Optimising Energy Recovery from Waste

Association of Public Sector Excellence

John CA Stewart,

B9 Organic Energy International Ltd

Prequel

People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices.

Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*

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Prequel

- **Adam Smith -** *'The real tragedy of the poor is the poverty of their aspirations'***.**
- *'Science is the great antidote to the poison of enthusiasm and superstition'.*
- **It's from this last premise that I hope to approach the energy and waste linkage today**

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Relevance of these quotations in an energy and waste context?

- We need meeting of minds to appreciate the link between energy and waste
- We need government to grasp the need for urgent action on technology introduction
- We need to lift our aspirations in order to optimise that change
- In the context of the foregoing, how can we optimise our technological opportunities and make the right decisions for change?

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Overview

- What are the elements of waste from which energy can be recovered?
- What are the various means of recovering energy from waste and what are their relative efficiencies?
- How can we achieve excellence in Scotland in optimising our resources?

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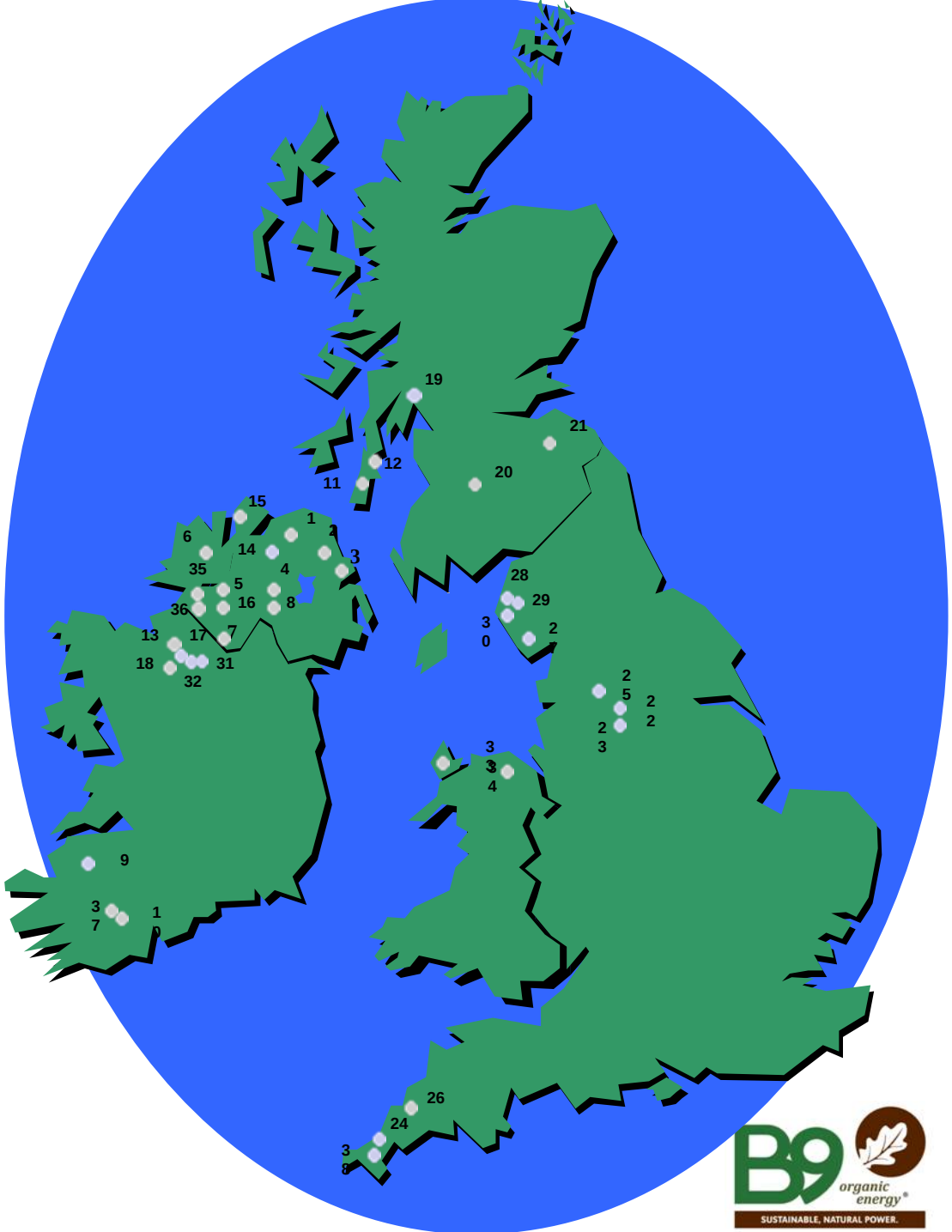
RES / B9 Energy

