Better by design™

WHITE PAPER

DATA STRATEGY

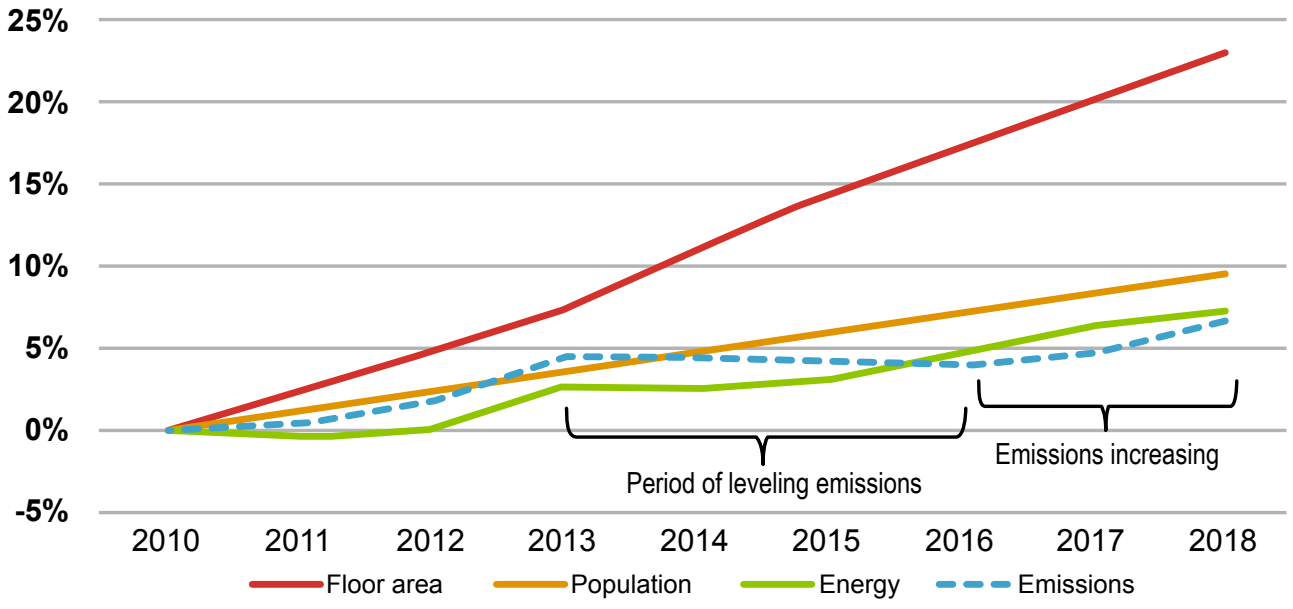
Reliable® controls

The answers are in the data:

The impact of data analytics on energy efficiency and building performance

We exist in an era where data is always being generated and always available. As the volume of data in the world has grown over the past few decades, terabytes (10^{12}) of data were superseded by petabytes (approximately 1,000 terabytes). Petabytes were then superseded by exabytes (approximately 1,000 petabytes), and exabytes have now been superseded by zettabytes (approximately 1,000 exabytes).[1]

Buildings are a source of data generation that will continue to increase: "Over the next 40 years, the world is expected to build 230 billion square meters in new construction," according to the Global Alliance for Building and Construction.[2] A large proportion of new construction, along with the existing stock, consumes 36 percent of the final global energy used, generating 9.7 gigatons of carbon dioxide. These alarming figures are on trend to increase (Figure 1); the worldwide demand for space cooling in built environments rose more than 33 percent from 2010 to 2018, with 5 percent of that growth in the last year. The energy demand for appliances increased 18 percent during the same 8-year period, and the amount of energy used to heat water increased by 11 percent in that time.[3]



Source: Derived from IEA (2019a), *World Energy Statistics and Balances 2019*, **www.iea.org/statistics** and IEA (2019b) *Energy Technology Perspectives,* building model, **www.iea.org/buildings.**

Figure 1: Changes in floor area, population, building sector energy use, and energy-related emissions globally, 2010–2018.

