



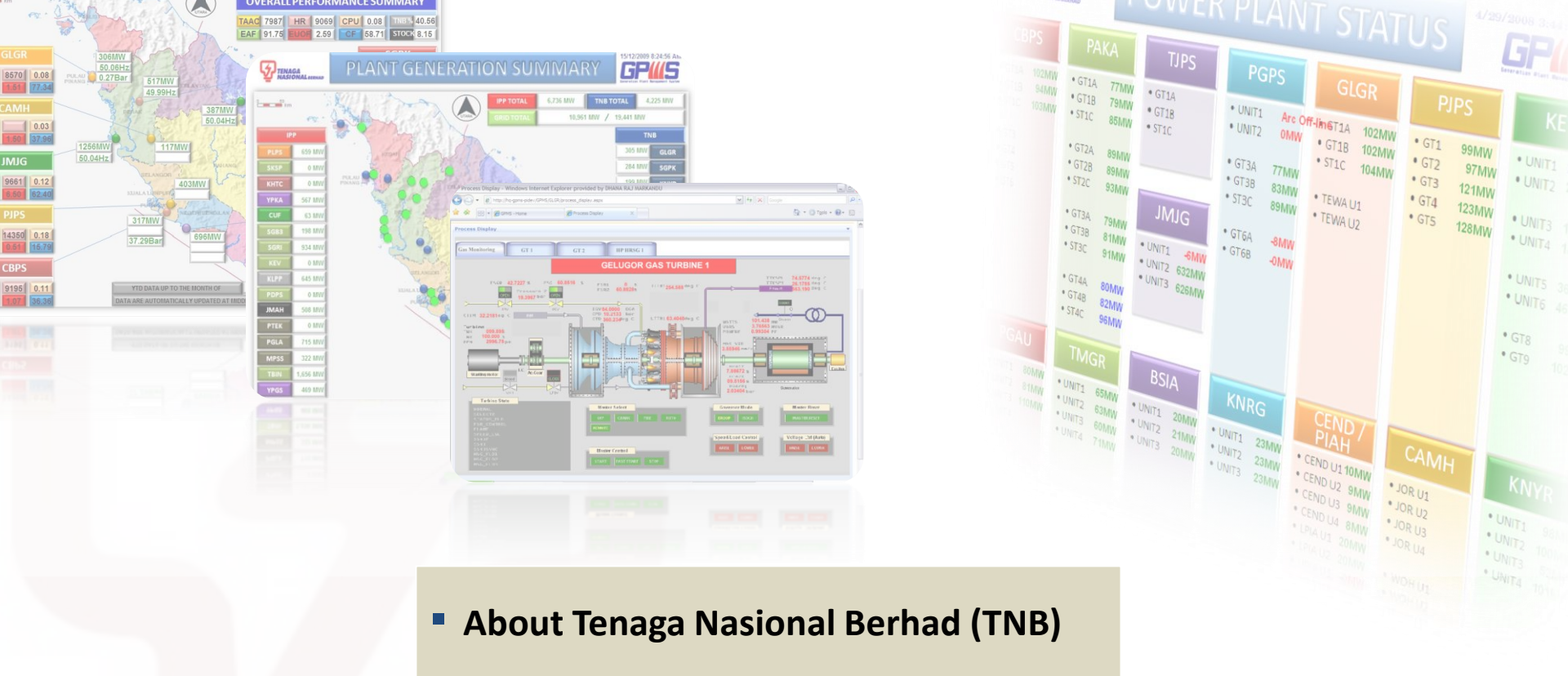
# TNB's Journey With PI

## Beyond PI User

Presented by:

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## ■ About Tenaga Nasional Berhad (TNB)

- Our Journey With PI System
- Beyond PI User

**Tenaga Nasional Berhad is the main power utility company in Malaysia providing power generation, transmission and distribution services.**



**Established in 1949**

**USD 24 billion assets**

**USD 11.5 billion market capitalisation**

**30,000 employees**

**Installed generation capacity of 11 GW**

**Contributes 55% of total national capacity**



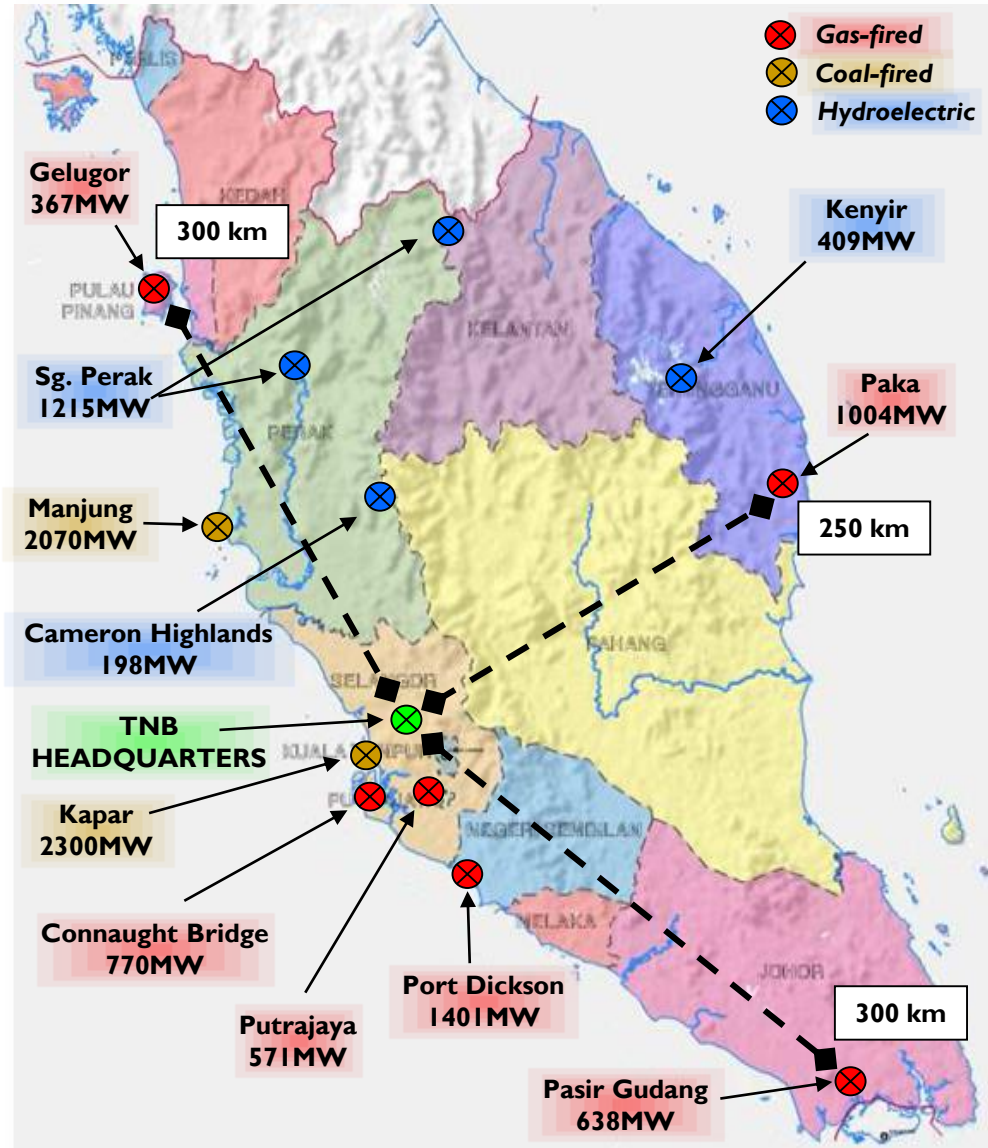
# Generation Division of TNB manages and operates all TNB power plants.

