

Enhancing Education with AI-Driven Connected Buildings

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Today's Presenters



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Agenda

- Market Trends in Artificial Intelligence (AI)
- Modern Building Automation
- AI Facility Results
- Educating Students on AI



Market Trend: A Focus on Technology

Technology expectations are evolving rapidly



Market Trend: The Promise of AI

AI is powering cutting-edge solutions that bring about significant advancements in labor productivity, personalized customer experiences and accelerated design approaches (e.g., product development and/or application engineering)

1

IT Platforms



Embedded AI in strategic IT platforms (e.g., ServiceNow, Microsoft, etc.)

2

Internal ChatGPT-like Tool



Empower personal productivity with ChatGPT-like tools and functional productivity with content generation tools

3

AI in Product Offerings



Expedite the product development process, generating novel and optimized designs that push the boundaries of what's possible

Shared team commitment to unlocking the potential of generative AI

Artificial Intelligence

Over-arching field focused on providing machines the capability to perform tasks that normally require human intelligence

Traditional AI (“Smart Assistant”)

Usage of models designed to perform specific tasks based on predefined parameters

personalized recommendations

spam filters

fraud detection

predictive maintenance

image recognition

credit scoring

Generative AI (“Creative Assistant”)

Trained on an extensive database to recognize patterns and generates new data

summarize text

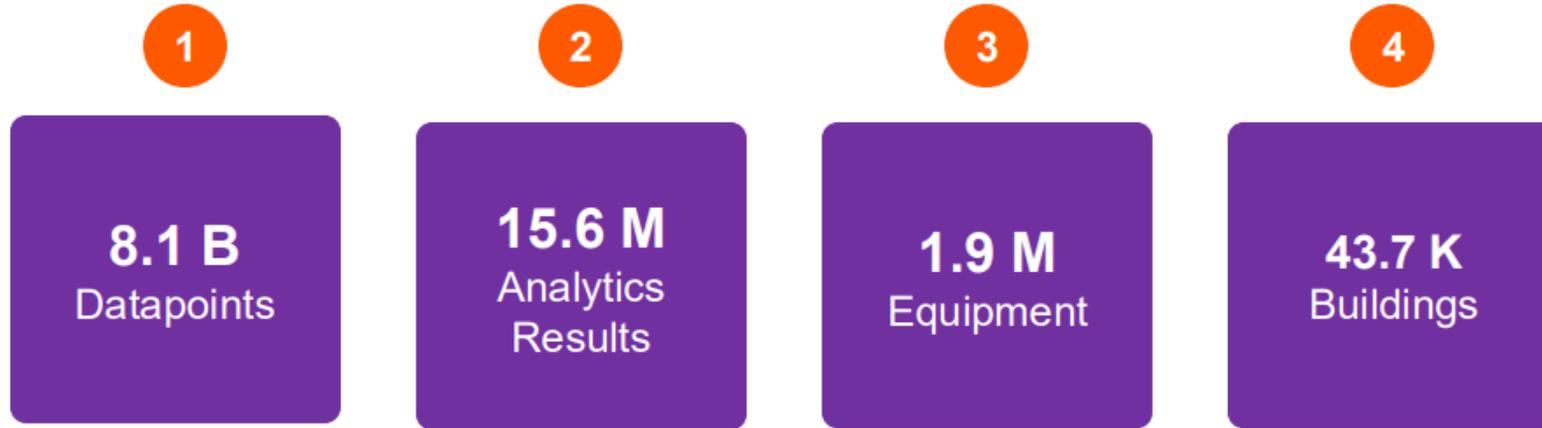
animate videos

create images

compose music

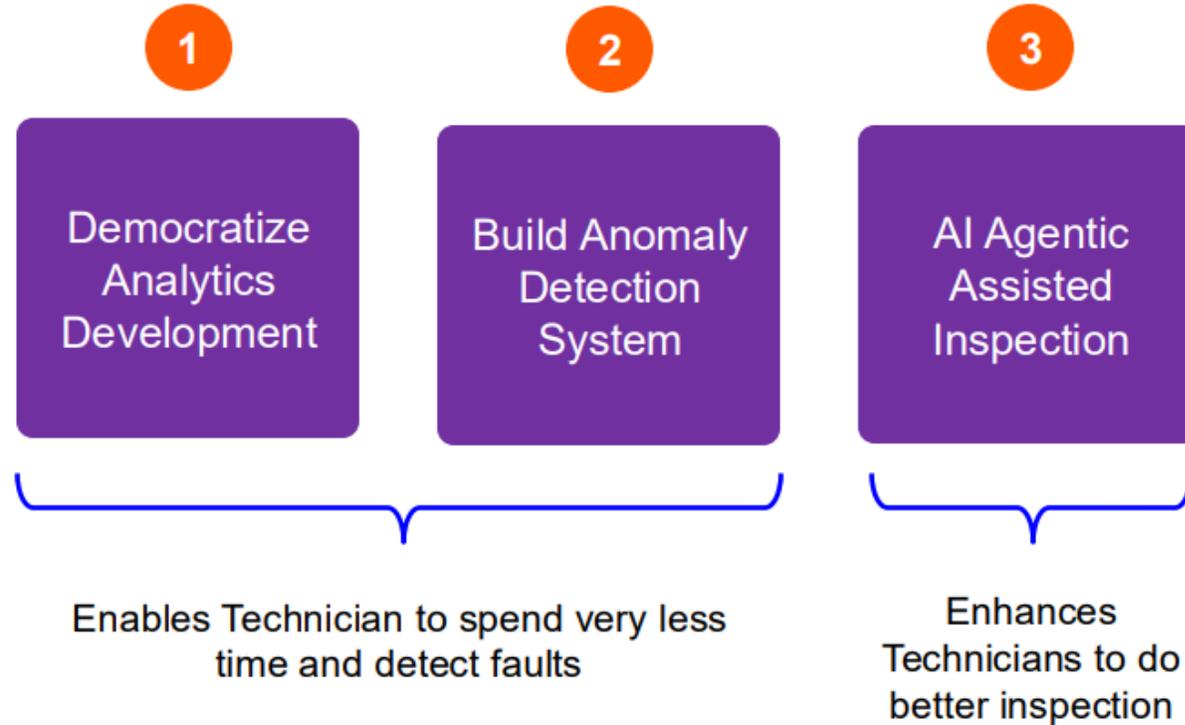
develop code

Trane Technologies – Digital Services



High Volume System, ingests billions of data points every single day

Trane Technologies – Digital Services



Key inputs to service processes in the HVAC world

Technicians are constantly jumping from one file/system to another



**Telemetry &
Fault Data**

What's
the temp
in this
zone?