B9 Energy O&M Ltd managed wind farm sites in UK and Ireland



40 wind farms

>600 wind turbines

>400 MW

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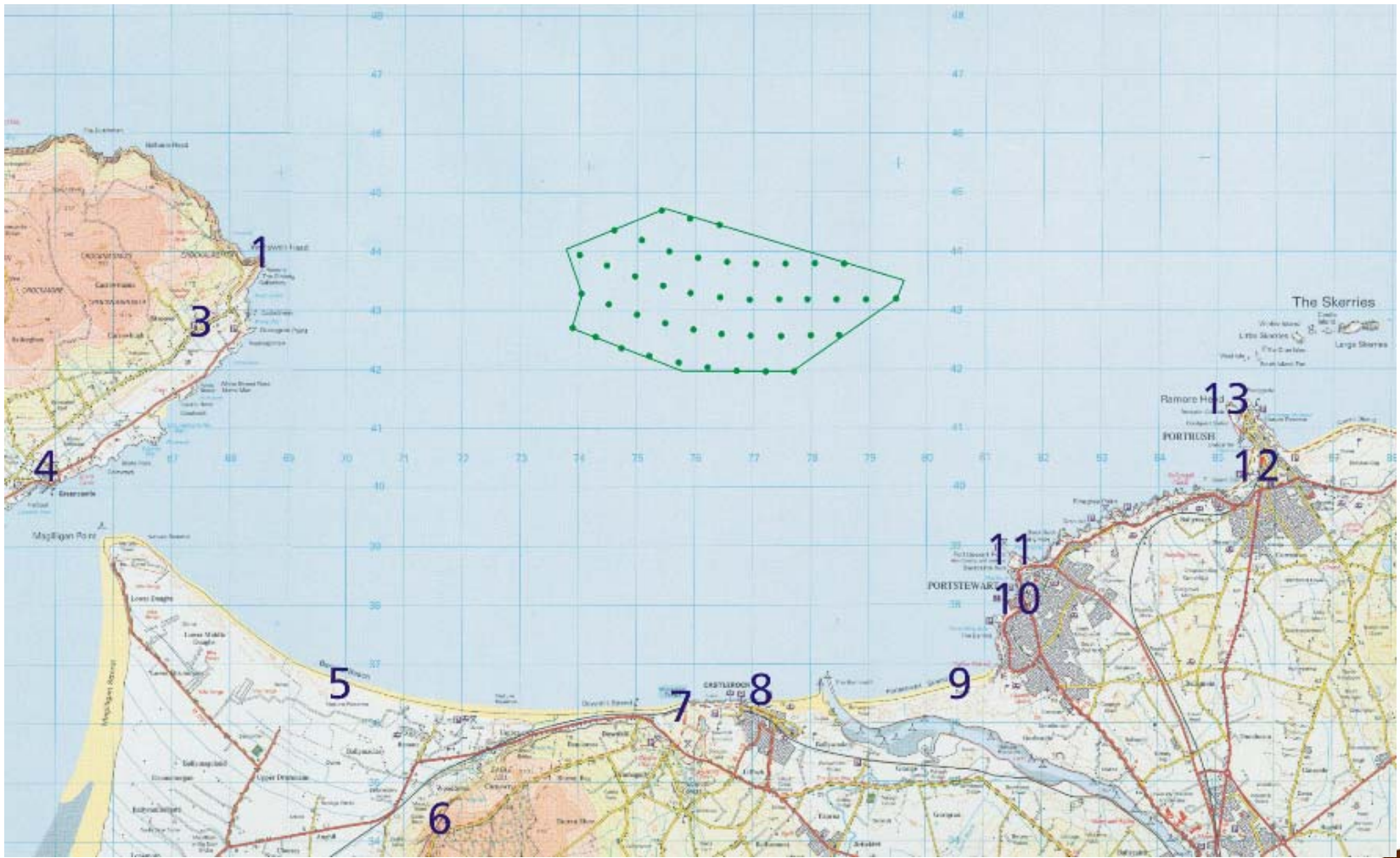
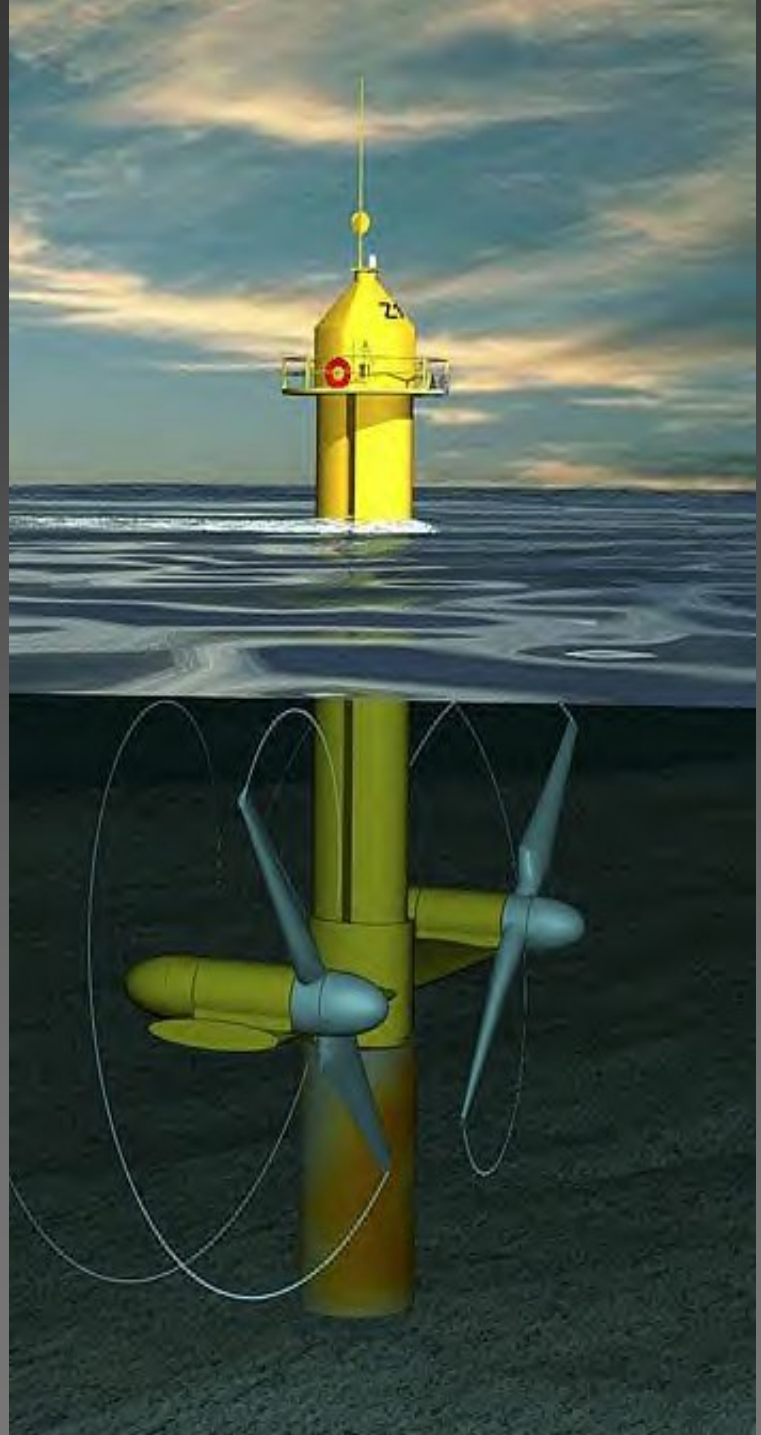
Offshore – 150 MW
Tunes Plateau





And Now . . ..

