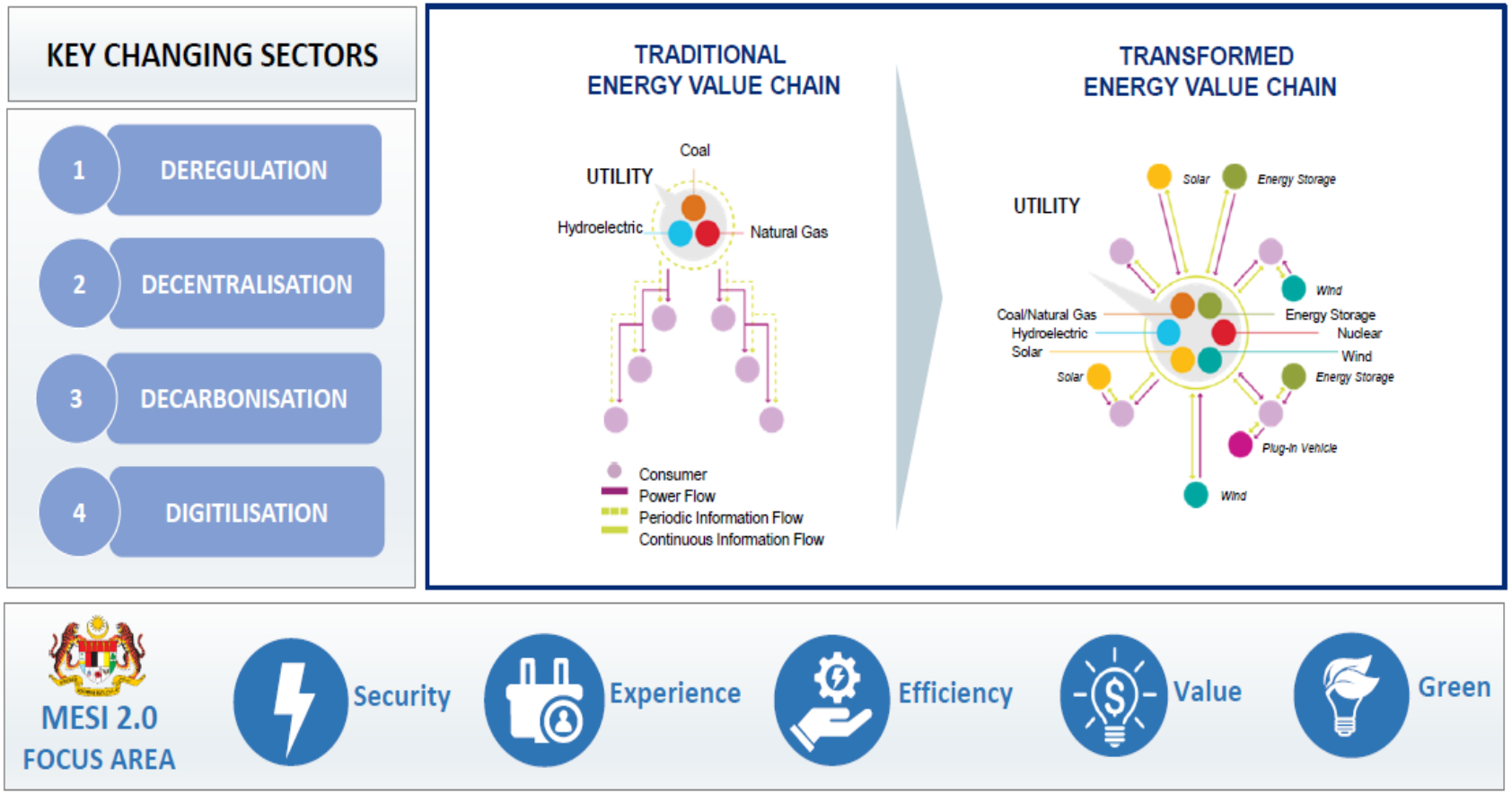
SMART GRID IN MALAYSIA :
POLICY, PLANNING AND INSTITUTIONAL ASPECTS

SURAIYA NADZRAH RAMLI
ENERGY COMMISSION, MALAYSIA

5th ASEAN SMART GRID CONGRESS
3-4 OCTOBER 2019 | Le Grandeur Palm Resort Hotel, Johor

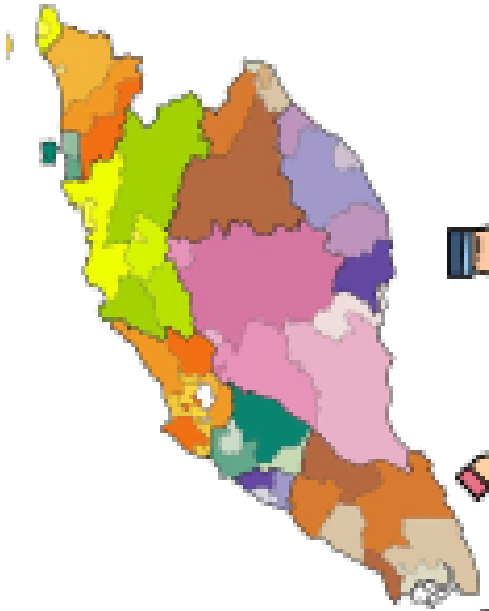
2 key external challenges (4D's revolution & MESI 2.0)



Source: **TNB Distribution Network's Smart Utility Roadmap (conceptual) by TNB**

REIMAGINING MESI 2025

Enhancing Governance of Malaysia Electricity Supply Industry (MESI)

