CTECK
ENERGY & ENVIRONMENT

PROOF OF CONCEPT REPORT

WWW.CTECK.COM.AU

Office of the Queensland Chief Entrepreneur

innovation architects

Low Carbon Accelerator

Queensland Government

Published July 2024

TABLE OF CONTENTS

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The CTECK Proof of Concept (PoC) program, under the LCAP initiative, has proven the significant potential of the CTECK Air Conditioning Energy Savings Device. This program, implemented across various applications and climates in Queensland, followed rigorous International Performance Measurement and Verification Protocol (IPMVP) Option B standards. Independent engineers ensured accurate and reliable performance data.

Key Achievements

Energy Savings
Achieved an average of 29% energy savings per installation, reducing 45.12 kWh per system weekly.

Environmental Impact
Significant CO_2 reduction, averaging 30.66 kg per system weekly.

Economic Benefit
Users saved $13.99 weekly, with an ROI of just three years

Potential Impact in Queensland

With extensive air conditioning usage in Queensland, scaling this technology promises transformative impacts:

- **Market Size**: With 1.8 million residential dwellings, 80% have AC units, resulting in approximately 1.1 million units.
- **Total Market Potential**: Assuming that CTECK technology is accepted at the same rate of adoption as solar (60% in a mature market), this would equate to 864,000 installations.
- **Projected Financial and Environmental Impact**: This would translate to

Key Learnings

The PoC project has enhanced our understanding of technology, product, and market needs, leading to growth initiatives:

Refined Solutions: Streamlined for lower-capacity units and infrequent use, improving ROI.

High-End Market Integration: Demand for visualisation and real-time data for better AC monitoring.

Consumer Behaviour Insights: Users often sacrifice comfort due to high operating cost fears.

Journey from Idea to Commercial Viability

CTECK's journey from concept to commercially validated business showcases the impact of the LCAP program and over 30 years of HVAC and energy management experience. Extensive R&D, testing, and market analysis refined the device's functionality and effectiveness. The PoC program validated real-world performance, reducing market entry barriers with independently verified success and scalability. Our long-term technology development plan ensures the device meets current and future market demands, maintaining its position at the forefront of energy efficiency technology.

Reducing Barriers to Market Entry

The PoC provided robust, independently verified evidence of the device's effectiveness, reassuring customers and stakeholders of its reliability and cost-effectiveness. Demonstrating significant energy savings and CO_2 reductions highlights the scalability of CTECK's benefits, offering a compelling value proposition for various clients.

Energy Savings
467,804,160 kWh annually

CO_2 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

ACKNOWLEDGMENT: *CTECK was supported by Evergreen Power Solutions who provided their Energy Bridge Power Monitoring Solution which captured the energy consumption of the 60 air conditioners in the POC*

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

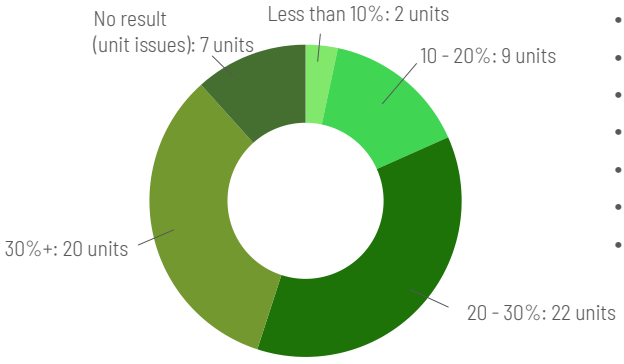
National Expansion

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



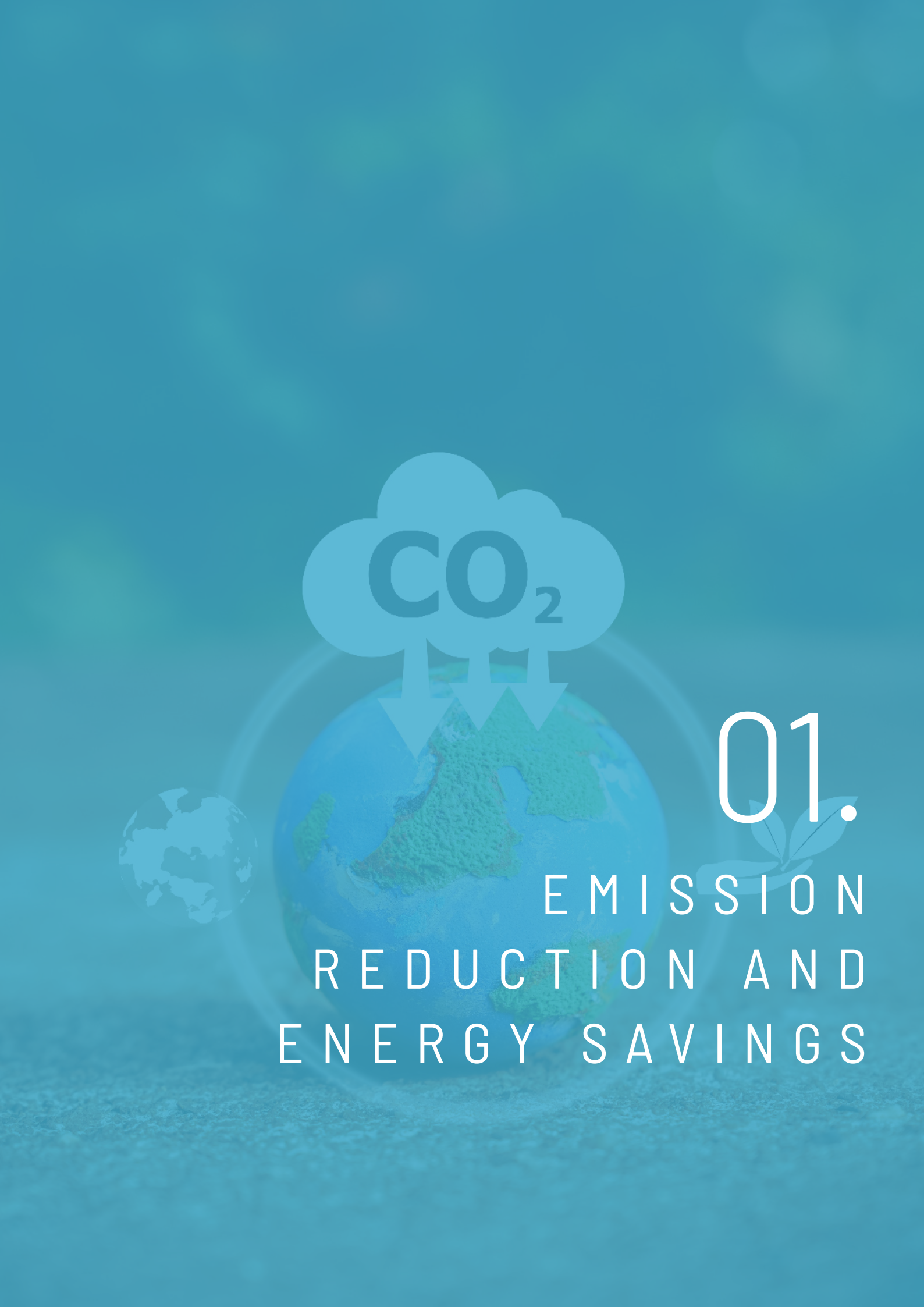
AC System Styles

- 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

Office of the Queensland Chief Entrepreneur | innovation architects | Low Carbon Accelerator | Queensland Government



01.

EMISSION REDUCTION AND ENERGY SAVINGS

01. EMISSION REDUCTIONS & ENERGY SAVINGS

Australia has long been at the forefront of climate change discussions, given its unique environmental landscapes and significant carbon-intensive industries. The Australian Government's approach to emission reduction and climate change involves a combination of international commitments, domestic policies and programs aimed at transitioning to a low-carbon economy while ensuring energy security and economic stability.

Australia is a signatory to several international agreements aimed at combating climate change. The most notable of these is the Paris Agreement, which Australia ratified in November 2016. Under this agreement, Australia committed to reducing its greenhouse gas emissions by 26-28% below 2005 levels by 2030. This target reflects Australia's commitment to global efforts to limit the increase in global average temperature to well below 2 degrees Celsius above pre-industrial levels, with an aim to limit the temperature increase to 1.5 degrees Celsius.

In addition to the Paris Agreement, Australia is a party to the Kyoto Protocol and has fulfilled its commitments under both the first and second commitment periods. The Kyoto Protocol, which predates the Paris Agreement, set binding targets for industrialised countries to reduce greenhouse gas emissions. Australia's adherence to these international frameworks underscores its dedication to playing a constructive role in the global fight against climate change.

The Australian Government is working to reduce emissions by:

- upgrading the electricity grid to support more renewable power
- reducing the price of electric vehicles
- supporting businesses and industries to innovate and adopt smarter practices and technologies
- encouraging businesses and consumers to reduce emissions
- regulating and reporting on greenhouse gas emissions
- helping the land and agriculture sector reduce greenhouse gas emissions
- partnering with our Indo-Pacific neighbours to reduce emissions
- helping negotiate and meet Australia's obligations under the Paris Agreement
- reducing baselines under the Safeguard Mechanism predictably and gradually over time.

The Australian Government is developing a Net Zero 2050 plan, as outlined in the Minister for Climate Change and Energy's 2022 Annual Climate Statement to Parliament and consistent with the recommendations of the Climate Change Authority.

The Australian Government's Powering Australia plan is focused on creating jobs, reducing pressure on energy bills and reducing emissions by boosting renewable energy. Powering Australia is a comprehensive plan with commitments on Australian leadership, backing industry, agriculture and carbon farming, transport and electricity. It capitalises on Australia's abundant natural resources to drive growth, new industries and become a renewable energy superpower.

Further, the Australian Government encourage businesses, industries and consumers to reduce their emissions through a number of programs and initiatives, including:

1. The Emissions Reduction Fund (ERF) aims to provide incentives for a range of organisations and individuals to adopt new practices and technologies to reduce their emissions and store carbon.
2. Climate Active encourages Australian businesses to become carbon neutral by awarding Climate Active Carbon Neutral Standard certification.
3. The Renewable Energy Target (RET) scheme reduces emissions by encouraging more electricity generation from renewable sources.
4. Australia's long-term strategy and domestic actions are underpinned by rigorous emissions monitoring and accountability systems.
5. The National Greenhouse and Energy Reporting (NGER) scheme is a single national framework for reporting greenhouse gas emissions, energy production and energy consumption.
6. The Safeguard Mechanism requires Australia's largest greenhouse gas emitters to keep their net emissions below a limit that will be reduced over time.
7. Australia has made commitments to reduce its greenhouse gas emissions and track progress towards those commitments. The Government report's each year on Australia's greenhouse gas emissions.

While the Australian Government works to limit future climate change through the Powering Australia plan and emissions reduction and reporting, the Government is also increasing the country's capacity to adapt to the climate crisis. The Roles and Responsibilities for Climate Change Adaptation in Australia 2012 outlines the responsibilities of each level of Australian government to plan and implement adaptation activities. The National Climate Resilience and Adaptation Strategy 2021 – 2025 outlines how the Australian Government will fulfil its 2012 COAG Roles and Responsibilities.

Further the Australian Government works through its portfolio agencies, organisations and partnerships on climate change initiatives:

- The Australian Energy Infrastructure Commissioner manages complaints about wind farms, large-scale solar farms, energy storage facilities and new major transmission projects.
- The Australian Renewable Energy Agency (ARENA) finances low emissions technology and renewable energy projects.
- The Commonwealth Scientific Industrial Research Organisation (CSIRO) uses climate simulations to project future climate.
- The Clean Energy Finance Corporation (CEFC) finances clean energy projects.
- The Clean Energy Regulator administers the NGER, ERF, and RET schemes that the Government develops and oversees.
- The Climate Change Authority advises the Government on Australia's climate change policies and future emissions reduction targets.
- The Bureau of Meteorology monitors, analyses and communicates observed and future changes in Australia's climate
- The Australian Climate Service works across Australian Government agencies to develop climate information to support better planning and preparedness for climate and natural hazards.

The Annual Climate Change Statement to Parliament is a requirement Under the Climate Change Act 2022. It provides an overview of the economic, environmental and social impacts of climate change, places Australian action within the context of global efforts and reports on Australia's domestic policies to mitigate and adapt to climate change. The Annual Climate Change Statement also responds to independent advice from the Climate Change Authority in their Annual Progress Report.

Despite these efforts, the Australian Government's approach to emission reduction has faced criticism. Critics argue that the emission reduction targets are not ambitious enough to meet the goals of the Paris Agreement and that more robust policies are needed to drive significant reductions in emissions. There is also concern about Australia's continued reliance on fossil fuels, particularly coal, for energy production and export.

Additionally, the effectiveness of some programs, such as the ERF, has been questioned, with critics pointing to the need for more stringent monitoring and verification of emission reductions. The government's support for new fossil fuel projects has also been a contentious issue, with environmental groups calling for a stronger shift towards renewable energy sources.

Looking ahead, the Australian Government is likely to face increasing pressure to enhance its climate policies and commitments. The transition to a low-carbon economy will require continued investment in renewable energy, energy efficiency, and innovative technologies. Strengthening international collaborations and increasing ambition in national policies will be crucial for Australia to meet its long-term emission reduction goals and contribute meaningfully to global climate efforts.

The Australian Government has implemented a range of policies and programs aimed at reducing greenhouse gas emissions and addressing climate change. Through international commitments, national policies, and targeted programs, Australia is working towards a more sustainable and low-carbon future. While challenges remain, particularly regarding the ambition of emission reduction targets and the transition away from fossil fuels, ongoing efforts and future enhancements to climate strategies will be essential for achieving long-term sustainability and environmental protection.

Queensland Government

Queensland, Australia's second-largest state by area, has recognised the pressing need to address climate change and reduce greenhouse gas emissions. The Queensland Government has committed to transitioning to a net-zero economy by 2050, with ambitious interim targets and policies aimed at driving significant reductions in emissions. Central to these efforts is the $60 billion Queensland's Jobs and Energy Plan, designed to promote economic growth, create jobs and ensure a sustainable energy future. This essay explores Queensland's emissions reduction and climate change policies, highlighting key programs and the strategic initiatives underpinning the Queensland's Jobs and Energy Plan.

Queensland's climate is changing and requires the Government to build resilience and secure a sustainable future for Queensland communities, environment and economy. To this end, the Queensland Government has set targets to reduce emissions and increase renewable energy use.

Emissions reduction:

- 30% below 2005 levels by 2030
- 75% below 2005 levels by 2035
- net zero emissions by 2050

Queensland has already exceeded its 2030 emissions reduction target, having reduced emissions by 35% since 2005 based on the latest 2022 data. Demonstrating that the Government's targets are a floor, not a ceiling to our ambition.

Renewable energy use:

- 50% by 2030
- 70% by 2032
- 80% by 2035

The Queensland Government's renewable energy targets support a balance between generating renewable energy and maintaining energy security and affordability for households and businesses, while aligning with international efforts to combat climate change.

On 18 April 2024, the Queensland Government passed the Clean Economy Jobs Act 2024, enshrining our emissions reduction targets into law as part of our pathway to a clean economy. The Queensland Government has also released Queensland's 2035 Clean Economy Pathway: 75% by 2035, which identifies how Queensland will achieve the 75% emissions reduction target.

All Queenslanders have a role to play in adapting to the changing climate with the Government's climate adaptation strategy providing the framework for action. This legislation aims to drive clean economy investment and jobs with a new emissions reduction target of 75% below 2005 levels by 2035, as well as enshrining in legislation the State's commitment to net zero emissions by 2050.

Queensland's renewable energy targets and emissions reduction targets work together to drive action and set Queensland up for the future. Setting ambitious and considered targets supports more green industries, develops new and innovative technologies, creates a new generation of jobs and attracts important global and local investment.

Queensland is currently at 35% below 2005 levels, having exceeded our first interim emission reduction target of 30% by 2030. Legislating a 75% emissions reduction target by 2035 will secure traditional jobs in our regions, ensure our traditional industries remain globally competitive and deliver a world leading response to climate change to safeguard the Great Barrier Reef.

The legislation establishes a framework for accountability and action, including an expert panel to provide advice to government, the development of sector plans by the end of 2025, 5-yearly review, and annual reporting to Parliament.

