Transport for NSW

Net Zero Cities Action Plan

October 2022

NSW GOVERNMENT

dpie.nsw.gov.au/NetZeroCities

Contents

Acknowledgement of Country

The NSW Government acknowledges that we work on Aboriginal land. We acknowledge the Traditional Custodians of the land and we show our respect for Elders past, present and emerging. In doing our work, we will be thoughtful and collaborative, and show our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically and where their strong connections to Country are celebrated and embraced.

Minister's message

When it comes to action on climate change, the NSW Government is leading the way.

We were one of the first jurisdictions in the world to target net zero emissions by 2050 and backed this with our Net Zero Plan Stage 1: 2020-2030.

We have some of the most ambitious renewable energy and electric vehicle policies in Australia, and we are taking big steps to reduce our waste, as a major contributor to emissions. Our main business and economic sectors in NSW have plans for transitioning to net zero.

But there's more to do, the next frontier for net zero is in our cities.

In NSW, more than 86 per cent of people live in cities and urban areas[1]. Cities consume about 78 per cent of the world's energy and produce more than 60 per cent of the world's emissions. Greater Sydney alone produces 38 per cent of the emissions in NSW.

The science is unequivocal. We cannot achieve our target of net zero by 2050 without taking action in our cities.

We need our cities to be the crucible of innovation to drive energy transition and new approaches to drastically cut and curb our emissions.

We need to tackle big drivers of emissions, including the embodied carbon and operational efficiency of our buildings and infrastructure. We need to explore the built and natural environment of our cities and unlock opportunities for a net zero future.

We can do this by changing the way we build our homes and design our neighbourhoods. By generating and storing more energy in our homes. By greening our city to reduce urban heat. By building footpaths and cycleways so people are confident to leave the car at home. And by changing the way we move goods and freight.

Our cities and urban centres are the part of the problem, but they can also be the solution to achieving net zero.

Small measures on their own may seem insignificant – but the sum is greater than the whole of its parts.

This Action Plan showcases what we can all do to play a part in a net zero future.

I encourage you to be part of the future. Do what you can as individual, a household, a community member or business. Collaborate with us on delivering net zero cities.

By focusing on cities and urban areas we can accelerate our transition to net zero at the same time as reducing pressure on cost of living and creating healthier, more vibrant places.

The Hon. Robert Stokes

Minister for Infrastructure, Cities and Active Transport

[1] https://blog.id.com.au/2014/population/demographic-trends/how-urbanised-is-australias-population/

It's our future

Over 85 per cent of Australians live in cities and urban areas. Our cities are the urban fabric that brings us together as a community. This includes the houses, townhouses, and apartments we live in; the neighbourhoods we build community connections in; and the centres where we work, shop, relax and play. Our cities are knitted together by infrastructure, industry, and services, helping operate and sustain our economy and built environment.

> Almost 70 per cent of global end use carbon emissions are generated by cities[1]

Our cities also have a large impact on our carbon footprint. In NSW, Greater Sydney alone is responsible for 38 per cent of the state's greenhouse gas emissions.[2] While this Plan includes actions that apply specifically to metropolitan areas, our inland and coastal regional cities also have a critical role to play. Significant work has put in place approaches to reduce emissions from the energy sector, to reduce waste, and to increase the uptake of zero-emissions vehicles. However, cities are now the next frontier in our journey towards a net zero future.

> 'The **cumulative scientific evidence is unequivocal**: climate change is a grave and mounting threat to human wellbeing and the health of the planet.
>
> Any further delay in concerted global action will miss a brief and rapidly closing window to secure a liveable future.'
>
> *Dr. Hoesung Lee, Chair, Intergovernmental Panel on Climate Change, 6 June 2022*

The Intergovernmental Panel on Climate Change (2022) reports that climate change is having a dramatic impact in every country. The impacts are more widespread and severe than previously thought. Even with extreme action, climate impacts are unavoidable due to the build-up of greenhouse gases already in the atmosphere.[3]

It is clear we need to cut our emissions, and every government, business, community, and person has a role to play.

By focusing on carbon reduction in cities, we can make real progress towards achieving our net zero targets. Our cities offer unique opportunities for reducing carbon emissions in NSW.

The Net Zero Cities Action Plan (the Action Plan) builds on the objectives set by the *NSW Climate Change Policy Framework 2016* to achieve net zero emissions by 2050 and make NSW more resilient to a changing climate. The Action Plan also aligns with the priorities identified by the *Net Zero Plan Stage 1: 2020–2030* to reduce carbon emissions, reach our 50 per cent emissions reduction target by 2030, and to achieve net zero emissions by 2050.

