



STRATEGIC PLAN: CLIMATE ACTION IN PLANNING AND TRANSPORT RESEARCH PROGRAM

2025-2028

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Acknowledgement

This work was produced on the lands of the Wadjuk Noongar people. We acknowledge the Wadjuk people, past, present and future, as the original custodians of this land.

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2025-2028

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About PATREC

The Planning and Transport Research Centre (PATREC) is a collaboration between the Government of Western Australia and local universities, constituted to conduct collaborative, applied research and teaching in support of policy in the connected spaces of transport and land use planning. The collaborating parties are: The University of Western Australia, Curtin University, the Department of Transport, Main Roads Western Australia, the Western Australian Planning Commission and the Western Australian Local Government Association.

Publisher

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EXECUTIVE SUMMARY

This Strategic Plan has been prepared to guide the new program of research: Climate Action in Planning and Transport (CAPTR). Manifesting PATREC's broader mandate, the purpose of the CAPTR program is to conduct collaborative, applied research and teaching in the connected spaces of transport and land use planning in supporting Western Australian (WA) cities, towns and communities to:

- Adapt urban settlements to improve resilience to climate change; and
- Achieve Net Zero emissions consistent with science-based targets.

The Plan presents how this will be achieved through PATREC's four key strategic activities:

- Conducting multi-disciplinary, multi-institutional research in response to identified agency research requirements and knowledge gaps
- Knowledge transfer and communication
- Providing training and teaching, including professional development through short courses, executive programs and "expert" courses on key topics and teaching into units
- Attracting additional research funds through business development.

Strategic drivers informing the Plan were sources through:

- Policy review to update the local and national contextual environment
- Literature review to identify relevant conceptual frameworks and theoretical approaches to frame the Plan
- Semi-structured interviews with key stakeholders to obtain policy and practice insights
- Workshop with researchers to identify available capacity, capability and experience as well as eliciting research suggestions.

Informed by the strategic drivers, five research focus areas were identified to guide and scope the research program over the next four years:

- Climate risk and adaptation
- Transport decarbonisation
- Infrastructure and built environment decarbonisation
- Circular economy and materials
- Land use planning and sustainable communities.

Research project activity will be aligned with the focus areas, including:

- Completion of Stage 2 of 'foundation' projects
- Developing new core and external projects with PATREC partners and wider
- Undertake the 3-year AURIN WA Node to develop research infrastructure (data and tools) to support research in climate action in transport and land use planning
- Investigate the opportunity to participate in emerging Cooperative Research Centres (CRC), such as the Future Freight CRC (includes decarbonising freight) under development to replace the iMOVE CRC which ends in 2027.

Delivering on the Plan includes:

- Commencing with hosting a half-day PATREC Research Forum to showcase climate action program projects, continue to promote PATREC research more widely
- Appointing a Program Leader at Curtin
- Incorporating this Plan into the PATREC Strategic Plan 2026-28, including with 3-year KPI targets and budget, if feasible to separate from the 'traditional' program.

1. Introduction

1.1. Background

The current Strategic Plan 2023-2025 of the Planning and Transport Research Centre (PATREC) included initial reporting on the establishment of a new PATREC program of research: Climate Action in Transport and Land Use Planning, as agreed by the PATREC Board in 2022. This decision followed the release of the Western Australian Climate Policy (Department of Water and Regulation, 2020) which highlighted the need for stronger engagement of government with industry and research organisations to, inter alia, develop and support technology pathways for net zero emissions. Given the overlap of four of the six Climate Policy themes with planning and transport, the Director General of Transport in collaboration with the Chairman of the WA Planning Commission, and with the backing of the Chief Scientist, proposed establishing a new research program of climate action related to transport and land use planning, through PATREC, aligned with established PATREC mandate and strategic activities and governance and process mechanisms.

The Department of Transport provided some set-up funding in 2022 to support administrative activities involved in establishment. PATREC collaborating partners agreed to fund the first two-years of the program (2023 and 2024), with some supplementary project funding contributions from the Department of Transport, Public Transport Authority and Department of Planning, Lands and Heritage.

In 2023 the Climate Action Research Advisory Committee (CARAC) was established, three foundation projects contracted and progressed with a small biodiesel trial evaluation project proposed. A PATREC Climate Action Program Leader was appointed at Curtin to, amongst others, progress the development of this Strategic Plan for the climate action program. The development of this Strategic Plan was delayed due to the need to replace the first appointed Program Leader due to unforeseen circumstances.

The new Program Leader commenced in April 2024 and was able to devote attention to the preparation of this Strategic Plan. In parallel, significant progress was made with the foundation projects in 2024, with two completed and two substantially completed. A further two years of funding for the program (2025 and 2026) was secured and extensions to the foundation projects agreed.

The PATREC Business Plan for 2025 needed to be prepared before this Strategic Plan was completed and relevant short-term activities have been incorporated into this Plan.

1.2. Purpose

This Strategic Plan has been prepared to guide the new program of research: Climate Action in Planning and Transport (CAPTR). Manifesting PATREC's broader mandate, the purpose of the CAPTR program is to conduct collaborative, applied research and teaching in the connected spaces of transport and land use planning in supporting Western Australian (WA) cities, towns and communities to:

- Adapt urban settlements to improve resilience to climate change; and
- Achieve Net Zero emissions consistent with science-based targets.

These climate action objectives extend the ambit of the traditional PATREC research program to deliver value to government collaborating partners in achieving policy objectives of reducing the need to travel, increasing the share of public transport and active modes, moving more freight onto rail, improving traffic flow - deferring the need for new road infrastructure and improving road safety.

