PRESENTED BY
Aileen Natasha
Anastasia Jesica
Dennis Jonathan

ECO SPARK

PREPARED FOR
Your Melbourne 2024

Reimagining Waste: Energizing Communities with Sustainability & Innovation

Meet the Team

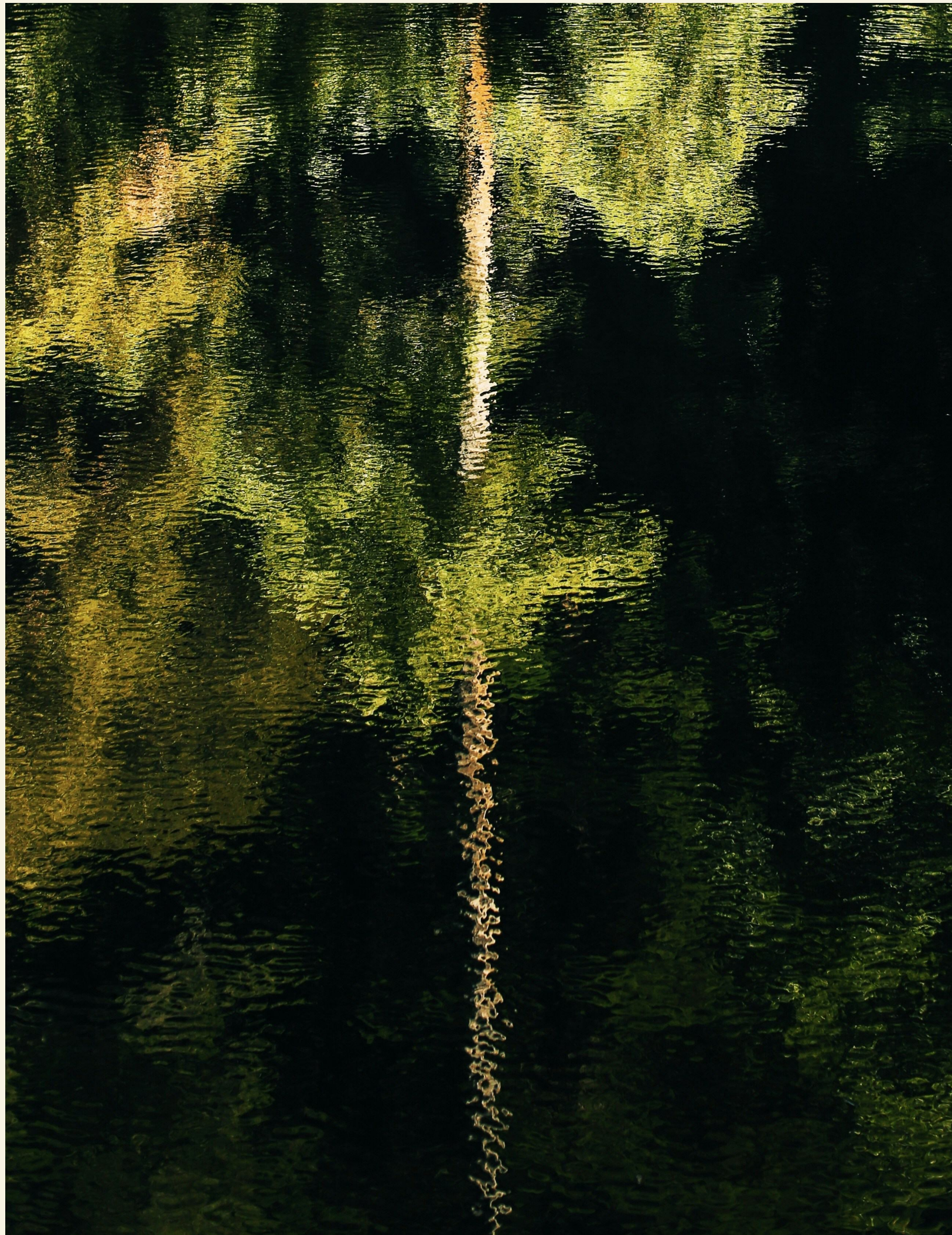**AILEEN NATASHA**

Master of Design, Innovation, and Technology

ANASTASIA JESICA

Doctoral of Civil Engineering

DENNIS JONATHAN

Master of Management (Finance)

Eco Spark

Your Melbourne

ACKNOWLEDGEMENT OF COUNTRY

We acknowledge the Traditional Owners of Country throughout Australia and recognize the continuing connection to the lands, waters & communities. We pay our respect to Aboriginal and Torres Strait Islander cultures; and to Elders past and present.
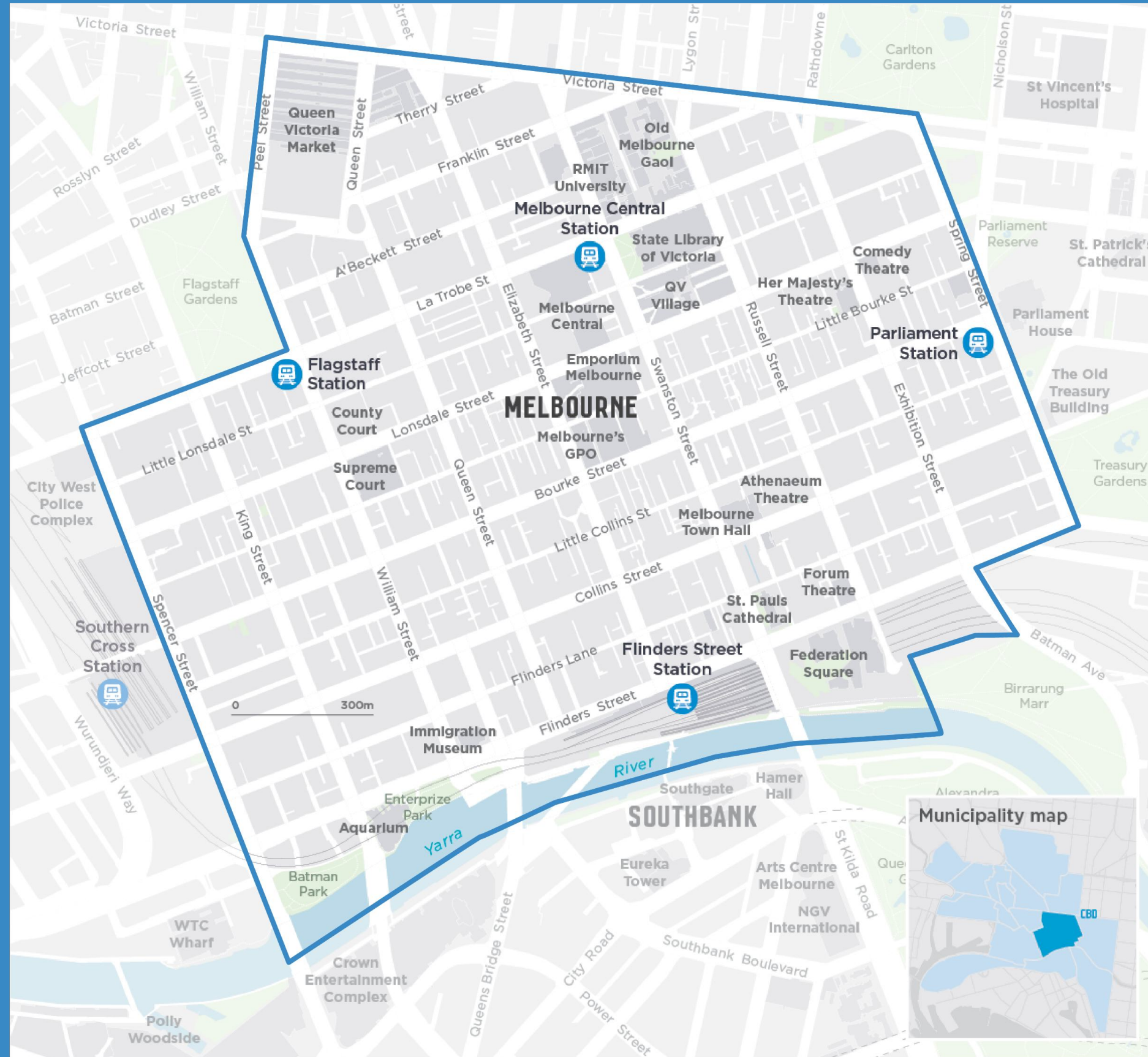
The Problem at hand

Understanding the overpopulation challenge in
Melbourne CBD and our proposed solution

Introduction

Melbourne CBD: the heart of Melbourne

The Melbourne CBD, including the Hoddle Grid, is the centre for the business, education and entertainment activity of Victoria. The Melbourne neighbourhood encompasses much of the CBD.

Eco Spark

Centralized urban planning around CBD discouraged people from living in suburbs

Business Activity
Melbourne CBD makes up 55% of the total businesses, and 48% of the total jobs in the City of Melbourne.

Education Activity
Home to some of the most prestigious universities and TAFEs. Most of them are located in or close to the city centre.

Entertainment Activity
Home to Melbourne's famed laneways, arcades and café culture, a distinct blend of contemporary and Victorian architecture and a diversity of events, shopping, dining, and nightlife. Many of Melbourne's most iconic landmarks are located here.

Cencus Findings
In 2021, 69% of households are renting and that 69% of residents are born overseas.
In 2023, the population density of CBD is projected to increase to 21,893 persons/km2, a significant increase from 2021 census

Source: ABS, Participate Melbourne, Economy.id

Your Melbourne

Proposed Solution

Contributing to the development of sustainable city to alleviate CBD infrastructure strain

Melbourne CBD — Consists of →

Residents (9%)

Commuters (42%)

Visitors (49%)

— Causing →

Traffic Congestion

Infrastructure Overcrowding

Packed Pedestrian Walkway

Inefficient Micro-mobility

Increased Pollution

Crammed Public Transport

— Our Proposed Solution →

Develop a new sustainable city that offers the same level of facilities, in terms of business, education, and entertainment activities, to reduce the burden of CBD.

Where would it be?

Fishermans Bend !!

Business & Entertainment activities increase the number of commuters
88% of the workers in Melbourne CBD are commuting from the suburbs

Entertainment activities increase the number of visitors
As of March 2024, domestic and international visitors spent a total of 82.1 million nights in Melbourne over the year.

Past, Present, & Future Fabric

Fishermans Bend was a lowland formed from swamps & sand ridges on the delta of the Yarra River.

The area lost most of its natural character during the second world war due to a large-scale reclamation and filling.