Energy efficiency

The need for more commercial building space and the energy required to create healthy and productive built environments demands that building sector professionals be proactive and responsible stewards of the earth and its limited resources. This sector needs to be more accountable. As building professionals, we have a significant obligation to improve operational efficiency while reducing emissions and waste.

The 1992 Earth Summit initially brought countries together under the United Nations Framework Convention on Climate Change, with the aim of reducing emissions under the Kyoto Protocol. The Kyoto Protocol was in place until the Sustainable Innovation Forum in 2015, when 197 countries signed the Paris Climate Agreement, or COP21.[4] This international treaty aimed to reduce the emission of gases that contribute to global warming and replaced the Kyoto Protocol.

A subsequent World Green Building Council report in 2019 called for accelerated energy efficiency uptake in buildings, increased indoor air quality through additional sensors, renovation of existing building stock toward energy efficiencies, and coordinated action to stop global warming.[5]

To be empowered to meet these objectives, building professionals require tools that ensure data ownership, data integrity, and unfettered data access. Building automation systems are ideally positioned to provide the required smart interface for this availability and connection.

Building automation systems are currently capturing and archiving building data faster, more efficiently, and on a larger scale than ever before. The availability of archived data is no longer an issue for building operators and managers. An issue we do face, however, is identifying and transposing correct, high-value data into meaningful information in the right form, for the right people, at the right time.

Analyzing live data allows you to identify in real time where your mechanical equipment is not performing optimally. This provides you with the opportunity to respond to issues immediately and address the causes of waste in a timely manner, potentially before occupants are impacted.

IFDD FlexTiles

Live data analysis is now available to building professionals using Integrated Fault Detection and Diagnostics (IFDD) FlexTiles™ from Reliable Controls. IFDD FlexTiles embed the fault detection intelligence engineered by the National Institute of Standards and Technology's (NIST) AHU Performance Assessment Rules,[6] VAV Box Performance Assessment Control Charts,[7] and economizer rules[8] directly into the Reliable Controls field controller where data is collected (Figure 2). In addition to compliance with the NIST rules, IFDD FlexTiles offer building professionals the option to generate their own rules, for their own data, generated by their own systems and customed to their individual needs.

Figure 2: NIST AHU Performance Assessment Rules incorporated into Reliable Controls IFDD FlexTiles.

Equipment that is not in an alarm state is not necessarily equipment performing efficiently. Poorly performing equipment increases emissions, increases energy inefficiency, increases operating costs, and reduces equipment life cycles. IFDD FlexTiles are designed to analyze live data and immediately detect suboptimal performance, then provide step-by-step tasks to help you diagnose the cause of any issue and empower technical staff to take corrective action.

Integrated Fault Detection and Diagnostics

Benefits:

1. Real-time fault detection
2. Incorporation of industry rules
3. Actionable diagnostic tasks
4. Archived responses
5. Reduced emissions
6. Reduced operating costs
7. Longer equipment life
8. Customizable rules and tasks

Figure 3: IFDD FlexTile intuitive actionable diagnostics.

The color of IFDD FlexTiles indicates the performance of the equipment being monitored (Figure 2 & 3):

- Green IFDD FlexTiles indicate that equipment is performing as expected.
- Red IFDD FlexTiles indicate equipment is operating outside the expected performance rules and therefore inefficiently. Clicking a red IFDD FlexTile displays in red the broken rules associated with equipment performance. Clicking a broken rule displays the diagnostic tasks that empower operational staff to step through specific remedies. Completing these diagnostic tasks will likely uncover the cause of the issue and return the equipment to expected performance. Once all the rules are in a normal state, the IFDD FlexTile turns green.
- An amber IFDD FlexTile indicates corrective work has commenced on the broken rules but not yet completed.
- A yellow IFDD FlexTile indicates a rule was broken, but the condition that broke the rule corrected itself. Clicking a yellow IFDD FlexTile displays the rule that changed state and allows you to review the trend logs of the rules within the IFDD FlexTile to further diagnose the problem.
- You can log the states of all the rules within IFDD FlexTiles to create a historical review and record of corrective actions.

