TECK
ENERGY & ENVIRONMENT

PROOF OF CONCEPT

Project Summary

WWW.CTECK.COM.AU

Office of the Queensland Chief Entrepreneur

innovation architects

Low Carbon Accelerator

Queensland Government

EXECUTIVE SUMMARY

The Proof of Concept (PoC) program undertaken by CTECK Pty Ltd was designed to validate the effectiveness and commercial viability of its innovative HVAC&R energy-saving technology. The PoC was conducted under the Low Carbon Accelerator Program (LCAP), supported by the Queensland Government. The primary objective of the PoC was to demonstrate the potential for energy savings, emission reductions, and financial benefits across a variety of air conditioning systems in different sectors, including residential, commercial, and industrial settings. This PoC covered installations across multiple locations in Queensland, testing the system's performance under diverse climate conditions.

Key Results

Energy Savings

An average of **29% reduction in energy usage** was recorded per system, resulting in weekly savings of **45.12 kWh.**

CO2 Reductions

On average, each system contributed to a reduction of **30.66 kg of CO2** emissions per week.

Financial Benefits

Users saved approximately **$13.99** per system weekly, translating into a potential annual saving of **$727** for frequently used systems.

Broader Implications

The success of the CTECK PoC program points to its broader implications for energy efficiency and sustainability across Queensland and beyond. By reducing energy consumption and CO2 emissions, CTECK's technology aligns with the state's ambitious emission reduction targets and supports the transition to a low-carbon economy. Additionally, the scalability of the solution means it can be expanded both nationally and internationally, offering a transformative approach to energy management in various sectors.

> **These results demonstrate the potential for significant energy and emissions savings across Queensland, particularly as the state has over 1.1 million air conditioning units in residential use alone. Scaling the technology could lead to substantial environmental and financial impacts, contributing to the state's long-term sustainability goals.**

Energy Savings
467,804,160 kWh annually

CO2 Reduction
317,882,880 kg annually

Financial Savings
$ 145,019,290 annually at $0.31 per kWh

Emission Reduction
contributes over 0.5% to Queensland's 2032 emission reduction target

Broad Benefits Across Multiple Sectors

Residential

Reduced energy bills and improved efficiency, lowering household expenses, 25%+ average savings over the PoC

Commercial

Decreased operational costs and enhanced sustainability in retail, hospitality, and office spaces 23% average savings over the Poc

Education

Reduced energy costs, allowing more funds for educational resources 30%+ average over the PoC

Health

Fitness industry (Gyms), training and health & wellness facilities, fitness studios 35%+ average savings over the PoC

Hospitality

Hotels and tourism facilities enjoy reduced energy costs, enhancing competitiveness and sustainability 27% average savings over the PoC

Industrial

Commercial & Industrial, Manufacturing, minim, transport and logistic service 30%+ average savings over teh PoC

National and International Potential

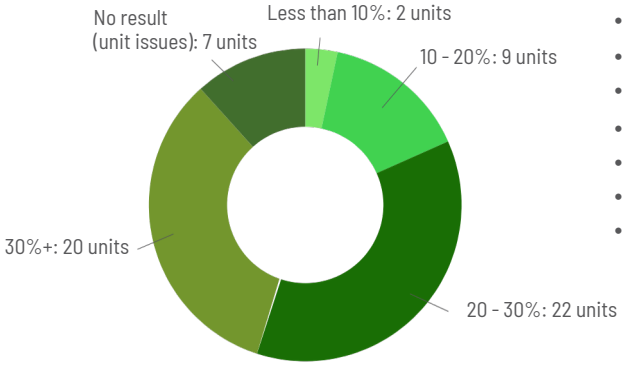
National Expansion

Adoption across Australia could lead to substantial energy and emissions savings, supporting climate action commitments

International Impact

Globally, CTECK's technology enhances energy efficiency and reduces carbon footprints, valuable for international sustainability

Savings Achieved



AC System Styles

- Higwall Split
- Cassette
- Ducted
- Ducted VRV
- Multi Head VRV
- Cassette VRF
- Ducted VRF

