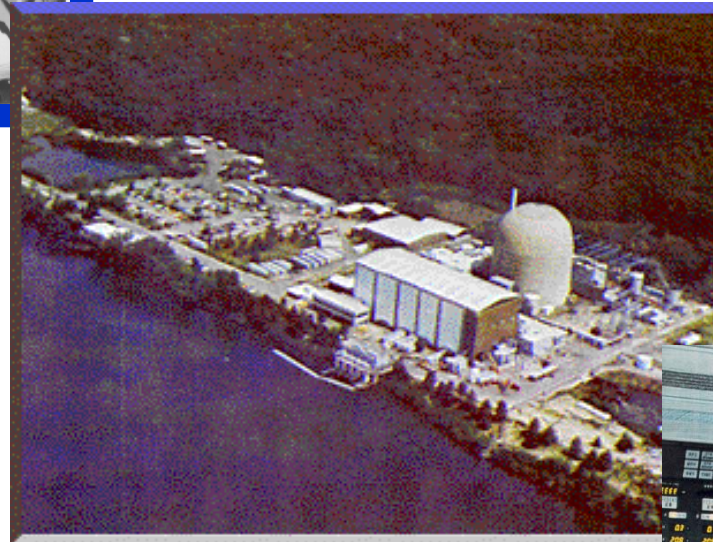


# Nuclear Plant I&C Modernization



**HPI, LLC**  
***Nuclear Capabilities***  
***Economic Justification***  
***Typical Applications***



# HPI Nuclear Experience



- **Experience with the Nuclear Industry for over 30 years**
- **Provided digital control technology to the Nuclear Industry since 1980's**
- **Provided over 3000 Critical Control Systems to Power Plants around the world**
- **Recent Experience Includes:**
  - Ontario Power Generation - Pickering
  - Ontario Power Generation - Lampton
  - DTE Energy Fermi Station
  - Brown's Ferry, STP, Savannah River
  - Other sites – UK, etc.



# Modern I&C Systems Can Improve Performance

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- In order to improve the performance, tools and systems to allow improvement must be in place
- An I&C Upgrade Strategic Plan should be developed to determine the best course of action for future modifications
  - Identify areas where cost savings can be enhanced through common applications and focused efforts
  - Re-evaluate the relationships between the plant operation systems
    - Phased modernization approach versus “forklift” replacement of legacy equipment



# Economic Benefits – Nuclear Opportunities



- **Replace obsolete equipment with commercially-available (COTS) digital hardware and redirect repair/testing/re-engineering staff to higher value activities**
  - **Lower the cost of maintaining high availability/capacity factor**
- **Maximize MW output (1-2%)**
  - **Increased Revenue ~ \$100K / year and support Corporate Market Growth strategy**
    - **using AVR on turbine-generator**
    - **more accurate calorimetric calculations to support better core heating control and operate closer to plant thermal limit**
- **Incorporate BWR steam regulation into turbomachinery controls**
  - **Integrated steam management drives efficiency gains and tighter controls**
    - **Maintain more consistent/predictable reactor pressure for higher MW/t output**



# Economic Benefits – Other Metrics



- **Increased fossil plant production by approx 5 MW avg. by automating controls of steam turbine letdown valves**
- **Reduced load on refinery's motor-driven gas compressors**
  - **Reduced electrical consumption by several amps per machine**
    - **\$250,000 annual savings each train**
- **Extend ethylene plant runtime 20% between outages**
  - **Accurate and reliable controls/safety systems resulted in less mechanical wear on plant and no nuisance trips**
    - **\$100 Millions in annual savings and increased revenue**
- **Refinery guarantees supply of 100,000 barrels of oil products daily to meet its contract requirements**
  - **Self-diagnosing, Fault-tolerant digital systems keep the plant online**
    - **Retain market share, realize predictable revenue**
    - **Improved customer satisfaction**