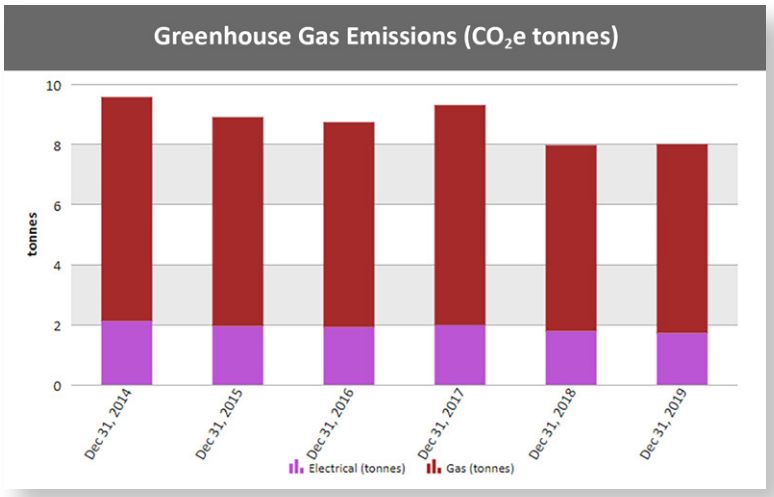
IFDD FlexTiles provide real-time fault detection and immediate tasks to help you diagnose the cause of faults in monitored equipment. IFDD FlexTiles save you energy and time normally spent on identifying suboptimal performance and equipment failure while reducing building waste and emissions.

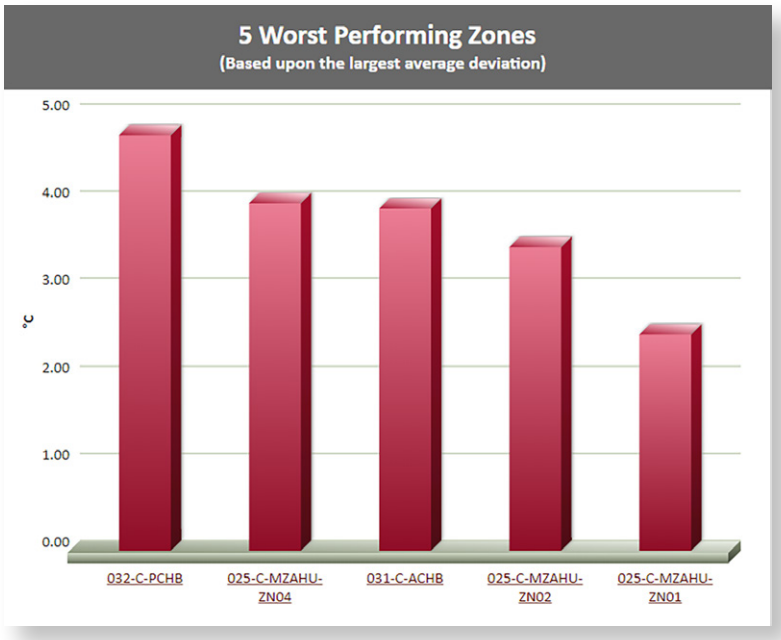
Reliable Controls augments the live fault detection and diagnostics capabilities of FlexTiles with analytics on archived data via RC-Reporter®, transposing collected building data into insightful information. The volume of data archived by building automation systems is not an issue; the challenge is in identifying data of high value and presenting it in the right form, for the right people, at the right time. RC-Reporter is engineered to help you recognize high-value data, transpose it into understandable information, and use it to make intelligent decisions.

