



Continuous commissioning promises ongoing gains

CASE STUDY

✓ Key features

- Invested in people, not technology
- Established multi-disciplinary team to optimise HVAC
- ‘Continuous commissioning’
- 28 recommendations for improving its energy use were identified in an already efficient building

✓ Key benefits

- 22% reduction in overall energy use
- \$60,000 project cost
- Less than one year project pay back
- Best ever staff satisfaction

✓ Sector relevance

- Owners and managers of commercial buildings

There’s always room for improvement when it comes to a building’s energy efficiency – always.

That’s the basis of ‘continuous commissioning’. It starts from the proposition that the heating and cooling systems of any building, new or old, are invariably operating inefficiently and that gains of 20% are always achievable.

This approach was well proven at Wellington’s Reserve Bank building. Already outperforming the industry’s energy efficiency benchmark by around 30% (partly due to the nature of the RBNZ’s functions), recommissioning achieved further energy savings of 22% and cost savings of 14%.

Background

Number 2 The Terrace is an 18-storey office block completed in 1973 and partly occupied by the Reserve Bank of New Zealand (RBNZ) ever since. Typical occupancy of the 25,480 m² space is around 500 people, which includes staff

from RBNZ and several other tenants. It was built to a high standard and has been well maintained. Most services have been replaced at least once with progressively more energy-efficient equipment and better control technologies increasing the potential to reduce energy use. Major developments have included new dual-fuel boilers, installed in 1981 as a result of the ‘70s oil crisis, a major re-fit in 1988 when full air-conditioning was installed and new lift controls in 1992.

Continuous commissioning invests in people time to monitor, manage, investigate, diagnose and generally question every aspect of the way energy is used and controlled. It’s an ongoing process of ‘adjust – measure – adjust – measure’.



The foyer at the bank.

Energy management gained an even higher profile after the Reserve Bank commissioned its first energy audit in conjunction with the Energy Efficiency and Conservation Authority (EECA) in 1997. Highlights since then have included a dedicated hydronic cooling system for the computer server rooms which cut cooling costs by 19%, variable speed drives fitted to pumps, lighting upgrades, new burners and controls for the boilers and replacement air handling controls.

This high level of energy awareness and activity had resulted in an EPI (Energy Performance Indicator) of 193 kWh/m²/year. This is 30% better than the Property Council's benchmark for buildings of this type.

Driver for change

Despite all this work, energy use and costs were still increasing steadily. It was decided to produce a zero-based review of energy, considering every factor and not just major items or areas where costs had changed. Following a recommendation by energy consultant Norman Smith, a Level 2 Audit (part-funded by EECA) was completed in March 2008.

The auditor, Rob Bishop of Energy Solutions Ltd., made eight recommendations which involved investing in proven energy savings technologies. These included improving power factor, installing efficient showerheads and investigating solar water heating to service summer hot water requirements.

The ninth recommendation was the most innovative because it proposed investing in people, not technologies. Apart from \$5,000 for gas metering, the \$60,000 requested would fund an energy team of six, bringing together staff along with external contractors and consultants, all of whom worked for the Bank and knew the building well.

The project team would recommission the building using the continuous commissioning approach.

Combining expertise

As well as Chris Ward and his RBNZ Building Services colleague Terry Clubb, the project team included consultant Norman Smith and energy auditor Rob Bishop.

Their expertise was combined with that of representatives of the Bank's three principal building services contractors – Peter Appleby of Advanced Building Services (HVAC and associated services), Glyn Benson of Set Point Solutions (building controls) and mechanical engineer Des Farkas. Genesis Energy assisted with ToU (Time of Use) electricity consumption data.

Rob Bishop, who had recommended the team approach in his audit, was so confident of a result he offered to waive his fee if the Bank didn't achieve at least a three-year payback.

Results

“Essentially, the project team had a brief to ‘play around a bit’ with the building’s heating and cooling systems,” says RBNZ building supervisor Chris Ward. “The closer we looked, the more opportunities we found.”

‘Play around’ the team did. It gathered data, brainstormed, and eventually identified and implemented 28 different system optimisation opportunities. Four more have been targeted for the following year.

Their work has certainly paid off. The optimisation project delivered a 22% reduction in energy use that will save \$60,000 annually.

Gas usage was reduced by 35% (projected to improve to 46% in future years), electricity for cooling by 54% and overall energy use by 22%.

At this level of savings, the project has a payback of 12 months on externals. If internal staff costs are added, payback is 14 months.

Staff satisfaction

HVAC savings can’t be measured in isolation – it would be very easy to make significant savings simply by turning thermostats down. So the HVAC Optimisation Project was also evaluated against the level of staff satisfaction with their working conditions and comfort measured in terms of complaints. These had been monitored monthly since 2003.

