Sustainable Development of Energy and Electricity Policy in Cambodia

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Tokyo, Japan

03-June-2014

Content

I. Cambodian Background

Geography and Demography

- Located at Southeast Asia bordered with Lao PDR, Vietnam and Thailand.

- Two seasons: Dry season (Jan-May) and Raining Season(June-Nov)

- Population: 14.7 Million (NIS 2012)

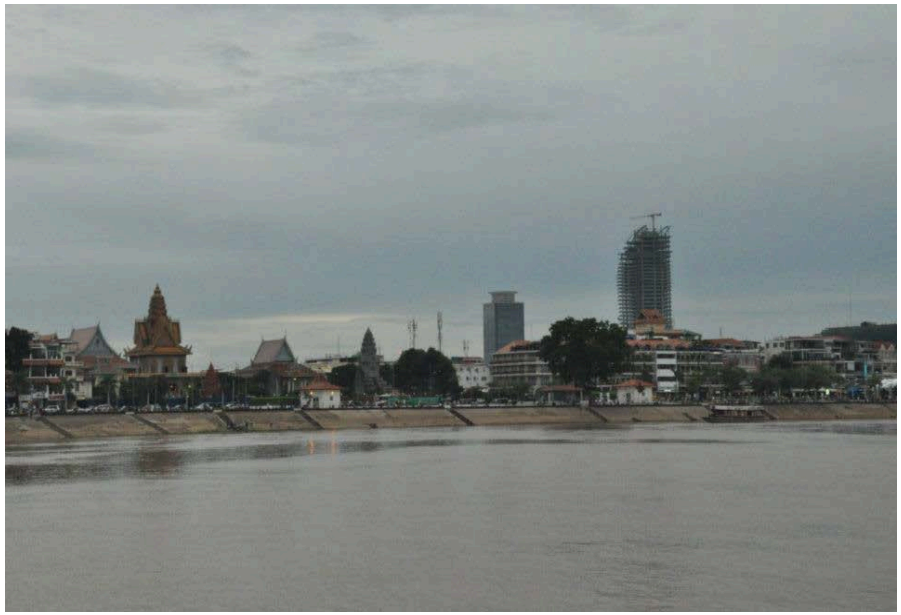
- Total GDP: 11.66 MUSD And GDP/capita: 830 USD (NIS 2010)

