

# Turning organic waste into energy

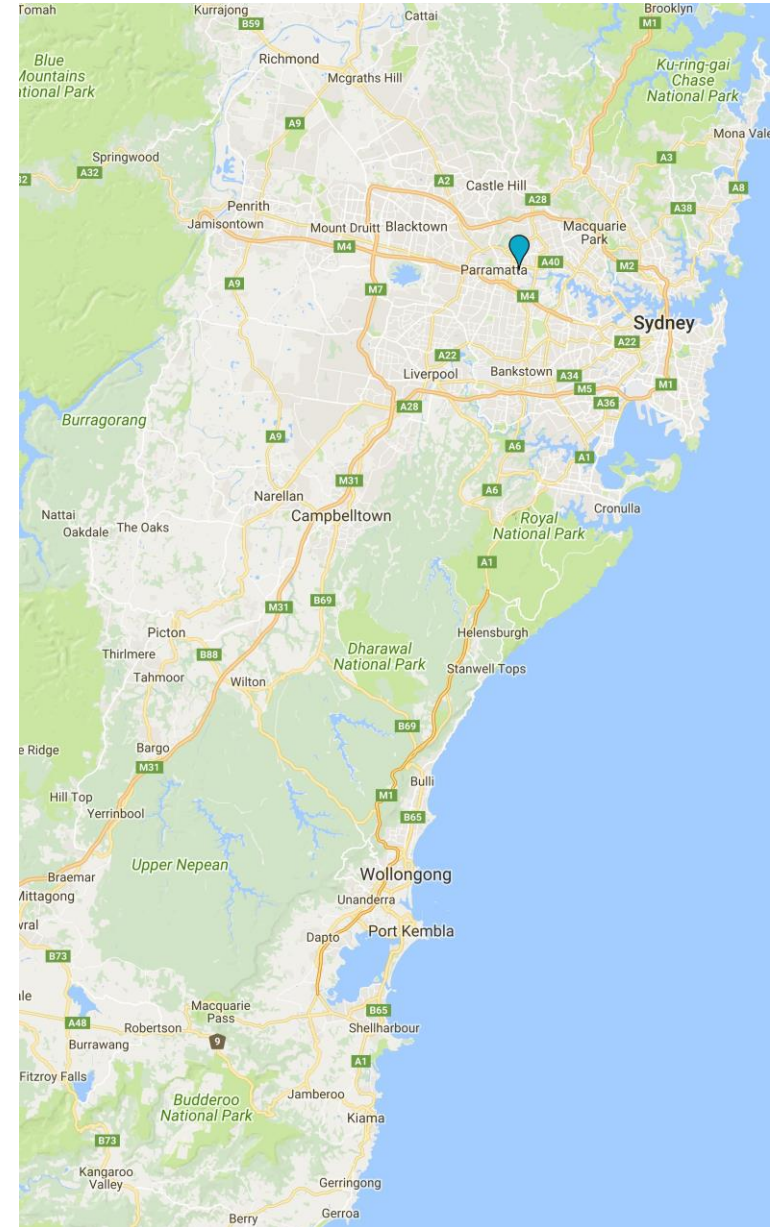
delivering a resource efficient,  
high energy productivity future

Waste Strategy Summit, 28 June 2018

Phil Woods, Service Planning Lead (Energy)

# Question: How many commercial, large scale AD sites in Sydney?

1 (Earthpower)?



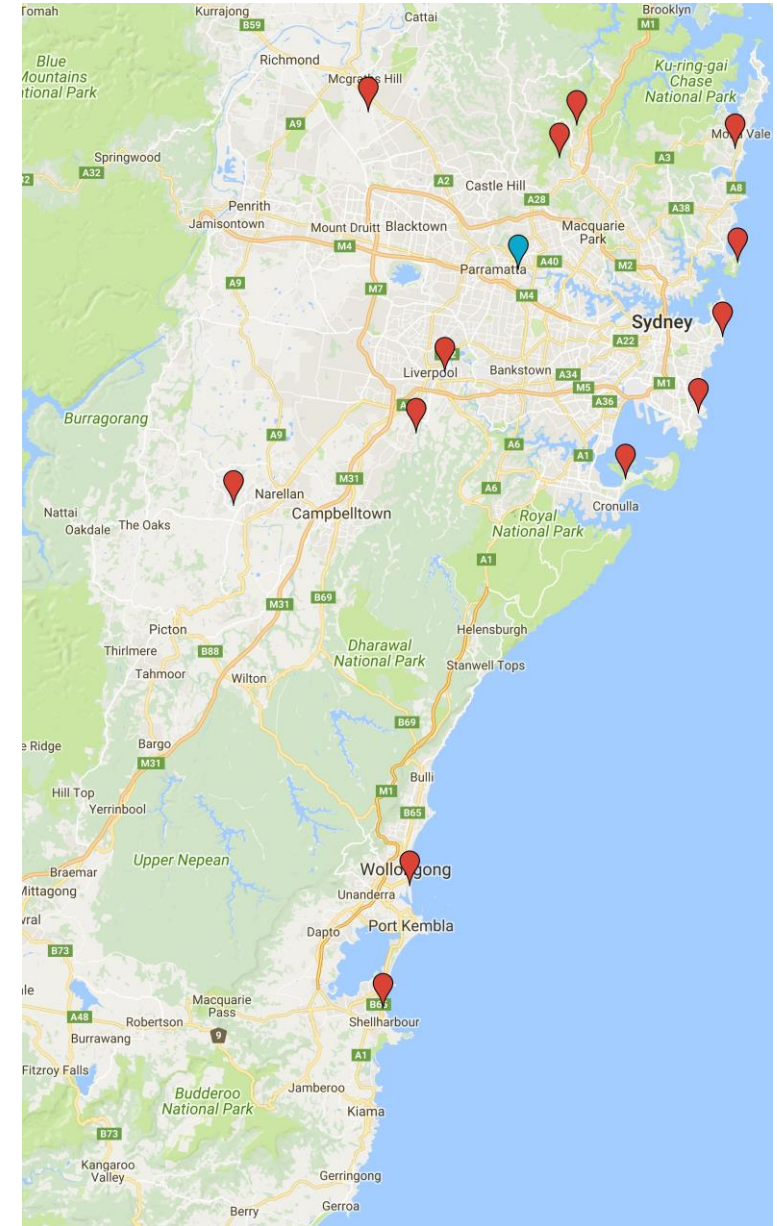
# Question:

