The Impact of Artificial Intelligence in Mechanical Equipment, Design and Systems

How AI is being implemented in equipment, building mechanical systems, and mechanical design — and how it is reshaping engineers, contractors, and owners.

Equipment • Systems • Design

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Agenda/Questions We Need to Adress Together

- AI vs Analytics In Mechanical Systems
  - What's the difference and how has it evolved over time?
- What is driving the change in our industry?
- AI in Mechanical Equipment and Controls
- AI in Mechanical Design
- AI In Contracting and Service Teams
- What are the Risks?
- Call to action: How do we become thought leaders in this space?

AI vs. Analytics

Analytics helps you identify. AI helps you predict, recommend, and sometimes act.

Traditional analytics

- Uses rules, thresholds, dashboards, and trend logs
- Usually answers: what happened, where, and how often
- Needs a person to interpret the data and decide what to do
- Example: alarm summary shows zone repeatedly going out of range leading to production loss

Artificial intelligence

- Learns from patterns across many points and time periods
- Can answer: what is likely to happen next and what action makes sense
- Can prioritize faults, estimate impact, and support automatic control changes
- Example: AI predicts efficiency drift and recommends action before zone goes out of range. It then adjusts operation to minimize future issues and estimates opportunity cost saved.

Simple distinction: analytics is primarily descriptive; AI is descriptive + predictive + prescriptive.

Why AI Matters in Mechanical Systems

Mechanical Systems are one of the largest and most controllable building energy loads

1. Equipment intelligence

More telemetry, fault detection, self-tuning logic, and adaptive setpoint optimization.

2. Building system intelligence

BAS / BMS platforms combine sensor streams, occupancy, weather, and utility signals to optimize comfort, energy, and maintenance actions continuously.

3. Design intelligence

AI-assisted analysis in BIM, energy modeling, load prediction, and option evaluation earlier in design.

- Lots of existing datapoints to capture and leverage
- Cloud analytics and edge controllers can now process building data continuously
- Owners and operators are under pressure to cut energy, carbon, complaints, and downtime at the same time with less resources

Mechanical systems offer one of the most compelling AI use case stories to provide bottom-line business impact.

AI in Mechanical Equipment

Equipment Senses, Reacts, and Integrates.

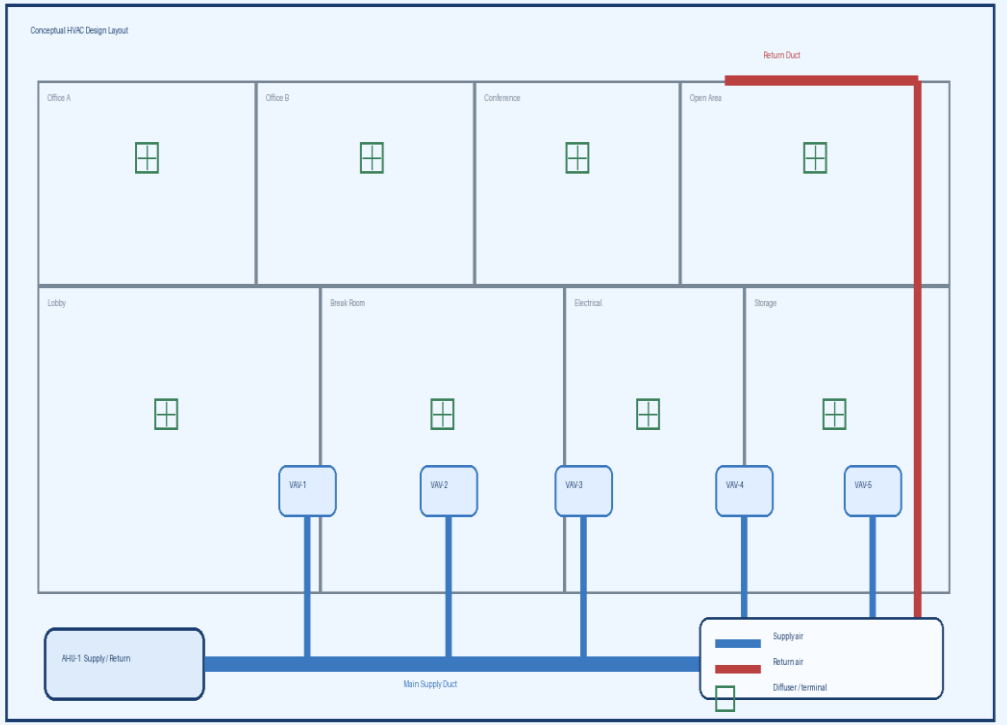
- Smart Equipment: equipment that changes internal operation to optimize output and provide predictive feedback
- Advanced troubleshooting and parts identification
- Out of the Box Controls and Connectivity: Individual pieces of equipment “know” the system and SOO and connect to the system automatically
- Automatic Interoperability to Building Management and Asset Managements Systems
- Shift from I am a piece of equipment to I am part of a system