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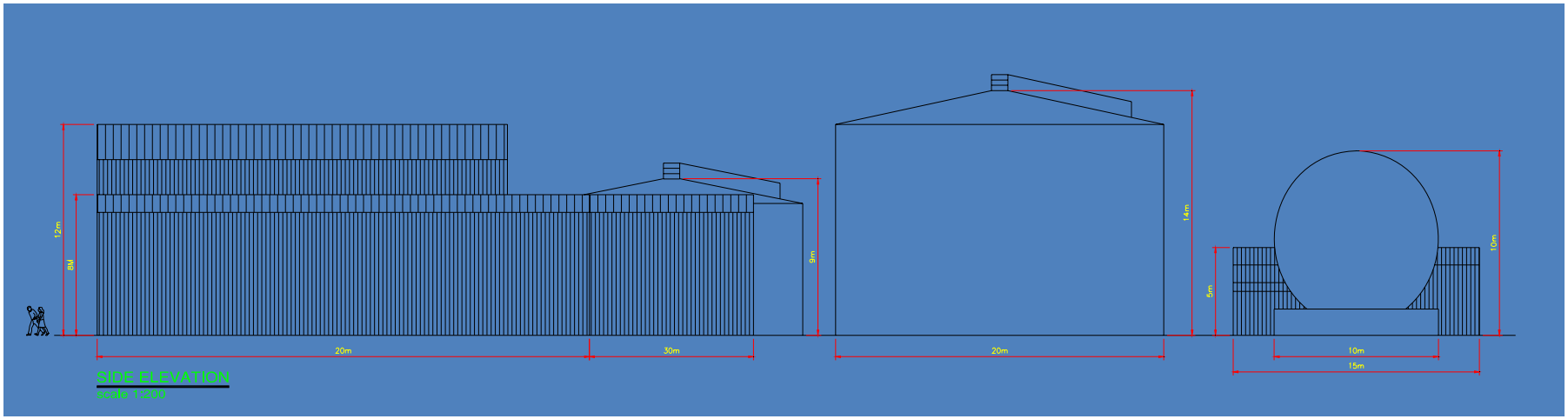
Energy from Waste through:

1. Landfill gas development
2. AD waste treatment facilities
3. Government sponsored research project to enhance AD efficiency.