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[2] Kinesis, 2017, *Exploring Net Zero Emissions for Greater Sydney*, p. 5.
[3] Intergovernmental Panel on Climate Change, 2022, *Impacts, Adaptation and Vulnerability: Working Group II contribution.*

The Action Plan sits alongside other key programs aimed at reducing our carbon footprint:

- NSW Net Zero Industry and Innovation Program
- NSW Electric Vehicle Strategy
- NSW Electricity Infrastructure Roadmap
- NSW Waste and Sustainable Materials Strategy
- NSW Primary Industries Productivity and Abatement Program.

The Action Plan outlines steps we can all take to achieve a net zero future. It includes 17 actions the NSW Government will pursue to show leadership, create partnerships, and support innovative approaches to emissions reduction in our urban centres.

By focusing on cities and urban areas we can accelerate our transition to net zero while reducing pressure on cost of living and create healthier, more vibrant places.

When our buildings are designed sustainably,
they are cheaper to heat and cool,
last longer and create less waste.

We can generate and store energy
in our homes and communities
to provide heating, power cars, and run appliances.

We can be more efficient
in the way we use resources and materials
and the way we connect and move around our cities.

We can design our neighbourhoods, our suburbs and our cities
leveraging new technologies to help create places that are
more accessible, more efficient, and more sustainable.

Net zero is an opportunity for everyone

This Action Plan is for everyone. Every household, every business, and every community.

It will help us all to take pragmatic steps to shape a brighter, more sustainable future and harness the benefits of achieving net zero cities.

Reduced cost of living and improved financial security

With a net zero home, you could save up to $1,750 per year on energy costs and by switching to a zero-emissions vehicle, you could save $1,000 per year on fuel.[4] The savings are even bigger for councils and businesses operating property and fleet services. Banks are introducing lower interest rates on loans for energy efficient homes, so you could save on your loan with a net zero house too.

Improved health and wellbeing

In 2020, more than 2,500 people died from extreme heat in Australian capital cities.[5] By 2050 this number is predicted to exceed 5,500.[6] A sustainably designed, energy efficient home can directly improve your family's health and well-being. For example, good insulation and ventilation will keep your home cool in summer, protecting you from extreme heat and reducing air conditioning costs by up to 20 per cent.[7] Limiting the use of heating and air conditioning also reduces the risk of respiratory diseases like asthma by minimising the circulation of dust, mites and mould.

Better resilience to the effects of climate change

Net zero cities use less water, energy and natural resources. A net zero home is more comfortable to live in and more resilient to climate and weather extremes. Natural materials used in net zero homes can be less flammable and, in some cases, won't burn at all, reducing the risk of fire.

New business opportunities, new economies, and new jobs

Implementing the recommendations in the NSW *Net Zero Plan Stage 1: 2020-2030* will create 9,000 jobs. In the housing sector alone, a focus on net zero homes could create more than 7,000 jobs by 2030.[8]

Better public amenities and greener cities

A net zero city is sustainable and has great streets, plazas, public open spaces, public transport, and green infrastructure corridors.

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[4] Pipkorn J, 2020, *Net Zero and zero carbon homes*, Australian Government, https://www.yourhome.gov.au/live-adapt/zero-carbon

[5] Jackson WJ, Argent RM, Bax NJ, Bui E, Clark GF, Coleman S, Cresswell ID, Emmerson KM, Evans K, Hibberd MF, Johnston EL, Keywood MD, Klekociuk A, Mackay R, Metcalfe D, Murphy H, Rankin A, Smith DC, Wienecke B, 2016, *Australia state of the environment 2016,* Australian Government Department of the Environment and Energy, Canberra.

[6] Ibid.

[7] Pipkorn J, 2020, *Net Zero and zero carbon homes*, Australian Government, https://www.yourhome.gov.au/live-adapt/zero-carbon

[8] Australian Sustainable Built Environment Council, 2019, *Growing the Market for sustainable homes: Industry roadmap*, https://www.asbec.asn.au/wordpress/wp-content/uploads/2019/06/190701-ASBEC-CRCLCL-Growing-Market-for-Sustainable-Homes-web.pdf

Let’s take action together

Net zero at home

Every household can make changes to reduce carbon emissions, whether you are in a house, townhouse or unit. Households can choose locally grown produce where available to limit transport emissions; improve energy efficiency using the Nationwide House Energy Rating Scheme (NatHERS) Scorecard assessment; and reduce, reuse, recycle, and repurpose as much household waste as possible –every little bit counts.

