Smart Meter Pilot Project in Tenaga Nasional Berhad, Malaysia: 3 Different Communication Technology Tested

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Director, Smart Billing Project

Tenaga Nasional Berhad
Agenda

- Background of Tenaga Nasional Berhad (TNB), Malaysia
  - TNB’s Smart Grid Drivers
  - Pilot Project Overview and Implementation
  - Performance of the technologies tested
  - Lessons to Leverage for Full Scale Rollout
  - TNB’s proposed nationwide rollout roadmap
Tenaga Nasional Berhad (TNB) is the largest utility company undertaking the role of developing, managing and operating the Generation, Transmission and Distribution of Malaysia’s Electricity Supply Industry, with presence in Peninsular Malaysia & Sabah.

<table>
<thead>
<tr>
<th>Resources</th>
<th>Peninsular Malaysia</th>
<th>Sarawak</th>
<th>Sabah</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees</td>
<td>~36,146 people</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assets</td>
<td>RM 110.7 billions (as of 2014)</td>
<td>RM 105,000 GWh (FY 2013/14)</td>
<td>RM 8.3% losses (FY 2013/14)</td>
</tr>
<tr>
<td>Fuel mix</td>
<td>§ Gas: 53.8%</td>
<td>§ Gas: 53.8%</td>
<td>§ Gas: 53.8%</td>
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<tr>
<td></td>
<td>§ Coal: 35.3%</td>
<td>§ Coal: 35.3%</td>
<td>§ Coal: 35.3%</td>
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<tr>
<td></td>
<td>§ Hydro: 10.3%</td>
<td>§ Hydro: 10.3%</td>
<td>§ Hydro: 10.3%</td>
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<tr>
<td></td>
<td>§ Distillates: 0.6%</td>
<td>§ Distillates: 0.6%</td>
<td>§ Distillates: 0.6%</td>
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<td></td>
<td>§ MFO: 0.04%</td>
<td>§ MFO: 0.04%</td>
<td>§ MFO: 0.04%</td>
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<table>
<thead>
<tr>
<th>Capacity</th>
<th>Peninsular Malaysia</th>
<th>Sarawak</th>
<th>Sabah</th>
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</thead>
<tbody>
<tr>
<td>Customers</td>
<td>~8.1 million</td>
<td>0.504 million</td>
<td>0.49 million</td>
</tr>
<tr>
<td>Installed Capacity</td>
<td>21,060 MW</td>
<td>2,930 MW</td>
<td>1,241 MW</td>
</tr>
<tr>
<td>Max Demand</td>
<td>16,901 MW</td>
<td>1,758 MW</td>
<td>917 MW</td>
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<table>
<thead>
<tr>
<th>Financial</th>
<th>Peninsular Malaysia</th>
<th>Sarawak</th>
<th>Sabah</th>
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<tbody>
<tr>
<td>CAPEX</td>
<td>RM 10 Billion (FY 2014/15)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revenue</td>
<td>105,000 GWh (FY 2013/14)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T&amp;D losses</td>
<td>§ 8.3% losses (FY 2013/14)</td>
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<table>
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<tr>
<th>Performance</th>
<th>Peninsular Malaysia</th>
<th>Sarawak</th>
<th>Sabah</th>
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<tbody>
<tr>
<td>Electrification Penangula 99.99%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sabah 90.81%</td>
<td></td>
<td></td>
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<tr>
<td>SAIDI (Distribution)</td>
<td>55 mins</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SAIDI (Transmission)</td>
<td>0.1 min</td>
<td></td>
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</table>
TNB’s Smart Grid Drivers

Existing business model imposes multitude of challenges towards sustainability

Higher customer demand
- Require significant technologies and equipment to meet customer demand

High dependency on fossil fuels (more than 90% from gas and coal)
- Reliance on 100% imported coal - issue on energy security

Increasing cost of supply
- Rationalizing energy subsidies and recovery of higher cost of supply

Reduction of CO₂ emission & low carbon economy
- Commitment to reduce up to 40% in emission intensity of GDP in year 2020 compared to 2005 levels