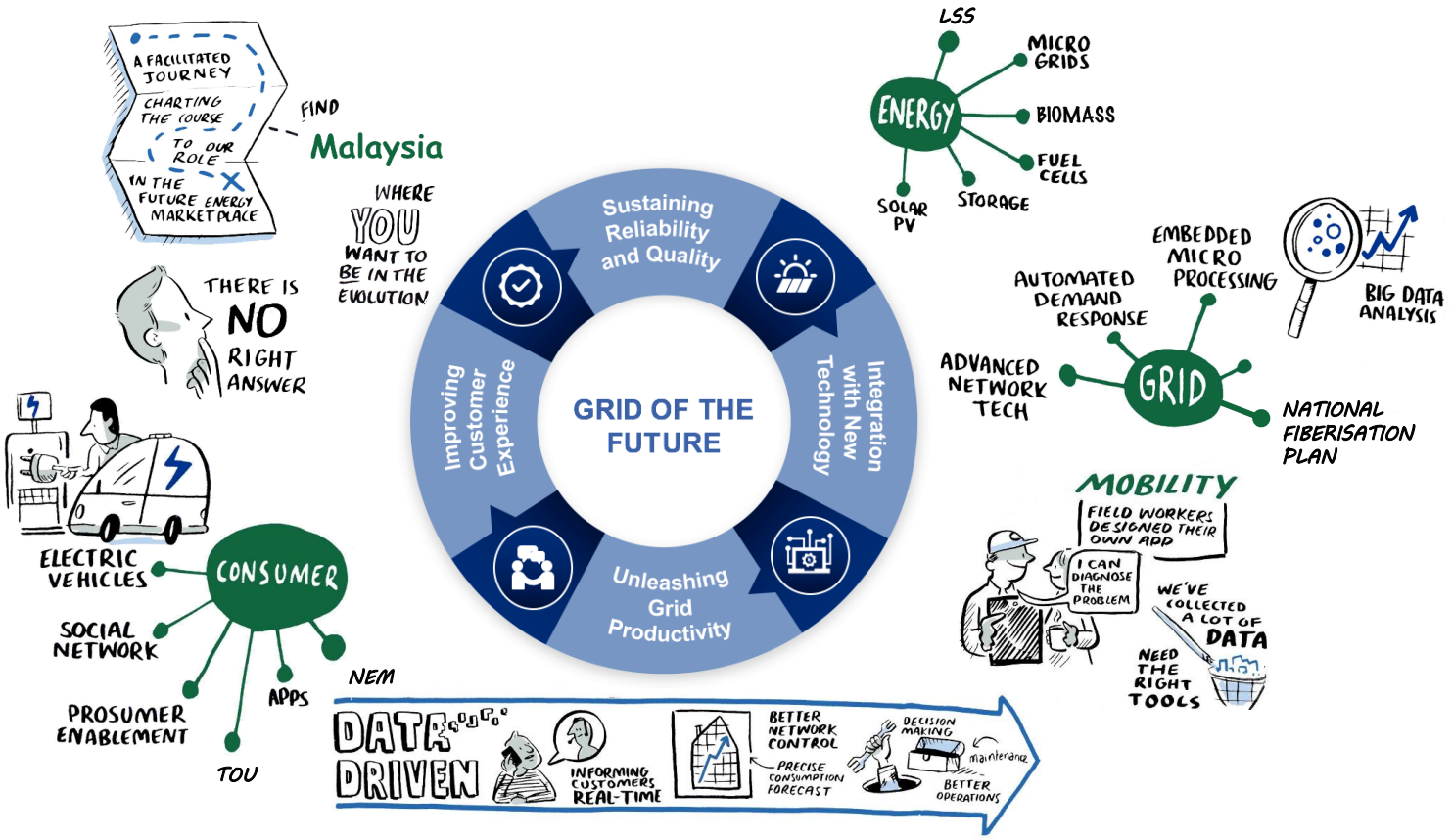


- Strengthening Suruhanjaya Tenaga's Monitoring and Enforcement of Service Levels
- Improving Complaint and Dispute Resolutions with TNB
- Optimising the Structure of MESI
- Ensuring Reasonable and Competitive Tariffs
- Reviewing the Customer Connection Charges (CCC) Guidelines
- Optimising the Reserve Margin
- Strengthening the Grid

Source: **inisiatif.mestecc.gov.my**

Grid of The Future (GoTF) in Distribution Network

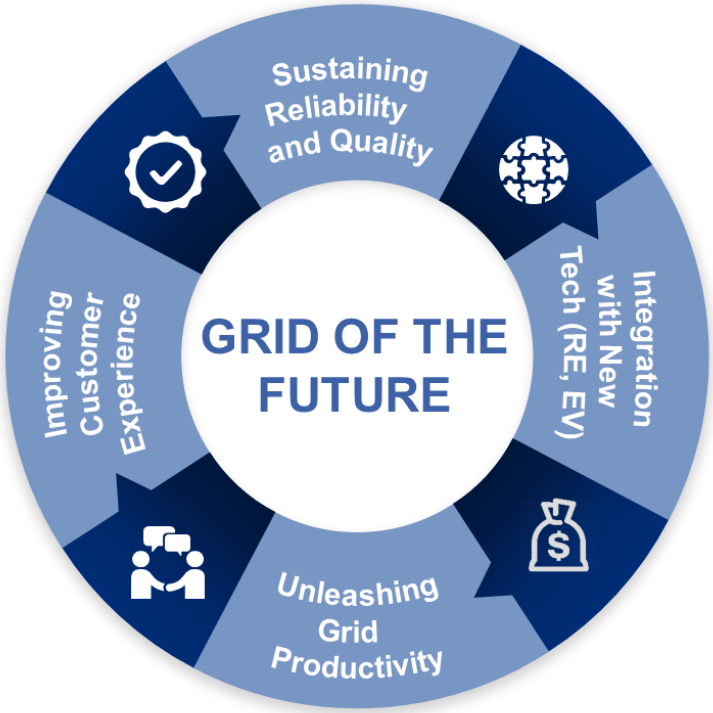
Smart Grid technology showed TNB the obvious; what is needed to support the GoM & building the Nation – *we have designed a "Grid of the Future" (GoTF)*



TNB's Grid of the Future to support the Government in building the nation's future

Source: **Incentive Based Regulation (IBR) Proposal For Regulatory Period 2 (2018 – 2020)**

