# PYRMONT PENINSULA SUSTAINABILITY FRAMEWORK

## SCOPING REPORT

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BUILDINGS IN THE INNER-CITY SHOULD BE CONSIDERED AS INFRASTRUCTURE. LIKE GEOLOGICAL FORMATIONS THAT INVITE HABITATION OVER A LONG PERIOD OF TIME IN A VARIETY OF WAYS.

# PYRMONT PENINSULA SUSTAINABILITY FRAMEWORK

## SCOPING REPORT

This report scopes a sustainability framework for the Pyrmont Peninsula Place Strategy, analysing the challenges and opportunities for the peninsula to deliver key sustainability performance outcomes across greenhouse gas emissions, energy and water consumption, waste, transport and urban heat and greening.

To scope the key sustainability opportunities for the peninsula, a 2020 baseline of sustainability performance is established, in addition to a 2041 growth scenario of 4,000 new dwellings and almost one million square metres of new non-residential floor space.

Getting to net-zero carbon emissions in Pyrmont will require rapid and tactical innovation from all levels of government and private investment.  The scale of these challenges can often feel overwhelming, given the political, social and economic perplexities.

Precinct based sustainability solutions are demonstrated to be critical to Pyrmont Peninsula as it evolves under a growth and development scenario of an additional 4,000 dwellings and almost one million square metres of new non-residential floor space over the next twenty years.

Not only will the deployment of strategically located multi utility hubs facilitate the step change required for sustainability, it will also enable a series of affordability and public space co-benefits which need to be accelerated to maintain and improve on the liveability of Pyrmont Peninsula.

The Pyrmont Peninsula Sustainability Framework delivers a set of transformative place making and sustainability interventions coupled with a monitoring framework to ensure success can be measured as change occurs with the agility to refine and offset solutions where required.

There are four sustainability framework pillars proposed:

1. **Multi-Utility Hubs as Precinct Infrastructure**
2. **Green Streets and Active Spaces**
3. **High Performance New Buildingsw**
4. **Offsetting to deliver a Net Zero Outcome.**

THE FOUR SUSTAINABILITY PILLARS

# PYRMONT PENINSULA SUSTAINABILITY FRAMEWORK

**NET ZERO**
emissions by 2041

**25MW**
of new local renewable energy, meeting 10% of demand

**100MWh**
of grid scale and EV battery storage to manage peak demands

**10ML/YEAR**
of recycled water for new urban greening water demands

**ZERO**
on-site parking in new residential development

**1200**
precinct parking spaces distributed in multi-utility hubs enabling the strategic removal of resident on-street parking

**$100,000**
of potential savings from the cost of a new dwelling

**20,000**
truck movements avoided through less excavation for parking

**2 HECTARES**
of new public space through the delivery of greener streets and active spaces

**25%**
canopy cover delivered across the peninsula for a cooler and more resilient urban environment

# 1. BACKGROUND

In March 2020 the Department of Planning, Industry and Environmental (the Department) released Directions for the Pyrmont Peninsula Place Strategy:

1. Development that complements or enhances the area
2. Jobs and industries of the future
3. Centres for residents, workers and visitors
4. A unified planning framework
5. A tapestry of greener public spaces and experiences
6. Creativity, culture and heritage
7. Making it easier to move around
8. Building now for a sustainable future
9. Great homes that can suit the needs of more people
10. A collaborative voice.

The development of the Sustainability Framework for the Pyrmont Peninsula Place Strategy builds on these directions to determine the key strategies and outcomes that should be delivered.

The Pyrmont Peninsula study area is outlined in Figure 1 and extends from Boundary Street to the south and, crossing the Parramatta River to Isabella Street to the north.

The study area covers the suburbs of Pyrmont, Ultimo and aspects of Darling Harbour, which is currently estimated to include approximately 35,000 jobs, 9,500 dwellings (90% of which are apartments) and 3.5 million m2 of floor space, with the largest proportion used for residential apartments (1.5 million m2) and commercial office buildings (770,000 m2)[1].

A growth and development scenario of an additional 4,000 dwellings and almost one million square metres of new non-residential floor space over the next twenty years has been modelled and analysed as part of this Sustainability Framework.

PYRMONT PENINSULA STUDY AREA

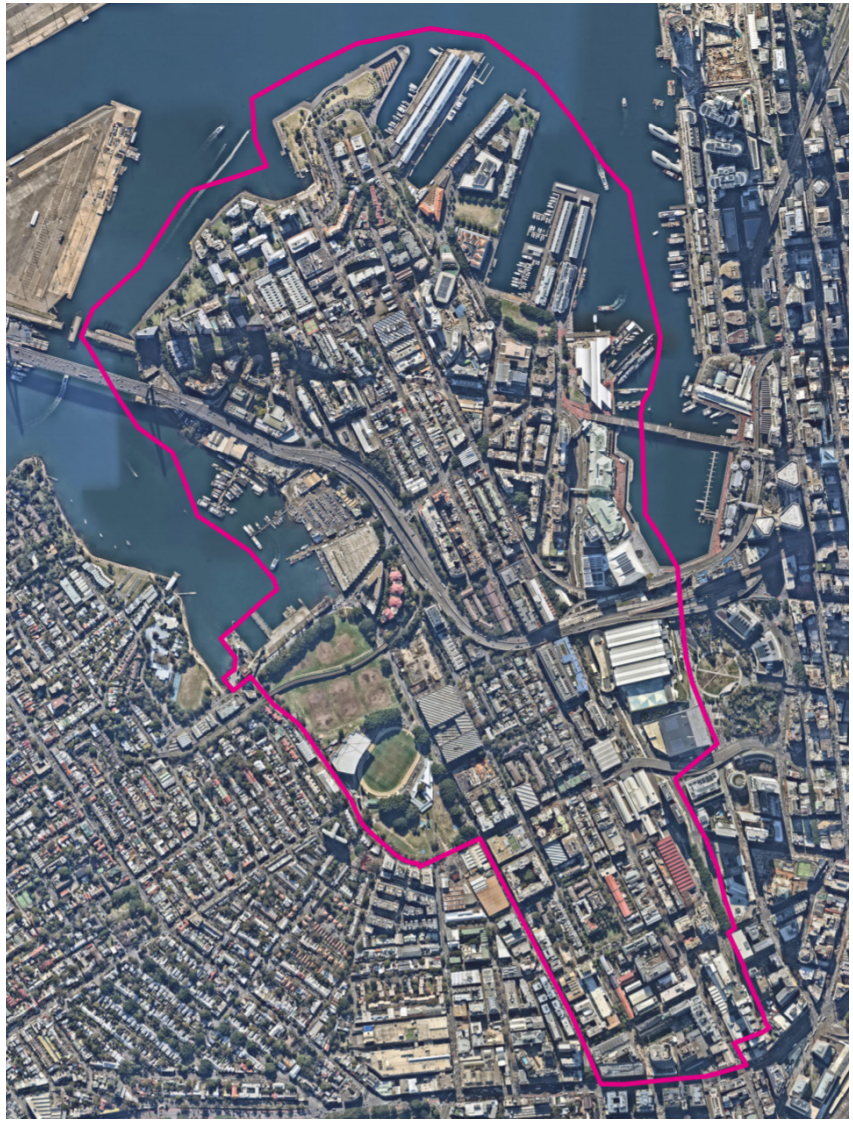


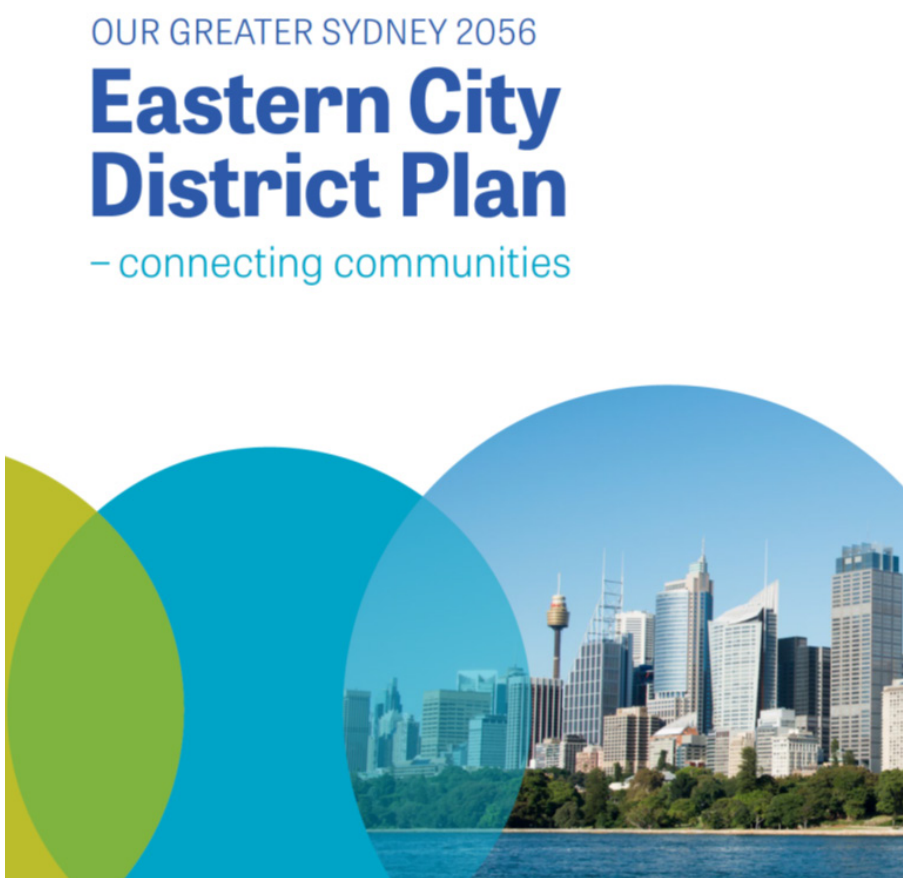
Figure 1: Pyrmont Peninsula Study Area and focus for baseline analysis

1 City of Sydney Floor Space and Employment Survey (FES) 2017.

# 2. STRATEGIC CONTEXT

**The Pyrmont Peninsula provides the ideal opportunity to enable precinct solutions for low-carbon, high performance precincts and deliver on the aspirations of state and local policy.**

## A Metropolis of Three Cities




The Greater Sydney Region Plan, A Metropolis of Three Cities, establishes a 20-year plan to manage growth and change for Greater Sydney in the context of social, economic and environmental matters.

The Eastern City District Plan identifies the need for the delivery of more efficient, low carbon and low water development. It is envisaged that Pyrmont Peninsula will play a significant role in delivering the actions of the Eastern City District Plan, including:

- Expand urban tree canopy in the public realm.
- Support initiatives that contribute to the aspirational objective of achieving net-zero emissions by 2050, especially through the establishment of low-carbon precincts in Planned Precincts, Collaboration Areas, State Significant Precincts and Urban Transformation projects.
- Support precinct-based initiatives to increase renewable energy generation, and energy and water efficiency, especially in Planned Precincts, Collaboration Areas, State Significant Precincts and Urban Transformation Projects.
- Protect existing and identify new locations for waste recycling and management.

