Power Development Plan

Dialogue – Institute of Energy, January 10th 2014

REVIEW PDP 7 WITH REGARD TO SUSTAINABLE ENERGY DEVELOPMENT

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- Electricity demand forecast
- Energy efficiency
- Power source development plan
- Renewable energy

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Electricity demand forecast

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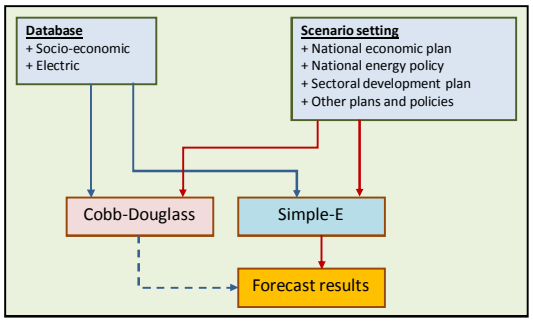
Forecasting tools

- The Cobb-Douglass
- Simple-E model



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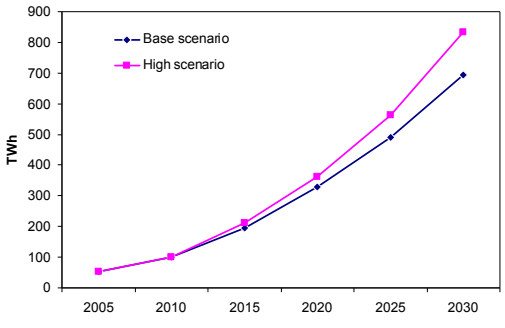
Main assumptions and results for the forecast

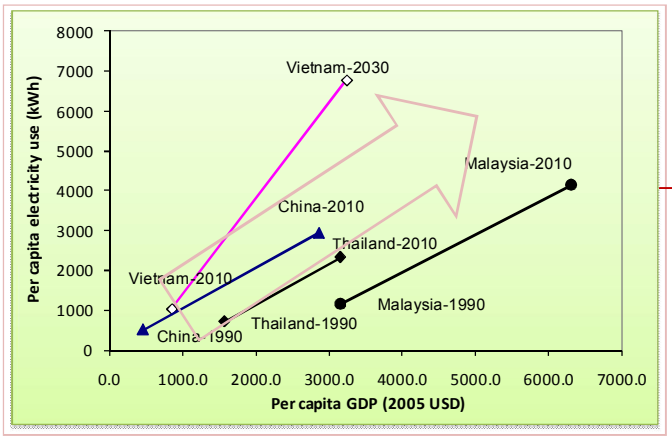
	2010	2015	2020	2025	2030	AAGR (%) 2011-2015	2016-2020	2021-2025	2026-2030
Base scenario									
GDP (Bill $ 2000)	62.79	90.14	132.45	192.82	280.70	7.5	8.0	7.8	7.8
Population (Mill.)	86.90	91.37	96.0	99.4	102.42	1.0	1.0	0.7	0.6
Generation (TWh)	100	194.3	329.4	489.6	695.1	14.2	11.1	8.2	7.3
Pmax (MW)	16,048	30,803	52,040	77,084	110,215				
High scenario									
GDP (Bill $ 2000)	62.79	92.26	138.09	208.60	315.11	8.0	8.4	8.6	8.6
Population (Mill.)	86.90	91.37	96.0	99.4	102.42	1.0	1.0	0.7	0.6
Generation (TWh)	100	210.8	361.9	561.5	833.8	16.1	11.4	9.2	8.2
Pmax (MW)	16,048	33,426	57,180	88,401	132,201				

Average growth rate:
-Base scenario: 10%/year
- High scenario: 11.2%/year



Discussion of the forecast results

Expected evolution of per capita electricity use in Vietnam between 2010 and 2030 and the historical data of selected developing countries



Forecast result is different from historical data of countries in the region.

Source: World Bank, World Development Indicator, 2013. Data after 2010 for Vietnam is taken from PDP 7

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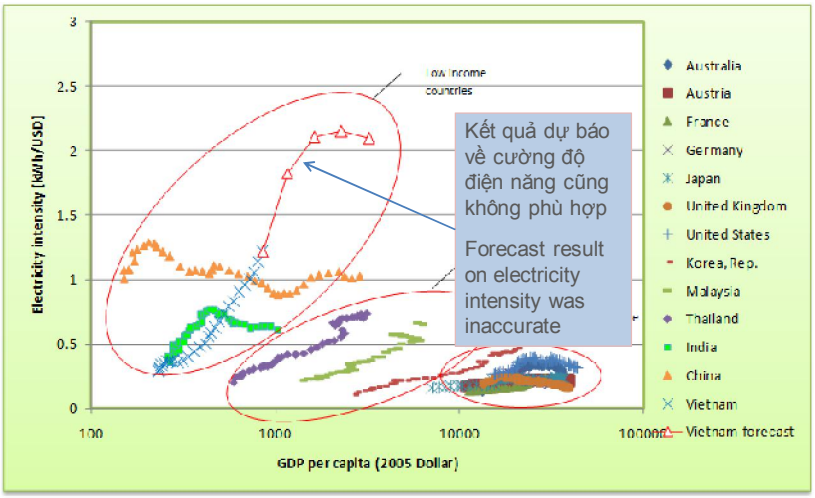
Discussion of the forecast results