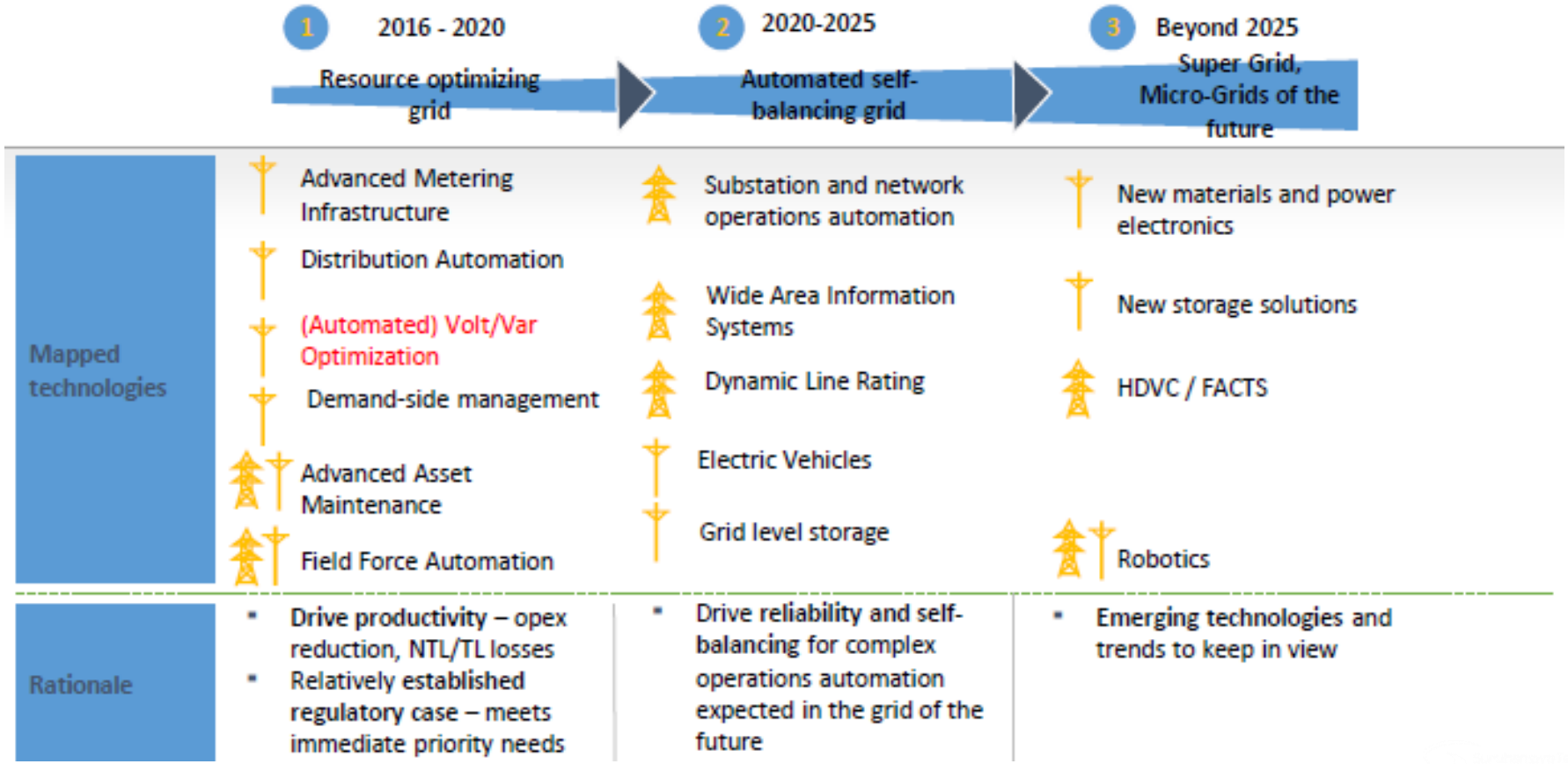
GRID oF THE FUTURE (GoTF) KEY DRIVING FACTORS



Investment Objectives		
A	Deliver a **resilient, reliable** and high **power quality grid**	Moving towards high value maintenance practices (i.e. predictive maintenance, analytics & automation)
B	**Accommodate intermittent RE generation, EV and distributed generation**	Integrating DG/RE, storage, EE etc. System is becoming complex (Bidirectional power flow) & require more effort to manage.
C	Deliver **'value for money' to ESI Stakeholders** – optimized TOTEX for the service	Regulatory support and collaboration will be required. Strategic CAPEX investment that reduces OPEX in the long-term.
D	Enable a seamless digital **customer experience and new services** – e.g. energy efficiency, smart home	Superior customer service requires investment in both CAPEX and OPEX for customer service , product development

Source: **Special Projects in IBR RP2** Delivering the Grid of The Future (GoTF) by TNB

Implementation of projects

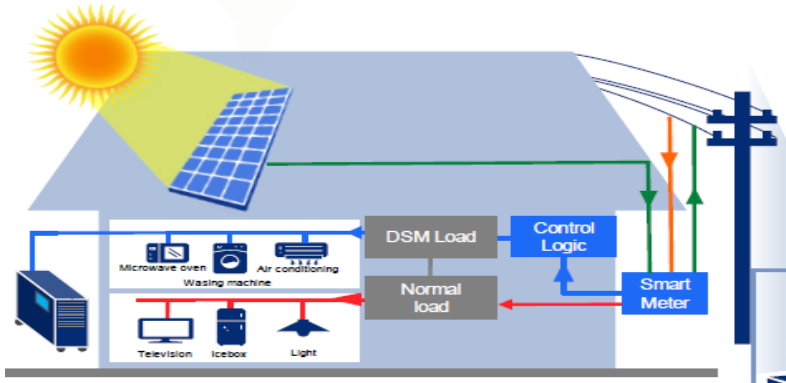


Source: **Special Projects in IBR RP2** Delivering the Grid of The Future (GoTF) by TNB

In building the GoTF; it will be a more complex grid, with bi-directional flows at consumer and local grid level – *AMI becomes the foundational element*

Bidirectional flows to-and-from future consumers

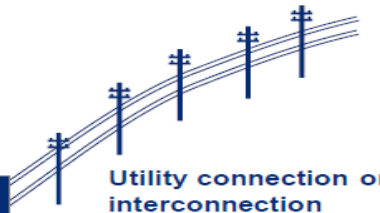
Greater complexity in the distribution grid with distributed generation in place



Essential future community services and facilities for smarter rural environments

Community micro-grid control system
- Active management at local level maintains stable operation