# STRATEGIC CONTEXT


## Greener Places Design Guide

The actions of the Eastern District Plan are further supported by the Greener Places Design Guide developed by the Government Architects in 2020 sets a framework for defining and achieving greener places. For the Pyrmont Peninsula, this includes the establishment of a 25% canopy cover target in medium to high density areas and measurable criteria for access and the quality of open spaces in urban areas.


## Housing Strategy

A Discussion Paper (May 2020) for a Housing Strategy for NSW for requires the consideration to improve environmental sustainability and resilience in residential precincts.

It proposes that many environmental performance technologies are more efficient at a precinct scale than at the individual dwelling scale as the costs can be shared. The list of technologies it proposes include precinct-scale batteries for energy, waste treatment, or precinct-scale water reuse and waste management are all explored in the Sustainability Framework.


## Sustainable Sydney 2050

Sustainable Sydney 2030 is a set of goals that have been set for the city to help make it as green, global and connected as possible by 2030. The City is currently reviewing and updating Sustainable Sydney 2030 with a view to 2050, which involves reviewing environmental targets and actions. Relevant targets for the growth and development of the Pyrmont Peninsula are:

- Net zero emissions by 2040.
- Zero increase in potable water use by 2030 from 2006 baseline.
- Increased waste recovery from residential, commercial and construction/demolition.
- Canopy cover is increased to 23 per cent by 2030 and to 27 per cent by 2050.

Additional City of Sydney targets considered in this framework are provided in the Appendix to this report.

For the Pyrmont Peninsula, the overall outcome of these policies focuses on the delivery of **precinct infrastructure solutions, zero carbon outcomes and greener places.**

# 3. 2020 BASELINE SUMMARY

## 75%

**Proportion of greenhouse gas emissions from electricity**

Pyrmont and Ultimo are second only to the Sydney CBD as the most GHG emissions intense precinct across Sydney. 75% of these emissions are from the electricity demand of buildings. However, residential emissions per dwelling are approximately half that of the average Sydney Metropolitan household. See Appendix, Figure 9.

## 15%

**Reduction in electricity demand in the last 10 years**

Electricity demand across Pyrmont and Ultimo has consistently declined since 2010. This reflects trends in energy efficiency in both residential and commercial buildings, from improved lighting, air conditioning and appliances. See Appendix, Figure 10.

## 1%

**Percent of residential dwellings with solar PV**

Similar to the City of Sydney as a whole, Pyrmont and Ultimo both have very low levels of renewable energy, approximately 1% of all dwellings. This is a reflection of the high-density built form and high concentration of rental households (approximately 60%). See Appendix, Figure 11.

## 40%

**Higher per dwelling water use than the City of Sydney average**

Despite the high-density built form of Pyrmont and Ultimo, per dwelling water consumption is high when compared to both the City of Sydney and the Greater Sydney average. While it is often assumed that garden irrigation is the largest contributor to water demands across the residential sector, apartments (with very small irrigation areas) can often have higher demands due to lack of water metering and associated leaks that remain undetected. See Appendix, Figure 14.

## 33%

**Households without a car**

Pyrmont and Ultimo have areas with some of the lowest car ownership rates in Australia. The average household owns 0.77 vehicles per dwelling, and 33% of all households do not own a car. Car ownership, however, is not uniform across the peninsula with higher ownership in the northern areas with lower accessibility and higher income. See Appendix, Figures 17 and 18.

## 0.8

**Average parking ratio provided in new dwellings**

Over the last 10 years, the average amount of on-site parking provided in new development is 0.8 spaces per dwelling, which is slightly higher than the average current car ownership rate. It should also be noted that a parking space in Pyrmont and Ultimo currently adds approximately $100,000 to the sale price of a new apartment.

There are currently over 2,000 resident, visitor and car share on street parking permits in the study area.

## 27%

**Households with car share membership**

Low car ownership rates across the peninsula support high amounts of car share (vehicles shared and leased) amongst many residents and businesses across the peninsula. Currently, over 2,000 residents across the peninsula are car share members. See Appendix, Figure 19.

## 12%

**Percent of canopy cover**

Analysis by Kinesis has proven a strong correlation between higher canopy cover with lower land surface temperatures in Sydney's urban areas. Pyrmont and Ultimo currently has on average low levels of green space and canopy (approximately 12% on average) but includes pockets of high canopy within high density areas (up to 34% across the area). See Appendix, Figures 15 and 16.

# 4. FOUR PILLARS OF THE FRAMEWORK

The Pyrmont Peninsula has the key foundations of being able to materially improve sustainability, affordability and inclusiveness, playing an active role in supporting the urbanism of the Sydney CBD and creating a better and richer experience for residents, workers and visitors.

The delivery of precinct-based solutions for improved environmental performance is cited in both State and Local Government policy directions. Pyrmont Peninsula is the perfect scale and size to protype and validate what this actually means, including the partnerships, governance and technology to make it happen. This strategy identifies four key mutually reinforcing enablers to facilitate world-class sustainability performance for the precinct which delivers on the aspirations of state government policy and local government leadership. These are:

1. **Multi-Utility hubs as precinct infrastructure**
2. **Green streets and active spaces**
3. **High performance new buildings**
4. **Offsetting to deliver a Net Zero Outcome**

Multi-utility hubs are effectively the delivery of precinct solutions to energy, water, waste and transport (Figure 2). These hubs are supported by high performance buildings which draw less energy from the grid and provide renewable energy for local distribution, and enable greener streets by removing on-street parking and providing recycled water for increased canopy and green space.

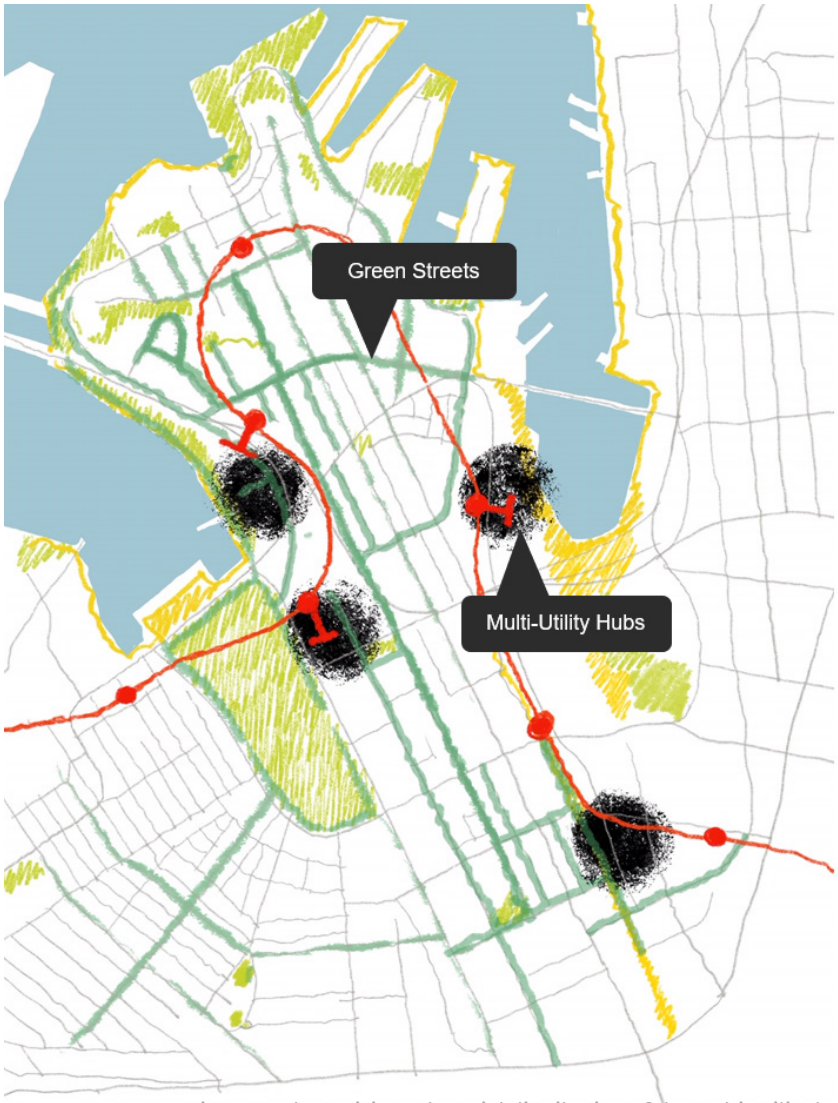



Figure 2: The anticipated spatial distribution of the multi-utility hubs

# 4.1 MULTI-UTILITY HUBS

Buildings in the inner-city should be considered as infrastructure. Like geological formations that invite habitation over a long period of time in a variety of ways. The implications of such an approach have yet to be explored. This Sustainability Framework explores this concept for the Pyrmont Peninsula through the delivery of multi-utility hubs.

Multi-utility hubs are buildings which house multiple utilities to deliver precinct solutions to energy, water, waste and transport (Figure 3). For the Pyrmont Peninsula, it is proposed that these hubs are strategically located across the peninsula to deliver:

1. Precinct parking so that no new residential redevelopment across the peninsula is required to deliver on-site parking, and on-street parking can be removed to create better and cooler streets.
2. Electric vehicle charging so that when electric vehicles are available, infrastructure does not clutter the footpath.
3. Grid-scale battery storage to optimise local renewables and electric vehicle charging.
4. Organic waste systems to manage local food waste from residents, creating compost for local garden and landscaping needs.
5. Recycled water factories to create local drought-proof water supply for a cooler and greener place.
6. Social infrastructure to deliver bike and end-of-trip facilities to support people in small dwellings and businesses in older buildings. Additionally, roof space could be allocated to experimental urban farming and commu nity gardens.

The combination of the above precinct infrastructure investments would significantly de-risk development by providing the infrastructure upfront and hence not necessitating it be provided on a site by site basis by individual developers.