Electricity intensity in relation to GDP per capita



Source: World Bank, World Development Indicator, 2013. Data after 2010 for Vietnam is taken from PDP 7

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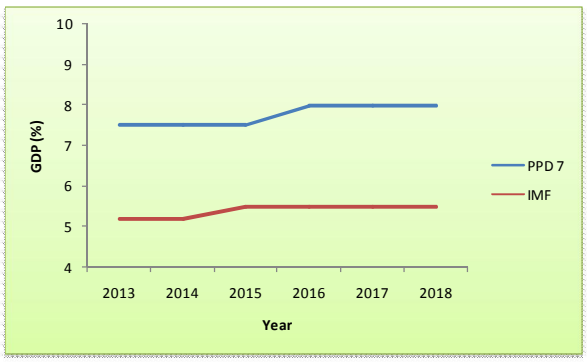
Reasons for the over projection of demand

- High GDP growth assumption
  - ➢2011 – 2015: 7.5%
  - ➢In fact: 2010: 6.78%, 2011: 6.89%, 2013: 5.42%, 2014 (expected): 5,8%



Source: World Economic Outlook, April 2013

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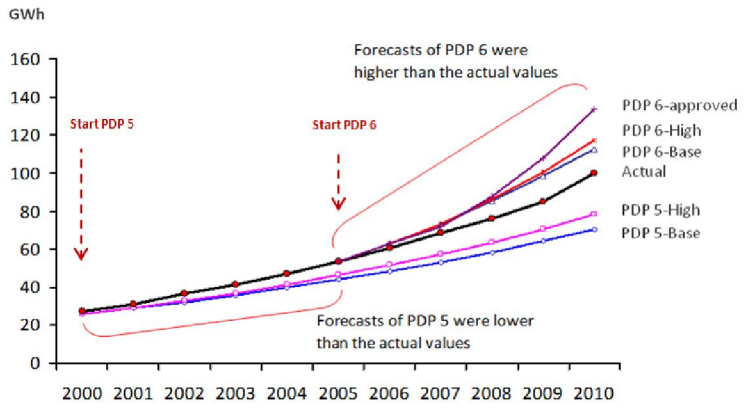
Reasons for the overestimation of demand

-High elastic coefficient
- ➢Consequence of previous forecasts
- ➢Directives of government



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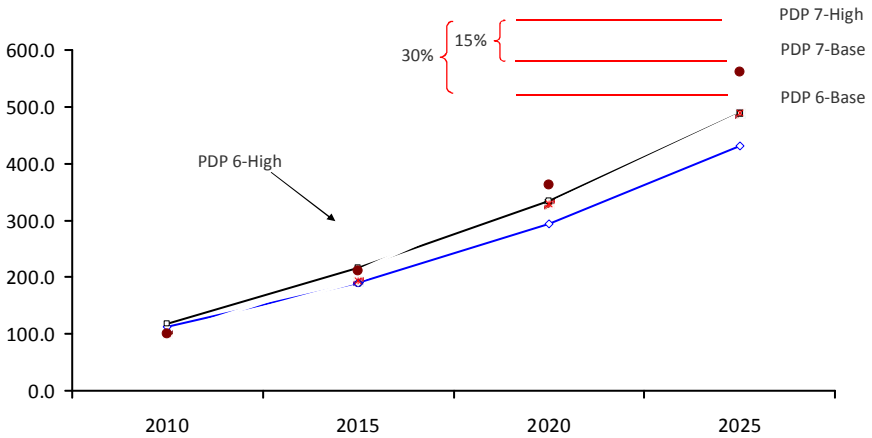

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Forecast implications:

-Overinvestment in source and network
-Low capacity factor
-Profound difference between production cost and the electricity tariff
-Increase of national debt

Investment capital requirement for energy sector

Period	Coal	Power	Oil and gas
till 2015	2.0 bill USD/yr	4.9 bill USD/yr	1.0 bill USD/yr
2016–2020	1.0 bill USD/yr		0.5 bill USD/yr
2021–2030	0.4 bill USD/yr	7.5 bill USD/yr	

