Electricity Demand and Power Plant Development in Indonesia

Potentials, Issues and the Way Forward

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Outline

1. JICA and Its Experience in Indonesia
2. JICA's Contribution in the Energy/Power Sector
3. Electricity Demand Growth in Indonesia
4. Advantage & Disadvantage of Each Generation Type
5. – 6. Coal-fired Power
7. – 9. Geothermal Power
10. – 13. Hydro Power
14. Way Forward

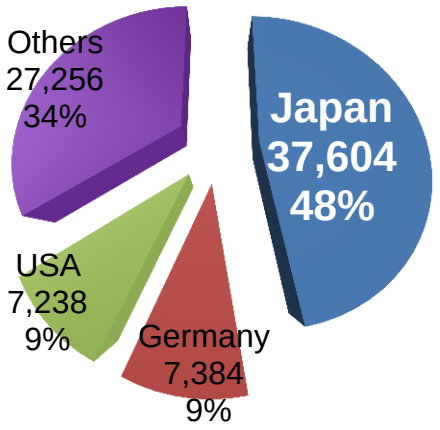
1. JICA and its experience in Indonesia

The largest development partner with over 50 years of cooperation

- JICA is Japan's official development agency of:
  - Grant Assistance (e.g. Research lab, power plant rehabilitation, etc.)
  - Technical Cooperation (e.g. Master plans, Human resource dev., etc.)
  - Low-interest Yen Loans (e.g. Power plant, road construction, etc.)
- Cumulative total of cooperation in Indonesia: **4.6 trillion yen (approx. $ 54 billion)**
- Energy development has been one of the highest priority areas

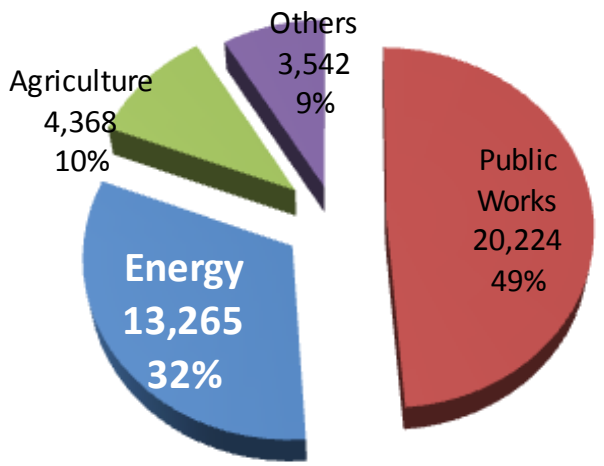
Development Assistance to Indonesia by Country

(1960-2008)
USD million



JICA's Cooperation in Indonesia by Sector (Projects)

(1960-2008)
USD million



2. JICA's Contribution in the Energy/Power Sector

In the areas of power plant financing, master plans and policy improvements

Sector Overview

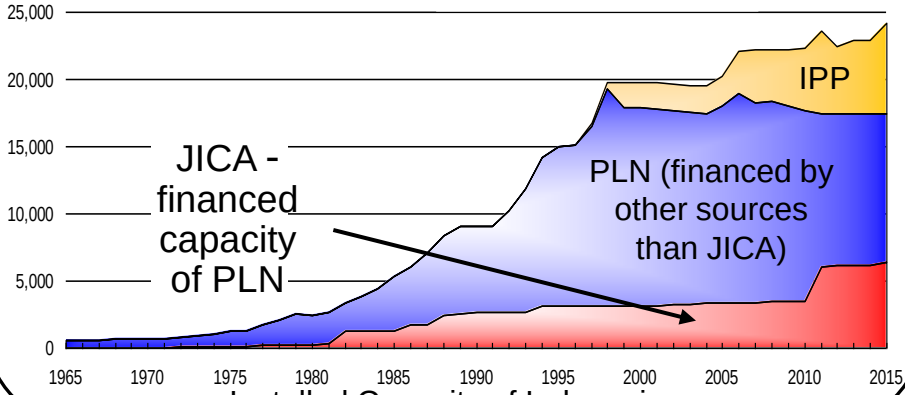
Electrification Ratio:
Village: 92%, Households: 61%