# Economic Benefits – Sustainability



- **Positive public image is a key benefit in all cases**
  - **Digital automation supports:**
    - **Reliability, Safety and Low Cost Operation**
    - **Modern facilities which attract and retain quality talent**

**These are the hallmarks of the positive corporate branding energy companies strive to achieve for the benefit of shareholders and the community, ultimately driving Earnings per Share**



# Where Do We Start? Questions to Ask



- **What is the status of the technology/manufacturers of the systems being considered for replacement?**
- **What is the documented contribution to Unplanned Capability Loss Factor (UCLF) from these systems?**
- **What is the value of associated in-stock spare parts?**
- **What is the annual expenditure on replacement parts?**
- **What is the cost of specialized test equipment and procedures associated with these systems?**





# Where Do We Start? Questions to Ask



- How many technicians/engineers and instructors are dedicated to these systems?
- How many man-hours are expended each year on surveillance/calibration/repair of these systems?
- What is the station/fleet's assumption regarding the direct and indirect value of UCLF/hour?
- What is the Mean Time Between Failure of these systems?
- Can we map modernization, in hard or soft metrics, to corporate initiatives such as lower operating cost, improved capacity factor, reduction in LERs, etc.





# Economic Parameters



- **Reassignment or Reduction of Staffing**
  - I&C Maintenance
  - Operations
  - Engineering
- **Reduce Spare Parts Costs**
- **Reduced Testing**
- **Reduce Training Costs**
- **Risk Reduction / Availability**
- **Increased Plant Performance/Efficiency**

**Clearly state how the investment meets corporate IRR or supports strategic goals**



# Strategic Planning



- **A Collection, in one single location, of all the I&C Systems**
- **An Evaluation of present I&C Systems, configurations, needs / requirements and level of obsolescence**
- **Identification of concepts and configurations for maintaining the I&C Systems**
- **Identification of Design and Licensing issues and recommended approaches**
- **Recommended modifications for each I&C System**
- **Estimate and Implementation plan / schedule**
- **Economic Evaluation and Justification for the overall plan**



# Path Forward



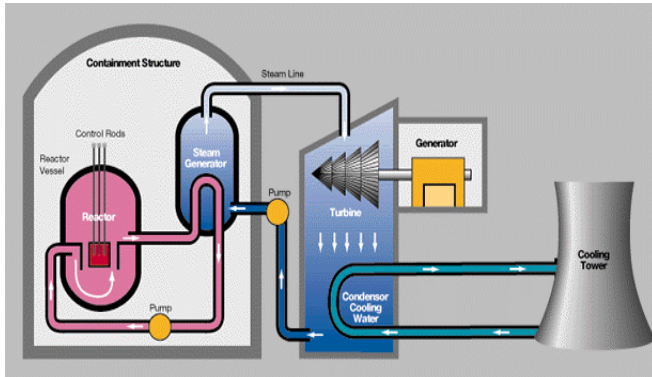
- **HPI recommends that the Operator work with a partner whose nuclear experience, experience with of qualified technology, proven track record of support and strategic growth in the nuclear market is suited for delivery of a total Control & Safety Solution**
  - **HPI can provide a study to include:**
    - **Confirmation of Operator's corporate objectives and goals associated with digital upgrades**
    - **Surveys of key sites and interviews with personnel to identify existing and future automation issues**
    - **Document ability of digital upgrades to address site and corporate goals**
      - *Including parts & labor cost-savings and availability estimates*
    - **Recommend budget plan and pilot site(s) as part of draft program for technology deployment**
    - **Develop design package template for upgrade/retrofits**
      - *Including +/-20% cost estimate and schedule*
    - **Develop technology, installation, training and licensing execution plan with Corporate sponsor(s) and/or client-approved A-E**
    - **Formulate Alliance-level commercial structure**