It is now a predominantly industrial site and projected to be the biggest renewal area in Melbourne's inner city

Source: Fishermans Bend Heritage Study, Fishermans Bend Population & Demographics

Population target by 2050:

80.000

Residents

Household Waste Recycling Rate Target:

70%

By 2050

Land Availability:

480

Hectares

Number of targeted area:

5

Precincts

The Proposed Area: Fishermans Bend "Employment Precinct" (NEIC)

Why?
- Extensive land availability owned by the government meant to attract high potential start-ups
- Expected influx of people in the future with the University of Melbourne's plan to open a campus & new industries
- Potentials for improvement & within close distance from the CBD
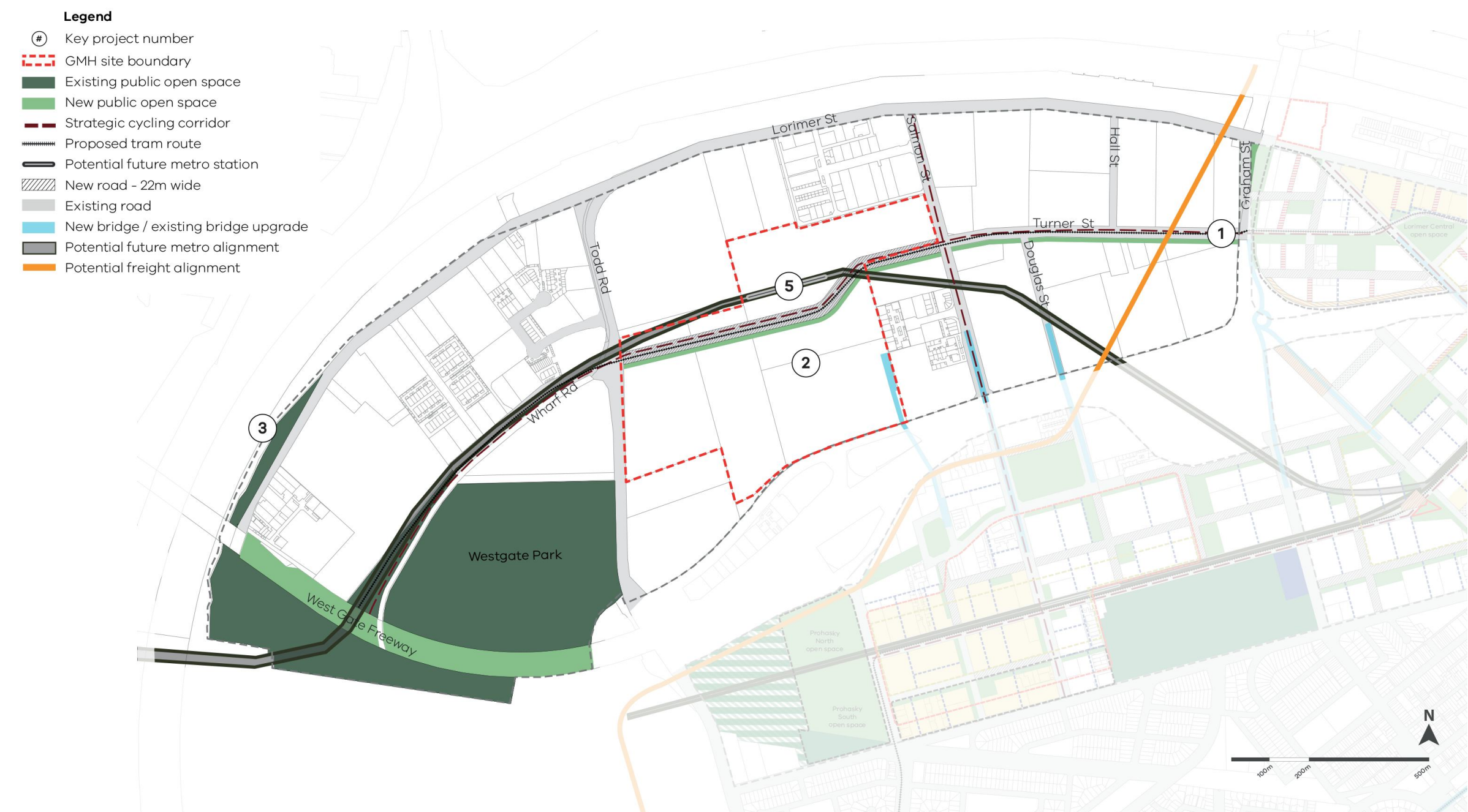
Source: Fishermans Bend Framework

Eco Spark

Your Melbourne

Historically, Fishermans Bend was viewed as a polluted area and dumping ground due to its proximity to the CBD. Our project challenges this perception by exploring ways to transform waste into a positive resource for the community.

Source: LIFE ON THE BEND A social history of Fishermans Bend, Melbourne

Legend
- Key project number
- GMH site boundary
- Existing public open space
- New public open space
- Strategic cycling corridor
- Proposed tram route
- Potential future metro station
- New road - 22m wide
- Existing road
- New bridge / existing bridge upgrade
- Potential future metro alignment
- Potential freight alignment

Urban Planning Concept

The sustainable 15-minute city model
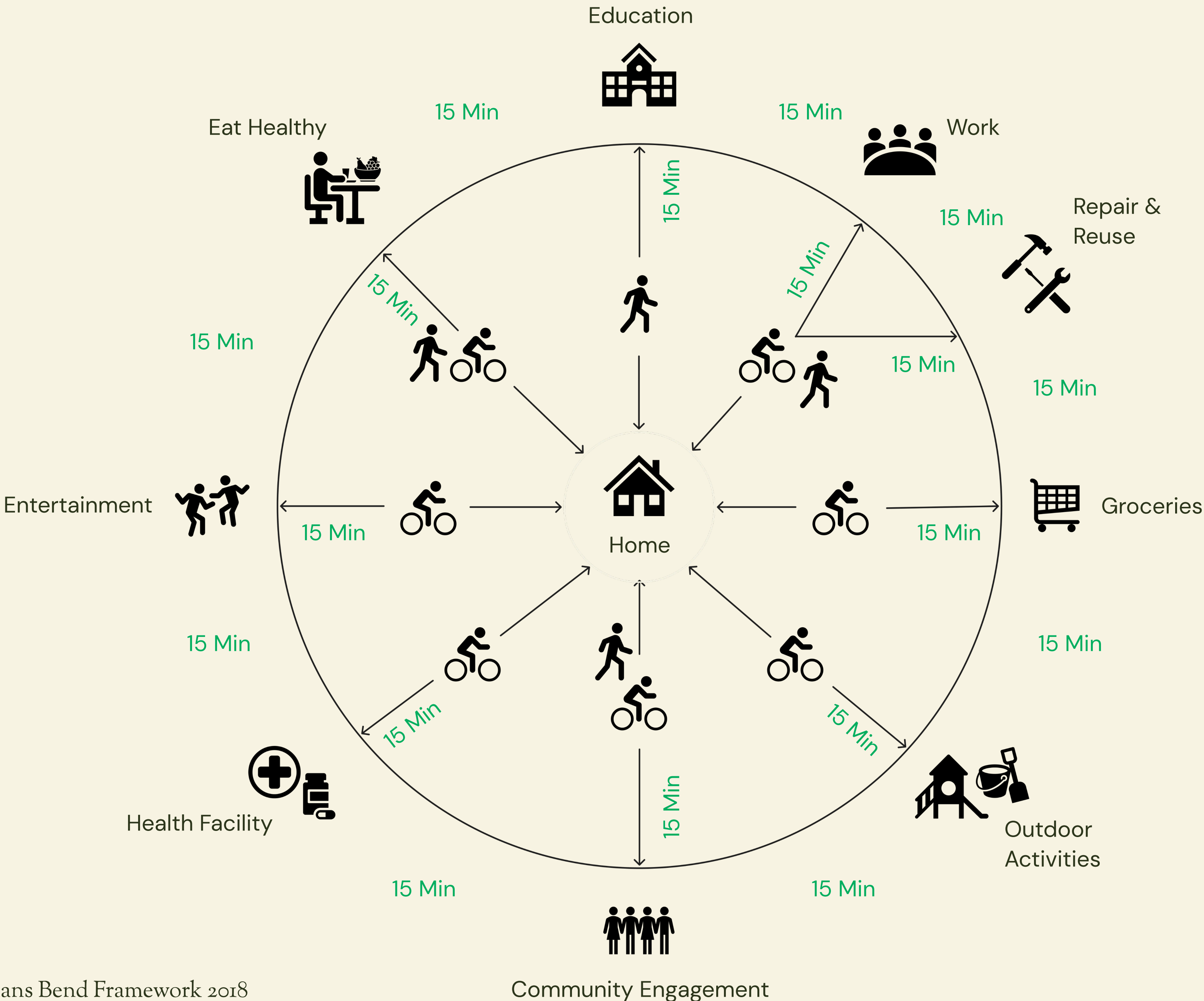
Why are we proposing this model?
15-minute city urban planning ensures that everyone in a city has access to essential services within a 15-minute walk or bike ride. A key focus is enhancing **accessibility for everyone**, incorporating micro-mobility solutions such as shared e-bikes (detailed in Appendix 1) and autonomous electric vehicles as part of our eco-mobility plan

Which stakeholders should be involved?
A study indicates that a population density of around 10,000 people/km2 is needed to support a sustainable 15-minute city.

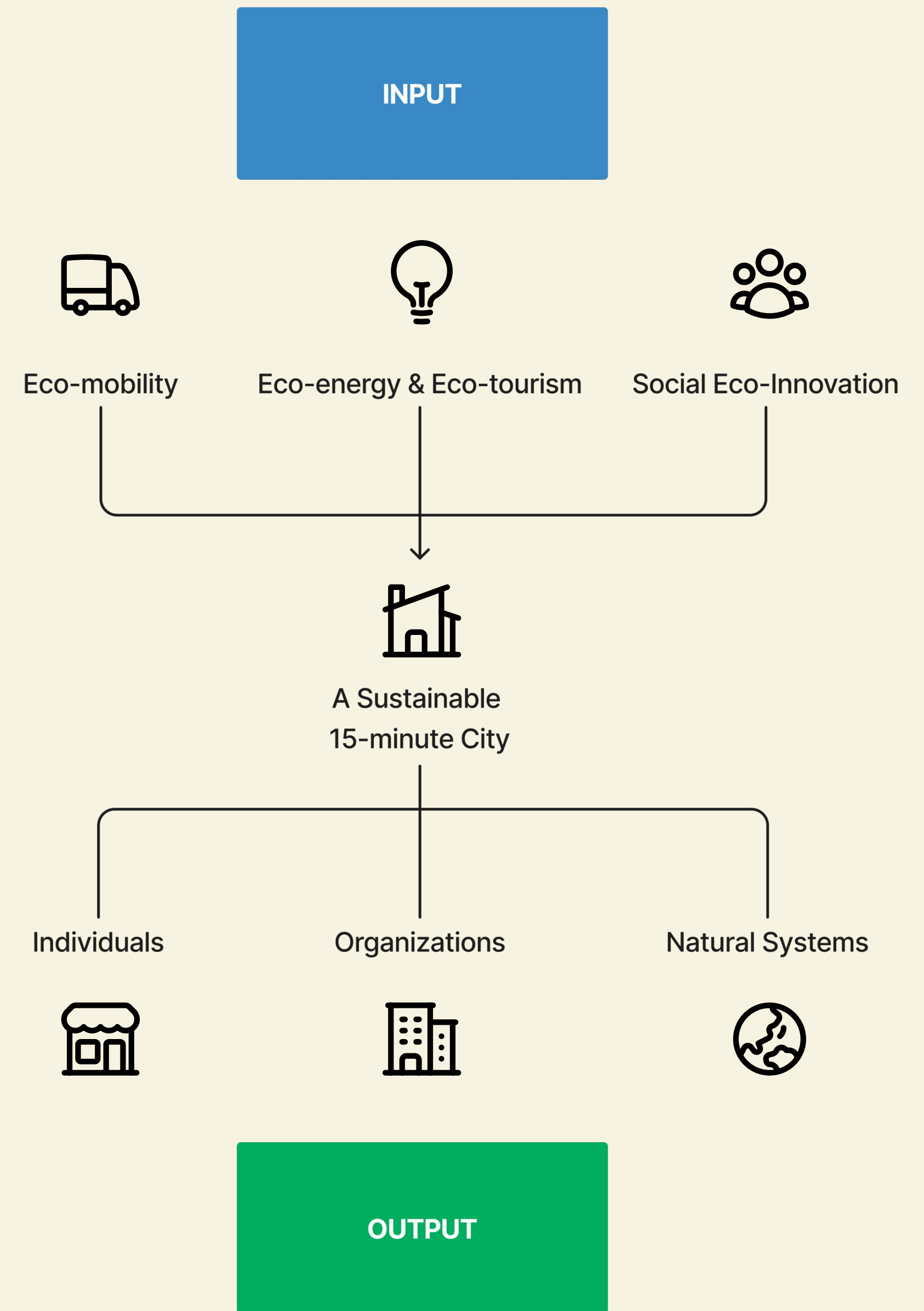To attract this population, the city must engage with stakeholders in the following areas:

