Digitalizing Decarbonization

Johnson Controls

Raghav Rao Parnandi, Presales Leader – Digital Solutions, MEA – Dubai, UAE

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Agenda

- Introductions
- Global Mega Trends and Customer Challenges
- Commercial Building Decarbonization Digital Maturity Model
- What is OpenBlue?

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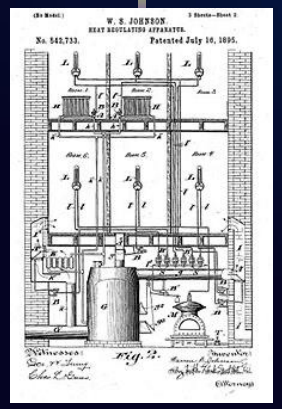
About Johnson Controls

90% of the world's most iconic buildings and campuses are equipped with our intelligent building solutions

Bellwether of intelligence in buildings (Founder **Warren Johnson** developed the world's 1st electric thermostat in 1885)



Smart building exemplars in the MEA region

Burj Khalifa Tower
Dubai

Shanghai Tower
Shanghai

Mecca Royal Clock Tower
Saudi Arabia

Shanghai World Financial Center
Shanghai

Taipei 101 Tower
Taipei

Museum of the Future
Dubai

DEWA Al Shera'a HQ – 1st govt net-zero building
UAE

FIFA World CUP 8 Stadiums
Qatar

Bee'ah HQ – Office of the Future
UAE

2000+ Dedicated resources

550+ Digital patents awarded/files

500+ Smart building use cases

126M+ Sq ft monitored and accessible

4000+ Connected buildings

240K+ Total connected equipment

12 Languages

20K+ Rules and FDD

550+ AI/ML logics

Frequent Product releases

8700 active patents In-house innovation hub

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Johnson Controls is a recognized leader in building technology

- Recognized in more than 40 leading sustainability awards and indexes, including Ecovadis and Sustainalytics
- Award-winning technology and AI
- Microsoft's Global Independent Software Vendor Partner of the Year and US Education Partner of the Year 2023
- Winners of the IoT Breakthrough Awards for both Company CEO of the Year 2022 and Enterprise Software Company of the Year

Verdantix named Johnson Controls a global leader in providing Internet of Things platforms to connect building systems and devices.

IoT Breakthrough, leading market intelligence organization in global Internet-of-Things (IoT) market, awards Johnson Controls as winner of the IoT Enterprise Software Company of the Year award.

Top 100 Global Innovator 2021 Clarivate

NAmed in the Top 100 Global Innovators 2021 for the sixth year in a row. The award acknowledges companies and institutions that contribute new ideas, solve problems and create new economic value.

Johnson Controls wins 2023 Microsoft Global Independent Software Vendor Partner of the Year and US Education Partner of the Year

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Johnson Controls named a market leader in smart building IoT

OpenBlue innovations move us ahead

Independent analysis of the world's **top 17 platforms** to connect building systems and devices gives Johnson Controls high scores for:

- Asset management, monitoring and control
- Balancing occupant well-being and energy efficiency
- Space booking and comfort management
- Building security capabilities

Our scalable solutions align with the market's priorities:

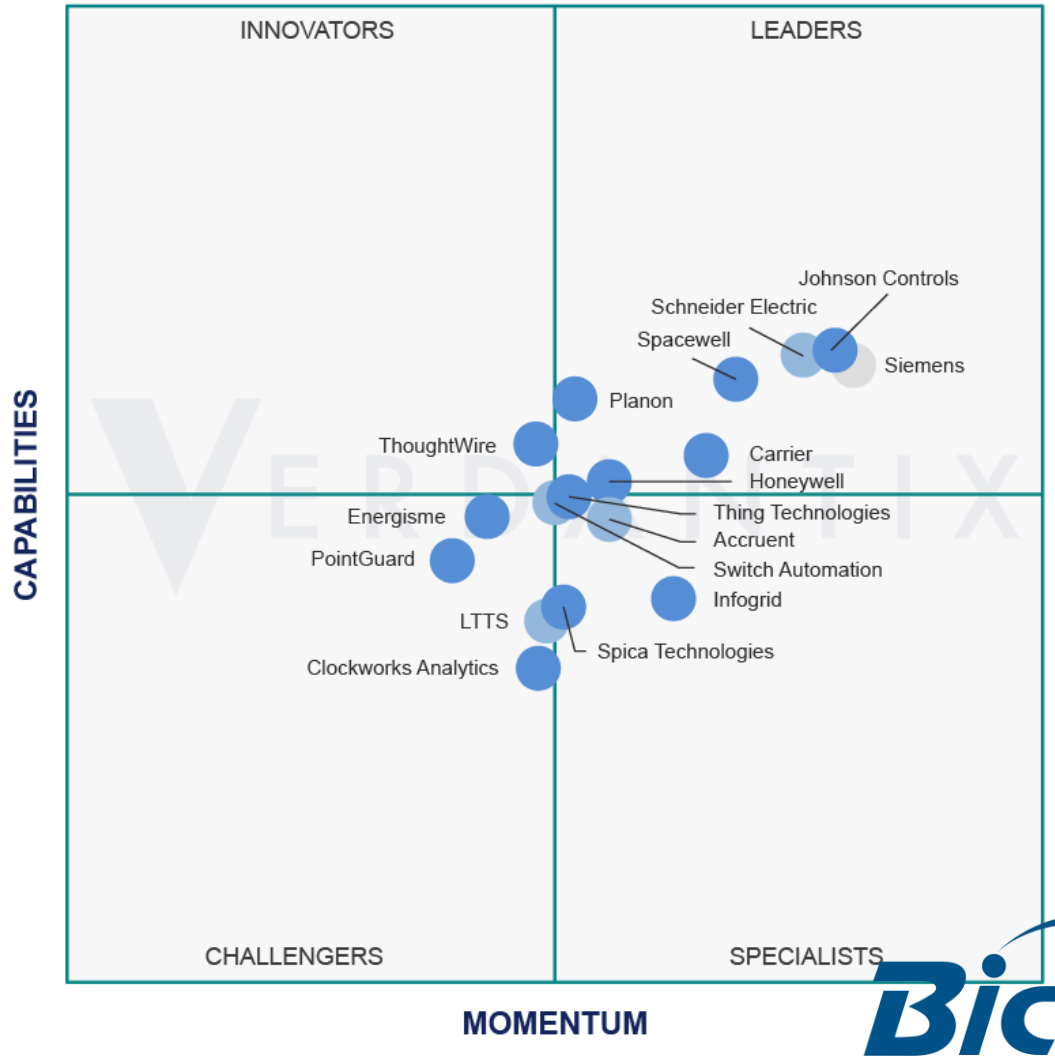
- Decarbonize to meet sustainability goals
- Optimize space use and reduce real estate costs
- Improve occupant health and well-being
- Proactively monitor and maintain assets
- Make building security nimbler and more effective

