

Zero Emissions Energy:
Building a sustainable, net zero circular economy from residual regional
materials

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Part of the Marathon Group of Companies



CIRCULAR, NET ZERO



1. The Challenge
2. What are we doing?
3. Why?
4. Where is our focus?
5. How? Collaboration & Integration is key!
6. Challenges we face
7. What Impact do we expect to have?
8. Innovation and Value Chains
9. Summary

IPCC 2022 - AUS



OBSERVED CHANGES & IMPACTS

Climate trends and extreme events have combined with exposure and vulnerabilities to cause major impacts for some human systems (*high confidence*).

Climate impacts are cascading and compounding across sectors and socioeconomic and natural systems (*high confidence*).

Further climate change is inevitable, with the rate and magnitude largely dependent on the emission pathway (*very high confidence*).

PROJECTED RISKS & IMPACTS

There are important interactions between mitigation and adaptation policies and their implementation (*high confidence*).

Integrated policies in interdependent systems across biodiversity, water quality, water availability, energy, transport, land use and forestry for mitigation can support synergies between adaptation and mitigation. These have co-benefits for the management of land use, water and associated conflicts and for the functioning of cities and settlements.

IPCC 2022



CHALLENGES & SOLUTIONS

A range of incremental and transformative adaptation options and pathways is available as long as enablers are in place to implement them (*high confidence*).

New knowledge on system complexity, managing uncertainty and how to shift from reactive to adaptive implementation is critical for accelerating adaptation (*high confidence*).

CHALLENGES & SOLUTIONS

A step change in adaptation is needed to match the rising risks and to support climate resilient development (*very high confidence*).

Delay in implementing adaptation and emission reductions will impede climate resilient development, resulting in more costly climate impacts and greater scale of adjustments (*very high confidence*).

INTEGRATION

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The interactions between transport, land use, and energy-environment have a significant impact on the functioning and development of metropolitan cities. As these interactions become increasingly complex and interrelated, a deep understanding of the dynamics is crucial for the introduction of sustainable and innovative mobility solutions. Also, transport, economic growth, and CO2 emissions are mutually dependent, and environmental degradation is significantly impacted by economic growth in urban areas.

Alipour, D.; Dia, H. A. Systematic Review of the Role of Land Use, Transport, and Energy-Environment Integration in Shaping Sustainable Cities. *Sustainability* 2023, 15, 6447. <https://doi.org/10.3390/su15086447>

Additionally, the analysis shows that a tailored approach is necessary to address the diversity in regional characteristics and constraints of urban mobility, as a one-size-fits-all approach may lead to suboptimal solutions...

...this research also highlights the significance of the strategies such as promoting transit-oriented developments... However, ... it has become apparent that research on recent green mobility technologies...adoption have mostly focused on the short-term impact on congestion and emission, overlooking the long-term impact on regional land use interactions, job accessibility, alternate mobility scenarios, livability, the transition period with human drivers, and environmental effects.

THE CHALLENGE



1. Emissions are still rising in key sectors
2. Landfill is still viewed as the 'least cost' form of residual waste disposal
3. Traditional alternatives to landfill rely on large, secured waste volumes
4. Regions are often locked out of new innovation markets
5. The same sectors that have rising emissions are less amenable to pure electrification
6. Alternatives to LPG, diesel and natural gas energy sources are needed for many industries reliant on these sources of energy
7. Circular, net zero economies are NOW issues

Table 3: Actual annual emissions, by sector, for the year to September 2021 and 2022

Sector	Annual emissions (Mt CO ₂ -e) year to September 2021	Annual emissions (Mt CO ₂ -e) year to September 2022	Change (%)
Energy – Electricity	162.0	157.0	-3.1%
Energy – Stationary energy excluding electricity	103.7	104.5	0.7%
Energy – Transport	89.3	93.1	4.3%
Energy – Fugitive emissions	49.3	47.9	-3.0%
Industrial processes and product use	33.0	32.5	-1.3%
Agriculture	78.9	81.4	3.2%
Waste	13.4	13.6	1.5%
Land Use, Land Use Change and Forestry	-39.4	-39.5	0.0%
National Inventory Total	490.2	490.5	0.1%

Quarterly Update of Australia's National Greenhouse Gas Inventory: September 2022

DRIVERS FOR CHANGE

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- Local Governments:
 - Climate Change, Circular Economy and Climate Resilience
 - Cost of infrastructure, service delivery and savings to community
 - Economic Development and inbound investment
- Industry / Users
 - Market demand for ESG / sustainability credentials, future contracts
 - Decarbonisation of business, ESG commitments (direct, supply chain)
 - Price and costs stability, energy security
- State Government / Federal Government
 - Climate Change and Decarbonisation / Net Zero commitments
 - Inbound investment
 - Energy and fuel security, sovereign capability, local manufacturing
 - Regional transition



WHAT?