AC Unit Capacities

- 3.5 kWr
- 5 kWr 7
- kWr 7.1
- kWr 8.5
- kWr 10
- kWr 12
- kWr 12.5
- kWr 14
- kWr
- 15 kWr
- 15.5 kWr
- 16.5 kWr
- 18 kWr
- 22 kWr
- 24 kWr
- 25 kWr
- 33.5 kWr

PROJECT OVERVIEW

Deployment Strategy

The deployment of CTECK's technology followed a comprehensive approach that ensured real-world applicability across a broad spectrum of users. The key elements of the deployment strategy included:

- **Site Selection:** Installations were chosen to represent a diverse range of climate zones and usage applications, ensuring thorough testing in different environmental conditions. This included sites in residential homes, retail spaces, hospitality venues, and educational institutions in regions like Brisbane, Townsville, and Far North Queensland.

- **Installation and Monitoring:** The technology was installed following industry best practices, with on-site HVAC&R contractors overseeing the installation process. A thorough monitoring period followed, during which energy consumption and internal environmental conditions were recorded to validate the system's performance.

- **Stakeholder Engagement:** Close collaboration with industry stakeholders, such as HVAC&R service providers and facility managers, was crucial to the program's success. This engagement ensured alignment with market expectations and enhanced the adoption potential of the technology.

This deployment strategy helped CTECK demonstrate the broad applicability and effectiveness of its HVAC&R energy-saving technology across multiple sectors and operational environments.

Objectives

The primary objective of the Proof of Concept (PoC) program was to validate the effectiveness and commercial viability of CTECK's HVAC&R energy-saving technology in reducing energy consumption and carbon emissions. Specifically, the PoC sought to:

- Demonstrate the energy savings achievable through the deployment of CTECK's technology across small to medium enterprise (SME) style air conditioning systems.

- Assess the system's capability to operate across diverse climate zones, usage applications, and air conditioning configurations.

- Identify the commercial potential and scalability of CTECK's technology for future market penetration.

Scope

The PoC program encompassed extensive testing and evaluation across 60 installations, including residential homes, commercial offices, hospitality venues, educational institutions, and other settings. The key scope of the program included:

- Testing in various climate zones to ensure the technology's adaptability and performance under differing environmental conditions, ranging from Queensland's Southeast to the tropical regions in the north.

- The technology was deployed across a wide array of usage applications, such as residential settings, retail establishments, educational facilities, and healthcare institutions.

- The PoC tested the compatibility and effectiveness of CTECK's technology across various HVAC&R system configurations, including high wall splits, cassette systems, and ducted multi-head VRF systems.

- Engagement with stakeholders from the electrical, HVAC&R, and solar industries was part of the process to gather feedback and assess market demand and usability.

METHODOLOGY AND DATA COLLECTION

Methodology

The Proof of Concept (PoC) project followed a structured methodology to rigorously test and validate CTECK's energy savings technology across various climate zones and air conditioning system configurations. The primary goal was to assess the system's ability to reduce energy consumption and CO2 emissions in real-world conditions. The PoC used a combination of independent engineering oversight and advanced data collection technologies to ensure accurate and verifiable results.

During the PoC, CTECK technology was installed at 60 sites, representing diverse environments, including residential homes, corporate offices, and commercial buildings. Independent engineers were engaged to oversee the installations and ensure that performance data was collected in compliance with International Performance Measurement and Verification Protocol (IPMVP) Option B standards. This protocol ensures that energy savings are measured with high accuracy, focusing on direct measurements of power consumption and operational hours of air conditioning units.

The systems were monitored continuously with and without the CTECK device, providing baseline consumption data and optimised performance data when the device was active. These measurements were then compared to determine the actual energy savings and reductions in CO2 emissions. Cooling Degree Day (CDD) metrics were also incorporated to norm data across varying external temperature conditions, ensuring that savings were attributed to the CTECK device's performance rather than environmental changes.