Business	Education	Entertainment
The precinct is designated as one of the seven NEIC in Melbourne. It is recognized as an established Industrial area	The University of Melbourne Engineering & Design campus is expected to open in 2025	There is no major tourist attraction in the area yet, but 30 hectares of government land offers potential for development.

Source: 15-minute city, Dublin Democratic Planning Alliance, Fishermans Bend Framework 2018

Education

Eat Healthy

15 Min

15 Min

Work

15 Min

Repair & Reuse

15 Min

15 Min

15 Min

15 Min

15 Min

Home

Entertainment

15 Min

Groceries

15 Min

15 Min

15 Min

15 Min

15 Min

15 Min

Health Facility

Outdoor Activities

15 Min

15 Min

Community Engagement

PROJECT OVERVIEW

How Eco Spark can address
Melbourne's multi-faceted issues

Eco Spark

INPUT

Eco-mobility   Eco-energy & Eco-tourism   Social Eco-Innovation

A Sustainable
15-minute City

Individuals   Organizations   Natural Systems

OUTPUT

Your Melbourne

Eco Mobility

Connecting Melbourne CBD to the Fishermans Bend area through various means

Eco-mobility User Journey

"Ruby" chooses the most scenic option, she finds that she can ride an autonomous water shuttle and is recommended to book an autonomous electric shuttle within the next 15 minutes so that when she arrives at the port, the shuttle is ready. The entire journey takes her a satisfying 20 minutes, and she loves the experience

Ruby
International Tourist

- Age: 32
- Occupation: Employee
- Home Country: Indonesia
- Initial Location: Melbourne CBD
- Destination: EcoSpark

"Ruby" is an international tourist who has traveled to Melbourne several times as she loves the city very much. She decided to stay in CBD as she always did. Then she heard about the new Innovative hub near Melbourne CBD, in particular the state-of-the-art Eco-Spark. This time, she downloads the PTV apps and is amazed at how easy she can navigate the transport option.

Legend
Path of Autonomous Catamaran Ferry
Path of Autonomous Electric Vehicle

Eco Spark

Your Melbourne

Autonomous Catamaran Ferry

Leveraging Yarra River through the innovative autonomous water shuttle

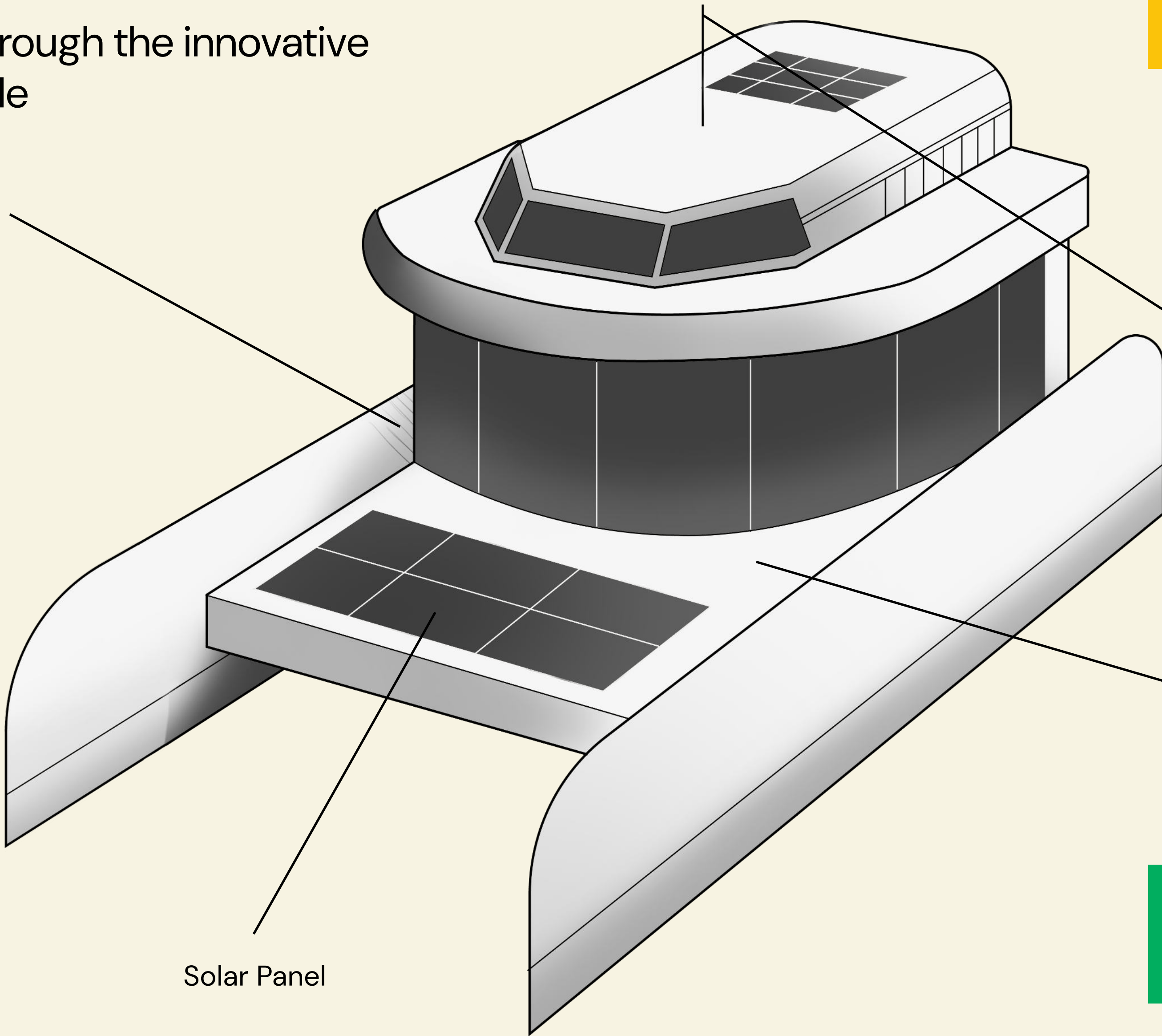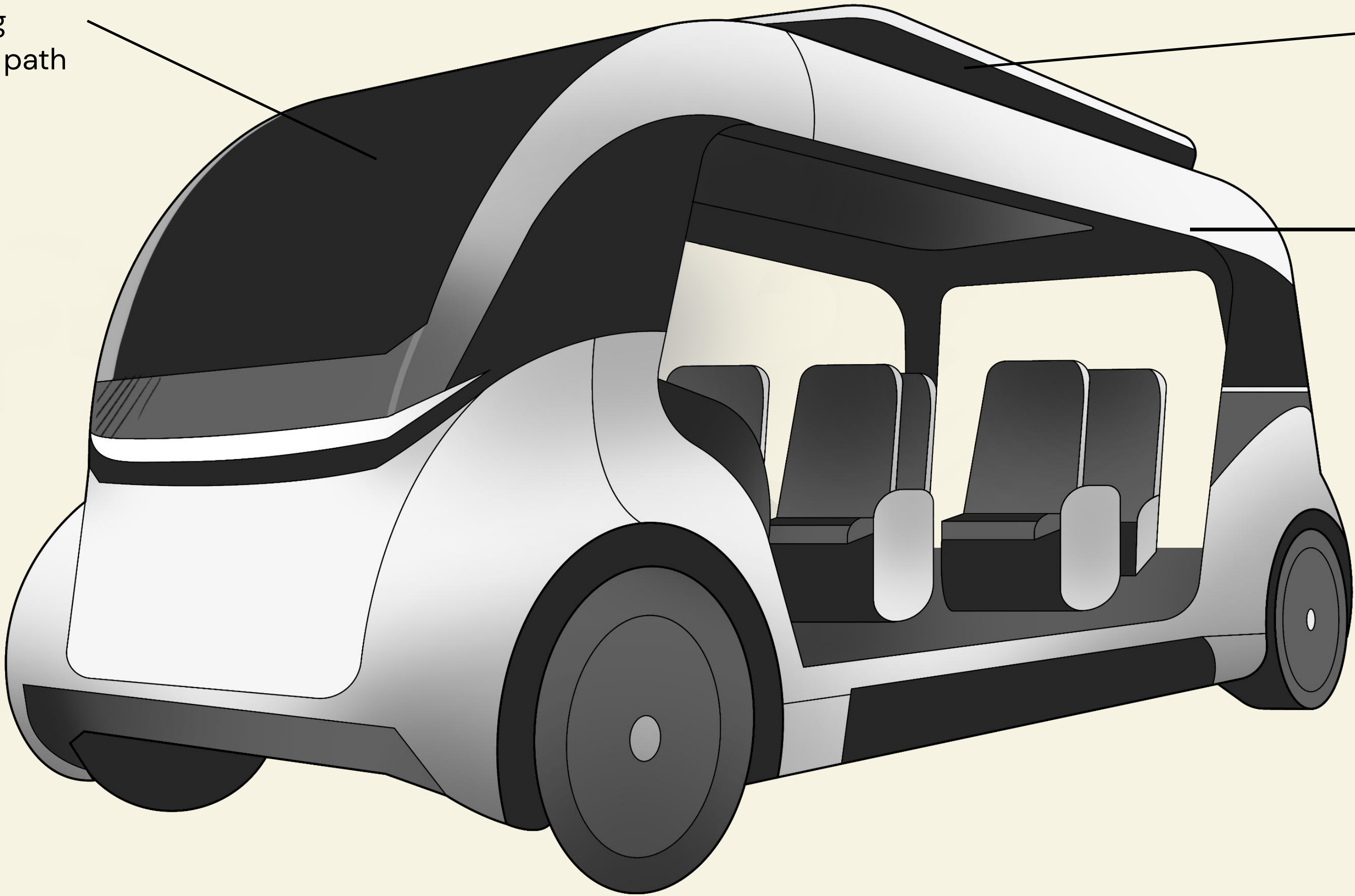Autopilot based on the setpoints given by the motion planning algorithm, enabling dynamic path planning