**Equipment
Manuals**

How do I
replace this
sensor on
this unit?



**Workorder &
Asset Data**

What's the
make/model?

When was
this unit last
serviced?



Parts Data

What part
do I
need?

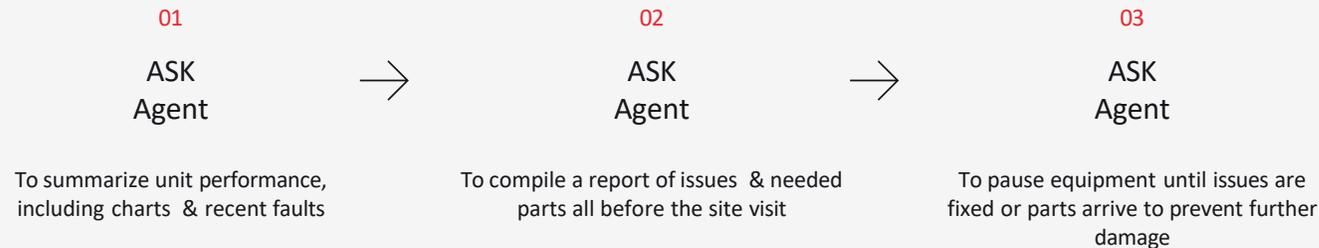
Slashing issue resolution time

Scenario: Hot call received from a retail store manage in Boise, Idaho

CURRENT STATE



AI AGENT



* Includes 2 hours discovery work (\$150) and initial visit (\$420 from 2 hours of work (\$230) + travel (\$115) + truck charge (\$75))

** Includes 10 minutes of discovery work (\$12) and initial site visit eliminated

CURRENT STATE



\$570*



2-hour discovery



Site visit(s)