Examples of AD plant

Side View



- Typical 50,000 tpa plant
- Footprint approximately 2 acres of land

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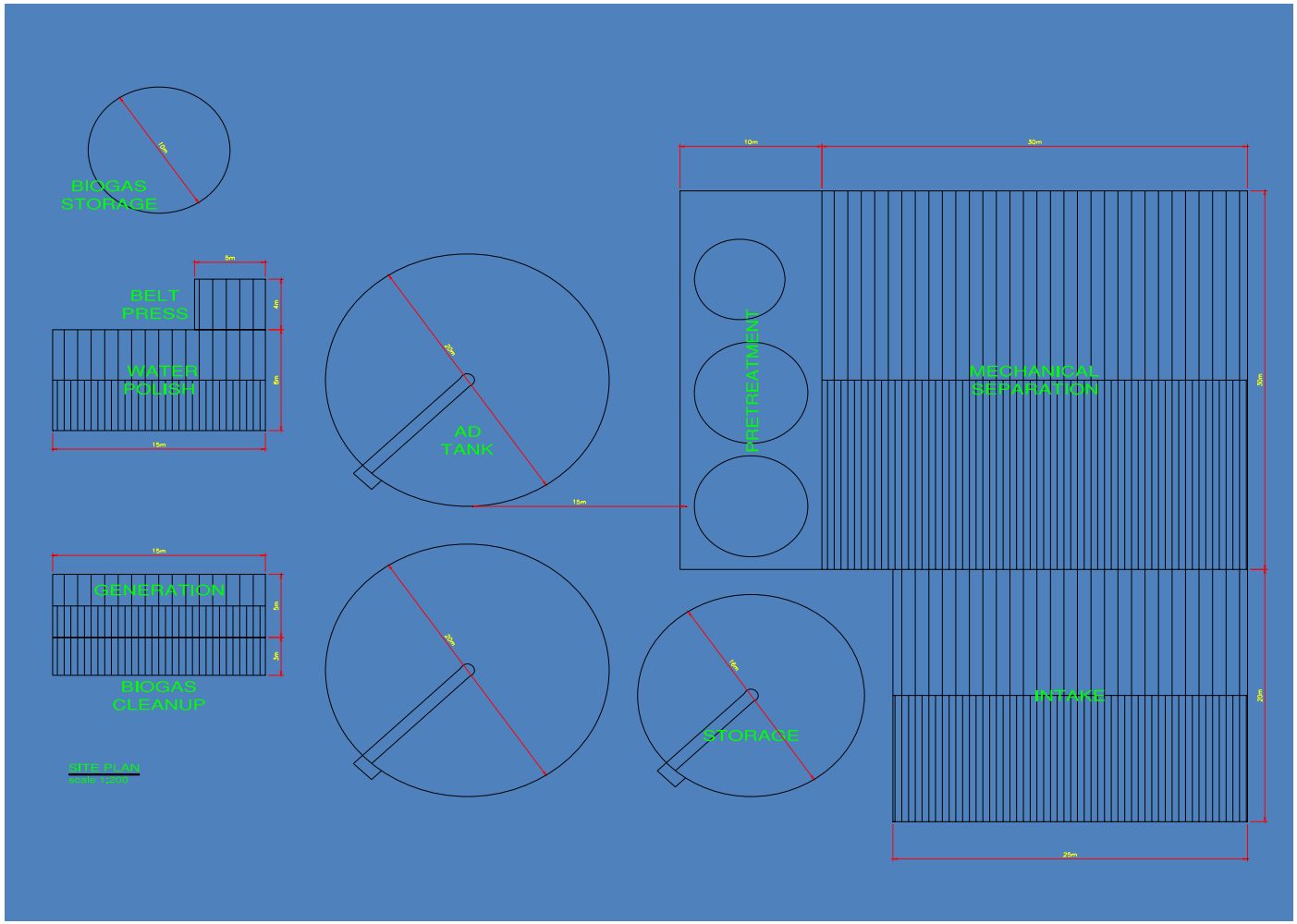
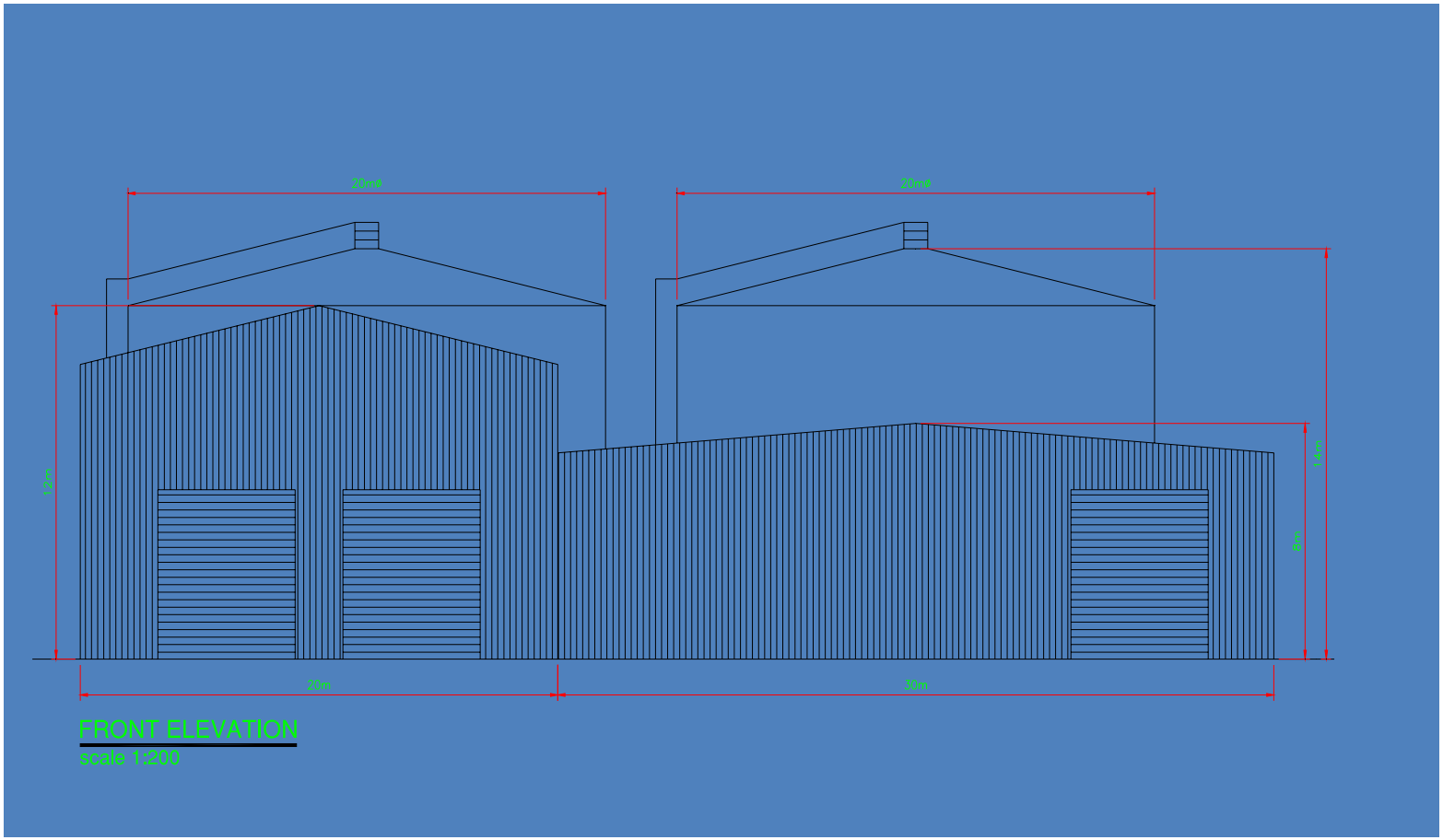
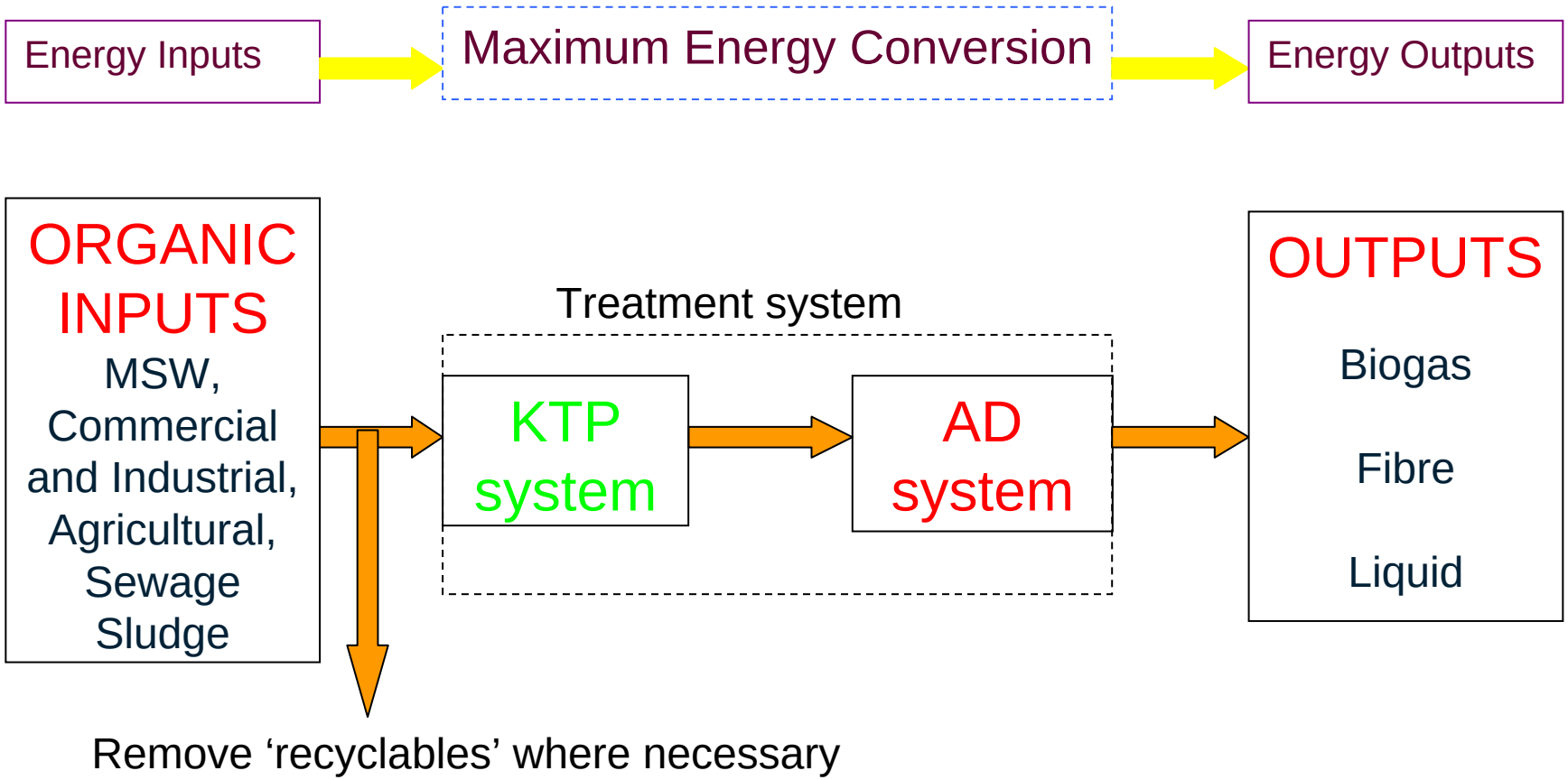
Site Plan