80% of Population live at Rural area

63% are Working Age

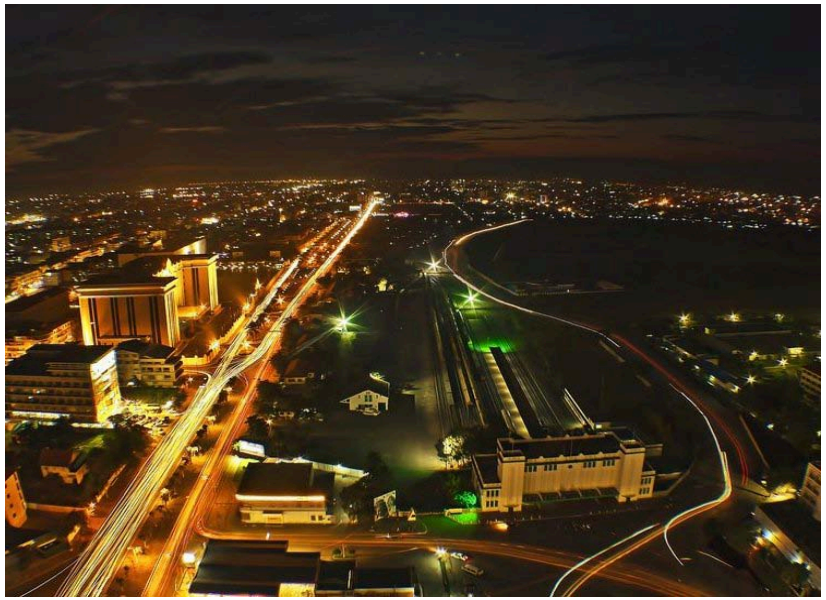
53% are Labour Force

City and Urban Household



Rural Household

City or Urban Household



Rural Household

Passenger Transportation

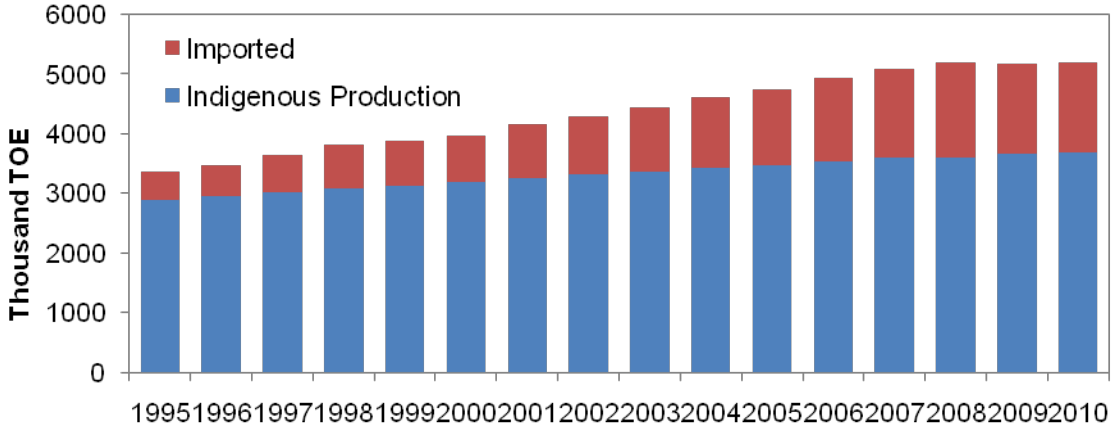
Freight Transportation

II. Cambodian Energy demand and supply

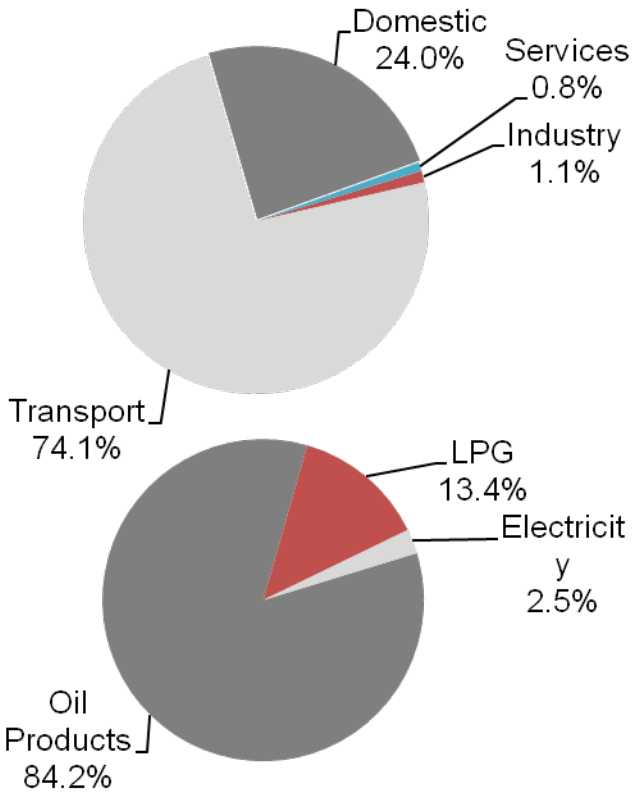
Pattern Of Energy Consumption and Supplies

- **In 2010:**
  - **the total final Energy supply was about 5.19 Million TOE**
  - **the total final Energy Consumption was about 4.5 Million TOE**