Figure 1: A net zero home

1. Solar panels, renewable energy and solar hot water system
2. Light roof colour to reduce absorbed heat in summer
3. Door and window seals, double glazing and window coverings to keep the house cool in summer and warm in winter without air conditioning and heating
4. House uses passive design: orientation and layout maximises access to natural light, ventilation and airflow, and heat from the sun
5. Organic waste recycling, compost bins, worm farms and vegetable patches reducing landfill and carbon miles for food and waste
6. Recycling bin: Bin sensors to alert when incorrect sorting has happened and weight total recycling output
7. Electric vehicles, e-bikes and e-scooters
8. Home battery, electric vehicle and vehicle to everything (V2X) power
9. Smart water and energy meters, providing live information on resource use
10. Smart sensors to monitor building conditions and operate lights and blinds automatically
11. House is built using eco-friendly, non-toxic and renewable materials to produce a well-insulated home
12. LED lights, energy efficient and electric (rather than gas) appliances
13. Onsite greywater recycling, water tanks and water efficient appliances and fittings

Net zero in your neighbourhood

Community members, community organisations, businesses and local councils can work together to achieve progress on net zero objectives. This could include initiatives supporting a circular economy like food swaps or garage sales; using public transport and micromobility options; and making the most of active transport through cycling or walking.

Figure 2: A net zero neighbourhood

1. Rooftop solar panels
2. Community gardens to reduce food carbon footprint
3. Diversity of land uses and mix of housing, including apartment complexes that utilise community batteries, rooftop solar, electric vehicle charging infrastructure and optimised electricity usage in communal areas
4. Recycled materials in roads and infrastructure projects
5. Car sharing
6. Community scale batteries and Virtual Power Plants (VPPs)
7. Tree planting, green public spaces and landscaping supported by smart irrigation and water sensitive urban design
8. Connected waste bins for efficient waste disposal and materials tracking and data
9. Solar hot water and heat pumps at community sites
10. Shared composting and recycling schemes to reduce waste to landfill
11. Solar operated street furniture and community facilities, with charging ports and free wifi
12. Accessible active and micro-mobility transport links and infrastructure, like bike racks, charging bays and air stations
13. Connected technology gathering data to make public spaces more efficient
14. Solar powered, sensor-operated street lighting
15. Electric vehicle charging infrastructure
16. Emission-free, regular and reliable public transport

Net zero in your suburb or city

By joining forces, everyone living, working and visiting a city or suburb can play a role in achieving net zero at a precinct scale. This impact can be much larger, involving city-wide infrastructure and circular economy opportunities at an industrial level. This could include retrofitting or repurposing buildings; councils, government and businesses digitising service delivery, reducing customer trips; and generating new ideas and commercialisation pathways for products and services to reduce carbon emissions.

Figure 3: A net zero suburb

1. Distributed energy network and micro-grid
2. Recycling facility to reduce waste
3. Detailed data on precinct materials and waste to support circular economy opportunities
4. New commercial buildings designed with low embodied and operational carbon impacts, and with renewable materials that can be reused
5. Drones and EVTOL (electric vertical take-off and landing) supporting freight and logistics
6. On-site management of organic waste
7. High-quality public and open space, with waterways, recreational space, bushlands and parks, supported by water sensitive urban design, smart irrigation and other connected technologies
8. Transit-oriented development and efficient public transport links around public transport hubs
9. Connected active transport and micro-mobility paths and infrastructure, like bike racks, charging bays and air stations
10. E-bike charging stations
11. Multi-use tunnels, such as underground highways and transit lanes, to shift cars and trucks away from bike lanes and green spaces above, to encourage more pedestrian and active transport travel
12. Accessible end of trip facilities
13. Fully integrated electric vehicle charging network
14. Integrated water cycle management, including urban waste water heat-recovery
15. Industrial symbiosis - using the waste from one company as raw materials for another
16. Heat capture from data centres recovered to power surrounding buildings
17. Commercial premises fitted with sensors and connected technologies to be responsive, including predicative maintenance, thermal controls, movement activated lighting

Leading the way

The NSW Government will take steps over the next three years to achieve net zero cities. We will do this by:

showing leadership and generating insights

creating partnerships and delivering pilots

supporting innovative approaches.

We have identified 16 actions for Government. Each action aligns with priorities set out in the *Net Zero Plan Stage 1: 2020-2030* to tackle the financial, social and environmental challenges posed by climate change, and using solutions based on science, innovation and economics.

Priority 1	Drive uptake of proven emissions reduction technologies that grow the economy, create new jobs and reduce the cost of living
Priority 2	Empower consumers and businesses to make sustainable choices
Priority 3	Invest in the next wave of emissions reduction innovation to ensure economic prosperity from decarbonisation beyond 2030
Priority 4	Ensure the NSW Government leads by example.

Delivering on our commitments

Achieving the objectives of this Action Plan requires a commitment from the NSW Government to monitor and evaluate progress so that we know if the actions are having the intended impact.

Ongoing monitoring and evaluation will also help identify emerging risks and opportunities enabling the NSW Government to be more agile in this rapidly changing space.

Transport for NSW (Cities and Active Transport) will take a lead role in managing the implementation of the Action Plan, including tracking delivery of actions. Responsibility for the delivery of individual actions will remain with the lead agency identified.