Data Collection

Data collection for the PoC was executed using precise, independent energy consumption meters provided by Wattwatchers and collected through the evergreen powers solutions data breach gateway, installed at each site to track real-time energy usage. These meters captured critical metrics such as:

- **Power consumption (kWh):** This was continuously recorded to determine the energy used by each air conditioning system before and after the CTECK device was installed.
- **Internal and external temperatures:** These readings helped assess how well the air conditioning units maintained comfort levels while optimising energy usage.
- **Humidity levels:** Internal humidity data was logged to ensure that the CTECK device did not compromise the system's ability to regulate indoor air quality.
- **CO2 emissions:** The device's impact on emissions reduction was calculated based on the reduction in energy use, directly contributing to a decrease in greenhouse gas emissions.

The data was collected over a period of several months, during which systems were subjected to various operational loads and external conditions to simulate both residential and commercial usage scenarios.

KEY FINDINGS & RESULTS

Energy Savings

The CTECK Proof of Concept (PoC) program successfully achieved an average **29%** energy savings across the 60 installations tested in Queensland. The energy savings per system averaged **45.12 kWh** per week, exceeding the expected performance range of 20-25%. The system optimization provided significant reductions in energy consumption for various types of air conditioning systems, making the technology viable for both residential and commercial applications.

CO2 Reductions

In terms of environmental impact, the PoC program demonstrated significant CO2 reductions, averaging **30.66 kg** per system per week. This result translates into meaningful contributions towards Queensland's 2032 emissions reduction targets. When deployed at scale, CTECK technology could play a key role in supporting the state's environmental objectives, contributing over **0.5%** of the total reduction target for 2032.

Financial Impact

Financial savings were another strong outcome of the PoC program. Each system produced average savings of **$13.99** per week, equating to $2.33 per day. When annualized, these savings could range between $600-$800 per system, depending on usage. The calculated return on investment (ROI) for the systems varied from **2 to 3 years**, based on energy usage patterns and local energy costs.

System Performance

The PoC revealed that system performance varied depending on several factors, including the age of the air conditioning units, load levels, and usage patterns. Some systems, particularly those operating in high-load environments or where air conditioners were used intensively, outperformed expectations. On the other hand, systems that were less frequently maintained or in low-use environments showed more modest energy savings. The results highlighted the versatility of the CTECK technology, as it consistently delivered energy savings across a wide range of air conditioning types and settings.

The technology performed well across both high-load and low-load systems, demonstrating its ability to optimize energy consumption in diverse usage environments. Systems such as VRV/VRF multi-head air conditioners in commercial settings benefited the most from CTECK's optimisation, achieving savings well above the average, while smaller residential units still saw measurable improvements.

CASE STUDIES

Kienan Street Residential Installation (Redland Bay, Queensland)

This installation was conducted in a large multi-generational home located in the Redland Bay area. The house featured a 15.5 kW Haier ducted air conditioning system with eight zones, including bedrooms and living spaces.

Results:

- Achieved a 21.9% reduction in energy consumption.
- Saved 57.64 kWh over a seven-day testing period.
- Reduced 39.07 kg of CO2 emissions. Resulted in $17.86 saved during the testing period, with an annual savings projection of $321.48
- Return on investment (ROI) of 2.8 Years

Mueller College Test Installations (Brisbane North)

This educational institution was used as a testing ground for several Mitsubishi Electric high wall and ducted systems. The installations aimed to evaluate energy efficiency in a school setting, with different zones tested for optimisation.

Results:

- Test 1 on a 7.1 kW high wall system in classrooms achieved energy savings of up to 49.57% in some areas. CO2 emissions were reduced by 10.57 kg during the test, with cost savings reaching$3.28 for the period.
- Multiple systems showed high variability in savings, with some zones achieving up to 77.7 kWh saved.

Ozcare Kittyhawk Drive Installation (Chermside, Queensland)

Another installation in a large residential home located in the inner western suburbs of Brisbane. The residence was equipped with a Daikin VRV ducted air conditioning system, designed for large-scale cooling.

