Power Development Program (Power Supply Plan)

Methodology, Workflow and Technical Issues

- Mr. Hiromi Sakakibara (JICA)

Result of PDP(2004-2013)

- Ms. Thelma Ejercito (DOE)

Work Sharing of the PDP

- DOE：Main Player for Preparing the PDP
  - Coordination of the schedule with related organizations
  - Preparation of the PDP with the JICA study team
  - Documentation of the PDP
  - Public consultation
  - Submission of the PDP to the congress
- JICA：To assist the DOE
  - Technical assistance for the PDP simulation
  - Technical coordination among the related organization
  - Technical analysis of the specific project
  - Confirmation of the future data collection flow

Collaboration with DOE

Integration with Subordinate Programs

Integration Policy

Integration & Coordination of all Projects

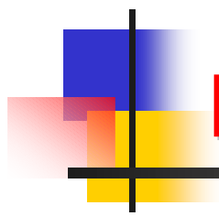
- Transmission Development Plan (TDP)
  - Coordination of Power Sources & Transmission Lines
  - Interconnection Issues

Data Integration

- Distribution Development Plan (DDP)
  - Data Collection and confirmation for Demand Forecasting

Document Integration

- Missionary Electrification Development Plan (MEDP)
  - Power Development Plan for Un-energized Area



Data Collection

EPIRA Regulation

- A Generation Company shall submit to DOE any information as may be required by the DOE for the preparation of the PDP, subject to appropriate measures to preserve the confidentiality of proprietary or commercially sensitive information.

Present Situation

- Daily operation report of the system (Luzon, Visayas and Mindanao) are informed by the system operator.

  However:

  - Reports are submitted in the form of paper document
  - Generation facility data described in the report are not sufficient for the PDP

There is no effective data gathering system to collect the necessary information for the PDP

Data Collection Issues

DOE has to collect the necessary data for the PDP directly from all generation companies in future.

In order to relieve the data collection & integration work, the followings are expected:

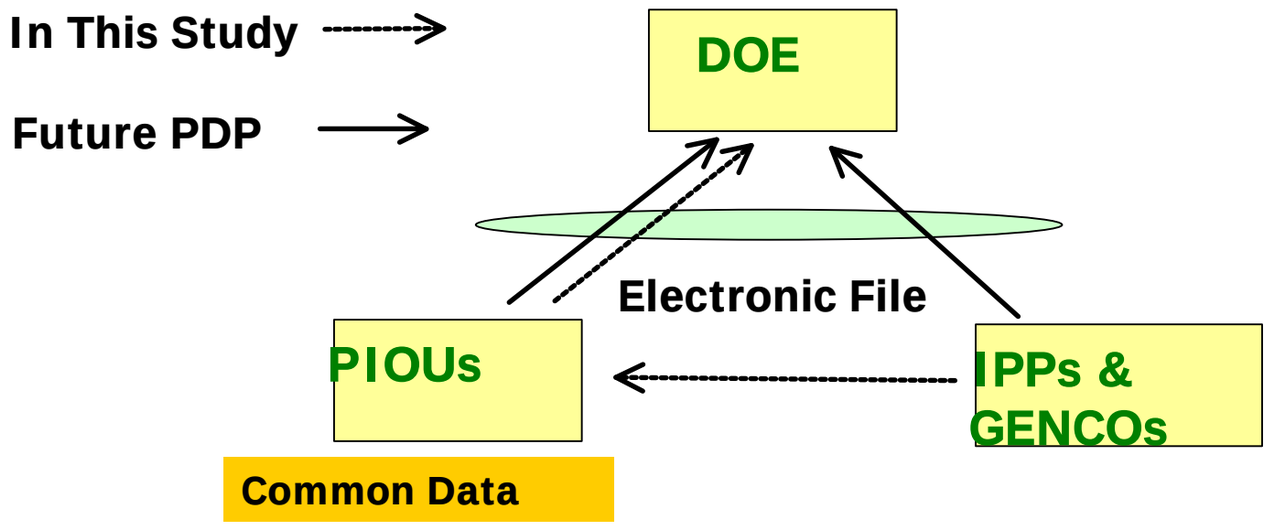
- **To collect it in the form of electronic files.**
- **To use the integrated data format**

Data Collection for this study

Data collection was conducted for PIOUs in this study by using the integrated electronic format

- **15 out of the 19 distribution utilities answered the questionnaire.**
- **11 of which submitted in the form of Paper document**
- **4 submitted electronic copy**
- **1 submitted by using individual format**

Data Collection Flow in Future

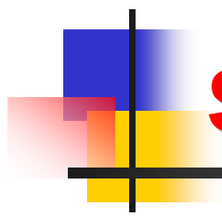


Common Data

- Generation Facility Data for Power Supply Plan

AS a Part of DDP (for PIOUs)

- Demand and Supply data for demand forecasting
- Name of facilities contributing the power system



Simulation Methodology

Simulation Software

The following software are used for preparing the PDP:

WASP-IV:

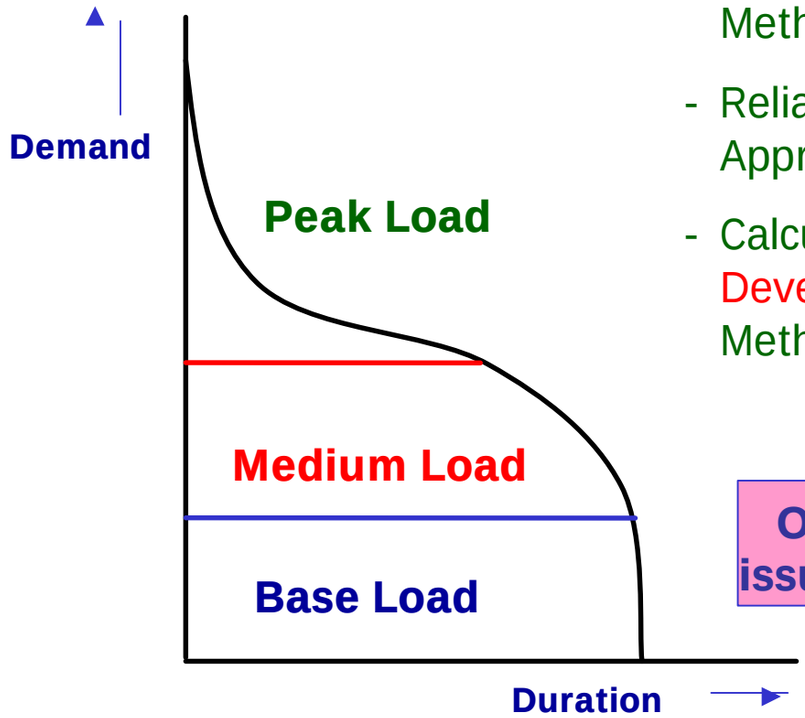
-For calculating the optimal (least cost) power development plan

GTMax :

- For evaluating the power flow and the optimal location of power sources

Inside of Simulation Software

- WASP-IV -

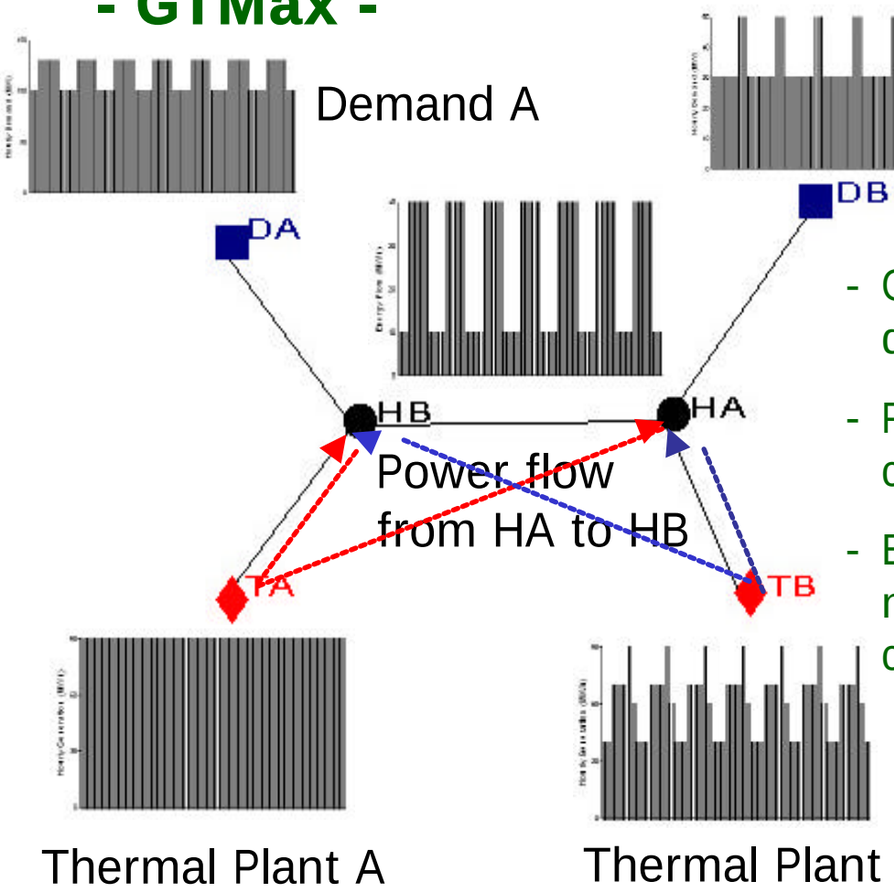


- Operation Cost Calculation by Duration Method
- Reliability Analysis by Probabilistic Approach
- Calculation of Optimal Power Development by Dynamic Programming Method

