Evolution of the PI System in Tenaga's Power Generation Fleet

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TENAGA NASIONAL BERHAD

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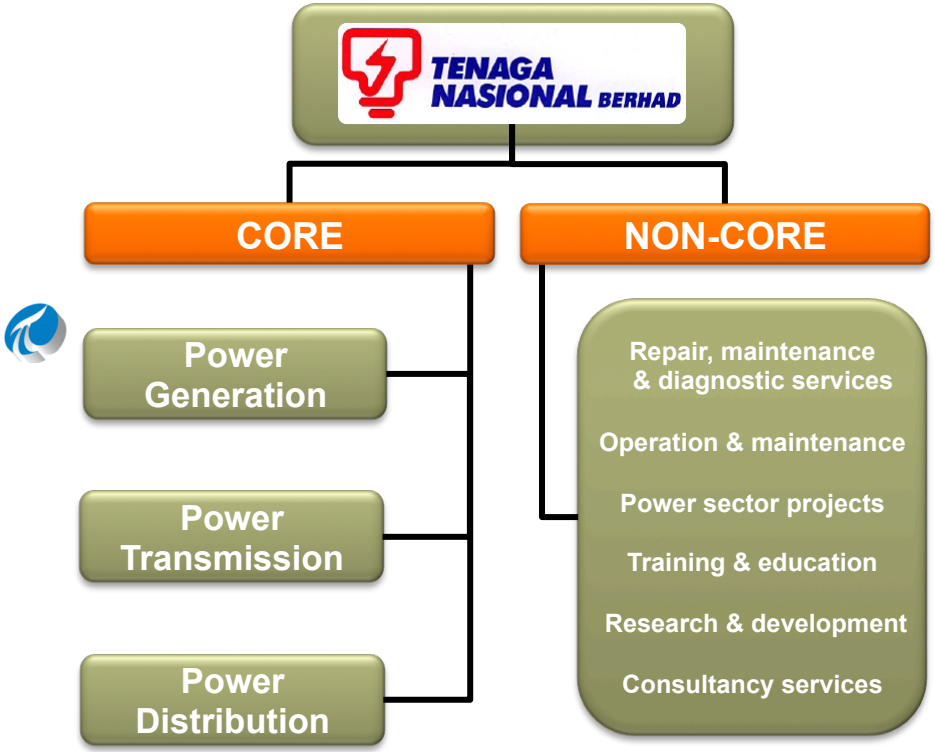
About Tenaga

Where we're from...

Images courtesy of Google Maps

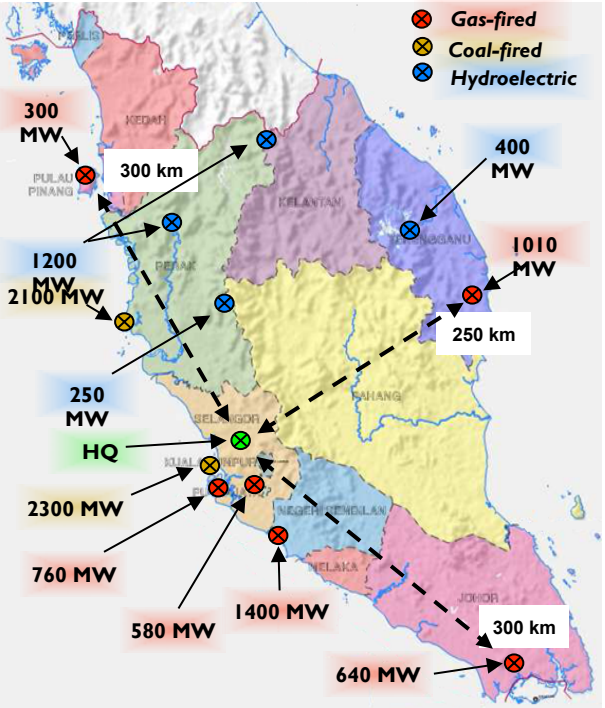
What we do...



