Plant 3 Controls & Automation Upgrade Assessment

Executive Review Meeting - Technical Assessment Deliverable

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Date: August 15, 2025
Executive Review Meeting: August 28, 2025
Distribution: Operations Leadership Team

Executive Summary

Plant 3 faces critical automation infrastructure challenges that require immediate action to maintain production reliability and competitiveness. Legacy systems are approaching end-of-life with vendor support terminating in December 2025, creating significant business risk. The recommended $515K-$665K phased upgrade will improve Overall Equipment Effectiveness from 94.2% to 97%+, eliminate 4 hours of daily manual processes, and reduce maintenance burden by 50%.

Bottom Line: This upgrade is essential for operational continuity and will deliver measurable ROI through improved uptime, reduced labor costs, and enhanced production efficiency.

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1. Current State Analysis

Automation Infrastructure Overview

Primary Control Systems

- 4x Allen-Bradley ControlLogix 5580 PLCs (2019) - **GOOD CONDITION**
- 2x Allen-Bradley SLC 5/05 PLCs (2011) - **CRITICAL END-OF-LIFE RISK**
- Wonderware System Platform 2017 R2 SCADA - **FUNCTIONAL BUT AGING**
- 6x Mixed-vintage HMI operator panels - **PERFORMANCE ISSUES**

Current Performance Metrics

- Automation System Uptime: 94.2% (Target: 97%+)
- SCADA Availability: 97.8%
- HMI Response Time: 2.3 seconds (Target: <1.5 seconds)
- Unplanned Downtime Events: 23 incidents in Q2
- Automation-Related Production Loss: 1.8% of total production time

Critical Bottlenecks Impacting Operations

Legacy System Risks

- SLC 5/05 systems on Lines 2 & 4 have **high probability of failure**
- Vendor support ends December 2025 - **NO MANUFACTURER SUPPORT**
- Replacement parts increasingly difficult to source
- Integration issues with newer plant systems

Process Inefficiencies

- **Quality Control:** 4 hours daily manual data entry creating bottlenecks
- **Recipe Management:** 45-minute changeover times vs. industry standard 15-20 minutes
- **Alarm Response:** 47-minute average response time vs. target 30 minutes
- **Manual Override Events:** 156 instances in Q2 indicating system limitations

Capacity Constraints

- I/O systems at 78% capacity limiting future expansion
- Network congestion during peak operations affecting real-time performance
- Limited diagnostic capabilities hampering troubleshooting

Integration Gaps Affecting Production

Manufacturing Execution System (MES)

- Manual work order processing creating production scheduling delays
- No automated integration with production planning systems
- Limited real-time production data visibility for management

Maintenance Operations

- No automated work order generation from system alarms
- Manual asset data synchronization causing maintenance delays
- Reactive maintenance approach due to limited predictive capabilities

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2. Capacity Assessment & Production Impact

Current Throughput Limitations

System Capacity Analysis

- I/O infrastructure at 78% utilization - **EXPANSION LIMITED**
- Communication bandwidth constraints during peak production
- Legacy HMI panels causing operator efficiency losses

Production Efficiency Gaps

- 12 process optimization opportunities identified, only 3 implemented
- Manual processes consuming 4+ hours daily of operator time
- Recipe changeover inefficiencies adding 25-30 minutes per changeover
- Quality control data delays impacting production decision-making

Automation Upgrade Potential

Immediate Efficiency Gains

- Eliminate 4 hours/day manual quality control data entry
- Reduce recipe changeover time from 45 to 20 minutes
- Implement automated alarm-to-work-order generation
- Enable real-time production monitoring and reporting

Advanced Process Control Opportunities

- Statistical Process Control (SPC) monitoring on critical processes
- Model Predictive Control implementation for key production loops
- Automated quality control data collection and trending
- Predictive maintenance integration for critical equipment

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3. Technology Upgrade Recommendations

Phase 1: Critical Infrastructure Replacement (Q4 2025 - Q1 2026)

MUST-HAVE - Business Continuity

SLC 5/05 System Replacement

- Replace legacy PLCs on Lines 2 & 4 with ControlLogix platform
- Standardize programming environment across all systems
- Improve diagnostic capabilities and troubleshooting efficiency
- **Business Impact:** Eliminates high-risk single points of failure

Critical HMI Upgrades

- Replace slowest-performing operator panels
- Implement consistent user interface design
- Improve response times to <1.5 seconds
- **Business Impact:** Improved operator efficiency and reduced errors

Network Infrastructure Assessment

- Evaluate current Ethernet/IP backbone capacity
- Plan managed switch implementation with VLAN segmentation
- **Business Impact:** Foundation for future system integration