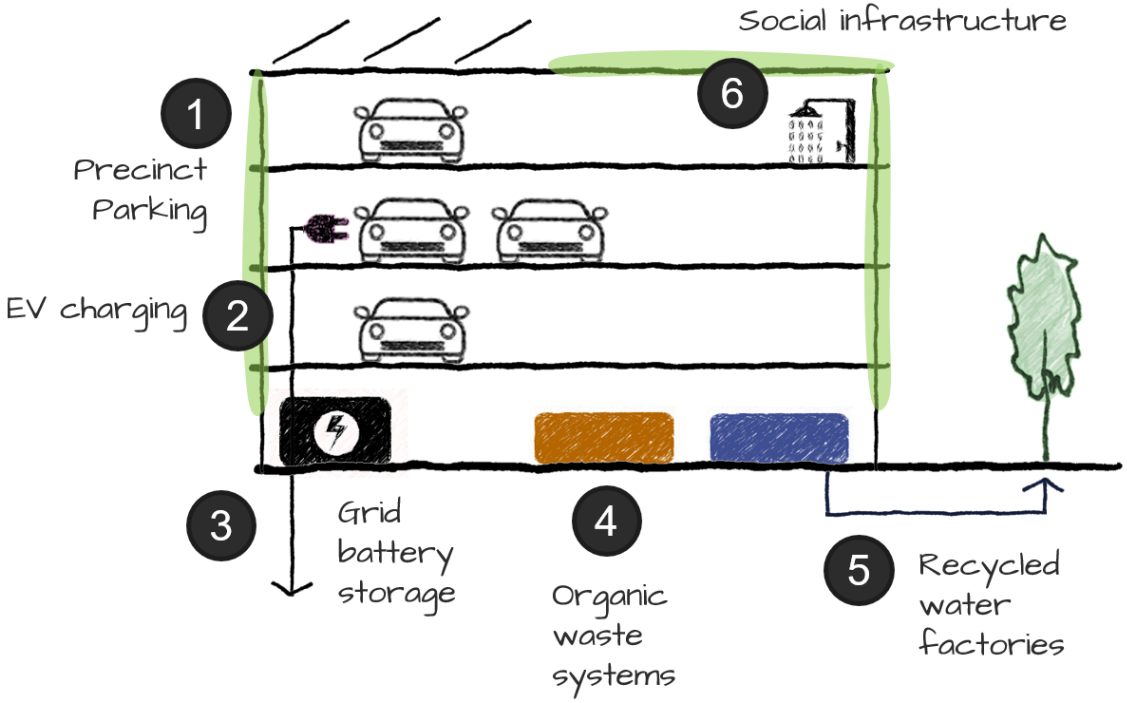



Figure 3: Multi-utility hub concept for Pyrmont Peninsula

# PRECINCT PARKING

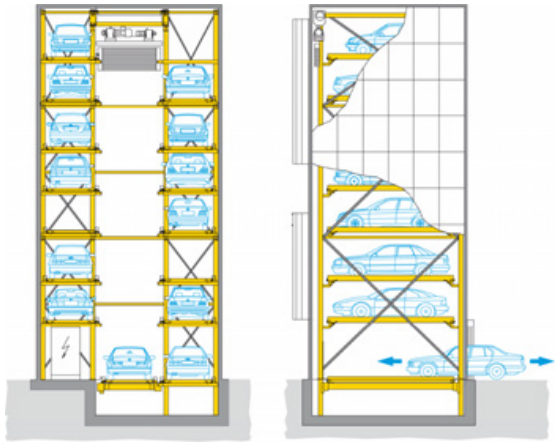
**Combined with new mobility tools, precinct parking solutions could reduce the need for parking in cities and help make housing more abundant and affordable. With some of the lowest car ownership rates in metropolitan Sydney and immediate proximity to over 300,000 jobs the Pyrmont Peninsula is a perfect precinct to test and validate, in an accelerated way, the impact of decoupled and precinct parking solutions across all new residential development.**

Zero on-site parking in new residential development coupled with the strategic removal of on-street parking provides young children and adults the opportunity to explore the street as living space equal to gardens, balconies, and public parks. It recognises that streets are essential parts of any community, not simply roads for traffic and parked cars.

Multi-utility hubs would deliver approximately 1,200 parking spaces across 4 sites, delivering a lower amount of shared parking for all new development and enabling the staged transfer of all residential on-street parking permits to multi-utility hubs. This solution is expected to:

- Improve housing affordability, removing the cost of parking which can add approximately $100,000 to the cost of a new apartment.
- Prevent an estimated 20,000 truck movements during building construction as the need for underground parking and excavation is limited.
- Limit new local car trips, vehicle circulation and local congestion by keeping traffic to the perimeter of the Peninsula.

The construction of the multi-utility hubs can be lightweight and adaptable to enable parking space in the hubs to be transitioned to other uses over time as the demand and need for car ownership and parking declines. As long as the package of parking and mobility solutions for resident provides similar or improved level of conveniences, it is expected residents would be willing to displace and possible give up the private car.



Precinct parking building designs

# EV CHARGING


**By 2041 it is estimated that 70% of all vehicles will be electric. These vehicles require electric vehicle charging infrastructure.  In areas where off-street parking is scarce and many residents still park vehicles on-street, cities are implementing electric vehicle charging infrastructure along the footpath, further clogging up street space for vehicle infrastructure.**

To address this, parking in Multi-Utility Hubs would be suitable for electric vehicle charging and grid scale battery storage. This solution allows for the following local benefits:

- Delivers electric vehicle charging infrastructure for the over 1,200 future EVs which facilitates the electrification and decarbonisation of local transport.
- Solves the problem of electric vehicle charging for existing and future residents without cluttering streets with more impediments.
- Delivers grid reversable car battery storage to further support grid resilience (see 3. Grid Scale Battery Storage).

Precinct parking will avoid clutter on footpaths

# GRID-SCALE BATTERY STORAGE

An example of grid scale battery storage

**Electric vehicles are likely to represent the largest "new" demand on the electricity distribution network in 50 years.**

While electric vehicles may not significantly increase overall consumption, if not managed well, the impact on peak charging requirements will require significant infrastructure upgrades. As an example, a new electric car is likely to have a battery capacity 4-5 times a standard domestic scale battery, with the potential charging demand equivalent to 3-4 new domestic air conditioners.

In addition, with some of the lowest renewable energy take-up in Metropolitan Sydney, the delivery of significant local renewable energy across the Pyrmont Peninsula will require local distribution of this electricity generation to manage export.

Coupled with electric vehicle charging infrastructure, Multi-Utility Hubs have the potential to manage this challenge.  It is estimated that these hubs could deliver:

- A combined battery storage of grid scale (50 MWh) and grid reversable car batteries (50 MWh) to manage evening peak demands and create increased network resilience.
- Facilitate the management of local electric vehicle charging peak demands.
- Facilitate the distribution and management of any locally and externally generated renewable generation required to reach net zero emissions.

# RECYCLED WATER FACTORIES


Recycled water infrastructure

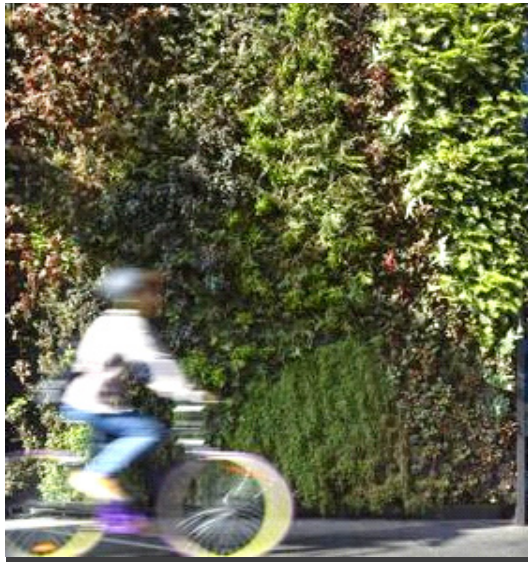
**The additional greening proposed across the Pyrmont Peninsula can be supported by recycled water delivered through the Multi-Utility Hubs.**

The Hubs would enable recycled water factories that draw on locally available sewer/blackwater and treat this water for:

- Irrigation of streets and canopy and public open space.
- Internal non-potable uses in new buildings, including irrigation of green roofs and walls, toilet, laundry and cooling towers.

It is proposed that these water factories are connected through a recycled water network, with the potential for the systems to be connected to the existing Central Park recycled water plant at the south end of the Pyrmont Peninsula.

The delivery of recycled water for these uses would ensure a drought-proof and resilient water supply for a cool, urban environment (see Greener Streets as Active Space), as well as enabling high performance building outcomes (see High Performance New Buildings).



Greening with recycled water

# LOCAL WASTE SOLUTIONS

An example of modular food waste processing systems designed to process approximately 5 tonnes of food waste per day.
Source: Goterra Organics Waste Management Systems

**Local food and garden organic waste could be delivered to Multi-Utility Hubs where food waste is treated in small-scale organic waste systems.**

Waste bins line many of the peninsula's laneways, blocking pedestrians and road space for cyclists. Multi-Utility Hubs provide a solution to local waste collection which could enable:

- Smaller waste trucks and, in the future, autonomous vehicle collection removing large trucks from the street, creating more active street potential.
- The relocation and/or use of smaller bins for roadside collection as waste collection is more frequent.

The initial delivery of local waste solutions in Multi-Utility Hubs could focus on local treatment of residential food and garden organics. Across the Pyrmont Peninsula it is estimated that approximately 6 tonnes of food waste is generated by residential dwellings each day. This food waste would typically end up in a resident's red bin, destined for landfill and is a large contributor to the waste-related emissions for the Peninsula.

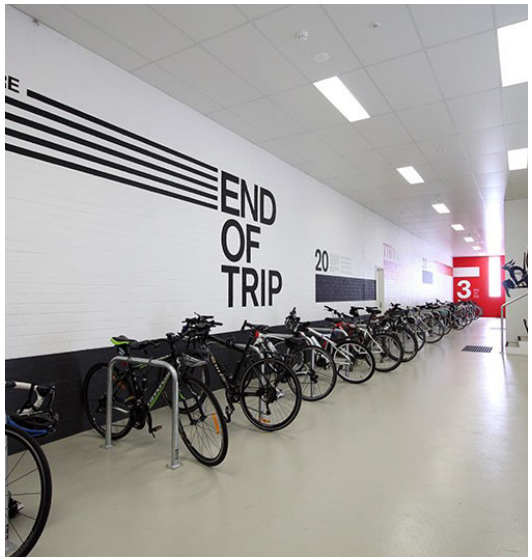
Local food and garden organic waste could be delivered to Multi-Utility Hubs where food waste is treated in small-scale organic waste systems. The waste by-product from these organics waste systems would generate compostable materials for local garden and landscaping needs.

# SOCIAL INFRASTRUCTURE

Example Social Infrastructure for Multi-Utility Hubs

As flexible, urban space Multi-Utility Hubs have the potential to deliver not only precinct infrastructure to enable higher environmental performance, but social infrastructure for local community needs. Located adjacent to key cycle ways it is proposed that Multi-Utility Hubs house end of trip facilities to support people in small dwellings and businesses in older or heritage buildings where these facilities are not available.

In addition, roof space in Multi-Utility hubs not used for renewable energy should be dedicated for community shared space, such as community gardens or experimental urban farms, again supporting residents in high density buildings without space for gardens or food production. These gardens would also benefit from the food waste compost delivered within the Hubs.