Unit cost of electricity from various generation technologies in Vietnam (US cent/kWh)

		Domestic coal	Imported coal	FO	Natural gas	Big	Small
Capacity factor	20%	10.9	10.9	14.2	8.7		
	30%	7.7	8.0	11.9	6.8		
	40%	6.1	6.6	10.8	5.8	3.5	5.1
	50%	5.1	5.7	10.1	5.2		
	60%	4.5	5.1	9.6	4.8		
	70%	4.0	4.7	9.3	4.6		
	80%	3.7	4.4	9.1	4.3		
	90%	3.4	4.2	8.9	4.2		

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Energy efficiency

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Energy efficiency in PDP 7 and its potential

Energy efficiency in PDP 7
-Based on National Target Program on Energy Efficiency and Conservation
-Total energy saving by 2011-2020: 8-10%

-**Incommensurate** with its potential

Unplanned technical potential of electricity saving in Vietnam

	2015	2020	2025
	MWh/year	MWh/year	MWh/year
Total	**18,409,032**	**37,393,276**	**76,041,633**
Demand side	14,328,648	27,510,916	58,904,898
Industry	9,777,711	11,912,961	15,469,290
Commercial	1,670,720	3,341,440	5,012,160
Residential	2,880,217	12,256,515	38,423,447
Other (including agriculture)			
Supply side	4,080,384	9,882,360	17,136,735

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Source: TA-7764 REG: Ensuring Sustainability of GMS Regional Power Development

Actions to realize the potential:

Demand side

Industry
- **Cement**
  - *Waste heat recovery:*
  - *Technology substitution:*
  - *Increase the ratio of additives in clinker:*
- **Iron and Steel**
  - *Waste heat recovery:*
  - *Development of complete manufacturing line:*
  - *Upgradation of technology:*
- **Brick making**
  - *Waste heat recovery:*
  - *Technology substitution:*
- **Pulp and Paper**
  - *Developing biogas from waste water*
  - *Recover waste heat*
- **General measures**
  - *Installing Variable Speed Devices* (VSDs)
  - *Replacing low efficiency motors and air compressors*
  - *Mandatory EE reporting:*

Commercial and Residential
- *Lighting improvement:*
- *Energy efficiency standard and labeling:*
- *Thermal conductance of window:*
- *Solar water heater:*
- *Improving COP of chiller plants:*

Other measures
- *Capital incentives:*
- *Promotion of Energy Service Companies (ESCOs):*
- *Gradual removal of subsidized energy prices:*

Supply side
- Efficiency improvement of electricity generation
- Efficiency improvement of power network

Source: TA-7764 REG: Ensuring Sustainability of GMS Regional Power Development and other relevant document.

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EE options which could be modeled as generation technologies

✓Investment cost, O&M cost, energy consumption of both the existing and alternative technologies are required.
✓Replacement (penetration) level is required

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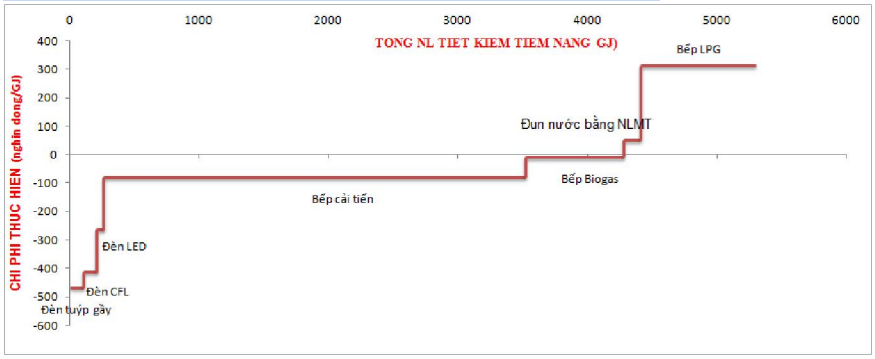
Cost curve to form a basis for scenario construction

An example of cost curve to save energy



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Other options

✓"Profile" of saving energy solutions in comparison with the system
✓Benefits of evaluating the potential reduction of energy and power losses

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Power source development plan

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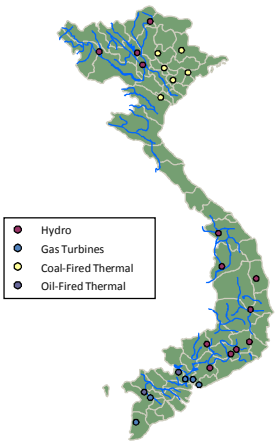
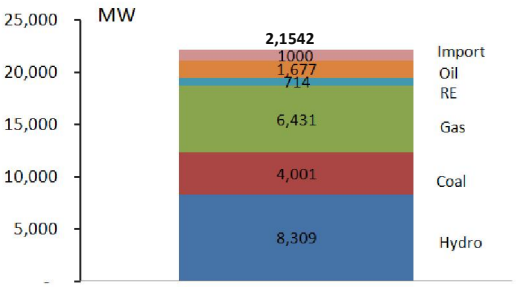
Current status of electricity sources