- Established in 1949
- Largest electricity utility in Malaysia
- USD 24 billion assets
- USD 11.5 billion market capitalisation
- 28,000 employees
- Installed generation capacity of 11 GW
- Contributes 55% of total national capacity

Our journey with the PI System

Why we needed it...



- Diverse power plant fleet
- Inhomogeneous sources of operational data
- Real-time process data locked within isolated control systems
- Technical performance & business intelligence reliant on offline data

UNIFIED REAL-TIME DATA PLATFORM EASILY ACCESSIBLE TO ALL STAFF

How we deployed it...

Phase I (2005 - 2007)

- Pilot project at one plant & headquarters
- Turnkey project implementation
- **PROJECT VENDOR**
  PI System infrastructure, applications, user training & technical support
- No direct OSIsoft involvement



Phase II (2007 - ongoing)

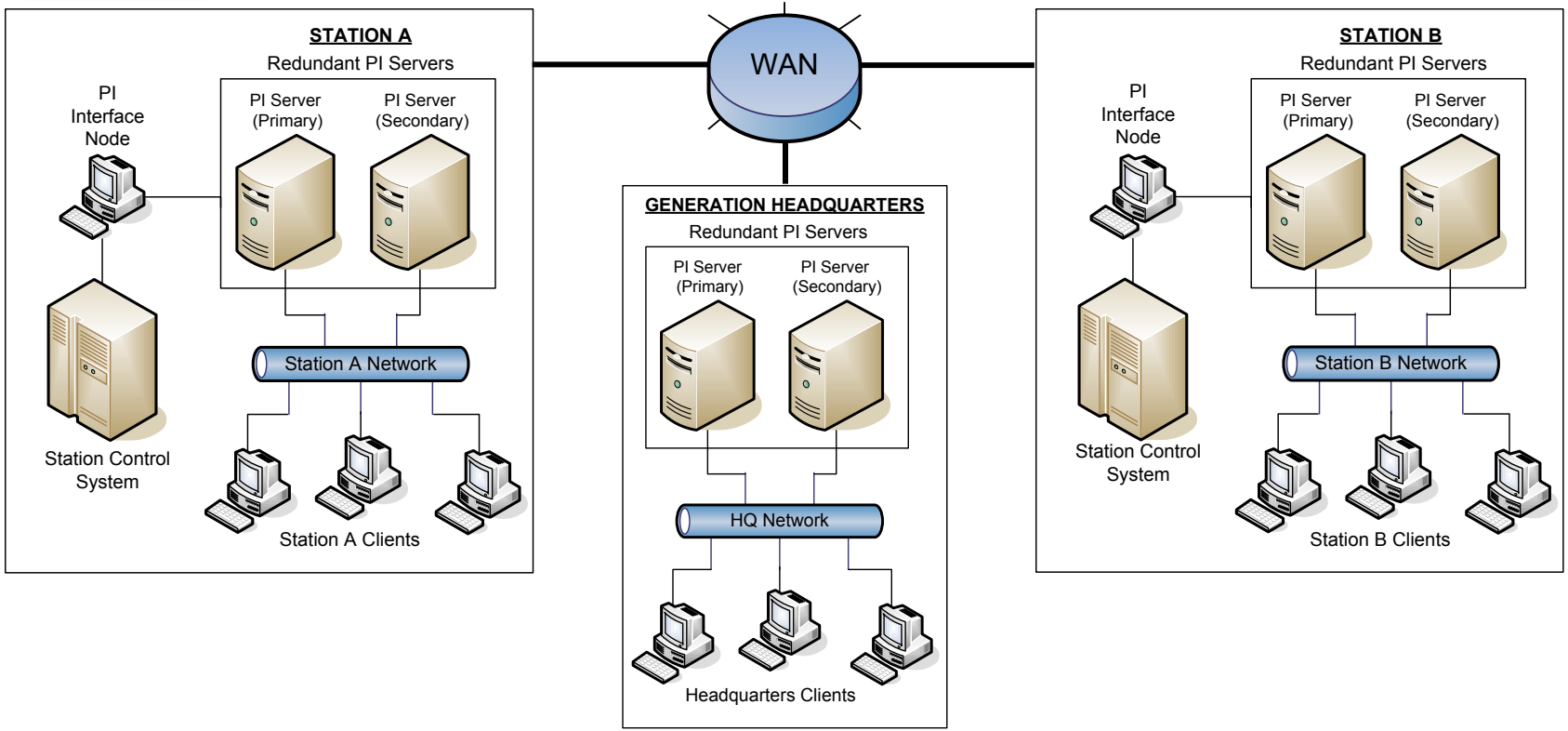
- Concurrent deployment to the other 9 plants
- Federated in-house project implementation
- **TENAGA PERSONNEL**
  PI System infrastructure, applications, user training & technical support
- OSIsoft involvement at initial project deployment & as backup techsupport