Specifications
Capacity: 25 passengers
Engine: 4 e-thruster
Energy input: solar panel
Electric range: 15 hours
Speed: 6–8 knots

Operations
Number of ferries: 2 units
Distance per trip: 4 km
Duration per trip: 15 min
Stops: 1 at each end point
Waiting time: up to 15 min
Hour: 08.00 - 20.00

Source: Zeabuz

Require two-way real-time communication with the remote operating centre, through 4G / 5G connectivity

Array of sensors on board to sense vessel's surroundings and detect obstacles. Typical sensors are radar, lidar, cameras, and AIS

Solar Panel

**Emission reduction:
175 ton CO2e / year / ferry**

7 AFFORDABLE AND CLEAN ENERGY

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

11 SUSTAINABLE CITIES AND COMMUNITIES

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

14 LIFE BELOW WATER

17 PARTNERSHIPS FOR THE GOALS

Eco Spark

Your Melbourne

Autonomous Electric Vehicle

Source: EasyMile EZ10

On-demand mobility through our innovative autonomous electric shuttle

Autopilot based on the setpoints given by the motion planning algorithm, enabling dynamic path planning

Require two-way real-time communication with the remote operating centre, through 4G / 5G connectivity

Geolocation technologies, comprising of LIDAR, cameras, GPS, IMU, and odometry

Specifications
Capacity: 9 passengers
Energy input: renewable energy from the WtE Plant
Electric range: 12 hours
Charging time: 8 hours (to fully charged)
Speed: 16 km/hour (autonomous)

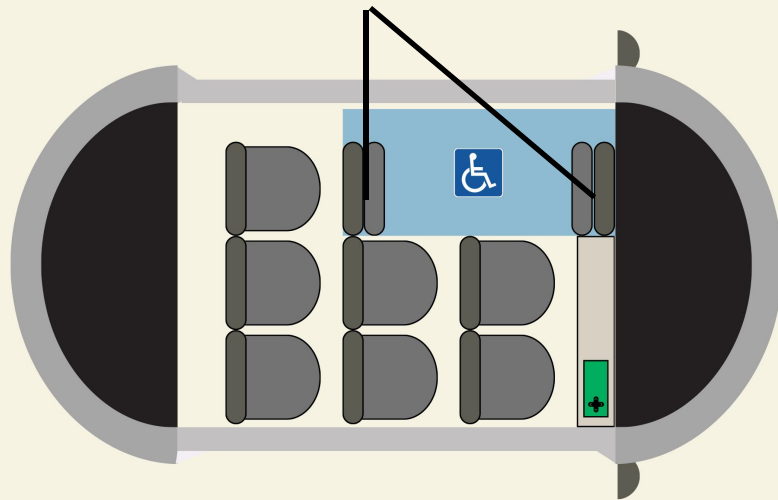Foldable chairs to make space for wheelchair users

Operations
Number of shuttle: 1 unit
Operation type: on-demand
Distance covered: up to 2 km within Port of Melbourne, Unimelb, and WtE Plant
Waiting time: up to 15 min
Hour: 09.00 - 18.00

Emission reduction: 90 ton CO2e / year

Eco Spark

Your Melbourne

7 AFFORDABLE AND CLEAN ENERGY

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

11 SUSTAINABLE CITIES AND COMMUNITIES

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

17 PARTNERSHIPS FOR THE GOALS

PTV Apps Update

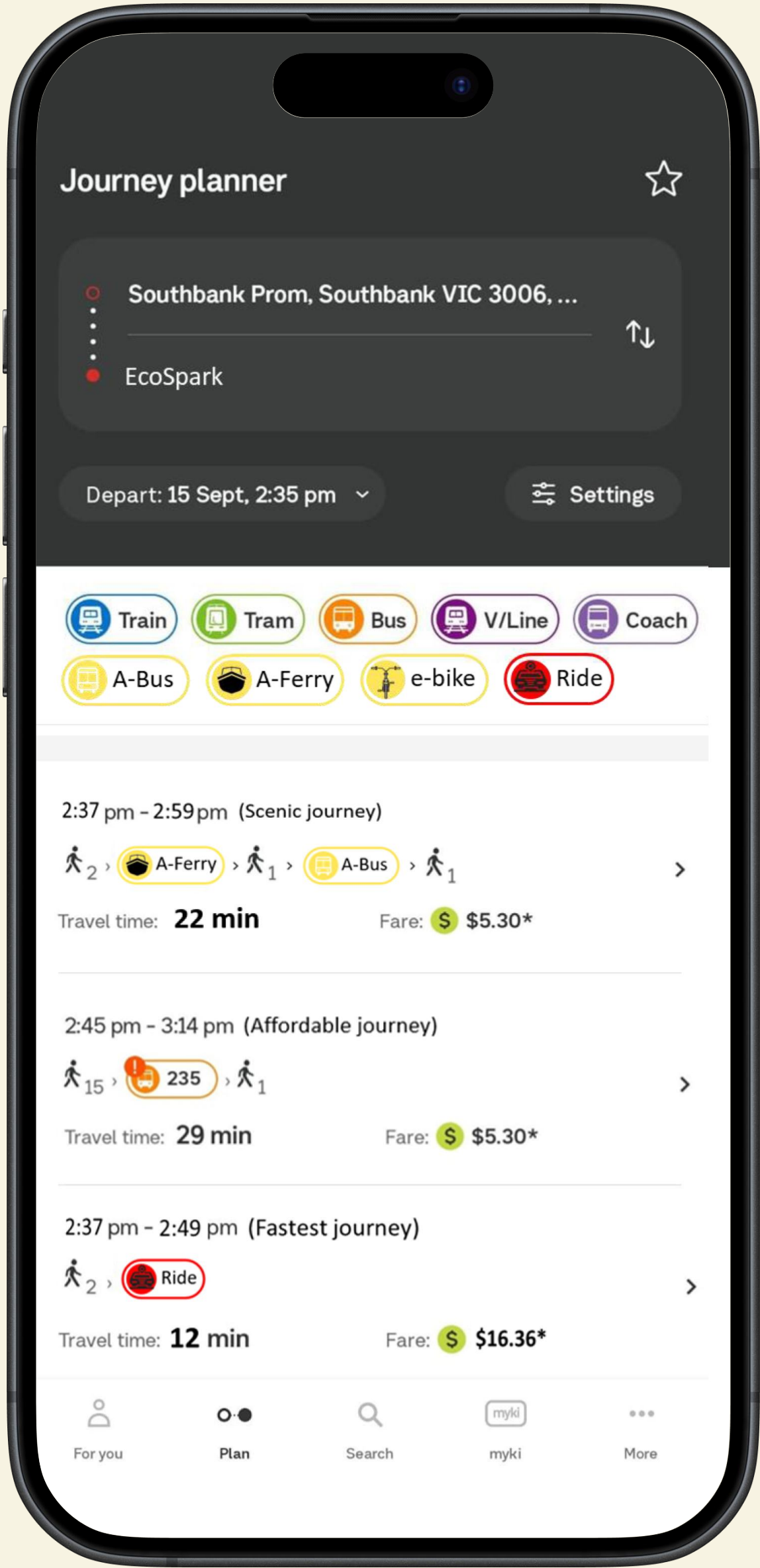## PTV apps to achieve level 3 MaaS – Integration of the service offer

In Transport Australia Society Discussion Paper (2019), Mobility-as-a-Service (MaaS) is categorized into 4 different levels:

1. Level 0 encompasses standalone apps with no integration (ex. Uber)
2. Level 1 includes journey planners integrating different transport modes (ex. Google Maps)
3. Level 2 is level 1 + allowing individuals to make separate payments in the multi-modal journey planner
4. **Level 3 is level 2 + allowing personalized bundles in the form of subscription package**
5. Level 4 is level 3 + integrate a jurisdiction's societal goal

PTV to achieve level 3 MaaS and operates as people's mobility companion, by partnering with a MaaS developer to integrate various mode of transportations, such as public transports, shared e-bike, and other ride sharing apps.

Source: Skedgo,
Transport Australia Society Discussion Paper (2019)

Eco Spark

Journey planner

Southbank Prom, Southbank VIC 3006, ...

EcoSpark

Depart: 15 Sept, 2:35 pm   Settings

Train   Tram   Bus   V/Line   Coach
A-Bus   A-Ferry   e-bike   Ride

2:37 pm – 2:59 pm (Scenic journey)
2 > A-Ferry > 1 > A-Bus > 1
Travel time: **22 min**   Fare: $ $5.30*

2:45 pm – 3:14 pm (Affordable journey)
15 > 235 > 1
Travel time: **29 min**   Fare: $ $5.30*

2:37 pm – 2:49 pm (Fastest journey)
2 > Ride
Travel time: **12 min**   Fare: $ $16.36*

For you   Plan   Search   myki   More

Monitor mobility wallet and history of activity

Log in and uniquely identified by the App

Users able to browse mobility plans on offer, and opt-in to a plan for the next period

