) 54MW	377.6	Francis	21-3-09	K 15.285	US$ 25
14	Shweli.1	Namkham, Shan (N) State	(100MWx6Nos) 600MW	4022	Francis	30-11-05	-	-

Existing Coal Fire Thermal Power Station

Sr.	Name of Project	Location	Installed Capacity (MW)	Annual Energy (GWh)	Annual Required Amount of Coal (Tons)	Commi-ssioned Year	Project Cost	
							Local (million)	Foreign (million)
1	Tigyit (Coal Fired)	Pinlaung, Shan (S) State	(60MWx20Nos) 120MW	600	640,000	25-12-04 3-5-05	K 15115.185	US$ 42.936

Current Installed Generation Plants (Continued)

Existing Gas Turbine and Thermal Power Station

Sr.	Name of Station	Installed Capacity (MW)	Annual Energy (GWh)	Commi-ssioned Year	Gas Requirement Per day (MMCF)	
					onshore	offshore
1	Kyunchaung	(18.1 MW x 3 Nos) 54.3 MW	300	1974	18	27
2	Mann	(18.45 MW x 2 Nos) 36.9 MW	238	1980	12	18
3	Shwedaung	(18.45 MW x 3 Nos) 55.35 MW	300	1984	18	27
4	Myanaung	(18.45 MW x 1 No) 18.45 MW	200	1984	6	9
		(16.25 MWx1 No) 16.25 MW		1975	5	8
5	Thahtone	(18.45 MW x 1 No) 18.45 MW	300	1985	6	9
		(16.25 MW x 2Nos) 32.5 MW		2001	10	16
6	Mawlamyaing	(6 MW x 2 Nos) 12 MW	60	1980	0	8

Current Installed Generation Plants (Continued)

Existing Gas Turbine and Thermal Power Station

Sr.	Name of Station	Installed Capacity (MW)	Annual Energy (GWh)	Commi-ssioned Year	Gas Requirement Per day (MMCF)	
					onshore	offshore
7	Hlawga	(33.3 MW x 3 Nos) 99.9 MW	640	1996	33	48
	Steam	(54.3 MW x 1 No) 54.3 MW	350	1999		
8	Yawma	(18.45 MW x 2 Nos) 36.9 MW	238	1980	12	18
	Yawma(NEDO)	(24 MW x 1 No) 24 MW	140	2004	8	12
	NEDO steam	(9.4 MW x 1 No) 9.4 MW	60	2004		
9	Ahlone	(33.3 MW x 3 Nos) 99.9 MW	640	1995	33	48
	Ahlone Steam	(54.3 MW x 1 No) 54.3 MW	350	1999		
10	Thaketa	(19 MW x 3 Nos) 57 MW	368	1990	18	27
	Thaketa Steam	(35 MW x 1 No) 35 MW	200	1997		

Unit Generated & Cost per unit

Unit Generated for Year 2008-09		
Type	(mill kWh)	(%)
Hydro	4,027.710	60.83 %
Gas & Steam	2,290.877	34.60 %
Coal	2,19.853	3.32 %
Diesel	39.950	0.60 %
Mini Hydro	43.369	0.65 %
Total	6,621.652	100.00 %

Generation Cost

Currency Unit	Coal	Diesel	Gas		Hydro
			Inland	Off Shore	
Myanmar (Kyat)	31.33	300	3	-	4.5
US (Cent)	-	-	-	12.6	-

Average generation cost and average tariff

Average generation cost & Average Retail Tariff	
Average generation cost (including Salaries & wages, Fuel consumption, Depreciation Maintenance & Repairs, Interest Expenses, Commertial Tax)	26.79 kyat/kWh
Average Retail Tariff	34.23 Kyat/kWh

Current tariffs adequate to ensure full cost recovery.

How will the generated electricity be transmitted to load centre?
Who will finance these transmission line?

Generated electricity is transmited to the load center by transmission lines owned by Ministry of Electric Power No.2.

Envisaged Demand Growth from 2010-2030

Year	Demand (MW)	Demand Growth Rate(%)
2006 - 2007	1,200.00	
2007 - 2008	1,284.00	7.00%
2008 - 2009	1,373.88	7.00%
2009 - 2010	1,470.05	7.00%
2010 - 2011	1,572.96	7.00%
2011 - 2012	1,730.25	10.00%
2012 - 2013	1,903.28	10.00%
2013 - 2014	2,093.60	10.00%
2014 - 2015	2,302.96	10.00%
2015 - 2016	2,533.26	10.00%
2016 - 2017	2,761.25	9.00%
2017 - 2018	3,009.77	9.00%

Year	Demand (MW)	DemandGrowth Rate(%)
2018 - 2019	3,280.65	9.00%
2019 - 2020	3,575.90	9.00%
2020 - 2021	3,897.73	9.00%
2021 - 2022	4,190.06	7.50%
2022 - 2023	4,504.32	7.50%
2023 - 2024	4,842.14	7.50%
2024 - 2025	5,205.30	7.50%
2025 - 2026	5,595.70	7.50%
2026 - 2027	5,987.40	7.00%
2027 - 2028	6,406.52	7.00%
2028 - 2029	6,854.98	7.00%
2029 - 2030	7,334.82	7.00%

New Generation Capacity (2010-2020)

- In order to overcome the present insufficient power supply situation and to meet the electricity demand throughout the country, the Government laid down the energy policy to exploit and utilize enormous hydropower potentials of the country.

- At present, (19) hydropower projects are under construction by

  - (DHPI) Department of Hydropower Implementation,

    the Ministry of Electric Power No.(1)

  - (ID) Irrigation Department

    the Ministry of Agriculture and Irrigation

  - Private Companies

New Generation Capacity (2010-2020) (Continued)

Sr	Name of Project	Name of River	Location	Installed Capacity (MW)	Annual Energy (GWh)	Type of Turbine	Implement-ation period
1	Kun	Kun	Phyu Township, Bago Division	20MWx 3Nos 60 MW	190	Francis	2002~2011
2	Phyu	Phyu	Phyu Township, Bago Division	20MWx2Nos 40 MW	120	Francis	2002~2010
3	Shwekyin	Shwekyin	Shwekyin Township, Bago Division	18.75MWx4Nos 75 MW	262	Francis	2001~2009
4	Yeywa	Namtu	Mandalay Division	197.5MWx4Nos 790MW	3550	Francis	2010
5	Tha-htay	Tha-htay	Thandwe Township, Rakhine State	37MWx3Nos 111MW	386	Francis	2005~2015
6	Upper Paunglaung	Paung - laung	Pyinmana Township, Nay Pyi Taw Division	70MWx2Nos 140MW	454	Francis	2004~2011

New Generation Capacity (2010-2020) (Continued)

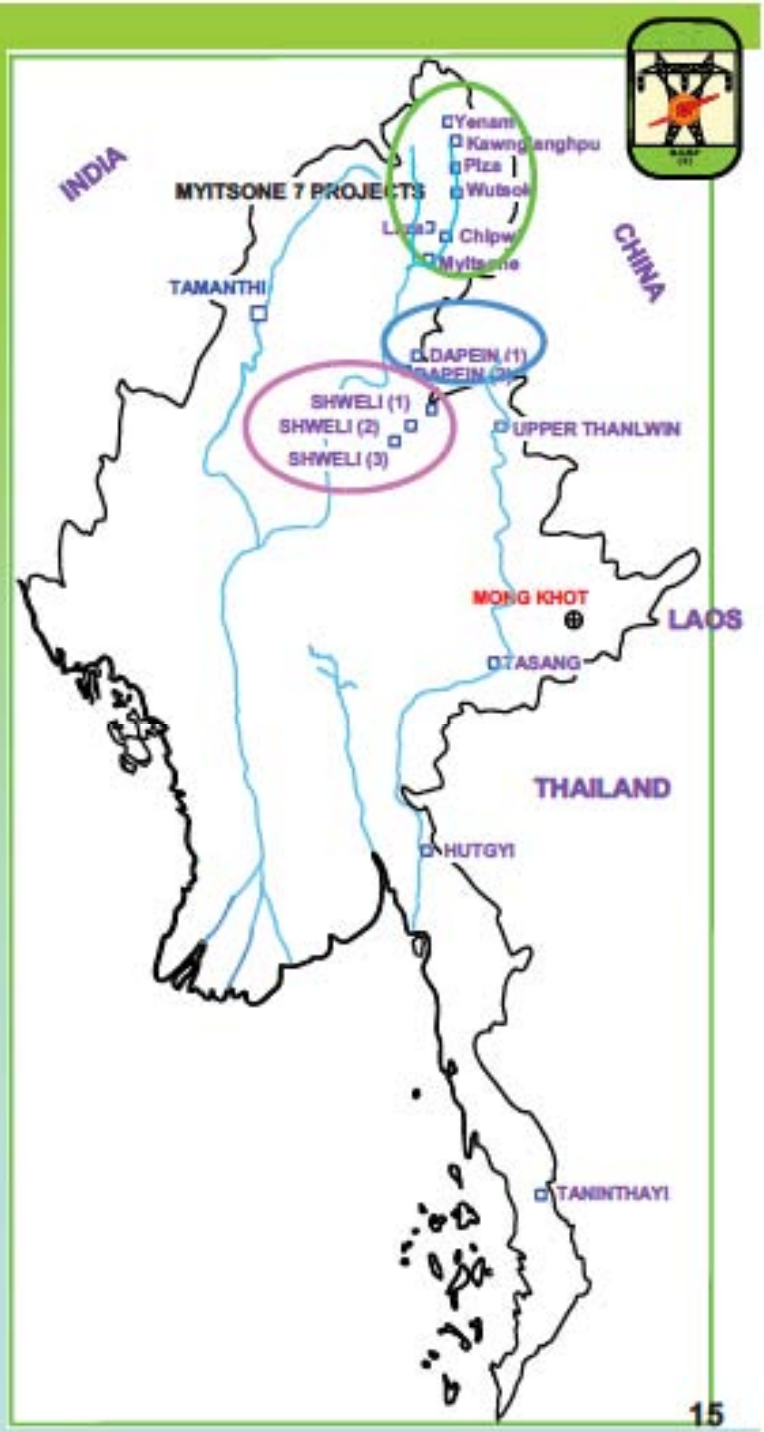
Sr.	Name of Project	Name of River	Location	Installed Capacity (MW)	Annual Energy (GWh)	Type of Turbine	Implement-ation period
7	Nancho	Nancho	Pyinmana Township, Nay Pyi Taw Division	20MWx2Nos 40MW	152	Francis	2006~2010
8	Thaukyegat(2)	Thaukye-gat	Tounggu Township, Bago Division	40MWx3Nos 120MW	604	Francis	2006~2011
9	Ann	Ann	Thandwe District, Rakhine State	5MWx2Nos 10MW	44.53	Francis	2004~2010
10	Dapein (1)	Dapein	Bamaw Township, Kachin State	60MWx4Nos 240MW	1065	Francis	2007~2010
11	Tamanthi	Chindwin	Pakhouku Township, Sagaing Division	200MWx6Nos 1200MW	6685	Francis	-

New Generation Capacity (2010-2020) (Continued)

Sr.	Name of Project	Name of River	Location	Installed Capacity (MW)	Annual Energy (GWh)	Type of Turbine	Implement-ation period
12	Manipur	Manipur	Kalay Twonship, Sagaing Division	95MWx4Nos 380MW	1903	Francis	-
13	Chipwinge	Chipwi	Chipwi Township, Kachin State	33MWx3Nos 99MW	320	Pelton	2009~2010
14	Baluchaung(3)	Balu-chaung	Loikaw Township Kayah Stat	24MWx2Nos 48MW	334	Francis	2008~2012
15	Upper Keng Tawng	Nam - Teng	Lin Khe Township, Southern Shan State	17MWx3Nos 51MW	267	Francis	-
16	Tasang	Thanlwin	Shan State	7100	35446	-	2020
17	Kyee-on Kyee-wa	Mone	Magway Division	74	330	-	-
18	Bu-ywa	-	Magway Division	42	195	-	-
19	Myogyi	-	Mandalay Division	30	135	-	-

Power Projects for Cross-border Power Interconnection

Sr. No.	Name of Project	Installed Capacity (MW)	Annual Energy (GWh)	Current Status and Progress
1.	Yenam	1,200	6,650	Negotiation for Joint Venture Agreement with China Power Investment Corp: (16,500 MW)
2.	Kawnglangphu	2,700	14,730	
3.	Pisa	2,000	11,080	
4.	Wutsok	1,800	10,140	
5.	Chipwi	2,800	15,210	
6.	Laza	1,900	10,440	
7.	Myitsone	4,100	18,320	
8.	Dapein (1)	240	1,065	MOA with DUHD Submitting Joint Venture Agreement to Cabinet.
9.	Dapein (2)	140	633	MOU with DUHD in (25.9.08)
10.	Shweli (1)	600	4,022	Commissioning in 2008 by DHPI & YUPD.
11.	Shweli (2)	640	3,310	MOU signed with Huaneng Lancang River Hydro Power Co. Ltd in 14th Nov 2009.
12.	Shweli (3)	800	3,995.5	Will be implemented by DHPI.
13.	Upper Thanlwin	1400	7,338	MOA with Hanergy Holding Group Ltd.
14.	Ta Sang	7110	35446	JV Basis with MDX Group, Thailand, But project is delayed.
15.	Hutgyi	1,360	7,325	Negotiation for MOA with EGAT
16.	Tanintharyi	600	3,476	MOU with Italian-Thai.
17.	Mong Khot	3x123	-	Thailand
18.	Tamanthi	200x6	6688	Agreement signed NHPC (India)
Total		31,059		



Power Projects
for Cross-border Power interconnection (Continued)

- Shweli-1 Hydropower Project (600 MW) is implemented by the joint - venture basis with YUPD of China and MOEP(1).
- It's commercial operation started on 6th November 2008 and it becomes the first interconnection project.
- 50 % of generation sent to Yunnan, China.

- The MOU is planned to sign between MOEP (1) and Huaneng Lancang River Hydropower Co. of China to develop the Shweli-2 Hydropower Project (640MW).

- The Shweli-3 Hydropower Project (800MW) will be construct by MOEP(1).

Power Projects
for Cross-border Power interconnection (Continued)

- The MOU was signed between
  MOEP 1 and China Power Investment Corporation (CPI) of China
  to develop seven Hydropower Projects (16,500 MW) on the Mekha river basin.
- The commercial operation of the first machine is expected in coming seven years.

- The MOU was signed between
  MOEP 1 and DUHP (Datun United Hydro Power Development Co.) of China
  to develop the Dapein(1) Hydropower Project (240 MW).
- Its commercial operation will be started in 2010 and it will become the second interconnection project.
- The second stage of Dapein Hydropower Project Dapein(2) (160 MW) will also be cooperated with DUHP.

Power Projects
for Cross-border Power interconnection (Continued)

- Ta Sang Hydropower project (10x 711 MW) was planned to be developed by joint-venture basis with MDX Group Co., Ltd, Thailand and MOEP 1. But the development of the project is delayed.

- The MOA was signed between MOEP 1 and EGAT of Thailand to develop the Hutgyi Hydropower Project (1360 MW).
- The final feasibility study report and detailed design report of Hutgyi Hydropower Project have been completed in Aug 2007 and Sept 2007 respectively.

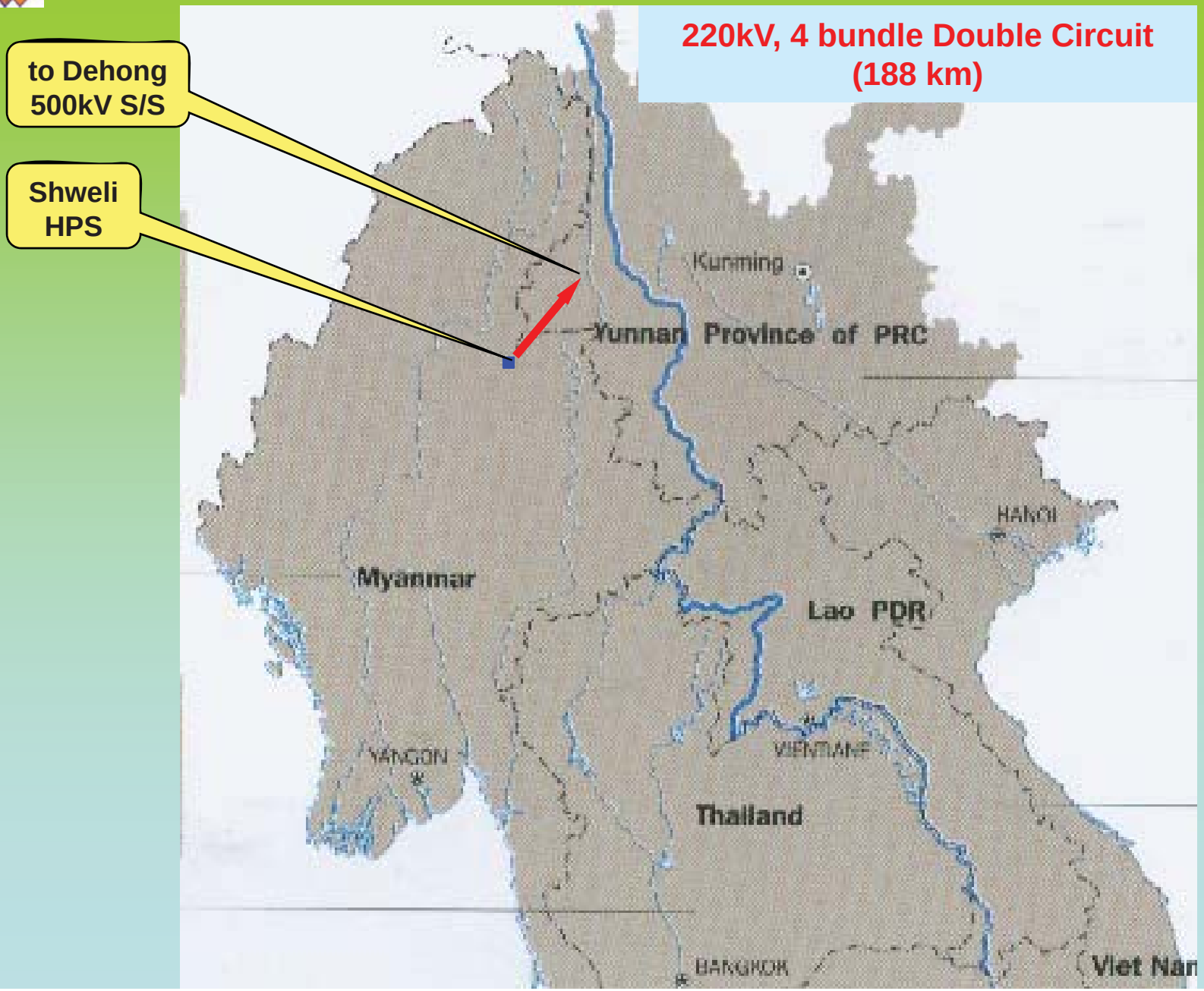
- The MOU was signed between MOEP 1 and Italian-Thai for the joint development of the Taninthayi Hydropower Project (600 MW).

Private Sector Participation

Local investors are allowed to participate in the scheme of Independent Power Producer (IPP) for hydropower projects

- ✓ The MOU on **Thaukyegat(2)** Hydropower Project (120 MW) was signed between MOEP(1) and Asia World Company Limited on 2nd May 2008.
- ✓ The MOU on **Baluchaung No.(3)** Hydropower Project (48 MW) was signed between MOEP(1) and High Tech Concrete Technology Company Limited on 2nd May 2008.
- ✓ The MOU on **Saidin** Hydropower Project (76.5 MW) was signed between MOEP(1) and Futrue Energy Company Limited on 5th November 2009.(BOT)
- ✓ The MOU on **Upper Baluchaung** Hydropower Project (40 MW) was signed between MOEP(1) and King Anawrahta Company Limited on 5th November 2009.(BOT)

First interconnection lines in operation



First interconnection lines in operation (Contd:)

In the current situation, Myanmar and China developed the **Bilateral Power Trading** between two countries.

The **Power Purchase Agreement** for Shweli(1) Hydropower Plant was recently signed between MEPE and the Joint Venture Company (SHPC) in September 2009.

LARGE SCALE OF POWER PURCHASE FROM SHWELI (1) HYDROPOWER PLANT

SHWELI (1) HYDROPOWER CO. LTD	Yuan	Cent (US)	Kyat
	0.184	2.69	26.9

- The transaction price for electricity purchased by Myanmar Power Grid from Shweli (1) Hydropower Co. shall be kept at the **same transaction price for electricity purchased by Yunnan Power Grid**, that is RMB 0.184 Yuan/kWh.
- If adjustment has been made to the transaction price for power purchase by one side of Power Grid, both side shall be adjusted accordingly.

CROSS-BORDER POWER TRADE

AT PRESENT, MOSTLY CROSS – BORDER SMALL SCALE POWER PURCHASE FROM THAILAND AND CHINA EXISTED UPON APPROVAL OF MINISTRY.

