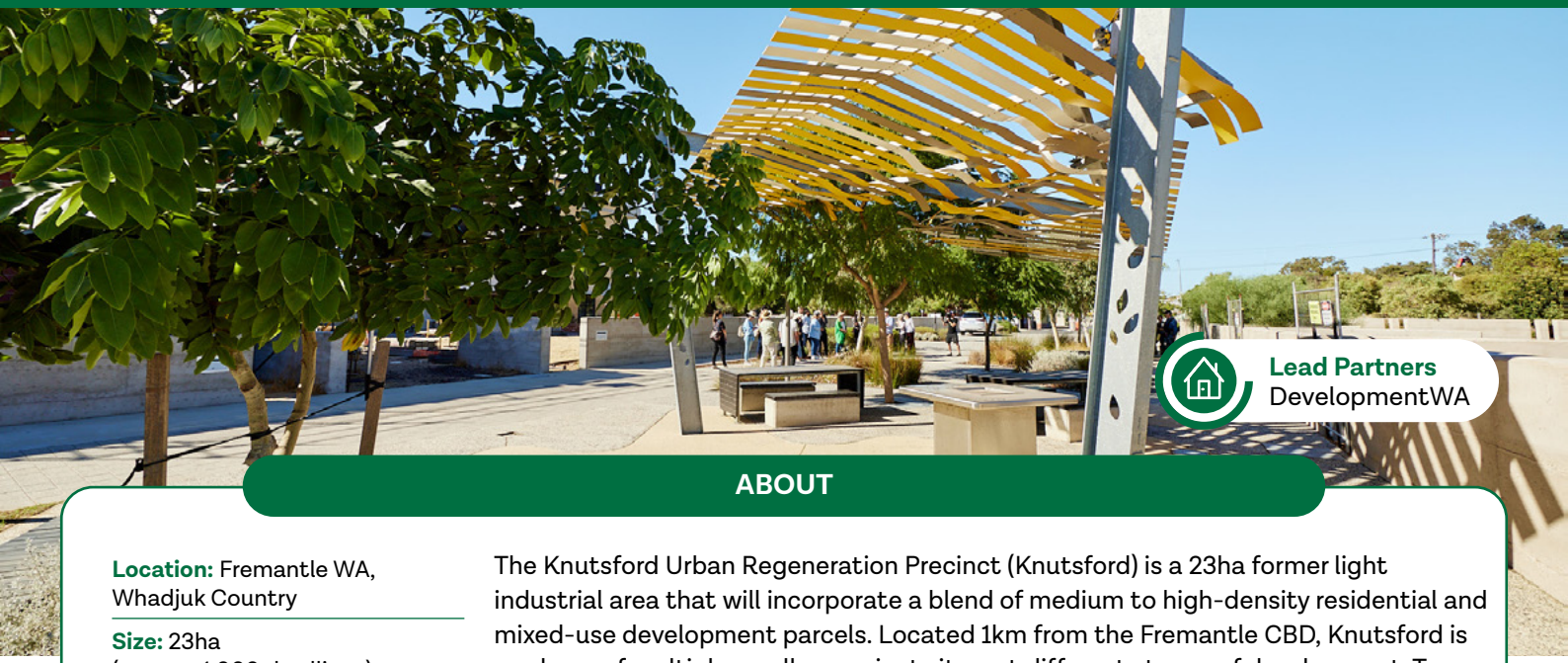
pathways to net zero precincts

RACE for 2030 RELIABLE AFFORDABLE CLEAN ENERGY

CASE STUDY FACTSHEET
Knutsford Urban Regeneration Precinct



Lead Partners
DevelopmentWA

ABOUT

Location: Fremantle WA, Whadjuk Country

Size: 23ha (approx. 1,000 dwellings)

Typology: Residential + Minor Neighbourhood Commercial

Status: In operation and development

The Knutsford Urban Regeneration Precinct (Knutsford) is a 23ha former light industrial area that will incorporate a blend of medium to high-density residential and mixed-use development parcels. Located 1km from the Fremantle CBD, Knutsford is made up of multiple smaller precinct sites, at different stages of development. Two of these sites are the subject of the Pathways to Net Zero Precincts research – East Village, and the Swanbourne Street Structure Plan Area, both led by DevelopmentWA. The nearby WGV precinct by DevelopmentWA is also forming part of this case study scope of work given the relevant learnings from this now established project.