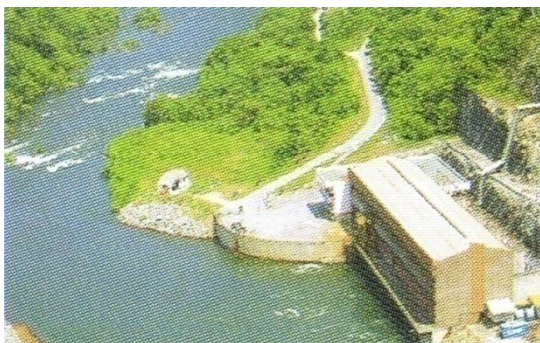
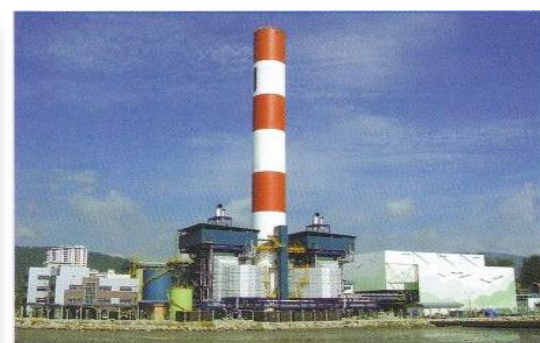
## Capacity from fully owned stations: 8000MW

- Coal-fired (1 station): 2,100MW
- Gas-fired (6 stations): 4,100MW
- Hydro (3 stations): 1,800MW

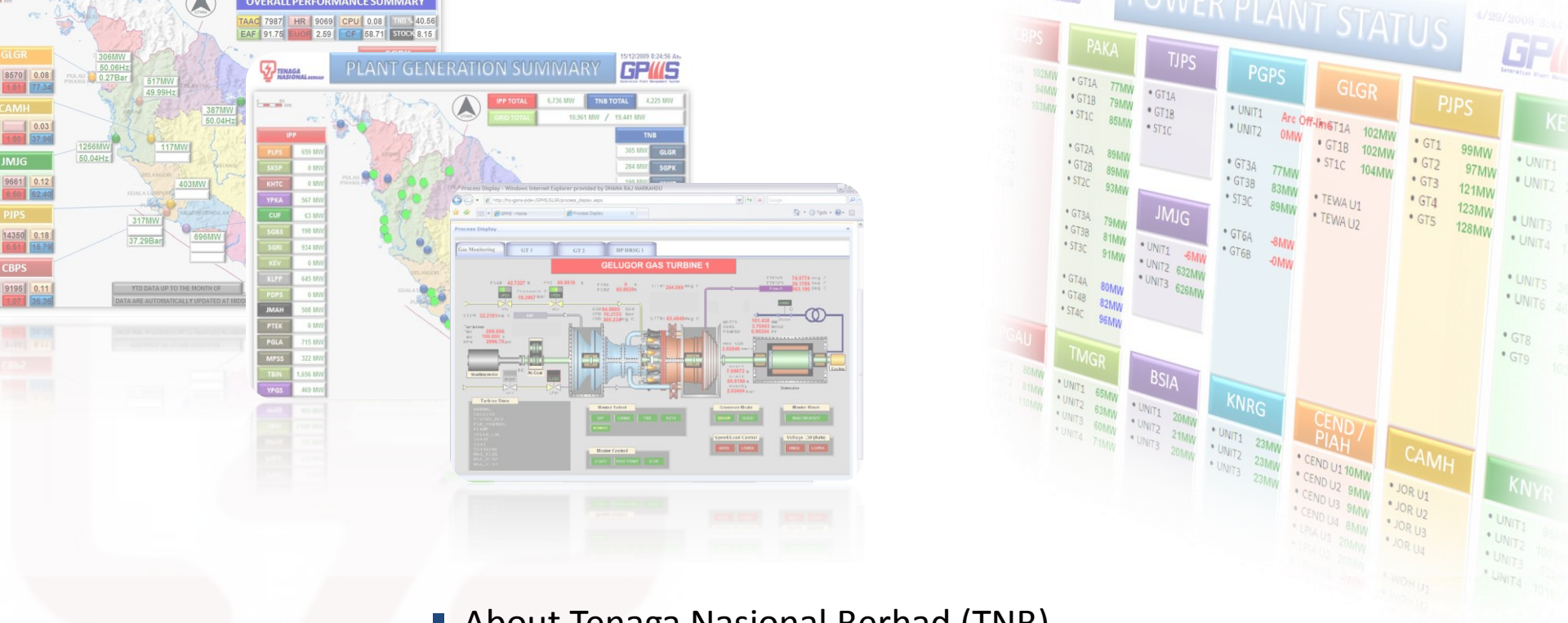
## Capacity from 60%-owned subsidiary :