USD 7 million savings

Staff competency in PI System

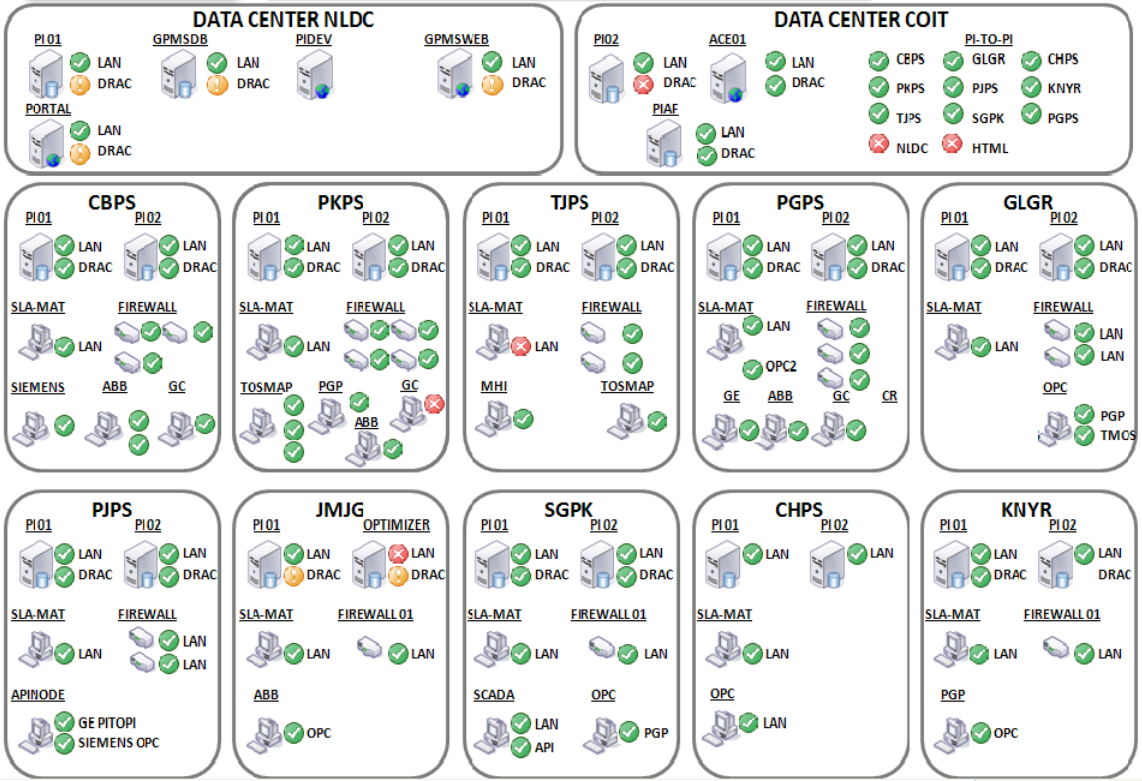
How we deployed it

Generic architecture...