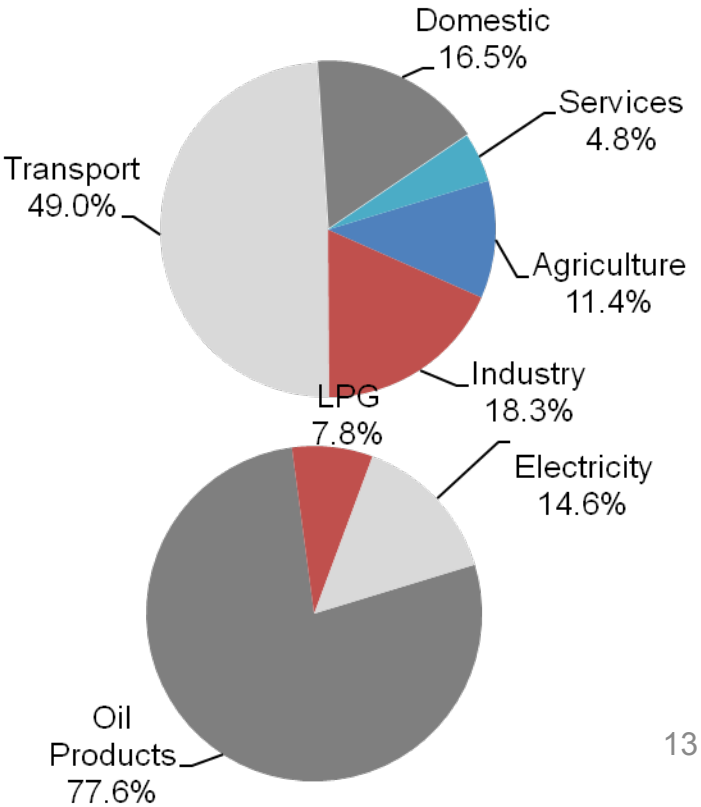
Where, 1 MTOE= 11630 GWh



Year 1995

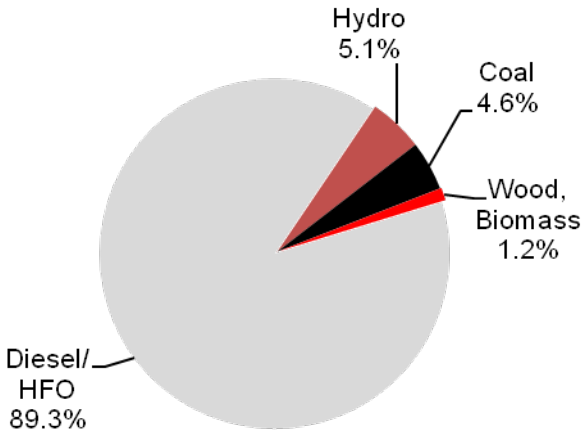


Year 2010

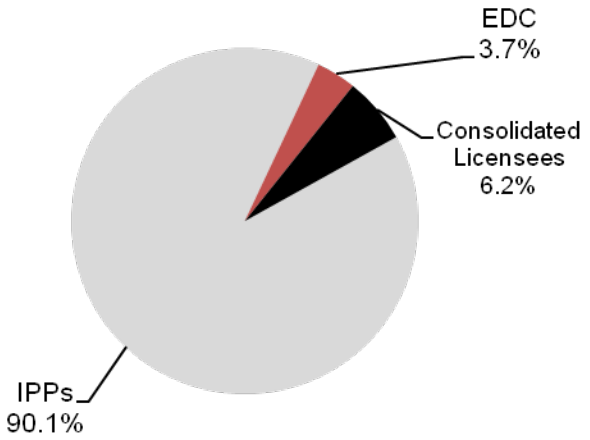


Electricity Sector Background

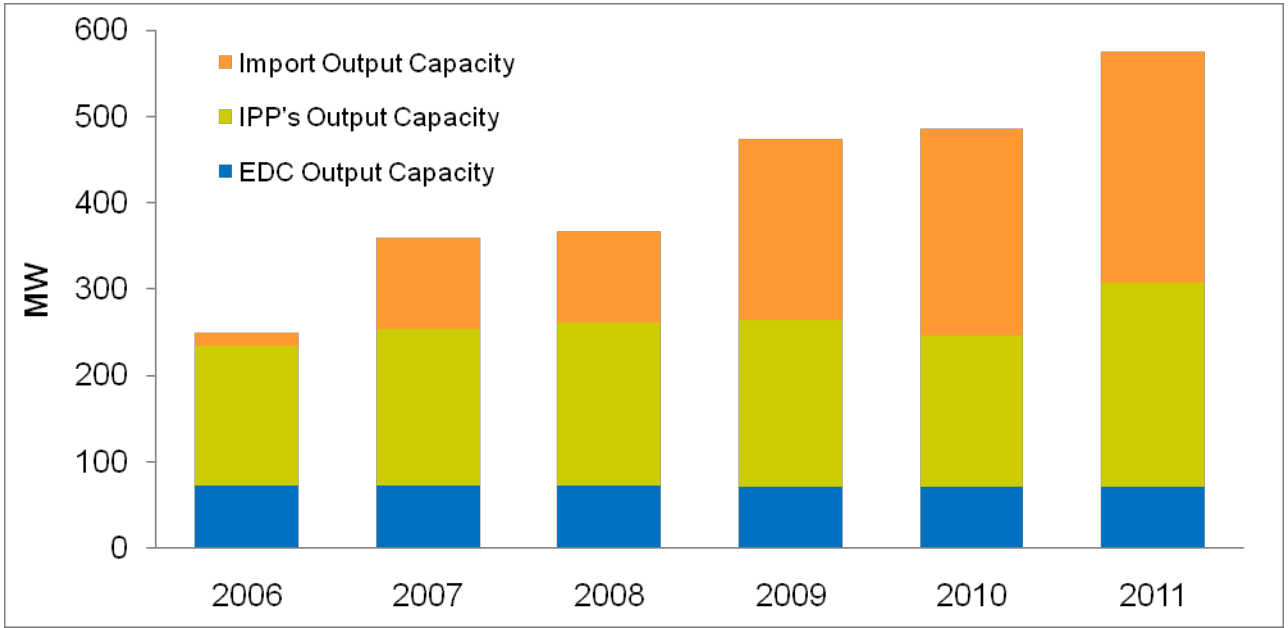
Local Generation by fuel type



Electricity by Source



Electricity Supply



Economic background

	1995	2000	2005	2006	2007	2008	2009	2010
Agriculture, Fisheries & Forestry	46.6	37.9	31.0	29.5	28.7	28.4	30.1	29.4
Mining	0.3	0.3	0.4	0.4	0.4	0.5	0.6	0.7
Manufacturing	9.3	16.9	20.7	21.9	22.0	21.3	18.0	22.0
Construction	5.9	5.5	6.7	7.3	7.2	7.1	7.5	5.3
Energy	0.4	0.4	0.5	0.6	0.6	0.6	0.7	0.7
Services	37.6	39.1	40.7	40.4	41.1	42.1	43.2	42.0
Total GDP	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total GDP (Billion Riel)[a]	15,328	21,853	34,137	37,812	41,675	44,464	44,503	47,155
Total GDP (Billion US$)[b]	3.79	5.40	8.44	9.35	10.31	10.99	11.00	11.66
Population (million)	11.17	12.45	12.93	13.04	13.15	123.60	13.81	14.02
GDP per capita (US$)	339	434	653	717	784	808	797	832

Source: NIS, 2011

III. Outlook of Energy demand and supply projection

Main Factor of Energy Demand and Supply

- Energy Balance
- Demography
- Economic Sectors
  - Agriculture
  - Construction
  - Mining
  - Manufacturing
    - Food and tobacco
    - Textile,Wearing Apparel & Footwear
    - Other Industry
  - Services
- Household Sector
  - Rural
  - Urban

Demography scenarios

Only one Scenario of population growth has been consider:

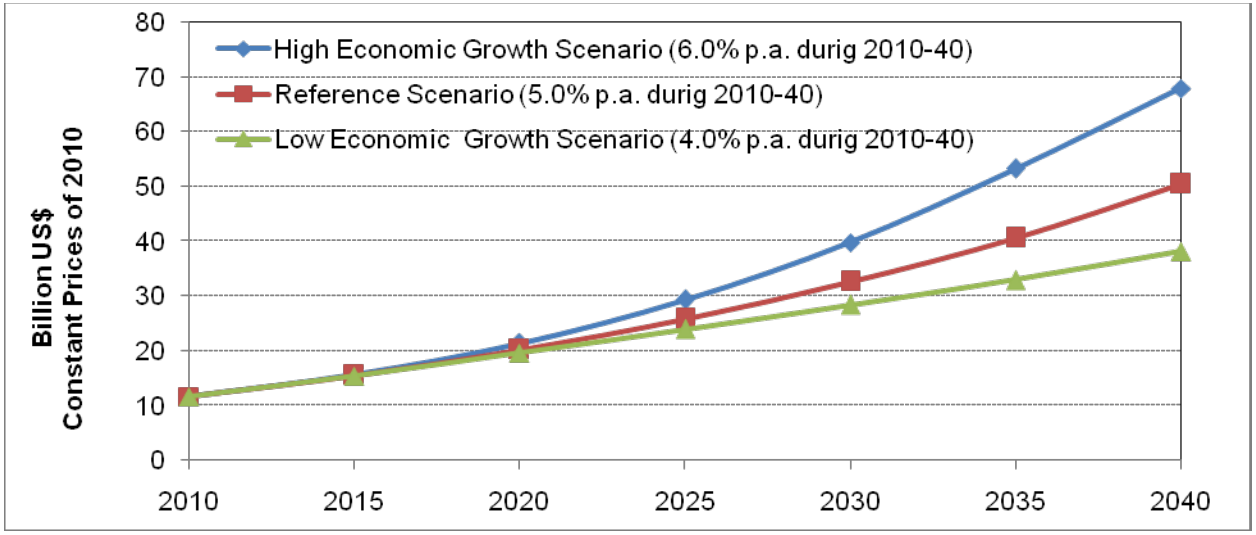
	2010	2015	2020	2025	2030	2035	2040
Total Population (million.)	14.02	14.89	15.79	16.73	17.72	18.71	19.71
Growth rate (% p.a.)		1.21	1.18	1.16	1.15	1.10	1.05
Rural Population (million.)	11.29	11.62	11.88	12.06	12.14	12.07	11.83
Growth rate (% p.a.)		0.58	0.44	0.30	0.13	-0.11	-0.41
Share (%)	80.5	78.02	75.22	72.07	68.52	64.51	60.00
Urban Population (million.)	2.73	3.27	3.91	4.67	5.58	6.64	7.89
Growth rate (% p.a.)		3.67	3.63	3.61	3.60	3.55	3.50
Share (%)	19.50	21.98	24.78	27.93	31.48	35.49	40.00
Population Inside Large Cities (million.)	2.20	2.60	3.08	3.63	4.28	5.04	5.91
Share in Total Population (%)	15.7	17.5	19.5	21.7	24.2	26.9	30.0
Persons per Household	4.72	4.62	4.51	4.40	4.27	4.14	4.00
Total Households (million.)	2.97	3.22	3.50	3.81	4.14	4.52	4.93
Potential Labor Force (million.)	8.00	8.23	8.57	9.16	9.79	10.45	11.13
Participating Labor Force (million.)	4.30	4.81	5.38	6.00	6.70	7.46	8.28

