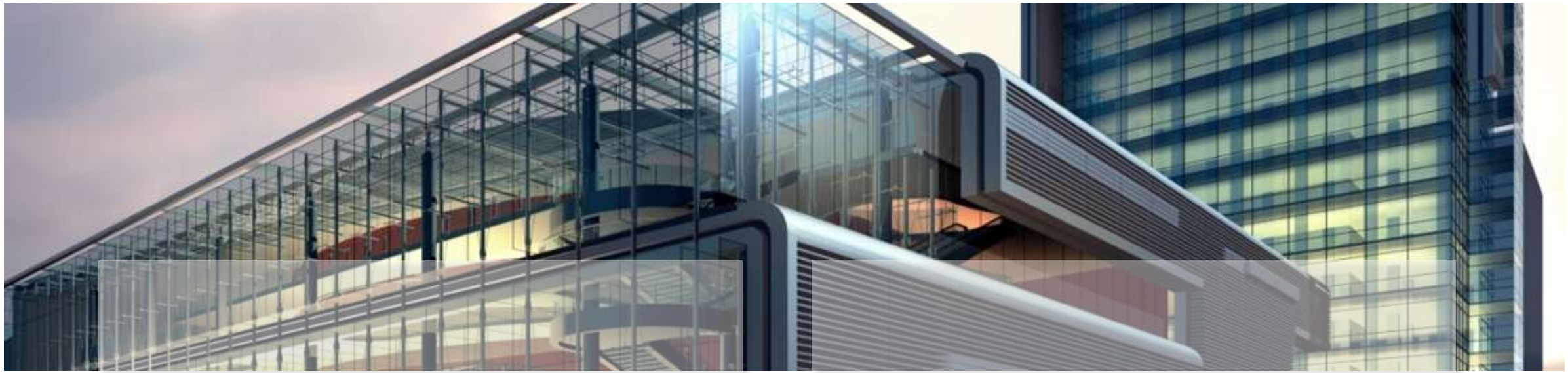
The Importance of Sustainable Energy Efficiency & Predictive Insights

Tim Ashton & Toby Warren
April 12, 2024

AGENDA



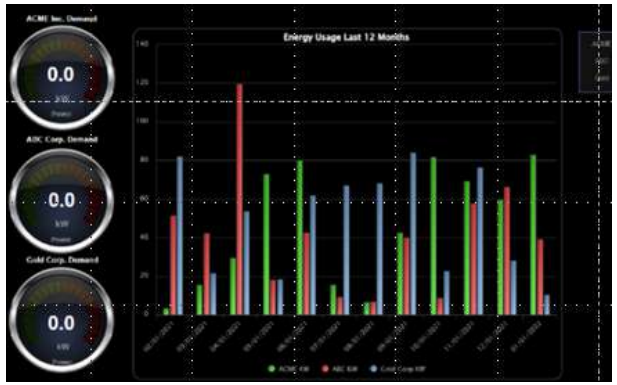
Tim Ashton

Introduction and Setting The Stage

Toby Warren

Operational Energy Efficiency

Commission adopts EU-wide scheme for rating sustainability of data centers 2024-03-15



- First phase: requires data center operators to report the key performance indicators to the European database by 15 September 2024 and ongoing reporting….and more to come…..
- Scheme targets increase transparency, promote new designs and efficiency developments in data centers that can not only reduce energy and water consumption.
- Promote the use of renewable energy, increased grid efficiency, or the reuse of waste heat in nearby facilities and heat networks.

Data centers with an installed IT power demand of at least 500 kilowatts will be required to publicly report their energy performance on an annual basis.

EU Energy Efficiency Directive (EED) data center reporting metrics are:

- Name of the data center
- Location of the data center
- Total IT space area
- Total IT power demand
- Annual incoming and outgoing data traffic
- Amount of data stored and processed within the data center
- Temperature set points
- Power usage effectiveness (PUE)
- Carbon usage effectiveness (CUE)
- Water usage (WUE)
- Renewable energy use
- Cooling effectiveness ratio
- Energy reuse factor

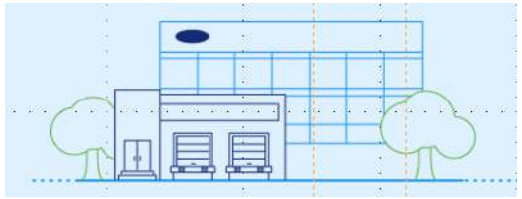
Global Leader in Intelligent Climate and Energy Solutions

A greener planet demands innovative solutions. Carrier plays a vital role in helping address climate change with digitally enabled lifecycle solutions and services that meet the needs of our customers and drive sustainability. We optimize indoor spaces for occupant health and safety while improving energy efficiency.

