

Solar PV – The Game Changer in Malaysian Electricity Supply Industry

By
MPIA

16 February 2015



Thailand

Cumulative solar in 2014 :
1.2GW

Solar market size (2014):
800MW

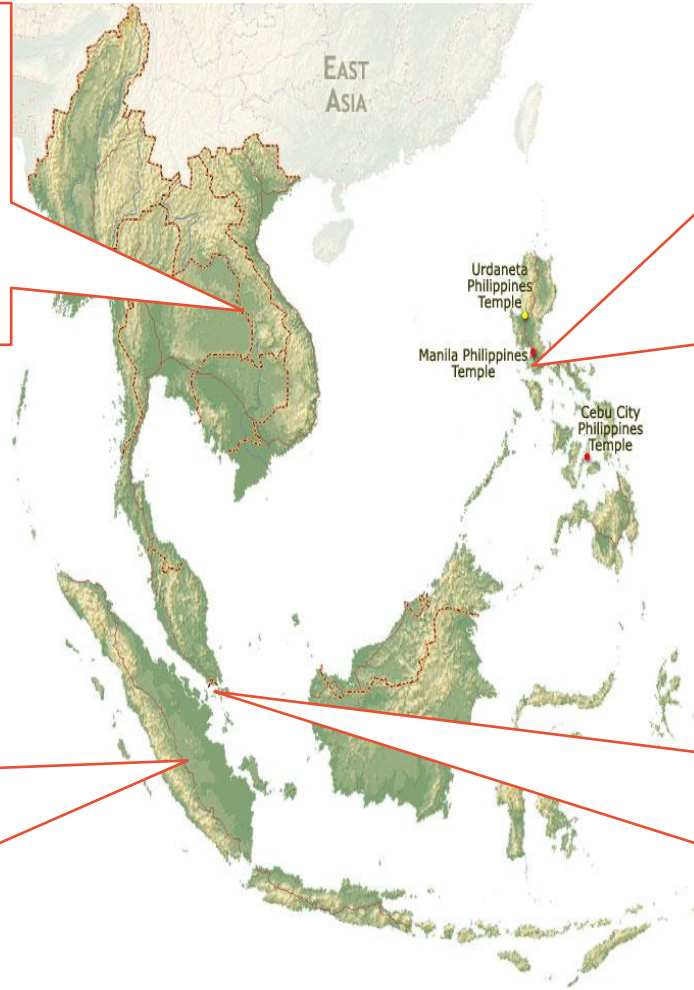
Solar pipeline from
2015~2016: 1GW

Solar Capacity target in
2021: 3.8GW

Indonesia

Solar market size
(2014): 20MW

Solar Capacity target:
620GW (2020)



Philippines

Solar market size (2014):
112MW

Solar Capacity Target
(2015)
: 500MW

Available for Net
Metering policy with no
quota limit with Php
5/kWh (RM 0.40/kWh)

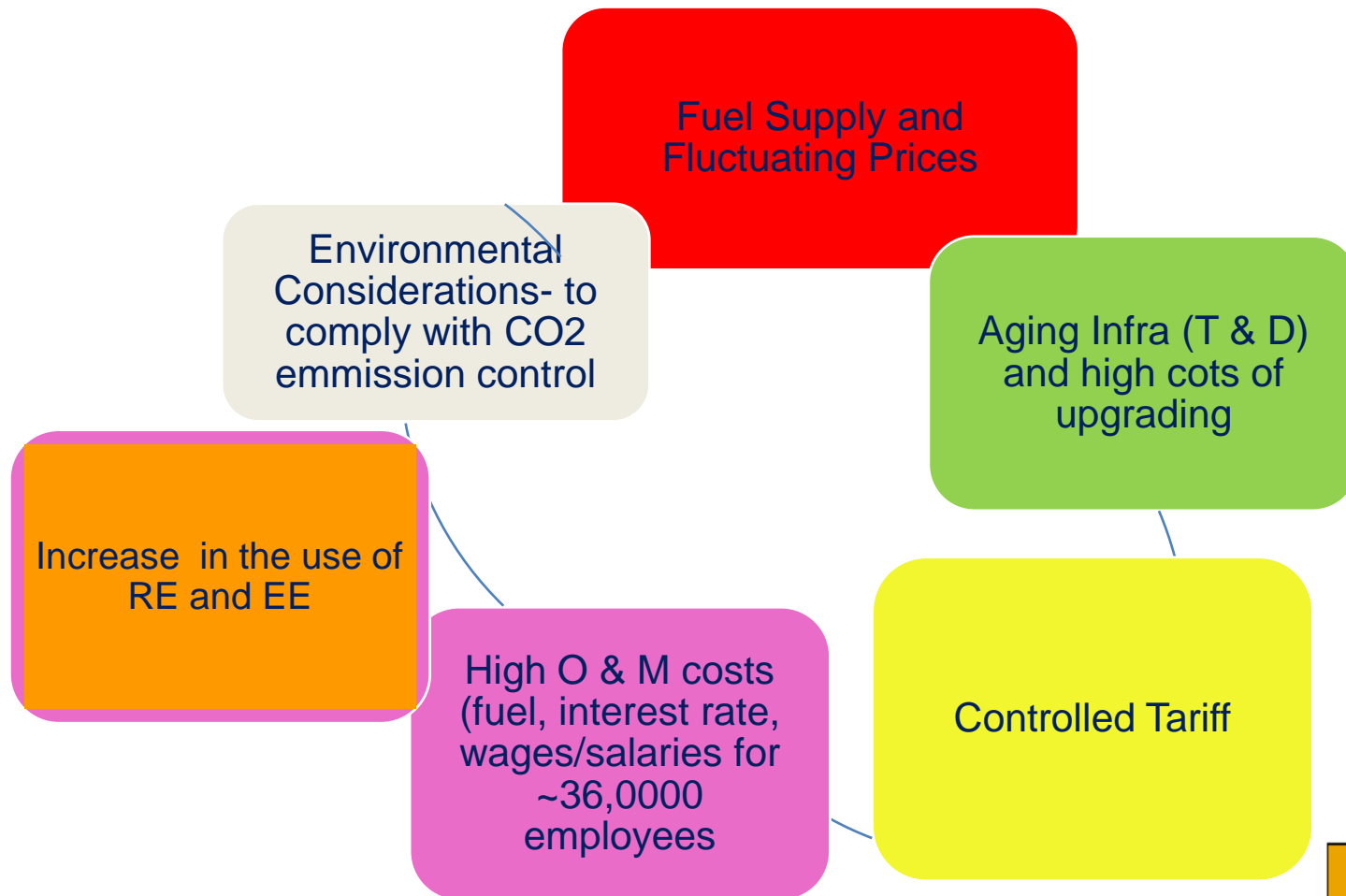
Solar market size
(2015) for HDB project
: 50MWp

Allow consumer to
export solar energy
back with S\$0.05/kWh
lower from the tariff
rate.

Why Solar PV is Game Changer?

- **Electricity users** now have the choice and capability to generate its own electricity more efficiently and at competitive costs.
- **Electricity users** are now more sophisticated and better informed and can manage how electricity is used through the use of modern communication devices and technology. All these affect revenues to conventional electricity supplier like TNB.
- **Complies** with the demand of clean environmental considerations
- **Infinite source of fuel** - SUN

Current Challenges Facing Regulated Electric Utilities



Current Challenges Facing Electricity Customers (Commercial and Industrial)

Contribution to RE Fund is burdensome
~ (RM 300 million a year) – on average
RM > 24,000 per month (FMM as of
2014)

Penalties imposed for being energy efficient
(SIT)