- Kapar Energy Ventures (coal + gas): 2,300MW









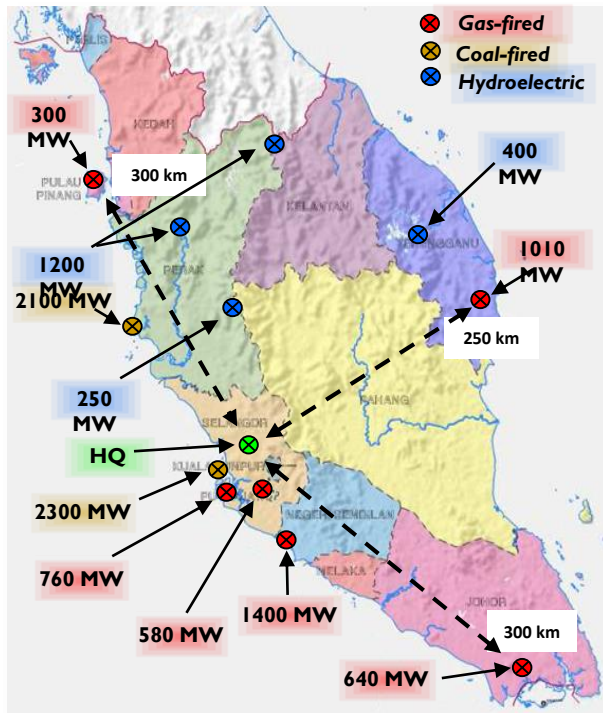
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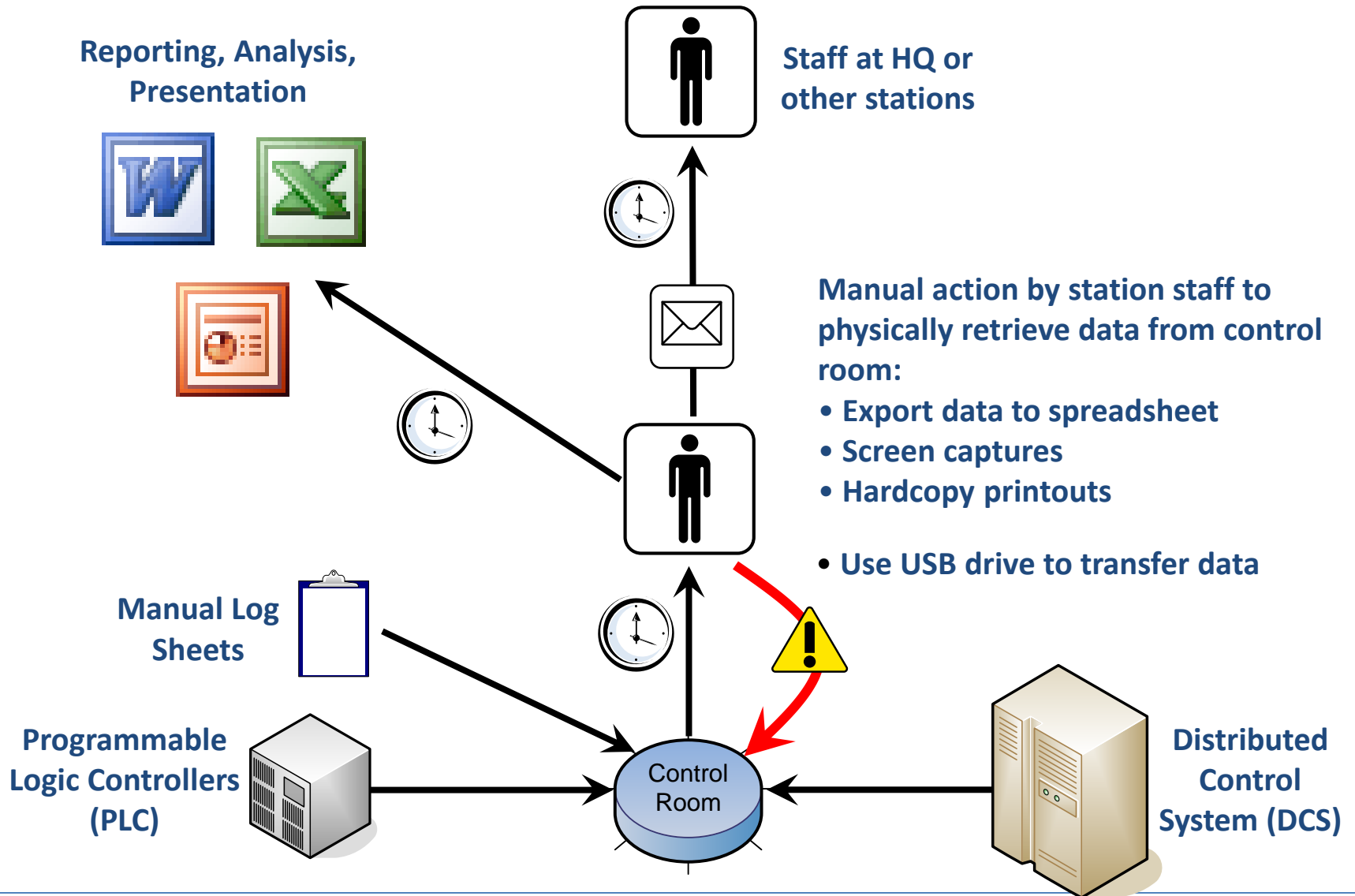
- *Why we needed it...*
- *How we deployed it...*
- *What we're doing with it...*
- *Where we're going with it...*

We have a lot of data but all of them are 'locked' at various sites making intelligence gathering and analysis almost impossible.



	Infi90	P14	Siemens	MHI	Netmation	MHI Up	Toshiba	GE MarkV	Onsite SCADA
GLGR	✓							✓	
PAKA	✓	✓					✓		
PJPS			✓					✓	
CBPS		✓	✓						
TJPS				✓				✓	
PGPS		✓			✓				✓
SGPK	✓								
CHPS			✓						
MNJG	✓								
KNYR	✓								

# Data gathering, analysis and interpretation of data are very inefficient and always lagging in nature.





# The management realized the benefit of having real-time data available on desktop outside control rooms for analysis and diagnostic.

- 1 Phase I (2005 - 2007)
- 2 Pilot project at one plant & headquarters
- 3 Turnkey project implementation
- 4 **PROJECT VENDOR**  
PI System infrastructure, applications, user training & technical support
- 5 No direct OSIsoft involvement

## LESSONS LEARNED

Vendor not fully understand our need

Minimum transfer of technology and knowledge

Time taken too long

Roll-out to all plants will be expensive

Users failed to see the true potential of the technology

Base on the experience and lessons learned from pilot implementation, the management agreed to relook and reconsider an alternative approach.

- 1 Phase II (2007 – 2009)
- 2 Concurrent deployment to the remaining 9 plants
- 3 Federated in-house project implementation
- 4 **TNB PERSONNEL**  
PI System infrastructure, applications, user training & technical support
- 5 OSIssoft involvement at initial project deployment, capability building & support