Secure data integration and advanced analytics improve building operations, performance and planning

- Better insights
- Better decisions
- Better results

VERDANTIX

Green Quadrant IoT Platforms For Smart Buildings 2022



Source: Green Quadrant: IoT Platforms For Smart Buildings 2022

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Business conditions around the world are changing rapidly. Sustainability is an imperative component of every organization on the planet.

ELECTRIFICATION

Across the U.S., A Surge Toward Electrification

A smart, sustainable, and sudden shift is helping the country's buildings go electric.

ENERGY

Inflation Reduction Act Benefits: Millions Of Efficient Electrified Buildings

ENERGY PRICE VOLATILITY

Energy prices: Businesses 'struggling to survive' as bills rise

BUSINESS

Energy crisis: Can the EU tame soaring prices?

Pressure is building for an EU-wide cap on the cost of gas and electricity, as prices soar. How does the power market work and can it be reformed to avoid so much volatility?

CLIMATE CHANGE RESILIENCY

Industry

Adapting to hotter summers means building resilience

Climate change is disrupting the building and real estate sectors

OPERATIONAL RESILIENCY

Government urged to protect food supply chain from energy rationing 'disaster'

The urgent need for infrastructure adaptation

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There is no decarbonising the planet without decarbonising buildings

George Oliver
CEO and Chairman
Johnson Controls

Buildings
account for circa
40% Global GHG emissions

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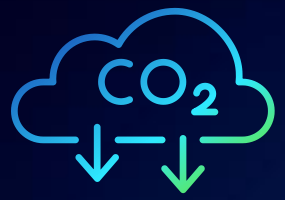
Global trends affecting sustainability and energy priorities



Decarbonization

- Increasing customer and investor demands for carbon reduction
- Differentiate brand as leader
- Pressure to improve energy use, water and waste management

Rising energy costs

- Price volatility continues, affecting your cost of doing business
- Need to maximize assets and energy efficiency to manage costs

Regulatory pressures

- Building owners worldwide must reduce their carbon footprint
- Technology is driving privacy and cybersecurity regulations
- Staying compliant will satisfy stakeholders and drive progress

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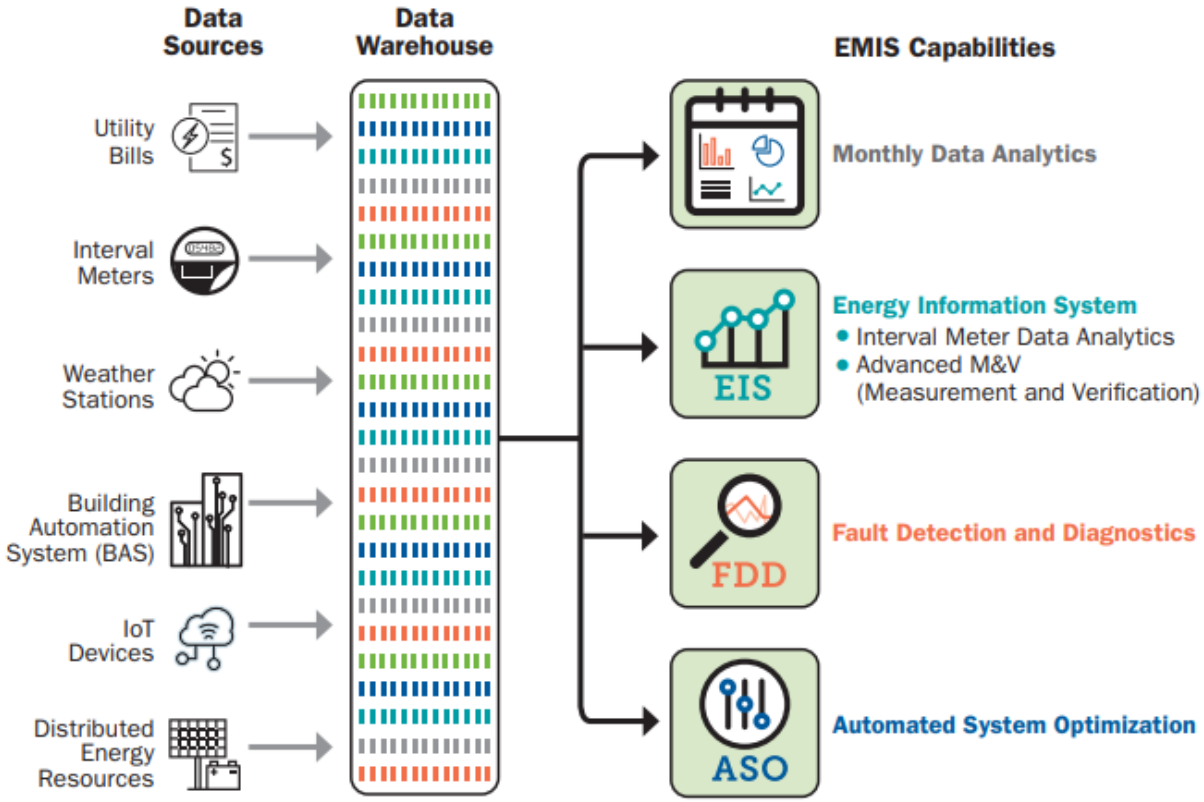
Categories of Smart Building software for decarbonization



