Goals and Challenges of Modernizing ITAIPU PI System Infrastructure

Presented by Roger Daniel F. Ferreira
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Agenda

• About ITAIPU
• Business Goals & Challenges
• OT Infrastructure Projects
• PI System Timeline
• PI System Data Sources
• PI System Architecture
• PI System Benefits
• EA Roadmap
• Conclusion
About ITAIPU

Located at the border of Brazil & Paraguay

World leader in clean and renewable energy 2.3 billion MWh since 1984

Installed Capacity of 14,000 MW 20 generating units

New 2016 World Record in annual Power Generation for Hydro Plant 103.1 million MWh
Business Goals & Challenges

ITAIPU Technological Modernization Plan

- Increase the digitalization degree of the plant
- Full modernization of supervision, control, automation, protection & monitoring systems
- Over 200,000 TAGs

Enterprise Agreement (EA) contract signed in 2014

- Be prepared for the increasing demand
- Condition Based Monitoring deployment program
OT Infrastructure Projects

ENES.DT
Technical & Contract Management

- Technical Specification
- Acquisition Process
- Contract
- FAT
- SAT / Commissioning
- Guarantee
PI System Timeline

PI-SCADA
SCADA/EMS

2002
PI-SIRI
SIRI Deployment

2006

2012
PI-SIRI
2012 Upgrade

2015
EA Contract
& Matrix Project

2017
PI-SIRI
Latest Upgrade

2018
Modernization Plan

SIRI – Industrial Network Integrated System
### PI System Data Sources – PI-SIRI Integrated Systems (70,000 TAGs)

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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<tbody>
<tr>
<td>SCADA/EMS</td>
<td>• Power plant supervision and control (30,000 TAGs)</td>
</tr>
<tr>
<td>STH</td>
<td>• Hydrological Data (1,000 TAGs)</td>
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<tr>
<td>Matrix Project</td>
<td>• Condition Monitoring System</td>
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<tr>
<td></td>
<td>• System designed to collect temperature, vibrations and partial discharges (8,000 TAGs)</td>
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<tr>
<td>Others</td>
<td>• SMG – GIS Monitoring System</td>
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<tr>
<td></td>
<td>• SMT – Transformer Monitoring System</td>
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<td></td>
<td>• RPMF – Oscilograph &amp; Phasor Measurement</td>
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PI System Architecture – PI-SIRI

Current Production Environment
- Data Archive (HA)
- AF
- PI Interfaces: PI to PI, RDBMS, UFL
- PI WebParts

New Production Environment
- Data Archive (HA)
- AF
- PI Interfaces: PI to PI, RDBMS, UFL
- Notifications
- PI Coresight
- Asset Analytics

New Test Environment
- Full PI System in 2 VMs
PI System Architecture – PI-SCADA to PI-SIRI

Scada Network

Scada/EMS

Scada/EMS Historian (PI System)

PI to PI Interface

SIRI Network

SIRI Data Server (PI System + PI AF)

Corporative Network

VPN Connection

Corporative Stations

Scada/EMS

Scada/EMS Historian (PI System)

PI to PI Interface

SIRI Data Server (PI System + PI AF)

VPN Connection

Corporative Stations
PI System Architecture – PI System Data Access for BI

Data Model
- PI AF
- CIM

Data Extraction & Transformation
- Performance Equations
- Data Reference
- Pentaho Data Integration

Data Analysis
- Data Warehouse
- Analysis Server
- MS Excel

ETL – Extract, Transform and Load
PI System Architecture – PI System Data Access for BI

ETL – Extract, Transform and Load
PI System Architecture – PI System Data Access Special Purpose

Operation OT Team Solution

LASSE R&D+I Solution
PI System Benefits - So What Value do We get from all of this?

BI Study Case I
_Situational Awareness_
Operational Profile of UG Drain Pumping
Activations & Working Time

BI Study Case II
_Situational Awareness_
UG Unavailability
2014 1st Semester – 50 & 60 Hz Sector
PI System Benefits - So What Value do We get from all of this?

PI ProcessBook new Widgets
Phasor Measurement Study Case
Electrical Synoptic & Phasor Diagram & Capability Curve
PI System Architecture – Modernization Plan

RTA
- OT Network
- SIRI Modernization & Expansion
- Industrial system integration
- Multiservices

UTAs
- Access Terminal Units
- Users & External systems interconnection
- Wifi network

PI System
- Core HA infra
- DMZ server / services
- Interface nodes distribution
- NOC with managed PI
EA Roadmap – 2016-2017

- Matrix Project Commissioning
- Network Security Perimeter
- Develop Asset Framework (AF) Structure
- PI Coresight as Mobile & Web solution
PI System Infrastructure & ITAIPU Technological Modernization Plan

**COMPANY and GOAL**
ITAIPU is pursuing the modernization of its OT infrastructure, mostly based on 80ths technology, to make the PI System the main data hub with which to integrate every OT system.

**CHALLENGE**
Improve the operational data infrastructure in order to support the power production growth and digital transformation.

**SOLUTION**
Using the PI System as solution to monitor, manage and analyze large sets of operational data.

**RESULTS**
PI System infrastructure consolidation, helping ITAIPU to reach the new world record in annual power generation for a hydro electrical power plant.

- Total production of 103.1 million MWh in 2016.
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Questions

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