The results after the project were equal to the best-ever recorded.

“In 40 years as a mechanical engineer, it’s the first time I’ve seen building services the focus of such intense scrutiny,” says Des Farkas. “I believe a similar effort would produce the same level of energy savings in every other building in town.”

Continuous commissioning

A key factor in the success of the project was a willingness to start with a clean sheet of paper and engage in ‘continuous commissioning’.

“Recommissioning HVAC systems is by far the most cost-effective energy efficiency measure,” says Dr Dan Turner, Director of Energy Systems Laboratory, Texas A&M University.

Texas A&M University’s Energy Systems Laboratory is a leader in promoting the concept of continuous commissioning.

Based on results in 300 commercial buildings, they’ve built a working method based on an initial assumption that the heating and cooling energy services of any building, new or old, are invariably operating very inefficiently and that with ‘tuning’, energy savings of 20% will be achieved.

That’s exactly what the Reserve Bank’s team achieved – except they halved the Energy Systems Laboratory’s projected 24-month payback.

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Recommendations for optimising the RBNZ building’s system included:

- Increasing ‘deadbands’ between heating and cooling set points to reduce overlap
- Reducing minimum outside air through all air handlers to prevent over-ventilation
- Reducing the service hot water setpoint
- Embedding lockout temperatures, so chillers don’t run when it’s colder

than 14°C outside, and boilers don’t run when it’s over 18°C

- Finding and stopping hidden overrides that start boilers when they’re not needed.

Savings were measured using IPMVP, the International [Energy] Performance Monitoring and Verification Protocol. The IPMVP provides an overview of current best practice techniques available for verifying results of energy efficiency and renewable energy projects.

Four-year cycle

Twelve months is considered the minimum for such a process; two years to lock in the savings and add more; and it is reasonable to expect new cost-effective efficiencies to be identified in years three and four.

While it may seem counter-intuitive, opportunities identified in years two and three and beyond can be greater than at the beginning. These are the result of a deeper understanding of the interaction between all the energy-consuming equipment in the building. This understanding enables the project team to make significant adjustments they weren't comfortable making originally.

Again, this is the experience with the Reserve Bank building. Significant opportunities are emerging which could not have been identified 12 months ago.

Ongoing review

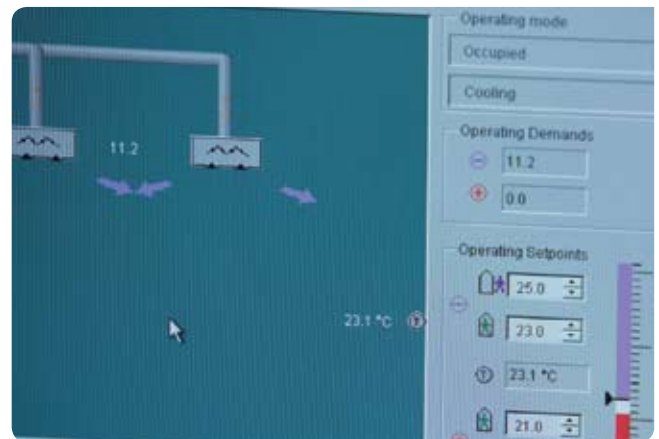
Most commissioning processes focus on bringing a building's operation to the original design intent. But a commercial building is a dynamic system in which staff numbers, patterns of use and technologies are changing constantly.

Realising the potential of advanced HVAC technology to improve building comfort and decrease energy consumption demands a process of ongoing operational review – the process of 'continuous commissioning'.

Wide application

Perhaps the most telling lesson from this project has been the relative ease with which significant new savings have been found in a building that was already a top performer for energy efficiency.

Few of the 564 buildings larger than 9,000m² that account for around 2% of New Zealand's total energy consumption would exceed the Property Council's EPI benchmark by a margin as wide as RBNZ's 30%. Clearly, continuous commissioning is a process with wide application and exciting potential.



The ongoing process of 'adjust – measure – adjust – measure' is key to 'continuous commissioning'.


EECA enables organisations to increase their domestic and international competitiveness by adopting energy efficiency and renewable energy practices.

We work with businesses to identify the opportunities for energy management that are available to them and help them develop energy management action plans to make the most of these opportunities.

Good energy management has many benefits for businesses, including lower costs, increased productivity, reduced greenhouse gas emissions and a positive effect on the brand.

We have a particular interest in:

- encouraging new or under-used technology that can make processes more efficient
- projects that reduce greenhouse gas emissions, and
- developing the wood fuel industry.

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