EIS: meter-level monitoring (hourly or more frequent intervals) at plant or submeter level. Auto identify opportunity with anomalies or comparison with predictive models

FDD: automates detecting poor performance of building systems and helps diagnose potential causes using control system data. Different than a plant automation or SCADA alarm. Rule-based or model-based diagnostics

ASO: continuously analyzes and modifies plant automation system setpoints to optimize utility cost while maintaining comfort & reliable operation. 2-way communication with command/control to plant automation

BERKELEY LAB
Bringing Science Solutions to the World

Kramer, H., Lin, G., Curtin, C., Crowe, E., and Granderson, J. "*Proving the Business Case for Building Analytics*" **Lawrence Berkeley National Laboratory (LBNL)**, October 2020. https://doi.org/10.20357/B7G022

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Our Blueprint of the Future

What is OpenBlue?

OpenBlue is an integrated and open digital platform with in-built scalability and security to power a new class of smart buildings that are secure, healthy and sustainable. A complete ecosystem of connected technologies, expertise and services.

How does it work?

Gathers. Analyses. Predicts. Recommends. Automates. Optimizes.

OpenBlue reads the live activity of the building and makes sure it adapts to this information, continuingly fine-tuning until it performs perfectly.

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OpenBlue Platform

Outcomes

Sustainability & Energy Efficiency | **Space, Wellbeing & Productivity** | **Operational Efficiency & Equipment Optimization** | **Security, Safety & Compliance** | **…. Other Outcomes**

OpenBlue Solutions

OpenBlue Enterprise Manager – Single Pane of Glass Experience

OpenBlue Twin

Digital Twin

Data Mesh

Digital Twin (Location, Events, Assets & People)

Data Enrichment

Artificial Intelligence & Machine Learning

OpenBlue Cloud

Central Cloud Services

API Driven

Command and Control

Security

Data Pipeline

Authentication & Access

OpenBlue API

OpenBlue Bridge

Gateways & connectors

Edge Devices & Solutions

Edge Connectors

Edge Applications

Edge AI

External Services

External Systems

Cloud Services

Security Connectors | **Safety Connectors** | **OT Connectors** | **IT Connectors** | **Third Party Connectors**

Typical IT/OT Systems

Safety & Security

CCTV, Fire, PA/VA, ACS

Building Level Automation

Water Leak, Elevators, Lighting, Power, Occupancy, Meters, Air Quality, Water

IT & Third-Party Systems

email, SMS, ERP, Cafeteria, BIM, AD, Signage, AR/VR, Voicebot, Parking, GIS, Waste

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Unlock the performance of your building

Energy Efficiency & Sustainability

Your gateway to net zero and improving your bottom line. Take realistic steps with digital solutions that track, optimize and control energy use and accelerate progress to net zero emissions.

Space, Wellbeing & Productivity

Drive space efficiency, optimal occupant health and experiences. Create world-class spaces and experiences that engage tenants, attract and retain talent, boost health and increase occupant productivity.

Operational Efficiency & Equipment Performance

Efficient building system optimization and smart facility management. Operational consistency, risk mitigation and lower lifetime costs across your assets and building portfolio.

Security, Safety & Compliance

Holistically protect people and property. Holistic management of all systems and processes critical to the safety and security of your building, people and assets.

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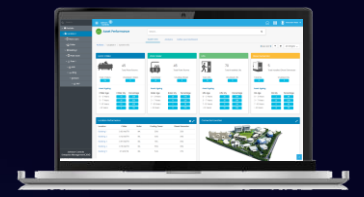
Journey to Decarbonization – Enterprise Manager

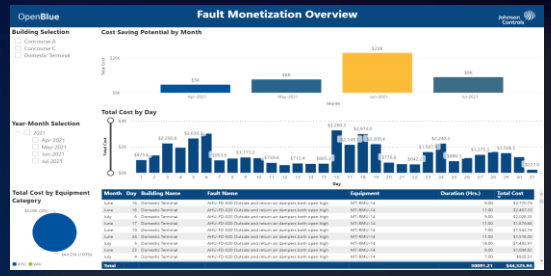


1 Monitoring energy and carbon footprint against goals

- Cultural and organization-wide alignment
- Decarbonization roadmap and strategy
- Energy Manager automatically collects, analyses, and displays information for all configured physical meters
- Reduced energy use and carbon

