

Sustainable Usage of Energy to Support Growth

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I. INTRODUCTION

17.1 Energy security is the vital cog to sustain economic growth. Numerous key measures have been undertaken to ensure security of energy supply during the Tenth Malaysia Plan, 2011-2015. Concurrently, the growth of renewable energy (RE) as an alternative energy source was further enhanced to support the continuous increase of energy demand complemented with nominal efforts on energy efficiency (EE) measures. During the Eleventh Malaysia Plan, 2016-2020, energy security and RE would continue to be given focus while demand side management (DSM), a major paradigm shift incorporating EE and conservation measures would be implemented to ensure sustainable management of energy resources.

II. TENTH MALAYSIA PLAN, 2011-2015: PROGRESS

17.2 The security of energy supply was improved to meet the increased energy demand. Efforts were undertaken to ensure the long-term sustainability of the energy sector through resources diversification, continuous investment in new infrastructure and technology enhancement. Domestic reserves were added to ongoing investments, which enhanced energy security. In addition, the improvement in productivity and efficiency as well as the implementation of efficient resource utilisation measures were also undertaken.

Energy Demand

17.3 During the Tenth Plan, final energy demand increased from 41,476 kilo tonne of oil equivalent (ktoe) in 2010 to 53,222 ktoe in 2013 and is expected to increase to 57,123 ktoe in 2015, as shown in *Exhibit 17-1*. The demand for all energy sources is expected to have an average annual growth rate of 6.6% from 2011 to 2015. Final energy demand per capita increased from 1.5 toe/person in 2010 to 1.8 toe/person in 2013 and is expected to increase to 1.9 toe/person in 2015.

Exhibit 17-1

Final Energy Demand¹ by Sources, 2010-2015

Source	Kilo Tonne of Oil Equivalent ² (ktoe)			% of Total			Average Annual Growth Rate (%)
	2010	2013	2015 ^e	2010	2013	2015 ^e	2011-2015 ^e
Petroleum Products	24,403	29,132	32,389	58.8	54.7	56.7	5.8
Natural Gas	6,254	12,015	10,225	15.1	22.6	17.9	10.3
Electricity	8,993	10,536	11,996	21.7	19.8	21	5.9
Coal and Coke	1,826	1,539	2,513	4.4	2.9	4.4	6.6
Total	41,476	53,222	57,123	100	100	100	6.6
Final Energy Demand per capita (toe/person)	1.5	1.8	1.9				5.0

Notes: ¹ Final energy demand refers to the quantity of energy delivered to final users including transformed energy

² One tonne oil equivalent to 7.6 barrels

^e Estimates

Source: Energy Commission and Economic Planning Unit

17.4 The transport sector consumed 42.3% of the final energy demand in 2013. This substantial amount of energy consumption was spurred by increase in private vehicle ownership which is the preferred mode of transportation. The second largest sector was industrial¹ with 25.1% share followed by the non-energy use with 17.1%, as shown in *Exhibit 17-2*.

Exhibit 17-2:

Final Energy Demand¹ by Sectors, 2010-2015

Sector	Kilo Tonne of Oil Equivalent ² (ktoe)			% of Total			Average Annual Growth Rate (%)
	2010	2013	2015 ^e	2010	2013	2015 ^e	2011-2015 ^e
Transportation	16,828	22,522	23,535	40.6	42.3	41.2	6.9
Industrial	12,928	13,384	13,367	31.2	25.1	23.4	0.7
Residential and Commercial	6,951	7,378	10,339	16.8	13.9	18.1	16.4
Non-Energy	3,696	9,111	8,968	8.9	17.1	15.7	19.4
Agriculture and Forestry	1,074	827	914	2.6	1.6	1.6	-3.2
Total	41,476	53,222	57,123	100	100	100	6.6

Notes: ¹ Final energy demand refers to the quantity of energy delivered to final users including transformed energy

² One tonne oil equivalent to 7.6 barrels

^e Estimates

Source: Energy Commission and Economic Planning Unit

¹Industrial include manufacturing, construction and mining.

Energy Supply

17.5 The total supply of energy increased from 76,809 ktoe in 2010 to 89,605 ktoe in 2013 and is expected to increase to 95,802 ktoe in 2015, as shown in *Exhibit 17-3*. Natural gas and crude oil will remain as the main sources of supply. In 2013, the total share of fossil fuels namely crude oil and natural gas as well as coal and coke declined, while the share of hydro had steadily increased. The changing share reflects the decreasing dependency on fossil fuel sources.

Exhibit 17-3
Primary Energy Supply¹ by Sources, 2010-2015

Sector	Kilo Tonne of Oil Equivalent ² (ktoe)			% of Total			Average Annual Growth Rate (%)
	2010	2013	2015 ^e	2010	2013	2015 ^e	2011-2015 ^e
Natural Gas	35,447	39,973	42,441	46.1	44.6	44.3	3.7
Crude Oil	25,008	31,877	29,507	32.6	35.6	30.8	3.4
Coal and Coke	14,777	15,067	20,118	19.2	16.8	21.0	6.4
Hydro	1,577	2,688	3,736	2.1	3.0	3.9	18.8
Total	76,809	89,605	95,802	100	100	100	4.5

Notes: ¹ Primary energy supply refers to the supply of commercial energy that has not undergone a transformation process to produce energy

² One tonne oil equivalent to 7.6 barrels

³ Natural gas excludes flared gas, re-injected gas and exports of liquefied natural gas

^e Estimates

Source: Energy Commission and Economic Planning Unit

Oil and Gas Subsector

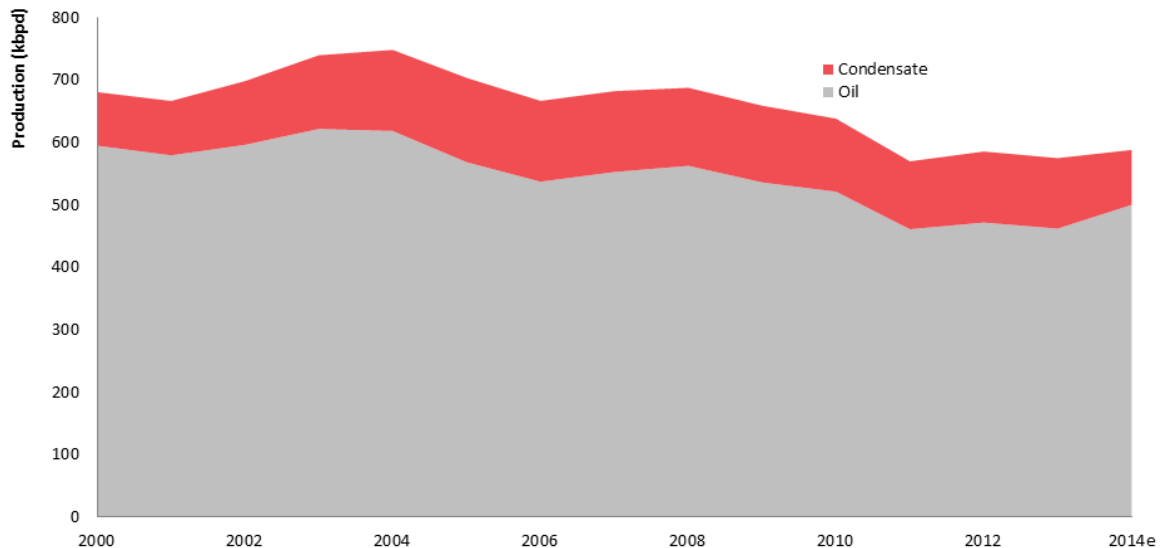
17.6 Oil and gas remain as important sources in the energy mix. Production during the Tenth Plan was sufficient to meet the demand growth. Domestic reserves have increased due to continuous investments in the upstream sector. In addition, Regasification Terminal 1 (RGT-1) in Sungai Udang, Melaka was completed in 2013 to enhance the security of gas supply. Subsidy rationalisation measures were undertaken for piped natural gas, petrol and diesel to achieve market parity. Cleaner transport fuel was introduced to improve air quality.

Crude Oil

17.7 Oil reserves stood at 5.8 billion barrels of oil equivalent (boe) in 2014. Average production of domestic crude oil and condensates decreased from 667,000 barrels per day (bpd) in 2006 to 586,000 bpd in 2012. Production level recorded the lowest in 2013 at 576,000 bpd as shown in *Exhibit 17-4*. At 2013 production level, domestic crude oil including condensate, has a reserve life of 28 years. An average Overall Resource Replenishment Ratio

(ORRR)² of 1.94 was achieved from 2011 to 2013. The healthy ORRR is attributed to the continuous investments by Petroliaam Nasional Berhad (PETRONAS) in the upstream exploration and production (E&P) activities to replenish the depleting reserves.

Exhibit 17-4
Crude Oil and Condensate Production, 2000-2014



Notes: ^e Estimates

Source: PETRONAS

17.8 Crude oil and condensate export generated an average income of RM32.1 billion annually between 2010 to 2014, as shown in *Exhibit 17-5*. There was a marginal decline of export volume from 2010 to 2014. However, the export value had risen due to increase in oil price.

² ORRR is an indicator to measure discovered reserves versus production where a ratio of 1.0 and above is healthy.

Exhibit 17-5

Crude Oil and Condensate¹ Production, Export Volume and Value, 2006-2014

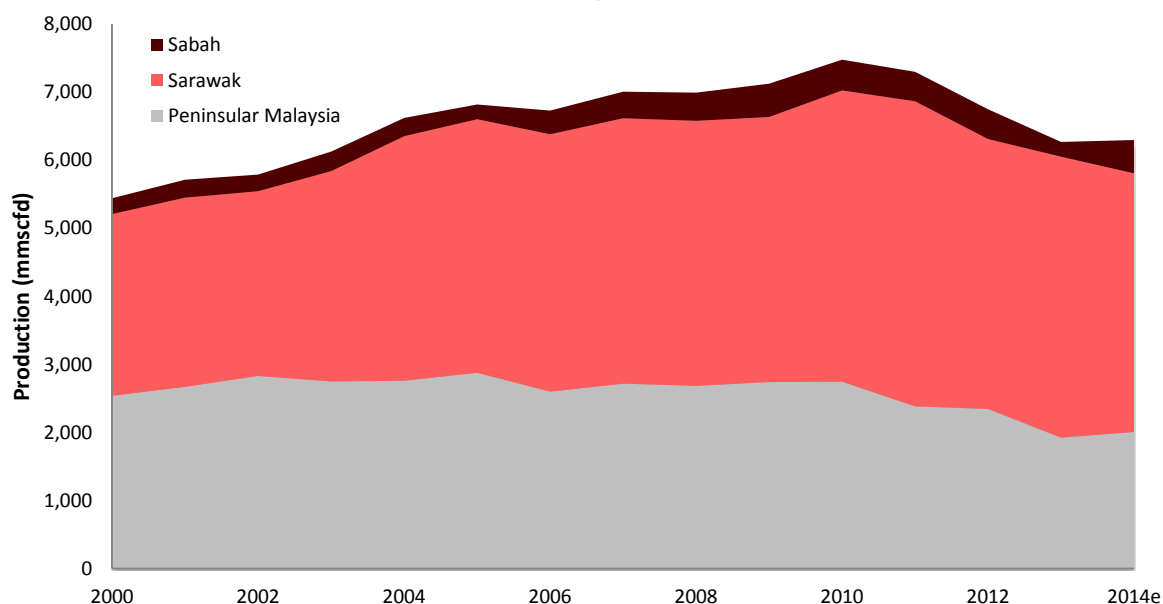
Notes: ¹ Condensate is crude oil component derived from natural gas streams, comprising pentane and heavier hydrocarbons

Source: Department of Statistics Malaysia and Economic Planning Unit

Natural Gas

17.9 Natural gas reserves stood at 16.8 billion boe in 2014. The discovery of new gas fields contributed to the increase in reserves from 90 trillion cubic feet (tcf) in 2011 to 98.3 tcf in 2012. The production of gas increased at a compound annual growth rate of 6%, as shown in *Exhibit 17-6*, with Sarawak as the leading producer. Average natural gas production decreased from 7,476 million standard cubic feet per day (mmscfd) in 2010 to 6,730 mmscfd in 2013. At 2013 gas production level, gas has a reserve life of 42 years.