Local energy assets and resources



Utility connection or interconnection

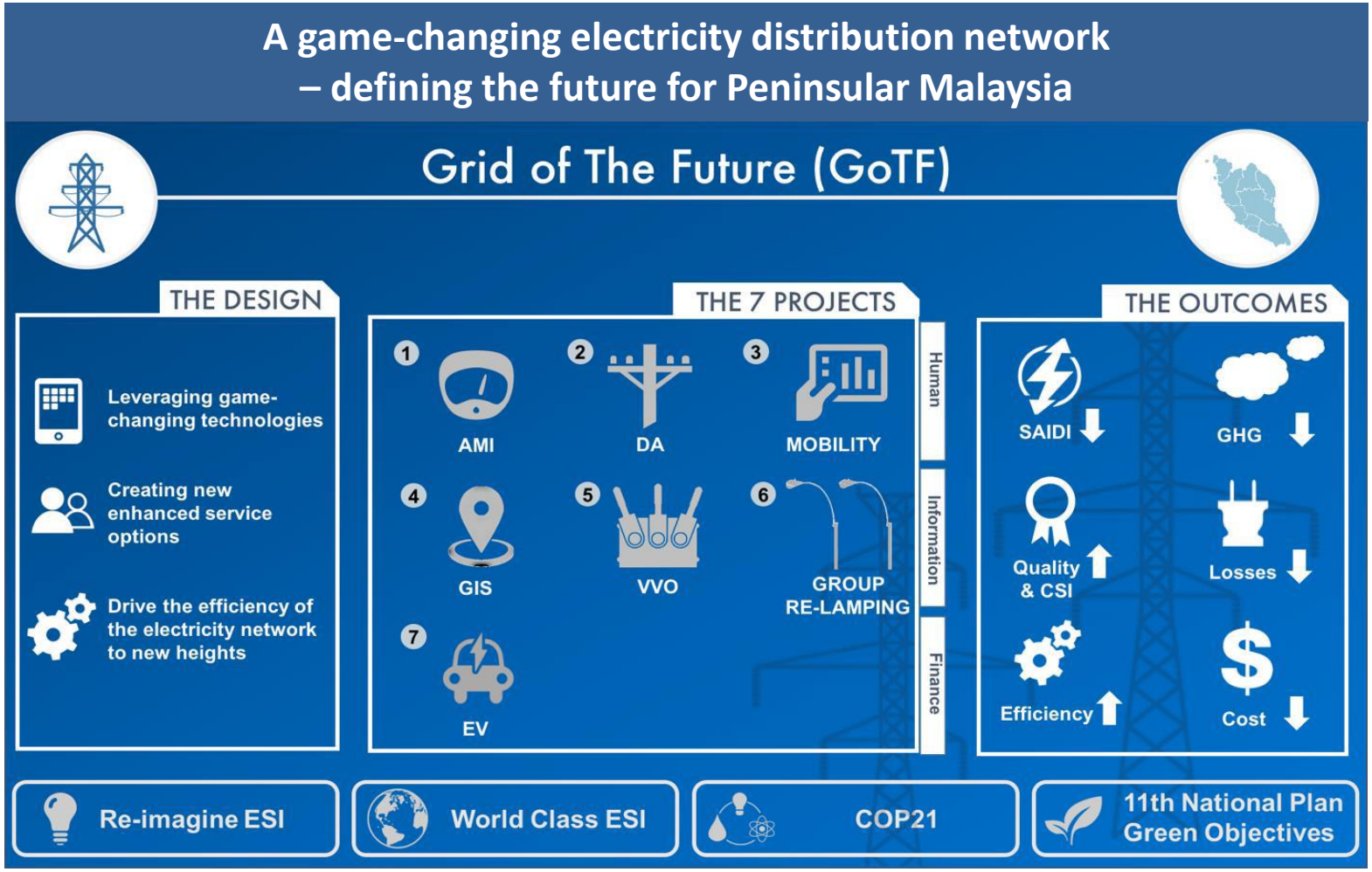
Final connection to main grid
- Dynamic load balancing, driven by weather patterns
- Bi-directional energy flows

Micro-grid

Delivering standalone and grid feed in service and autonomous operations

Source: **Special Projects in IBR RP2** Delivering the Grid of The Future (GoTF) by TNB

A game-changing electricity distribution network – defining the future for Peninsular Malaysia



Source: TNB Distribution Network Special Projects Report (AMI only) for the Incentive Based Regulation (IBR) Regulatory Period 2 Review

1. Grid of the Future – AMI: *Infrastructure that underpins and enables Smart Grid*

Objective: Implement across Peninsular Malaysia an Advanced Metering Infrastructure (AMI) that enhances customer control, supports national objectives, enables effective and efficient management of the grid.

Proposition:

- Provide a "Smart Meter" to all customers.
- Functionality facilitates, RE, FiT, NEM, ToU, remote connect / disconnect, DSM capabilities and Home Energy Management.
- Reduce customer complaints on billing related queries
- National Objectives include RE, EV and energy storage support

Benefits: +

- Empower the Customer to manage their usage, load profiling info and participation in new service offerings (i.e. ToU / Demand Response program)
- On time / prompt billing
- Planned outage and restoration notification to customers
- Pre-paid option for billing
- As a grid sensor supports DA and VVO thereby improving supply reliability
- Facilitates the introduction of RE / EV / Distributed Generation

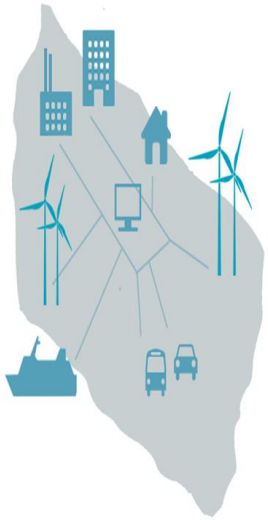
Cost Components: -

- Supply and install 8.27million Smart Meters
- Communication systems
- Network Management and security / Meter Operations Centre
- IT Systems (Hardware & Software)
- IT Systems Integration

Source: **Special Projects in IBR RP2** Delivering the Grid of The Future (GoTF) by TNB

2. Grid of the Future – Distribution Automation :

Driving operational efficiency and improving reliability



Objective: To deliver improved grid reliability, customer satisfaction and operational efficiency. Reduce system losses and support for GoTF functions.