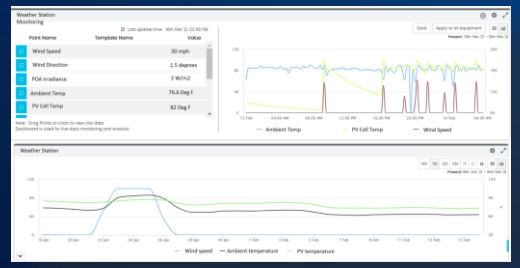
2 Advanced FDD with energy impacts

- Continuous decarbonization operations management plan
- Monitor and manage equipment energy and performance through FDD
- Automated energy cost avoidance associated with triggered faults
- Increase uptime and reliability for critical spaces



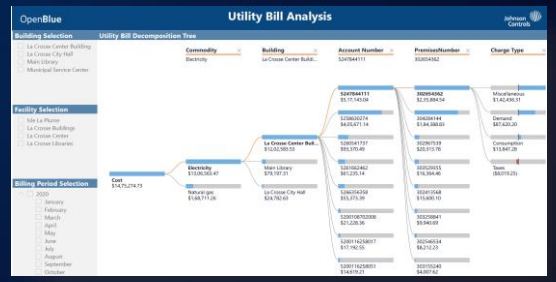
3 Renewables, Grid Services and Offsets

- On-site generation, storage monitoring
- Asset optimization and grid interactivity
- Carbon reduction tracking
- Traceable decarbonization dashboards



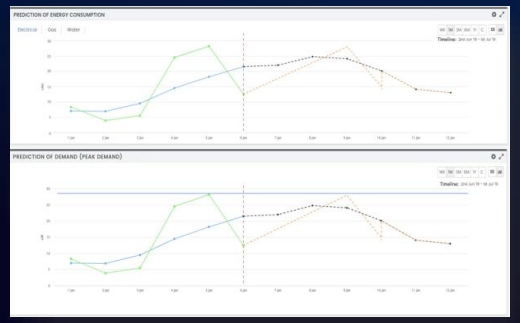
4 Utility wise distribution of energy and spend

- Transparent utility distribution mapping and spend of spaces
- Summarized data of submetering loads
- Anomaly detection of utility patterns against decarbonization objective



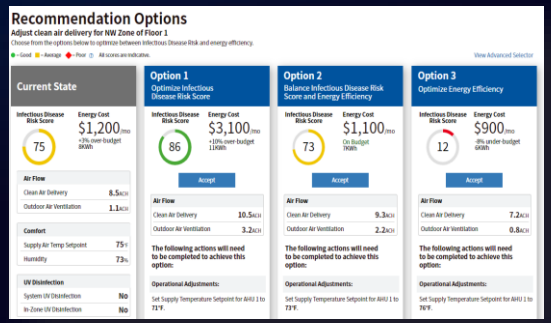
5 AI based prediction of energy profiles

- Advanced machine learning algorithm to accurately predict the energy consumption & peak demand
- Data-driven building decision-making using predictive, automated, responsive capabilities
- Leveraging digital models for master planning and scenario assessment



6 AI based operational **recommendations**

- AI enabled recommendations
- Temperature setpoint adjustment, HVAC reset opportunities, economizer modes suggestions based both current and predicted trends
- Asset maintenance actions based on faults predicted
- Multi-solve simulations



Energy Efficiency & Sustainability

Your gateway to net zero and improving your bottom line

Baseline energy performance

- Manage energy and carbon performance (Scope 1 and 2) with manual and automated utility bill uploads
- Metering of utilities – electric, water, gas, etc.
- Normalization of energy data and spend for benchmarking

Decrease carbon footprint

- Automated identification of data health issues and gaps
- Extensive visualization and reporting of energy KPIs
- Savings estimates and project tracking for energy conservation measures (ECMs)

Optimize building performance

- Advanced fault detection and diagnostics with monetization to prioritize energy-saving actions
- AI-powered advisory to optimize utility costs and carbon emissions
- Work order integration for closed loop action

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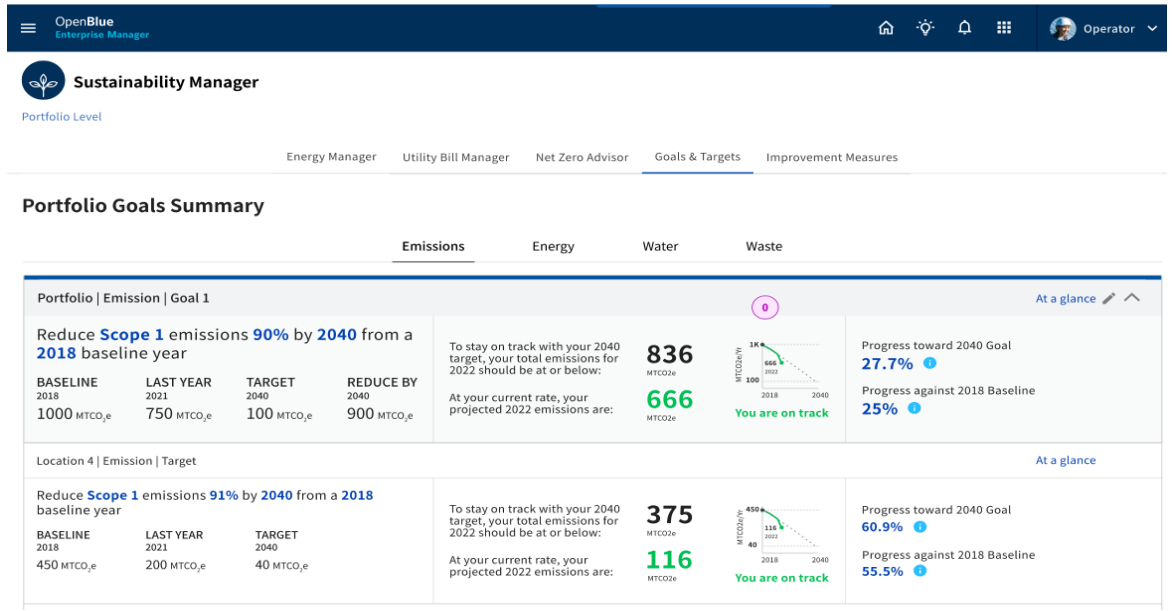
Regulatory compliance