Thew two primary benefits of Queensland's emission and climate actions are setting targets aligned to the Paris Agreement protects our world-class environment, particularly the Great Barrier Reef. And, that the actions will attract investment in low emissions and renewable technologies from international partners prioritising clean economies. To achieve these targets a range of current plans, partnerships and strategies have been developed by the Queensland Government, which include the:

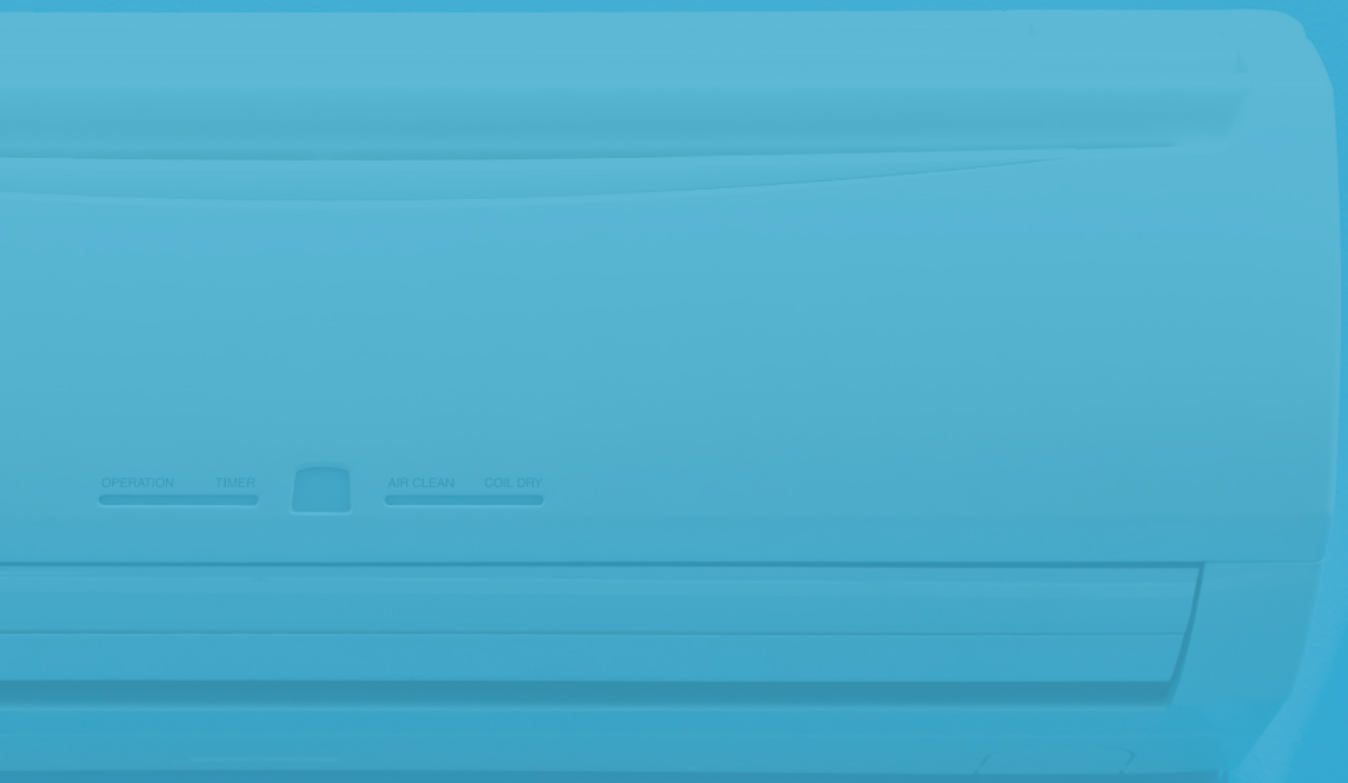
- Queensland Climate Action Plan
- Queensland Energy and Jobs Plan
- Job Security Guarantee (Action 3.2)
- Low Emissions Investment Partnerships
- Zero Emissions Vehicles Strategy and Action Plan
- Resources Industry Development Plan
- Low Emissions Agriculture Roadmap
- Biodiversity Conservation Strategy
- New-Industry Development Strategy
- The Australian Government's Safeguard Mechanism is the Commonwealth Government's policy for reducing emissions at Australian's largest industrial facilities.

The Queensland Government also plans to establish an expert panel to advise on emission reduction strategies, and commit to engaging with stakeholders, including communities, industry and First Nations people.

All of the Queensland Government emissions and climate policies and programs aim to 'decarbonise', which simply means reducing the State's carbon footprint. The Government is developing state sectoral decarbonisation plans that will cover all sectors of our economy:

- electricity and energy
- industry
- resources
- the built environment
- agriculture and land
- transport

The Queensland Government's emissions reduction and climate change policies reflect a comprehensive and forward-thinking approach to addressing one of the most pressing challenges of our time. The $60 billion Jobs and Energy Plan serves as a cornerstone of this strategy, driving clean energy generation, energy efficiency, and sustainable economic development. Through a combination of ambitious targets, innovative programs, and strategic investments, Queensland is well-positioned to lead the transition to a net-zero economy, ensuring a sustainable and prosperous future for its residents.



02.

INTRODUCTION

02. INTRODUCTION

The introduction section provides context for the PoC program, outlining the background of CTECK Pty Ltd and the LCAP initiative.

2.1. Introduction to the Low Carbon Accelerator Program (LCPA)

The Low Carbon Accelerator Program (LCAP) is a comprehensive initiative that fosters innovation and accelerates the adoption of low-carbon solutions within Queensland industries. Led by the Queensland Government, LCAP offers a structured pathway for entrepreneurs and businesses to explore product-market fit, receive mentorship, and access resources to develop and test innovative solutions to reduce carbon emissions.

The LCAP program presents a unique opportunity for entrepreneurs and businesses to collaborate with industry stakeholders, access resources, and accelerate the development and implementation of low-carbon solutions. By fostering innovation and collaboration, LCAP contributes to Queensland's efforts in addressing climate change and achieving its emission reduction targets.

Cohort Support and Engagement: Participants in the LCAP cohort are provided with tailored support and guidance throughout the program. Mentors and experts collaborate with participants to develop effective go-to-market strategies and foster business growth. Additionally, engagement opportunities with stakeholders from Queensland's climate technology networks, including government bodies, universities, industries, and investors, enable valuable connections and insights.

Pathway for Piloting Solutions: One of the primary objectives of LCAP is to provide a pathway for industry players to pilot and test innovative solutions that can contribute to lowering their carbon emissions. Through a structured process encompassing three stages of support, participants have the opportunity to refine their solutions, access industry partnerships, and secure funding for Proof-of-Concept projects.

Program Stages: The LCAP program is structured into three stages:

1. **Bootcamp (Stage One):** Shortlisted applicants participate in a two-day bootcamp where they engage with the program team, partners, and fellow innovators. Through workshops and discussions, participants gain a comprehensive understanding of their products and businesses, setting clear objectives for further development.
2. **Growth Lab (Stage Two):** Ten companies selected from Stage One proceed to the six-week Growth Lab program. Here, participants receive intensive support from the program team, expert mentors, and a network of industry contacts to develop robust business cases for their innovations. Participants focus on securing Proof-of-Concept contracts with industry partners and receive a $10,000 grant to accelerate the process.
3. **Proof-of-Concept (Stage Three):** The most promising companies from the Growth Lab receive grants ranging from $20,000 to $80,000 to implement their Proof-of-Concept projects in collaboration with industry partners. Additional support from expert navigators ensures participants maximise the opportunities presented by their projects.

Participant Criteria and Eligibility: LCAP seeks innovative products with the potential to significantly reduce carbon emissions across various Queensland industries, including sustainable tourism, built environment, energy, resources, manufacturing, transport, agriculture, and food systems. The program is open to founders, business owners, or key product leads of startups and Small to Medium Enterprises (SMEs) who have achieved some early traction and are ready to undertake trials or partnerships in Queensland within the next three months.

Key Dates and Application Process: Key dates for the LCAP program, including the Climate Tech Showcase, Information Session, and application deadlines, are outlined for prospective participants. Eligible applicants are required to submit applications demonstrating their product's innovation, potential decarbonisation impact, and alignment with Queensland's Climate Action Plan. Competitive assessment against specified criteria determines participant selection for each stage of the program.

Participation and Outcomes: Over six months during the 2022-23 period, LCAP successfully engaged with 22 companies, guiding them through a process of ideation, development, and implementation of decarbonisation initiatives. The program showcased notable achievements at a dedicated event, featuring groundbreaking projects such as:

- ARTEH's strategic emissions reduction platform,
- CTECK's energy-efficient AC system,
- Linked Group Services' solar-powered EV charging station, and
- givvable's AI-enabled sustainable procurement solution.

These projects exemplified the collaborative efforts between entrepreneurs, industry leaders, and innovators, inspiring connections and advancing the collective pursuit of reducing greenhouse gas emissions in Queensland.

2.2. Introduction to CTECK Pty Ltd

CTECK stands as the epitome of innovation and sustainability, blending over 40 years of industry expertise, engineering research, and a unique approach to energy efficiency. Our mission is simple yet profound: to simplify the pursuit of energy efficiency in small to medium air conditioning systems across residential and commercial sectors. With a keen focus on creating a better environment for future generations, CTECK addresses the pressing challenges of emissions reduction and rising energy costs while ensuring a tangible return on investment for users. By prioritising the needs of both energy and the environment, CTECK offers solutions that deliver real-world benefits without compromising the functionality or operation of air conditioning units. Welcome to a new era of efficiency with CTECK.

What is CTECK?

CTECK stands as a small yet powerful electrical device, discreetly installed into the outdoor unit of your air conditioning system. At its core, CTECK embodies a microprocessor – a smart little computer with a monumental task: to optimise energy usage and drive significant savings.

What Does It Do?

The brilliance of CTECK lies in its ability to deliver tangible results. By leveraging advanced algorithms and intelligent control logic, CTECK can reduce power consumption by up to 25%, translating into substantial savings on your energy bills. Moreover, by operating more efficiently, CTECK also contributes to a reduction in carbon emissions, aligning with global efforts to combat climate change.

How Does it Work?

CTECK's operation unfolds in a series of strategic steps, each aimed at maximising energy efficiency while ensuring your comfort remains uncompromised. Firstly, CTECK learns your air conditioning unit's usage patterns and performance relative to external conditions – a crucial aspect known as the load profile. Armed with this knowledge, CTECK identifies opportunities for energy savings without sacrificing comfort. Finally, through seamless communication with your AC unit, CTECK implements micro-savings, optimising energy usage and driving efficiency gains of up to 25%.

CTECK: The Efficiency Driver

To illustrate CTECK's role, consider it as a super-efficient economy driver for your air conditioning unit. Much like adjusting the accelerator in your car for optimal fuel efficiency, CTECK fine-tunes your AC unit's operation to keep it in the efficient range more consistently, thereby reducing energy consumption and operating costs.

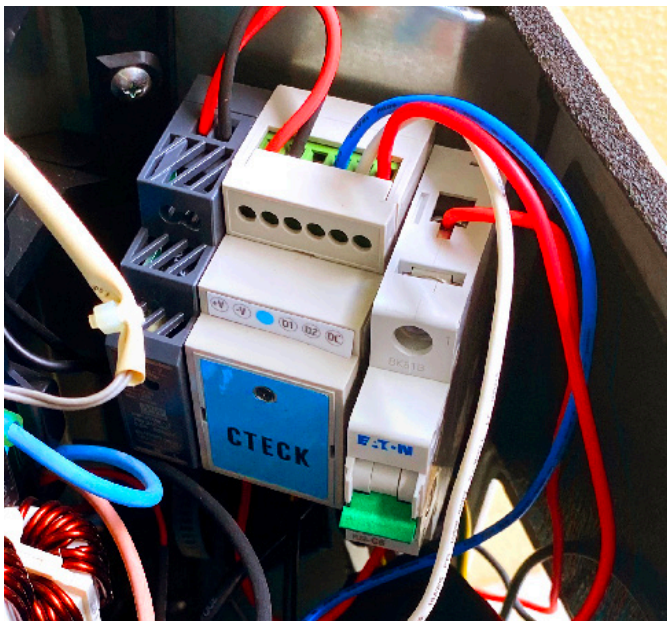
Realising the Benefits

The impact of CTECK extends far beyond mere efficiency gains – it represents a tangible investment in sustainability and cost savings. With typical return on investment (ROI) periods ranging from 12 to 18 months, CTECK offers a compelling value proposition for homeowners and businesses alike.

Taking Efficiency to New Heights

While modern air conditioning units are designed to meet stringent energy efficiency standards, CTECK takes efficiency to new heights. Through proprietary control logic, artificial intelligence (AI), and machine learning algorithms, CTECK enhances the intelligence of compatible AC units, ensuring optimal performance tailored to specific environments and operational needs. By continuously adapting to changing load profiles, CTECK provides sustained savings and operational excellence.

In essence, CTECK represents a convergence of innovation, sustainability, and efficiency. With its transformative capabilities and unwavering commitment to driving positive change, CTECK paves the way for a future where energy consumption is optimised, costs are reduced, and environmental impact is minimised. Experience the power of CTECK and embark on a journey towards a smarter, greener tomorrow.



03.

PROJECT OVERVIEW

03. PROJECT OVERVIEW

Objectives

The Proof of Concept (PoC) program was initiated with the primary objective of validating the efficacy and commercial viability of CTECK's HVAC energy savings technology. Specifically, the program aimed to:

- Validate the application of CTECK's technology to Small and Medium Enterprise (SME) style air conditioning (AC) systems.
- Assess the potential energy savings and emission reductions achievable across various climate zones, usage applications, and AC system configurations.
- Evaluate the feasibility of commercialising the technology and identify strategic pathways to market penetration.

Scope

The PoC program encompassed a comprehensive testing and validation process conducted across 60 installations. The scope of the program included:

- Testing operations across diverse climate zones to assess the adaptability and performance of CTECK's technology under varying environmental conditions.
- Evaluating the application of the technology across different usage applications, including residential homes, corporate offices, retail facilities, hospitality venues, schools, and universities.
- Assessing the compatibility and effectiveness of the technology across a variety of AC system configurations, including different sizes, styles, and functionalities.
- Engaging with stakeholders from the Electrical/HVAC and Solar industries to gather feedback and insights on the usability and market demand for the technology.

Methodology

The PoC program employed a systematic methodology to achieve its objectives:

- **Deployment and Installation:** CTECK's technology was deployed across the selected installations, with careful consideration given to the diversity of climate zones, usage applications, and AC system configurations.
- **Testing and Validation:** Rigorous testing protocols were implemented to evaluate the performance and energy-saving potential of the technology. This involved monitoring energy consumption, assessing system functionality, and analysing environmental impact metrics.
- **Data Collection and Analysis:** Data was collected throughout the testing period to measure key performance indicators, including energy savings and internal and external temperatures to determine system performance, emission reductions, and operational efficiency. Advanced analytics were employed to analyse and interpret the collected data, enabling insights into the technology's effectiveness and potential for commercialisation.
- **DATA:** The data was collected by the Evergreen Power Solutions Energy Bridge Platform, which provided the data in the IPMVP format for HVAC Alliance to use during the analysis process
- **Stakeholder Engagement:** Collaboration and feedback from stakeholders, including end-users, HVAC service providers, and industry experts, were solicited to gain valuable insights into market demand, usability, and improvement opportunities.

Rationale

The rationale behind deploying the HVAC energy savings technology across different climate zones, usage applications, and AC system configurations was twofold:

- **Market Validation:** By testing the technology in diverse real-world scenarios, the program sought to validate its commercial viability and effectiveness across a broad range of applications and environments.
- **Performance Optimisation:** The diverse testing environments provided valuable insights into the technology's adaptability and performance under varying conditions. This knowledge facilitated the optimisation of the technology for maximum efficiency and impact.

Overall, the PoC program served as a crucial step in validating CTECK's HVAC energy savings technology, laying the groundwork for future commercialisation efforts and market expansion.

04.