Exhibit 17-6
Gas Production, 2000-2014



Note: ^e Estimates

Source: PETRONAS

17.10 The average demand for natural gas in Peninsular Malaysia between 2010 and 2012 stood at 2,000 mmscfd taking into account the offshore supply constraint. However in 2013, the gas demand of 2,419 mmscfd was met with the completion of RGT-1, which has a capacity of 3.8 million tonnes per annum (mtpa). The completion of RGT-2 in Pengerang, Johor, by 2017 would increase the gas supply level to 2,900 mmscfd. From 2010 to 2013, the electricity subsector was the major consumer of gas, taking 52% of the total gas demand, followed at 41% by the non-electricity subsector while the remaining 7% was exported to Singapore. Notwithstanding the situation, the gas supply for electricity subsector is expected to decline with the current efforts to shift the fuel mix from being dominated by gas. However, gas demand for Sabah is projected to gradually increase from 350 mmscfd in 2013 to 523 mmscfd in 2015. For the same period, demand for gas in Sarawak is met by existing volume of 279 mmscfd.

17.11 Export of liquefied natural gas (LNG) increased from 22.9 million metric tonnes in 2010 to 25.3 million metric tonnes in 2013 and is expected to increase to 26.7 million metric tonnes in 2015. Main export destinations are Japan, the Republic of Korea and Chinese Taipei. In 2015, total export earnings are expected to reach RM62.5 billion as compared to RM38.7 billion in 2010.

17.12 Subsidy rationalisation measures were undertaken to address artificial demand and inefficient allocation of resources. Periodic adjustments of gas prices for the electricity subsector and non-electricity subsector were made when regulated prices fall way below its market value. Gas which is a scarce and finite resource need to be priced at market value for maximum optimisation of its most economic value. In the Tenth Plan, gas price for electricity subsector was increased from RM10.70/million British thermal unit (MMBtu) to RM15.20/MMBtu while for non-electricity subsector was revised from RM15.35/MMBtu to RM21.35/MMBtu. The price for RON97 petrol was set using managed-float system since 2010. Subsequently, using the same system, the subsidy for RON95 petrol and diesel was removed since December 2014.

17.13 In the transportation sector, initiatives were undertaken to control emissions from motor vehicles through increase in usage of energy efficient vehicles and biofuels. The Government gazetted EURO 4M standards in 2013 and enforce its use in RON97 in 2015. To support implementation of bio-diesel B5 Programme (5% bio-diesel blending in automotive fuel), 35 depots were constructed nationwide with in-line blending facilities. By end of 2014, Malaysia introduced the bio-diesel B7 programme (7% bio-diesel blending) nationwide. The introduction of B7 is expected to utilise 575,000 tonnes of bio-diesel, thus saving 667.6 million litres of diesel a year. The implementation of B7 programme has managed to reduce greenhouse gases (GHGs) emission by 1.7 million tonnes of carbon dioxide equivalent (tCO₂eq).

17.14 Major developments are underway in the downstream oil and gas subsector to ensure sustainable economic growth and security of energy supply. A large-scale project with an area of approximately 9,100 hectares in Pengerang, Johor is being developed for Pengerang Integrated Petroleum Complex (PIPC), which includes the Pengerang Integrated Complex (PIC) by PETRONAS and Deepwater Petroleum Terminal by DIALOG-Vopak. This terminal, which started operation in April 2014 will pave the way for PIPC to become the regional hub for oil storage. In addition, expansion of LNG liquefaction plant in Bintulu, Sarawak is scheduled to be ready for operation in 2016.

Electricity Subsector

17.15 A total of 5,458 megawatts (MW) generation capacity was added with the commissioning of 10 power plants to ensure the security and reliability of electricity supply. Among the major projects commissioned during the Tenth Plan were Bakun Hydroelectric in Sarawak as well as Kimanis and SPR gas-fired power plants in Sabah with an added capacity of 2,785 MW. In terms of fuel mix, the share of coal to the total generation mix is expected to experience minimal increase from 41.6% in 2010 to 43% in 2015, while natural gas is expected to decline from 51.5% in 2010 to 40.1% in 2015, as shown in *Exhibit 17-7*.

Exhibit 17-7:

Percentage of Generation Mix, 2010-2015

		Oil	Coal	Gas	Hydro	RE	Total (GWh)
		%					
Malaysia	2010	1.4	41.6	51.5	5.4	0.1	108,175
	2013	3.2	38.3	46.9	10.4	1.1	143,497
	2015 ^e	0.4	43.0	40.1	14.4	2.1	158,843
Tenaga Nasional Berhad	2010	0.1	43.3	51.6	5.0	0.0	96,495
	2013	2.5	43.0	49.6	4.6	0.2	120,893
	2015 ^e	0.0	51.5	41.9	4.5	2.1	128,006
Sabah Electricity Sdn. Bhd.	2010	26.3	0.0	60.0	10.2	3.5	4,332
	2013	18.0	0.0	58.3	6.6	17.2	7,433
	2015 ^e	3.0	0.0	85.0	3.3	8.7	8,383
Sarawak Energy Berhad	2010	3.6	43.3	45.7	7.4	0.0	7,347
	2013	1.0	20.2	20.0	58.6	0.4	15,171
	2015 ^e	1.7	10.5	12.8	75.0	0.0	22,453

Note: ^e Estimates

Source: Energy Commission

17.16 In tandem with the growth of the economy, peak demand increased from 16,943 MW in 2010 to 19,219 MW in 2013, as shown in *Exhibit 17-8*. Installed capacity rose from 24,275 MW in 2010 to 24,970 MW in 2013, which was sufficient to meet the demand. The total annual electricity generation recorded a growth of 32.7% from 108,175 gigawatt hour (GWh) in 2010 to 143,497 GWh in 2013. Bulk of the demand came from the industrial, commercial and residential sectors, as shown in *Exhibit 17-9*. Transportation and agriculture sectors consumed the lowest electricity at 616 GWh.

Exhibit 17-8

Installed Capacity, Peak Demand and Reserve Margin, 2010 – 2015

Year	Generation by System	Installed Capacity ¹ (MW)	Peak Demand ² (MW)	Reserve Margin (%)
2010	TNB	21,817	15,072	44.8
	SESB	1,111	780	42.4
	SEB	1,347	1,091	23.5
	Total	24,275	16,943	43.3
2013	TNB	21,753	16,562	31.3
	SESB	1,172	874	34.1
	SEB	2,045	1,783	14.7
	Total	24,970	19,219	29.9
2015 ^e	TNB	22,070	17,697	24.7
	SESB	1,522	983	54.8
	SEB	4,581	2,935	56.1
	Total	28,173	21,615	30.3

Notes: ¹ Installed capacity is defined as the maximum possible capacity (nameplate rating) that can be provided by the plant

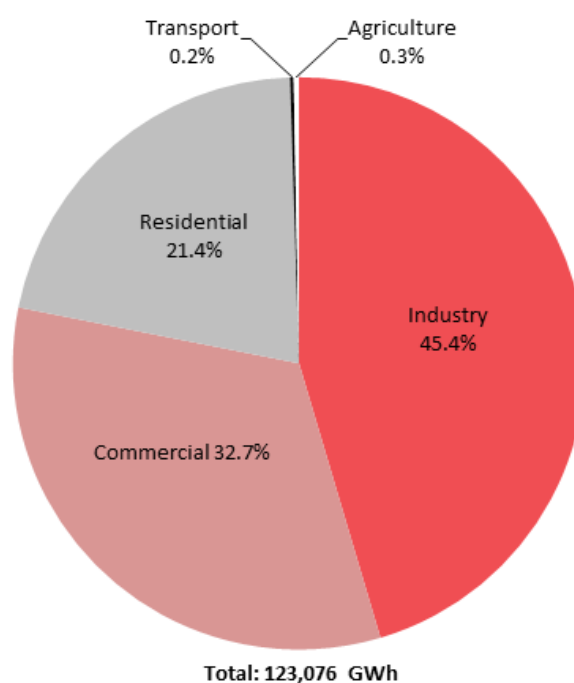
² Peak Demand is the maximum electricity demand registered by a customer or a group of customers or a system in a stated period of time such as a month or a year. The value may be the maximum instantaneous load or more usually, the average load over a designated interval of time, such as half an hour and is normally stated in kilowatts or megawatts

^e Estimates

Source: Energy Commission, Tenaga Nasional Berhad, Sabah Electricity Sdn. Bhd. and Sarawak Energy Berhad

Exhibit 17-9

Electricity Consumption by Sectors, 2013



Source: Energy Commission

17.17 The transmission and distribution systems were further expanded to improve the quality of services and meet the growing demand. The improvements include the completion of new transmission projects, which linked new generation plants to the main grids and connections to new industrial and commercial areas. The completed transmission line projects, among others, were the Air Tawar-Bukit Merah in Perak, Bukit Kapar-Meru in Selangor, Komanis-Lok Kawi in Sabah and Bakun-Similajau in Sarawak. The distribution network was also expanded to provide access to new development areas and extend electricity to rural areas.

