The Malaysian Electricity Supply Industry (MESI) - Stakeholders

CISB413 Malaysian Electricity & Power Landscape

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TENAGA NASIONAL BERHAD (200866-W)

CONTENTS

Part 1:
Power System Review

TENAGA NASIONAL BERHAD (200866 - W)

Electricity Characteristics

What's so special about electricity?

- Electricity is an essential (public?) service
  - guarantee of supply & price are politically sensitive issues
- Electricity cannot be easily stored, i.e. delivery is practically instantaneous
  - Generation & demand are permanently in balance
- Supply of electricity requires networks, where electricity is injected or retrieved *but cannot be traced*
  - Network duplication does not make economic sense
- Also *(not so special)*
  - Large & dedicated investments
  - Complex decision making under much uncertainty
  - Predictable cyclical variations in demand

Illustration of Power Delivery

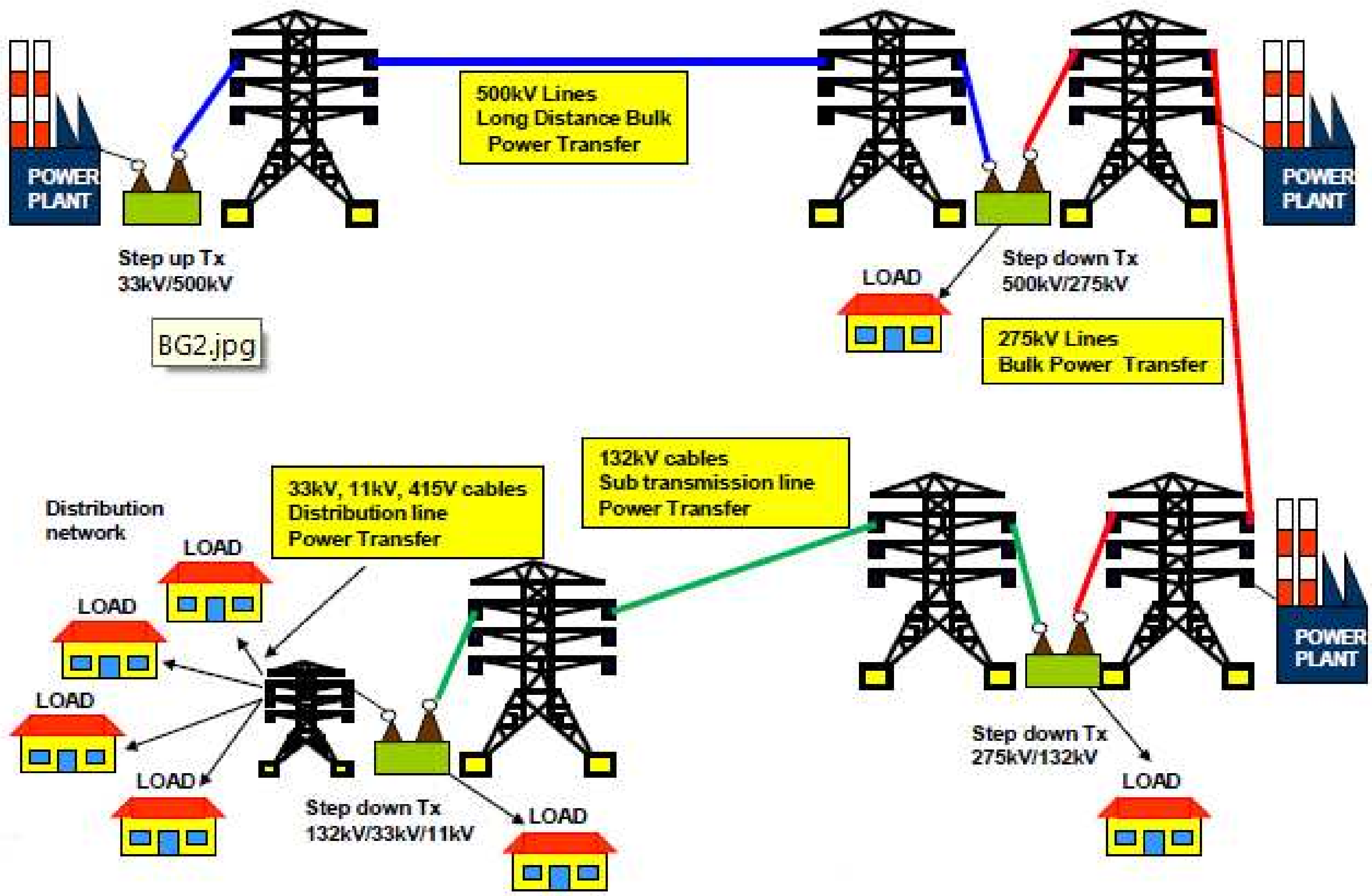


Illustration of Generation Sources

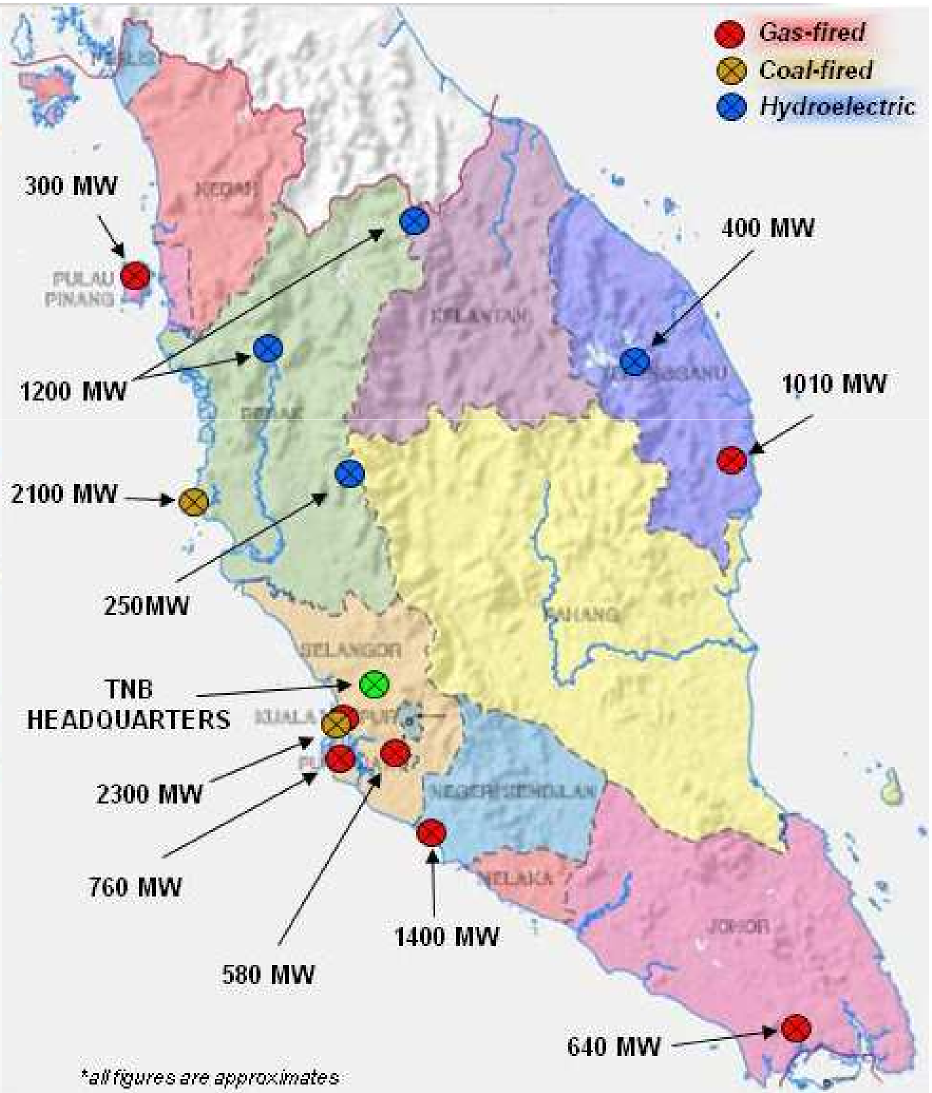
Installed generation capacity of 11 GW

- 2 Coal-fired stations: ~ 4.4 GW
- 6 Gas-fired stations: ~ 4.7 GW
- 3 Hydro schemes: ~1.9 GW

~55% of total national power generation capacity

Additional 1.6 GW due online by 2015

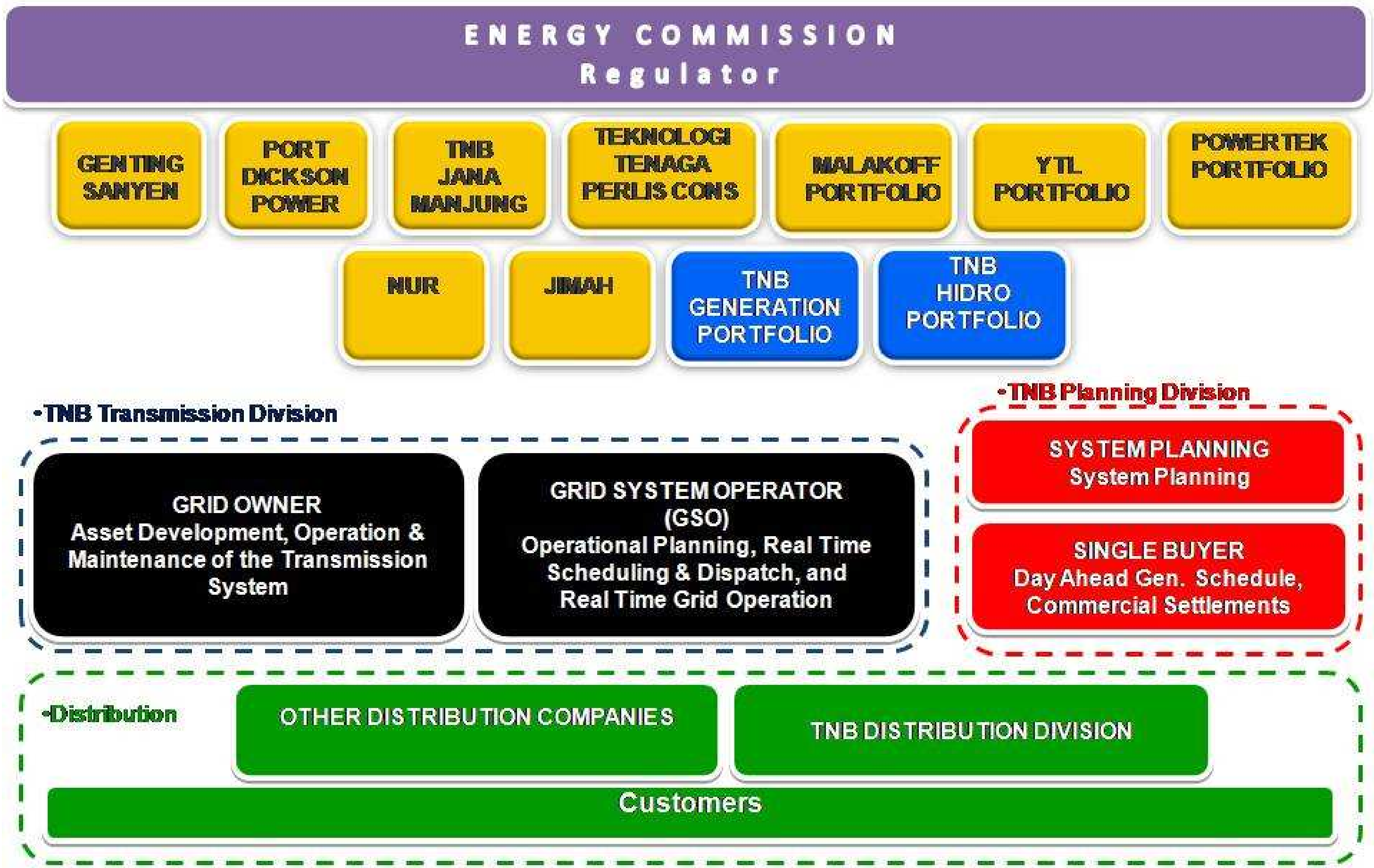
- 1 Coal-fired unit: 1 GW
- 2 Hydro schemes: 0.6 GW