Actions in brief

Showing leadership and generating insights

ACTION 1	Reduce carbon emissions from new infrastructure
ACTION 2	Deliver net zero precincts
ACTION 3	Improve the carbon performance of new buildings
ACTION 4	Showcase a Net Zero Home
ACTION 5	Develop an interactive Net Zero Cities portal
ACTION 6	Establish net zero targets in the six cities

Creating partnerships and delivering pilots

ACTION 7	Partner to enable thriving and healthy neighbourhoods
ACTION 8	Deliver pilots to create net zero opportunities in existing and heritage buildings
ACTION 9	Enable micromobility as a smarter way to move freight
ACTION 10	Partner with the Western Parkland City to accelerate circular economy opportunities
ACTION 11	Assist local communities to take up net zero opportunities

Supporting innovative approaches

ACTION 12	Trial Vehicle to Grid capability
ACTION 13	Develop a household net zero monitoring tool
ACTION 14	Establish a Net Zero Layer in the Spatial Digital Twin
ACTION 15	Improve understanding of the value of green infrastructure in cities
ACTION 16	Develop an active transport data platform

Actions in detail

Showing leadership and generating insights

The NSW Government will continue to show leadership and provide new insights on net zero. This will encourage investment, highlight opportunities for governments and business, and deliver new projects that could significantly reduce carbon emissions in our urban environments.

Action 1: Reduce carbon emissions from new infrastructure

The largest source of carbon emissions in the building sector in the coming decades is expected to be construction materials, like steel and cement. Cement alone accounts for 8 per cent of total global carbon emissions and makes up the single largest source of industrial emissions. This is equivalent to emissions from the global car fleet.[9]

NSW has a record pipeline of investment in infrastructure including a $112.7 billion, four-year infrastructure program and a $2.8 billion Housing Package.[10] The State Infrastructure Strategy 2022-2042 sets out an ambitious plan to make new and existing assets more resilient.

This requires cost-effective initiatives to reduce emissions from State assets and infrastructure, including the embodied emissions.[11] Emerging technologies are being explored, with green concrete a key focus.

As a major contributor to the infrastructure pipeline, Transport for NSW has identified a range of actions across industry procurement, project development and supply chains. These include:

- developing a Roadmap to Net Zero Infrastructure at Transport for NSW
- introducing sustainability performance measures, which will become minimum contract requirements
- increasing the use of renewable energy and recycled and low embodied-carbon materials in projects
- developing technical guidance to Design for Decarbonisation and Design for Circularity
- reviewing standards and specifications to align with net zero commitments
- continuing to invest in the Sustainable Materials Research Workstream with Australia's leading universities.

Lead agency	Collaborators	Delivery
Infrastructure NSW Transport for NSW	Developers Businesses Households	Ongoing

Action 2: Deliver net zero precincts

The NSW Government established Barangaroo as the first carbon-neutral precinct in Australia. It was set up to operate with net zero carbon emissions. The Barangaroo model established an approach that provides a template for other key precinct developments across Sydney, including Bays West, Redfern North Eveleigh, Central Precinct and Blackwattle Bay.

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[9] Beyond Zero Emissions, 2017, *Zero Carbon Industry Plan: Rethinking Cement*, https://bze.org.au/wp-content/uploads/2020/12/rethinking-cement-bze-report-2017.pdf

[10] NSW Government, 2022, *2022-23 NSW Budget: Steadfast support for families and businesses today, vision and reform on education, health, housing, women's opportunity, environment*, https://www.nsw.gov.au/media-releases/2022-budget

[11] Infrastructure NSW, 2022, *Staying Ahead. State Infrastructure Strategy 2022-2042*, https://www.infrastructure.nsw.gov.au/media/3503/state-infrastructure-strategy-2022-2042-full-report.pdf

The NSW Government will take a net zero commitment for state-significant precincts, achieved through a range of approaches. This includes:

- using no fossil fuels in regular precinct operations
- pursuing renewable energy opportunities, including on-site sources
- being demand-responsive to reduce energy and water consumption, and ready for smart utility grids.

Globally significant innovation districts like Tech Central and Westmead Health and Innovation District will also take action to reduce carbon emissions at a precinct scale. These precincts will track and measure progress towards achieving net zero by 2030, including initiatives to encourage public transport usage. The Bradfield City Centre in the Western Sydney Aerotropolis will be Australia's first net zero and hydrogen-ready city – a greenfield development with sustainability at its core, taking new approaches to decarbonising cities and transport.

All precincts are committed to providing extensive green cover, delivering natural cooling of the air and surfaces. The reduced heat provides health and wellbeing benefits while also reducing the need for energy consumption.

Lead agency	Collaborators	Delivery
Infrastructure NSW Transport for NSW Greater Cities Commission Placemaking NSW	NSW Treasury (Office of Energy and Climate Change) Local government Businesses Households	1 to 2 years. Target achievement is ongoing.