BIOGAS STORAGE
BELT PRESS
WATER POLISH
AD TANK
PRETREATMENT
MECHANICAL SEPARATION
GENERATION
BIOGAS CLEANUP
STORAGE
INTAKE
SITE PLAN

Front View



Research Project



What elements of Municipal waste provide energy recovery opportunity?

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The Origins of waste resources

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Look at the origins of the waste – the origins of all things

- Rocks and ores –metals, aggregates, glass – non-combustibles or non-biodegradable
- Forest – wood, paper – combustible and biodegradable
- Farm – all food – combustible and biodegradable
- Oil well – fuels, plastics - combustible

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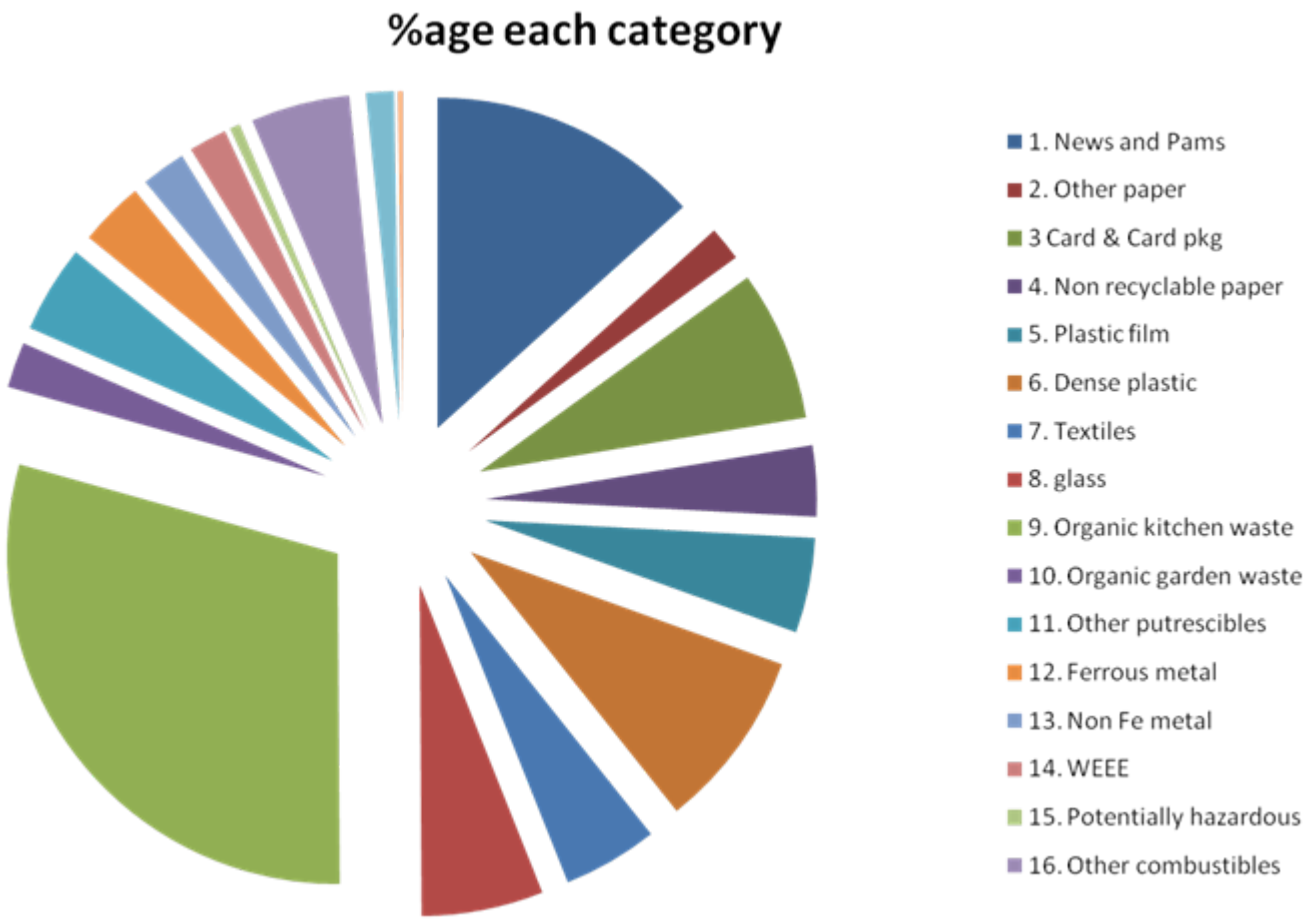
Constituents of waste?