Meet regulatory compliance requirements and track progress effectively.

- Net Zero solutions enable customers to collect and consolidate portfolio energy data in one location
- Convert energy consumption automatically into green house gas emissions for reporting purposes
- Track progress toward goals highlighting buildings with the greatest opportunities for improvement



Net Zero Advisor

Save time with automated energy reports

Janet

Energy Manager for a portfolio of office buildings

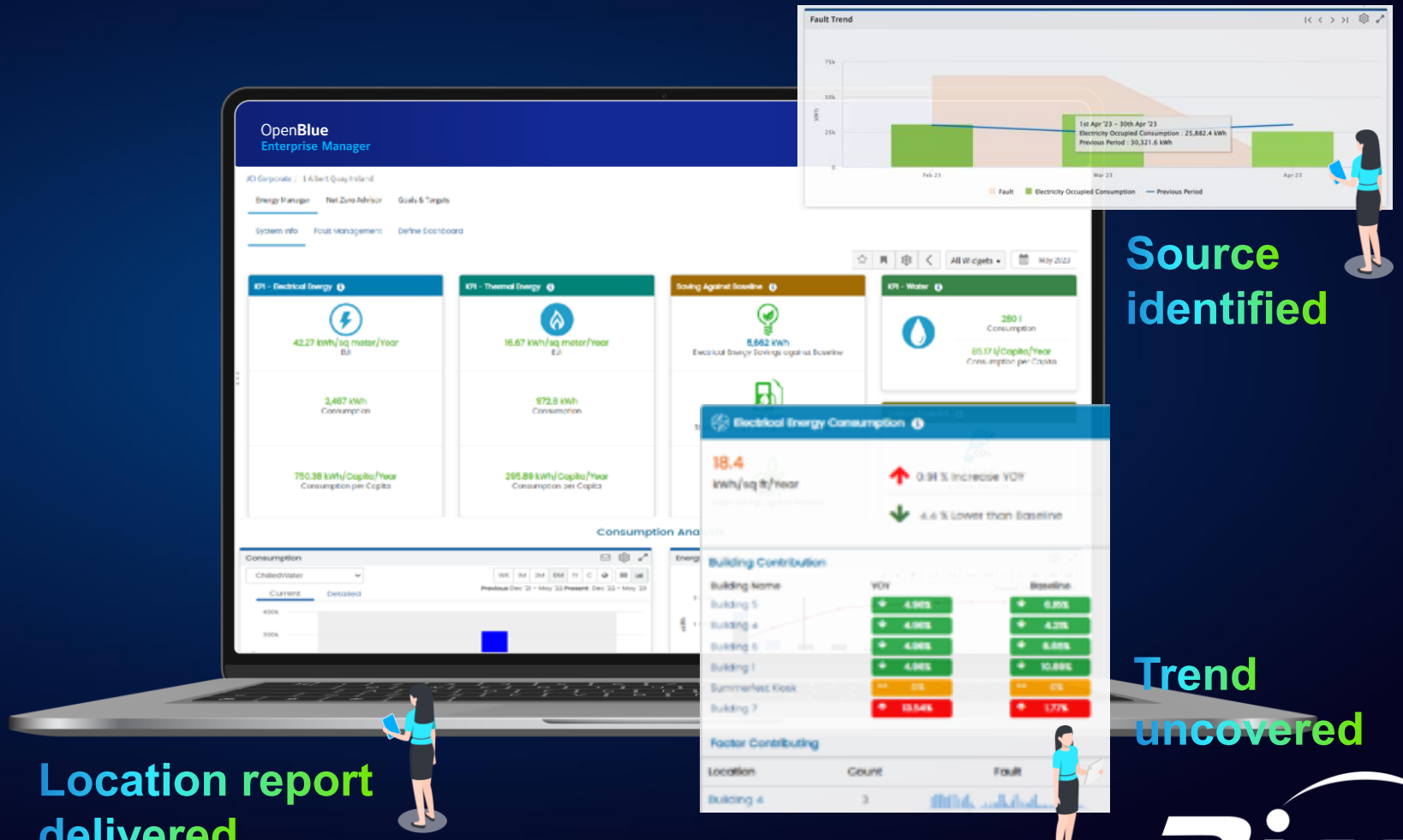
1. **Scheduled energy comparison report by location received**

2. **Report is delivered to Janet**
   She notices 5757 N Green Bay campus energy use is trending higher than other sites.

3. **Source identified**
   She signs into OpenBlue Enterprise Manager and navigates to 5757 N Green Bay Campus and checks the dashboard. Janet sees building 3 is using the most natural gas. She investigates by switching to the fault management tab.