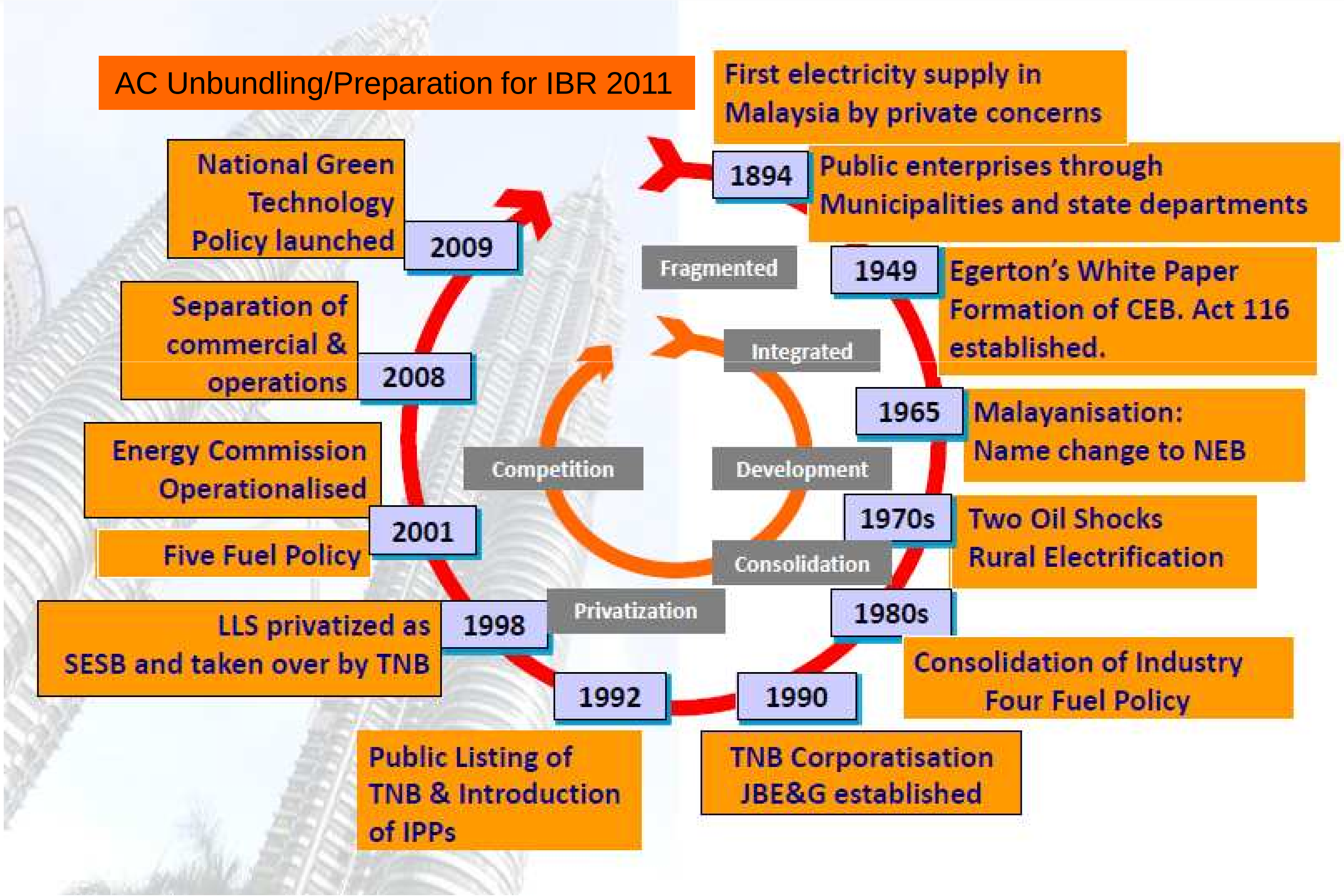
Part 2:
Malaysian Electricity Supply Industry

TENAGA NASIONAL BERHAD (200866 - W)

MALAYSIA ELECTRICITY SUPPLY INDUSTRY (M-ESI)



Evolution of the MESI

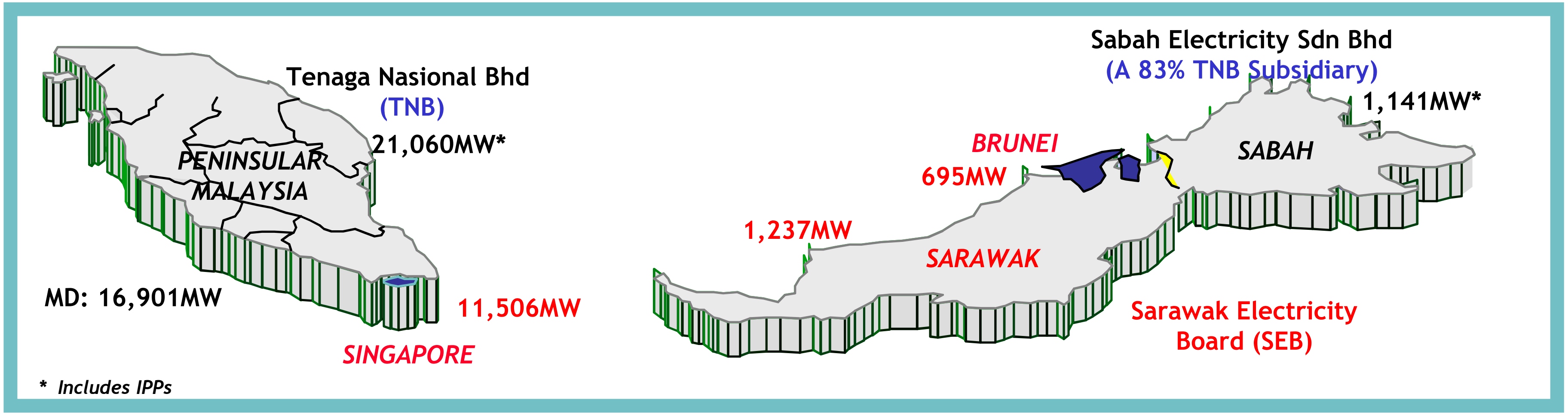


Evolution of the MESI (cont)

1. 1894 – First private supply of electricity to Rawang by Loke Yew and Thamboosamy Pillai
2. 1904 – First public supply inaugurated in Penang
3. 1905 – First public supply to KL from the Ulu Gombak HEP
4. 1928 – Commissioning of 18MW Malim Nawar Station by Perak River Hydro. KED established
   – 27MW Chenderoh HEP commissioned
5. **1937-1949 The Electricity Department**
6. **1949-1964 The Central Electricity Board established**
7. 1953 – 1958 – Connaught Bridge and Malacca Power Station commissioned
8. 1963 - Cameron Highlands HEP commissioned
9. **1965 – CEB renamed as National Electricity Board**
10. 1982 – Takeover of PRHEP and KED by NEB
11. 1986 – 275Kv loop completed, forming the National grid
12. **1990 – NEB corporatised and privatised as TNB**

Introduction to Tenaga Nasional Berhad

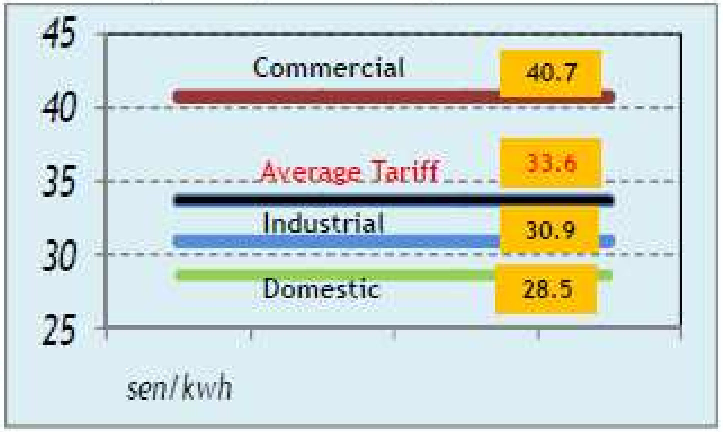
Three Major Utilities in Malaysia



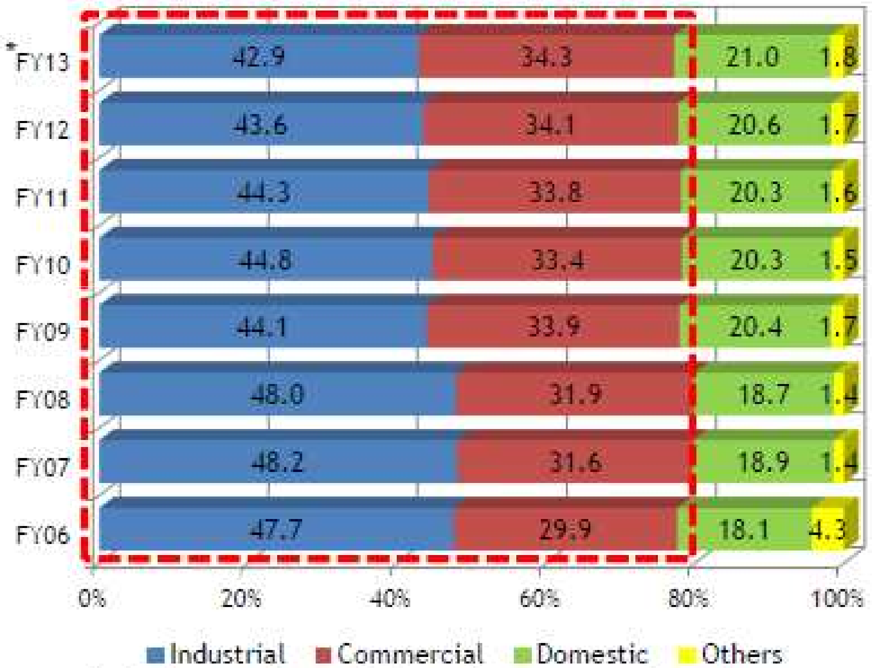
	FY'09	FY'10	FY'11	FY'12	1HFY'13
TNB -Peninsula Installed Capacity (MW)	11,530	11,530	11,530	11,462	11,462
Total units sold (GWh)	87,780	95,197	97,888	102,132	52,129
Total customers (million)	7.59	7.87	8.11	8.36	8.47
Total employees	29,149	30,535	31,935	33,568	34,353
Total assets (RM billion)	71.4	75.9	79.1	88.5	88.3

Customer VS Sales

Average Tariff by Sector



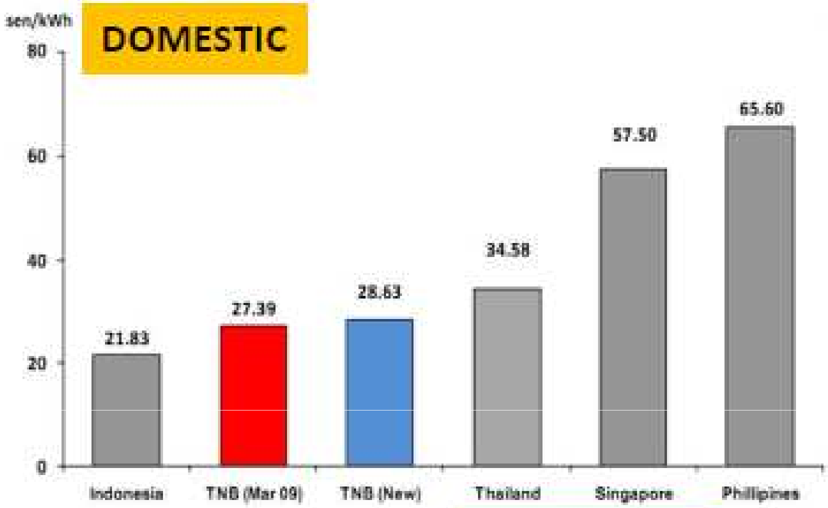
Sectoral Sales Analysis (Gwh)