Location of power plants(2010)



Installed câpcity(2010)



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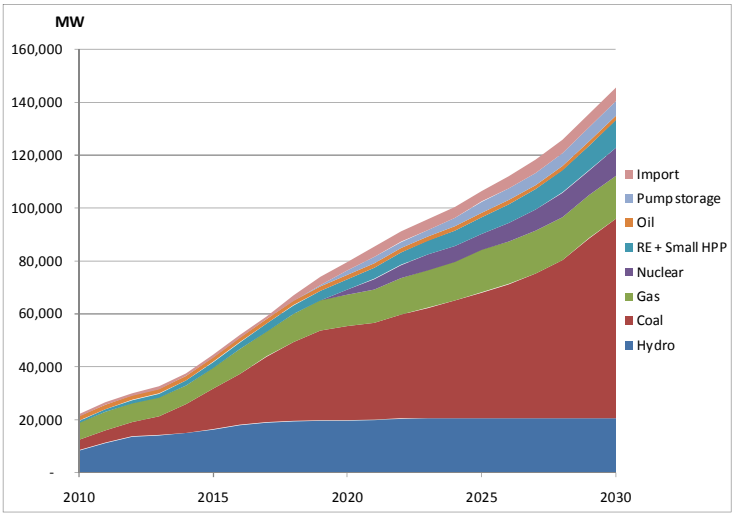
Results of Power source development plan



+By 2020, total installed capacity would reach 75,000 MW, of which hydropower: 23.1%, coal: 48.0%, power using renewable energy: 5.6%, etc

+ By 2030, The total power plant capacity will be about 146,800 MW, of which hydropower: 11.8%, coal thermal power 51.6%; power using renewable energy 9.4%, etc

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Discussions and recommendations:

✓The choice of power generation technologies has been actually made from the view point of the power sector not the economy (for example: cost of fuel)
✓No link between the average electricity price and total electricity demand has been considered.
✓The role of energy efficiency (mentioned above) has not paid due attention
✓The chosen power generation mix depends too much on coal fired power plants.
✓The reserve margin of 30% after 2015 would be high, which is caused by the choice of low capacity factors of power plant (coal-fired, gas)
✓The importance of nuclear power should be recognized on the basis of updated demand forecast. Besides, their economics should be re-evaluated with actual data.

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Renewable energy

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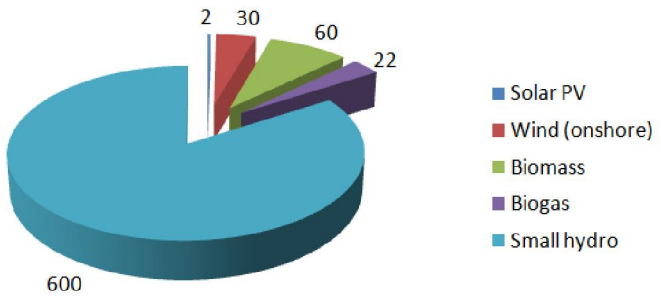
Current status of renewable energy development

+Total installed renewable energy capacity in 2010 was about 714 MW



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Development plan

- Capacity of renewable energy will account for 5.6% by 2020 and 9.4% by 2030
- Wind: 2020: 1000 MW; 2030: 6200 MW
- Biomass: 2020: 50 MW; 2030: 2000 MW

Year	Added capacity (MW)	Year	Added capacity (MW)
2011	180	2021	400
2012	238	2022	450
2013	310	2023	500
2014	420	2024	550
2015	350	2025	600
2016	350	2026	600
2017	500	2027	700
2018	200	2028	800
2019	230	2029	950
2020	300	2030	1,150
2011-2020	**3,078**	**2021-2030**	**6,700**
Total by 2020	**3,792**	**Total by 2030**	**10,492**

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Discussions

✓The renewable energy development targets in PDP 7 are higher than that in previous studies (PDP 6 or the draft Master plan on renewable energy development)
✓However, the target for renewable energy against installed capacity, the MW planned to develop by year are lower
✓Moreover, there seems to be a lack of foundation for these development targets (for example, wind power)

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Recommendations

✓Take consideration into development of Solar PV, especially in commercial buildings.
✓Conduct background study for intermittent renewable energies (wind, solar) about:
✓ Correlation with hydropower
✓Regional smoothing effect (wind)
✓Supply curve which can be used as basis to construct development scenarios.

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