Lack of insights

AI AGENT



\$12**



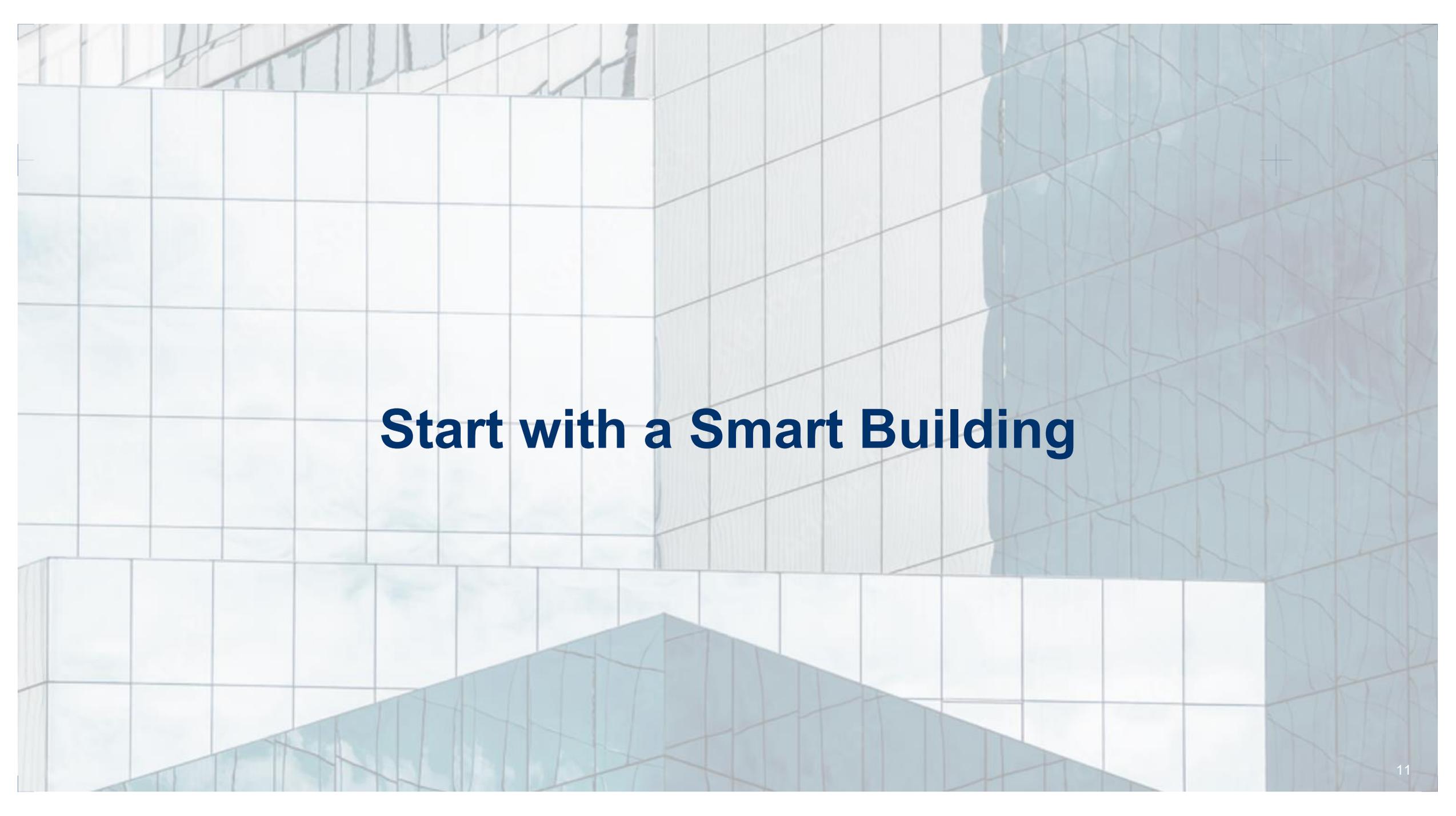
10-minute discovery



No initial site visit



Clear procedure & part list

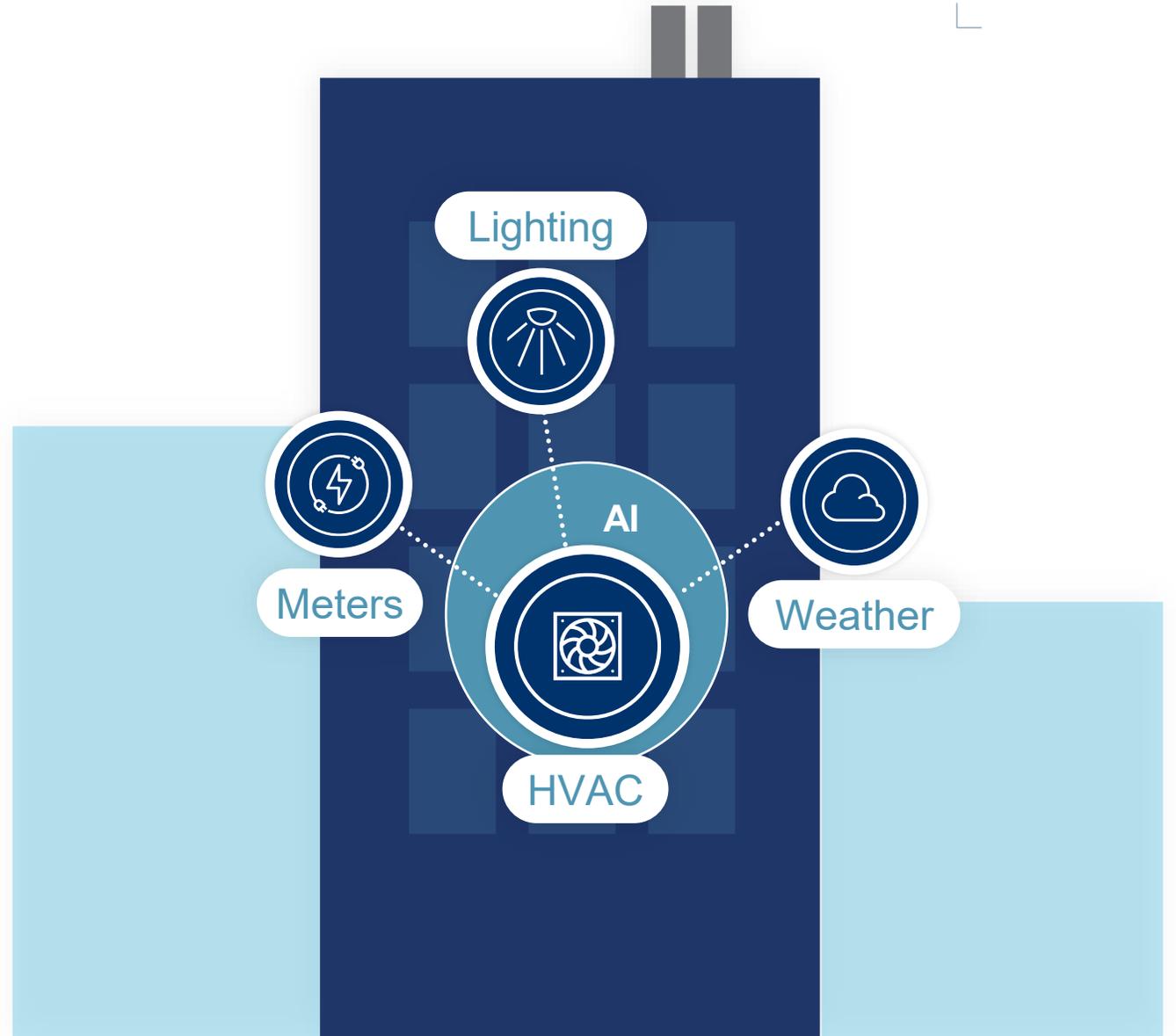


Start with a Smart Building

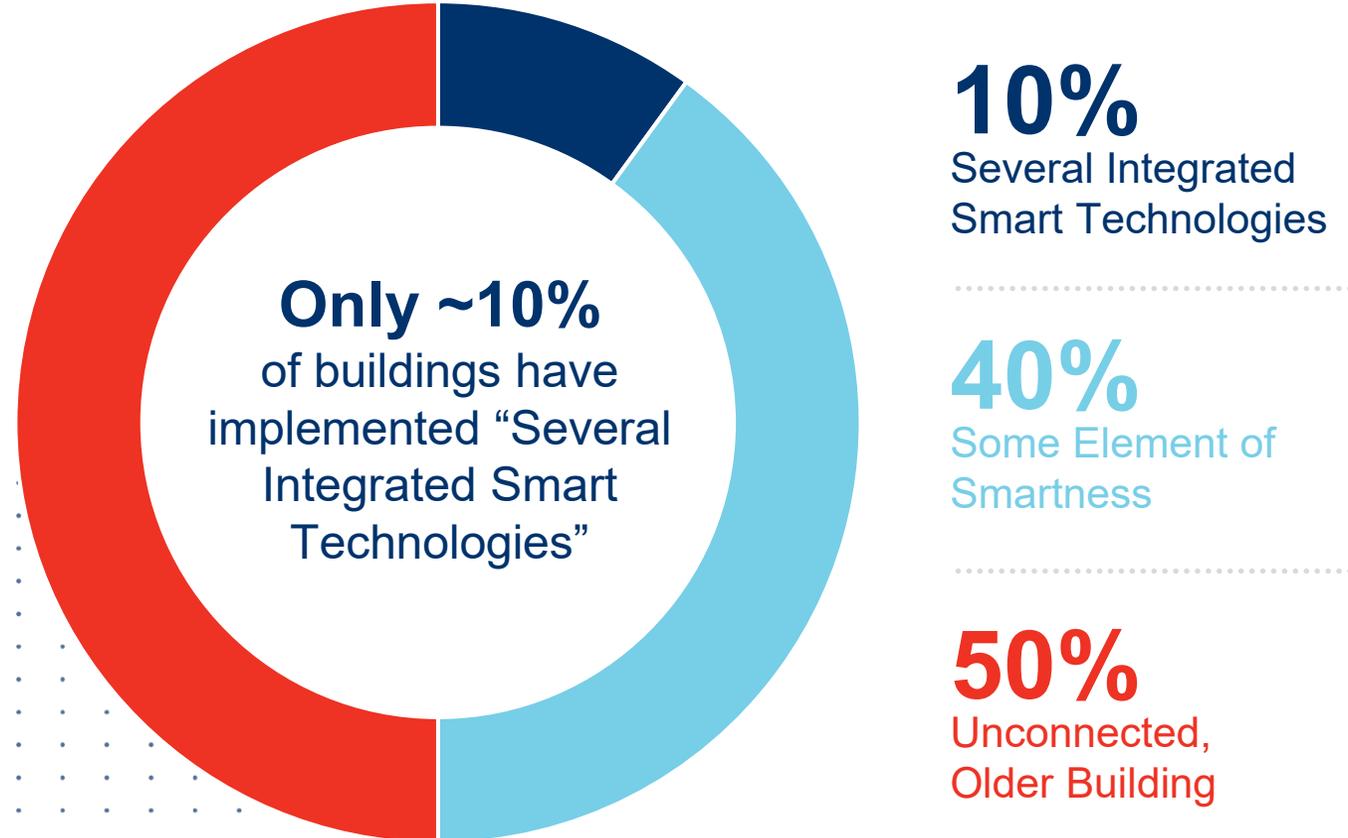
What is a Smart Building?