## LESSONS LEARNED

USD 7 million saving

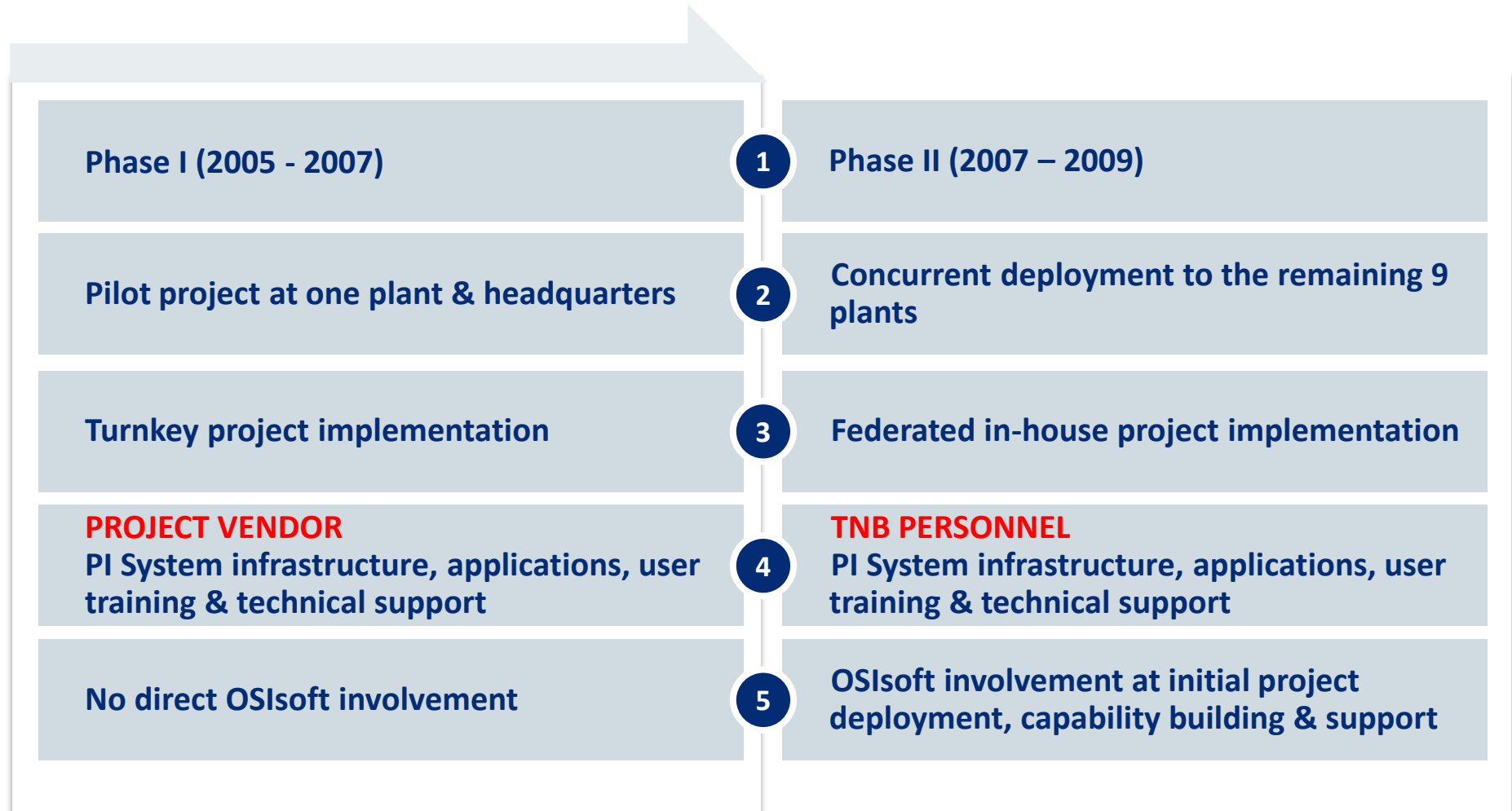
Implementation scheduled is extended due to sites availability

Increased staff competency in PI system

Potential for providing training and System Integration service

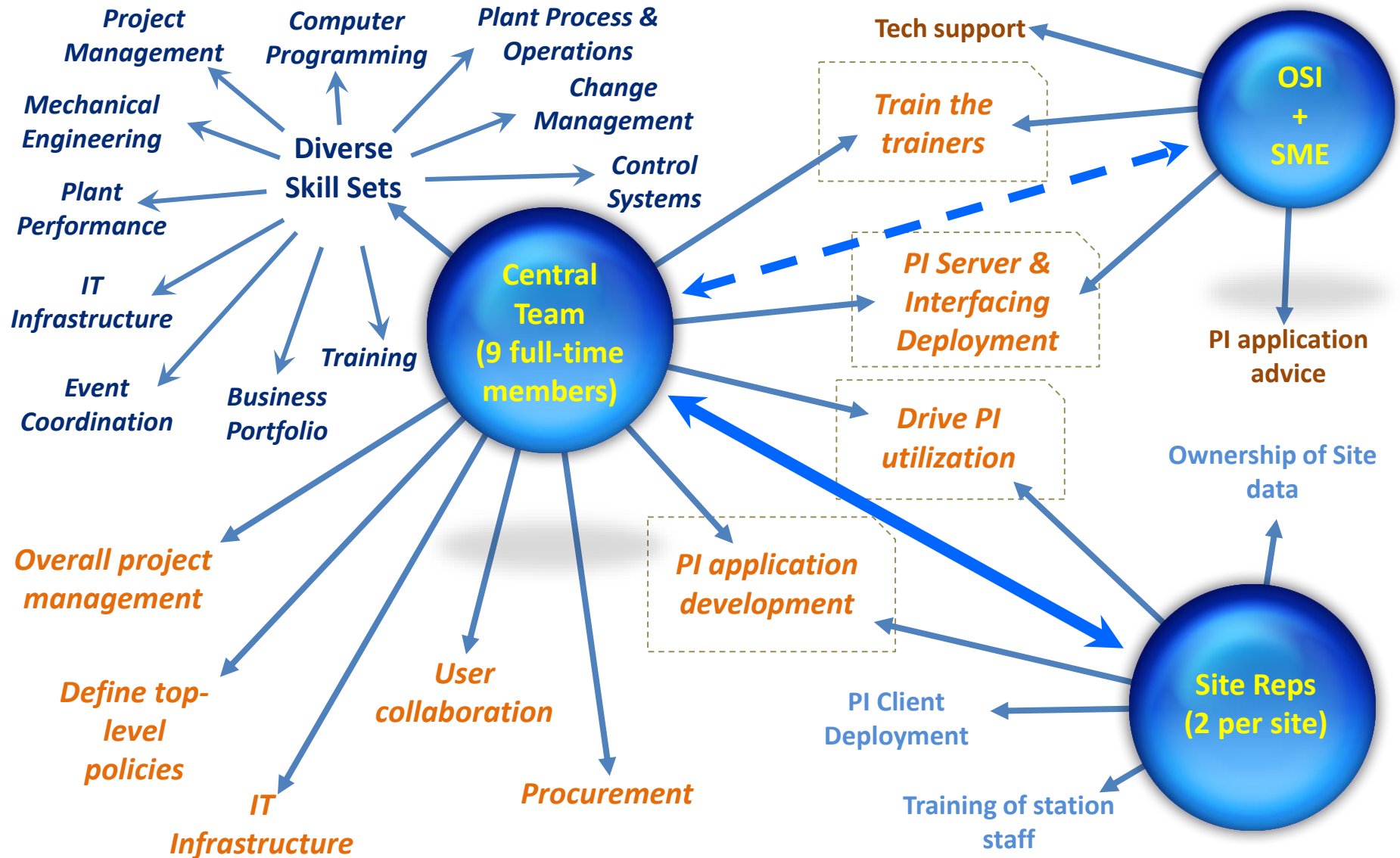
Users see the true potential of the technology

# The most difficult part of the project implementation is convincing the management that we can do it ...

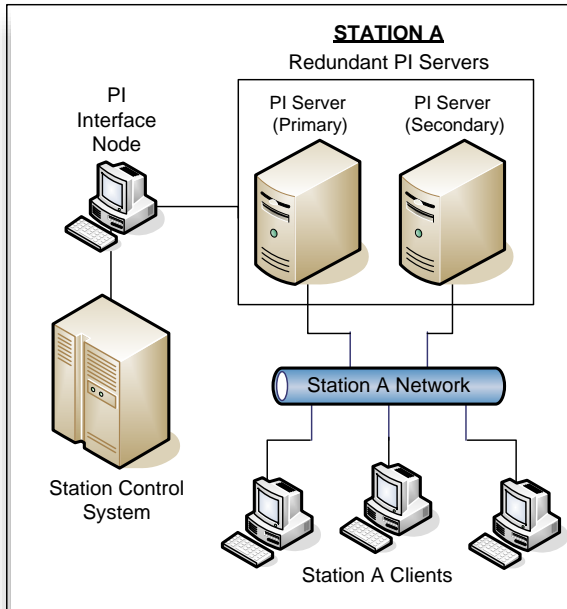




Formation of a project team with full-time IT savvy process people is one of the critical success factors in our federated in-house approach.