DEPLOYMENT STRATEGY

04. DEPLOYMENT STRATEGY

CTECK Pty Ltd adopted a strategic deployment approach for the Proof of Concept (PoC) program, focusing on meticulous planning and execution to ensure comprehensive coverage and representation across target regions and industries. The deployment strategy encompassed:

- **Location Selection:** Deployment locations were carefully selected to encompass diverse climate zones, usage applications, and air conditioning system configurations. This ensured a comprehensive assessment of the technology's performance under varying environmental conditions and usage scenarios.
- **Device Installation:** CTECK's technology was installed at selected locations following industry best practices and manufacturer guidelines. In all cases the incumbent site Electrical and or Mechanical contractor was engaged to complete the installation in Collaboration with air conditioning system manufacturers, enhancing the reliability and effectiveness of the deployed devices and giving project ownership to frontline stakeholders during the PoC and into the future.
- **Collaboration with Stakeholders:** Close collaboration with stakeholders, including HVAC service providers, industry experts (independent engineers and manufacturers), and end-users, was integral to the deployment strategy. This collaboration facilitated market validation, and knowledge sharing, enhancing the overall success of the PoC program.

Project Timeline

The PoC program followed a detailed timeline encompassing key milestones, activities, and deliverables:

- **Phase 1:** Planning and Preparation: Conducted comprehensive market research, stakeholder engagement, and device procurement. Duration: 3 months.
- **Phase 2:** Deployment and Installation: Installed CTECK's technology across selected locations, conducted testing and validation, and gathered performance data. Duration: 6 months.
- **Phase 3:** Data Analysis and Evaluation: Analysed collected data, evaluated performance metrics, and documented findings. Duration: 2 months.
- **Phase 4:** Reporting and Recommendations: Prepared a detailed report outlining PoC findings, implications, and recommendations for commercialisation efforts. Duration: 1 month.

Note# phases did run concurrently and simultaneously across many clients where some phases overlapped.

Resource Allocation

CTECK allocated resources judiciously to ensure the successful execution of the PoC program:

- **Human Resources:** Dedicated project management team, technical experts, and field personnel for deployment and installation activities.
- **Budget:** Adequate financial resources allocated for device procurement, installation, testing, data analysis, and reporting.
- **Technology:** Utilisation of advanced monitoring and analytics technology for data collection, analysis, and performance evaluation.

Risk Management

Identified potential risks and challenges encountered during the PoC program and the mitigation strategies employed:

- **Technical Challenges:** Mitigated through rigorous testing, quality assurance protocols, and collaboration with technology partners.
- **Logistical Constraints:** Addressed through meticulous planning, resource allocation, and contingency measures covering deployment of product, installation staff at 3 points across each client implementation (Install, halfway of monitoring) and post monitoring, retrieval of monitoring equipment and collection of 3rd party data for analysis.
- **Stakeholder Engagement:** Ensured proactive communication, feedback capture, and stakeholder involvement to mitigate misunderstandings and ensure alignment of objectives.
- **Regulatory Compliance:** Adhered to relevant regulations and standards, collaborating with legal and industry authorities to ensure compliance.

CTECK successfully executed the PoC program by effectively managing risks and challenges, achieving its objectives, and laying the groundwork for future commercialisation efforts.

05.

PERFORMANCE METRICS AND EVALUATION

05. PERFORMANCE METRICS AND EVALUATION

The data collection and analysis section provides insights into the performance evaluation of deployed devices and the market analysis conducted during the PoC program. It presents findings related to Environmental impact, Emissions reductions (CO_2), energy savings, adaptability, market demand, Potential ROI for the end-user and customer feedback, supported by quantitative and qualitative data analysis.

Deployment Approach

This PoC initiative aimed to assess the CTECK device's environmental and financial benefits across various applications, including residential homes (large and small), multi-generational living spaces, retail businesses, educational facilities, industrial and manufacturing sites, and hospitality and tourism facilities.

The PoC program was structured to mirror the success of residential and SME solar power installations over the past decade, with the goal of achieving a similar contribution to the reduction of CO_2 emissions. The deployment strategy targeted diverse climatic zones, from Queensland's Southeast corner to the Far North tropics, ensuring comprehensive testing of the device's efficacy in both temperate and tropical environments.

CTECK partnered with facility owners, tenants, facilities managers, and electrical and air conditioning service providers to tailor installations to specific site requirements and ensure seamless integration. This collaborative approach facilitated the management of different installation environments.

Implementation involved several phases: planning and preparation, actual installation, and subsequent monitoring and evaluation. Each phase was designed to minimise disruption, adhere to local regulations, and gather robust data on energy consumption and savings. Continuous monitoring allowed for real-time assessment of the device's performance across various environments and usage patterns, providing a solid foundation for analysing both environmental impact and cost savings. Additionally, CTECK focused on reducing barriers to market adoption by presenting independent evidence of the device's success across various market sectors and usage applications.

The outcomes of the PoC program included significant energy savings, lower electricity bills for users, and reduced carbon emissions, contributing to broader sustainability goals. By thoroughly evaluating the device's performance in a wide range of applications and climatic conditions, CTECK demonstrated the scalability potential of its technology, positioning it for broader adoption across Queensland and beyond. This strategic approach ensured that stakeholders had access to credible, independent data, bolstering confidence in the device's benefits and facilitating wider market acceptance, ultimately reflecting CTECK's potential to achieve significant CO_2 emission reductions similar to those accomplished by solar power installations.

Data Collection Methods

• Data Collection Methods: The PoC program employed meticulous data collection methods to evaluate the performance of CTECK's Air Conditioning Energy Savings Device. Independent data capture technologies were installed during setup to monitor and record real-time performance statistics. Independent energy consumption meters (Wattwatchers provided by Evergreen Power Solutions) were precisely calibrated to measure the air conditioning units' energy usage. These meters provided continuous data on energy consumption, enabling accurate analysis of the device's impact on energy savings.

As part of a strategic approach to data collection, independent data loggers were used to capture internal space conditions serviced by the optimised air conditioning units. These loggers recorded crucial parameters such as temperature and humidity, providing a detailed understanding of the indoor environment's response to the device. The data loggers ensured that variations in internal conditions were accurately documented, which was essential for evaluating the effectiveness of the CTECK device in maintaining optimal indoor climates while reducing energy consumption.

The independent engineer overseeing the project comprehensively analysed the device's performance. By accessing real-time and historical performance data, the engineer could evaluate how external factors such as temperature and humidity influenced the device's efficiency. These tools were deployed at installation and retrieved after the monitoring and verification (M&V) phase, ensuring a thorough and reliable assessment of the device's capabilities.

During the Proof of Concept (PoC) program, several key performance indicators (KPIs) were measured to evaluate the effectiveness of the CTECK Air Conditioning Energy Savings Device. These KPIs included the energy consumed by the air conditioning systems, recorded in kilowatt-hours (kWh), which provided a direct measure of energy savings. Internal temperature, measured in degrees Celsius (°C), and internal humidity of the serviced spaces were also tracked to assess the device's ability to maintain comfortable indoor conditions. Additionally, the program measured the CO2 carbon emissions the air conditioning units produced to evaluate the environmental impact. External temperature and humidity were monitored to understand their influence on the air conditioning unit's operation and overall performance. These comprehensive KPIs ensured a detailed analysis of the energy efficiency and environmental benefits of the CTECK device.

Data Analysis and Interpretation

Presents a detailed analysis of the collected data, including statistical analysis and trend identification.

- The Data collected was to identify the Power Consumed with and without the CTECK system operating in 7-day blocks along with ambient conditions and other factors that affect the operation and energy consumption of air conditioning systems and determine the power and GHG reductions by the CTECK systems.
- Power metering:
  - The power metering Platform we used is a bespoke platform developed by Evergreen Power Solutions (Evergreen) using Wattwatchers power meters with all the data being held within the Evergreen cloud.
    - In addition to the base kW, kWh, kVa, Power factor, Current and Voltage, which is measured in real time, the Evergreen platform has been set up to simultaneously monitor and measure:
      - Ambient temperature
      - Humidity
      - Dew Point
      - Cooling Degree Day value
      - kWh Per Cooling Degree Day
      - Green House Gas Emissions
- The Graph below is a typical sample of the User Interface of the Monitoring and Metering Platform.
    - Reports are generated when all of the parameters are selected and a table as per below is generated for the independent Engineer (HVAC Alliance) to decipher the data and make reports accordingly

PoC-BWS Manly QLD - AC1											
Data from: 15 Apr 2024, 00:00 to: 25 Apr 2024, 00:00											
ALL energy readings in kW											
Date:	pF	vRMSMax	iRMSMax	temperature	humidity	dew point	CDD	kWh	cost	GHG	kWh/CDD
15 Apr 2024, 00:00:00	0	0	0	21.85	0.76	17.31	16.83	0	0	0	0
16 Apr 2024, 00:00:00	0.98	243.4	11.185	22.13	0.78	17.84	17.27	12.15216	3.1595616	8.23916448	0.70365721
17 Apr 2024, 00:00:00	0.98	244	7.294	21.93	0.81	18.45	16.55	14.109648	3.66850848	9.56634134	0.85254671
18 Apr 2024, 00:00:00	0.98	243.3	7.23	21.81	0.86	19.44	16.99	13.705824	3.56351424	9.29254867	0.80669947
19 Apr 2024, 00:00:00	0.97	246.2	13.965	21.55	0.78	17.27	16.92	12.292056	3.19593456	8.33401397	0.72648085
20 Apr 2024, 00:00:00	0.96	244	6.017	19.58	0.8	15.96	15.32	9.503976	2.47103376	6.44369573	0.62036397
21 Apr 2024, 00:00:00	0.9	245.5	6.247	18.81	0.91	17.43	13.93	5.505216	1.43135616	3.73253645	0.39520574
22 Apr 2024, 00:00:00	0.92	244.5	6.235	20.56	0.79	16.6	16.2	6.183504	1.60771104	4.19241571	0.38169778
23 Apr 2024, 00:00:00	0.95	245.2	5.558	20.75	0.81	17.13	16.25	8.092896	2.10415296	5.48698349	0.49802437
24 Apr 2024, 00:00:00	0.97	244.3	7.95	20.88	0.8	17.07	16.34	10.753056	2.79579456	7.29057197	0.65808176
25 Apr 2024, 00:00:00	0.95	244.7	15.692	20.66	0.79	16.74	16.17	8.04264	2.0910864	5.45290992	0.49738033

In addition to the above Table and graph HVAC Alliance ratified the ambient conditions from the Australian Bureau of Meteorology against those metered above.

Monitoring and Verification Protocols

The key to all M&V projects is to validate findings in a way that is clear, concise, and easy to understand. Unlike other energy-saving technologies in lighting and solar, air conditioning is not as linear. Factors such as indoor and outdoor temperatures, humidity, and the AC system's set point contribute to inconsistencies in before-and-after analysis. The main influencing factors are temperature and humidity fluctuations daily and hour to hour.

The program's methodology involves the Cooling Degree Day (CDD) to kWh factor. Here, energy consumption data is normalised relative to CDD, removing any benefits from ambient condition changes. This approach provides confidence that the energy and environmental savings are due to the technology or activity being tested without external influence.

Proof of Concept (PoC) program for the CTECK Air Conditioning Energy Savings Device adhered to rigorous monitoring and verification protocols to ensure the accuracy and reliability of the performance data. The protocols were aligned with the International Performance Measurement and Verification Protocol (IPMVP) Option B (Retrofit Isolation) standards. This alignment ensures that energy savings are evaluated with the highest integrity and precision.

Option B Standards: Option B, as outlined by the IPMVP, mandates that all parameters associated with the energy conservation measure must be directly measured rather than estimated. This includes critical factors such as the power drawn by the air conditioning systems and the hours of operation. By measuring these parameters directly, the PoC program produced highly accurate and credible energy consumption and savings data.

Key Measurements Under Option B:

- Power Drawn: This involves the continuous measurement of the electrical power consumed by the air conditioning units. Using precise energy consumption meters like Wattwatchers, the program captured real-time data on the power usage, ensuring that any reductions in energy consumption due to the CTECK device were accurately recorded.
- Hours of Operation: The program also tracked the operational hours of the air conditioning units. This measurement was essential to distinguish between energy savings achieved through reduced power draw and those resulting from decreased operational time.

Following IPMVP Option B standards, the PoC program ensured that the energy savings attributed to the CTECK device were verifiable and based on actual measured data. This approach eliminated the uncertainties associated with estimated values, providing a robust and defensible evaluation of the device's performance. The adherence to these protocols facilitated a transparent and reliable assessment, enhancing the credibility of the results and supporting the case for broader adoption of the CTECK technology.

Independent Engineers

The monitoring and verification processes were further strengthened by the involvement of independent engineers from HVAC Alliance, a boutique engineering consultancy specializing in air conditioning design and reporting. HVAC Alliance undertook the critical task of reporting on and verifying the individual results from the monitoring and metering data platforms identified for the 60 systems. Their expertise ensured that the performance data was thoroughly analyzed and accurately interpreted.

The independent engineers were entrusted with capturing and verifying data related to the performance and energy savings achieved by the deployed devices. They utilized a range of data capture tools, including energy consumption meters and data loggers for internal temperature and humidity. The program ensured that the evaluation was unbiased and credible by having independent engineers oversee the data collection and analysis. The engineers had the advantage of accessing both real-time and historical performance data, enabling them to conduct comprehensive analyses and validate the effectiveness of the CTECK device.

Verification Process

This section outlines the rigorous verification process conducted by independent engineers to ensure the accuracy and reliability of the data captured

- In addition to the automated processes and data derived from the metering systems, verification processes were implemented to ensure the hours with and without the CTECK systems operating were the same. HVAC Alliance had the task of normalizing these and other differences, a crucial step to ensure all the outliers affecting the energy consumed were equal, thereby maintaining the accuracy of the data
- At several sites, manual operation and adjustments to the air conditioning systems created differing results, which had to be considered when nominating the savings.
- There were occasions when the air conditioning units failed mechanically or control-wise. HVAC Alliance identified this from the metered data, which was used to determine the No Result systems.

06.

KEY FINDINGS AND RESULTS

06. KEY FINDINGS AND RESULTS

The Proof of Concept involved 60 systems throughout Queensland with various air conditioning types, capacities, and operations. Systems were monitored with and without CTECK optimisation activated, providing a baseline "normal" consumption profile and an optimised profile in which CTECK functions to reduce energy consumption.

	% Energy Saved	kWh Saved	Kg/CO_2 Saved	$ Saved
AVERAGE per savings period (6 Days)	29.88	45.12	30.66	$13.99
Per Day		7.52	5.11	$2.33
7 days		52.64	35.77	$16.32

CTECK has exceeded expectations of results with an anticipated 20-25% savings possible, achieving a 29% savings provides a significant opportunity to reduce CO_2 Emissions when deployed at scale through Queensland and beyond.

Results:

- ✓ **Average savings 29%**
- ✓ **Average weekly kwh saved 52.64 kWh**
- ✓ **Average weekly CO_2 Saved 35.77 kg**
- ✓ **Average weekly Dollars Saved $16.32**
- ✓ **Average ROI 2.2 Years**

The air conditioners chosen varied from 3 months to 7 years old and from the smallest 3.5kW high wall split system up to 45kW VRV/F multi-head systems.

We proved that not even identical systems doing the same job and operate in shared or identical areas maintain the same temperature or consume the same amount of energy.

Several systems saved more energy than we thought they should have and some less than we thought they should have. This was relative to the maintenance levels, who was selecting the room temperatures, and the hours operated each day.

It is evident that the different makes and models of air conditioners vary in operation from low load to high load, which is affected by how the air conditioner is installed and operated at the time

The many factors involved in operating air conditioners have made this POC a great success. We have encountered real-life situations that show how diverse the operation of an air conditioner is relative to how and where it is installed.

The fact that we have had the success we have and included the good with the bad shows the versatility of the CTECK solution and its ability to reduce energy and the associated greenhouse gas emissions across the board.

It shows how this LCAP exercise will contribute to the Net Zero programs simply and cost-effectively.

Across the PoC provided many learnings aside from the Validation of the CTECK technology, key findings:

- We learnt that some households and businesses do not operate AC units unless they need to maintain conditions because they fear Energy costs.
- We learnt how different applications use their AC systems, how many hours/days, and how many days/weeks. This unveiled the diverse usage patterns across residential and commercial applications.
- We learnt how unit manufacturers interpret and deploy the DRED interface with many different interface and performance characteristics.

Through our learning, we have understood many different usage profiles and how different people/businesses utilise their AC systems. We have identified that the CTECK devices are certainly a commercially viable solution to reduce energy consumption for the end-user and significantly contribute to reducing carbon emissions.

From what we have learned, we can provide the findings below to highlight the commercial viability of the CTCEK units. From systems that are used minimally (only 12 weeks a year), possibly a few weeks in the height of summer and in the Cold of winter, to applications where systems are used 52 weeks of the year, the table below shows the potential ROI across the range.