Carrier delivering Sustainable Solutions

Carrier is aiming to reduce our customers' carbon footprint by more than 1 gigaton by 2030 in part through a tailored approach for specifying and commissioning equipment, and providing assessment services based on each customer's sustainability, operational and budgetary goals.

- Achieve **carbon neutral** operations.
- Reduce **energy intensity** by 10% across our operations.
- Achieve **water neutrality** in our operations, prioritizing water-scarce locations.
- Deliver **zero waste** to landfill from manufacturing locations.
- Establish a **responsible supply chain program** and assess key factory suppliers against program criteria.



Enable

efficiencies through sustainable solutions

Design

lead with design and assessment expertise

Deliver

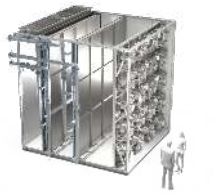
recurring value via service and reporting

REDUCE OUR CUSTOMERS' CARBON FOOTPRINT BY MORE THAN
1 GIGATON.

Supporting customers across Solutions Lifecycle

Sustainability throughout Data Center life cycle

Carrier DC HVAC Products

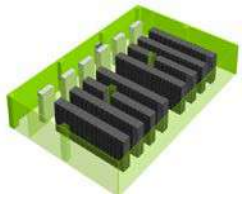


Fan Wall AHUs

High-Efficiency Chillers

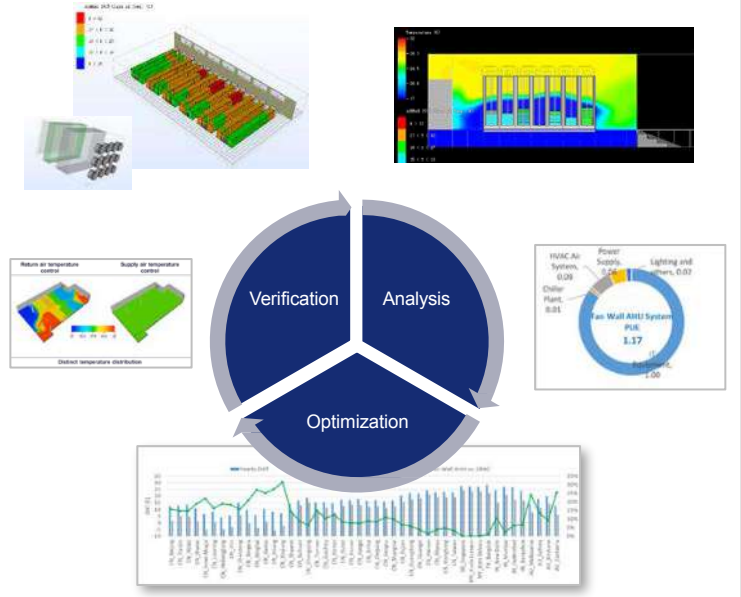
Advanced Controls

DC HVAC System Design



- High Efficiency Chiller Plant Design
- High Efficiency Chiller Plant Control
- Air System Free Cooling

Digital Solutions



- IT Rack Cooling Effectiveness Verification
- Air System Design Optimization
- PUE & WUE optimization
- Carbon Emission Reduction

Product Environmental Profile (PEP)

Ecopassport® Program type III environmental declaration according to ISO 14025 standard (electric, electronic & HVAC-R products

- **Provides**
  - Reliable information about product environmental impact through quantified and multi-criteria environmental data obtained from Life Cycle Assessment calculation.
  - PEP declaration to provide reliable data in compliance with international standards.
- **Documents give the following information:**
  - Life Cycle Assessment methodology (LCA), allowing the collection and analysis of the environmental data, based on validated scientific background
  - LCA report is the basis for the verification of the PEP and contains the hypothesis and the LCA results.