Demand:
8.5% annual growth rate
(Need for 5,500MW increase annually)

Energy Mix:
Renewables 7% ('04) → 15% ('25)

Contributions

• Financed approx. 20% of PLN's production capacity in Jawa-Bali (3,500MW)



Installed Capacity of Indonesia

Key Issues

1. Stable supply of electricity
- Grid strengthening
- Promotion of PPP in power development
- Promotion of clean coal technology

2. Climate change mitigation
- Promotion of renewable energy, especially geothermal and hydro
- Promotion of energy conservation

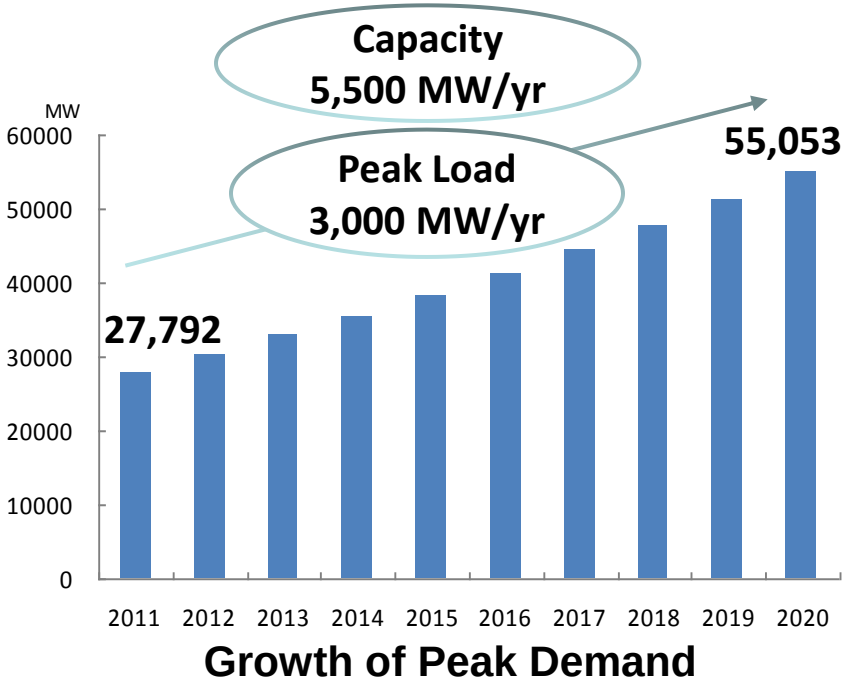
Major Projects

Geothermal	• FIT, Geo Fund designs (2009～) • Geothermal Master Plan (2007) • 540MW of PP financing (2003 ～)
Hydro	• Hydro Master Plan (2011) • 1,580MW of PP financing(1970 ～)
Thermal	• CCT Roadmap (2012) • USC (coal) & Gas-CC (2003～)
Transmission Lines	• Java-Sumatra HVDC (2008 ～) • Northwest Sumatra T/L (2006～) • Java-Bali T/L (～2006)

