MES Introduction

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An ICIS introduction to MES and its role in plant operations

icis Bridging the Gap Between Data and Knowledge

Introduction

MES allows for the integration, analysis and review of manufacturing operations and processes utilising business support applications and tools that translate manufacturing data to business critical information. This empowers an array of users from Management to Engineering to drive down manufacturing costs plus improve and increase operational and process efficiency.

MES slots into the middle layer of an organisation in order to provide the missing link between a sites business applications and the manufacturing process.

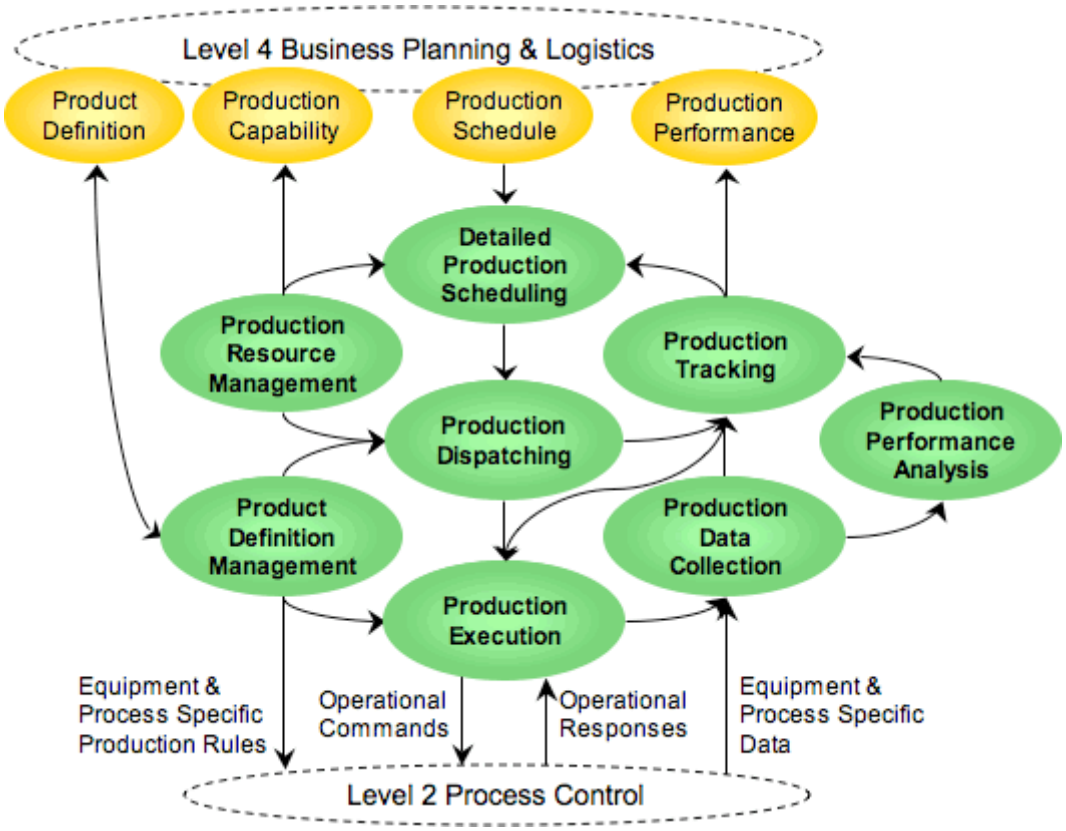


Figure 1 – Sample MES Integration

By providing this middle layer, MES contains a number of vital components and applications that when integrated into a sites business allow for the following:

1. Identification and analysis of true manufacturing operational performance
2. Provide detailed process and operational data to Enterprise and Web applications
3. Real-time KPI reviews and dashboards are available from standard desktops
4. Operational, Engineering and Quality processes are linked for common reports
5. Process and Operational data is consolidated into one central repository
6. Disparate reports are replaced with generic site standard ones
7. Analysis tools such as Cycle Time, OEE, Product Tracing, Waste and Energy consumption to name but a few are available across the entire site

By utilising MES tools and its infrastructure there is no longer a restriction on what information is available and to whom.