Operational % / weeks per year		Unit Cost	kWh Saved	Kg/CO_2 Saved	$ Saved	ROI Years
25% year	13	$900	684	460	$ 212.04	4.2
50% Year	26	$900	1,363	917	$ 422.53	2.1
75% year	39	$900	2,052	1,380	$ 636.12	1.4
year	52	$900	2,737	1,842	$ 735.63	1.2

CTECK understood that the mark of customers looking to reduce energy consumption typically use less than 3 years as a gauge of acceptable return on investment in the commercial setting and as evident in the residential setting homeowners consider ROIs of 4+ years to be acceptable given the acceptance of Residential Solar ROIs.

Potential Impact across QLD

- 80% of QLD homes have 1 AC unit or more
- Average residential electricity cost $0.31 kWh
- Low consumption would be 12 weeks of operation per year

Operational % / weeks per year		Unit Cost	kWh Saved	Kg/CO_2 Saved	$ Saved	ROI Years
23%	12	$900	541.44	367.92	$167.88	5.3

https://www.abs.gov.au/articles/snapshot-qld-2021

With 1.8M+ residential dwellings across QLD, 80% of residential homes have 1 AC unit or more, providing 1.4M+ AC units. Conservatively, CTECK could apply to 60% of the units, which are 860,000+ potential installations.

Providing potential savings of

- ✓ **467,804,160 kWh**
- ✓ **317,882,880 Kg Co2**
- ✓ **$145,019,209 back into homeowners' pockets at $0.31 / kWh**

Providing greater than 0.5% of QLD total emission reduction target for the year 2032

*Unit cost is the average installed unit cost when purchased singularly

Individual savings depend on factors such as operational performance, age, user needs, user education and operational understanding, installation environment, and correct system design/installation.

The table below shows results ranging from Nil savings, where systems suffered operational deficiency & from poor mechanical performance to 50%+ and higher, where systems were oversized and poorly designed. CTEK provides an avenue to reduce unnecessary operation of such systems.

CTECK - LCAP RESULT SUMMARY								
Site	Location	Make	Type	Capacity kW	kWh/CDD Result %	kWh Reduction	kg GHG Reduction	Cost $ Reduction
Keirnan Street	Residential	Haier	Ducted	15.50	21.9	57.46	39.07	17.81
Benelong Street	Residential	Daikin VRV	Ducted VRV	24.00	30.2	112.25	76.1	34.80
Boundary Road	Residential	Fujitsu	Ducted	15.00	26.9	87.1	59.1	27.00
Mueller College Test 1	D11 N	Mitsubishi Electric	High Wall	7.10	49.57	10.57	7.15	3.28
Mueller College Test 1	D11 S	Mitsubishi Electric	High Wall	7.10	70.56	14.63	9.98	4.54
Mueller College Test 1	D12 N	Mitsubishi Electric	High Wall	7.10	57.91	13.4	9.92	4.15
Mueller College Test 1	D12 S	Mitsubishi Electric	High Wall	7.10	77.7	10.83	7.38	3.36
Mueller College Test 1	D13 N	Mitsubishi Electric	High Wall	7.10	55.26	7.05	4.77	2.19
Mueller College Test 1	D13 S	Mitsubishi Electric	High Wall	7.10	47.97	10.25	6.99	3.18
Mueller College	H204 N	Mitsubishi Electric	High Wall	7.10	21.64	13.64	9.22	4.23
Mueller College	H204 S	Mitsubishi Electric	High Wall	7.10	22.62	9.02	6.12	2.80
Mueller College	H203	Mitsubishi Electric	Ducted	16.50	23.96	46.56	31.56	14.43
Mueller College Test 1	Tuck Shop	Mitsubishi Electric	Ducted	14.00	2.47	15.06	10.21	4.67
Komatsu	AC7	Daikin	Ducted	12.50	10.00	47.00	32.10	14.57
Komatsu	AC7	Daikin	Ducted	15.5	25.00	93.00	63.80	28.83
Komatsu	AC10	Daikin	Ducted	12.50	17.00	45.65	30.95	14.15
Transurban	AC3	Mitsubishi Electric	High Wall	10.00	16.8	0.58	0.39	0.18
Oonoonba Hotel Townsville	AC1	Panasonic	High Wall	7.00	15.60	9.99	6.8	3.10
Oonoonba Hotel Townsville	AC2	Panasonic	High Wall	7.00	No Result			0.00
Grosvener Banyo Office	AC1	Mitsubishi Electric	High Wall	7.80	23.71	8.46	5.77	2.62
Mossman Gorge Accomodation	AC3	Mitsubishi Electric VRF	Cassette	22.00	13.40	16.00	10.92	4.96
Ozcare Kitty Hawke Drive	ACU2	Daikin VRV	Cassette	18.00	30.90	37.11	25.31	11.50
Mossman Gorge Accomodation	AC1	Mitsubishi Electric VRF	Cassette	22.00	23.59	109.00	74.33	33.79
Mossman Gorge Accomodation	AC2	Mitsubishi Electric VRF	Cassette	22.00	21.08	75.26	51.32	23.33
Lucinda Big 4 Cabin Accomodation	AC1	Mitsubishi Heavy Ind	High Wall	3.50	30.65	11.99	8.13	3.72
Lucinda Big 4 Cabin Accomodation	AC14	Mitsubishi Heavy Ind	High Wall	3.50	34.43	16.55	11.18	5.13
Lucinda Big 4 Cabin Accomodation	AC3	Mitsubishi Heavy Ind	High Wall	3.50	26.28	12.39	8.4	3.84
Lucinda Big 4 Cabin Accomodation	AC4	Mitsubishi Heavy Ind	High Wall	3.50	32.36	13.93	9.5	4.32
Lucinda Big 4 Cabin Accomodation	AC5	Mitsubishi Heavy Ind	High Wall	3.50	35.21	15.74	10.73	4.88
Lucinda Big 4 Cabin Accomodation	AC6	Mitsubishi Heavy Ind	High Wall	3.50	No Result			0.00
Wildlife Habitat Port Douglas	Kitchen	Daikin	Under Ceiling	8.50	32.65	49.88	33.8	15.46
Oaks Apartments Felix Street	Level 23	Mitsubishi Electric Multi	High Wall	5.00	24.12	76.34	51.76	23.67
Oaks Apartments Margaret Street	Level 21	Mitsubishi Electric	High Wall	3.50	43.55	37.56	25.47	11.64
Blygold Office Yatalla	SME	Daikin	Ducted VRV	15.00	20.05	47.84	32.44	14.83
Mueller College Test 2	D11 N	Mitsubishi Electric	High Wall	7.10	20.26	8.02	5.44	2.49
Mueller College Test 2	Tuck Shop	Mitsubishi Electric	Ducted	14.00	34.28	31.21	21.16	9.68
Mueller College Test 2	D11 S	Mitsubishi Electric	High Wall	7.10	8.03	3.71	2.51	1.15
Mueller College Test 2	D12 N	Mitsubishi Electric	High Wall	7.10	12.3	5.13	3.48	1.59
Mueller College Test 2	D12 S	Mitsubishi Electric	High Wall	7.10	21.94	8.2	5.5	2.54
Mueller College Test 2	D13 N	Mitsubishi Electric	High Wall	7.10	23.16	6.93	4.7	2.15
Mueller College Test 2	D13 S	Mitsubishi Electric	High Wall	7.10	22.13	9.77	6.63	3.03
Canterbury College	Q01	Daikin VRV	Ducted VRV	25.00	22.89	55.05	37.32	17.07
Canterbury College	D01	Daikin VRV	Multi Head	12.00	29.5	12.45	8.44	3.86
Canterbury College	DO2	Daikin VRV	Multi Head	12.00	58.46	35.18	23.85	10.91
Canterbury College	DO3	Daikin VRV	Multi Head	12.00	27.87	7.89	5.35	2.45
Canterbury College	DO4	Daikin VRV	Multi Head	12.00	34.89	13.58	9.88	4.21
Canterbury College	Q02	Daikin VRV	Ducted VRV	25.00	No Result			0.00
REA Solar Anytime Fitness Newfarm	Level 1	Mitsubishi Electric VRF	VRF Cassette	33.50	36.42	416.00	282.00	128.96
REA Solar Anytime Fitness Newfarm	Level 2	Mitsubishi Electric VRF	VRF Cassette	33.50	41.41	517.00	350.80	160.27
PTP Finance Cleveland Office	SME	Panasonic	Ducted	10.00	25.99	15.77	10.69	4.89
Griffith Uni Nathan- N24 Admin Building	1.1 Front	Mitsubishi Electric	Cassette	5.00	No Result			0.00
Griffith Uni Nathan- N24 Admin Building	Front Office	Fijitsu	Cassette	7.00	18.6	31.62	21.44	9.80
Griffith Uni Nathan- N24 Admin Building	Back Office	Fijitsu	Cassette	7.00	39.28	21.00	14.23	6.51
BWS Manly	AC1	Samsung	Cassette	14.00	29.21	26.34	17.86	8.17
BWS Manly	AC2	Samsung	Cassette	14.00	18.93	11.90	8.07	3.69
BWS Manly	AC3	Samsung	Cassette	14.00	16.72	12.96	8.78	4.02
Granny Flat	Residential	Mitsubishi Electric	Ducted	5.00	26.75	9.35	6.34	2.90
Komatsu	AC1	Daikin VRV	Cassette VRV	15.00	No Result			0.00
Komatsu	AC2	Daikin VRV	Cassette VRV	15.00	No Result			0.00
Griffith Uni Gold Coast Gym	AC1	Daikin VRV	Casette		No Result			0.00
					Total	2,391.15	1,625.14	741.26
						2.39MWh	1.625 Ton	$ 741.26

We are pleased to present the official validation report regarding the application of CTECK technology across 60 installations.

CTECK successfully validated the application of its technology to Small and Medium Enterprise (SME) style air conditioning (AC) systems with Demand Response Enabling Device (DRED) interface options. The validation process encompassed testing operations across various sizes, styles, and functionalities of AC systems in diverse climate zones and usage scenarios, including residential homes, corporate offices, retail facilities, hospitality venues, schools, and universities.

Through rigorous testing and evaluation, we have achieved significant milestones in validation, learning, and research and development, which lay a strong foundation for the potential growth of the technology and its applications.

Our primary goal was to establish the viability of the technology in commercial settings, with an anticipated 20% (±) savings based on early-stage research and development projections. We are delighted to announce that the average savings achieved surpassed expectations, reaching an average of 29.32% kWh/CDD across all systems. .

This achievement resulted in an actual reduction of 2.39 MWh of energy consumption across 52 systems, leading to a substantial decrease of 1.625 Tons in greenhouse gas emissions, exceeding the projected Proof of Concept (POC) results. *Note the average CTECK operation time was 6 days.*

rom our comprehensive learnings, we can confidently assess an average energy saving of 29.32% for compatible AC systems in operation. This translates to return on investments (ROIs) ranging from 12 to 36+ months, contingent upon usage patterns and air conditioning capacity.

Customers realised average savings of $13.99 per AC unit over a 6-day operational period. In a commercial SME setting where units operate 70%+ of the year, potential annual savings could amount to $800+ per unit, with an ROI of less than 24 months (based on an average energy cost of $0.31 per kWh).

In residential settings, the savings are directly correlated with consumer usage patterns. CTECK's technology significantly reduces consumers' living costs by optimising AC usage to achieve desirable living conditions.

Throughout our validation process, we encountered applications that exceeded our expectations and instances where outcomes were not viable. We observed cases where AC systems failed or broke down during monitoring, highlighting the importance of robust technology and maintenance practices.

Our findings also revealed a lack of understanding among business owners regarding the actual cost of ownership and maintenance of AC systems. Many businesses operated decentralised systems without comprehensive asset data or maintenance strategies, resulting in excessive energy consumption and operational costs.

CTECK's collaboration with onsite HVAC service providers has had a significant impact in adjusting operational practices and educating stakeholders on optimising AC systems for energy efficiency and cost savings. By fostering collaboration and knowledge-sharing, we aim to transform AC systems from mere cost centres to valuable assets.

CTECK's technology has delivered tangible results, demonstrating significant energy savings and emission reductions. This success reaffirms its potential to revolutionise the HVAC industry. Our commitment to innovation and excellence remains steadfast as we advance sustainable solutions for a greener future. .

Project Findings & Results

CTECK POC partners include.

- Muller Collage Stage 1 (Brisbane Nth)
- Muller Collage Stage 2 (Brisbane Nth)
- Komatsu (Brisbane West)
- Transurban (Brisbane Metro)
- Oonoonba Hotel (Townsville)
- Grosvenor Engineering Office (Banyo)
- Mossman Gorge (far Noth QLD)
- Ozcare Brisbane Metro)
- Big4 Holiday Park Lucinda (Nth QLD)
- Port Douglas Wildlife Habitat (Far Nth QLD)
- Canterbury College (Sth Brisbane/ Logan)
- REA Solar & ANYTIME Fitness (Brisbane Metro)
- BWS (Brisbane East)
- Griffith University (Brisbane & Gold Coast)
- Point to Point Finance (Cleveland)
- OAKS hotel 2 sites (Brisbane Metro)
- Blygold (Gold Coast)
- Residential House (Redland Bay)
- Residential House (Metro Brisbane)
- Residential House (Nth Brisbane)
- Granny Flat (Redland Bay)

Coolmaster GoodEarth GROUP Mueller College KOMATSU

Transurban NRMA Parks + Resorts OONOONBA HOTEL MOTEL THOMPSON COOLING PTY LTD AIR CONDITIONING SPECIALISTS

GROSVENOR engineering group BIG4 HOLIDAY PARKS Canterbury Wildlife habitat port douglas Ozcare

REA SOLAR™ ANYTIME FITNESS BWS Griffith UNIVERSITY Queensland, Australia

Electric FEVER electrical & air conditioning BHElectrics SAFETY - INTEGRITY - EFFICIENCY HAMPSHIRE PROPERTY GROUP OAKS HOTELS & RESORTS POINT TO POINT FINANCE

Net Zero CARBON & ENERGY A.G.Coombs Blygold CORROSION PROTECTION

07.
CASE STUDIES

SITE INSTALLATION 1 : KIENAN STREET

The site, located in the Redland Bay area of Queensland, is a large private residence. It's a 2-level multi-generational home, chosen specifically to represent a larger consumer / residential setting, making it an ideal location for our energy efficiency project. Benelong Street is a multi-level residence located in the inner western suburbs of Brisbane.

- ✓ **Savings Achieved a 21.9% reduction in kWr**
- ✓ **57.64 kWh over seven days**
- ✓ **39.07 kg CO_2 in carbon dioxide emissions.**
- ✓ **$17.86 Saved (Testing period)**
- ✓ **$321.48 annual saving**
- ✓ **2.8 years ROI**

- The house has a Haier 15.5kW ducted air conditioning system with Haier zone damper controls, eight zones consisting of Bedrooms and living spaces. The Haier system is two years old and has had no operational issues. The system is DRED compatible and requires an interface card to be supplied by HAIER; the card is readily available and costs an additional $40, bringing the total installed cost to $924.00 (Inc GST).
- The home is 20+ years old and combined Brick and FC cladding to the exterior walls with Tin roof and roof blanket insulation. The house is in Southeast QLD, approximately 200m from southern Moreton Bay.
- The system ran 24/7 during the testing, reflecting the owner's standard functionality across the summer period. The owner used the systems 24/7 from early November to late February (accounting for 10-12 weeks) and similar in Winter through June and July (accounting for some 6-8 weeks of operation). The Average operation per year across cooling and heating applications is 18 weeks.

- During the testing period, the house was undergoing significant renovations, and periods with the roof open (a new roof was being fitted) in summer conditions put the air conditioning system under maximum load.
- The system was installed within 45 minutes by a local Air-conditioning contractor with Support from the CTECK engineering team.
- The property occupants did not report any system functionality or performance change over the testing period, and internal conditions remained comfortable.

SITE INSTALLATION 2 : BENELONG STREET

The site is a two-story residence in Brisbane's inner western suburbs. The house was chosen to represent a medium consumer / residential setting. The home is constructed using external cladding to the walls and a flat metal roof.