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- A Network of Waste to Hydrogen (WXH) facilities
- As the centre of regionally focussed Circular, Net Zero Hubs
- Targeting 100% diversion of waste and the creation of high value products – seeking the up-valuing of materials wherever possible
- Decoupling hydrogen and water availability
- Building out the value chain necessary for a domestic hydrogen economy
- Targeting mobility and stationary energy use , for harder to abate sectors
- Integrating products and materials back into regional economies, increasing circularity of materials

WHY?

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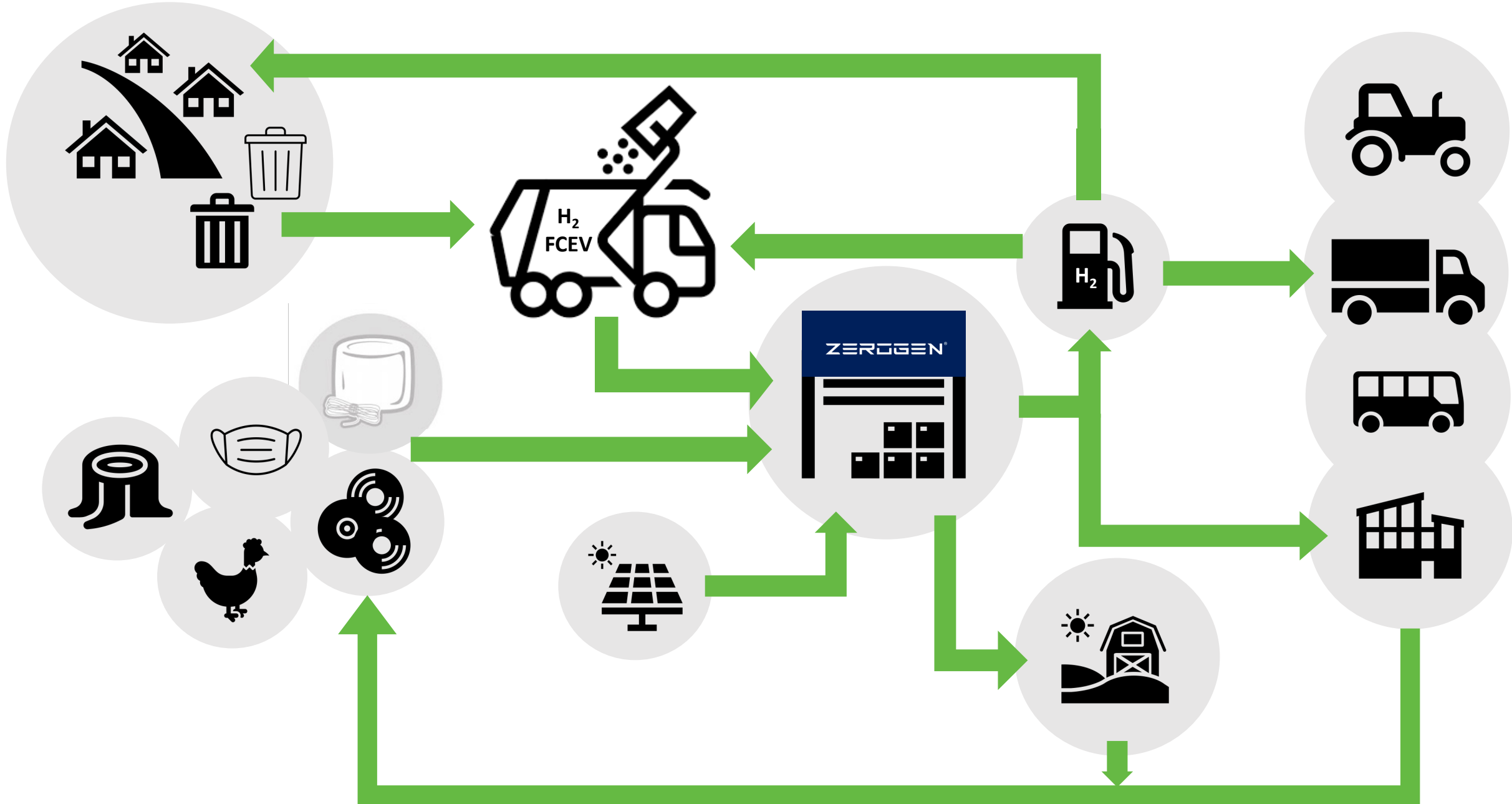
- “What can you do with waste?”
- High cost of waste management, particularly residuals, to community
- Inaccessibility to metro markets for key materials
- Council owned landfills ~50% of Council Scope 1 emissions
- Progressive regional and rural municipalities seeking to transition from landfill, save \$ and decarbonise infrastructure and operations
- Those same councils often locked out of ‘at scale’ metro solutions
- Opportunity to retain and create value in our regions, keeping benefit local
- Our partners and relationships, knowledge of our local economies
- Policy, market, ethics and commercial drivers

