Resolute Helps PNC Arena Reduce Energy Consumption and Costs While Improving Fan Comfort

Lacking the visibility, real-time data and analytics needed to optimize facility performance and reduce costs, PNC Arena turned to Resolute Building Intelligence.

Located in Raleigh, NC, PNC Arena is a state-of-the-art sports and entertainment venue that annually welcomes over 1.5 million guests and plays host to more than 150 events, including major concert tours and family shows. The 770,000-square-foot, 18,680-seat facility is also home to the NHL’s Carolina Hurricanes and NC State University men’s basketball team.

Committed to Energy Efficiency

Prior to partnering with Resolute, PNC Arena had already reduced annual energy costs by 30%, primarily through lighting upgrades and some operational and capital initiatives. Eager to build on this initial success, Arena executives wanted to drive even greater energy efficiencies across their facility. Not only were they an enthusiastic partner in the National Hockey League’s Green Initiative, which is dedicated to improving sustainability across the League, but Arena executives were convinced that the implementation of a comprehensive energy management program could help eliminate wasteful energy consumption and costs, improve ice conditions and fan comfort, and significantly reduce the Arena's environmental impact. It was a win all the way around.

“What Resolute has done for us is to provide us with the data and the tools to find additional scales of efficiency in our existing systems.”

DENNIS MOORE, CFO, PNC ARENA

INDUSTRY
Stadiums & Arenas

CHALLENGE
Lacked the visibility, real-time data and analytics needed to drive strategies for optimizing Arena performance and reducing costs

SOLUTION
Implemented Resolute’s cloud-based software to collect and analyze Arena performance data in real-time and use this data to develop and implement strategies to improve Arena operations, including the reduction of energy consumption and costs

RESULTS
- $230,000 in annual utility savings to date with target of $400,000+ annually
- 7% reduction in electrical consumption
- 11% reduction in natural gas consumption
- 15% reduction in domestic water consumption
- Improved fan comfort by increasing bowl temperature
- Maintained ice temperature at NHL recommended temperature

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The Challenge and the Solution

The challenge was that Arena executives had no real way to achieve these goals as they lacked the performance visibility, real-time data, and analytics needed to develop strategies for achieving their Arena optimization and energy objectives. In the end, they decided they needed a partner that could provide the visibility and data critical to getting the job done. That’s when they turned to Resolute Building Intelligence and our cloud-based building energy management solution.

Getting Started

Energy optimization starts and ends with data. In PNC Arena’s case, it was clear they needed more and better data as well as analytics-driven strategies to achieve greater levels of energy efficiency. PNC Arena had taken a responsible, proactive approach to improving energy efficiency, including lighting upgrades and the automation of key processes such as equipment scheduling and others. But once this effort was complete, the question then became: now what? How do we optimize energy performance across the multiple systems of the arena? How do we tune and sustain that optimization from one year to the next and so on? How do we truly become an energy-efficient facility? This is the exact situation PNC Arena was facing. After receiving a multi-million dollar proposal from a major equipment manufacturer to try and drive energy efficiency through a massive equipment upgrade, PNC Arena decided to explore Resolute’s software-based, data-driven approach at a fraction of the cost with a much faster payback period and demonstrable ROI.

At that, a partnership was born, and the team got to work right away. After installing a few new meters and sensors, Resolute integrated all meters and sensors, as well as more than 1,500 BAS points, into the software and began pulling data. PNC Arena was now able to gain real-time insights into how to optimize building and ice plant operations.
KPIs and Data Collection

The team established upfront a set of Key Performance Indicators to track and measure the important aspects of Arena operations, such as ice temperature, bowl temperature, electrical consumption (kwh), peak demand (kW) and several others. The Resolute software collects and tracks this data across an entire season, monthly, weekly and even at the game-day level. Resolute's ability to track Arena performance data for individual games is, well, game-changing, providing a level of monitoring unmatched in the industry. Not only can Resolute compare game-day metrics to one another to identify trends and anomalies, this granular data can also be used to accurately determine the KPIs that drive Arena energy usage night-in and night-out. This allows the team to make changes and implement strategies that will have the most immediate and meaningful impact on performance.

Graph 1

Compares game-day electrical consumption versus attendance. This regression analysis reveals that, based on the current operation of the Arena’s HVAC systems, attendance is not the driving factor behind electrical consumption during hockey games.

\[ y = -0.1992x + 53095 \quad R^2 = 0.00563 \]

Graph 2

Compares the same game-day electrical consumption, but this time it’s plotted against outside air enthalpy. This regression analysis indicates that OA enthalpy is the true driving factor for hockey game electrical consumption.

\[ y = 1059.6x + 27627 \quad R^2 = 0.8347 \]
Data Analytics

Resolute also programmed more than 30 active analytics into the software to monitor critical Arena HVAC and meter operations. These analytics continuously monitor system and equipment performance, capturing when equipment, sensors and meters are not operating properly and immediately alerting the Arena team of any issues. Because of the flexibility of our solution, custom analytics can be created at any time, allowing us to seamlessly tailor the output of the software to match evolving Arena requirements for alerts and reporting.

Custom Insights

To provide focused, real-time visibility into critical KPIs of greatest interest to the PNC Arena team such as ice conditions and bowl temperature, Resolute then developed a Custom Insights page that can be accessed to immediately understand the status of key business-impacting performance metrics.