- ✓ **Savings Achieved a 30.2% reduction in kWr**
- ✓ **112.25 kWh over seven days**
- ✓ **76.1 kg CO_2 in carbon dioxide emissions.**
- ✓ **$34.70 Saved (Testing period)**
- ✓ **$485.8 annual saving**
- ✓ **2.1 years ROI**

- The house has a Daikin VRV ducted air conditioning system with My Air controls. This has been a very common installation combination in the past 5+ years, with many new construction homes opting for this type of system. The MyAir control system offers a high-level of zone control to different parts of the house, enabling more efficient operation in achieving differing desired conditions within multiple spaces for the home.
- The Daikin system is two years old and has had no operational issues. The system is DRED compatible and requires an interface card to be supplied by Daikin; the card is readily available and costs an additional $180, bringing the total installed cost to $1,064.00 (Inc GST).
- The system ran 24/7 during the testing, reflecting the owner's standard functionality across the summer period. The owner used the systems 24/7 from late November to late February (accounting for eight weeks) and similar in Winter through June and July (accounting for some six weeks of operation). The Average operation per year across cooling and heating applications is 14 weeks.
- This result highlights the effect of the CTECK unit operating in conjunction with a well-known high-end control system .
- $0.31 per / kWh cost of energy

SITE INSTALLATION 3 : BOUNDARY ROAD

The site is a single-level residence/business in the outer northern suburbs of Brisbane; it was chosen to represent a medium-sized residential application.

- ✓ **Savings Achieved a 30.2% reduction in kWr**
- ✓ **87.1 kWh over seven days**
- ✓ **60.0 kg CO_2 in carbon dioxide emissions.**
- ✓ **$27.00 Saved (Testing period)**
- ✓ **$810.00 annual saving**
- ✓ **1 year ROI**

- The house has a Fujitsu ducted air conditioning system with My Air controls. This has been a very common installation combination in the past 5+ years, with many new construction homes opting for this type of system. The MyAir control system offers a high-level of zone control to different parts of the house, enabling more efficient operation in achieving differing desired conditions within multiple spaces for the home.
- The system ran 24/7 during the testing, reflecting the owner's standard functionality across the summer period. The owner used the systems 24/7 from late September to late February (accounting for 18-20 weeks) and similar in Winter through May to July (accounting for some 10-12 weeks of operation). The Average operation per year across cooling and heating applications is 30 weeks. The property owners are electrical contractors and operate an office from home.
- The Fujitsu system is two years old and has had no operational issues. It is DRED compatible and requires an interface card to be supplied by Fujitsu; the card is readily available and costs an additional $90.00, bringing the total installed cost to $975.00 (Inc GST).

- The residence has an extensive solar system fitted, and the energy reduction from the CTECK system reduced the load on the battery system and made more feed-in tariff available.
- The home is sun five years old and combined. Brick the exterior walls with Tin roof and roof blanket insulation. The home is a modern construction and offers very good insulation properties. The house is in Southeast QLD,
- This result highlights the effect of the CTECK unit operating with a well-known high-end control system and still providing a 26.9% kWh/CDD saving, measured over a week-on/week-off comparison test.
- Energy costs $0.31 per / kWh

SITE INSTALLATION 4 : MUELLER COLLEGE

The site is a ministry of Mueller Community Church. The College was established in 1990 as a Christian, co-educational day school. Mueller caters to students from Christian and non-Christian backgrounds, with a total enrolment of approximately 1800 students from Prep to Year 12.

- ✓ **Average Savings Achieved a 31.6% reduction in kWr**
- ✓ **Average kWh savings over five days was 16.67kWh (Per unit) 150kWh per week over 9 units.**
- ✓ **11.22 kg CO_2 in carbon dioxide emissions average over five days (per unit) 100.95 kgco2 over 9 units**
- ✓ **$46.50 Saved (Testing period five days)**
- ✓ **$1,767.00 annual saving based on 38 weeks of operation.**
- ✓ **3.8-year ROI**

- The school has a vast array of air conditioning systems. Electric Fever, the school's air conditioning maintenance contractor, selected ten systems to install the CTECK units onto for the Proof of Concept.
- Eight units were high wall split systems, and two were ducted. All units are Mitsubishi Electric.
- These units underwent two tests, one winter and one summer, to witness the difference in operation and the effect of the CTECK unit in the different climates.

  i. The average savings for ten units during winter testing was 42.9%. This high result coincides with the compressors' higher cycling under low load in winter. The average kWh reduction in the 5-day operating period was 7.24kWh and 4.91kgCO2 in Carbon Dioxide emissions.

  ii. The average savings during the summer testing for seven units was 20.3%. The average kWh reduction in the 5-day operating period was 9.15kWh and 6.20kgCO2 in Carbon Dioxide emissions.

  iii. The above results clearly show that whilst very high kWh/CDD percentages are achieved during the winter period, the actual kWh reduction during the higher load summer period provided higher kWh reductions.

- While the air conditioning systems were timeclock controlled, temperature selection was carried out by the different staff occupying the rooms. This provided a diverse and varying range of air conditioning operations, making it a further challenge for the CTECK units to reduce energy, which they did.
- The buildings combined older brick cladding with a tin roof and newer Brick / FC cladding with a tin roof.
- The school AC operates an average of 8:30 – 3:00, Monday through Friday (5 days), 38 weeks per year.
- The Mitsubishi units were DRED enabled and did not require an additional interface card, allowing simpler installation with multiple units. The speed of deployment was reduced, allowing the units to be installed for $750 each, a $6,750 project.
- $0.31 per/kWh Cost

SITE INSTALLATION 5 : KOMATSU (STAGE 1)

Coolmaster – Air Conditioning Brisbane & Gold CoastThe site is the Administration and assembly plant for the Komatsu large machinery plant in Wacol, located in the western suburbs of Brisbane; the site was chosen to represent light industrial applications.

Komatsu Australia provides essential equipment, technologies and services to the construction, mining, energy, government, waste, and quarry industries. Our purpose is to create value through manufacturing and technology innovation to empower a sustainable future where people, businesses and our planet thrive together.

- ✓ **Average Savings Achieved a 17.3% reduction in kWr**
- ✓ **185.63kWh over the testing period**
- ✓ **124.94 kg CO_2 in carbon dioxide emissions over the testing period**
- ✓ **$57.54 Saved (Testing period seven days)**
- ✓ **$2,992.35 annual saving**
- ✓ **1-year ROI**

- The air conditioning maintenance contractor (Coolmaster) selected two Daikin ducted air conditioning systems. One was in a conference room, and the other was in an open office.
- Both systems ran 24/7 throughout the testing. We could not run two tests on AC10 because the CTECK was inadvertently isolated during the first week of the CTECK On period. This was identified through the Evergreen metering system, which allowed us turn the CTECK unit on for the second week.
- The installation required the addition of 2 Daikin interface cards at a cost of $120 each. The electrical contractors completed the overall installation efficiently within 5 hours. This included signing into the site and being escorted to the roof, where the condensers were located.

- The installation required external DRED interface cards to be installed.
- Project installation value $3,200
- Although the air conditioning systems had the same capacity, their operation and energy consumption differed.
- The above results show that while percentage savings are a standard benchmark, actual kWh savings greatly vary depending on Setpoint, area usage, occupancy levels, and building insulation.
- $0.31 Per / kWh energy costs

SITE INSTALLATION 6 : TRANSURBAN

Image result for transurban logoTransurban is a road operator that manages and develops urban toll road networks in Australia, Canada, and the United States. It is listed on the Australian Securities Exchange (ASX) and is the world's largest toll road operator. Within Australia, Transurban is the full owner of CityLink in Melbourne and currently has stakes in six tolled motorways in Sydney and six tolled motorways in Brisbane.

Transurban selected an equipment room on a site in Heathwood, south-western Brisbane. The Switch room houses electronics and hardware that monitor the toll point at Heathwood along the Logan Motorway.

- ✓ **Average Savings Achieved 16.8% reduction in kWr**
- ✓ **0.58kWh over the testing period**
- ✓ **0.39 kg CO_2 in carbon dioxide emissions over the testing period**
- ✓ **$0.17 Saved (Testing period)**
- ✓ **$8.80 annual saving**
- ✓ **Not commercially viable**

  - The CTECK unit was installed on a Mitsubishi Electric high-wall split unit in the room.
  - For the week of testing with the CTECK system operating, the average daily temperature was 2.0^{0}C higher than the week of testing without the CTECK unit operating; the higher temperature created a higher load on the air conditioner. Without the CTECK unit operating, the kWh (Energy consumed to maintain temperature) would have increased considerably; however, in this case, the kWh was reduced by 0.58kWh, showing that in this case, instead of reducing consumption week on week, the CTECK prevented increased consumption.

  - The air conditioning unit runs 24/7 in this room.
  - The room in the middle of the building is very well insulated. The building is brick construction with a tin roof.
  - The units selected had the DRED interface onboard and did not require any additional interface cards, allowing for a quick/efficient installation with a project value of $900.00
  - This was a good test for the CTECK unit as there is a high constant load.
  - This case highlights the Cooling Degree Day (CDD) calculation. Normalising the effect of the higher ambient temperature identified an actual energy and CO2 reduction of 16.8%.

SITE INSTALLATION 7 : OONOONBA HOTEL, TOWNSVILLE

This site is an older hotel. Oonoonba is a suburb of Townsville, approximately 5.8 kilometres (3.6 miles) south of the Townsville central business district. Townsville, in northern QLD, the Oonoonba Hotel is a local landmark established in 1963. It sits on a large 3,739 square meter corner block with double street frontage.

The hotel is part of Liquor Marketing Group, LMG is Australia's largest membership-owned retail liquor group, proudly representing over 1,400 independent liquor stores. LMG is currently working with the Good Earth Group to understand current and future Energy savings measures that may apply to its portfolio of members; Good Earth Group is, in turn, working closely with CTECK across several projects focused on HVAC / Air conditioning efficiency.

- ✓ **Savings Achieved 15.4% reduction in kWr**
- ✓ **9.99 kWh over the testing period**
- ✓ **6.8 kg CO_2 in carbon dioxide emissions over the testing period**
- ✓ **$3.10 over the savings period**
- ✓ **$161.00 Annual savings**
- ✓ **5.5 Year ROI**

- The building is a typical older style construction and has undergone many renovations, extensions and revamps over time; it is evident that little thought has been given to the practical design of the Air conditioning system
- The air conditioning maintenance contractor (Van Erde Airconditioning and Refrigeration) selected two Panasonic high-wall split air conditioning units to serve the dining area for the CTECK units.
- The Panasonic Units are DRED enabled and require an additional interface card fitting, which costs $60 per card and is available from Panasonic directly.
- Project cost $900.00 per unit (ROI on 1 unit)
- The air conditioners run for different times each day depending on patronage and are manually operated by the duty manager.
- One of the air conditioners (AC2) had mechanical issues during the testing period and was a No Result
- Energy Costs $0.31 per kWh

GROSVENOR]
engineering group
innovative | intelligent | sustainable

SITE INSTALLATION 8 : GROSVENOR ENGINEERING, BANYO OFFICE

Banyo Office, Grosvenor, re a trusted building services partner to leading property portfolios across ANZ, passionate about delivering outcomes and long-term value for building owners, managers and their occupants.

With 20 branches across Australia and New Zealand, our clients are supported by over 800 employees, including specialist engineers, technicians, project managers, estimators, site personnel, and service specialists.

This branch operates out of Commercial premises in Banyo an outer northern suburb of Brisbane, located near the Brisbane Airport.

The facility has an open plan for the main Administration office.

- ✓ **Savings Achieved 23.7% reduction in kWr**
- ✓ **8.46 kWh over the testing period**
- ✓ **7.73 kg CO_2 in carbon dioxide emissions over the testing period**
- ✓ **$2.60 Saved (Testing period)**
- ✓ **$136.00 Annual savings**
- ✓ **5.5 Year ROI**

- Grosvenor selected one of the Mitsubishi Electric high walls split air conditioners for testing.
- The unit has the DRED interface onboard and does not require an additional interface card.
- The installation was efficient and had a total project cost of $750.00.
- The air conditioning operates five days per week between 8 to 11 hours per day.
- This unit was one of 3 air conditioners in the open area, and the CTECK unit produced an excellent result.

SITE INSTALLATION 9 : OZCARE KITTYHAWK DRIVE, CHERMSIDE

Ozcare supports Queenslanders with aged care, retirement living, hospital, disability care, respite care, nursing, allied health, and dementia advisory and support services.

The site: Kittyhawk Drive Chermside; the building is a multi-level building and is a significant administration hub for Ozcare in the north Brisbane region.

- ✓ **Savings Achieved a 30.9% reduction in kWr**
- ✓ **37.11 kWh over the testing period**
- ✓ **25.163 kg CO_2 in carbon dioxide emissions over the testing period**
- ✓ **$11.50 Saved (Testing period)**
- ✓ **$598.00 Annual savings**
- ✓ **2.1 Year ROI**

- The Air conditioning Contractor, Thompson Cooling, selected testing to be carried out on the system serving the ground-floor training/break room, which runs 24/7.
- The more extensive Daikin VRF system has multiple cassettes throughout the training area.
- The building is a relatively new construction of a multi-story cement block with the area serviced well-insulated from external conditions; the room had a glass wall across one side.
- The system tested was a single Daikin Split ducted Unit.
- The unit required an additional DRED interface Card to be installed.
- Due to the location of the AC condenser, an additional enclosure was required, which increased the time required and the extra costs.
- The installation was approx. $1,280.00.
- This test yielded exceptional savings over the trial period. The client was recommended to reduce the systems' operation to 10 hours daily, five days weekly.

SITE INSTALLATION 10 : MOSSMAN GORGE CULTURAL CENTRE ACCOMMODATION

The Mossman Gorge Cultural Centre is an award-winning ecotourism destination that welcomes 370,000 visitors annually and employs 90 people from May through September, with a 90% Indigenous workforce. But a few decades ago, the Centre was still the dream of Kuku Yalanji elder Roy Gibson. Roy's dream became a reality with the support and funding from the Indigenous Land and Sea Corporation (ILSC). Now, the Centre supports environmental and economic well-being for the entire community.

Mossman Gorge Cultural Centre offers visitors a unique mix of cultural, historical, and environmental experiences. In addition to welcoming guests to the world's oldest continually surviving rainforest, the centre provides a valuable connection to the Indigenous community and protects a vulnerable ecosystem.

- ✓ **Savings Achieved 19.36% kWr**
- ✓ **197.0kWh over the testing period**
- ✓ **132.58 kg CO_2 in carbon dioxide emissions over the testing period**
- ✓ **$61.07Saved (Testing period)**
- ✓ **$3,175.64 Annual savings**
- ✓ **1.16 Year ROI**

- Mossman Gorge is in Queensland, Australia, located approximately 77 km north of Cairns, 20 km north of Port Douglas, and approximately 2 km from the tiny township of Mossman. Mossman is one of the most remote townships still connected to QLD's main supply electrical grid. Due to its remoteness and being at the "end of the Grind," the region often suffers from power stability/ supply issues and can be limited in the demand capacity available.
- The MGCC site is Approximately 12 years old and constructed of a cement block and FC sheeting mix. The units are approximately 5 years old; the site Electrical Contractor, BD Electrical (Port Douglas), selected testing to be carried out on 1 unit serving Block A and two units serving Block B accommodation blocks. These units operate 24/7.

- The air conditioning systems are larger Mitsubishi Electric VRV units with multiple cassette units throughout the sleeping quarters and standard rooms.
- The units selected required the installation of an additional DRED interface card and are some of the larger units tested across the PoC; this is also a challenge, given the known power supply/stability issues.
- Due to the installation's complexity and the site's remoteness, the project costs were approx. $3,700.00.
- Energy costs $0.31 per / kWh

SITE INSTALLATION 11 : BIG 4 CARAVAN PARK LUCINDA

The Big 4 Caravan Park is part of the Hampshire Property Group. It is in tropical Northern QLD opposite the tip of World Heritage-listed Hinchinbrook Island, approximately 140km north of Townsville. The park is bounded by the Herbert River and Hinchinbrook Brook channel flowing into the Coral Sea.

The property is part of the Hampshire Property Group. This family-owned Australian business operates a growing portfolio of over 50 land lease communities, holiday parks, and mixed-use caravan parks.

The Lucinda holiday park offers 150 accommodation buildings, ranging from studio-style bungalows to Family cabins / Huts; the facility was chosen as the accommodation option to represent small room/site applications in the hotel/accommodation sector and mirror applications in the Low-income housing market.