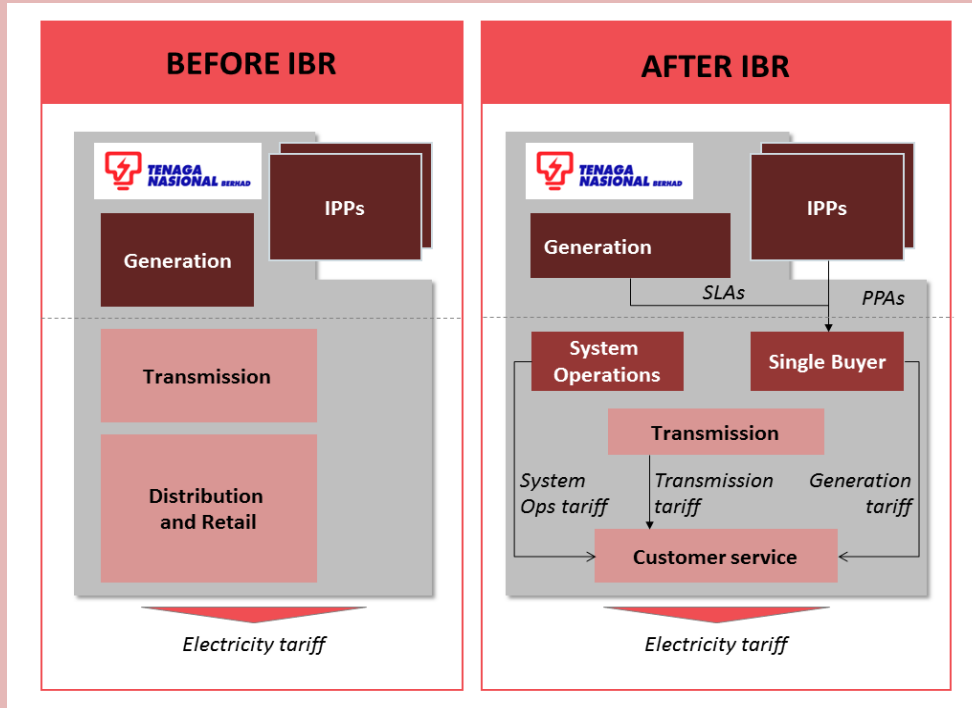
17.18 The Incentive-based Regulation (IBR) was introduced early 2014 for the electricity subsector as part of the modernisation of the electricity supply industry. This allows a structured, transparent and informed way of tariff setting taking into cognisance huge requirement for capital expenditure (CAPEX) and operational expenditure (OPEX) by the utilities, as shown in *Box 17-1*. IBR ensures the utility companies, namely, Tenaga Nasional Berhad (TNB) and Sabah Electricity Sdn. Bhd. (SESB) to continuously enhance their efficiencies and increase transparency in providing electricity supply to customers in full compliance of the projected expenditures. In addition, Energy Commission (ST) continues to audit and review past performances as well as accommodate new requests from the utility companies. The main components of the IBR are:

- Determination of the regulatory period to ensure the tariff revision is carried out periodically and consistently;
- Determination of the regulated and non-regulated business for the utility and the separation of accounts;
- Determination of financial performance and technical efficiency targets of the utility;
- Implementation of the imbalance cost pass-through mechanism to enable the recovery of actual fuel-related and other generation specific costs; and
- Implementation of efficiency sharing mechanism to provide the utility a continuous and sustained incentive to pursue cost efficiencies in every regulatory period.

Box 17-1

Incentive-based Regulation

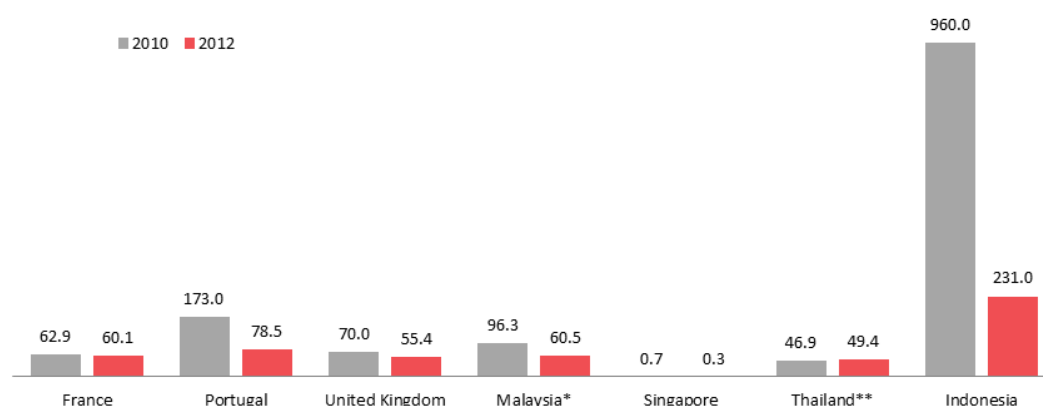
- IBR is an economic regulatory framework, introduced as part of the Malaysia Electricity Supply Industry (MESI) restructuring exercise. MESI is a departure from the classical approach of letting the utility companies solely responsible for all expenditures and tariff-setting mechanism.



- Key objectives of IBR are:
 - to safeguard consumer interest by ensuring competitively priced end user tariff; and
 - to allow utility companies to earn a fair return on investments for the electricity supply infrastructure such as transmission facilities, to be installed within IBR period.
- Benefits of IBR are as follows:
 - Efficient.** Incorporates mechanisms to incentivise cost efficiencies over every regulatory period and allows the efficiency gains to be passed through to end-users;
 - Transparent.** Allows the regulator a greater transparency over the operational and financial performance of every business unit including Generation, Transmission, Distribution, Single Buyer and System Operator;
 - Financially Sustainable.** Enables periodic pass-through of fuel-related and other generation specific costs through the Imbalance Cost Pass-Through mechanism, while providing a fair return to the utility; and
 - Enables Growth.** Allows for recovery of future investments, provided they are done in a cost-efficient manner and therefore ensures security of electricity supply to the nation.

17.19 Significant improvement was recorded in the productivity and efficiency of electricity supply services. TNB, SESB and Sarawak Energy Berhad (SEB) registered improved performance through reduction in the number of interruption incidences. System Average Interruption Duration Index (SAIDI) for Sabah and Sarawak improved from 687 minutes/customer in 2010 to 424 minutes/customer in 2013 and 232 minutes/customer to 168 minutes/customer respectively. SAIDI in Peninsular Malaysia improved from 96.3 minutes/customer in 2010 to 60.5 minutes/customer in 2012, which is at par with SAIDI of other selected countries, as shown in *Exhibit 17-10*.

Exhibit 17-10:
**SAIDI Performance Comparison with Utilities of Selected Countries, 2010 and 2012
(minutes/customer)**



Notes: * Malaysia: figures from Tenaga Nasional Berhad

** Thailand: figures from Metropolitan Electricity Authority

Source: Council of European Energy Regulators (CEER) and Tenaga Nasional Berhad

17.20 Electricity supply in Sabah has been a primary focus with the Government continuously providing CAPEX to ensure SESB meets its key performance index (KPI) to reduce SAIDI. The utility company has embarked on numerous transmission and distribution network reinforcement projects including the commissioning of Kimanis and SPR power plants to boost electricity supply, which would enhance the system resilience and network reliability by 2020.

17.21 During the Tenth Plan, the supply of electricity to rural areas was further improved, as shown in *Exhibit 17-11*. The implementation of rural electrification projects benefited 115,153 housing units, mainly in Sabah and Sarawak. Majority of the rural electrification projects were undertaken through grid connection. In some remote areas which are too far from the grid systems, alternative systems such as mini hydro, solar hybrid and biomass were utilised.

Exhibit 17-11

Electrification Rates by Region, 2010-2015

Region	2010 (%)	2013 (%)	2015 ^e (%)
Peninsular Malaysia	98.9	99.7	99.9
Sabah	84.4	92.9	95.1
Sarawak	72.1	88.0	94.0
National	92.5	96.9	98.2

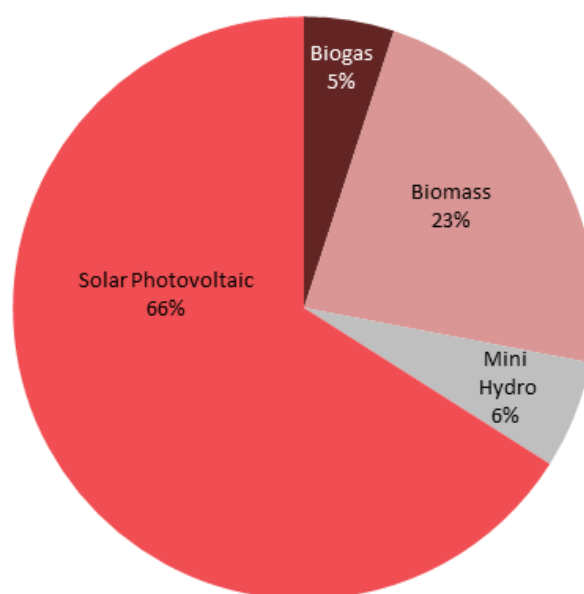
Notes: ^e Estimates

Source: Ministry of Rural and Regional Development

17.22 The RE development was given an impetus after the Renewable Energy Act, 2011 was enforced on 1 December 2011 and the Feed-in Tariff (FiT) mechanism was introduced. The FiT allows electricity to be generated from RE sources to be sold to utility companies at a fixed premium price for a specific duration. In 2014, RE sources contributed 243.4 MW or 1% of the total installed capacity in Peninsular Malaysia and Sabah, as shown in *Exhibit 17-12*. As of 2013, this initiative reduced GHGs emission by 432,000 tCO₂eq.

Exhibit 17-12

Renewable Energy Installed Capacity by Sources, 2014



Total installed capacity in 2014: 243.4 MW

Source: Sustainable Energy Development Authority

Demand Side Management

17.23 The Government has shifted focus from increasing supply to meet the demand to reducing consumption by introducing EE and conservation measures. Agencies such as Ministry of Energy, Green Technology and Water (KeTTHA), ST and Sustainable Energy Development Authority (SEDA) have carried out programmes and projects to implement EE and energy conservation. Among the programmes implemented were EE measures for buildings, Sustainability Achieved via Energy Efficiency (SAVE) and Minimum Energy Performance Standard (MEPS) as well as equipment labelling programmes.

17.24 During the Tenth Plan, efficient designs were incorporated in new Government buildings while some existing buildings were retrofitted to reduce energy consumption. Four government buildings located in Putrajaya were retrofitted between 2011 to 2014 and successfully reduced electricity use ranging from 4% to 19% monthly, equivalent to RM7,000 to RM130,000 savings. Other measures promoted include setting air-conditioner temperature at minimum of 24°C and reducing 5% of electricity bills for all Government buildings. Uniform Building By-Law (UBBL), 1984 was also revised in 2012 to incorporate the Malaysian Standard: Code of Practice on Energy Efficiency and Renewable Energy for Non-Residential Buildings (MS1525). Currently, Selangor and Terengganu state governments have incorporated MS1525 into their state UBBL.

17.25 In 2011, the SAVE programme was implemented to encourage utilisation of energy efficient equipment. A total of RM44.3 million was allocated for the programme to offer rebates for any purchase of new energy efficient refrigerators and air conditioners for domestic use as well as chillers for industries. Total energy saved from these equipment for the period from 2011 to 2013 was 306.9 GWh, as shown in *Exhibit 17-13*. This has resulted in GHGs avoidance amounting to 208,705 tCO₂eq.

Exhibit 17-13
SAVE Programme Output, 2011-2013

Appliance	EE Sales (Unit)	Savings Achieved (GWh)
Refrigerator	337,704	84.0
Air-Conditioner	166,505	124.9
Chiller	89,454 RT ¹	98.0
Total		306.9

Note: ¹ RT refers to Refrigeration Tonne

Source: Sustainable Energy Development Authority

17.26 MEPS and energy labelling were completed for five products through the Electricity Regulation 1994 (Amendment 2013). Efforts are also being undertaken to expand the MEPS and labelling to cover six more products namely rice cooker, electric kettle, washing machine, microwave oven, clothes dryer and dishwasher. These include data gathering and setting criteria for the six products.