3. Electricity Demand Growth in Indonesia

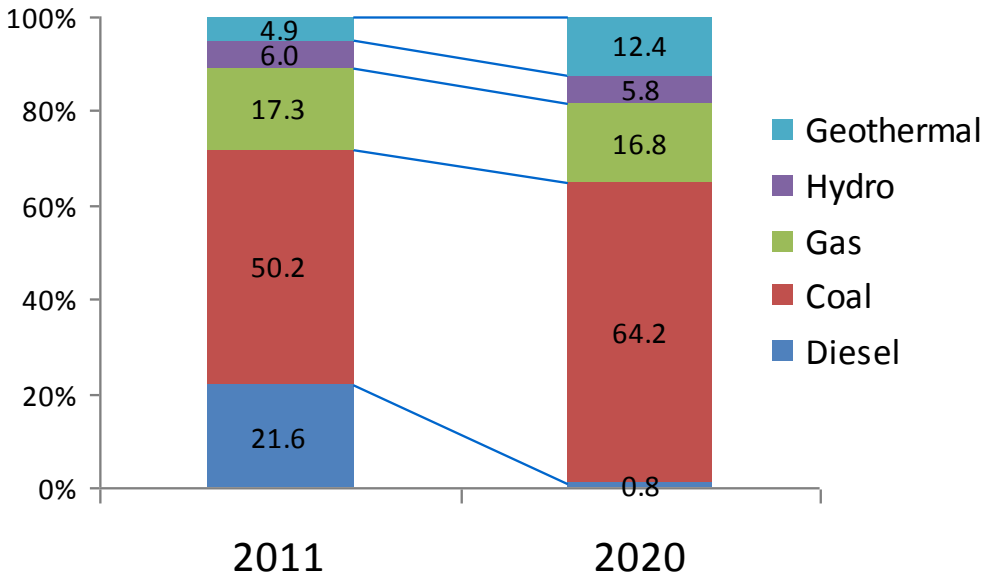
Steady development of new power plants and energy diversification are key

- Electricity consumption is expected to increase at an ave. of 8.5%/yr until 2020
- Peak load is expected to increase by an ave. of 3,000MW/yr, and PLN plans to increase the generation capacity by an ave. 5,500MW/yr
- In the electricity-generation energy mix, focus is put on:
  - ✓ Large-scale coal-fired power plants
  - ✓ Share of renewable energy to almost double by 2020 through geothermal and hydro



Growth of Peak Demand

Source: RUPTL 2011-2020



Energy Mix Target

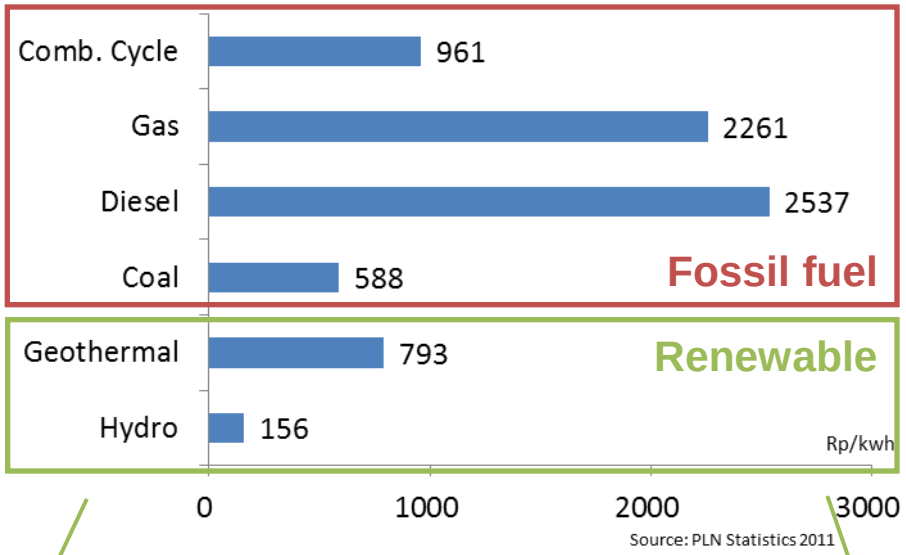
4. Advantage and Disadvantage of Generation Types

Fossil fuel based and renewable energy based generation

- Coal, as the least-cost option, and Geothermal & Hydro, as renewables, are the focus of the government and PLN

Advantage
✓Use of transportable fuel makes investment risks lower
✓Large-scale generation capacity (excl. diesel)

Disadvantage
✓CO2 emissions (coal)
✓Lack of infrastructure (gas)
✓Large impact of fuel cost fluctuation