Proposition:

- Detect location and type of fault, enable automatic isolation and power rerouting.
- Requires deployment of SCADA/DMS technologies integrated with field equipment
- DA is a support for other GoTF functions (DG, VVO, AMI, ESS).

Benefits: +

- Outage duration reduction – by automatically re-switching the network
- As a grid sensor –sense and control the network dynamically
- Improve network management
- Enhanced customer satisfaction – by minimising outage frequency and

Cost Components: -

- DA equipment (i.e. RTU, FTU, RMU, VCB)
- Installation and maintenance
- Communications infrastructure

This infrastructure also provides a base for the VVO project

Source: **Special Projects in IBR RP2** Delivering the Grid of The Future (GoTF) by TNB

3. Grid of the Future – Mobility Solutions

Enhance customer satisfaction through faster supply connection & increase reliability

Objective: Slim down work flows and reduce task complexity; eliminate paperwork and simplify data collection. Increase worker safety.

Proposition:

- Mobility technologies deliver information to and from the field and enrich it with situational awareness
- All field and supervisory work flow can be impacted.
- Productivity improvements from 5% to 50% are not uncommon.

Benefits: +

- Mobility enables business process automation increasing productivity
- Improves data collection eliminating replication of data and errors
- Makes the field worker situationally aware
- Enhanced customer satisfaction by reducing time to repair

Cost Components: -

Base infrastructure for a Mobility platform:

- Security and policy deployment
- Development of apps
- Purchase of devices
- Management of end devices
- Corp Apps store
- Integration with backend systems

Source: **Special Projects in IBR RP2** Delivering the Grid of The Future (GoTF) by TNB

4. Grid of the Future – GIS

Enhance customer satisfaction through faster response,enable coordinated system performance and information notification

Objective: Improve TNB's service quality, reduce operating costs and achieve greater operational efficiency. Included is two data collection technologies to provide allow accurate spatial data input.

Proposition:

- Mapping 1.3 million kilometres of distribution wire and how it is connected to over 8.6 million customers
- Improves the productivity of many tasks and activities - such as fault and customer location, constructed assets and their spatial relationships.
- Integrates with key applications to enhance their effectiveness

Benefits: +

Improve operations through

- Accurate Location information
- Assisting sharing of information
- Provide a means to empower field staff
- Facilitating planning and construction
- Locate customers faster

Improve other systems by providing Geospatial reference:

- Asset Management
- Outage location
- Mobility
- Grid Switching

Cost Components: -

GIS system software implementation and integration

- Support and licensing
- ERMS data management
- Mobile mapping with laser scanning for LV data collection
- UAV (Un-manned Aerial Vehicle) for MV overhead bare conductor data collection

Source: **Special Projects in IBR RP2** Delivering the Grid of The Future (GoTF) by TNB

5. Grid of the Future – VVO

Enhance network operations and support Government policy on RE

Objective: Improve power quality, grid efficiency (reduce technical losses). Reduce customer impacts (equipment damage due to voltage variations). Allow integration of higher levels of RE as a distributed generation source.

Proposition:

- VVO enhances network efficiency by reducing power losses and mitigates severe voltage variations
- In addition to increasing system efficiencies VVO has the ability to free capacity.
- With Distributed Generation VVO can provide a balance to stabilise the grid and improve the consistency of energy.

Benefits: (+)

Improving power quality – both voltage and reactive power which will:

- Reducing network losses
- Release capacity
- Enhanced customer satisfaction by minimising voltage variations and subsequent equipment damage.

Cost Components: (-)

- Supply capacitor banks for LV and MV.
- Implement and commission pole-top and pad mount devices.
- Other smart grid technology that integrates will be installed in RP3 period.

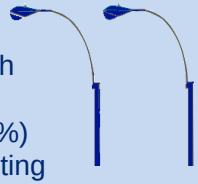
Source: **Special Projects in IBR RP2** Delivering the Grid of The Future (GoTF) by TNB

6. Grid of the Future – Group Street Light Re-lamping

Enhance customer satisfaction through higher reliability of street lighting

Objective: To reduce the street light failure rate and avoid repetitive breakdowns in the same street lighting unit. Reduce complaints and the high cost of maintenance for street lighting.

Proposition:



- Eliminate high failure rates (currently 20%) for street lighting and reduce this failure rate to less than 2%.
- Street lighting failure is correlated to the age of street lighting equipment. This program will ensure lights to be relatively new (young age) and therefore lower failure rate.

Benefits: +

- Reduce operation and maintenance costs, savings accrue from a planned replacement over the existing run-to-failure strategy.
- Reduce customer complaints– by taking failures from 20% pa to 2% pa.

Cost Components: -

- Capital cost of lamps (for four year replacement).
- Installation cost every four years.

Source: **Special Projects in IBR RP2** Delivering the Grid of The Future (GoTF) by TNB

7. Grid of the Future – EV Charging

Enabling the proliferation of electric transport in accordance with Electric Mobility Blueprint

Objective: Implement fast charging infrastructure that kick-starts the uptake of electric vehicles throughout the Malaysian Peninsular. Reduce the Malaysian dependency on oil.

Proposition:

- This is a project specifically to support the Government National Electric Mobility Blueprint
- EV Charging Station is one the core infrastructures of EV ecosystem.
- This project aims to fast track the growth of electric mobility and stimulate EV markets into the acceptance of charging stations nationwide by 2020.
-
- The EV Charging project improves the country's energy sustainability and supports the Governments goal to improve air quality

Benefits: +

National Benefits:
- 1.7 million tonnes of CO_2 reduction
- Enhance economic growth - RM328 million investment by 2020
- Reduce health care cost related to air pollution

Energy Supply Industry:
- Encourage DSM, V2G and Improve efficiency

Electric mobility industry
- Boost demand for EVs

Raykat:
- Reduce vehicle fuel costs 69% and maintenance cost by 64%
- Improve the air quality within cities
- Minimise building façade discolouration
- Increased the quality of life by offering the Rakyat sustainable transport options

Source - EMB

Nominal values quoted

Cost Components: -

- 24,000 Charging stations
- EV charging point purchase, implementation and commissioning
- Metering
- Floor marking and signage
- O&M costs