III. ISSUES AND CHALLENGES

17.27 During the Tenth Plan, the energy sector faced multiple issues concerning the oil and gas as well as the electricity subsectors. These include security and reliability of supply, market distortion, lack of regulatory framework especially on third party access for gas supply, overdependence on fossil fuels, governance and lack of awareness as well as acceptance on energy issues among the public.

Energy Sector

Governance Issues

17.28 Fragmented governance and multiple agencies with overlapping roles, authorities, responsibilities and jurisdiction have created complexities in governing the energy sector. This has resulted in confusion and lack of holistic policies to the industry players and other stakeholders. Among the main issues are inconsistent policies, lack of clarity in demarcation of regulatory oversight as well as dual role of a single entity being the industry player and the regulator at the same time. Strong and effective governance is required to compel all stakeholders adhering to the proposed regiment to ensure the energy sector is managed efficiently.

Ineffective Communication

17.29 Currently, there is a lack of coordination in communicating issues of public interests with respect to the energy sector. To bring profound and impactful overall awareness, an integrated approach by all stakeholders is essential.

Oil and Gas Subsector

17.30 The major issues in the domestic oil and gas subsector include security and reliability of supply, lack of competition, market distortion and lack of coverage of compressed natural gas (CNG) for transport and piped natural gas infrastructure. In addition, there is limited growth in the downstream subsector namely refining and petrochemical processing. In short, the issues faced by the oil and gas subsector during the Tenth Plan are as follows:

- Fragility of security and reliability of energy supply;
- Lack of regulatory framework for competition in gas business;
- Barrier to clean fuel usage;
- Lack of focus in the downstream subsector;
- Heavy reliance of local players on domestic jobs in Oil and Gas Services Industry (OGSI);
- Uneconomic demand area for piped natural gas coverage; and
- Heavily discounted fuel price.

Fragility of Security and Reliability of Energy Supply

17.31 Domestic hydrocarbon fields are maturing and their production is declining. Thus, under business-as-usual condition, domestic production would not be able to meet demand. Oil and gas reserves could last for more than 20 years, however, some of the fields are currently not economical to be developed as they are small, scattered and remotely located. Therefore, additional supply needs to be secured to cater for future demand growth.

17.32 Unplanned shut down of the upstream oil and gas infrastructure severely affects the security and reliability of energy supply. During the Tenth Plan, gas curtailment was imposed to users as a result of a fire incident at offshore Bekok C Platform in east coast Peninsular Malaysia. The reduction of required gas supply volume from 1,350 mmscfd to 900 mmscfd between the months of November and December 2011 severely affected the electricity subsector, resulting in additional costs due to utilisation of other fuel sources. These additional costs were collectively borne by the Government, PETRONAS and TNB. Such incident warrants the need to increase energy security and reliability by securing volume of gas from other sources.

Lack of Regulatory Framework for Competition in Gas Business

17.33 The scope of existing regulatory framework for gas subsector is limited to the distribution pipeline. It does not cover the operation of regasification terminal and transmission pipeline both owned and operated by Petronas Gas Berhad (PGB), which is a subsidiary of PETRONAS. Access to this infrastructure at fair pricing for other players is important to promote level playing field and competitiveness in the gas business. However, lack of regulatory framework covering third party access to this infrastructure has not been able to attract other parties to use the spare capacity in the regasification terminal.

Barrier to Clean Fuel Usage

17.34 The regulated price for CNG is the main barrier to new entrants and expanding the service coverage. PETRONAS NGV Sdn. Bhd. is the only provider of CNG and its infrastructure is heavily concentrated in the Klang Valley. When CNG was introduced in 1989, the price set was deemed sufficient to cover cost of production and profits. However, the current price is insufficient to cover the cost of production. In 2013, PETRONAS had subsidised an accumulated amount of RM3 billion for CNG.

17.35 Current petrol specification based on EURO 2M standard has a higher concentration of sulphur at 500 parts per million (ppm) and 5% benzene, which is carcinogenic. In comparison, EURO 4M which is of a higher petrol standard, contains 50 ppm sulphur and 3.5% benzene in its emissions. However, the roll-out of EURO 4M and EURO 5 for petrol and diesel requires new investment for additional processing, which needs to be balanced with the right pricing for the consumers. The benefit in the adoption of EURO 4M and EURO 5 fuel standards would be better air quality while usage of CNG as an environment-friendly clean fuel could help the nation realise its pledge to reduce GHGs emission by 40% carbon intensity to the gross domestic product (GDP) by 2020 as compared to 2005 baseline.

Lack of Focus in the Downstream Subsector

17.36 There has been limited growth in the downstream of oil and gas subsector as currently the main focus is on upstream activities to yield crude oil and gas. The nation has only four facilities refining oil and gas into petroleum products, with the combined refining capacity of 635,000 bpd of crude oil. The largest refinery is in Sungai Udang, Melaka with a capacity of 270,000 bpd, followed by 234,000 bpd in Port Dickson, Negeri Sembilan and 123,000 bpd in Kerteh, Terengganu which are not sufficient to tap into the increasing local and regional demand for refined petroleum products by 2020. The Organisation of Petroleum Exporting Countries World Oil Outlook 2014 forecasted the demand for refined products in the Asia-Pacific region excluding People's Republic of China, is expected to increase from 19.2 million bpd in 2013 to 21 million bpd in 2020. In addition, the

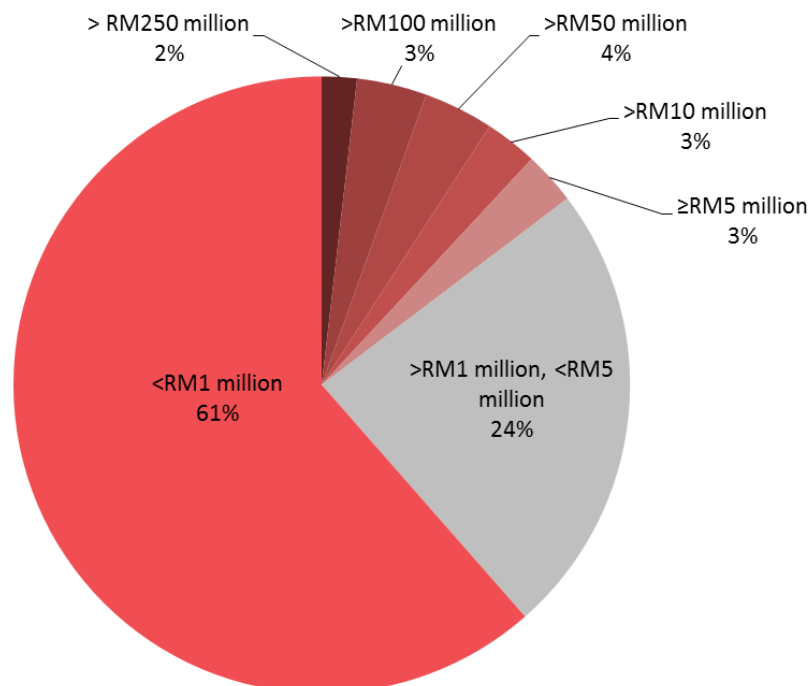
International Energy Agency Oil Market Outlook 2014 indicated the non-Organisation for Economic Co-operation and Development countries in Asia demand is expected to expand by approximately two million bpd by 2019. This is more than the region's planned refinery capacity expansions thus, requiring the need to upgrade current refineries and construct new infrastructure.

Heavy Reliance of Local Companies on Domestic Jobs in the Oil and Gas Services Industry

17.37 There are more than 4,000 companies serving 40 different activities in the domestic OGSi. Approximately 90% of the turnover for the local OGSi companies is derived from domestic jobs of which 84% of the total turnover is from services and 16% from manufacturing. The competitive edge of the local companies in the international front is limited as compared to their counterparts due to the following factors:

- Lack of size and capacity to bid for international tenders. Two thirds of the companies have a paid up capital of less than RM1 million, as shown in *Exhibit 17-14*. In addition, 78% of these companies have less than 50 employees;
- Higher cost structure; and
- Services activities in the upstream E&P mostly utilise off-the-shelf imported technologies.

Exhibit 17-14:
Malaysian Oil and Gas Services Companies by Paid-Up Capital, 2011



Source: Malaysia Petroleum Resources Corporation

Uneconomic Demand Areas for Piped Gas Coverage

17.38 There are still pockets of areas with low demand which could not be reached by gas distribution pipeline because it is not economically viable. These small pockets of demand centres such as Pekan and Mentakab in Pahang, Kinta Valley in Perak and Kota Kinabalu in Sabah, require gas for industrial purposes. Currently, more expensive fuel such as diesel, liquefied petroleum gas (LPG) and medium fuel oil are used as alternatives. In order to lower industrial production costs in these areas, alternative ways of delivering natural gas need to be explored.

Heavily Discounted Fuel Price

17.39 Natural gas is heavily subsidised even though some are sourced at market prices from Indonesia and Malaysia-Thailand Joint Development Area (JDA). Subsidised energy prices are not sustainable which unintentionally promotes an energy intensive economy. Efforts to rationalise gas subsidy were taken but has yet to bridge the price gap between LNG and piped natural gas. Current regulated natural gas price of RM15.20/MMBtu for electricity subsector is below the weighted average LNG price of RM48/MMBtu in 2014. Cumulative subsidy for natural gas until 2014 is approximately RM227 billion. Compounding the issue, the LPG price structure which is also heavily subsidised has not changed since 1983.

Electricity Subsector

17.40 The electricity subsector faces multi-dimensional challenges to deliver reliable and affordable electricity supply to consumers as well as to support national development objectives. The key challenges are depleting indigenous energy resources, increasing costs of new planting up, volatile fuel prices, high consumption growth rate and strong public concerns on the issues of environment. The issues faced by the electricity subsector during the Tenth Plan are as follows:

- Overdependence on fossil fuels;
- Impasse to comprehensively reform the electricity supply industry;
- Moderate growth in renewable energy; and
- Lack of holistic demand side management.