Unit Generation Costs by Type
(incl. depreciation)

Advantage
✓CO2 emission reduction
✓Less exposure to fuel cost fluctuation

Disadvantage
✓Large investment risk (esp. geothermal)
✓Environmental issue (endangered species)
✓Social issue (resettlement (hydro))
✓Forest use permission issue

5. *Coal*: Characteristics of Coal Utilization in Indonesia

Use of low-rank coal and high-efficiency technology is key

Advantage of Coal Utilization

Abundant reserves

● Oil and Gas production is projected to decline, while coal production is projected to increase.

Low cost source of electricity

● Coal is the most economical source of energy for electricity production and has abundant resources in Indonesia.

Challenges of Coal Utilization

GHG (Greenhouse Gas) emissions

● Coal has the highest CO2 emissions among primary energy fuels.

● Indonesia has a target to reduce GHG emissions by 26% compared with BAU by 2020.

Low rank coal

●A large proportion of Indonesian coal resources is low rank coal, which requires higher technology for power generation.

Indonesia needs to explore technological innovations with the following specifications through the formulation of CCT roadmap

- Utilization of low rank coal
- Increasing the efficiency of the coal fired power plants through introduction of Clean Coal Technology (CCT) to reduce CO2 emissions

6. *Coal*: Clean Coal Technology Introduction Roadmap

JICA worked with GOI CCT roadmap: USC plants by 2017 and IGCC in 2020s

Clean Coal Technology for Coal Fired Power Plants

Ultra Super Critical (USC)

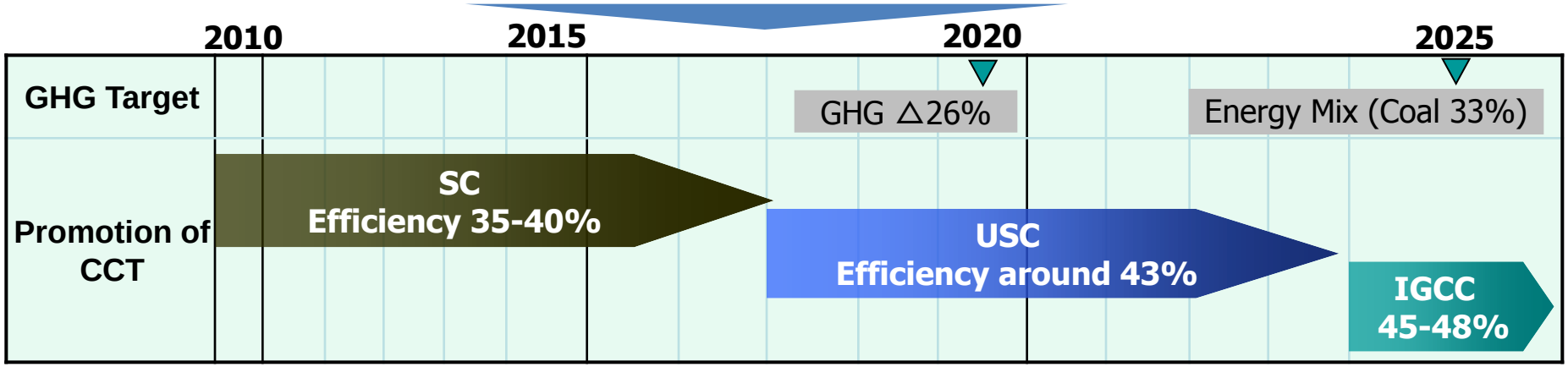
Matured technology to achieve low electricity costs & low GHG emissions

- Proven and already commercialized technology
- Introduced all around the world
- Can utilize low rank coal with above average ash melting point
- Economic superiority to SC
- Lower GHG emission compared to SC

Integrated Coal-Gasification Combined Cycle (IGCC)

Promising technology to achieve low electricity cost, lower GHG emissions & LRC utilization