Building on the initial program activities which commenced in late 2022 and progressed in 2023 and 2024 to kick-start the program, the purpose of this CAPTR Strategic Plan (Plan) is to set out PATREC's

strategic approach to advance the knowledge base and forge new and innovative evidence-based solutions for effectively planning and managing WA's climate-impacted future in relation to planning and transport. The Plan presents how this will be achieved through PATREC's four key strategic activities: conducting multi-disciplinary, multi-institutional research in response to identified agency research requirements and knowledge gaps; knowledge transfer through publications (academic and technical), connection events; training (including short courses, student supervision, guest lectures); and attracting additional research funds through business development (described more fully in the PATREC Strategic Plan 2023-2025, pg 6).

This time period of this Plan was selected to align with the timeframe of the next overall three-yearly PATREC Strategic Plan 2026-2028, into which this CAPTR Plan will be incorporated, due for presentation to the PATREC Board in late in 2025.

1.3. Approach

The Plan has been informed by a literature review, stakeholder interviews and a workshop, with oversight, inputs and feedback provided by the CARAC:

- Desktop review of peer-reviewed, academic literature and policy documents to investigate policy changes since the release of the WA Climate Policy and any learnings applicable to appropriate ways of framing climate action research
- Semi-structured interviews conducted with PATREC stakeholders as users of climate action research. The intention was to understand their perspectives on the gaps and opportunities in the climate action research space for transport and land use planning in WA
- Workshop convened of WA researchers with interests in climate action in transport and land use planning to map capabilities and generate potential future project ideas.

Key aspects are summarised in the Plan, with the detail of this informing material contained in a supplementary volume ('Climate Action in Planning and Transport Research – Discussion Paper').

1.4. Structure

Broadly following the outline of the PATREC Strategic Plan 2023-25, this Plan has the following sections:

- Strategic drivers
- Research focus
- Research activity – core, external, new opportunities to be pursued
- Knowledge transfer and dissemination
- Delivering on the Plan – human and financial resources, management and operations (CARAC, project selection process, project management, KPIs).

Where content is the same as in the PATREC Strategic Plan, it is not duplicated here - rather referenced.

2. Strategic Drivers

2.1. Contextual informants

This Plan has been informed by a consideration of international and local contextual factors including policy environment updates since that reported in the PATREC Strategic Plan 2023-2026, conceptual frameworks, providing theoretical and structuring devices to ensure inclusion of the depth and breadth of relevant factors and insights from stakeholders. Semi-structured interviews were conducted with PATREC stakeholders to understand their perspectives on the gaps and opportunities in the climate action research space. A workshop was convened of WA researchers with interests in climate action in transport and land use planning to map capabilities and generate potential future project ideas.

2.2. Policy developments

Since the publication of relevant policies summarised in the PATREC Strategic Plan 2023-2025, there have been further policy developments in WA that are pertinent to this Plan. On 30 November 2023 the State Government introduced the Climate Change Bill 2023 to Parliament to contribute to national and global goals for decarbonisation, provide certainty for businesses, and attract the investment required to transition to net zero GHG emissions.

WA's first Climate Adaptation Strategy was released in July 2023 to ensure WA communities, environment and economy are resilient to future climate change. Key directions are provided for State Government agencies to enhance the resilience of our communities, regions, economic sectors and environment, with relevant extracts for this Plan being:

- Direction 1: Produce and communicate credible climate information and resources
 - Understand how climate may change - research is also needed to improve consideration of how the changing climate will impact our environment, and public and private infrastructure. We need to better understand the 'urban heat island' effect on our cities, as well as the implications of changes in bushfire seasons, marine heatwaves, flood risk and other extreme weather events
 - Strengthen adaptation research to drive innovation - further investment in adaptation research and collaboration between research institutions needed as well as partnerships between government, researchers, industry and communities, to ensure research is focused on priority needs and research outcomes applied
- Direction 2: Build public sector climate capability and strengthen accountability
 - Incorporate climate adaptation into the State Planning Framework and policies to inform land use planning and management decisions
 - Drive transformation through State Government leadership - strengthen the capability of the public sector to assess and manage climate risk through training programs and tools
 - Develop appropriate metrics to measure progress - establish robust metrics to measure progress towards building climate resilience and adaptation
- Tracking progress of the Climate Adaptation Strategy - develop a framework for monitoring, evaluation and reporting to track implementation progress.

https://www.wa.gov.au/system/files/2023-07/climate_adaption_strategy_220623.pdf

The Sectoral Emissions Reduction Strategy (SERS), also published in 2023, demonstrates the State Government's commitment to working with all sectors of the economy to transition to net zero emissions by 2050 and provides a high-level, least-cost pathway and priority actions for the state's transition to net zero emissions. Pathways for electricity, industry, buildings and waste, transport, a

just transition, agriculture and land, are outlined. The most relevant areas for PATREC to contribute to, in building on the foundation provided in the SERS, are:

- The buildings sector is one of the most cost-effective sectors to decarbonise:
 - Solutions to achieve near-zero emissions from buildings are already mature and commercially competitive or have been demonstrated at scale
 - Energy efficiency has the added benefit of reducing household cost-of-living pressures
 - Using products and materials with lower embedded emissions is critical in the decarbonisation of the buildings sector
- Circular economy principles will not only reduce emissions associated with the manufacture of products, but help to minimise waste generation and other environmental impacts
- Transport decarbonisation will be led by the adoption of battery EVs in the passenger market. Complementary measures such as public and active (cycling and walking) transport will also help to reduce emissions through a reduction in vehicle use. Road freight vehicles, rail and aviation pose additional challenges to transition, with further electric technology improvements and alternative fuel options under development
 - Develop a statewide strategy for future electric road transport charging infrastructure required to support the transition to net zero
 - Develop a road freight decarbonization strategy for south-west Western Australia in consultation with the road freight sector
 - Increase the State Government fleet EV target to at least 50 per cent of all new purchases in eligible categories
 - Identify opportunities to leverage business investment in the production of advanced biofuels (renewable diesel) and low-emission fuels for the state’s agriculture, mining and transport industries.