Figure 4: Barangaroo - Australia's first carbon neutral precinct (Copyright State of New South Wales (Transport for NSW))

Action 3: Improve the carbon performance of new buildings

Buildings account for over 50 per cent of electricity use in NSW and Australia and represent over 25 per cent of national emissions. Reducing the energy used to operate buildings has the triple benefit of saving money, reducing emissions, and creating space in the grid.

The new Sustainable Buildings State Environmental Planning Policy (SEPP), introduced by the Department of Planning and Environment, will address carbon emissions in buildings. It includes increased Building Sustainability Index (BASIX) targets for new residential buildings and net zero requirements for new non-residential buildings. The Sustainable Buildings SEPP covers the operational performance of buildings and measurement of embodied emissions. There will be a 12-month delayed commencement to allow industry to adjust to the new standards. Lead agencies will develop the implementation plan and the staging strategy for future building typologies to be included.

Lead agency	Collaborators	Delivery
Department of Planning and Environment Government Architect NSW	NSW Treasury (Office of Energy and Climate Change)	Within 12 months

Action 4: Showcase a Net Zero Home

The Green Building Council of Australia have noted that 57 per cent of Australia's total built environment emissions come from our homes.[12] A net zero home can therefore have significant impact in reducing emissions as well as improving comfort and easing cost-of-living pressures.

The NSW Government will partner with a leading developer to create a contemporary, optimal net zero home meeting BASIX 10-star rating. The Net Zero Home will include passive design, low-carbon materials, insulation, on-site renewable energy (like rooftop solar), electric vehicle charging, energy efficient appliances, on-site water recycling, full waste recycling, landscaping design and smart technologies.

Once the home is occupied, performance data will be collected to showcase its impact on household carbon emissions and cost savings over time.

People would be able to take virtual and in-person tours of the home, to learn about net zero opportunities, so they can make changes to their own home.

Future work might also include different building types and scales, including a showcase net zero townhouse, a net zero unit block and a net zero non-residential building.

Lead agency	Collaborators	Delivery
Landcom Transport for NSW – Cities and Active Transport	NSW Treasury (Office of Energy and Climate Change	1 to 2 years

[12] Green Building Council Australia, 2020, *Green Star for Homes: A strategy for the future.*

Action 5: Develop an interactive Net Zero Cities portal

There is an extensive portfolio of information available to consumers about opportunities and pathways to achieve net zero. However, a lot of the information is hard to find or understand.

The NSW Government is creating a new website to combat this. This will give households, communities, local government and business owners with practical advice and information to help contribute to a net zero city, while saving money and the environment.

The Net Zero Cities portal will build on information already available across a range of NSW Government resources, showcasing case studies and providing tools and resources to help people measure their carbon emissions. A key component will be the articulation of clear pathways so that consumers can understand not only why particular opportunities are of value, but also how to take advantage of them.

The portal will also include an online calculator for people to assess the environmental performance of residential and non-residential buildings. The calculator will bring together current star ratings into a single tool which is focused on energy performance in buildings.

Lead agency	Collaborators	Delivery
Transport for NSW – Cities and Active Transport	NSW Treasury (Office of Energy and Climate Change) Local government	Within 12 months

Action 6: Establish net zero targets in the six cities

The Greater Cities Commission is bringing together the three cities of Greater Sydney – the Western Parkland City, Eastern Harbour City and Central River City – with the cities of the Lower Hunter, Central Coast, and Illawarra-Shoalhaven to create a globally competitive six cities region.

For each of the six cities, and across the six cities region, the Greater Cities Commission and Transport for NSW will set targets to achieve net zero, including:

- emissions reduction targets
- targets for zero emissions vehicles
- targets for accelerated electrification of public transport
- strategies for increasing public transport.

Lead agency	Collaborators	Delivery
Greater Cities Commission Transport for NSW	Local Government	1 to 2 years

Creating partnerships and delivering pilots

There are great opportunities for NSW Government agencies, businesses, local councils and communities to work collaboratively towards a net zero future. Strong partnerships provide the opportunity to network and learn, and achieve emissions reductions faster, at a lower cost, and with more chance of success.

Action 7: Partner to enable thriving and healthy neighbourhoods

People riding bikes and scooters or walking, instead of using their cars, is one of the most practical ways to achieve net zero outcomes. A person swapping just one trip per day from driving a car to cycling, will reduce their carbon footprint by about 0.5 tonnes per year, as well as improving their health and well-being.[13]

There are opportunities for State and Local governments to work together to promote and support active transport for short trips.

Governments can enable walking and cycling by ensuring people have safe, well-designed, and connected streets, with the right infrastructure. Best practice approaches are included in key policies and guidance including the Transport for NSW Road User Space Allocation Policy and the NSW Government's Movement and Place Framework.

Enabling more sustainable and walkable neighbourhoods will drive net zero outcomes at a local level and can be supplemented with local engagement. There may also be opportunities to use behavioural insights to engage communities on their walking and cycling habits and preferences.