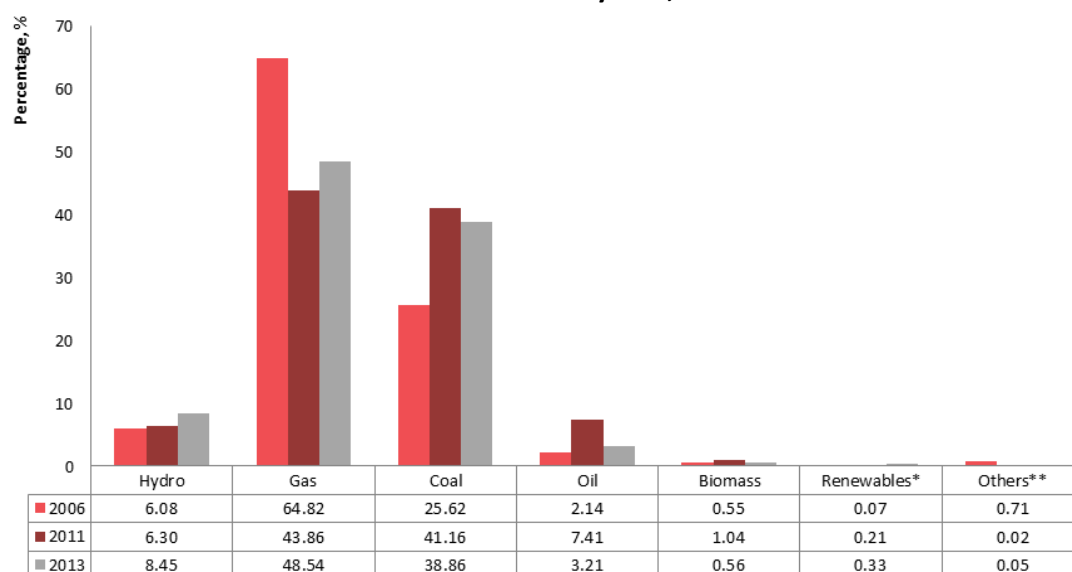
Overdependence on Fossil Fuels

17.41 The generation mix for the electricity subsector continues to rely heavily on fossil fuel³ sources amounting to 92.6% in 2006, 92.4% in 2011 and 90.6% in 2013, as shown in *Exhibit 17-15*. Although the Government has introduced the Four-Fuel Diversification Policy

³ Fossil fuel refers to oil, gas and coal.

in 1981 and Five-Fuel Diversification Policy in 2000, there are still economic constraints to reduce dependency on fossil fuels, particularly natural gas and coal. One of the factors contributing to the unbalanced energy mix is the highly subsidised natural gas, which is the preferred fuel for the electricity subsector as it incurs the least cost. On the other hand, by reducing subsidy for natural gas, coal would become a more economically attractive source. In addition, hydro sources potential are almost exhaustively developed except in Sabah and Sarawak. Apart from that, RE has limitation on the cost of the technology and stability of the energy supply system.

Exhibit 17-15
Generation Mix by Fuel, 2006–2013



Notes: * Renewables including solar PV, mini hydro, biogas, municipal solid waste except biomass

** Others refer to co-generation and self-generation

Source: Energy Commission

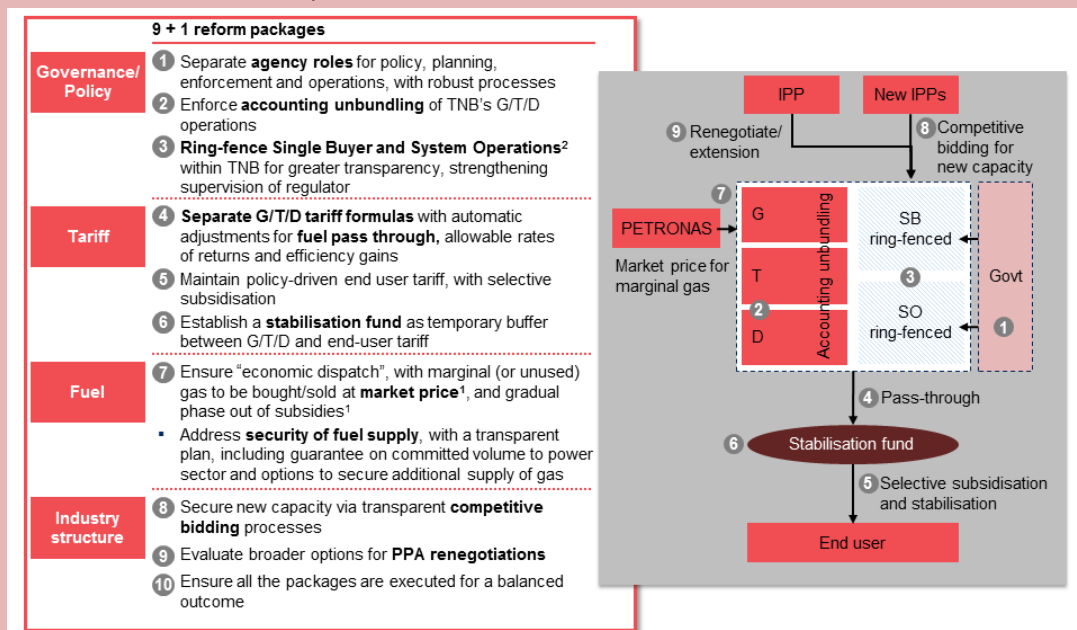
Impasse to Comprehensively Reform the Electricity Supply Industry

17.42 Malaysia Electricity Supply Industry (MESI) was targeted to undergo gradual reform through various initiatives, as shown in the *Box 17-2*. However, the reforms had not been comprehensively carried out. Seven of these initiatives were successfully implemented while another two initiatives namely establishment of Stabilisation Fund and separate agency roles for policy and planning, were not implemented as they were deemed not feasible. The implementation of tariff setting mechanism still requires approval from the Government. The complete reform would require a holistic restructuring the existing institutional frameworks involving Ministries and Agencies.

Box 17-2

MESI Reform Initiatives

- MESI reform initiatives ensure a reliable, high-quality and cost-effective supply of electricity. MESI has gradually departed from conservative and overlapping institutional structures as well as rigid cost mechanism towards a well-defined industry that enables a level playing field and implementation of performance based cost recovery structure.
- MESI restructuring takes into account energy security and sustainability issues to increase the competitiveness of the electricity subsector and thus attract new investors and industry players. All nine MESI reform initiatives were introduced in 2011. The implementation of these initiatives was prioritised due to their complexity and involvement of multiple stakeholders.
- The goals of MESI are to:
 - ensure uninterrupted electricity supply for industry players to invest in additional capacity, operational improvements and new technology; and
 - provide equitable and affordable electricity through reasonable end-user tariff, access for rural areas, increased consumer choice and enhanced service standards.
- MESI reform covers 9+1 initiatives of which the last initiative is to ensure all the packages are executed for a balanced outcome. All these initiatives relate to governance and policy, tariff, fuels and industry structure. The initiatives under MESI reform are as shown below:



Notes: 1. Market price, paid to PETRONAS, offset by cash subsidy on fixed gas volume allocated to the industry – i.e. 1350 mmscfd

2. Single Buyer: Entity responsible for contracting power plant capacity. System Operator: Entity responsible for scheduling and dispatching generation capacity

* Numbering does not indicate sequencing of reform packages

Source: MyPOWER

Moderate Growth in Renewable Energy

17.43 SEDA has targeted 415.5 MW of RE out of total installed capacity based on approved FiT applications by 2014. However, as of 31 December 2014, only 243.4 MW was connected to the grid. There are many challenges in the RE industry, especially on the reliability of RE plants and problems in securing adequate feedstock for long-term supply, particularly for biomass. Other challenges are lack of experts in the sector including RE project developers, financial personnel as well as service providers and difficulties to secure financing to develop RE installations. The current RE sources are focusing on biomass, biogas, mini hydro and solar photovoltaic (PV) while new RE sources has not been explored extensively.

Lack of Holistic Demand Side Management

17.44 Many efforts were taken to implement EE and energy conservation measures by various government and private agencies such as retrofitting of selected government buildings, MEPS, SAVE programmes and usage of green building rating tool namely Green Building Index (GBI). However, there is no comprehensive long-term DSM policy for efficient management of energy sources. The DSM master plan would cover the entire spectrum including electrical, thermal and transportation sector energy usage. A comprehensive policy would ensure well-coordinated efforts could be undertaken rather than independently pursued projects with short-term targets. This will provide holistic and comprehensive information for nationwide DSM implementation. Beside this, the Special Industrial Tariff (SIT) discourages efficient use of energy by the industrial customers.

IV. ELEVENTH MALAYSIA PLAN, 2016–2020: WAY FORWARD

17.45 The main strategies for the energy sector will be focused on improving infrastructure and service deliveries. Specific strategies in tackling governance and public communication issues will be undertaken. The oil and gas subsector will be strengthened by improving security and reliability of supply, instituting regulatory framework for gas market, enhancing the downstream business and eliminating market distortion. The strategies for the electricity subsector will focus on creating a sustainable tariff framework, better management of resources and enhancing rural electrification. DSM marks an important paradigm shift for Malaysia towards efficient management of energy sources.

Energy Sector

Improving Governance

Establishing Focal Point for Energy-Related Issues

17.46 The energy sector governance landscape across various ministries and agencies mandated to plan and implement policies relating to supply, demand and market intervention. There are currently many Government agencies which have jurisdiction on energy issues making it a hugely fragmented sector. The roles of these multiple agencies need to be streamlined for greater accountability, clarity in roles and responsibilities in the energy sector. This includes oil and gas, electricity supply industry involving policy and regulatory functions for effective management of the subsector.

17.47 Comprehensive governance allowing more structured inter-agency collaboration in the area of planning and management for the energy sector will be instituted. In this regard, National Petroleum Advisory Council has been established to oversee comprehensive planning and management of the energy sector and streamline the interests of all parties.

Communication Plan

Improving Communication Plan on Tariff Increase

17.48 A comprehensive and effective communication plan on the sustainable use of energy sources is required. This will improve public awareness and understanding as well as manage public acceptance of the subsidy rationalisation programme. KeTTHA with the collaboration of related agencies and utility companies will continuously develop a rigorous communication plan to improve public awareness on these issues through the electronic, printed, and social media. This is to ensure the industries and public are well informed on energy-related decisions made by the Government.

Implementing Communication Plan on Coal and Nuclear Power Plant

17.49 Managing public perception towards development of coal-fired and nuclear power plant are crucial to overcome negative perceptions. The public must be informed on availability of new clean coal and emission control technologies to protect the environment. This includes communication and public awareness programmes to build buy-in for the development of coal and nuclear power plants required for security of electricity supply. As the country is preparing to embark on use of nuclear power, communication plan need to

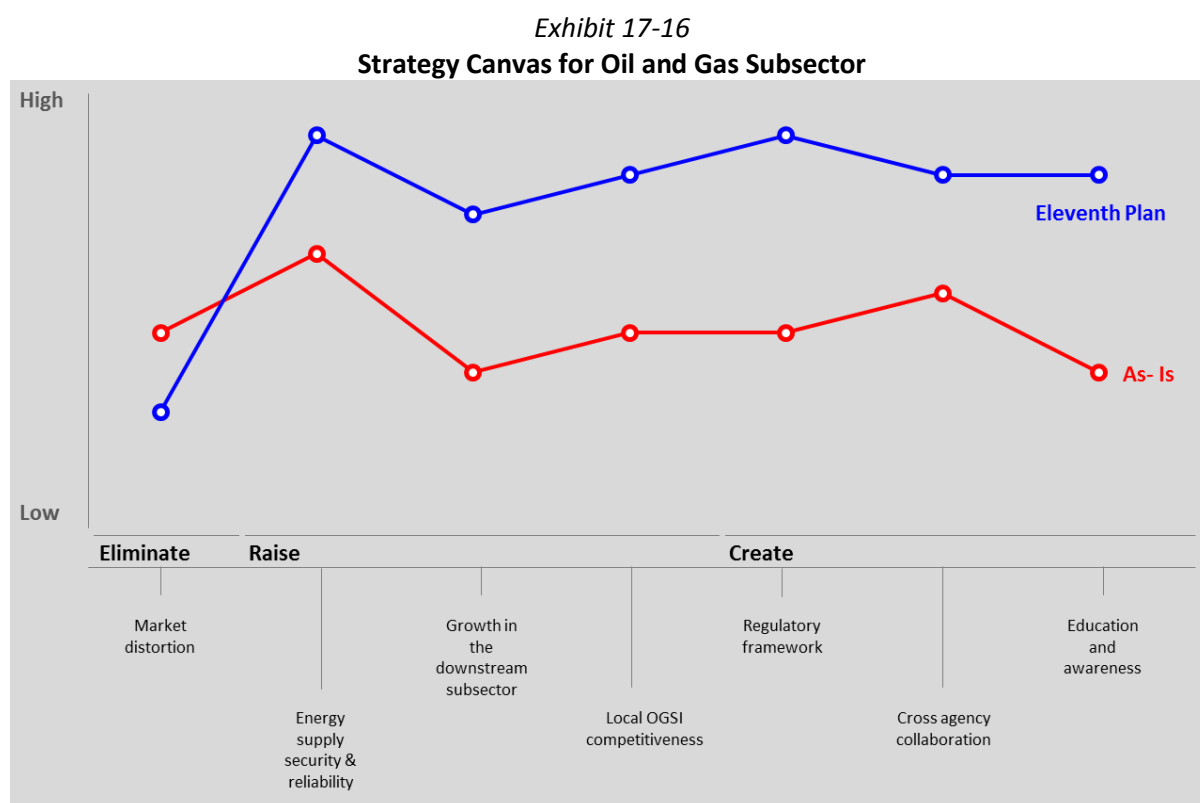
be rolled out immediately. The Government will spearhead coordinated communication plan for this purpose. This initiative will incorporate public communication, stakeholder management strategies and plans of actions. Specific strategies will be targeted for civil society, non-governmental organisations (NGOs), mass media, teachers, community leaders and other relevant groups.