<https://www.wa.gov.au/system/files/2024-07/sers-final-report-20240702.pdf>

2.3. Conceptual Frameworks

There are a number of guiding theoretical frameworks presented in the literature from different perspectives and for different purposes, but each offering particular insights in delivering a research program with climate action impacts. Some are particularly focussed on transport while others relate more widely to the built environment, infrastructure and sustainable development. While all the frameworks investigated, to a greater or lesser extent, argue for a systemic change, some are focussed on particular technologies or elements of the system, while others emphasise the importance of cultural changes to drive transformation. The most useful frameworks as informants to this Plan are summarised in Table 1 with the particular areas of relevance noted in the last column.

Table 1: Summary of relevant theoretical frameworks

Framework	Approach	Relevance to this Plan
Avoid, Shift, Improve (A-S-I) (GIZ – German Society for International Collaboration)	Strategic actions to reduce carbon emissions in the transportation sector: <ul style="list-style-type: none"> • Avoid/reduce the need to travel (system efficiency) • Shift to more sustainable modes (trip efficiency) • Improve energy efficiency of vehicles (vehicle efficiency) 	Largely in line with PATREC’s traditional program of research but with a focus on decarbonisation co-benefits. Use A-S-I to frame transport decarbonisation research

<p>Leverage points Meadows, D 1999 The Sustainability Institute Abson D et al. 2017 Leverage Points for Sustainability Transformation</p>	<p>Leverage points/places at which to intervene in a system to transform it to be more sustainable:</p> <ul style="list-style-type: none"> • small shifts may lead to fundamental changes in the system as a whole • “deeper” points (system design and intent (culture) are more difficult to do but have greater potential for impact (as opposed to “shallow” leverage points - individual elements/technologies and processes) 	<p>Research is needed at each intervention point of the system to transform it but make an effort to include more, harder to do research at “deeper” intervention points, to get to the root causes of unsustainable systems to effect great impact with more co-benefits. This requires greater trans-disciplinarity so expand the reach across disciplines when resourcing projects and provide opportunity for cross-disciplinary interactions and solution-generation</p>
<p>Transition Dynamics Framework (Water Sensitive Cities CRC https://watersensitivecities.org.au/content/wsc-transition-tools-manual/)</p>	<p>Transitioning from an old culture, structure, practice to a new one, is a process with distinct phases and enabling factors which need to be in place to progress to the next phase. Knowledge (including research) is one of six enabling factors/catalysts for change, the focus of which varies with each phase. Others are champions, platforms for connecting, projects and applications and implementation guidance</p>	<p>Focus on the right kind of research for the particular transition phase underway For cultural transition to progress, need all enabling factors to be working together – not just research. PATREC’s other activities of knowledge transfer, communication, training and governance are important</p>
<p>Avoid, Switch, Improve (A-SW-I) (PAS 2080: 2030)</p>	<p>Similar to the A-S-I for transport decarbonisation, A-SW-I is a standard for managing whole-life carbon for infrastructure and built environment assets using the Carbon Reduction Hierarchy in meeting the need to:</p> <ul style="list-style-type: none"> • Avoid new construction if can reuse or re-purpose • Switch to alternate scope, design, materials and technology solutions to reduce whole of life carbon emissions • Improve - use of resources and design life, including using circular economy principles and nature-based solutions 	<p>Use the A-SW-I to frame research relating to whole-of-lifecycle infrastructure and built environment decarbonisation of assets</p>

2.4. Stakeholder Engagement

Stakeholder interviews with individuals from key government partners and agencies who would typically be the drivers and users of the research, confirmed the overall benefits of applied research collaborations in fundamentally changing practice, suggesting wider collaboration and communication through training:

- Need for cross-government collaboration including departments not traditionally connected to climate action, such as the Department of Health

- Supporting decision makers in government administration positions, politicians and industry leaders through **education** such as short courses, professional development training and guides to improve understanding and awareness of climate action.

Suggestions for inclusion in the research agenda:

- **Trial and prototype** new materials or products that have reduced carbon and that can then be scaled up
- Include a focus on **just transitions** in climate action research e.g. supporting workers, industries and communities in the shift from carbon-intensive industries (such as Collie in WA)
- Identify and promote **co-benefits** of climate action to other departments and sectors in also achieving other goals, providing additional motivation for collaboration, buy-in and action
- Need for more **long-term visioning**, necessary for designing effective strategies in land use and transport planning, with the participatory process of creating such a vision acting as a catalyst for capability-building
- Research focus to date been on 'Technology' and 'Processes' leverage points, with more focus needed on '**Systems**' and '**Cultures**'
- Include research to addressing structural barriers (governance, institutions, funding, systems, policies and tools), particularly revising standard **business case and cost benefit analysis templates**, to explicitly incorporate climate action considerations
- Integrating **indigenous perspectives**, as a counterpoint in questioning assumptions and values and when making recommendations of how to change current systems and cultures.

2.5. Researcher Workshop

Researchers from WA universities participated in a workshop held to identify local research capacity, capability and expertise to participate in the research program and to elicit research ideas.

Research ideas can be grouped in any number of ways, but some theme areas emerged as follows:

- Integrating **technological innovation**, such as AI and smart systems, to enhance transport sustainability and efficiency
- Understanding and modifying **behaviour**
- Energy systems, electrification and the shift towards **electric vehicles** (EVs), including infrastructure, reliability and emissions assessments
- Sustainable **land use practices** and urban development strategies to mitigate climate impacts and support livable communities, including understanding motivations, indicators, triggers for land development companies
- **Equitable access** to safer, more sustainable transport options for all communities
- Achieving net-zero goals by reducing carbon emissions and incorporating **circular economy** principles for a range of scales and applications
- Reducing **structural barriers**, including policies, funding mechanisms and governance changes.

Research capacity available in WA to support climate action research is summarised in Table 2.