Tariff Structures

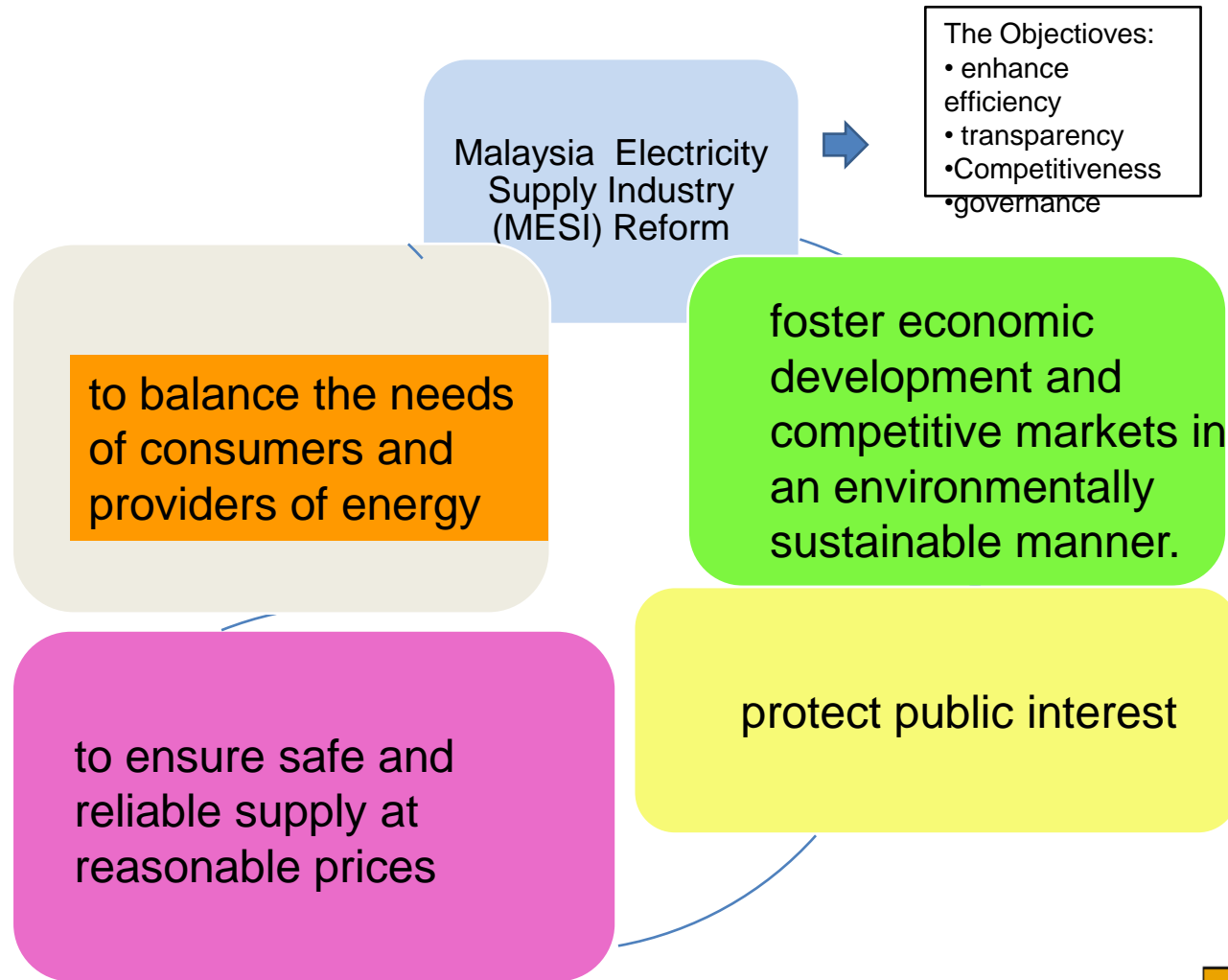
Stringent supply of gas

Minimum Wage

Water rationing

Tariffs involve 16 different industries, with many kinds of incentives i.e. off peak Electricity Rider, Time of Day Use, Off Peak Tariff Rider, TOU and SIT

Current Challenges Facing Electricity Regulators (Suruhanjaya Tenaga)



Challenges Facing Policy Makers (KeTTHa, EPU, PEMANDU, dll)

- To meet CO₂ emission reduction targets
- Energy Security

Transformation of Malaysia Electricity Supply Industry in Malaysia

- Public Electric Utilities 3 (TNB, SEB and SESCO)
- IPP's
 - Conventional (18 in Peninsular and 8 in Sabah)
 - RE:100 (solar PV/MH, Biomass, Landfill)
 - Micro IPP's~ 2000 (solar PV), 4000 at the end of 2015.
- Distributed Licencees (DL): 200

Strategies Options for Electric Utilities

In the face of dramatic change, electric companies will need to examine a host of potential strategies and associated business models to solve the equation for disruption.

DEFENSIVE
"STATUS QUO"

AND



Up to the Meter

Keep costs low

Redesign customer rates

Increase kWh sales

OR

OFFENSIVE
"EXPLOIT CHANGE"

AND



Up to the Meter

Generally low risk

Leverage new technologies,
i.e., grid-scale storage and
renewables

OR

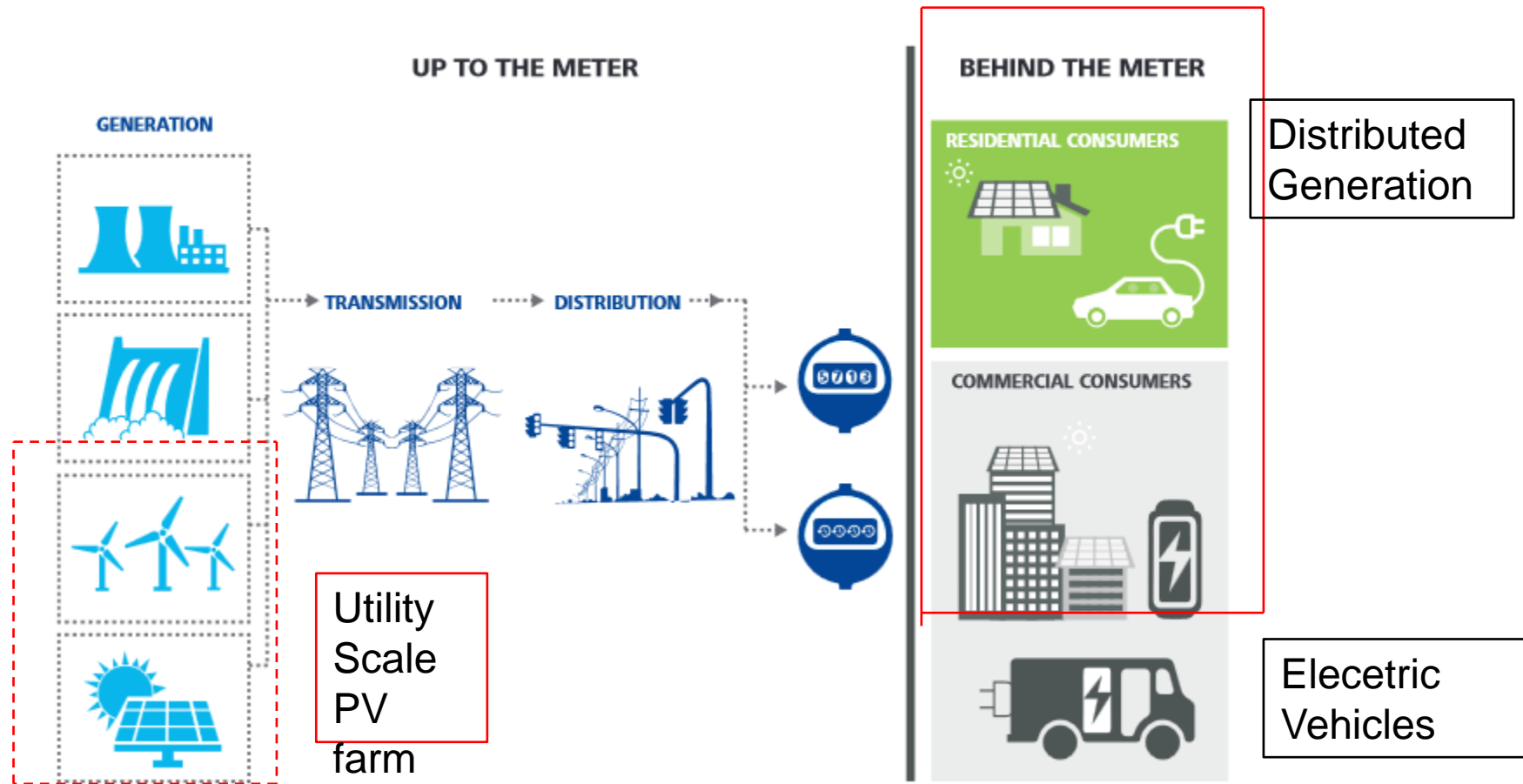


Behind the Meter

New frontier of opportunity
and risk, i.e., distributed
generation and energy
management technologies

Strategies Options for Electric Utilities

Up to and Behind the Meter



ACTS RELATED TO PUBLIC AND PRIVATE LICENCEES (SELF-CONSUMPTION)

ELECTRICITY SUPPLY ACT 1990

EFFICIENT MANAGEMENT OF ELECTRICAL ENERGY REGULATIONS 2008

[P.U.(A)444]

ARRANGEMENT OF REGULATIONS

PART I

PRELIMINARY

Regulation 9. Licence for a private installation.

A licence for a private installation shall be in Form F as prescribed in the First Schedule.

Regulation 10. Fee for public or private installation.

(1) The fee payable for the issue of a licence for a public installation, other than the generation referred to in subregulation (2), shall be on an annual basis and shall be at the rate as prescribed in Part III of the Second Schedule.

(2) The fee payable for the issue of a licence for a public installation for generating electricity using biomass, hydro power, solar power, geothermal power, wind power, waves and tides sources with aggregate power not exceeding 10MW shall be paid on an annual basis and shall be at the rate as prescribed in Part IIIA of the Second Schedule.

Interpretation

2. In these Regulations, unless the context otherwise requires –

“private installation licensee” means a person granted a licence under the Act to use, work or operate an installation solely for the supply of electrical energy to and for the use thereof on the person’s own property or premises;

Application

3. (1) These Regulations shall apply to -

- (a) any installation which receives electrical energy from a licensee or supply authority with a total electrical energy consumption equal to or exceeding 3,000,000 kWh as measured at one metering point or more over any period not exceeding six consecutive months; or
- (b) any installation which is used, worked or operated by a private installation licensee with a total net electrical energy generation equal to or exceeding 3,000,000 kWh over any period not exceeding six consecutive months.