RATE OF SMALL SCALE POWER PURCHASE FROM CHINA

Name of Town	Yuan	Cent (US)	Kyat
Muse, Namkhan, Manhero, Hopin, Kunlon, Manton	1.2	17.587	175.87
Muse(105 mile)	1.4	20.518	205.18
Kyukoke	1.5	21.975	219.75

RATE OF SMALL SCALE POWER PURCHASE FROM THAILAND

Name of Town	Baht	Cent (US)	Kyat
Tachileik	6.25	17.692	176.92
Phayathonesu	6	16.973	169.73
Myawaddy	4.5	12.725	127.25

Power for export to India

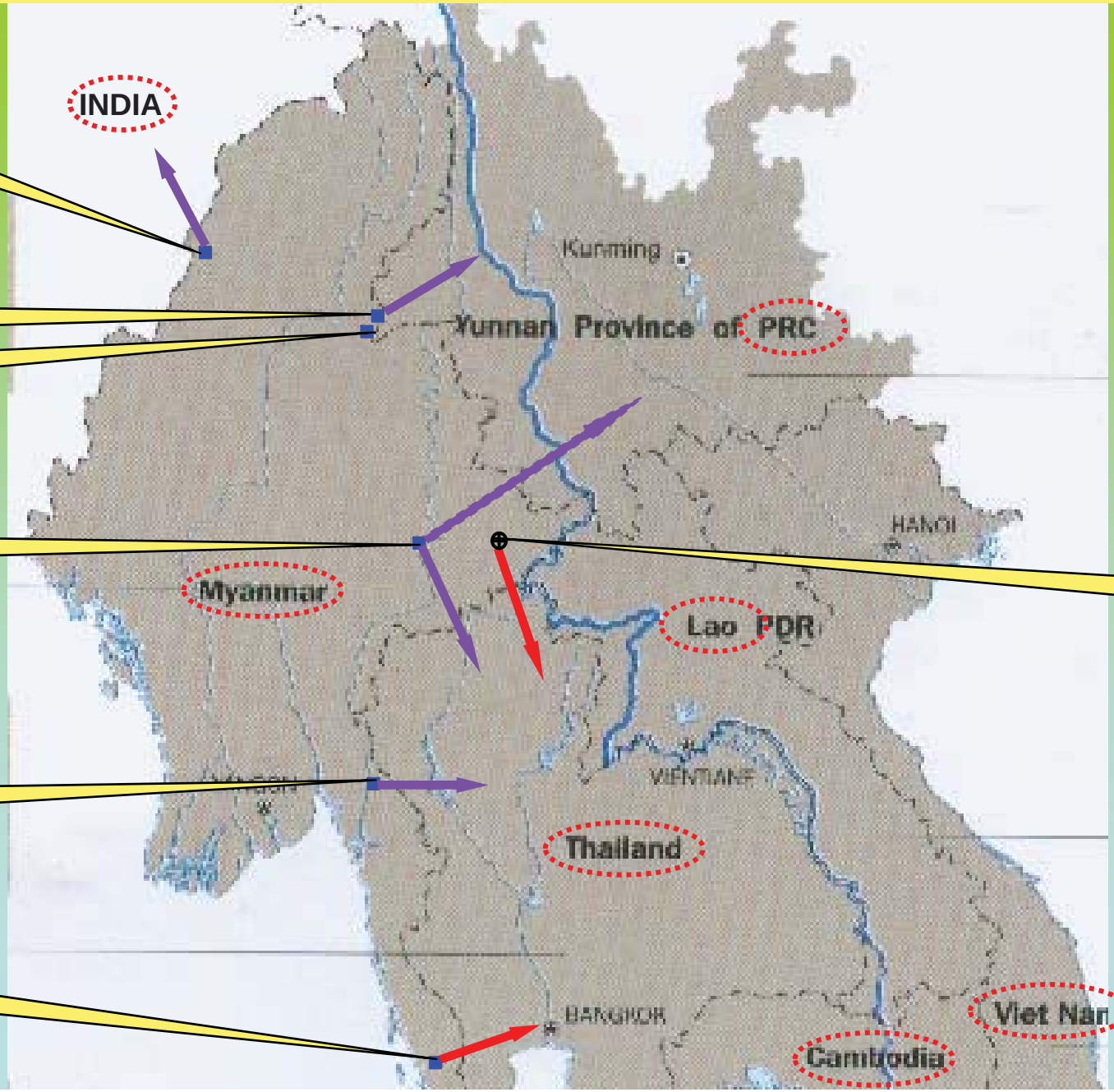
Tamanthi HPP

2008, MOU on Hydropower Development Projects in Chindwin River Basin with National Hydroelectric Power Corporation (NHPC) (India)

This project is multi purpose project,
Generating the average annual energy about 6685 million kWh, (200x6 =1200MW)
Irrigating for 1 million acres of farm lands,
Improving the navigation and preventing the floods.

For the implementation of the project and consulting services, the agreements were signed with National Hydroelectric Power Corporation (NHPC-India) and Colenco Power Engineering Ltd.(CPE-Switzerland) on(25.10.2004) and (10.3.2006) respectively.

230kV,500kV interconnection lines under plan (2010-2020)



Tamanthi HPP

Dapein 1 HPP

Dapein 2 HPP

Ta Sang HPP

Hutgyi HPP

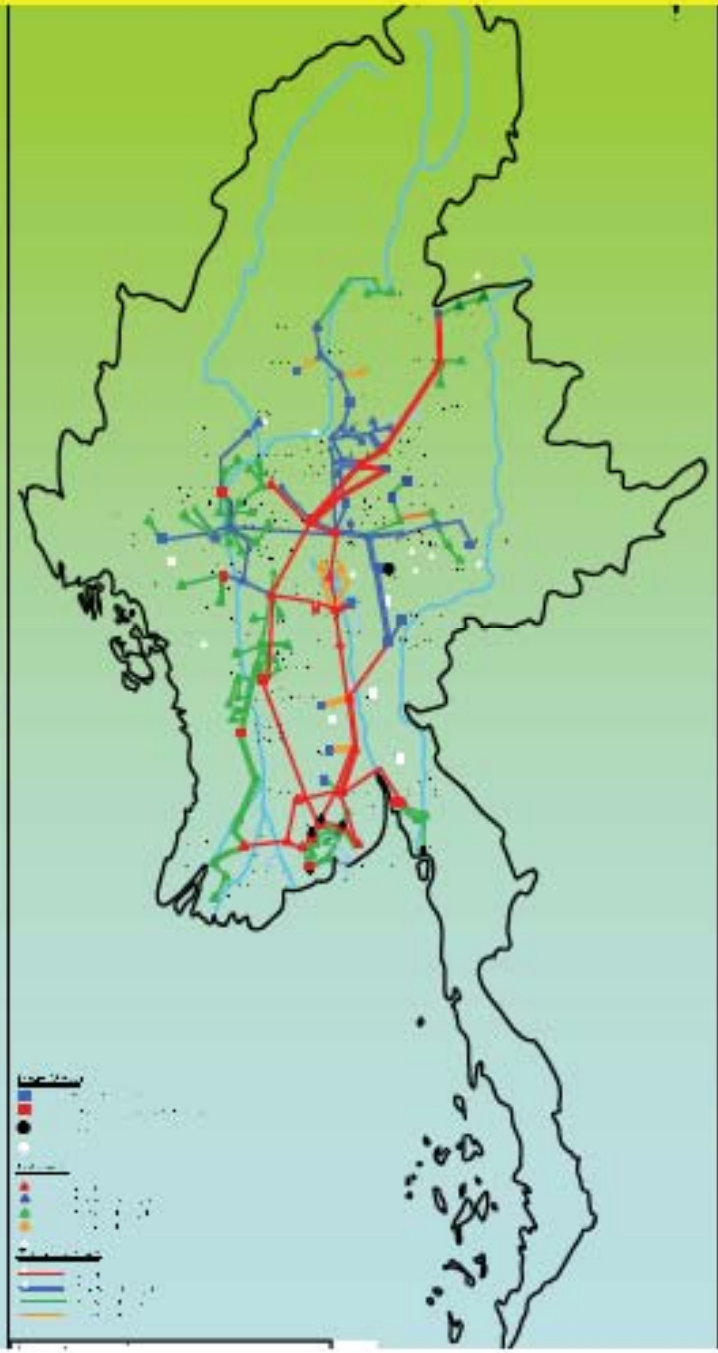
Tanintharyi HPP

Mong Khot Coal Fire PS

230 kV

500 kV

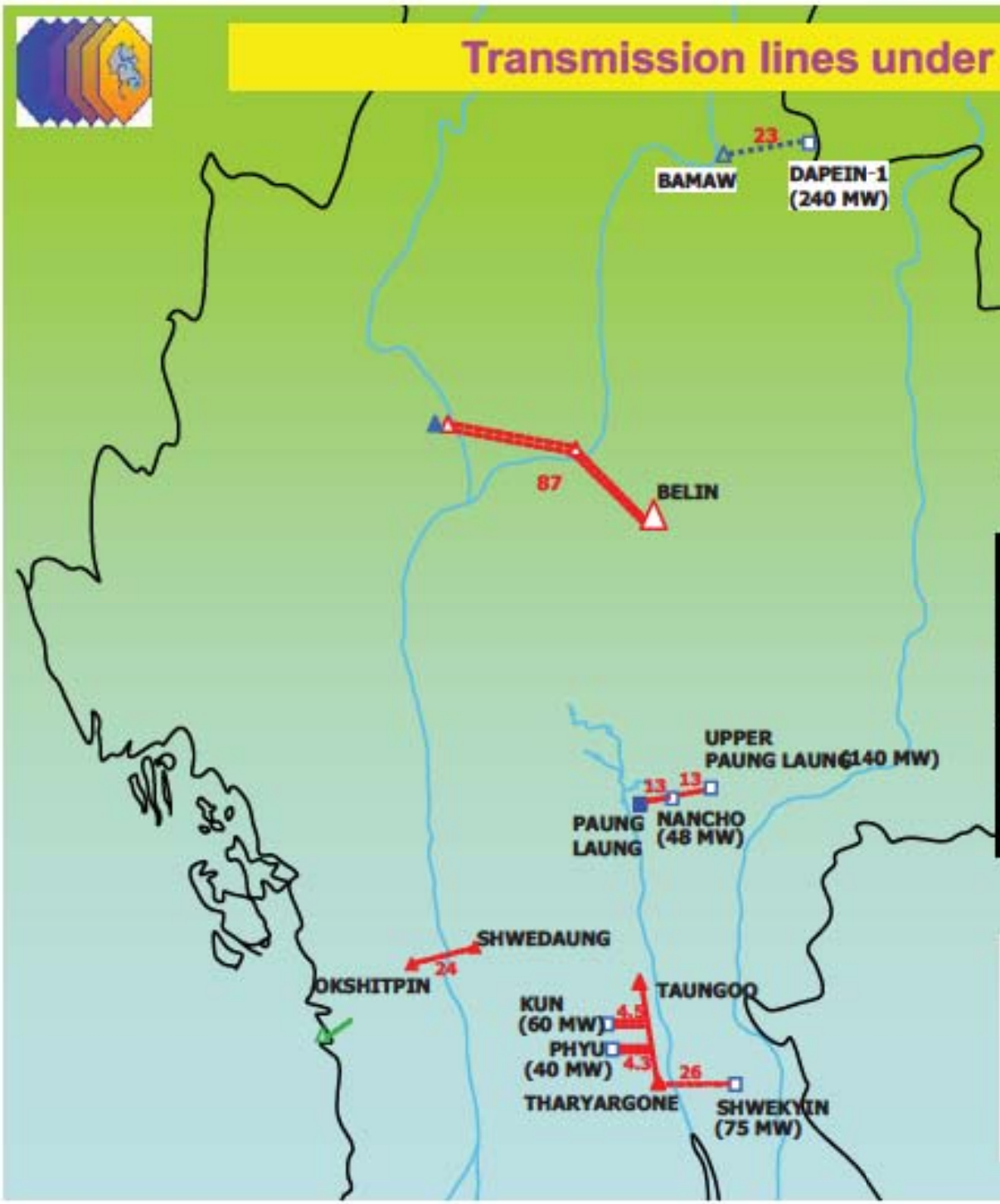
Transmission lines in operation



Existing		
kV	Nos. of Lines	km
230	29	2680
132	28	2012
66	72	2520
Total	129	7212

No transmission line owned and operated by the IPP/BOT developer.

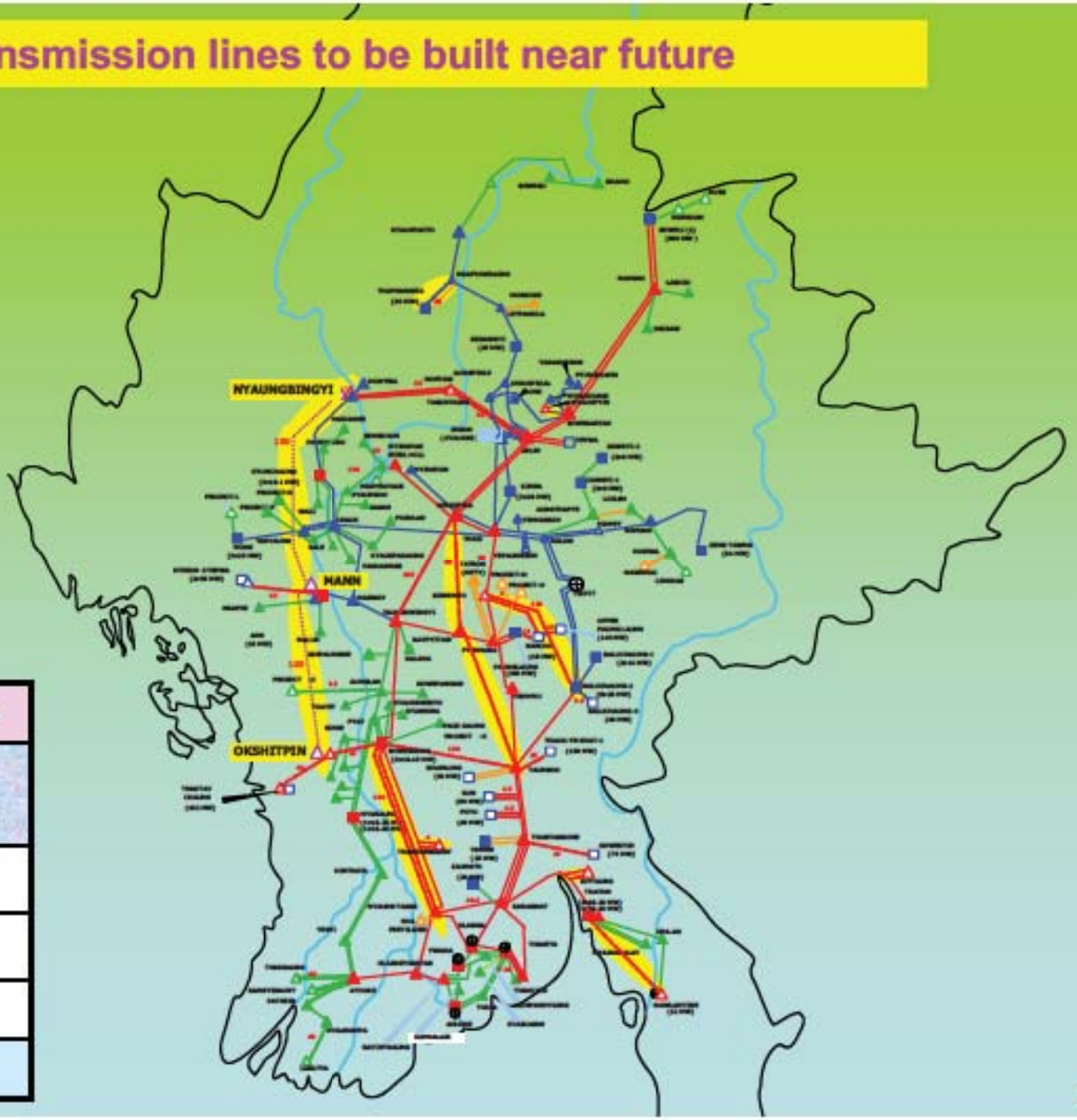
Transmission lines under construction



Under Construction		
kV	Nos. of Lines	km
230	6	277
132	1	37
Total	7	314

These transmission lines will be financed, constructed and operated by MEPE,MOEP-2.

Transmission lines to be built near future



T/L to be built Near Future		
kV	Nos. of Lines	km
500	2	400
230	6	820
132	1	58
Total	9	1278

Future Myanmar Grid System

T/L to be built between (2010 ~ 2020)		
kV	Nos. of Lines	km
500	6	2,833
230	49	5,374
132	7	636
Total	62	8,843

transmission lines to be built between (2010 ~ 2020) (Continued)

Sr	Name of 500 kV T/L	Length (km)
1	Belin - Naypyitaw - Taungoo - Kamanut 500 kV Transmission Line	507
2	Monywa - Mann - Okshitpin - Hinthada 500 kV Transmission Line	587
3	Myitsone - Moemeik - Belin 500 kV Transmission Line	692
4	Htamanthi - Myitsone 500 kV Transmission Line	354
5	Htamanthi - Monywa 500 kV Transmission Line	370
6	Tasang - Naypyitaw 500 kV Transmission Line	322
	Total	2833

Sr	Name of 230kV T/L	Length (km)
1	Thahtay Chaung - Okshitpin 230 kV Transmission Line	80.5
2	Naypyitaw - shwemyo 230 kV Transmission Line	48.3
3	Thahtay - Maei - Ann 230 kV Transmissoin Line	209.3
4	Ann - Kyauktaw 230 kV Transmission Line	193.2
5	Bhamo - Myitkyina 230 kV Transmission Line	136.85
6	Bhamo - Moemeik 230 kV Transmission Line	128.8
7	Moemeik - Ngapyawdaing 230 kV Transmission Line	120.75
8	Ngapyawdaing - Ohntaw 230 kV Transmission Line	144.9
9	Thaukyekhat - Taungoo 230 kV Transmission Line	40.25

transmission lines to be built between (2010 ~ 2020) (Continued)

Sr	Name of 230kV T/L (continued)	Length (km)
10	Bawgata - Thayargone 230 kV Transmission Line	32.2
11	Hinthada - Myaungtaga 230 kV Transmission Line	128.8
12	Manipur - Gantgaw 230 kV Transmission Line	136.85
13	Gantgaw - Pakkhokku 230 kV Transmission Line	152.95
14	Pakkhokku - Myingyan 230 kV Transmission Line	64.4
15	Belin - Myingyan 230 kV Transmission Line	128.8
16	Naypyitaw - Thephyu 230 kV Transmission Line	48.3
17	Minekhot - Kengtong 230 kV Transmission Line	119.14
18	Minekhot - Minesat 230 kV Transmission Line	61.18
19	Minekhot - Tacheleik 230 kV Transmission Line	103.04
20	Tapein(1) - Shweli(1) 230 kV Transmission Line	112.7
21	Tapein(1) - Tapein(2) 230 kV Transmission Line	16.1
22	Shweli(1) - Shweli(2) 230 kV Transmission Line	24.15
23	Shweli(2) - Shweli(3) 230 kV Transmission Line	51.52
24	Shweli(3) - Moemeik 230 kV Transmission Line	48.3
25	Moemeik - Mansan 230 kV Transmission Line	88.55
26	Tagaung - (Moemeik - Ngapyawdaing) 230 kV Transmission Line	144.9
27	Myitsone - Myitkyina 230 kV Transmission Line	96.6

transmission lines to be built between (2010 ~ 2020) (Continued)

Sr	Name of 230kV T/L (continued)	Length (km)
28	Myitkyina - Hopin 230 kV Transmission Line	112.7
29	Hopin - Indaw 230 kV Transmission Line	112.7
30	Indaw - Ngapyawdaing 230 kv Transmission Line	144.9
31	Htamanthi - Hopin 230 kV Transmission Line	161
32	Htamanthi - Phaungpyin 230 kV Transmission Line	161
33	Phaungpyin - Kalewa 230 kV Transmission Line	144.9
34	Kalewa - Monywa 230 kV Transmission Line	152.95
35	Shwesayae - Monywa 230 kV Transmission Line	40.25
36	Upper Thanlwin - Kunlon - Theinni 230 kV Transmission Line	144.9
37	Theinni - Minenaung 230 kV Transmission Line	120.75
38	Kholan - Minenaung 230 kV Transmission Line	88.55
39	Tasang -Minesat 230 kV Transmission Line	64.4
40	Hutgyi - Mawlamyaing 230 kV Transmission Line	198.03
41	Hutgyi - Thaton 230 kV Transmission Line	96.6
42	Mawlamying - Ye 230 kV Transmission Line	132.02
43	Ye - Dawei 230 kV Transmission Line	80.5
44	Mayyon - Myeik 230 kV Transmission Line	64.4
45	Myeik - Dawei 230 kV Transmission Line	96.6

transmission lines to be built between (2010 ~ 2020) (Continued)

Sr	Name of 230kV T/L (continued)	Length (km)
46	Mayyon - Bokpyin 230 kV Transmission Line	209.3
47	Bokpyin - Kawthaung 230 kV Transmission Line	193.2
48	Hinthada - Athoke 230 kV Transmission Line	128.8
49	Athoke - Pathein 230 kV Transmission Line	64.4
	Total	5374.18

Sr	Name of 132kV T/L	Length (km)
1	Ann - Mann 132 kV Transmission Line	128.8
2	Upper Kengtaung - Kholam 132 kV Transmission Line	56.35
3	Upper Sedawgyi - Sedawgyi 132 kV Transmission Line	24.15
4	Buywa - Kyeeon Kyeewa 132 kV Transmission Line	136.85
5	Buywa - Pakkhokku 132 kV Transmission Line	112.7
6	Tasang - Kengtaung 132 kV Transmission Line	40.25
7	Thaton - Kawkareik 132 kV Transmission Line	136.85
	Total	635.95

Electrification Ratio

Year	Electrification Ratio
Before 1988	10.59 %
2005-06	15.83 %
2009 May	23.27 %
2020	60 %
2025	80 %

Thanks for your kind attention.