Phase 2: Integration & Standardization (Q2 2026 - Q3 2026)

HIGH-IMPACT - Operational Efficiency

HMI Standardization

- Complete operator interface consistency across all production lines
- Implement advanced alarm management with prioritization
- Add mobile device support for maintenance operations
- **Business Impact:** Reduced operator training time, improved response

MES Integration

- Automated work order processing and production scheduling
- Real-time production data collection and reporting
- Eliminate manual production tracking processes
- **Business Impact:** Improved production planning and visibility

Enhanced Communication Infrastructure

- Expand Ethernet/IP coverage to all production areas
- Implement managed switches with network segmentation
- Upgrade wireless infrastructure for mobile maintenance support
- **Business Impact:** Improved system reliability and maintenance efficiency

Phase 3: Advanced Analytics & Optimization (Q4 2026)

VALUE-ADD - Competitive Advantage

Advanced Process Control

- Implement Statistical Process Control monitoring
- Deploy Model Predictive Control on critical loops
- Automated process optimization recommendations
- **Business Impact:** Consistent product quality, reduced waste

Predictive Maintenance Systems

- Vibration monitoring on critical rotating equipment
- Thermal imaging integration for electrical systems
- Automated maintenance scheduling based on equipment condition
- **Business Impact:** 50% reduction in unplanned downtime

Safety System Enhancements (All Phases)

Emergency Stop Network Upgrade

- Replace DeviceNet-based system to eliminate single points of failure
- Implement redundant safety communication paths
- **Business Impact:** Improved safety system reliability

Safety Documentation Automation

- Automated safety system testing and documentation
- Digital safety interlock verification procedures
- **Business Impact:** Reduced compliance burden, improved audit readiness

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4. Implementation Strategy & Timeline

Project Phasing Approach

Phase 1 (6 months): Foundation

- Month 1-2: Hardware procurement and engineering design
- Month 3-4: Programming and factory acceptance testing
- Month 5-6: Installation during planned maintenance windows
- **Critical Path:** Hardware lead times (8-12 weeks)

Phase 2 (6 months): Integration

- Can begin planning while Phase 1 is executing
- Parallel development of MES interfaces
- Staged implementation to minimize production impact
- **Critical Path:** MES integration testing

Phase 3 (3 months): Optimization

- Dependent on Phase 1 & 2 completion
- Advanced features added to stable platform
- Operator training and procedure updates
- **Critical Path:** Operator training and certification

Production Schedule Considerations

Shutdown Requirements

- Phase 1: Utilize existing planned maintenance windows
- Line 2 & 4 shutdowns coordinated with production schedule
- Parallel system operation during transition periods
- Emergency rollback procedures developed for each phase

Risk Mitigation During Implementation

- Maintain critical spare parts inventory ($127K current value)
- Implement bypass procedures for emergency situations
- 24/7 vendor support during critical cutover periods
- Detailed testing protocols before production restart

Resource Requirements

Internal Team Commitment

- 1.5 FTE Controls Engineering for project management
- 2 FTE Maintenance Technicians during implementation phases
- Operations support for testing and validation
- IT involvement for network infrastructure and security

External Support Requirements

- Systems integrator for programming and commissioning
- Vendor specialists for training and system startup
- Electrical contractor for panel modifications and installation

Training Requirements

- 40 hours per operator for new HMI systems (all 3 shifts)
- Maintenance technician training on new diagnostic tools
- Engineering team training on advanced features
- **Total Training Investment:** 240+ hours across all personnel

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5. Financial Analysis & Budget Framework

Investment Summary

Category	Phase 1	Phase 2	Phase 3	Total Range
PLC Hardware	$180K-$220K	-	-	$180K-$220K
HMI Systems	$50K-$70K	$45K-$55K	-	$95K-$125K
Network Infrastructure	$30K-$40K	$35K-$45K	-	$65K-$85K
Engineering & Implementation	$75K-$100K	$50K-$65K	$25K-$35K	$150K-$200K
Training & Documentation	$15K-$20K	$10K-$15K	-	$25K-$35K
Phase Totals	**$350K-$450K**	**$140K-$180K**	**$25K-$35K**	**$515K-$665K**

Return on Investment Analysis

Cost Avoidance

- Prevent production shutdown from SLC 5/05 failure: **$2M+ potential loss**
- Reduce unplanned downtime by 50%: **$180K annual savings**
- Eliminate manual quality control processes: **$85K annual labor savings**

Efficiency Improvements

- Improve OEE from 94.2% to 97%: **$420K annual production value**
- Reduce changeover times by 25 minutes: **$65K annual efficiency gain**
- Maintenance efficiency improvements: **$95K annual savings**