WGV – a well-established 2.2ha residential development of approximately 80 dwellings with a diverse range of climate responsive housing options, including single residential homes and apartments. WGV is considered a pioneering model for net zero planning and early adoption of emerging renewable energy technologies, including shared solar with battery storage at the multi-residential building scale.

East Village is a 1.5-hectare brownfield residential development, including 36 town houses moving into occupancy stage, a fully-occupied 39-unit mixed-use apartment building and future terrace houses currently under construction. The all-electric sub-precinct features climate responsive design, shared solar energy systems (behind the meter household PVs and shared battery), rainwater harvesting, localised stormwater management, a groundwater supply scheme, and strata-managed billing for shared services.

Swanbourne Street Structure Plan Area is 8.3ha of former industrial land that will soon move into the subdivision planning phase with a remit to be a leading model of urban regeneration and sustainability. Different development scenarios will be tested using a novel modelling tool called Envision Tomorrow Australia (ET-Oz) to understand feasibility and environmental performance outcomes.

Knutsford demonstrates a comprehensive, real-world model for implementing net-zero precinct attributes, integrating high performance buildings, a range of renewable energy initiatives and Integrated Urban Water Management.

HIGHLIGHTS

01

The East Village 36 town home development is aiming to be 90% self-reliant in energy and net energy positive. The development is aiming for an 80% reduction in mains water demand.

02

Early insights from the Envision Tomorrow Australia (ET-Oz) modelling tool research show that net zero design features such as shared solar, batteries, EV charging, and green infrastructure significantly increased market value, confirming that integrating sustainability attributes may enhance financial performance while supporting net zero ambitions.

03

The importance of collaboration; access to reliable technical and financial information and advice for residents and strata managers; and actively fostering a connected precinct community have emerged as early findings for net zero enabling governance.

Image by J Wyld

KEY RESEARCH QUESTIONS

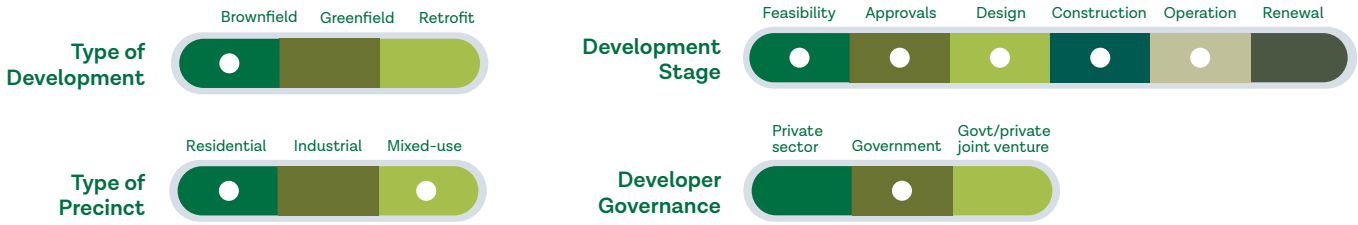
How can precinct-scale renewable energy systems, like those deployed at Knutsford, be financially modelled to optimize shared ownership and long-term value capture in urban infill developments?

How can fit for purpose governance models enable precincts to meet their net zero goals over the lifetime of the precinct?

To what extent can the Knutsford model inform scalable governance and planning frameworks for implementing net zero precincts in Australian metropolitan areas under varying regulatory and market conditions?

How can we better share distributed energy resources across a precinct, especially when land title rules make this difficult?