Thailand Country Report :
Progress of PDP & Transmission Projects

Presented by
Dr. Suthep Chimklai
EGAT, Thailand

at

8th Meeting of Focal Group (FG8)
Regional Power Trade Coordination Committee (RPTCC)

Luang Prabang, Lao PDR
25 - 27 November 2009

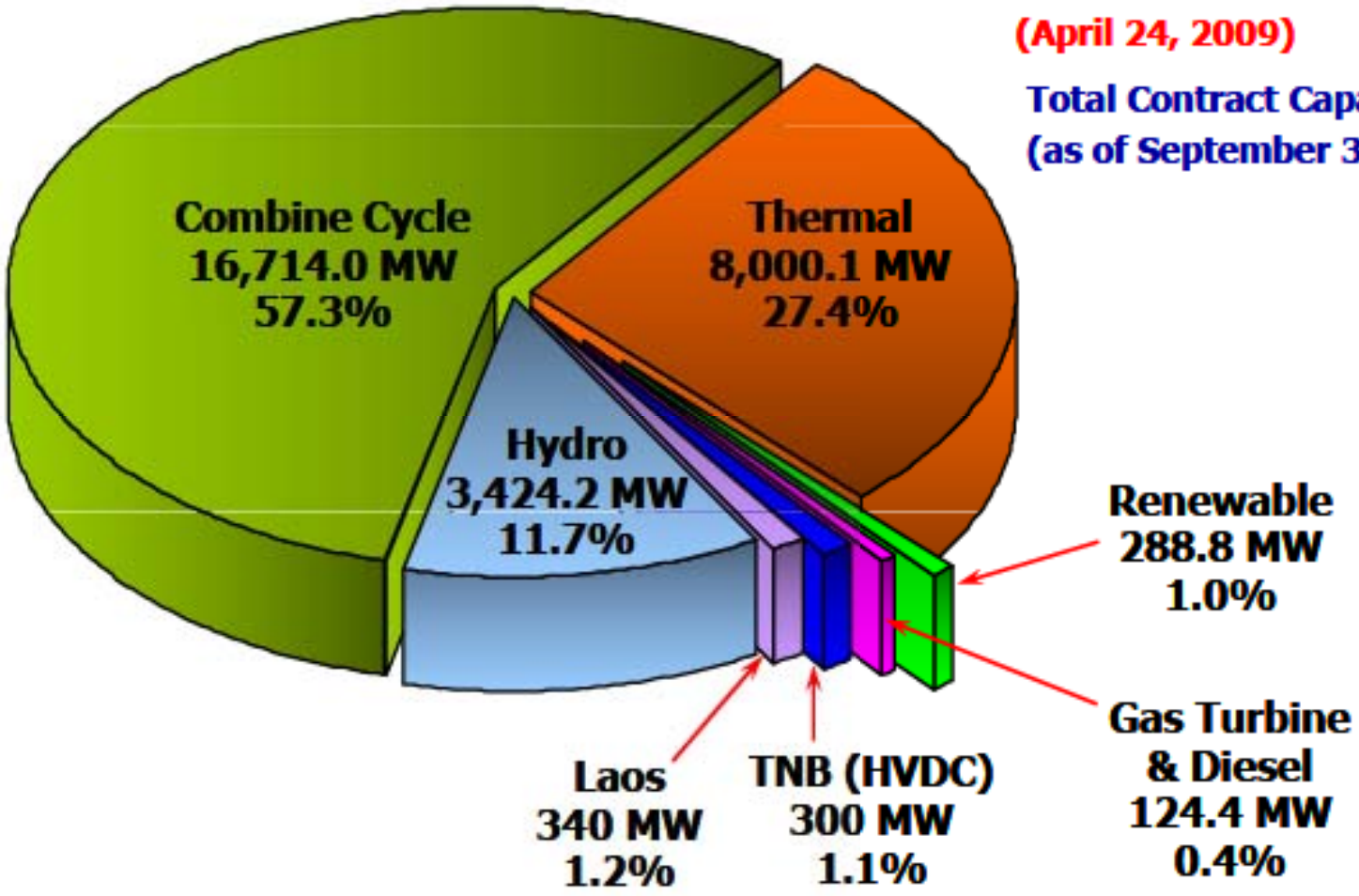
I. Presentation of Power Sector Development

Current Status of Power Generation

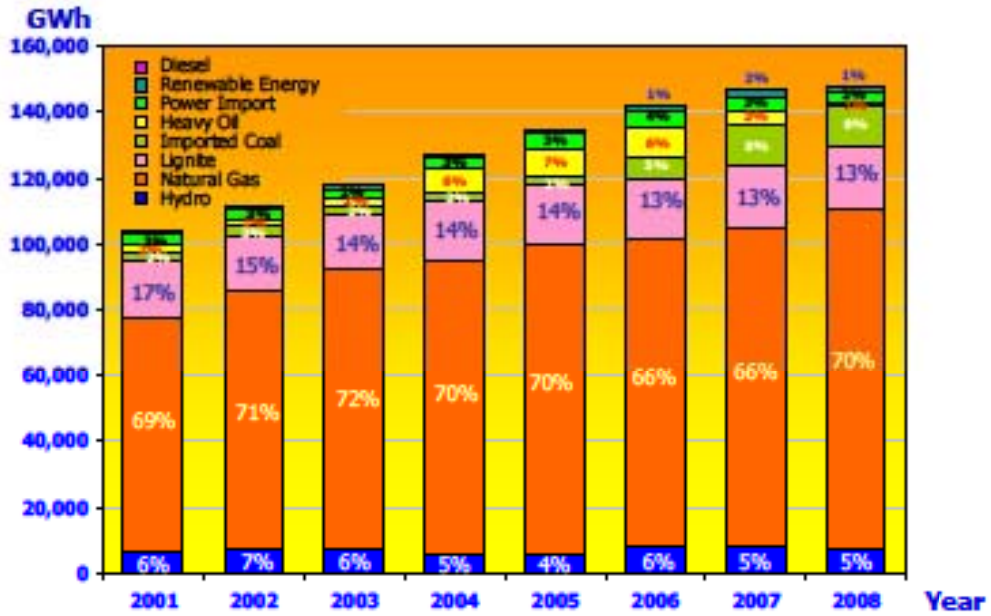
Total Capacity by Power Plant Type

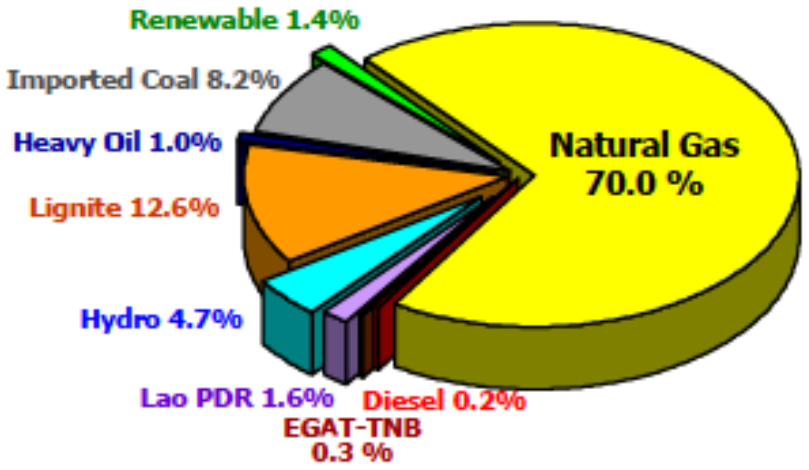
Total Peak Demand **22,044.9 MW**
(April 24, 2009)

Total Contract Capacity **29,191.0 MW**
(as of September 30, 2009)

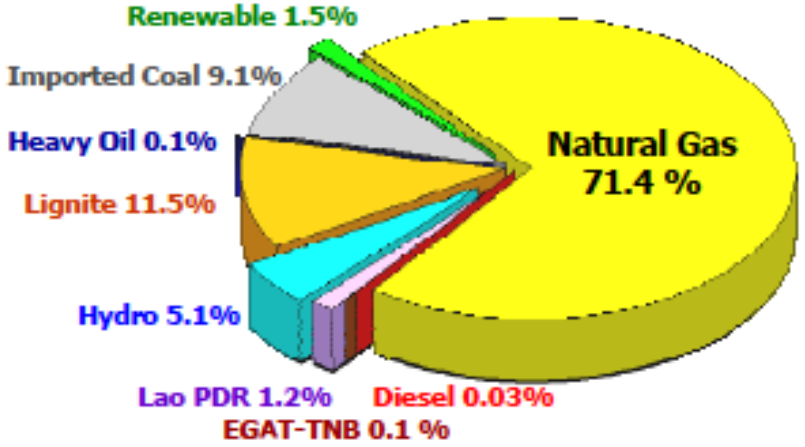


Total Energy Generation by Fuel Type





January 1 – December 31, 2008
148,201 GWh

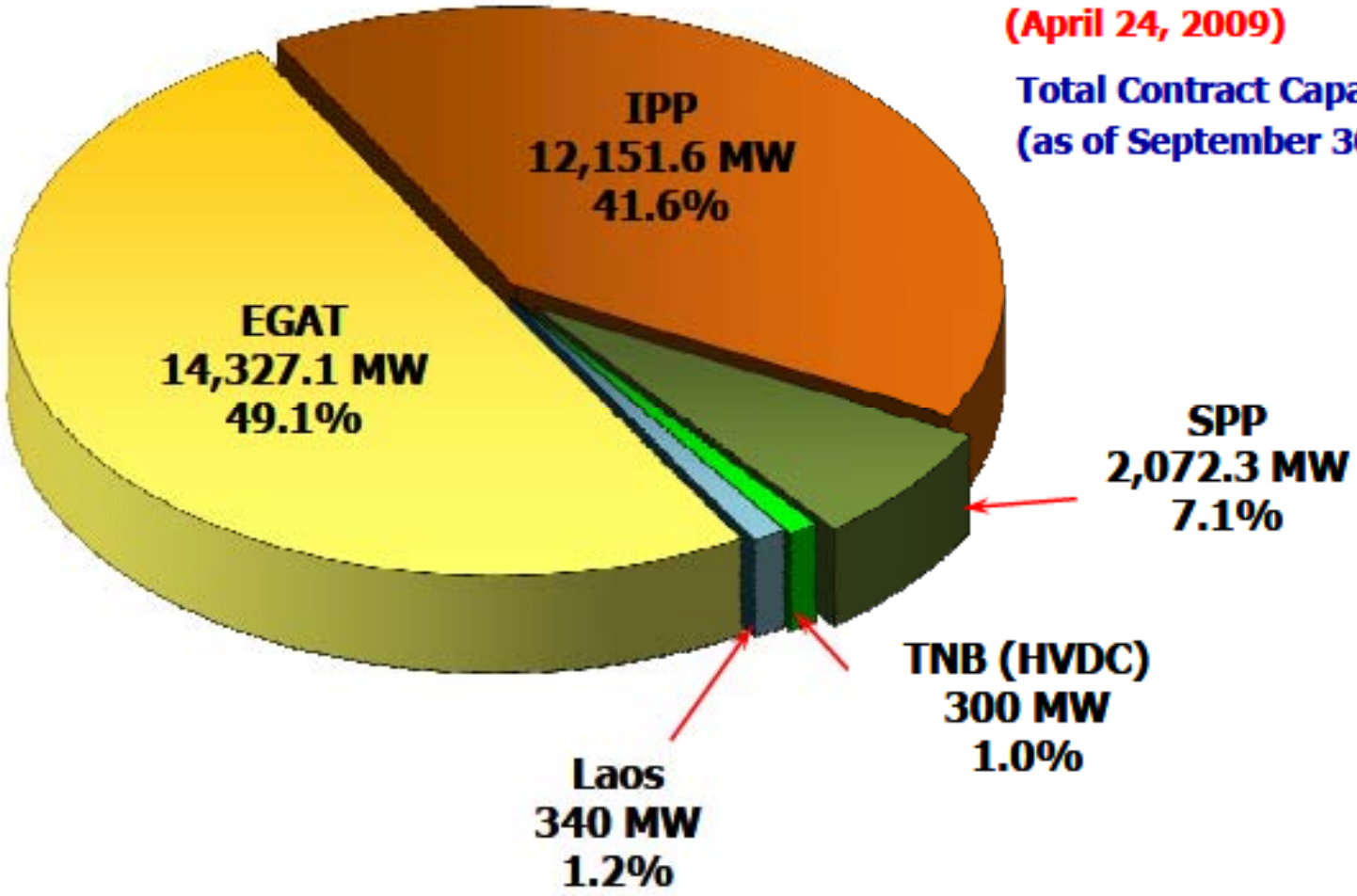


January 1 – September 30, 2009
108,426 GWh

Total Capacity by Producer

Total Peak Demand **22,044.9 MW**
(April 24, 2009)

Total Contract Capacity **29,191.0 MW**
(as of September 30, 2009)



Geographical Location of EGAT's Hydroelectric Plant

Hydroelectric Plant	Capacity (MW)
1 Bhumibol	779.2
2 Sirikit	500
3 Sirinagarind	720
4 Vajiralongkorn	300
5 Rajjaprabha	240
6 Pak Mun	136
7 Lam Takhong	500
8 Ubolratana	25.2
9 Chulabhorn	40
10 Sirindhorn	36
11 Bang Lang	72
12 Tha Thung Na	39
13 Kang Krachan	19
14 Mae Ngat	9
15 Nam Pung	6
16 Bansanti	1.275
17 Huai Kum	1.06
Total	3,402.374

Geographical Location of EGAT's Thermal Plant

Thermal Power Plant	Capacity (MW)
1 Bang Pakong	2,204
2 Mae Moh	2,180
3 Krabi	315
Subtotal	4,699

Combined Cycle Power Plant	Capacity (MW)
1 Wang Noi	1,910
2 South Bangkok	1,588
3 Nam Pong	650
4 Bang Pakong	628
5 Chana	710
Subtotal	5,486

Diesel Power Plant	Capacity (MW)
1 Mae Hong Son	4.4
Subtotal	4.4

Total	10,189.4

Geographical Location of IPP Power Plant

Plant Type	Capacity (MW)
Existing Projects	
Thermal Power Plant	
1 Ratchaburi	1,440
2 BLCP Power	1,346.50
3 Khanom	140.10
Combined Cycle Power Plant	
4 Ratchaburi	2,041
5 Rayong	1,175
6 Khanom	678
7 Tri Energy	700
8 Independent Power Producer	700
9 GlowIPP	713
10 Eastern Power & Electric	350
11 Gulf Power Generation	1,468
12 Ratchaburi Power	1,410
Subtotal	12,152

Future Projects

Plant Type	Capacity (MW)
1 Ghecocne (2011)	660
2 Siam Energy (2013)	1,600
3 National Power Supply (2013-2014)	540
4 Power Generation Supply (2014)	1,600
Subtotal	4,410
Total	**16,551.60**

Geographical Location of Power Purchase from Neighboring Countries

Existing Projects

Projects	Capacity (MW)
1 Theun Hinboun	214
2 Houay Ho	126
3 EGAT-IPP	300
Subtotal	640.00

Future Projects

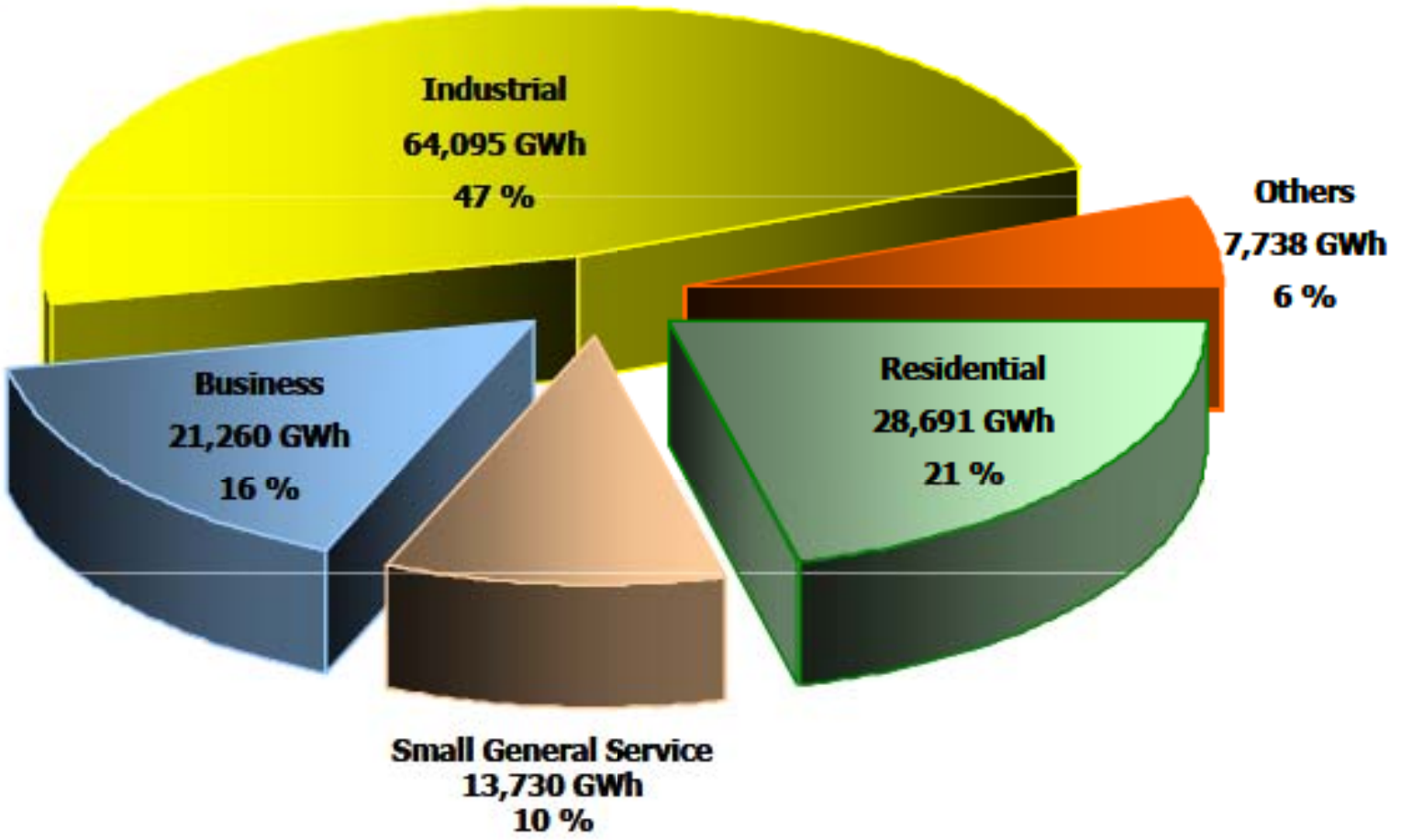
Projects	Capacity (MW)
4 Nam Theun 2 (Nov. 2009)	920
5 Nam Ngum 2 (2010)	597
6 Theun Hinboun Ex. (2012)	220
7 Hongsa (2015)	1473
Subtotal	3,210.00