## How many commercial, large scale AD sites in Sydney?

Or 14

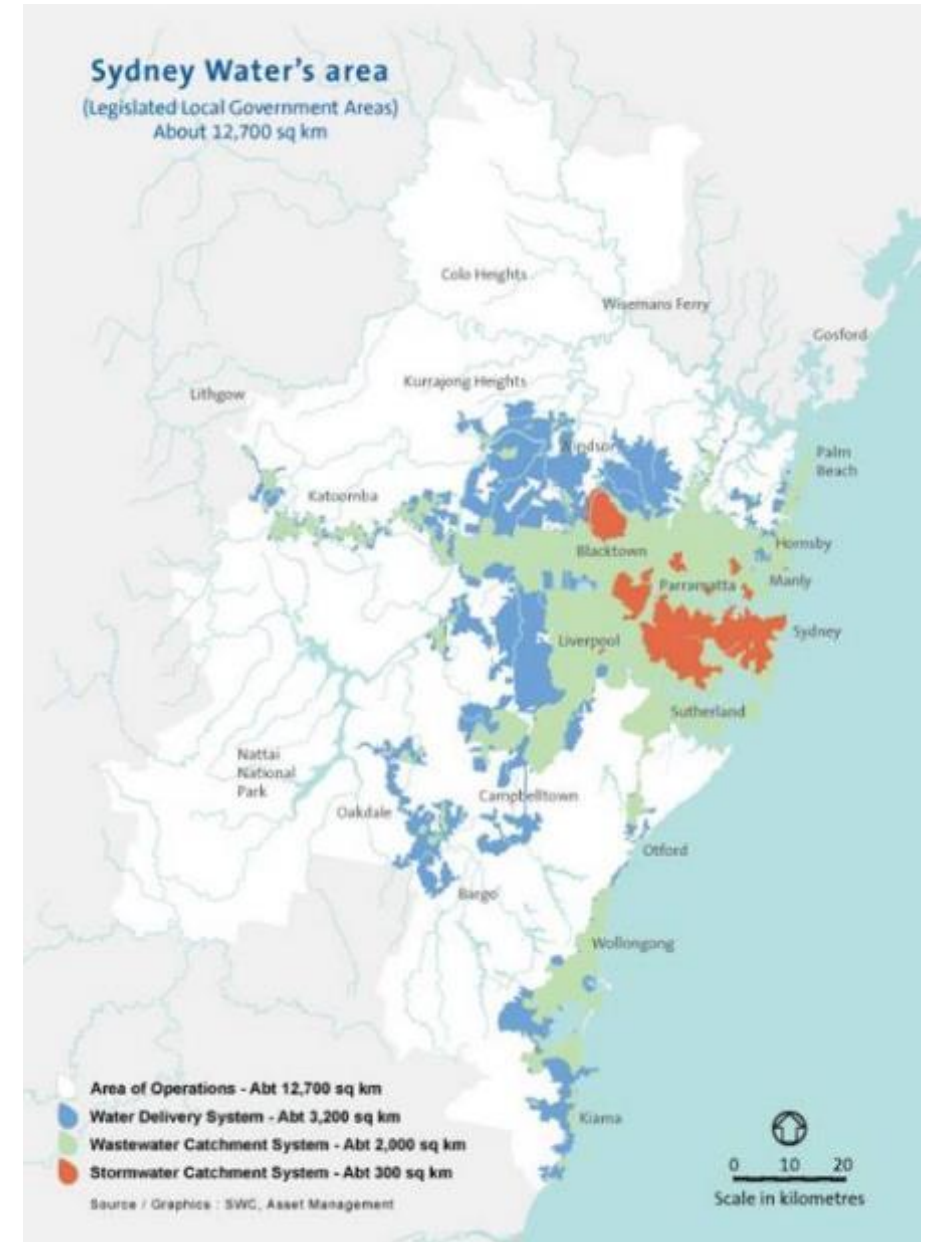
1 (Earthpower) + 13 (Sydney Water)

.....and at least 1 more to come



# Sydney Water

- 💧 4.9 million customers
- 💧 29 wastewater treatment plants
- 💧 1 billion litres of wastewater per day
- 💧 13 anaerobic digestion plants  
– 8 with cogeneration
- 💧 In the top 100 electricity users in Australia
- 💧 Self generate ~20% of our electricity





# Renewable generation



## 💧 Hydro

- Pressure reductions and gravity flows
  - 3 generators in the water and wastewater system
  - 6 MW Installed capacity – 5 GWh in 2016-17
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## 💧 Solar