Table 2: Summary of research capacity areas

Broad capacity areas	Examples of individual capacities
Big data, data analytics and geospatial analysis	Big data and visualization; data analytics (quantitative multivariate analysis) to support modelling; environment data science; geospatial analysis; remote sensing
Modelling, forecasting, decision support tools	Transport demand modelling, freight, public transport, integrated land use – transport modelling; population geography; mathematical modelling; complex systems (ML/AI); data driven applications; optimisation simulation
Sustainable urban planning and design	Urban design; scenario planning; climate-sensitive urban design; regional planning, urban futures, built form sustainability; freight planning; urban and regional planning; integrated land use and transport planning; housing and climate change adaptation; design thinking; human/user-centred design
Transport planning	Rail planning; active travel planning walking and cycling planning; greening across the active transport network based on social, environmental and urban heat parameters; accessibility analysis
Travel behaviour	Travel behaviour analysis; choice modelling; behaviour change; consumer attitudes
Evaluation	Life cycle assessment; climate change risk assessments, sustainability assessment; infrastructure sustainability ratings; multicriteria evaluation; integrated assessment; LCA/IOA; performance evaluation and benchmarking; development assessments
Risk assessment	Land use/strategic planning to respond to risks of more extreme and frequent natural hazards and disruption from climate change; land use planning policy recovery projects (bushfire, flood, storms); emergency management planning and resourcing
Economic analysis and business cases	Cost benefit analysis of transport infrastructure projects, economic analysis, carbon considerations in business case investment decisions; carbon accounting; environmental economics
Collaborative/deliberative planning	Co-design facilitation, visioning, community engagement; policy strategy and visioning; planning governance; education for sustainability; qualitative research methods, participatory action research; ethnographic and arts-based methodologies for conceptual change
Electrified and autonomous transport	Transitioning to emissions-free transport, EV infrastructure planning; energy transition, electrification; EV charging strategies / applications; barriers to adoption of zero emissions vehicles
Law and ethics	Environmental, carbon and planning law and applied ethics

3. Research Focus

Informed by policy development, conceptual frameworks, stakeholder interviews and the researcher workshop, five research focus areas have been identified to guide the scope of the research program over the next four years (Table 3). It is in relation to these focus areas that research will be undertaken, with new opportunities and resources sought both in terms of researchers and funding.

These focus areas have overlaps, are interrelated and have synergies and have purposefully not been strictly categorised as adaptation or mitigation, since the more system-related areas could relate to both risk and adaptation. Each focus area has potential for research on the specific leverage points of individual system elements/technologies, processes, systems or culture change, but the last two focus areas - circular economy and sustainable communities - are more systemic in nature with the greatest opportunity through which to address wider system and culture change.

Table 3: Research focus areas

Focus areas	Description	Potential research topics
Climate risk and adaptation	It is common for climate research to focus on climate mitigation and emissions reduction however climate risk and adaptation are key to managing unavoidable climate impacts. The State Government is developing sector adaptation strategies and plans, of which the built form is a key sector, with land use planning and transport included, along with broader infrastructure such as utilities.	Climate risk and vulnerability assessment; physical, transitional and financial risk, impacts to people, assets and infrastructure; urban greening and heat island; resilient communities and infrastructure; planning for long-term population movement from climate hotspots in regional WA.
Transport decarbonisation	The 'Avoid, Shift and Improve' framework is often used to articulate the most effective way to decarbonise transport systems, including freight. Avoid measures include integrated land use planning, working from home or local hubs, and walkable communities and amenities. Shift measures include investment, evaluation and measurement of active and public transport and behaviour change programs. Improve measures include the technology transition to zero emissions vehicles and fuels.	Barriers to behaviour change in adopting new technologies or shifting to more sustainable transport modes e.g. effectiveness of free public transport, evaluation and measurement tools for effective policy and investment, opportunity to integrate micro-mobility and e-mobility with the energy system and land use planning, emissions modelling and forecasting to inform policy and decisions making, understanding future technology, fuels and charging/refuelling needs.
Infrastructure and built environment decarbonisation	While infrastructure accounts for 79% of emissions across Australia, embodied emissions account for 3% of total emissions and this share will increase as grids decarbonise and vehicles transition to zero emissions. Reducing embodied emissions across the asset life cycle is therefore critical to meeting overall climate targets. Similar to transport system decarbonisation, PAS2080 (a global standard for managing infrastructure carbon that meets World Trade Organization requirements) provides a carbon management standard for addressing infrastructure decarbonisation with an 'avoid, switch, and improve' framework. Avoid measures include actions to minimise requirement for new infrastructure through tools such as travel demand management and modelling, refurbishing or reusing existing assets or reducing the footprint of new infrastructure. Switch measures include	Sustainable, low carbon materials such as concrete, steel, aggregates, plastics and asphalt; transition to zero emissions off-road machinery and equipment; using digital tools to maximise emissions reduction in planning and design phase; incorporating carbon values into business case planning and options analysis; life cycle assessment; general case studies of fast-track proofs of concept/trials of new technology and products used in large scale construction in transport that can then be scaled up once proved safe and effective (e.g., such as concrete, steel and aluminium); economics of climate risk for the built environment and infrastructure in WA.