During the site assessment, CTECK identified that the units onsite were the samlet units compatible with the technology; it was also identified that the units were only functioning intermittently, knowing that the outcome of a commercially viable financial return was unlikely CETCK and the client agreed to proceed with the installation to help CTECK understand any potential technology developments that may assist future applications such as this site as well as learning how the occupiers of these types of facilities utilise systems

- ✓ **Average Savings Achieved a 31.78% in kWr**
- ✓ **70.6 kWh over the testing period**
- ✓ **47.51 kg CO_2 in carbon dioxide emissions over the testing period**
- ✓ **$21.89 Saved (Testing period)**
- ✓ **$1,138.23 Annual savings**
- ✓ **3.51 years ROI**

Site Overview:

- The Electrical Contractor, Martin's Electrical and Instrumentation, selected six cabins to test the CTECK system. The cabins were a mixture of studio demountable units and family (multi-room) huts of brick construction with tin roofs.
- The air conditioners were the smallest units compatible with the CTECK system and had the DRED interface required.
- The units were Mitsubishi Heavy Industry High Wall Split systems (3.5kWr)

- This was an excellent test as tenants had a regular turnover, and all selected different temperatures throughout the week.
- These tests yielded excellent savings except 1 unit.
  - i. One application on this site provided irregular data on its operation, showing excessive highs and lows with internal temperatures and the energy consumed compared to the other five systems. This highlighted the vast operating conditions some air conditioners endure but is valuable information when comparing different yet identical systems.
  - ii. From this data, we have been able to understand some future product/technology developments that will enable CTECK to address smaller AC capacity units and how to understand very specific operations and user influence.
  - iii. Considering these units are the smallest AC units with the DRED interface, the ROI in this installation scenario of 3.51 years is quite acceptable.
  - iv. This data also underpins findings that a site can have identical AC systems in identical applications and may operate with very different consumption and performance characteristics.

SITE INSTALLATION 12 : WILDLIFE HABITAT PORT DOUGLAS

Wildlife Habitat is a Queensland wildlife park with an observation, appreciation, and conservation ethos. It is part of the CaPTA Group, which stands for Cairns and Port Trips and Attractions, and employs over 200 staff.

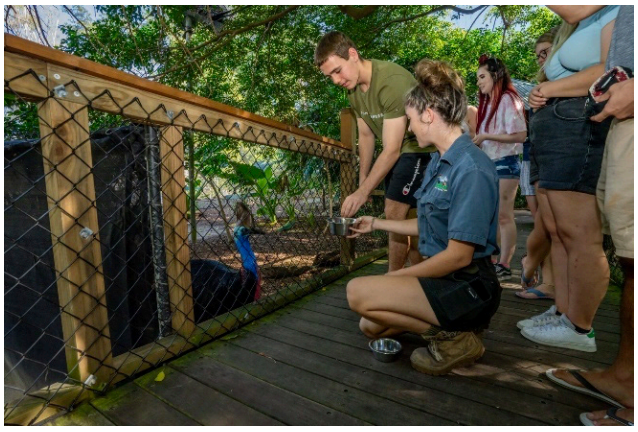
The group consists of Wildlife Habitat, Jungle Tours & Trekking, Tropic Wings Cairns Tours & Charters, Rainforestation Nature Park, Australian Butterfly Sanctuary, Cairns Koalas & Creatures, Wooroonooran Safaris, Careers Training Centre and ABC Sales & Maintenance.

Wildlife Habitat Port Douglas offers a rare and genuine opportunity for visitors to observe and interact with the wildlife of Tropical North Queensland in a full immersion experience. Visitors can walk freely amongst eight acres of lovingly recreated ecosystems and natural habitats up close and personal with some of Australia's most exquisite, elusive, and iconic native wildlife.

Port Douglas is a town on the Coral Sea in the tropical far north of Queensland, 65km north of Cairns, Australia. It's known for its beach resorts and as a base for visits to the Great Barrier Reef, the world's largest reef system, and Daintree National Park, home to biodiverse rainforest.

- ✓ **Savings Achieved a 32.65% reduction in kWr**
- ✓ **49.88 kWh over the testing period**
- ✓ **33.8 kg CO_2 in carbon dioxide emissions over the testing period**
- ✓ **$10.47 Saved (Testing period)**
- ✓ **$544.85 Annual savings**
- ✓ **1.9 years ROI**

- The Electrical Contractor BH Electrical (Port Douglas) selected 1 unit for testing.
- The air conditioning unit serving the Kitchen.
- The operation varies between 12 to 24 hours per day.
- The air conditioning system is a Daikin under-ceiling unit.



- This unit required installing an additional DRED interface card from the manufacturer, which cost an additional $120.
- The site is in far north QLD, the installation cost was $1,050.00.
- The system yielded excellent savings over the trial period.

SITE INSTALLATION 13 : OAKS APARTMENTS FELIX STREET BRISBANE

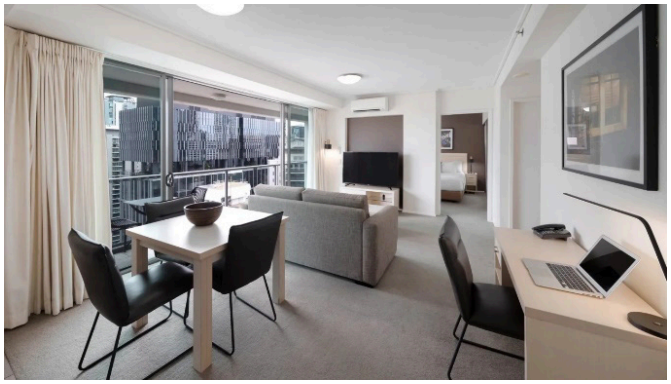
Oaks Hotels, Resorts & Suites is a hotel brand with over 60 properties predominantly located in Australia and New Zealand and fewer sites in other countries. Originally founded in Australia in 1991, the brand forms part of a larger global company.

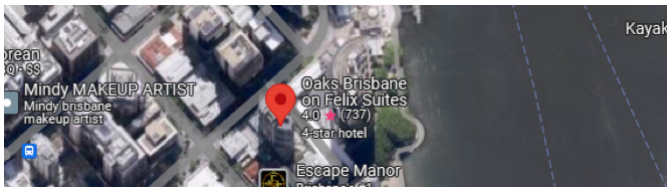
Oaks Brisbane on Felix Suites is located within the Brisbane CBD and 30 minutes from Brisbane Airport

The building is a 40-story building bosting 135 one and 2-bedroom apartments managed by the Oaks group.

- ✓ **Savings Achieved a 24.12% reduction in kWr**
- ✓ **76.34 kWh over the testing period**
- ✓ **51.76 kg CO_2 in carbon dioxide emissions over the testing period**
- ✓ **$23.65 Saved (Testing period)**
- ✓ **$614.9 Annual savings (26 weeks – 50% occupancy)**
- ✓ **1.2 Year ROI**

- The Facilities Manager selected a multi-room apartment (251) to test the CTECK unit.
- The unit is a 2-bedroom executive apartment.
- When occupied, this air conditioning unit operates 24/7.
- The average occupancy is 50% of the time.
- The air conditioning system is a Mitsubishi Electric 3-head multi-system.
- The system style has 1 Condenser with three indoor evaporators servicing two bedrooms and a living room.
- The system is DRED compliant with the interface onboard of the unit.
- The unit required the CTECK device to be externally mounted in a weatherproof enclosure.
- The condenser is located on the Balcony of the apartment.
- The installation cost of this project is approx $780.00
- The system yielded excellent savings over the trial period.





SITE INSTALLATION 14 : OAKS APARTMENTS MARGARET STREET BRISBANE

Oaks Hotels, Resorts & Suites is a hotel brand with over 60 properties predominantly located in Australia and New Zealand and fewer sites in other countries. Originally founded in Australia in 1991, the brand forms part of a larger global company.

Oaks Brisbane on Margaret Suites is located within the Brisbane CBD just 30 minutes from Brisbane Airport.

The building is a 30-story building that boasts 91 one—and two-bedroom luxury apartments managed by the Oaks group.

- ✓ **Savings Achieved a 43.55% reduction in kWr**
- ✓ **37.56 kWh over the testing period**
- ✓ **24,47 kg CO_2 in carbon dioxide emissions over the testing period**
- ✓ **$11.66 Saved (Testing period)**
- ✓ **$302.00 Annual savings (26 weeks – 50% occupancy)**
- ✓ **2.5 years ROI**

- The Facilities Manager selected a multi-room apartment (2803) to test the CTECK unit.
- The unit is a 2-bedroom executive apartment.
- When occupied, this air conditioning unit operates 24/7.
- The average occupancy is 50% of the time.
- The air conditioning system is a Mitsubishi Electric single-head system.
- The system is DRED compliant with the interface onboard of the unit.
- The unit required the CTECK device to be externally mounted in a weatherproof enclosure.
- The condenser is located on the Balcony of the apartment.
- The installation cost of this project is aprox $780.00
- The system yielded excellent savings over the trial period.

SITE INSTALLATION 14 : BLYGOLD BRISBANE

Blygold Oceania is a part of Blygold International, a global company with its Head Office in the Netherlands, which has been operating since 1976. With partners in over 55 countries worldwide, Blygold truly is the market leader in HVACR Corrosion Protection.

Blygold Oceania holds the Master Licence to operate the Blygold system throughout Australia, New Zealand and the Pacific Islands. With its Regional Head Office in Yatala, Queensland, Blygold Oceania has expanded across Australia with partners in New South Wales, Victoria, South Australia-Northern Territory and Western Australia. New Zealand also has a partner located in Auckland.

Blygold QLD joined the PoC. The site is in Yatala, QLD, located 1 hour south of the Brisbane CBD. The building is of tilt slab concrete construction with a tin roof. It is a Commercial premises.

- ✓ **Savings Achieved a 20.05% reduction in kWr**
- ✓ **47.84 kWh over the testing period**
- ✓ **32.43 kg CO_2 in carbon dioxide emissions over the testing period**
- ✓ **$20.44 Saved (Testing period)**
- ✓ **$522.28 Annual savings**
- ✓ **2 years ROI**

- The Area serviced is an open office on the 2nd floor.
- The unit operates 8hrs day / 5 days per week
- The air conditioning system is a Daikin VRV 15kW ducted system.
- The system is DRED compliant with the interface onboard of the unit.
- The unit required the CTECK device to be externally mounted in a weatherproof enclosure.
- The installation cost of this project is $1,050.00.
- The system yielded excellent savings over the trial period.

SITE INSTALLATION 16 : CANTERBURY COLLEGE

Canterbury College enjoys a well-deserved reputation as one of South-East Queensland's most innovative and inclusive private Anglican ELC, Kindy and Prep – Year 12 co-educational schools.

The College was established in 1987 by local Anglican Church parishioners to meet a need in the local education market: a faith-based co-educational preschool to Year 12 school serving the then Albert and Logan Shires, With Over 1,500 students. The College sits on 30.2 hectares of natural bushland, grassed ovals, and landscaped grounds in Waterford, located midway between Brisbane and the Gold Coast.

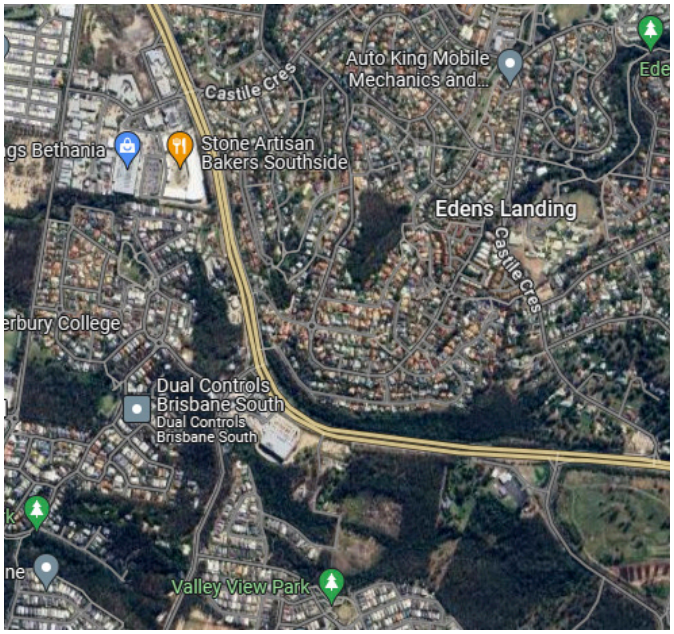
- ✓ **34.72% Saving in kWh.**
- ✓ **124.15kWh over the testing period**
- ✓ **83.55 kg CO_2 in carbon dioxide emissions over the testing period**
- ✓ **$38.48 Saved (Testing period)**
- ✓ **$1,616 Annual savings**
- ✓ **The projected ROI is 2.97 years**

The Air conditioning Contractor Thompson Cooling selected testing to be carried out on six air conditioning systems, four of which serve a group of four classrooms in one block and two of which serve an Administration building.

The classrooms are time-clock-controlled, with temperatures selected by staff as required. The Administration building is manually selected and operates between 12 and 24 hours daily.

One of the ager units in the administration building had an internal control issue, and was no result in the testing period.

- The classroom systems are Daikin VRF with four cassette units per room, and the Administration systems are larger Daikin VRF ducted systems.
- This test yielded excellent savings over the trial period.
- One of the air conditioning systems in the Administration building had an internal control issue across the testing period and was not operating correctly and was a No Result.
- CTECK witnessed the manual operation of the units across the site. The teachers manually turned on/ off units as they wished, resulting in very irregular operation.
- CTECK also witnessed very irregular temperature settings relative to whatever the teacher at the time of use desired,



- The data recorded has assisted CTECK in the future product development process, highlighting a Gap in the technology at the lower capacity / irregular usage application where further refinement is required to meet demanding commercial ROI tolerances; CTECK has initiated a fast track of R&D to address this market. (similar findings to the BIG4 Holiday Park application)
- The Systems did not have the DRED interface onboard and were purchased and installed by Thompson Cooling.
- The project costs were $4,800.00. (5 units)

SITE INSTALLATION 17 : ANYTIME FITNESS

Ranked #1 on Entrepreneur's prestigious Top Global Franchise list, Anytime Fitness is the fastest-growing gym franchise in the world, with over 3,000 gyms serving nearly 3,000,000 members on five continents. Open 24 hours a day, 365 days a year, Anytime Fitness prides itself on providing its members with convenient fitness options and friendly, personal service in well-maintained facilities with top-quality exercise equipment.

Anytime Fitness New Farm, Australia's biggest fitness community. Whatever fitness means to you, it's waiting here in the club. You need all the equipment to push yourself harder, with both cardio and floor training areas. There's 24/7 access to over 3,200 Anytime Fitness gyms worldwide. And there's the motivation to join an extraordinary movement of like-minded people. More Australians get fit with us than with anyone else.

REA Global, a leading Solar installer in Queensland, introduced the CTECK PoC to Anytime Fitness.

The REA Home Energy Solution lets you generate, store, and manage your home's energy to save money, become more energy-independent, and reduce your energy footprint. Their advanced Fusion solar technology is led by solar innovation and provides superior energy yield, reliability, and safety.

Description automatically generatedWith its strong commitment to a clean energy future, REA Global has become a world leader by delivering smart, easy-to-use technology that connects energy generation, storage, and management to one intelligent platform. With the help of our manufacturing partners, Hyundai Energy and Enphase, we have revolutionised solar power technology in Australia.

The gym is located in New Farm QLD, an inner-city suburb of Brisbane,

- ✓ **38.92% Saving in kWr**
- ✓ **466.8 kWh saved over the testing period**
- ✓ **316.4 kg CO_2 Reduction over the testing period**
- ✓ **$144.7 Saved (Testing period)**

- Savings were too aggressive for these particular AC units and impacted internal conditions (refinement of product tech underway).
- Description automatically generatedTwo Mitsubishi Electric Citi Multi air conditioners serve the gym's first and second floors,

- REA & CTECK selected both units for the testing.
- Each level AC unit is managed by a time-clocked; however, they operate different run hours.
- The air conditioning runs up to 22 hours per day. (Depending on classes)
- The testing yielded excellent results over the trial period.
- The units did require the addition of an eternal DRED interface card.
- CTECK did find new functional learnings via the data capture process. This has enabled CETCK to implement further refinement of the technology to suit the application better and will continue M&V of these developments post the PoC project,
- On of the units did result in internal temperatures being affected; anytime fitness, REA & CTECK have agreed to further R&D being conducted in this application to reduce the effect on the conditioned space; CTECK has commenced refinement of the software from learning, and we anticipate a reduced result of savings % of kWh we anticipate a 15 -20% saving being realised.
    - Model on the known data a reduced savings profile would provide potential results:
        - 230 kWh
        - 158 kgC02
        - $71 (approx. over one week)
        - $3,700 Annually (approx.)
        - Projected installation costs of new application $5,500
        - Projected ROI 1.4 – 2 Years

SITE INSTALLATION 18 : GRIFFITH UNIVERSITY NATHAN CAMPUS

Originally opened in 1975 with a cohort of 451 students, Nathan is Griffith's most historic learning ground. Almost 50 years later, the campus now hosts more than 13,000 students enrolled in degrees in business and government, engineering and information technology, environment, humanities and languages, law, and science and aviation.