IMPACT

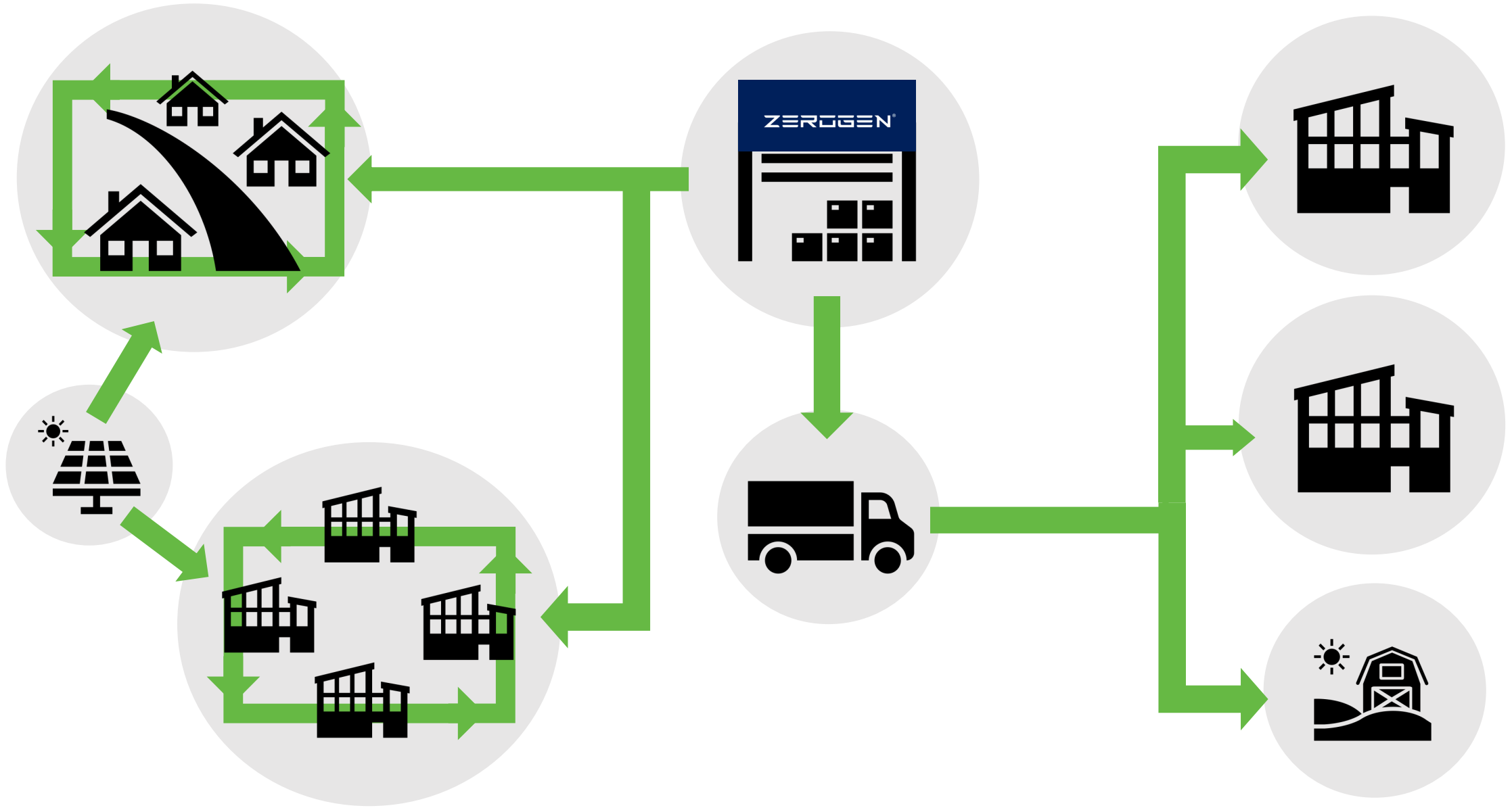
-  Waste
-  Energy security & sovereignty
-  Decarbonisation
-  Emissions
-  Environmental impact
-  Energy costs to industry & community
-  Community energy resilience
-  Sovereign manufacturing
-  Local investment