- Solar PV
  - 160 kW produced 183 MWh in 2016-17
  - Approval for another 160 kW
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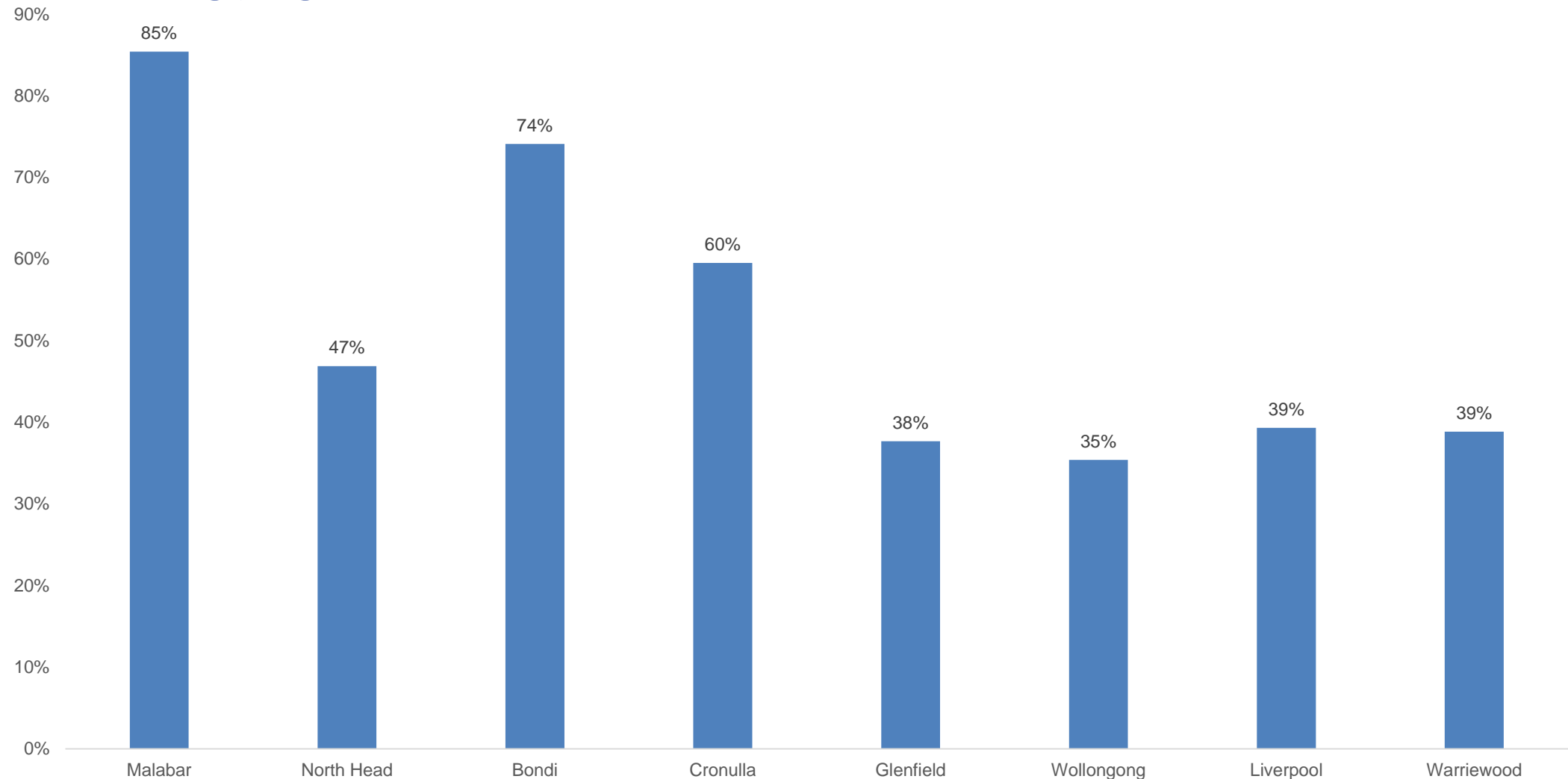
## 💧 Biogas

- Generation using biogas from wastewater treatment
  - 8 wastewater treatment plants
  - 10MW installed capacity – 60 GWh in 2016-17
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**Energy value ~\$15m per year**

# Energy positive wastewater treatment?

Energy generated as a % of total demand (2017)



# Energy Master Plan 2030 Goals

- 💧 Double energy self generation
  - Mostly biogas
- 💧 +4.5MW generation from sewage sludge
- 💧 +4.0MW from food waste

“Sydney Water will:

- Maximise energy recovery potential for all forms of energy, where cost effective
- Accept externally-sourced wastes to increase energy production
- Consider alternatives to on-site electricity generation when recovering energy.”

*Energy Master Plan 2018*

**Energy Master Plan on a Page**

Notes:  
1. Energy includes electricity, gas, heat, fuels.  
2. Electricity is the dominant energy source for Sydney Water.


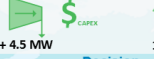




**Planning Vision** (with supporting objectives and aspirational goals)  
 “To be world class in the use and generation of energy to reduce the impact of energy on customer bills, cut waste, eliminate greenhouse gas emissions and decouple from the volatile energy market.”

<b>Minimise energy exposure</b> Reduce exposure to large electricity price increases Have a more reliable energy supply  <i>60% of our electricity costs not exposed to the short-term electricity market by 2030, increasing to 80% by 2050. All key processes not exposed to grid outages by 2030.</i>	<b>Maximise energy productivity</b> World-class energy using and generating water utility Actively manage our energy demand to respond to market opportunities and maintain grid stability  <i>Maintain grid-sourced electricity demand below 1990 levels to 2030. Self-generate 35% of our electricity by 2030.</i>	<b>Contribute to a decarbonised future</b> Reduce our carbon emissions to help meet NSW Government target of net-zero emissions by 2050 Leverage opportunities from a decarbonising energy grid  <i>Net-zero carbon emission sources provide 75% of our electricity demand by 2030 and 100% by 2050.</i>
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**Position statements**

<b>Energy resource recovery</b> Sydney Water will: - Maximise energy recovery potential for all forms of energy, where cost effective - Accept externally-sourced wastes to increase energy production - Consider alternatives to on-site electricity generation when recovering energy	<b>Self-generated renewable electricity</b> Sydney Water will: - Maximise renewable electricity generation potential of our assets, where cost effective - Maximise economic benefit of our generation - Leverage renewable electricity to improve energy security in our system.	<b>Energy efficiency</b> Sydney Water will: - Efficiently use all energy we purchase or generate - Optimise total energy demand and time of use to increase energy productivity - Embed energy efficiency focus into planning, design, operations and maintenance.	<b>Electricity purchasing</b> Sydney Water will: - Limit exposure to electricity price volatility - Preference cost-effective, low carbon sources - Leverage purchasing power as a large energy user to achieve better purchasing outcomes - Maximise income from green certificates - Generate income by participating in demand response to support grid stability.
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**Planning needs**

<b>Food waste digestion</b> Assess feasibility of co-digestion at all (current or potential) anaerobic sites  +\$gate fee	<b>Cogeneration and Hydro</b> Assess feasibility of expanding cogeneration and hydro capacity at existing and new facilities  + 4.5 MW	<b>Solar and wind</b> Assess feasibility of installing large scale solar or wind on Sydney Water assets / land  13.5 MW	<b>Energy efficiency in design and operations</b> Assess viability of achieving best practice energy design and operational benchmarks  - 37 GWh/yr	<b>Power purchase agreement (PPA)</b> Secure PPA with renewable energy generator to hedge electricity prices  130 GWh/yr	<b>Demand response</b> Assess ability for demand response for high energy consuming assets  + \$14k/MWh + \$130k/MWh
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**Procedures/Guidelines**

<b>Maximising energy productivity</b> Productivity guideline for planners and designers of infrastructure	<b>Codigestion waste selection</b> A model to estimate resource impacts for different wastes	<b>Viability of energy projects</b> Method to determine viability based on forecast electricity prices
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**Decision frameworks**

<b>Electricity procurement strategy</b> Purchasing method for grid-sourced electricity
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**Knowledge improvement**