Ability to choose between PAYG or subscription plan

Your Melbourne

Eco Energy & Tourism

A Clean & Multi-functional Waste to Energy Plant
and a Tourist Spot

Waste to Energy Plant

Generating Green Energy through a Waste to Energy (WtE) Plant

Junktopia: Mini Waste Museum

Waste Recovery
Building

Specifications
Total area: 20,000 m2
Waste feedstock capacity:
350,000 ton / year
Energy input: Residual Municipal &
Commercial Waste (non-recyclable)
Energy output:
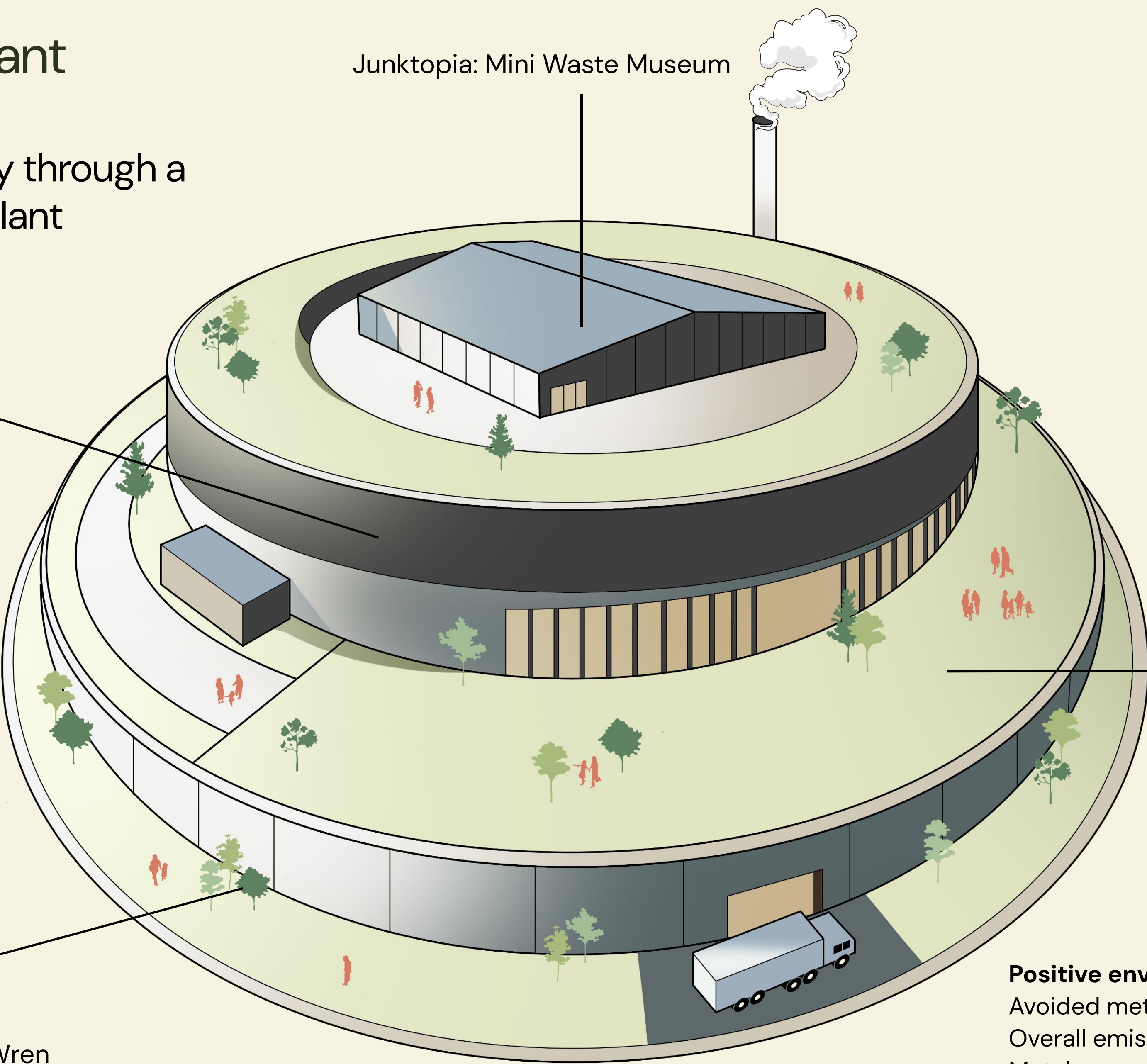District Heating & Electricity
District heating capacity: 100 MW
Electricity capacity: 35 MW(Gross)

Waste Collection Operations
Waste transport:
Utilizing Waste Truck
Operating area: Melbourne
CBD & surrounding suburbs

Walking Track &
Park for Public

Source: IEA Bioenergy,
Cleanaway Operations Pty Ltd

Wildlife Habitat for Superb Fairy-Wren

Positive environmental impact
Avoided methane emission by 85,000 tCO2e/year
Overall emission reduction by 200,000 tCO2/year*
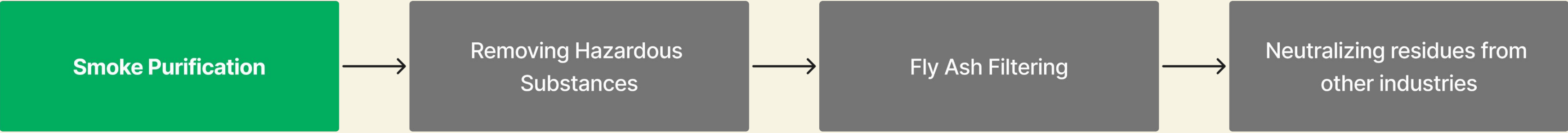Metal recovered from slag by 350 ton/year

Eco Spark

Your Melbourne

3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
15 LIFE ON LAND
17 PARTNERSHIPS FOR THE GOALS

Understanding why Eco Spark is the perfect solution for the community

- We prioritize the comfort of the community by implementing advanced odour control technology

| **Odour Control** | → | Loading Hall | → | Kept at a pressure lower than ambient air pressure. |
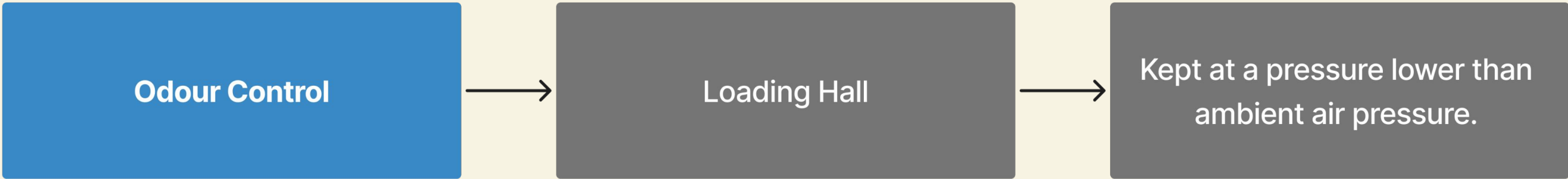
- We commit to maintaining the air quality for the community by utilizing effective smoke purification technology

| **Smoke Purification** | → | Removing Hazardous Substances | → | Fly Ash Filtering | → | Neutralizing residues from other industries |

- We address residual concerns for the community by offering advanced slag and water treatment technology

| **Slag Treatment** | → | Storing | → | Sorting | → | Maturing | → | Filling in Building & Construction |

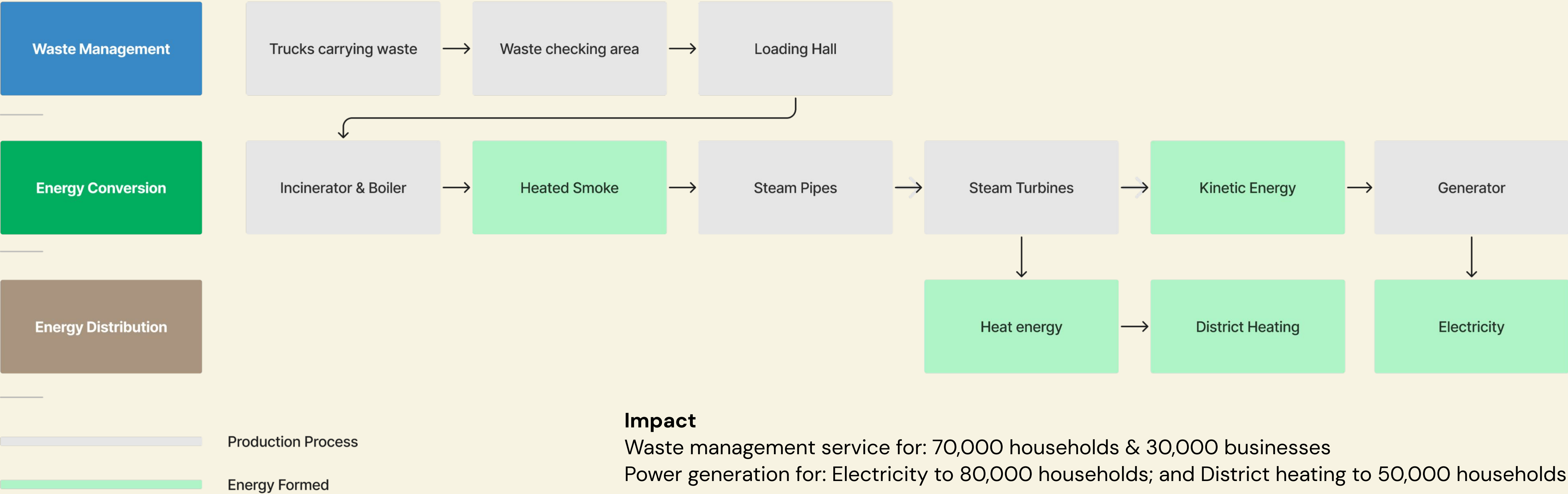| **Water Treatment** | → | Neutralizing Wastewater | → | Water Filtrating |

Source: ARC

Eco Spark

Your Melbourne
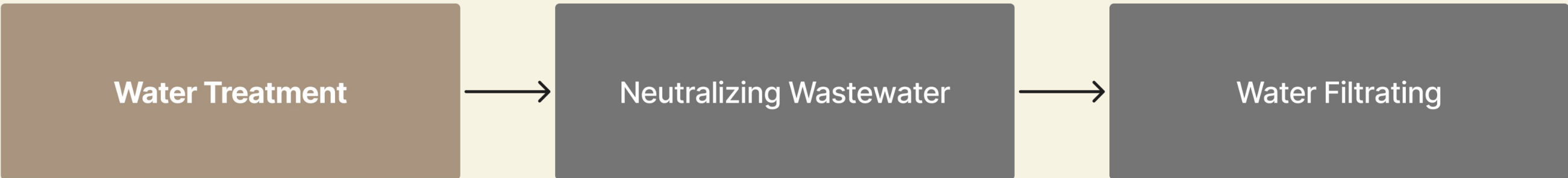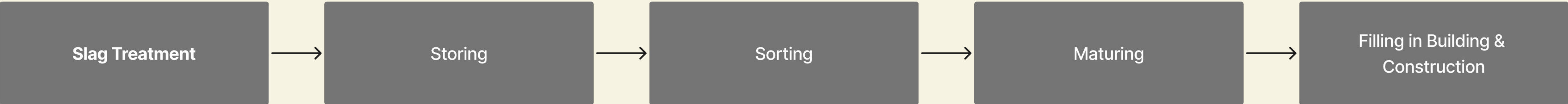
Understanding Why Eco Spark is the Perfect Solution for Waste Management and Energy Generation

## Simplified diagram of energy recovery process

Source: ARC

Waste Management

Trucks carrying waste → Waste checking area → Loading Hall

Energy Conversion

Incinerator & Boiler → Heated Smoke → Steam Pipes → Steam Turbines → Kinetic Energy → Generator

Energy Distribution

Heat energy → District Heating

Electricity

Production Process

Energy Formed

Impact
Waste management service for: 70,000 households & 30,000 businesses
Power generation for: Electricity to 80,000 households; and District heating to 50,000 households

Eco Spark

Your Melbourne

Park & Wetland

Understanding why Eco Spark is the perfect solution for wildlife conservation

In 2019, a stakeholder workshop to identify biodiversity objectives was held at Fishermans Bend, resulted in the identification of seven target species, including the **Superb Fairy-Wren.** According to Parsons et al. (2008), The planting of native shrubs and trees in suburban habitats surrounding existing Superb Fairy-wren territories (ie. Westgate Park) could increase connectivity between territories and potentially allow the spread of Superb Fairy-wrens in urban areas through the establishment of new territories

Shrubs:
Kalbarri Carpet,
Bottle Brush shrubs,
Winter Delight Grevillea,
Pink Cascade/Burgundy