4. **Trend uncovered**
   Fault information shows natural gas use has been increasing monthly. Janet generates a new work order and assigns it to John, the facility manager.

5. **Facility manager receives the notification and investigates**



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Net Zero Advisor Plus

Predict energy use and demand with consumption thresholds and alerts

John

Facility / Portfolio Manager for a range of office buildings

1. **Set consumption thresholds**
   Knowing exactly how much energy needs to be reduced by facility, Janet sets consumption thresholds for the facilities team for next year.

2. **Notifications on targets**
   Later that year, facility 3 has neared the threshold set by Janet numerous times. John received his second email notification this week that his facility may breach Janet's budgeted target.

3. **Inspect energy use by floor**
   He inspects the floor consumption and realizes it's consistent even though occupancy has been low during the day on floor 8 and 14.

4. **Use floors based on data**
   A heatwave is forecasted for tomorrow so he closes floors 8 and 14. Occupants move to other floors. Bill sees a significant reduction in energy use.

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Your gateway to smart facility management

24/7 monitoring and management

- Support sensor points available through respective vendor cloud platforms
- Normalization of equipment data for benchmarking across regions
- Extensive visualization and trending of KPIs; standard and custom reporting templates
- Graphical representation of asset performance and utilization data

Proactive and predictive maintenance

- Automated identification of data gaps and health issues
- API integration with third-party ESG reporting platforms
- Savings estimates and project tracking for energy conservation measures (ECMs)
- 3D visualization of issues impacting equipment performance
- Connect equipment KPIs to ECMs

Optimize maintenance and response time

- Automated FDD with monetization to prioritize maintenance actions
- Work order integration for closed loop action
- Manage equipment performance based on connectivity to BMS and equipment over OT protocols
- Manage equipment inventory with operational run times and performance history

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Equipment Performance Advisor
Operational efficiency and maintenance

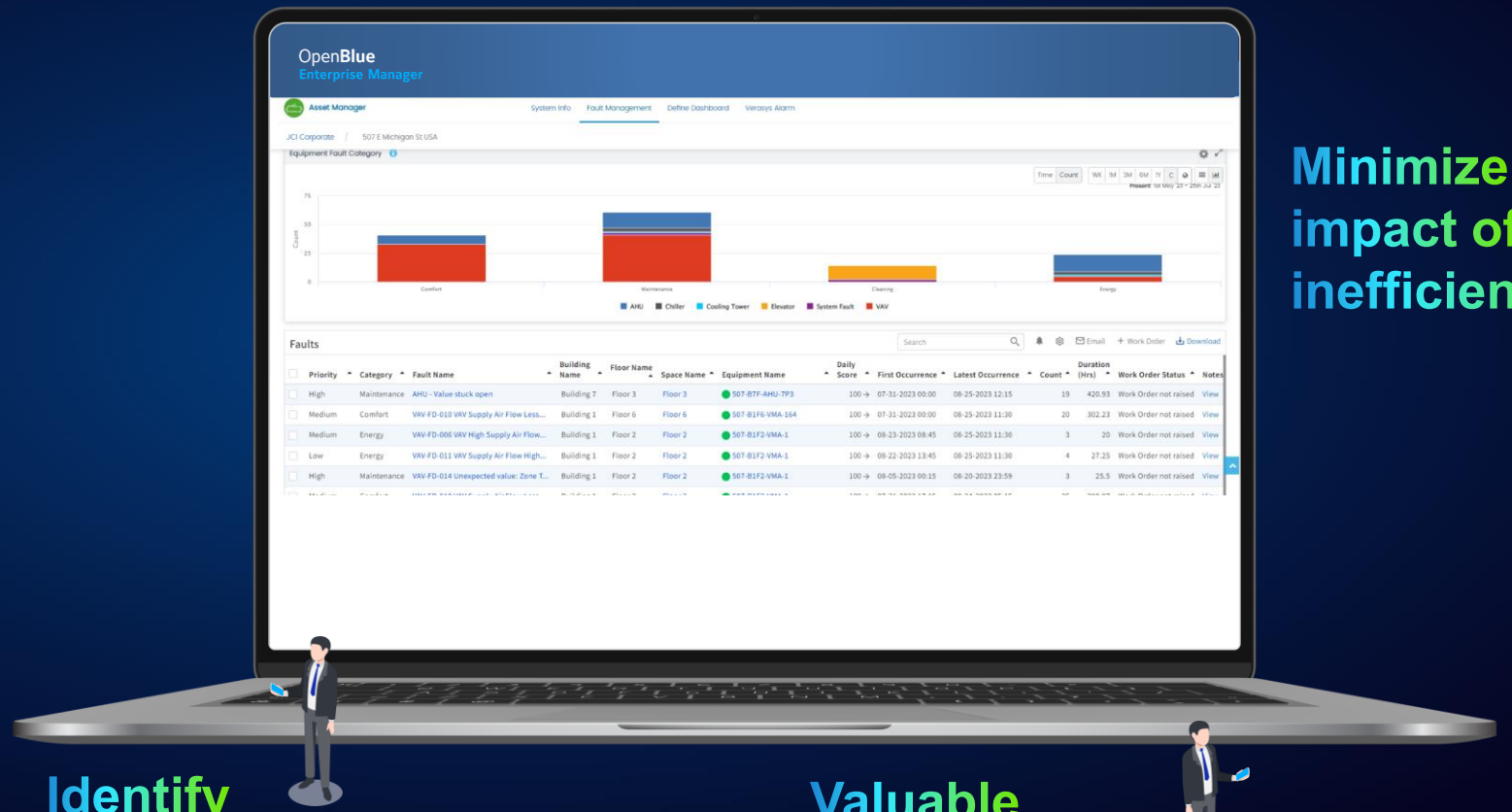
John
Facility Manager

1. **Identify opportunities**
   John needs to further analyze the data to identify operational efficiency gains and potential savings to share with Mary and the wider leadership team for rollout to other facilities.