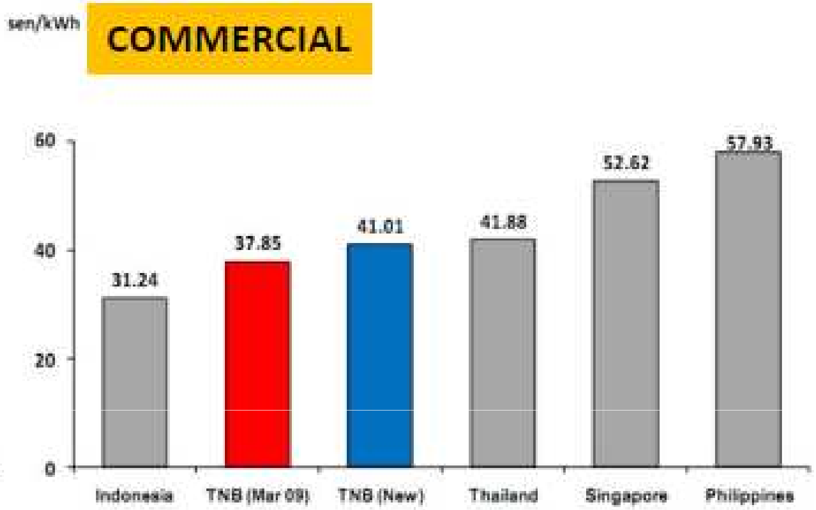


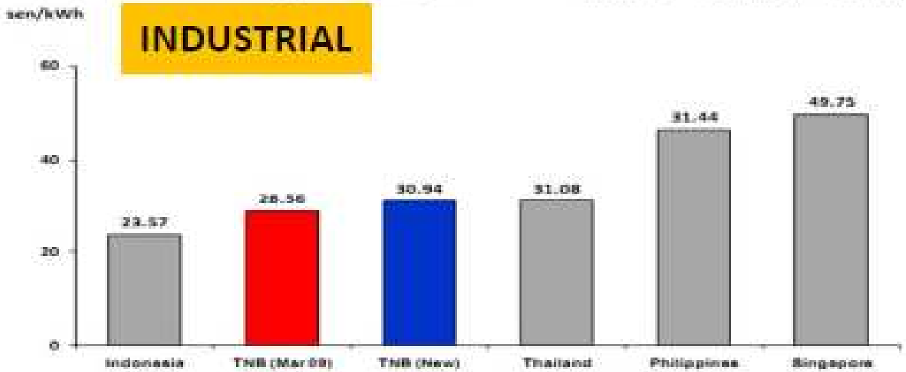
- Shift from Industrial-based to Service-based economy
- Increasing market share from Commercial sector
- Commercial sector contributes the highest electricity sales margin

*FY'13 - 1HFY13

Tariffs Comparison







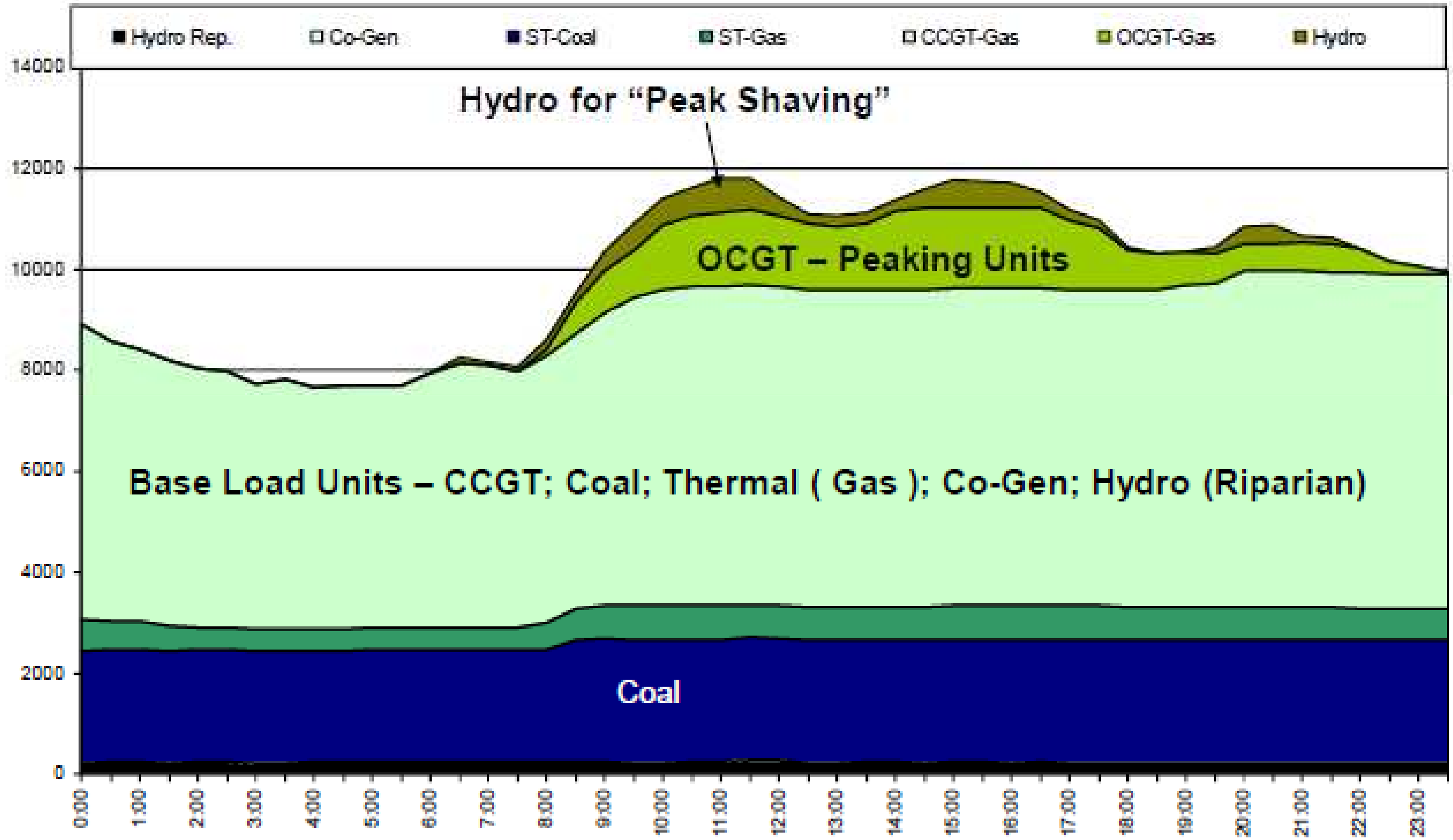
Notes:

1. Singapore - Average reduction of 3.3% from 1st Oct 2010 based on latest fuel cost pass-through
2. Thailand – Jan-Dec 2010, include fuel adjustment, (Ft). Ft has been maintained since Jan 2009.
3. Indonesia (PLN) – 10% tariff increase effective 1st July 2010 , Indonesia Govt. subsidy of about USD7billion per year
4. Philippines (Meralco) – Jan-Dec 2008
5. TNB (New) – average 7.12% increase effective 1st June 2011