Total	3,850.00

II. Presentation of Power Sector Planning

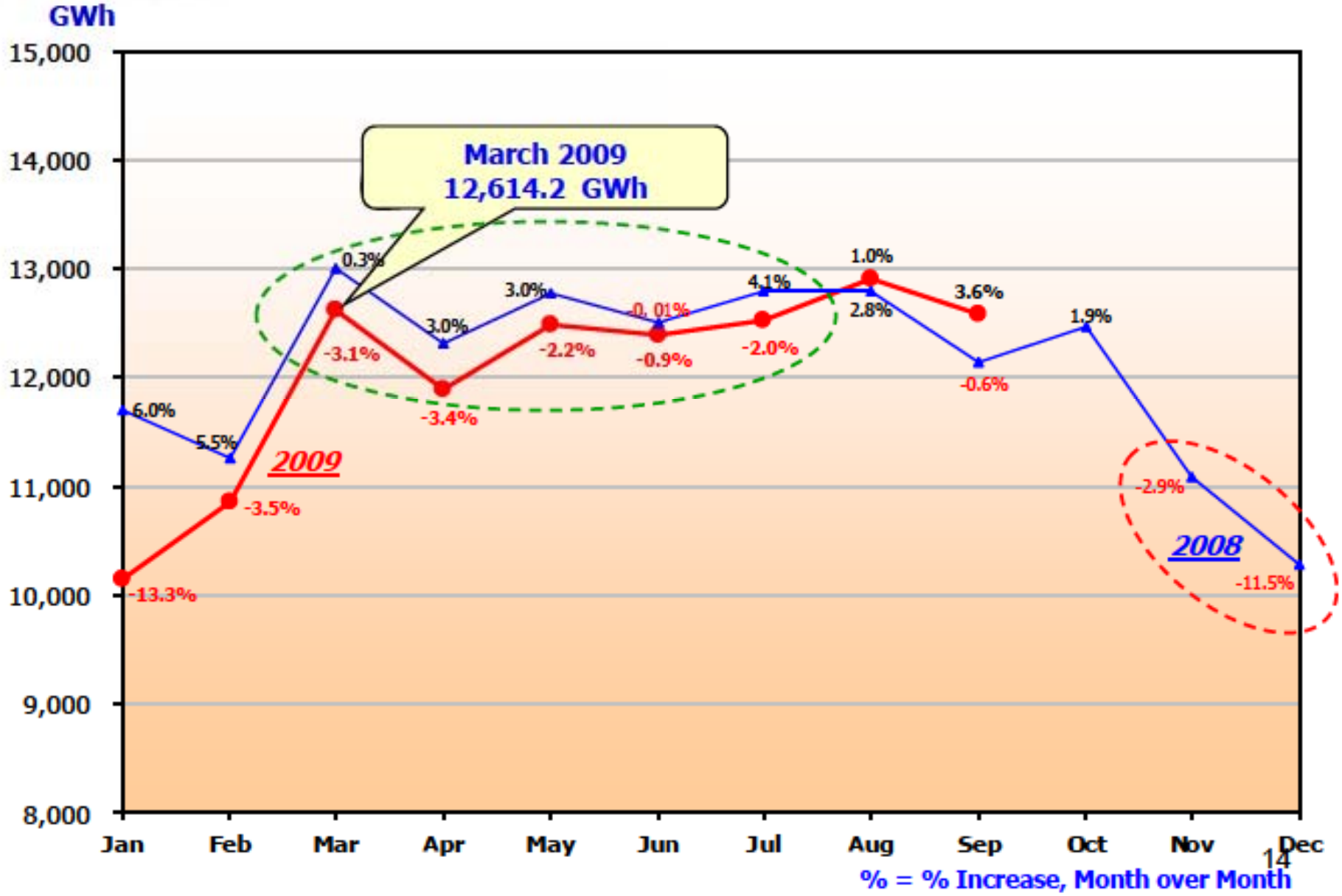
Demand Forecast

Energy Consumption by Sector (as of December, 2008)

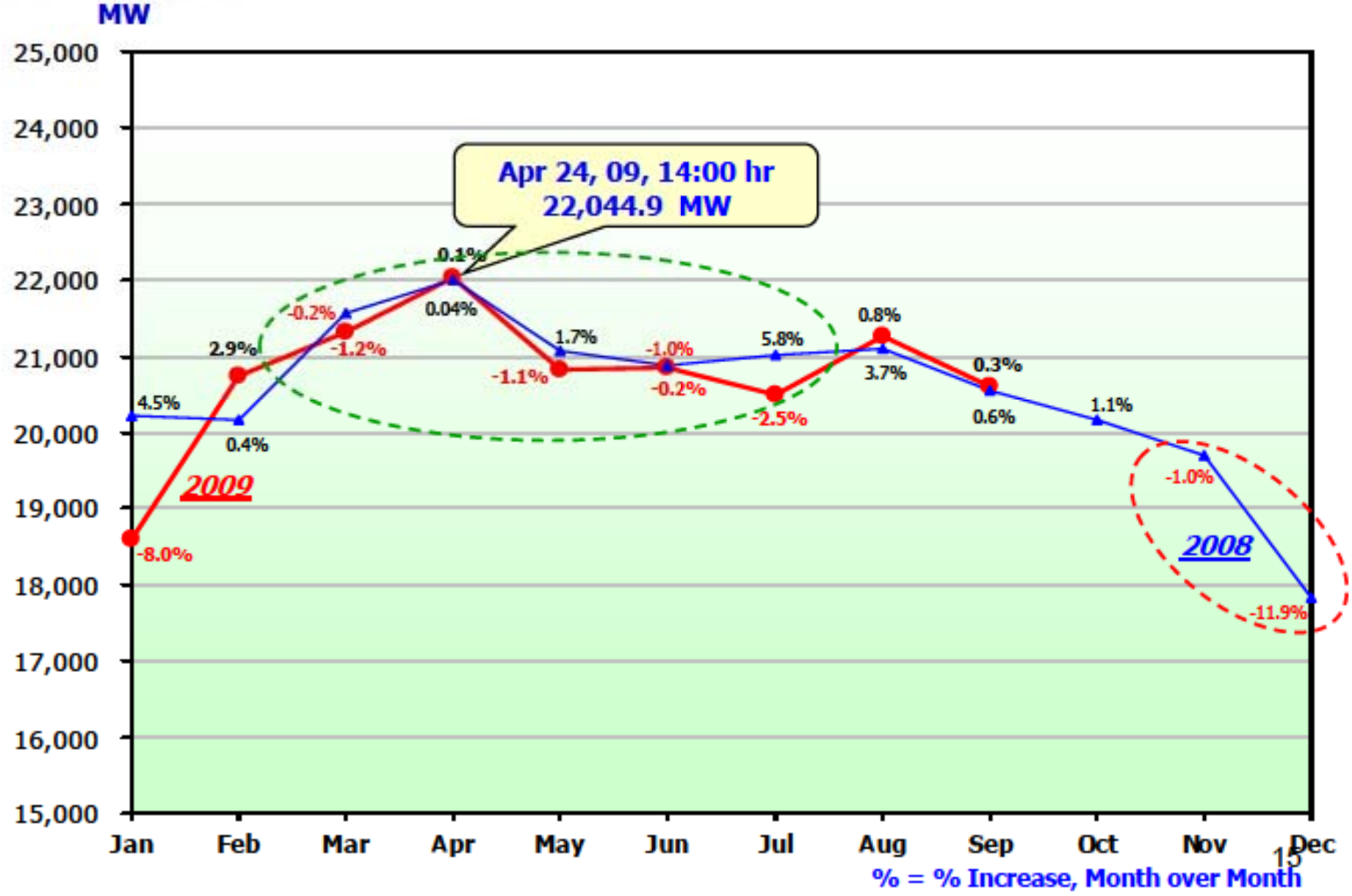


Total Energy Consumption 135,514 GWh

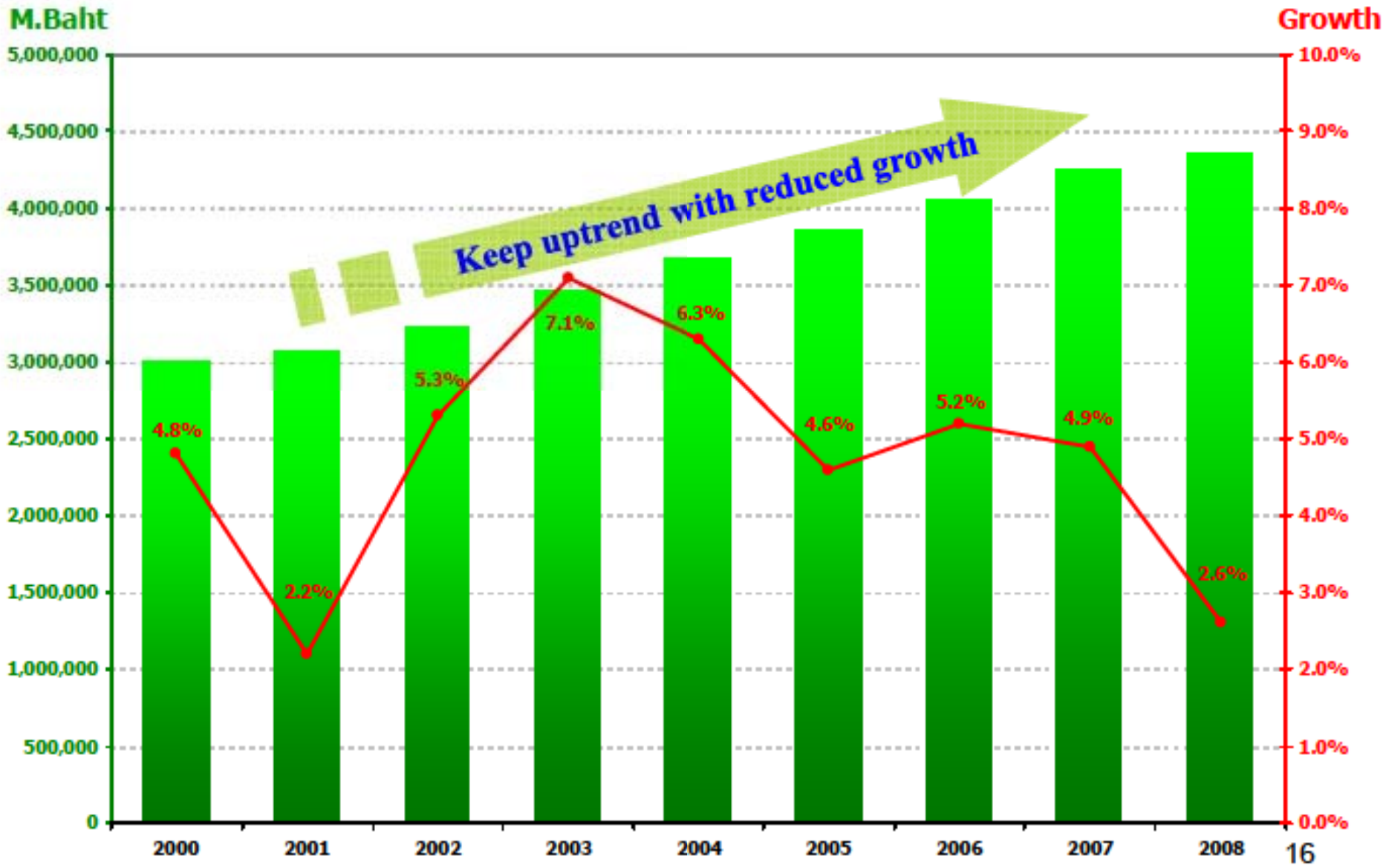
EGAT Monthly Energy Requirement (2008-2009)



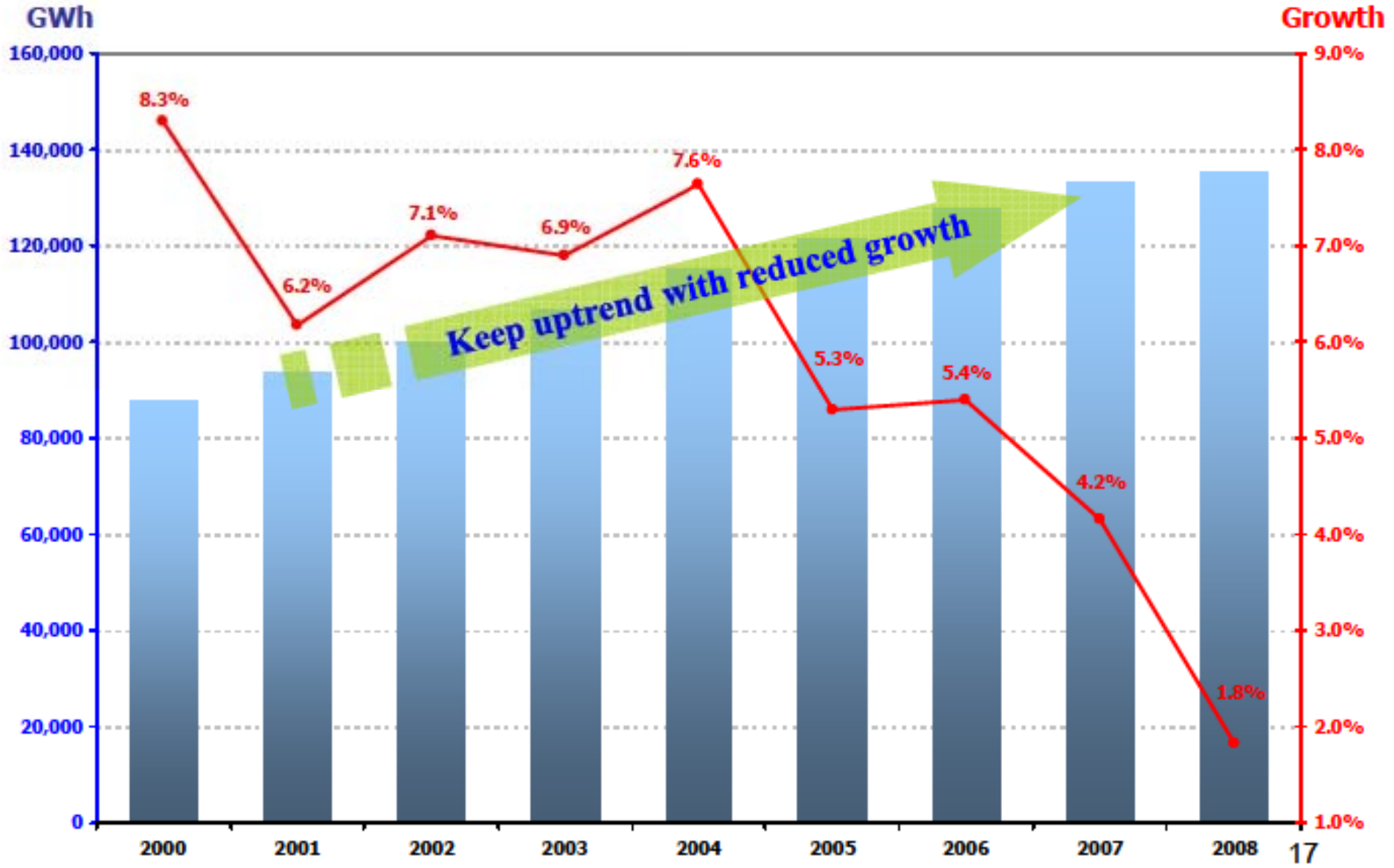
EGAT Monthly Peak Demand (2008-2009)



Thailand's Gross Domestic Product



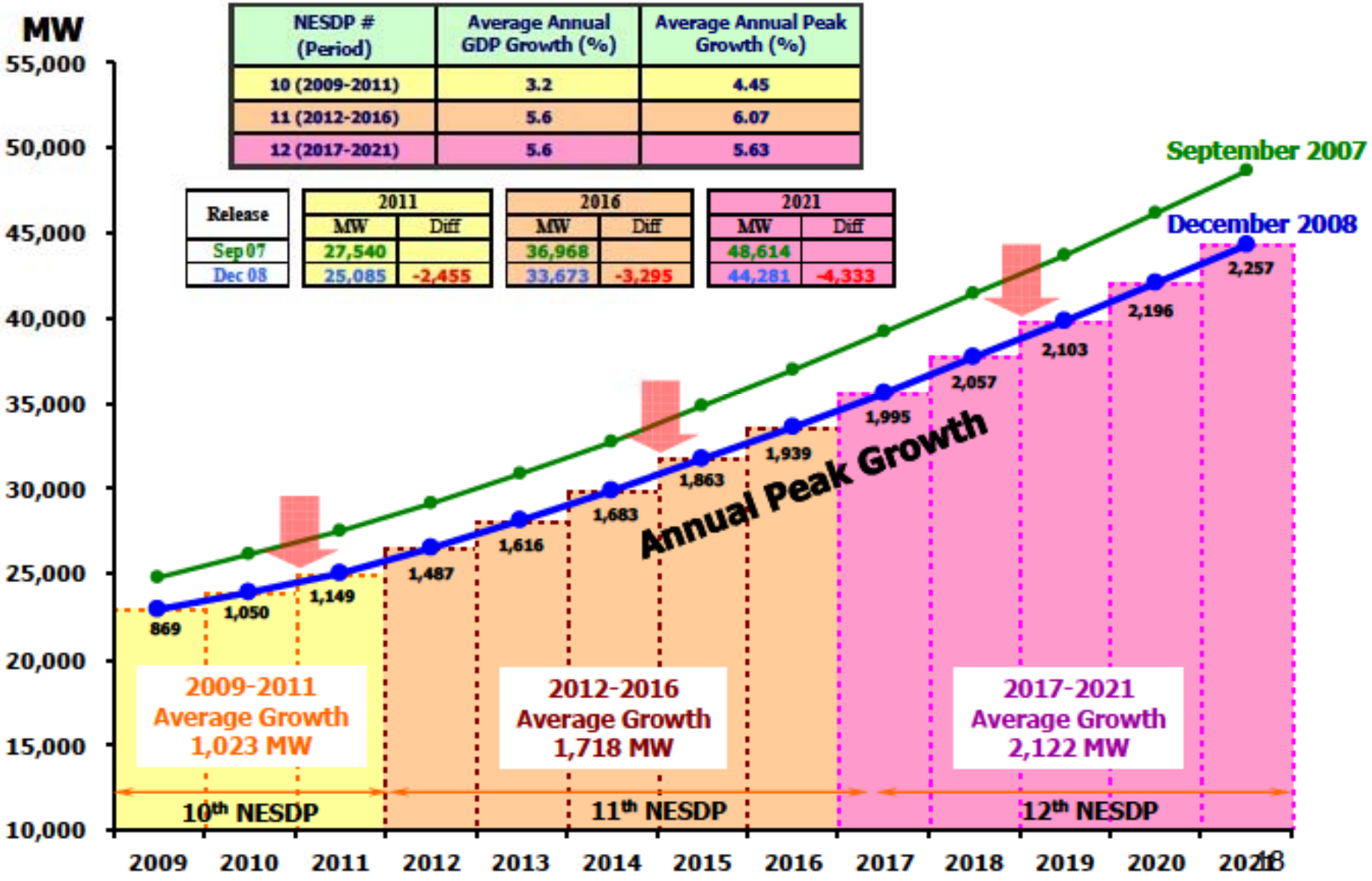
Thailand's Electricity Consumption



Adjusted Peak Demand Forecast

NESDP # (Period)	Average Annual GDP Growth (%)	Average Annual Peak Growth (%)
10 (2009-2011)	3.2	4.45
11 (2012-2016)	5.6	6.07
12 (2017-2021)	5.6	5.63

Release	2011		2016		2021	
	MW	Diff	MW	Diff	MW	Diff
Sep 07	27,540		36,968		48,614	
Dec 08	25,085	-2,455	33,673	-3,295	44,281	-4,333