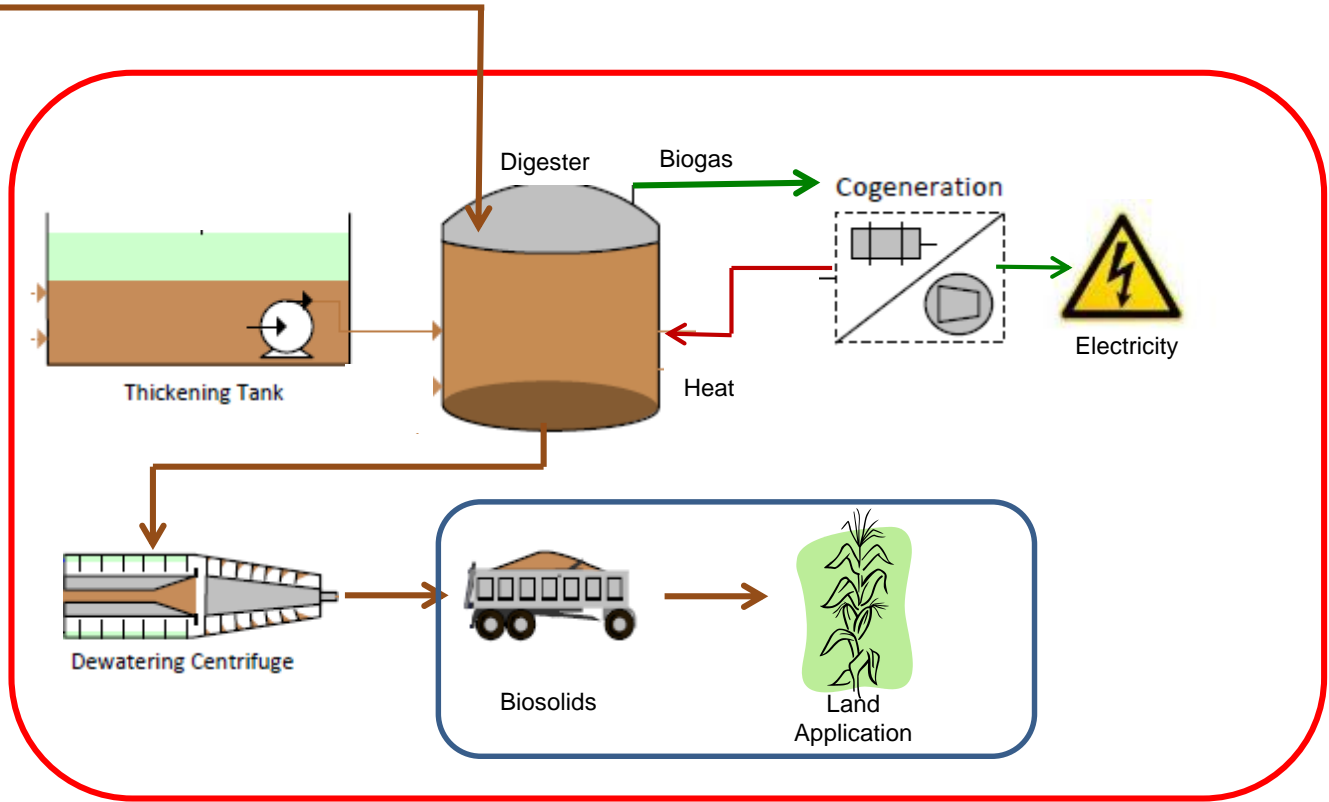
<b>International best practice benchmarks</b> Design benchmarks to drive best practice design and operations	<b>Energy technology roadmap</b> Guidance on application of best practice technologies	<b>Energy storage</b> Guidance on application for cost minimisation / improved reliability	<b>Mechanisms for energy export</b> Quality commercial options for maximising value of exports	<b>Energy Management System</b> ISO50001 compliant to drive improved data, reporting and assessment	<b>Alternate uses of biogas</b> R&D on the economics of biomethane export
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# Co-Digestion

Converting organic (food) waste to energy and fertiliser



Food waste





# Combining research with trials as the basis for moving forward



# Bondi Glycerol Pilot

- 💧 12 month trial completed in 2016
- 💧 Learn about waste handling and co-digestion dosing regimes
- 💧 Increased biogas production