Source: TNB Analysis, ASEAN Utility Data Exchange, SP Services

TYPICAL DAILY LOAD CURVE PATTERN

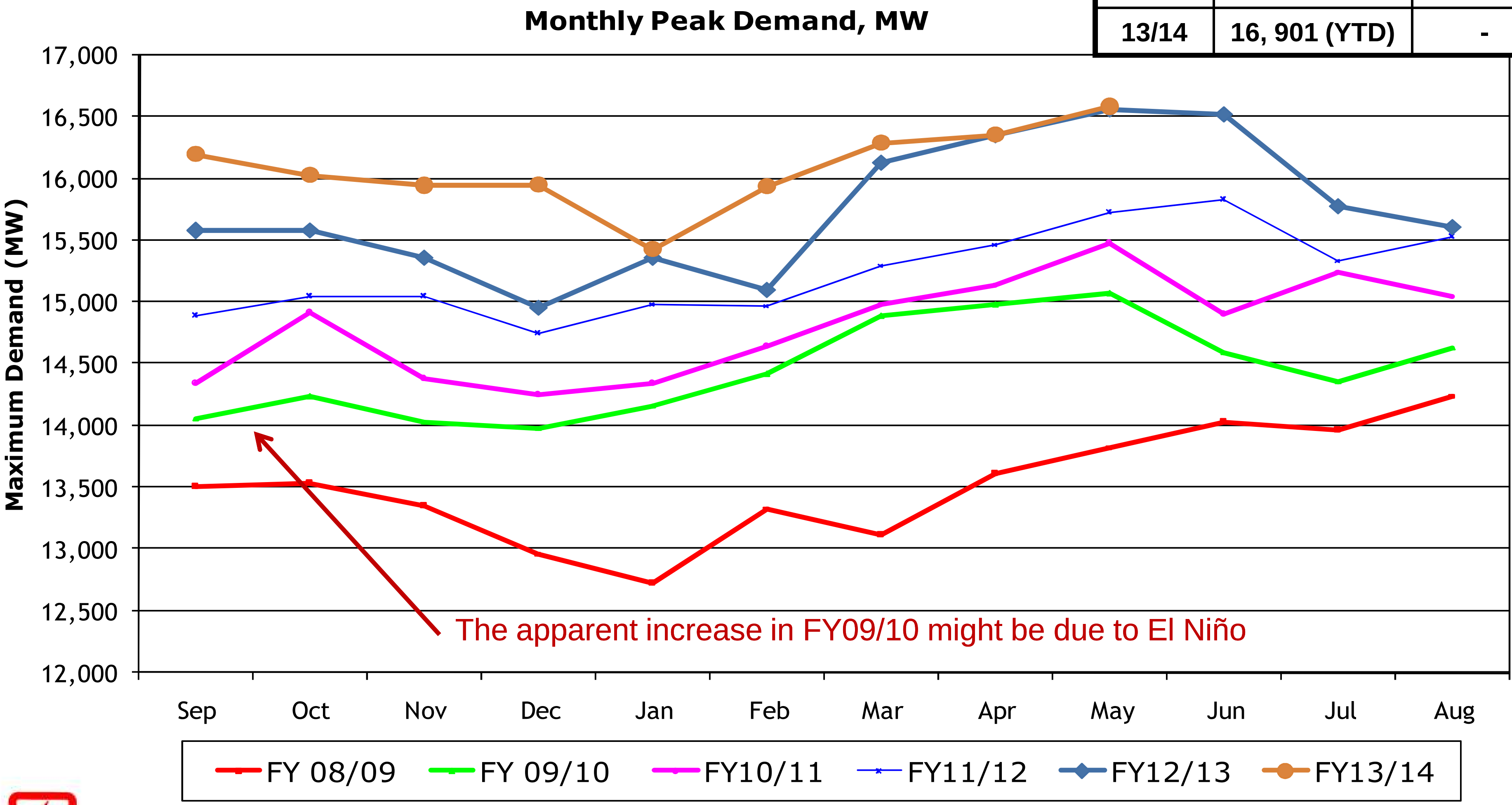
TYPICAL DAILY LOAD CURVE PATTERN



TENAGA NASIONAL BERHAD

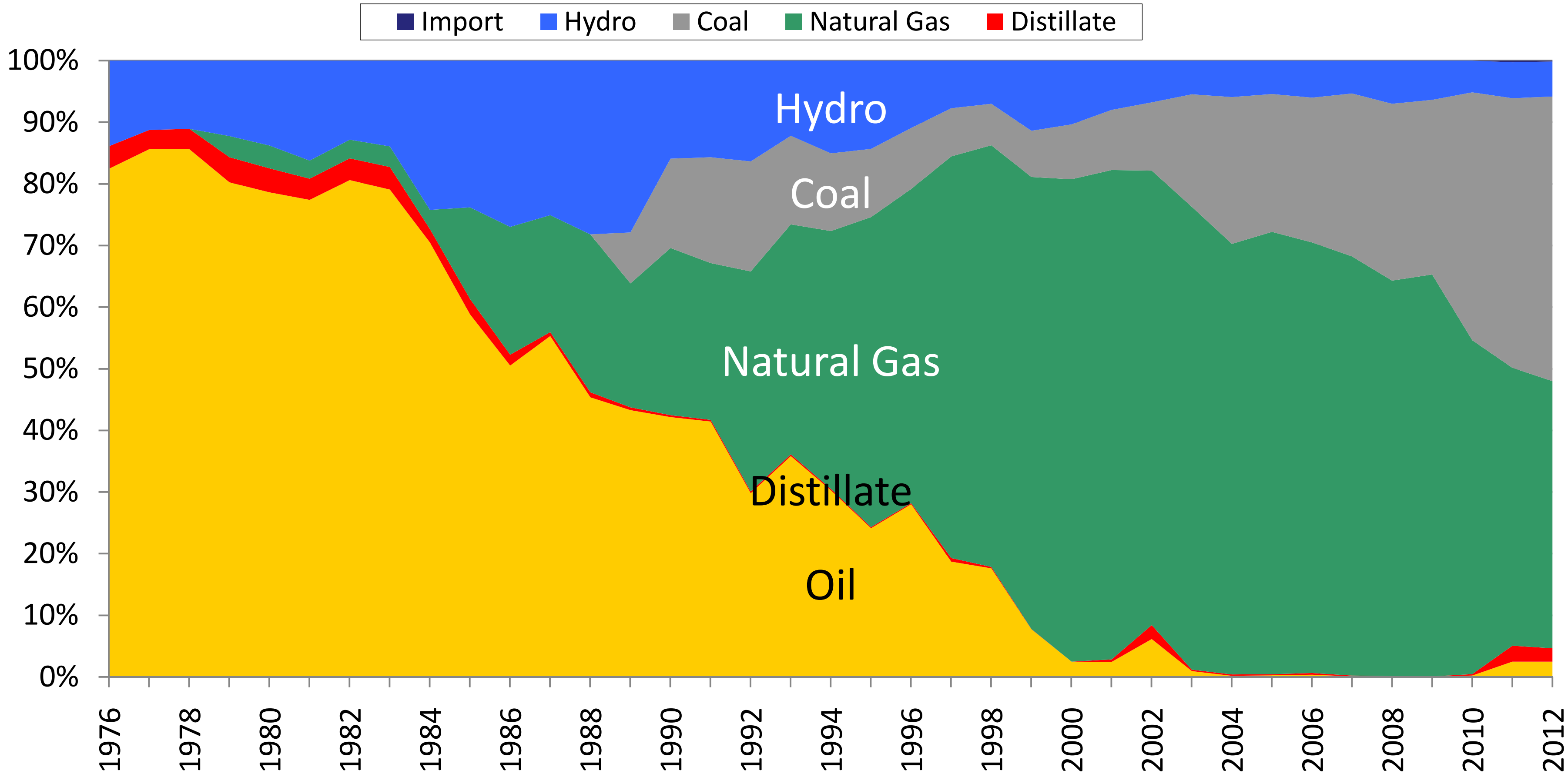
MONTHLY MAXIMUM DEMAND (FY09/10 – FY13/14)

FY	Highest Month (MW)	Growth (%)
09/10	15, 072	5.8
10/11	15, 476	2.7
11/12	15, 825	2.3
12/13	16, 562	4.7
13/14	16, 901 (YTD)	-

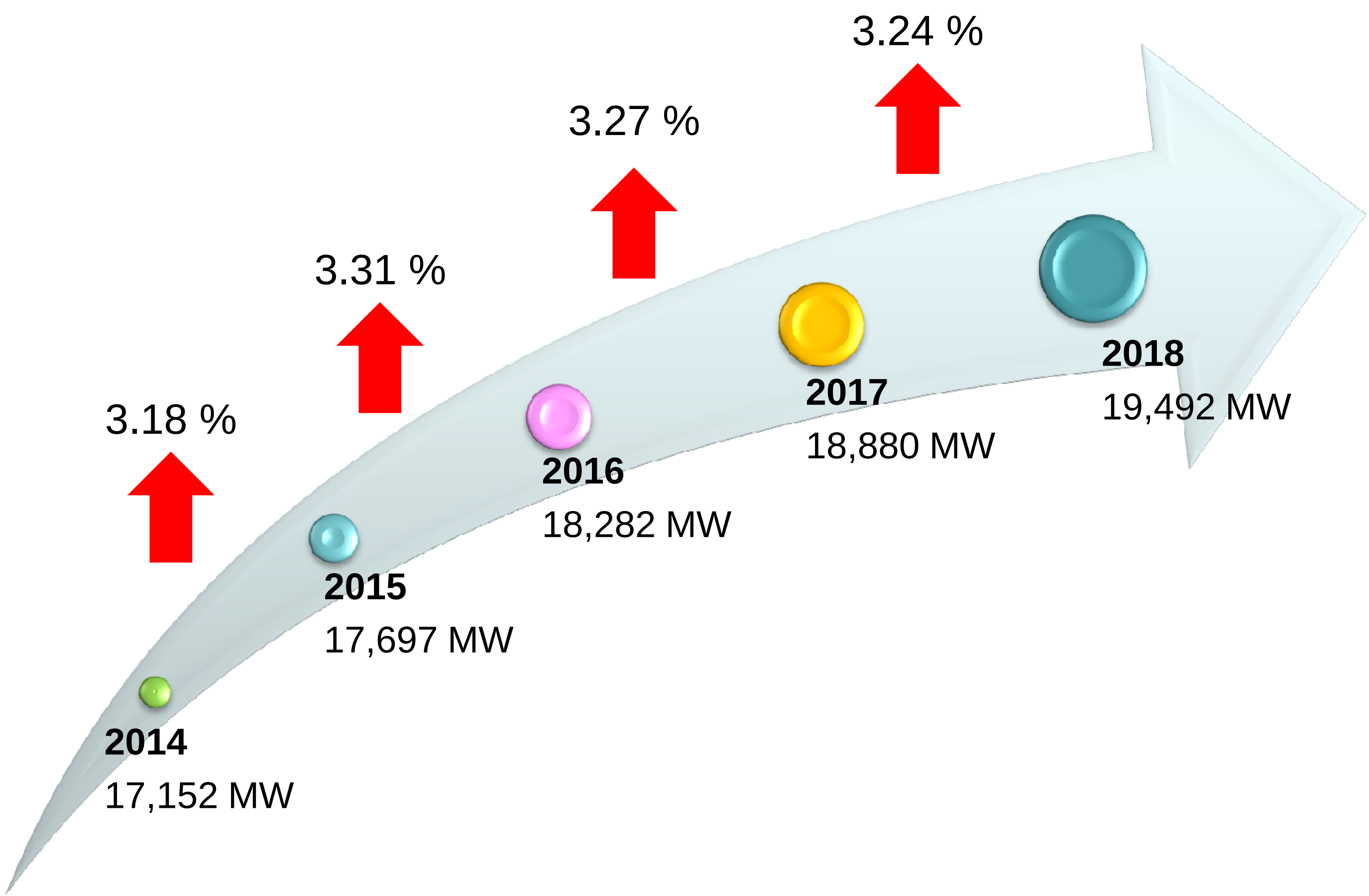


TENAGA NASIONAL BERHAD

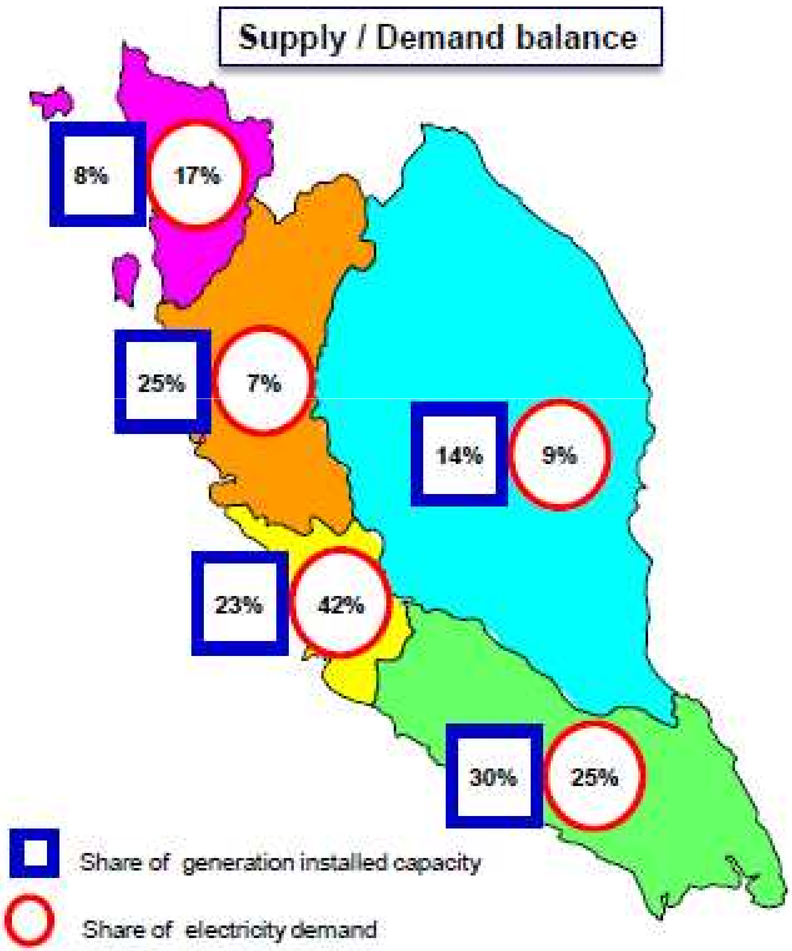
THE POLICY DRIVES THE FUEL MIX EVOLUTION FROM OIL DOMINANT TO GAS DOMINANT OVER A FEW DECADES



DEMAND GROWTH FORECAST



Typical Generation-Demand Scenario



Note: Central area is a nett importer of power

Typical Generation-Demand Scenario

ASEAN Power Grid – Inception under the ASEAN Minister of Energy (AMEM) and implemented under HAPUA

Existing Interconnection

- Peninsular Malaysia –Singapore (1986, 2 x 200 MW)
- Peninsular Malaysia – Thailand
  - HVAC Bukit Ketri – Sadao (1981, 85 MW)
  - HVDC Gurun – Khlong Ngae (2001, 300 MW)

Potential Interconnection

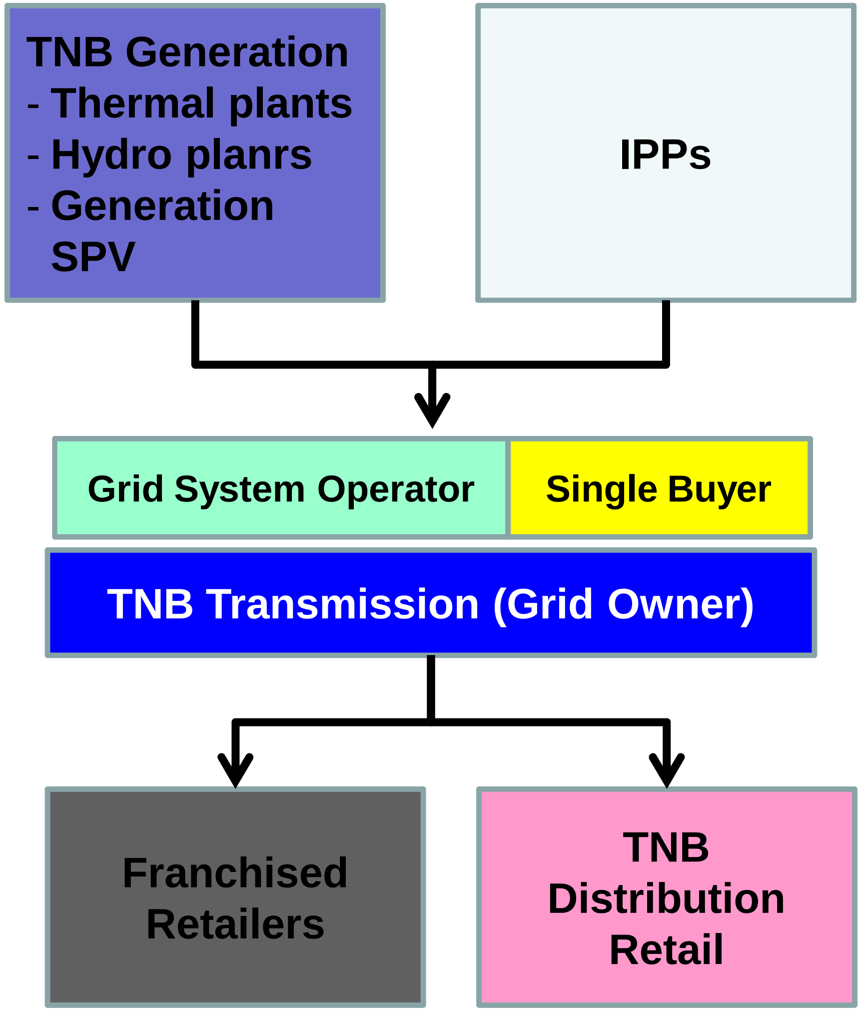
- Peninsular Malaysia – Sarawak (2022)
- Peninsular Malaysia – Sumatera (2018)
- Peninsular Malaysia – Thailand (2015, 2nd 300MW HVDC)
  - Rantau Panjang – Sg. Kolok (under discussion)