For example; using MES analysis tools a sites production process reviews / reports and KPIs are now available from a desktop anywhere in the manufacturing site or indeed anywhere in the world. This opens up a sites entire manufacturing data store and allows for the drive towards operational excellence through the implementation of Lean and Six Sigma process improvement programs.

By linking manufacturing processes and MES to provide business information, management can review and analyse real site performance and quality all at once. By providing the interface, MES removes the need for multiple reporting systems and applications thereby consolidating business critical information into a single source of review. Management now have the opportunity to isolate operational and performance issues and drive improvement programs that can be monitored in real-time.

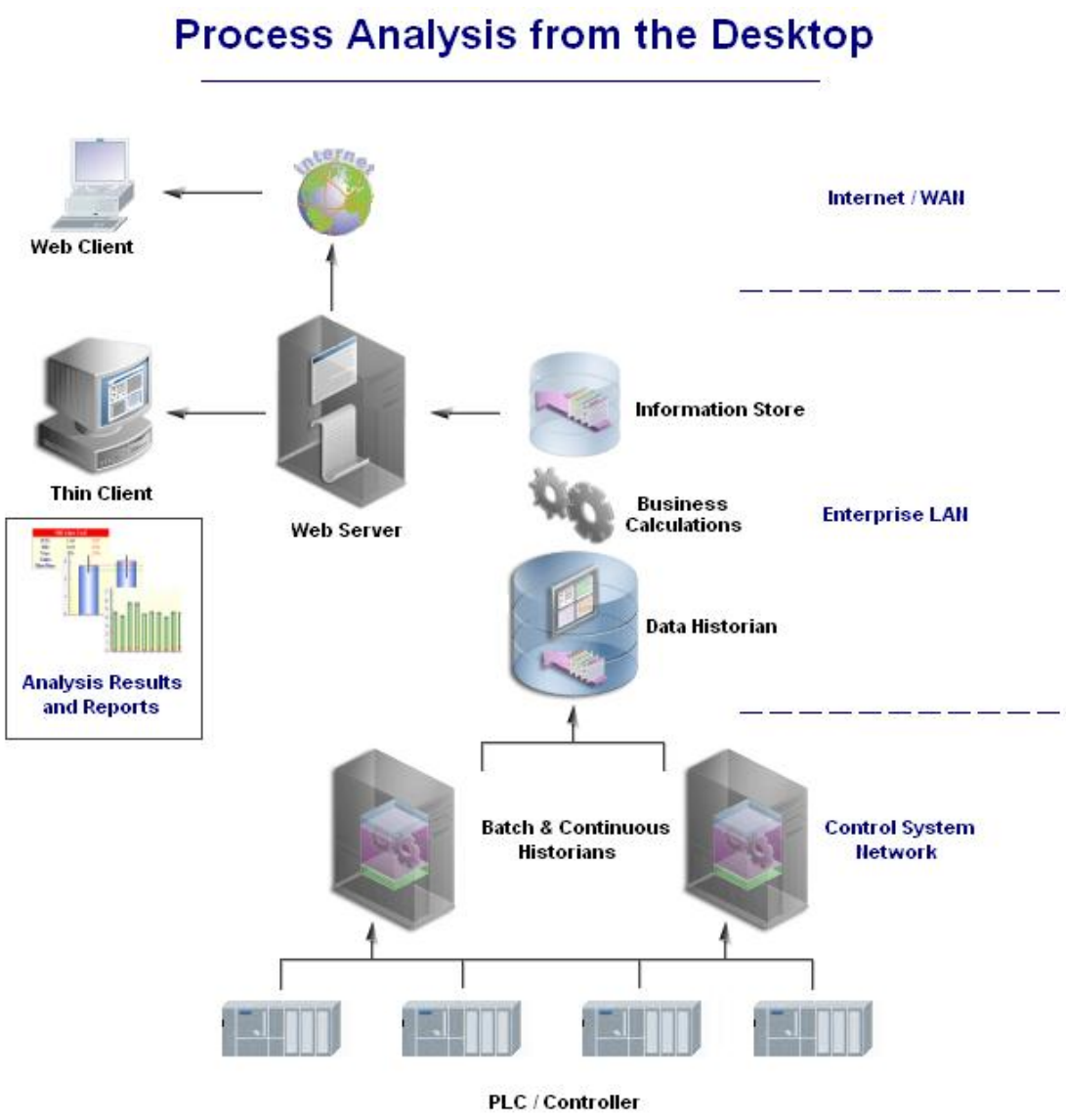


Figure 2 – Sample MES Analysis Tools & Infrastructure

The essence of MES is in providing the missing link between the enterprise management business systems and the shop floor control.