**We used high availability (HA) server configuration for our PI system, connected to control systems through PI interface node.**



**Infi90**

**Toshiba**

**Siemens**

**MHI Netmation**

**GE MarkV**

**P14**

**Onsite SCADA**

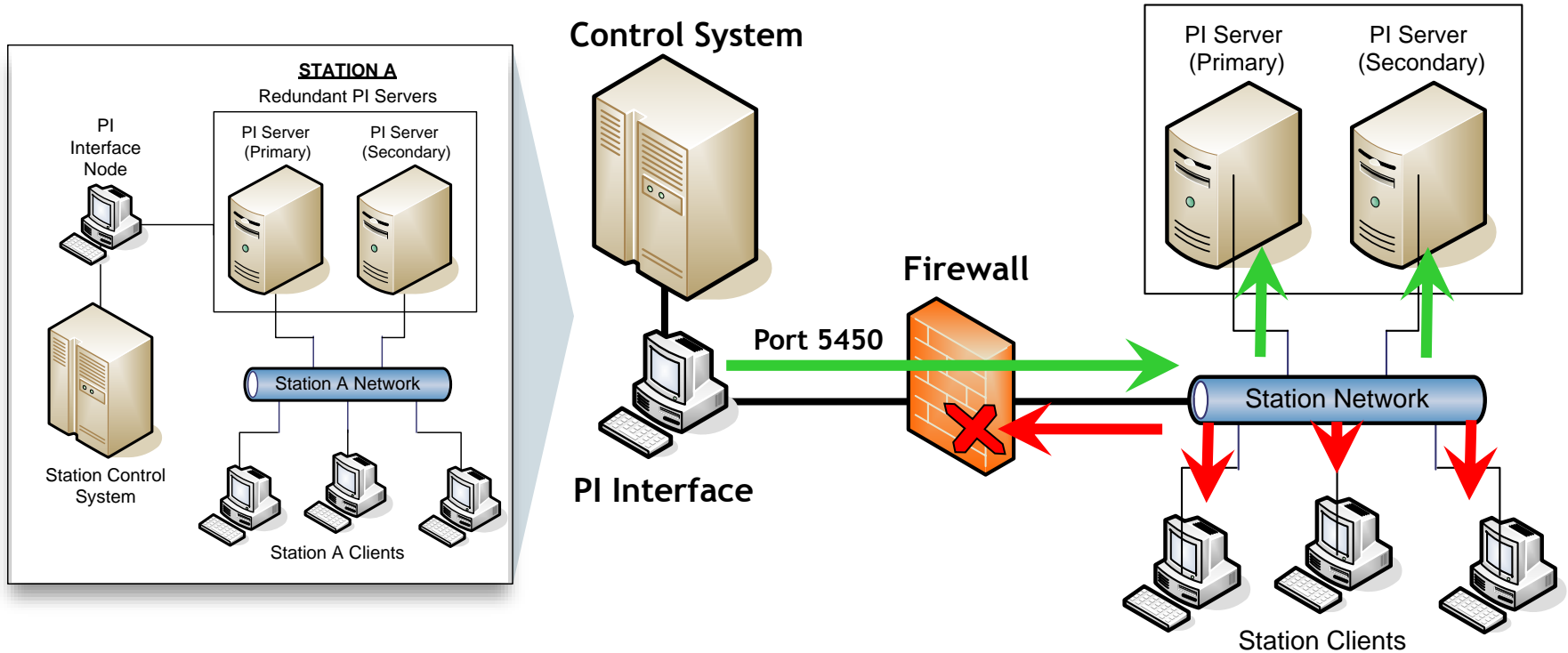
**PI OPC Interface**

**PI-to-PI (Embedded GE PI Historian)**

**PI PBS Interface**

**Custom Developed In-House**

**We secured the communication to allow only authorized read access. The configuration was audited and approved by in-house ICT security expert.**



**DIRECTIONAL FILTERING**

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

**PORT FILTERING**

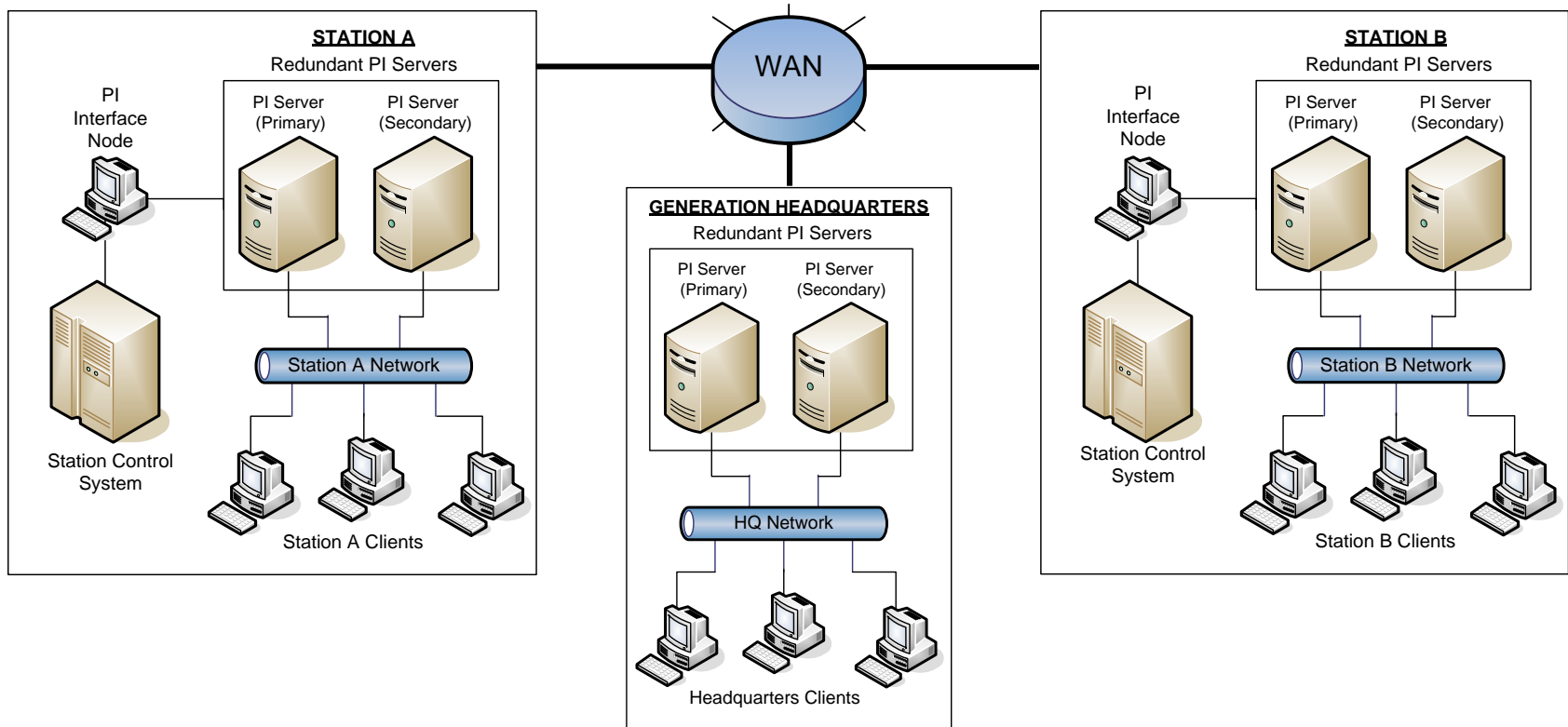
Only data on PI Server port 5450 is enabled