Optimal Location, Interconnection issues can not be treated by WASP-IV

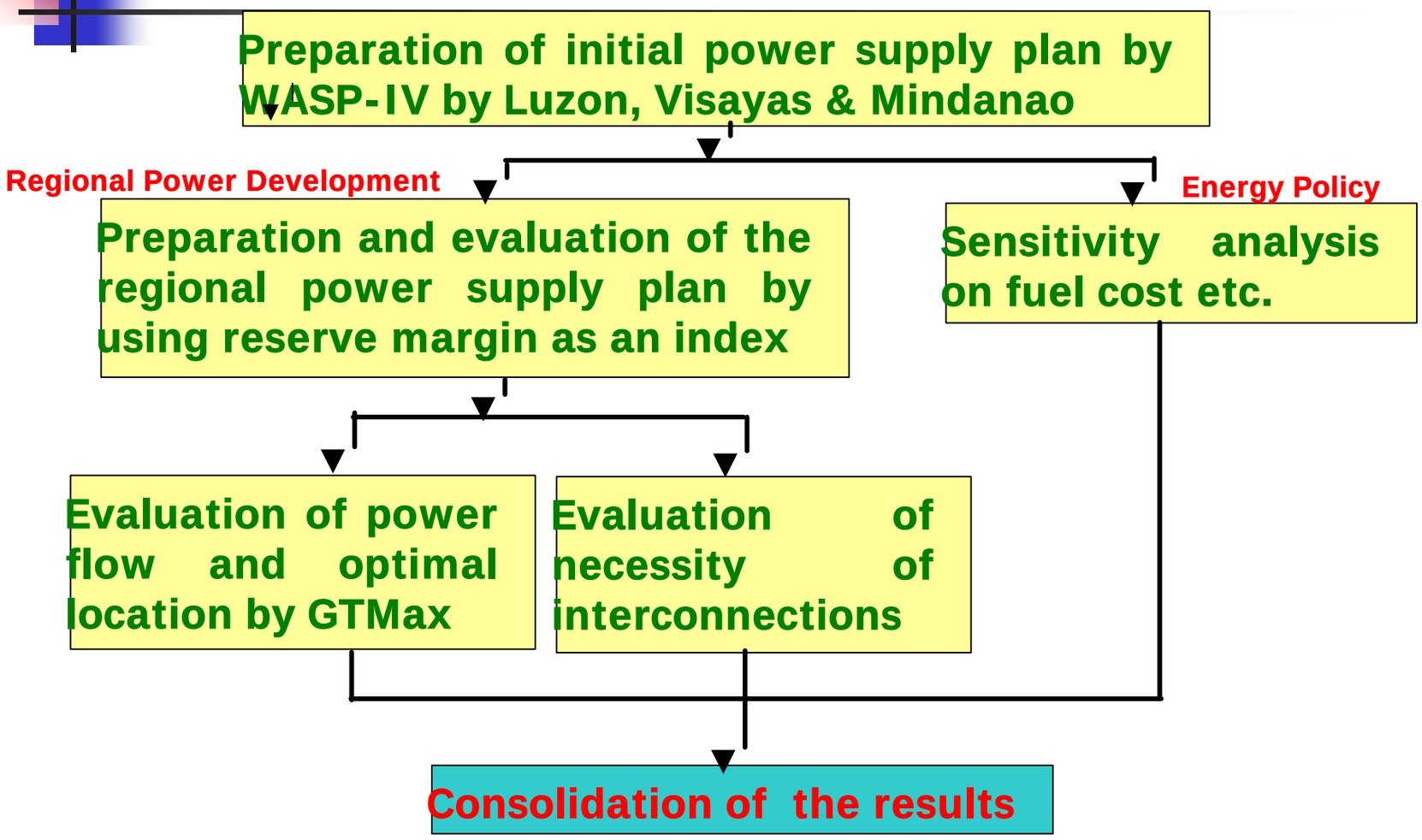
Inside of Simulation Software

- GTMax -



- GTMax analyzes the optimal power dispatch (operation) chronologically.
- Power flow of the interconnection is calculated automatically.
- By changing the connection point of new power sources, optimal location can be calculated.

Simulation Workflow for the PDP



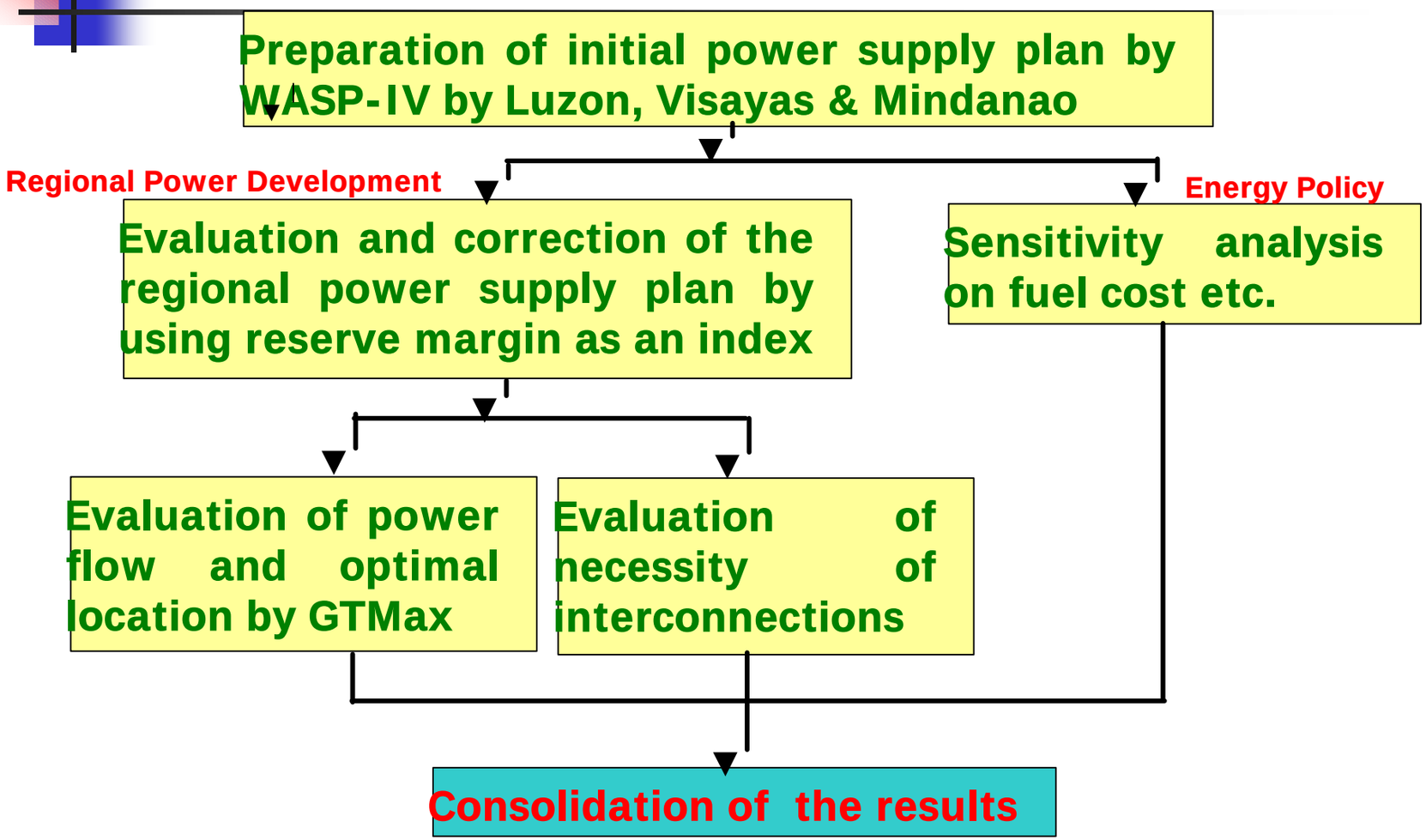
Regional Power Development Plan

Cebu Grid																				
Install				I.C.	Total	G.R.M	TL	Demand	Ex.Cpa	Install				I.C.		Total	G.R.M		TL
DS	GT05	CL05	acc							DS	GT05	CL05	acc	in	out				
			0	2	52	25.0%	35	406	427.5				0	153	-72	508	25.0%		200
			0	8	58	25.0%	35	441	427.5				0	183	-60	551	25.0%		200
			0	15	65	25.0%	100	481	427.5				0	200	-25	602	25.0%		400
			0	24	73	25.0%	100	530	427.5				0	211	24	662	25.0%		400
			0	73	79	19.7%	100	579	427.5				0	288	-23	692	19.7%		400
	50		50	29	85	14.8%	100	637	427.5		50		50	306	-52	731	14.8%		400
			50	41	97	15.2%	100	703	427.5		100		150	249	-16	810	15.2%		400
	50		100	3	109	14.4%	100	777	427.5	100			250	239	-28	888	14.4%		400
			100	18	125	15.4%	100	858	336.7	150	100	50	550	163	-59	990	15.4%		400
			100	34	140	14.9%	100	947	336.7	50	50	100	750	81	-30	1088	14.9%		400
			100	50	156	13.3%	100	1,046	336.7		50	100	900	8	-60	1185	13.3%		400