ELECTRICITY SUPPLY ACT 1990

LICENCE FOR GENERATION AND SUPPLY OF ELECTRICITY

PART I - GRANT OF LICENCE

**GARIS PANDUAN
TATACARA PELESENAN
PEMBEKALAN ELEKTRIK**

KRITERIA PERTIMBANGAN PERMOHONAN LESEN

1. Dalam menilai sesuatu permohonan lesen, pertimbangan dari segi perundangan untuk pemberian lesen adalah tertakluk kepada permohonan memenuhi keperluan mana-mana satu atau lebih peruntukan-peruntukan dalam Akta Bekalan Elektrik 1990 dan Akta Suruhanjaya Tenaga 2001 seperti berikut :

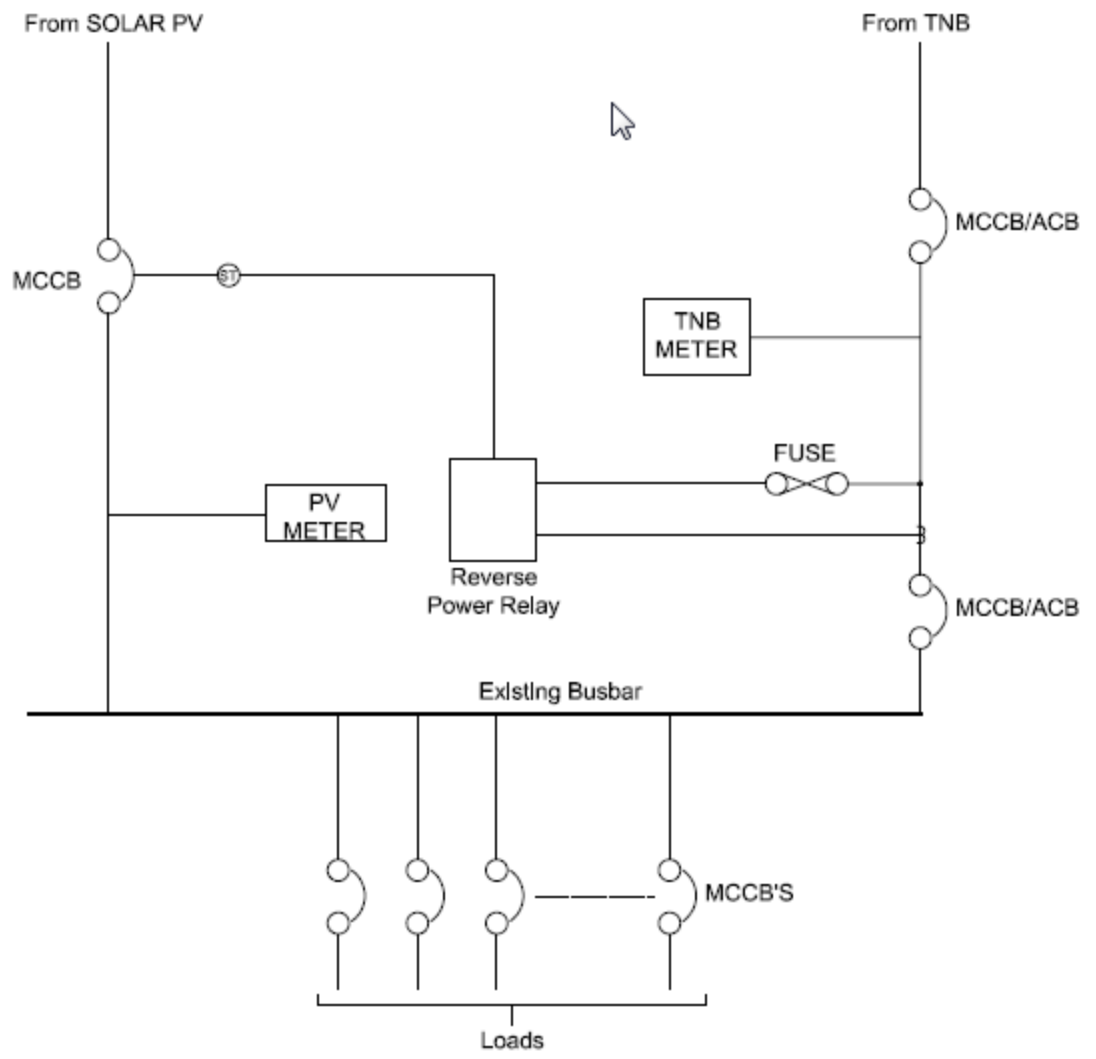
- i) menggalakkan persaingan dalam penjanakuasaan dan pembekalan elektrik untuk, antara lain, memastikan pembekalan elektrik yang optimum pada harga-harga yang munasabah;
- ii) menggalakkan dan menggiatkan penjanakuasaan tenaga bagi tujuan kemajuan ekonomi Malaysia;
- iii) memastikan bahawa segala tuntutan yang munasabah untuk bekalan elektrik dipenuhi;
- iv) memastikan kepentingan pelanggan dari segi harga yang berpatutan, *'security and reliability of supply'* dan kualiti perkhidmatan;
- v) memastikan pemegang lesen dapat membiayai perjalanan aktiviti-aktiviti yang dibenarkan sepertimana yang dinyatakan dalam lesen mereka untuk dijalankan; dan
- vi) menggalakkan penggunaan dan pembekalan tenaga dengan lebih cekap.

“Pemasangan persendirian” adalah pemasangan yang dikendalikan oleh pemegang lesen atau pemunya semata-mata bagi membekalkan tenaga kepada dan penggunaannya di atas harta atau premis kepunyaan pemegang lesen atau pemunya itu sendiri, atau, dalam hal seorang pengguna, yang mengambil elektrik daripada pemasangan awam atau pihak berkuasa bekalan, bagi kegunaan hanya di atas atau premis kepunyaan pemegang lesen atau pemunya sahaja;

2. Jenis aktiviti/pemasangan yang diberikan lesen persendirian adalah seperti berikut:
 - i) mengendali talian atas atau kabel elektrik bawah tanah sendiri yang melintasi jalan/jambatan/sungai/talian telekom/lintasan keretapi yang dimiliki oleh orang lain;
 - iv) mengendali penjanaan elektrik untuk kegunaan sendiri dengan menggunakan teknologi yang cekap seperti *co-generation* atau penjanaan dengan sumber-sumber tenaga yang boleh diperbaharui (*Renewable Energy – RE*) atau dengan sebab-sebab lain yang tertentu.

Self-
Consumption

**SELF CONSUMPTION SOLAR PHOTOVOLTAIC SYSTEM CONNECTION
TO SWITCHBOARD C/W REVERSE POWER RELAY**



REVISIONS		
NO.	DATE	DESCRIPTION
APPROVALS		
DESIGNED BY		
CHECKED BY		
NOTES		
1. All works to be done in accordance with the relevant standards and specifications.		
2. All works to be done in accordance with the relevant standards and specifications.		
3. All works to be done in accordance with the relevant standards and specifications.		
4. All works to be done in accordance with the relevant standards and specifications.		
5. All works to be done in accordance with the relevant standards and specifications.		
6. All works to be done in accordance with the relevant standards and specifications.		
7. All works to be done in accordance with the relevant standards and specifications.		
8. All works to be done in accordance with the relevant standards and specifications.		
9. All works to be done in accordance with the relevant standards and specifications.		
10. All works to be done in accordance with the relevant standards and specifications.		
PROJECT INFORMATION		
PROJECT NO.		
CLIENT		
LOCATION		
DATE		
PROJECT TITLE		
SELF CONSUMPTION SOLAR PHOTOVOLTAIC SYSTEM CONNECTION TO SWITCHBOARD C/W REVERSE POWER RELAY		
DESIGNED BY		
CHECKED BY		
DATE		
PROJECT DESCRIPTION		
This project involves the design and installation of a self-consumption solar photovoltaic system with a reverse power relay for protection against backfeeding into the grid.		
PROJECT SCOPE		
The scope of this project includes the design, procurement, and installation of all electrical equipment and materials required for the system.		
PROJECT DELIVERABLES		
The deliverables for this project include a detailed design, a bill of materials, and a complete installation.		
PROJECT RISK ASSESSMENT		
The risks associated with this project are low, and they can be managed through proper planning and execution.		



GUIDING PRINCIPLES OF NET ENERGY METERING

Guiding Principles for Net Energy Metering

- **Self-Generation and Access to the Utility Grid.**
Qualified retail electricity customers should have the right to install RE generation facilities such as rooftop solar PV systems at their premises and connect them to the utility grid without discrimination.

Guiding Principles for Net Energy Metering

- **Value of Solar PV generated Electricity.** Rooftop customer owned solar PV generation systems can offer many benefits to the electricity supply system and the nation. These include:-
 - Reduction in utility capacity and energy generation requirements, especially during the peak demand period which coincides with the PV generation profile.
 - Reduction in distribution system losses.
 - Avoidance or deferral of distribution and transmission system reinforcement investments.
 - Hedging against fuel price volatility especially for imported fuel.
 - Reduction in greenhouse gas emissions and water use.
- These benefits should be quantified to determine the true value of solar PV generated energy delivered to the grid.

Guiding Principles for Net Energy Metering

- **Capacity Limit on Rooftop PV Installations.**
Reasonable capacity limit should be imposed on the total rooftop PV generation as it forms “generation at point of use” and is a valuable addition to the national electricity generation fuel mix.

Guiding Principles for Net Energy Metering

- **Access to Billing Data.** Billing statements from utilities should clearly show the consumer's total electricity use, the PV generated electricity, and where applicable the net energy exported to the utility grid. This “credit” should be available for the consumer to utilize when required.
- **Metering Equipment.** The present 1-meter system under RE Act should continue
- **Customer Classes.** All customers should be able to participate in net metering.