**IP FILTERING**

PI Interface can only connect to PI servers



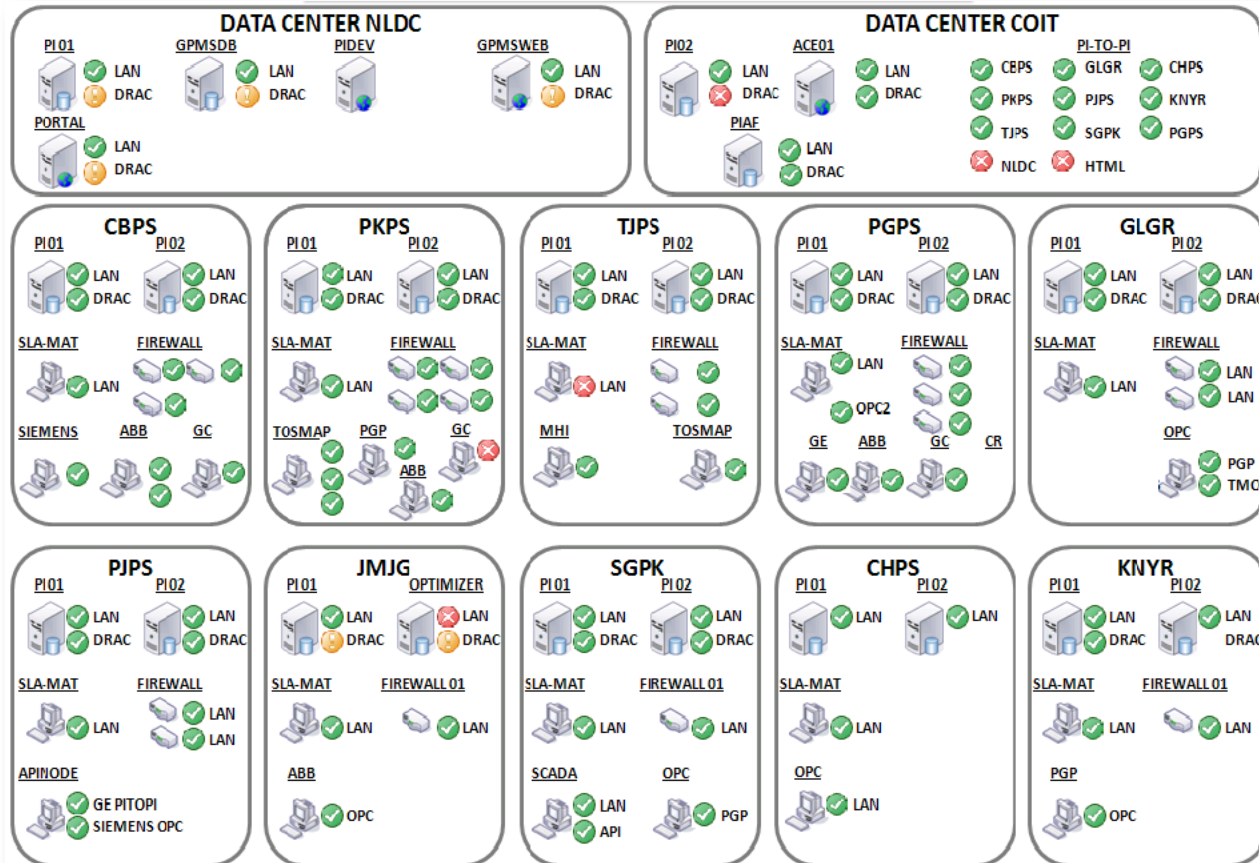
Similar configuration and architecture were established at all sites. These sites are connected with each other (including HQ) through TNB WAN.



**Besides interfacing with DCS, we also established interfaces with other non-DCS, including internet and other non-PI applications.**

Data Type	Data Source	Interfacing Method
Foreign Exchange	Internet	Custom Internet Interface
Weather Forecast		
Commodity Prices		
Combustion Emission Data	Emission Monitoring System	PI RDBMS
SLA Management System	ODBC	Custom ODBC interface

# We use PI to monitor the architecture health. We are preparing ourselves to install PI at 3 new plants in 2014/15.



11 sites (+ HQ)