# Cronulla Commercial Food Waste

- 💧 Pulped fruit and vegetable waste

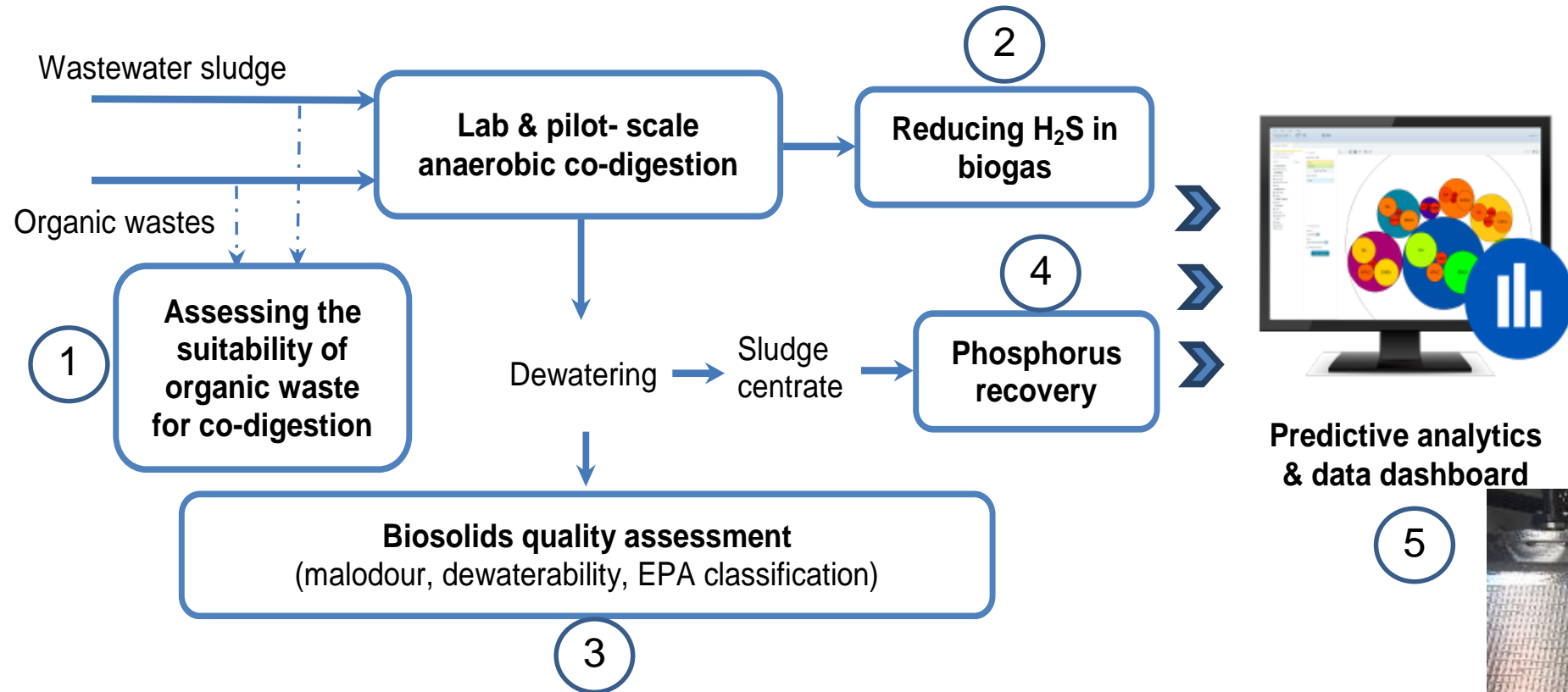
- 💧 Averaging 10kL per day

- 💧 Commenced October 2016



# Shellharbour R&D

## Australian Research Council linkage project



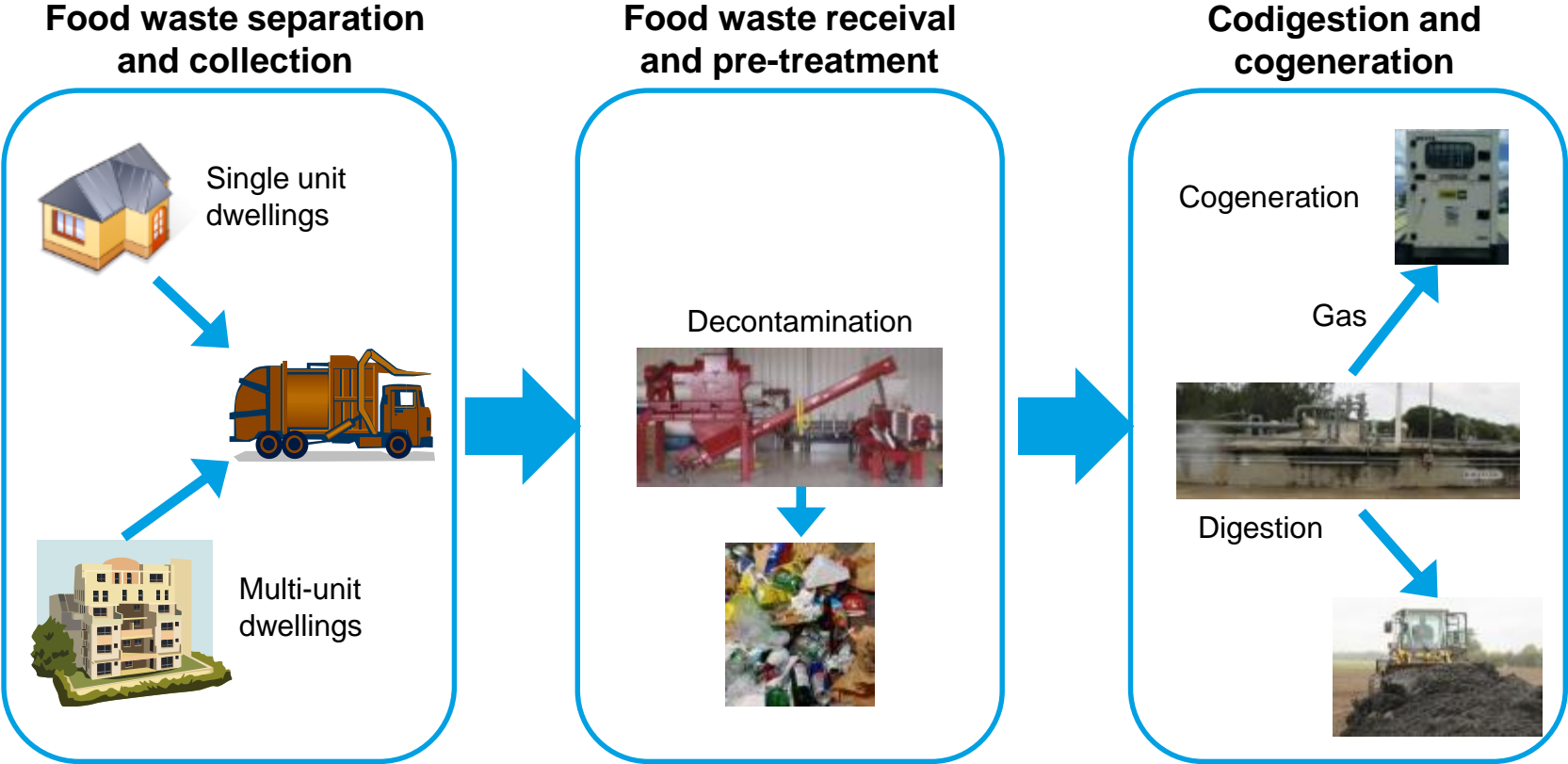
In partnership with Wollongong University & DC Water





# Malabar Food Waste Feasibility

Partnership with Randwick City Council (2014)