	<p>optimising design of planned infrastructure to reduce material requirements. Improve measures include applying circular economy principles utilising recycled and reuse materials, and zero emissions technologies.</p>	
<p>Circular economy and materials</p>	<p>Over 75% of natural resources are consumed in cities, which produce over 70% of global waste. With approximately half of emissions associated with material use, there is a need to transform linear value chains and preserve material value to achieve Net Zero at the city scale. There have been calls globally from organisations such as the Ellen MacArthur Foundation to move away from wasteful linear models of resource consumption to more sustainable circular resource models. The Australian Government established the Circular Economy Taskforce to address this issue and CSIRO have published circular economy mapping at national level to provide transparent understanding of material flows across the economy. At State level the government also has avoid, reuse and recycling targets for residential, commercial and C&D waste.</p>	<p>Life cycle assessment and material mapping, trials and application of recycled and reuse materials, marketplaces and financial models for circular economy practices, metrics and indicators for measuring circular economy, identifying opportunities for circular resource use in transport and land use planning.</p>
<p>Land use planning and sustainable communities</p>	<p>Given historical land development trends and preferences in Greater Perth and regional towns for large land parcels, low rise developments and urban sprawl, achieving optimal integrated land use planning and sustainable communities can be challenging. Providing tools and policy and practice solutions, as well as addressing structural barriers, is therefore needed. Changing consumer behaviour and preferences will be critical to having political support to do this. With materials, labour and housing costs rising with interest rates in recent years, a priority has been for faster, low-cost build and infill developments. Building the case for co-benefits with sustainable design and demonstrating evidence for this is therefore critical over the coming years.</p>	<p>Urban greening, zero carbon and resilient communities and neighbourhoods; sustainable planning and design; evaluation and metrics for measuring benefits of sustainable communities; visioning/reimagining/narratives for sustainable; climate friendly and just futures for WA communities, incorporating private sector, government and indigenous knowledge and views; addressing structural barriers (governance, institutions, funding, performance measurement systems, policies and tools, revising standard business case and cost benefit analysis templates, to explicitly incorporate climate action considerations; revised governance and expenditure models, alternative business KPI's and spending metrics for achieving more sustainable outcomes</p>

4. Research Project Activity

4.1. Foundation projects

This Plan does not begin with a ‘clean slate’, with four “foundation” projects having commenced in 2022/23 in parallel to the commencement of work on this Plan:

These foundation projects emanated from a previous initiative run by the Transport Portfolio, outside of any PATREC processes. The impetus and relationships developed in conducting these projects to date, has informed this parallel Plan development process, with project stakeholders contributing to interviews, workshops and reviews. It is therefore not surprising that the foundation projects align well with research focus areas of this Plan (Table 4).

Table 4: Alignment of foundation projects with research focus areas of this Plan

Research focus area	Foundation project title	Project aim
Transport decarbonisation	Feasibility of battery-electric buses for the Public Transport Authority’s regional school bus services	To assess the feasibility of battery-electric buses for regional school bus services in WA; identify and, where needed, propose solutions for electricity network capacity constraints; and identify the technical support services required for zero emissions buses and related infrastructure
	Biofuels - Evaluation of Hydrotreated Vegetable Oil (HVO) renewable diesel trial	To evaluate the trial of the use of HVO100 in the construction of the Byford Rail Extension (Metronet) to provide a third-party review of the suitability of HVO as a fuel source to achieve low carbon outcomes in the construction stages of the asset lifecycle and create increased confidence in the market to use the renewable diesel
Circular economy and materials	Mapping the circular economy of WA: Monitoring the contributions of circularity towards achieving Net Zero	To measure the materials footprint linked to final consumption in Greater Perth, quantifying resource inflows and waste outflows and related energy use and GHG emissions. Building on the materials footprint, prepare localised stock and flow accounts of actual material and energy use, providing a high-level overview and understanding of the socioeconomic metabolism of Greater Perth, and the wider WA economy
Land use planning and sustainable communities	Accounting for carbon in the planning for new residential suburbs	To understand how planning for new residential neighbourhoods can contribute to reducing greenhouse gas emissions (GHG), considering how accounting for emissions can be accomplished at the planning stage, followed through to implementation and delivery stages. WA’s State Planning Policy (SPP 7.2) includes a requirement for precinct structure planning to consider GHG reduction and incorporation of renewable energy sources, and the preparation of an Energy and GHG Emissions Statement. This research will support meeting this requirement, providing an evidence base and tools to support better decision making and assessment in planning and design of new neighbourhoods.

4.2. Project achievements to date

Since the establishment of the program in 2022, research project activity progress includes:

- Completion of three of four iMOVE/PATREC ‘foundation’ projects (Stage 1, 2023-24 program):
 - Feasibility of battery-electric buses for the Public Transport Authority’s regional school bus services, Stage 1 (UWA)
 - Mapping the Circular Economy of WA: Monitoring the contributions of circularity towards achieving Net Zero: Stage 1 (Curtin)
 - Biofuels - Evaluation of Hydrotreated Vegetable Oil (HVO) renewable diesel trial - independent evaluation of pilot project (Curtin).
- Substantially completed the fourth iMOVE/PATREC foundation project (Stage 1, 2023-24 program), scheduled for completion by March 2025:
 - Accounting for carbon in the planning for new residential suburbs (AUDRC UWA).
- Agreed to three, Stage 2 extensions to Stage 1 projects as part of the PATREC 2025-27 program of research, fast-tracked to optimise the opportunity to leverage iMOVE CRC funding:
 - One, commenced - Feasibility of battery-electric school bus services in WA: Scaling up the transition (Dept of Education school buses) (UWA)
 - Others due to commence by mid-2025
 - External project activity (projects not funded by core (annual PATREC subscription funding core): after two years of negotiation and funding applications, agreement stage reached for the AURIN WA Node - National Collaborative Research Infrastructure Strategy funding (NCRIS) in partnership with AURIN to establish a WA research infrastructure node for climate action in transport and land use planning (UWA, Curtin, JTSI, Uni Melbourne (AURIN), \$1,240 million over 3 years – 24/25 – 26/27).

4.3. Planned project activity 2025-28

4.3.1. *Approved and funded 2025-27 ‘fast-track’ core PATREC/iMOVE program*

- Complete the last foundation project (Stage 1, 2023-24 program): Accounting for carbon in the planning for new residential suburbs (AUDRC UWA)
- Complete the Stage 2 project: Feasibility of battery-electric school bus services in WA: Scaling up the transition (Dept of Education school buses) (UWA)
- Conceptualise, finalise funding contributions (including from non-core sources), execute agreements and commence Stage 2 projects, building on the findings and recommendations of the Stage 1 projects:
 - Stage 2: Accounting for carbon in the planning for new residential suburbs (AUDRC UWA)
 - Stage 2: Mapping the Circular Economy of WA: Monitoring the contributions of circularity towards achieving Net Zero (Curtin).