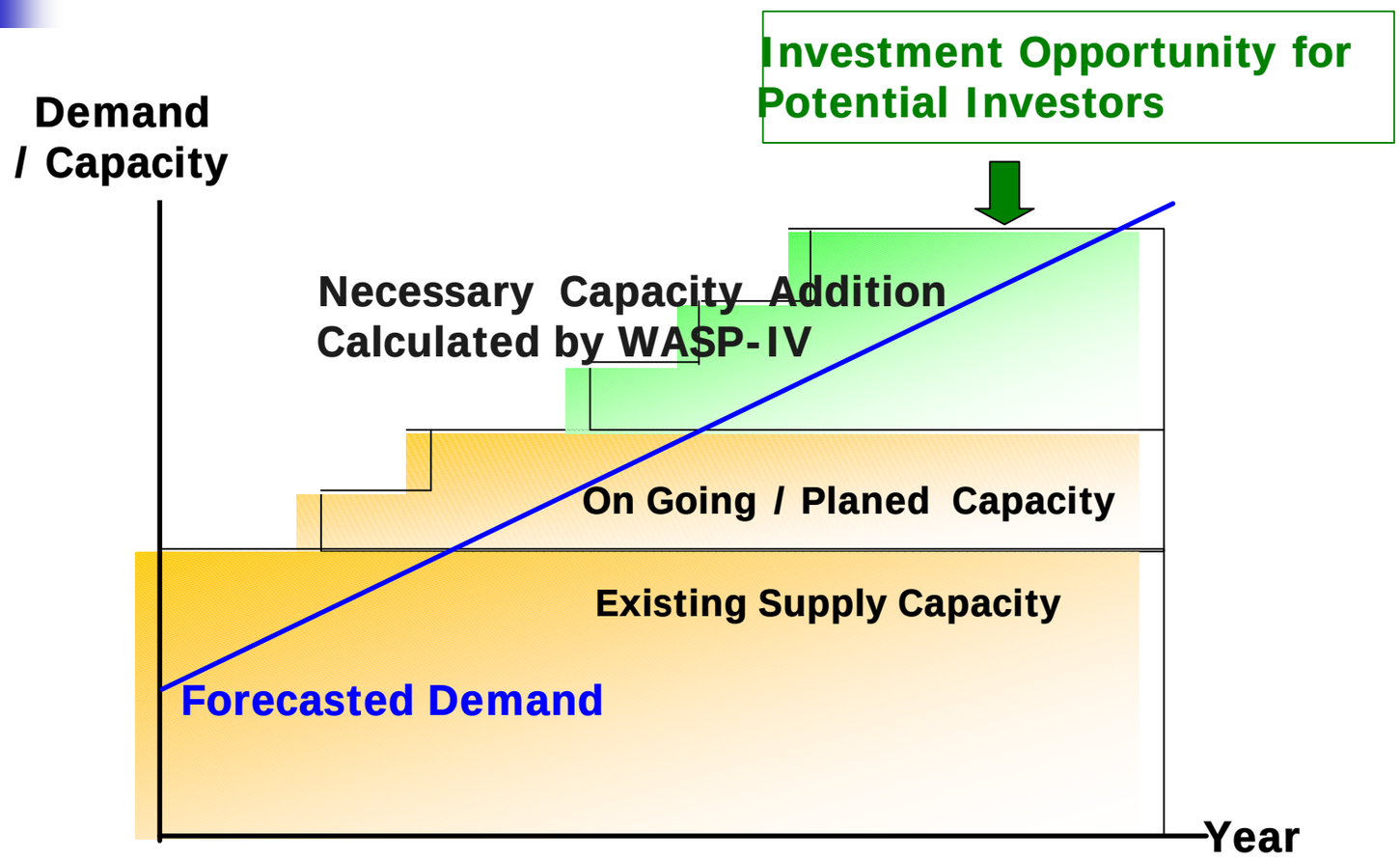
Output Of WASP-IV

	Panay										Total									
TL	Demand	Ex.Cap	Install Cap.				I.C.	Total	G.R.M	TL	Demand	Ex.Cpa	Install				I.C.	Total	G.R.M	
			DS	GT05	CL05	Acc							DS	GT05	CL05	acc				
80	182	132.6		50		50	45	228	25.0%	80	1,006	1,470		100		100	0	1,570	56.1%	
80	198	180.5				50	17	247	25.0%	80	1,093	1,518				100	0	1,618	48.0%	
80	216	180.5				50	40	270	25.0%	80	1,196	1,595				100	0	1,695	41.7%	
80	238	180.5	50			100	17	298	25.0%	80	1,319	1,595	50	50		200	0	1,795	36.1%	
80	260	154.8				100	56	311	19.7%	80	1,442	1,526				200	0	1,726	19.7%	
80	286	154.8				100	74	328	14.8%	80	1,591	1,526		100		300	0	1,826	14.8%	
80	316	154.8		50		150	59	364	15.2%	80	1,759	1,526		200		500	0	2,026	15.2%	
80	349	154.8	50			200	44	399	14.4%	80	1,946	1,526	150	50		700	0	2,226	14.4%	
80	385	154.8			50	250	40	445	15.4%	80	2,153	1,435	150	100	100	1050	0	2,485	15.4%	
80	426	154.8			50	300	34	489	14.9%	80	2,381	1,435	50	50	150	1300	0	2,735	14.9%	
80	470	154.8			50	350	28	533	13.3%	80	2,634	1,435	50	50	150	1,550	0	2,985	13.3%	