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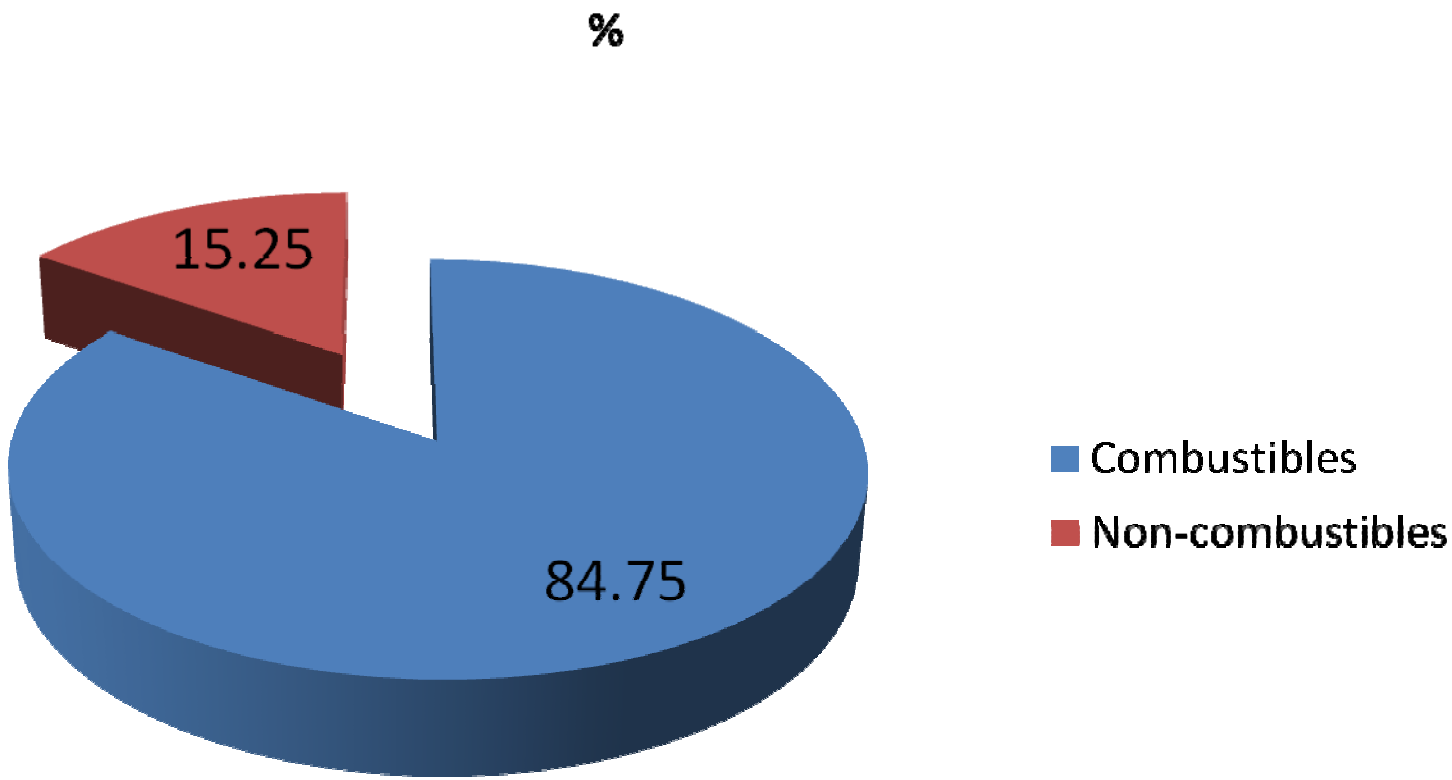
Combustibles



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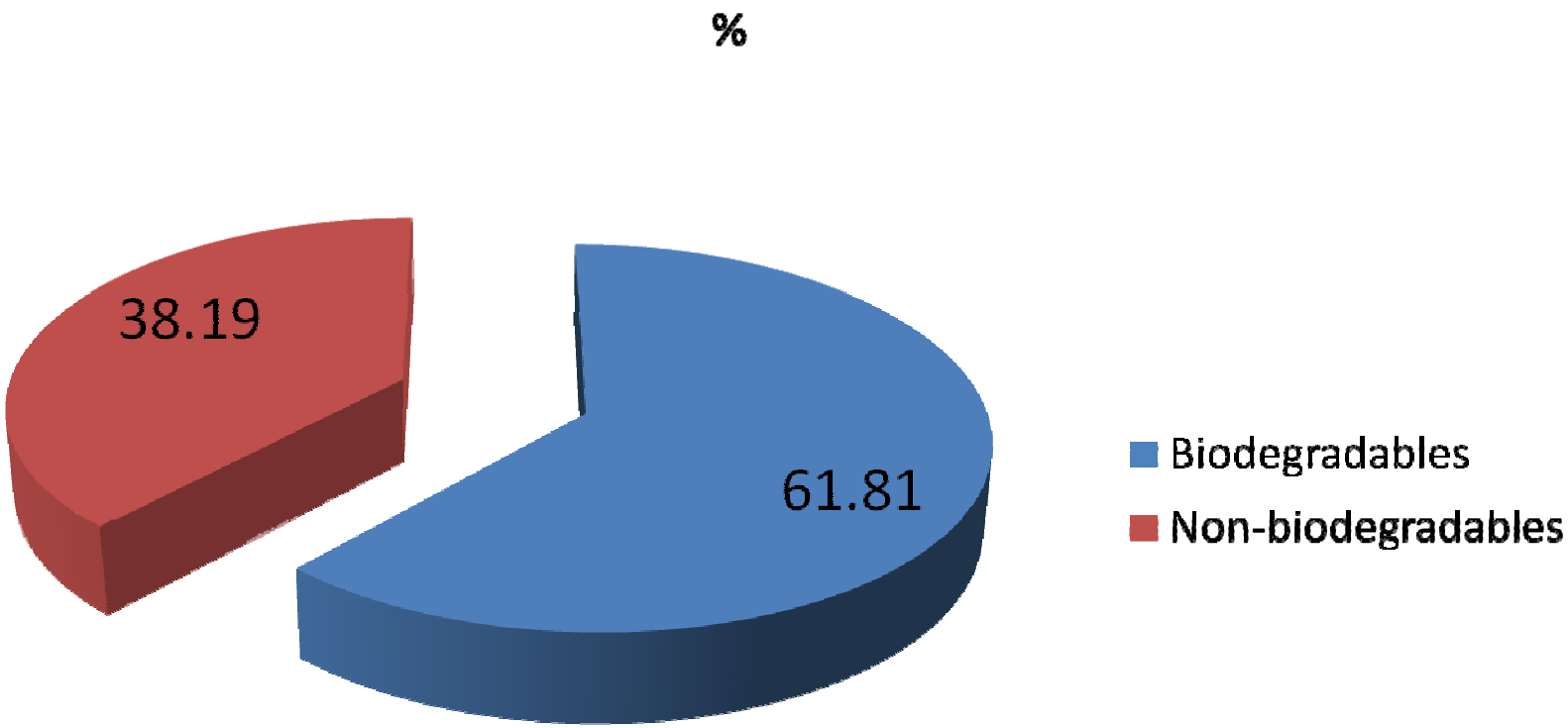
Biodegradables



