

# Topic 13: Minimum Disruption During Maintenance (M&E)

Highway Concession Conference (HCC) 2019  
15-16 July 2019



**‘ENHANCING USERS SATISFACTION THROUGH INNOVATION  
AND FINANCIAL RE-ENGINEERING’**

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Tenaga Nasional Berhad**

# Outline of Presentation



- 1** About TNB
- 2** Preventive, Corrective Maintenance of Underground Cable
- 3** Ensuring Road Users' Safety During TNB Works
- 4** Other Related Initiatives by TNB to Ensure Road Users' Safety

# 1.0 About TNB

Consists of four (4) core businesses, Generation, Grid, Distribution Network and Retail.

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## Generation

- Generation Division is entrusted to develop, operate and maintain TNB's portfolio of power generating units.
- It has thermal generation assets and major hydro-generation schemes in Peninsula Malaysia and one IPP operating in Pakistan.



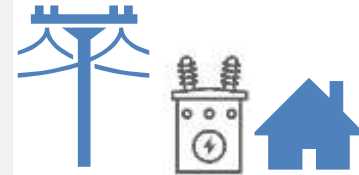
## Grid

- Grid Division manages and operates the 132 kV, 275 kV and 500 kV transmission network of TNB known as the National Grid.
- Main activities include strategy formulation, system planning, engineering, project management, control operations, maintenance, way leave management and more.



## Distribution Network

- Distribution Network Operations plans, constructs, operates, performs repairs & maintenance as well as manages the assets of the 33 kV, 22 kV, 11 kV, 6.6 kV and 415/240 volts in the Peninsula Malaysia's distribution network.



## Retail

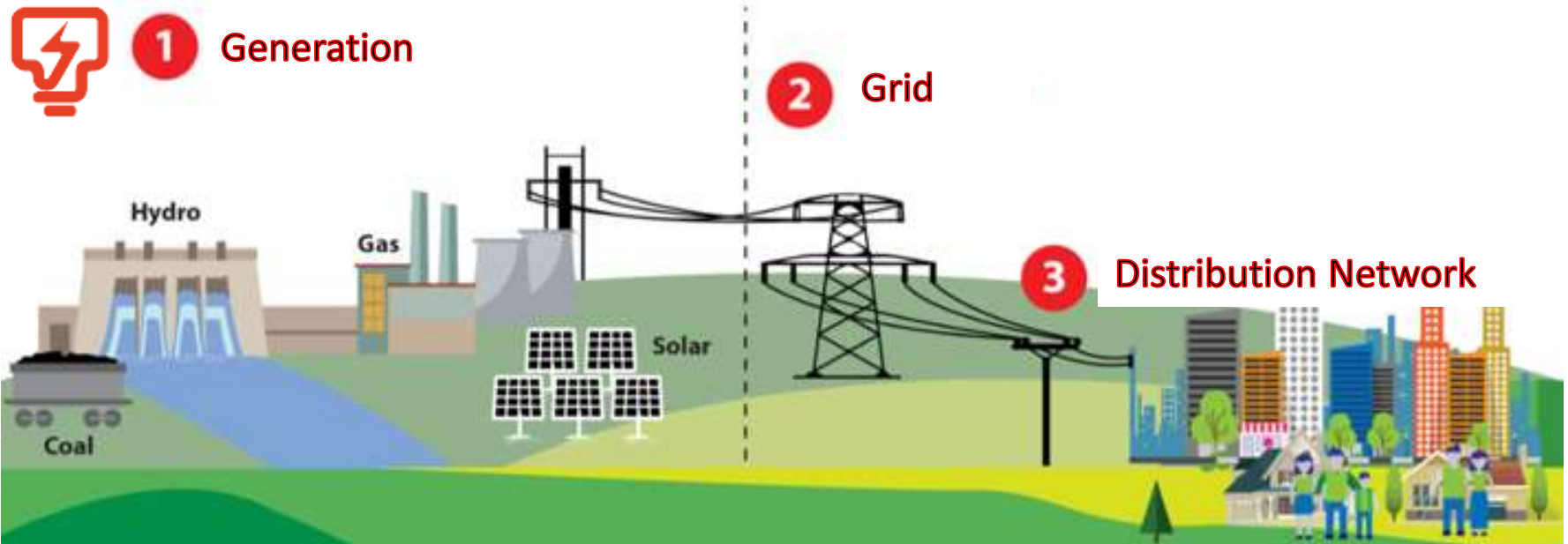
- The Division operates a network of state and area offices to purchase electricity from embedded generators; it markets and sells electricity, connects new supply, provides counter services, collects revenues, operates call management centres, breakdown services, and cultivates strong customer and government relationships.