The Path to MES

Overview

MES by its very nature incorporates multiple business applications and tools ranging from Production Scheduling to Plant Analysis. In order to approach the building of an MES in a structured path the system may be broken into separate modules each with there own sub-functionality and analysis tools.

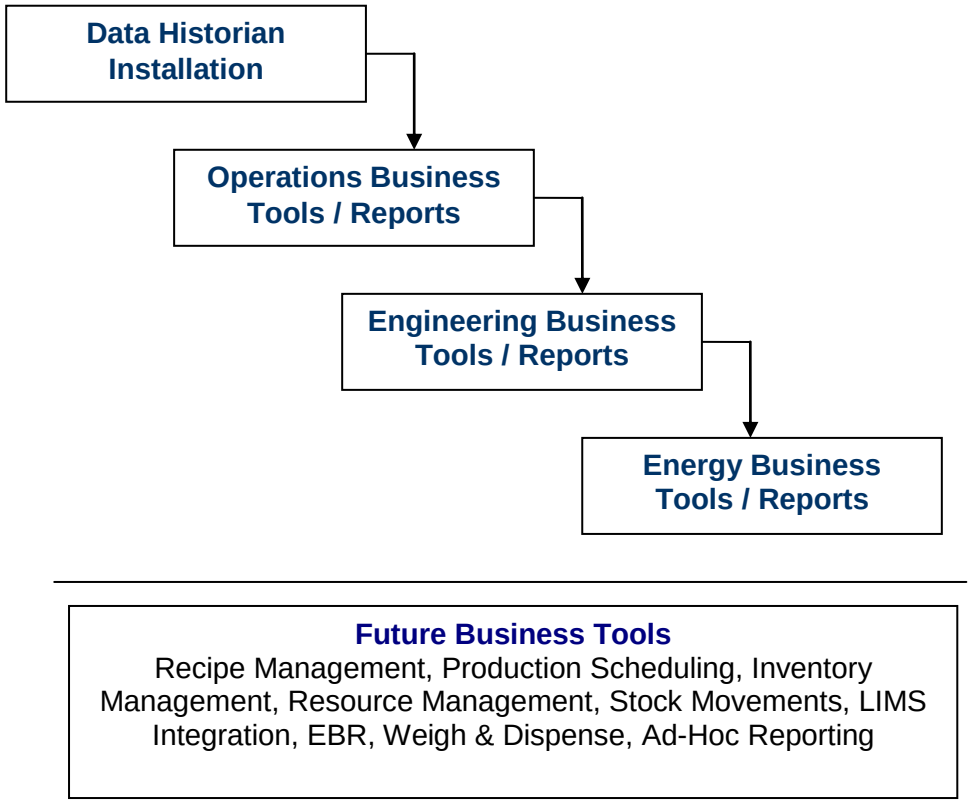


Figure 3 – MES Installation Flow

By approaching MES integration projects in a modular fashion a site can begin to reap the rewards of integrated data almost immediately. This in turn provides a strong return on investment for each module and helps drive the installation and expansion of future ones.

The Data Historian

At the core of the MES is the Data Historian. The Data Historian provides the link between enterprise business applications and the process control system. The Data Historian is the foundation building block for the MES. The Historian itself not only provides the data for business information to build upon but also provides tools for the analysis of its stored data. In summary the Historian can provide the following:

1. A real-time, large memory, high availability central repository for process data
2. Central Process variable, Batch and Alarm / Event data storage
3. Tools for Process and Batch Trending Analysis and Visualisation
4. Tools for Production Batch Analysis (Reports and Comparison)
5. Excel add-ins for Ad-Hoc user reporting
6. Web interfaces for portal trending and KPI reporting of plant data

Figure 3 – Historian at the core of MES

Operations Business Tools

Post installation of the Data Historian the operational tools can be deployed for use. Operational tools provide the interface into a sites performance, work practices and status. The tools allow for the analysis and various reporting requirements of multiple operational processes and work practices. Operational tools enable a site to truly understand its process, its current production capability and aid in the identification of areas for improvement in order to increase future capability.

