



Crown Melbourne & BUENO Systems: Energy and Operational Savings Across a Multi-Use Entertainment Complex

Case Study
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Crown Melbourne Analytics-Driven Energy and Operational Savings Across a Multi-Use Entertainment Complex

Crown Casino and Entertainment Complex is a large casino and entertainment precinct located on the south bank of the Yarra River, in Melbourne, Australia. Crown Casino is a unit of Crown Limited.

Originally built in 1997 the operations team identified that the complex had a huge potential for energy use reduction. An energy efficiency program was started in 2010 to achieve savings. SkySpark was implemented as part of a Building Optimisation System (BOS) program across the facility. This Case Study provides an overview of the project and results.

Our thanks to Crown Limited, the end user, and BUENO Systems, the SkySpark partner that implemented the system.

First Some Stats on the Crown Melbourne Entertainment Complex



- 536,000 square meters (5,769,000 square feet of space)
- 3 hotels, 1604 rooms
- 58 restaurants and bars
- 65 commercial tenants
- Conference & event spaces
- 17 million visitors a year
- 6,500 staff
- 1,500 contractors
- 24-7 operation
- 88 million kWh Electricity (equivalent of 11,000 homes!)
- 500,000 GJ Gas (equivalent of 23,000 homes!)
- 120,000t Carbon Emissions (173rd largest consumer on the NGERs list - National Greenhouse and Energy Reporting Scheme)



Crown Melbourne's Plant and Equipment

It was clear that the size of the system was too large to monitor, identify and address faults manually. Automated analytics would be essential to achieve optimisation goals.

Equipment systems included:

- 600 air handling units
- 2300 fan coil units
- 8 Cogeneration gas engines
- 27 Chillers (approx. 58MWt total capacity)
- 31 Boilers (approx. 38 MWt total capacity)
- 130 lifts and escalators
- 900 electrical boards
- 76,000 BMS points

The Crown team began a market review of available analytic solutions with the following objectives:

- Address faults before they create:
 - Issues for the customer (comfort)
 - Increased energy consumption
 - Equipment failure
- Reduce management costs
- Reduce maintenance costs
- Provide integrated reporting
- Avoid metering infrastructure

The results of their initial market review found:

- 8 software packages currently available
- Most have limitations
- Still in their infancy from a development and deployment standpoint
- Utilise metering to identify faults
- Cannot pinpoint fault cause
- Limited reporting capability
- Customisation of analytic rules was not available
- Costly to implement and maintain

After review they chose to move forward with **BUENO**, a SkyFoundry partner that provides a complete managed services approach to monitoring and analytics employing **SkySpark**.

The Results: Identifying and Tracking System Faults

The BUENO Solution - Phase 1

- Commenced September 2014
- Promenade Hotel (465 rooms, 517,000 sq ft/48,000 sq m)
- Integrated into Honeywell EBI (11,500 BAS points)
- “Skyspark” analytics platform
- BUENO provided setup and ongoing managed services working closely with the Crown operations team



The system was implemented with rules to detect common system faults including:

- Heating and chilled water valves not closing or failed
- Valves hunting
- Failed dampers
- VAV box failures/ issues
- Central plant short cycling
- Pumps/ fans hunting
- Temperature set points not being achieved
- Equipment left in manual override mode
- Invalid Occupancy readings from room control sensors

Group	Rules	comment	cost	alert	activation	software	Targets
Promenade 416 spots	AHU Cooling when zone below SP		7.42hr				12
	AHU Economy Cycle while heating		24.67hr				13
	AHU Fan running after hours	865.05	158.09hr				1107
	AHU Filter pressure unexpected value		70.58hr				151
	AHU HMRV valve is hunting		10.25hr				171
	AHU HMRV valve is opening		1.33hr				12
	AHU RAT Cold/Hot Main Zone		52.75hr				110
	AHU SFP excessive static pressure		15.42hr				12
	AHU SFP insufficient static pressure		5.33hr				12
	AHU SAT = OAT during economy cycle		9hr				14
	AHU SAT set point error		7.08hr				CC_MALL-01 Office Area
	AHU Cycling between heating and cooling		15.88hr				CC_MALL-01 L1 Meeting Room VAV
	AHU economy change is heating		27hr				16
	AHU heating coil starved		2.67hr				12
	AHU return damper is hunting		9.42hr				13
	Chiller entering IDWT too low		13.32hr				24 Chiller 1
	Chiller not making IDWT/Temp SP		31.40hr				CC_Chiller2

The Results:

- All the faults expected and more!
- Currently >150 SkySpark rule algorithms are active across the facility
- Approximately 350 Sparks active at any one time

Analytic Results

Examples of Sparks:

Hunting Chilled Water Valves (Indicates that the control loop is not properly tuned affecting both comfort and energy use)

“Passing” Chilled Water Valves. (Passing is the term used in Australia for the condition when the valve does not fully close off to stop the flow of water, thereby wasting energy)

Implementation of additional rule algorithms is planned based on results to date and the input of the Crown operations team and BUENO, SkyFoundry implementation partner.

Applying Analytics is a journey!