- **Sarawak and Sumatera interconnections are viable options to increase energy security**
- **The Singapore & Thailand Interconnections enhanced system security for all parties**

Part 3:
Governance & Institutional Framework

TENAGA NASIONAL BERHAD (200866 - W)

ESI Structure in Peninsular Malaysia

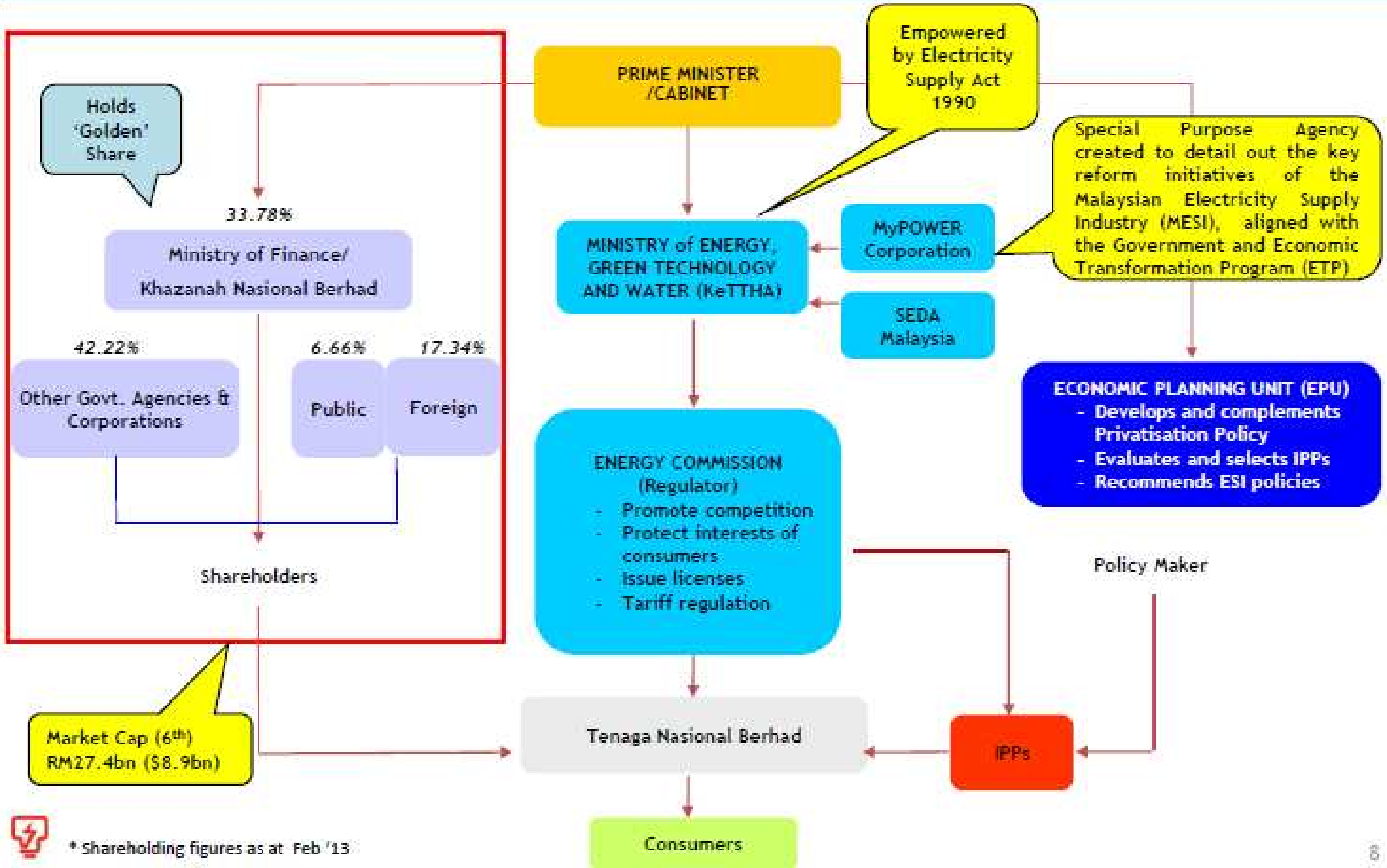


- Current ESI structure remains the same with TNB and IPPs as the key players in the generation sector
- However, the business activities of TNB is segmented into 5 business entities in anticipation of full implementation of Incentive Based Regulation (IBR) in 2015
- The System Operator and Single Buyer are in the process to be ring-fenced to enhance transparency, independence and fair play in generation scheduling and dispatch

Source:

- Energy Commission's Peninsular Malaysia Industry Outlook 2013

Industry Regulatory Framework



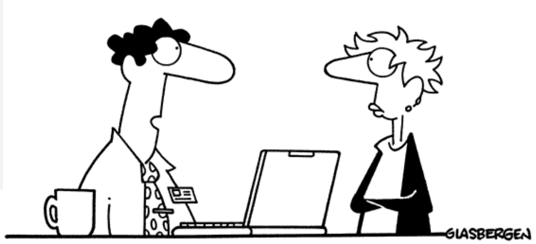
* Shareholding figures as at Feb '13

Institutions in the Sector

Economic Planning Unit	• Formulates macro national energy policy
KeTTHA	• Initiates, develops & implements energy policy and programmes
UKAS (Public Private Partnership Unit)	• Private Finance Initiatives in major project
Energy Commission	• Electricity and piped gas industry regulation
National Green Technology Centre	• Formulating green technology development plan. This centre function as the focal point to set standards and promote green technology
Petronas	• Oil and Gas exploration, production, processing, manufacturing and marketing
Petronas Gas	• Processing and transmission of natural gas
TNB, SESB, SESCO	• Electricity generation, transmission, distribution and supply
Gas Malaysia, Sabah Energy Corp, Sarawak Gas	• Distribution and reticulation of gas
Sustainable Development Authority	• Development of RE/ EE Initiatives and Implementation of FIT
MyPOWER Corp	• MESI Reform Initiatives

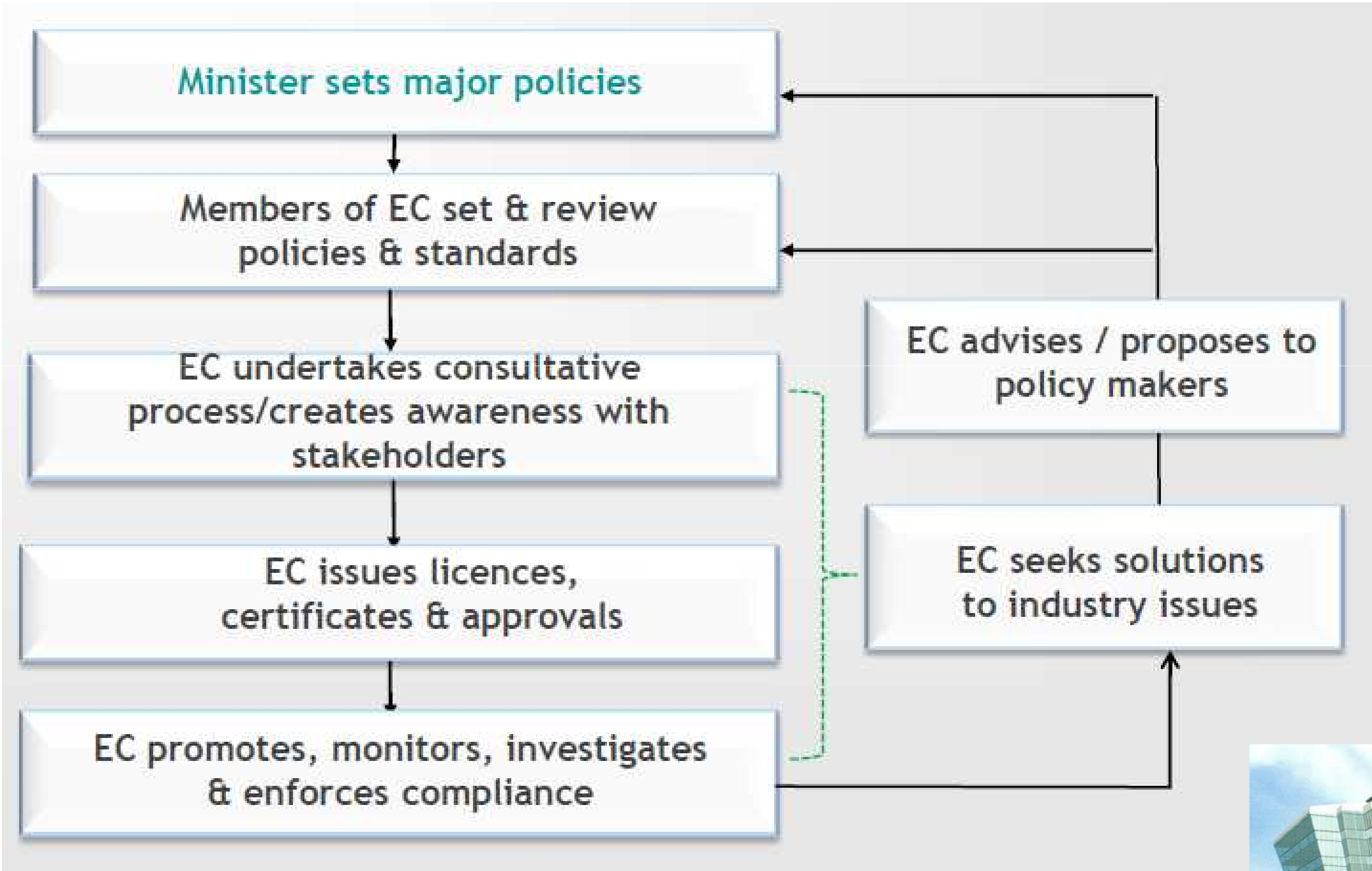
Key Energy Policies

Petroleum Development Act 1974	National Petroleum Policy 1975	National Energy Policy 1979	National Depletion Policy 1980	Four-Fuel Diversification Strategy 1981	Five-Fuel Diversification Strategy 2001
• Vested on PETRONAS the exclusive rights to explore, develop and produce petroleum resources of Malaysia	• To regulate downstream oil & gas industry via the Petroleum Regulations 1974	• To ensure adequacy, security and cost-effectiveness of energy supply • To promote efficient utilization of energy • To minimize negative environmental impacts in the energy supply chain	• To prolong lifespan of Malaysia's oil reserves for future security & stability of oil supply	• To pursue balanced utilization of oil, gas, hydro and coal	• Renewable Energy/ EE included as the "fifth fuel" in energy supply mix