Inculcating Sustainable Energy Use

17.50 A comprehensive communication plan will be undertaken in the Eleventh Plan to create awareness and educate the public, industry players and business people on sustainable energy use. The action plans will inculcate EE measures as a way of life through behavioural changes by understanding the principles of sustainable development and efficient use of energy beginning from their homes, schools and also at work places.

Oil and Gas Subsector

17.51 The strategy canvas for the oil and gas subsector, as shown in *Exhibit 17-16*.



17.52 There are seven initiatives identified for the oil and gas subsector as follows:

- Strengthening gas supply security and connectivity;
- Enhancing regulatory framework to promote competition;
- Enforcing cleaner fuel standard;
- Stimulating investment in downstream subsector;
- Increasing local oil and gas services industry competitiveness;
- Improving distribution of natural gas; and
- Rationalising fuel subsidy.

Targets

No.	Item	Target
1.	Security of natural gas supply	Peninsular Malaysia: <ul style="list-style-type: none"> • supply a total of 2,500 mmscfd • operationalise RGT-2 by 2017 • provide additional buffer from: <ul style="list-style-type: none"> ○ 10% supply from swing field offshore East Coast of Peninsular Malaysia (100-200 mmscfd) ○ 15% supply storage in RGT-1 Sungai Udang, Melaka (39,000 m³) Sabah: <ul style="list-style-type: none"> • link Sabah-Sarawak Gas Pipeline (SSGP) to Federal Territory (FT) Labuan • provide alternative bypass between platforms
2.	Regulatory framework	<ul style="list-style-type: none"> • Enforce amendment of Gas Supply Act, 1993 (Act 501) in 2016 • Ensure third party access to the Peninsular Gas Utilisation pipeline and regasification terminal
3.	Clean fuel usage	<ul style="list-style-type: none"> • Roll out EURO 4M fuel standard for RON95 by 2018 • Roll out EURO 5 diesel standard by 2020
4.	Growth in downstream oil and gas industry	<ul style="list-style-type: none"> • Increase petrochemical production capacity to 19.8 mtpa • Attract private investment worth RM125 billion
5.	Developing the oil and gas services industry (OGSI)	<ul style="list-style-type: none"> • Increase OGSI contribution to 15% of the overall oil and gas subsector's GDP • Increase the ratio of revenue from domestic to international to 85:15
6.	Virtual pipeline	<ul style="list-style-type: none"> • Promote operation of 24 prime mover trucks equipped with 74 trailers in Peninsular Malaysia for delivery of Compressed Natural Gas (CNG) • Operation of 17 prime mover trucks equipped with 28 trailers in Sabah for delivery of CNG
7.	Fuel subsidy rationalisation	<ul style="list-style-type: none"> • Rationalise piped natural gas and CNG price to market parity

Strengthening Gas Supply Security and Connectivity

17.53 Concerted efforts will be undertaken to increase and enhance security of gas supply as follows:

- Construction of additional pipeline from JDA to the gas receiving terminal in Kerteh, Terengganu;
- Development of RGT-2 in Pengerang, Johor;
- Commissioning of two floating LNG units offshore Sabah and Sarawak;
- Continuous application of advanced technology to extract oil and gas from matured and marginal fields;
- Additional pipeline connections from offshore fields to the demand centres in Kimanis and Kota Kinabalu, Sabah as well as Federal Territory (FT) Labuan;
- Provision of alternative bypass through multiple links in the event of any platform shutdown;
- Establishment of a pipeline connection between SSGP and FT Labuan; and
- Strengthening of National Strategic Reserve to reduce risk of gas curtailment during unplanned events through the following measures:
 - A swing field from offshore Peninsular Malaysia will provide 10% buffer of total supply volume between 100-200 mmscfd into gas processing plant in Kerteh, Terengganu to cater for east coast and southern Peninsular Malaysia demand; and
 - RGT-1 to have a 15% buffer of storage capacity to cover west coast Peninsular Malaysia demand centres.

Enhancing Regulatory Framework to Promote Competition

17.54 The Gas Supply Act, 1993 (Act 501) will be amended to create a level playing field for third party gas players to utilise natural gas supply infrastructure which are the Peninsular Gas Utilisation (PGU) pipeline and regasification terminal (RGT) at fair and transparent fees. The amended Act will be enforced in 2016 by ST covering economic regulation of domestic natural gas market spanning RGT, PGU pipeline and distribution pipeline infrastructure. This effort will unlock the additional revenue from the gas industry valued at estimated RM2.9 billion.

Enforcing Cleaner Fuel Standard

17.55 During the Eleventh Plan, higher fuel standard will continue to be enforced towards making the transportation sector more environment-friendly. RON95 petrol with EURO 4M standard will be rolled out by 2018 and EURO 5 diesel standard by 2020. The superior EURO 4M petrol standard with maximum 50 ppm sulphur content and 3.5% benzene will replace

the current EURO 2M petrol standard, in line with the Environmental Quality (Control of Petrol and Diesel Properties) (Amendment) Regulations 2013. The usage of bio-diesel will reduce the nation's dependency on imported diesel fuel. In addition, the current B7 programme will be further enhanced to the B15 programme (blending of 15% palm-based methyl ester with 85% petroleum diesel) in all sectors by 2020. The bio-diesel programme led by the Ministry of Plantation Industries and Commodities, offers the energy and transportation sectors, a sustainable, renewable, and environment-friendly source of energy.

Stimulating Investment in Downstream Subsector

17.56 The downstream subsector development will be anchored by the PIPC Project. National petrochemical production will be increased to 19.8 mtpa and refining capacity to 1.2 million bpd, requiring investment worth RM125 billion. Investments in PIPC will include development in refineries, petrochemical plants, crude oil and petroleum products storage as well as trading. In addition, the complex will have a 1,220 MW co-generation power plant of which 620 MW will be utilised by RAPID and the remaining 600 MW exported to the grid. The Government will provide support to construct essential infrastructure such as roads, drainage, and utilities for this development. The third project will be secured by the Johor Petroleum Development Corporation during the Eleventh Plan to complement existing investments by DIALOG-Vopak and PETRONAS.

Increasing Local Oil and Gas Services Industry Competitiveness

17.57 Increasing technological prowess and workforce capabilities among the local players will be the special emphasis in the Eleventh Plan. Industry players will be assisted to develop and own proprietary technologies to gain competitive edge to penetrate the regional market. Efforts will be focussed in developing specific technologies in the three identified clusters. This will be achieved via intense collaboration between industries and universities. An initiative to create an Industry Centre of Excellence (ICoE) for each cluster will be implemented. Initially, this initiative will be anchored by Universiti Teknologi Petronas for process engineering, Universiti Teknologi Malaysia for marine systems and Universiti Malaya for subsurface.

17.58 ICoE will assist local companies to enhance regional competitiveness and competency of the workforce in the industry. Programmes namely Structured Internship Programmes, Graduate Employability Programmes and industry driven research and development (R&D) programmes will be implemented to ensure adequate supply of qualified skilled oil and gas manpower. Malaysia Petroleum Resource Corporation will coordinate and monitor the implementation of this initiative.

Improving Distribution of Natural Gas

17.59 Distribution of natural gas to scattered demand areas in Peninsular Malaysia and Sabah will be improved through the virtual pipeline, which is the distribution of natural gas from city gate to consumers using trucks. A total of 41 prime mover trucks and 102 trailers are expected to be in service for this purpose. Industrial users in these areas are expected to be able to produce products at a lower energy cost. Alternative distribution methods, which are safe and economic will also be explored.

Rationalising Fuel Subsidy

Reducing Market Distortion

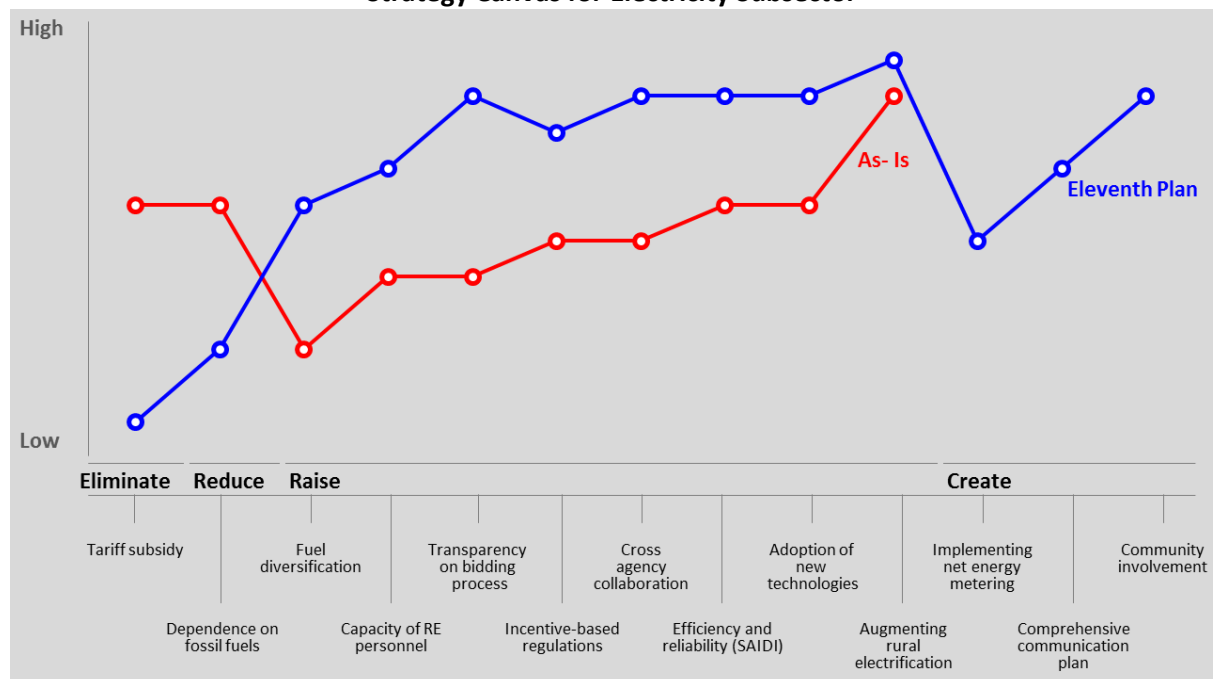
17.60 Sustained efforts to institute market-based energy pricing will be carried out to reduce the energy subsidies. Initiatives to review the pricing structure for gas supply will be continued to gradually align current piped gas prices towards market parity. In addition, IBR for gas will be introduced to ensure efficient resource allocation, usage and sustainable financial performance. The price for RON95 petrol, RON97 petrol and diesel will continue to be regulated using managed-float system to stem leakages. CNG prices will also be reviewed accordingly to gradually remove subsidies and encourage expansion of CNG retail infrastructure.