Design & Manufacturing in Europe

Nordics coverage

- **Sweden & Denmark**
  Sales & Service Support
- **Norway**
  Sales & Service Support
- **Finland & Baltics**
  Sales & Service Support

A Montluel
Commercial Chillers

B Culoz
Airside products

C Vence
Control systems & Connected services

D Montilla
Rooftop & Light commercial chillers

Nordics

3 Centers of Excellence

4 Centers of Excellence

3 Production Sites

Carrier

Carrier HVAC Solutions for Data Centers

Standard solutions

Holistic design

EQUIPMENT

- Chillers
- Air handling units
- Close control units
- Fan coil
- Heat exchangers
- Dry coolers
- Rooftops

30 XF-Z
Air-cooled variable-speed screw chiller

30RB / 30RBP
Air-to-air scroll liquid chiller

30XWV-ZE
Water cooled screw chiller

61XWH-ZE
High-temperature water sourced heat-pump

50CO/W
Close control unit

39CP
Air handling unit

39CZ
Air Handling Unit

SERVICE & RENTAL

- Connected services
- Connected technicians
- DCIM & Plant room management
- Rental

DESIGN, BUILD & CONSULTANCY

- High density cooling solutions
- All Air cooling systems
- Integration of data centers for Smart Cities
- CFD system modeling

New AquaForce® PUREtec™ 30XF-Z

Designed for the Data Center

Hydronic Free-Cooling, optional glycol free

Smart Free-Cooling™

Ultra fast-capacity recovery in less than 90 seconds

Dual Power connection 400/230V

Harmonics Electronic Filter

30XF-Z Variable-speed screw chiller with variable-speed fans

SEPR **6,10***

EER **3,80****

- Cooling capacity from **300 kW to 2000 kW****
- **Up to 30%** annual energy savings*
- Applications: **Operation -20°C up to 50°C** outdoor air temperature.
- Ultra low **GWP HFO R-1234ze** refrigerant
- High-chilled water temperature production 30°C / 20°C
- Smart Energy monitoring™ (Cooling & Power) / Power Factor 0.98

*in standard condition according to regulation (high temperature process 2016/2281)

**Data center application 30/20 external temperature 35°C

New Airside solutions for data centers

CRAC: Computer Room type Air Conditioning (DX)
CRAH: Computer Room type Air Handler (CW)