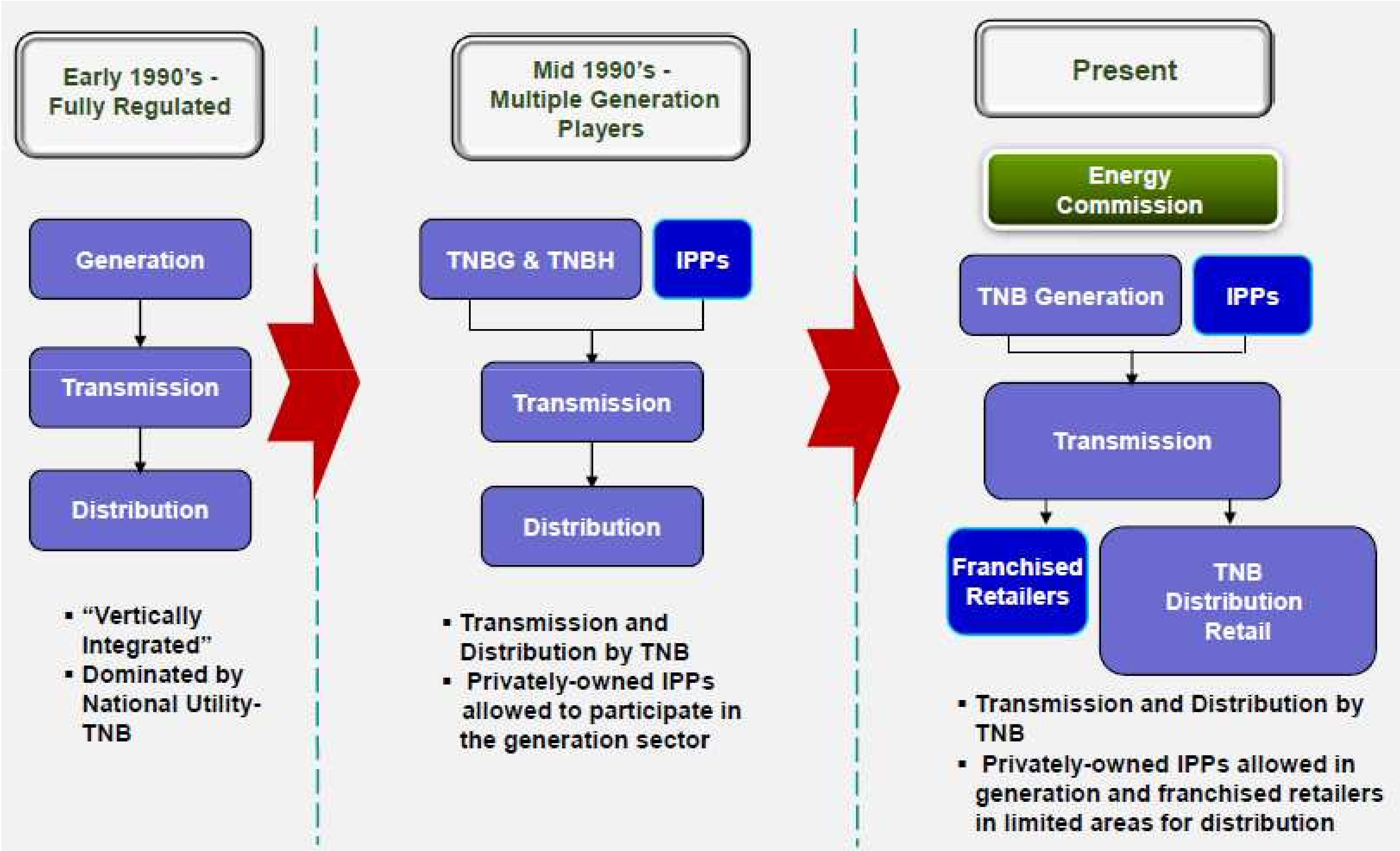


"What software would you recommend to give my presentation so much flash and sizzle that nobody notices that I have nothing to say?"

The Energy Commission: Regulatory Process



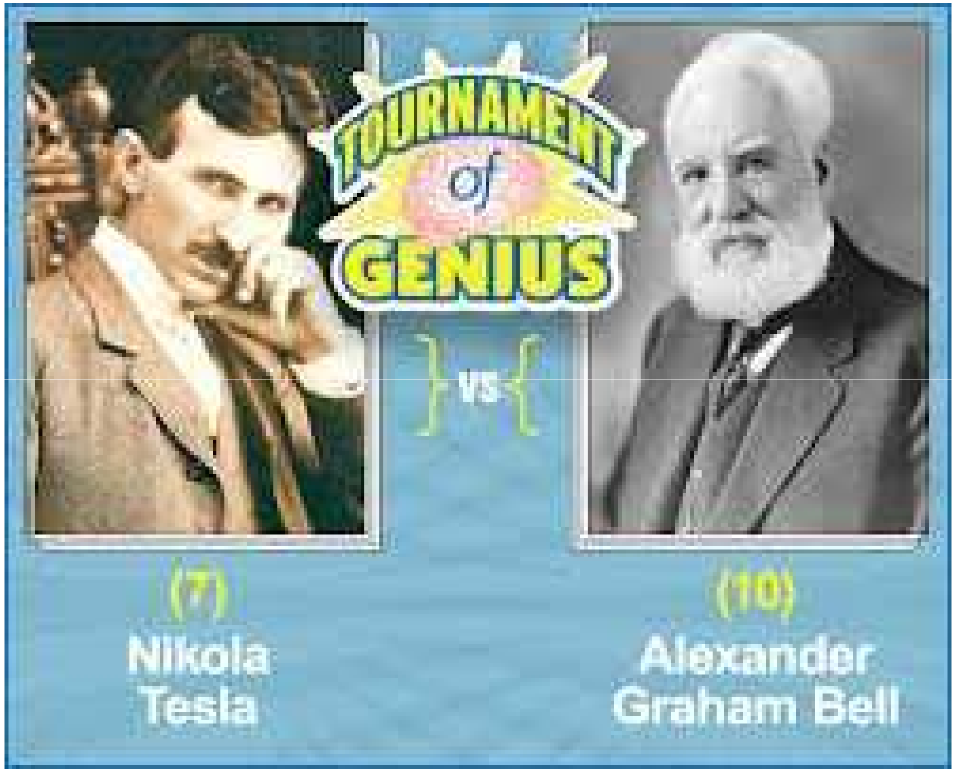
Historical Development of MESI Structure



Part 4: Use of Information Technology in Power Utility

TENAGA NASIONAL BERHAD (200866 - W)

Tesla vs Bell

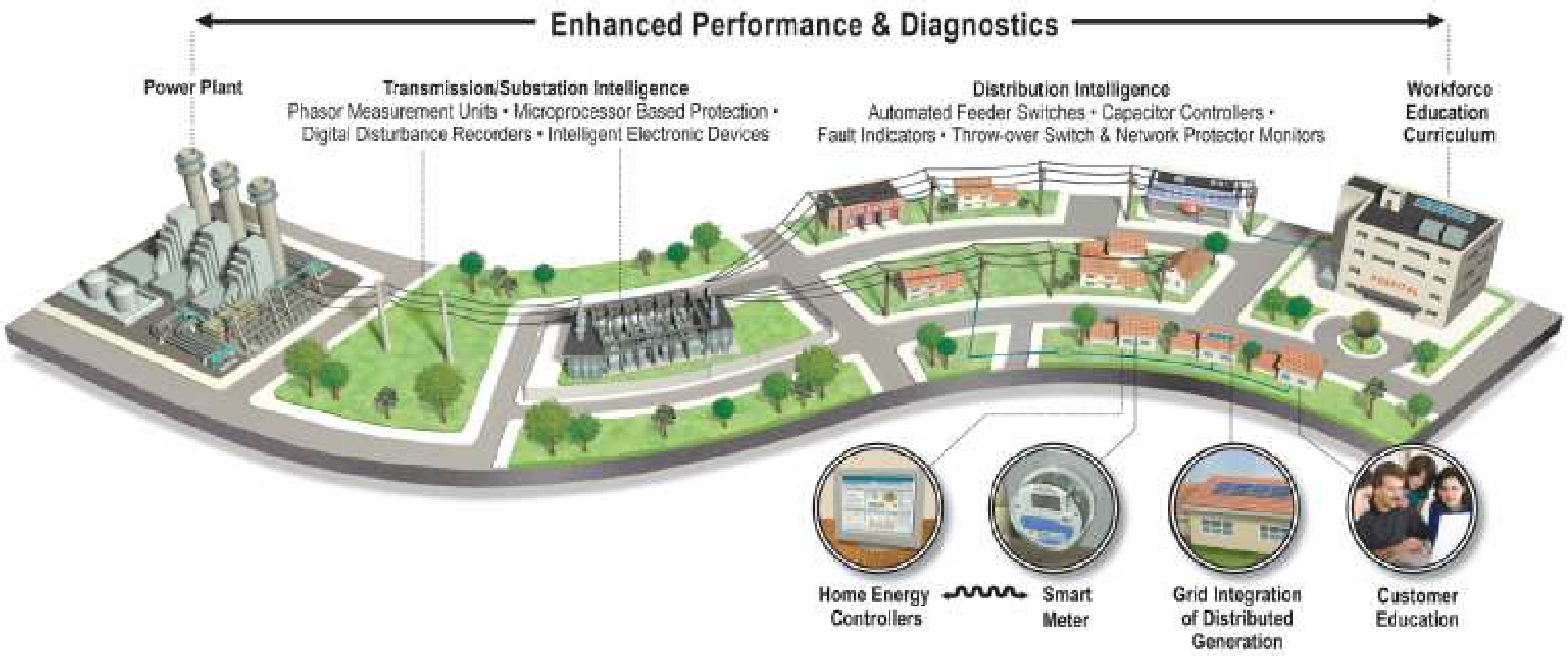


Disruptive Forces

Intelligent Grid

What is a Smarter Grid?

A smarter grid uses digital technologies to improve the reliability, security, and efficiency of the electric system.



What is Smart Grid

- "Smart Grid" is today used as a marketing term, rather than a technical definition. For this reason there is no well defined and commonly accepted scope of what "smart" is and what it is not.

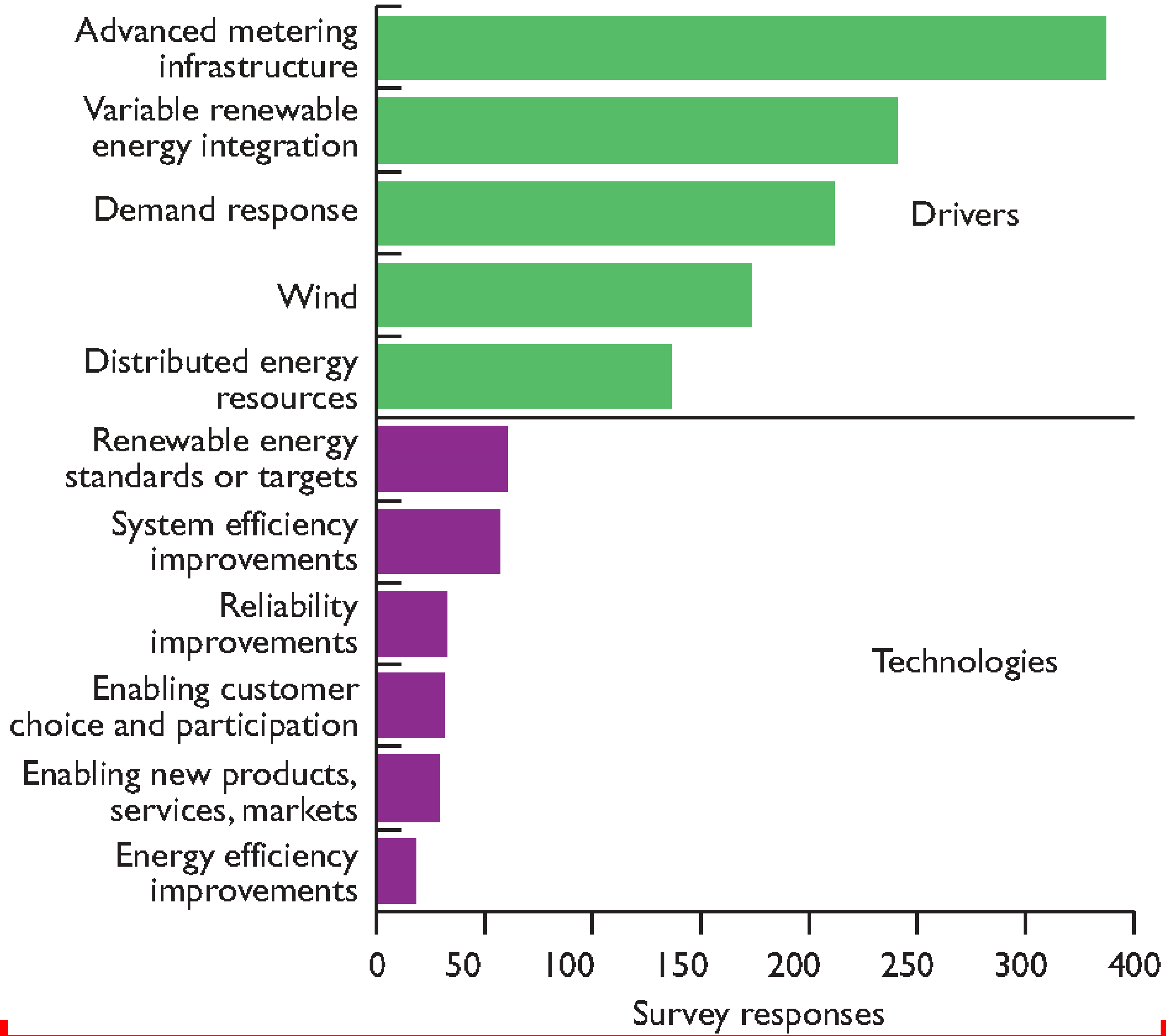
- The general understanding is that the Smart Grid is the concept of modernizing the electric grid. The Smart Grid comprises everything related to the electric system in between any point of generation and any point of consumption. Through the addition of Smart Grid technologies the grid becomes more flexible, interactive and is able to provide real time feedback.