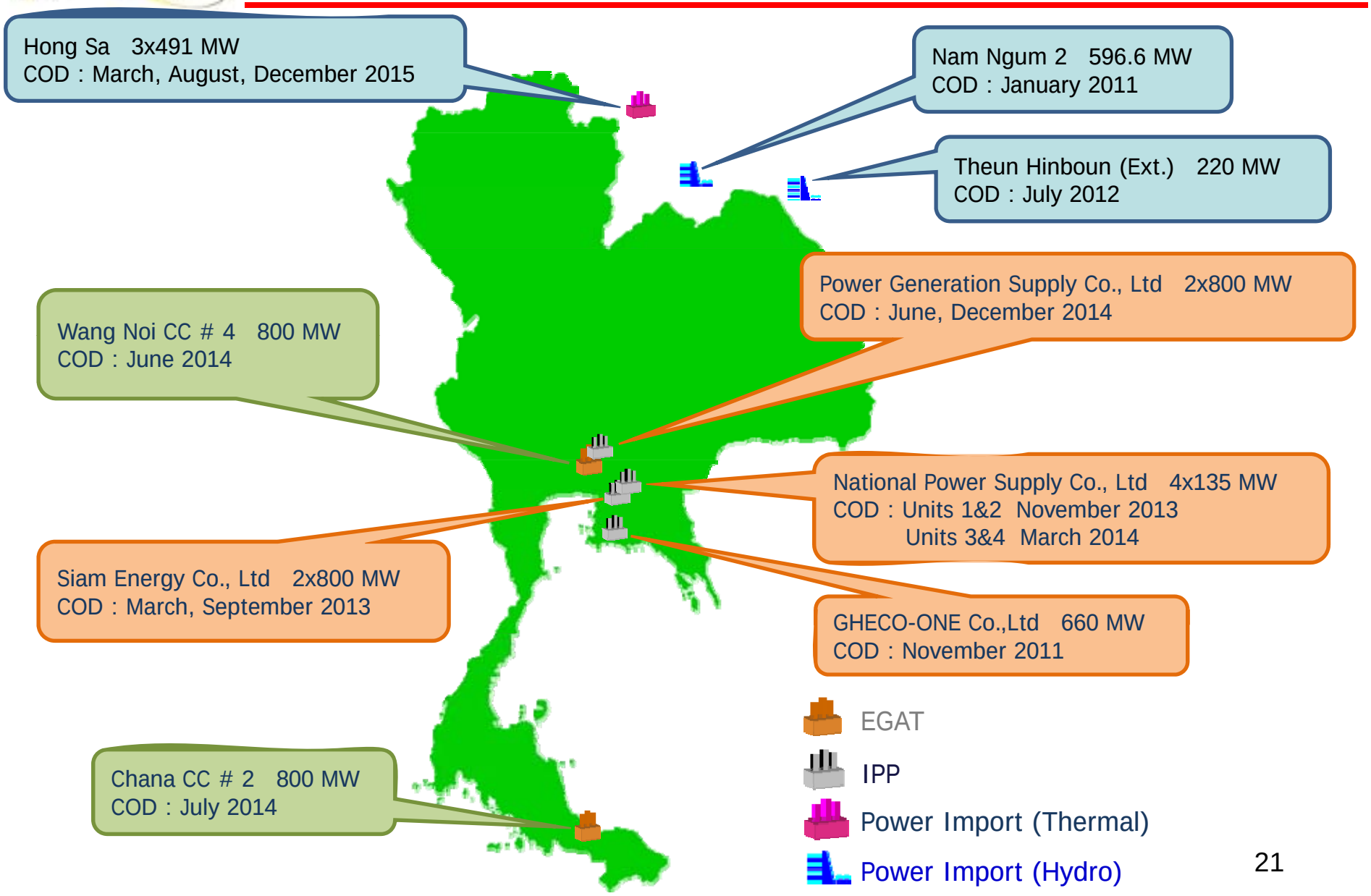
Load Forecast : PDP2007 Rev#2

Year	Peak			Energy			%
	MW	Increase		GWh	Increase		Load
		MW	%		GWh	%	Factor
2007	22,009.2	-	-	143,741.9	4,940.4	3.56	74.55
2008	22,018.0	8.80	0.04	145,111.6	1,369.7	0.95	75.03
2009	22,886	868	3.94	150,458	5,346	3.68	75.05
2010	23,936	1,050	4.59	155,645	5,187	3.45	74.23
2011	25,085	1,149	4.80	162,884	7,239	4.65	74.12
2012	26,572	1,487	5.93	172,593	9,709	5.96	74.15
2013	28,188	1,616	6.08	183,218	10,625	6.16	74.20
2014	29,871	1,683	5.97	194,326	11,108	6.06	74.26
2015	31,734	1,863	6.24	206,604	12,278	6.32	74.32
2016	33,673	1,939	6.11	219,339	12,735	6.16	74.36
2017	35,668	1,995	5.92	232,413	13,074	5.96	74.38
2018	37,725	2,057	5.77	245,950	13,537	5.82	74.42
2019	39,828	2,103	5.57	259,740	13,790	5.61	74.45
2020	42,024	2,196	5.51	274,144	14,404	5.55	74.47
2021	44,281	2,257	5.37	288,920	14,776	5.39	74.48

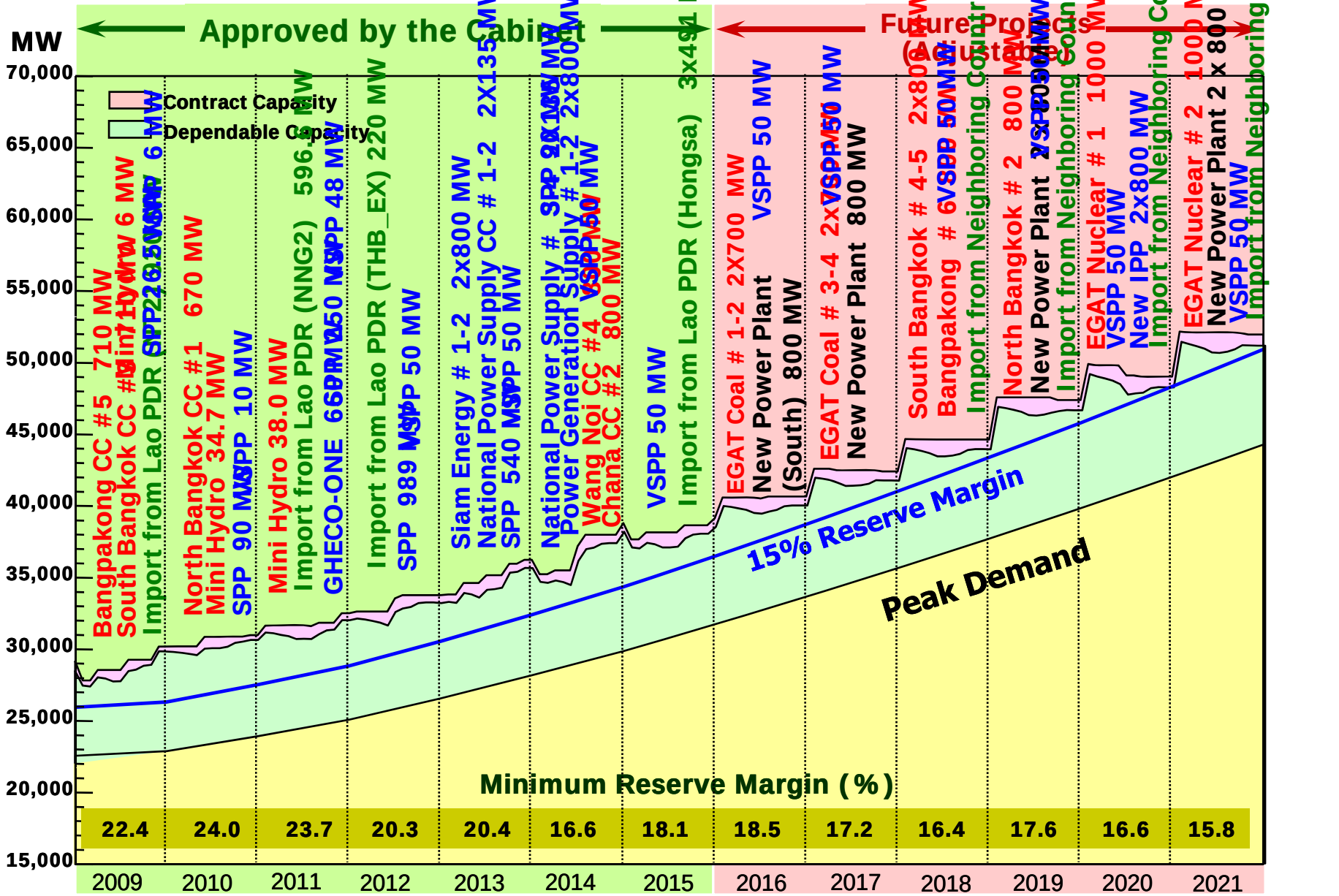
Thailand Load Forecast Sub Committee: December 2008

The updated Power Development Plan

Commissioning Power Plant (2011 – 2015)



Thailand Power Development Plan 2009-2021
(PDP 2007 Revision 2)



Energy Policy

THAILAND'S ENERGY POLICY delivered to the National Assembly on 30 December 2008 by Mr. Abhisit Vejjajiva, Prime Minister of Thailand and

ENERGY STRATEGY directed by Mr. Wannarat Channukul, Minister of Energy, on 12 January 2009

STRATEGY 1: ENERGY SECURITY

Policy Directive	Strategy	Target/Outcome	Implementation Methodology
Intensify energy development for greater self-reliance of the country with a view to achieving sufficient and stable energy supply by expediting exploration and development of energy resources at both domestic and international levels; negotiating with neighboring countries at the government level for joint development of energy resources; creating energy mix in power development to reduce risks pertaining to supply, price volatility and production cost; encouraging electricity production from potential renewable energy, particularly from small or very small scale electricity generating projects, as well as studying the appropriateness of other alternative energy for electricity generation.	1.1 Promote domestic production of crude oil and condensate and develop related infrastructure systems.	⌘ To be able to produce crude oil and condensate at more than 230,000 barrels/day in 2009 and 250,000 barrels/day in 2011.	⌘ Expedite and promote greater investment in exploration and production (E&P) of crude oil from domestic resources. ⌘ Support the development of oil depot system and oil transportation pipelines so as to reduce the cost of oil distribution to various regions. ⌘ Encourage the PTT and PTTEP to invest in the utilization of the deep-sea port in Ranong province as a supply base of petroleum E&P in the Gulf of Martaban. ⌘ Stimulate the PTT and PTTEP to invest in overseas E&P of crude oil to be supplied back to Thailand, particularly from oil resources in strategic partner countries having good relationship with Thailand, such as Oman, Iran, Qatar, Bahrain, Algeria and Egypt.

Fuel Reserve

Reserve of Gulf of Thailand Natural Gas and JDA

	Gulf of Thailand		Gulf of Thailand and JDA	
	(Bcf)	(Years)	(Bcf)	(Years)
Proved	8,242	8	11,436	11
Probable	10,120	10	12,345	12
Possible	3,357	3	6,059	6
Total	21,719	20	29,840	28

Note: 1) Reserves to current production rate (R/P ration) use the averaged production at **3,000 MMCFD**

2) Soure: Annual Report 2008 Department of Mineral Fuels (December 2008)

Coal Option

	Capacity	SCOD*
EGAT Coal #1-2	**2x700 MW**	**Jan 2016**
EGAT Coal #3-4	**2x700 MW**	**Jan 2017**

* With approval from the Cabinet to issue the LOI for the contractor by 1 Jan 2012

As of August 2009,

The overall progress is 28%

- Under technical study: coal logistic, transmission system, water resources
- 5 candidate sites
- Local acceptance is still the issue

Nuclear Option

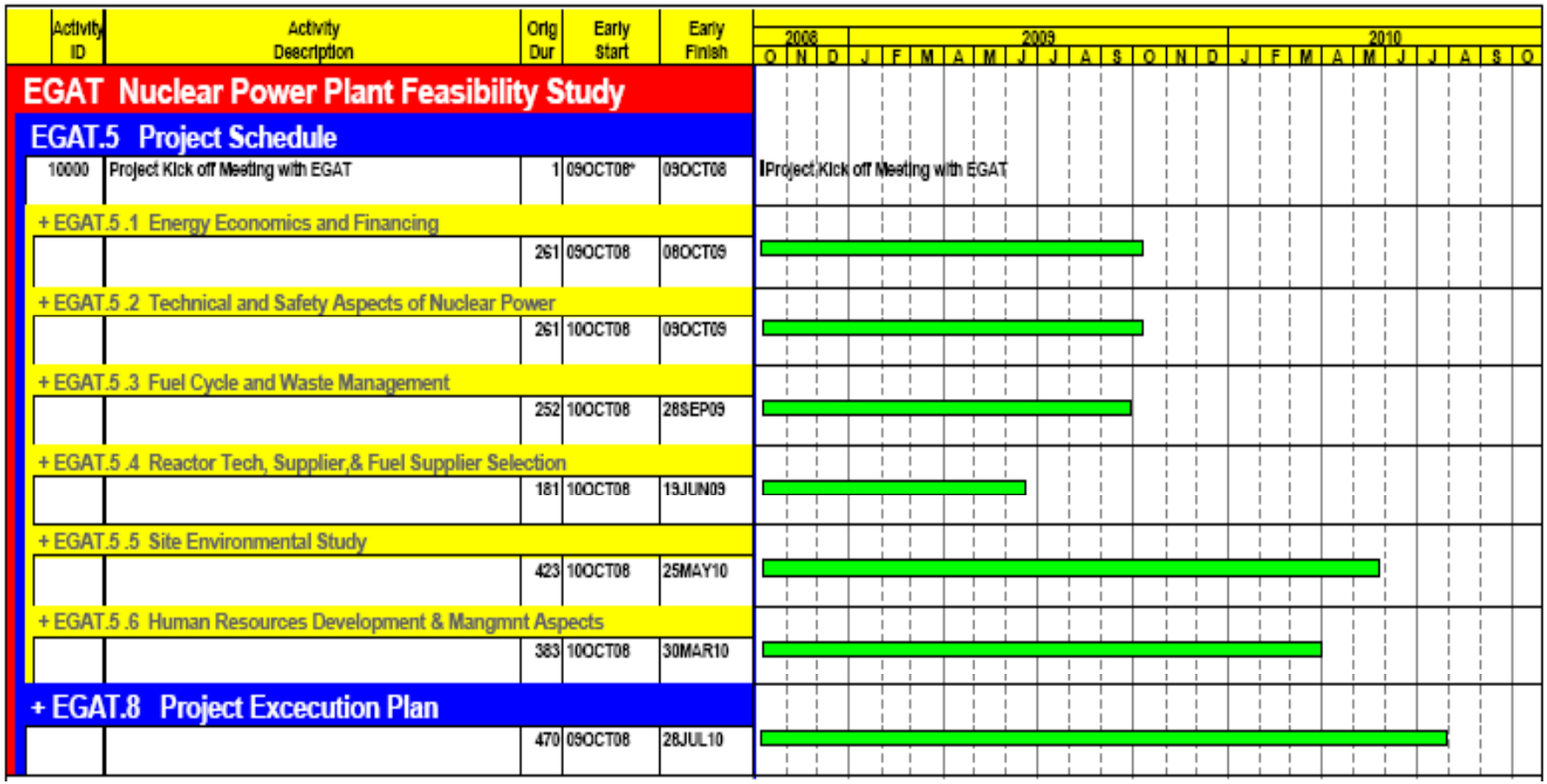
Facts

- **Thailand is highly dependent on piped gas**
- Nuclear power plants have high capacity and reliability
- Low production cost
- Advanced technologies
- Emission free

Barriers to Nuclear Energy

- Public acceptance:
  - Safety of the system
  - Radioactive waste
  - Site selection
  - Health and environmental impacts
  - **Correct information on nuclear energy to the public**
- Political issues: high investment, imported fuel
- Transportation and Fuel Management

Work Plan of EGAT-BRA Feasibility Study on Nuclear Power Plant Projects



Activity ID	Activity Description	Orig Dur	Early Start	Early Finish
EGAT Nuclear Power Plant Feasibility Study				
EGAT.5 Project Schedule				
10000	Project Kick off Meeting with EGAT	1	09OCT08*	09OCT08
+ EGAT.5 .1	Energy Economics and Financing	261	09OCT08	08OCT09
+ EGAT.5 .2	Technical and Safety Aspects of Nuclear Power	261	10OCT08	09OCT09
+ EGAT.5 .3	Fuel Cycle and Waste Management	252	10OCT08	28SEP09
+ EGAT.5 .4	Reactor Tech, Supplier,& Fuel Supplier Selection	181	10OCT08	19JUN09
+ EGAT.5 .5	Site Environmental Study	423	10OCT08	25MAY10
+ EGAT.5 .6	Human Resources Development & Mangmnt Aspects	383	10OCT08	30MAR10
+ EGAT.8 Project Excecution Plan				
		470	09OCT08	28JUL10

As of August 2009,

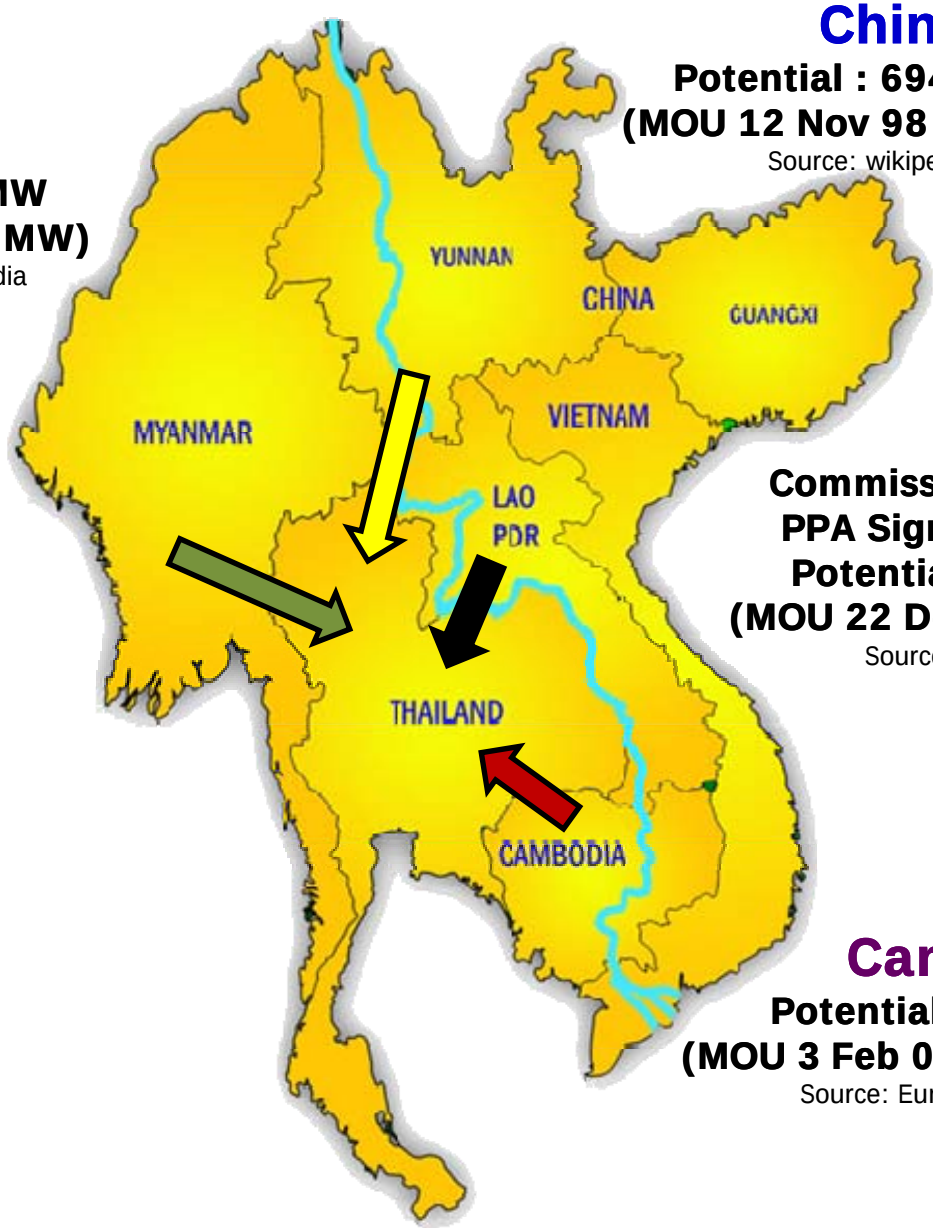
The overall progress is 50% (2% behind schedule).