**Multi-utility Hubs have the potential to deliver not only precinct infrastructure to enable higher environmental performance, but social infrastructure for local community needs.**

# 4.2 GREEN STREETS AND ACTIVE SPACES

Climate change is pushing up global average temperatures, and urban areas like the Pyrmont Peninsula are particularly vulnerable to hotter weather. The City of Sydney predicts that the frequency of extreme heat days over 35 degrees in the LGA is projected to increase from 3 days per year in 2015 to 15 days per year by 2070.

People living in the Pyrmont Peninsula will be more susceptible to the effects of heatwaves as a result of the urban heat island. The urban heat island is effectively the difference between the land surface temperature and the average air temperature. This is caused by the prevalence in cities of heat absorbing materials such as dark coloured pavements and roofs, concrete, vehicles, urban canyons trapping hot air, and a lack of shade and green space in dense urban environments.

Whilst the Pyrmont Peninsula has canopy cover in the range of 12% to 23% (Appendix Figure 11 and draft Greener Places Design Guide) this canopy is not well distributed. Baseline analysis by Kinesis further highlights that in high density urban environments, streets are often not enabled to facilitate high greening and canopy environments and, in fact, create hot urban environments (see Appendix, Figure 16). This is primarily due to:

- Street space allocated to vehicles, including on-street parking. A vehicle parked on the street in the sun generates >50 degree heat on a 35 degree day (see Figure 4).
- Footpaths and laneways often used as service ways for waste collection, reducing space for street trees and canopy.

It is proposed that key active streets are reconfigured to facilitate increased green space and canopy to create cooler environments, including increased permeable and soft landscaping, increased canopy cover and façade greening along these streets (Figure 5). These green streets would be support by drought-proof, resilient water supply:

- Streets, public domain and open space would be connected to the recycled water factories as a major customer (similar to a power purchase agreement).
- Council could provide easements in footpaths/roads for infrastructure and coordinate infrastructure delivery with programmed capital works projects for improved public domain works (i.e. widened footpaths, cycle ways, increased canopy cover, WSUD works etc).

Impact of street trees, greening and vehicles on urban heat

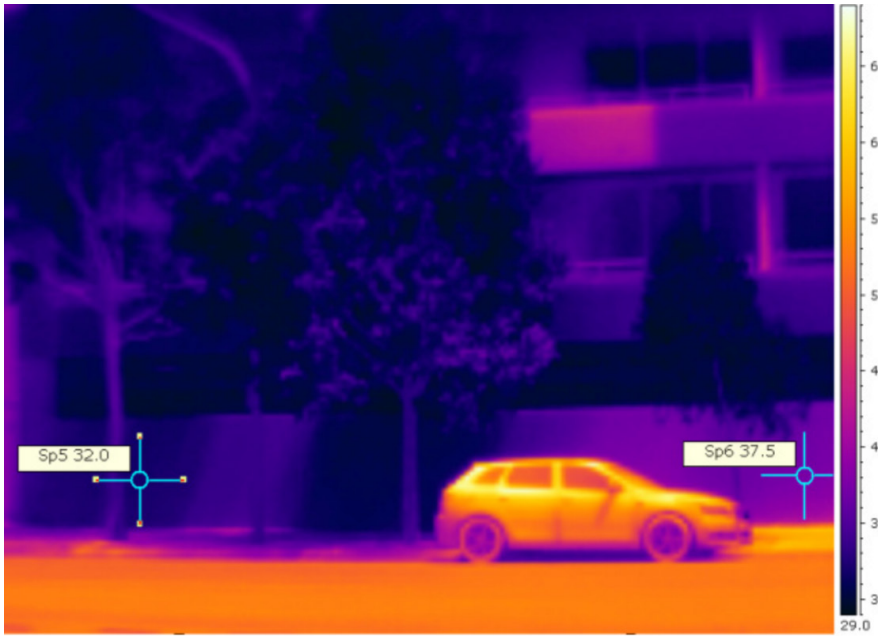



Figure 4: The heat impact of street trees and on-street parking.
Source: UNSW, Hassell (2010) Micro-Urban-Climatic Thermal Emissions in Medium-Density Residential Precincts.

From this: To this:

# GREEN STREETS AND ACTIVE SPACES

**25%**
**Canopy cover**

**2ha**
**Active public space**

**10ha**
**Green facades**

- Green roofs/facades could be supplied by recycled water.
- 3rd pipe installation could be considered for new residential and non-residential construction in areas adjacent to the recycled water network.

This solution could deliver the following benefits:

- 25% canopy cover targets for the Peninsula.
- 2 ha of distributed new active public space, equivalent in area of adding a new Pyrmont Bay Park sprinkled throughout the more urban areas of the Peninsula.
- 10 ha of new green facades delivered across the ground and lower facades of new contribution in the precinct.
- Reduction of local heat island for pedestrians and cyclists through shade and transpiration.

The delivery of green streets and active spaces could be facilitated through a Climate Improvement District. Similar to a business improvement district, local businesses and residents could fund the maintenance of the green space.

Example of green façade treatments


Figure 5: Resilient green streets connected to recycled water factories

# 4.3 HIGH PERFORMANCE RESILIENT BUILDINGS

Example of a combined solar and green roof apartment

High performance, resilient buildings are those that move the Pyrmont Peninsula towards net zero emissions and allow residents to be more resilient. While high density apartment living provides resilience through mobility and accessibility, this typology is often locked out of solar PV, water reuse and limited space for gardens and composting.

With the growth of the Pyrmont Peninsula high rise apartments, this key move works with the Multi-Utility Hubs and green streets to deliver new development to be both high performance and resilient; ensuring these dwellings are ready for disruption – ready to make use of solar, batteries, recycled water, electric vehicles, ready to transition parking to new mobility futures, and ready to respond to changes in climate. This can be delivered through the following high performance targets for new buildings:

- BASIX Energy
  - Single dwellings – BASIX 60
  - Apartments 2-3 storey - BASIX 50
  - Apartments 4-5 storey BASIX 45
  - Apartments 6-12 storey - BASIX 40
  - Apartments 13-19 – BASIX 35
  - Apartments 20+ storeys - BASIX 30
- BASIX Water 50 (assuming recycled water availability).
- No on-site parking delivering both more affordable dwellings as well as enabling housing and mobility choice.

Analysis by Kinesis suggests that the combination of these strategies would save residents between $500 and $800 per year in utility costs (energy and water). These high performance, resilient outcomes are also supported by the precinct parking, electric vehicle charging, recycled water, local waste solutions and social infrastructure delivered through the Multi-Utility Hubs.

High performance, resilient buildings will also be expended to non-residential development, including:

- Commercial office: 6 Star NABERS, or Certified Green Star Design & As Built rating with 5.5 Energy Points
- Shopping Centres: 6 Star NABERS +30%, or Certified Green Star Design & As Built rating with 13 Energy Points
- Hotels: 4.0 Star NABERS +10%, or Certified Green Star Design & As Built rating.

# 4.4 OFFSETTING TO DELIVER A NET ZERO OUTCOME

Despite the growth of approximately 4,000 dwellings and nearly 1 million square meters of non-residential floorspace, the delivery of multi-utility hubs and high-performance new buildings are expected reduce emissions by 90% across the entire precinct for both existing and new development. The remaining 10% of emissions are not expected to be able to be delivered within the precinct. As such, to achieve a net zero emissions outcome in line with the City of Sydney's targets, greenhouse gas emissions offsetting would be required.

A range of offsetting solutions are currently available or under research and evaluation but to date, the most practical and cost effective is carbon sequestration via tree planting. This has the additional benefit of providing shade, preventing salinity and soil erosion and providing shelter, food and habitat to native animals. Tree planting is one of the most viable offsetting methods currently, however prolonged drought conditions and the recent Australian bushfires have highlighted the fragility of this method as a long-term reliable solution.

The additional canopy cover and greening proposed across the Pyrmont Peninsula would deliver only a small amount of carbon sequestration. But the drought-proof, resilient water supply from recycled water will go a long way to supporting this outcome and ensuring tree canopy and sequestration within the precinct is maintained.

Analysis by Kinesis for the delivery of a net zero emissions outcome for the Peninsula assumes a ramp up of emissions offsetting as new development comes online. By 2041, these offsets would need to deliver approximately 60,000 tonnes CO2-e per year.

Greenhouse gas emissions offsets could be enabled through a combination of city governance and private sector response that ramps up the public disclosure and commitment to be effectively net zero by 2041.

Two key mechanisms could be investigated to deliver this:

- New buildings - Increase new building performance standards over time to require net zero emissions. This would require new buildings to deliver high performance standards and offset their remaining emissions through long term contracts, similar to power purchase agreements.

- Existing buildings – Establish a policy that slowly ramps up offsetting requirements for existing buildings. This could initially require buildings, tenants and residents to report their annual emissions (based on energy bills), and, over time, offsetting could be introduced and require this reporting to show evidence of verified offsets for the remaining emissions.

The City of Sydney already has experience working with building owners to report emissions (such as the Better Building Partnership and Smart Green Apartments).

# 5. 2041 PERFORMANCE CRITERIA

## Net Zero

**Net Zero emissions by 2041**

Despite the additional growth in jobs and floorspace modelled, a net zero outcome can be achieved as follows:

- **380,000 tonnes** (existing emissions)
- **+ 120,000 tonnes** (BAU growth)
- **– 440,000 tonnes** (reduction impact of four pillars and assumes AEMOs emissions trajectory of 0.1 kgCO2-e/kWh)
- **– 60,000 tonnes** (offsetting per year)

## 25MW

**New local solar PV delivered by Multi-Utility Hubs & high-performance buildings**

Delivered through Multi-Utility Hubs and new building standards, such as higher BASIX Energy targets and NABERS requirements for commercial buildings. This equates to approximately 10% of electricity delivered locally by 2041.

## Zero

**New on-site parking**

No on-site parking in new residential construction which is expected to deliver:

- Up to $100,000 saved from the cost of a new dwelling.
- $300 per year per space for lighting and ventilation energy demands.
- 20,000 less truck movements avoided through less excavation for parking.

## 200

**New potential shared mobility vehicles throughout the precinct**

By decoupling on-site parking and delivering lower parking rates there is the potential to deliver an additional 200 car share vehicles to the area through private investment.

## 100MWh

**Battery storage from multi-utility hubs and electric vehicles**

Delivered through the combination of grid scale battery and grid reversable batteries from electric vehicles, battery storage would help manage evening peak demands, create increased network resilience and facilitate increased local renewable energy.

## 10ML

**Recycled water generated for new greening water demands**

The Multi-Utility Hubs could enable recycled water factories that draw on locally available sewer/blackwater and treat this water for irrigation of streets and canopy and public open space. This could be extended to include internal non-potable uses in new buildings, including irrigation of green roofs and walls, toilet, laundry and cooling towers in adjacent buildings.

## 2ha

**New active public space**

The strategic removal of resident on-street parking (1,200 spaces) provides young children and adults the opportunity to explore the street as living space equal to gardens, balconies, and public parks. It recognises that streets are essential parts of any community, not simply roads to carry traffic and park cars, and delivers approximately 2 ha of distributed new active public space.