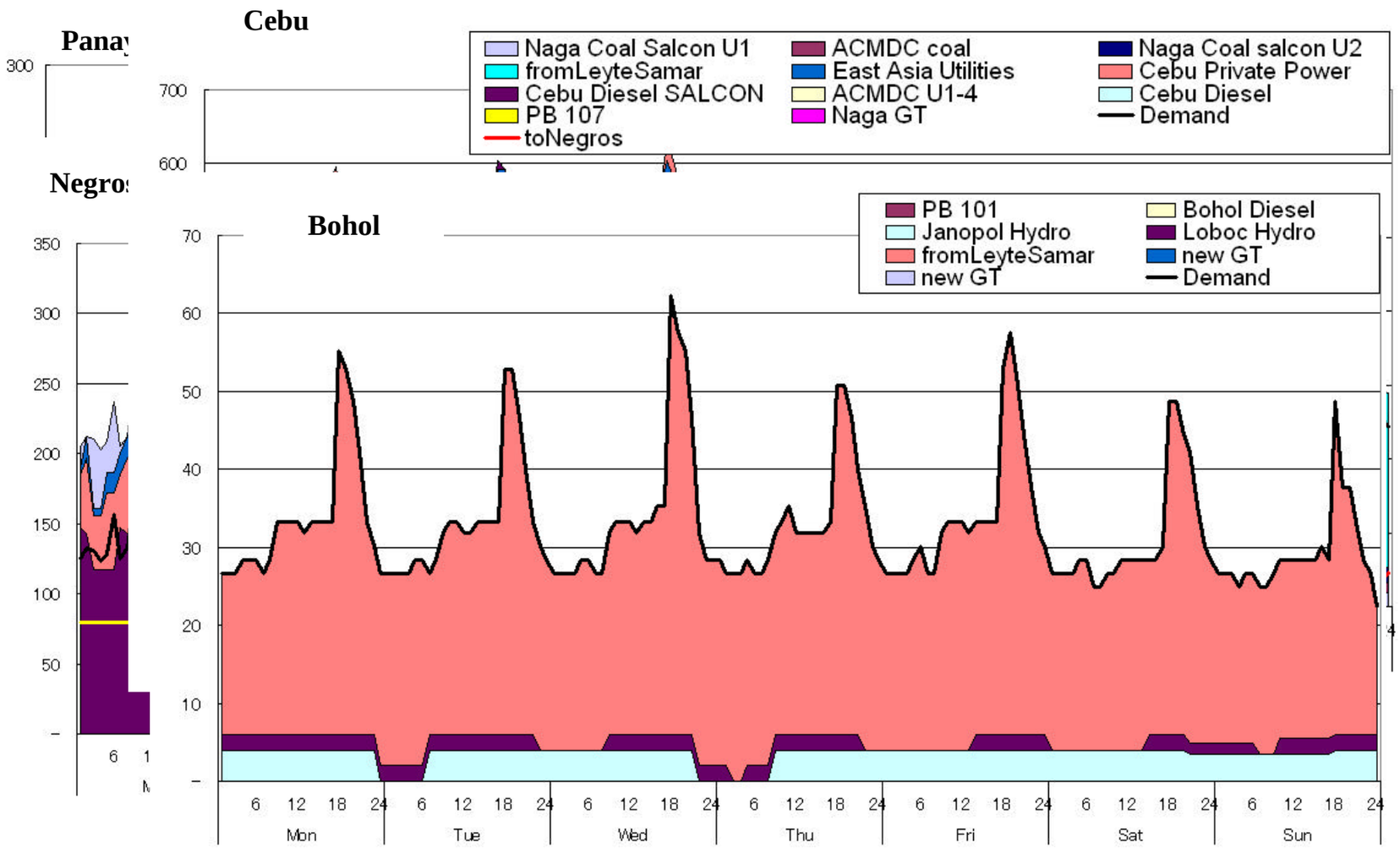
Simulation Workflow for the PDP



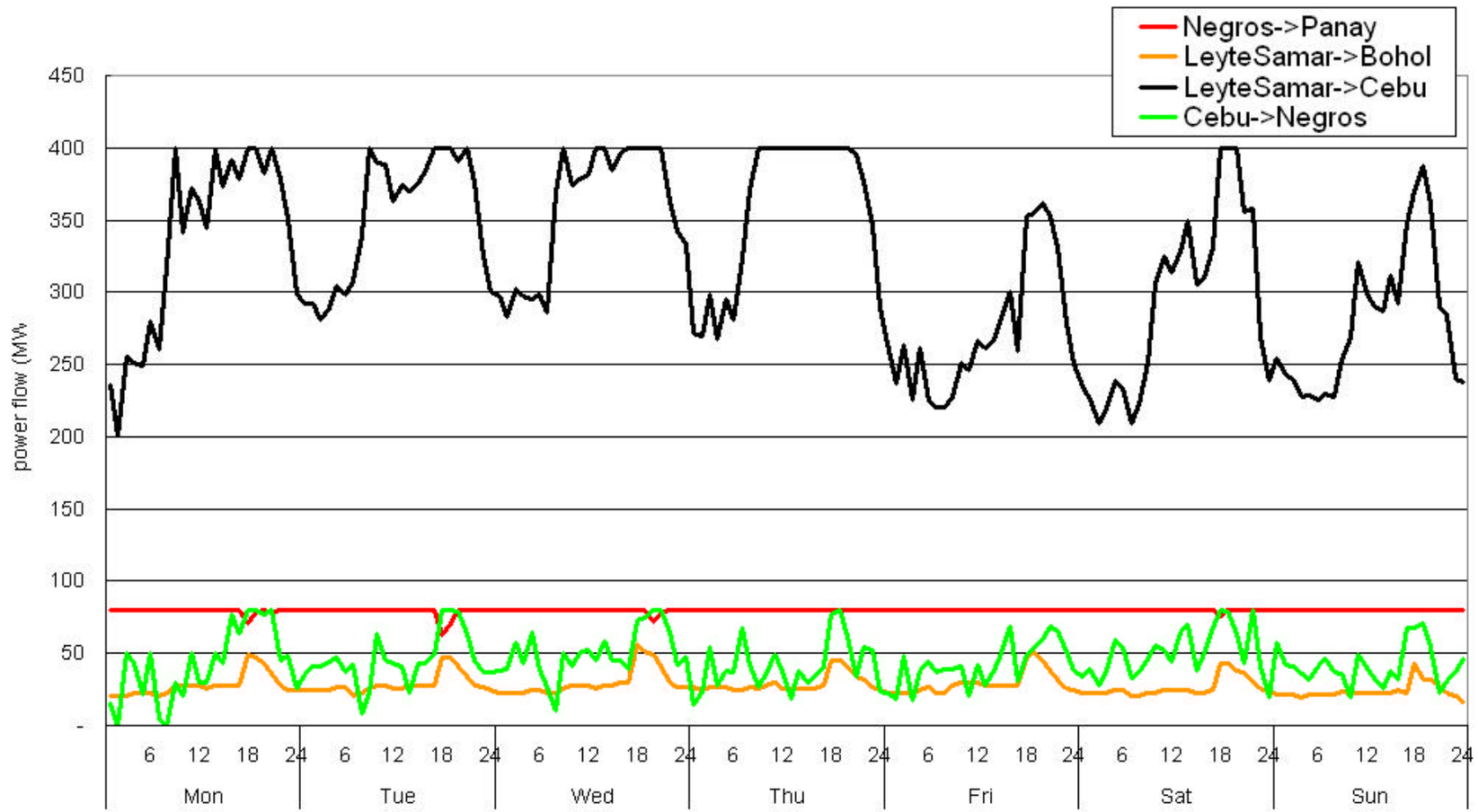
Power Development Program



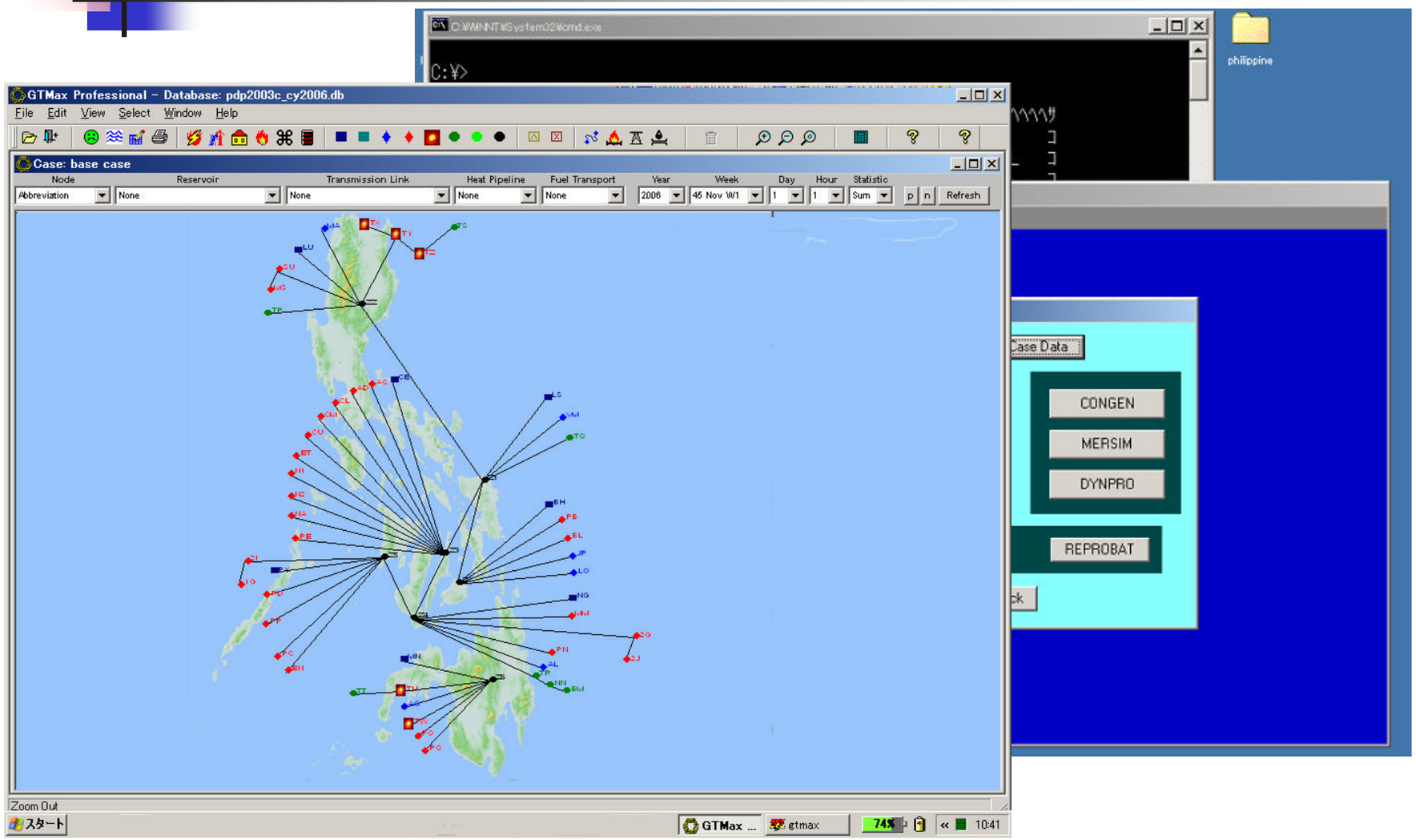
Regional Power Supply Balance in 2006



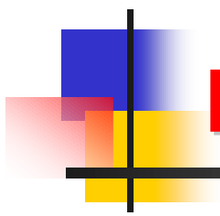
Interconnection Power Flow in 2006



Simulation Software (WASP-IV.GTMax)



Simulation Workshop



PDP assumptions

Reliability Criteria for Planning

- **LOLP (Loss of Load Probability)**
  Probability of blackout in the system considering the forced outage, maintenance
  --- 1 day / Year

- **GRM (Generation Reserve Margin)**
  Reserve capacity against the peak demand
  $$\text{GRM} = \frac{\text{System Capacity} - \text{Peak Demand}}{\text{Peak Demand}}$$
  --- 13.2 %

Data Assumption

Items	Basis
Dependable Cp.	Actual 2001 & 2002
Thermal Data	Actual 2001 & 2002
Hydro Data	Actual 1996, 2001 & 2002
Const. Cost	Past construction price in the Philippines, such as Pagbilao, Ilijan and San Lorenzo (For checking) International Market Price
Fuel Cost	Contract Price of Generation Companies (For checking) International Market Price
Discount Rate	12%

Committed Project

Area	Project Name	MW	Year
Luzon	Kalayaan 3 & 4	350	2004
	PNOC-EDC Wind	40	2006
	North-wind Power	25	2006
Visayas	Transfer Pinamucan	100	2004
	Northern Negros Geo	40	2005
	PNOC-Palinpinon Geo	20	2005
	Victrias Bioenergy	50	2005
Mindanao	Transfer PB103-104	64	2004
	Mindanao Coal	200	2006