Lead agency	Collaborators	Delivery
Transport for NSW – Cities and Active Transport	Local government Community groups Cycling organisations and advocacy groups	Ongoing

Action 8: Deliver pilots to create net zero opportunities in existing and heritage dwellings

Heritage buildings have significant social, historical and community value, however, they are not designed to the latest standards for efficiency and climate resilience. Retrofitting and adaptive reuse of old or unused buildings is a great way to reduce emissions. All retrofit projects must work within planning restrictions, but heritage buildings pose additional challenges to improving the carbon footprint of a building. Original wiring and plumbing may not be immediately compatible with solar installations or smart meters. Orientation and construction materials may not offer sufficient natural light or air flow. And location and adjacent development use may significantly restrict connectivity to green infrastructure services. Although the process may seem daunting, it's certainly worth the effort.

The NSW Government will pilot smart net zero technologies in heritage buildings and precincts in two phases:

1) Identify climate resilience opportunities in a precinct with heritage significance and suitable building diversity (residential and commercial).

[13] University of Oxford, 2022, *Get on your bike: Active transport makes a significant impact on carbon emissions.*

2) Investigate climate mitigation opportunities in heritage buildings, including improving energy efficiency and upgrades to decarbonise energy sources.

The Rocks in Sydney, for example, has a range of older residential and commercial buildings and may be ideally placed for a pilot.

The pilot may also identify adaptive re-use opportunities for heritage buildings, so they remain fit for purpose into the future.

The NSW Government will also consider optimised retrofits for existing buildings to improve performance and retain carbon already expended in existing construction, which aligns with the Accelerating Net Zero Buildings Strategy.

Lead agency	Collaborators	Delivery
Transport for NSW – Cities and Active Transport Department of Planning and Environment (Heritage NSW)	NSW Treasury (OECC) National Trust NSW Government Architect Sydney Living Museums Heritage Council of NSW Place Management NSW	1 to 2 years

CASE STUDY: Retrofitting Amsterdam towards zero energy buildings

The New Urban Energy City-Zen program aims to develop energy efficient carbon neutral cities across Europe. The Retrofitting of Amsterdam towards zero energy buildings initiative was launched to support a target to reduce carbon emissions from the city by 40 per cent compared with 1990 levels) by 2025.

Almost 41,000m^2 of heritage residential buildings in Amsterdam were upgraded with new insulation to improve thermal transfer, new heat pumps and solar thermal infrastructure to replace old heating and cooling appliances, and solar photovoltaic panels.

In 2019, energy use was reduced by 12,877,692kWh/year, or 2,945 tonnes/year of carbon emissions. Ongoing monitoring has confirmed this reduction has been sustained. Residents reported improved living comfort, healthier home environments, and a sense of pride in their involvement with the project.[14]

[14] New Urban Energy, 2019, *Retrofitting of Amsterdam towards zero energy buildings*, City Zen, Amsterdam.

Action 9: Enable micromobility as a smarter way to move freight

As consumers' shopping habits change towards more online shopping, an increasing demand for deliveries is causing congestion in our cities. Between 2019 and 2030, emissions from delivery traffic will increase by nearly a third and congestion will rise by over 21 per cent.[15]

For freight operators, delivery from the depot to the door (known as the last mile) is the most complex, accounting for 53 per cent of the delivery cost.[16]

Vans in an urban area contribute to (and suffer delays because of) congestion. Adopting alternate micromobility approaches can lead to productivity gains for courier businesses and reduce kerbside congestion and achieve environmental, social and commercial benefits in the urban environment. A bike courier run, for example, takes half the time of a van, travels less distance, and uses a third of the kerbside/footpath parking.

Transport for NSW established a courier hub in Goulburn Street in the Sydney CBD in 2016 with off-street parking, cages and lockers to transfer goods between delivery operators.

NSW Government will explore options to establish new hubs, including in Western Sydney. The hubs will have a particular focus on testing micromobility options for freight delivery.

Lead agency	Collaborators	Delivery
Transport for NSW – Freight	Local government Industry partners	1 to 2 years

CASE STUDY: Micromobility freight

Experiences in London, the Netherlands, Sweden and Sydney have shown the benefits of micromobility hubs for freight. These cities have used pedestrian porters and e-bikes, or small zero emissions vehicles instead of vans and trucks.

In 2016, Transport for NSW, with City of Sydney, established a Courier Hub operating from Goulburn Street carpark in the CBD. The versatility of courier bikes has been tested at the hub and they can be twice as efficient as deliveries by van in a high-density environment.

The Sydney CBD Courier Hub has grown since it was established. The daily throughput measured in May 2022 was 225 parcels by 47 courier bike trips. It is meeting key performance indicators, including 70 kilometres less distance for vehicles driving in the CBD per day.[17]

The hub provides a benchmark for further pilots in new locations in NSW.