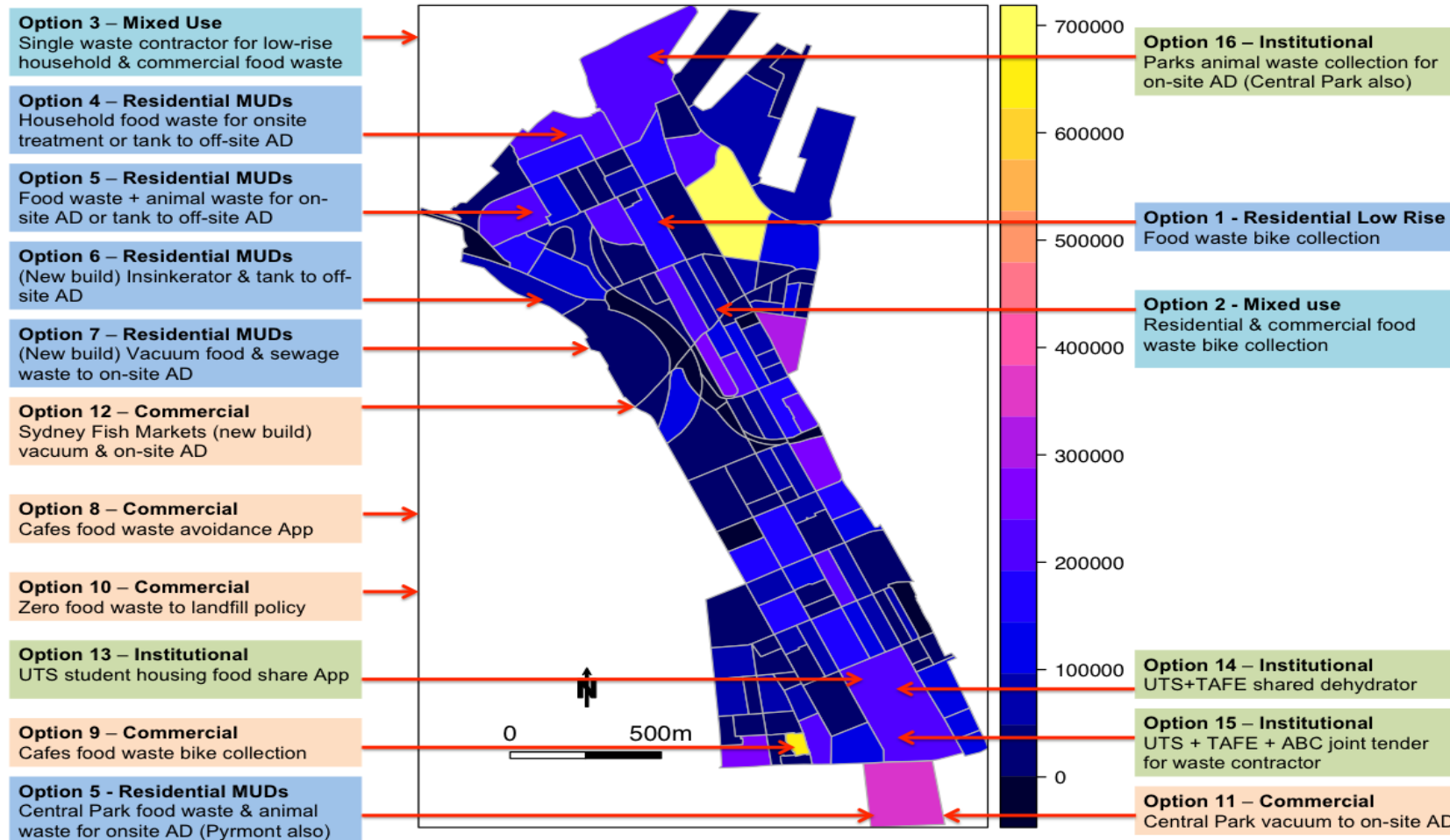


# Pymont Ultimo Precinct

Funded by Sydney Water and NSW EPA (2017)

Conducted by the Institute for Sustainable Futures

Total surveyed organic flows at mesh block scale [kg]



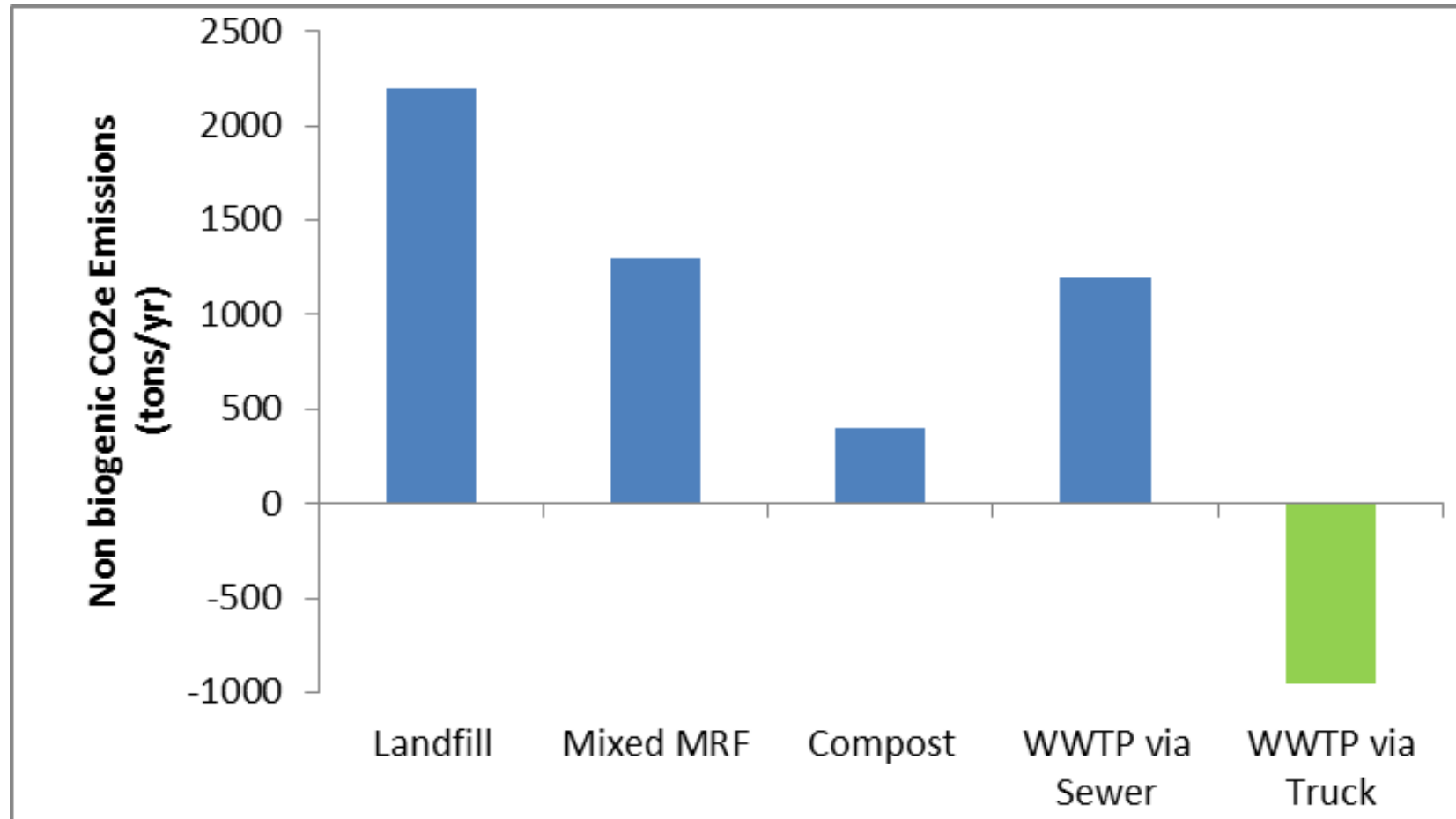
# Why food waste at WWTPs?