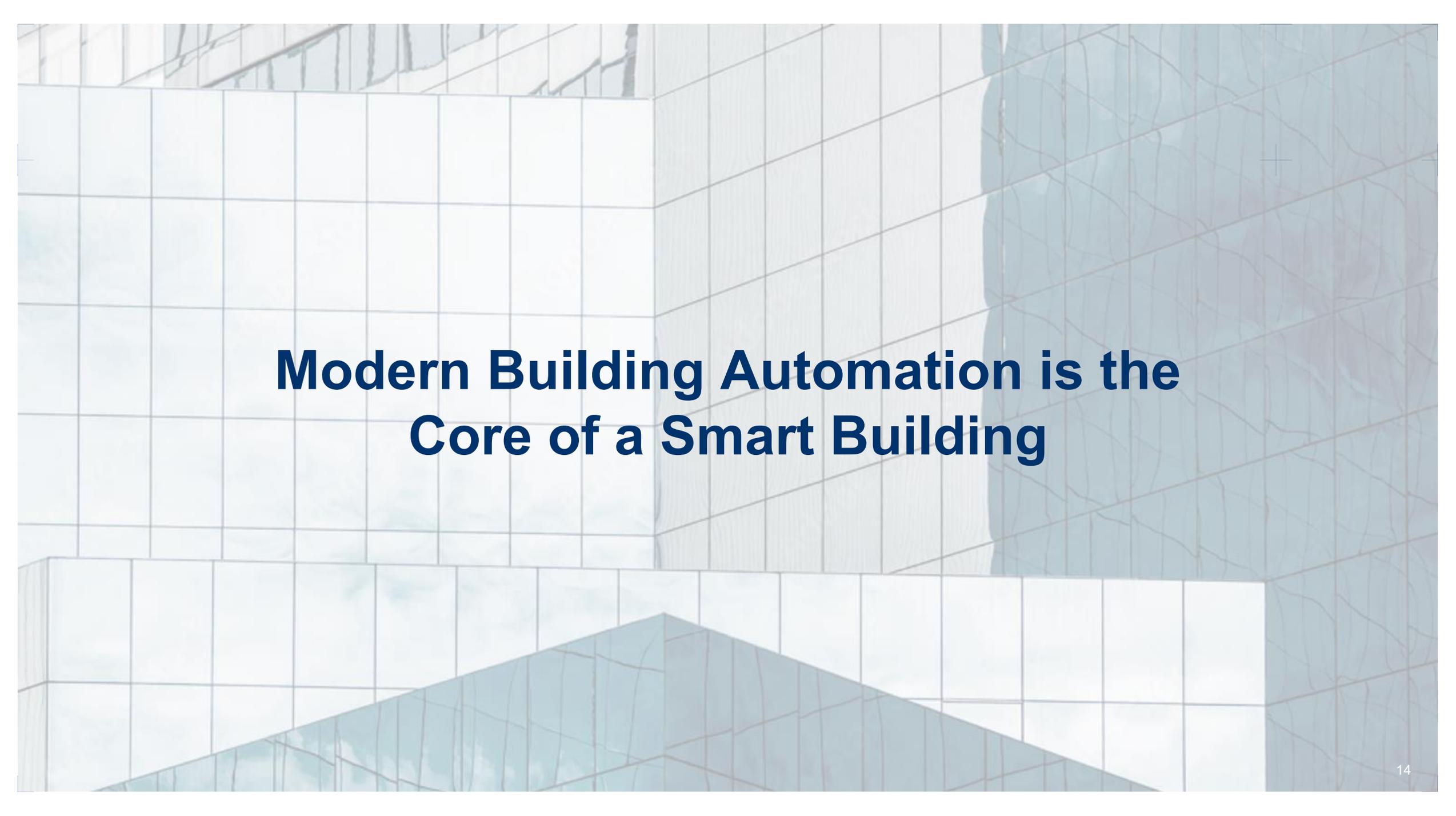
Smart buildings connect technologies and systems to achieve greater outcomes than any single system could.

Artificial Intelligence (AI) has entered the smart building space, having a significant role in advanced data analysis, predictive maintenance, and operational efficiencies.



How smart are *commercial buildings* in the United States?





Modern Building Automation is the Core of a Smart Building

Modern Building Automation

Most facilities have some level of building automation, ranging from schedules to complex plant and air system coordination.

**Coordinate
HVAC systems**

**Support
complementary
systems**

**Meet building
codes &
standards**

**Alert operators
or occupants**

Executing projects today to be ready for Tomorrow

Smart building technology can alleviate issues and achieve desired outcomes

Specify



- High-performing connected building systems
 - Support the needs of today
 - Enable the solutions of tomorrow
- Cadence and ownership of cybersecurity updates

Integrate



- Open standard BAS protocols
 - BACnet/IP, BACnet/Zigbee, BACnet MS/TP
- Support for common standards and guidelines
- “IT approved” connectivity to cloud applications
 - BACnet Secure Connect

Outcomes



- Adhere to cybersecurity needs
- “Shall be”/“shall be capable of”
- Adaptability to future needs
- Flexibility to future technology growth



**Now the Potential of AI can be
Realized**

Using AI to help increase energy efficiency for facility operators



Customer expertise in running their building



Artificial Intelligence combines...