Electricity Subsector

17.61 The strategy canvas for the electricity subsector, as shown in *Exhibit 17-17*.

Exhibit 17-17

Strategy Canvas for Electricity Subsector



17.62 There are 5 initiatives identified for the electricity subsector as follows:

- Ensuring energy security through better management of resources;
- Creating a sustainable tariff framework;
- Improving efficiency and reliability of electricity supply;
- Augmenting rural electrification; and
- Increasing share of renewables in energy mix.

17.63 The electricity subsector needs to strike a balance between security of supply, efficient utilisation and environment preservation. The targets set for the Eleventh Plan are as follows:

No	Item	Target
1.	Fuel diversity index, the Hirschmann-Herfindahl Index (HHI)	<ul style="list-style-type: none"> • Achieve below 0.5
2.	Installed Capacity & Reserve Margin for: Peninsular Malaysia Sabah Sarawak RE capacity in Peninsular Malaysia and Sabah Increase generation capacity in Peninsular Malaysia	<ul style="list-style-type: none"> • 24,943 MW with reserve margin of 20% • 1,782 MW with reserve margin of 34% • 5,103 MW with reserve margin of 19% • 2,080 MW or 7.8% of total installed capacity • 7,626 MW from new generation capacity & 2,253 MW by extending retiring units
3.	SAIDI for generation, transmission and distribution Peninsular Malaysia Sabah Sarawak	<ul style="list-style-type: none"> • 50 minutes/customer/year • 100 minutes/customer/year • 157 minutes/customer/year
4.	Strengthen Sabah electricity grid for reliability	<ul style="list-style-type: none"> • Transmission and distribution networks reinforcement
5.	Subsidy rationalisation for electricity tariff	<ul style="list-style-type: none"> • Tariff review to achieve market price
6.	Initial milestones for nuclear power development	<ul style="list-style-type: none"> • Establishment of an atomic energy regulatory commission • Atomic Energy Regulatory Bill passed by Parliament • Public engagement for acceptance of nuclear power plant development
7.	Augmenting rural electrification	<ul style="list-style-type: none"> • Achieve 99% national coverage
8.	A high level focal point in the Government for decision making on energy policy	<ul style="list-style-type: none"> • Instituted before 2020
9.	Increasing share of renewables in energy mix	<ul style="list-style-type: none"> • Exploring new RE sources • Enhancing capacity of RE personnel • Implementing net energy metering
10.	A comprehensive communications plan on issues related to tariff increase as well as construction of coal and nuclear power	<ul style="list-style-type: none"> • Initiated by 2017

Ensuring Energy Security through Better Management of Resources

17.64 The development of the electricity subsector will continue to take into account economic, social and environment considerations with view towards maintaining optimum generation mix. In managing the resources efficiently, the Hirschmann-Herfindahl Index (HHI) will be adopted with target to maintain below 0.5 in 2020 for electricity subsector. HHI exceeding 0.5 reflects overdependence on certain fuel resource and HHI for 2014 is 0.45 which indicates a healthy index. In reducing the electricity generation from fossil fuels, RE needs to be enhanced and the potential of implementing nuclear energy for electricity generation need to be initiated. The possibility of transferring hydro power from Sarawak to Peninsular Malaysia will also be considered.

17.65 Utilisation of RE sources including biomass, biogas, solar PV and mini hydro will be continued as alternative fuel sources for electricity generation. In addition, the potential of geothermal, wind and ocean energy will also be explored. RE capacity is expected to reach 2,080 MW by 2020, contributing to 7.8% of total installed capacity in Peninsular Malaysia and Sabah.

17.66 The implementation of Nuclear Power Infrastructure Development Plan and Nuclear Power Regulatory Infrastructure Development Plan would be an important step to develop nuclear power for electricity supply in the Eleventh Plan. This will support the multiple goals of improving energy security, spurring economic development as well as reducing GHGs emission. A new independent atomic energy regulatory commission will be established. A 10-Year Comprehensive Communication Plan and Strategies on Nuclear Power for electricity will be continued to increase awareness and public acceptance.

Creating a Sustainable Tariff Framework

Strengthening of Incentive-based Regulation

17.67 The implementation of IBR will be continued to ensure utility companies provide efficient services. The IBR framework is designed to incentivise utility companies to reduce costs and improve service levels. The separation of generation, transmission and distribution tariffs with automatic adjustments will take into account changes in fuel prices to increase transparency and efficiency of electricity supply. New power plants and extensions of existing power plants will continue to be undertaken through competitive bidding for greater transparency. This will create healthy competition among industry players resulting in more competitive tariffs and in turn benefiting end-consumers.

Rationalising Subsidy for Electricity Tariff

17.68 Fuel cost is the largest input in the electricity tariff and the generation fuel mix needs to be optimised to ensure low cost of supply and affordable tariff. In line with the policy to gradually remove energy subsidies, the tariff requires periodical adjustments. Therefore, the electricity tariff will be reviewed to achieve market parity. Based on current tariff structure, the first 300 kilowatts hour (kWh) of electricity consumption, which is the lifeline band will not be affected with the tariff increase.

Improving Efficiency and Reliability of Electricity Supply

Ensuring Security of Natural Gas Supply

17.69 Various efforts will be undertaken to ensure security of natural gas supply which is significant to the reliability of electricity supply. Key efforts include increasing PGU capacity through the laying of additional pipelines and installing another receiving terminal in Kerteh, Terengganu to receive additional gas volume from JDA. In addition, the commissioning of RGT-2 is expected to increase the gas supply to Peninsular Malaysia.

Increasing Generation Capacity, Reinforcing Transmission and Distribution Networks

17.70 New investments on generation capacity and reinforcement in transmission and distribution networks will be continued. Construction of new power plants to generate 7,626 MW will be initiated to meet the growing demand and replace retiring plants. A number of 500 kilovolts (kV) and 275 kV transmission projects are currently under construction and will be completed during the Eleventh Plan. These projects will enhance the security of supply to major load demand centres, particularly the central region encompassing Kuala Lumpur-Klang Valley area and to other strategic locations in Prai, Pulau Pinang; Tanjung Bin and Pengerang, Johor.

17.71 Electricity supply in Sabah will be strengthened through constructing and upgrading of generation, transmission as well as distribution systems to reduce limitation on the system and improve operational flexibility. The peak demand is projected to increase at an average rate of 6.4% per annum from 983 MW in 2015 to 1,331 MW in 2020. A 180 MW hydro power plant in Upper Padas and a 300 MW gas-fired power plant in Sandakan are scheduled to be constructed in the Eleventh Plan to ensure sufficient generation capacity. In addition, several transmission and distribution lines projects will be undertaken which are as follows:

- Construction of transmission lines from Upper Padas to Mengalong, Sipitang and Segaluid to Seguntor; and
- Construction of 33 kV and 11 kV distribution lines in Kent, Donggongan and Menggatal.

17.72 In anticipation of the projects planned in the Sarawak Corridor of Renewable Energy, the peak demand in the state is projected to increase at an average rate of 10.3% per annum from 2,935 MW in 2015 to 4,306 MW in 2020. The projected demand will require additional capacity in the system from the installed capacity of 4,109 MW in 2014. Thus, two units of 300 MW Balingian coal-fired power plants will be commissioned by 2018.

17.73 SAIDI in Peninsular Malaysia is targeted to improve from 60.4 minutes/customer in 2013 to 50 minutes/customer in 2020 indicating further improvement to the electricity supply. In Sabah, the completion of major networks and additional generations in Upper Padas and Sandakan by 2019 will further reduce SAIDI from 424 minutes/customer in 2013 to 100 minutes/customer by 2020. SAIDI in Sarawak is expected to be reduced from 168 minutes/customer in 2013 to 157 minutes/customer by 2020 with the completion of Balingian power plant as well as several transmission and distribution networks reinforcement projects.

Augmenting Rural Electrification

17.74 Rural electrification programmes, especially in Sabah and Sarawak will be enhanced to improve national coverage to 99% by 2020 from the current coverage of 94% and 91% respectively. Electricity supply would be provided through off-grid systems for areas which are too far from the grid.

Increasing Off-grid Generation

17.75 The focus of rural electrification is to continue with off-grid generation for remote and isolated areas. The development of alternative systems such as solar hybrid, mini and pico hydro will be supported by off-grid networks to ensure wider coverage. A pico hydro is a small-scale system with a generation capacity between 0.1 kW and 1 kW which uses flowing water to rotate electrical generator turbines. This system is suitable for rural areas as it does not require construction of dams and has no impact on the environment.

Strengthening Community Involvement

17.76 Community involvement in providing rural electrification will be promoted. The Government will explore collaborations with relevant communities to ensure sustainability of rural electrification systems. Partnership with NGOs will be formed to provide electricity supply for the rural communities using micro hybrid and RE sources. The community's involvement from an early stage is important to reduce the cost of development and maintenance of the electrification system.

Increasing Share of Renewables in Energy Mix

17.77 In the Eleventh Plan, focus will be given in exploring new RE sources, enhancing capacity of RE personnel and implementing NEM to further intensify the development of RE.

Exploring New Renewable Energy Sources

17.78 Studies will be conducted to identify new RE sources to diversify the generation mix. In the Eleventh Plan, new RE sources such as wind, geothermal and ocean energy will be explored. Currently, the national wind mapping exercise is underway and it is expected to be completed by 2016. The exercise will further enable a study on the feasibility of wind energy to be developed. Geothermal potential will also be further explored with the discovery of a 12 square kilometres geothermal field in Apas Kiri, Sabah. Viability of ocean energy will be explored to take advantage of Malaysia's geographical position of being surrounded by sea.

Enhancing Capacity of RE Personnel

17.79 The RE industry will diversify Malaysia's energy mix in a more sustainable manner, create employment, and enhancing skills. The industry is expected to create about 15,300 jobs, comprising of skilled and semi-skilled jobs. In this regard, the Government will provide training to 1,740 personnel through SEDA, as shown in *Exhibit 17-18*. These trainings will create experts in the field of biomass, biogas, mini hydro and solar PV. The participants will be employees from the industry such as RE project developers, financial institutions and potential service providers. In addition, the private sector will be encouraged to conduct training and increase the number of RE experts.