http://www.iec.ch/smartgrid/

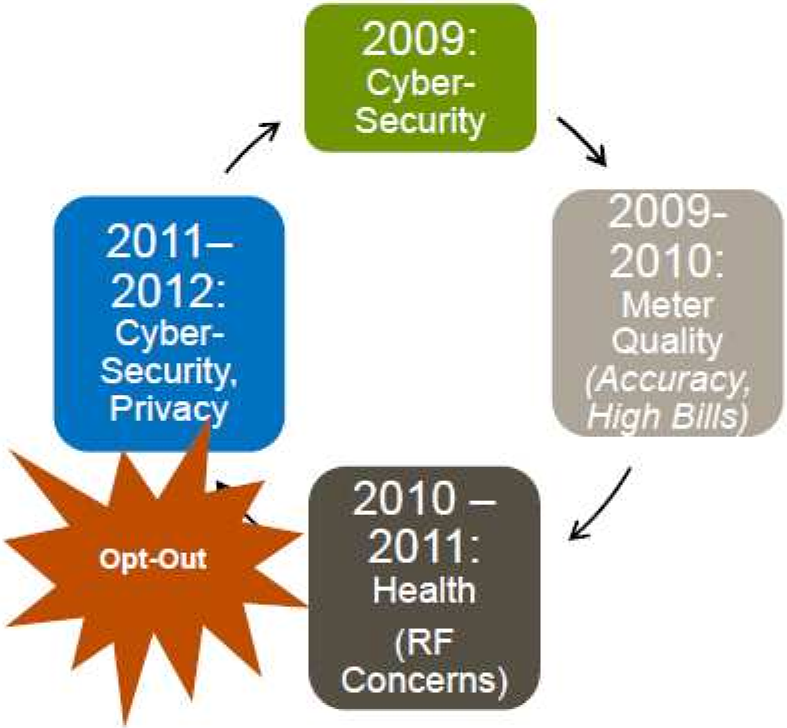
Smart Grid Drivers & Technology Options

	AMI	Distribution automation	HEMS/ BEMS	Energy storage	Demand response
Increasing renewable generation	√	√		√	√
Improved grid reliability	√	√		√	√
Reduce non technical losses	√	√			
EV integration			√	√	
Rising peak demand	√		√	√	
Ageing infrastructure	√	√	√	√	√

Smart Grid Drivers & Technology Options



Issues & Challenges – Customer Acceptance



SOUTHERN CALIFORNIA EDISON

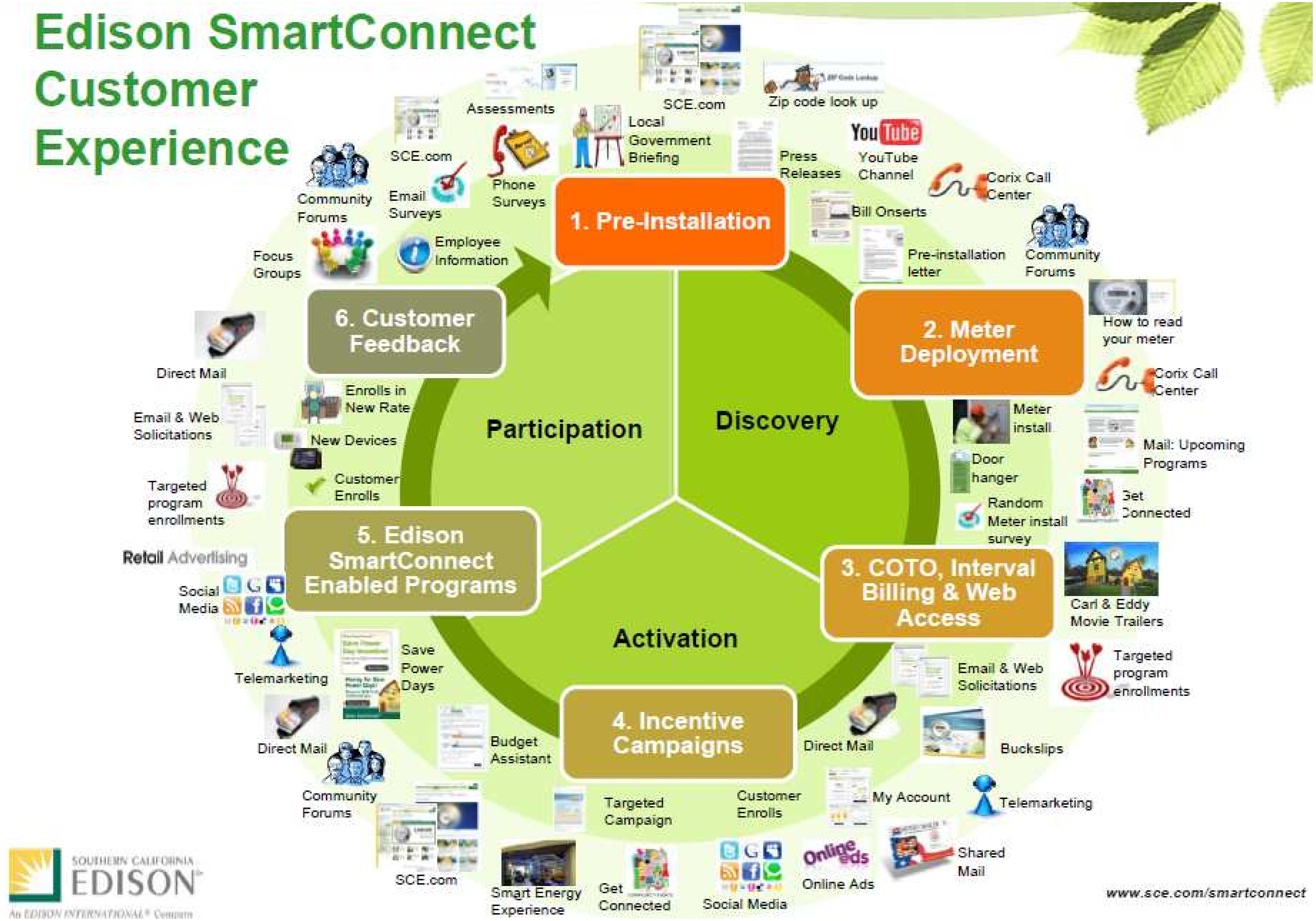
An EDISON INTERNATIONAL Company

30

www.sce.com/smartconnect

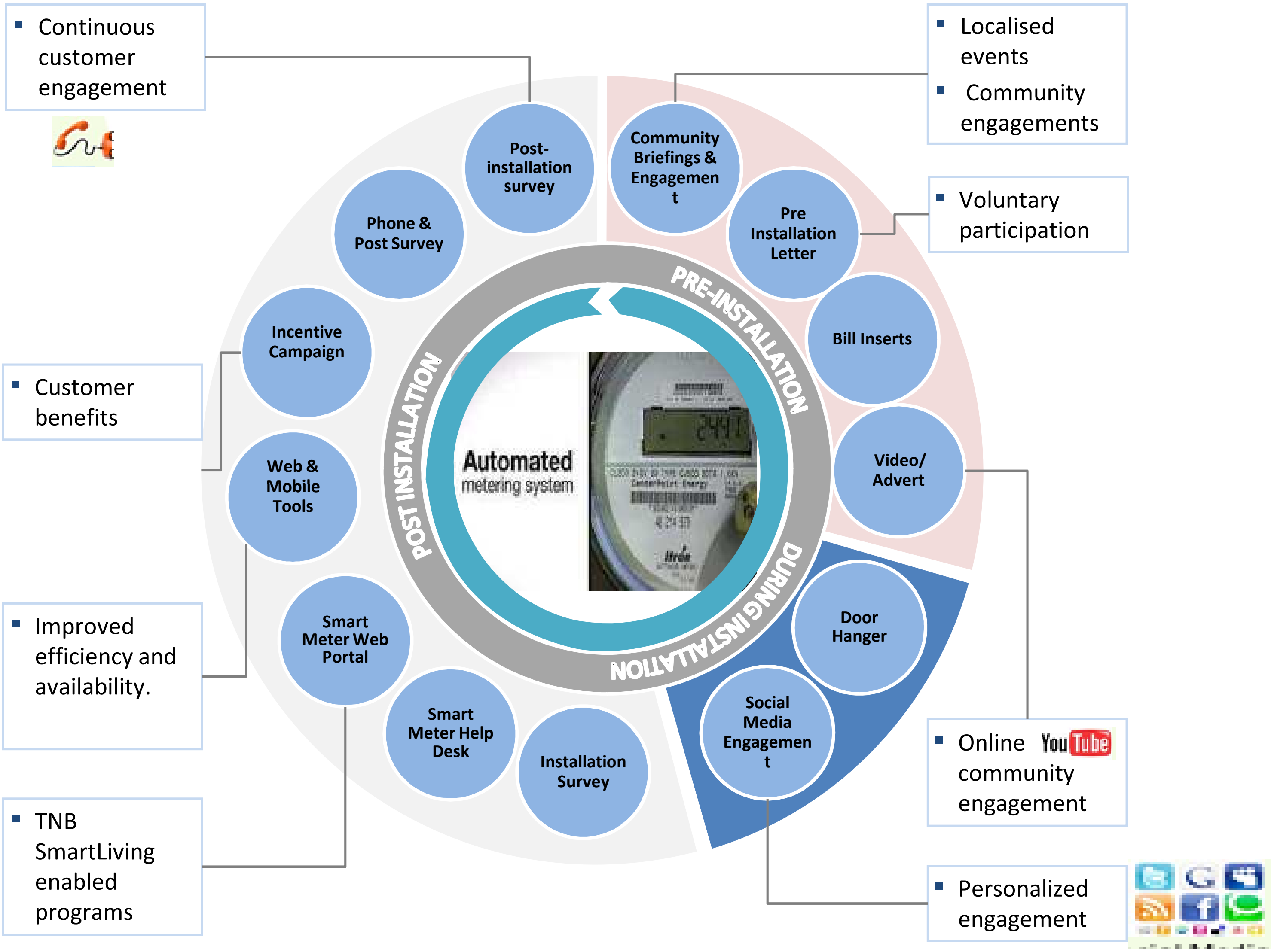
Better. Brighter.

Edison SmartConnect Customer Experience



COTO – cut over to operation

Pilot Smart Meter Deployment in Melaka - Customer Experience



Better. Brighter.

Challenges & Critical Enabler - Interoperability

- As information technology (IT) and operations technology (OT) converge in the smarter grid of the future, network interoperability will be the starting point and precondition for all.

- Interoperability in multiple network technology must support end-to-end data quality and security, network system performance and application service provisioning and management.