- Technology yet to be commercialized
- Will be introduced at the beginning of 2020s in commercial base in the world
- Promising technology for low rank coal with low ash melting point
- Economic superiority to SC and USC
- Lower GHG emission than SC & USC



SC: Super Critical USC: Ultra Super Critical IGCC: Integrated coal Gasification Combine Cycle

7. *Geothermal*: Characteristics of the Indonesian Geothermal Market

Geographical advantages of large resources & focus on IPPs

- Resource characteristics
  - World's largest potential
    - 96% (27.3GW/28.5GW) of potential remains undeveloped
  - Large-scale resources
    - Production capacity of each well is said to be larger than other countries
    - 65% of Fast Track Program 2 (FTP2) are above 55MW (35/54)
- Policy Directions
  - Focus on IPP-development
    - 87% of RUPTL & 70% of FTP2 (geothermal only) to be developed by IPPs
  - Resource development as a part of IPP's responsibility

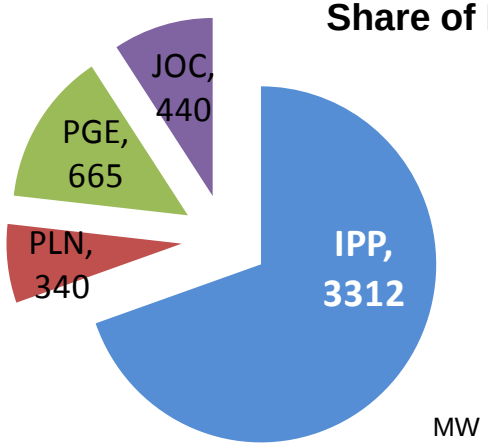
Countries with Geothermal Potential

Country	Geo Potential (MW)
Indonesia	28,000
USA	23,000
Japan	20,500
Phillipines	6,000
Mexico	6,000
Iceland	5,800
New Zealand	3,600
Italy	3,300

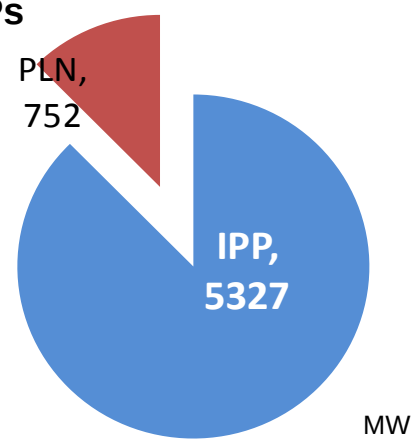
Projects with ≧55MW Capacity (Crash Program 2)

Capacity	# of projects	% (projects)
≧55MW	35	64.8%
<55MW	19	35.2%

Share of IPPs



Crash Program 2 (2010-2014) (4757MW)



Electricity Provision Plan (RUPTL) 2011-2020 (6079MW)

8. *Geothermal*: Issues for Development

Forestry permission and investment risk as main bottlenecks

- Investment risks

JICA's contribution

Pricing

- ✓ Bid price not necessarily reflected on PPA with PLN
- ✓ Low purchase price for geothermal power

Feed in Tariff Study ('08-'09)
Provided justification for FIT and benchmark price of 11.9 C/kWh

Off-take guarantee

- ✓ Gov't guarantee not in place for the off-take capacity of PLN

Geothermal Masterplan Study ('06-'07)
Provided priority listing of promising sites and road map for geothermal development

Exploration Risks

- ✓ All exploration risks are borne by IPPs

Exploration Fund Design Study ('10-'11)
Proposed an idea for exploration risk mitigation through a government fund to share the risk

Capacity Development for CGR ('10-'13)
Support Center for Geothermal Resources (CGR) for resource data collection and analysis

- Forest-use issue

Forestry Permission

- ✓ Over 50% of the expected capacity from FTP2 geothermal projects require forest use permissions*, whose processing time is extremely long