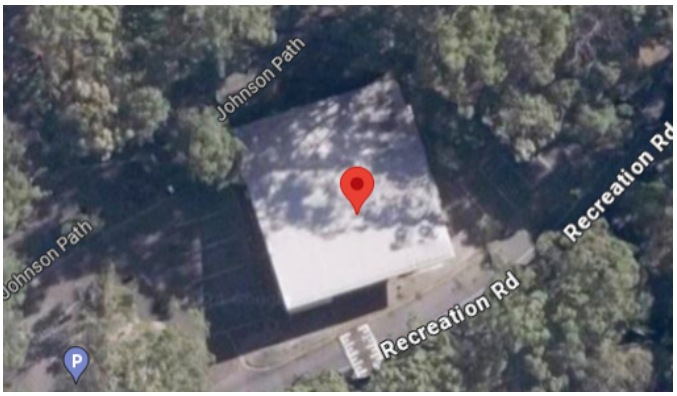
Nathan campus is home to world-class teaching and research on the environment, corporate sustainability, Asian studies and emerging biosciences. Here, you'll find the six-star, green-rated Sir Samuel Griffith Centre—Australia's first teaching and research building driven by solar power and hydrogen energy—and our recently completed, state-of-the-art Engineering, Technology and Aviation building.

The site is located in the inner southern suburbs of Brisbane (approximately) 15 km from the CBD.

- ✓ **28.94% Average saving in kWh**
- ✓ **52.62 kWh saved over the testing period.**
- ✓ **35.41 kg CO_2 Reduction over the testing period**
- ✓ **$16.31 Saved (Testing period)**
- ✓ **$848.23 Annual savings**
- ✓ **1.7 Year RO**

The maintenance contractor AG Coombs identified a stand-alone administration building with five air conditioning units for testing. The building is in a heavily wooded area with surrounding trees, providing significant shading throughout the day and reducing external heat load infiltration.

- The building has several Air conditioning systems servicing the office building.
- Three units were selected for the Poc. However, one unit serviced an individual office and was unoccupied across the testing period, producing no result.
- Two main air conditioning units service an open office area.
- Individual air conditioning units service three separate offices with multiple working spaces in each
- The two larger air conditioning units ran consistently over the testing period.



- The three units servicing the individual offices are run as required and not in a frequent sequence. It was identified that whilst savings would be achieved, the minimal operation would not provide a commercially viable solution.
- The two units serving the open area are Fujitsu Cassette systems,
- The 2 main units operate 24/7 and have provided the results below.
- The project installation costs $1,500.00 (2 units)
- The testing yielded excellent results over the trial period

SITE INSTALLATION 19 : BWS MANLY

BWS is part of Australia's largest retail drinks network operated by the Endeavor group, under the Dan Murphy's and BWS brands as well as operating the country's largest portfolio of licensed hotels with brands such as

BWS, Dan Murphys, ALH (Australian Liquor Holdings), EndevourX, Jimmy Brings, Langtons, Mixlion, Paragin Wines, Pinnacle Drinks, Shorty's Liquor

With more than 1,675 stores and 344 hotels, a growing and highly engaged customer base, and over 4.5 million active My Dan's members, the Endeavour group is leading in supporting suppliers and other industry partners, ranging over 3,000 mostly small suppliers in stores. Endeavour Group is heavily committed to a more sustainable business platform moving forward. Endeavour Sustainability Report .

Endeavour Group was introduced to the PoC program via BGIS. BGIS is a global leader in integrated facility management services, including maintaining the air conditioning units at all Endeavour sites.

BGIS is a technology-enabled, technically led global integrated facilities management provider focused on delivering disruptive business solutions for our clients through a culture of caring, innovation, and high performance. With a rich engineering background, a commitment to sustainability, and service excellence, BGIS ensures that our clients' real estate assets are operating optimally to support the people who use them.

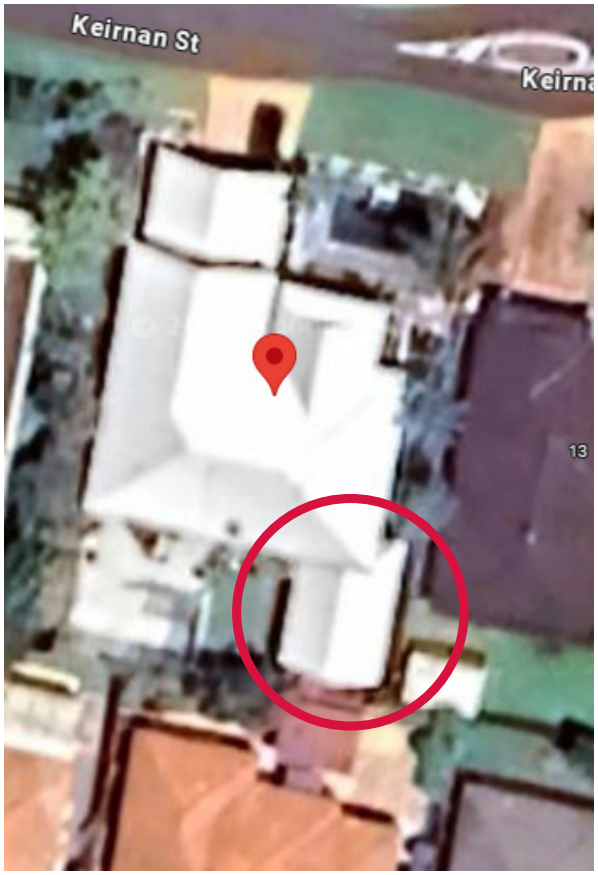
The BWS Manly site was chosen to participate in the PoC Program. The site is in Brisbane's Eastern suburbs,

- ✓ **21.62% average kWh Savings**
- ✓ **51.2kWh saved over the testing period**
- ✓ **34.46 kg CO_2 per AC unit Reduction over the testing period**
- ✓ **$15.87 Saved (Testing period)**
- ✓ **$825.34 Annual savings (3 units)**
- ✓ **3.2 Year ROI**

- The site has Three Panasonic cassette units.
- The Air Conditioning system provides air conditioning to the store with a 4m high ceiling.
- The site represents a Retail facility.
- The sit operational Hours are consistent across a weekly operation, and settings for the AC system remain consistent during its operation,
- The systems appear in good condition without evidence of impeded operation.
- The building is of brick construction and Tin roof, representing many retail applications.
- The testing yielded excellent results over the trial period.
- The installation costs of the site are $2,700.00

SITE INSTALLATION 20 : KEIRNAN STREET GRANNY FLAT

ShapeThis installation is a key opportunity in our PoC findings. It offers a chance to monitor CTECK's technology in a specific application known to challenge the current platform. This provides learnings and data to support our R&D initiatives, particularly in applications with exceptionally low kWh usage relative to operational time. This is a critical consideration that has and will influence our future product development strategies.



Location: Brisbane's eastern suburbs with close proximity to southern Moreton Bay.

- ✓ **Savings Achieved a 26.7% reduction in kWh**
- ✓ **9,3 kWh over the testing period**
- ✓ **6.3 kg CO_2 over testing period**
- ✓ **$2.8 Saved (Testing period)**
- ✓ **$57.2 Annual savings**

Installation Context: The Keirnan Street Granny Flat is a self-contained studio apartment-style living facility. This installation represents a typical scenario encountered in sectors that are a future target market of CTECK. The facility comprises single-story architecture with FC sheeting walls, a tin-pitched roof, and a wool insulation blanket.

Key Features:

- The air conditioning system deployed—a ceiling-mounted ducted 5 kW unit—
- The unit has the Demand Response Enabling Device (DRED) interface on board.
- Operated to maintain conditions for elderly residents.
- The building is designed with thermal insulation as a key feature to reduce the reliance on and operation of the AC systems and minimise long-term costs.

Insights and Learnings: Throughout the testing phase, the system's performance in this low-demand environment provided invaluable insights into usage patterns, operational dynamics, and energy consumption profiles. The low kWh usage relative to operational time highlighted such applications' unique challenges and opportunities. The learnings have reaffirmed our knowledge and informed decision-making in our short-term R&D endeavours.

SITE-SPECIFIC ANALYSIS

Attached is a comprehensive, site-specific overview for the implementation at each PoC participant site, along with a report from an independent engineer. HVAC Alliance has provided individual reports for each of the 60 units installed across the project. In some cases, applications were tested twice to gain a deeper understanding of site usage, the technology application to the unit, and how the technology interacted with the system, the site, and the usage patterns. These detailed reports offer invaluable insights and a thorough evaluation of the project's impact on each site.

UNIT 1 Keinan Street - Ducted
UNIT 2 Benelong Street - Ducted VRV
UNIT 3 Mueller College Test 1 - High Wall
UNIT 4 Mueller College Test 1 - High Wall
UNIT 5 Mueller College Test 1 - High Wall
UNIT 6 Mueller College Test 1 - High Wall
UNIT 7 Mueller College Test 1 - High Wall
UNIT 8 Mueller College Test 1 - High Wall
UNIT 9 Mueller College - High Wall
UNIT 10 Mueller College - High Wall
UNIT 11 Mueller College - High Wall
UNIT 12 Mueller College Test 1 - Ducted
UNIT 13 Komatsu - Ducted
UNIT 14 Komatsu - Ducted
UNIT 15 Transurban - High Wall
UNIT 16 Oonoonba Hotel Townsville - High Wall
UNIT 17 Oonoonba Hotel Townsville - High Wall
UNIT 18 Grosvenor Banyo Office - High Wall
UNIT 19 Mossman Gorge Accomodation - Cassette
UNIT 20 Ozcare Kitty Hawke Drive - Cassette
UNIT 21 Mossman Gorge Accomodation - Cassette
UNIT 22 Mossman Gorge Accomodation - Cassette
UNIT 23 Lucinda Big 4 Cabin Accomodarion - High Wall
UNIT 24 Lucinda Big 4 Cabin Accomodarion - High Wall
UNIT 25 Lucinda Big 4 Cabin Accomodarion - High Wall
UNIT 26 Lucinda Big 4 Cabin Accomodarion - High Wall
UNIT 27 Lucinda Big 4 Cabin Accomodarion - High Wall
UNIT 28 Lucinda Big 4 Cabin Accomodarion - High Wall
UNIT 29 Oaks Apartments Felix Street - High Wall
UNIT 30 Oaks Apartments Margaret Street - High Wall
UNIT 31 Blygold Office Yatalla - Ducted VRV
UNIT 32 Mueller College Test 2 - High Wall
UNIT 33 Mueller College Test 2 - Ducted
UNIT 34 Mueller College Test 2 - High Wall
UNIT 35 Mueller College Test 2 - High Wall
UNIT 36 Mueller College Test 2 - High Wall
UNIT 37 Mueller College Test 2 - High Wall
UNIT 38 Mueller College Test 2 - High Wall
UNIT 39 Canterbury College - Ducted VRV
UNIT 40 Canterbury College - Multihead
UNIT 41 Canterbury College - Multihead
UNIT 42 Canterbury College - Multihead
UNIT 43 Canterbury College - Multihead
UNIT 44 REA Solar Anytime Fitness Newfarm - VRF Cassette
UNIT 45 REA Solar Anytime Fitness Newfarm - VRF Cassette
UNIT 50 PTP Finance Cleveland Office - Ducted
UNIT 51 Griffith Uni Nathan - N24 Admin Building - Cassette
UNIT 52 Griffith Uni Nathan - N24 Admin Building - Cassette
UNIT 53 Griffith Uni Nathan - N24 Admin Building - Cassette
UNIT 54 BWS Manly - Cassette
UNIT 55 BWS Manly - Cassette
UNIT 56 BWS Manly - Cassette
UNIT 57 Granny Flat - Ducted
UNIT 58 Komatsu - Cassette VRV
UNIT 59 Komatsu - Cassette VRV
UNIT 60 Griffith Uni Gold Coast Gym - Cassette

08.

IMPLICATIONS AND RECOMMENDATIONS

08. IMPLICATIONS AND RECOMMENDATIONS

Implications of PoC Findings

- Commercial Viability: The PoC findings provide concrete evidence of the commercial viability of CTECK's technology. Achieving an average energy saving of 29.32 surpasses initial expectations and demonstrates that the technology can deliver tangible benefits to businesses and consumers.
- Market Potential: The PoC results underscore the significant market potential for energy-efficient AC solutions. With rising energy costs and increasing emphasis on sustainability, there is a growing demand for technologies that can help reduce energy consumption and emissions, particularly in the SME and residential sectors.
- Industry Awareness: The findings reveal a notable gap in understanding among business owners regarding AC system operation and maintenance. This lack of awareness presents both a challenge and an opportunity for CTECK to educate and empower stakeholders about the benefits of energy management solutions.

Recommendations for Advancing Commercialisation Efforts

Commercialisation Strategy: To capitalise on the market opportunity, CTECK should develop two primary paths to market. Firstly, establish a robust reseller/dealer network within the Electrical/HVAC and Solar industries. This network will serve as a direct channel for reaching end-users and providing them with CTECK's energy management solutions. Secondly, pursue strategic direct sales initiatives targeting large-scale organisations and government departments. By offering tailored solutions and advocating for energy efficiency, CTECK can position itself as a preferred partner for major stakeholders.

Collaboration and Partnerships: Forge strategic partnerships with industry stakeholders to amplify reach and impact. Collaborating with HVAC service providers, for instance, can facilitate the integration of CTECK technology into their service offerings. By aligning incentives and sharing resources, CTECK can leverage the expertise and distribution channels of its partners to accelerate market penetration.

Marketing and Sales Initiatives: Implement targeted marketing and sales initiatives to raise awareness and drive adoption. Position CTECK as a value-added solution that not only reduces energy costs but also contributes to sustainability goals. Tailor messaging to address the pain points of target customers, emphasising the simplicity and effectiveness of CTECK's energy management solutions. Through targeted outreach and educational campaigns, CTECK can establish itself as a trusted advisor and solution provider in the market.

Continuous Improvement: Commit to continuous improvement by gathering feedback from pilot programs and customer experiences. Invest in research and development to enhance the functionality and compatibility of CTECK's technology across different HVAC systems and usage scenarios. By staying at the forefront of innovation, CTECK can maintain its competitive edge and address evolving market needs.

Advocacy and Education: Advocate for the adoption of energy-efficient AC solutions at various levels of government and industry. Engage in proactive advocacy efforts to promote policies and incentives that incentivise the adoption of energy management technologies. Simultaneously, focus on educating businesses and consumers about the benefits of energy management and the role of CTECK technology in achieving cost savings and emission reductions. By raising awareness and building consensus, CTECK can create an environment conducive to widespread adoption and long-term success.

By implementing these recommendations, CTECK can effectively leverage the insights gained from the PoC program to drive commercialisation efforts and establish itself as a leader in the energy management industry. Through strategic partnerships, targeted marketing, continuous innovation, and advocacy efforts, CTECK can unlock the full potential of its technology and deliver meaningful impact to businesses, consumers, and the environment.

09.

FUTURE OUTLOOK AND ROADMAP

9. FUTURE OUTLOOK AND ROADMAP

Market Expansion Strategy

CTECK Pty Ltd aims to expand the adoption of its HVAC energy savings technology beyond Queensland and Darwin, exploring potential markets and regions for growth. The market expansion strategy involves:

- **Market Research**: Conduct comprehensive market research to identify potential target markets and regions with high demand for energy-efficient HVAC solutions.
- **Market Segmentation**: Segmenting target markets based on industry verticals, geographical regions, and customer demographics to tailor marketing and sales strategies accordingly.
- **Regional Partnerships**: Forming strategic partnerships with local distributors, HVAC service providers, and industry associations to facilitate market entry and establish a presence in new regions.
- **Market Penetration**: Deploying targeted marketing campaigns, sales initiatives, and educational programs to raise awareness and drive adoption of CTECK's technology in new markets.
- **Customer Engagement**: Engaging with potential customers through demonstrations, trials, and pilot programs to showcase the benefits of the technology and build trust and credibility.