- 💧 Financial win-win
- 💧 Diverts high strength organics from land-fill, soil injection or sewers
- 💧 Existing, decentralised infrastructure
- 💧 High on-site energy demand
- 💧 Maximise resource recovery
  - Renewable energy generation
  - 100% re-use of biosolids
- 💧 Lowest carbon emissions



# Comparison of alternatives to landfill

## Carbon emissions



Water Environment Research Foundation (WERF), 2012

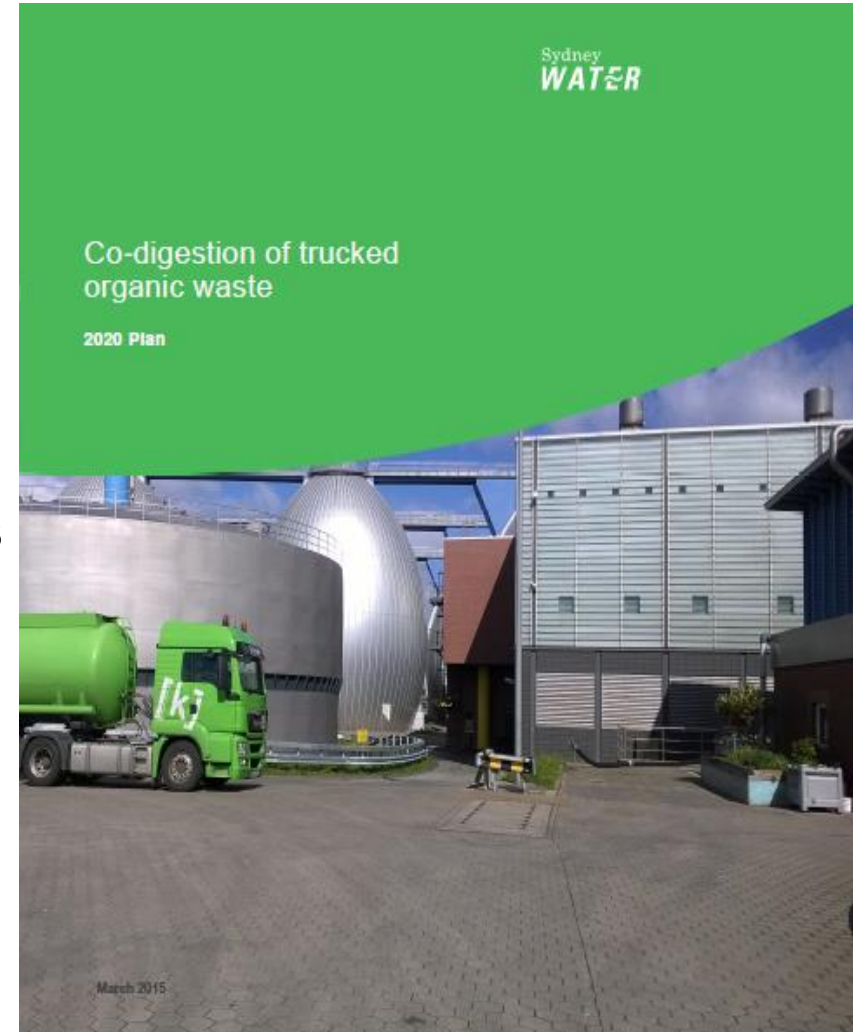
# Challenges and next steps

## Challenges

- 💧 Removing the historical silos between the solid waste and wastewater sectors
- 💧 Further engagement and partnerships
  - city planning, waste operators, local government, others
- 💧 Source control
- 💧 Combining regulated and unregulated businesses

## Next steps

- 💧 Continue building our knowledge & experience
- 💧 Identify new opportunities and integrate into our planning
- 💧 Assess potential business models