Economic scenarios

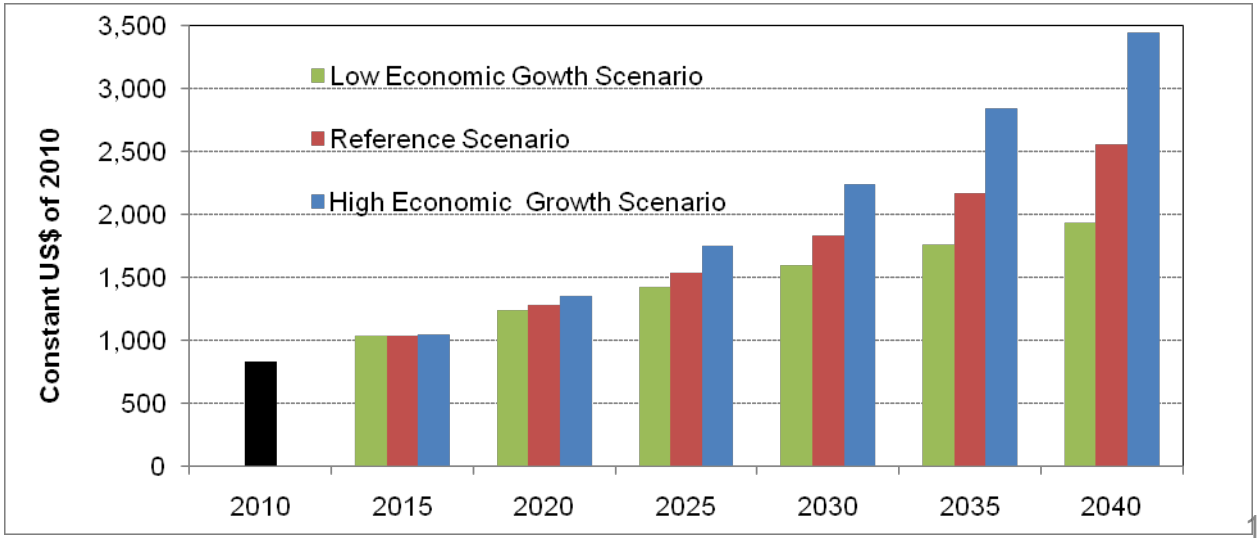
The economic scenarios base on :

- Reference Case:
  5% growth rate
- High Case:
  6% growth rate
- Low Case:
  4% growth rate

Total GDP (Billion US$)

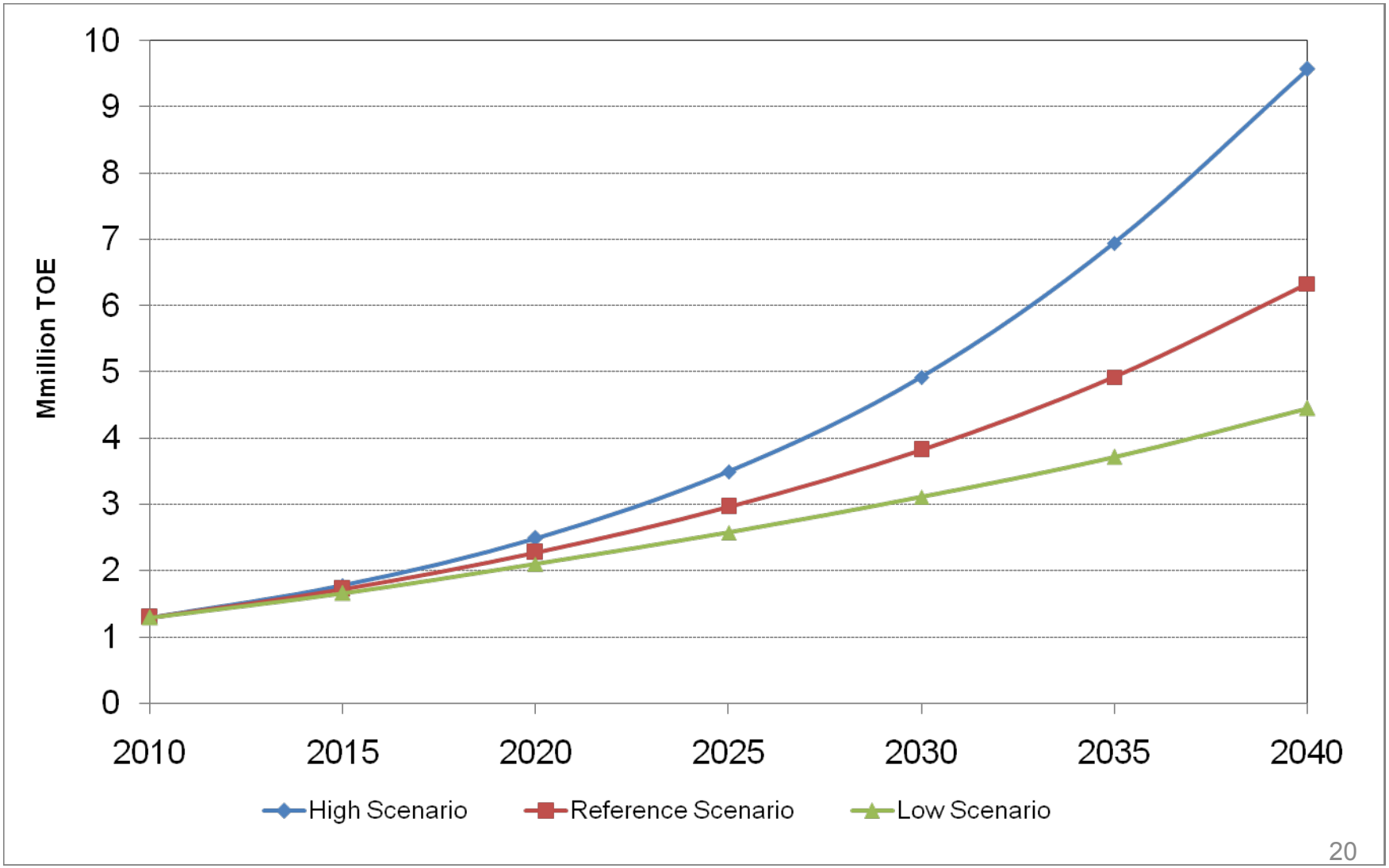


GDP/Capita (US$/capita)



Energy Demand Projections

Distribution of Final Energy Demand by Energy Forms (Million TOE)



Energy Demand Projections (2/2)