Cost Benefits of NEM

Benefits of NEM

- Roof top PV systems is planned to be limited to 30% of National maximum demand to shave the system peak and reduce the need for costly peak period generation plant like OCGT.
- Foregone revenues for PETRONAS to provide gas for power generation will be eliminated as gas subsidies are removed.
- The peak period energy generation cost to a utility is normally well above the average retail selling price. Thus TNB should see a net gain in profits even though its overall revenue may drop slightly. This is because every KWh sold during the peak period that is generated from conventional generation plant would have cost more than the average revenue

Benefits of NEM

- TNB will also gain in reducing the consumption of natural gas in running Open Cycle Gas Turbines during peak demand as it will be met by solar PV during that period.
- Saving in CO2 emissions. Assuming on average, a conventional fossil fired power plant emits 0.70 ton /MWhr of CO2, the total reduction in CO2 emission amounts to 5.17 million tons in the 10 year period.
- Improves energy security for the country as it reduces country dependence on gas and coal.
- The new employment created.
- Encourage growth of local components manufacturing capacity.

Enablers

- Investment Tax Allowance (ITA)
- Capital Allowance
- Net Energy Metering Act.

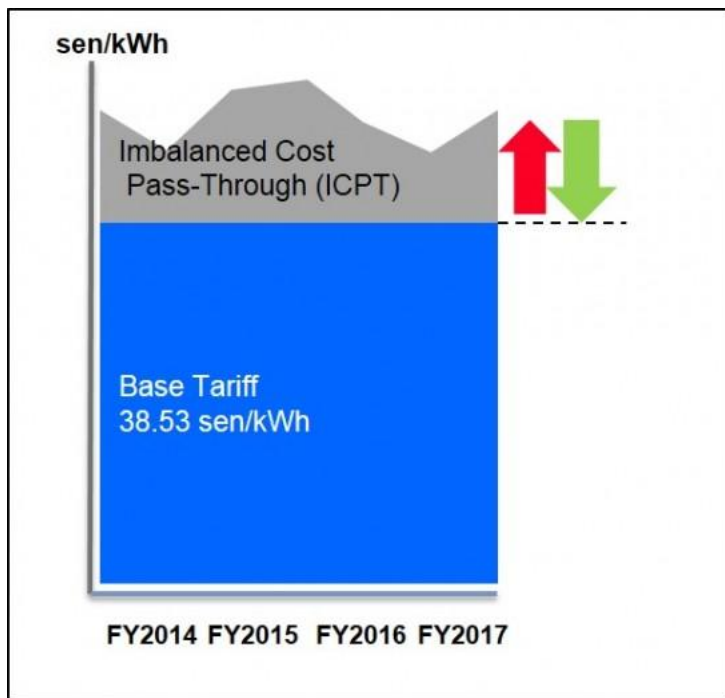
Issues with NEM

- Utility perceived income shrinks
- Cost of maintaining the grids will be shifted to middle and lower income groups.
- stability of the grids
- Premium value of clean electricity

Our Challenges now...

- To determine the capacity of roof top solar PV for next coming years (at least for next 5 years)
- To determine the tariff rates that take into account all factors .

Cost Analysis On Peak Demand Generation, Transmission & Distribution



69% Generation : RM0.2639

21% Distribution : RM 0.0824

9% Transmission : RM0.0366

1% Operation : 0.0024

Assumption 1

Assumption 2

Assumption 3

Generation Cost (OCGT) (RM/kWh)	Transmission Cost (RM/kWh)	Distribution Cost (RM/kWh)	Total Cost (RM/kWh)- LV	Total Cost (RM/kWh)- MV
0.5	0.0366	0.0824	0.619	0.5366
0.45	0.0366	0.0824	0.569	0.4866
0.35	0.0366	0.0824	0.469	0.3866

	Tariff Rate (RM/kWh)	Electricity Cost (RM/kWh)	TNB Gain/Loss
Tariff B - Low Voltage Commercial	0.509	0.619	-0.11
Tariff C1 - Medium Voltage General Commercial	0.365	0.537	-0.172
Tariff D -Low Voltage Industrial	0.441	0.619	-0.178
Tariff E2 - Medium Voltage Peak/Off Peak Industrial	0.355	0.537	-0.182

	Tariff Rate (RM/kWh)	Electricity Cost (RM/kWh)	TNB Gain/Loss
Tariff B - Low Voltage Commercial	0.509	0.569	-0.06
Tariff C1 - Medium Voltage General Commercial	0.365	0.487	-0.122
Tariff D -Low Voltage Industrial	0.441	0.569	-0.128
Tariff E2 - Medium Voltage Peak/Off Peak Industrial	0.355	0.487	-0.132

	Tariff Rate (RM/kWh)	Electricity Cost (RM/kWh)	TNB Gain/Loss
Tariff B - Low Voltage Commercial	0.509	0.469	0.04
Tariff C1 - Medium Voltage General Commercial	0.365	0.387	-0.022
Tariff D -Low Voltage Industrial	0.441	0.469	-0.028
Tariff E2 - Medium Voltage Peak/Off Peak Industrial	0.355	0.387	-0.032



Why PV Rooftop Installation Should Be Given priority !

	Generation Cost (RM/kWh)	Transmission Cost (RM/kWh)	Distribution Cost (RM/kWh)	Total Cost (RM/kWh)- LV
PV Utility Scale	0.45	0.0366	0.0824	0.569
PV rooftop	0.480	0	0	0.480

- Reduce max demand and energy. In commercial and industrial sector. This reduces high electricity cost.
- Maximize the use of unutilized roofs of residential, commercial and Industrial premises.
- Improve and reinforce distribution network.
- Delay in expensive upgrading distribution network
- Create more jobs for locals

PROPOSED NEM PROGRAM FOR COMMERCIAL & INDUSTRIAL ROOF TOP—ANALYSIS OF ITS MACRO & MICRO ECONOMIC COSTS & BENEFITS

Commercial & Industry Rooftop
Installation – Net Energy
Metering (NEM)

Proposed NET ENERGY METERING - Terms

and Conditions

PHASE 1 (less than 5% of energy mixed)

Maximum Installed Capacity : 80% of

Declared Maximum Demand

Energy Export Limit : Shall not be more than
25% of Energy Imported

Export Tariff : 10% lower than Import Tariff

Proposed NO CAP & NO QUOTA

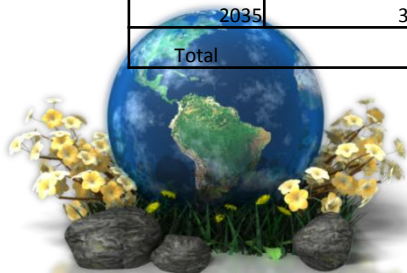
! PHASE 2 (More than 5% of energy mixed)

- Every kWh generated require to pay power grid fee
- Power grid Fee to be determined & negotiated by all Stake Holders