How we deployed it

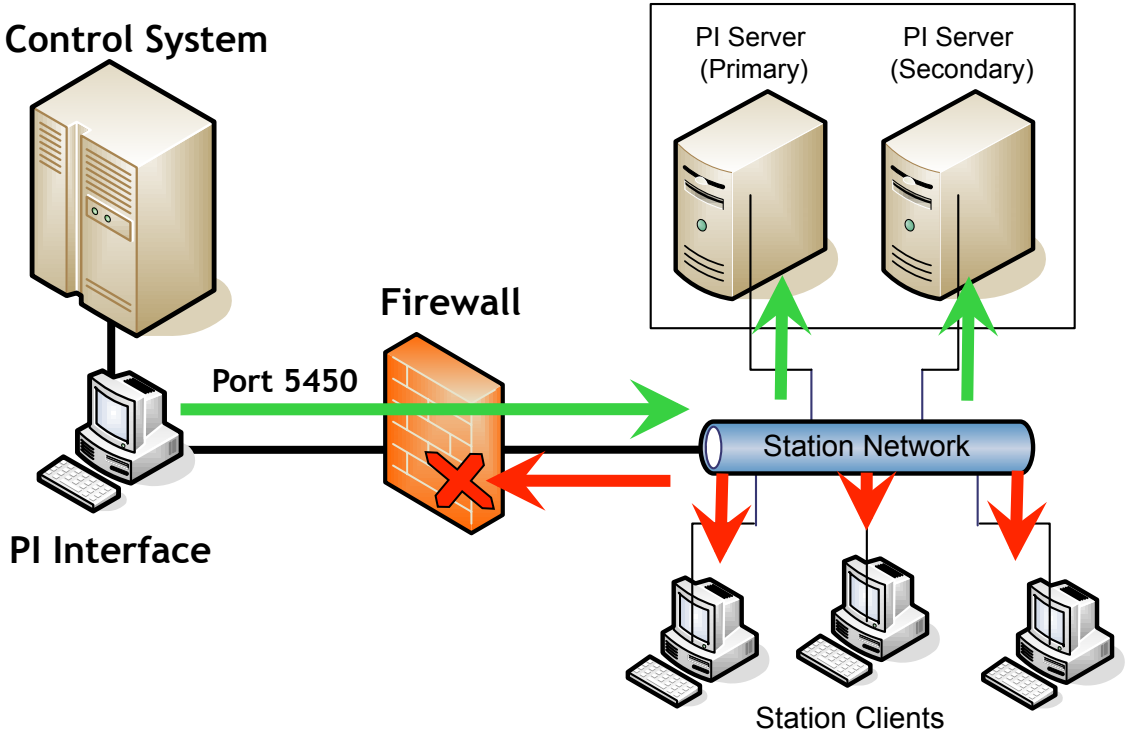
Actual infrastructure...



- 11 sites
- ~ 20 unique data sources
- 8 unique primary plant control systems
- 26 PI Servers
- > 50 Interfaces
  - 25 Standard
  - 12 PI-to-PI
  - > 15 Custom
- 150,000 tags
- AND GROWING...

How we deployed it

Interfacing cybersecurity...



DIRECTIONAL FILTERING
Data from control network can flow to corporate network, but not vice versa

PORT FILTERING
Only data on PI Server port 5450 is enabled

IP FILTERING
PI Interface can only connect to PI servers

Audited & approved by security experts from Tenaga ICT Division

How we deployed it

Change management...

Internal branding:
GENERATION PLANT MANAGEMENT SYSTEM
GPMS
Generation Plant Management System

Key Messages	Key Tactics	Key Actions
...technical & business performance project, NOT an IT project.	...empower all staff with real-time data & use quick-win live demos wherever possible.	...regular and customised training conducted internally for all levels of staff.
...a platform that makes data easily available, BUT the application of that data is in the hands of the end user.	...demonstrate multiple streams of actual or potential cost savings & return on investment to gain management buy-in.	...constant user engagement via workshops, newsletters, internal conferences, & subtle integration into daily work.