Expertise in system optimization

What to expect



Reduce HVAC Energy Costs Up to 25%



Reduce Carbon Emissions Up to 40%

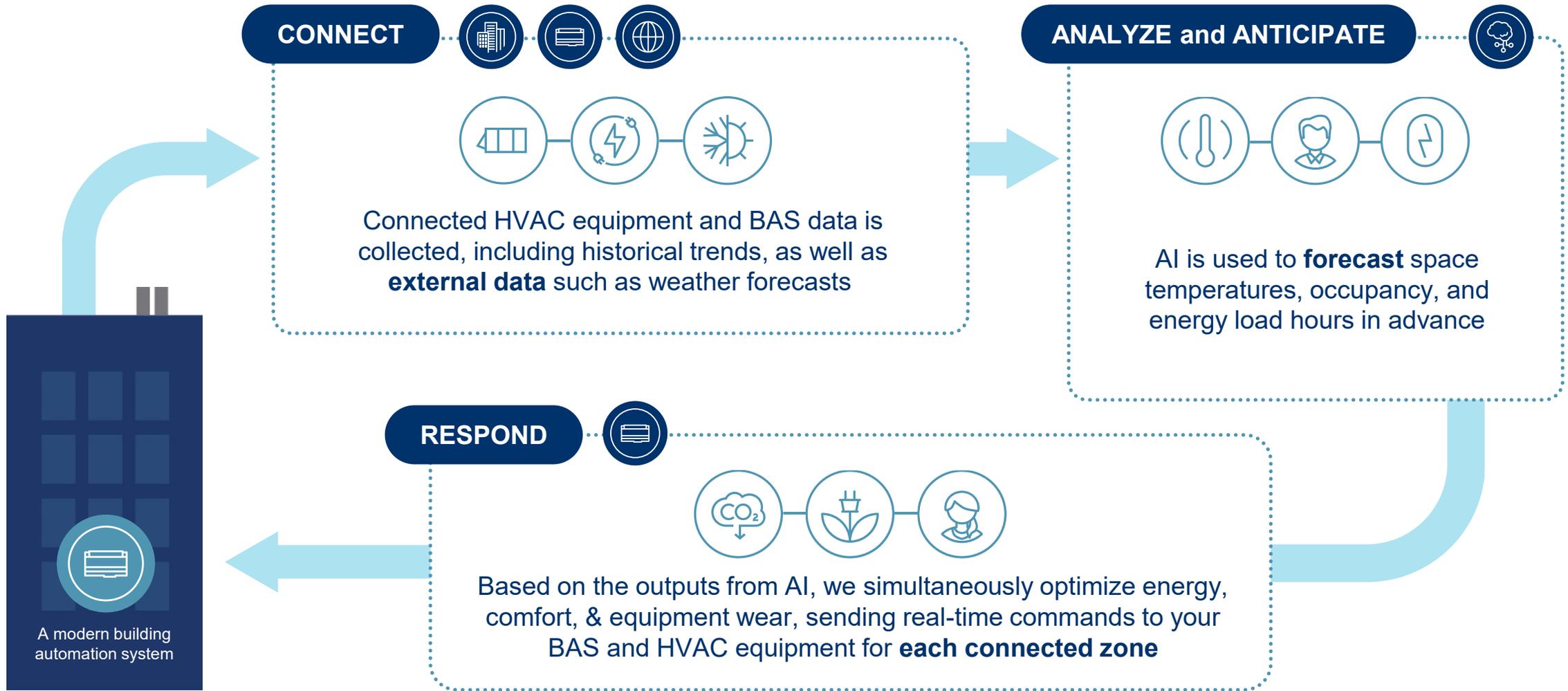


Extend Equipment Service Life Up to 50%



Improve Occupant Comfort Up to 60%

How does AI-Enabled Real-Time Optimization work?



Real-Life Customer Success

Motivated by bold sustainability initiatives, an industry-leading life sciences company had aggressive greenhouse gas (GHG) reduction goals across a national portfolio of facilities.