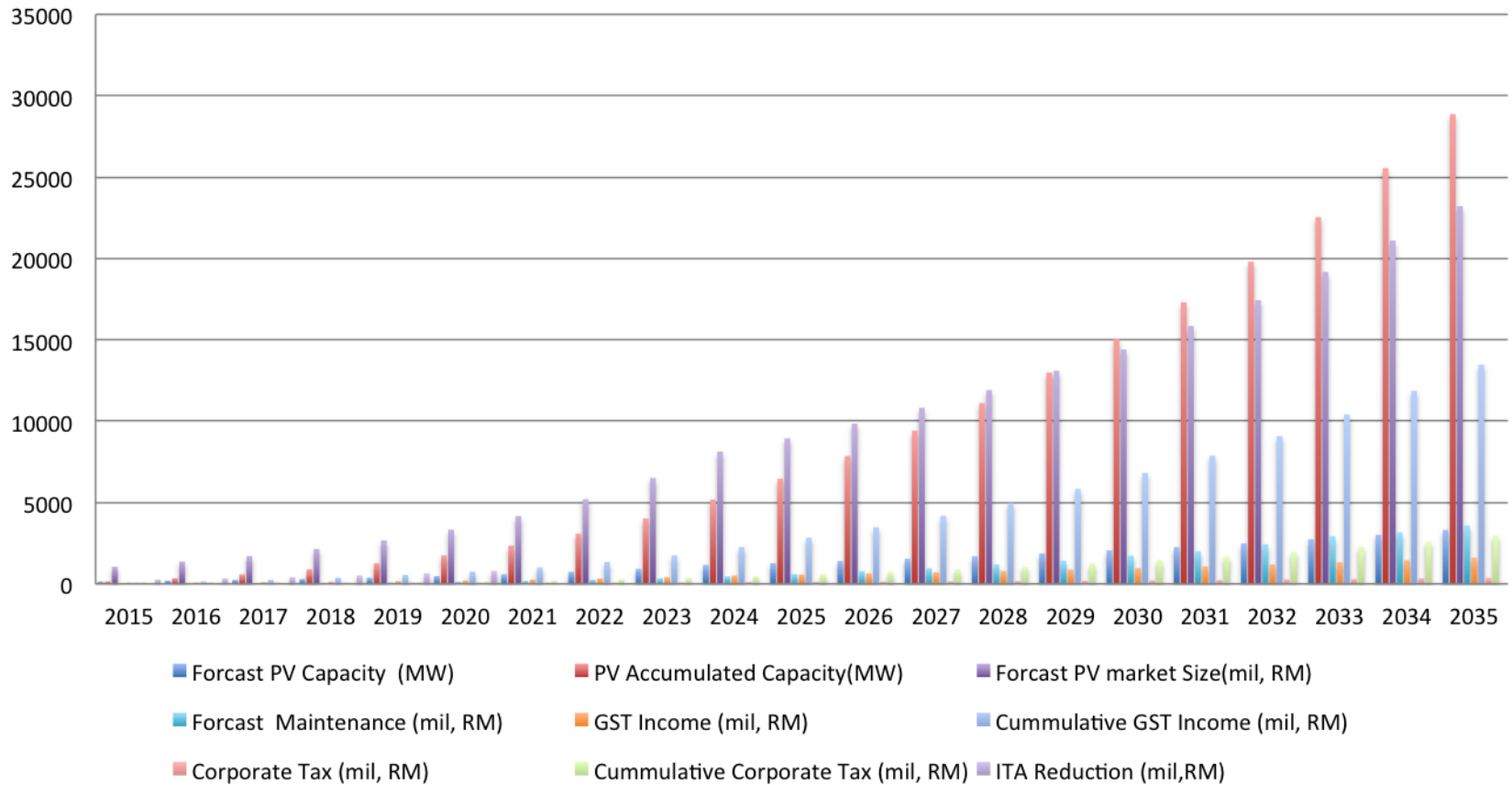


Government Tax Reduction, Tax Gain and Direct GDP Contribution – NEM Program

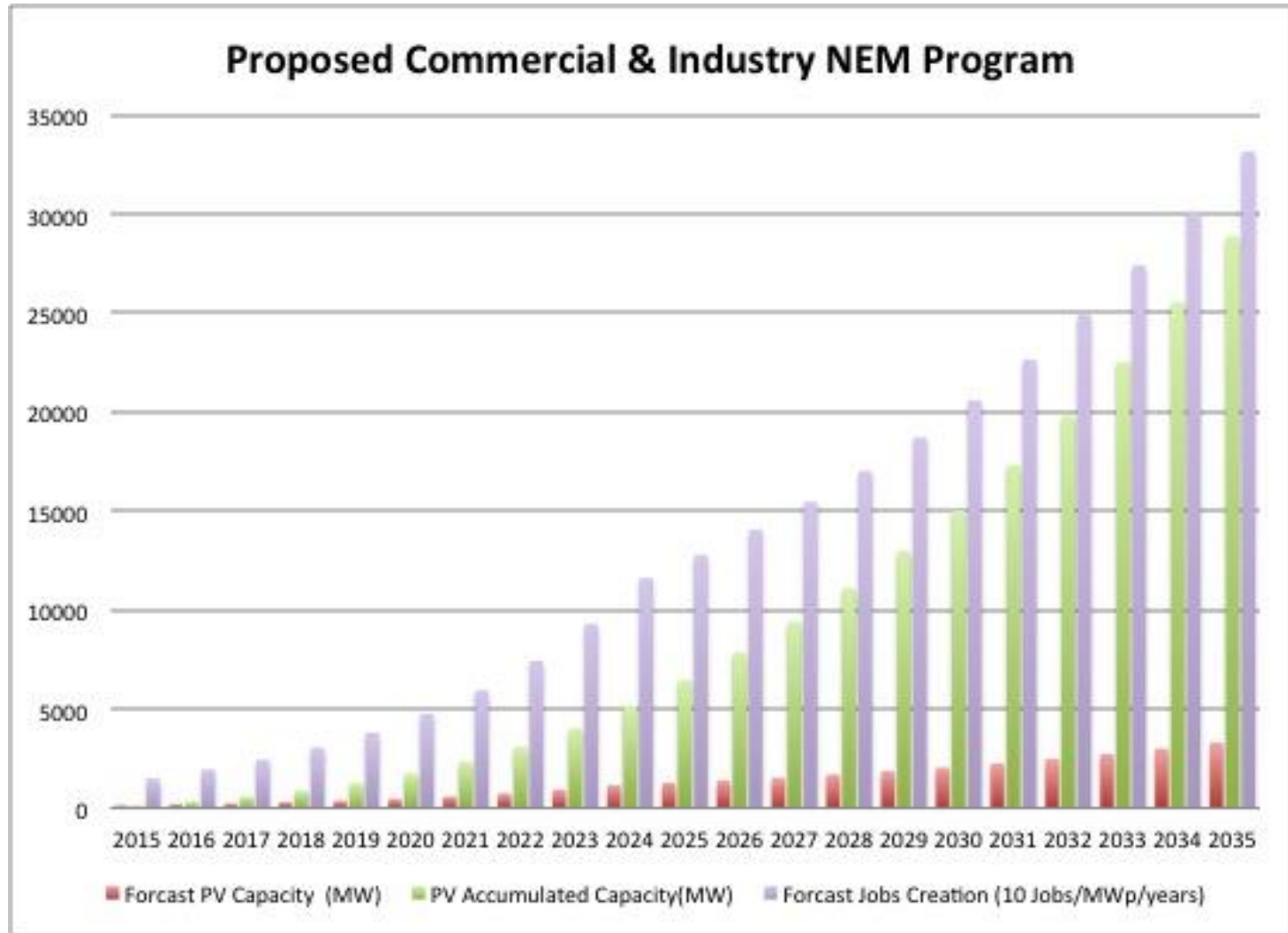
Year	Forecast PV Capacity (MW)	PV Accumulated Capacity(MW)	Forecast PV market Size(mil, RM)	Forecast Maintenance (mil, RM)	GST Income (mil, RM)	Cummulative GST Income (mil, RM)	Corporate Tax (mil, RM)	Cummulative Corporate Tax (mil, RM)	ITA Reduction (mil,RM)
2015	150	150	1,050.00	-	63.00	63.00	12.60	12.60	262.50
2016	195	345	1,365.00	-	81.90	144.90	16.38	28.98	327.60
2017	244	589	1,708.00	-	102.48	247.38	20.50	49.48	409.92
2018	305	894	2,135.00	58.90	131.63	379.01	27.03	76.51	512.40
2019	381	1,275	2,667.00	89.40	165.38	544.40	34.15	110.66	640.08
2020	476	1,751	3,332.00	133.88	207.95	752.35	43.20	153.86	799.68
2021	595	2,346	4,165.00	183.86	260.93	1,013.28	54.39	208.25	-
2022	744	3,090	5,208.00	258.65	328.00	1,341.28	68.70	276.95	-
2023	930	4,020	6,510.00	340.67	411.04	1,752.32	86.30	363.25	-
2024	1162	5,182	8,134.00	465.37	515.96	2,268.28	108.78	472.03	-
2025	1278	6,460	8,947.40	599.88	572.84	2,841.12	121.77	593.79	-
2026	1406	7,866	9,842.14	785.24	637.64	3,478.76	136.95	730.74	-
2027	1547	9,413	10,826.35	956.14	706.95	4,185.71	152.86	883.61	-
2028	1701	11,114	11,908.99	1,201.34	786.62	4,972.33	171.74	1,055.35	-
2029	1871	12,986	13,099.89	1,418.48	871.10	5,843.43	191.24	1,246.59	-
2030	2059	15,044	14,409.88	1,740.19	969.00	6,812.44	214.68	1,461.27	-
2031	2264	17,309	15,850.86	2,016.05	1,072.02	7,884.45	238.60	1,699.87	-
2032	2491	19,799	17,435.95	2,435.48	1,192.29	9,076.74	267.68	1,967.55	-
2033	2740	22,539	19,179.55	2,925.27	1,326.29	10,403.03	300.36	2,267.91	-
2034	3014	25,553	21,097.50	3,171.50	1,456.14	11,859.17	329.29	2,597.20	-
2035	3315	28,869	23,207.25	3,595.59	1,608.17	13,467.34	364.78	2,961.98	-
Total			202,079.76	22,375.88	13,467.34		2,961.98		2,952.18



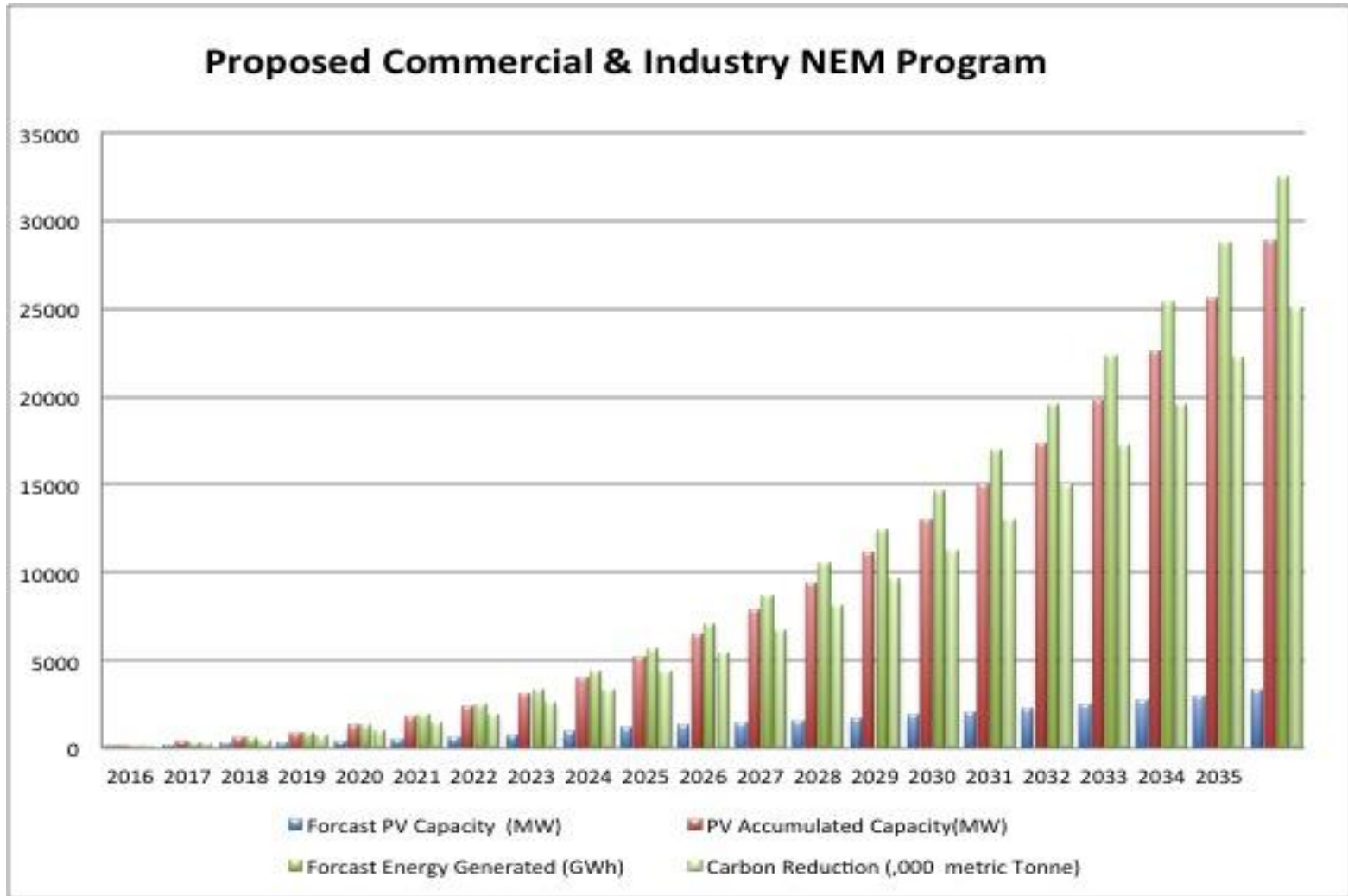
Proposed Commercial & Industry NEM Program