# NSSS & BOP Systems – HPI Capabilities



## Pressurized Water Reactor



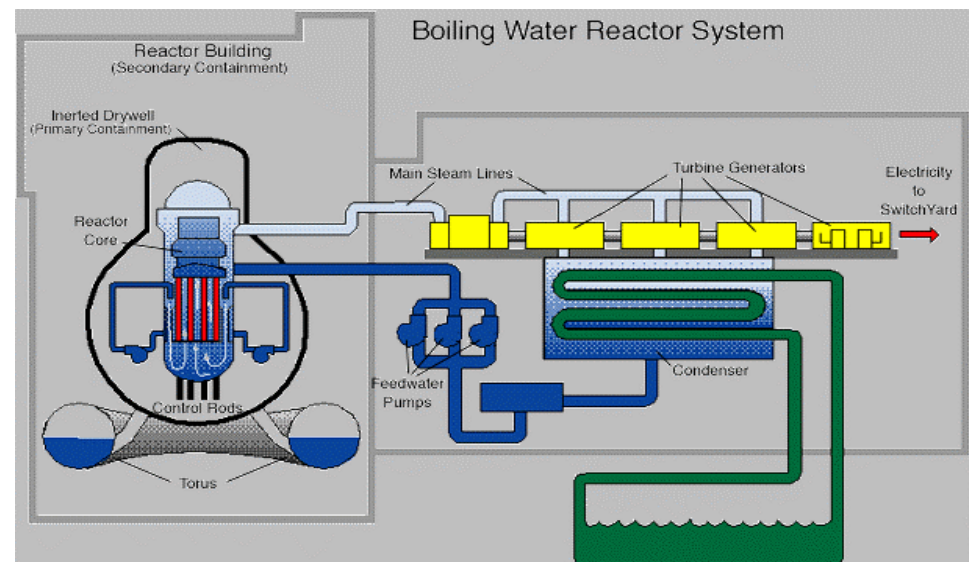
Turbine Generator Control  
 Speed/Frequency  
 Load  
 Over Speed  
 Lube Oil  
 Generator Monitoring

Data Acquisition Systems  
 Process Computer System  
 SPDS  
 Information Technology  
 Business Modules