Increasing pressure on energy security
- Availability and reliability of energy resources
TNB’s Smart Grid Drivers

“Upgrading capability of the existing electric power grid by deploying more automation and ICT technologies to enable the grid to operate more efficiently and reliably and offer additional services to consumers to save money and reduce CO₂ emissions”

– TNB Smart Grid Steering Committee (Sept 2010)
TNB Smart Meter Pilot Project

- The pilot project is funded by the Malaysian Government (MESITA Fund)
- Implementation of 1000 smart meters in the states of Melaka and Putrajaya
- The project is part of TNB’s smart grid Initiative
Implementation Stages and Progress

Pilot Phase

Sept 2014

Phase 1

Smart Meters, Communications, MDMS, Servers

Phase 2

Automated Billing, Load Profile Web Portal

Phase 3

Outage Notification, Load Management, Plug (DR)

Phase 4

New Billing Tamper Detection, Supply Automation, Smart Billing TOU

Project Phase

Dec 2015

IT Integration & AMI Services

Network Performance Evaluation

Larger AMI Rollout

Meter Tender award and Planning for Larger AMI rollout

AMI network and Meter deployment, Back-End Scaling

Meter and Network Install and Network Optimization

Meters, communications, and IT Hardware
<table>
<thead>
<tr>
<th>RF Network</th>
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</thead>
<tbody>
<tr>
<td><strong>Issue</strong></td>
<td><strong>Solution</strong></td>
</tr>
</tbody>
</table>
| Meter data arrived late at Trilliant Head End from RF Collector in Melaka due to weak RF links | 1. Installation of repeaters to improve weak RF links back to the RF collector  
2. Creation of additional tasks on HES to transfer these late meter reads to the MDMS.  
3. Enable MDMS to process Head End data until 6.00pm for the late meter reads. |
| Cellular RF Collector unreachable due to third party network issue (poor GPRS coverage) | Replace GPRS/2G sim card with 3G sim card to achieve better network availability |

<table>
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<td><strong>Issue</strong></td>
<td><strong>Solution</strong></td>
</tr>
<tr>
<td>PLC DCU unreachable due to third party network issue (poor GPRS coverage)</td>
<td>Replace GPRS/2G sim card with 3G sim card (with external router) to achieve better network availability</td>
</tr>
<tr>
<td>LAN interface on PLC DCU Putrajaya was down</td>
<td>Remote restart LAN port interface</td>
</tr>
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<table>
<thead>
<tr>
<th>GPRS Network</th>
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<td><strong>Issue</strong></td>
<td><strong>Solution</strong></td>
</tr>
<tr>
<td>59 smart meters using GPRS as backhaul communication not reporting consistently to the HES (49/59 not reporting at all)</td>
<td>Third party network operator increased its backhaul capacity to address network congestion issue in Melaka and Putrajaya</td>
</tr>
<tr>
<td>6 trouble meters not reporting daily until October 2015 due to backlog LP data stored in the meter – data too big to be pushed to HES via GPRS network</td>
<td>Solution proposed – next software upgrade on the current HES will allow staggered retrieval of meter data that will solve this problem</td>
</tr>
</tbody>
</table>
**Lessons to Leverage**

**AMI Implementation is Far Reaching**
- Many business processes are transformed
- Various systems (new and legacy) involved
- Important to setup a separate team/department dedicated to the project

**Important to clearly identify business requirements**
- Ensure technology chosen supports business requirements (i.e. real-time events, etc.)
- Important to find the right balance between performance requirements and commercial impact

**Communications Network Deployment**
- Allocate time for appropriate network planning and optimization
- Outage detection and other real-time event requirements have an impact on technology and network coverage required
- If using public cellular, work with Telco providers to ensure adequate connectivity and performance

**Customer/ Stakeholder acceptance**
- Ensure the customer is at the center
- Start engagement activities early
- Get buy-in from Government, Regulators and other stakeholders
Smart Billing Project Full Deployment Overview