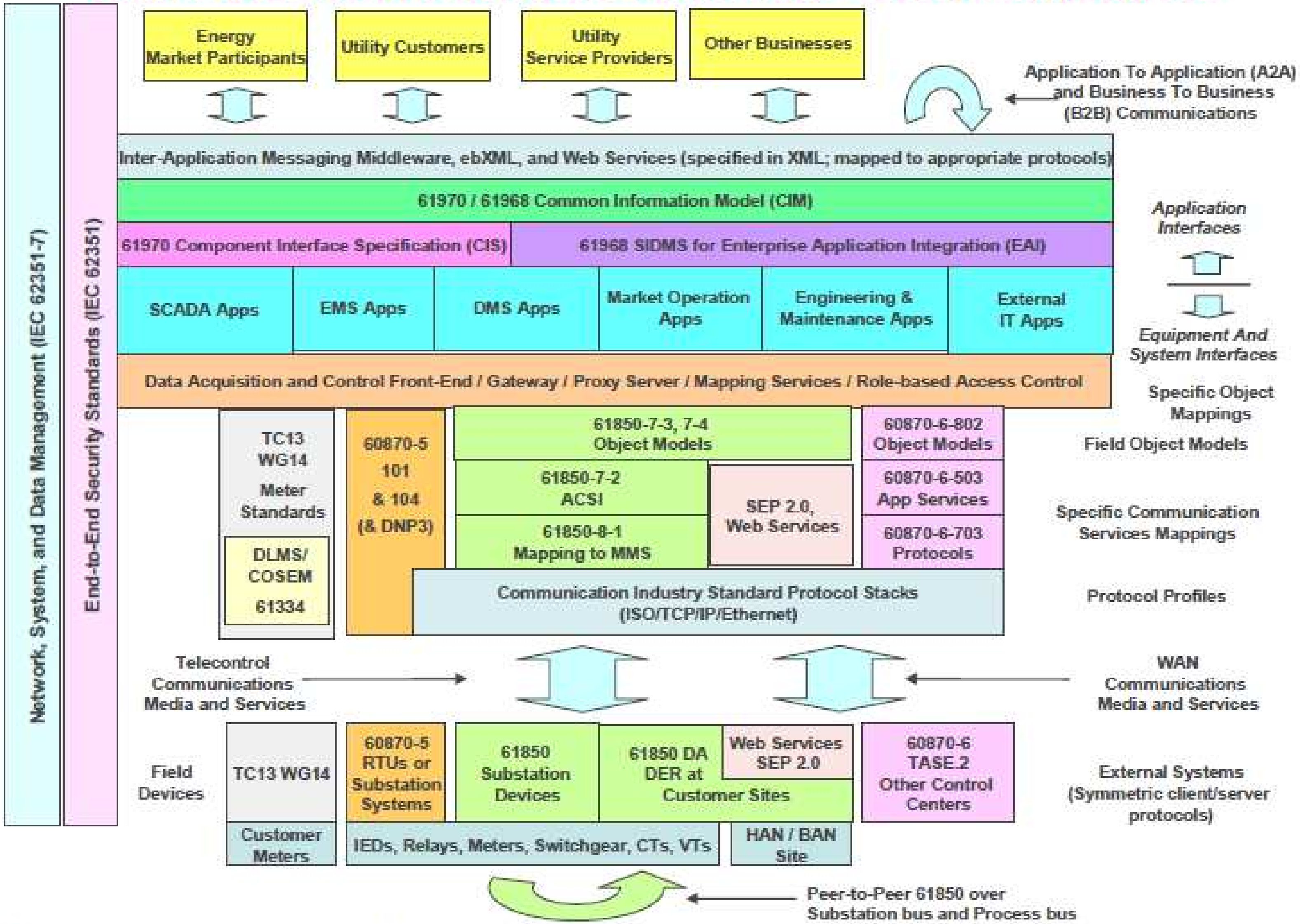
SGIP
SMART GRID
INTEROPERABILITY
PANEL

IEC TC 57
IEC TECHNICAL COMMITTEE

NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 3.0

Smart Grid and Cyber-Physical Systems Program Office
and Energy and Environment Division,
Engineering Laboratory

Current IEC TC57 Reference Architecture – Scope and Layers



*Notes: 1) Solid colors correlate different parts of protocols within the architecture.
2) Non-solid patterns represent areas that are future work, or work in progress, or related work provided by another IEC TC.

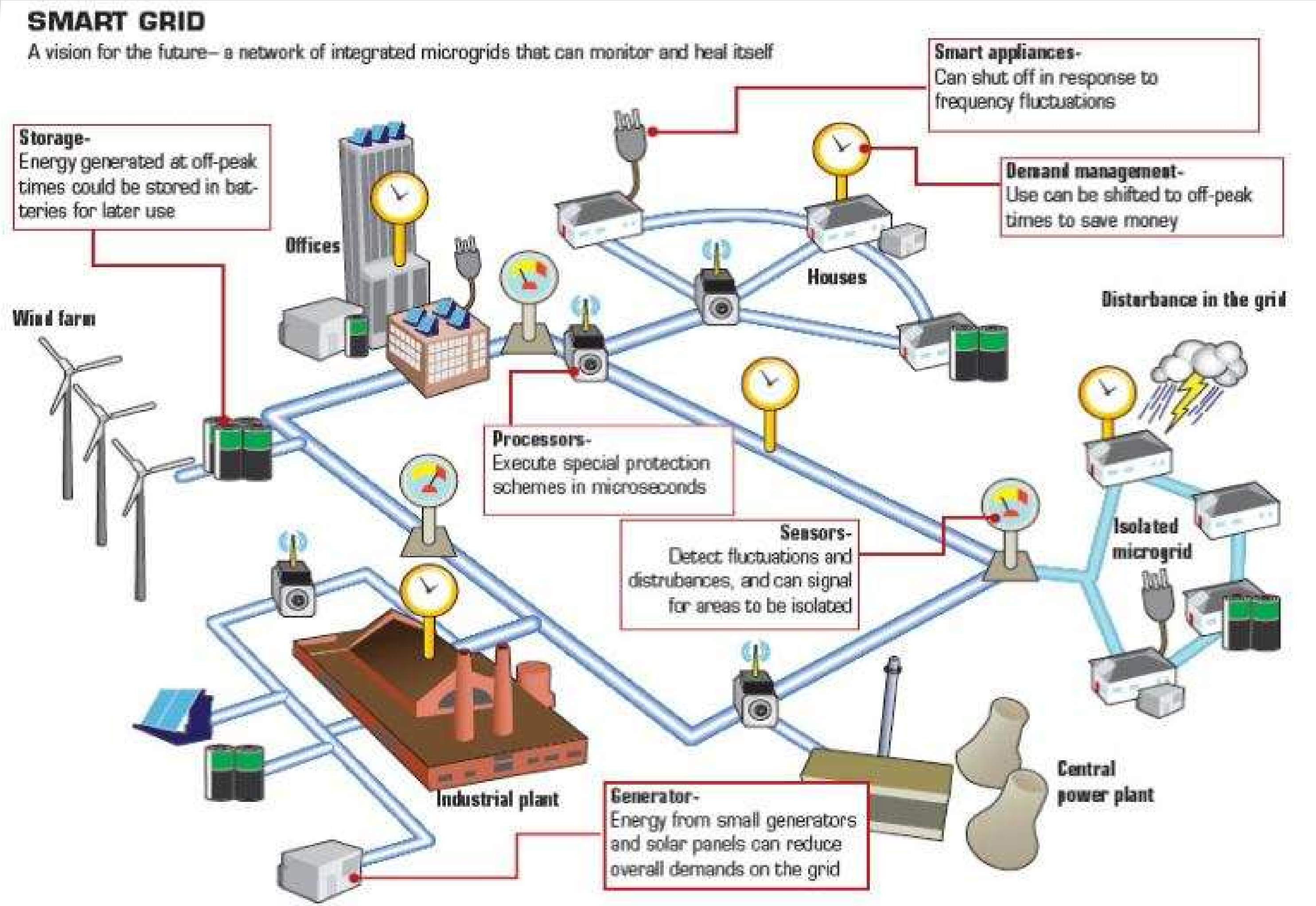
Challenges & Enabler – Infrastructure Development

- Shared vision for the smart electricity among stake holders
- Widespread deployment of Intelligent Electronic Devices (IED)
  - Retrofitting of existing components are required to make them "smarter" as well as keeping the cost lower
- Infrastructure for integrated communications need to be fully developed


Smart Grid gets boost via Pemandu lab in Apri
Malaysia's slow development of its Smar
Grid programme will get a boost from

South Korea Smart Grid Test-bed with budget allocation of $200 million has been made ($68 mil public funds, $170 mil private investment)

Host of New Technologies



A typical vision of a smart grid includes networks of micro-grids that can detect problems and disconnect themselves temporarily, demand-response equipment that shuts off nonessential appliances and other power drains if necessary, and sources of distributed power that can take some of the load off central power plants.

Part 5:
IPPs and PPAs

TENAGA NASIONAL BERHAD (200866 - W)

IPP's Beginning

- Beginning 1993, IPP license was awarded to a total of 15 IPPs to build and operate generating plants in Peninsular Malaysia.

1993
- YTL
- GSP
- SEV
- PDP
- PTEK

1998 - 1999
- TNB Janamanjung
- TTPC
- NUR
- Pahlawan

2001 - 2003
- Prai Power
- GB3 Sdn Bhd
- Panglima
- Kapar Energy

2003 – 2005
- Tanjung Bin
- TNB Janamanjung
- Jimah Energy

First Generation IPPs (1993)

Second Generation IPPs (1998 - 1999, 2001 - 2003)

Third Generation IPPs (2003 – 2005)

Independent Power Producers

	IPP	Capacity (MW)	Type of Plant	Fuel	Owner
First Generation IPPs	YTL Power Sdn Bhd	1,170	CCGT	Gas	YTL
	SEV Energy Ventures Sdn Bhd	1,303	CCGT	Gas	Malakoff
	Genting Sanyen Power Sdn Bhd	762	CCGT	Gas	Genting Group
	Powertek Bhd	434	OCGT	Gas	Tanjong
	PD Power Sdn Bhd	436.4	OCGT	Gas	Sime Darby
Second Generation IPPs	Pahlawan Power Sdn Bhd	322	CCGT	Gas	Tanjong
	Kapar Energy Ventures Sdn Bhd	2,420	CSP, OCGT	Coal, MFO, Gas	60% TNB/40% Malakoff
	Panglima Power Sdn Bhd	720	CCGT	Gas	Tanjong
	GB3 Sdn Bhd	640	CCGT	Gas	Malakoff
	Prai Power Sdn Bhd	350	CCGT	Gas	Malakoff
	Teknologi Tenaga Perlis Consortium Sdn Bhd (TTPC)	650	CCGT	Gas	Jati Cakerawala
Third Generation IPPs	TNB Janamanjung Sdn Bhd	2,070	CSP	Coal	TNB
	Tanjung Bin Power Sdn Bhd	2,100	CSP	Coal	Malakoff
	Jimah Energy Ventures Sdn Bhd	1,400	CSP	Coal	Jimah Teknik

Note: CCGT (Combined-Cycle Gas Turbine), OCGT (Open Cycle Gas Turbine), CSP (Conventional Steam Plant)

PPA :Product & Payment

Product

Minimum Take or Pay (Energy)
(YTL only)

Capacity & Energy

Payment

Energy Payment Only
(YTL only)

Capacity & Energy Payment

1st Generation

Product

Capacity & Energy

Payment

Capacity & Energy Payment

2nd Generation

Product

Capacity & Energy

Payment

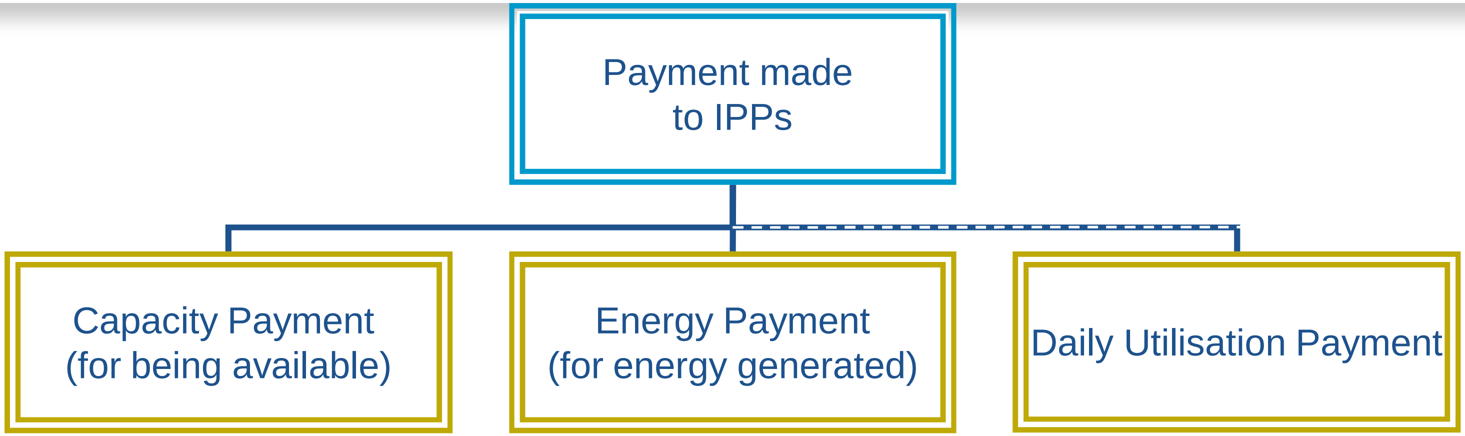
Capacity, Utilisation & Energy Payment

3rd Generation

1998 | 2002

PPA Signed

PPA: Product and Payment (2)



- Capacity Payment
  - → for availability & performance of the plant
  - → Payment is based on availability regardless of whether the plant is despatched or not.
- Daily Utilisation Payment (for Jimah & Tanjung Bin only)
  - → introduced to encourage IPP to share demand risks and to reduce fixed capacity payment when plant is not utilised.
- Energy payment
  - → Payment for energy despatched from the plant
  - → covers fuel & variable operating costs

ANY QUESTIONS?

TENAGA NASIONAL BERHAD (200866 - W)