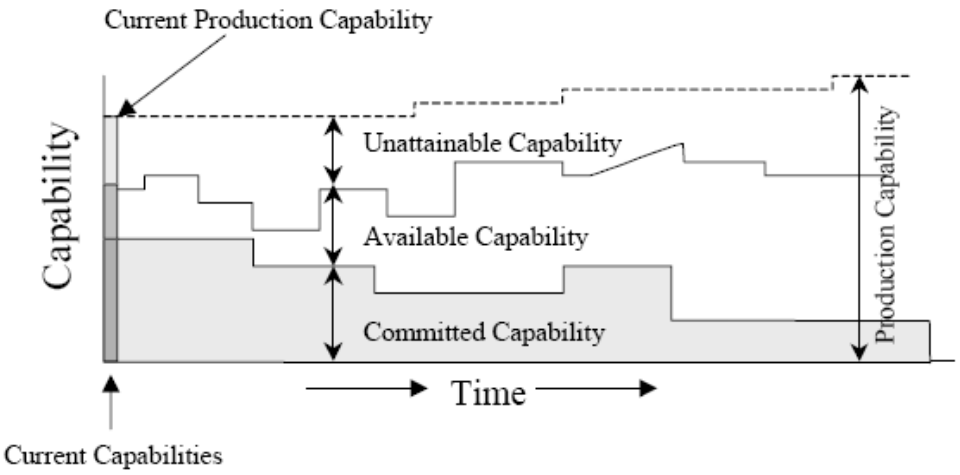


Figure 4 – Production Capability

Various analysis tools provide the vital charting and data table result sets that enable users to visualise the performance data and act upon its information. Therefore Management and Engineering can respond to events and performance issues as they happen as opposed to weeks after the event.

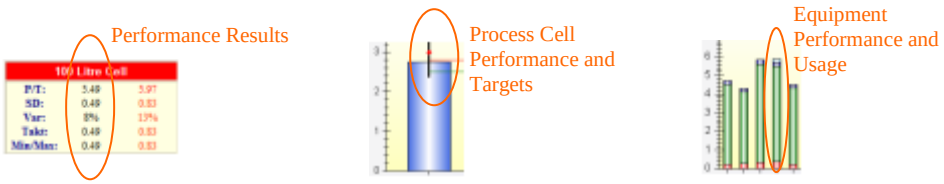


Figure 5 – Sample Business Analysis Results

Sample Operational Tools & Reports

1. **Operational performance and cycle time analysis**
    a. Analyse current plant performance
    b. Review cycle time analysis of areas and equipment
    c. Identify production and operational issues
    d. Identify under performing plant equipment and processes
    e. Assign targets and review real-time KPI for production areas

2. **Plant KPIs and Scorecards**
    a. Analyse vessel and process conformance
    b. Productivity reviews
    c. Obtain detailed information on losses and quality indices
    d. Create facility specific KPIs

3. **Extract, Loss and Waste calculations**
    a. Analyse real consumption and losses

4. **Vessel Cleaning scheduling and Asset Management**
    a. Review cleaning schedules and Plan in advance
    b. Manage production assets based on real-time asset utilisation and availability

5. **Batch and Continuous Process Analysis**
    a. Analyse batch data versus the “Golden Batch”
    b. Review historical trend and process data over multiple batches

6. **Product Batch Tracing**
    a. Review a Batch Genealogy and Quality results
    b. Search batches based on unit or product
    c. Link a batch and materials used from Brewhouse to Bottling

7. **Quality Linking**
    a. LIMS data linkage to batch reports
    b. By-directional flow of data between the Control System and LIMS via MES

8. **Production Batch Report**
    a. Review batch specific characteristics
    b. Detail batch parameters used
    c. Process Steps
    d. Enable calculated process data values
    e. Embed trends to the reports
    f. Display batch specific Alarms and Event

9. **Process Batch / Material Genealogy Report**
    a. Review Batch flow through the process
    b. Materials consumed
    c. Trace of all sub-batch components
    d. Link LIMS and quality results to a batch lifecycle