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ZERGEN® Net Zero Hydrogen – Stationary and Mobility Energy



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Net Zero Thermal – Stand-alone distributed

INTEGRATION

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FEEDSTOCK

Local Government, MSW, C&I,
B&D, Food & Fibre producers,
industry and manufacturers...

PARTNERSHIPS &
COORDINATION

BUSINESS
MODELS

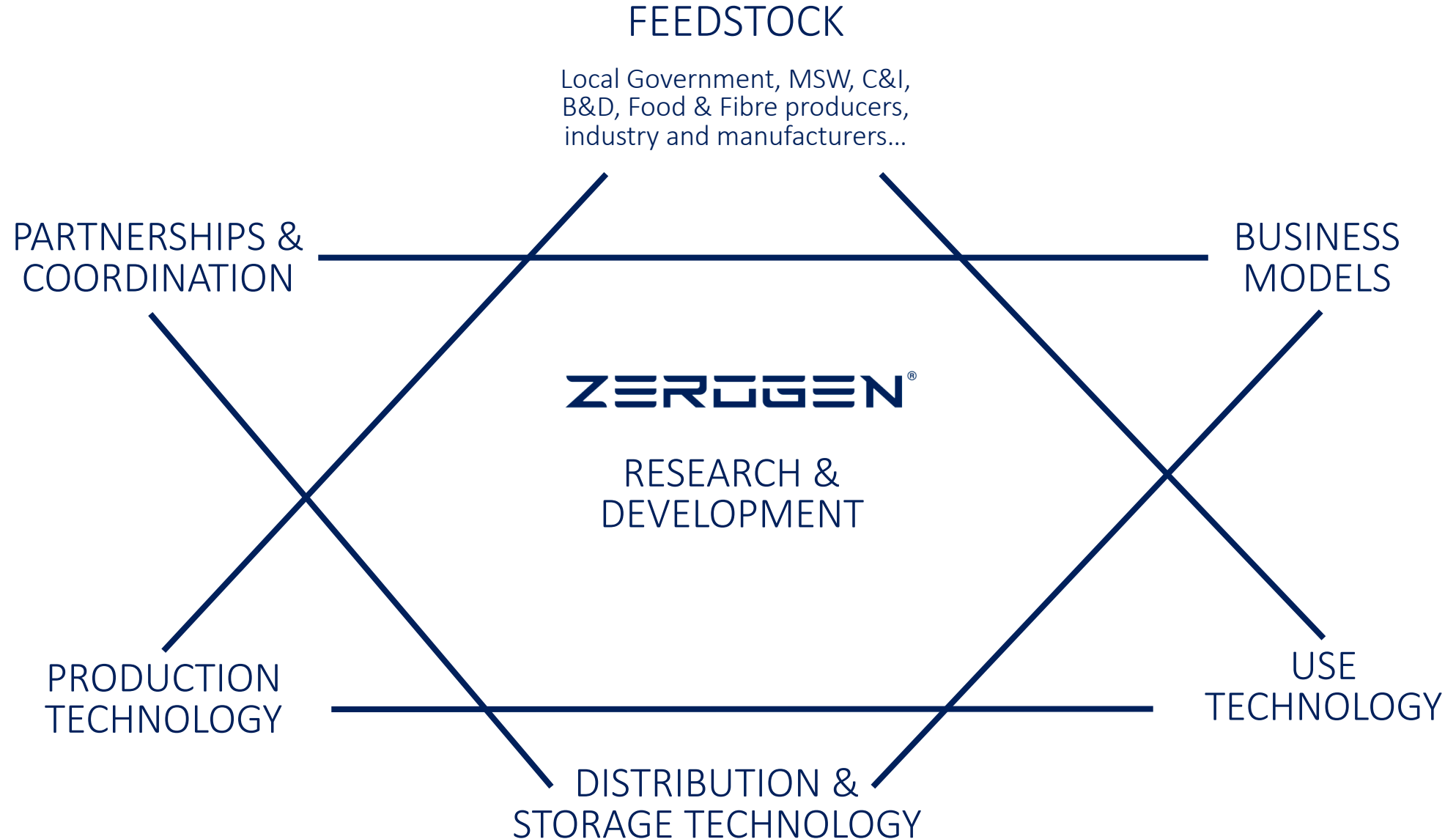
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RESEARCH &
DEVELOPMENT