CRAC / CRAH RECIRCULATION

Fan Wall
CW: Chilled water

Consult us to review your request

150 kW

200kW

CRAH
CW: Chilled water

5 kW

100 kW

DX: Direct Expansion
CRAC - 50C5 X

5 kW

50 kW

VENTILATION

Chilled water or
Direct Expansion
39CZ

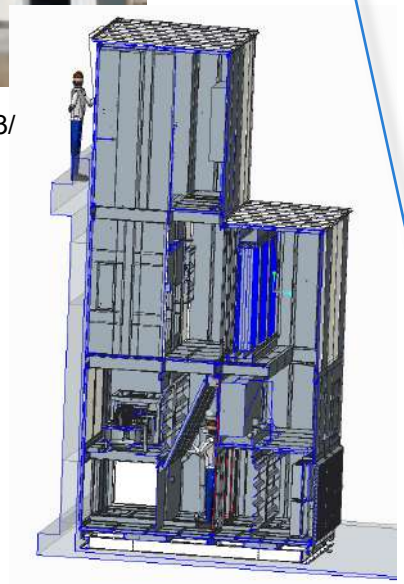
Chilled water or
Direct Expansion
39CF

0 30000 60000 90000 120000

Experience in Built to Order References

DATA CENTER PARIS

Data Center in Paris: 74 AHU – 55 000 m3/h, 250 kW



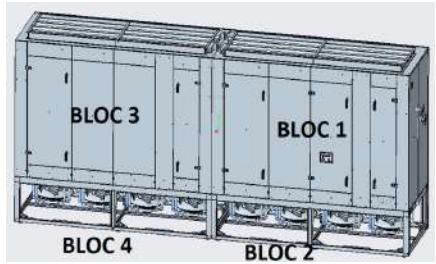
Lab test in Culoz

DATA CENTER MILAN

16 AHU - 55 000m3/h, 250kW

CUSTOMER REQUESTED DESIGN

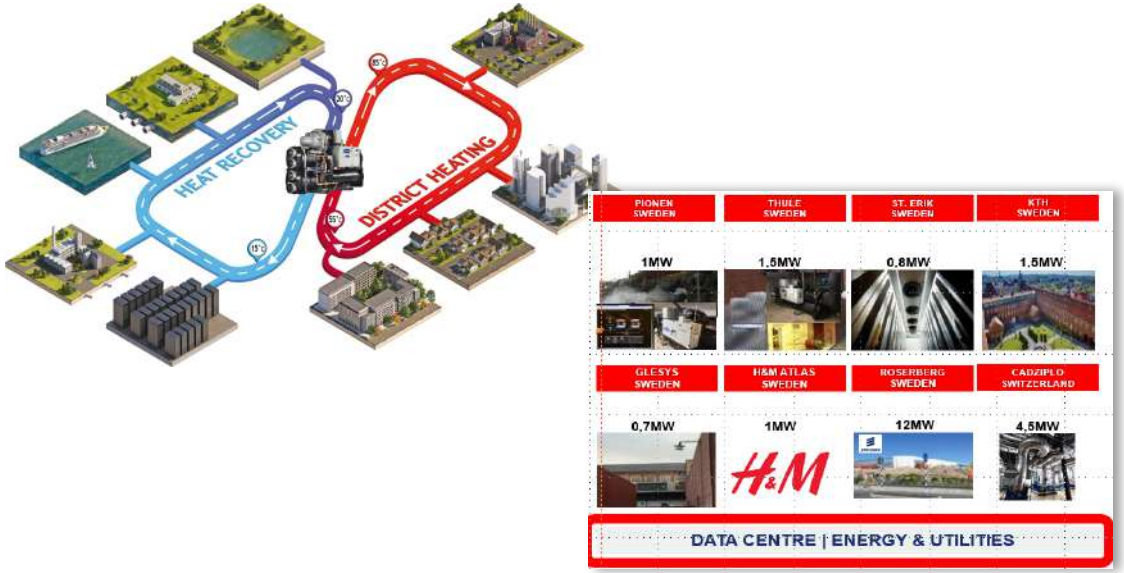
Fan Wall Solutions



Example of CRAH 400kW delivered in 4 blocs:

Data centers Support Communities

- Data centers produce **heat t**hat can be **Recovered, Recycled & Repurposed**.
- Smart Urbanisation enables Communities & Neighborhoods **benefit from data centers.**
- Our **heat-pump solutions recover h**eat rejected by data centers delivering **<85-120°C** to local / district heating grid.



AQUAFORCE 61XWHZE

High temperature water source heat pumps for district heating
300 to 1570 kW
Hot water up to 85°C

AQUAFORCE 61CW-Z

High temperature water source heat pumps
410 kW to 735 kW
Hot water up to 92°C

AQUAFORCE 61CWD

Ultra-high temperature water source heat pumps
110 kW to 540 kW
Hot water up to 120°C

District Heating Networks — Repurpose / Recover — **AquaForce® Screw Heat pumps**

Sustainability & Reporting

Why is Digital & Controls so important?