Resolute's software tracks 30+ custom analytics, enabling the PNC Arena team to proactively monitor equipment operation and react instantly when there is an issue anywhere in the Arena.

The Custom Insights page enables the PNC Arena team to quickly view key conditions critical to game-day Arena operation such as system brine and ice surface temperatures, inside and outside air temperatures and comfort chiller operating status.
Data-driven Strategies

Once the data had been collected, analyzed, and compared, Resolute and the Arena team developed and implemented a set of initial strategies to improve energy efficiency and facility operations and used the Resolute software to track the impact of these changes in real-time.

Chilled Water Supply Temperature Set-Point Reset
Data analysis found that chiller staging was operating in a predominately “manual” mode. This manual operation lead to excessive chilled water flow rates and low delta T syndrome. Resolute revised the chilled water plant sequences to prohibit or permit chiller staging based on the chilled water supply temperature compared to the chilled water supply temperature high-limit set-point as well as the amount of time left in the event.

Bowl Temperature Set-Point Optimization
Using the Resolute software, we were able to help the Arena team improve their dynamic bowl temperature set-point adjustments for different event types. As data is tracked in real-time, we were able to track critical KPIs and their responses to different bowl temperature set-points. This allowed the Arena team to program set-points that were energy efficient and aligned with acceptable standards while also improving fan comfort.

Economizer Operation Monitoring
Resolute worked with the Arena facilities team to develop analytics that monitor and trend the economizer operation of the Arena’s AHUs in real-time. The analytics were developed based on event type, allowing the Arena team to ensure economizer operations are properly optimized for outside air conditions as well as for indoor conditions required for a proper event-type climate. Any deviations from proper operating thresholds are automatically alerted so they can be quickly addressed.

Simultaneous Heating & Cooling Prevention
Analytics determined that several AHUs in the Arena were simultaneously pre-heating air and then cooling it. Resolute corrected the heating and cooling sequences on all AHUs, utilizing a pre-heat hot water control valve and a chilled water control valve. This strategy, therefore, does not allow for pre-heating when there is a call for cooling or cooling when there is a call for heating.

As part of our Chilled Water Supply Temperature Set-Point Reset strategy, Resolute programmed a Energy Conservation Measure (ECM) to automatically stage the comfort chillers based on actual building load. The result was an eight-hour reduction of chiller runtime (during a 24-hour game day) for the same indoor and outdoor game conditions.

The top graph indicates that the manual staging of the Arena's comfort chillers was resulting in inefficient equipment operation and excessive energy use.
I would tell any of my counterparts that the Resolute solution works. If you want to save money, it is a good partnership because they’re here to help you with that and to show you ways to save money on your energy.

DAVE OLSEN, EVP & GM, PNC ARENA

Results

Once the data had been collected, analyzed, and compared, Resolute and the Arena team developed and implemented a set of initial strategies to improve energy efficiency and facility operations and used the Resolute software to track the impact of these changes in real-time. Results to date:

- $230,000 in annual utility savings with target of $400,000+ annually
- 7% reduction in electrical consumption
- 11% reduction in natural gas consumption
- 33% reduction in domestic water consumption
- Improved fan comfort by increasing bowl temperature
- Maintained ice temperature at NHL recommended temperature

Achieving Objectives

- Comprehensive performance visibility across the Arena
- Real-time data and analytics for issue identification and resolution
- Findings and observations about overall Arena performance
- Data-driven strategies resulting in quantifiable energy savings
- Improved fan comfort and experience
- Insights and data to better manage risks and deploy capital

Moving Forward

Looking ahead, Resolute estimates it will increase annual savings to $400,000+ as we experience the effects of a full year of implemented strategies and take measures to shave Peak Demand charges. These additional savings will also be driven by resolving a significant Arena dehumidification issue. Through the data, Resolute was able to determine that 12 roof-top dehumidifiers are not properly contributing to the removal of moisture from the Arena bowl air. The units are short-cycling supply and return air and causing air stratification high in the bowl.

Resolute discovered this issue based on KPI data tracked for each game. Resolute observed that the 12 roof-top dehumidifiers were running but the data showed no impact on the Arena bowl humidity levels.

Concurrently, the data showed the comfort chillers operating in a manner that proved they were trying to overcome this lack of bowl dehumidification. This type of operation leads to excessive KW demand and kWh consumption by the chilled water plant, which is both expensive and wasteful. Additionally, this dynamic leads to much colder air being supplied to the Arena bowl, negatively impacting fan comfort during the game and the overall fan experience. To rectify this issue, the team will be implementing Resolute’s Demand Control Ventilation strategy to lessen the impact of dehumidification of outside air brought in through the AHUs to the chillers. By utilizing existing and new CO2 sensors in the AHU return air, Resolute can more accurately modulate the amount of outside air introduced into the Arena, thus reducing the cooling load and associated costs required for dehumidification.
ABOUT RESOLUTE®

Resolute’s cloud-based solution delivers the visibility, real-time data and analytics-driven strategies needed to help building owners and operators better understand energy use and run their buildings more efficiently, resulting in significant energy consumption reductions without significant capital investments.

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