Retirement

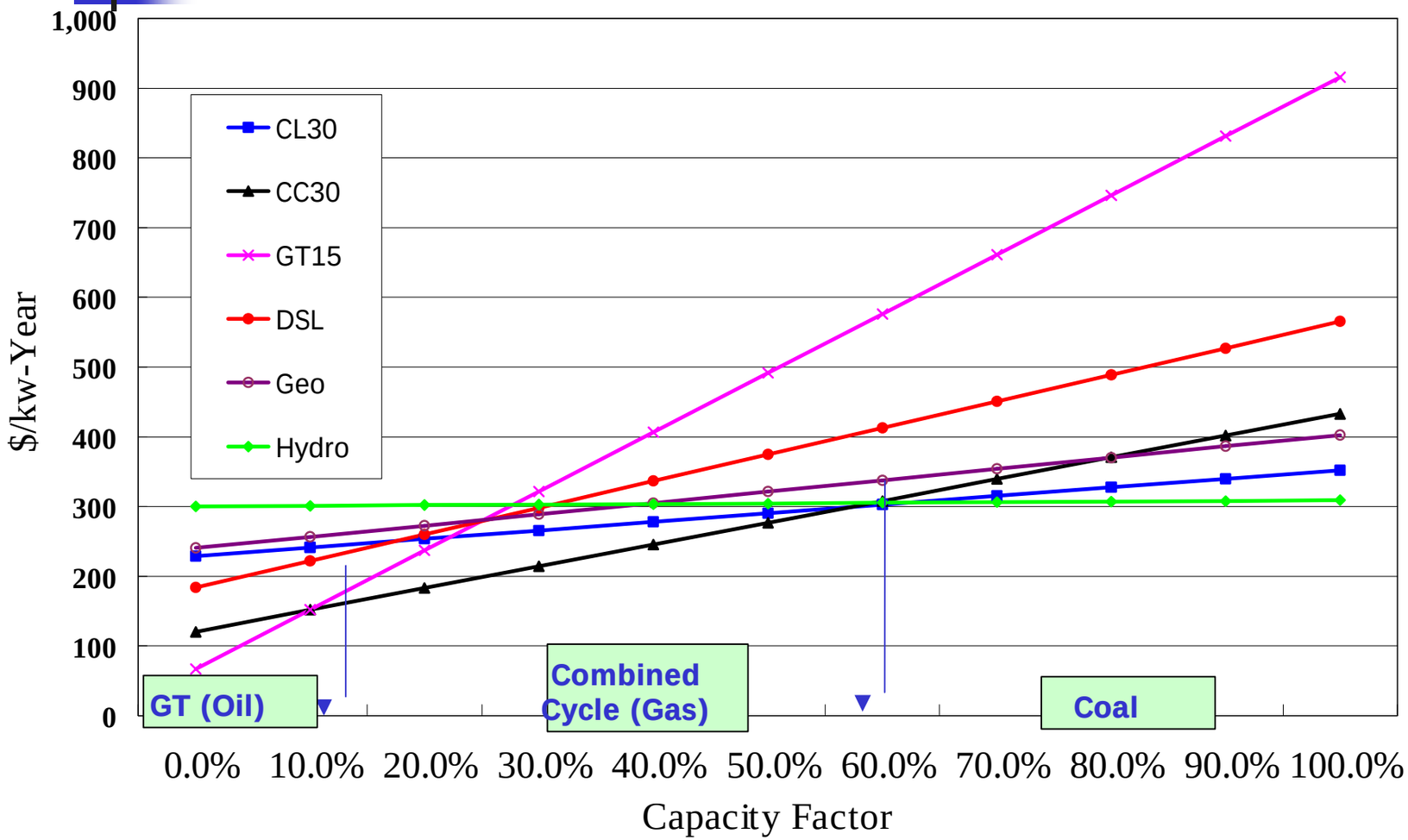
Area	Project Name	MW	Year
Luzon	Malaya 1 & 2	650	2010
	Hopewell GT*	210	2009
Visayas	Panay DPP1	36.5	2007
	Bohol DPP	22	2007
	PB101	64	2007
	Cebu Land Base GT	55	2011
	Cebu DPP	43.8	2011
Mindanao	PB103-104	64	2009

*Already Disconnected

Candidate for Simulation

- For Luzon
  - Coal fired plant (300MW:Coal)
  - Combined cycle power plant (300MW:Gas)
  - Gas turbine power plant (150MW:Oil)
- For Visayas, Mindanao
  - Coal fired plant (50MW:Coal)
  - Diesel power plant (50MW:Oil)
  - Gas turbine power plant (50MW:Oil)

Screening Curve



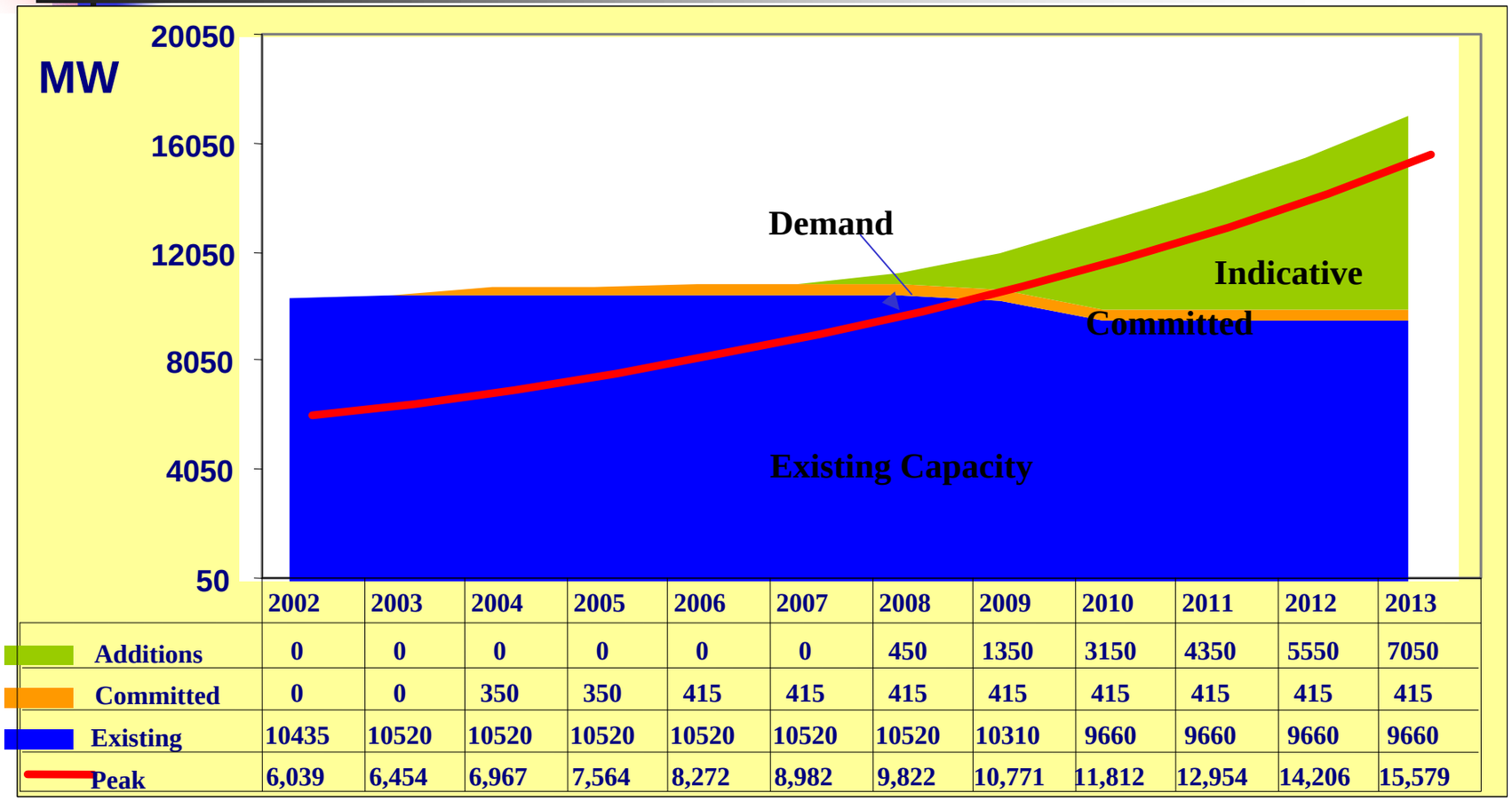
Result of the PDP(2004-2013)

CAPACITY ADDITIONS: LOW GDP

	LUZON		
	BASELOAD	MIDRANGE	PEAKING
2003			
2004			
2005			
2006			
2007			
2008			450
2009	900		
2010	1,800		300
2011	900		
2012	1,200		300
2013	1,200		
TOTAL	**6,000**		**1,050**
TOTAL/GRID	**7,050**		

