Monash University Clayton Campus and Monash Technology Precinct 360 City Scan Report

CLIENT:

January 2021

RESTRICTED

TRACTEBEL ENGINEERING S.A.
boulevard Simon Bolivar 34-36
1000 - Bruxelles - Belgium
engineering@tractebel.engie.com
tractebel-engie.com

TECHNICAL DOCUMENT

Our ref.: **TE_APAC/4NT/0746132/000/00**
TS:
Imputation: P.016780/0001

INTERNAL

Client:
Project: TE APAC MONASH UNIVERSITY MELBOURNE
Subject: **Monash University Clayton Campus and Monash Technology Precinct 360 City Scan Report**
Comments:

REV.	YY/MM/DD	STAT.	WRITTEN	VERIFIED	APPROVED	VALIDATED
00	2021 02 04	FIN	*P. Palacio	*J. Zarzycka		*E. Drouet

* This document is fully electronically signed on 2021 02 05.

PROJECT CONTACT PERSON

Jolanta ZARZYCKA
jolanta.zarzycka@tractebel.engie.com

AUTHORS & CONTRIBUTORS

TRACTEBEL

Jolanta ZARZYCKA

Maria Theresa QUIMPO

Pauline Belinda PALACIO

Tatjana Medvedev

Lina AHRIKAT

ENGIE Impact

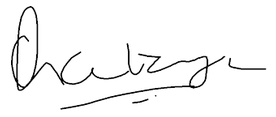
'Circularity' chapter and contribution to 'Conclusions'

Niels LEEMPUT

Chaitanya VANGALA

ON AUTHORS BEHALF, SIGNED BY:

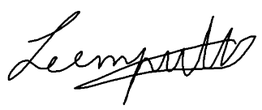
Maria Theresa QUIMPO
TRACTEBEL



Chaitanya VANGALA
ENGIE Impact

VERIFIED BY:

Jolanta ZARZYCKA
TRACTEBEL



Niels LEEMPUT
ENGIE Impact

APPROVED BY

Etienne DROUET
TRACTEBEL

Anna QUILLINAN
ENGIE

CONTENT

1. EXECUTIVE SUMMARY

The 360 City Scan project is part of Monash University Net Zero Initiative. It is well recognized that the Net Zero Initiative, aiming at 100% renewable energy future and net zero carbon emissions for all four Australian campuses by 2030, will contribute to the environmental sustainability of Monash University campuses. Monash University Clayton campus is an exemplar of environmental practice and the University is recognised a leader in the transition to Net Zero emissions. The University is looking to broaden this work by accelerating the transition to Net Zero in the broader Monash Technology precinct which surrounds the Clayton campus. The 360 City Scan refers to Monash Technology Precinct and includes the Monash University grounds, located in the core of the Precinct.

The Net Zero Initiative is aligned with ENGIE's focus on Zero Carbon transition. Therefore, ENGIE has been invited to support Monash University in achieving its ambitious goal. TRACTEBEL, being a part of ENGIE group, were requested to perform a 360 City Scan of the Monash University Clayton Campus and Monash Technology Precinct, to assess the actual characteristics of its development. The assessment reveals development needs throughout different city perspectives, giving basis to look for possibilities of embracing these needs within the Net Zero Initiative. This way the Initiative can be implemented in integrated and efficient way bringing benefits not only to environment, but also to the multiple stakeholders. This integrated approach has potential to become exemplary in implementing the energy transition projects on city scale.

THE TOOL & OUTCOME:

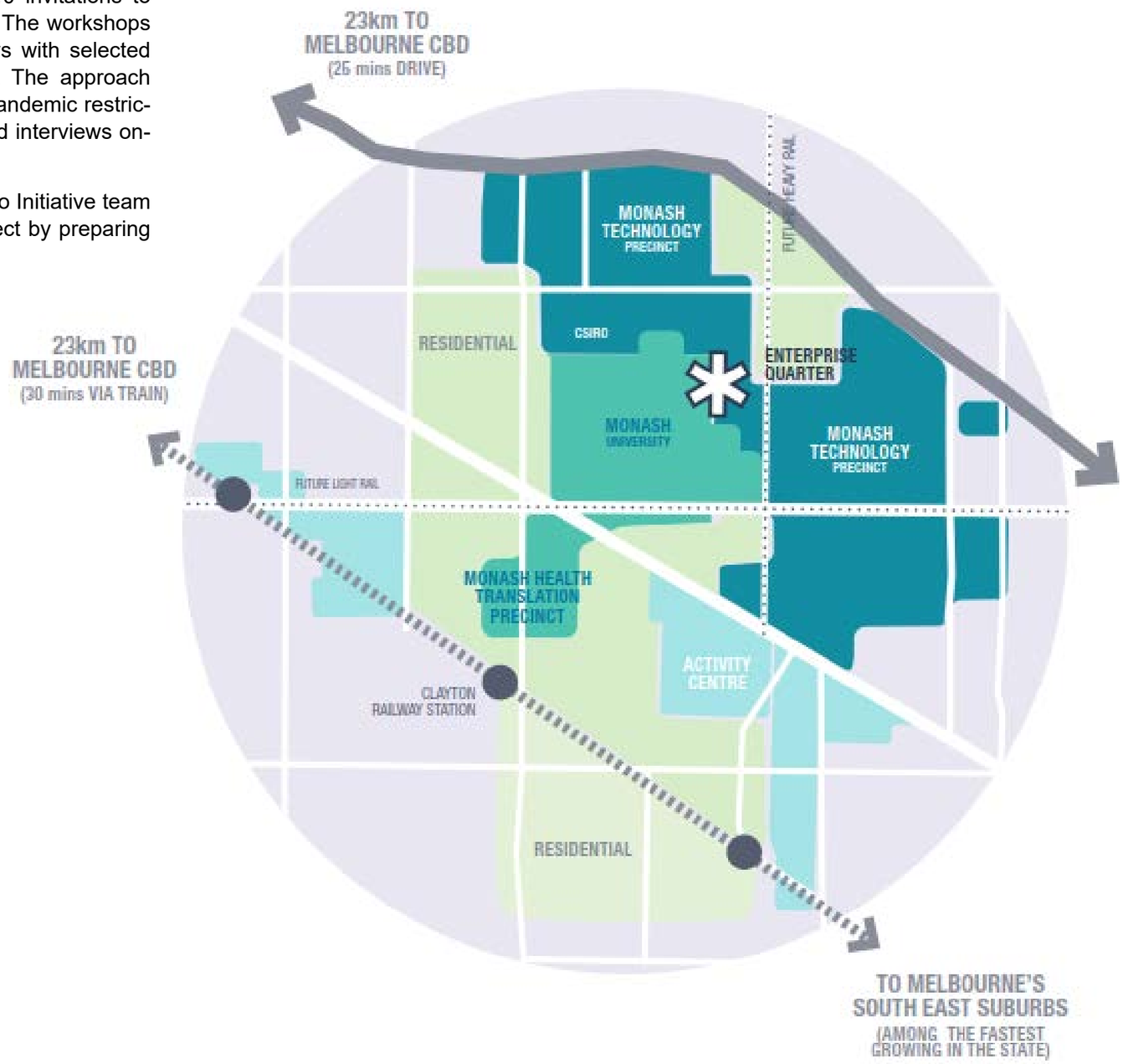
The 360 City Scan is an inhouse tool of ENGIE, developed by TRACTEBEL to support an assessment of the maturity of cities in a holistic way. It is applicable to small- or large-scale urban areas. A unique sustainable city footprint of the Precinct, presented in a form of a 'radar' with six perspectives and sub-themes, facilitated the discussion on development needs and priorities.

Methodology includes engagement with different stakeholders and encourages the local community in shaping their environment. Desktop research was followed by the stakeholders' engagement, forming the main part of the study, with a distribution of 240 invitations to workshops and 115 attendees. The workshops were followed by 1:1 interviews with selected Monash University executives. The approach was adapted to the Covid-19 pandemic restrictions, moving all workshops and interviews online.

The Monash University Net Zero Initiative team actively contributed to the project by preparing the input information, organizing the workshops, and reviewing the findings. Assessment of the energy related theme within the 360 City Scan has been supported by ENGIE Impact colleagues.

The results of the 360 City Scan presented in the report are mainly based on qualitative information gathered through: questionnaire filled by the Monash University team, discussions with the stakeholders, validation of the findings by the Monash University representatives during the revision process including the 1:1 executive interviews. Quantitative data has been provided according to its availability through web search.

Project area - The Monash Technology Precinct and wider Monash National Employment and Innovation Cluster



2. INTRODUCTION

MONASH NET ZERO INITIATIVE

Monash University has over 150 buildings spread across four domestic campuses and is considered a significant consumer of energy. Monash University, together with its efforts to reduce carbon emissions and drive sustainable sustainable development, was the first Australian university to commit to an energy reduction target and is a proud leader in taking action on climate change. The strategy, developed with Climate Works Australia, encompasses five key pillars with the aim of achieving net zero emissions for Monash's built environment by 2030[1]:

1. energy efficiency measures,
2. campus electrification,
3. addressing residual emissions through offsetting,
4. deployment of on-site and off-site renewable energy, and
5. a sustainable Microgrid

MONASH UNIVERSITY AND TECHNOLOGY PRECINCT

The Monash Technology Precinct is the catalytic center of the Monash National Employment and Innovation Cluster[2]. It is a part of the largest employment hub in Victoria, outside Melbourne's central business district (CBD) and is a significant contributor to the Victorian economy. The broader Cluster contributes AUD $9.4 billion to the Victorian economy per year, supports 13,000 businesses and employs 82,000 people[3].

The Monash Technology Precinct is located on the south east Cranbourne train line and Pakenham train lines of greater Melbourne and is 23 km from Melbourne's CBD and is close to two train station (Clayton train station is 1.9 km and Huntingdale station is 2.2 km from the campus).

Clayton campus and the Monash Technology Precinct have distinct features (compared to a regular City center) in that is built on a higher proportion of students, knowledge and ideas and has a younger and more transient population.

There are no strict administrative borders that would apply to the Monash Technology Precinct. The Campus area is established by the grounds on which the university operates. Both the Campus and the Monash Technology Precinct are located within the City of Monash.

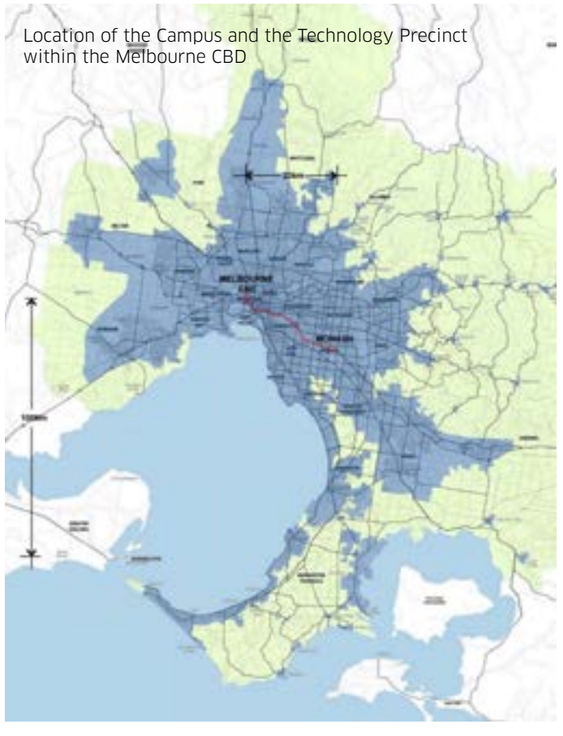
1 Monash Net Zero Brochure, https://www.monash.edu/__data/assets/pdf_file/0020/1140365/Monash-Net-Zero-Brochure.pdf#
2 https://www.monash.edu/industry/monash-technology-precinct/about-the-Precinct
3 https://www.monashprecinct.com.au/

TERMINOLOGY:

- Monash University Clayton Campus **('Campus')** – grounds belonging to the university or managed by the university, located within the Monash Technology Precinct
- Monash Technology Precinct **("Precinct)** - overall area of the studies, indicated in the Monash Planning Scheme as Special Use Zone, forming the core of the Monash Employment Cluster under Plan Melbourne.
- **Precinct excluding Campus** – part of the Monash Technology Precinct excluding the Monash University Clayton Campus
- **City of Monash** - area administrated by Monash City Council

The city Scan's findings, unless otherwise specified, reflect both the status of the Monash University Clayton Campus and the Monash Technology Precinct.