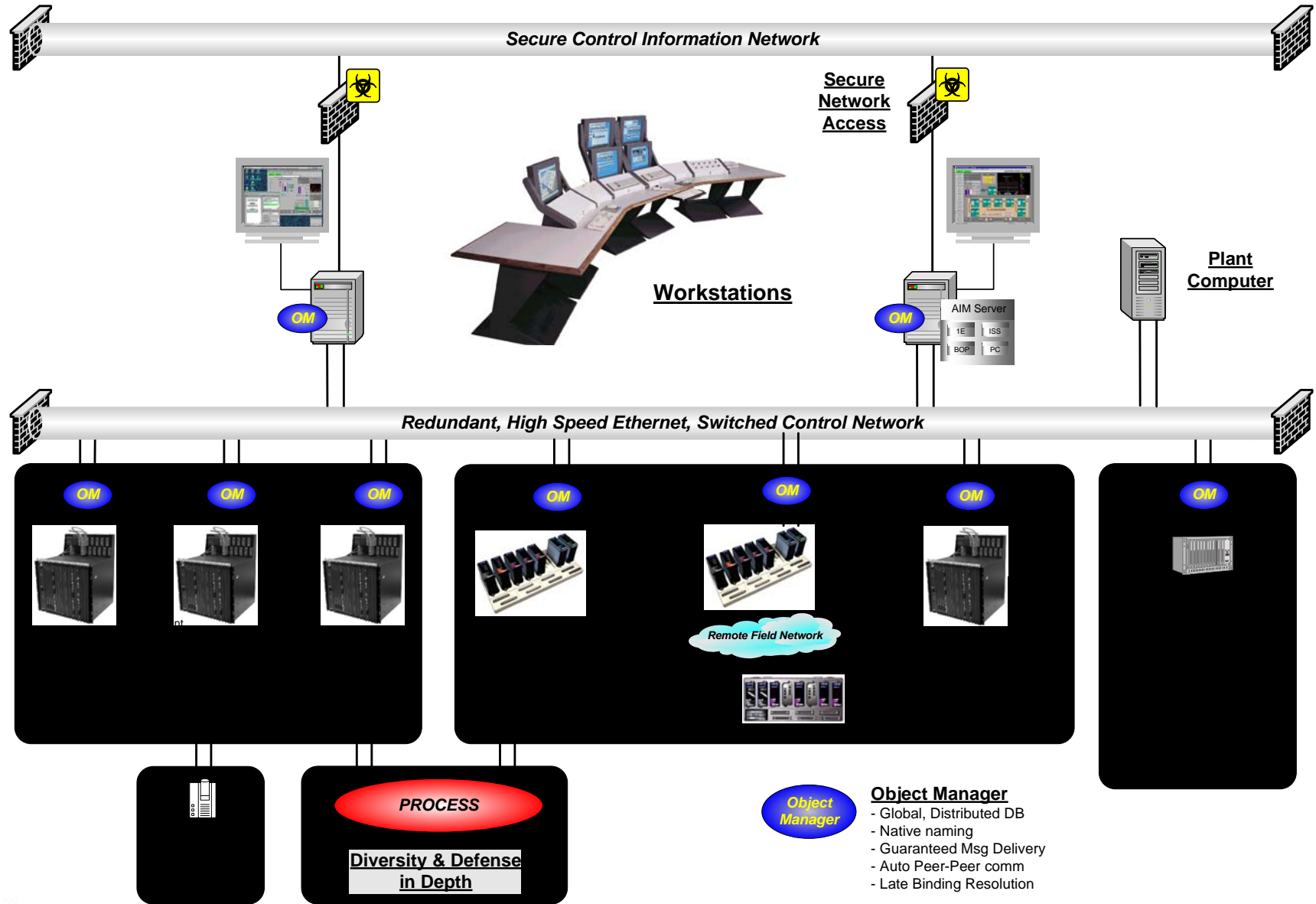
**NSSS & BOP Safety & Control Systems**  
 Reactor Protection  
 Reactor Regulating  
 Recirculation Control  
 Feedwater Control  
 Steam Dump & Bypass  
 Reactor Power Cutback  
 Rod Control  
 Rod Position  
 Pressurizer Pressure  
 Pressurizer Level  
 CVCS  
 Saturation Margin  
 RVLIS  
 Remote Shutdown  
 ATWS

**Control Systems**  
 ESFAS  
 HVAC  
 Emergency Diesel  
 Auxiliary Feedwater  
 Steam Dump  
 Process Computer System  
 Condenser  
 Condensate  
 Feedwater Heater  
 Main Steam Reheat  
 Deaerators  
 Component Cooling  
 EOF  
 TSC

## Boiling Water Reactor



# Integrated Safety, Control and DAS



- Object Manager**
- Global, Distributed DB
  - Native naming
  - Guaranteed Msg Delivery
  - Auto Peer-Peer comm
  - Late Binding Resolution

# Conclusions

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- **If more than 10 years of operation remain all systems will require replacement**
- **The use of current controls technology, through an integrated design, is possible and is the best balanced option for most systems**
- **The reduction in staffing costs, spare parts, training and maintained availability, if implemented correctly, can provide a positive payback**
- **A well thought out Plant/Organization Specific Strategic Plan is required to assure maximum benefit and minimum risk**



# Why HPI?



- **Worldwide Power Experience**
- **Strategy dedicated to the Nuclear Industry**
- **Suite of market leading products covering a wide range of applications**
- **Project Execution Capabilities to meet & exceed industry requirements**
- **Business Relationships to provide full service Nuclear Upgrade Solutions**
- **Solutions to demonstrate improved ROI and lower COO.**
- **Reduced Risk of LCO's and Licensing issues**
- **And we have proven we can perform.....globally.**