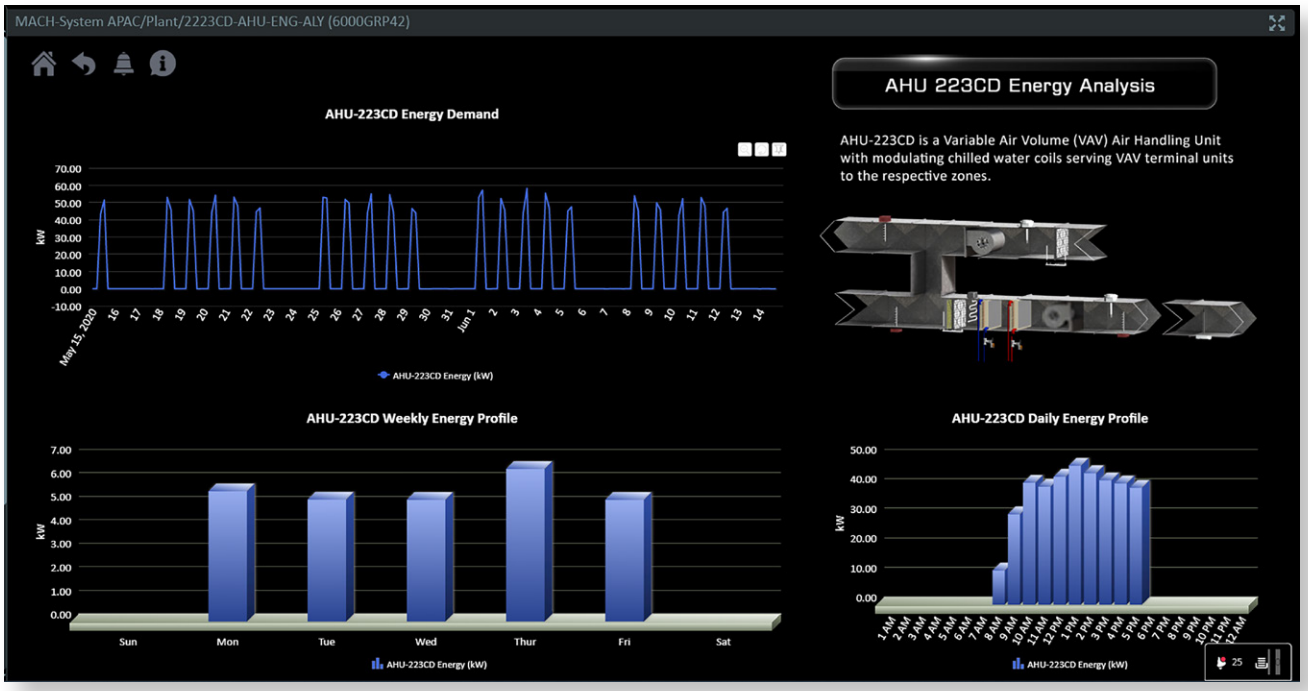
RC-Reporter

Benefits:

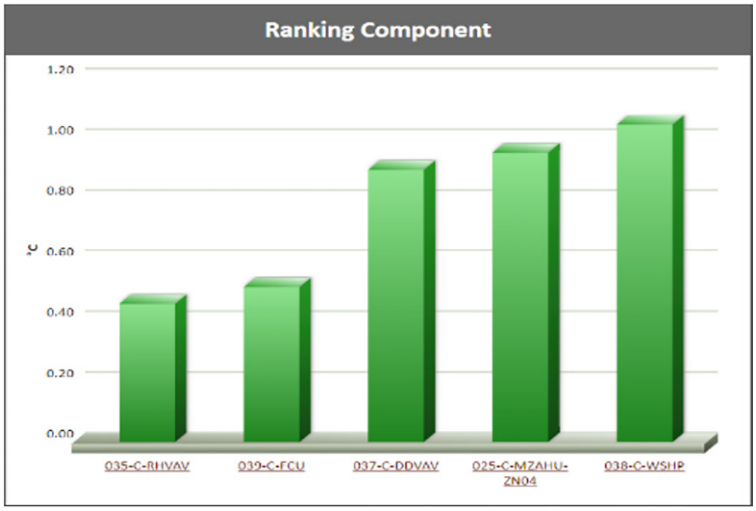
1. Analyze data over time
2. Analyze data sums and totals
3. Analyze how data correlates against other data
4. Analyze data profiles over time
5. Rank sets of data
6. Transpose data
7. Schedule emailed reports
8. Customize reports
9. Retain ownership of your data
10. Maintain data security
11. Maintain data integrity