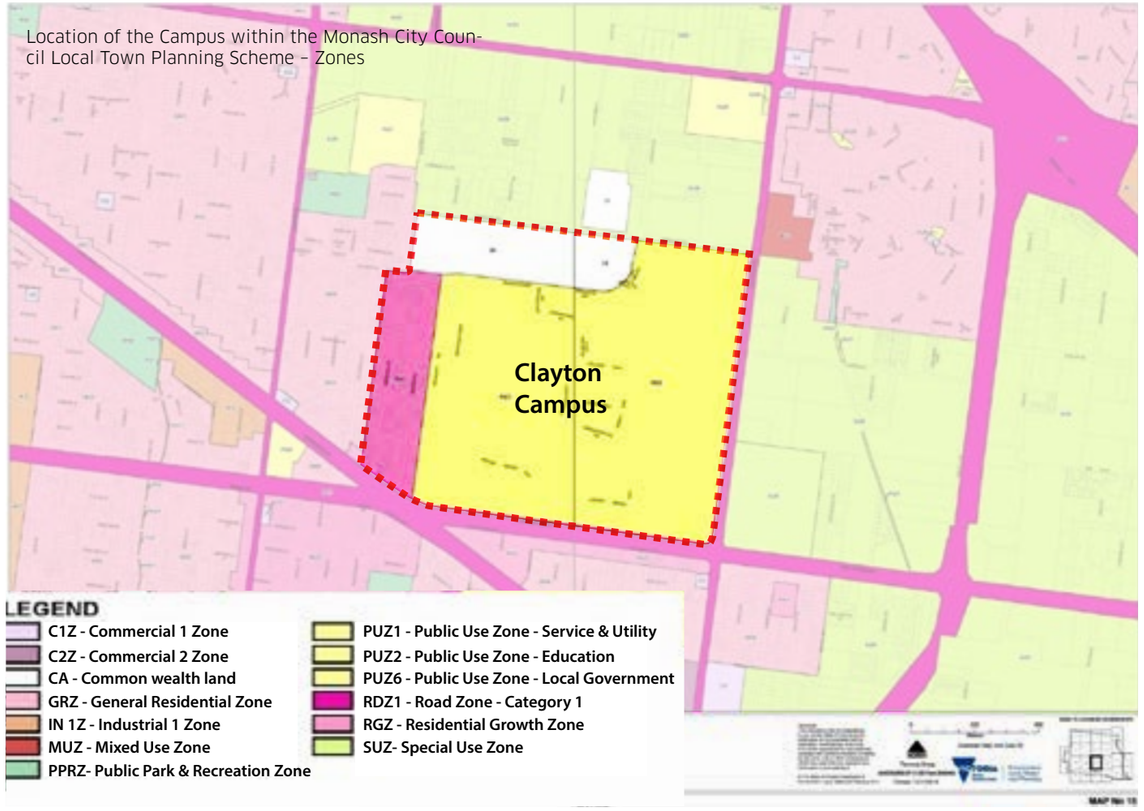
CITY OF MONASH / MELBOURNE CBD



Location of the Campus and the Technology Precinct within the Melbourne CBD

Monash University Clayton Campus and Monash Technology Precinct are part of the City of Monash. The City of Monash is home to 202,847 residents making it one of the most populous municipalities in Victoria. The City is 81.5 square kilometers and includes the following suburbs: Ashwood, Clayton, Glen Waverley, Hughesdale, Huntingdale, Mount Waverley, Mulgrave, Notting Hill, Oakleigh, Oakleigh East, and Wheelers Hill. Parts of Chadstone, Burwood and Oakleigh South.

Monash City Council regulations have established local town planning scheme - zoning plan. The Campus and Monash Technology Precinct land lies within Public Use Zone Education PUZ and it is surrounded by Residential Growth Zone RGZ3 to the south and west; Commonwealth Land to the north; Special Use Zone to the part of north and east.



Location of the Campus within the Monash City Council Local Town Planning Scheme – Zones

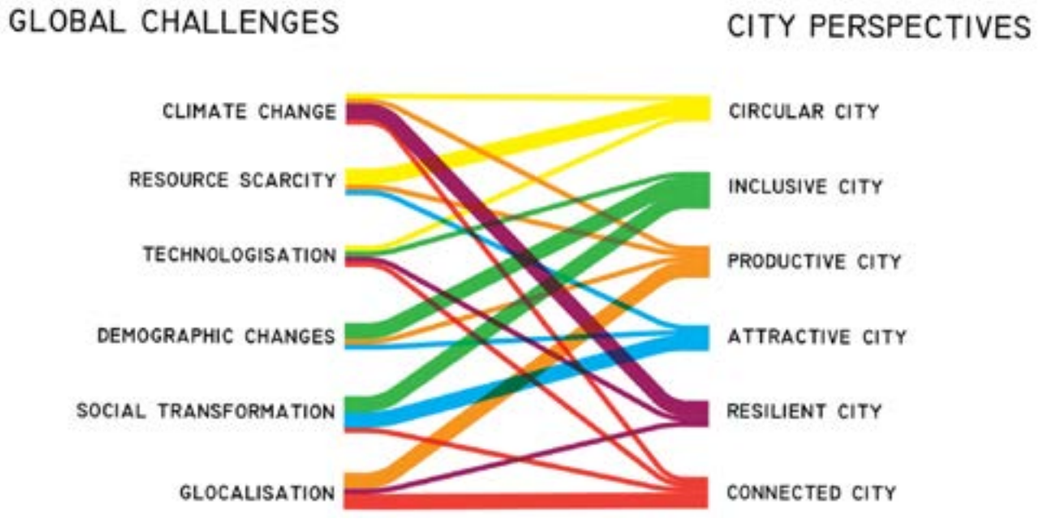
3. THE ENGIE 360 CITY SCAN METHODOLOGY

The 21st century is the century of cities; cities are expanding and its power is growing. At present 50% of the world's population reside in cities and by 2050, 2.5 billion more people will reside in urban areas and global challenges will continue to persist. Cities are finding solutions to global challenges and the solutions to these challenges are not easy. The infrastructure and framework in a city are so unique and complicated, that every intervention has to be customized.

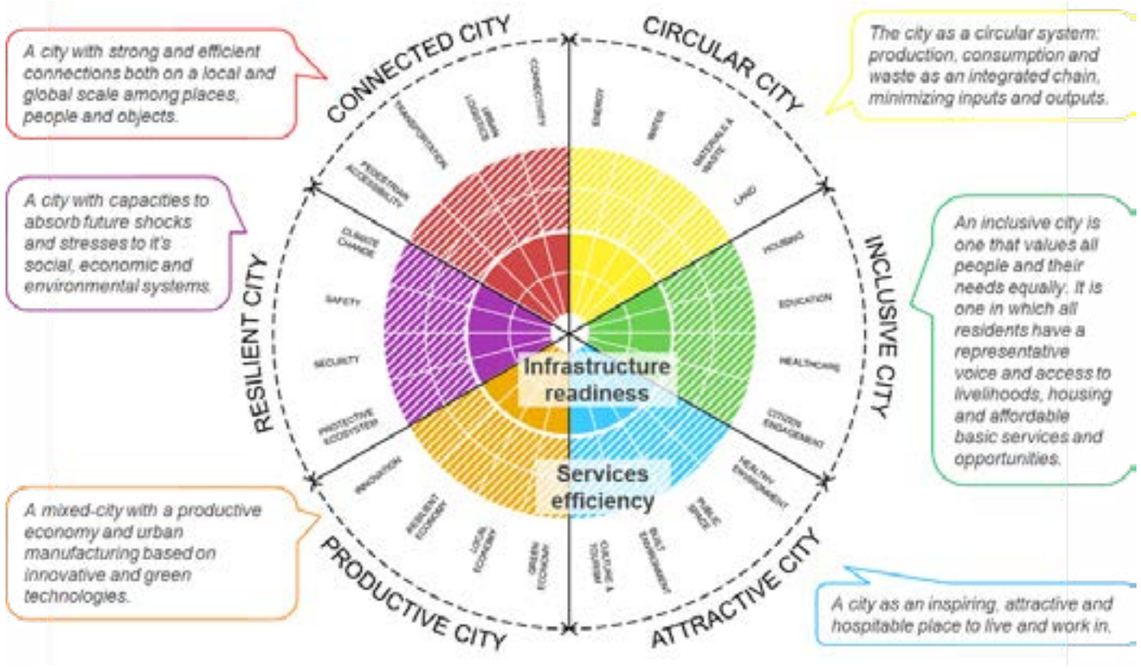
To investigate the current state and future urban vision, TRACTEBEL has defined six perspectives responding and interconnected to global challenges such as climate change, demographic changes, technologization, social transformation, glocalization, and resource scarcity for new types of production and consumption. The six perspectives are:

The perspectives are related to the current global challenges by giving it an accurate status against these threats. The perspectives work together as a whole towards a balanced city. The perspectives must be seen as different layers of a city, a balanced city encloses all the different perspectives in a good ratio. When one perspective is underdeveloped, the city does not work properly or excludes citizens. Preferably, each intervention in the city has a positive impact on all the perspectives.

There are many existing tools and instruments to investigate cities, but these perspectives give a unique reading of cities. It contains a current state of the city and a coherent vision for the future development, concerning the different global challenges. It is related to the Sustainable Development Goals (SDG's) concerning the urban area.



Each perspective is composed of different sectoral themes and these themes contribute to a specific goal/ strategy and comprehensive questions/ indicators to determine the current state of any built environment. The assessment of the urban area through these predefined perspectives reflects the status of its responsiveness to the area's challenges & threats. In a nutshell, it shows the area's maturity in relation to sustainable development. We believe that the mutual relationship between these themes, gives much more insight into cities than the themes apart. The different themes can also strengthen each other in achieving the common goal.



The 360° Scan is a semi-automated tool, developed by TRACTEBEL which can be applied for districts, cities, or metropolis of all sizes and of all maturity. The goal of the tool is not to be exact or quantitative, but to understand the level of maturity of a development area with respect to the different perspectives and themes, and lead to the identification of potential areas for intervention. By filling in the required data, discussing the result and connecting the different perspectives, the strengths and gaps become clear.