Decarbonization Goals



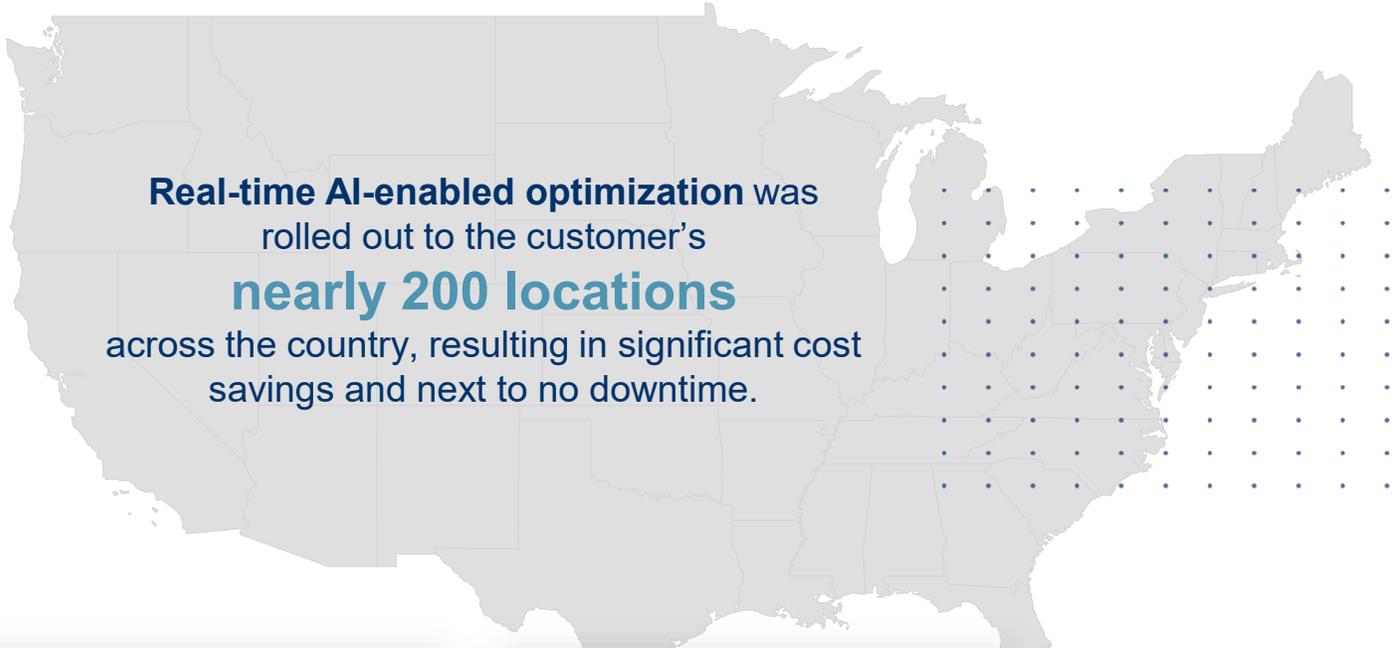
40%

reduction in GHG emissions by 2025



Achieve net zero by

2035



Critical Impacts

HVAC energy savings

5.78 GWh

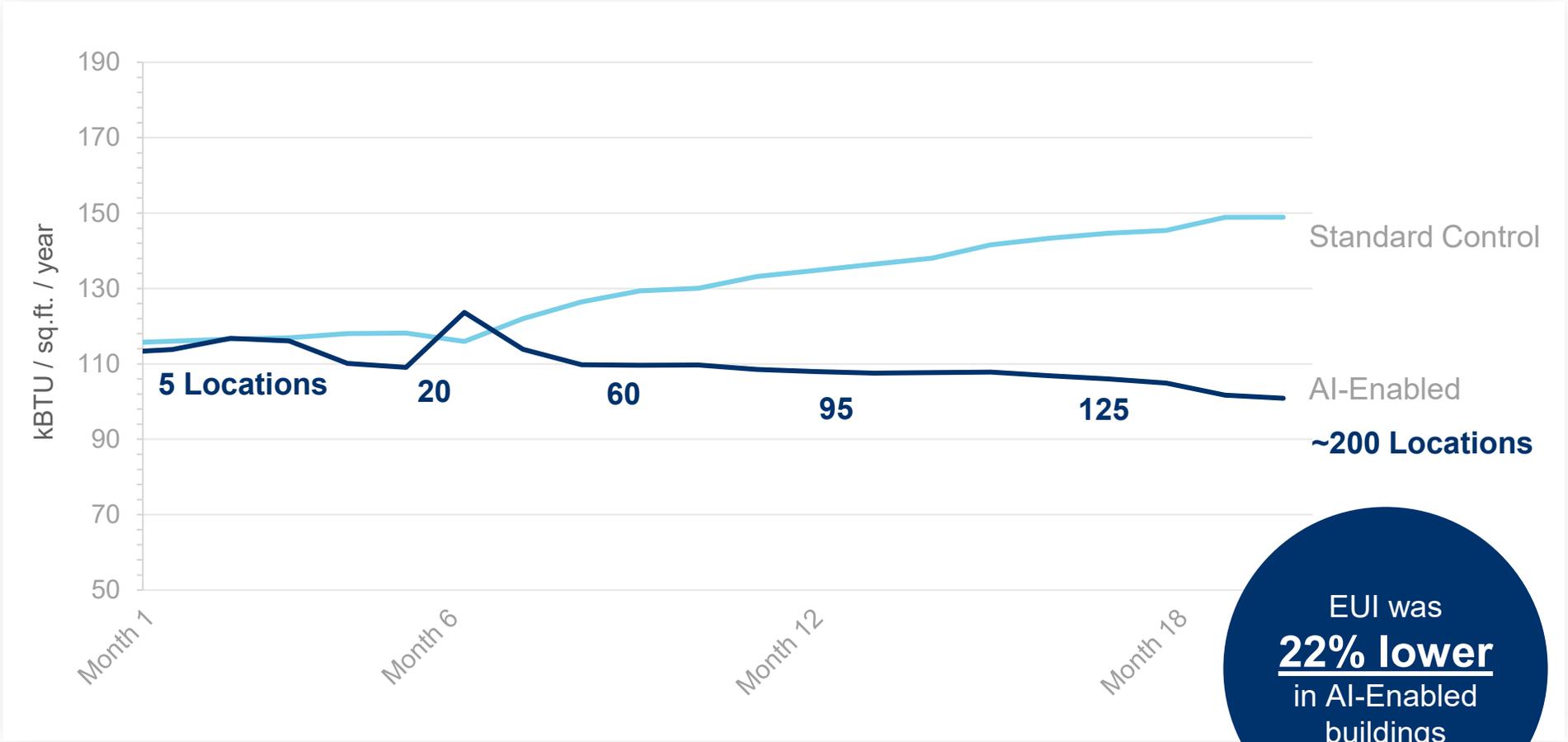
HVAC gas savings:

57,785 therms

Metric ton CO₂e avoided:

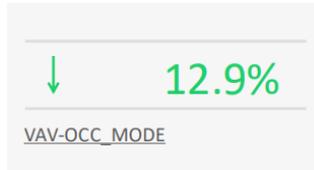
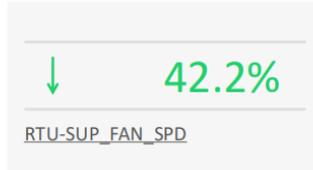
2,046

Energy Use Intensity – AI-Enabled Buildings



Higher Ed Facility in South Florida

Runtime Summary

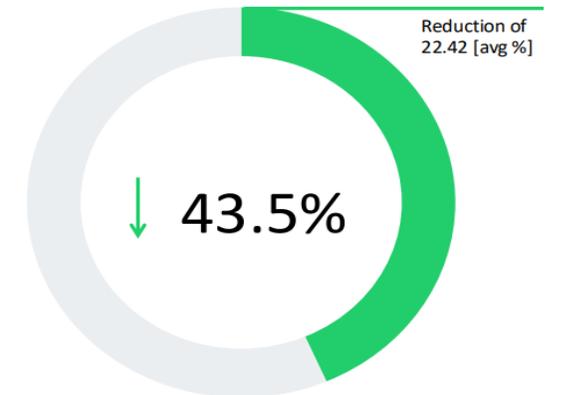


Equipment: RTU (Overview)

Component: Cool Position

| System | Without BBAI [avg %] | With BBAI [avg %] | Difference [avg %] | Reduction [%] |
|------------------|----------------------|-------------------|--------------------|---------------|
| RTU_01 | 46.26 | 34.17 | 12.09 | 26.1 |
| RTU_02 | 54.44 | 26.95 | 27.49 | 50.5 |
| RTU_03 | 53.7 | 31.17 | 22.53 | 42.0 |
| RTU_04 | 51.84 | 24.27 | 27.57 | 53.2 |
| Avg Total | 51.56 | 29.14 | 22.42 | 43.5 |

RTU Optimization Results



Every modern business will be a data business



Are you ready?