Building Management Systems for Datacenters

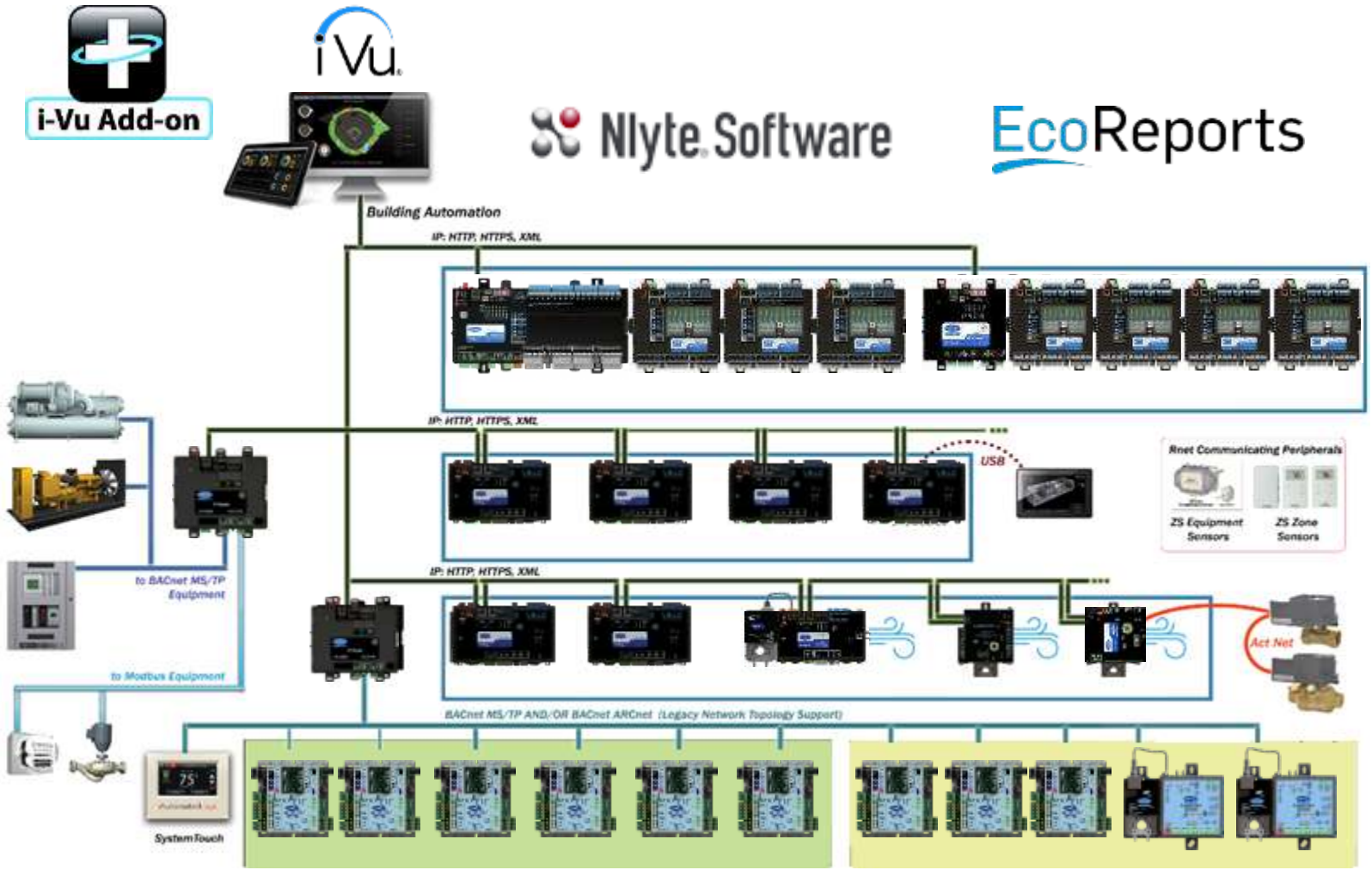
Operational/Energy Efficiency has 5 key priorities for Data Centers:

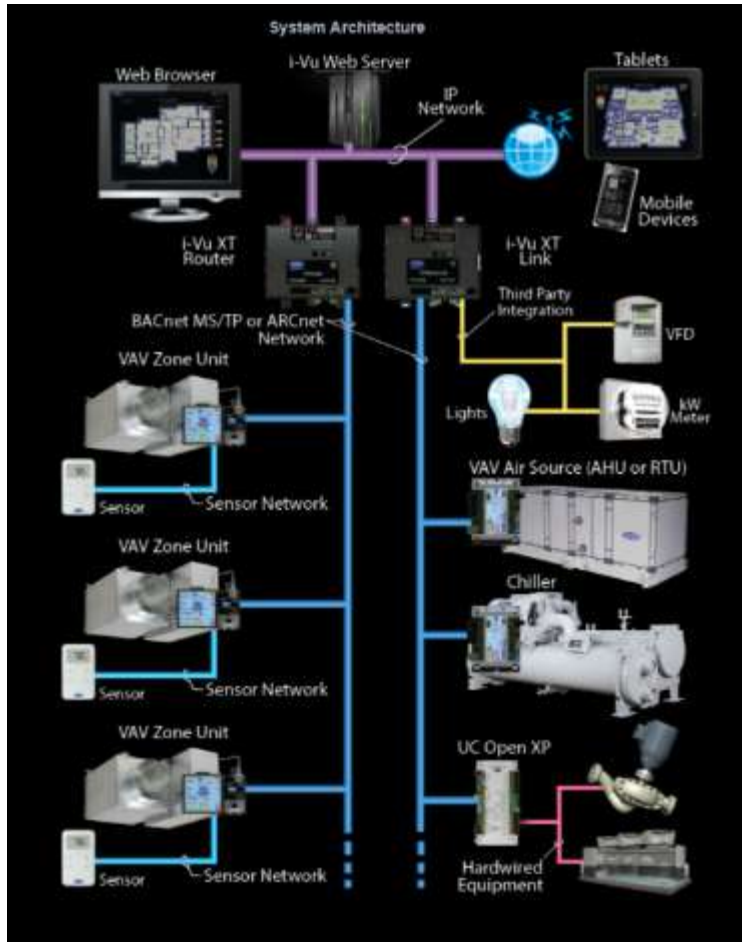
1. Manage the building assets to **maximizes uptime**
2. Facilitate the delivery of PUE meeting set environmental conditions
3. Advise on early fault detection and diagnostics to maximize uptime
4. Increase Lifecycle to its maximum length by optimizing the operation of the assets with full security.
5. Report the energy use and operational building data .