4. THE 360 CITY SCAN FOR MONASH UNIVERSITY CLAYTON CAMPUS AND MONASH TECHNOLOGY PRECINCT

The 360 City Scan was conducted in three phases. During the first phase, a questionnaire was sent to the Monash University project team. Together with desktop research, a first version of the city scan was generated. The second phase site observations were performed enriching the initial version of the findings which were later discussed with different focus groups (stakeholders) during online workshops. The online workshops were conducted between 13th and 22nd October, 2020 and were followed by 1:1 interviews with Monash University executives, scheduled until 9th December 2020. An updated version of the city scan was generated after completion of the online workshops, the third phase of the project included validation of findings and presentation of the 360 City Scan Report.

PROJECT PHASES

1

- **Questionnaire filled by Monash University**
- **Web information search by TRACTEBEL**

Project suspension due to Covid-19 restrictions / Adaptation of methodology to remote working

2

- **Site observation by local urbanist**
- **Digital Workshops with 'Focus Groups'**
- **Interviews with Monash University Executives**
- **Presentation of the Prelimiary Findings**

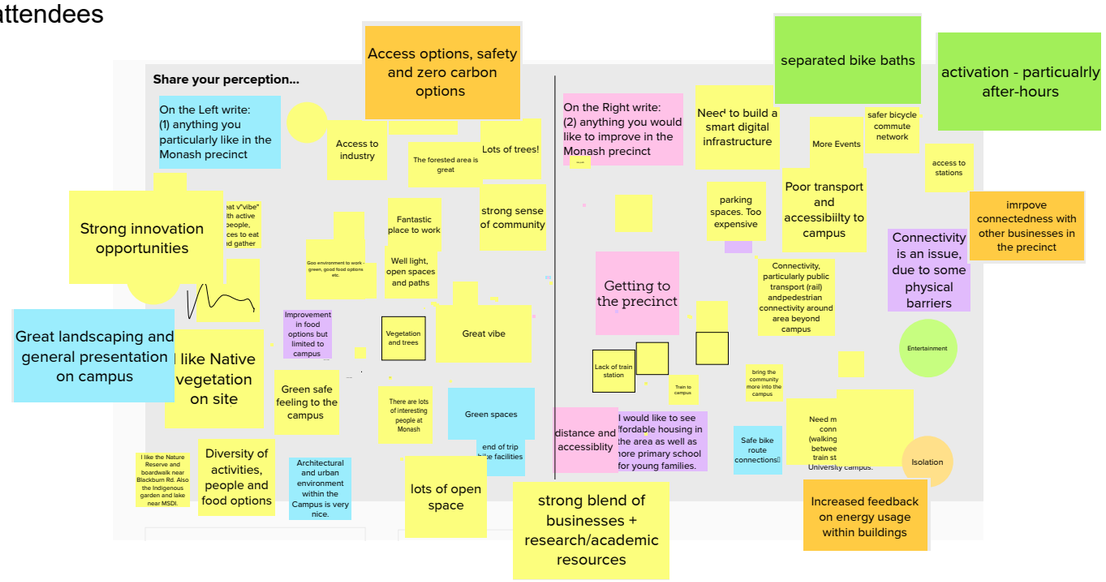
3

- **Validation of the findings with Monash Group**
- **Preparation of the Final Report**

List and information about 'focus groups' is presented below:

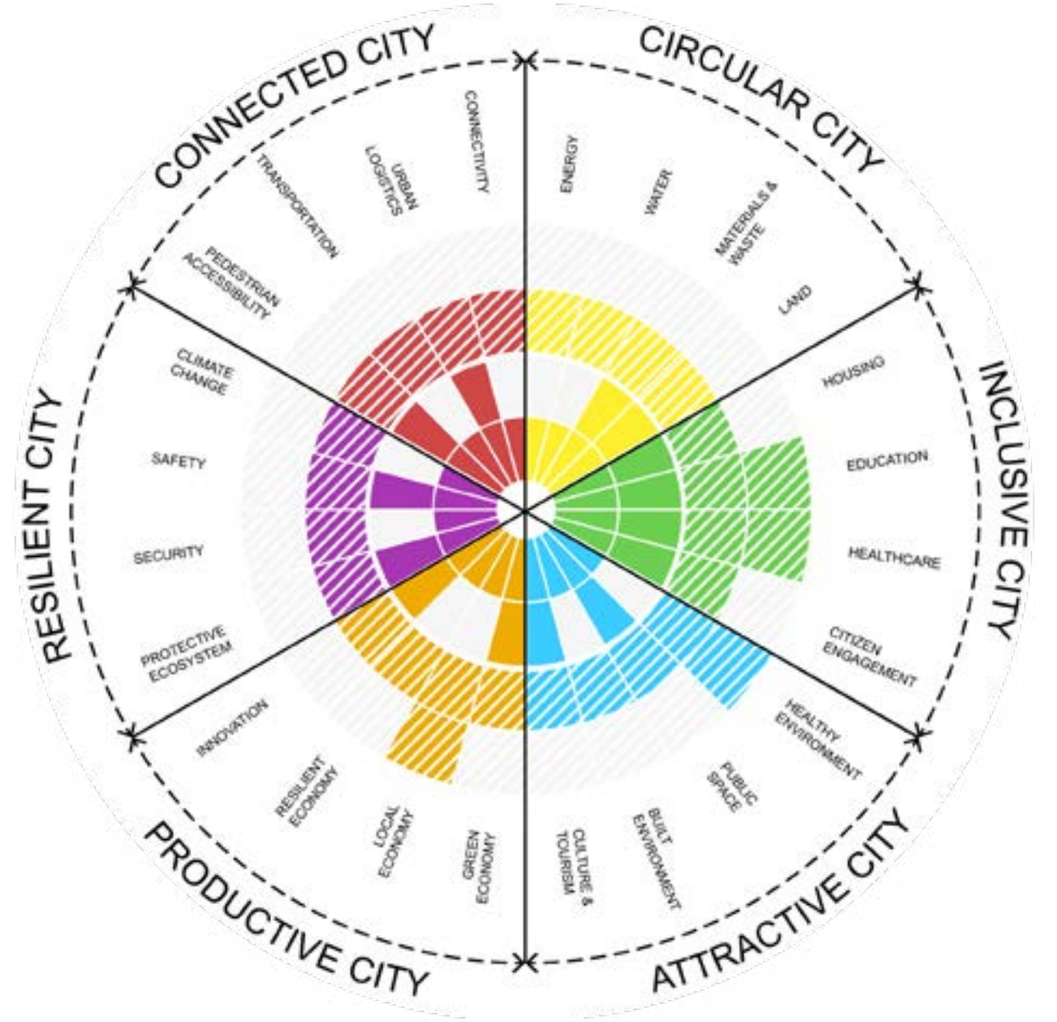
PEOPLE INVITED: 240			
PEOPLE WHO JOINED: 115			
WORKSHOPS PLANNING			
GROUP	**COMPOSITION**	**ATTENDANCE**	**DATE**
ACADEMICS, FACULTY AND PROFESSIONAL STAFF	Academics with expertise in key thematic areas, includes Associate Deans of Education and Research, Faculty General Managers & targeted central portfolios e.g. Finance, MRO, SMC	**31 Academics** **5 Professional Staffs**	October 13, 2020
STUDENT & SUPPORT SERVICES	Library, Disability services, Campus Community, Ally Network, Education services, Health services, Campus Community	**15**	October 14, 2020
CAMPUS SERVICE PROVIDERS	Retailers and suppliers	**12**	October 15, 2020
PRECINCT PARTNERS / BUSINESSES / EMPLOYERS	Victorian Government, Sustainability Victoria, Monash and Dandenong City Councils, CSIRO, ANSTO, Precinct industry partners and Utilities	**21**	October 19, 2020
OPERATIONS	Representatives of key functions across BPD	**19**	October 20, 2020
COMMUNITY	Local primary schools including John Monash Science School, Monash Children's Centre,	**12**	October 21, 2020

Snapshot of the digital whiteboard used during online workshops to collect ideas from the attendees



5. RESULTS

360 City Scan measures the level of maturity for the different themes and perspectives within a development area and detect potential areas for intervention. The scan result is represented in the radar below. The radar is divided into six perspectives, and each perspective presents four themes. The solid shaded area inside the radar represents infrastructure readiness or presence of infrastructure, while the etched area outside represents the efficiency of service delivery.



Infrastructure readiness

Services efficiency

Gap

KEY VALUES & STRENGTHS

Monash University Clayton Campus is perceived as a key highlight within the Monash Technology Precinct, impacting the precinct's potential and the level of sustainability.

- International reputation for quality higher education and innovative research.
- Accessible quality healthcare service, sport & leisure facilities.
- Demonstrated strong features for wellbeing.
- High quality of landscape design and architecture.
- Fostering equality and inclusion.
- Providing social spaces that encourage interaction.
- Adaption of water sensitive urban design and green spaces arranged with indigenous plants.
- Advanced use of renewable energy.
- Potential for collaboration with industry to drive innovation.
- Walkable space, cycling paths and outdoor leisure facilities including BBQ.
- Well connected by car with sufficient parking spaces supported by intelligent parking system on campus.

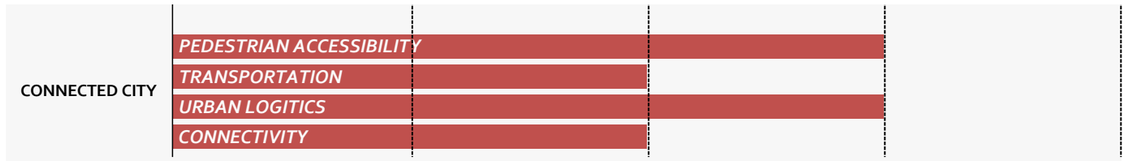
KEY CHALLENGES & GAPS

- Disconnect between Campus & Precinct community, fragmented urban design.
- Underdeveloped connections of Precinct with the Melbourne CBD and Melbourne airport.
- Car oriented design and car-oriented society.
- Net Zero initiative is not well-recognized within the Precinct and the local community.
- Boosting circular economy applications and limitation of waste generation (eg: food sharing programs, green waste recovery and reuse…)
- Increase productivity for local purposes like urban farming

Connected City Perspective

CONNECTED CITY	
DEFINITION	A city with strong and efficient connections both on a local and global scale among places, people and things.
MOTIVATION	Addressing challenges as social transformation, glocalisation, technologisation and climate change.
KEY QUESTION	How do we connect our physical, human, social, and digital capital?
THEMES	PEDESTRIAN ACCESSIBILITY > accessibility, pedestrian space, inclusive design... TRANSPORTATION > public transport, traffic congestions, intermodal hubs... URBAN LOGISTICS > freigth transport, intermodal hub, rail transport, water transport... CONNECTIVITY > Wifi, internet, mobile phone, smart solutions, cloud...