Power Import From Neighboring Countries

Power Import from Neighboring Countries

China
Potential : 694,000 MW
(MOU 12 Nov 98 : 3,000 MW)
Source: wikipedia.org

Myanmar
Potential : 39,720 MW
(MOU 4 Jul 97 : 1,500 MW)
Source: Ministry of Power, India



Laos
Commissioned : 640 MW
PPA Signed : 3,210 MW
Potential : 26,000 MW
(MOU 22 Dec 07 : 7,000 MW)
Source: United Nations

Cambodia
Potential : 10,000 MW
(MOU 3 Feb 00 : Yet to Defined)
Source: European Commission

Power Purchase from Lao PDR

There is an MOU to develop power projects and export 7,000 MW to Thailand

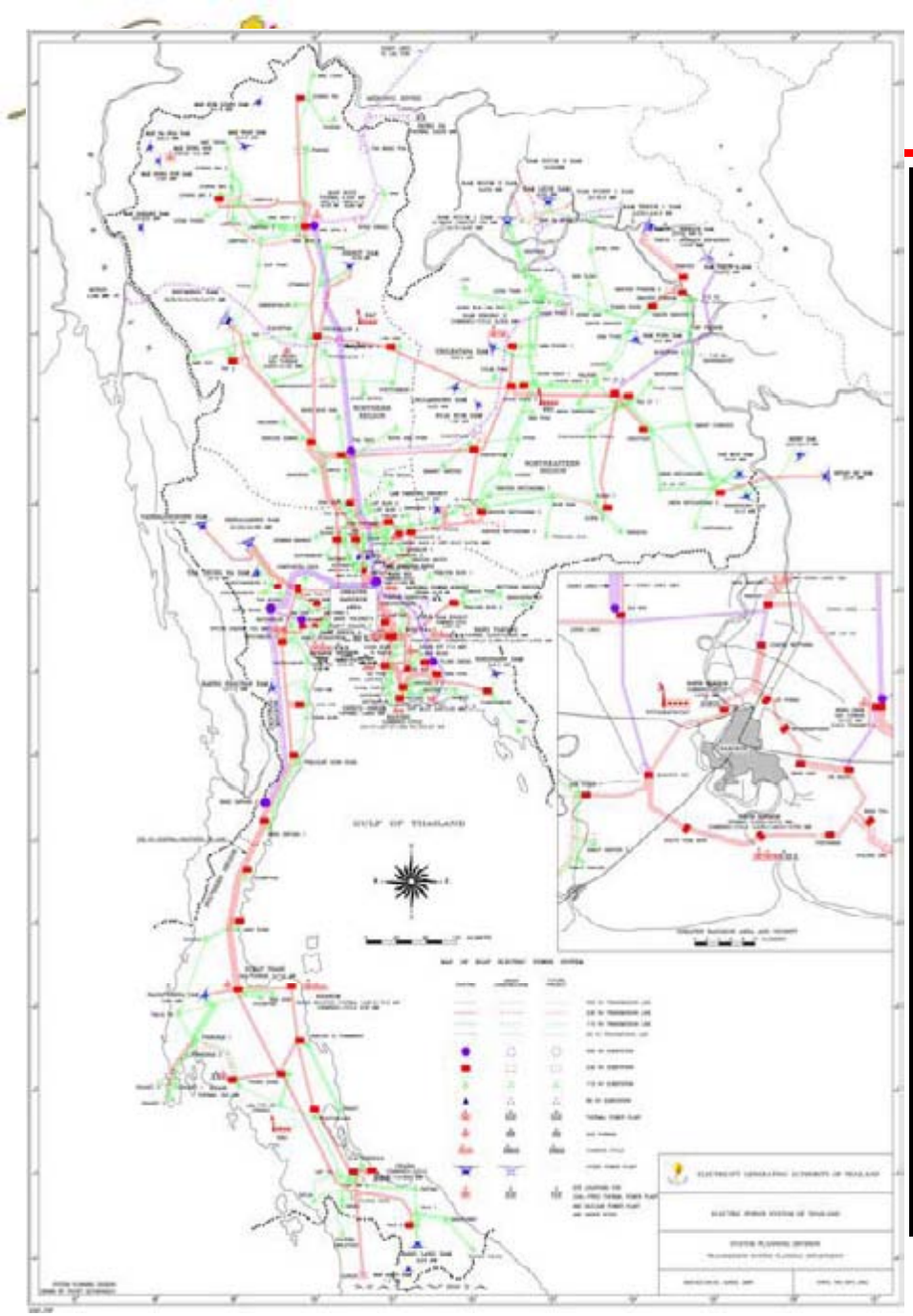
Status of Power Purchase Projects from Laos

(1) PPA Signed and Under Construction

Nam Theun 2	920	MW	(2009)
Nam Ngum 2	597	MW	(2010)
Theun Hinboun (Extension)	220	MW	(2015)
Total	1,737	MW	

(2) Tariff MOU Signed

Hong Sa (Lignite)			
Unit #1	491	MW	(Mar, 3015)
Unit #2	491	MW	(Aug, 2015)
Unit #3	491	MW	(Dec, 2015)
Total	1,473	MW	



Transmission System

Voltage	Substation		Transmission Lines (Circuit-km)
	Number	Transformer (MVA)	
500 kV	10	15,849.99	3,721.951
230 kV	68	41,360.04	13,393.049
115 kV	131	14,556.24	13,279.803
132 kV	-	133.40	8.705
69 kV	-	188.00	16.800
300 kV HVDC	-	388.02	22.988
Total	**209**	**72,287.69**	**30,445.296**

(As of May 2009)

The Promotion of Renewable Energy

Alternative Energy Development Plan
(AEDP 2008-2022)

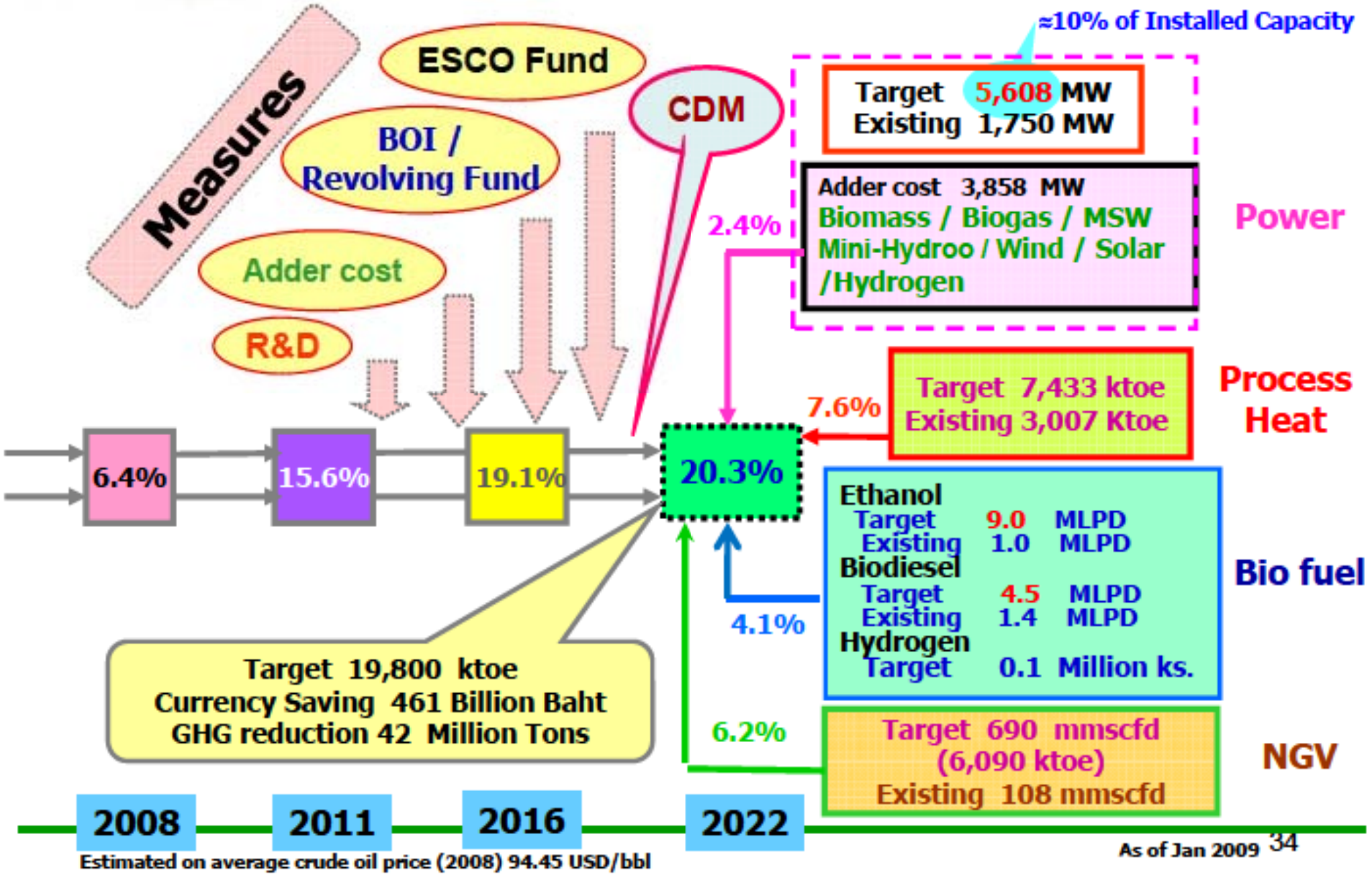
Objectives

1. To utilize alternative energy as energy supply of the country for replacing oil import,
2. To increase energy security of the country,
3. To promote an integrated green energy utilization in communities,
4. To enhance the development of alternative energy technology industry ,
5. To research, develop and encourage high efficiency alternative energy technologies.

Goal

"To increase a share of alternative energy mixed to be 20% of the country final energy demand in the year 2022"

Alternative Energy Development Plan
(AEDP 2008-2022)



Estimated on average crude oil price (2008) 94.45 USD/bbl

As of Jan 2009

Renewable Energy Potential and Target

Type of Energy	Potential	existing	2008 - 2011		2012 - 2016		2017 - 2022	
Electricity	**MW**	**MW**	**MW**	ktoe	**MW**	ktoe	**MW**	ktoe
Solar	50,000	**32**	**55**	6	**95**	11	**500**	56
Wind Energy	1,600	**1**	**115**	13	**375**	42	**800**	89
Hydro Power	700	**56**	**165**	43	**281**	73	**324**	85
Biomass	4,400	**1,610**	**2,800**	1,463	**3,220**	1,682	**3,700**	1,933
Biogas	190	**46**	**60**	27	**90**	40	**120**	54
Municipal Solid Waste	400	**5**	**78**	35	**130**	58	**160**	72
Hydrogen			**0**	0	**0**	0	**3.5**	1
Total		**1,750**	**3,273**	1,587	**4,191**	1,907	**5,608**	2,290

EGAT's Renewable Projects

As of 31 August 2009,

EGAT's renewable capacity 1.034 MW including

Fang
0.300 MW

- **Solar Energy 0.542 MW**
- **Wind Energy 2.692 MW**
- **Geothermal 0.300 MW**

Phromthep Peninsular
0.192 MW

Lam Takong Dam
2.500 MW

San Kamphang
0.014 MW

Pha Bong
0.500 MW

Klong Chongklam
0.020MW

Phromthep Peninsular
0.008 MW

And the up-coming 97.70 MW including

- **Small Hydro 78.70 MW**
- **Solar Energy 1.00 MW**
- **Wind Energy 18.00 MW**

Siridhorn Dam
1.0 MW

Pasak
Cholasith Dam
6.7 MW

Naresuan Dam
8.0 MW

Khundan
Prakarnchol Dam
10.0 MW

Kwae Noi Dam
30.0 MW

Mae Klong Dam
12.0 MW

Chao Phraya Dam
12.0 MW

Lam Takong Dam
18.0 MW

Besides, EGAT also supports researches on renewable energy potential for electricity generation.

Demand Side Management

Demand Side Management (DSM)

Reduce

- Energy Consumption
- Energy Expenses
- Energy Resources
- Environmental Problems

Reduce

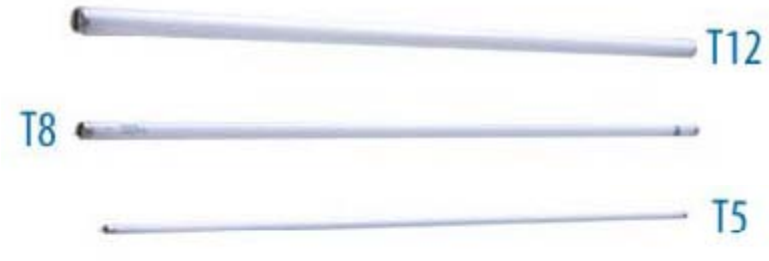
- Global Warming & Climate Change
- CO_2

Demand Side Management (DSM)

Substituting T8 fluorescent lamp with T5 fluorescent lamp program

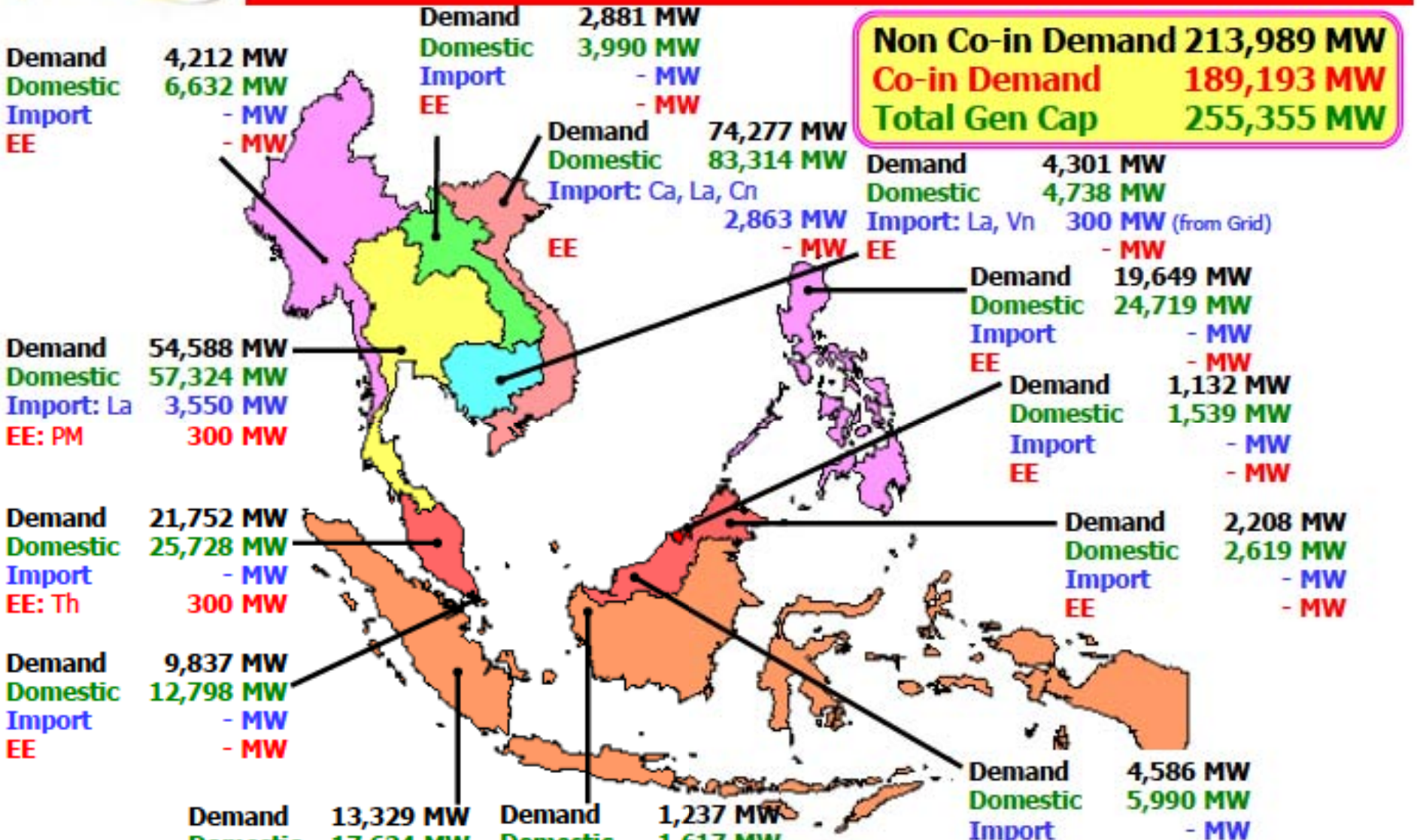
The Program Target:

Target Amount	83 Million lamps
Energy Saving	4,842 GWh/year
CO2 Reduction	2.4 Million Ton/year



III. HAPUA's ASEAN Interconnection Master Plan Study-II (AIMS-II)

Demand & Gen Supply in 2025 (Individual)



Note:
1) Peak demand of individual systems
2) Domestic capacity includes existing, committed and generic projects
3) Import and EE capacity includes existing and committed projects only

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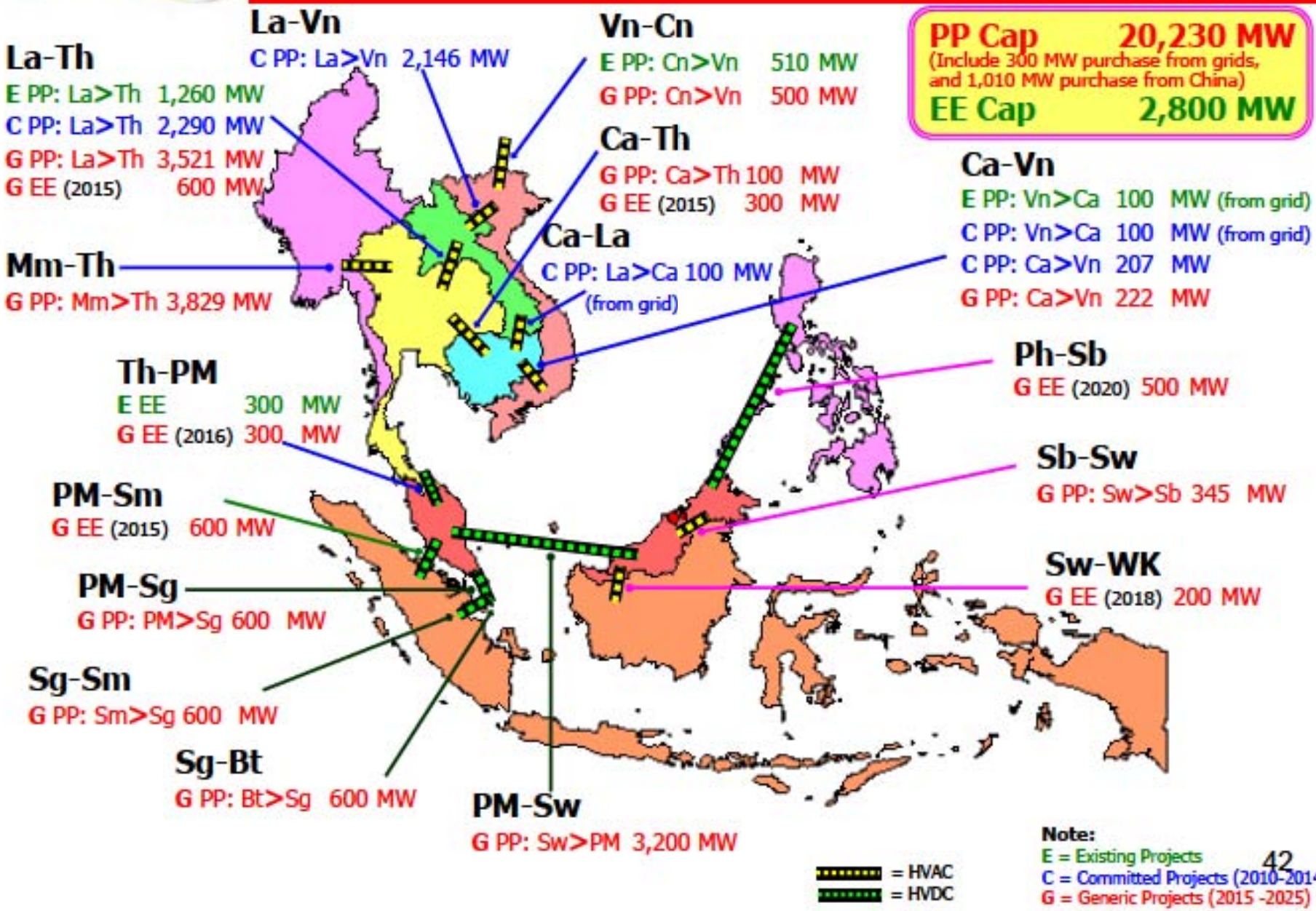
Interconnection Master Plan



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Merry X'Mas & Happy New Year 2010
End of Presentation
Thank you

Greater Mekong Subregion
seventh meeting of the Planning Working Group (PWG-7)

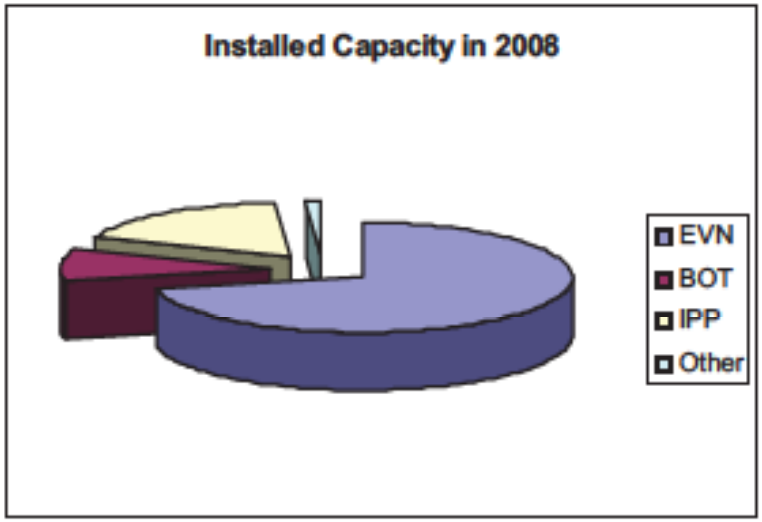
PROGRESS OF vietnam POWER DEVELOPMENT AND TRANSMISSION INTERCONNECTION PROJECTS

Luangprabang, November 25-27th 2009

1. current power system situation

Installed Capacity 2008

Owner	Installed Cap.	Percentage
EVN	11,947	71%
BOT	1,578	9%
IPP	3,026	18%
Other	200	1%
Total	**16,751**	