Seating Area

Junktopia
Building

Trees:
Coral Gum,
Silky Oak

Ground layer plants:
Flax-lillies, Mat-rushes,
Creeping Boobialla
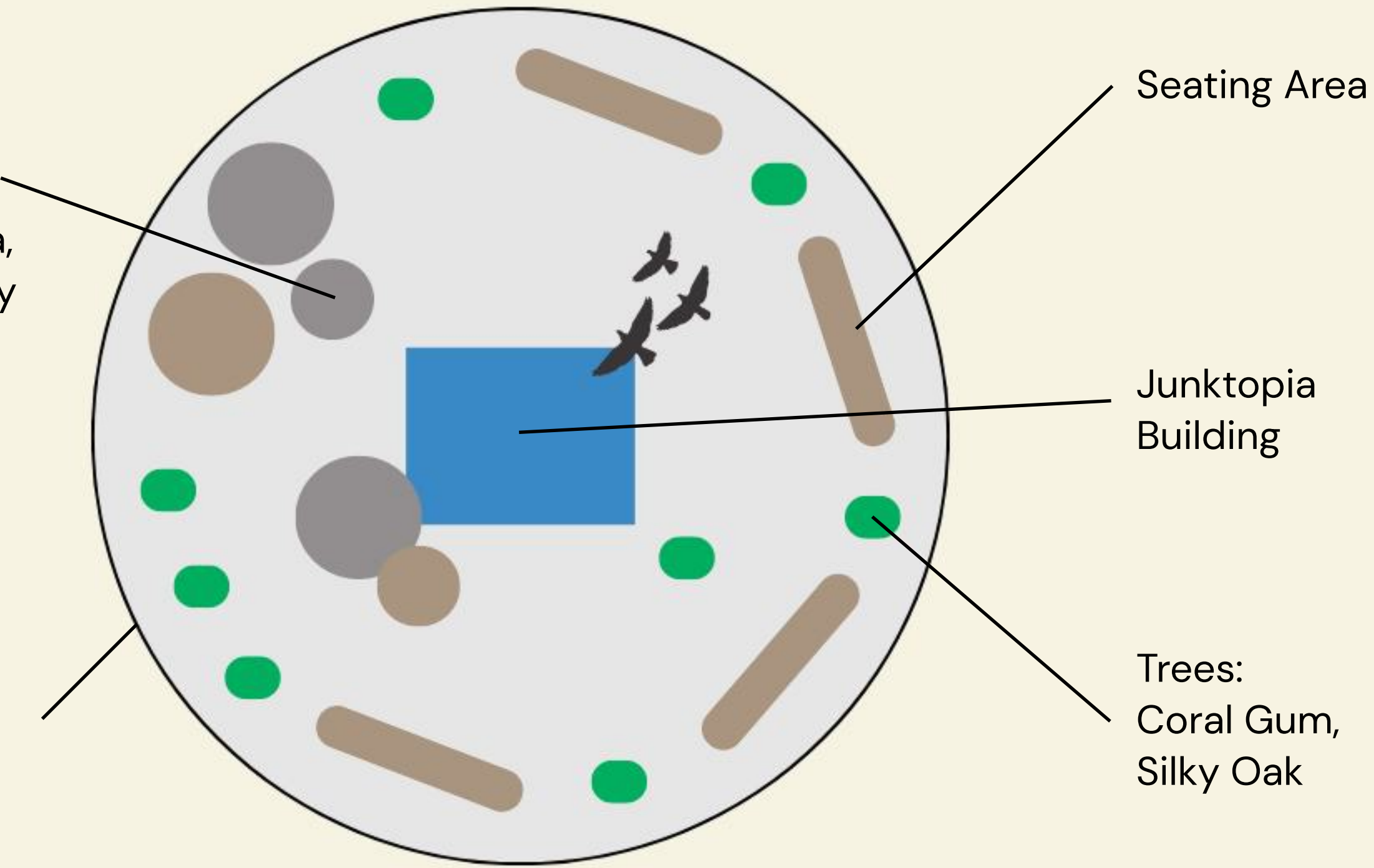
Source: Australian Museum, Boobook Explore, Fishermans Bend Biodiversity Report

03

Social Eco Innovation

Encouraging sustainability through community engagement
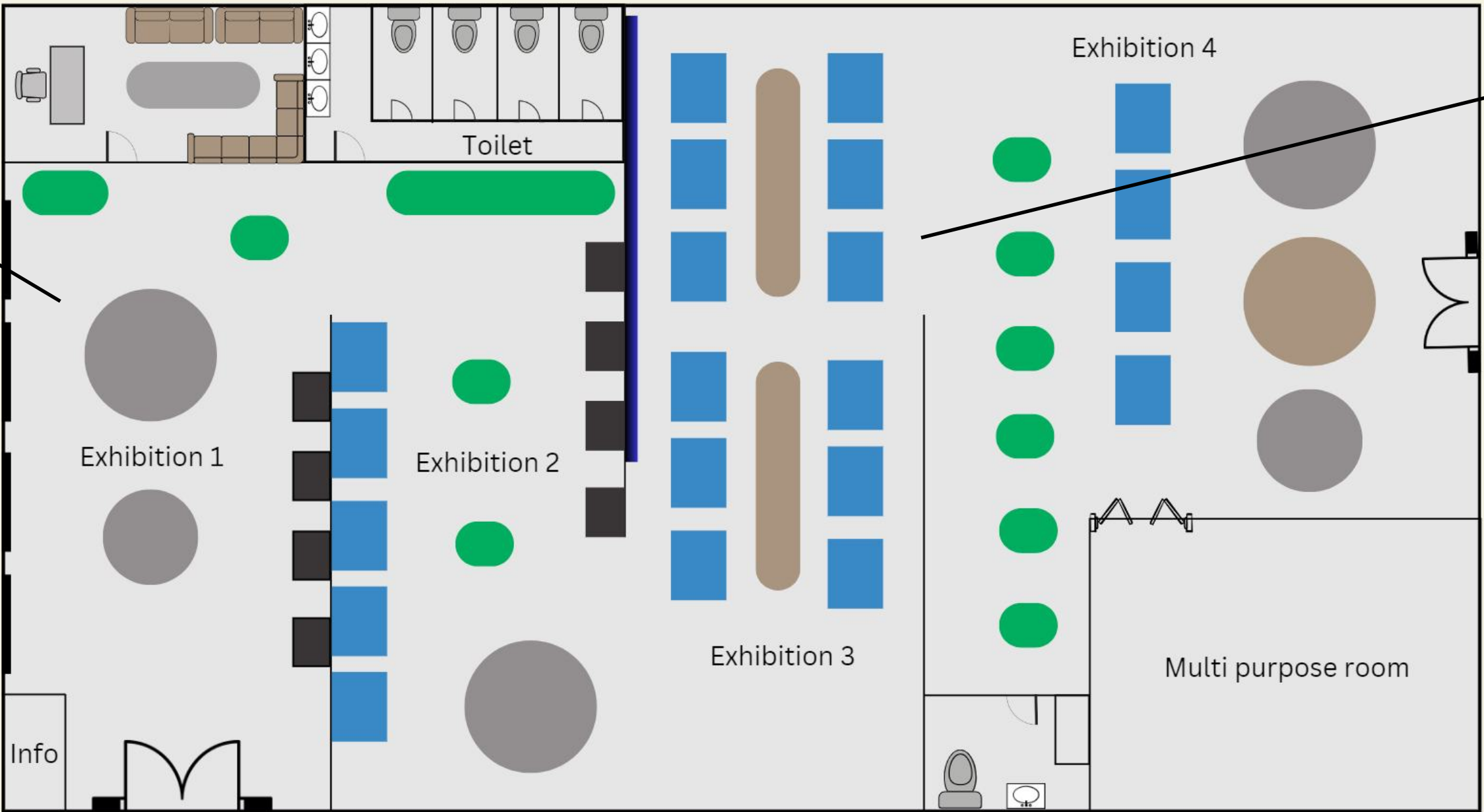
Junktopia: Mini Museum & Exhibition

Showcasing Creative Arts Featuring Recycled Materials

2 ZERO HUNGER

3 GOOD HEALTH AND WELL-BEING

4 QUALITY EDUCATION

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Themes will change every 6 months

Education Space

Tourist Attraction

Weekend Destination

Specification
Energy input: renewable energy from the WtE Plant
Location: on the top of the WtE Plant

Funding Source

Government

Auction

Sponsorship & donation

Operations
Hour: 10.00 – 17.00
Events: Recycled materials to art competition, Annual auctions, a collaboration events with schools & universities

Toilet

Exhibition 1

Exhibition 2

Exhibition 3

Exhibition 4

Multi purpose room

Info

Emission reduction: 18 ton CO2e / year

Eco Spark

Your Melbourne

Junktopia's Recycled Art Competition

Promoting Creativity and Environmental Awareness through a Social Innovation Project
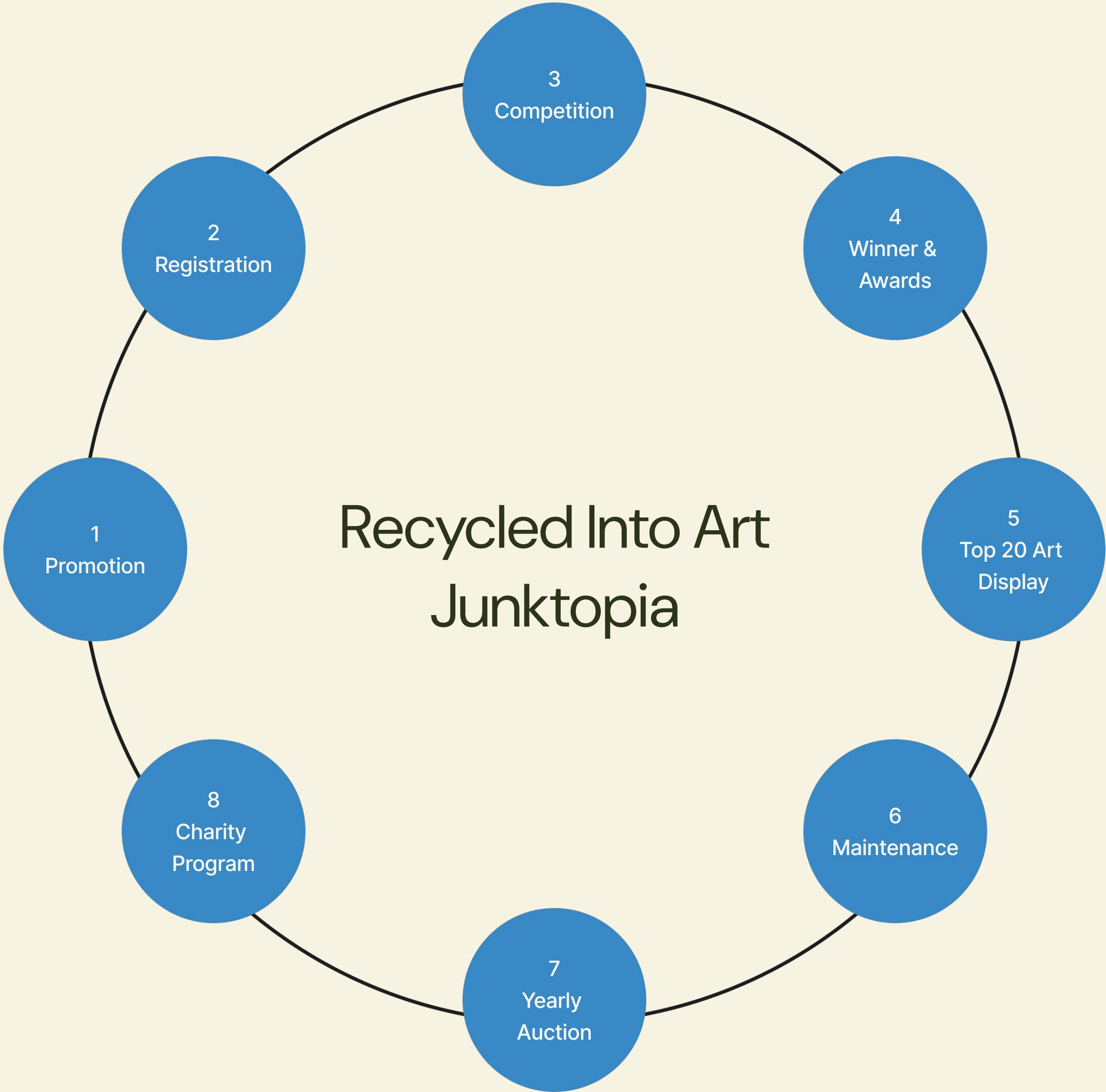
Recycled-into-art competition is an event held by Junktopia that encourage participants to transform discarded materials into artistic creations. Most of the engagement will come from **local communities and schools**, although the competition is open to everyone. Additionally, **recycling workshops** will also be held in collaboration with local schools.