ANALYSIS OUTCOME



WHAT PEOPLE TOLD US

"We are car- dependent to move through the precinct". Precinct Partner

"Traveling by public transport to Monash will take you 2 to 3 times longer than using the car. And you might have to take several bus and train trips." Student

"The Campus has its own main roads and there are major intersections (one of the biggest in the south east suburb) which makes it daunting to cycle or walk to the Campus." Community Member

"We don't venture outside of the campus. There are nice places around but we feel disconnected by the large roads." University Staff

"Developing an 'on demand' local bus service or Monorail for mobility around Campus and in the Monash Technology Precinct might help improve coonecti-vity." Operations

KEY STRENGTHS

- Good road network infrastructure
- Excellent bike lanes and dedicated facilities within the Campus
- Pedestrian connections are established
- Campus has smart parking solutions which should be also implemented in the Precinct area where parking problems are encountered
- Campus has good WIFI access

KEY GAPS

- Campus is disconnected and isolated from its surrounding community
- Difficult access and circulation for emergency vehicles
- Public transport is not preferred
- Cycling culture is not popular outside the Campus and routes are not well signposted
- Not connected to a digital smart city network

FINDINGS PER THEME

PEDESTRIAN ACCESSIBILITY

Main findings & observations

- Pedestrian mobility access is provided around the precinct for **buildings, street crossings** and **public transport.**
- The large highways and roads around the Campus are **not pedestrian friendly** and **not safe to cycle on** due to the large number of intersections.

- Pedestrian connections are predominant and established within the Campus, for all buildings and activity places..
- One of the key qualities of the Campus is the no car environment, walkable catchment for those who study and work in the precinct.
- All buildings have ramps and elevators. Street crossings are adjusted with ramps and tactile paving for visually impaired individuals. All buses servicing the Precinct have low floor access.

TRANSPORTATION

Main findings & observations

- **Road network infrastructure is good,** but congestion is experienced during peak hours.
- Cars and taxi are the main transport means used in the Precinct and to get to the Campus.
- **Trains and busses are used extensively** but are challenging for most commuters and people accessing the Campus. People experience **longer travel time, unavailability of direct trips** to the Precinct from certain locations, and **lack of connections** between the Clayton train station and the Campus.
- Within the Campus, excellent biking connectivity is provided with **safe pleasant bike lanes**, and **dedicated facilities** (parking, lockers, shower, repair shop).
- Outside the Campus, cycling is not safe and bike use is low because of **extensive road traffic** and **absence of dedicated lanes.**

CARS

- People usually find it more convenient to use personal cars even when some roads are congested. It is still less time consuming than public transport and allows more flexibility (dropping kids at school, shopping…).
- Contactors and Campus visitors who have a flexible schedule adjust their trips to avoid rush hours and road congestion.
- Almost all car users drive alone

PUBLIC TRANSPORT

- Mobility to and from the Precinct is very car oriented, however buses are also available and popular.
- Great number of buses (19) terminate at the Campus and run during the day.
- Travel time by bus is longer due to congestion. Buses are often late and take longer because they run long routes.
- The challenge of traveling by train to Monash Precinct is not about the frequency but the design of the system and trip path. The network is focused on Melbourne CBD rather than connecting suburbs with one another. Depending on passenger location, travel to the precinct may require the passenger to take a train to a central location (closer to the CBD) and then catch an interconnecting train out to Monash. The passenger will then need to catch a bus to campus. Inter campus bus service is available for staff and students. A station servicing Monash Clayton Campus is planned as part of the first stage of the Suburban Rail Loop. Works for the new underground rail line are set to commence in 2022.

BIKING

- In the residential areas, bikes share roads with other vehicles and do not have dedicated lanes.
- Some safe and pleasant bike connections to the Campus exist but are ‘hidden’ and mostty unknown. Many of the residents have discovered these during the lockdown.

URBAN LOGISTICS

Main findings & observations

- **Good parking availability** but most find it **expensive**.
- Limited contractors’ parking space and **restricted use in time** (two hour time limit).
- Up to date **parking availability and access data** are well displayed on all parking buildings.
- **Difficult access and circulation of service and emergency vehicles** (waste collection, contractors and other service providers, fire brigade) due to the the pedestrian nature of the Campus.

- Internal pedestrian paved paths are enclosed with bollards at every intersection with perimeter road. Emergency vehicles and fire brigade both need to wait for Security to let them in. Occasionally it delays the access.
- The No-Car environment is a challenge to contractors with building projects on the Campus. They have opted to purchase electric vehicles that can help them to haul materials and debris to and from the site to the designated contractors parking area.

CONNECTIVITY

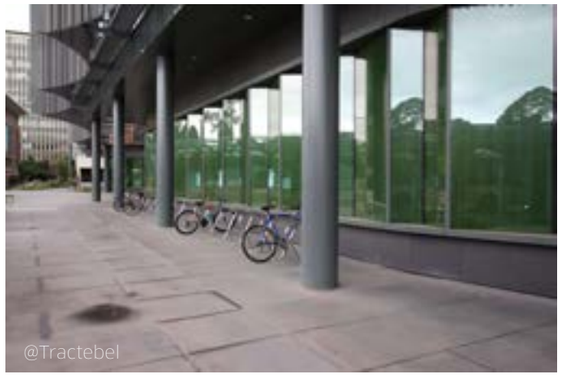
Main findings & observations

- The Campus is **disconnected and isolated** from its surrounding areas by large roadsand highways.
- To date, Precinct has not been connected to a **digital smart city network.**
- The Campus has **good free WIFI access.**

- Major road intersection is located to the south-east comprising Wellington Road going east-west and Blackburn Road going north-south. Wellington Road to greater extent creates a barrier for movement south of the Campus and Monash Technology Precinct.
- In general, the roads around the Campus are busy and create physical barriers limiting the interaction with neighboring areas. People who work or study in the Campus do not usually go to the Precinct.

IMAGE GALLERY

Main perimeter access road is sufficient for the purpose and offer dual carriage way for cars and allocated bike lanes. Pedestrian crossings and footpaths are ample for the local and internal commuters.



Bike parking is provided throughout the Campus. They are located: inside the parking garages on the ground floor; near the main entry of all buildings and near the bus stops. Bike repair is also available for all patrons.

Internal pedestrian paved paths are wide and provide a grid of various walkways connecting all buildings. Entry to almost all university buildings is from the internal pedestrian network as well as their main facades.

Connection to the nearest Clayton Metro Train station is 1.9km south and few busses are commuting to and from the station. Eleven different busses are traveling in both directions.

All mobility access is provided around the Precinct. Ramps, level access, tactile paving, elevators.

Deliveries and rubbish collection are facilitated at the rear of all buildings. Everything is well maintained, enclosed and labeled.

Freight transport trucks at the Monash Technology Precinct

Wellington Road servicing the Campus

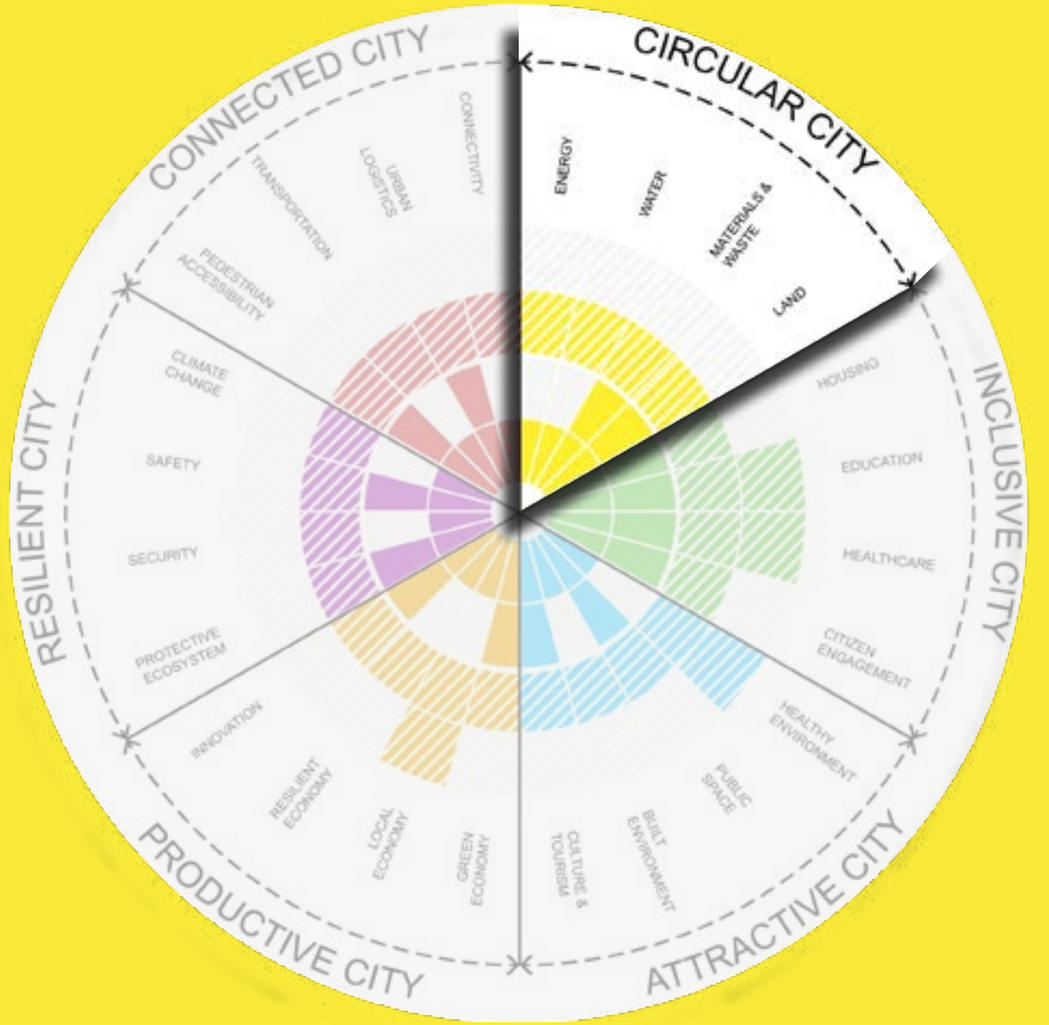
Busy crossroad between Wellington road and Princes Highway

AREAS OF IMPROVEMENTS AND SUGGESTIONS

CONNECTED PERSPECTIVE

- **Improve public mass transport to reduce car dependency in the Monash Technology Precinct by:**
  - Strengthening the rail connection which is already planned within Monash Suburban Rail Loop project
  - Implementing a Precinct wide bike share program.
- **Promote safer walking and bicycle commuting by:**
  - Expanding separated bike paths throughout the university and surrounding community.
  - Installing information about connection routes.
- **Increase uptake of Electric Vehicles in precinct fleets and promote EV charging facilities.**
- **Implement digital traffic management solutions to reduce traffic congestion**
- **Soften boundaries around the campus and create deliberate spaces for people to mix and mingle.**

Circular City Perspective



CIRCULAR CITY	
DEFINITION	The city as a circular system: production, consumption and waste as an integrated chain, minimising inputs and outputs. A continuous, positive development cycle based on reducing, recycling and reusing.
MOTIVATION	In a circular city, the demand for resources is declining because the city needs less new materials and reuses more. The resource scarcity will decrease. This also concerns the use of fossil fuels, which has a positive effect on climate change. For a circular city, a certain level of technologisation is needed.
KEY QUESTION	How independent for its resources is the city from the surrounding environment?
THEMES	ENERGY > energy efficiency, public lighting, transport... WATER > waste water, rainwater, drinking water... MATERIALS > waste, goods, recycling sites, dump sites... LAND > brownfields, greenfields, urban sprawl, housing density...