Direct Jobs Creation – NEM Program



Reduction CO2 Emission –NEM Program



PROPOSED EXTENSION OF FIT (10years)+NEM
FOR RESIDENTIAL – ANALYSIS OF ITS MACRO
& MICRO ECONOMIC COSTS AND NENEFITS

Proposed Residential -10 years FIT +NEM

2016-2025 FIT Program (10 years Power Purchase Agreement)

Proposed FIT Rate

2016 -2017 – RM1.00/kWh , Capacity : 125MWp
2018- 2019 – RM0.95/kWh , Capacity : 225MWp
2020- 2021 – RM0.90/kWh, Capacity : 325MWp
2022- 2023 - RM0.85/kWh, Capacity : 425MWp
2024- 2025 – RM0.80/kWh, Capacity : 525MWp

After 10years PPA , Automatic Grant with NEM license.

2026-2035 Net Energy Metering Program

Proposed TERMS AND CONDITIONS

10 Years PPA – FIT Program

Installation Capacity : Maximum 5kWp per installation (Single Phase)

Maximum 12kWp per installation (Three Phase)

Applicant : Must be property Owner (No Quota Limit Per Applicant)

Net Energy Metering

Installation Capacity :

Single Phase System

Maximum 5kWp per installation without Energy

Storage

No limit per installation with Energy Storage

Three Phase System

Maximum 12kWp per installation without Energy

Storage

No limit per installation with Energy Storage



Residential - FIT + NEM Program 's Cost, Fund , Tax Income & Direct GDP Contribution

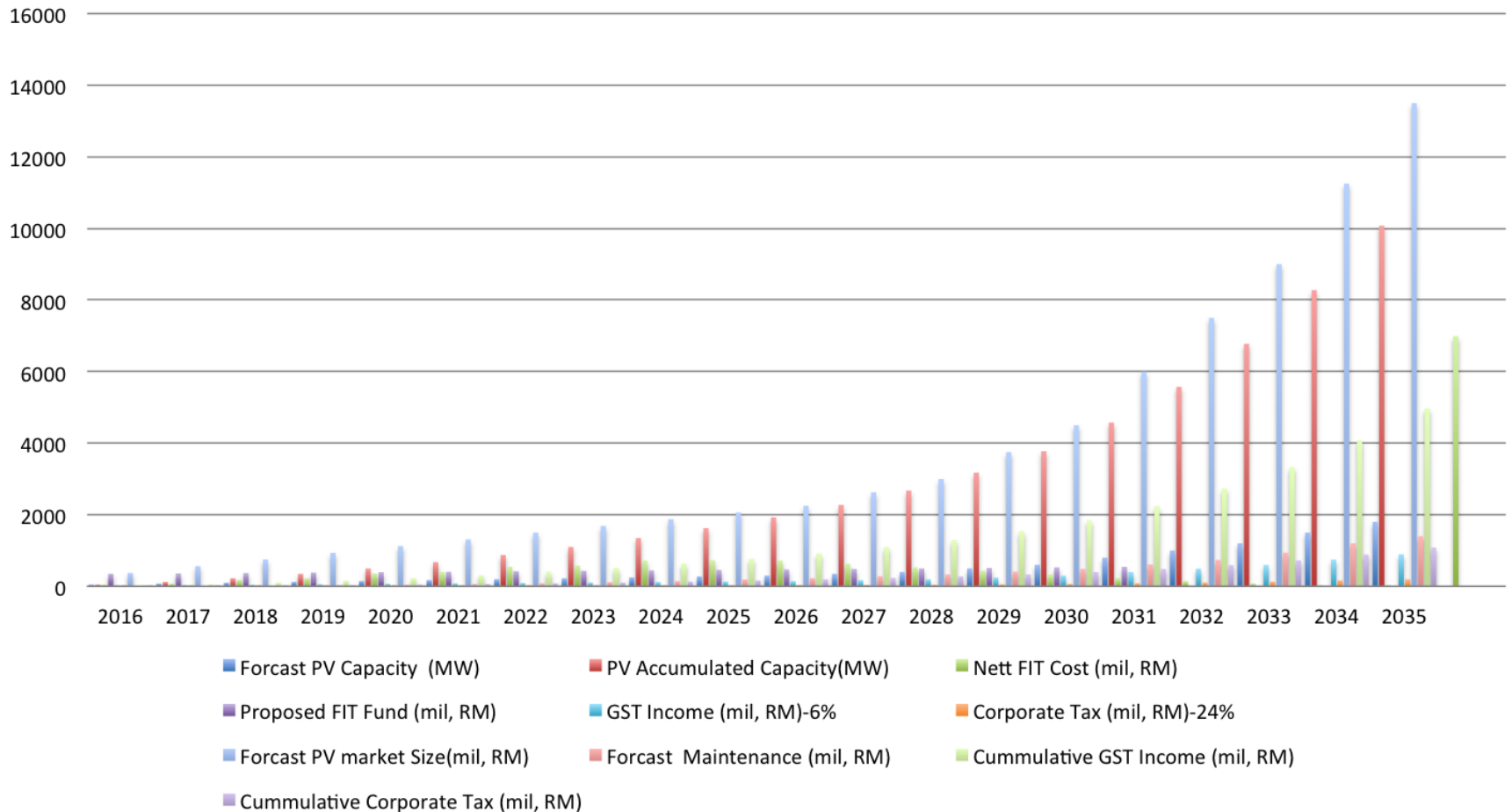


Year	Forcast PV Capacity (MW)	PV Accumulated Capacity(MW)	Nett FIT Cost (mil, RM)	Forcast PV market Size(mil, RM)	Forcast Maintenance (mil, RM)	GST Income (mil, RM)-6%	Cummulative GST Income (mil, RM)	Corporate Tax (mil, RM)-24%	Cummulative Corporate Tax (mil, RM)	Proposed FIT Fund (mil, RM)
2016	50	50	43.75	375.00	-	22.50	22.50	4.50	4.50	350.00
2017	75	125	74.57	562.50	-	33.75	56.25	6.75	11.25	360.50
2018	100	225	180.60	750.00	-	45.00	101.25	9.00	20.25	371.32
2019	125	350	221.51	937.50	27.00	57.87	159.12	11.90	32.15	382.45
2020	150	500	358.59	1,125.00	42.00	70.02	229.14	14.51	46.66	393.93
2021	175	675	400.63	1,312.50	63.00	82.53	311.67	17.26	63.92	405.75
2022	200	875	547.17	1,500.00	85.05	95.10	406.77	20.04	83.96	417.92
2023	225	1100	581.22	1,687.50	115.76	108.20	514.97	23.03	106.99	430.46
2024	250	1350	715.07	1,875.00	145.53	121.23	636.20	25.99	132.98	443.37
2025	275	1625	729.02	2,062.50	187.54	135.00	771.20	29.25	162.23	456.67
2026	300	1925	716.92	2,250.00	225.74	148.54	919.75	32.42	194.65	470.37
2027	350	2275	628.66	2,625.00	280.78	174.35	1,094.09	38.24	232.89	484.48
2028	400	2675	531.91	3,000.00	331.83	199.91	1,294.00	43.96	276.85	499.02
2029	500	3175	431.31	3,750.00	409.69	249.58	1,543.58	54.83	331.68	513.99
2030	600	3775	331.10	4,500.00	486.26	299.18	1,842.76	65.67	397.35	529.41
2031	800	4575	235.54	6,000.00	607.06	396.42	2,239.18	86.57	483.92	545.29
2032	1000	5575	150.71	7,500.00	735.71	494.14	2,733.33	107.66	591.58	
2033	1200	6775	79.09	9,000.00	941.35	596.48	3,329.81	130.59	722.17	
2034	1500	8275	28.95	11,250.00	1,201.17	747.07	4,076.88	163.83	886.00	
2035	1800	10075	3.94	13,500.00	1,397.25	893.84	4,970.71	195.53	1,081.54	
Total	10075		6,990.27	75,562.50	7,282.73	4,970.71		1,081.54		7,054.91