A yearly auction will be conducted and the profit will fund:
1. **The charity program** that provide **food relief** for vulnerable members of the community.
2. **Future Competition**
3. **Maintenance**

Benefits

Environmental Impact

Platform for Expressions

Raising Awareness

Eco Spark

Recycled Into Art Junktopia

- 3 Competition
- 4 Winner & Awards
- 5 Top 20 Art Display
- 6 Maintenance
- 7 Yearly Auction
- 8 Charity Program
- 1 Promotion
- 2 Registration

Your Melbourne

Dance with Us

Creative Expression for a Greener Future

Dance with us is a unique public space, featuring kinetic tiles, designed to encourage movement while promoting sustainability. The venue is open to everyone, allowing individuals to dance and exercise without any cost. This helps foster a sense of community and provides an opportunity for people with all backgrounds to engage in physical activity.

How Kinetic Tiles Works

People move across the floor → Kinetic Energy → Electricity → Lighting up "Dance with Us" venue
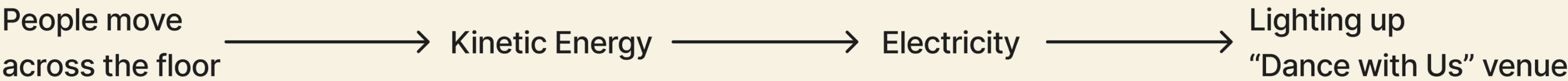
Booking System

To manage the flow of visitors and to ensure a smooth experience, participants need to book their time slots through Eco Spark website.

This system helps organize the use of space and prevents overcrowding.

Generated Electricity

⚡ Up to 35 Watts/Steps

📱 Dancing for 2 hours = Fully Charged phone (3000 mAh)

THANK YOU!

OUR TEAM

Aileen Natasha

Anastasia Jesica

Dennis Jonathan

Scan Me for Video

References

ARC (2024). From waste to energy - ARC. [online] ARC. Available at: https://a-r-c.dk/amager-bakke/from-waste-to-energy/
#:~:text=Flue%20gas%20purification&text=Amager%20Bakke%20is%20also%20the [Accessed 24 Sep. 2024].

Australian Bureau of Statistics (2021). 2021 Melbourne City, Census All persons QuickStats | Australian Bureau of Statistics. [online] www.abs.gov.au. Available at: https://
www.abs.gov.au/census/find-census-data/quickstats/2021/20604.

Bend, F. (2019). Fishermans Bend Framework. [online] Fishermans Bend. Available at: https://www.fishermansbend.vic.gov.au/framework [Accessed 1 Sep. 2020].

Brodene AA (2023). Brodrene Aa - energy efficient fast ferries in carbon fibre. [online] Brodrene Aa - energy efficient fast ferries in carbon fibre. Available at: https://www.braa.no/
fast-ferries/estelle [Accessed 24 Sep. 2024].

City of Melbourne (n.d.). E-bike hire | City of Melbourne. [online] www.melbourne.vic.gov.au. Available at: https://www.melbourne.vic.gov.au/e-bike-hire.

Cleanaway Operations Pty Ltd (2023). Melbourne Energy and Resource Centre - Development Licence Application. pp.6–9; 103-106.

Dublin Democratic Planning Alliance (2021). DDPA - Sustainable Density. [online] sites.google.com. Available at: https://sites.google.com/ddpa.ie/ddpa/want-to-know-more/
sustainable-density.

EasyMile (n.d.). how does autonomous technology work? | EasyMile. [online] easymile.com. Available at: https://easymile.com/technology/how-it-works.

Economy.id (informed decisions) (2024). Economic indicators | Melbourne | economy.id. [online] economy.id.com.au. Available at: https://economy.id.com.au/melbourne/indicator.

Engineers Australia (2019). Mobility as a Service (MaaS) - Transport Australia Society Discussion Paper.

Fishermans Bend Heritage Study. (2013). Available at: https://www.portphillip.vic.gov.au/media/gbpcyiw1/fishermans-bend-heritage-study-apr-2013.pdf.

Fishermans Bend Population & Demographics. (2016). Available at: https://www.fishermansbend.vic.gov.au/__data/assets/pdf_file/0021/31674/Fishermans-Bend-Population-and-
Demographic-Report_April-2017.pdf.

Giblin, E. (2016). Docklands' latest tower will soar 43 levels. [online] Realestate.com.au. Available at: https://www.realestate.com.au/news/voyager-docklands-latest-tower-43-
levels/ [Accessed 26 Sep. 2024].

Google Earth Maps (2024). Available from: https://earth.google.com/

Government of Victoria (2022). Waste to energy | Victorian Government. [online] Vic.gov.au. Available at: https://www.vic.gov.au/waste-energy.

Kirk, H., Garrard, G., Croeser, T., Hurley, J., Backstrom, A., Thomas, F., Berthon, K. and Bekessy, S. (2019). Fishermans Bend Urban Ecology Strategy: Biodiversity Report. [online]
Available at: https://www.fishermansbend.vic.gov.au/__data/assets/pdf_file/0038/185996/FB_BiodiversityReport_ICONScience_FINAL.pdf.

Land Transport Guru. (2019). EasyMile EZ10. [online] Available at: https://landtransportguru.net/easymile-ez10/ [Accessed 24 Sep. 2024].

LIFE ON THE BEND A social history of Fishermans Bend, Melbourne. (n.d.). Available at: https://www.fishermansbend.vic.gov.au/__data/assets/pdf_file/0020/31583/FB-FINAL-
Social-History-web.pdf.

References

Lime (n.d.). Lime Electric Bike – Bike Rentals Near Me. [online] Lime Micromobility. Available at: https://www.li.me/vehicles/electric-bike.

Luscher, D. (2020). Introducing the 15-Minute City Project. [online] 15-Minute City. Available at: https://www.15minutecity.com/blog/hello.

Mar, E. (2021). Waste-to-Energy and Social Acceptance: Copenhill Waste-to-energy plant in Copenhagen. IEA Bioenergy.

Metropolitan Waste and Resource Recovery Group (2017). Fishermans Bend Waste and Resource Recovery Strategy.

Museums Victoria. (2019). Cutting emissions and energy bills at Museums Victoria. [online] Available at: https://museumsvictoria.com.au/media-releases/cutting-emissions-and-energy-bills-at-museums-victoria/.

News, A.M. (2024). Superb Fairy-wren. [online] The Australian Museum. Available at: https://australian.museum/learn/animals/birds/superb-fairy-wren/#:~:text=The%20Superb%20Fairy%2Dwren%20is%20found%20in%20south%2Deastern%20Australia [Accessed 21 Sep. 2024].

On, M. (2020). Heating Accounts for 70% of Museum's Energy Savings. [online] www.ashrae.org. Available at: https://www.ashrae.org/technical-resources/ashrae-journal/featured-articles/heating-accounts-for-70-of-museum-s-energy-savings.

Participate Melbourne. (2015). Fishermans Bend Urban Forest. [online] Available at: https://participate.melbourne.vic.gov.au/urban-forest-precinct-plans/fishermansbend [Accessed 19 Sep. 2024].

Participate Melbourne. (2021). (Re)discover our neighbourhood | Participate 3000. [online] Available at: https://participate.melbourne.vic.gov.au/participate-3000/rediscover-our-neighbourhood.

Participate Melbourne. (2024). Neighbourhood overview | CBD Neighbourhood Portal. [online] Available at: https://participate.melbourne.vic.gov.au/neighbourhoods/cbd/overview.

Patel, N. (2023). How much power is generated? [online] Energy Floors. Available at: https://energy-floors.com/how-much-power-can-we-generate/#:~:text=How%20much%20power%20do%20Kinetic.

Proud, J. (2018). Grow Natives to Encourage Australian Birdlife. [online] Boobook Explore. Available at: https://www.boobookexplore.com.au/grow-natives-to-encourage-australian-birdlife/ [Accessed 24 Sep. 2024].

SkedGo. (2024). MaaS for Cities & Councils. [online] Available at: https://skedgo.com/maas-for-cities-councils/ [Accessed 24 Sep. 2024].

Tourism Research Australia (2024a). IVS results for the year ending March 2024 compared to March 2023.

Tourism Research Australia (2024b). National Visitor Survey results data tables for the year ending March 2024 compared to March 2023.

United Nations (2015). The 17 Sustainable Development Goals. [online] United Nations. Available at: https://sdgs.un.org/goals.

Wendering, S. (2021). Bus, train, car or e-scooter: carbon emissions of transport modes ranked. [online] Navit.com. Available at: https://www.navit.com/resources/bus-train-car-or-e-scooter-carbon-emissions-of-transport-modes-ranked#:~:text=Nevertheless%2C%20they%20are%20still%20significantly [Accessed 24 Sep. 2024].

Zeabuz. (2024). Technology – Zeabuz. [online] Available at: https://www.zeabuz.com/technology/ [Accessed 24 Sep. 2024].