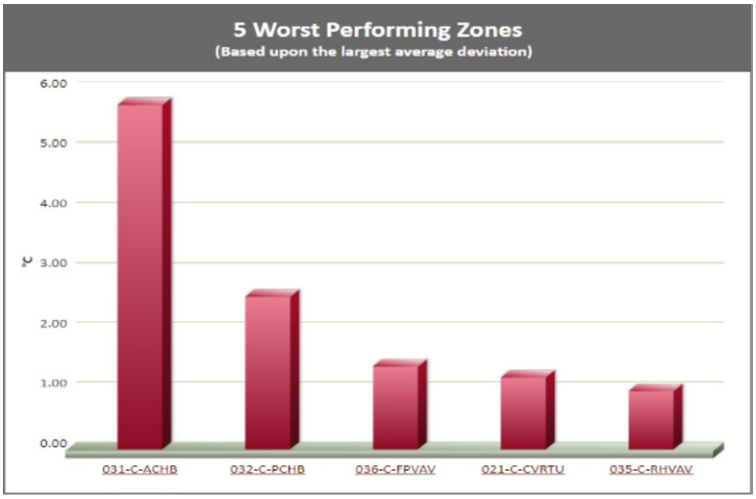






Archived data holds valuable insights about how buildings and systems use energy, how systems operate, and how they perform over time. Energy use, operation, and performance data is easiest for our brains to process if the information is presented visually in the currency of the appropriate audience. Energy managers need information in an energy-performance currency. Business owners need information in a cost currency. Maintenance staff need information in a currency that identifies the poorest performing equipment and directs them to what needs their immediate attention. Presenting information in a meaningful way enables each stakeholder to work toward reducing emissions, reducing operational costs, increasing efficiencies, increasing the life cycle of equipment, and ultimately reducing greenhouse gas emissions and global warming.