ANALYSIS OUTCOME

WHAT PEOPLE TOLD US

"Street lights are designed to be on for the rest of the night. It is not optimal in terms of energy consumption." Community member

"Uptake has been slow on use of electric vehicles." EV charging solutions provider

"Rainwater collection system gets overwhelmed and leads to flooding. The old infrastructures are put under pressure by the expanding population." Buildings and Property Division

"Warehouse center for reuse of furniture and other equipment helps minimize wastes that is diverted to landfills." Operations

"Lecture theaters are usually fully booked, but there are many cases when 'a place for 100 people is occupied by 10 persons." Student

KEY STRENGTHS

- Several renewable energy initiatives (Photovoltaic, Power Purchase Agreements, Battery Energy Storage System) and energy efficiency initiatives (LED lighting, Electric Vehicle Service Equipment) are implemented in the Campus
- Water sensitive urban design is applied to the Campus
- General waste collection and sorting is available and well-functioning
- Land within the Campus is well-allocated

KEY GAPS

- Untapped potential for energy demand side management across the Precinct
- Slow uptake on use of electric vehicles
- Presence of vacant lands in the industrial part of the Precinct without any targeted function (missed opportunity for temporary use for urban farming, water retention or enriching biodiversity - creating habitats for indigenous plants and wild animals)
- Commercial centers in Monash Technology Precinct require development

FINDINGS PER THEME

ENERGY

Main findings & observations

- The Campus has taken **notable initiatives** not only to decrease its energy dependency on the surrounding environment, but also progress change towards the **Net Zero Initiative.** These involve:
    - Adoption of **Renewable Energies**
    - Adoption of e**nergy-efficient Technology** for buildings and street lighting
    - Introduction of **Electric Vehicles**
    - Development of a microgrid
- Additional initiatives could be implemented in terms of **renewable energies, energy management and low-carbon mobility** options **to reach the full potential** of the Precinct.

- Campus clean energy initiatives include installation of solar panels on the rooftops of buildings generating about 3MW of solar power, signing a long-term power purchase agreement (PPA) with Murra Warra 1 wind farm to buy rights to both electricity and large-scale generation certificates (LGCs), incorporating battery 1MWh of battery storage to help provide flexibility as a part of micro-grid, and evaluating the use case of hydrogen to reduce its carbon footprint.
- The Campus has replaced existing lighting to LED technology including replacing 8,000 lights at the Clayton campus and replacing inefficient gas boilers to increase energy efficiency.
- The Campus and the Council work with industry experts to incorporate smart building technology to alter its temperature based on the preferences of its occupants there by reducing energy requirements.
- A microgrid within the Clayton campus is being developed to receive and store energy from various renewable energy sources. The micro-grid will allow for more control and reduce demand and strain on the network during peak times.
- EV charging stations established at the Clayton campus that includes both fast and standard charging.
- EV charging infrastructure is perceived as sufficient, but there is a general belief that additional initiatives could be implemented to incentivize further adoption of low-carbon mobility options.

WATER

Main findings & observations

- Water is **effectively managed** at the C**ampus** level
- **Poor drainage and sewers** in surrounding **suburbs** require upgrades.

- Although water is effectively managed at the Campus level, poor drainage and sewers in surrounding suburbs require upgrades.
- The Campus has implemented initiatives to reduce the overall use of water and has a dedicated water management system to recycle and reuse water.
- An effective rainwater catchment system is in place at the Campus that limits wastage/ drainage of rainwater.
- The rainwater is locally stored and reused for watering gardens, sport grounds, football fields.
- Water collection and storage initiatives are perceived to be satisfactory within the Campus. Some areas in the Precinct (excluding Campus) are prone to flooding due to poor infrastructure and drainage systems.

MATERIAL & WASTE

Main findings & observations

- In the Campus there are initiatives aimed at overall **reduction** of waste.
- There are also initiatives and implementation examples to **recycle and reuse** the waste generated in the Campus.
- There is an **opportunity to promote and spread** the Campus's initiatives to the Precinct and a need to **raise awareness** and **encourage behavior change.**

- For the that is unavoidable waste is segregated for appropriate handling, recycling and/or disposal. Waste triage systems are in place and are satisfactory.
- The specific, dangerous, or hazardous waste from medical research laboratories go to specially allocated incinerators prior to leaving the building. Toxic and hazardous waste is carefully evacuated from the labs to specialized medical waste facilities.
- Precious Plastics Monash led by students and involved in learning and researching new ways to improve recycling methods and finding new materials that can be a substitute for plastic.
- All green waste produced is stockpiled and twice a year turned into compost and put back on the campus gardens. Furthermore, there is food waste digestor at the Menzies building.

Main findings & observations

• The l**and allocation** with the Clayton campus is **effectively used and well allocated** to current buildings and amenities.

• There is r**oom to accommodate commercial development** within the Precinct and it immediate surrounding areas .

- The Precinct (excluding Campus) is mostly low density residential and business parks with few large warehouses and storage facilities.
- All surrounding residential homes have their back fences towards the university and there is no active interface with the campus.
- The area around the campus has limited offering for shopping, entertainment, and restaurants.
- Land allocation within the campus is efficient. However, stakeholders believe that area around the campus can be better utilized.

IMAGE GALLERY

① Solar panels are installed on the rooftop of several buildings on campus. Monash intends to increase its on-site solar generation in-line with its Net-Zero Initiative.

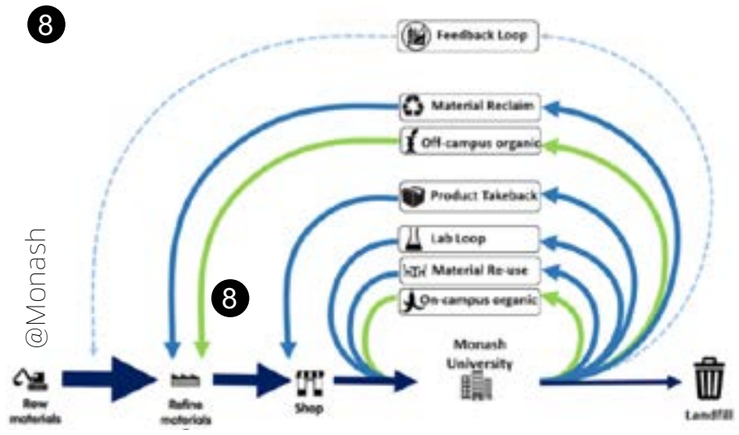
② Electric vehicle (EV) charging stations are installed on two locations. Charging is available to staff, students, and visitors to charge their vehicle whilst on campus. Charging station are on North One, Ground level (N1) on 10 Research Way and South Two (S2) on 20 AncoraImparo Way.

③ Infrastructure in place to promote biking within the campus as an alternate to fossil-fuel based transport.

④ Few share car stations are scattered around the precinct's perimeter. They can be booked by mobile app.

⑤ Water treatment plant at the Monash Technology Precinct

⑥ Run-off rainwater is used to water all gardens on site with various well-designed curb and channel water access. Drainage and water filtration through water gardens is provided on site.



⑦ Water storage tanks in the campus to store catchment water. This water is used to irrigate the vegetable garden (also seen in photo)

⑧ Monash University has begun to implement certain initiatives towards zero waste and enhance circularity.

⑨ Monash waste transfer and recycling station located at the Monash Technology Precinct

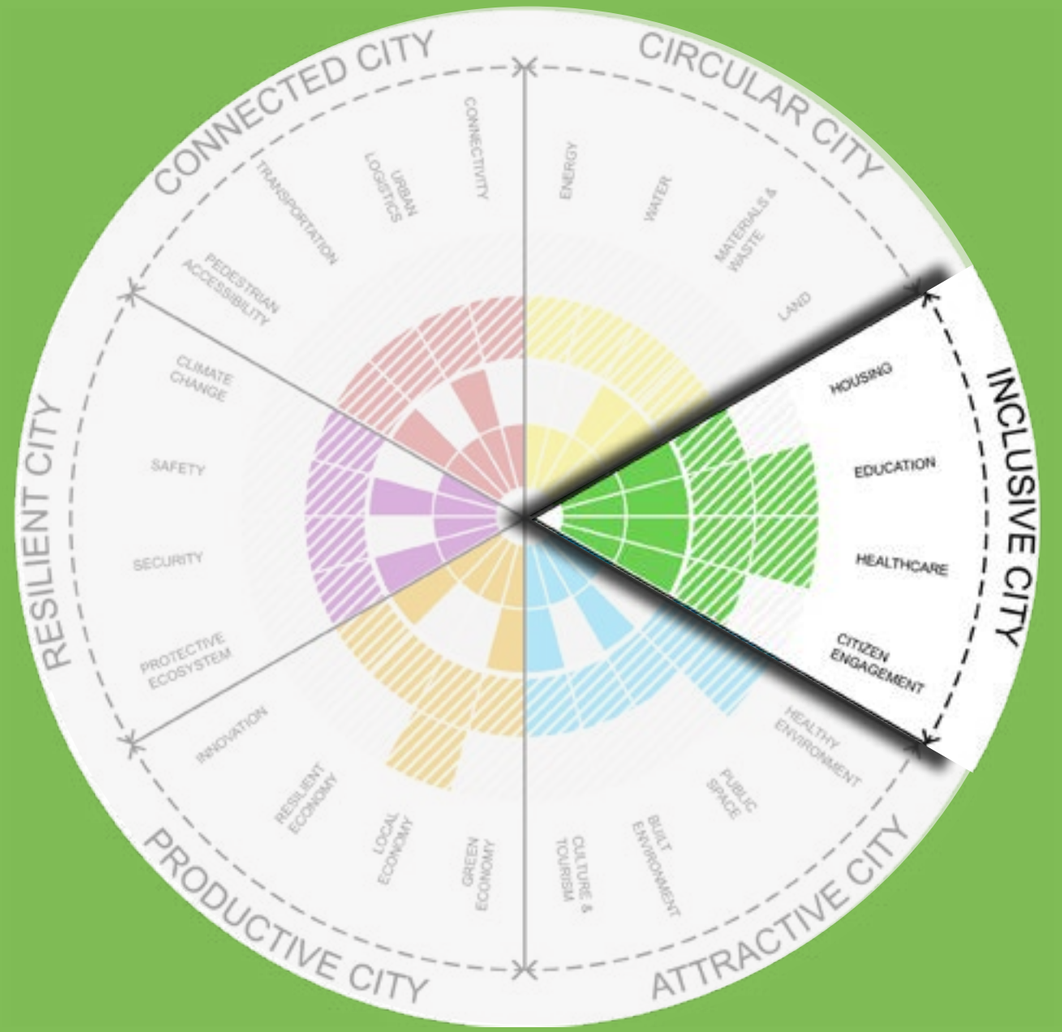
⑩ General waste collection and waste sorting is well allocated, available, and functional. Specific waste is collected at the back of each research center, subject to type and disposal requirements.

AREAS OF IMPROVEMENTS AND SUGGESTIONS

CIRCULAR PERSPECTIVE

- Increasing on-site renewable energy production through additional solar PV installations.
- Allocating additional battery storage and load control.
- Enhance demand side management and utilization of dashboards for increased energy efficiency and visibility.
- Developing the EV charging infrastructure further and incentivizing people to transition to EVs.
- Reducing the dependency on fossil-fuel powered transport. This could include increased bus frequency from the Clayton train station, provision of bike or car sharing at the Clayton station for last-mile transport, increasing safe bike and walking paths within and around the campus.
- Installing activity sensors within buildings and intelligent street lighting to increase energy efficiency.
- Improving infrastructure of sewers and drainage in surrounding suburbs.
- Increasing water usage efficiency through initiatives such as sensor-activated taps or low-flow taps within buildings, and additional water harvesting initiatives in addition to storm water catchment.
- Enhancing and promoting plastic waste reduction initiatives.
- Developing pilot waste recycling programs and platforms that can be scaled up such as sharing of used clothes, furniture, organizing second-hand events and fairs, and knowledge and experience sharing sessions.