Core outcome: fewer nuisance alarms, tighter control, less wasted runtime, and earlier detection of performance drift.

AI in Building Mechanical System Controllers

From standalone controls to an operating layer across the whole building.

- System and variable-aware control: ventilation, zone scheduling, and after-hours operation can respond to actual use instead of static schedules
- Weather-aware optimization: pre-cooling, morning warm-up, and plant sequencing can be adapted to conditions ahead of time
- In-the-loop AI: systems can incorporate live feedback while still minimizing energy and demand cost
- Demand response: AI can coordinate with utility price signals and carbon reduction goals

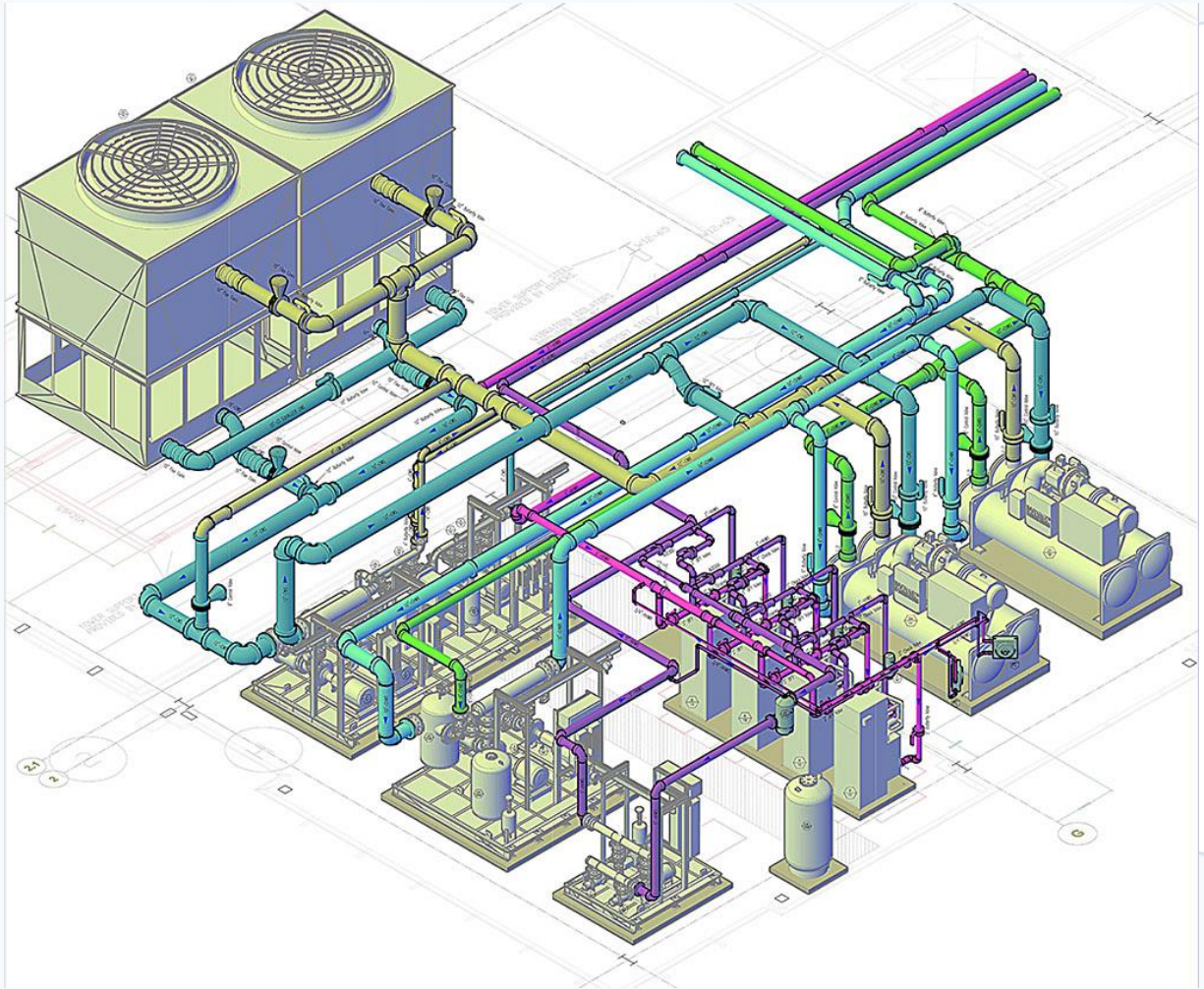


Sensors + BAS data → **AI review** → **Control actions** → **Operator oversight**

Core Outcome: Dynamic system optimization utilizing real time data.

AI in Mechanical Design

Where engineering teams are starting to see leverage.



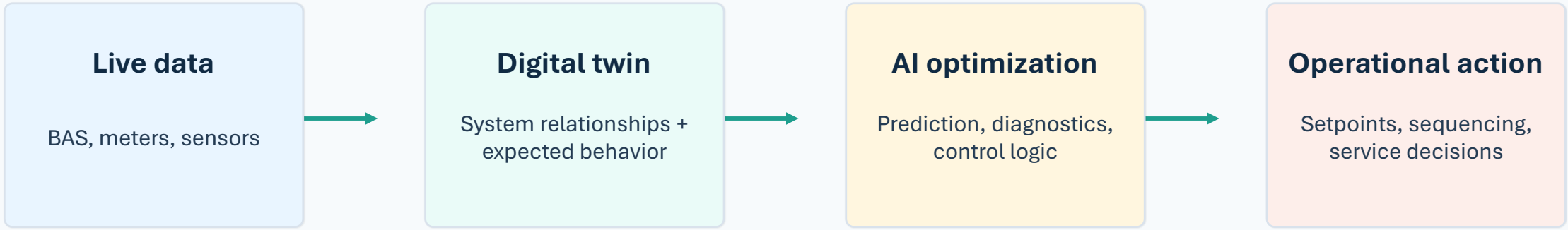
Emerging design use cases: Optimizing Systems and Reducing Risk

- Option screening for system selection using many variables faster than a manual first pass
- Coordination support through clash detection, constructability review, and data tagging
- Early identification of design-to-operations risks by connecting model assumptions with likely operating behavior (digital twin)
- Minimizing risk through AI assisted commissioning and specification compliance

AI is not replacing engineering judgment; it is accelerating comparison, simulation, and documentation.

Digital Twins Connect Design Intent to Real Operation

Leveraging existing systems to optimize future designs and decisions.



- A digital twin helps translate point data into expected system relationships and performance context
- That context improves fault detection, control tuning, and design-to-operations feedback

Changes can be made on a real world system without risking real world consequences

Impact on engineers

Mechanical engineering shifts from static assumptions toward data-backed design and system optimization.