# 1.0 About TNB

This is the process of delivering electricity. The electricity that power plants generate (generation) is delivered to customers over transmission (grid) and distribution power lines (distribution networks).

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## Distribution Network

- Plan
- Construct
- Operate
- Maintain
- Repair
- Refurbish Dist Network Assets

4 Retail

# 1.1 About Distribution Network Division

Distribution Network Division has extensive network system that covers all 13 states in Peninsular Malaysia to distribute electricity to customers through our primary assets.



Substation Type	Underground Cable (km)	Overhead Lines (km)	Transformer (MVA)
Primary Distribution (PPU): 851	33kV: 8,352	33kV: 6,034	Total: 114.540
Primary Switching Station (SSU): 398	22kV: 1,817	22kV: 38	
Secondary Distribution Substation (PE): 80,320	11kV: 160,819	11kV: 16,196	
Total: 81,624	6.6kV: 309	415V: 332,580	
	415V: 137,264	Total: 354,848	
	Total: 308,618.60		

2.0

## Preventive, Corrective Maintenance of Underground Cable

Asset Maintenance Regime of Underground Cable in TNB.

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<b>Asset Maintenance of Underground Cable in TNB</b>	<b>Preventive Maintenance</b> Early detection method on potential failure in order to avoid unplanned road digging for repair
	<b>Corrective Maintenance</b> When it is necessary to repair, we use technology to pinpoint the location so that we can avoid longer span of road digging and therefore will minimise road damage and traffic congestion.

2.1

## Preventive Maintenance of Underground Cable

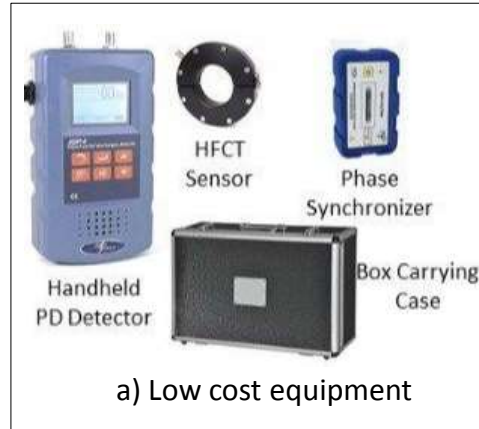
The following conditions below are generally providing a sound basis for assessing cable through levels.

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<b>Preventive Maintenance of Underground Cable</b>	<b>Level 1</b> Non-intrusive test that requires no supply interruption. Tests are conducted online. <b>Example: Online Partial Discharge (PD) Scanning</b>
	<b>Level 2</b> Intrusive test that is conducted offline with feedback supply system availability. No power interruption to customer. <b>Example: Offline Testing</b>

## Level 1- Online Partial Discharge (PD) Scanning

- **Online Partial Discharge (PD) Scanning** is introduced in 2018 to scan and identify cable with potential defect to assist selection for further investigation.





## Level 2: Offline Testing

- **Offline Testing** is performed on de-energized cable.
- This technique locates potential faults in joints and terminations.



a) Offline testing set is connected with the earth connector must be connected to earth