Inclusive City Perspective



INCLUSIVE CITY	
DEFINITION	An inclusive city values all people and their needs equally. It is a city in which all residents have a representative voice and access to livelihoods, housing and affordable basic services and opportunities.
MOTIVATION	An inclusive city incorporates the challenges from demographic changes and social transformation. The increasing technologisation has to be accessible for all citizens.
KEY QUESTION	Are the benefits and opportunities the city offers accessible to everyone?
THEMES	HOUSING > social housing, slums, affordable housing... EDUCATION > literacy rate, affordable schools... HEALTHCARE > hospitals, mortality... CITIZEN ENGAGEMENT > citizens' rights, gender equality, community involvement...

ANALYSIS OUTCOME

WHAT PEOPLE TOLD US

"I would like to see affordable housing in the area as well as more primary school for young families." Academic member

"I would like to see more diverse community events" Community member

"Monash Campus feels like an island in the middle of the sea, very disconnected from the surrounding community." Community member

KEY STRENGTHS

- State of the art education facilities
- Healthcare services are available, including Monash Heart Hospital which is under construction
- New and modern student housing is available on Campus
- Sports and art facilities in the Campus are open to public

KEY GAPS

- Low offer of affordable and attractive housing in the Precinct suitable for different types of residents
- Community participation and engagement in Monash University initiatives are affected by the reduced accessibility to the Campus and insufficient communication about the initiatives

FINDINGS PER THEME

HOUSING

Main findings & observations

- Housing is provided in the **residential areas** in the Monash Precinct and student housing is available on Campus.
- Lack of housing options: it is mostly **low-density**, and **students focused**.
- **Investment focused residential areas** result in **lower standards** and **decreased variety** of accommodation offer for different types of residents.

- Property on Campus is mainly considered as an investment for students' rental and therefore prices are considered not competitive for people looking to purchase an apartment for themselves.
- Housing around the Campus is mostly low-density single-detached homes, and oriented toward student lodging. Bigger houses are converted into shared houses with basic amenities accommodating up to 8 students per 4-bedroom house, kitchenette and toilet facilities are shared.
- Students who live in the residential halls are mostly international students. Local students tend to live out and commute to Campus using private vehicle or public transport.

EDUCATION

Main findings & observations

- International reputation for **quality higher education** and **innovative research**
- **State of the art education** is provided on site with all required lecture halls, auditoriums, classrooms, libraries, laboratories, etc.

- Various education courses are provided and opportunities for further education are available for best performing students.
- Comprehensive course offerings and a wide range of classes to broaden and deepen knowledge.
- Monash libraries are Australia's leading academic libraries, supporting high standard of learning, teaching and research.
- Monash University supports entry pathway to university courses for indigenous people.
- Monash staff and faculty are sending their children to primary schools near to Monash where they work.
- Monash was the first university in Australia to establish a dedicated Indigenous centre. The William Cooper Institute helps Indigenous students and staff achieve their aspirations and has a Reconciliation Action Plan, policies and procedures and a range of programs which support and respect indigenous cultures and histories.
- Monash has an Indigenous Advisory Council which advises Monash in relation to Indigenous programs including Indigenous access, participation and success in education, research and employment.
- The Monash Indigenous Access Pathway (MIAP) program is designed to support Indigenous applicants in making a successful transition to university study.

HEALTHCARE

Main findings & observations

- **Basic health care** providers are located on Campus.
- Various **specialized testing and health assessments** can be done at the Campus.
- First **dedicated cardiac facility,** the Victorian Heart Hospital, is under construction as part of the Precinct.

- Two childcare centers are available on Campus and faculty, staff, and students have priority booking.
- Healthcare on Campus is heavily subsidized with students receiving a special discount for services and treatments.
- Health-care providers in the University Health Service are available to provide a wide range of services including minor surgery, vaccinations, mental health counselling, and referrals.
- The Victorian Heart Hospital is being built and will be completed in 2022. The present hospital servicing Monash residents is Monash Health Centre, a public general hospital and the biggest hospital in the state. It is also a partner hospital of the university where students learn and intern.

CITIZEN ENGAGEMENT

Main findings & observations

- University occasionally organizes **events** on Campus to attract people.
- **Sport and art facilities** on campus are **open to the public**.
- **Community participation and engagement** are affected by the accessibility and **lack of accessible public transport** options to the Monash Precinct.

- Local community engagement is mostly through sporting and art facilities on Campus.
- Sport facilities & the Monash University Student Theatre are accessible to the general public. They are also utilized by local schools and community. Alexander Theater is an excellent engagement space.
- Local schools near the Campus have conducted holiday programs for children of the Monash University staff.
- Campus and Precinct attendance to on-campus events depend on accessibility and transport options.
- Parking is hard for community members visiting the Campus: it is expensive unless you have a permit. In the evenings, Parking is free but most people are not aware of it.

Image Gallery

Student housing on campus is new and modern and is in the proximity to the campus center, small shops, and food court. Bike links and bike parking connect all buildings. Buildings are located near wetlands and surrounded by established trees.

Basic health care providers are located on site. Additional specialized clinics and research centers are dotted in and around the perimeter of the Campus. Dedicated cardiac facility, the Victorian Heart Hospital is currently being constructed.

St. Peters primary School is one of the primary schools present at the Monash Technology Precinct.

Monash Community Cooperative is a non-profit cooperative focused on children's education.

State of the art educational facilities are core busines of the campus. Great new buildings are covering large ray of educational options. Research, doctoral and postdoctoral opportunities are also offered on the campus.

Individual buildings are competing with their one-of architecture styles.

Surrounding residential streets have a mix of single storey weatherboard 1960's houses, single storey brick veneer 1980's houses and two storey detached houses recently built. All houses are turning their back to the Precinct with tall 1.8m fences.

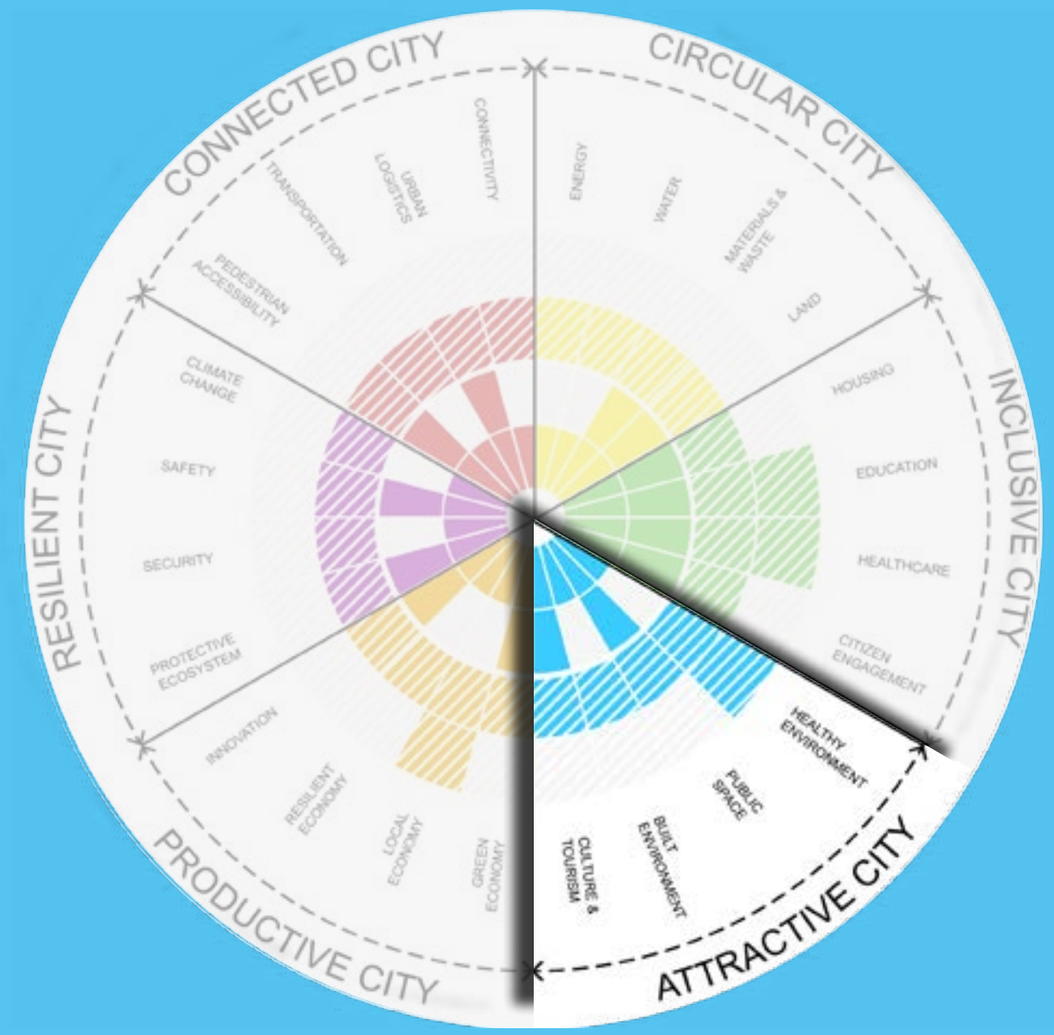
Monash Community Center in the foreground and the Corpus Christi Retirement Village in the background.

AREAS OF IMPROVEMENTS AND SUGGESTIONS

INCLUSIVE PERSPECTIVE

- Need to promote higher density housing in the Precinct.
- More affordable housing in the area that is not just for students.
- Cooperation possibilities of the university with local schools could be developed further.
- Establishment of more day care centers and primary schools and offerings to students and staff.
- Increase promotion of community events in Campus and Precinct.
- Organize regular community events to encourage interaction between campus staff, students, and Precinct community members.

Attractive City Perspective



GENEROUS CITY	
DEFINITION	A city as an inspiring, attractive and hospitable place to live and work in. A healthy environment in which communities and individuals are invited to interact and are active on creating public life.
MOTIVATION	Addressing to challenges as social transformation, glocalisation, demographic changes and climate change.
KEY QUESTION	How qualitative and diverse is the public infrastructure that the city offers to its inhabitants and visitors?
THEMES	HEALTHY ENVIRONMENT > noise, air quality, pollution... PUBLIC SPACE > area, recreation, green, walking distance... BUILT ENVIRONMENT > urban governance, architectural quality... CULTURE & TOURISM > heritage, institutions, tourist infrastructure...