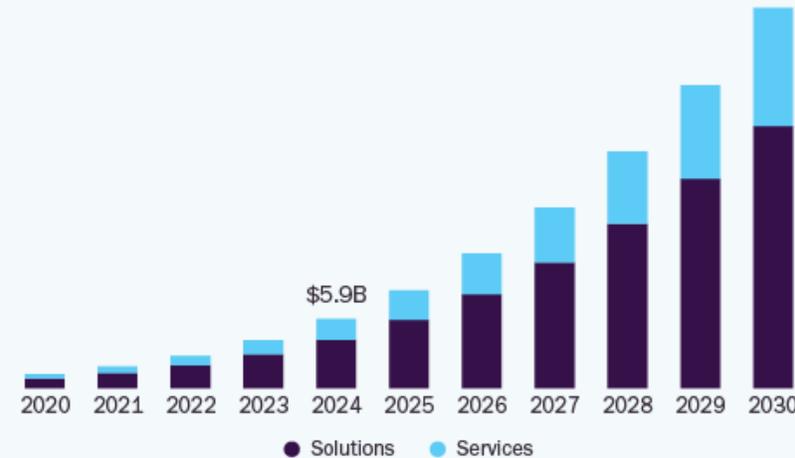
AI Penetration in Education

Applications Examples

- **Adaptive Learning**
 - Curate lesson plans based on a student's strengths, weaknesses, learning pace, and preferences
- **High-Level Tutoring**
 - Simulate one-on-one tutoring experiences, helping students understand complex concepts and practice problem-solving
- **Automated Grading and Assessment**
 - Reduces the workload for educators and provides immediate feedback to students
- **Smart Administration**
 - Automated scheduling, enrollment, and messaging

AI In Education Market

Size, by Component, 2020 - 2030 (USD Billion)



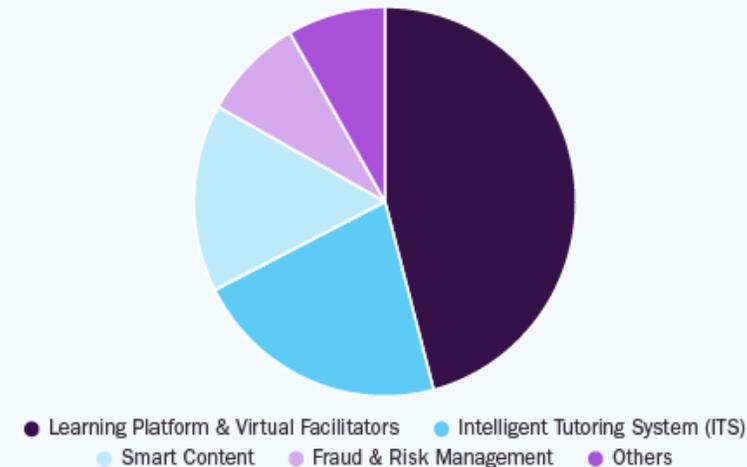
31.2%

Global Market CAGR,
2025 - 2030

Source:
www.grandviewresearch.com

AI In Education Market

Share, by Application, 2024 (%)



\$5.9B

Global Market Size,
2024

Source:
www.grandviewresearch.com

Reimagining What's Possible in Education

Innovate, Engage and Drive Outcomes



Public-Private
Collaboration



Adoption of
New Tools



Professional
Development



Building a
Sustainable
Model

Industry Relevant AI Certification

Trane is proud to be an industry sponsor of the National Coalition of Certification Centers (NC3), a nonprofit that brings industry relevant certifications to educators and their students.



www.nc3.net
<https://www.nc3.net/partner-trane/>

Digital Trane NC3 Certifications

- ✓ Generative Artificial Intelligence
- ✓ Data Analytics 1&2
- ✓ Decarbonization



HVAC Trane NC3 Certifications

- ✓ Building Automation Systems
- ✓ Residential Systems



NC3 is a network of education providers and corporations that advance the cause of C.T.E. through its certification program.

NC3 is a nonprofit that brings industry relevant certifications to educators and students

Enhance and Up-Skill The Workforce

Educational facilities offer ideal settings for interactive education and skills training

Establish



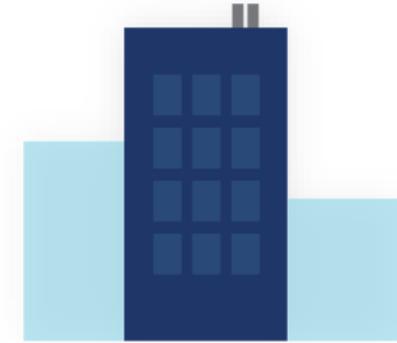
- High-performing connected building systems
 - **Demonstrate smart building operations**
- Establish **on-site learning hubs**

Facilitate



- Student engagement
 - Provide AI-driven interactive lessons and chatbots
- Use data to match students with internships, co-ops, apprenticeships, and facility tours
- **Focus on AI and automation**

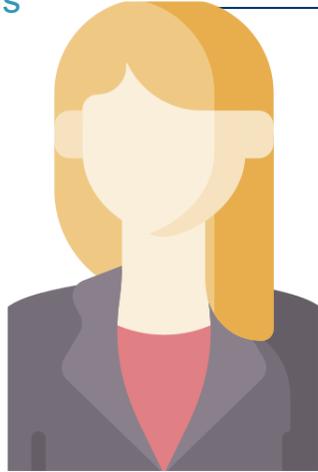
Support



- Dual enrollment pathways
- **Micro-credentialing**
- Focus on real-time skill-gap analysis and advancing technical competencies

How do students use AI?