## 25%

**Canopy cover**

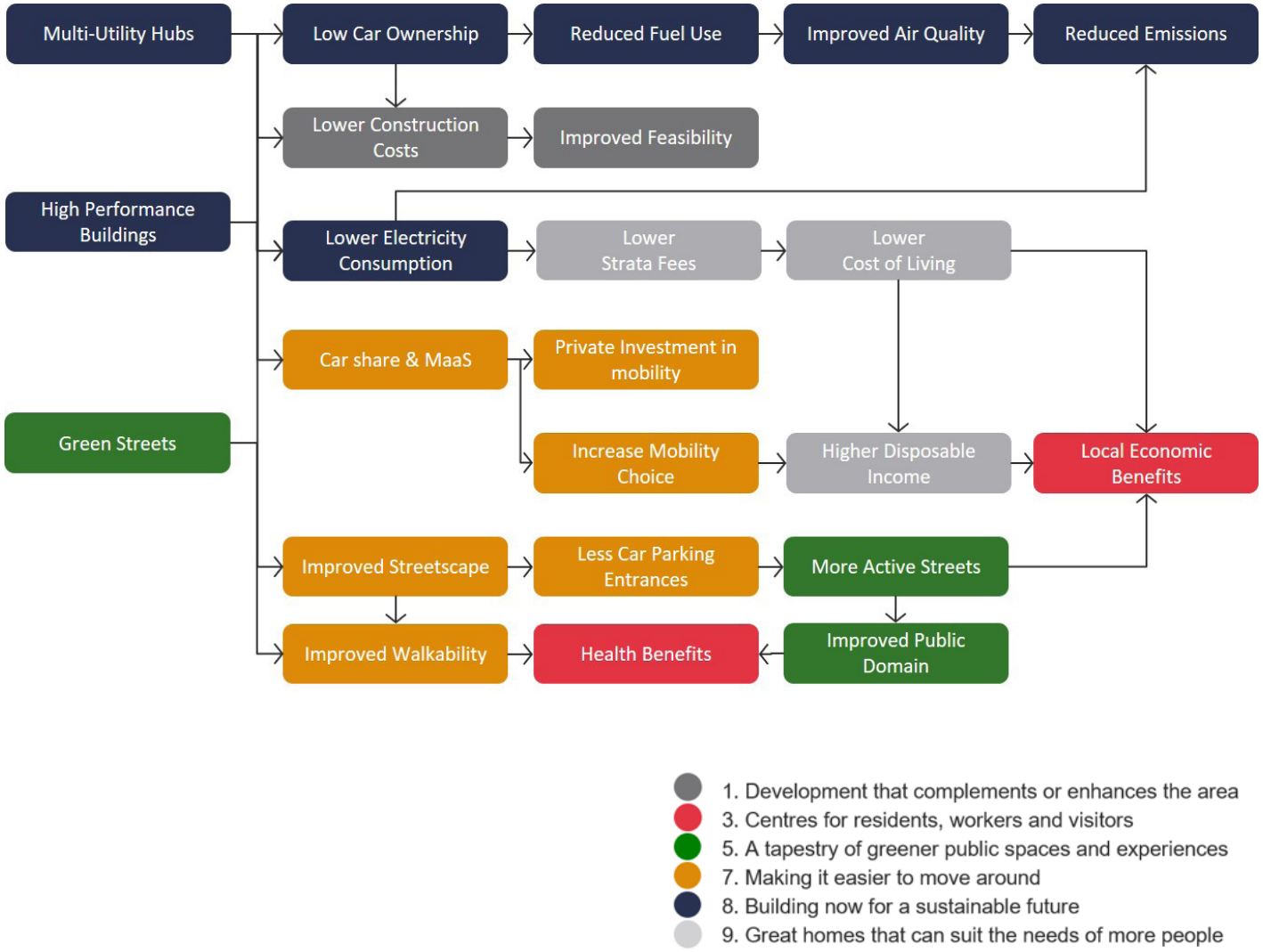
Delivered through green streets which would enable approximately 2 ha of distributed new active public space and 10 ha of new green facades across the ground and lower facades of new buildings, fed through recycled water.

# 6. ALIGNING TO THE 10 DIRECTIONS

**Mutually reinforcing outcomes of the Sustainability Framework, linked to the 10 directions of the Pyrmont Peninsula Place Strategy.**

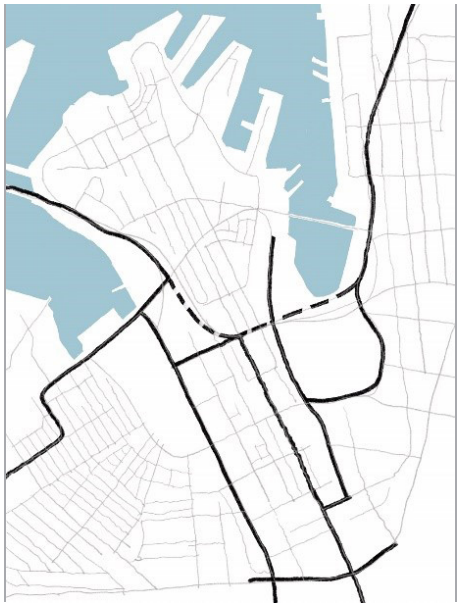
This framework supports the 10 Directions of the Place Strategy, delivering significant environment, social and economic benefits through an integrated design, building, technology, public domain and infrastructure pathway for a net-zero emissions, resilient and sustainable peninsula.

From the 10 Directions, the Sustainability Framework enables 6 Key Directions. A flow diagram of the integrated and mutually reenforcing environmental, social and economic benefits of the four pillars, linked to key Directions of the Place Strategy is provided to the right.



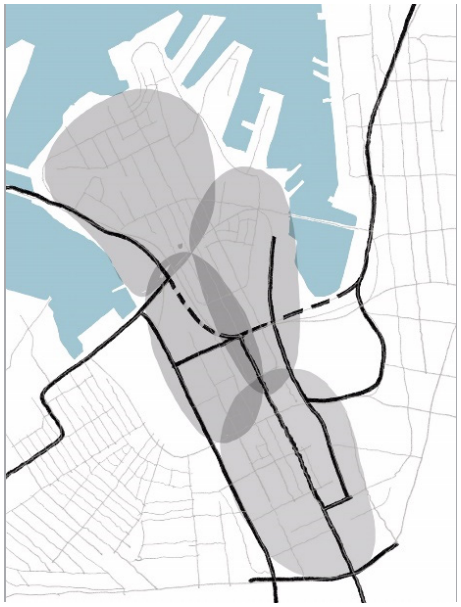
# 7. LOCATION CRITERIA FOR MULTI-UTILITY HUBS

This Framework proposes an upfront and staged implementation of precinct based multi-utility hubs so we de-risk development and accelerate and meet all the parking, water, waste and energy charging demand for new and existing residents. Located on public or private land as either standalone or integrated into the revitalization of a larger area, potentially using land that is marginal in suitability for residential or commercial development such as under elevated roadways.



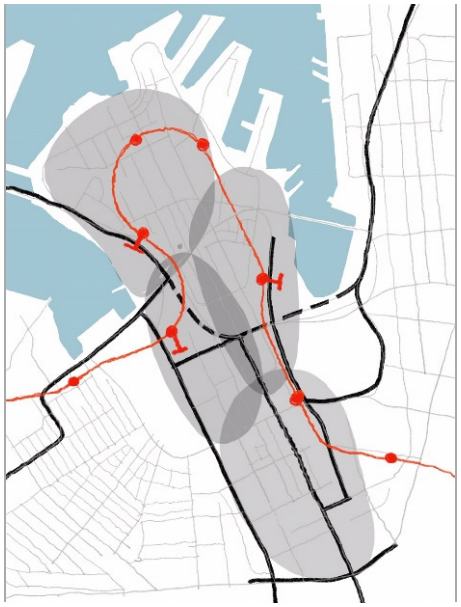
### 1. Near main roads

Near main roads for access – to work effectively the decoupled parking component must ideally be located near major access roads.



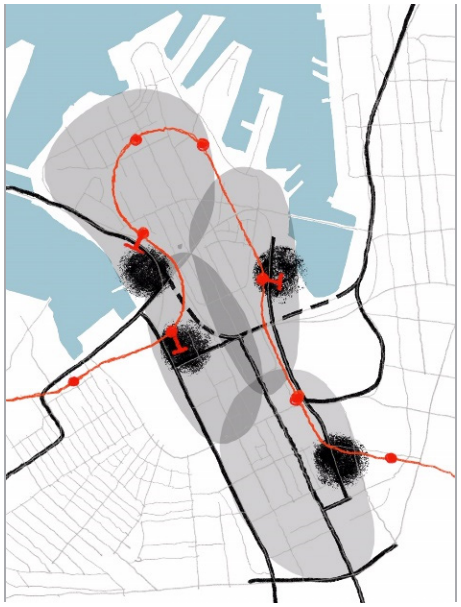
### 2. Good access for community

Accessible by foot and within close proximity to residential and mixed-use areas to prevent local traffic from being generated by residents trying to find on-street parking.



### 3. Near light rail rail for transport integration

Near light rail for transport integration – positioned within 400m of light rail stops, future Metro and bus transport locations so to be embedded within and leverage the existing mobility infrastructure.



### 4. Integration of Multi-Utility Hubs

Multi-Utility Hubs are located and configured for decoupled and adaptable parking, electric vehicle charging, grid-scale storage, recycled water, organic waste digestion and social infrastructure.

Key next steps to be resolved are:

- **Site identification** - work through the ordering hierarchy of connectivity, access, ownership etc and confirm and locate sites.
- **Feasibility and governance option**s - Develop business case for capital and operational costs, collaboration, funding and ownership models.
- **Design a demonstration scheme** - explore an urban concept on the best and most appropriate first site and which areas of Pyrmont Peninsula would be prioritised with street and public domain improvements.

# APPENDIX

**Supporting baseline data and analysis for the Pyrmont Peninsula study area.**

# BASELINE DATA ANALYSIS FOR PYRMONT PENINSULA

## Greenhouse Gas Emissions (GHG)

The Pyrmont Peninsula emission profile is an example of how dense urban areas can be extremely efficient in responding to the climate problem. Further, it is logical for areas such as this to be strategically optimised for metropolitan areas to achieve any net zero carbon aspirations as well as any national emission reduction targets. Current key data points for benchmarking include:

- Pyrmont and Ultimo are second only to the Sydney CBD as the most GHG emissions intense precinct across Sydney, i.e. tonnes CO2-e per m2 of land area (Figure 7). However, similar to the City of Sydney LGA as a whole, residential emissions per dwelling are approximately half that of the average Sydney Metropolitan household (Figure 8). Transport emission are relatively small compared to the broader metropolitan area, reflecting the local high accessibility and low car ownership.
- Electricity use contributes to 75% of the total emissions of the precinct, followed by transport (14%) then waste (7%) and gas (4%). Since 2006, total emissions for Pyrmont and Ultimo have dropped by 13%. This has primarily driven by a reduction in electricity use (through energy efficiency) and reductions in the emissions intensity of the electricity grid (Figure 9).