Providing micro-mobility solution through partnership with e-bike Operator
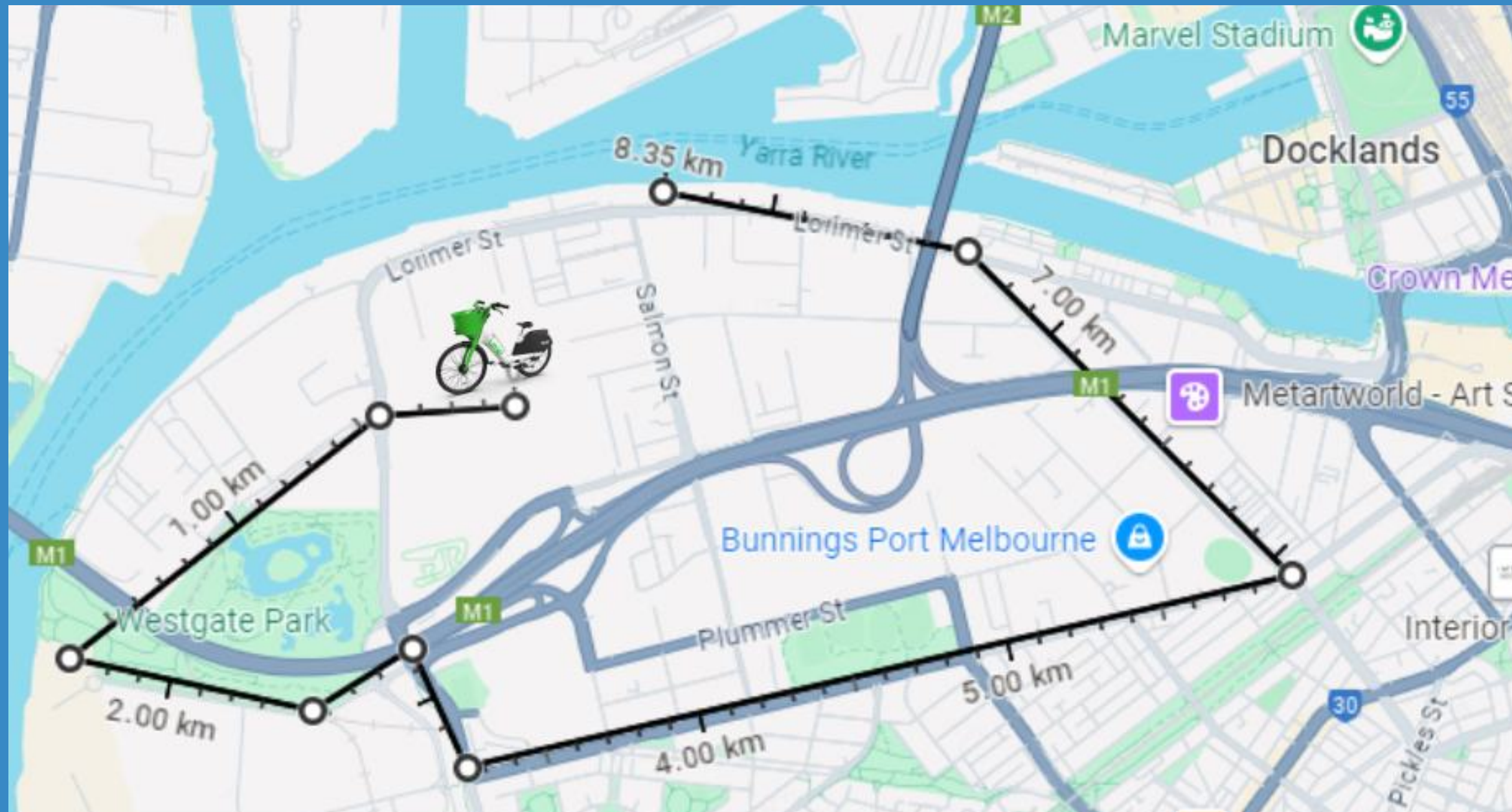
After the wholeshome experience at Eco Spark, Ruby feels like strolling around the city. Even though she can walk to any destinations, she feels tired after the whole day. So, she decides to book a nearby shared e-bike through the PTV apps and enjoy cycling around city

Eco Spark

We suggest the continuation of partnership with Lime, operators of e-bikes across Melbourne, with the bikes available to book through the Uber, Lime, or PTV app. The network serves as a micro-mobility solution. As a traveler arrives at certain point served by other public transport options, they can opt to use this solution to reach the final destination

Impact

The e-bike hire encourages cycling in the city and reduces transport emissions and congestion. Hence, the benefits expand more than just reducing emissions but also promoting healthy lifestyle.

Relevant SDG

Source: Lime, City of Melbourne

Your Melbourne

Appendix 2 – The numbers behind CBD Crowds

Facts – Population

Residents in CBD 2021: 43,825 people (9% of total crowds)

Facts & Assumption – Commuters

Jobs in CBD 2021: 217,913 jobs
Residents in CBD in labor force: 69%
CBD residents working in CBD: 80%
Employed CBD residents = 43,825 x 69% x 80% = 24,202 people

Employed residents in City of Melbourne 2021: 97,811 people
Commuters from City of Melbourne = 97,811 – 24,202 = 73,609 people
Commuters from Greater Melbourne = 217,913 – 24,202 – 73,609 = 120,102 people
Number of commuters = 73,609 + 120,102 = 193,711 people (42% of total crowds)

Facts & Assumption – Tourists

International overnight visitors to Melbourne YoY March 2024: 53,472,409 nights
Domestic overnight visitors to Melbourne YoY March 2024: 28,664,696 nights
Number of tourists = (53,462,409 + 28,664,696) / 365 = 225,033 people (49% of total crowds)

Total crowds = 43,825 + 193,711 + 225,033 = 462,569 people

Appendix 3 – The numbers behind emission reduction for Autonomous Vehicle

Assumption for autonomous water shuttle (self–generated energy through solar panel, in battery)

Distance per trip: 4 km
Speed: 15 km/hour (eqv. to 8 knot)
Number of trip per hour: 1 / (4 / 15) = 3.75 trip (round down to 3.5 trip)

Battery capacity: 188 kWh (for 15 hours of operation per day)
Our operation: 12 hours
Distance travelled in a day = 3.5 x 4 x 12 = 168 km/day
Emission per passenger = 123 gr CO_2e / passenger / km (diesel powered)
Emission per passenger = 0 gr CO_2e (solar powered)
Ferry capacity: 25 people

Total emission reduction = (123 – 0) x 25 x 168 x 365 = 188.5 tCO2/year (round up to 190 tCO2/year)

Assumption for autonomous electric shuttle (electric powered, stored in battery)

Operation time = 8 hours
Speed = 16 km/hour
Distance travelled in a day = 8 x 16 = 128 km/day
Emission per passenger = 0.93 kg CO_2e / passenger / km (diesel powered)
Emission per passenger = 0.72 kg CO_2e (electric powered)
Bus capacity: 9 people

Total emission reduction = (0.93 – 0.72) x 9 x 128 x 365 = 88.3 tCO2/year (round up to 90 tCO2/year)

Source: Navit

Appendix 4 – The numbers behind waste serviced and avoided methane emissions

Waste management in Fishermans' Bend

Waste Type	Year	Population	Total waste	Landfill	Recycling
MSW	**2030**	21,850	6,992	**4,370**	2,622
	2050	80,000	25,600	16,000	9,600
C&I waste	**2030**	33,000	59,400	**28,809**	30,591
	2050	80,000	144,000	69,840	74,160

Waste management in City of Melbourne (exclude Fishermans Bend)

Waste Type	Year	Population	Total waste	Landfill	Recycling
MSW	2030	219,541	70,253	43,908	26,345
C&I waste	2030	541,576	974,837	472,796	502,041

Note: population unit in 'people'; waste and capacity unit in 'ton'

Waste Type	year	Total waste	Capacity
MSW	2030	48,278	30,729
C&I waste	2030	501,605	319,271
Total		**549,883**	**350,000**

Assumption:
- MSW generation: 200kg/person/year of landfill and 120kg/person/year of recycling
- C&I waste generation: 873kg/EFTE/year of landfill and 927kg/EFTE/year of recycling
- 1 households: 2.11 people
- 1 business: 10.69 people

	Waste type	Capacity		Waste Management Serviced			
Capacity	MSW	30,729	ton	153,645	people	**72,879**	households
	C&I	319,271	ton	329,145	FTE	**30,783**	businesses
	Total	**350,000**	ton	**482,790**	people		

Source: City of Melbourne, Fishermans Bend, Cleanaway Operations Pty Ltd - MERC Project, IEA Bioenergy

Avoided methane emission from landfill gas (LFG)

GHG LFG = mass from MSW x Emission Factor MSW + mass from C&I Waste x Emission Factor C&I Waste

= 30,729 x 1600kgCO2e/t2 + 319,271 x 1300kgCO2e/t2 = **464,219 tCO2e/year**

Avoided emission = (1 – capture rate) x GHG LFG – (1 – capture rate) x GHG LFG x Methane oxidation rate – Emission from waste combustion = (1–0.75) x 464,219 – (1–0.75) x 464,219 x 0.2 – 5,551 = **87,293 tCO2e/year (round down to 85,000 tCO2e/year)**

Assumptions:
Methane Capture rate: 75%
Mehane oxidation rate: 20%

Appendix 5 – The numbers behind energy generation and emission reduction

Assumption

Area: 20,000 m2
Waste burned: 350,000 ton/year
Gross electricity capacity: 35 MW
Internal facility usage: 11.2%
CHP technology. Heat capacity: 100 MW
Capacity factor: 90%
Avg electricity per household: 3050 kWh/year
Avg heat per household: 15144 kWh/year
Waste to electricity rate: 0.70 MWh/ton
Waste to heat rate: 2.70 MWh/ton

Calculation for energy generation:

Calculation for energy generation:
Electricity generated = 35 x 90% x 8760 hour/year
= 275,940 MWh
Heat generated = 100 x 90% x 8760 hour/year =
788,400 MWh
Total energy generated = 275,940 + 788,400 =
1,064,340 MWh

Calculation for required waste:

Calculation for required waste:
Waste burned: 350,000 ton/year
Electricity generated = 0.70 x 350,000 = 245,000 MWh (>275,940 MWh)
Heat generated = 2.70 x 350,000 = 945,000 MWh (>788,400 MWh)

Calculation for Household Serviced:

Electricity = 275,940 x 1000 x (1–11.2%) / 3050
= 80,328 homes (round down to **80,000** homes)
Heat = 788,400 x 1000 x (1–11.2%) / 15144
= 52,059 homes (round down to **50,000** homes)

Assumption

Residuals:
slag / bottom ash: 20% of the waste burned
metal = 0.005 ton / ton of slag
MERC project: 46MW, CO2 reduction: 230,000 tCO2e/year, therefore eqv to 5,000 tCO2e/MW

Calculation for residual and emission reduction:
Metal
Metal recovered = 350,000 x 20% x 0.005 = **350 ton / year**

CO2 Emissions:
Our project = 35 x 5,000 = **175,000 tCO2e/year**

Appendix 6 – The numbers behind emission reduction for Junktopia

Facts

Audain Art Museum is located on Blackcomb Way, Canada
contains permanent and temporary exhibit galleries, workshops, a
public lobby, a gift shop, education space, offices and a suite for a
live-in building manager
Area: 4750 m2
Heating: 368,833 kWh / year
Electricity: 1,361,742 kWh / year
Total energy: 1,730,575 kWh / year, therefore eqv. to 364 kWh / m2

Assumptions

Junktopia area: 300 m2
Total energy required = 364 x 300 = 109,299 kWh / year
Total Eco Spark energy generation: 1,064,340 MWh / year
Emission reduction: 175,000 tCO2e / year, therefore eqv. to 0.164 kgCO2e/kWh
Emission reduction for Junktopia = 0.164 x 109,299 = **18 tCO2e / year**

Source: Ashrae