ANALYSIS OUTCOME

WHAT PEOPLE TOLD US

"Fantastic place to work. Academic! The environment is not too intense, I wouldn't like working in the city where it is too exhausting." Academic member

"Broader Monash Precinct is dull and uninspiring" Monash Staff

"For me, it (the Precinct) looks mostly industrial. I am not sure where the 'action' is." Student

"Art Gallery is actually really good but no one knows about it" Community member

KEY STRENGTHS

- Campus environment is landscaped and has natural open areas; well-maintained public spaces for exercising, seating, bbq, and eating
- Sports and cultural facilities are well developed
- Award winning architecture and landscapes
- Diverse international community

KEY GAPS

- Lack of vibrancy and night life options in the precinct, apart from Clayton area in the Precinct
- Lack of options for after-work events and hang-outs in the Precinct
- Non-homogenous urban development between the Campus and surrounding areas

FINDINGS PER THEME

HEALTHY ENVIRONMENT

Main findings & observations

- Campus is a great **pedestrian friendly environment** with several **landscaped and natural open areas.**
- **Natural environment is discontinuous** between the Campus and the **Precinct which lacks green open spaces.**
- Overall, **good air quality,** but the large roads, highways, and industries around the Campus **generate air pollutants and CO2 emissions.**

- The students, university staff and visitors of the Campus appreciate the natural surroundings with native vegetation and often use outside areas during their breaks or stay behind after work to go for a walk.
- Lockdown was a good opportunity to discover the immediate natural surrounding area.
- Campus is very clean and there is no vandals or graffiti.
- Campus has plenty of parkland, which is very different from the other areas of the Precinct.

PUBLIC SPACE

Main findings & observations

- Buildings are surrounded with **clean and well-maintained public spaces f**or seating, BBQ and eating. Well maintained grass surfaces are also scattered throughout the Campus.
- **Sports and cultural facilities are well developed** and usually used by students and residents.
- The Precinct has g**ood leisure areas and entertainment facilities** (cinemas, cafés & restaurants, recreation, retail areas), however they are disconnected and unknown by most.
- **Lack options** in terms of **nightlife and evening or after-work events.**

- Weekends are mostly quiet and only residents (students and community) living near campus use the public spaces.
- In the past few years, the Campus has become livelier: you can now feel a community in its infancy; students live on campus, there are supermarkets, and sport facilities.
- For residents, the lockdown was a good opportunity to discover the area and its entertainment facilities. Leisure areas in and around the Campus include: Scotchman's creek trail, the Nature Reserve and boardwalk near Blackburn Rd, the Indigenous garden and lake near Monash Sustainable Development Institute (MSDI), picnic areas at Oakleigh Mt. Waverly, pinewood cinema, pool and theatre at Clayton complex, galleries, music performances at Monash University.
- People who study or work on Campus do not go to the Precinct's residential and industrial areas as it does not offer much entertainment activities. The restaurants and cafés there cater mostly to working people with not many incentives for people to spend time (quick in and out for lunch time).
- Bars & pubs in the Precinct are more attractive than the one on Campus but are further away and not as convenient.
- The Bus station is a mobility hub which provides not only public transport connections but also it is an attractive public space where people can gather and enjoy the experience of using public transport.

BUILT ENVIRONMENT

Main findings & observations

- Monash Campus contains **award winning Architecture and landscapes.**
- The Precinct **residential and industrial areas are not attractive**.
- **Non homogenous urban development** between Campus and other areas within the Precinct.

- Campus includes a mix of new and old buildings, there is an ongoing effort to refurbish older buildings.
- Campus is included in an Architectural Tour that starts in Melbourne CBD.
- Urban sprawl is prevalent in the Precinct (excluding Campus), characterized by the lack of green space.

Main findings & observations

- **Unique university culture** is dominant, and environment is respectfully tailored for **best educational performance.**
- The University attracts a diverse **international community.**
- Various **events are organized** by the university and **open to the public.**
- There is a **lack of communication and advertisement** around the events and entertainment opportunities within the Precinct to better inform and involve the community.

- Monash is one of the fastest growing & developing councils and one of the most diverse in terms of age and nationality. There is a number of different cultures coexisting within Monash.
- Cultural events are mostly provided in the Melbourne City Centre and therefore people from the campus commute to and from the city for it.
- The Theatre has a robust program but is underutilized and there is not much knowledge from the community about what is going on in the theatre.
- People are attracted to work in the university environment which is focused on knowledge development.
- Campus attracts a diverse international community, around 30% of all students are from other countries.
- Indigenous culture and heritage is well acknowledged and promoted (Aboriginal Garden).

IMAGE GALLERY

Wetlands and well-maintained trees and shrubs are surrounding the campus. On site landscape maintenance is engaged full time in planting and maintaining vegetation and water features.

Football Oval (Frearson Oval) adjacent to the student residence on campus and Monash University Cricket Club.

Elevated bike and pedestrian bridge.

Sunken garden green space and water overflow zone.

Above left: Cultural Precinct Aboriginal recognition house.

Above right:Monash Gallery of Art (MGA).

Cultural Precinct Japanese Garden house.

The Ian Potter Centre for performing arts surrounded by the large grassed area.

Façade design accommodating stage seating.

AREAS OF IMPROVEMENTS AND SUGGESTIONS

ATTRACTIVE PERSPECTIVE

- Expand urban farming and native vegetation to other areas within the Precinct.
- Encourage interventions and incentivize initiatives that promote improved air quality and pollution reduction measures.
- Provision of some covered walkways on highly utilized routes within the campus.
- Replace steel tables and chairs, during hot summer months these are too hot and not practical for use.
- Enhance establishment of on campus facilities: convenience store, supermarket, laundry service, and retail shops.
- Encourage conversion of abandoned lots in the Precinct into green spaces.
- Need to establish more restaurants and cafes in the Campus that can cater after work events and gatherings.
- Expand promotion of Monash cultural offerings, centers, and museums in the campus and overall Precinct area to encourage visitors.

Productive City Perspective

PRODUCTIVE CITY	
DEFINITION	A mixed-city with a productive economy and urban manufacturing based on innovative and green technologies. A place where production is encouraged and is allowed to be seen and connected to daily life.
MOTIVATION	Addressing challenges as resource scarcity, demographic changes and social transformation.
KEY QUESTION	How independent is the city in terms of economic production and local employment?
THEMES	GREEN ECONOMY > resource efficiency, polluting industry... LOCAL ECONOMY > local employment, reinvestment, local presence... RESILIENT ECONOMY > multi industry focus, professional education and trainings... INNOVATION > start-up & scale-up, identity of city's economy...

ANALYSIS OUTCOME

WHAT PEOPLE TOLD US

"Urban farming (local production) initiatives do exist, but are not well recognized and underutilized, run by volunteers." Academic member

"Contractors and service providers experience difficulties in accessing sites with equipment, tools, and storage." Contractor / Campus Service Provider

"It is easy to get good qualified people to come work in the Precinct." Local Business

KEY STRENGTHS

- Monash Technology Precinct is a strong employment center outside Melbourne's CBD
- Intellectual capital present in the Precinct
- Strong cooperation ambition between university, industries, and government on piloting smart and sustainable solutions
- Quick adaption of new normal practices, COVID limitations

KEY GAPS

- Urban farming of small scale for local production is not well recognized and underutilized
- Room for comprehensive application of circular economy approach
- Local marketing needs to be strengthened to promote awareness on innovative initiatives developed in the Precinct
- Not connected to a digital smart city network

FINDINGS PER THEME

GREEN ECONOMY

Main findings & observations

- **Urban farming (local production) initiatives** exist but not well recognized and underutilized, run by volunteers.
- There is still room for the **comprehensive adoption of circular economy approach.**

- Community gardens established throughout the campus and utilized by campus staff and students.
- Promotion of sustainability and urban food production on Campus.
- Initiatives to promote resource efficiency – limitation of use of plastic in university canteens (e.g. drinking water fountains instead of plastic bottles), reduce food waste and paper waste, compost green waste, reuse of grey water, investigate possibilities to install local grey water treatment facilities – try to establish research programs related to resource efficiency and pilot projects within the CampusInstall intelligent lighting and cooling/ heating systems – switchin on only when in use.

LOCAL ECONOMY

Main findings & observations

- The Precinct is the **biggest employment center** outside Melbourne's central business district.
- Strong **intellectual capital** is present in the Monash Precinct.
- Campus offers **specialised jobs with highest level of education.**

- Lack of local commercial activity - wholefood markets and shops are located in the neighboring centers some 3.5 km away from the Precinct.
- The majority of people working in the campus live outside the Clayton area and are commuting up to one hour each way to work or study.
- To facilitate connections between indigenous businesses and the University's procurement function, Monash is a member of Supply Nation which is a leading database of verified Indigenous businesses.

RESILIENT ECONOMY

Main findings & observations

- **Quick application of adaptation measures** as a result of growing restrictions following COVID pandemic.
- Contractors and service providers experience **difficulties in accessing sites** on Campus.

- Monash City Council's promotion of virtual conference for small to medium business following COVID limitations on social gathering.
- COVID pandemic impacted university budget, estimated losses at ~AUS300 Million.
- Contractors and service providers have difficulty in accessing sites on Campus, specifically with their equipment and tools, narrow roadways, lack of storage for equipment and temporary storage for green waste.

INNOVATION

Main findings & observations

- **Strong collaboration between research / education and industry.** Localized innovation initiatives are not communicated to the immediate community.

- Industries established in the Campus who initiate piloting of smart and sustainable transport options (electric buses), Net Zero Initiative projects etc.
- Local marketing of innovation initiatives needs to be strengthened to promote awareness.

Image Gallery

Research centers and education are largest employer in the campus.

Education is the main economic pilar of the precinct, employing large number of teachers and support staff.

Small businesses are servicing main activities on the campus. On the Sports Walk Supermarket forms the corner on the ground floor.

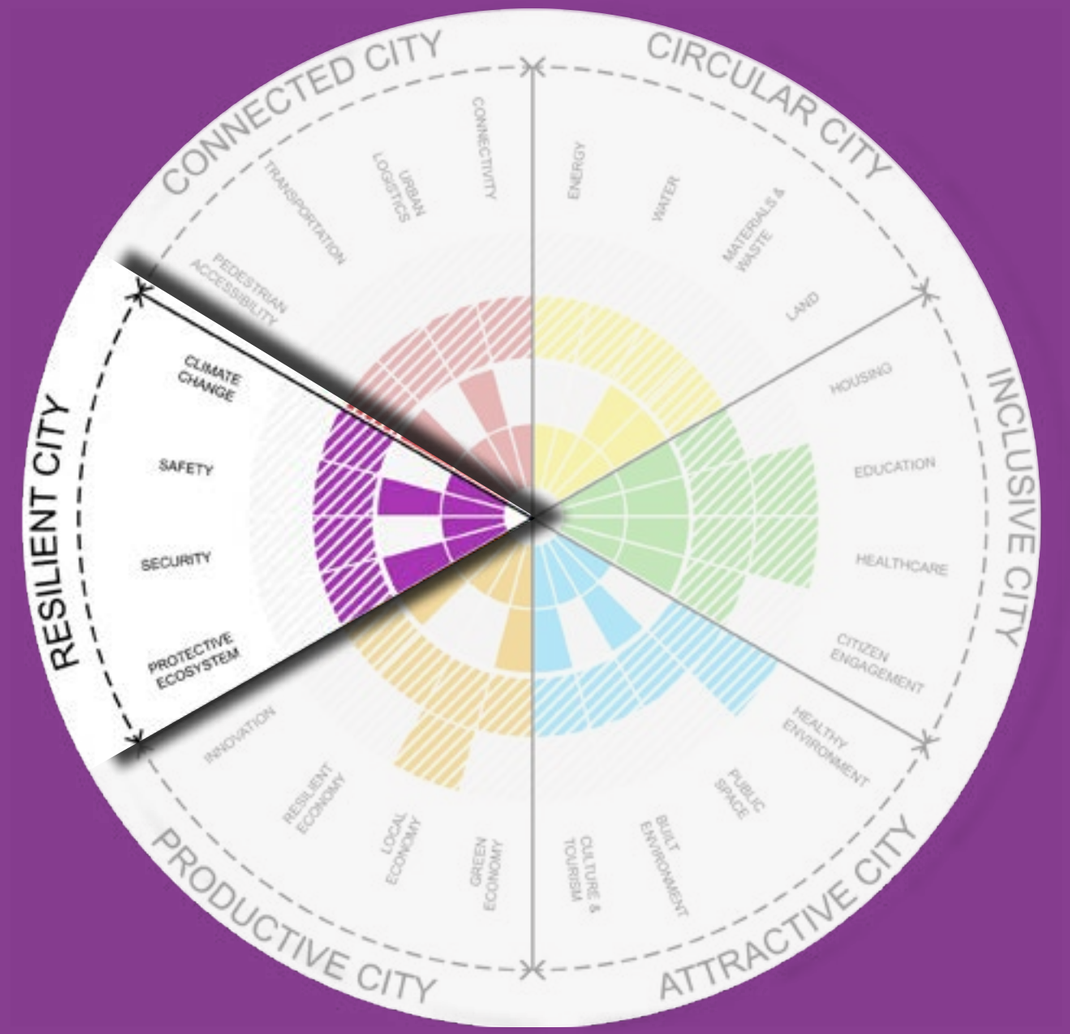
Small market gardens are located on the eastern side of Blackburn Road. Water collection, vegetable gardens and small observatories are on site adjacent to the business building.