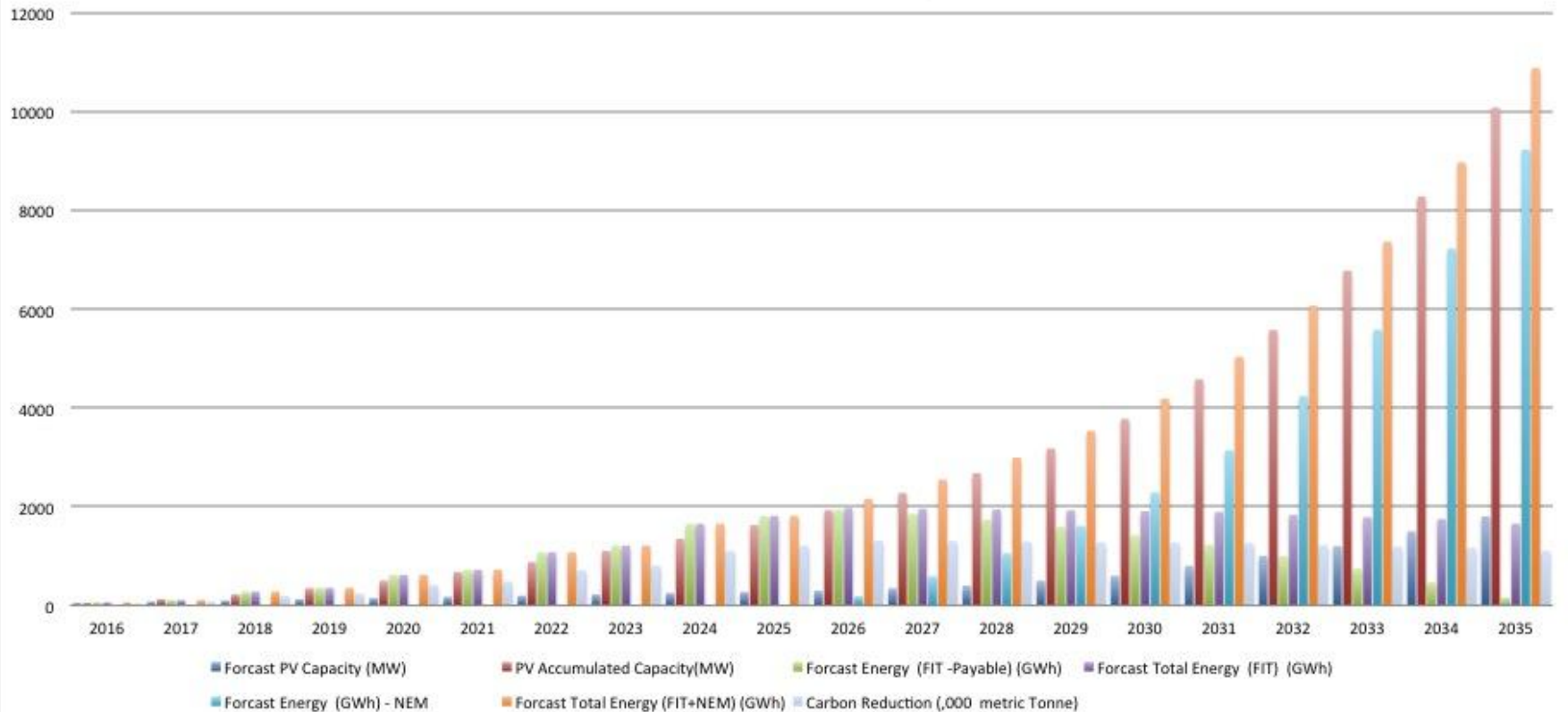
Residential - FIT + NEM Program 's Cost, Fund , Tax Income & Direct GDP Contribution