4.3.2. *Use remaining 2025-26 core funding for additional projects*

Once detailed budgets for the approved Stage 2 projects have been agreed in project agreements, propose and obtain approval to use any remaining core funds to put towards additional projects (other sources may also be sought to fill any funding gaps), which may include those currently under discussion, such as:

- Biofuels – if any more trial data from METRONET sites and Fremantle ports becomes available, progress with proposing and conducting a Stage 2 trial evaluation project (Curtin)

4.3.3. Develop 2027-29 core program of research

In anticipation of core funding contributions for both programs being secured to 2028 (variation agreement due for presentation to the Board in December 2025 and execution in 2026), a core project selection process will commence in July 2026 in accordance with the approved PATREC process (Figure 1) and will be run simultaneously for the traditional and climate action programs, by PATREC’s two research advisory committees (RAC) - PRAC and CARAC.

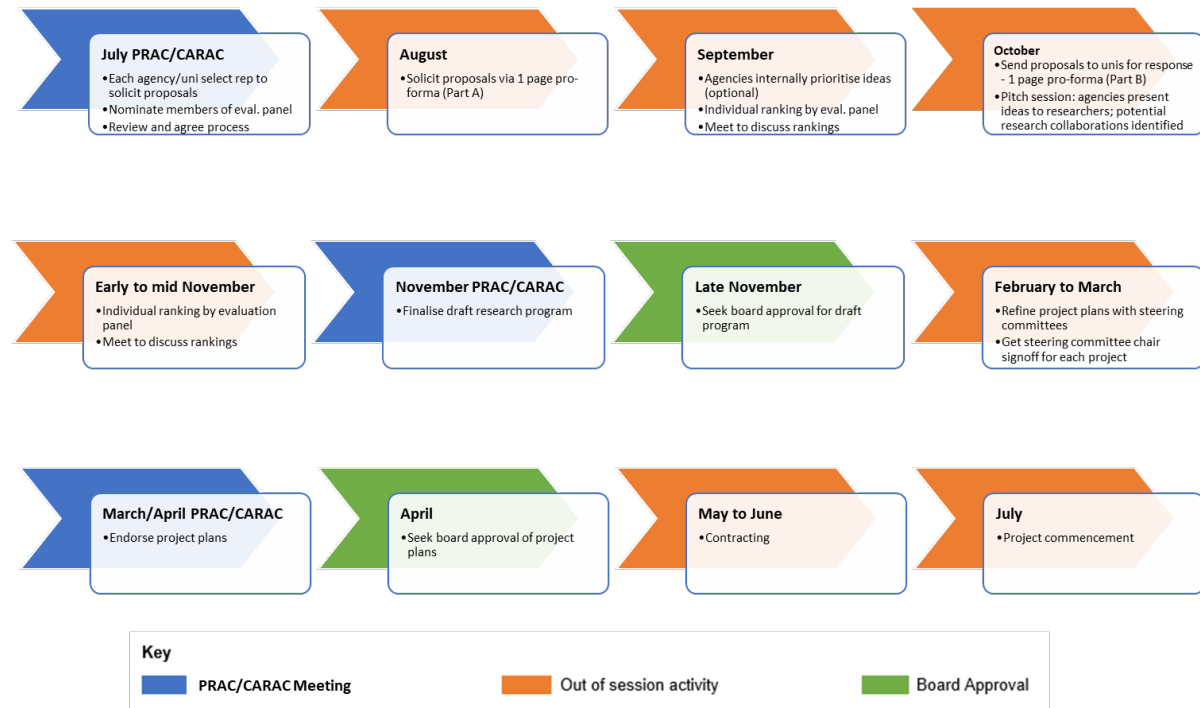


Figure 1: Formal core project selection process (run every two years)

Selection criteria are given in the PATREC Strategic Plan 2023-25 (section 9.3.2) but may be amended to specifically be responsive to this Plan.

4.3.4. External projects

External projects are those not using any core funding, rather use ‘additional’ funding from collaborating partners and/or other funders not formally part of PATREC. The focus is to commence, progress and complete the new AURIN WA Node (three-year project) and develop new external projects with current PATREC collaborating partners as well as other agencies involved in the climate action program:

- Commence, progress and complete the National Critical Research Infrastructure Strategy (NCRIS), AURIN WA Node to support climate action in transport and land use planning research through key accessible datasets and (modelling) tools. The three-year funding will support at least two fulltime appointments, one each at Curtin and UWA, to resource the project (Lead: AURIN (Uni Melbourne); \$1,240k (\$620k Commonwealth; WA leverage (\$310k; unis (Curtin, UWA) \$310k)
- Develop and secure new external projects with wider agency involvement and funding: building on the momentum of the project ideas put forward at the researcher workshop and stakeholder interviews, captured in this Plan and supplementary discussion document.
 - Consider running a process in parallel to the PATREC mini-selection process to be undertaken in early 2025 (to identify ‘replacement’ projects for withdrawn traditional

- core projects) but extended to include a call for external project ideas for the climate action program in line with this Plan
- Follow-up on opportunities with other agencies, raised during the stakeholder interviews, including:
 - Cooperation with DPLH and WAPC on funding more land-use based climate action research customized to the Departmental needs
 - Cooperation with DWER to explore opportunities for adaptation research based on previous work conducted by DWER (currently shared with PATREC)
 - Working with the RACE for 2030 CRC and MOJO Car Share on a research project to drive greater social and environmental impact through shifting to car share services
 - Collaboration with the RAC, UDIA and other industry bodies in the land use planning and transport space to better understand the commercial aspects of this space and work on common climate action topics.
- Investigate opportunities to participate in emerging CRCs including the potential Future Freight Cooperative Research Centre (CRC), particularly in the ‘decarbonising freight’ stream - the current iMOVE CRC team is looking to propose another CRC: Future Freight CRC, initially focussed on decarbonising freight but more recently broadened to include safety and efficiency. This CRC provides an opportunity to cut-across both transport and planning research. The key question for the proposed CRC: “How can we most effectively decarbonise freight whilst also improving efficiency for the benefit of the sector, the economy and the environment?” by “generat[ing] evidence-based knowledge and innovative solutions that accelerate decarbonisation and enhance efficiency of multimodal movement of goods by road, rail, sea and air”. It would be run along the same model as the current iMOVE CRC (ending in June 27). This new CRC would commence in early 2027, if successful. As with the current iMOVE CRC, it is strongly industry led so the bid team is in the first instance, talking to government and industry around the country, identifying some initial potential “areas of work” (Figure 2). It is proposed that as a first tangible step, a project agreement be developed as part of the current iMOVE CRC program to develop a research agenda for decarbonising freight in WA. Good to ensure balance between transport and planning research.