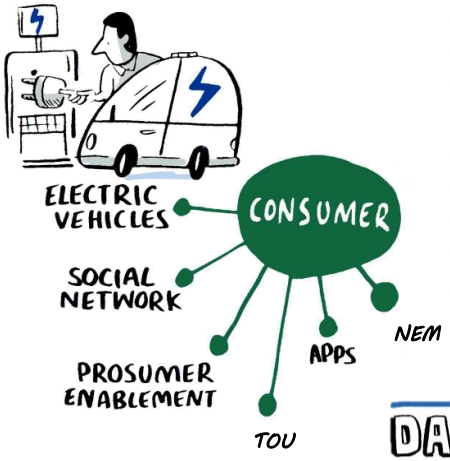
Source: **Special Projects in IBR RP2** Delivering the Grid of The Future (GoTF) by TNB

So what does the GoTF deliver in Malaysia in 15 years time?

This is a story set for a long-term vision….

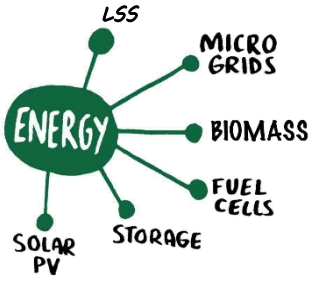
For our Rakyat

- EV's & Electric Bikes
- Reduced transport bills
- Solar on the rooftops
- Optimise our power bills with ToU & DSM
- Air is cleaner
- Affordable Power



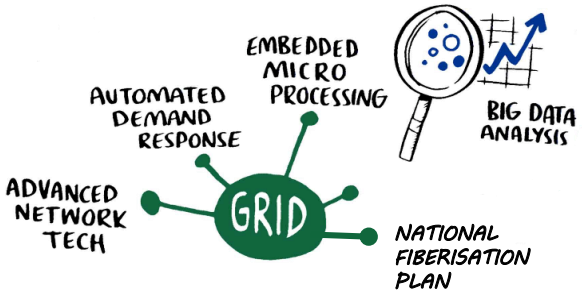
For our Nation

- Reduced power costs relative to wage growth
- Subsidies for EV's & Solar
- Malaysia manufactures & exports EV induction pads



For TNB Operations

- RE fits into the grid
- 8 million + Advanced meters
- Customer choices:
  - *FiT, NEM, LSS, ToU, DS*
- Reliability ↑, outages ↓
- Network losses ↓
- Mobility has transformed all jobs
- Street Lamp costs &complaints ↓
- 25,000 public charging stations



Source: **Incentive Based Regulation (IBR) Proposal For Regulatory Period 2 (2018 – 2020)**

MiGHT
Malaysian Industry-Government Group
for High Technology

WORLD BANK GROUP

BRIEF ON GEF 6 UNIDO SUSTAINABLE CITY DEVELOPMENT (SCD) IN MALAYSIA

SMART GRID PROJECT

GEF6 Project Overview

Global Partners

gef | WORLD BANK GROUP | UNIDO

National & State Partners

KPKT | MiGHT

Sustainable City As Integrated Approach

Integrates economic, environmental, and social objectives :

ECONOMIC	ENVIRONMENT	SOCIAL
Competitive Cities	**Green & Resilient Cities**	**Liveable & Inclusive Cities**
Fostering economic growth through the benefits of density.	Protecting natural resources and ensuring investments as well as pro-active risk reduction and management	Ensuring access to affordable services for Rakyat

Smart Cities

- High adoption of ICT as Enabler
- To support Integration of City Systems

(Source : World Bank and MIGHT)

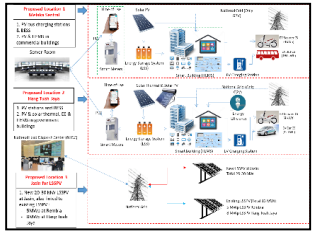
Project Scope – 4 Key Components

Output 1. - National and State Policies on Sustainable Cities (SMART Grid Framework)

Output 2 - Capacity Building (SMART Grid)

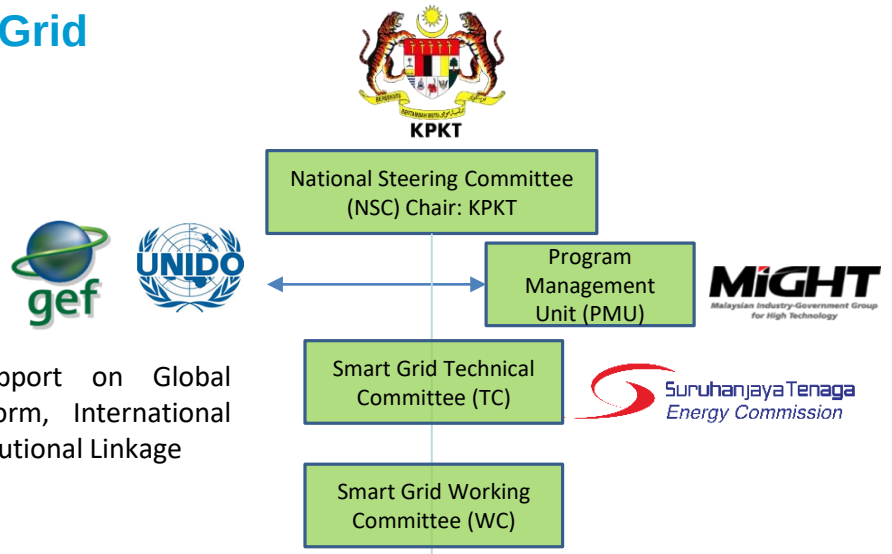
Output 3 – Awareness (SMART Grid)

Output 4 - Smart Grid Demonstration Project



Integrated Approach in Urban Planning in both Strategic Contents and Federal-State Level Linkages