What are we doing with it...

- Diverse power plant fleet
- Inhomogeneous sources of operational data
- Real-time process data locked within isolated control systems
- Technical performance & business intelligence reliant on offline data

DATA

- UNLOCK
- UNIFY
- HISTORISE
- DISPLAY
- NOTIFY
- REPORT
- DIAGNOSE
- ANALYSE
- OPTIMISE

What are we doing with it

Display, notify & report...

All notifications done using customised VBA coding within PI ProcessBook

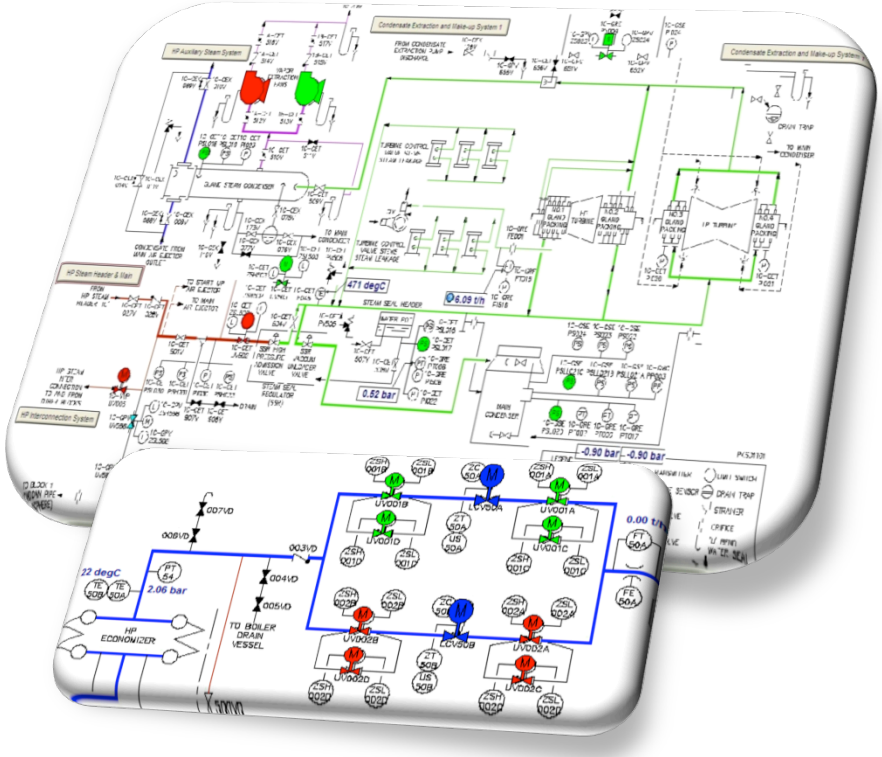
- PI ProcessBook
- Real-time fleet monitoring
- Linked to outage management system
- Scheduled reports automatically compiled, formatted & e-mailed daily
- Ad-hoc snapshots delivered on-demand using e-mail or text message
- Trip notifications by e-mail & text message

Fleet status anytime, anywhere

Management buy-in

What are we doing with it

Diagnose...