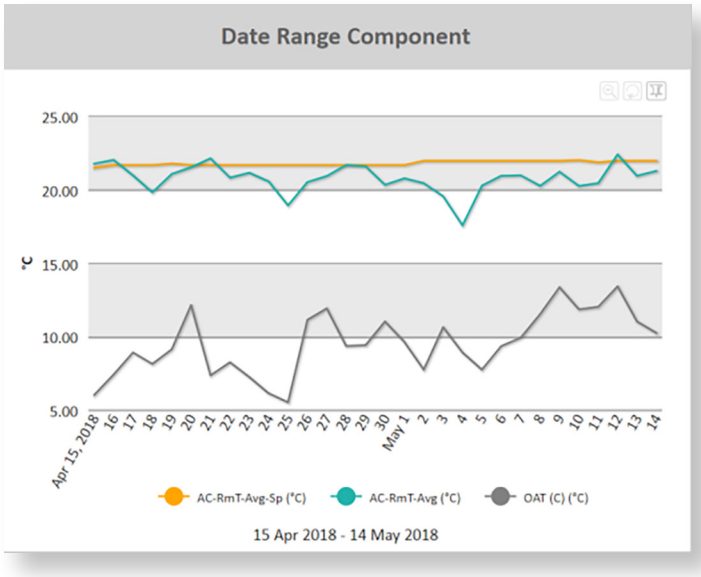


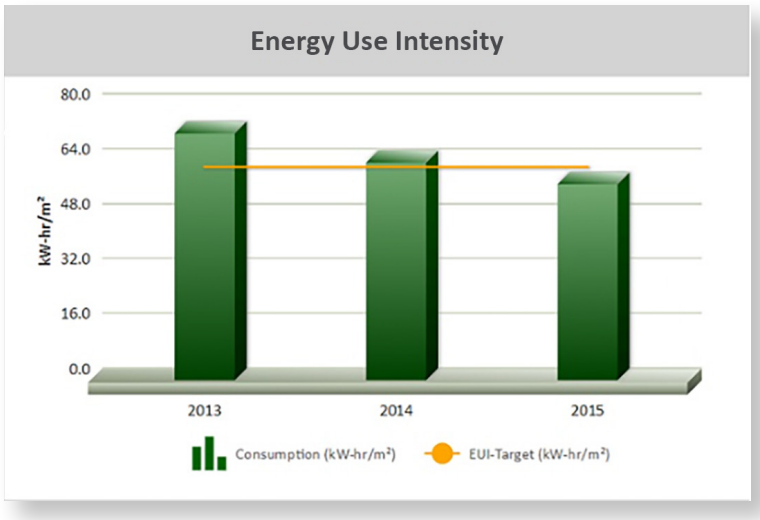


RC-Reporter provides tools that filter valuable information and present it in formats appropriate to different stakeholders in a building or across a portfolio of buildings.

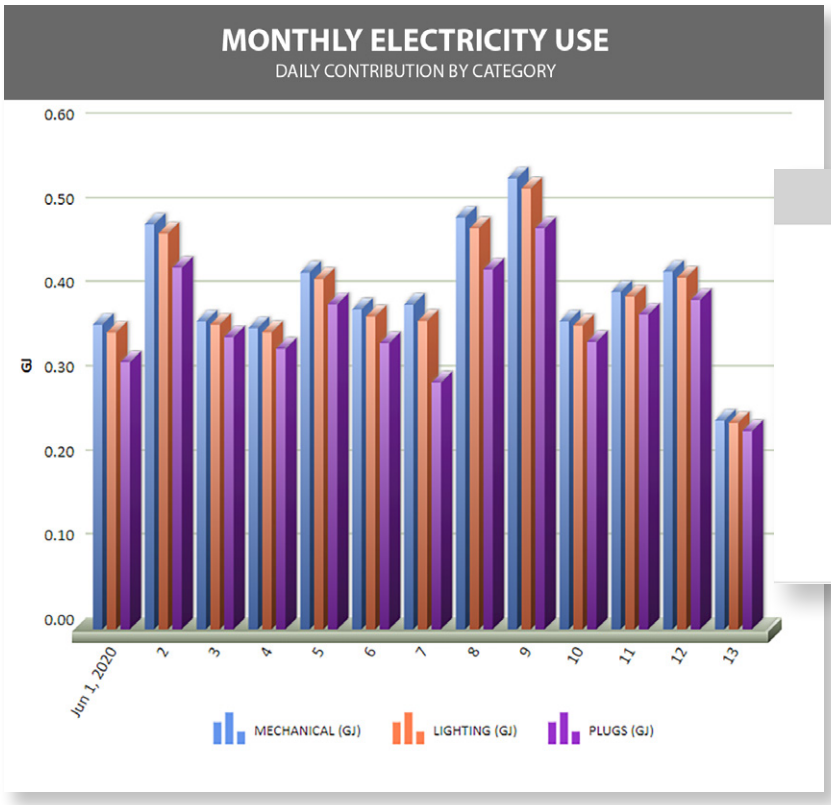
The Ranking component queries data sets for groups of equipment and presents information that helps you identify the worst or best performing systems.