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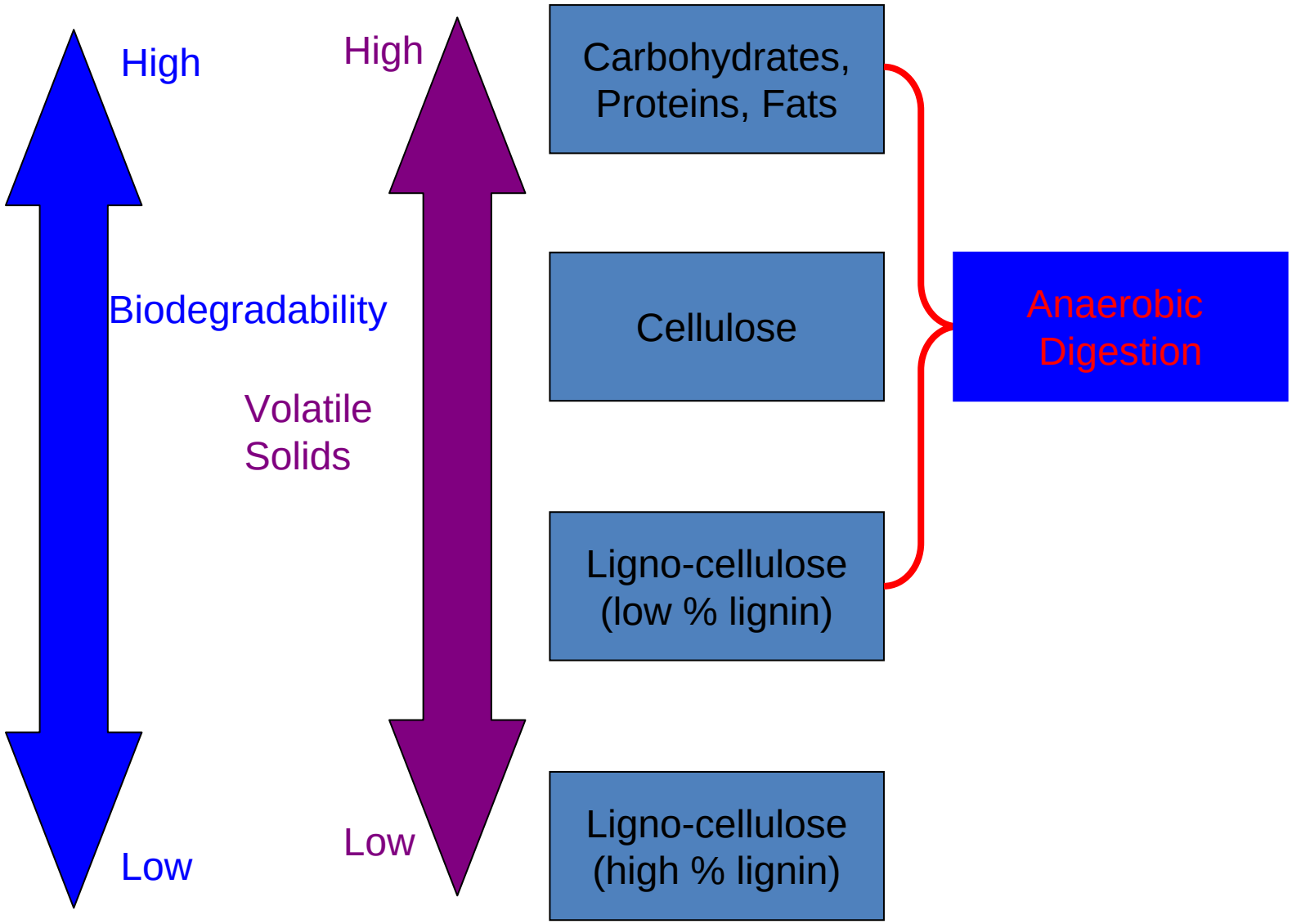
Organic Wastes – Natural Compounds



What are the energy values of the constituents?

- Plastics have similar calorific value to oil and have, arguably the greatest need for optimisation, being non-renewable
- The organic fraction or BMW is over 60% by weight but much of that weight is water
- Plastics therefore, can be combusted with net energy output
- In order to drive off the moisture in BMW, large energy inputs are required – **“burning water”**
- E.g. Sewage sludge: >10MW in – 1MW out

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Means of recovering energy from waste

- Thermal treatment
- Anaerobic digestion
- Are there synergies between these technologies and are there conflicts?
- What are the relative economic implications?

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The efficiency equation

- Overall efficiency =
- % of feed used in process (proportion into process) X
- % converted by process (proportion burnt) X
- % efficiency of process (boiler efficiency) X
- % efficiency of drive (turbine) X
- Correction for power used on site

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Efficiency comparison 1

Using MSW

	% available for process	% converted	% efficiency process	% efficiency drive	% Consumed on site	% Overall efficiency	Efficiency based on what used	KWhr/Te	What is left
Incineration	100	98	79	32	15	21.1	21.1	526.5	Got an ash
AD current	62	55	89	40	15	10.3	16.6	258.0	Got a sludge
AD Future	62	85	89	40	15	15.9	25.7	398.7	Soil coditioner + recyclate or 950 KWhr of energy

Efficiency Comparison 2

Using food waste

	% available for process	% converted	% efficiency process	% efficiency drive	% Consumed on site	Overall efficiency	Efficiency based on what used	KWhr/Te	What is left
Incineration	100	98	74	32	15	19.7	19.7	167.1	Got an ash (warning low furnace temp)
AD current	98	55	89	40	15	16.3	16.6	138.1	Got a sludge
AD Future	98	85	89	40	15	25.2	25.7	213.5	Soil coditioner + recyclate or 17 KWhr of energy

Conclusions on efficiency

- Efficiency depends on what you put in.
- No single favourite.
- Non of the efficiencies shown are what we need!
- Cannot rely on electricity alone!
- Need to beneficially use by product heat.
- Advanced AD uses some of heat for the MRF.
- What is key is that plant is at a scale where heat can be used! (Small or integration is beautiful)