CASE STUDY FEATURES OF INTEREST



1. A CULTURE OF SUSTAINABILITY

DevelopmentWA is the State Government's land and development agency – with the remit to "drive economic and employment growth, demonstrate innovation and champion sustainability".[1] One of the major ways the organisation champions sustainability is through 'Demonstration through Innovation' projects such as those in the Knutsford Urban Regeneration Precinct.

A strong collaboration with the local government, the City of Fremantle, who shared a strong culture of sustainability, was critical to enabling flexible planning frameworks and approvals for innovative housing typologies and precinct infrastructure at these sites.

For example, at WGV, the flexible planning approach adopted by the City of Fremantle enabled approval of diverse and innovative housing typologies, including the Gen Y Demonstration House, and the Sustainable Housing for Artists and Creatives (SHAC) co-housing project. The City of Fremantle also supported precinct-scale infrastructure at WGV including a community bore, and local management of non-potable water for public and private landscape irrigation, underpinned by a special area rate funding model.

2. AVOIDING UNNECESSARY CARBON EMISSIONS IN UTILISING LAND

Redeveloping an existing urban site had the additional benefit of unlocking open space for public use whilst avoiding carbon emissions in greenfield land development.

3. SHIFTING TO LOWER CARBON EMISSIONS IN DEVELOPMENT PROCESSES

Retaining landform (and limiting excavation and fill) through thoughtful approaches to built form will be an important consideration for the development of the Swanbourne Structure Plan Area given the steep topography of the site.

4. IMPROVING PERFORMANCE WITH LOWER CARBON TECHNOLOGIES

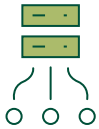
In East Village, homes are designed for 7.5-star energy efficiency, reducing energy bills by an estimated 50% compared to standard builds. The renewable energy microgrid is expected to reduce grid reliance by 90% and be overall net energy positive. The site also supports EV charging.

WGV and East Village showcase best-practice urban infill models in sustainable water management which, alongside enabling water conservation and climate resilience, also lowers carbon emissions by decreased demand on energy-intensive infrastructure needed for water treatment and pumping. At WGV, a combination of household water efficiency measures, rainwater harvesting and a City of Fremantle-managed groundwater bore achieved a 60–70% reduction in mains water use. A standout feature was the conversion of a stormwater

[1] https://developmentwa.com.au/

sump into a landscaped community park, enabling stormwater infiltration, groundwater recharge, and public amenity. The dual-pipe system delivers non-potable bore water for garden irrigation, while the City of Fremantle supported a finance model to manage the system through special area rates.

Building on WGV's success, East Village aims for an 80% reduction in mains water demand, with 7kL rainwater tanks connected to toilets and washing machines in every home. A shared groundwater bore irrigates all public landscapes, designed with hydro zoning and water-efficient planting to minimise demand. Stormwater is directed to vegetated areas for passive irrigation, contributing to microclimate cooling.



5. TESTING SCENARIO MODELLING TOOLS FOR SUSTAINABILITY AND NET ZERO DECISION MAKING AT PRECINCT SCALE

In an Australian first, researchers are using these sites at the Knutsford Urban Regeneration Precinct to develop the Envision Tomorrow Australia (ET-Oz) scenario modelling tool to support better decision making for sustainability and net zero outcomes at the planning stage of precincts. This tool provides a structured methodology to evaluate the financial feasibility and sustainability outcomes of precinct-scale developments by integrating residual land value (RLV), return on investment (ROI), and emissions data into GIS-based urban design scenarios. At WGV, ET-Oz has been used to model three different apartment building typologies. Preliminary modelling of these has shown that developments with net zero attributes such as shared solar, EV charging, and green infrastructure yield significant value uplift, with one typology achieving a 79% increase in market value*.