[15] World Economic Forum, 2020, *The Future of the Last-Mile Ecosystem*, Geneva.
[16] Pointer G, Snood S, 2022, *Future of delivery: Unleashing the potential of micromobility for the last mile*, WSO, Sydney.
[17] Transport for NSW, 2022

Action 10: Partner with the Western Parkland City to accelerate circular economy opportunities

A circular economy adds value to resources by extending their use, can reduce costs to consumers and reduces emissions linked to the production of new materials.

The transition to a zero-waste state is critical. Without moving to a circular economy, we will only get halfway to NSW's goal of net zero emissions by 2050, even with a transition to renewable energy.

Having data on the materials that exist in our built environment or the waste streams we are producing is critical to achieve a circular economy.

The NSW Government recently ran a Smart City Innovation Challenge to seeking new ways to generate, model and access precinct-level material usage, reuse, recycling and disposal data. Solutions are being piloted in the Western Parkland City and Wagga Wagga Special Activation Precinct.

There is an opportunity to leverage the model of Sustainability Advantage's highly acclaimed Net Zero Emissions Leadership Accelerator and Net Zero Emissions Pathways initiatives. This supports businesses join with others in their area to trial and scale net zero innovations and strategies.

The NSW Government will build on the outcomes of the innovation challenge to identify circular economy linkages across Western Parkland City businesses. The Sustainability Advantage Program can act as a broker to bring together businesses and local councils. This approach offers a pilot that can be replicated in other precincts including regional locations.

Lead agency	Collaborators	Delivery
NSW Treasury (Office of Energy and Climate Change)	Environment Protection Authority Transport for NSW Western Parklands City Authority Local councils	1 to 2 years

Action 11: Assist local communities to take up net zero opportunities

The NSW Government will partner with local communities to better understand current challenges preventing action to achieve net zero and uncover success stories. The focus is to support communities to unlock their own opportunities.

The initial phase will be a Community Batteries Program that can support links to Australian Government funding for community-owned and led energy storage initiatives. The program will explore appropriate placement of energy storage at the neighbourhood level, microgrid applications and opportunities for new operating models (such as a cooperatives model).

Future focus areas may include an Electric Transport Support Program to address challenges for zero emissions vehicle uptake, including access to public charging infrastructure.

Lead agency	Collaborators	Delivery
Transport for NSW – Cities and Active Transport	NSW Treasury (Office of Energy and Climate Change) Department of Planning and Environment Local councils Local communities	1 to 2 years

Figure 5 - Uptake of zero emissions vehicles will help achieve net zero cities. (Copyright State of New South Wales (Transport for NSW))

Supporting innovative approaches

Technology can play a critical role in helping us achieve net zero. The NSW Government will continue to leverage opportunities for data solutions and the adoption of new technology to help us achieve this goal.

Action 12: Trial Vehicle-to-Grid (V2G) capability

As the adoption of battery zero emissions vehicles outpaces traditional internal combustion engine vehicles, home based charging and battery storage options will become increasingly important. To date, zero emissions vehicles have had one-way chargers.

New technologies mean that bidirectional chargers are entering the Australian market. This means zero emissions vehicles can discharge energy to power a home (known as vehicle-to-home), reducing the draw on baseload power. They can also export energy to the grid (vehicle-to-grid), increasing baseload capacity of the electricity grid; improving resilience in our energy infrastructure; and addressing peak demand.

To ensure the new technologies can be adopted easily in NSW, we will undertake a trial of vehicle-to-grid capability for zero emissions vehicles. Transport for NSW will use its own fleet vehicles and engage transport and electricity market participants to support the trial.

The trial will run for 12 months and the results will be published to support adoption.

The Government recognises the key role that electrifying transport can play in reducing carbon emissions. This action will also consider other potential opportunities, such as zero emissions ferries and garbage trucks.

Lead agency	Collaborators	Delivery
Transport for NSW – Cities and Active Transport	NSW Treasury (OECC) Energy network providers (distributors) Vehicle manufacturers Charging infrastructure providers	1 to 2 years

Action 13: Develop a household net zero monitoring tool

Australian households are a major generator of emissions, with residential buildings responsible for 12 per cent of Australia's total carbon emissions.[18]

Smart technologies like water and electricity meters have given households more information on their resource use. However, there is no simple way for a household to calculate its carbon emissions.

The NSW Government will partner with industry to find new ways to bring data on a household's full carbon profile together, covering energy, transport, water and waste. This would allow households to track consumption, better understand how to reduce their footprint and save money.

Lead agency	Collaborators	Delivery
Transport for NSW – Cities and Active Transport	NSW Treasury (Office of Energy and Climate Change) Industry innovators	Within 12 months

Action 14: Establish a Net Zero Layer in the Spatial Digital Twin

The NSW Spatial Digital Twin is a powerful collaborative environment that shares and visualises information in a 4D model of the real world, in near real time. This digital replica of NSW can help us make more informed decisions, saving money and creating efficiencies.