Power Supply and Demand Profile

Luzon



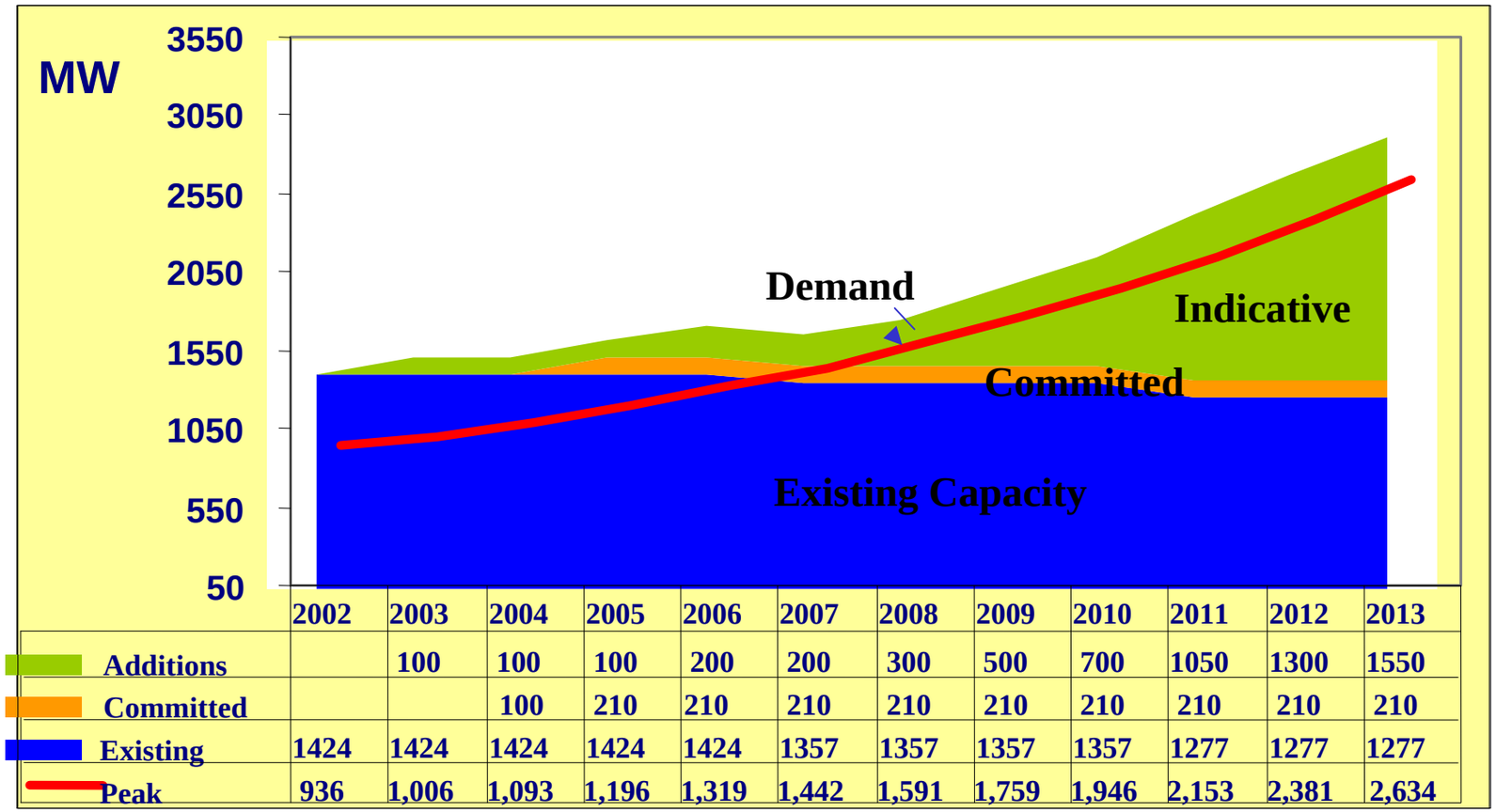
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Additions	0	0	0	0	0	0	450	1350	3150	4350	5550	7050
Committed	0	0	350	350	415	415	415	415	415	415	415	415
Existing	10435	10520	10520	10520	10520	10520	10520	10310	9660	9660	9660	9660
Peak	6,039	6,454	6,967	7,564	8,272	8,982	9,822	10,771	11,812	12,954	14,206	15,579

CAPACITY ADDITIONS: LOW

	VISAYAS		
	BASELOAD	MIDRANGE	PEAKING
2003	0	0	100
2004	-	-	-
2005	-	-	-
2006	-	50	50
2007	-	-	-
2008	-	-	100
2009	-	-	200
2010	-	150	50
2011	100	150	100
2012	150	50	50
2013	150	50	50
TOTAL	**400**	**450**	**700**
TOTAL/GRID	**1,550**		

Power Supply and Demand Profile

Visayas



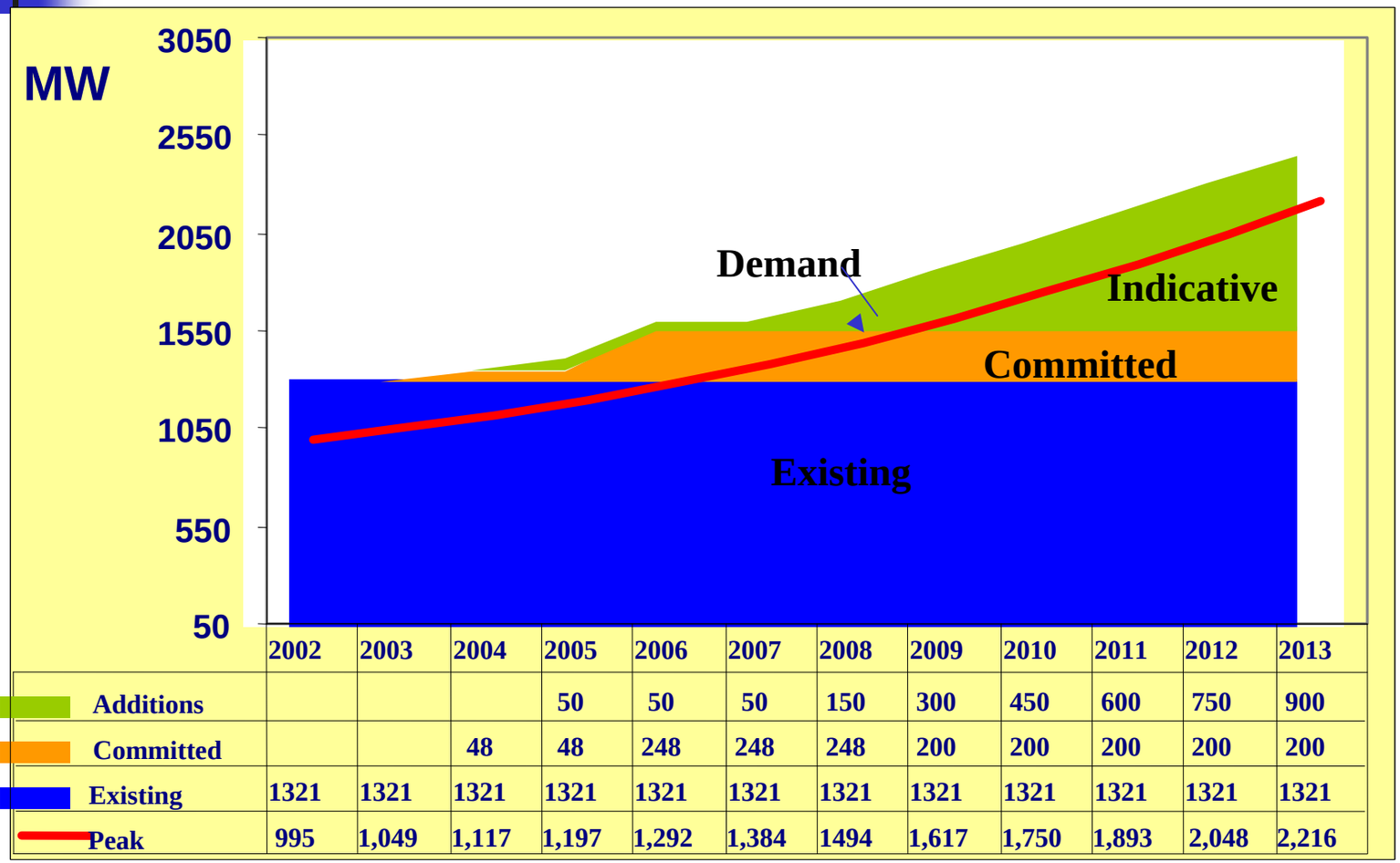
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Additions		100	100	100	200	200	300	500	700	1050	1300	1550
Committed			100	210	210	210	210	210	210	210	210	210
Existing	1424	1424	1424	1424	1424	1357	1357	1357	1357	1277	1277	1277
Peak	936	1,006	1,093	1,196	1,319	1,442	1,591	1,759	1,946	2,153	2,381	2,634

CAPACITY ADDITIONS: LOW

	MINDANAO		
	BASELOAD	MIDRANGE	PEAKING
2003			
2004			
2005			50
2006			
2007			
2008			100
2009	150		
2010	150		
2011	100		
2012	100	50	
2013	100	50	50
TOTAL	**600**	**100**	**200**
TOTAL/GRID	**900**		