Carrier i-Vu for Datacenters

- The iVu® System for mission critical facilities maximizes uptime
- iVu Predicts chiller load with advanced machine learning controls
- Powerful Graphics and Dashboards
- Optimizes the asset performance based on building operation requirements
  - Leading to increased uptime and longer lifecycle
- Products and services that are "Secure by Design"

Carrier i-Vu – Manages an entire building





Facilitating PUE and Increasing Efficiency

Increase energy efficiency while delivering precise cooling capacity management
The Carrier chiller plant control system is a sophisticated, scalable, native BACnet control solution. It supports network integration using Carrier CCN, Modbus® and open protocols for precise equipment operation and global data sharing.

Plant Scheduling

- Reduces unnecessary run time and operating costs

Chiller Staging

- **Optimized Chiller Staging:** Minimum number of chillers operate at maximum efficiency to reduce energy consumption, short cycling and equipment wear and tear

Demand Limiting

- **Demand Limiting:** Avoids excess electrical demand charges

Setpoint

- **Chilled Water Setpoint Reset**: Reduces energy consumption; allows plant to operate at higher chilled water setpoint in lighter load conditions

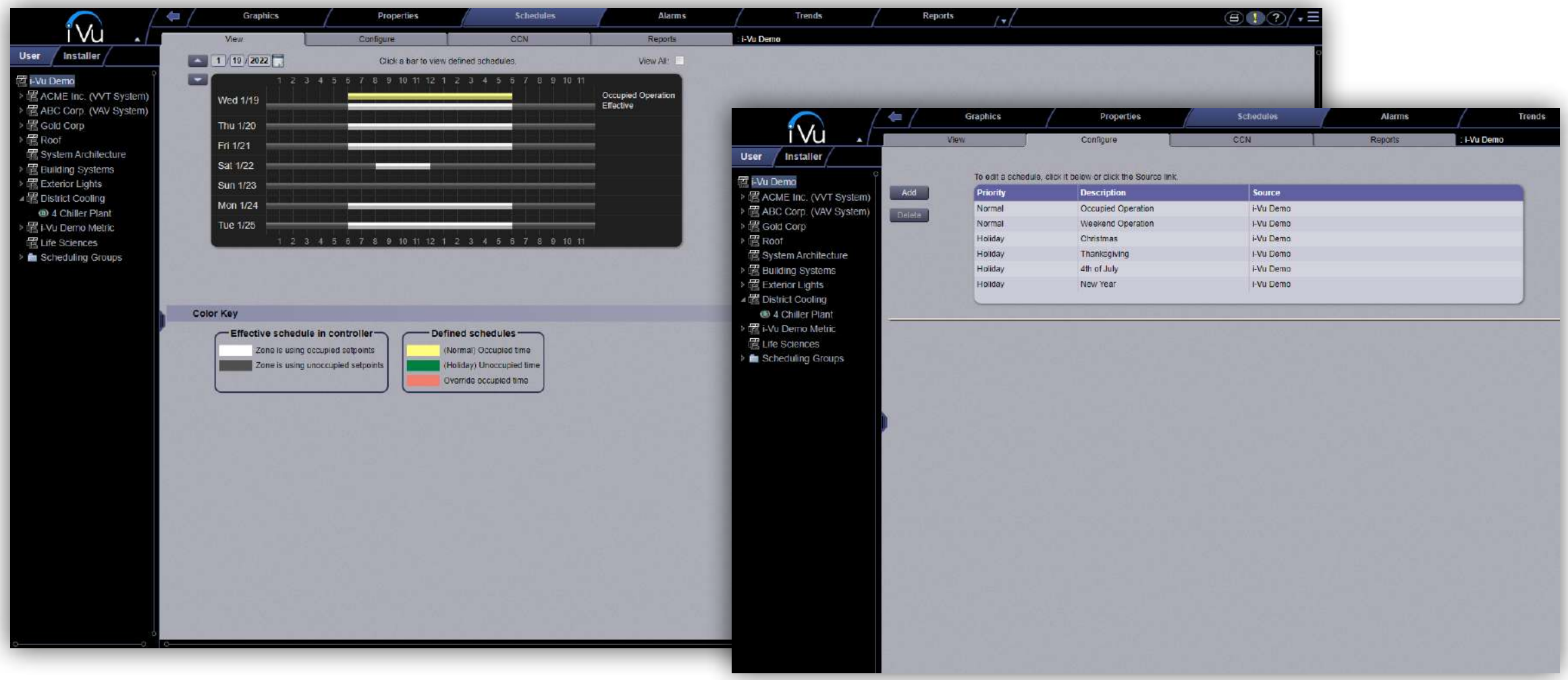
Water Pump

- **Primary/ Secondary Water Pump Staging and Speed Control:** Reduces energy consumption while preventing insufficient chilled water flow and subsequent chiller short cycling

Cooling Tower

- **Cooling Tower Staging and Speed Control:** Minimizes fan run time/number of running towers, reducing energy consumption