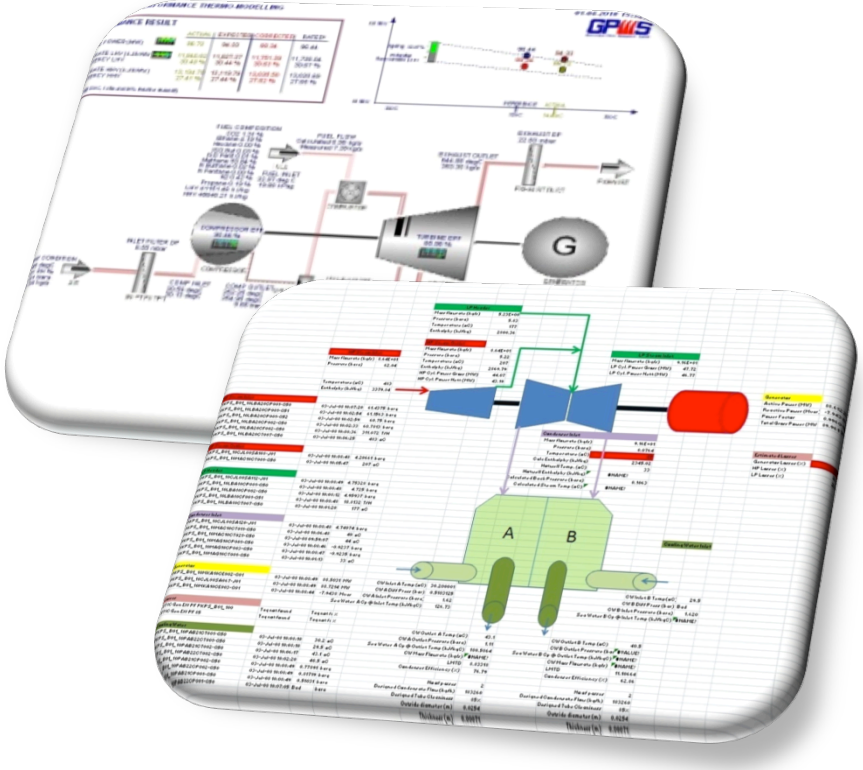


- PI ProcessBook
- Real-time process data overlaid on static plant schematics
- Hyperlinked plant schematics for fast navigation & drill-down
- Ad-hoc trending
- Historical playback
- Virtual on-site presence

- Faster plant troubleshooting
- Improve technical competencies

What are we doing with it

Analyse...



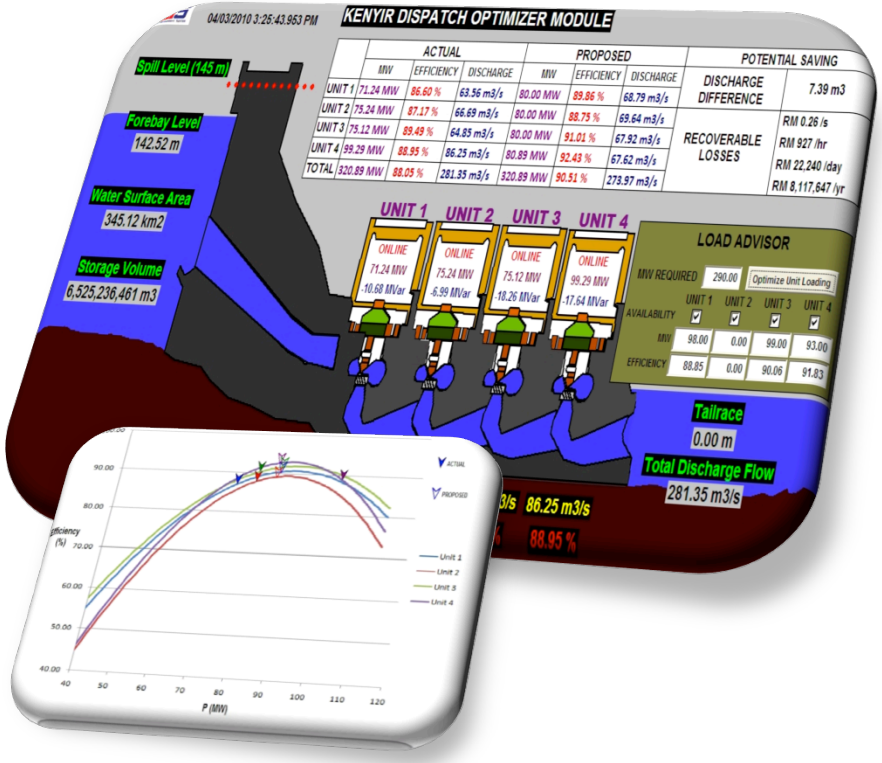
- PI ProcessBook, PI Datalink, PI ACE, PI AF
- Real-time performance analysis of individual equipment & overall plant
- Mass & heat balance analysis
- Degradation tracking
- Recoverable losses
- Justification for plant improvement projects

Over USD 10 million expected annual fuel cost savings

Greater performance awareness

What are we doing with it

Optimise...