PRODUCTION
TECHNOLOGY

USE
TECHNOLOGY

DISTRIBUTION &
STORAGE TECHNOLOGY



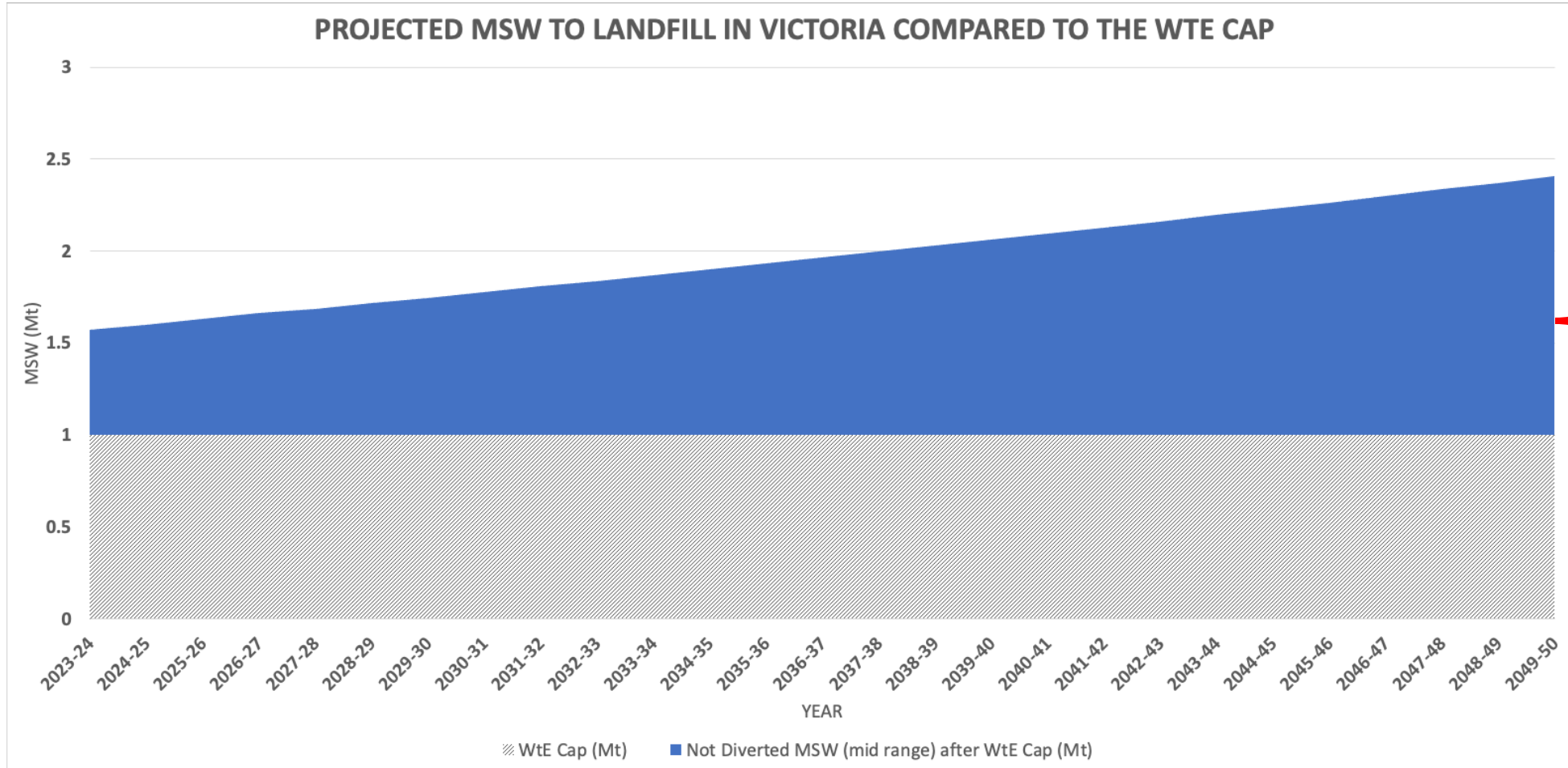
POLICY CHALLENGES VIC

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1. Legislation not fit-for-purpose (Amendments to the Circular Economy Act)
2. **Internal conflict in Vic Gov policies**
3. **Poor definitions**
4. **Economic, social and environmental costs of policy**
5. **Market defined, or market defining**
6. Placing limits on innovation and decarbonisation
7. Limiting investment into the State
8. Biased against regions
9. Constraining progress to Net Zero and Circular Economy in Vic



VIC WASTE TO ENERGY POLICY COSTS TO SOCIETY



- **\$2.8 Billion** in lost benefit
- **26.2Mt** MSW to landfill
- **9.6Bt CO₂-e** in unavoided emissions

*Against a Zerogen baseline cost, State average cost to landfill, and lifetime emissions per tonne waste to controlled landfill, for MSW only
 RV Data dashboards – projections for MSW statewide,
 SV 2019 Greenhouse gases from the waste sector and opportunities for reduction, Section 5 Table 3

Just to compare...

Our Project

Our flagship development is a **5GW offshore wind farm** off the coast of Gippsland, within Australia's first declared area



Operational by 2032

The first phase of Elanora Offshore will be operational by **2032**, with the second phase completing by end **2034**



40% of Victoria's current energy needs

Once fully operational, the Elanora Offshore project will deliver over **20 TWh** of clean, secure energy to Victoria every year



Limiting visual and social impact

Wind turbines will be situated where they won't be seen and interference with other marine users will be minimal, limiting our visual and social impact



600 million tonnes of CO2

600 million tonnes of CO2 emissions will be avoided over the project lifetime



Local jobs

The 5GW Elanora Offshore project will create **10,000** direct jobs during construction and **320** direct jobs during operations



600 million tonnes of CO2

600 million tonnes of CO2 emissions will be avoided over the project lifetime

*Image taken from Elanora Offshore website 16 October 2023
www.elanoraoffshore.com.au

POLICY CHALLENGES NSW

1. A simple regulation with a dramatic impact
2. **Not many people live near Parkes or Goulburn!**
3. Impact on truck movements and transport infrastructure?
4. Sydney's dumping ground? Someone else's problem?
5. If circularity is the focus, what's our system of interest?
6. Placing limits on innovation and decarbonisation
7. **Limiting investment, and increasing costs**
8. **Regulation enforced landfill? Offense to reduce landfill and emissions?**
9. Constraining progress to Net Zero and Circular Economy