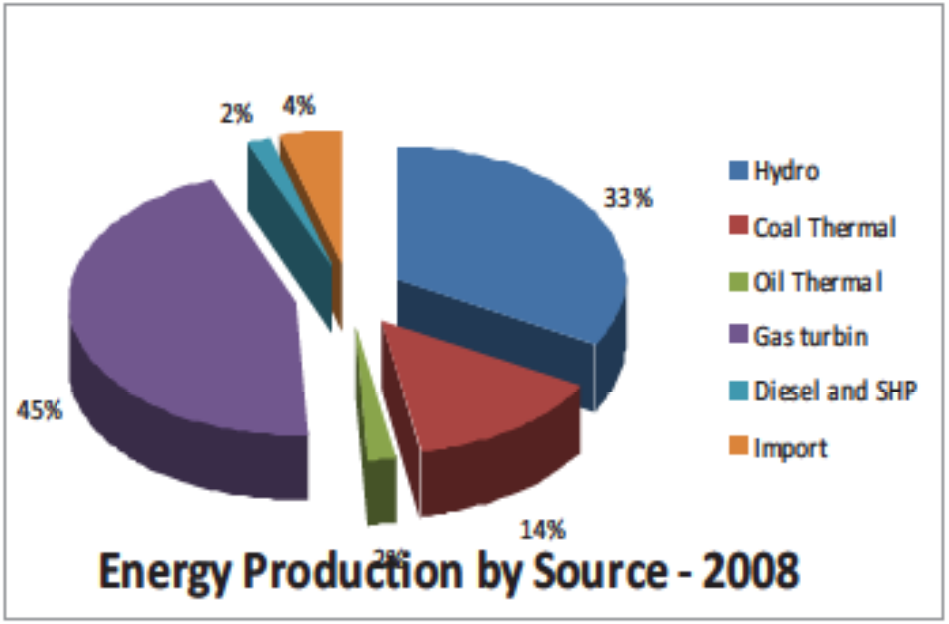


Average Installed Capacity growth rate in 2006-2008: 11,5%/annum
(including import from China)

1. current power system situation

By 12/2008

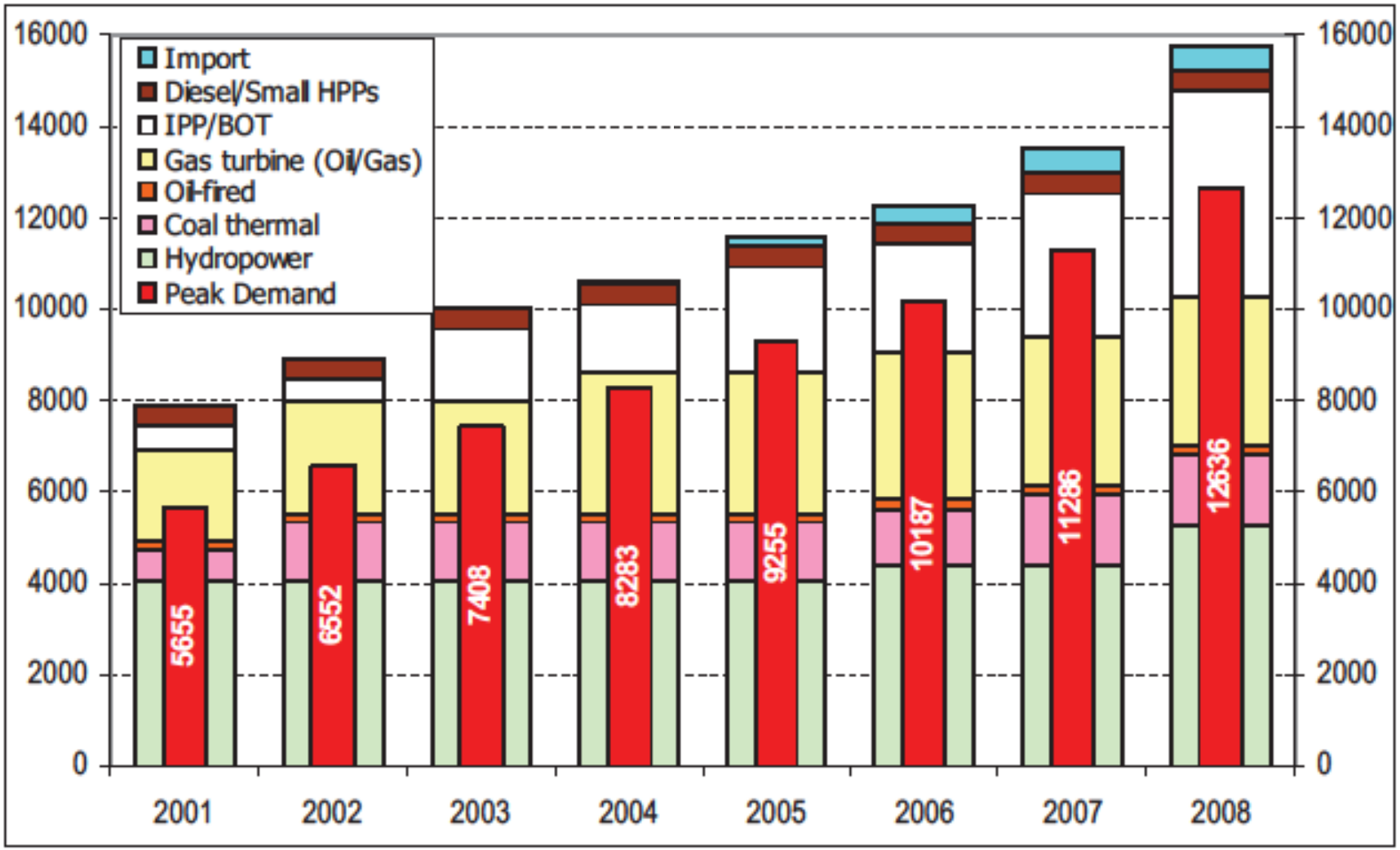
Source	Energy (MWh)	Percentage
Hydro	24,585,976	33.3%
Coal Thermal	10,223,891	13.8%
Oil Thermal	1,553,080	2.1%
Gas turbin	32,950,025	44.6%
Diesel and SHP	1,383,332	1.9%
Import	3,220,498	4.4%
North	**28,035,735**	**37.9%**
Central	**7,080,711**	**9.6%**
South	**38,800,357**	**52.5%**
Total	***73,916,803***	



PEAK LOAD	**MW**	**12,582**
SALES	**GWh**	**65,900**
NUMBER OF CUSTOMERS	**-**	**12,473,284**

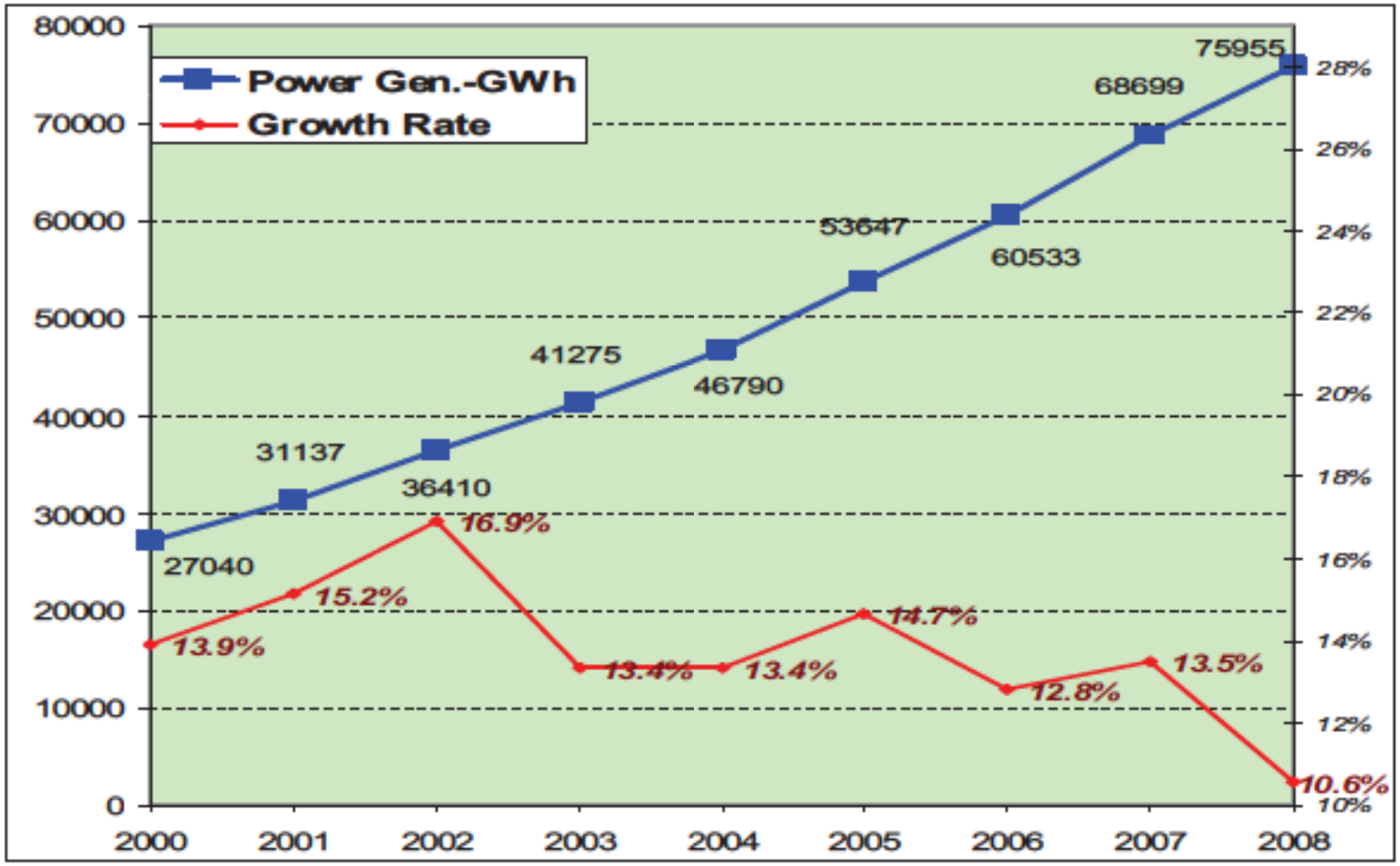
1. current power system situation

generation fuel mix from 2001 to 2008



1. current power system situation

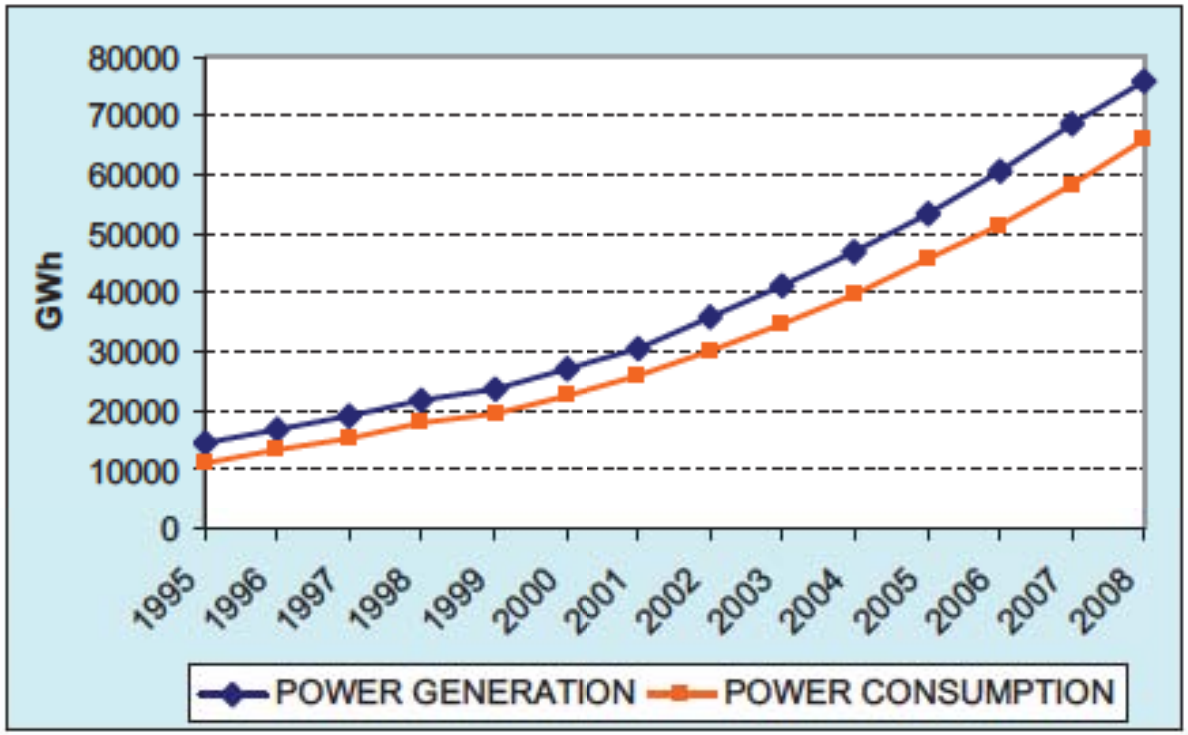
POWER GENERATION 2001 - 2008



Average Power Generation growth rate per annum: 12,3%/ann

1. current power system situation

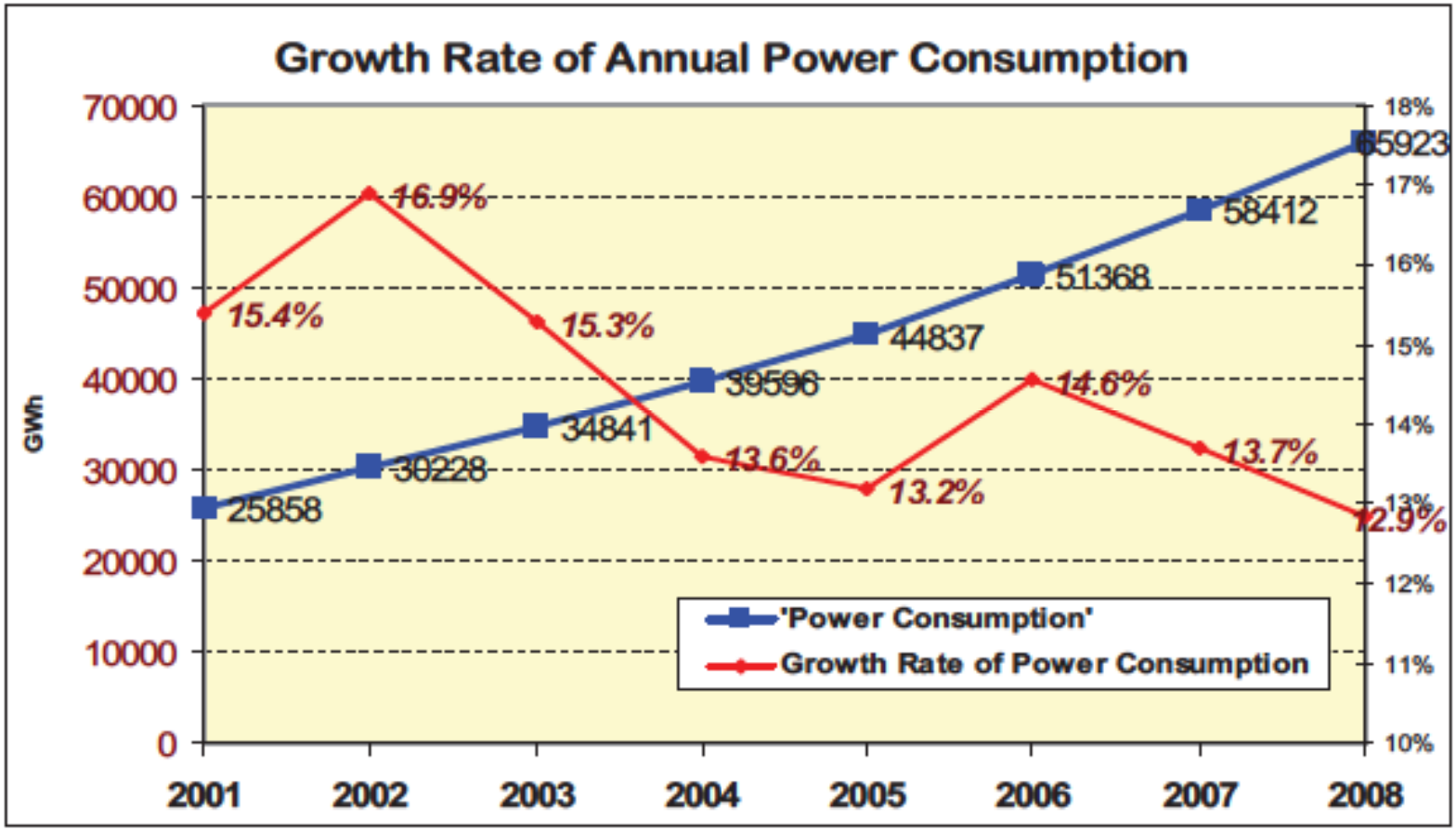
Annual Electricity Consumption
Period 1995 - 2008



- Growth rate of Electricity consumption period 1996 -2000: 14.9%
- Growth rate of Electricity consumption period 2001 -2005: 15.3%
- Growth rate of Electricity consumption period 2006-2008: 13.7%
- T&D losses is reduced from 21.7% (1995) to 12.0% (2005); 11.4% (2006); 10.6% (2007) & 9.35% (2008)

1. current power system situation

Power Consumption



Average growth rate per annum of Power Gen. 2006-2008: 13,7%/ann

1. current power system situation

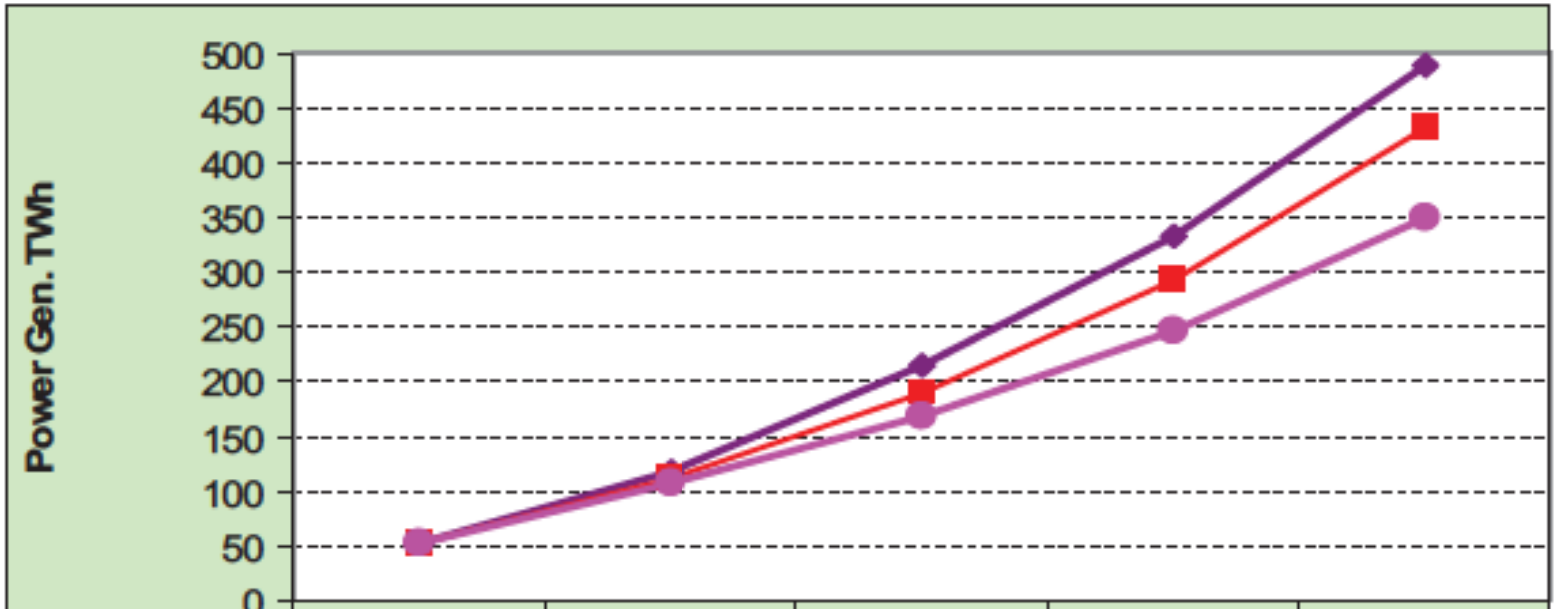
TRANSMISSION NETWORK AS OF 2008

Rural electrification as of 2008
-100% districts,
- 97,2% communes, and
- 94% rural households accessed to national power grids