Power Supply and Demand Profile

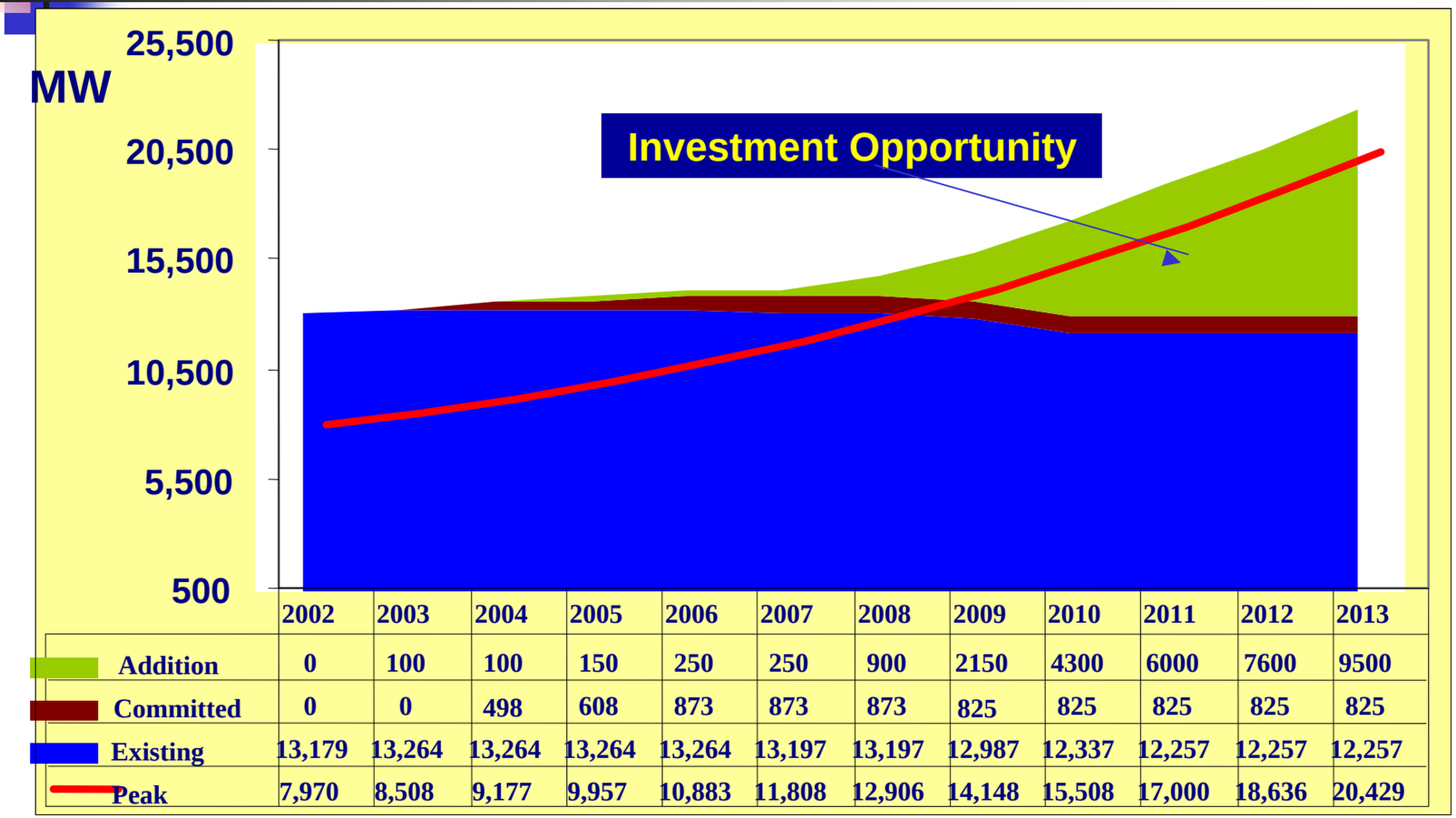
Mindanao



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Additions				50	50	50	150	300	450	600	750	900
Committed			48	48	248	248	248	200	200	200	200	200
Existing	1321	1321	1321	1321	1321	1321	1321	1321	1321	1321	1321	1321
Peak	995	1,049	1,117	1,197	1,292	1,384	1494	1,617	1,750	1,893	2,048	2,216

Power Supply and Demand Profile

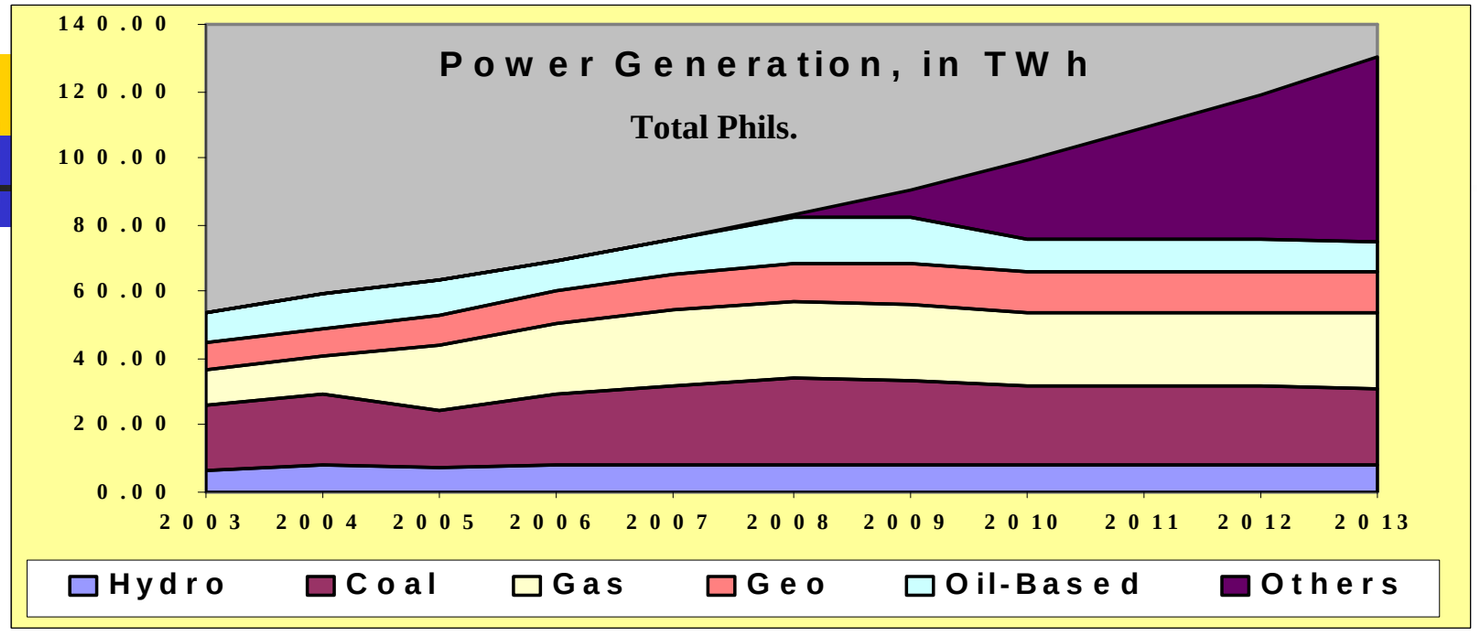
Philippines



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Addition	0	100	100	150	250	250	900	2150	4300	6000	7600	9500
Committed	0	0	498	608	873	873	873	825	825	825	825	825
Existing	13,179	13,264	13,264	13,264	13,264	13,197	13,197	12,987	12,337	12,257	12,257	12,257
Peak	7,970	8,508	9,177	9,957	10,883	11,808	12,906	14,148	15,508	17,000	18,636	20,429

INDICATIVE PROJECTS

PROJECT	MW	YEAR AVAILABLE
Luzon		
Makban Geo Rehabilitation	220	2005
Tiwi Geo Rehabilitation	220	2005
Bacman Optimization	40	2007
Sucat NG Conversion	450-850 MW	2007
Limay Expansion (LNG) unit 1	250	2007
Limay Expansion (LNG) unit 2	250	2008
Mariveles Greenfield (LNG) unit 1	600	2008
Mariveles Greenfield (LNG) unit 2	600	2009
Visayas		
Mirant Diesel PP (Iloilo)	40	2004
Trans-Asia Diesel PP (Boracay)	7.5	2004
Southern Leyte Geothermal	100	2008
KEPCO Clean Coal PP (Panay)	100	2005
Mindanao		
Mt. Apo Geothermal Expansion	20	2006
Tagoloan Hydro	68	2008
Sultan Kudarat Coal PP	150-200	2013
Agus 3 Hydro	225	2013
Pulangi V	300	2013



GENERATION MIX (%)

	2004	2006	2008	2010	2013
Oil-Based	17.4	13.12	16.6	9.9	7.4
Coal	36.7	30.54	31.9	23.7	17.7
Gas	18.8	30.62	26.9	22.4	17.0
Hydro	13.1	11.24	9.8	8.1	6.2
Geo	14.0	14.24	14.3	12.0	9.2
NRE	0.0	0.22	0.2	0.2	0.1
Others	0.0	0.02	0.4	23.7	42.3

FUEL REQUIREMENTS

(2003 – 2013)

OIL-BASED	-	168 Million Barrels
NATURAL GAS	-	1,419 Billion Cubic Feet
COAL	-	105 Million Tons
Local	-	24 Million Tons
Imported	-	81 Million Tons