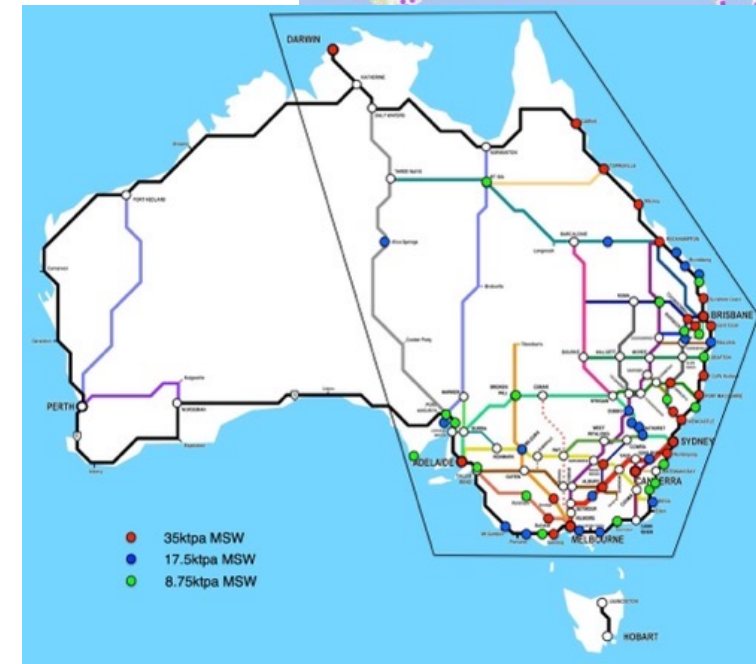
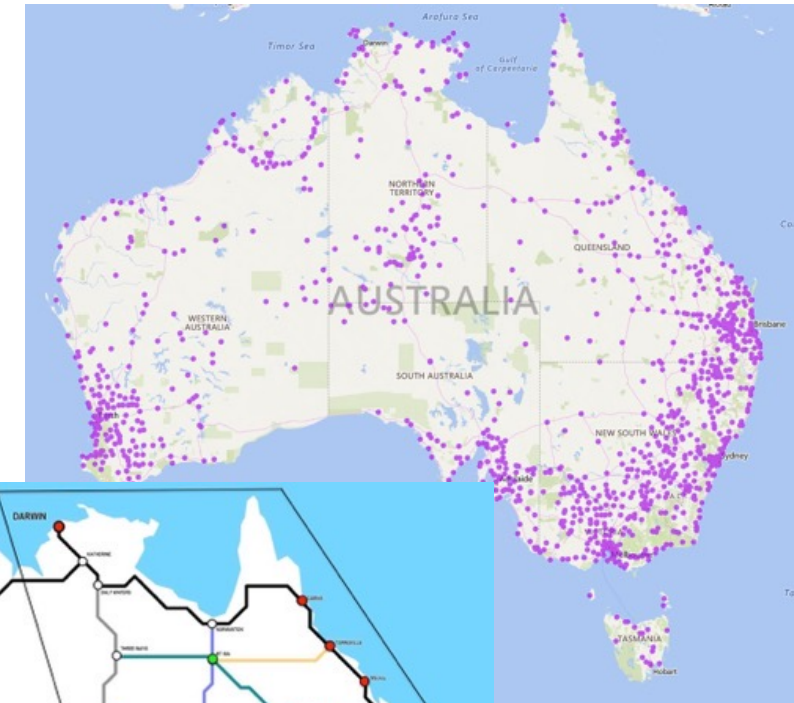
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WHERE

1. **Everywhere!**
2. Modular, scalable, suited for regional Councils and communities
3. From 10ktpa to 100+ktpa
4. **Integrated alongside existing waste infrastructure or stand-alone site**
5. Local – inbound investment
6. Local – localised treatment of residual materials
7. Local – utilisation of created products
8. Local – value retention and creation

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Boson Services
Australian
modelling of a
potential
hydrogen
highway based
on waste to
hydrogen
facilities

COLLABORATION



- 1. Crucial to success**
2. Locally – with Councils, industry and business partners
3. Globally – with technology suppliers and experience
4. Central role of R&D, both commercial and University based
5. The source of innovation
- 6. Inside-out design**
7. Circular & Net zero WILL NOT occur without collaboration
- 8. Centrepiece to vertical and horizontal integration**
- 9. Is required throughout the whole value chain/circular system**

INNOVATION



1. New ideas occur through collaboration
2. **Limited support for innovation and early development in Australia**
3. Policy is limiting innovation in some areas
4. Underpinned by relationships across community, industry, academia and government
5. Support and interest decreases as you go up levels of government
6. Australia's finance sector still weighs traditional risk higher than innovation and climate action – “Get to FC then come back to us!”
7. **Innovation is not just technology based, should also be in responsive and adaptive business models – where we've had as much success as with technology**
8. **Formed and shaped by relationships**

WORKFORCE

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Australian
Renewables Academy



EMPOWER AUSTRALIA FORUM 2023

SHAPING A RESILIENT RENEWABLE ENERGY WORKFORCE

Thursday 23 November
Lardner Park Event Centre
Gippsland, Victoria



Waste to Hydrogen (to X)
technology becomes an enabler
for transitioning to an integrated,
circular, net zero economy &
society

ZERO WASTE | ZERUGEN[®] | ZERO EMISSIONS

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Contact

Scott McArdle
Director

+61 400 098 219

scott@zerogenenergy.com.au

info@zerogenenergy.com.au

www.zerogenenergy.com.au