CO-LOCATION OF INDUSTRIES TO RECYCLE WATER + WASTE AND PRODUCE ENERGY

INTEGRATED APPROACH TO WATER MANAGEMENT AND CITY PLANNING

WATER-SENSITIVE URBAN DESIGN



WATER SUPPORTING A STRONG ECONOMY



RIVER CITY

HARBOUR CITY

GARDEN CITY

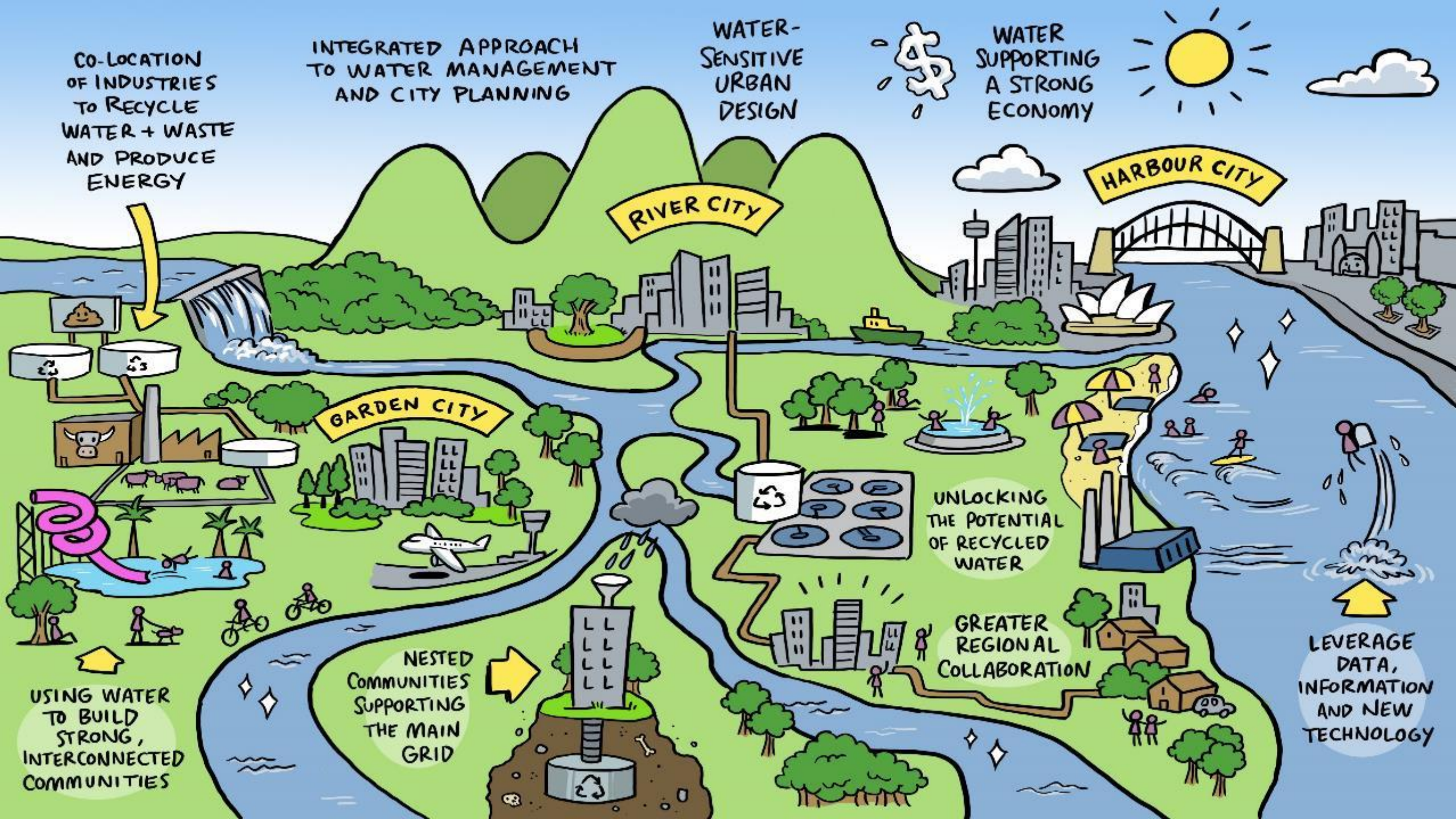
UNLOCKING THE POTENTIAL OF RECYCLED WATER

GREATER REGIONAL COLLABORATION

LEVERAGE DATA, INFORMATION AND NEW TECHNOLOGY

USING WATER TO BUILD STRONG, INTERCONNECTED COMMUNITIES

NESTED COMMUNITIES SUPPORTING THE MAIN GRID

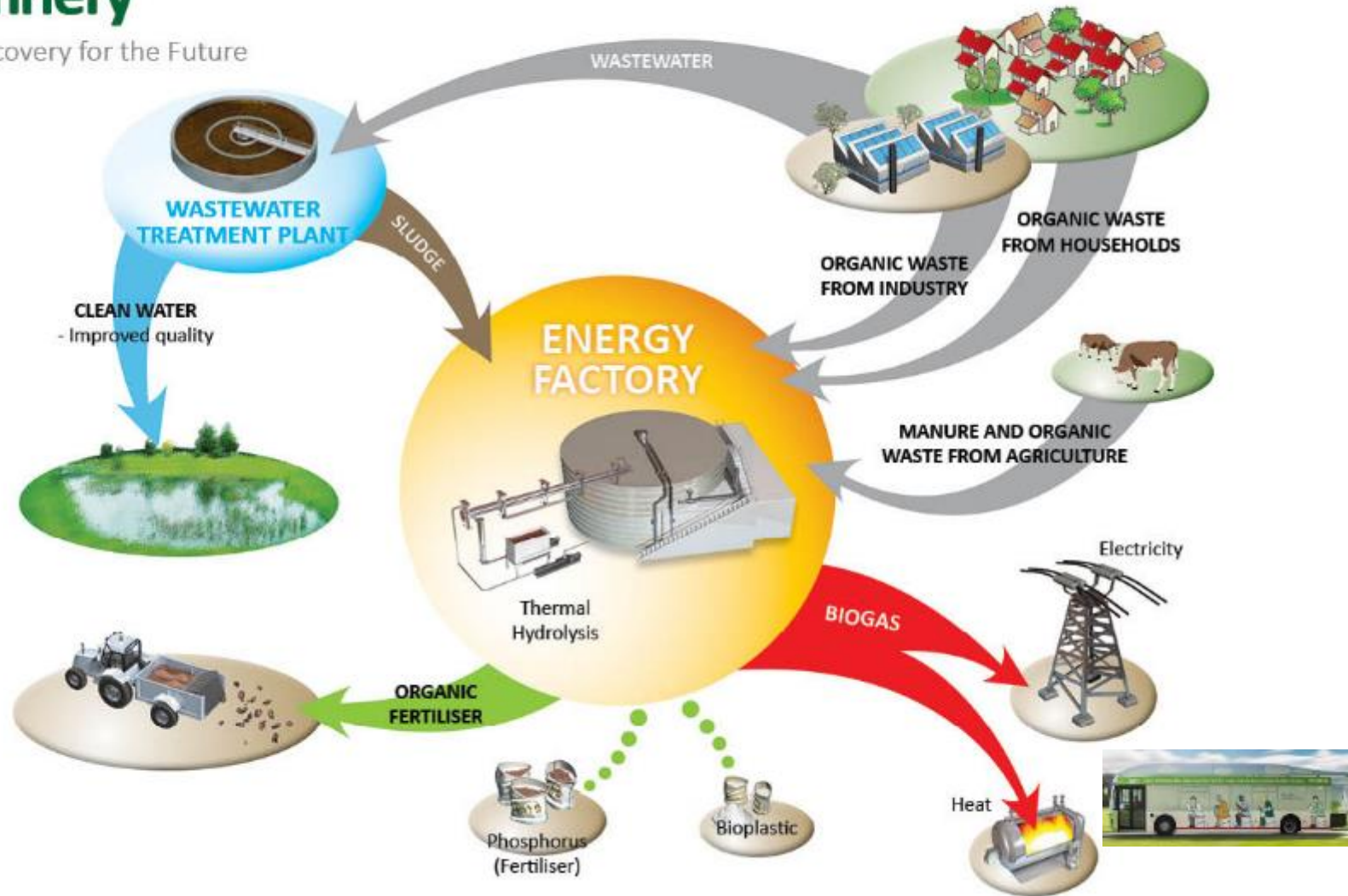




# The plant of the future?



Resource Recovery for the Future



# Questions?

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