10. **Shift Hand-over Report:**
    a. Detail active plant programs
    b. Display current vessel status
    c. Detail current active batches
    d. Provide projected batch / program completion times
    e. Display current plant area alarms

11. **Area Vessel Report:**
    a. Review current status
    b. Detail vessel clean information (Last cleaned and next scheduled)
    c. Provide area production summaries

12. **Extract and Loss / Waste Reports**

13. Material Consumption Reports

a. Raw materials usage

b. Packaging material usage (Labels, bottles etc)

14. WIP Reports

Engineering Business Tools

Engineering tools allow for the analysis of plant items such as maintenance activities, downtime analysis and maintenance scheduling. Using engineering tools from MES empowers engineering and maintenance groups to pre-empt equipment failures, quickly respond to plant issues and aid in overall performance improvement programs.

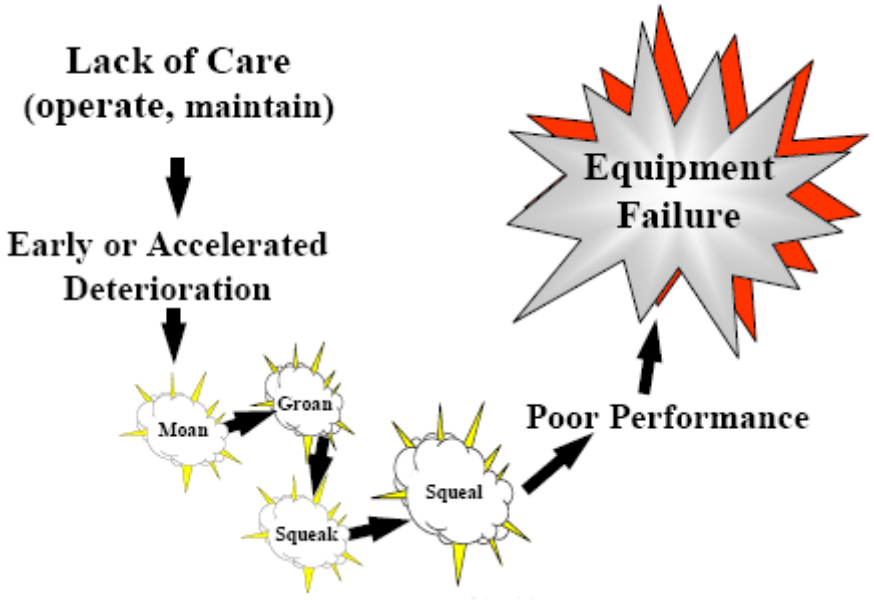


Figure 6 – Cause of Equipment Failure

Poor maintenance programs or lack of review on excessive device use will lead to equipment failures. Incorporating MES into a site maintenance program will greatly improve equipment performance and aid in preventing failures.

Engineering Business Tools & Reports

1. **Maintenance**
    a. MES links the planning of assets for improved scheduling
    b. Review motor run hours and valve activations
    c. Predictive maintenance based on device usage
    d. Record device maintenance history
    e. Area maintenance reports for equipment and calibration activities

2. **Downtime and Failure Analysis**
    a. Review plant equipment downtimes
    b. Isolate repeat equipment failures
    c. Central store allows for the equipment failure reviews
    d. Track failures and build the support knowledge base

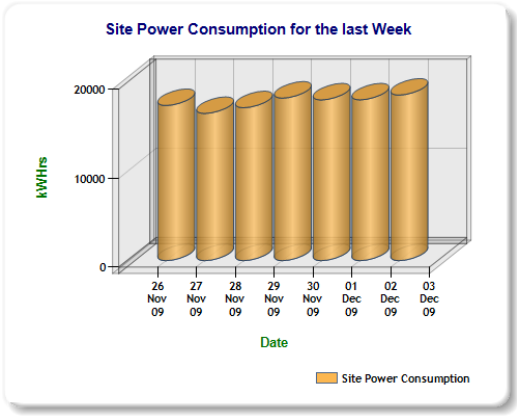
3. **Plant Utilisation and Optimisation (OEE)**
    a. Analyse equipment uptime
    b. Review process characteristics and identify improvements
    c. Review quality, waste and performance of kegging and bottling equipment
    d. Real-time equipment performance KPIs
    e. Compare similar equipment for performance mapping