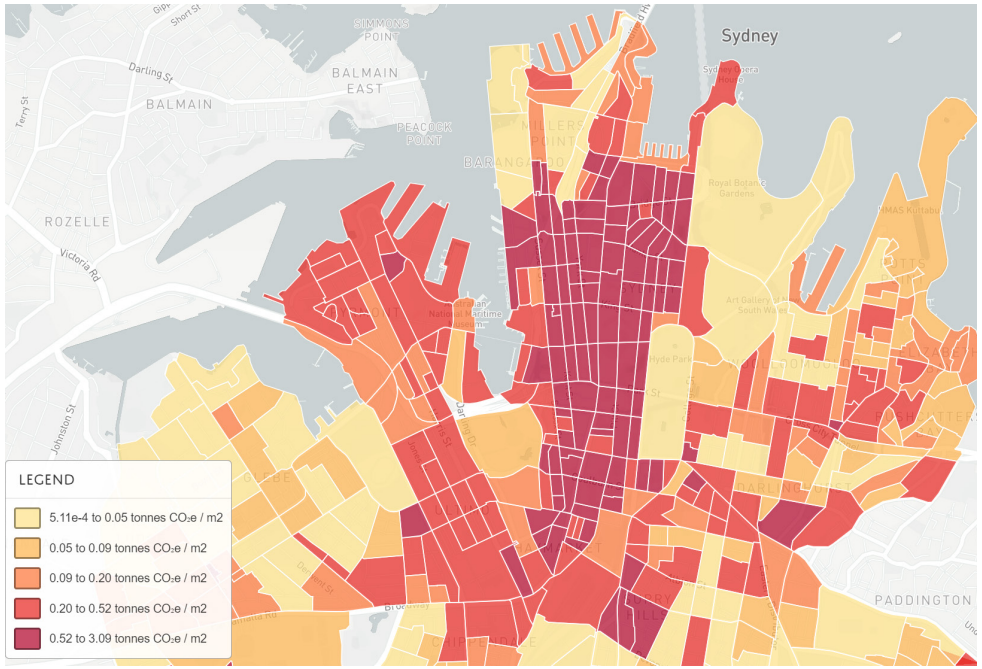



Figure 7: Emissions per m2 of land area, highlighting areas of high emissions intensity (Source: Kinesis analysis of data from Ausgrid, Jemena, EPA and Transport for NSW)

EMISSIONS PER DWELLING BY SOURCE

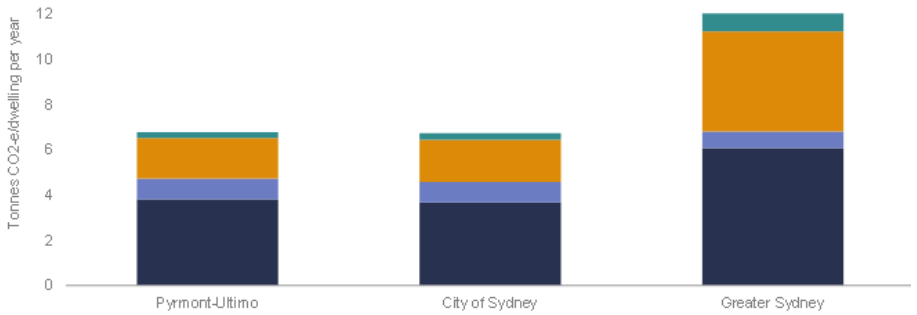



Figure 8: Average emissions per dwelling by emissions source (Source: Kinesis analysis of data from Ausgrid, Transport for NSW and City of Sydney)

TOTAL EMISSIONS V GROWTH

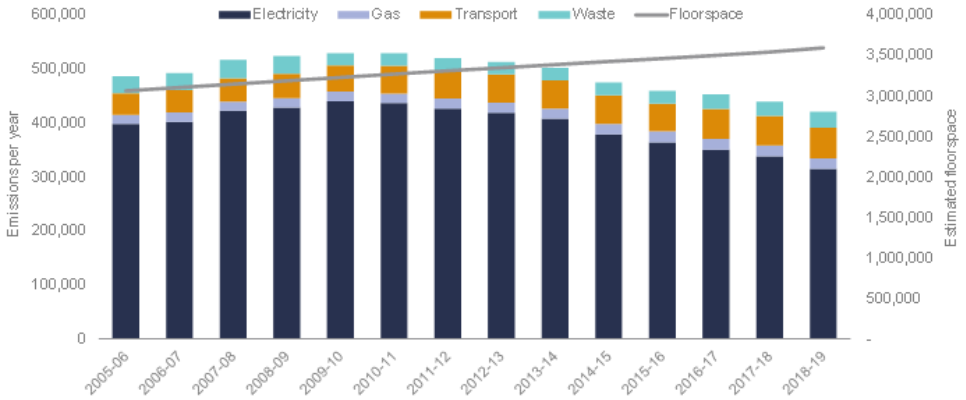



Figure 9: Total emissions for Pyrmont and Ultimo compared to floorspace growth (Source: Kinesis analysis of Ausgrid, Transport for NSW and City of Sydney FES data)

## Energy and Renewables

The Pyrmont Peninsula demonstrates the immediate challenges of how established, dense urban areas can be extremely difficult to integrate any meaningful renewable energy capacity in their local response to energy resilience and the climate problem. However, it is logical for areas such as this to be strategically optimised for local energy generation and storage for energy affordability and network resilience and stability solutions. Current key data points for benchmarking include:

- Electricity use contributes to 95% of the total energy consumption, with gas delivering 5% of the energy needs of Pyrmont and Ultimo.
- Despite growth in residential and non-residential floorspace, electricity demand across Pyrmont and Ultimo has consistently declined since 2010 (Figure 10). This reflects trends in energy efficiency in both residential and commercial buildings, from improved lighting, air conditioning and appliances.
- However, similar to the City of Sydney as a whole, Pyrmont and Ultimo has very low levels of renewable energy, approximately 1% of all dwellings. This is a reflection of the high density built form. The highest areas of renewable energy across Australia are areas of low density with high home ownership and low levels of rental (see Figure 11).

ELECTRICITY DEMAND V GROWTH

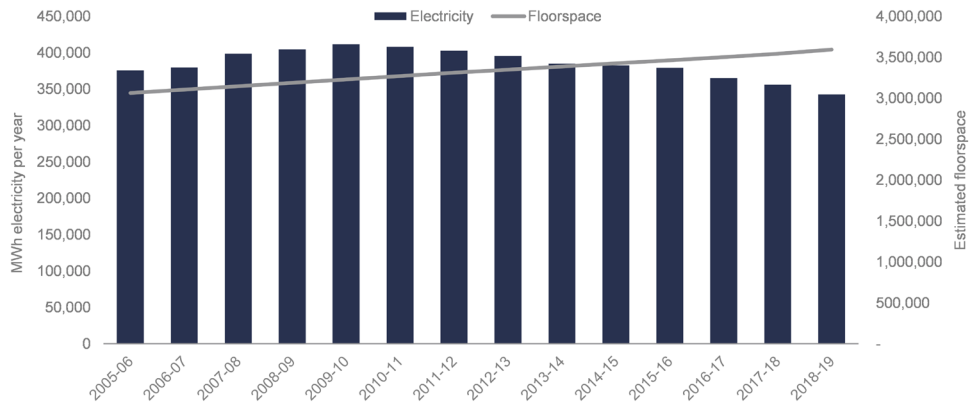



Figure 10: Total electricity consumption for Pyrmont and Ultimo compared to floorspace growth (Source: Ausgrid and City of Sydney FES)

RENEWABLE ENERGY COMPARISONS

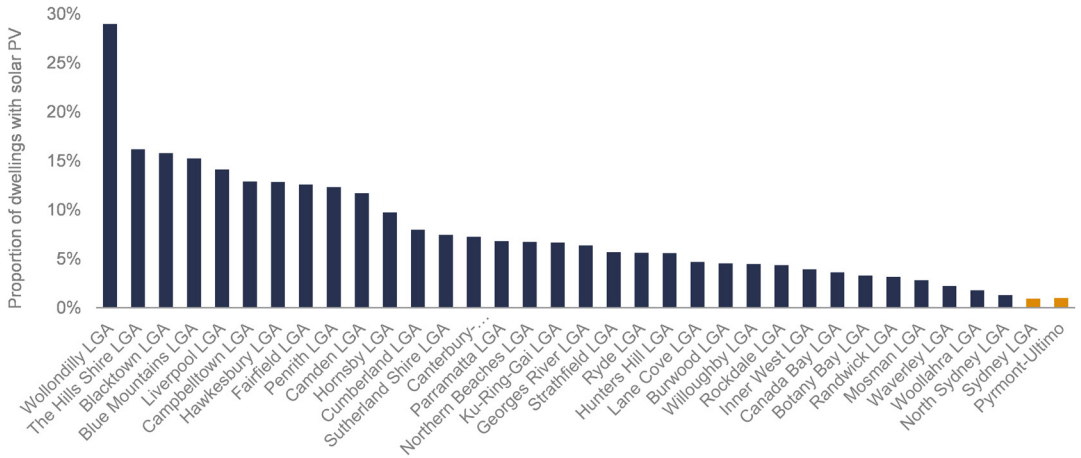



Figure 11: Proportion of dwellings with solar PV (Source: Kinesis analysis of APVI and Census data).

## Water Use and Demand

The Pyrmont Peninsula should be an example of how dense urban areas can be extremely water efficient compared to more suburban locations, however trends show otherwise. Further, it is certain for areas such as this, in any response to urban heat island and local greening water consumption will increase significantly based on the current low irrigation demands. Current key data points for benchmarking include:

- Pyrmont and Ultimo are second only to the Sydney CBD as the most emissions intense precinct across Sydney, i.e. kL of water per m2 of land area (Figure 12).
- Water consumption across Pyrmont and Ultimo has largely followed growth in residential and non-residential floorspace (Figure 13). This reflects little movement in water efficiency in high density urban environments that are less impacted by water restrictions for reduced irrigation demands.
- Despite the high density built form of Pyrmont and Ultimo, however, per dwelling water consumption is high when compared to both the City of Sydney and the Greater Sydney average (Figure 14). While it is often assumed that garden irrigation is the largest contributor to water demands across the residential sector, apartments (with very small irrigation areas) can often have higher demands due to lack of water metering and associated leaks that remain undetected.