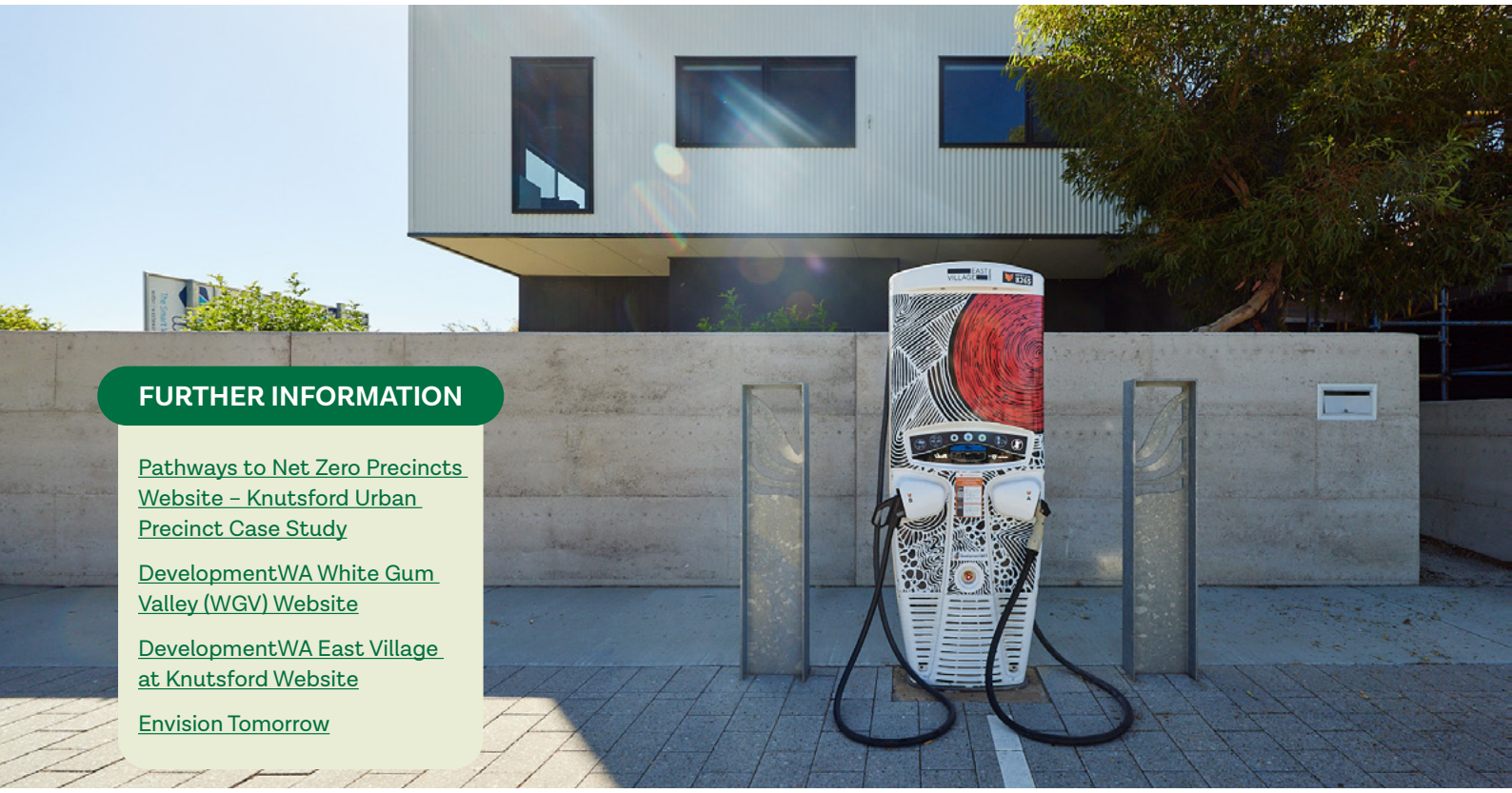
For East Village, which includes advanced sustainability features like a shared 670 kWh battery and a shared groundwater scheme, ET-Oz is being used to quantify lifecycle cost savings, emissions reductions, and land value impacts resulting from its renewable energy model. These insights are now being extended to the adjacent Swanbourne Street Structure Plan Area, where early-stage modelling will guide the optimal balance between density, affordability, and net zero design at the planning and design stages of a precinct.