What changes

- More time spent on option evaluation, controls strategy, and operational consequences
- Greater need to understand BAS data, fault detection outputs, and real-world performance drift
- Specifications increasingly need to address data access, point quality, interoperability, and cybersecurity
- Post-occupancy feedback becomes more useful because AI tools can connect outcomes back to design assumptions. I.E. a Smart Contract

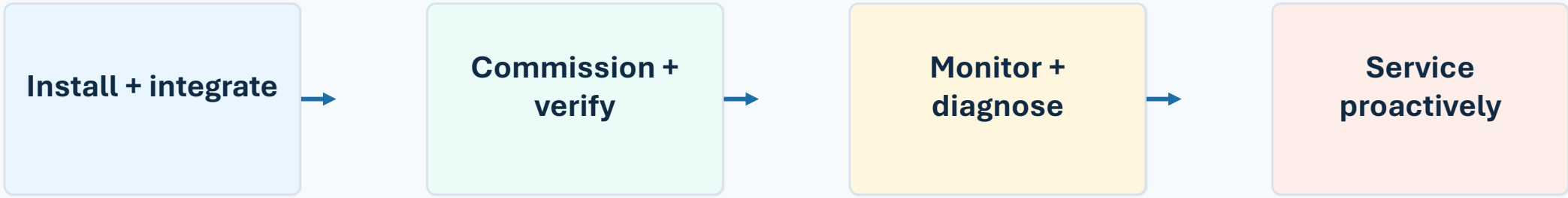
What does not change

- Engineering judgment still defines acceptable comfort, resilience, maintainability, and code compliance
- AI can accelerate comparison and highlight patterns, but it does not own the basis of design
- The engineer still must decide what should happen when the building is noisy, wrong, or incomplete

Core Outcome: Better System Efficiency with Lower Risk.

Impact on Contractors and Service Teams

AI makes field work more data-rich, but also raises the bar for commissioning and troubleshooting.



- Minimized scope gap and warranty risks
- Commissioning becomes more important as contracts are increasingly moving toward validation
- Service contracts can shift toward performance guarantees, remote monitoring, and condition-based maintenance to help optimize resources

Clear installation and commissioning scope with improved resource allocation and client service response.

The Punch Line AI Use Case

Simple workflow, strong ROI, and easy to explain to every stakeholder.

1. Sense

Vibration, amps, temps, pressures, runtime

2. Detect

Anomalies, drift, probable failure modes

3. Prioritize

Risk score, remaining life, urgency

4. Act

Work order, parts, planned downtime

Why it resonates

- Engineers see better data about actual equipment and system behavior
- Contractors can schedule service before failure instead of only after alarms
- Owners get fewer comfort events, less downtime, and more predictable maintenance planning

Impact on Owners

Owners care less about the algorithm and more about the operating result.

Lower energy and demand cost

Dynamic control, schedule optimization, and better plant sequencing reduce wasted runtime.

Less downtime and fewer complaints

Earlier detection and better prioritization reduce surprise failures and comfort events.

Longer asset life and better capital planning

Trend data helps owners understand what is drifting, what is recoverable, and what truly needs replacement.

Better ESG and reporting readiness

The same data backbone can support benchmarking, carbon reduction, and operational storytelling.

Risks

The most important piece

Data quality

Bad sensors, missing points, and weak naming conventions can undermine otherwise good analytics.

Cybersecurity and Liability

More connectivity increases the need for secure access, segmentation, and update discipline.

People + process

Teams need ownership for alarms, overrides, model drift, and escalation paths.

In My Opinion: AI is demanding a higher level of engineer, contractor, and operator, but it is being marketed as taking the place of those people.

Key takeaways

- AI in mechanical equipment is already practical in predictive maintenance, controls optimization, and analytics-enabled operations.
- Mechanical design teams are beginning to use AI to accelerate comparison, simulation, and coordination—not to replace engineering judgment.
- The biggest organizational impact is a shift toward data-backed decisions for engineers, contractors, and owners.
- The most successful programs start with a focused pilot and strong attention to data quality and workflows.
- Most importantly: we need to lean on each other and the expertise in this room to be thought leaders in this space.

Questions/Open Discussion Items?