~ 20 unique data sources

8 unique primary plant control systems

26 PI servers

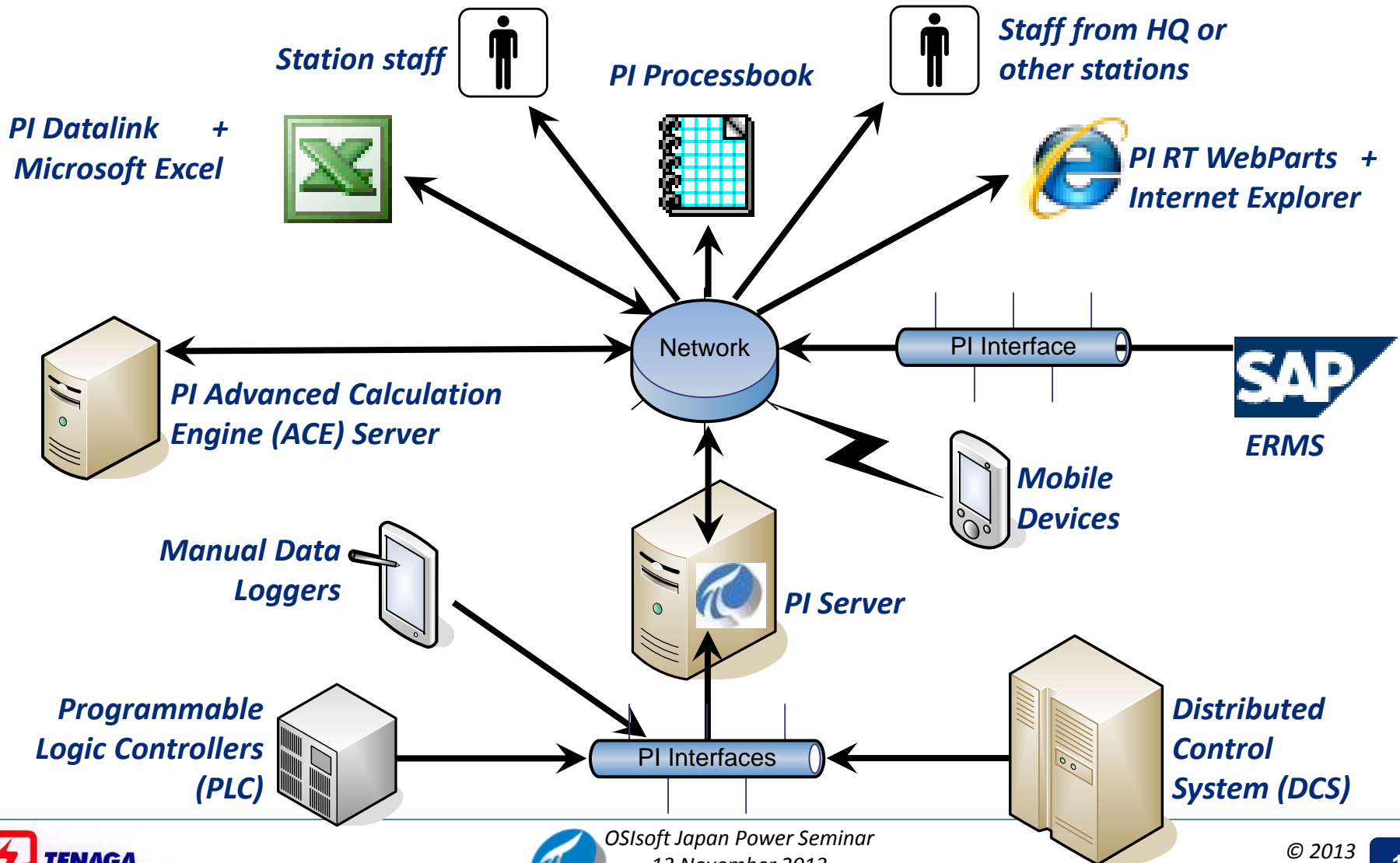
> 50 interfaces

- 25 standard
- 12 PI-to-PI
- > 15 custom

200,000 tags  
....and growing



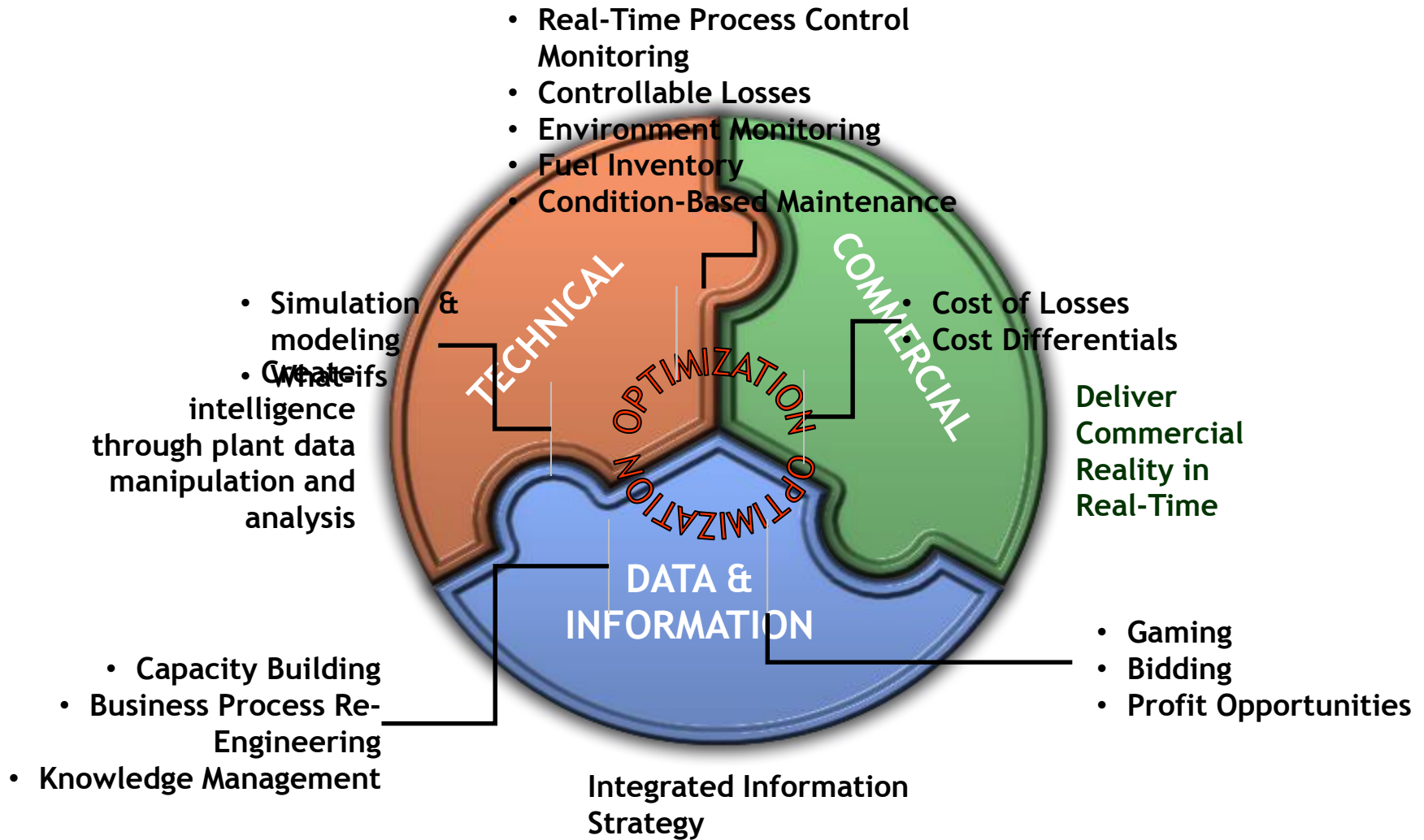
Deploying PI System provides the infrastructure to unify, store, visualize and analyze data from various sources of different protocol.