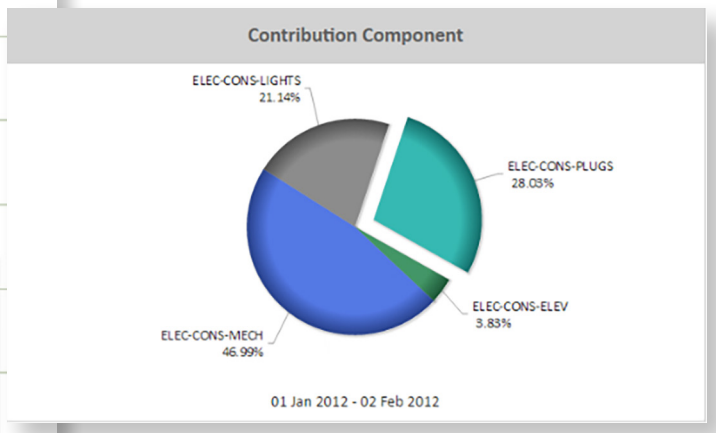
The Date Range component queries data over specified dates and presents information from a single piece of data or multiple data series in a line chart, bar chart, or table.



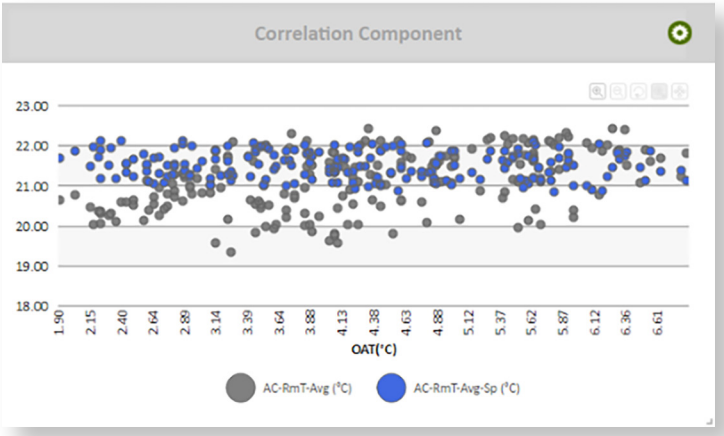


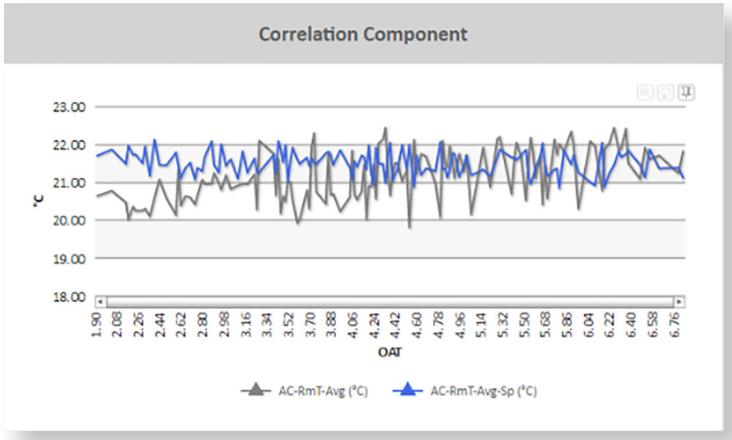
The Contribution component queries multiple pieces of data or multiple monitored systems and presents information as a portion of the whole.