**Indicative based on market value transaction and building costs*

INITIAL LEARNINGS

DEVELOPMENT STAGE	PRELIMINARY INSIGHTS FROM THE CASE STUDY
Overall	• The site highlights the importance of precinct-scale thinking, where infrastructure, services, and community design are co-optimized for emissions reduction and liveability. • Collaboration with stakeholders with aligned sustainability and net zero ambitions, (alongside enabling governance and planning flexibility) can unlock high-performance, low-carbon precincts. • By applying ET-Oz during the feasibility phase, planners can test development scenarios for density, affordable housing, infrastructure staging, and carbon performance, enabling data-driven decisions that align financial viability with sustainability targets.
Feasibility/ Business Case	• Using the ET-Oz modelling tool, researchers found that net zero design features such as shared solar, batteries, EV charging, and green infrastructure significantly increased market value, confirming that integrating sustainability attributes can enhance financial performance while meeting carbon reduction ambitions. • Decisions made at the concept and feasibility stages—such as site orientation, infrastructure capacity, and housing typology mix—have lasting impacts on a precinct's carbon footprint and liveability-reinforcing that sustainability must be embedded at feasibility stage to unlock long-term urban and economic value.
Approvals/ Planning	• Flexible planning frameworks and strong collaboration with local government enabled approvals for innovative housing typologies and precinct infrastructure.
Design	• Initial findings from using the scenario modelling tool of ET-Oz at WGV and East Village indicated that single storey typology achieved the highest development efficiency making it the most financially efficient scenario relative to its development cost whilst medium density 4-storey typology supported by a high gross development value (GDV) provide the most cost-efficient structure. (*Note; these findings are within the WA context and may differ in other jurisdictions). • Renewable energy features are critical to provide transformative value to building typology and impact investment decision making. Hence, design typology trade-offs are not just dependant on density and development efficiency but also on renewable energy.

DEVELOPMENT STAGE	PRELIMINARY INSIGHTS FROM THE CASE STUDY
Construction	• Embedding sustainability at the design and construction stage ensures that the physical infrastructure supports net zero targets from day one, avoiding costly retrofits and enabling post-occupancy performance monitoring to validate design intent.
Operation	• Well-designed sustainability infrastructure, when paired with user engagement and governance, can consistently deliver low-carbon, resource-efficient living. • Early findings on governance which enables precincts to meet their net zero goals over the lifetime of the precinct point to the importance of: a. Collaboration between the developer, government and the local community to ensure alignment of sustainability goals and facilitate the design of precincts with net zero ambitions. b. Ensuring design guidelines for net zero buildings are adhered to and that the construction code is followed to create energy efficient buildings c. Reliable technical and financial information and advice is provided to enable residents and strata managers to maximise benefit from shared renewable energy systems d. Connected community being fostered to motivate residents to keep on track with net zero goals



FURTHER INFORMATION

Pathways to Net Zero Precincts Website – Knutsford Urban Precinct Case Study

DevelopmentWA White Gum Valley (WGV) Website

DevelopmentWA East Village at Knutsford Website

Envision Tomorrow

Curtin University

RACE for 2030

DevelopmentWA

HESPERIA

Sustainable Built Environment National Research Centre AUSTRALIA

hawaiian

western power

University of South Australia

RMIT UNIVERSITY

Curtin's support includes the CISCO Curtin Centre for Future Networks

Image by J Wyld

*The initial findings and outputs presented from the ETOz (Envision Tomorrow Oz) model are intended for research, scenario planning, and policy exploration purposes only. While every effort has been made to ensure the accuracy of data inputs and methodological integrity, results are indicative and should not be interpreted as financial, investment, or development advice. Assumptions used may not reflect actual market conditions or regulatory changes. Users should exercise independent judgment and consult qualified professionals before making decisions based on these results. Neither the authors nor affiliated institutions accept liability for any outcomes resulting from the use of ETOz findings.