Final Commercial Energy Demand Projections by Sectors (Million TOE)

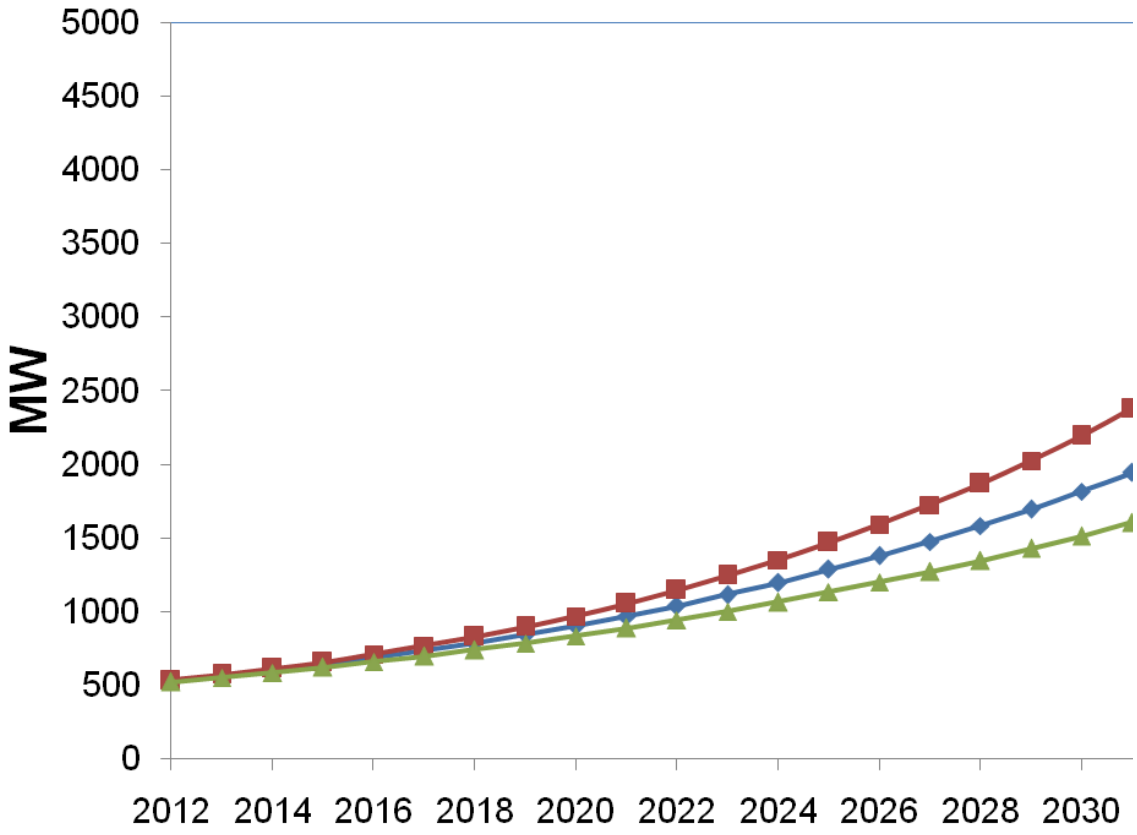
	Growth Rate [% p.a.]	Amount [million TOE]		Share [%]	
	2010-2040	2010	2040	2010	2040
Reference Scenario	5.91	1.294	7.234	100.00	100.00
1. Agriculture	2.62	0.147	0.320	11.37	4.42
2. Construction	5.45	0.0002	0.001	0.02	0.02
3. Manufacturing	9.08	0.237	3.211	18.31	44.39
4. Transport	3.06	0.642	1.586	49.65	21.93
5. Household	7.59	0.205	1.843	15.86	25.47
6. Service	5.08	0.062	0.273	4.78	3.78
High Scenario	7.11	1.2936	10.168	100.00	100.00
1. Agriculture	1.89	0.147	0.258	11.37	2.54
2. Construction	6.50	0.0002	0.002	0.02	0.02
3. Manufacturing	10.99	0.237	5.402	18.31	53.13
4. Transport	3.76	0.642	1.941	49.65	19.09
5. Household	8.24	0.205	2.209	15.86	21.73
6. Service	6.00	0.062	0.355	4.78	3.49
Low Scenario	4.60	1.2936	4.991	100.00	100.00
1. Agriculture	3.05	0.147	0.363	11.37	7.27
2. Construction	4.47	0.0002	0.001	0.02	0.02
3. Manufacturing	6.64	0.237	1.629	18.31	32.63
4. Transport	2.33	0.642	1.281	49.65	25.67
5. Household	6.88	0.205	1.512	15.86	30.29
6. Service	4.09	0.062	0.206	4.78	4.12

Electricity Demand by Sector

	Quantity [GWh]				Share [%]				Growth Rate [%p.a.]
	2010	2020	2030	2040	2010	2020	2030	2040	2010-2040
Reference Scenario	2,205	4,448	8,950	18,394	100.0	100.0	100.0	100.0	*7.3*
1. Agriculture	83	118	157	199	3.8	2.7	2.7	1.1	*3.0*
2. Construction	0.4	0.7	1.2	2.0	0.02	0.02	0.02	0.01	*5.8*
3. Manufacturing	379	888	1,865	3,712	17.2	20.0	20.0	20.2	*7.9*
4. Transport	-	-	7	10	-	-	-	0.1	-
5. Households	1,141	2,449	5,363	12,097	51.8	55.0	55.0	65.8	*8.2*
6. Services	602	993	1,557	2,375	27.3	22.3	22.3	12.9	*4.7*
Electricity/capita (kWh/capita)	157	282	505	933					*6.1*
High Scenario	2,205	4,789	10,816	24,532	100.0	100.0	100.0	100.0	*8.4*
1. Agriculture	83	105	136	161	3.8	2.2	2.2	0.7	*2.2*
2. Construction	0.4	0.7	1.5	2.7	0.02	0.02	0.02	0.01	*6.8*
3. Manufacturing	379	1,013	2,642	6,245	17.2	21.2	21.2	25.5	*9.8*
4. Transport	-	-	8	12	-	-	-	0.0	-
5. Households	1,141	2,605	6,099	14,899	51.8	54.4	54.4	60.7	*8.9*
6. Services	602	1,065	1,930	3,213	27.3	22.2	22.2	13.1	*5.7*
Electricity/capita (kWh/capita)	157	303	611	1,244					*7.1*
Low Scenario	2,205	4,123	7,467	13,843	100.0	100.0	100.0	100.0	*6.3*
1. Agriculture	83	131	179	226	3.8	3.2	3.2	1.6	*3.4*
2. Construction	0.4	0.7	1.1	1.5	0.02	0.02	0.02	0.01	*4.8*
3. Manufacturing	379	777	1,315	2,038	17.2	18.8	18.8	14.7	*5.8*
4. Transport	-	-	6	8	-	-	-	0.1	-
5. Households	1,141	2,286	4,680	9,868	51.8	55.4	55.4	71.3	*7.5*
6. Services	602	928	1,286	1,703	27.3	22.5	22.5	12.3	*3.5*
Electricity/capita (kWh/capita)	157	261	422	702					*5.1*