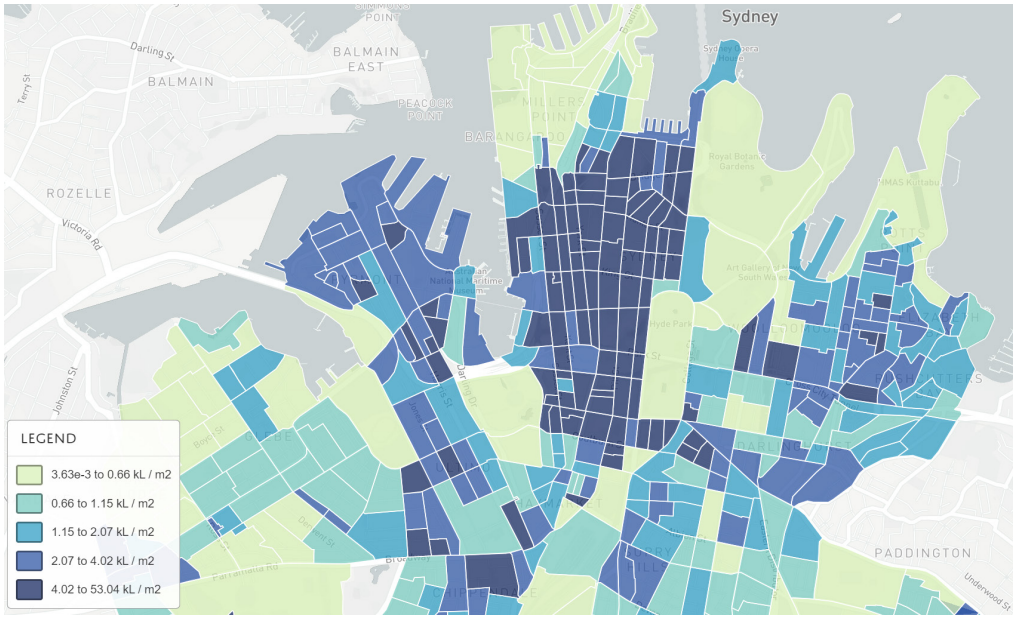



Figure 12: Water consumption per m2 of land area, highlighting areas of high water use intensity (Source: Kinesis analysis of data from Sydney Water)

TOTAL WATER USE V GROWTH

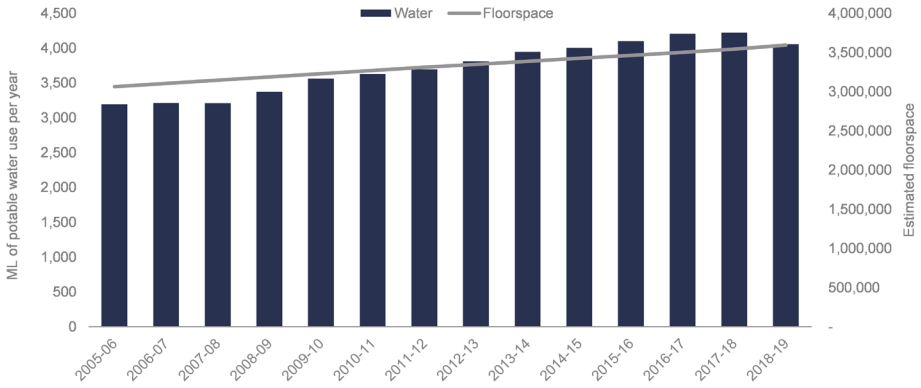



Figure 13: Total water consumption for Pyrmont and Ultimo compared to floorspace growth (Source: Sydney Water and City of Sydney FES).

WATER USE PER DWELLING


Figure 14: Average water use per dwelling (Source: Kinesis analysis of data from Sydney Water).

## Canopy Cover and Urban Heat

The Pyrmont Peninsula canopy cover and surface temperature profile represents the modern urban challenge of providing high levels of comfort and evenly distributed urban greening and amenity to residents, workers and visitors. Further, it is important that key areas of foot traffic and local recreation spaces consider what type of greening and cooling solutions are appropriate and sustainable to survive and prosper to be any benefit in addressing local air quality, comfort and amenity improvements. Current key data points for benchmarking include:

- Analysis by Kinesis has consistently highlighted a strong correlation between surface types and vegetation with lower land surface temperatures (Figure 15).
- Pyrmont and Ultimo currently have on average low levels of green space and canopy (approximately 12% on average) but includes pockets of high canopy within high density areas (up to 34% across the area), as shown in Figure 16.
- Major heat waves are Australia's deadliest natural hazards, and the Pyrmont Peninsula is more susceptible to the effects of heatwaves due to urban heat island. This is caused by the prevalence in cities of heat-absorbing materials such as dark coloured pavements and roofs, concrete, and a lack of shade and green space in dense urban environments.
- However, in high density areas, shading and built form can have a strong impact on the street level experience of urban heat and/or thermal mapping data, as shown in the adjacent Sydney CBD. For the Pyrmont Peninsula, despite taking advantages of cooling harbour breezes, local places and streets can still be problematic for residents and visitors. Canopy cover by itself does not guarantee well designed cool streets with high public amenity. Incorporating other influences such as surface treatment, on-street parking, urban form, footpath and road widths all contribute to their impacts.  Some examples are highlighted in Figure 16.
- In addition, heat island and extreme heat events have a direct impact on electricity demand for air conditioning which is expected to increase peak electricity demands and household electricity costs.

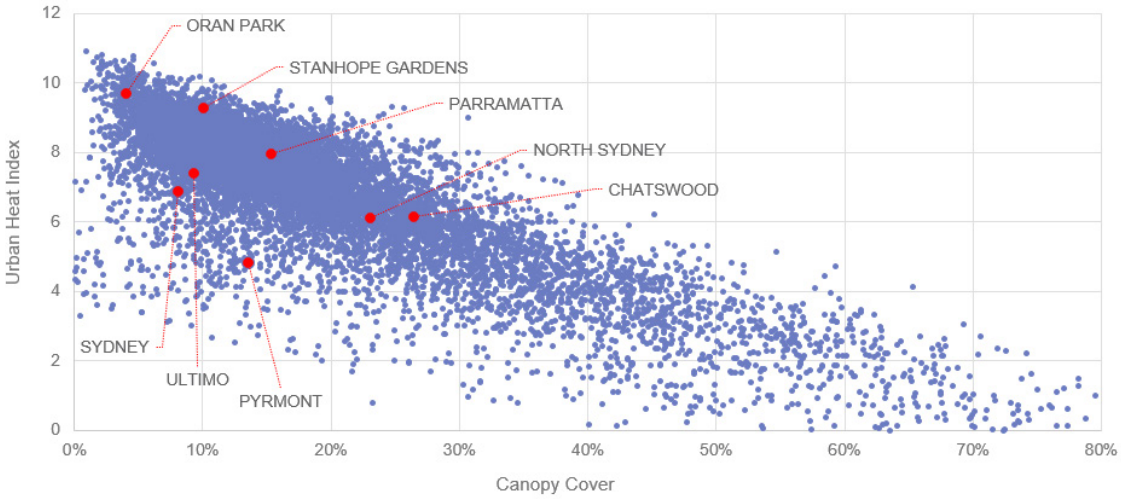



Figure 15: Average water use per dwelling (Source: Kinesis analysis of data from DPIE)

Note: Despite relatively low canopy cover, the suburbs of Pyrmont and Ultimo are heavily advantaged by cooling harbour breezes in providing increased comfort levels compared to areas of similar density that are further west and do not experience the same cooling breezes (e.g. Parramatta).

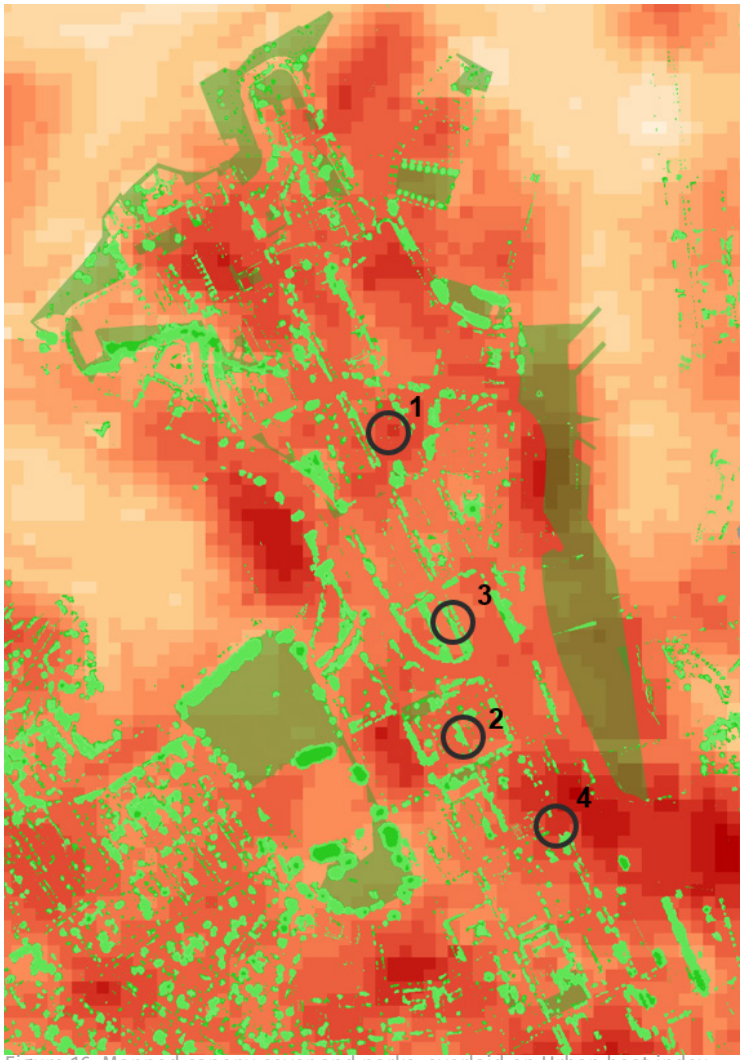



Figure 16: Mapped canopy cover and parks, overlaid on Urban heat index (Source: City of Sydney and UHI)


Paternoster Row near Pyrmont Bridge Road


Harris Street near Allen St


Bulwara Road near Quarry Street


Harris Street near Macarthur Street

## Car Ownership and Mobility

The Pyrmont Peninsula highlights how dense urban areas can be less reliant on cars and extremely efficient in the uptake of active transport solutions. However, Pyrmont also represents an opportunity to better optimise the built urban form to create more affordable and higher amenity areas. Current key data points for benchmarking include

- Pyrmont and Ultimo have areas with some of the lowest car ownership rates in Australia. Currently, the average household owns 0.77 vehicles per dwelling, and 33% of all households not own a car. Car ownership, however, is not uniform across the peninsula with higher car ownership at the northern tips in areas with lower accessibility, as well as areas of higher income (Figure 17).
- Unlike broader metropolitan Sydney which has seen a slight increase in car ownership over the last 10 years, car ownership in the City of Sydney and Pyrmont/Ultimo has remained flat and recently declined slightly (Figure 18).
- Low car ownership rates support high amounts of car share (vehicles shared and leased amongst many residents and businesses across the peninsula. Figure 19 shows the location of existing car share bays across the Pyrmont Peninsula, which are largely located on-street (rather than within a building or carpark).