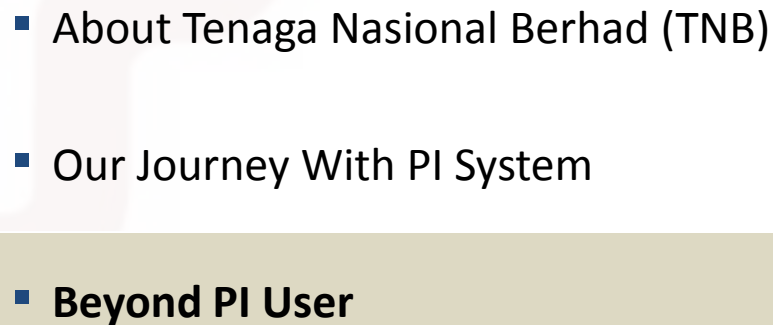
The real challenge is to transform this data into actionable information in order to make the right decisions and thus improve our technical and business performance.



The infrastructure installed allow us to analyze data and make strategic decision related to technical and commercial aspects of the business.







# PI is the main unifying infrastructure for our GPMS. The federated in-house approach has benefited TNB in many ways.

*GPMS – Generation Plant Management System*

## BUSINESS CHALLENGE

Diverse power plant fleet

Homogenous sources of operational data

Real-time data locked within isolated control systems

Technical performance & business intelligence reliance on offline data

## SOLUTION

Deploy the PI system as a unifying infrastructure for the entire fleet

Adopt in-house implementation approach to build internal competencies

Continuous change management

Continuous in-house application development and knowledge sharing

## RESULTS & BENEFIT

Plant data available to all personnel

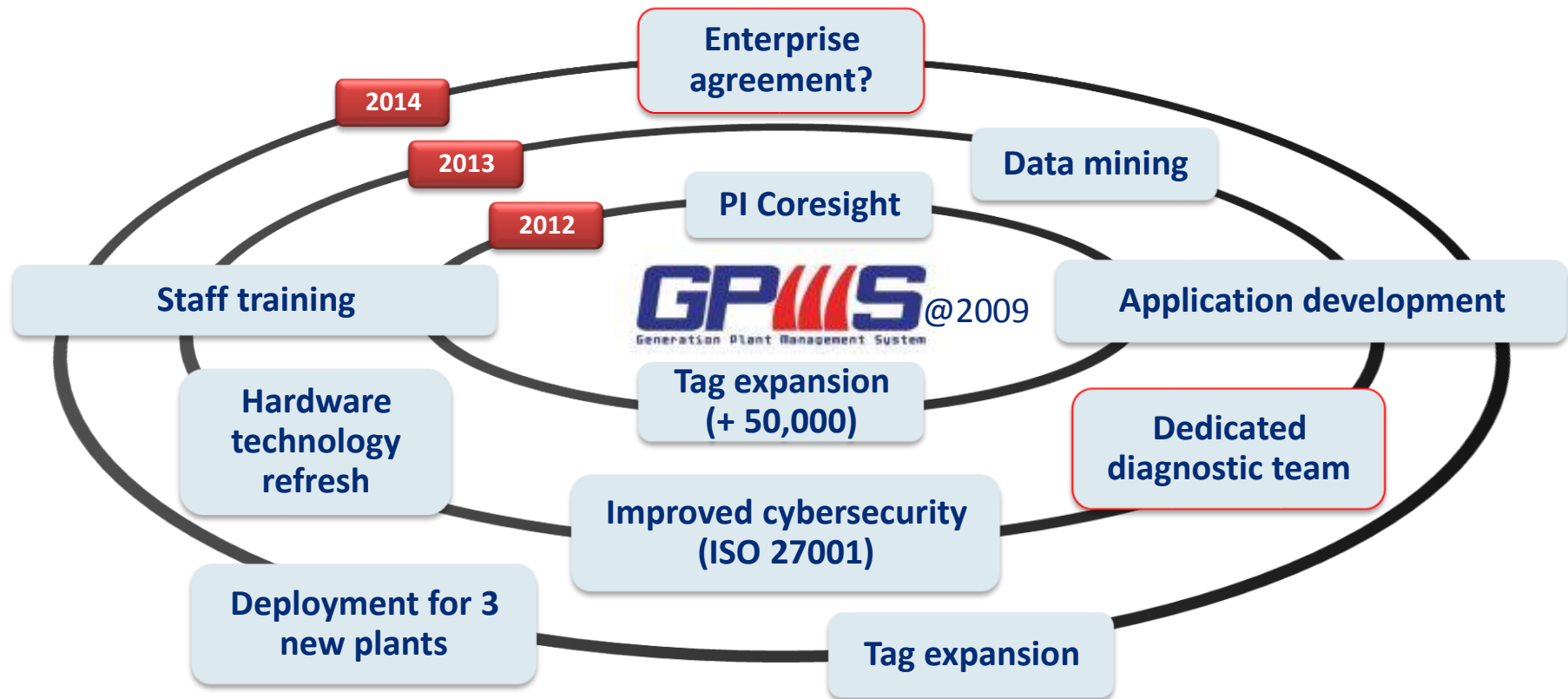
Over USD 7 million savings from in-house project implementation approach

Over USD 10 million tangible savings from plant analysis and optimization after 2 years

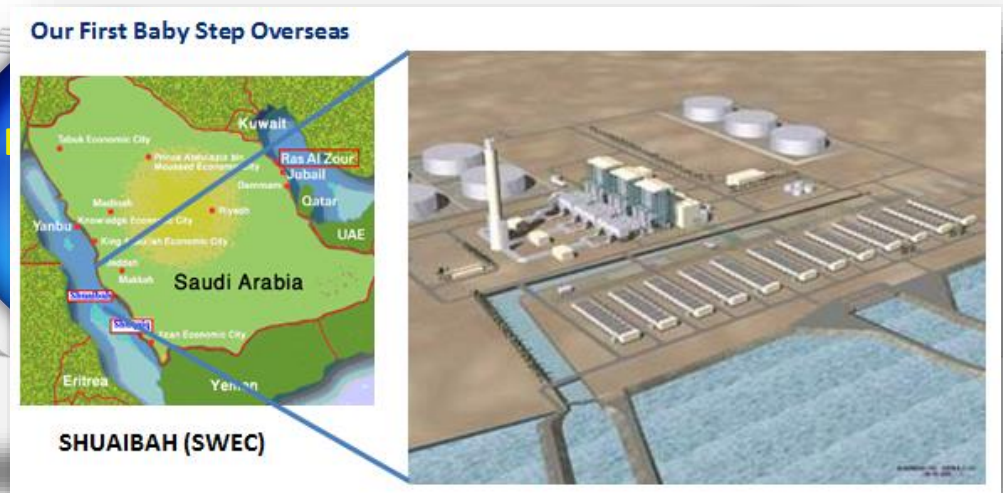
Generate revenue by providing PI system deployment service to others

# Installing PI system is only the beginning of a long journey in establishing credible centralised diagnostic team.

*GPMS – Generation Plant Management System*



**We are happy to share TNB's journey with PI system and proud to progress beyond just a PI user.**



- Package in one box!!
- In line with TNB's aspiration
  - Geographical Expansion (farviges)
  - Overseas power plant monitoring and optimization



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ありがとう  
Thank You

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