Electricity Demand Projections

- Curve of Power Demand in All scenario

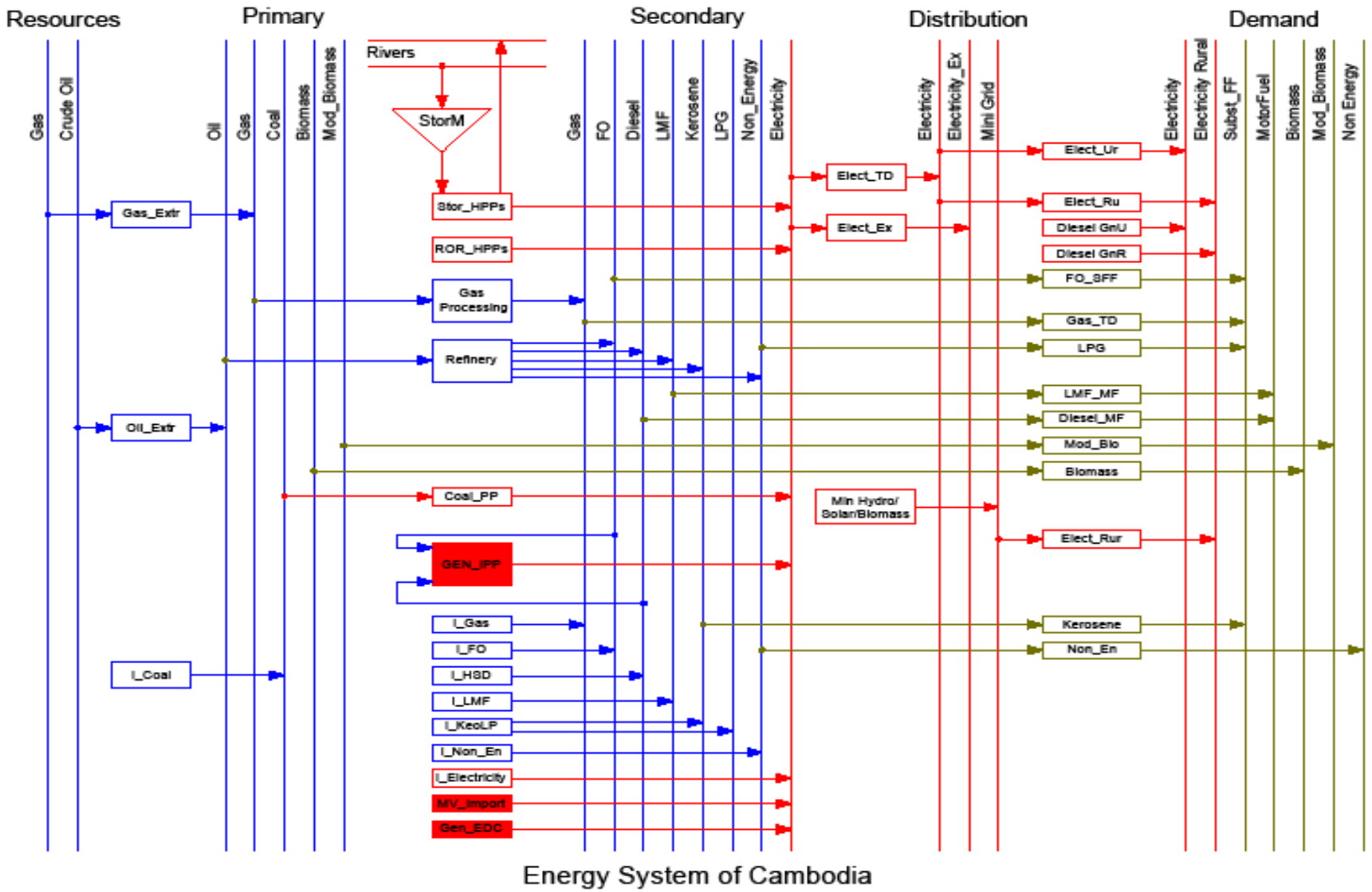


High

Reference

low

Energy System of Cambodia



Energy System of Cambodia

Potential of Indigenous Energy Resource

- Hydro: About 10,000 MW while it is only 10% under implementation

- Renewable: Good sunshine for PV systems and biomass rescued for Biomass Plant

- Oil and Gas: 100% import currently. Estimated resource, Oil 700 million barrels and Gas 140 Billion cubic meter. RGC plan to explore and develop this resource.