**Potential areas of work
– from industry discussions to date**

CLEAN	EFFICIENT	SAFE	CROSS CUTTING
Supporting demonstrations of new fuels	Sensing technology- including ITS	Understand safety considerations as freight task changes	Insights & evidence Data, AI, enhanced decision support Policy development Policy level required to achieve benefit Behaviour change Adoption & advocacy Skills development Resilience Focus on Australian needs
Energy systems	Harmonisation of software, hardware and infrastructure	People safety	
Develop decision making tools	Benefits and cost comparisons	Vehicle safety	
Circular economy	Digital twinning To understand efficiency and decarb scenarios	Economic and insurance implications	

Figure 2: Work-in-progress – initial and evolving potential areas of focus for the Future Freight CRC (https://imoveaustralia.com/wp-content/uploads/2024/11/Future-Freight-CRC_Melbourne-Workshop-Slides_12nov2024.pdf)

- Curtin will investigate submitting an ARC Linkage application in relation to a circular economy project.

4.4. Knowledge Transfer, Communication and Training

- Continue to update and refresh the PATREC website on an ongoing basis with climate action activities, with links to LinkedIn and other relevant media outlets
- Release media statements/briefing for Ministers e.g. in relation to the climate action program once the strategic plan has been approved, and subsequently, as appropriate
- Encourage PATREC researchers to publish evidence-based contributions in planning/transport focused media outlets
- Continue to host PATREC dissemination seminars and webinars for completed projects
- Promote PATREC research through participation at relevant conferences
- With the climate action program now well underway, hold a half-day PATREC Research Forum to showcase climate action projects (including related projects from the traditional program e.g. biochar, active travel etc.) to PATREC's wider stakeholder group, beyond PATREC partners, including researchers, government agencies, industry, consultants, RAC, UDIA
- Pursue opportunities to engage with industry groups involved in planning, development and transport to promote research outcomes and generate interest in solutions requiring their involvement
- Identify, initiate and coordinate short courses on topical climate action issues across the research focus areas, which could be the precursor for formal units, with strong links with industry
- Consider opportunities for providing transformational leadership education (e.g., executive leadership programs, 'transformation labs', study tours and climate leadership fellowships to contribute to increasing actors' knowledge, skills and ability to collaborate for Climate Action
- Investigate the opportunity of setting up a community of practice to maintain key researcher involvement and building of the researcher base

5. Delivering on the Plan

5.1. Human Resources

5.1.1. Appointment of a Program Leader

A key HR activity will be to appoint a PATREC CA Program Leader at Curtin to provide capacity in leading and managing PATREC projects across both programs but focussing initially on the climate action program as well as driving the development and funding of new, especially external, projects. With the position at Curtin, the purpose of the position would further be aimed at working with Curtin's Urban Planning team to draw in Urban Planning expertise to strengthen PATREC's land use research capability to supporting WAPC and DPLH, in the climate action as well as the more traditional PATREC programs of research. The intention is that core funding will partly support this role, with the balance, funded through project funding. An opportunity is to appoint someone to the program leader role who has the right kind of expertise to also undertake the 3-year funded role of product manager/data analyst/software engineering expertise for the NCRIS-funded AURIN WA Node.

5.1.2. Wider research team

With leadership, administration and coordination by a small PATREC core team, a much wider team of PATREC project research associates from across the partner universities and with some support from adjuncts, consultants and PhD students, are called upon to conduct policy-informing, applied research. Through the mechanism of project steering committees, researchers are supported and enabled by a dedicated team of agency stakeholders who ensure that the research is well-aligned with policy objectives and that the research outcomes are well-communicated within the agencies and wider if required (Table 5).

Table 5: Current project researchers and steering committee members

CA researchers	CA project steering committee members	
Julian Bolleter, AUDRC, UWA	Steve Beyer, DoT	Cara Francis, DWER
Bill Grace, Adjunct, AUDRC, UWA	Susie Page, DoT	John Bailly, PTA
Chris Lund, Adjunct, AUDRC, UWA	Callie Cummins, DoT	Ariadne Macleod, DWER
Thomas Braunl, Prof, Electrical, Electronic and Computer Engineering, UWA	Ying Huang, DoT	Jesse McDonald, SWDC
David Harries, Adjunct, Electrical, Electronic and Computer Engineering, UWA	Stephanie Zhang, DoT	Julie Brockman, City of Canning
Mark McHenry, Adjunct, Murdoch University	Alexandra Meek, DoE	Lilli Dorn, DPLH
Guido Wager, RA, Electrical, Electronic and Computer Engineering UWA	Anne Sashegyi, DoE	
Dora Marinova, Prof, CUSP, Curtin	Melinda Payne, DPLH	
Josh Hopkins, CUSP, Curtin	John Clifton, DevWA	
Roberto Minunno, CUSP, Curtin	Ryan Falconer, DoT	
Yun Yu, Chemical Engineering, Curtin	Helen McGettigan, IWA	

As part of the development of this Plan a map of researcher names and capabilities was gathered from the attendees at the researcher workshop. This list will be consulted and used when circulating calls for expressions of interest to respond to prioritised project ideas.