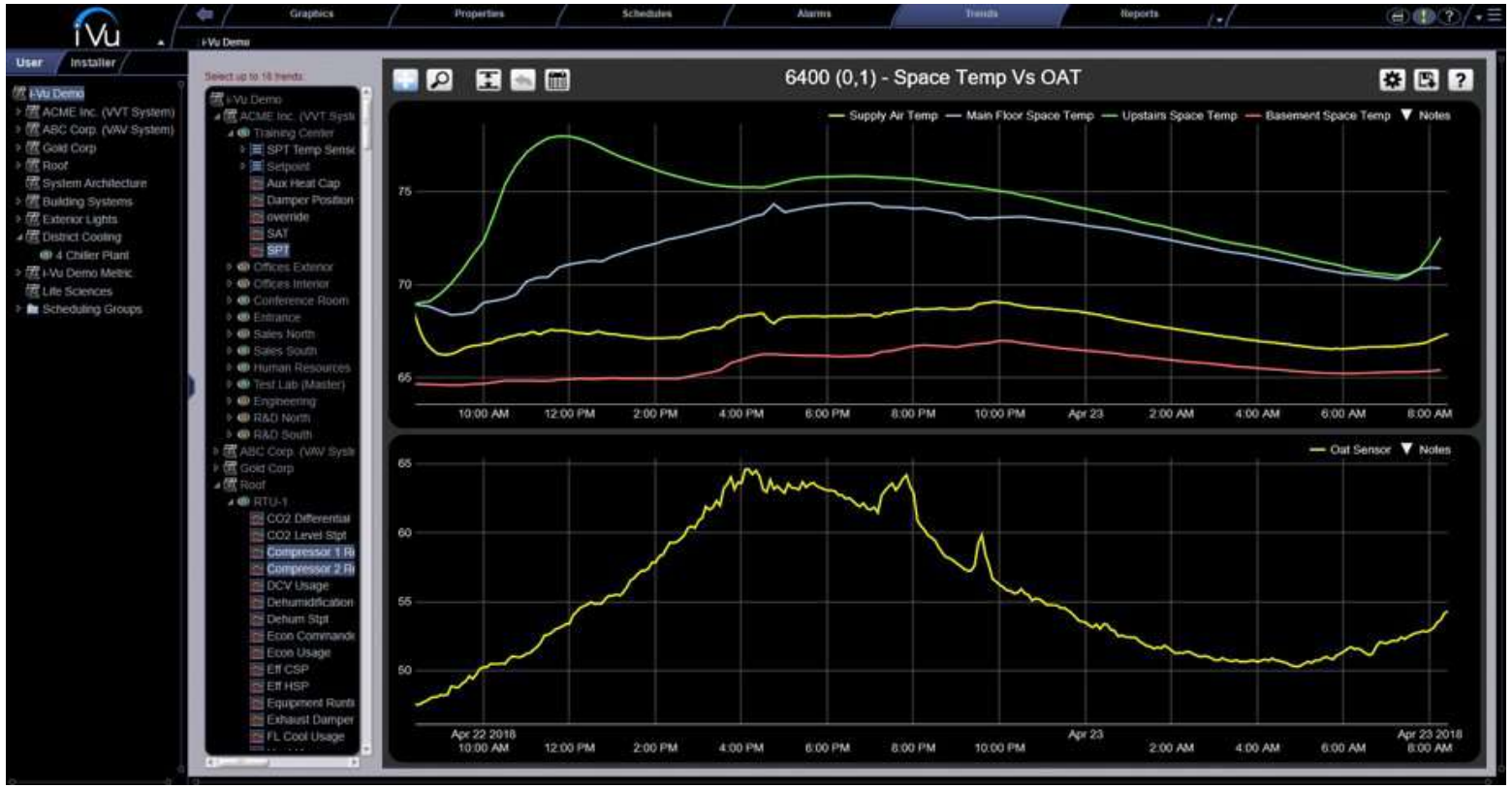
Save Energy when rooms are not in use



Early Fault Detection with Proactive Alarming

1. Alarms on potential faults provide early warnings of equipment failing
2. Tailored Alarm System to set priorities

Analytics with Pinpoint Anomolies & Built-in Trends



- Trend analysis allows pinpointing of any anomalies

Dashboarding

- Dashboarding tailored to reporting requirements

Meeting EU Energy Reporting directives

- Energy reporting dashboard tailored to that required by EU regulations

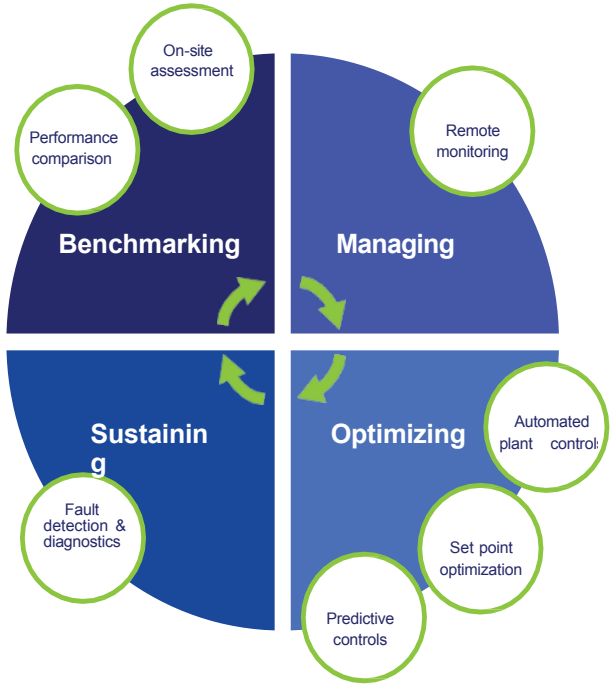
Carrier's Data Center Automation Projects

✓ More than 20 data center projects delivered in the Nordics

Your Service Partner to improve efficiency

Solutions that empower your team to visualise, advise, and optimise the lifecycle and outcomes of your HVAC system.

- 24/7 remote monitoring
- Proactivity to anticipate breakdowns
- Precision monitoring
- Demonstrated maintenance impact
- Easy and secured access



- ✓ Use of AI to intelligently adjust set points in chilled water systems resulting in 3% to 15% energy savings
- ✓ Advanced fault detection and diagnostics that helps prioritize where to focus first by estimating the cost of energy waste per fault
- ✓ Energy Reporting- Reports energy usage in line with EU regulations

* **BLUEDGE DIGITAL** is the new name for Connected Service – Technology remains the same

THANK YOU