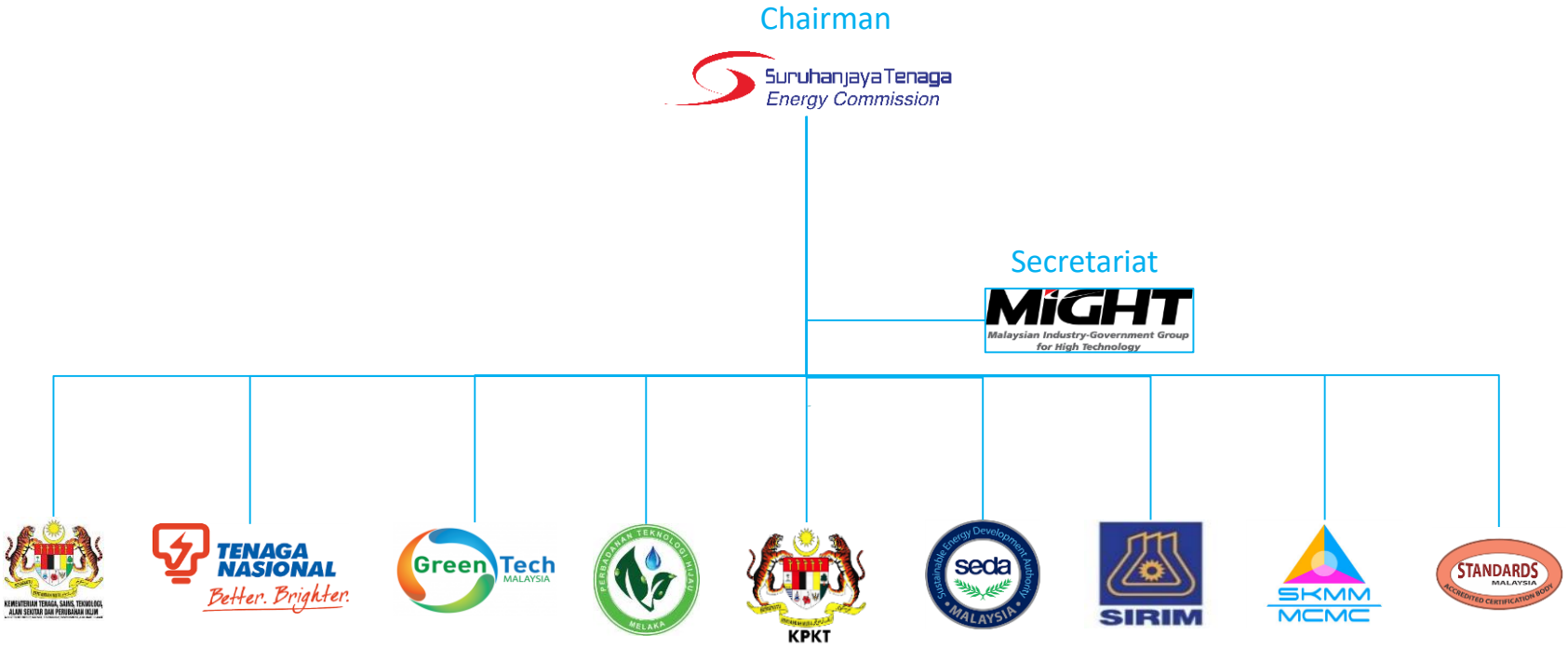
GEF6 Project Governance on SMART Grid Project



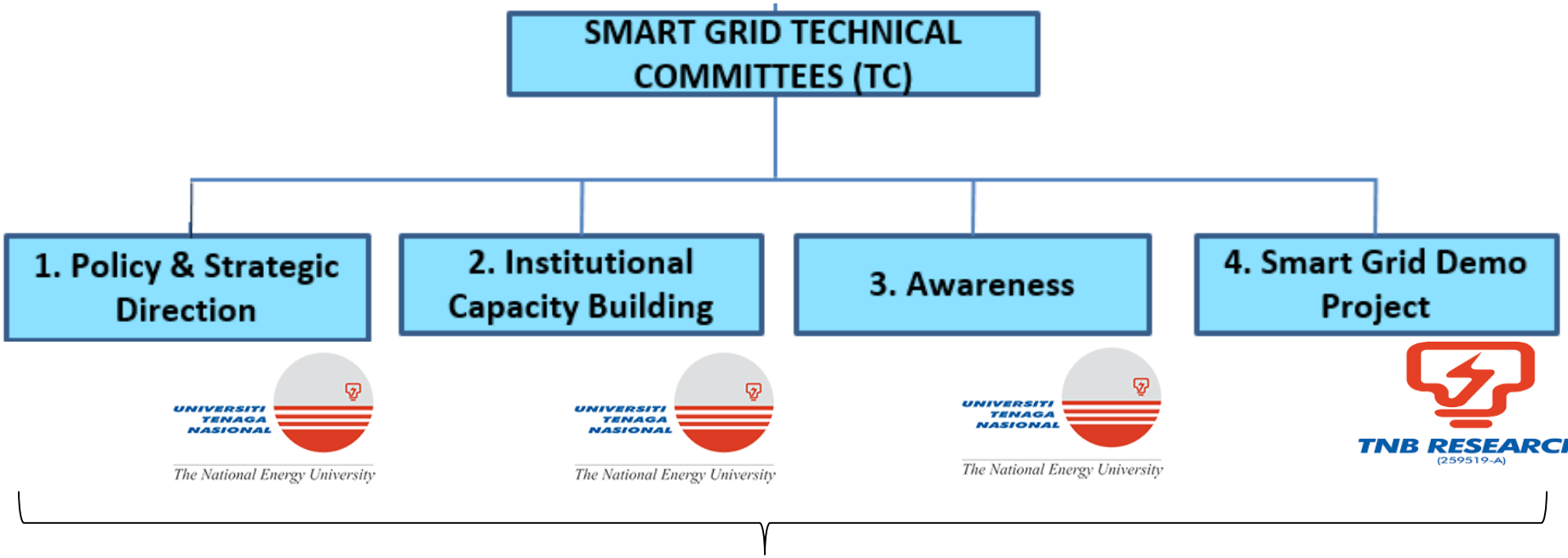
International Support on Global Knowledge Platform, International Expert & UN Institutional Linkage

PROJECT DELIVERABLES	1. Policy & Strategic Direction	2. Institutional Capacity Building	3. Awareness	4. Integrated Smart Grid Demo Project
PROJECT DELIVERY PARTNERS	UNITEN	UNITEN	UNITEN	TNBR
PROJECT DURATION IN THREE PHASES	**THREE YEARS PROJECT DURATION IN THREE PHASES (36 months)**			

PROPOSE SMART GRID TECHNICAL COMMITTEE



SMART Grid Project Governance Structure



Project Delivery Partners (PDPs)

SMART Grid Key Deliverables

COMPONENT 1
POLICY FRAMEWORK

- Develop policy and regulatory framework, roadmap and implementation guidelines for Smart Grid;
- Develop scale-up and replication plans for smart grid, allowing other cities to rapidly adopt them.