Technical Issues

- Fuel Price Impact
- Interconnection Issue

(1) Sensitivity Study

Fuel Price Impact

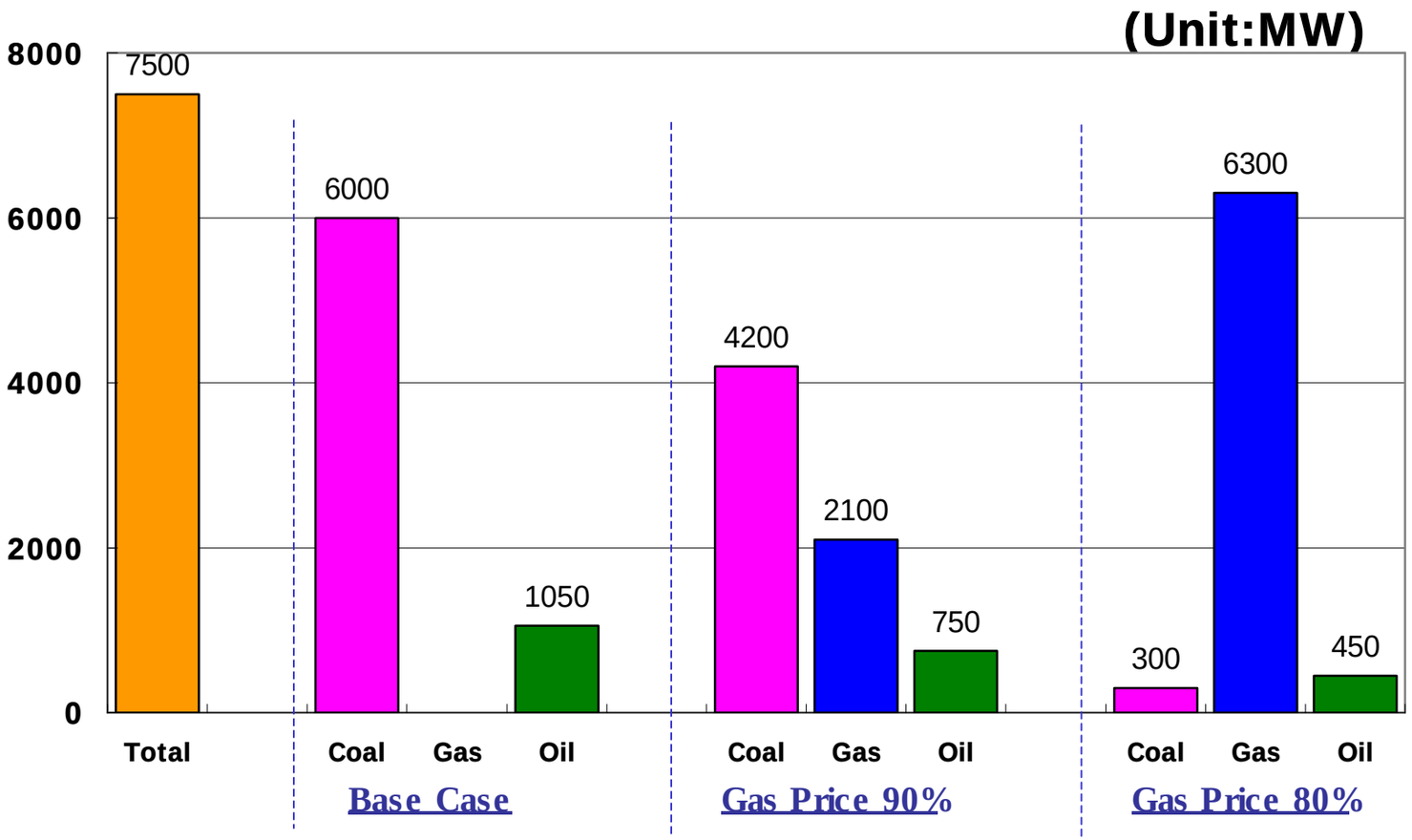
Objective:

To enhance the effective use of natural gas, price impact of natural gas is studied

Fuel Name	Scenario
Natural Gas	- Present Price - 95%, 90%, 85% and 80% of Present Price
Coal	-Present Price
Oil & Others	-Present Price

(1) Sensitivity Study

Necessary Development for 10 years (2004-2013)



(1)Sensitivity Study

Consideration

- Natural gas is one of clean fossil energy.
- Initial investment of gas fired power plant is cheaper than that of coal fired power plant.

- In order to enhance the effective use of domestic natural gas, gas price should be determined deliberately.
- On the other hand, initial investment cost of gas infrastructure might be great.
- Therefore, the effort to decrease the gas price should be continued in future.

(2) Interconnection Issues

Basic Approach for Interconnection

Project A : No Interconnection

Simulation for Independent Area : A

+

Simulation for Independent Area : B

Project B: New Interconnection

Simulation for Synthesized Area: A +B

+

Construction / Up-rating Cost of Interconnection

Total System Cost
(Investment & Operation Cost)
should be compared

(2) Interconnection Issues

Evaluation of Interconnection Project

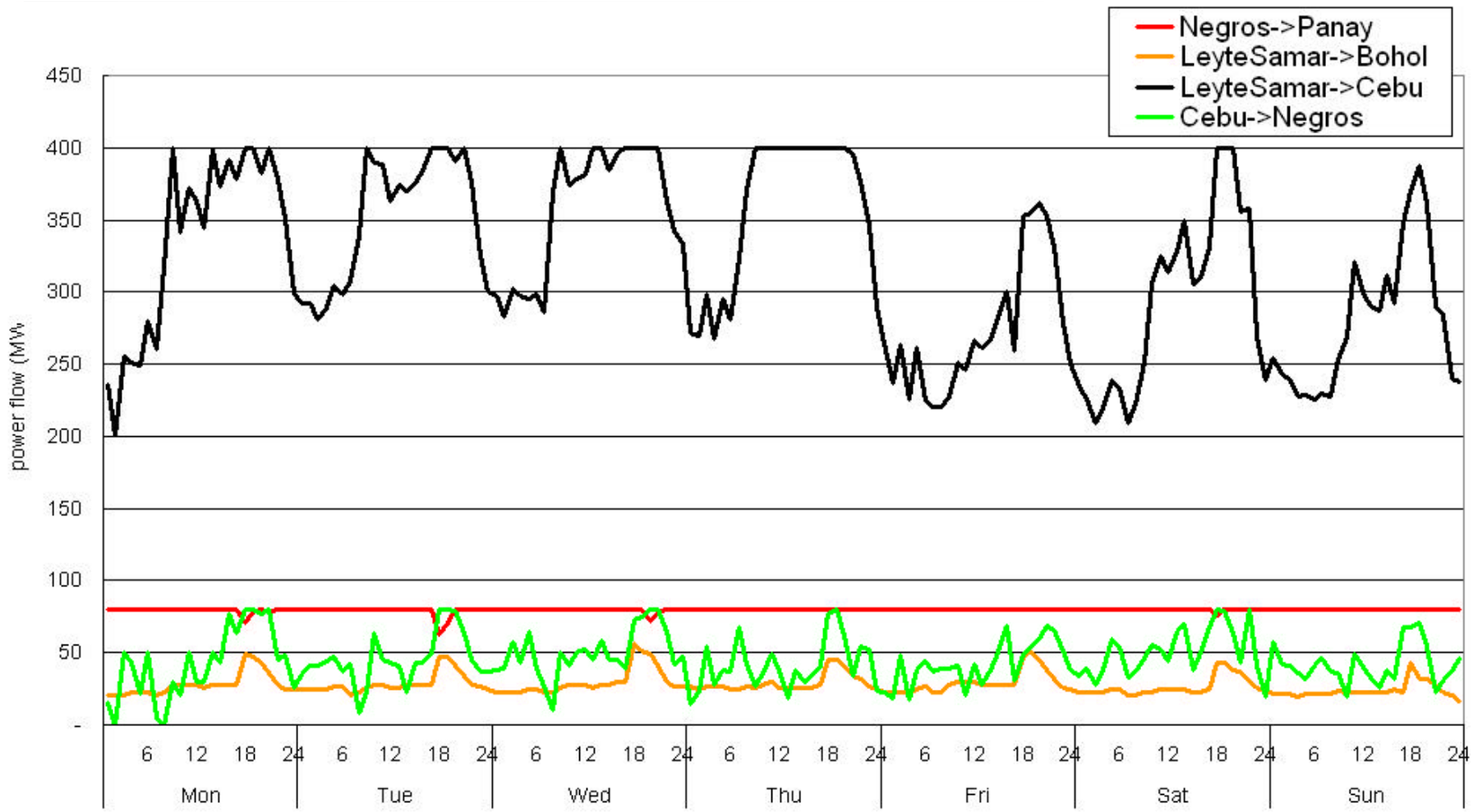
Assumption :

All power plant will start operating as scheduled

Project Name	Evaluation
Leyte - Cebu Uprating (200->400 MW)	Necessary
Leyte - Bohol Uprating (35->100 MW)	Feasible
Cebu - Negros - Panay Uprating	Not Economical
Leyte - Mindanao New Interconnection (HVDC)	Not Economical

(2) Interconnection Issues

Interconnection Power Flow in 2006

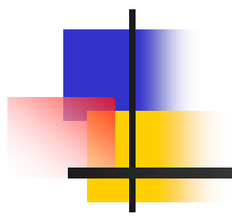


(2) Interconnection Study

Consideration

- From the point of economical view, some interconnection projects are considered as not economical.
- However, power plant will not always start operating as scheduled.
- In addition, Merit of interconnection is not only economic operation but also improvement of reliability.

Further evaluation should be required on the necessity of interconnection projects.



Thank You !