2. **Minimize impact of inefficiencies**
   He wants to understand where the inefficiencies are and whether they are impacting energy or maintenance costs and whether the comfort of his tenants is being affected.

3. **Valuable insights shared**
   Shawn the technician gives John clear guidance on actions he can take to improve facility maintenance and realize savings, but also what information OEMs need to maximize the efficiency of their assets.

4. **Managing communication**
   Work orders help manage all of this communication within the tool.



Minimize impact of inefficiencies

Identify opportunities

Valuable insights and communication

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Equipment Performance Advisor Plus
Command center operations

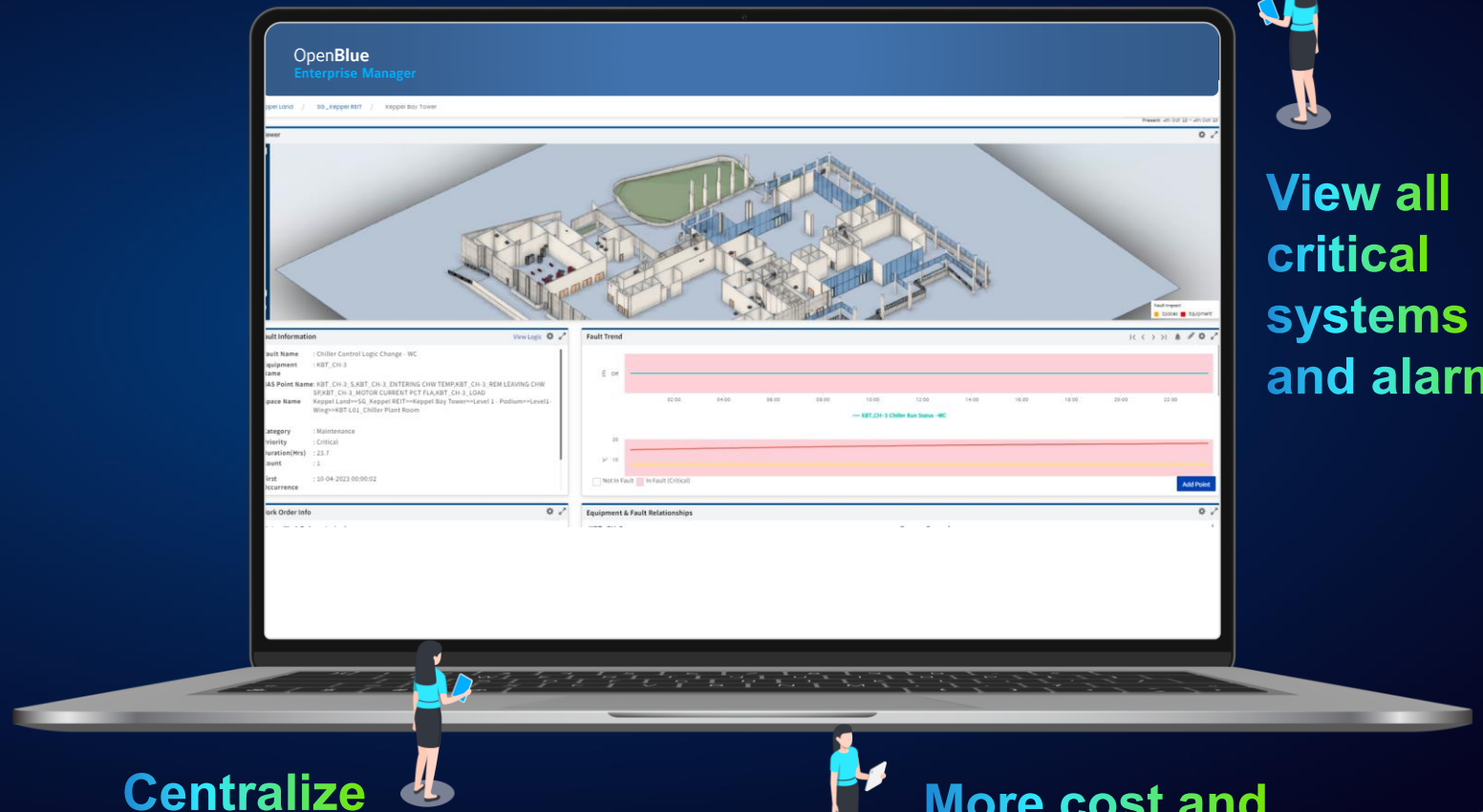
Mary
Portfolio Manager

1. **Centralize operations**
   Mary tasks Andrew with overseeing a common command center to centralize operations across the building.

2. **View all critical systems and alarms**
   In conversation with Johnson Controls, Mary and Andrew understand the value OpenBlue Enterprise Manager can add to existing operations by allowing them to view all critical systems and alarms on one screen and take action.

3. **3D visualizations and impacts**
   Andrew can see 3D visualizations of the building which highlight all critical faults and alarms. When he clicks on a fault, he is redirected to the fault management tab and is also made aware of critical systems impacted as a result.

4. **More cost and time savings**
   Andrew is more productive as he spends less time responding to issues. There is also much less downtime which drives cost savings throughout the business.