Testimonials from Trane Interns



“As a college student with an AI certificate, I use AI for resume finetuning, to generate ideas, to sort through complex data, and as an editing tool.” ~Elissa Irwanto



“I use AI to streamline Excel tasks. It cleanly extracts and processes data from Word tables into Excel. I also explored how refrigeration works, getting step-by-step explanations and even diagrams.” ~Natalie Zamora

Internship Example at Trane Technologies

Automated Test Results - Load time: 1.297 s June 6, 2025 - June 19, 2025

| TIS Equipment Name | TIS Equipment Type | Fri | Sat | Sun | Mon | Tue | Wed | Thu | Fri | Sat | Sun | Mon | Tue | Wed |
|----------------------------------|---------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 07th Floor VAS | Variable Air System | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ |
| 08th Floor VAS | Variable Air System | ✗ | ✓ | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ | ✓ | ✗ | ✗ | ✗ |
| 09th Floor VAS | Variable Air System | ✗ | ✓ | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ | ✓ | ✗ | ✗ | ✗ |
| 10th Floor VAS | Variable Air System | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ |
| 11th Floor VAS | Variable Air System | ✗ | ✗ | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ | ✗ | ✗ | ✗ |
| Automated Tests - 11th Floor VAS | Variable Air System | ✓ | ✓ | - | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | - | ✓ | ✓ | ✓ |
| AHUVAV Floor 11 | Air Handler | ✗ | ✗ | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ | ✗ | ✗ | ✗ |
| VAV 11-01 | VAV Box | ✓ | ✓ | ✓ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| VAV 11-02 | VAV Box | ✓ | ✗ | ✓ | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ | ✓ | ✗ | ✗ |
| VAV 11-03 | VAV Box | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| VAV 11-04 | VAV Box | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ |
| VAV 11-05 | VAV Box | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ | ✗ | ✓ | ✓ |
| VAV 11-06 | VAV Box | ✓ | ✗ | ✓ | ✗ | ✗ | ✓ | ✓ | ✗ | ✗ | ✓ | ✗ | ✗ | ✗ |
| VAV 11-07 | VAV Box | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ |
| VAV 11-08 | VAV Box | ✗ | ✗ | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ | ✗ | ✗ | ✗ |
| VAV 11-09 | VAV Box | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ |
| VAV 11-10 | VAV Box | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| VAV 11-11 Suite 1103 | VAV Box | ✗ | ✗ | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ | ✗ | ✗ | ✗ |

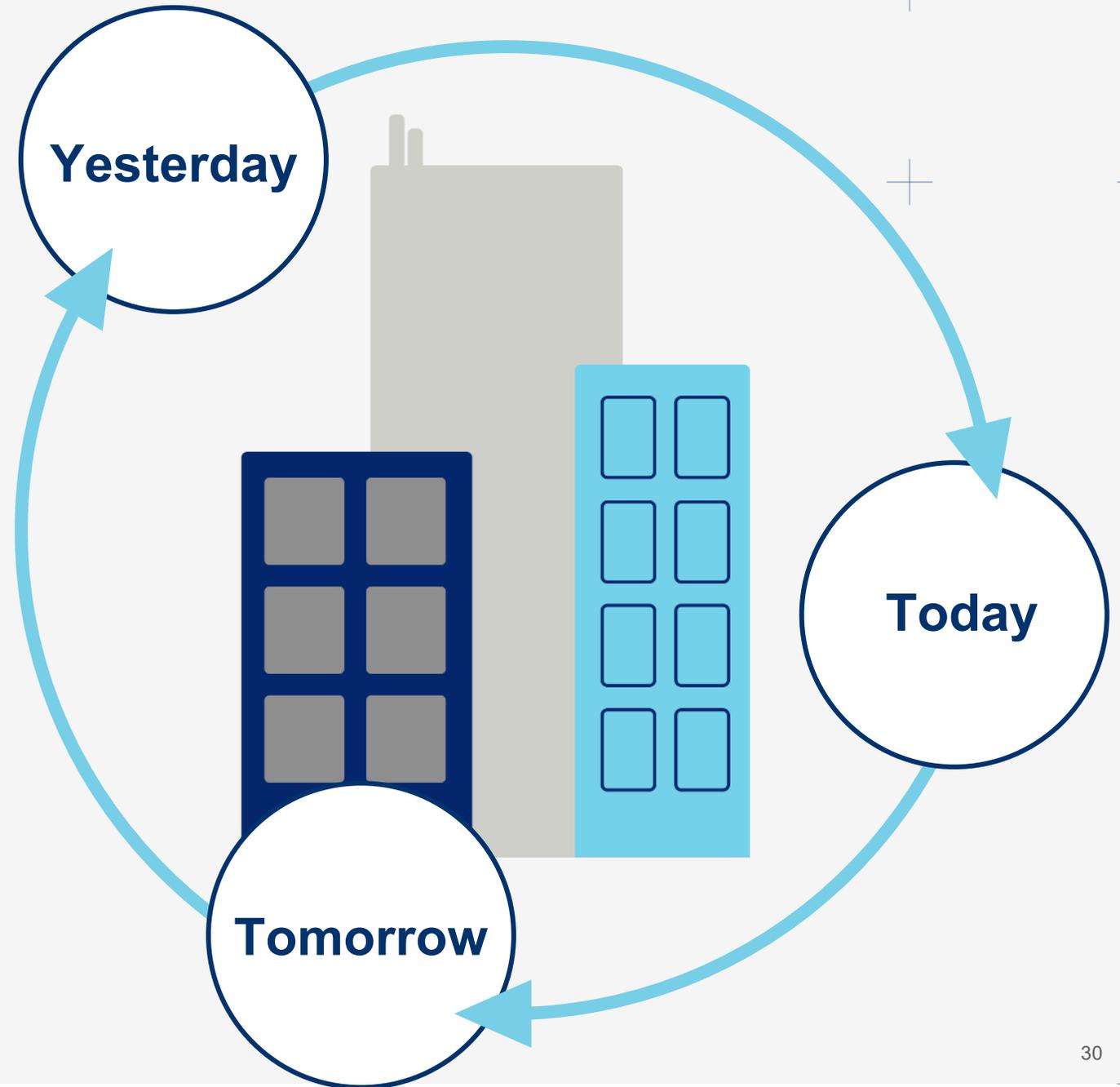
Action

Lead with modern building automation. *A modern smart building supports a diversity of systems and equipment.*

Educate yourself *on emerging technologies.*

Evaluate your building or projects *for future-readiness.*

Integrate interactive student education and skills training *around data-analytics and AI.*



What questions do you have?