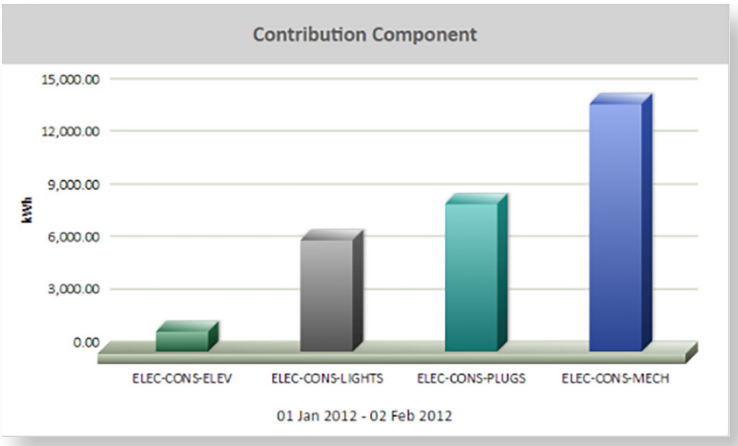


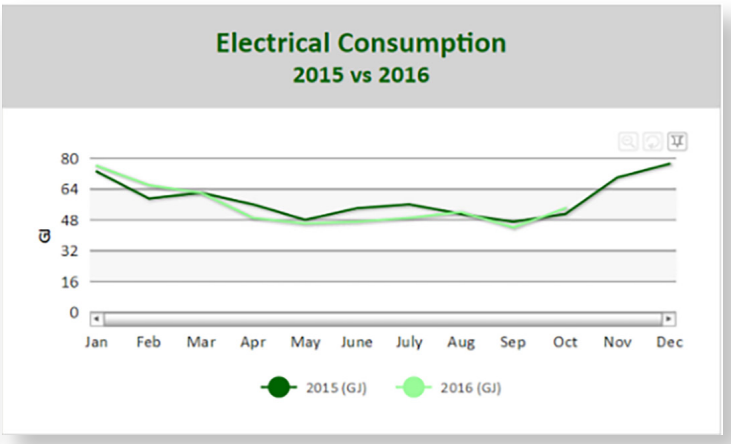
The Correlation component queries one piece of data against how it affects other data and presents information in scatter or line charts.





The Profile and Periodic components query data and present information for a defined day, month, or year. They also allow comparison of information from different time periods.





Combine components in RC-Reporter to craft effective reports with images and text that provide context, understanding, and insights suitable to each audience, empowering your stakeholders to make informed decisions.

In keeping with the hallmarks of simple, flexible, and sustainable, Reliable Controls provides building owners and operators with the ability to generate their own queries and reports according to their unique needs while ensuring sensitive data and information remain in their domain. It is the fundamental right of any building owner to maintain ownership, integrity, and security over their building data and analytics.

Empowering informed decisions

IFDD FlexTiles and RC-Reporter bring context to the vast data available to building professionals. Context leads to valuable insights and allows building managers to maintain efficient operations, make educated decisions, and find opportunities for improvement. This in turn provides improved occupant safety, comfort, and productivity; improved operational efficiency and equipment life cycles; reduced waste and emissions; reduced operating costs; and ultimately reduced greenhouse gas emissions.

It is imperative that modern built environment professionals identify high-value data and use it to make a long-term, positive impact. Reliable Controls has solutions to help you make a difference and stand at the helm of building sustainability now and in the future.

THE USE OF IFDD FLEXTILES AND RC-REPORTER LEADS TO IMPROVED OCCUPANT SAFETY, COMFORT, AND PRODUCTIVITY; IMPROVED OPERATIONAL EFFICIENCY AND EQUIPMENT LIFE CYCLES; REDUCED WASTE AND EMISSIONS; REDUCED OPERATING COSTS; AND ULTIMATELY REDUCED GREENHOUSE GAS EMISSIONS.

1 https://www.bernardmarr.com/

2 Global Alliance for Building and Construction Report 2017

3 Global Alliance for Building and Construction Report 2011

4 https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

5 World Green Building Council Annual Report 2018/19

6 https://www.nist.gov/publications/programmers-guide-air-handling-unit-performance-assessment-rule-dll

7 https://www.nist.gov/publications/application-control-charts-detecting-faults-variable-air-volume-boxes-1

8 ASHRAE: CH-99-05-2

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