Updates on the power sector

- ✓ The formation of Nation Power Transmission Corporation (NPT) under Vietnam Electricity.
- ✓ Electricity tariff was increased by 8.9% since March 01 2009
- ✓ 220 kV Interconnection to Takeo – Phnom Penh (Cambodia) was energized

ELECTRIC POWER DEMAND FORECAST



	2005	2010	2015	2020	2025
Low Case	53.5	117.3	215.8	334.2	489.6
Base Case	53.5	112.7	190.0	294.0	431.7
High Case	53.5	106.7	169.2	247.4	349.4

	2005	2010	2015	2020	2025
Elect. generation per Capita (kWh/cap)-HIGH	*645*	*1,337*	*2,320*	*3,415*	*4,803*
BASE	*645*	*1,284*	*2,043*	*3,005*	*4,234*
LOW	*645*	*1,215*	*1,820*	*2,528*	*3,427*
Growth Rate – HIGH CASE		17.0%	13.0%	9.1%	8.0%
BASE CASE	**15.3%**	**16.1%**	**11.0%**	**9.1%**	**8.0%**
LOW CASE		14.8%	9.7%	7.9%	7.2%

2. power plant construction

NEW CAPACITY ADDED IN 2008 & 2009

No	Power plants	Type of power plant	Capacity-MW		Scheduled in MP6	Investor
			2008	*2009*		
1	Dai Ninh	Hydropower	300		2007	EVN
2	Tuyen Quang	Hydropower	342		2008	EVN
3	A Vuong	Hydropower	210		2008	EVN
4	Ba Ha river	Hydropower		220	2008	EVN
5	Buon Kuop #1	Hydropower		140	2008	EVN
6	Song Con II	-Hydropower		60	2009	JSC Song Con
7	Ca Mau I-add-on steam turbine	Gas thermal power plant	265		2008	PV power
8	Nhon Trach GT 1+2	GT	300		2008	PV power
9	Ca Mau II	CCGT	771		2008	PV power
10	Nhon Trach ST	CCGT		150		PV power
11	Dzung Quat TPP	Oil/gas fired TPP		84	2009	PV power
12	Omon I TPP, #1	Oil/gas TPP		330	2009	EVN
13	Tuy Phong	Win power		7.5		JSC Tuy Phong
	Total		**2188**	**991.5**		

Q IV-2009 is exspeted about more 1,400 MW will come in to operation

Total installed Capacity in 2009 is estimated about 18,000 MW

2. power plant construction

POWER PLANTS ARE UNDER CONSTRUCTION

- Number of Power Plant Projects **29 (20 Hydropower & 9 Thermal Power Plants)**
- Total capacity **10,029 MW (62.9% of capacity are HPPs)**
- **Expected Schedule capacity will be in operation:**
  - *2010:* ***3981 MW***
  - *2011:* ***2068 MW***
  - *2012:* ***3420 MW***
  - *2013:* ***560 MW***
- Average annual capacity added in 2009 - 2013: **2507 MW**

2. power plant construction and interconnection

temporary revised power generation development and interconnection

According to Update Demand forecast

	2010		2015		2020	
Peak Demand– MW	***15,803***		***31,194***		***51,104***	
Total Installed Capacity – MW	**21,868**	**%**	**40,729**	**%**	**64,819**	**%**
Reserve Cap.	**5,622**	38.4	**8,917**	30.6	**12,998**	26.8
Hydropower – PSPP	8,516	*40.2*	14,434	*35.4*	18,167	*28.0*
Coal thermal	4,525	*20.3*	12,950	*31.8*	20,600	*31.8*
Gas/Oil thermal-CCGT	7,663	*34.3*	10,388	*25.5*	13,338	*20.7*
Small Hydro & Renewable	444	*2.0*	1,274	*3.1*	2,824	*4.4*
Nuclear power plant	-		-		1,000	*1.5*
Import	720	*3.2*	1,683	*4.1*	8,840	*13.6*

Introduction of Hydropower Projects are being considered in Lao PDR

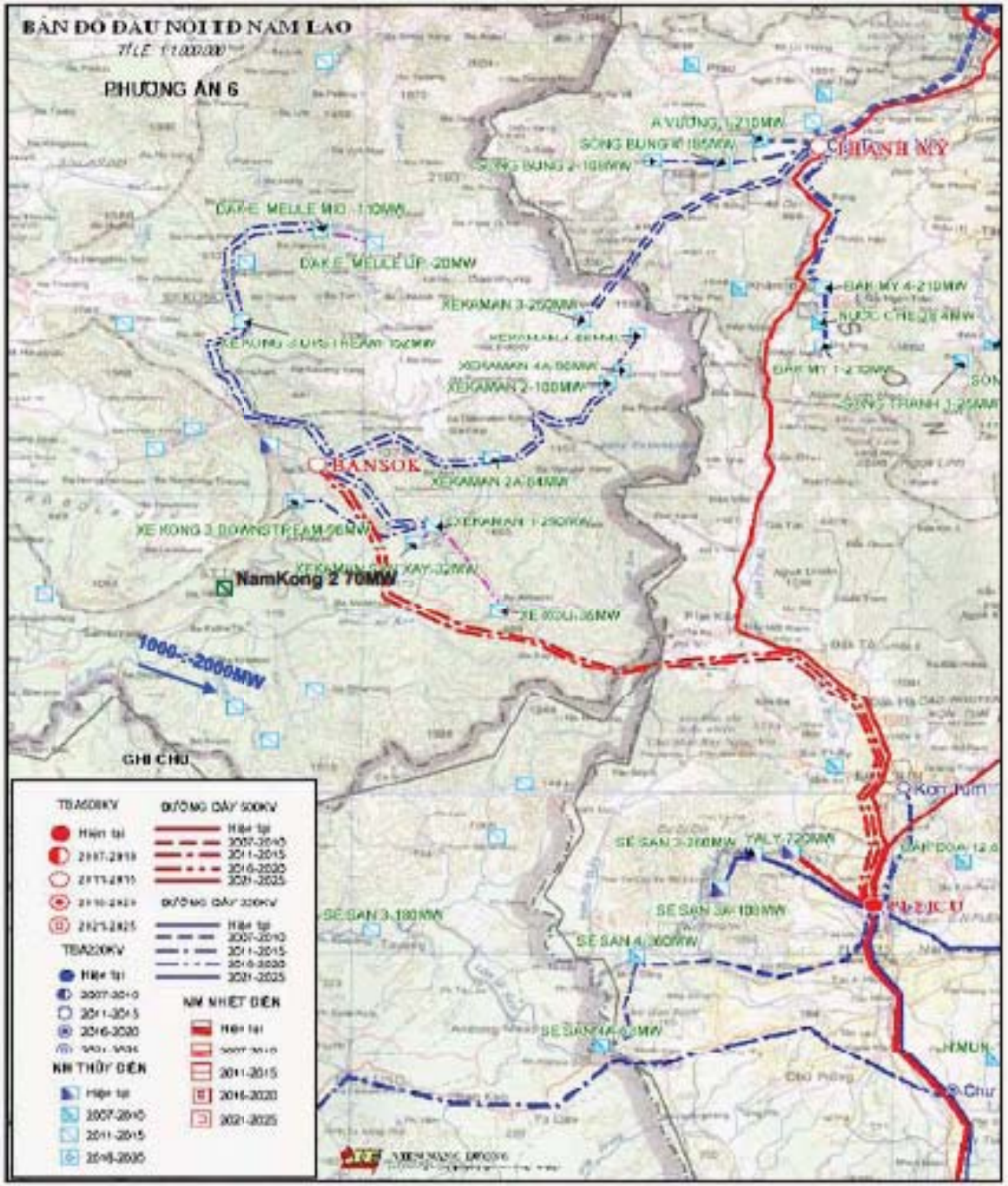
	Name of Projects	Capac. MW	Comissioning	Developers	Remarks
1	Nam Et 1	140	2012-2013	EVN-Sovico	MOU-Planning
2	Nam Et 2	170	2012-2013	EVN-Sovico	MOU-Planning
3	Nam Et 3	110	2013-2014	EVN-Sovico	MOU-Planning
4	Nam Mo	105	2012	VN developer	PreF/S
5	Nam Kan	66	2012-2013	EVN-...	PreF/S on-going
6	Nam Kong 2	70	2014	EVN-Cavico	Planning
7	Xe Xou	60	2013	EVN-Cavico	Planning
8	Xe kaman 3	250	2009-2011	EDL-VietLao PJS	Under Contr.
9	Xe kaman 1	290	2011-2012	VietLao PJS	F/S
10	Xe kaman 2&2A	100+64	2015	VN developer	Planning
11	Xe kaman 4&4A	74+69	2013	Lao & VietLao PJS	MOU & PreF/S
12	Xe Kong 3 upper	152	2013-2014	VietLao PJS	PreF/S
13	Xe Kong 3 down	96	2014-2015	VietLao PJS	PreF/S
14	Dak E Meul Upper	23	2014-2015	Lao & VietLao PJS	PreF/S
15	Dak E Meul Mid	115	2014-2015	Lao & VietLao PJS	PreF/S
16	Xe kaman Xanxay	32	2011-2012	Lao & VietLao PJS	F/S
17	Luong PhaBang	1410	2015-2016	Lao-PVN-Song Da Co	PreF/S on-going
18	SeKong 4	420	*TBD*	Region Oil & Others	F/S on-going
19	SeKong 5	250	*TBD*	Region Oil & Others	F/S on-going
20	Nam Kong 1	100	*TBD*	Region Oil & Others	F/S on-going
21	HP Projects in Nam Xam river	~730	*TBD*	Saigon Invest & Others	Planning
	Total	**4896**			


Luongphabang -Nho quan
500kV line projects
NamEt2 170MW
NamEt3 110MW
NamEt1 140MW
LuongPhabang 2000MW
2000-÷-3000MW
3100-÷-4200MW
Nam Xam 1,2,3
from Pak Beng 1200MW

Introduction of Hydropower Projects are being considered in Cambodia

	Name of Projects	Capac. MW	Comissioning	Developers	Remarks
1	SeSan 1	90	2013-2014	VN-Cambodia PJS	PreF/S on-going
2	Lower Sesan 3	180	To be dated	Na	Planning
3	Lower Sesan 2	420	2014-2015	VN-Cambodia PJS	PreF/S on-going
4	Prek Lieng 1&2	64+64	To be dated	Na	Planning
5	Lower Srepok 5,6,8 &9	~300	To be dated	Na	Planning
6	SamBor	467	To be dated	Na	Planning
	Total	**1685**			

Ban Sok-Pleiku
500kV line projects



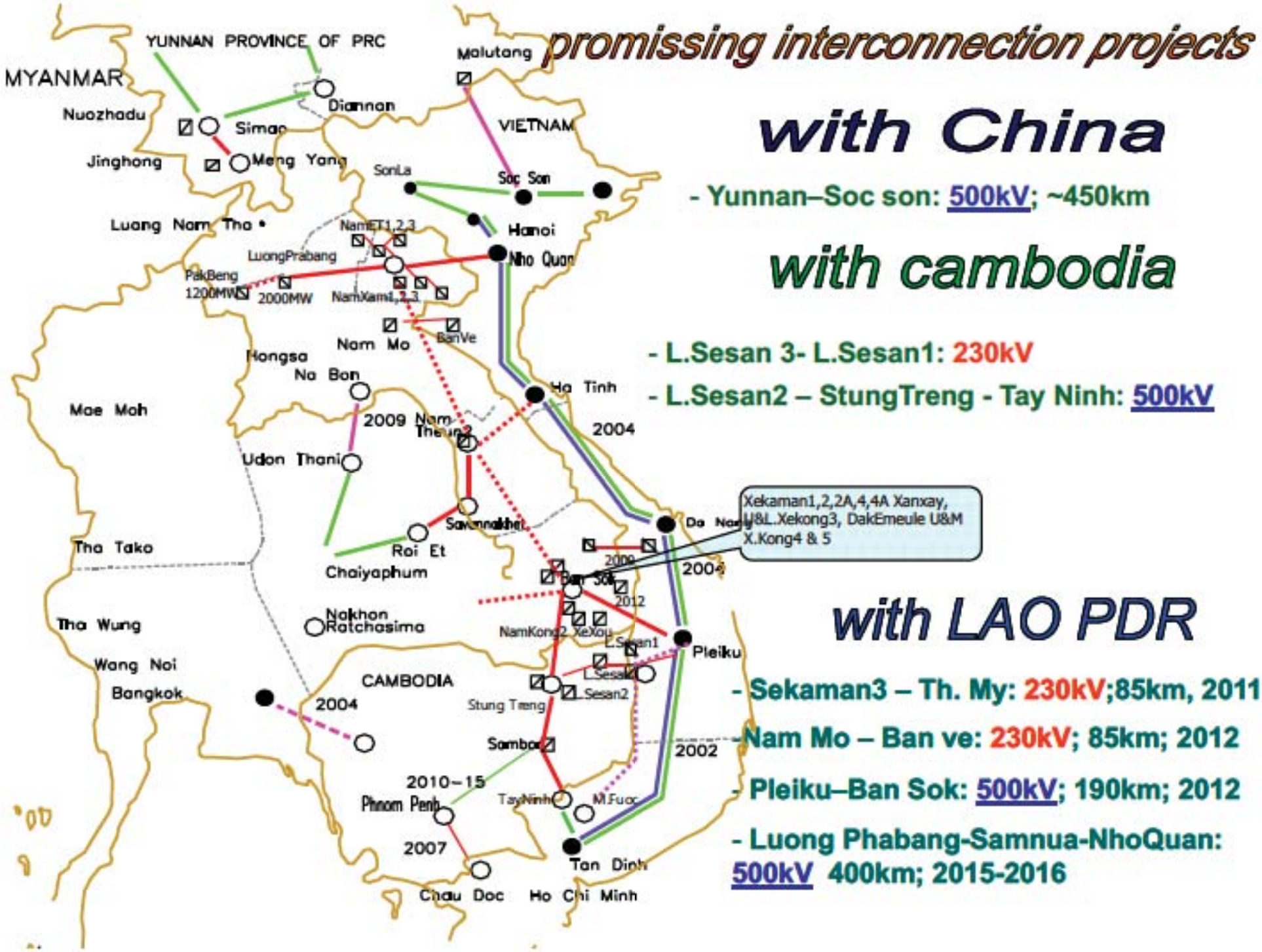
Curent INTERCONNECTION-ELECTRICITY TRADE

with China

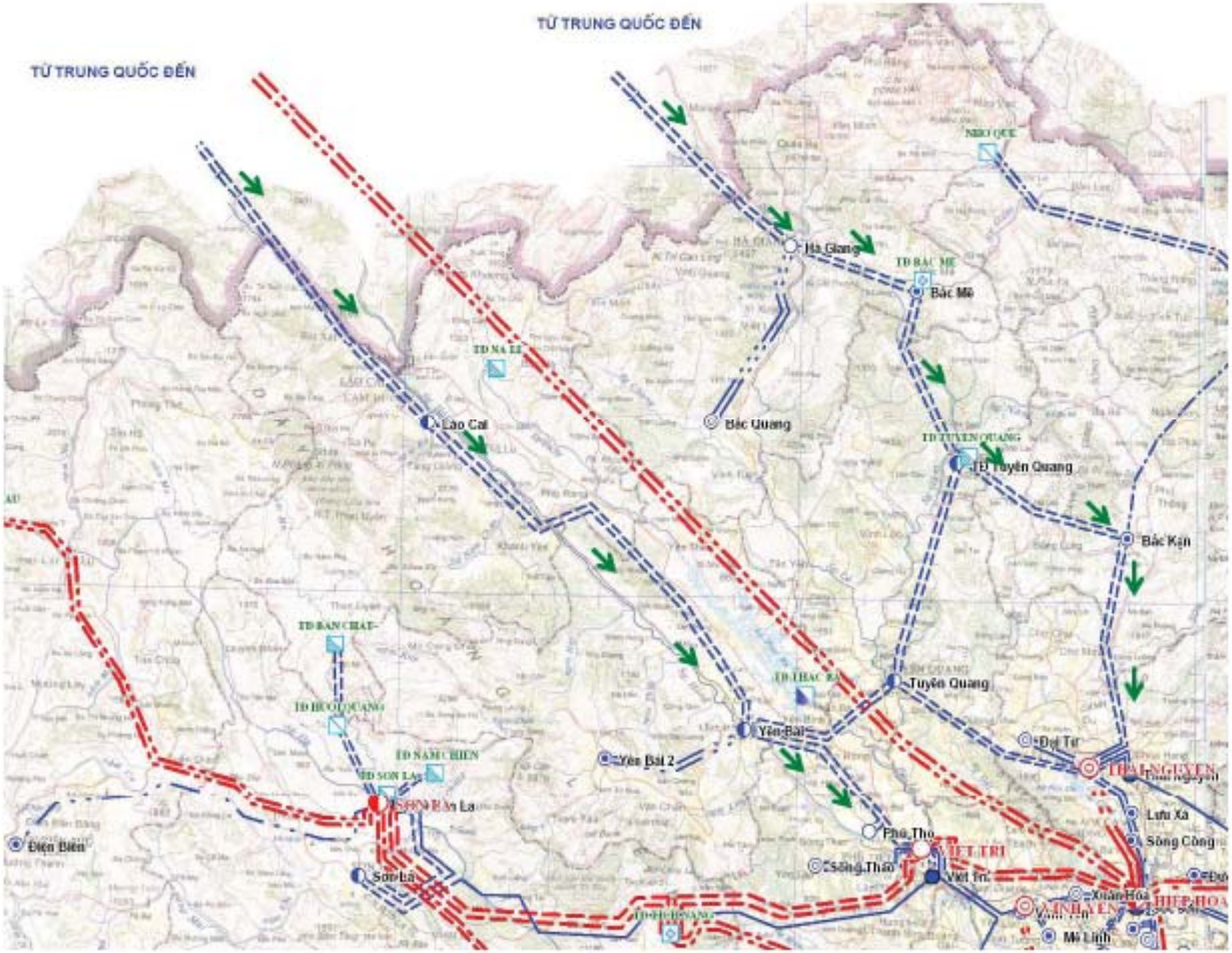
- Honghe–Laocai, Venshan-Hagiang - 110kV
- Phangcheng-MongCai - 110kV
- HongHe-Lao Cai: 220kV (2006)
- Venshan-ThaiNguyen: 220kV (2007)

with Cambodia

- Chau Doc–Phnom Penh: 230kV, 2008


promissing interconnection projects
with China
- Yunnan–Soc son: 500kV; ~450km
with cambodia
- L.Sesan 3- L.Sesan1: 230kV
- L.Sesan2 – StungTreng - Tay Ninh: 500kV
with LAO PDR
- Sekaman3 – Th. My: 230kV;85km, 2011
- Nam Mo – Ban ve: 230kV; 85km; 2012
- Pleiku–Ban Sok: 500kV; 190km; 2012
- Luong Phabang-Samnua-NhoQuan: 500kV 400km; 2015-2016
YUNNAN PROVINCE OF PRC
MYANMAR
Malutang
Diannan
Nuozhadu
Simao
Jinghong
Meng Yang
VIETNAM
SonLa
Soc Son
Hanoi
Nho Quan
Luang Nam Tha
NamET1,2,3
LuongPrabang
PakBeng
1200MW
2000MW
NamXam1,2,3
Nam Mo
BanVe
Hongsa
Na Bon
Ha Tinh
2004
Mae Moh
2009 Nam Theun2
Udon Thani
Xekaman1,2,2A,4,4A Xanxay, U&L.Xekong3, DakEmeule U&M X.Kong4 & 5
Da Nang
Savannakhet
Tha Tako
Roi Et
Chaiyaphum
2009
2006
Ban Sok
2012
Nakhon Ratchasima
Tha Wung
NamKong2 XeXou
L.Sesan1
Pleiku
Wang Noi
Bangkok
CAMBODIA
L.Sesan2
2004
Stung Treng
Sambor
2002
2010–15
Phnom Penh
TayNinh
M.Fuoc
2007
Tan Dinh
Chau Doc
Ho Chi Minh

EXISTINGPOWER TRANSMISSION LINES BETWEEN CHINA-VIETNAM



Key isssues

- ✓ It is necessary to facilitate the proceed of consultant selection to study the **500kV line from China to Vietnam** (timing? AC or DC option?,…)
- ✓ It is necessary to build a **transmission system** with 500 kV level recommended as a mainstay that is strong enough to interconnect Vietnam – Laos – Cambodia grids
- ✓ There will/may be the 500kV lines:
  1. **from Ban Sok – Pleiku**
  2. **from Ban Sok - Stung Treng -Tay Ninh**
  3. **from Luongphabang – Xamnua – Nho Quan**

- ✓ The **economics options** of transmission lines should be proposed
- ✓ **The investor/owner, legal organization, operation & maintenance, wheeling charges**?
- ✓ A **"Master plan of Indochina's power transmission system"** might be carried out
  1. ***A budget's sponsor?***
  2. ***An International consultant?***

Thank you