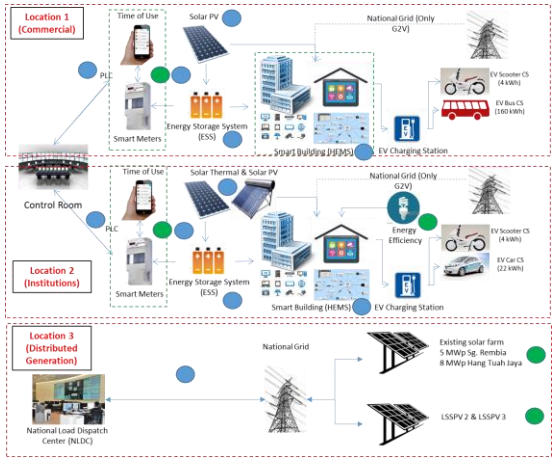
COMPONENT 2
CAPACITY BUILDING

- Training courses on RE-integrated smart grid, solar powered EV charging stations, EE and RE applications in buildings; costs and benefits analysis on smart grid-related investment
- Training courses (2-3) on data analysis and management smart grid.

COMPONENT 3
AWARENESS

- Outreach programmes for stakeholders and consumers on smart grid with RE-powered EV charging stations, EE and RE applications buildings and ICT system

COMPONENT 4
DEMO PROJECT



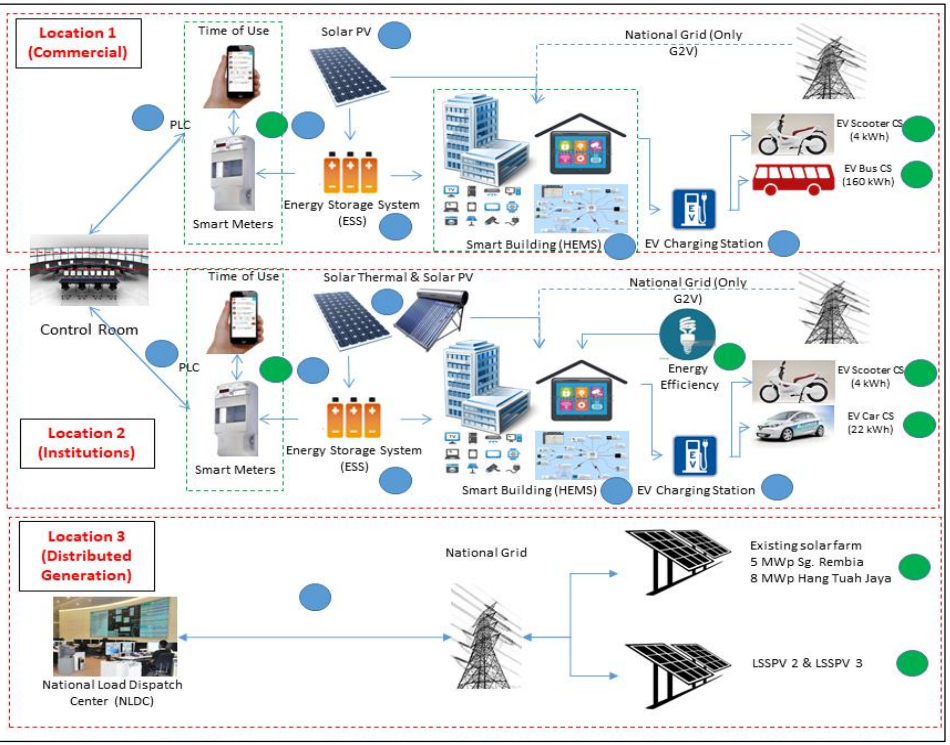
COMPONENT 4 : SMART GRID DEMO PROJECT

Smart Grid Demo Project at Melaka {Lead by TNBR}

Phase 1
Preliminary Data Integration & Reporting of Selected Energy Projects in Melaka

Phase 2
Data Integration & Analytics for Selected Energy Projects in Melaka, Future Large Scale Solar (LSS) & Rooftop Solar PV Projects via Net Energy Metering (NEM), Feed in Tariff (FiT) and setting-up of Integrated Server Room in Melaka which is also ready for NLDC Connection

Phase 3
Data Integration & Visualization of Selected Energy Projects in Melaka, Future Large Scale Solar (LSS) PV & Rooftop Solar PV Projects via Net Energy Metering (NEM), Feed in Tariff (FiT) and Future Green Mobility Project connected to National Load Dispatch Center (NLDC)



Co-Financing Direct Financing

TNB RESEARCH (259519-A)

UNIVERSITI TENAGA NASIONAL
The National Energy University

SMART GRID DEMO PROJECT GREEN HOUSE GASES (GHG) COMMITMENT

In total, the project is expected to give result in terms of:

a) Direct annual energy savings of 244,169 GJ in the last year of the project (2021).
b) A total 20-year reduction of 4,590,386 GJ (assuming a 20-year lifetime of investments).
c) Annual reductions of 45,089 tonnes CO2eq per year as direct GHG reductions in the last year of the project (2021)
d) A total 20-year reduction of 847,675 tonnes CO2eq as direct GHG reductions & indirect GHG emissions avoided of 3,607,129 tonnes CO2eq.

Be Energy smart

Suruhanjaya Tenaga
Energy Commission

No. 12, Jalan Tun Hussein, Precinct 2, 62100 Putrajaya, Malaysia.
Toll Free: 1-800-2222-78 Tel: (603) 8870 8500 Fax: (603) 8888 8637

Suraiya Nadzrah Ramli
suraiya@st.gov.my

Deputy Director
Electricity/ Gas Supply And Service Quality Unit