Proposed Individual/Residential FIT (10 years) + NEM Program

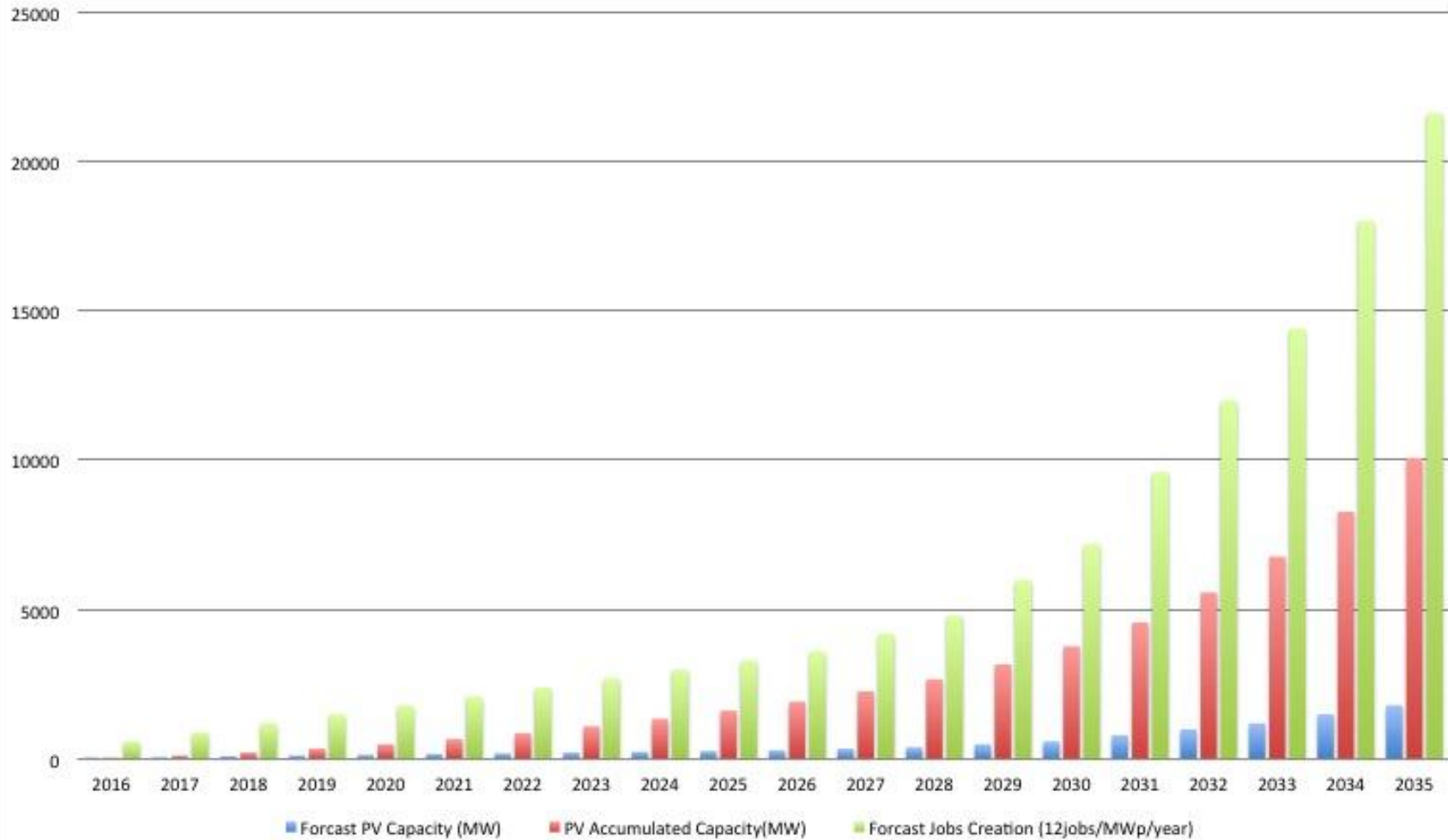


Reduction CO2 Emission

Residential -FIT +NEM Program



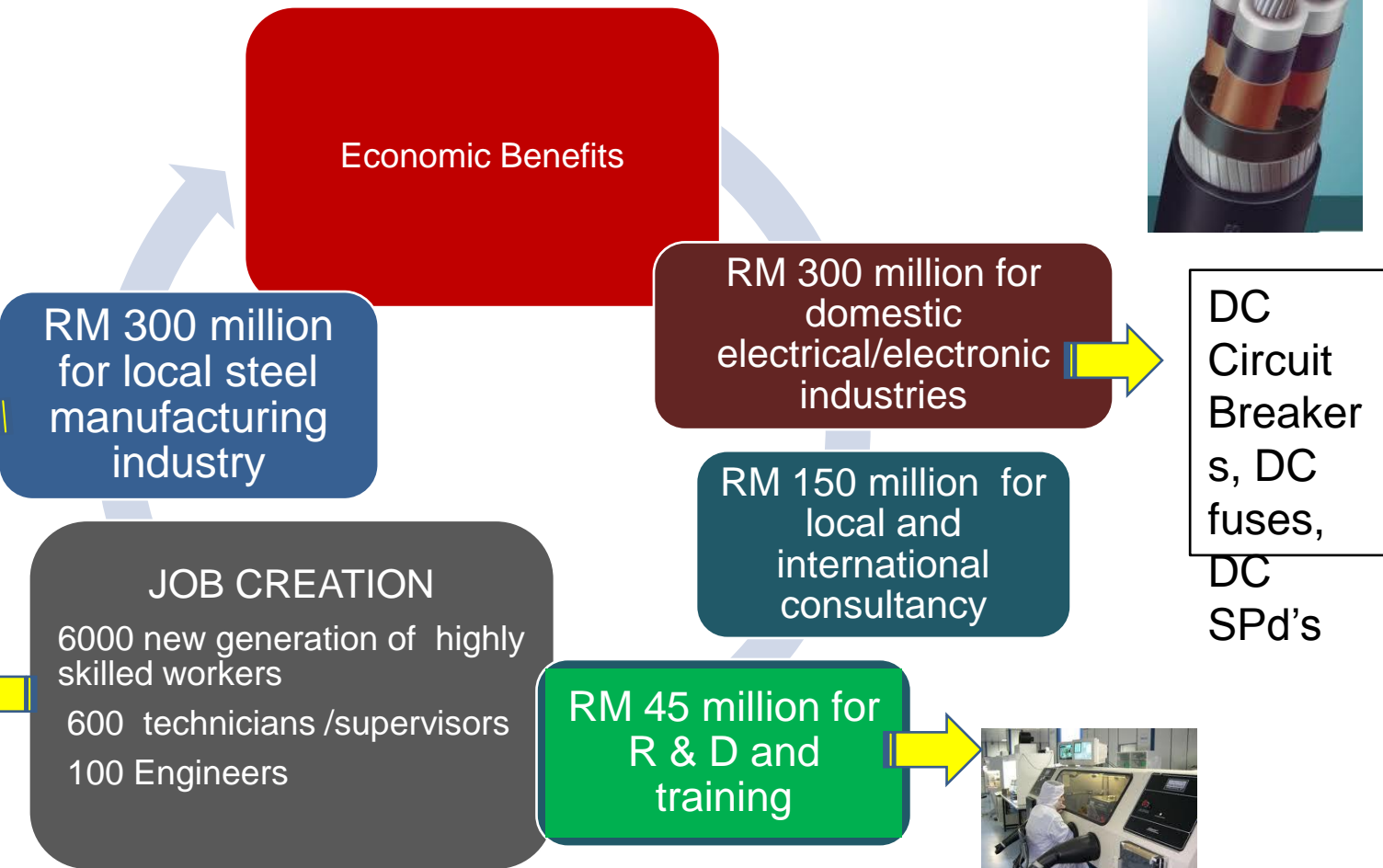
Proposed Individual/Residential FIT + NEM Program (Jobs Creation)



WHAT PV INDUSTRY Can Contribute

Business Spin Offs of PV Industry

Local Manufacturing of Solar PV Components



RM 300 million for local steel manufacturing industry

Economic Benefits

RM 300 million for domestic electrical/electronic industries

DC Circuit Breakers, DC fuses, DC SPd's

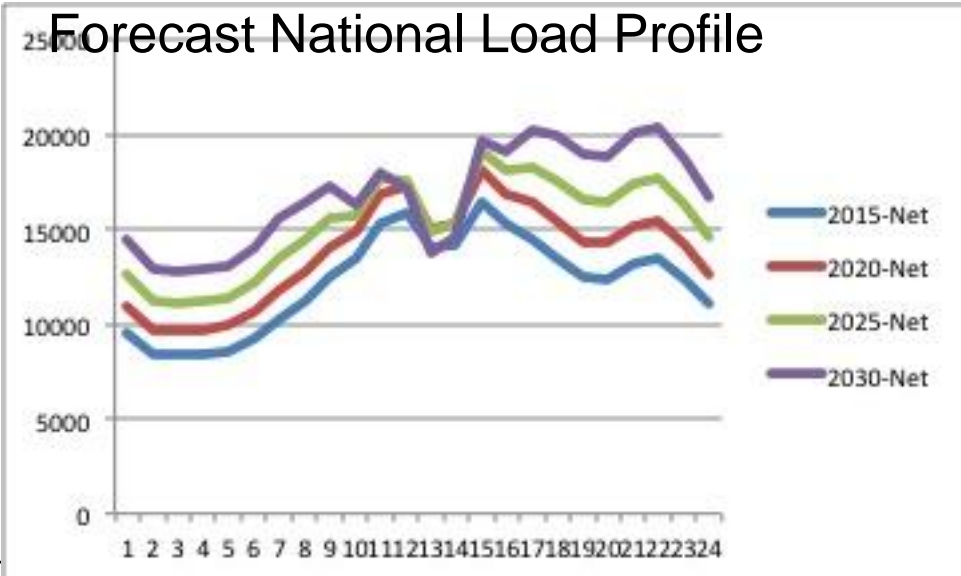
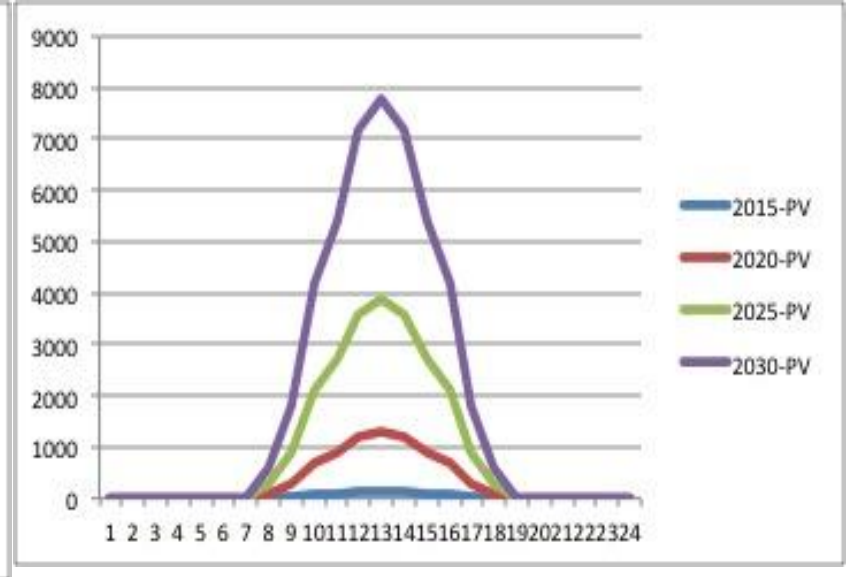
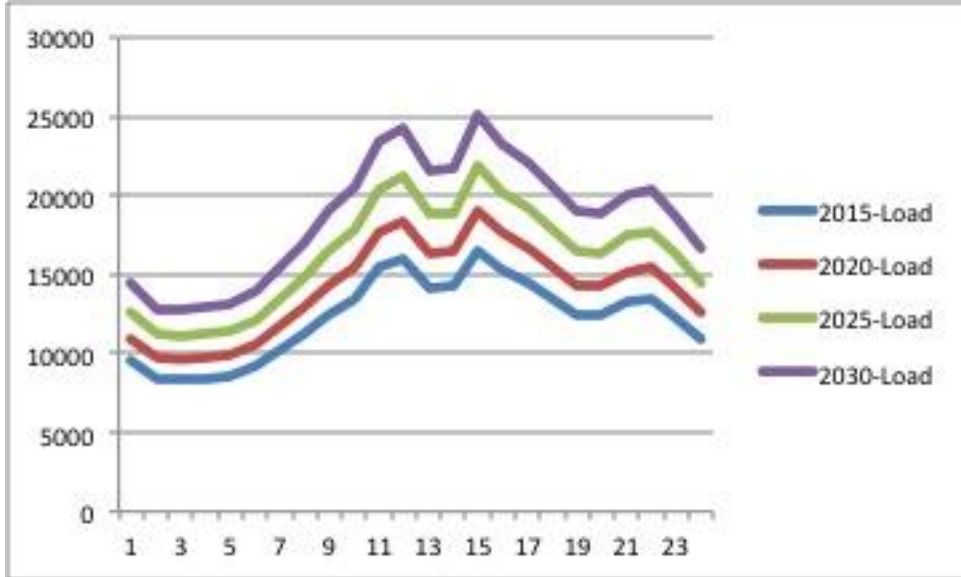
RM 150 million for local and international consultancy

JOB CREATION
6000 new generation of highly skilled workers
600 technicians /supervisors
100 Engineers

RM 45 million for R & D and training



The Impact of Rooftop PV installation on National Load Profile



Forecast PV Generation

2015 – 200MW
 2020 – 2000MW
 2025 – 6000MW
 2030 – 12000MW



Proposed Strategies and Future PV Capacity for Malaysia

Commercial and Industry - NET ENERGY METERING (2015 – 2025)

2015-2020 - With Investment Tax Allowance (1.75GW)

2021-2025 - Without Investment Tax Allowance (5 GW)

2026-2035 - Without Investment Tax Allowance (22.4 GW)

Extension of FIT +NEM – Individual/Residential Quota Only (2016-2025)

2016-2025 – 10 years Power Purchase Agreement (1.65GW) - 200,000 rooftops

2026-2035 – Net Energy Metering (8.45GW) – 1,000,000 rooftops

PV Utility Scale Installation - Future



Direct GDP Contribution and Direct Jobs Creation

Commercial and Industry - NET ENERGY METERING (2015 – 2025)

2015-2020 -Direct GDP Contribution (RM12.25bil) & Direct Jobs Creation (476)

2021-2025 - Direct GDP Contribution (RM32.96bil) & Direct Jobs Creation (12,

2026-2035 – Direct GDP Contribution (RM156.8bil) & Direct Jobs Creation(33,1

Residential FIT +NEM (2016-2025)

2016-2025 – Direct GDP Contribution (RM12.2bil) & Direct Jobs Creation (3300

2026-2035 – Direct GDP Contribution (RM63.37bil) & Direct Jobs Creation (183



Now Everyone Can Generate Own Electricity



MPiA

CONCLUSIONS



BRIGHT FUTURE OF SOLAR PV IN MALAYSIA AND WORLDWIDE



Lets Change the World, Use Solar Energy