An Integrated Approach to Central Energy Plant Control Systems

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Is This Your Controls Staff?
Agenda

- Typical Design Approach
- Integrated Design Approach
- Integrated Design Approach Implementation
- Case Studies
- Summary
Typical Design Approach
Typical Design Approach

► Local Control Systems
  • Come with packaged systems provided by OEM

► Plant Control System
  • Interfaces with Local Control Systems for display to Operator in Control Room
  • Plant Control System picks up miscellaneous BOP IO
System Architecture

- **GAS COMPRESSOR**
  - CTRL

- **DIESEL GENERATOR**
  - CTRL

- **GAS TURBINE**
  - CTRL

- **WATER TREATMENT**
  - CTRL

- **CONDENSATE TANK/PUMPS**
  - CTRL

- **DEAERATOR**
  - CTRL

- **BOILER**
  - CTRL

- **HEAT RECOVERY STEAM GENERATOR**
  - CTRL

**Legend:**
- PLANT CONTROL SYSTEM
- LOCAL CONTROL SYSTEM
- CTRL = CONTROLLER & IO
- RIO = REMOTE IO
- HARDWIRED
- DATALINK
## So What’s the Problem?

<table>
<thead>
<tr>
<th>DESIGN ATTRIBUTE</th>
<th>IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple Platforms</td>
<td>Increased O&amp;M Costs</td>
</tr>
<tr>
<td>Variations in IO/Logic/HMI</td>
<td>Increased Complexity of O&amp;M</td>
</tr>
<tr>
<td>Datalinks between Local Control Systems and Plant Control System</td>
<td>Lower Plant Availability</td>
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Integrated Design Approach
Integrated Design Approach

► Local Control Systems
  • Minimize as far as practical
  • Extent depends on the following:
    ▪ New plant vs existing plant
    ▪ Type of packaged system
    ▪ Suitability of Plant Control System platform for control

► Plant Control System
  • Controls as much of the plant as possible
System Architecture (one of many)

- GAS COMPRESSOR
  - CTRL

- DIESEL GENERATOR
  - CTRL

- GAS TURBINE
  - CTRL
    - GT/HRSG CTRL

- WATER TREATMENT
  - CTRL

- BOILER
  - CTRL
  - HEAT RECOVERY STEAM GENERATOR
    - Boiler CCS CTRL

- CONDENSATE TANK/PUMPS
  - CTRL

- DEAERATOR
  - CTRL
  - BOILER
    - Boiler BMS CTRL

- BOP CTRL

- PLANT CONTROL SYSTEM
- LOCAL CONTROL SYSTEM

CTRL = CONTROLLER & IO
RIO = REMOTE IO
HARDWIRED
DATALINK
What Are the Benefits?

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<th>DESIGN ATTRIBUTE</th>
<th>IMPACT</th>
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<tr>
<td>Minimize number of platforms</td>
<td>Decreased O&amp;M Costs</td>
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<tr>
<td>Standardized Control System Design</td>
<td>Decreased Complexity of O&amp;M</td>
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<tr>
<td>Native Network Between Plant Control System and Packaged Systems</td>
<td>Increased Plant Availability</td>
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Integrated Design Approach Implementation
How Much to Integrate into Plant Control System?

► New Plant
  • As much as possible
  • Things to consider leaving out:
    ▪ Machine control systems
    ▪ Standard product control systems
    ▪ Equipment Control is not suitable for Plant Control System

► Existing Plant
  • As much as possible
  • Things to consider leaving out:
    ▪ Anything O&M staff wants to continue to use OEM for services
    ▪ Equipment Control is not suitable for Plant Control System
Plant Control System Design Criteria

► Minimum one set of redundant controllers
► Segregate multiple steam/electricity/chilled water units based on availability requirements
► For Boiler or fired HRSG, need separate Combustion Control and Burner Management controllers per NFPA 85
► Other segregation as needed based on plant design
Plant Control System Integration with Skids

WATER TREATMENT SKID

Field Devices

Junction Box

CTLR

WATER TREATMENT SKID

Field Devices

RIO

CTLR
Plant Control System Standardization: Hardware

- Controllers
- IO Modules
- Communication Modules
- Networking Components
- Power Supplies
- Human Machine Interface
Plant Control System Standardization: Software

► IO
  • Standardized tagging/naming convention

► Logic Design
  • Develop functional structure to match plant design
  • Standardized logic for plant components

► Graphic Design
  • Standard templates and faceplates with macros
  • Color standards
  • Alarming standards
  • High performance graphics
Project Execution

► Define design standards to be used
  • IO
  • Logic
  • Graphics
  • HW Design

► Develop spec documents:
  • Control system architecture
  • IO List
  • Specification
  • Include design standards

► Verify implementation during submittal reviews and FAT

► If Engineering firm is also system integrator can streamline process
Project Execution: Integration of OEM Equipment (New Plants)

► Design Input from OEM
  • P&IDs
  • Functional Input – one or more of the following:
    ▪ Sequence of Operation
    ▪ Functional Description
    ▪ Control Narrative
    ▪ Logic Diagrams
  • Cut Sheets of Field Devices
  • Drawings of Skid Interface
    ▪ Schematic for junction box
    ▪ Remote IO panel drawing

► Execution Support from OEM
  • Review implementation of design into control system
    ▪ Logic
    ▪ Graphics
    ▪ IO
    ▪ BMS drawings
  • FAT support
  • FAT acceptance
  • Site support
Case Studies
New Plant Design

Maintain Local Control System

Functional segregation of PCS

CTRL = CONTROLLER & IO
RIO = REMOTE IO

HARDWIRED

DATALINK
Existing Plant Upgrade

Maintain dedicated controllers

Utilize RIO to minimize cabling changes

Functional segregation of PCS
SUMMARY
Summary

► Integrated design approach offers the following benefits
  • Improved availability
  • Simplified and more effective O&M
  • Lower O&M costs

► Integrated design approach requires different approach for design and project execution

► Integrated design approach will result in different Plant Control System architectures depending on the following:
  • New vs existing plant
  • Objectives of Owner
Let’s Get This Guy Some Help!