Forest Category	# of projects* (out of 54)	Total MW (Total Geo: 4,757MW)	% (MW)
Conservation	7	610	12.8%
Protection	15	1,930	40.6%

* Based on the MoU between MEMR & MOFR in Dec. 2011

9. *Geothermal*: Measures Taken and Way Forward

Some measures taken for investment risks, but further measures needed for all issues

	Measures taken	For further promotion….
• Investment risks		
Pricing	✓Obligation for PLN to sign PPA if winning bid is lower than 9.7 cents/kwh	☐ Introduction of Feed-in Tariff
Off-take guarantee	✓Gov't guarantee for off-taker risk is provided for FTP2 projects	☐ Geothermal tender process to be aligned with PPP tender process to secure PLN off-take guarantee
Exploration Risks	✓Established a Geothermal Fund for gov't involvement in exploration activities	☐ Detail of Geothermal Fund to be set and implemented
• Forest-use issue		
Forestry Permission	✓ MoU between MEMR & MOFR to accelerate the forest permission processes	☐ Coordination with Ministry of Forestry for accelerating the issuance of forestry permits

10. *Hydro*: Issues for Development

JICA has a long history in hydro, but environmental/social challenges remain

Hydro Power Potential in Indonesia

About 95% of Potential is not utilized

Region	Resources	Installed Capacity
Jawa, Bali	4,531 MW	2,536 MW
Sumatra	15,804 MW	868 MW
Kalimantan	21,611 MW	30 MW
Sulawesi	10,203 MW	210 MW
Others	23,475 MW	5 MW
Total	75,624 MW	3,649 MW

Reference: JICA study team analysis as of August 2011

Why?

Bottleneck for hydro power development

1. Forest use permit

Case 1: PLTA Poigar 2 (North Sulawesi)

- Project site was situated in a conservation forest
- Forest use permit not been issued till now

2. Environmental Issues

Case 2: PLTA Kusan 3 (South Kalimantan)

- Project site was situated in a proboscis monkey habitat
- The monkey is protected by the IUCN Red List of Threatened Species and cannot be reallocated

3. Social Issues

Case 3: PLTA POKO (South Sulawesi)

- The Project was delayed due to resettlement of more than 1,000 people.

11. *Hydro*: Project Screening through Hydro Master Plan

GOI and JICA worked together to prioritize potential hydro projects

- Based on environmental, economic and regulation factors, the screening of potential projects revealed about 8,700MW worth of projects for priority development

Screening Criteria		
Environmenta & Social		
	Forest Classification	
	A	Not Restricted
	B	Production Forest
	C	Protection Forest
	D	Conservation Forest
	Resettlement	
	A	0-50 household replacement
	B	50-400 household replacement
	C	400-1,000 household replacement
	D	1000- household replacement
	Inundated area	
	A	0-100 ha
	B	100-1,000 ha
	C	1,000-10,000 ha
	D	10,000- ha
Project Economy		
	EIRR	
Others		
	Overlap with IPP minihydro	
	Electricity Demand	

Screening Result of Hydro Projects

Priority	# of projects	MW
A	35	2,189
B	22	3,082
C	11	3,411
D	101	12,394
Total	169	21,077

Potential for development in the short to mid run

12. *Hydro*: Further Issues

Main issues of hydro development: forest use and optimization of resources

Forest-use Permissions

- Collaboration between power and forestry regulators is necessary to speed up the permission process for hydro power development