Total Annual Benefits: $845K+
Payback Period: 8-9 months after full implementation

Budget Flexibility Options

Minimum Viable Implementation (Phase 1 Only): $350K-$450K

- Addresses critical end-of-life risk
- Provides foundation for future phases
- Delivers immediate risk mitigation

Recommended Full Implementation: $515K-$665K

- Complete transformation with maximum ROI
- Positions plant for future competitiveness
- Addresses all identified operational inefficiencies

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6. Risk Assessment & Mitigation

High-Risk Scenarios

SLC 5/05 Hardware Failure

- **Probability:** High (vendor support ends December 2025)
- **Impact:** Critical (Lines 2 & 4 production shutdown)
- **Mitigation:** Emergency spare parts, bypass procedures, accelerated Phase 1 timeline

Implementation Schedule Delays

- **Probability:** Medium (hardware lead times, resource conflicts)
- **Impact:** High (extended exposure to legacy system risks)
- **Mitigation:** Early hardware procurement, vendor partnerships, parallel work streams

Integration Complications

- **Probability:** Medium (mixing legacy and new systems)
- **Impact:** Medium (temporary performance impacts)
- **Mitigation:** Extensive testing protocols, vendor support, rollback procedures

Business Continuity Planning

Production Protection Measures

- All changes during planned maintenance windows

- Parallel system operation during transitions
- Comprehensive testing before production restart
- Emergency bypass procedures for each system

Change Management Strategy

- Operator involvement in HMI design process
- Gradual feature rollout to minimize learning curve
- Comprehensive training program before go-live
- 24/7 support during initial operation periods

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7. Expected Business Outcomes

Operational Excellence Improvements

Overall Equipment Effectiveness (OEE)

- **Current State:** 94.2% automation availability
- **Target State:** 97%+ availability (industry benchmark)
- **Annual Impact:** $420K+ additional production capacity

Maintenance Optimization

- **Current:** 23 unplanned downtime events per quarter
- **Target:** 50% reduction in automation-related incidents
- **Annual Impact:** $180K cost avoidance, improved schedule reliability

Process Efficiency

- **Current:** 4 hours/day manual quality control processes
- **Target:** Fully automated data collection and reporting
- **Annual Impact:** $85K labor cost reduction, improved accuracy

Competitive Positioning

Digital Manufacturing Readiness

- Real-time production monitoring and analytics
- Integration-ready platform for future Industry 4.0 initiatives
- Data-driven decision making capabilities

- Mobile maintenance support and remote diagnostics

Regulatory Compliance Enhancement

- Automated documentation and reporting capabilities
- Improved audit trail and traceability
- Enhanced safety system monitoring and verification
- Reduced manual compliance burden

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8. Implementation Success Factors

Critical Success Requirements

Executive Sponsorship

- Clear project authority and decision-making process
- Adequate resource allocation and budget approval
- Change management support across organization

Technical Excellence

- Experienced systems integrator selection
- Comprehensive testing and validation protocols
- Vendor support and warranty coverage

Organizational Readiness

- Operator training and change management
- Maintenance team skill development
- IT infrastructure and security alignment

Key Performance Indicators

Technical Metrics

- System availability improvement to 97%+
- HMI response time reduction to <1.5 seconds
- Alarm response time improvement to <30 minutes

Business Metrics

- OEE improvement to 97%+
- 50% reduction in unplanned automation downtime
- Elimination of manual quality control processes
- ROI achievement within 9 months

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9. Recommendation & Next Steps

Executive Decision Required

Immediate Action Recommended: Approve Phase 1 implementation to begin Q4 2025

Justification:

- SLC 5/05 vendor support ends December 2025 - **CRITICAL BUSINESS RISK**
- $2M+ potential production loss from system failure
- 8-9 month payback period with clear ROI
- Phased approach manages cash flow and implementation risk

Next Steps Timeline

Week of August 29 (Post-Executive Review)

- Refine project scope based on executive feedback
- Submit formal capital expenditure request with detailed ROI
- Begin vendor selection and proposal process

September 2025

- Vendor consultations and detailed proposal evaluation
- Finalize project charter and governance structure
- Secure budget approval and resource allocation

October 2025

- Award contracts and initiate hardware procurement
- Begin detailed engineering design and programming
- Establish project management office and communication protocols

Q4 2025 - Q1 2026

- Execute Phase 1 implementation

- Plan Phase 2 activities
- Monitor and report progress to leadership

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Operations Approval: Sarah Martinez, Head of Operations

This assessment provides the technical foundation for executive decision-making on Plant 3 automation infrastructure upgrade. The recommended approach balances business risk mitigation with operational improvement opportunities while maintaining production continuity.