- PI ProcessBook, PI DataLink, PI ACE, PI AF
- Real-time unit dispatch optimiser for hydroelectric plant
- Potential savings by displacing gas units
- Dynamic tracking of unit efficiency curves
- Load advisor & what-if simulator
- Daily automated report via e-mail

USD 3000 average daily fuel cost savings in 2011

Greater optimisation awareness

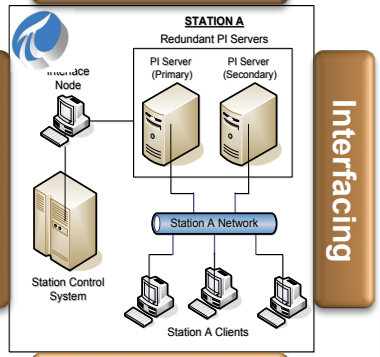
Where are we going with it...

Installation

Training

Interfacing

Tech Support



Derive value from the PI System by going beyond being just an end user

2010 - Provide PI System deployment services for others

2008 - Continuous in-house application development

2007 - Deploy the PI System with internal personnel

2005 - Engage vendor for pilot PI System deployment

60+ years of power industry experience

Internally-developed applications

Where are we going with it

Internal & external services...

Internal Clients

- Expand PI System to other Tenaga divisions
- Pilot project with Distribution ongoing
- Preliminary talks with Transmission ongoing
- Offering PI System infrastructure for corporate Facility Energy Management project

The PI System as preferred data unification platform

Enterprise agreement for Tenaga

External Clients

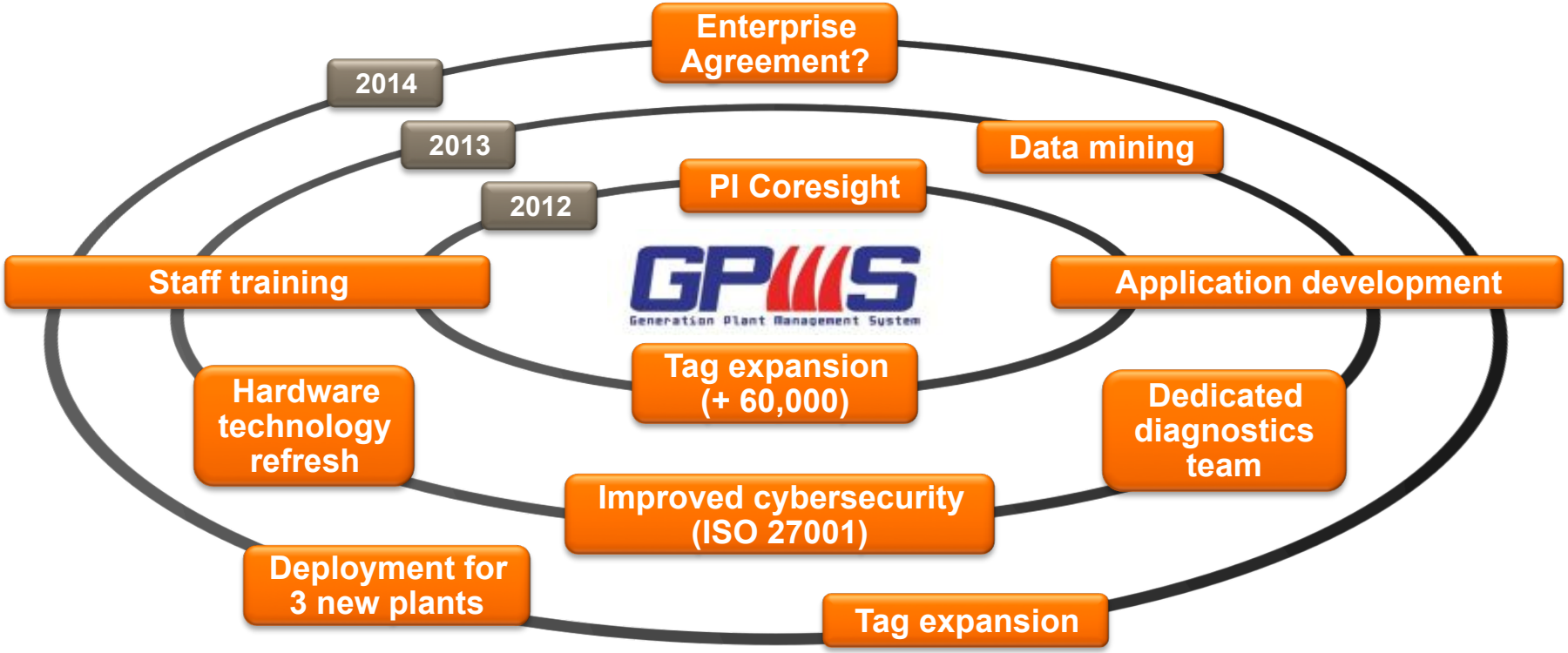
- Provide full scope of PI System deployment services to external customers
- Completed projects: Two independent power plants in Malaysia & one integrated water and power plant in Saudi Arabia
- Additional training & application development requested after project completion