By integrating new datasets across a range of sectors including energy, water, wastewater, transport, waste and communications infrastructure and services, into the Spatial Digital Twin, we can establish a Net Zero Digital Twin. This can be used to test and simulate scenarios and interventions, and help governments and industry make decisions about changes and investments to reduce emissions.

The Spatial Digital Twin also presents an opportunity to integrate electric vehicle charging station locations with the FuelCheck app data to display real-time information about charger functionality, availability and pricing. This would encourage more people to adopt zero emissions vehicles.

Lead agency	Collaborators	Delivery
Department of Customer Service	Transport for NSW Department of Planning and Environment NSW Treasury (Office of Energy and Climate Change)	Within 12 months for data integration 1 to 2 years to pilot the tool 3 to 5 years for scenario integration and supplementary products (such as electric vehicle charging app)

[18] Department of Climate Change, Energy, the Environment and Water, 2022, *Government Priorities: Residential Buildings*, https://www.energy.gov.au/government-priorities/buildings/residential-buildings

Action 15: Improve understanding of the value of green infrastructure in cities

Green infrastructure is important for our cities and their people. It provides health, wellbeing and ecological benefits, and helps combat the effects of climate change. Examples of green infrastructure include remnant bushland, private and community gardens, parks, biodiversity corridors, nature reserves and trails, sporting ovals, street trees and rooftop gardens.

The NSW Government will develop ways to accurately measure the carbon sequestration capabilities of existing green spaces across urban areas. This will provide baseline data and spatial mapping of the six cities area showing natural levels of carbon sequestration in urban forests, around waterways, in and around buildings and within rail corridors.

The data will be used to create a digital tool to help identify areas where more green infrastructure is needed to form an interconnected green grid and connect communities, improve local amenity and reduce carbon.

Buildings provide opportunities for future greening. Mass planting on rooftops, for example, can improve carbon sequestration in urban areas, reduce urban heat, improve sound insulation, and improve biodiversity in our cities. Rooftop gardens are particularly well suited to flat roofs in high density residential and commercial areas. The digital tool and spatial data will help identify potential locations for rooftop gardens.

There are opportunities to collaborate with the Department of Planning and Environment on projects already underway, including the Greener Neighbourhoods program.

Lead agency	Collaborators	Delivery
Transport for NSW – Cities and Active Transport NSW Government Architect	Sydney Metro Department of Planning and Environment Local government Transport for NSW	1 to 2 years

Action 16: Develop an active transport data platform

The NSW Government is committed to encouraging people to walk or cycle as part of their everyday travel and has committed $950 million for footpaths, cycleways and other links over the next five years.

Even though most people know how to ride a bike, NSW has the lowest cycling participation rate across Australia. Just 13 per cent of residents ride weekly, 20 per cent ride monthly and 33 per cent ride annually. In comparison, almost 50 per cent of residents in the Northern Territory ride a bike annually.[19]

The good news is that NSW participation rates have risen recently, with cycling in Sydney increasing by almost 8 per cent in the last two years. This is likely due to COVID-19 and the provision of pop-up cycleways.

One of the greatest barriers to cycling participation is people's concern about safety when cycling, particularly about sharing roads with motor vehicles. Many locations have good cycling facilities, but there is no easy way for people who want to cycle to find information on this when they are planning bicycle trips.[20]

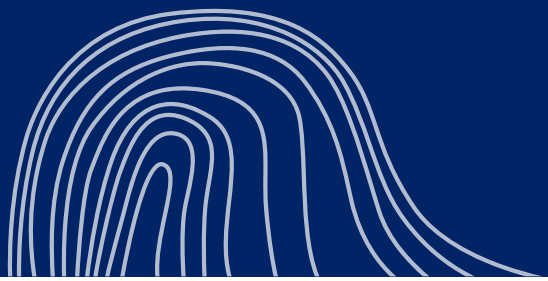
[19] Cycling and Walking Australia and New Zealand, 2021, *National Walking and Cycling Participation Survey*.
[20] City of Sydney, 2020, *On The Go: How Women Travel Around Our City*.

To support the uptake of active transport, the NSW Government will make more information available to customers on active transport networks and supporting infrastructure, including how cycling, e-bikes, e-scooters and pedestrians interact and intersect.

This could include using artificial intelligence (AI) and data mapping capabilities to develop an app or online tool with a detailed active transport map, including bike parking and end-of-trip facilities. This approach could build on the concept Opal+ trial, which supports journey planning for public transport usage, and apply an active transport lens and potential links.

Transport for NSW will also improve collection and availability of data about how many people are using the active transport networks. This will help us deliver infrastructure where it's needed the most and will help people wanting to cycle or use a shared path or cycleway plan their journeys.

Lead agency	Collaborators	Delivery
Transport for NSW – Cities and Active Transport	Local government	1 to 2 years



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