Technology Roadmap

CTECK's technology roadmap outlines the future development path for the HVAC energy savings technology, encompassing planned enhancements and innovations to further improve performance and functionality. Key elements of the technology roadmap include:

- **Enhanced Compatibility**: Continuously improving compatibility with a wider range of HVAC systems, including different makes, models, and configurations.
- **Advanced Analytics**: Integrating advanced analytics capabilities to provide deeper insights into energy consumption patterns, system performance, and optimisation opportunities.
- **IoT Integration**: Leveraging Internet of Things (IoT) technology to enable remote monitoring, control, and management of HVAC systems for enhanced efficiency and convenience.
- **Leveraging AI and ML**: CTECK aims to further optimise energy usage, enhance system performance, and pioneer innovative solutions that lead to unprecedented levels of efficiency and effectiveness in the HVAC industry.
- **Integration with Renewable Energy**: Exploring integration with renewable energy sources such as solar power to further reduce reliance on grid electricity and enhance sustainability.
- **Developing an integrated platform**: that seamlessly automates and integrates cross-platform providers in the smarter control sector. This initiative aims to streamline operations, enhance interoperability, and optimise energy management across diverse HVAC systems and other energy and Environmental inputs (Consumption, generation, and wellness), leveraging advanced automation and integration capabilities to deliver unprecedented efficiency and convenience to end-users.

Sustainability Initiatives

CTECK Pty Ltd is committed to sustainability and environmental stewardship, leveraging technology to drive positive impact both internally and externally to our business operations. Key sustainability initiatives include:

- **Energy Efficiency**: Helping businesses and consumers reduce energy consumption and carbon emissions through the adoption of energy-efficient HVAC solutions now and across integrated platforms into the future.
- **Emission Reduction**: Contributing to global efforts to combat climate change by reducing greenhouse gas emissions associated with HVAC operations.
- **Resource Conservation**: Promoting the efficient use of resources, including electricity (All energy sauces) and refrigerants, to minimise environmental impact and preserve natural resources.
- **Education and Advocacy**: Educating stakeholders about the importance of energy conservation, sustainability, Wellness (personal and environmental) and the role of technology in achieving environmental goals.
- **Corporate Responsibility**: Demonstrating corporate responsibility through environmentally conscious business practices, ethical sourcing, and community engagement initiatives.

By executing its market expansion strategy, advancing its technology roadmap, and championing sustainability initiatives, CTECK Pty Ltd aims to drive continued growth, innovation, and positive impact in the HVAC industry and beyond.

10.

CONCLUSION

10. CONCLUSION

The CTECK Proof of Concept (PoC) program has successfully demonstrated the significant potential of the Air Conditioning Energy Savings Device across various applications and climatic zones in Queensland. The program's rigorous monitoring and verification protocols, adherence to IPMVP Option B standards, and collaboration with independent engineers ensured the accuracy and reliability of the performance data.

The results of the PoC program are impressive. On average, installations achieved energy savings of 29%, translating to an average weekly savings of 45.12 kWh per system. This reduction in energy usage resulted in substantial environmental benefits, with average weekly CO2 savings of 30.66 kg. Additionally, the program yielded economic advantages for users, with average weekly savings of $13.99 and a projected return on investment (ROI) of just three years.

The potential statewide impact of scaling this technology is enormous. Queensland has over 1.8 million residential dwellings, with 80% containing at least one air conditioning unit, amounting to approximately 1.1 million units. Conservatively, if CTECK technology were applied to 60% of these units, it could result in around 864,000 installations. This widespread adoption could achieve:

- ✓ **467,804,160 kWh in energy savings annually**
- ✓ **317,882,880 kg reduction in CO_2 emissions annually**
- ✓ **$145,019,290.00 in savings for homeowners annually, at an electricity cost of $0.31 per kWh**

These savings would contribute significantly to Queensland's environmental goals, accounting for more than 0.5% of the state's total emission reduction target for the year 2032. This substantial contribution highlights the potential of CTECK technology to support the Queensland state government's energy and emission reduction targets, aligning with broader sustainability objectives and climate action plans.

Business Development Through LCAP

The LCAP program has been a catalyst for transforming an initial idea and basic concept into a tangible prototype and subsequently into a viable business entity known as CTECK Environment & Energy. With a suite of products specialised in HVAC/R energy efficiency, CTECK serves various sectors, including residential, retail, commercial, education, health, hospitality, and more. The program has not only validated our technology but also established CTECK as a commercially viable entity, achieving success and contributing to the pursuit of a net-zero future.

National and International Impact

The success of the PoC program in Queensland sets a precedent for potential national and international expansion. By showcasing significant energy savings and environmental benefits, CTECK technology can make a meaningful impact on a broader scale. Nationally, the adoption of CTECK devices across Australia could lead to substantial reductions in energy consumption and greenhouse gas emissions, supporting the country's commitment to climate change mitigation and sustainable energy practices.

Internationally, CTECK's innovative solutions have the potential to address global energy efficiency challenges. As countries worldwide strive to meet their carbon reduction targets, the deployment of CTECK devices can contribute to global efforts in reducing energy consumption and lowering carbon footprints. By providing a proven, effective solution for optimizing air conditioning systems, CTECK can play a vital role in international sustainability initiatives, promoting energy efficiency and environmental responsibility across various sectors and regions.

In summary, the CTECK PoC program has demonstrated the device's significant potential for energy savings and emission reductions, validated through rigorous protocols and independent verification. With the foundational support of the LCAP program, CTECK is poised to make a substantial impact both nationally and internationally, contributing to a sustainable future and the global pursuit of net-zero emissions.

11.

ACKNOWLEDGMENTS

11. ACKNOWLEDGMENTS

Acknowledgements

We extend our heartfelt gratitude to all those who made the LCAP Proof of Concept (PoC) possible. This initiative was a collaborative effort involving numerous organizations and individuals whose support and contributions were invaluable.

Key Supporters and Facilitators

Firstly, we acknowledge the significant support from the Queensland State Government and the Queensland Office of the Chief Entrepreneur. Their commitment to innovation and entrepreneurship provided the foundational support necessary for this project. We also extend our thanks to Innovation Architects for the delivery, guidance and facilitation of the Low Carbon Accelerator Program, and fellow LCAP cohort participants, whose collaboration and shared insights were instrumental throughout the program.

Industry Partners and Collaborators

Our industry partner, Evergreen Power Solutions, played a crucial role in this project. Their expertise and resources were vital for the successful deployment and monitoring of the CTECK devices. The HVAC Alliance, a boutique engineering consultancy specializing in air conditioning design and reporting, provided indispensable verification and analysis of the data collected.

Installation and Reseller Partners

We deeply appreciate our installation and reseller partners, whose dedication and technical support ensured the seamless integration of the CTECK devices. Special thanks to:

1. Coolmaster - Komatsu
2. Electric Fever – Mueller College
3. Thompson Cooling – Canterbury College
4. Van Erde Refrigeration – Oonoonba Hotel
5. BD Electrical – Mossman Gorge
6. Martins Electrical and Instrumentation – Big 4
7. REA Solar – Anytime Fitness
8. AG Coombs – Griffith University Nathan Campus
9. PTP Finance
10. Oaks Apartments
11. Blygold
12. Endeavour Group – BWS - BGIS
13. Hampshire Property Group
14. Transurban
15. GoodEarth Group
16. Grosvenor Engineering Group
17. Ozcare
18. Wildlife Habitat

End Users and Technical Support

We express our gratitude to the end-user customers who allowed us to deploy, install, monitor, and utilize their air conditioning systems throughout the PoC. Your cooperation and trust were essential for the project's success. We also acknowledge the key mechanical service providers who participated and provided technical support, ensuring the high performance and reliability of the installations.

OEM Collaborations

Lastly, we recognize the collaborative relationships with key original equipment manufacturers (OEMs), specifically Mitsubishi Heavy Industries (MHI), Samsung and Haier. Your support was crucial in demonstrating the effectiveness of the CTECK technology.

Thank you to all the teams, partners, and individuals who contributed to making this project a success. Your efforts have paved the way for significant advancements in energy savings and sustainability within the air conditioning industry.

Office of the Queensland Chief Entrepreneur

innovation architects

Low Carbon Accelerator

Queensland Government

CTECK - LCAP RESULT SUMMARY

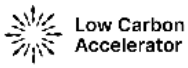
Site	Location	Make	Type	Capacity kW	kWh/CDD Result %	kWh Reduction	kg GHG Reduction	Cost $ Reduction
Keirnan Street	Residential	Haier	Ducted	15.50	21.9	57.46	39.07	17.81
Benelong Street	Residential	Daikin VRV	Ducted VRV	24.00	30.2	112.25	76.1	34.80
Boundary Road	Residential	Fujitsu	Ducted	15.00	26.9	87.1	60.1	27.00
Mueller College Test 1	D11 N	Mitsubishi Electric	High Wall	7.10	49.57	10.57	7.15	3.28
Mueller College Test 1	D11 S	Mitsubishi Electric	High Wall	7.10	70.56	14.63	9.98	4.54
Mueller College Test 1	D12 N	Mitsubishi Electric	High Wall	7.10	57.91	13.4	9.92	4.15
Mueller College Test 1	D12 S	Mitsubishi Electric	High Wall	7.10	77.7	10.83	7.38	3.36
Mueller College Test 1	D13 N	Mitsubishi Electric	High Wall	7.10	55.26	7.05	4.77	2.19
Mueller College Test 1	D13 S	Mitsubishi Electric	High Wall	7.10	47.97	10.25	6.99	3.18
Mueller College	H204 N	Mitsubishi Electric	High Wall	7.10	21.64	13.64	9.22	4.23
Mueller College	H204 S	Mitsubishi Electric	High Wall	7.10	22.62	9.02	6.12	2.80
Mueller College	H203	Mitsubishi Electric	Ducted	16.50	23.96	46.56	31.56	14.43
Mueller College Test 1	Tuck Shop	Mitsubishi Electric	Ducted	14.00	2.47	15.06	10.21	4.67
Komatsu	AC7	Daikin	Ducted	12.50	10.00	47.00	32.10	14.57
Komatsu	AC7	Dakin	Ducted	12.5	25.00	93.00	63.80	28.83
Komatsu	AC10	Daikin	Ducted	12.50	17.00	45.65	30.95	14.15
Transurban	AC3	Mitsubishi Electric	High Wall	10.00	16.8	0.58	0.39	0.18
Oonoonba Hotel Townsville	AC1	Panasonic	High Wall	7.00	15.60	9.99	6.8	3.10
Oonoonba Hotel Townsville	AC2	Panasonic	High Wall	7.00	No Result			0.00
Grosvener Banyo Office	AC1	Mitsubishi Electric	High Wall	7.80	23.71	8.46	5.77	2.62
Mossman Gorge Accomodation	AC3	Mitsubishi Electric VRF	Cassette	22.00	13.40	16.00	10.92	4.96
Ozcare Kitty Hawke Drive	ACU2	Daikin VRV	Cassette	18.00	30.90	37.11	25.31	11.50
Mossman Gorge Accomodation	AC1	Mitsubishi Electric VRF	Cassette	22.00	23.60	109.00	74.33	33.79
Mossman Gorge Accomodation	AC2	Mitsubishi Electric VRF	Cassette	22.00	21.08	75.26	51.32	23.33
Lucinda Big 4 Cabin Accomodation	AC1	Mitsubishi Heavy Ind	High Wall	3.50	30.65	11.99	8.13	3.72
Lucinda Big 4 Cabin Accomodation	AC14	Mitsubishi Heavy Ind	High Wall	3.50	34.43	16.55	11.18	5.13
Lucinda Big 4 Cabin Accomodation	AC3	Mitsubishi Heavy Ind	High Wall	3.50	26.28	12.39	8.4	3.84
Lucinda Big 4 Cabin Accomodation	AC4	Mitsubishi Heavy Ind	High Wall	3.50	32.36	13.93	9.5	4.32
Lucinda Big 4 Cabin Accomodation	AC5	Mitsubishi Heavy Ind	High Wall	3.50	35.21	15.74	10.73	4.88

Lucinda Big 4 Cabin Accomodation	AC6	Mitsubishi Heavy Ind	High Wall	3.50	No Result			0.00
Wildlife Habitat Port Douglas	Kitchen	Daikin	Under Ceiling	8.50	32.65	49.88	33.8	15.46
Oaks Apartments Felix Street	Level 23	Mitsubishi Electric Multi	High Wall	5.00	24.12	76.34	51.76	23.67
Oaks Apartments Margaret Street	Level 21	Mitsubishi Electric	High Wall	3.50	43.55	37.56	25.47	11.64
Blygold Office Yatalla	SME	Daikin	Ducted VRV	15.00	20.05	47.84	32.44	14.83
Mueller College Test 2	D11 N	Mitsubishi Electric	High Wall	7.10	20.26	8.02	5.44	2.49
Mueller College Test 2	Tuck Shop	Mitsubishi Electric	Ducted	14.00	34.28	31.21	21.16	9.68
Mueller College Test 2	D11 S	Mitsubishi Electric	High Wall	7.10	8.03	3.71	2.51	1.15
Mueller College Test 2	D12 N	Mitsubishi Electric	High Wall	7.10	12.3	5.13	3.48	1.60
Mueller College Test 2	D12 S	Mitsubishi Electric	High Wall	7.10	21.94	8.2	5.5	2.54
Mueller College Test 2	D13 N	Mitsubishi Electric	High Wall	7.10	23.16	6.93	4.7	2.15
Mueller College Test 2	D13 S	Mitsubishi Electric	High Wall	7.10	22.13	9.77	6.63	3.03
Canterbury College	Q01	Daikin VRV	Ducted VRV	25.00	22.89	55.05	37.32	17.07
Canterbury College	D01	Daikin VRV	Multi Head	12.00	29.5	12.45	8.44	3.86
Canterbury College	D02	Daikin VRV	Multi Head	12.00	58.46	35.18	23.85	10.91
Canterbury College	D03	Daikin VRV	Multi Head	12.00	27.87	7.89	5.35	2.45
Canterbury College	D04	Daikin VRV	Multi Head	12.00	34.89	13.58	9.88	4.21
Canterbury College	Q02	Daikin VRV	Ducted VRV	25.00	No Result			0.00
REA Solar Anytime Fitness Newfarm	Level 1	Mitsubishi Electric VRF	VRF Cassette	33.50	36.42	416.00	282.00	128.96
REA Solar Anytime Fitness Newfarm	Level 2	Mitsubishi Electric VRF	VRF Cassette	33.50	41.41	517.00	350.80	160.27
PTP Finance Cleveland Office	SME	Panasonic	Ducted	10.00	25.99	15.77	10.69	4.89
Griffith Uni Nathan- N24 Admin Building	1.1 Front	Mitsubishi Electric	Cassette	5.00	No Result			0.00
Griffith Uni Nathan- N24 Admin Building	Front Office	Fijitsu	Cassette	7.00	18.6	31.62	21.44	9.80
Griffith Uni Nathan- N24 Admin Building	Back Office	Fijitsu	Cassette	7.00	39.28	21.00	14.23	6.51
BWS Manly	AC1	Samsung	Cassette	14.00	29.21	26.34	17.86	8.17
BWS Manly	AC2	Samsung	Cassette	14.00	18.93	11.90	8.07	3.69
BWS Manly	AC3	Samsung	Cassette	14.00	16.72	12.96	8.78	4.02
Granny Flat	Residential	Mitsubishi Electric	Ducted	5.00	26.75	9.35	6.34	2.90
Komatsu	AC1	Daikin VRV	Cassette VRV	15.00	No Result			0.00
Komatsu	AC2	Daikin VRV	Cassette VRV	15.00	No Result			0.00
Griffith Uni Gold Coast Gym	AC1	Daikin VRV	Casette		No Result			0.00
					Total	2,391.15	1,625.14	741.26
						2.39MWh	1.625 Ton	$ 741.26


TECK
ENERGY & ENVIRONMENT


Office of the
Queensland
Chief Entrepreneur


innovation
architects


Low Carbon
Accelerator


Queensland Government