Exhibit 17-18

Proposed Training Programme for Renewable Energy Capacity Building, 2016-2020

Training	Biomass	Biogas	Mini Hydro	Solar PV	Total
New training module	1	1	1	-	3
Participants (skilled)	130	100	150	300	680
Participants (semi-skilled)	210	170	250	430	1,060
Number of training	13	10	16	30	69

Source: Sustainable Energy Development Authority

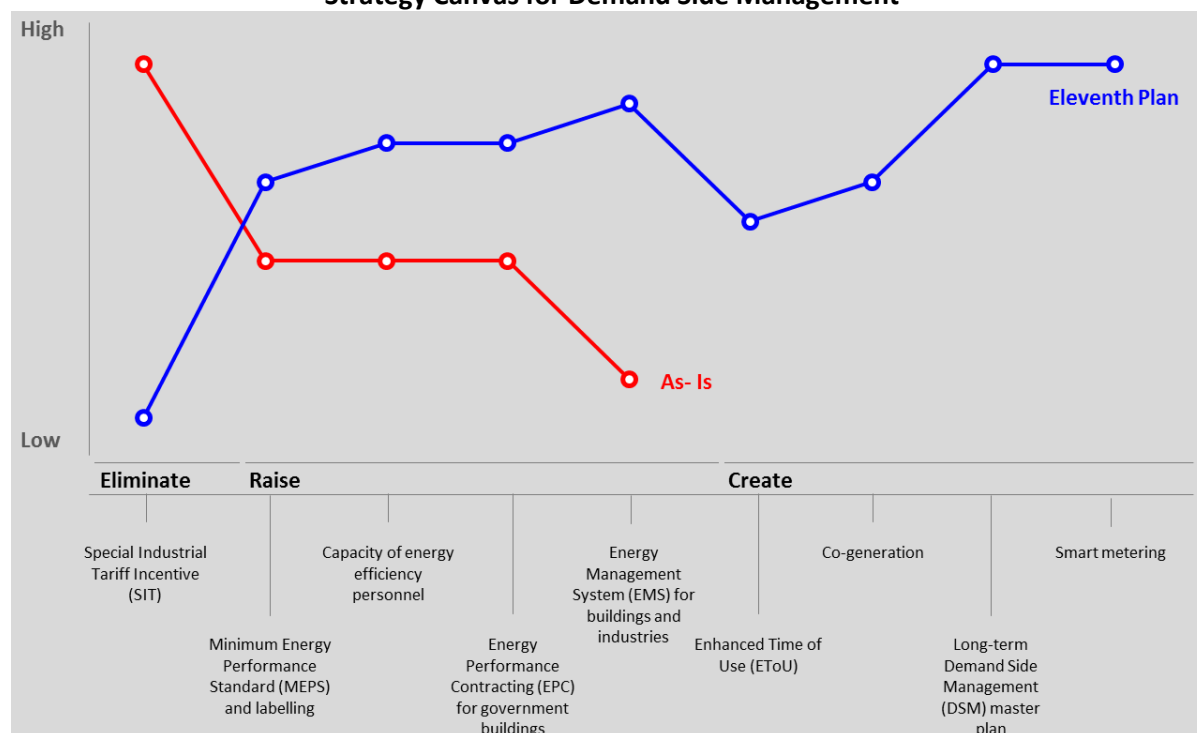
Implementing Net Energy Metering

17.80 To complement the current FiT mechanism in encouraging the take-off of RE, a new instrument termed as NEM will be implemented in the Eleventh Plan. The objective of NEM is to promote and encourage more RE generation, by prioritising internal consumption before any excess electricity generated is fed to the grid. NEM is anticipated to encourage manufacturing facilities and the public to generate electricity without any restriction on their generation capacity. This will further assist the Government's effort to increase the contribution of RE in the generation mix. NEM will be executed by KETTHA and utility companies and regulated by ST based on amended legal provisions.

Demand Side Management

The strategy canvas for the DSM, as shown in *Exhibit 17-19*.

Exhibit 17-19

Strategy Canvas for Demand Side Management

17.81 The initiatives for DSM are as follows:

- Reinvigorating demand side management
 - ✓ Formulating a comprehensive demand side management master plan
- Demand side measures for buildings, industries and households
 - ✓ Increasing number of registered electrical energy manager
 - ✓ Promoting energy services companies for Government and private buildings maintenance
 - ✓ Increasing number of retrofitted Government buildings
 - ✓ Promoting ISO 50001 for buildings and industries
 - ✓ Implementing Enhanced Time of Use (EToU) tariff
 - ✓ Abolishing the Special Industrial Tariff (SIT)
 - ✓ Promoting co-generation
 - ✓ Implementing smart grid
 - ✓ Enhancing Minimum Energy Performance Standard (MEPS) and labelling

17.82 DSM is set to be a major shift for the energy sector in the Eleventh Plan. In the previous five year development plans, focus was on supply-side management to meet the energy demand. DSM is expected to bring significant cost benefits to energy users through reduction of energy demand and prudent management of energy sources. The targets in the Eleventh Plan are as follows:

No.	Item	Target
1.	Comprehensive long-term DSM master plan	<ul style="list-style-type: none"> Formulating policy and action plan covering the entire spectrum of the energy sector including electrical, thermal and usage in the transport sector
2.	Buildings	<ul style="list-style-type: none"> Achieve 700 Registered Electrical Energy Manager (REEM) Extend Energy Performance Contracting (EPC) to other government buildings All new government buildings to adopt energy efficient design Retrofit 100 government buildings Register 70 Energy Service Companies (ESCOs) Target 100 companies to implement ISO 50001
3.	Industries	<ul style="list-style-type: none"> Introduce Enhanced Time of Use (EToU) with three different time zones Abolish Special Industrial Tariff (SIT) Install 4 million smart meters Increase on-grid co-generation capacity of 100 MW or more by reviewing utility standby charges
4.	Households	<ul style="list-style-type: none"> Additional appliances with Minimum Energy Performance Standard (MEPS) and labelling programme

Reinvigorating Demand Side Management

17.83 A comprehensive long-term DSM master plan is required for prudent energy usage. The Economic Planning Unit, Prime Minister's Department (EPU) will initiate a study on DSM which covers the whole spectrum of the energy sector. DSM is a vital tool to reduce peak electricity demand impacting the overall load on an electricity network. This will have beneficial effects including mitigating electrical system emergencies and increasing system reliability. It will also result in less dependence on expensive imports of fuel, reducing peak electricity demand and minimising harmful emissions to the environment.

17.84 DSM will be able to maximise the return on utilisation of existing and new electricity supply assets. The flattening of the demand curve will positively constrain demand growth and result in deferment of construction of new electricity supply infrastructure. The scope of the new DSM master plan will include the electric and thermal energy, including usage in the transportation sector.

Buildings

Increasing Numbers of Registered Electrical Energy Manager

17.85 ST expects to enlist 700 Registered Electrical Energy Managers (REEM) by 2020, which is an increase of 29% from the current 497 REEM. These energy managers will strengthen the enforcement of the Efficient Use of Electrical Energy 2008 Regulations to ensure all electrical installations comply with the law. Currently, two entities are offering training for REEM to accelerate the number of competent energy managers. ST will continue to accredit identified universities and skill training institutes to conduct the REEM programmes.

Promoting Energy Services Companies for Government and Private Buildings Maintenance

17.86 Currently, there are 50 active Energy Service Companies (ESCOs) in the country. By the end of the Eleventh Plan, the number will be increased by 29% to 70 ESCOs. This is a new business venture which could be promoted in the energy sector. The ESCOs are essential in accelerating the implementation of Energy Performance Contracting (EPC) concept which could spin off new entrepreneurs. EPC has an important role in assisting building owners to use energy efficiently as well as reduce utility bills.

Increasing Numbers of Retrofitted Government Buildings

17.87 Most of new government buildings currently are fitted with EE features. The Government has initiated retrofitting measures for existing buildings in an effort for them to be energy efficient. This has been a promising venture as the EPU and Ministry of Finance buildings were retrofitted with a payback period of 1.6 years and 4.7 years, respectively. During the Eleventh Plan, the EPC concept will be used to retrofit 100 government buildings.

Promoting ISO 50001 for Buildings and Industries

17.88 ISO 50001 is the Energy Management System (EMS) framework to improve the organisations' energy management. A total of 100 companies are targeted to implement ISO 50001 from the current eight companies. This standard will ensure companies undergo a systematic measure for EE practices. All government agencies will be encouraged to develop and implement an EMS plan in line with ISO 50001.

Industries

Implementing Enhanced Time of Use Tariff

17.89 At present, the Time of Use tariff offers two time zones which are peak and off-peak. The EToU tariff will be introduced as an option to the low and medium voltage commercial users as well as high voltage industrial users. This is an improved scheme with three different time zones namely off-peak, mid-peak and peak to improve efficiency in load management as well as minimising operational costs. The tariff will also be extended to domestic users. In the long-term, the EToU tariff will also be able to reduce generation costs.

Abolishing the Special Industrial Tariff

17.90 In line with the rationalisation of energy subsidy and adoption of EE measures, SIT will be abolished by 2020. Based on current SIT mechanism, companies with higher usage of electricity will benefit from eligibility to more discounts. The total cumulative discounts given from 1997 to 2013 under the SIT were RM5.2 billion. The abolishment of SIT will cause electricity-intensive industries to implement EE measures and reduce their operation costs.

Promoting Co-Generation

17.91 Co-generation or combined heat and power system has been practiced in some of the earliest installations of electrical generation. The result is a much more efficient use of fuel which can generate substantial savings for the end user. Utility standby charges offered by utilities will be reviewed to encourage industries to produce electricity through co-generation. In the Eleventh Plan, policy and regulations on future co-generation development will be comprehensively studied and formulated.

Implementing Smart Grid

17.92 The implementation of smart grid systems for the electricity industry with the introduction of smart meters will assist customers in managing their own electricity supply. A total of 4 million smart meters will be installed by 2020 at an estimated cost of RM4 billion by the utility company. Smart grid will benefit customers to obtain information on their electricity usage. By harnessing smart grid facilities, consumers can make decisions in optimising their electricity consumption and reduce their bills. It will also allow faster outages detection and restoration of services, resulting in less disruption to customers.

Households

Enhancing Minimum Energy Performance Standard and Labelling

17.93 MEPS and energy labelling help to improve the energy efficiency of appliances enabling consumers to choose products which uses less energy. An additional four domestic appliances which are vacuum cleaner, instant water heater, iron and electric oven will be included in the MEPS and labelling programme. There will be 14 appliances under this programme and the scope of MEPS for air-conditioner and refrigerator will be expanded.

V. CONCLUSION

17.94 Energy security is paramount to any economy. Sustainable usage of energy with prudent and efficient management of resources will be a major focus in the Eleventh Plan. Measures will be undertaken to ensure the reliable supply of energy and minimise supply disruption. This will be done by strengthening the security of supply in the oil and gas through enhancement of upstream and downstream infrastructure. The efficiency and reliability of the electricity supply will be further improved through continued investments in generation, transmission and distribution projects. A comprehensive DSM master plan will pave the way towards a balanced management of the entire energy spectrum. In addition, local capabilities in the energy-related industries and services will be promoted.