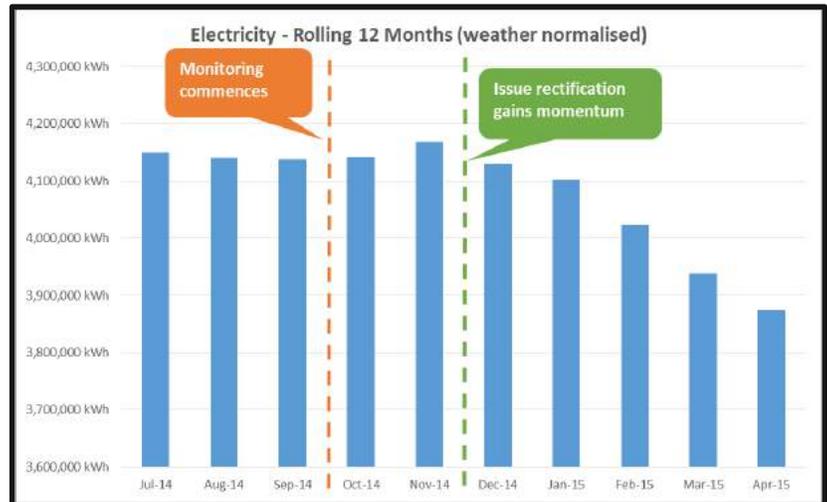


The Financial Results

Electricity Savings

6% reduction in HVAC electrical consumption to date (10-15% by year end)

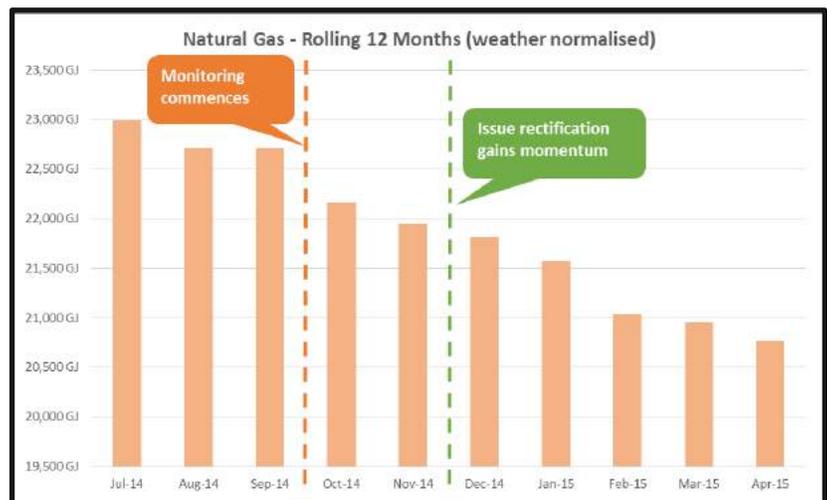
Savings accomplished by systems tuning and OPEX work only !!!



Nat. Gas Savings

9% reduction in HVAC gas consumption (15-20% by end of year)

Accomplished with systems tuning and OPEX work only !!!



The Way Forward

- Continue to add new rule algorithms
- Roll-out analytics to the remainder of Melbourne and Perth facilities adding >5 Million additional sq ft (>450,000 sq m) and >65,000 additional points!
- Integrated Warranty Period Corrections and Building Tuning
- Expand analytics to other services - water, lighting, lifts & escalators
- Automation of fault-rectification - maintenance system integration
- Continuously improve, innovate and stay ahead

Going Forward All buildings will have the BOS !!!

SkySpark® – Analytics for a World of Smart Device Data

The past decade has seen dramatic advances in automation systems and smart devices. From IP connected systems using a variety of standard protocols, to support for web services and xml data schemas, it is now possible to get the data produced by the wide range of devices found in today's buildings and equipment systems.

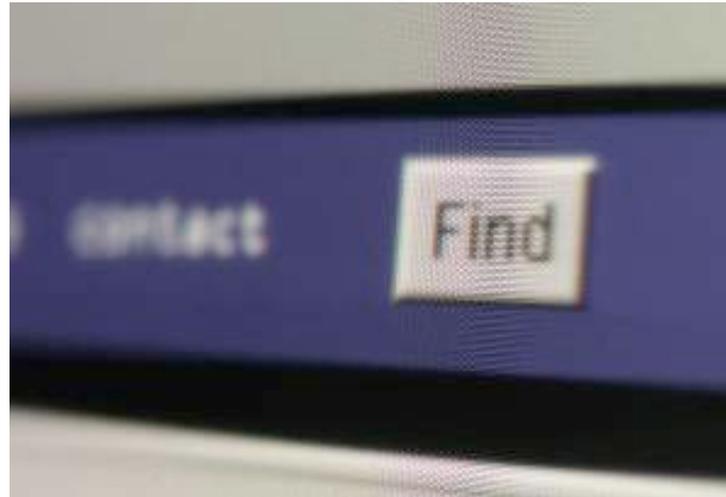
Access to this data opens up new opportunities for the creation of value-added services to help businesses reduce energy consumption and cost and to identify opportunities to enhance operations through improved control, and replacement or repair of capital equipment. Access to the data is just the first step in that journey, however. The new challenge is how to manage and derive value from the exploding amount of data available from these smart and connected devices. SkyFoundry SkySpark directly addresses this challenge.

About SkyFoundry

SkyFoundry's mission is to provide software solutions for the "Internet of Things". Areas of focus include:

- Building automation and facility management
- Energy management, utility data analytics
- Remote device and equipment monitoring
- Asset management

SkyFoundry's software helps customers derive value from their investments in smart systems. Learn more and request a demonstration at www.skyfoundry.com.



The new frontier is to efficiently manage and analyze data to find what matters™.

SkyFoundry

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