5.2. Management and Operations

5.2.1. Governance

5.2.1.1 Climate Action Research Advisory Committee (CARAC)

This Plan is built on the persistent and valuable work of the Climate Action Research Advisory Committee (CARAC) who oversaw and nurtured the development of the CAPTR Strategic Plan. The Members of CARAC for 2025 are:

- Steve Beyer (Chair) Department of Transport
- Susie Page (Deputy) Department of Transport
- Ryan Falconer Department of Transport
- Louis Bettini Main Roads WA
- Gemma Habens Department of Planning, Land & Heritage
- Sam Wilkinson Department of Water and Environmental Regulation
- John Clifton Development WA
- Helen McGettigan IWA
- Bill Grace UWA AUDRC
- Dora Marinova Curtin, CUSP
- Andrea Down Public Transport Authority

5.2.1.2 Project management

Once projects are underway, Leaders will report three times a year on progress against milestones to CARAC and the Board. The reporting requirements will not be onerous but will be sufficient to enable the Director and CARAC to identify whether the project is on track or if there are issues requiring attention. A reporting template comprising 3-4 questions on progress will be provided and the need for quarterly reporting will be included as a requirement in the project plan or contract. At the end of each project, a close-out template is completed by the project steering committee chair to note value and impact – included as a KPI as an impact statement.

5.2.1.3 Key performance indicators

PATREC delivers value to government and academic collaborating partners and KPIs have been developed accordingly (Table 6). Targets are set in the annual Business Plans and in the latest Business Plan 2025, have not been separated into targets for each program. The feasibility of this will be assessed as part of the preparation of the PATREC Strategic Plan 2026-28 due to be presented to the Board in December 2025.

Table 6: Key Performance Indicators

Performance Indicator
Number of journal papers published
Number of peer-reviewed conference papers published in proceedings
Number of post graduate research students attracted, retained and/or graduated)
Value (\$) of research funding secured [all income except for traditional and CA core subscriptions]
Annual academic project ROI (5-yr 2021 - 2025)
Number of high impact, policy-informing projects/sub-projects completed
Number of substantive Technical Reports/Working Papers accepted/published
Number of PATREC Perspectives/iMOVE news articles published on PATREC/iMOVE websites
Number of presentations at PATREC and other connection events (including conference presentations not published)
Number of connection events arranged and held
Number of short courses, unit contributions presented
Impact statements – completed projects (qualitative)
Stakeholder (academic and policy) annual satisfaction indicator

5.2.2. Budget

A three-year forward budget for 2026-28 for the climate action program will be prepared as part of the PATREC Strategic Plan 2026-28 to be presented to the PATREC Board in December 2025. There is still a decision to be made about the feasibility of strictly allocating income and expenditure to each program. In the interim, the 2025 PATREC budget as presented in the approved PATREC Business Plan 2025 is included (Table 7) to provide short-term guidance. An indicative split has been made between the climate action and traditional program budgets.

5.2.3. Variation agreement to December 2028

It was agreed at the Board meeting held on 3 August 2023 that the variation to extend PATREC by a further period, be amended to occur every two years rather than annually and that the climate action program be integrated into the process. Accordingly, the variation agreement executed on 18 July 2024:

- extended both (usual) annual contributions and additional (CA) contributions to 31 December 2026 (one year for traditional program and 2 years for the CA) – bringing the two programs into alignment
- with the next variation agreement to be agreed by the Board in December 2025 (in two years), extending both annual contributions and additional (CA) contributions by a further period of two (2) years to 31 December 2028

In alignment with the Strategic Plan 2026-28, and with consideration of the outcome of the internal review of the PATREC funding model, the next variation agreement will be presented to the Board at its last meeting of 2025.

Table 7: PATREC budget for 2025 as per the approved PATREC Business Plan 2025 with indicative split between the traditional and climate action (green shaded) programs

PATREC Income and Expenditure	Budget 2025 Strat Plan	Final Bus Plan 25 Trad	Final Bus Plan 25 CA	Final Bus Plan 2025 combined
INCOME				
WA Government Grants (core subscriptions - trad)	322,938	322,938		322,938
Universities Sponsorship (core subscriptions - trad)	232,977	207,604		207,604
External Research Grants & Contracts - trad	970,000	900,000		900,000
iMOVE -trad	370,000	400,000		400,000
Climate action (WA gov core subscription)	290,000		290,000	290,000
Climate action (WA uni core subscription)	100,000		72,500	72,500
Climate action (external income)	250,000		200,000	200,000
Climate action (iMOVE)			300,000	300,000
Accrued Interest	0	11,487	11,487	22,973
Total Income	2,535,915	1,842,029	873,987	2,716,015
EXPENDITURE				
PATREC OFFICE	310,805	156,500	209,500	366,000
Director (0.4)	105,886	75,000	32,000	107,000
CA Program Director (0.4)	88,707		140,000	140,000
Administrative support (0.6)	80,345	58,000	25,000	83,000
General Office Costs - website, cloud storage	5,000	2,500	2,500	5,000
Board Chair Stipend	30,867	21,000	10,000	31,000
RESEARCH PROJECTS	2,201,889	1,660,000	645,000	2,305,000
Research Co-ordination (Dir. 0.6)	158,829	110,000	50,000	160,000
Research Co-ordination (CA Program Dir.0.6)	133,060		125,000	125,000
iMOVE participation & add. Project contrib.	550,000	630,000	170,000	800,000
PATREC Research Fellows	410,000	370,000		370,000
Researcher Assistants, Services, Expenses	650,000	550,000		550,000
Climate action researchers, services, expenses	300,000		300,000	300,000
Total Expenditure	2,512,694	1,816,500	854,500	2,671,000
YTD BALANCE	23,221	25,529	19,487	45,015
Balance Brought Forward	43,861			9,601
CLOSING BALANCE (incl Balance B/F)	67,082			54,616