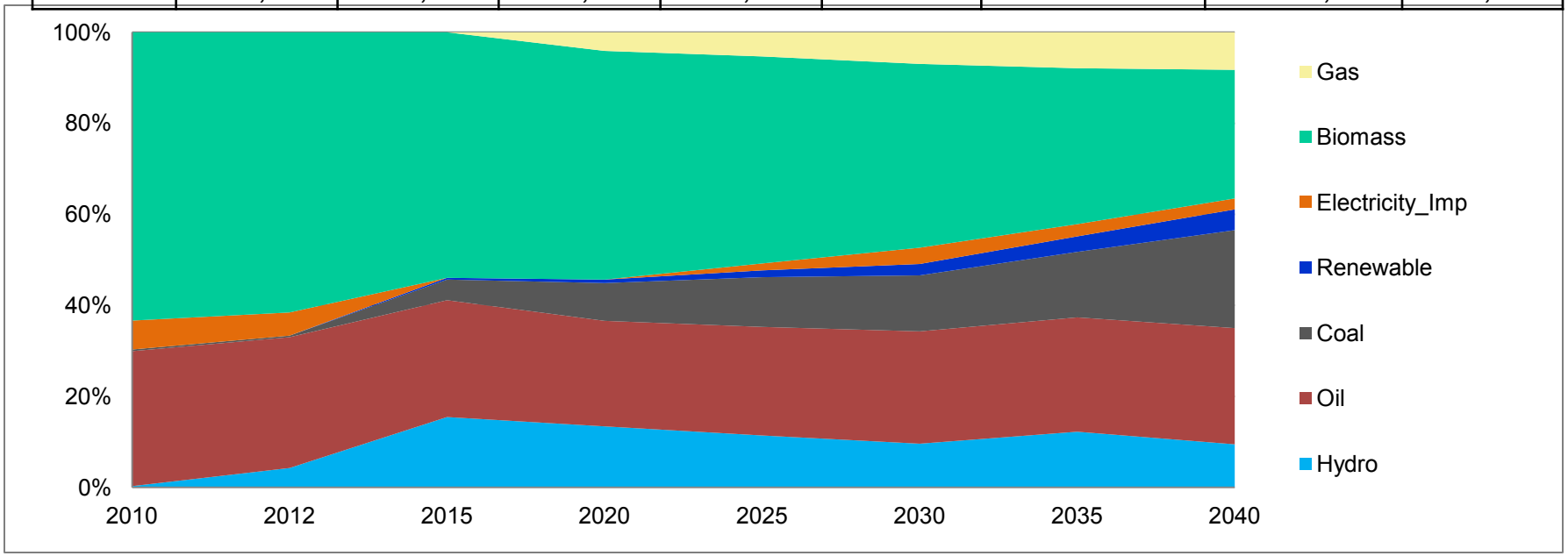
<u>Import options</u>

Coal : The power plant import coal from Indonesia and Australia

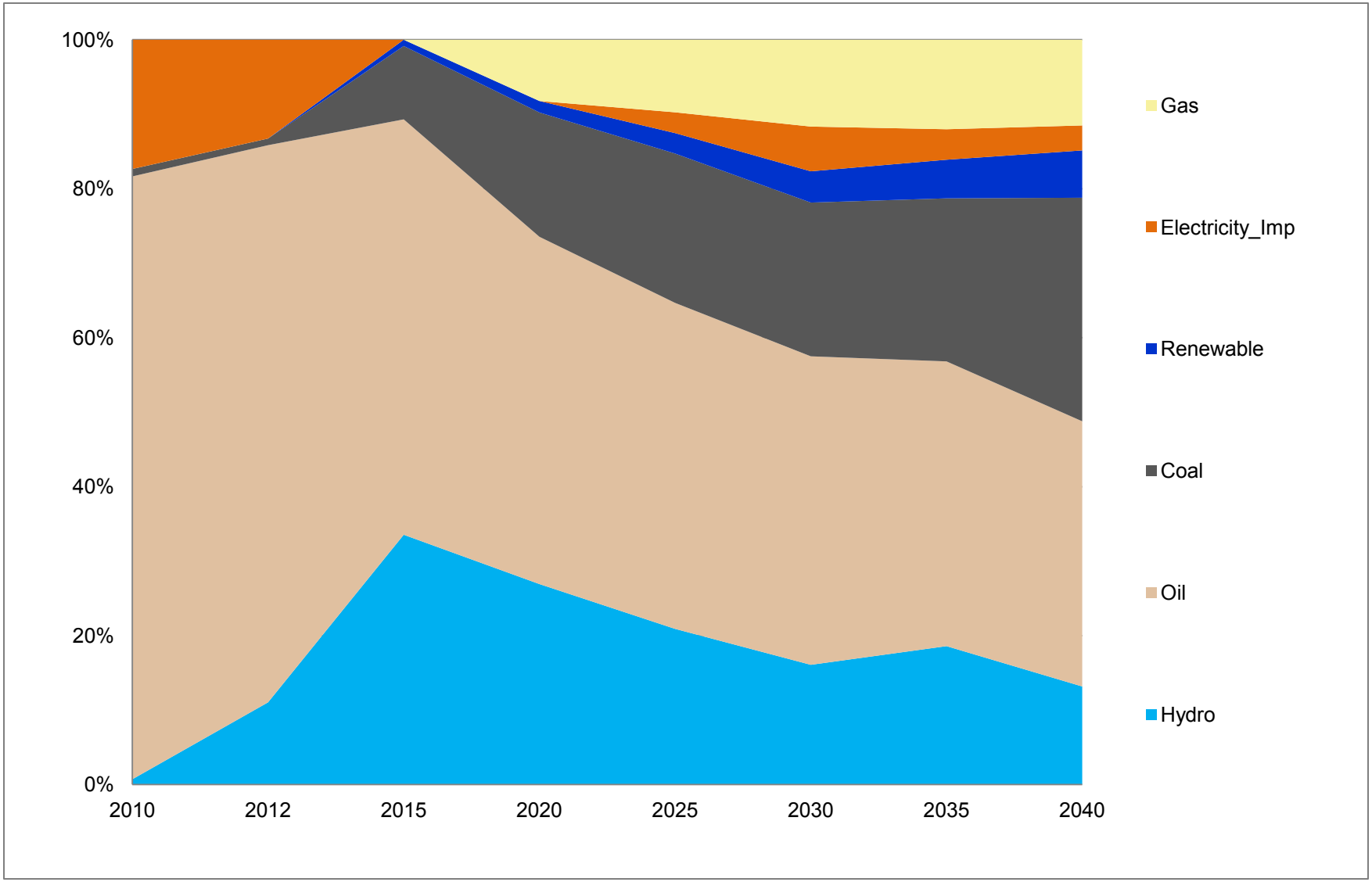
Gas import possible (LNG)

• Primary Energy Supply (KTOE)

	Hydro	Oil	Gas	Coal	Rene-wable*	Imported Electricity	Biomass	Total
2010	13	1,480	-	18	-	317	3,162	4,991
2012	225	1,527	-	18	-	271	3,270	5,310
2015	981	1,632	-	288	24	-	3,429	6,354
2020	981	1,699	300	608	56	-	3,682	7,327
2025	981	2,054	457	941	129	131	3,917	8,611
2030	981	2,527	711	1,259	256	366	4,134	10,236
2035	1,537	3,161	993	1,810	429	338	4,311	12,580
2040	1,487	4,018	1,298	3,387	717	379	4,447	15,734



- Primary Commercial Energy mix



- Primary Commercial Energy Supply (KTOE)