Optimization of Resources

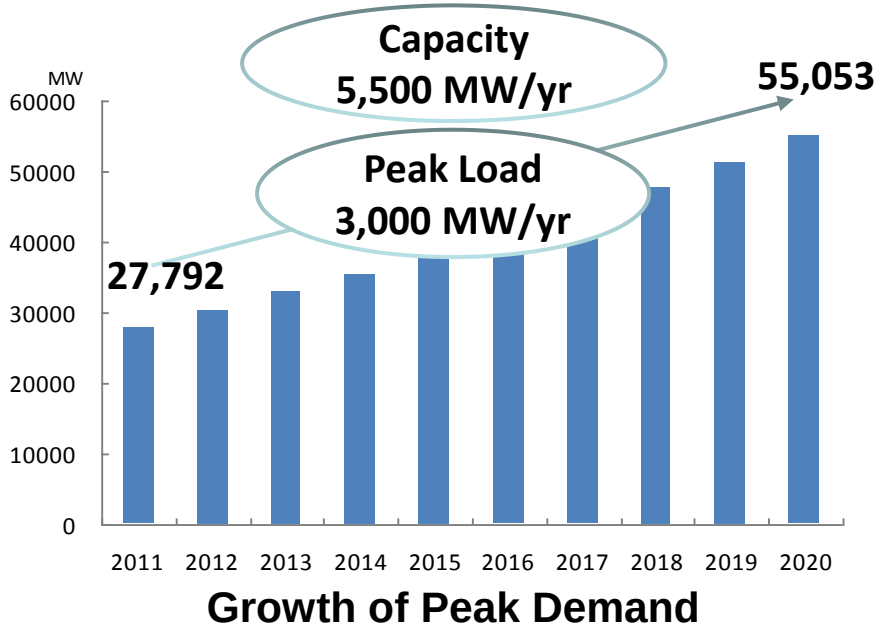
- FIT has encouraged developers, but it also led to excessive formulation of projects under 10MW: resource potential is not fully utilized at many rivers
- Government instruction is required to realize the country's hydro potential fully

13. Way Forward

Issues have been identified and the implementation of effective measures needed

- Key remaining issues for achieving stable & sustainable power supply

Coal	Geothermal	Hydro
-Utilization of low rank coal -Introduction of CCT to minimize GHG emissions	-Introduction of FIT -Tender process alignment with PPP -Exploration risk mitigation mechanism -Forestry permission	-Forestry permission -Optimization of resources



Growth of Peak Demand

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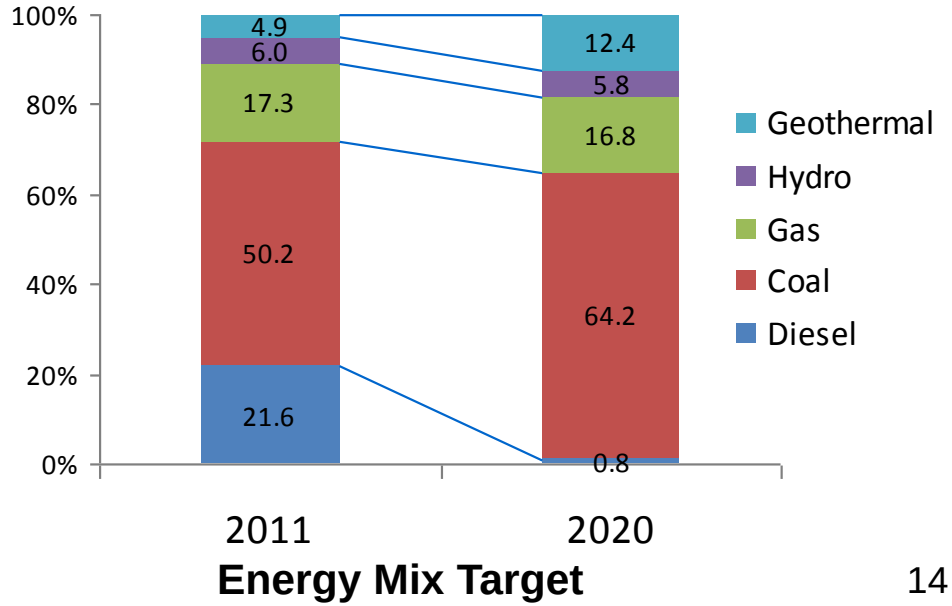

Energy Mix Target

Thank you for your attention.