4. **Alarm Rationalisation**
    a. Align a site with EEMUA 191
    b. Analyse top alarms and implement rational programs to reduce plant errors
    c. Generate alarm analysis reports
    d. Less Alarms = Greater Performance

Alarm Rate	Acceptability
More than 1 / min	Unacceptable
One / 2 min	Over-demanding
One / 5 min	Manageable
Less than 1 / 10 min	Acceptable

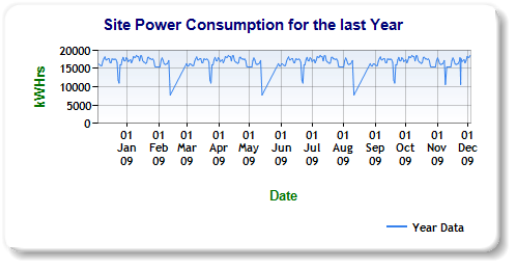
Energy Business Tools

Energy tools allow for the usage analysis of site Power, Water, Steam and Gas. By utilising MES tools and reports, management and engineering can gain an understanding of energy usage and cost across an entire site. Assigning targets and KPIs (EPI) to energy consumption and making cost centres responsible for specific energy usage aids in energy and cost reduction programs.



Site Power Summary Costs

	Quantity	Cost ($)
Week to Date	6405438.29 kWHrs	508964.89
Month to Date	3368372.25 kWHrs	271653.90
Year to Date	403453749.96 kWHrs	31480249.15



	Meter	Description	Target	Value	Average	Variance
Utility Water	Meter1	Building Water	80m³	5.32m³	70.81m³	49.91%
Softened Water	Meter2	Production Water	100m³	5.32m³	4.34m³	13.10%
Waste Water	Meter3	Building Waste	45m³	0.03m³	6.69m³	2.90%

Figure 8 – Sample Water Usage Data table

By utilising MES energy analysis tools and reports management can have a real-time insight into a sites consumption. This enables isolation of heavy energy users and equipment that may have never been known before. Maintaining control over energy consumption is vital for all manufacturing sites with ever increasing carbon taxes and energy costs. By monitoring this energy consumption a site can also utilise the information to track down faulty equipment such as leaking steam valves and excessive processes such as CIP flushes.

Engineering Business Tools & Reports

1. **Energy Analysis**
    a. Build a site Energy map for Power, Water and Steam
    b. Review real-time and historical energy consumption
    c. Set Energy KPIs (EPI) and review in real-time
    d. Analyse metered data or create custom energy consumption calculations where no metered data is available
    e. Review energy improvement programs with energy reports and comparison tools
    f. Utilise Web based applications and reports
    g. Compare energy usage across units and identify under performing ones

2. **Cost Analysis**
    a. Assign site cost centres and charges
    b. Review real energy costs for Power, Water and Steam
    c. Predict future energy consumption trends
    d. Drive down energy costs
    e. Provide energy reports and comparison data on improvements

Future Expansion

By utilising the core building blocks of MES discussed previously sites can begin to look forward to the further implementation of MES modules. By doing this a site is empowering itself to be open to new technologies and work practices that will further improve its operations. Some items not discussed here but are within the realms of MES are:

1. ERP Integration
2. Linking production scheduling from the enterprise to the control layer for true batch and campaign coordination
3. Recipe Management and BOM from the enterprise to the control layer
4. Integrate goods issued and consumed from the control system to the enterprise
5. Record stock movements and WIP to accounting systems
6. Electronic batch records for manual processes and process synchronisation
7. Integrate weigh and dispense applications into the central MES for generic control and reporting
8. Control the disposition process by linking batch to quality and all the other separate work flow activities of a site.

About Us:

*i*cis provide custom BMS, Data Historian and SCADA / DCS reporting solutions for a variety of systems. As we are not affiliated with any specific vendor and have crossed the divide in terms Automation Integration and Enterprise Reporting we can provide unbiased consultancy reviews and recommendations for your best path forward in terms of MES, Automation integration and plant reporting. Contact us to see what we can do for you in terms of a site / system design review and study.

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