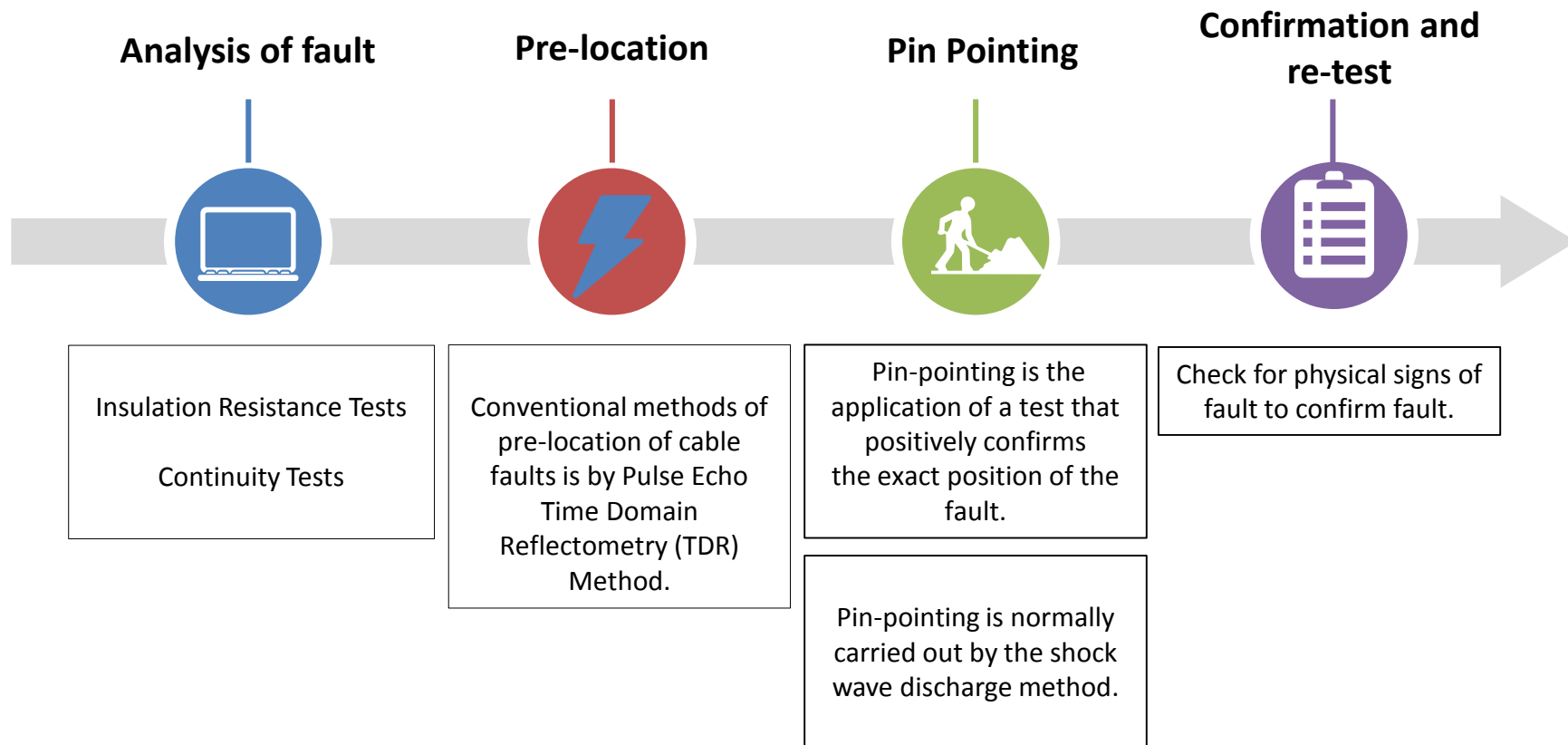


b) Offline testing set in a van

## 2.2 Corrective Maintenance of Underground Cable

When it is necessary to repair we use cable fault location methodology to pinpoint the location of cable fault so that we can avoid longer span of road digging and therefore will minimise road damage and traffic congestion.

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## Cable Fault Location Methodology-Pin Pointing

- **Pin pointing technique** positively confirms the exact position of the fault. Pin pointing is done on pre-located fault distance.
- TNB is able to save existing cable networks from damage, therefore reducing unnecessary digging through this technique.



a) Fault locating in progress on the road and near the woods.



b) Fault locate test set in a lorry.

### 3.0 Ensuring Road Users' Safety During TNB Works

- Challenges arise when reinstating the road as closely as its original condition after digging in roads and verges due to underground cable maintenance work.
  - Implementation of the initiatives below shall ensure safe condition of road during/after underground cable maintenance work by TNB.
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**Road Users'  
Safety is Our  
Priority**



**Competent  
Workforce**

Sustaining competent TNB contractors through:

- Comprehensive training in ILSAS by IKRAM
- Mandatory requirement of Technical Competency Card for TNB contractors appointment
- Manuals on underground cable as reference
- Audit – pre appointment of vendors



**Effective  
Traffic  
Management**

Effective Traffic Management as per Malaysian Institute of Road Safety Research (MIROS) guideline.



## Comprehensive training in ILSAS by IKRAM

This training is now being put into common practise by TNB vendors, pictures as below.

Coring test is conducted to ensure that the thickness of the road resurfacing work is according to council specifications.



Road marking is painted once coring test result is approved indicating that overall work of underground cable maintenance is completed.