AREAS OF IMPROVEMENTS AND SUGGESTIONS

PRODUCTIVE PERSPECTIVE

- Promotion of urban farming / community gardening in vacant lots in the Precinct.
- Establish evidence-based baseline information on waste sources and generation in preparation for mainstreaming sustainable consumption and production initiatives.
- Improve communication on green economy (posters, digital platforms, social media…) throughout campus regarding circular economy, resource efficiency).
- Space for pop-up business activities where participants can sell goods and produce during Friday evenings, weekend markets, or scheduled dates.
- Explore ppossibilities of developing night-time activity / after office hours.
- Provision of designated roads and ample space for contractors and service providers to store equipment.
- Go digital: Establish digital platforms for exchange of information (“Smart City” management) and support local initiatives and start-ups related to digital development (like sharing of goods, transports and space…).

Resilient City Perspective



RESILIENT CITY	
DEFINITION	A city with capacities to absorb future shocks and stresses to its social,economic and environmental systems. A city ready to face the challenges posed by climate change, disaster events, rapid urbanisation and the economic downturn.
MOTIVATION	Addressing challenges as glocalisation, technologisation and climate change.
KEY QUESTION	How robust and secure is the city against incidents and disasters?
THEMES	PROTECTIVE ECOSYSTEMS > nature management, disaster prevention.... SECURITY > crime, police, fire department, security system.... SAFETY > transportation fatalities, safety perception.... CLIMATE CHANGE > carbon footprint, urban heat island effect, flood....

ANALYSIS OUTCOME

WHAT PEOPLE TOLD US

"The busy roads surrounding Campus put people off riding bikes. There is no safety on the roads, and it is hard to find bike lanes." Community member

"I sometime feel vulnerable at night in the Precinct and choose to walk on busier paths to feel safe" Operations

There are areas on campus where it is scary to walk around in Winter when its dark at night, like walking to the Car Park for example." Monash Staff

"The only major impact we felt from the fires was smoke which impacted air quality." Operations

"During Summer, there isn't enough shade in certain areas and the outdoor steel tables don' look appealing and are not practical." Monash Staff

KEY STRENGTHS

- Campus plays an exemplary role in showcasing protection of green ecosystem; allowing space for trees and water infiltration, contribute to protection against heat waves and improved air quality.
- The Precinct is equipped with some stationary cameras. Security cars circulate frequently.

KEY GAPS

- Construction sites impact the feeling of safety feeling for pedestrians due to high fences and being 'empty'.
- Low sense of safety on Campus at night – parts without sufficient streetlights, and lack of night activities. Precinct is a robbery hot spot with foreign students as main targets.
- Crossing of main roads is not fit to pedestrian and cyclist needs – short green light, long waiting, mixed lanes.
- Many road collisions occur due to extensive traffic and major arterial roads.

FINDINGS PER THEME

PROTECTIVE ECOSYSTEMS

Main findings & observations

Local protective ecosystem is ex**ceptional source of outdoor recreation opportunities.**

- Ecosystem services' function is well beyond its surrounding suburbs, and even its surrounding neighborhood.
- Air quality, humidity and trees' shade improves the environment for all in the precinct.

SECURITY & SAFETY

Main findings & observations

- **Extensive application of emergency services protocols** including police security and fire systems throughout the Campus.
- **Efficient underground infrastructure / utility lines** are installed throughout the Campus.
- **Decreasing road safety** in the Precinct due to **increasing traffic.**
- **Low sense of security at night** on campus, people choose to use busier paths. Streetlights are not enough.
- **Potential fire risk** related to increase presence of **battery storage** - EV vehicles, batteries storage

- There is a roving security on Campus and strong presence of protective services officer (PSO) outside the the Campus. However, there are safety concerns in the Precinct outside the university.
- Security has increased on the Campus. There are stationary security cameras (CCTV network) installed and security cars with built-in dash cameras. The increased presence of cars with cameras gives a sense of security. Offences per 100 000 population are well below the state average, however according to police the precinct is identified as a robbery hot spot, targeting specifically students, with higher number of robberies of international students than domestic.
- Fire system and network system is intricate, manned by an engineering services officer 24/7 on a 12-hour rotating shift. Precinct is generally safe in terms of fires, however there are occasional interventions related to fires and floods. Access in the Campus is an issue that comes from time to time.
- Security is considered through activation of building facades with numerous access points. Security might be compromised by the specific time frame buildings are used – during working hours/ school hours and at night there would be much less people on campus.
- The flow of cars and people are increasing due to the new construction of buildings near the shopping mall and the increased number of houses which brings more people and more cars, and with the lack of car park space, streets are becoming congested.
- A high number of collisions is registered by the police due to many vehicles passing through the area (eg Monash Freeway)
- Around the Precinct there are emergency points to press if you need a way finder. Visitor can indicate the number of the pole and get guidance.

CLIMATE CHANGE

Main findings & observations

- **Climate change mitigation** initiative is considered throughout the Campus.
- **Flooding occurs after heavy rains** because old infrastructure.
- There is a need to i**nstall / retrofit infrastructure** to mitigate heat island effect.

- Climate change mitigation initiatives solar panels, water collection, water sensitive urban design, share car stations, bike transport promotion and by promoting Precinct self-sufficiency.
- Old infrastructure such as sewers and drainage are unable to support expanding population.
- Wellington Road (North East corners) always floods when it rains.
- Heat waves generate hot temperature for several weeks during summertime. Need to install shaded connection between buildings on the engineering precinct, and some gaps in the campus center.

Image Gallery

Dense vegetation in allocated green zones on site.

Night lights are located along all pedestrian links even through the parks.

Solar panels on roofs. Monash has installed solar rooftop capacity of 2.3 MW, equating to over 7,000 solar rooftop PV.

AREAS OF IMPROVEMENTS AND SUGGESTIONS

RESILIENT PERSPECTIVE

- Promotion of native vegetation in the Precinct area.
- Downgrading traffic on large roads and improving traffic management.
- Installation of safer walking and more connected bike paths throughout the Precinct.
- Installation of auto/smart-lighting throughout the campus.
- Improving CCTV infrastructure.
- Increase community engagement in safety (raise awareness, establish cooperation).
- Include fire safety in the plans for installation of battery storage and EV parking.
- Initiatives on installation of modern landscapes and use of porous pavements to reduce concrete walkways / pathways.
- Build green infrastructure improvements into regular street upgrades.
- Encourage building of green roofs and vertical gardens as an ideal heat island reduction strategy, providing both direct and ambient cooling effects.

6. CONCLUSIONS, RECOMMENDATIONS & NEXT STEPS

The City Scan confirms that Monash University and the Monash Technology Precinct is well developed on the six dimensions of a sustainable city. **Monash University remains committed to the Net Zero Initiative.**

The university area (campus) is outstanding in its design with the availability of parks featured with indigenous plants and water sensitive solutions. Sport and leisure facilities are available for local community. Intelligent parking system and bus hub facilitate the mobility connection with distant city center.

Some of the precinct's performance could be developed further, serving the Net Zero Initiative of Monash University by reducing energy demand & GHG emissions while addressing local development needs and embracing the Monash Technology Precinct potential. In this respect we would like to highlight following recommendations:

SPREAD AND CONNECT

- Strengthen **collaboration with industry & government** – leverage **innovation implementation**
- Embrace the **community** – work out common programs, remove barriers, go **beyond the Campus grounds**
- Promote **intermodal transport** (External & Internal connections)

COMMUNICATE & INSPIRE

- **Share** the Net Zero Initiative plans and initiatives
- **Inspire** the local initiatives & innovation towards zero carbon
- **Promote good practices** & share the experience (like the Water Sensitive Urban Design, energy efficient passive building)

CLOSE THE LOOP

- Optimize **use of resources** and increase **energy efficiency**
  - Network solutions – micro-grid extension within the Precinct, district heating and cooling network
  - Shared fleet – EV cars, bikes, digital car-pooling platform
  - Efficient use of lecture rooms & result oriented facility management
  - Reduced use of plastic
  - Intelligent street lighting
  - Smart building technology – room activity sensors, zoning, automated shading

- Boost **circular economy**
  - Local food production (urban farming) & food donations
  - Local composting of food scraps and other organic material
  - Increase practice of waste segregation
  - Reduction of waste – reuse of plastic, paper, promotion of repurposed materials (upcycling), reuse of pre-owned clothing, electronics, and household items, repair cafes
  - Selective collection and reuse of grey water
  - Facilitate digital platforms dedicated to circular economy perspectives

WHAT ARE THE NEXT STEPS?

Above mentioned recommendations indicate general directions where there is a need to define projects and actions. Following steps shall be considered for further progress on the integrated path of the Net Zero Initiative implementation:

(1) A discussion shall be organized aiming at definition of development priorities on the basis of revealed gaps.

(2) Once the priorities are established the ambition shall be precise and followed by definition of detail development goals such as for example (%) share of public transport users; expected energy efficiency in different type of buildings; surface made available for solar PV installations; reduction in dependency on fossil-fuel powered transport…

(3) Finally projects shall be defined fulfilling development goals, as well as timeline of their implementation and Performance Indicators allowing to assess the progress.

All the above mentioned elements can be grouped in Development Roadmap forming the next step project.

THE PROJECT TEAM

It is our pleasure to support Monash University Net Zero Initiative. We are looking forward to further assist in the development of this initiative.

«Sustainability is no longer about doing less harm. It's about doing more good.»

Jochen Zeitz

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TRACTEBEL ENGINEERING S.A.
boulevard Simon Bolivar 34-36
1000 - Bruxelles - Belgium
tractebel-engie.com

Jolanta ZARZYCKA
tel. -
fax +32 2 773 8900
jolanta.zarzycka@tractebel.engie.com