**Software MDMS & ePORTAL Installation**
- MDMS Selection & Development (Pre-project)
- MDMS Project implementation
- MDM Go Live
- Appointment of system integrator
- Data & server management structure and training

**Network Communication, Firewall & Head End System**
- RF MESH Network, Firewall & Head End System (including DR)
- Network infrastructure installation
- TNB Telecomm. Network Upgrading
- Network to support TNB Meter Operations Centre (MOC)
- ICT Control Centers

**AMI Features Deliverables**
- Auto Billing
- Validation, Estimation & Load Profile
- Supply Automation & Outage Mgmt.
- Non Technical Loses
- Smart Payment
- Time of Use (TOU) Program
- Demand Respond
- Smart /Mobile apps
- Meter Spec.
- Meter Delivery
- Policy, Regulatory, Guidelines & Standards (Pre-project)

**Smart Meter Rollout**
- Roll Out Software
- Mobility for workforce mgmt.
- Project team
- Tools & Equipment (PPE)
- SJHT revision
- Contractor selection
- Contractor training
- Scrapping procedure
- SOP to contractors

**Smart Meter Rollout**
- Final design approval
- Tender process
- MOC Renovation work
- Network installation
- Dashboard and system installation
- Training

**Change Management**
- Meter reader transformation
- Weekly bulletin
- Business Process Development Exercise
- Ownership Communication and Involvement to Sustain Continuous Develop and Sustain Capabilities
- Training and Performance Support
- Organization and Roles Alignment
- Half yearly Audit Programs Development

**Stake Holder Engagement**

**Pre-Installation**
- Smart Meter Briefing & Awareness Program
- Pre-Installation Letter
- Pamphlet
- Promotion Program

**During Installation**
- Door hanger
- Social Media

**Post Installation**
- Continuous Customer Engagement Program
- Customer Benefit Program
- Customer Reference Center

**Engagement**

**Operation**

**Technology**

**Change Management**
**Stakeholder Engagement Plan**

**“Driving the Green Agenda”**
- Smart Meter colloquium
- Develop and setup conducive legal framework to support smart meter installations.
- Identify and benchmark utility best practices for task teams.

**“Introducing Smart & Efficient Living”**
- Strategic Partnership to develop and execute smart lifestyle.
- Appoint as Independent Customer Advocates to manage customer issues.

**“Supporting national agenda”**
- Identify champions for rollout programs
- Smart meter familiarization benchmarking with best utilities.

**“Innovative & Dynamics”**
- Media visit & benchmark to best smart meter deployment
- Cultivate long term relationships / engagement plan with the right people in media

**“Expanding our services to customers”**
- Keep all staff informed – free flow of information
- Ambassador programs – career path
- Vibrant workforce - champions to the customers

**“Expanding our business solutions”**
- Avoid surprises – transparent reporting
- Maintain goodwill /credibility

**“Strategic Business Partners”**
- Strategic Partnership
- Cultivate long term & ongoing relationships
- SOP and SLA

**“Introducing value-added services to consumers”**
- Pre-installation - Public mind conditioning programs (Town hall / media outreach programs / etc)
- During installation – monitor SOP through installation day survey.
- Post installation – introduce value-added services
TNB AMI DEPLOYMENT STRATEGY

- TNB Board of Directors has endorsed the proposed nationwide implementation of Advanced Metering Infrastructure (AMI) of eight (8) million smart meters over five (5) years beginning 2015

  Evaluation phase on technologies, customers, partners, processes and risks mitigation before embarking on the nationwide roll-out

PILOT
Pilot Smart Meter Project implemented in Melaka & Putrajaya (1000 smart meters)
2014-15

1st PHASE
Smart Meter roll-out for the state of Melaka
2016

300 thousand

2nd PHASE
Nationwide implementation
2017

2 million

8.3 million

COMPLETE
2021

Industrialised Process Established in Phase 1

Annual Meter Rollout

Year


Phase 1
Phase 2
Completed

Number of meters

0 500000 1000000 1500000 2000000
THANK YOU