Establish track record as PI System service provider

Non-core revenue for Tenaga

Where are we going with it

Enhancing ourselves...



Summary & Conclusions

EVOLUTION OF THE PI SYSTEM IN TENAGA'S POWER GENERATION FLEET

"Deploying the PI System provides the infrastructure to unify, store, visualise and analyse our data. The real challenge is to transform this data into actionable information in order to make the right decisions and thus improve our technical and business performance."

Abd Ghafar Abd Latif
Project Manager
Generation Plant Management System

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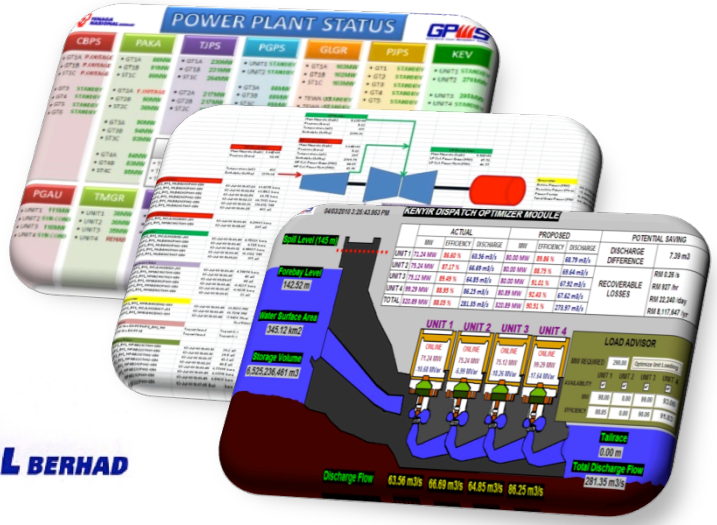

BUSINESS CHALLENGE	SOLUTION	RESULTS & BENEFITS
Diverse power plant fleet	Deploy the PI System as a unifying data infrastructure for the entire fleet	Plant data available to all personnel
Inhomogeneous sources of operational data	Adopt in-house implementation approach to build internal competencies	Over USD 7 million savings from in-house project implementation approach
Real-time process data locked within isolated control systems	Continuous change management	Over USD 10 million tangible savings from plant analysis & optimisation
Technical performance & business intelligence reliant on offline data	Continuous in-house application development	Generate revenue by providing PI System deployment service to others

Conclusions...

Tenaga has reaped the benefits of the PI System not just as a user, but also as a project implementer & service provider

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THANK YOU

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