Results:

- Achieved a 30.9% reduction in energy consumption.
- Saved 37.11 kWh over the testing period. Reduced
- 25.31 kg of CO2 emissions. Resulted in $11.50 saved during the testing period, with projected annual savings based on continuous energy optimisation.

Big 4 Holiday Park Installation (Lucinda, Queensland)

The Big 4 Holiday Park installation in Lucinda, Queensland, involved multiple cabins, each fitted with Mitsubishi Heavy Industries high wall split air conditioning systems. These units are crucial in maintaining comfort for holidaymakers in tropical northern Queensland's climate.

Results:

- Achieved energy reductions between 26.28%and 35.21% across different cabins.
- Saved between 11.99 kWh and 16.55 kWh over the testing period.
- Reduced 8.13 kg to 11.18 kg of CO2 emissions. Resulted in
- savings of $3.72 to $5.13 per cabin over the testing
- period, with annual savings projected based on peak occupancy.

These case studies demonstrate the diverse applications of CTECK technology in residential and educational environments, achieving substantial energy savings, cost reductions, and positive environmental impacts. The results highlight the scalability and effectiveness of CTECK solutions in different settings, contributing to sustainability goals.

CONCLUSION & RECOMMENDATIONS

The CTECK Proof of Concept (PoC) demonstrated significant success in validating the company's technology for reducing energy consumption in small and medium-sized air conditioning systems. The results showed an average energy **savings of 29.32%** across all participating units, translating into substantial **CO2 reductions of over 1.625 tons** across 60 installations.

This achievement highlights the potential of CTECK's technology to significantly impact environmental sustainability, especially within the commercial, residential, and educational sectors. Additionally, the financial benefits were equally impressive, with users saving an average of **$13.99 per system weekly**, which translates into notable cost reductions, particularly for larger systems with high usage rates.

These savings are aligned with national and state-level goals, contributing meaningfully to Queensland's 2032 emissions reduction target. Scaling CTECK's technology further could have widespread benefits across various sectors, with a projected market potential of over 860,000 installations in Queensland alone, offering long-term financial and environmental benefits.

Future Outlook

The CTECK technology presents a clear opportunity for both national and international expansion. Domestically, the growing demand for energy efficiency solutions, supported by government-backed initiatives such as the Low Carbon Accelerator Program (LCAP), provides an ideal landscape for scaling CTECK's solutions. With a significant portion of the Australian residential and commercial air conditioning market still untapped, the company is well-positioned to increase its market share.

Internationally, CTECK's technology has the potential to address global sustainability goals, especially in countries facing similar climate challenges. Its scalability for both residential and commercial sectors, combined with the increasing global emphasis on reducing carbon footprints, makes CTECK's solution attractive for markets in North America, Europe, and Asia. Additionally, the technology's adaptability across a wide range of air conditioning systems enhances its potential for global adoption.

Recommendations

To maximise the commercial and environmental impact of the technology, the following steps are recommended:

1. Accelerate Market Penetration: Focus on expanding within Queensland, where energy consumption and HVAC&R usage are high, through targeted marketing and strategic partnerships with HVAC&R service providers and government energy programs.

2. Strengthen Industry Partnerships: Collaborating with leading air conditioning manufacturers and energy utilities can facilitate the integration of CTECK's technology into new and existing systems. This will enhance the visibility of the solution and drive adoption in key markets.

3. Expand Internationally: Leverage Australia's reputation as a leader in sustainability initiatives to enter markets with strong government support for energy efficiency technologies, such as the United States, Canada, and the European Union.

4. Optimise for Broader Applications: Continue to refine the technology to ensure compatibility with more air conditioning system types, including newer, larger, and industrial systems, thereby broadening the potential customer base.

5. Ongoing Innovation: Maintain a strong focus on R&D to continuously improve the performance of the technology. This includes enhancements in real-time energy monitoring and better integration with smart home and building automation systems.

By focusing on these strategies, CTECK can solidify its position as a leader in HVAC&R energy optimisation, contributing to global carbon reduction efforts while delivering financial savings to consumers and businesses alike.