# Mandatory requirement of Technical Competency Card for KKB appointment



1. Pembinaan & Mulatugas Pencawang Elektrik
2. Senggaraan Pencawang
3. Pengurusan Trafik

Bilangan Hari : 5, 3, 2 = 10

Substation



1. Pengurusan Trafik & Penurapan Semula Jalan
2. Amalan Rentangan Kabel Hingga 11/33kV - BO Terhad ATAU Amalan Rentangan Kabel 33kV (Tanpa BO Terhad)

Bilangan Hari : 3, 3 = 6

Cable



1. Sesalur Atas Voltan Rendah (SAVR)
2. Pengurusan Rentis
3. Pengurusan Trafik
4. Kerja Talian Hidup Voltan Rendah - Liveline

Bilangan Hari : 3, 2, 2, 3 = 10

Overhead LV



1. Kabel Bertebat Diudara Voltan Tinggi
2. Medium Voltage Arial Bundle Cable
3. Pengurusan Rentis
4. Pengurusan Trafik

Bilangan Hari : 3, 2, 2, 3 = 10

Overhead HV



1. Sistem Lampu Jalan (Pemasangan & Senggaraan)
2. Pengurusan Trafik
3. Kerja Talian Hidup Voltan Rendah - Liveline

Bilangan Hari : 3, 2, 3 = 8

Street Lighting



1. Pemasangan / Pengalihan Meter OPC

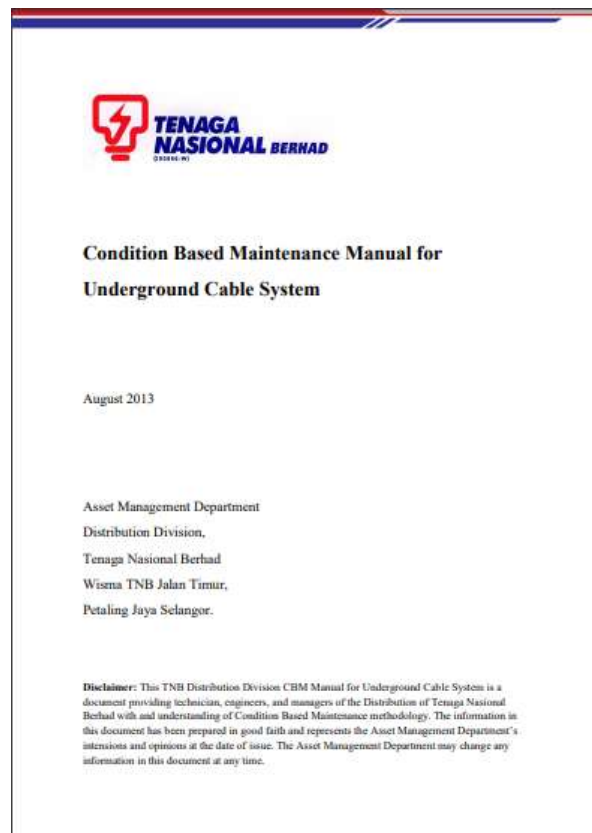
Bilangan Hari : 3

Meter

## Manuals on underground cable as reference

These manuals provide **instructions/guidelines on cohesive fundamental on underground cable** in hopes to **develop world class competent workforce in TNB.**

- Underground Cable System Design Manual, June 2012.
- Condition Based Maintenance Manual for Underground Cable, August 2013.
- Standard Pembinaan Sistem Kabel Bawah Tanah Pembahagian, Jun 2014



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#### Road Users' Safety is Our Priority



#### Competent Workforce

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#### Effective Traffic Management

Effective Traffic Management as per Malaysian Institute of Road Safety Research (MIROS) guideline.





## Effective Traffic Management

- **Effective Traffic Management** is exercised in TNB during construction/ maintenance of TNB's works to signal early indicator to road users on danger ahead.
- Traffic Management is important to isolate and protect both road users, pedestrians and staff working from potential hazards.



Sample sites where effective traffic management is practiced

## 4. Other Related Initiatives by TNB to Ensure Road Users' Safety

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### Call Before You Dig (CBYD)

1

- TNB's Enrolment of 'Call Before You Dig' (CBYD) Program Organized by Malaysian Access Forum Berhad.
- CBYD provides a platform for contractors to notify and alert the participating members before any digging work to be carried out.

### Horizontal Directional Drilling (HDD)

2

- **HDD** is an alternative method to open cut as this method **reduces traffic and requires minimum digging** .
- However, **only selective new projects and selective locations (road crossings and heavy traffic flow)** are preferred for HDD over open cut due to
  - i. High cost,
  - ii. Space constraint to install and place HDD equipment in congested city,
  - iii. High density of underground utilities and
  - iv. De-rating cable capacity of the section.

### Cable Route Mapping by Geospatial Information System (GIS)

3

- Cable route mapping has been implemented in GIS Application for underground cables in TNB.
- In the near future, we are developing magnetic marker technology to facilitate mapping of cable route for new projects.

# Cable Route Mapping in Geospatial Information System (GIS)

Cable route of underground cable can be located through GIS Application.



Thank you!