	Hydro	Oil	Gas	Coal	Renewable	Imported Electricity	Total	Import Dependency
2010	13	1,480	-	18	-	317	1,829	99%
2015	981	1,632	-	288	24	-	2,926	89%
2020	981	1,699	300	608	56	-	3,645	66%
2025	981	2,054	457	941	129	131	4,694	72%
2030	981	2,527	711	1,259	256	366	6,101	58%
2035	1,537	3,161	993	1,810	429	338	8,270	54%
2040	1,487	4,018	1,298	3,387	717	379	11,287	44%

- Additional Generation Capacity (MW):

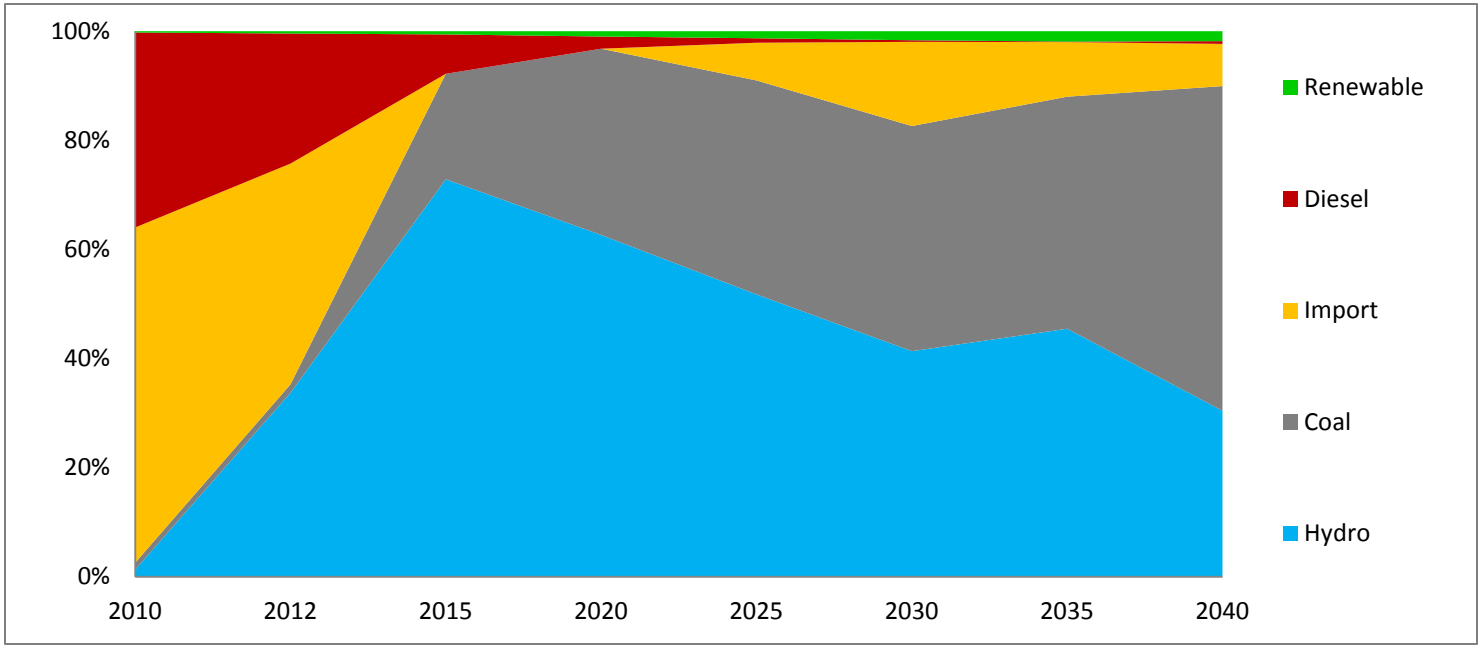
	Scenario	Hydro	Coal	Renewable	Total
2012-2015	Base	704	370	7	1,081
2016-2020	Base	-	270	11	281
2021-2025	Base	-	-	15	15
2026-2030	Base	-	199	28	227
2031-2035	Base	429	386	41	856
2036-2040	Base	-	1,226	31	1,257
Total	Base	1,133	2,451	132	3,717

- Total capacity requirement (MW) :

Year	2012	2015	2020	2025	2030	2035	2040
Capacity (MW)	852*	1,933	2,214	2,229	2,455	3,311	4,569

- Electricity Generation (GWh) :

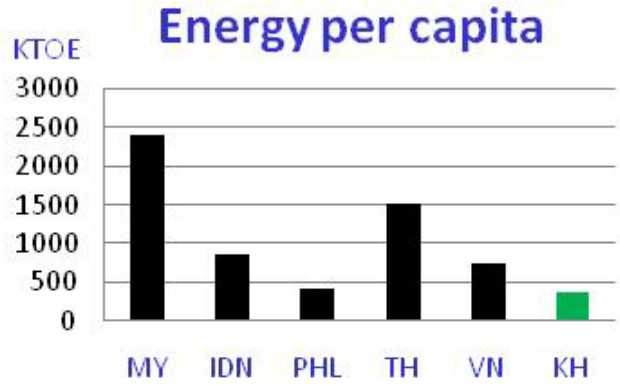
	Hydro	Coal	Renew-able	Diesel	Import	Total	Surplus	Net Supply
2010	32	32	6	899	1546	2515	-	2,515
2015	4,351	1,156	35	431	-	5,973	2,359	3,615
2020	4,351	2,372	68	155	-	6,946	1,748	5,197
2025	4,351	3,299	109	69	581	8,409	991	7,418
2030	4,351	4,345	174	31	1,625	10,526	-	10,526
2035	6,816	6,379	286	14	1,501	14,996	-	14,996
2040	6,594	12,902	395	108	1,678	21,678	-	21,678



IV. Main Issue of Energy Policy

Main Issue of Energy Policy

- Energy is the essential input for socio-economic development of a country. Nearly every aspects of development – from reducing poverty and raising living standards to improving health care, and industrial and agriculture productivity – require reliable access to modern energy sources.
- Main energy issues:
  - **Low energy use and low electrification rate**
  - **High import dependency**
  - **Small energy resource base**



V. Purpose and ongoing work

Purpose and ongoing work

The main purpose of this training program are:

- To get and exchange some knowledge from Japan and other trainee countries on energy policy
- To analyze the current energy situation and estimate future energy needs
- To assess the indigenous energy resource potential and explore possibilities for energy resource development
- To develop a long-term strategy for expansion of energy supplies on the basis of least-cost planning analysis for sustainable development

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-Thank You- ありがとう

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