TRENDS IN CAR OWNERSHIP

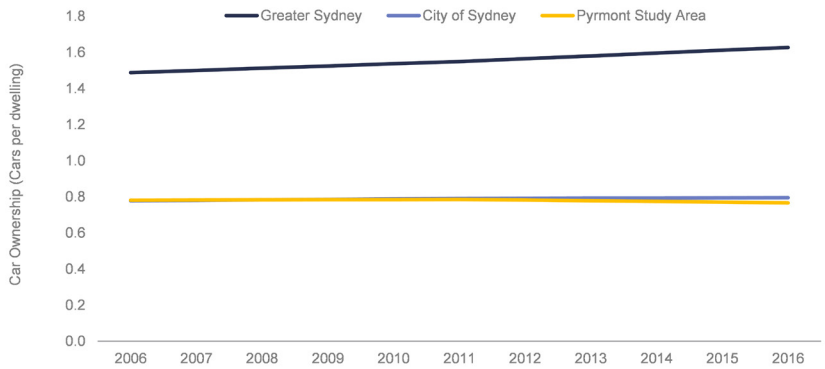



Figure 18: Car ownership from 2006 to 2016 showing average vehicles per dwelling for Greater Sydney, the City of Sydney LGA and Pyrmont/Ultimo (source: ABS Census).

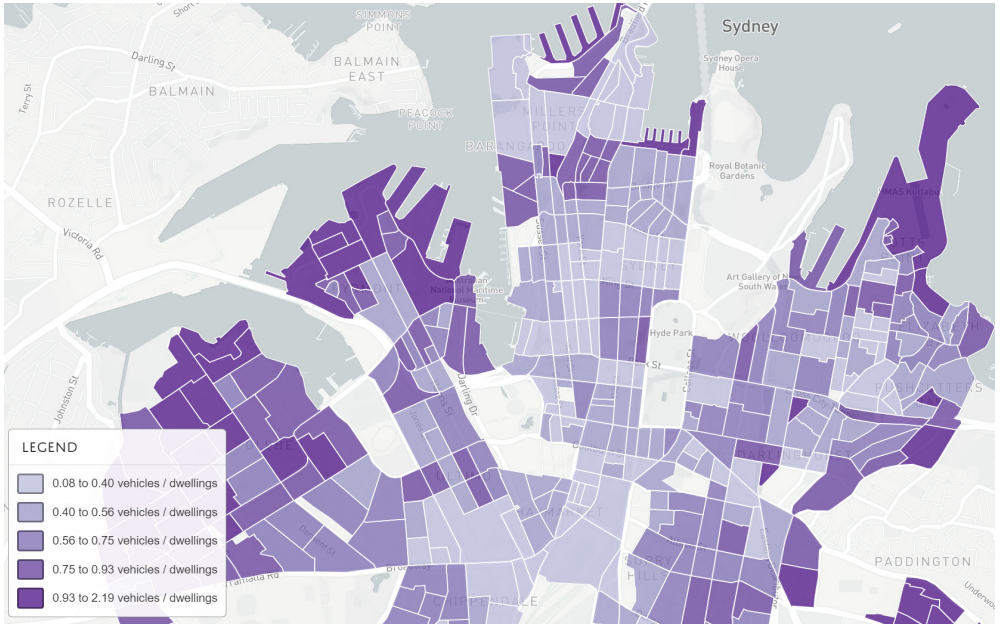



Figure 17: Car ownership across Pyrmont and Ultimo, highlighting areas of high ownership in less accessible and higher socio-economic areas (Source: ABS Census)(Source: Kinesis analysis of data from

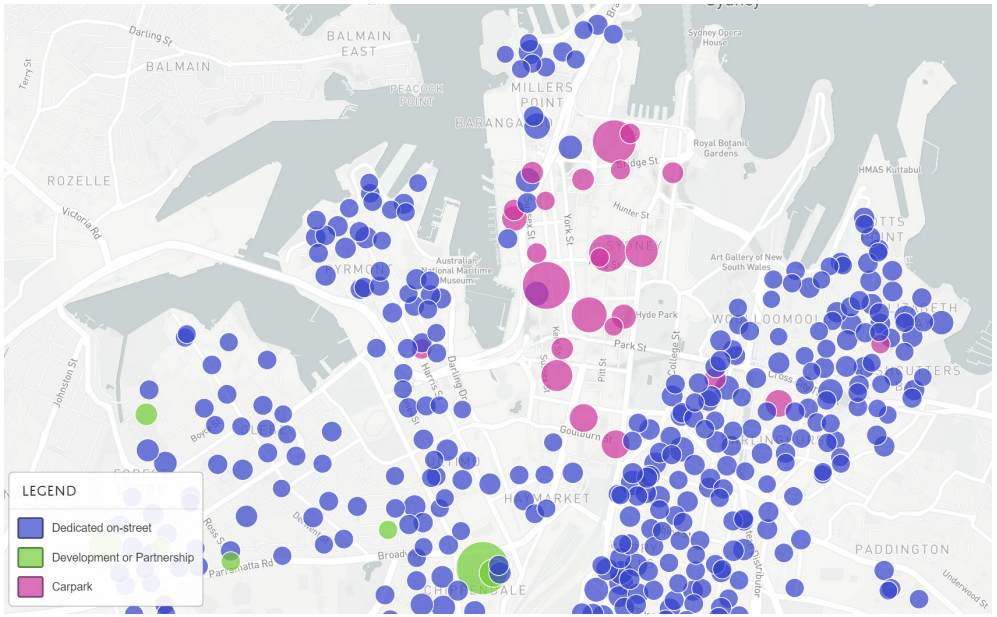



Figure 19: Car share bays across Pyrmont and Ultimo highlighting high demand for car share in areas with low car ownership. (Source: GoGet).

# Cost of Living and Affordability

The Pyrmont Peninsula cost of living and affordability profile is a typical complex illustration of the trade-offs that dense and connected urban living can present. Relative higher cost of housing and commercial floor space is typically offset by connectivity and colocation benefits offered by such areas. Further, it is logical for areas such as this to be strategically optimised to generate high levels of employment activity and affordable housing and lifestyles for the full range of existing and future residents. Current key data points for benchmarking include:

- Affordability is often considered only in the context of the cost of housing. However, when looking at average household expenditure, transport costs associated with car ownership and fuel consumption can be as high as housing costs (Figure 20).
- Compared to an average household in NSW, residents across the City of Sydney spend more money on housing and less money on transport (Figure 21).
- This is consistent in Pyrmont and Ultimo with low proportions of average cost of living expenses from transport, energy and water. Higher areas of estimated household cost of living is attributable to higher car ownership rates and associated transport costs.

Household expenditure has been calculated by Kinesis using the following method to give a representative and relative affordability analysis for the peninsula:

- Housing costs were calculated based on the purchase of a home at the median house and unit sales price for the last 12 months, assuming 5% deposit, 30 year loan, 5% interest rate.
- Transport costs were calculated based on average existing car ownership and travel patterns (car use and public transport use).
- Utility costs were calculated based on existing average energy and water consumption for the average household, assuming current retail tariffs.

For the purpose of this analysis, all other household expenditure including food, clothing, household items, medical and recreation were based on the average expenditure reported in the ABS Household Expenditure Survey.

AVERAGE HOUSEHOLD EXPENDITURE

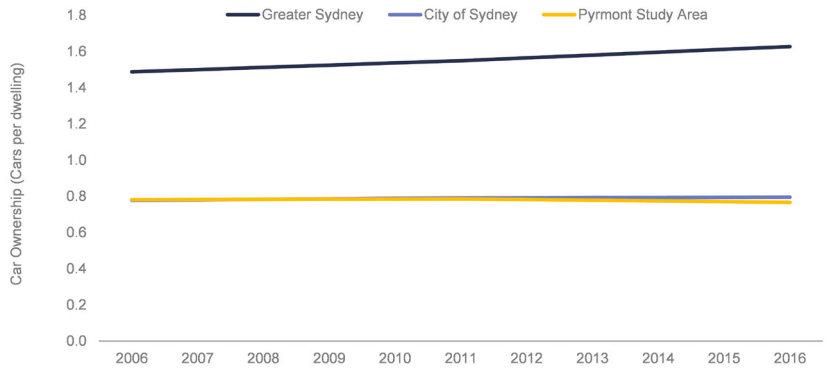



Figure 20: Estimated average household expenditure highlighting housing, transport and utilities (Source: Kinesis estimate)

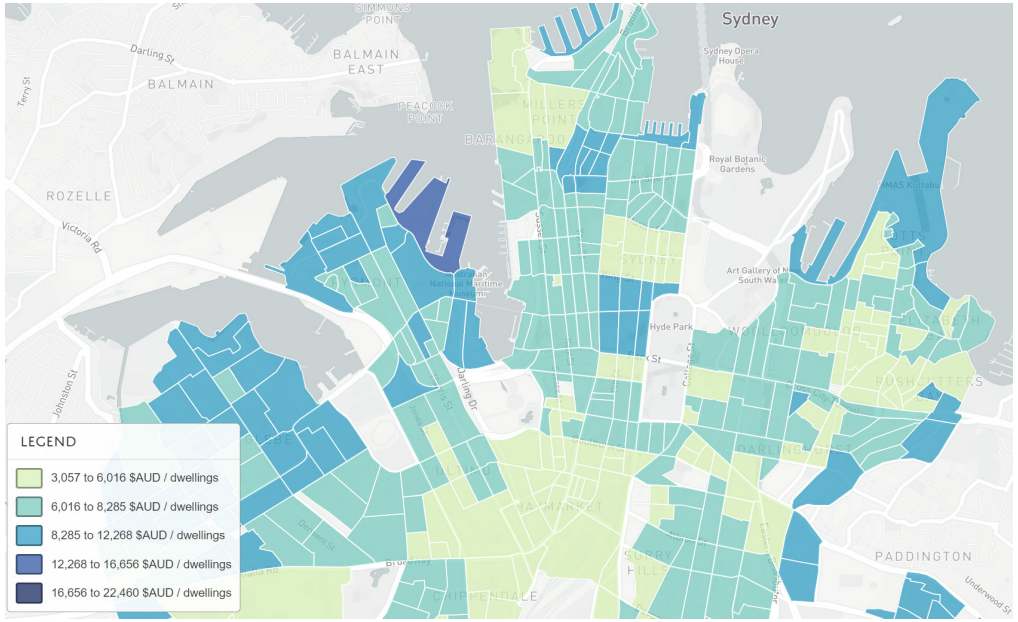



Figure 21: Mapping estimated household expenditure based on local car ownership and utility bills (Source: Kinesis estimate)

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