View all critical systems and alarms

Centralize operations

More cost and time savings

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Your gateway to optimize the utilization and health and experience of your spaces

Improve utilization of real estate and amenities

- Connectivity to BMS and extensive sensor network
- Normalization of space performance data for benchmarking across regions
- Global benchmarking and peer-to-peer comparison of building performance
- Near real-time graphical representation of the status of rooms and desks

Enhance occupant wellness and productivity

- Automated identification of data gaps and data health issues with sensors and other source data
- APIs for integration with customer data warehouse and third party reporting platforms
- Detailed report analyzing the building's indoor air quality (IAQ) in the past month

Show regulatory compliance and obtain certifications

- AI-enabled clean air delivery and energy spend analysis
- Leverage occupancy, IAQ and weather data to optimize HVAC operations
- Extensive visualization and trending of KPIs; standard and custom reporting templates

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Workplace Advisor – Space

Reach operational savings goals across your portfolio

Janet

Head of Real Estate Strategy

1. **Analyze floor space across portfolio**
   Janet needs to make 15 percent operational savings year on year. She analyzes floor space use to find spaces in the portfolio given that 70 percent of employees are in the office thrice a week.

2. **Find out peak utilization per floor**
   Using data from traffic counting sensors, Janet notices the average floor utilization was 43 percent, with an average peak utilization of 64 percent. Certain buildings and floors had peak utilizations under 40 percent.

3. **Free up leases to make savings**
   Janet recommends freeing up leases on a large number of floors, thus comfortably achieving his 15 percent annual savings. She used the system reports to confirm that utilization levels increased, but not to levels that would have affected employee productivity or comfort.

Analyze floor space across portfolio

Find out peak utilization per floor

Free up leases to make savings

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Workplace Advisor – Space

Reconfigure spaces to suit capacity and employee needs

John

Facility Manager for a single site facility

1. **Efficient space utilization**
   John noticed that conference room reports indicated a shortage of these on Tuesdays and Wednesdays, and this was confirmed by his colleagues

2. **Preference for smaller conference rooms**
   John also noticed that larger conference rooms were also heavily utilized on Tuesdays and Thursdays, but the numbers attending were small. People clearly required smaller conference rooms more.

3. **Adapting rooms to meet demand**
   Working with the facilities team, John converted 10 large conference rooms into 20 smaller conference rooms. The conference room reports confirmed that small conference rooms were no longer in short supply and the numbers using them increased substantially.

Efficient space utilization

Preference for smaller conference rooms

Adapting rooms to meet demand

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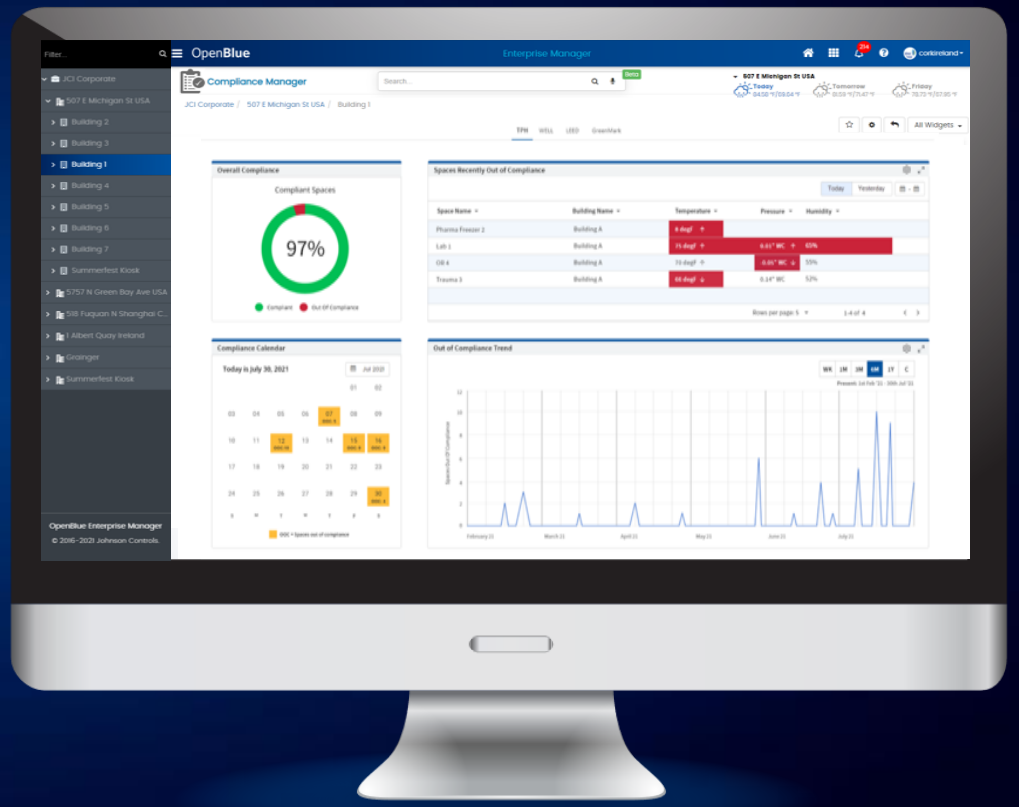
One simple dashboard – multiple benefits

- View essential metrics quickly
- Receive automatic notifications
- Identify trends and detect issues early
- Speed troubleshooting and repairs
- Easy log-in for nursing and lab directors
- Simplify reporting, streamline inspections and minimize downtime



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Thank you

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