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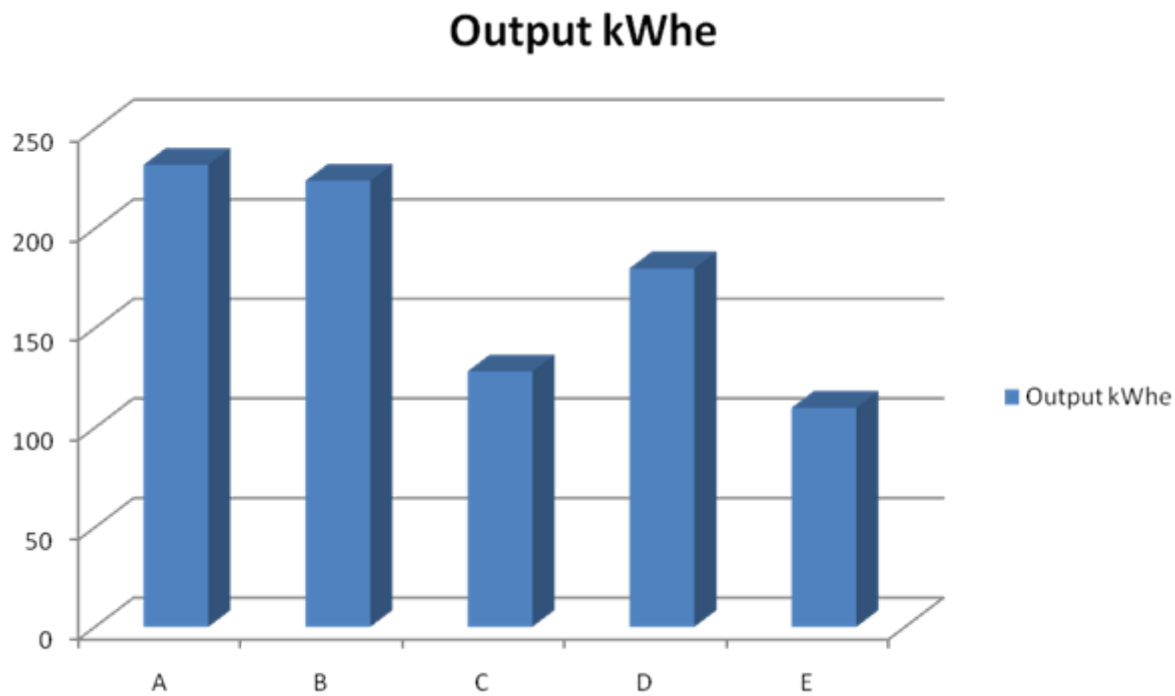
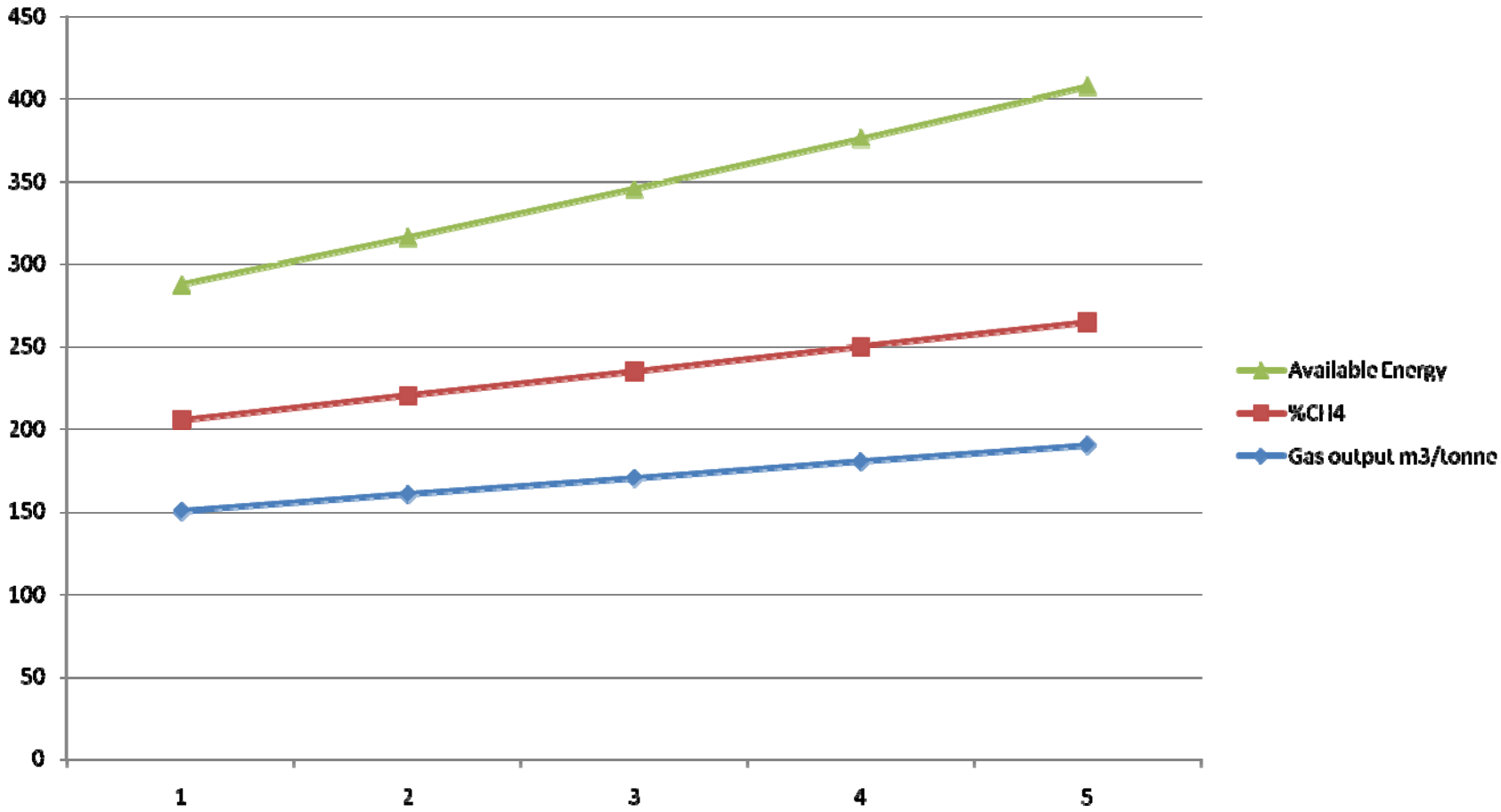
What are their relative efficiencies?

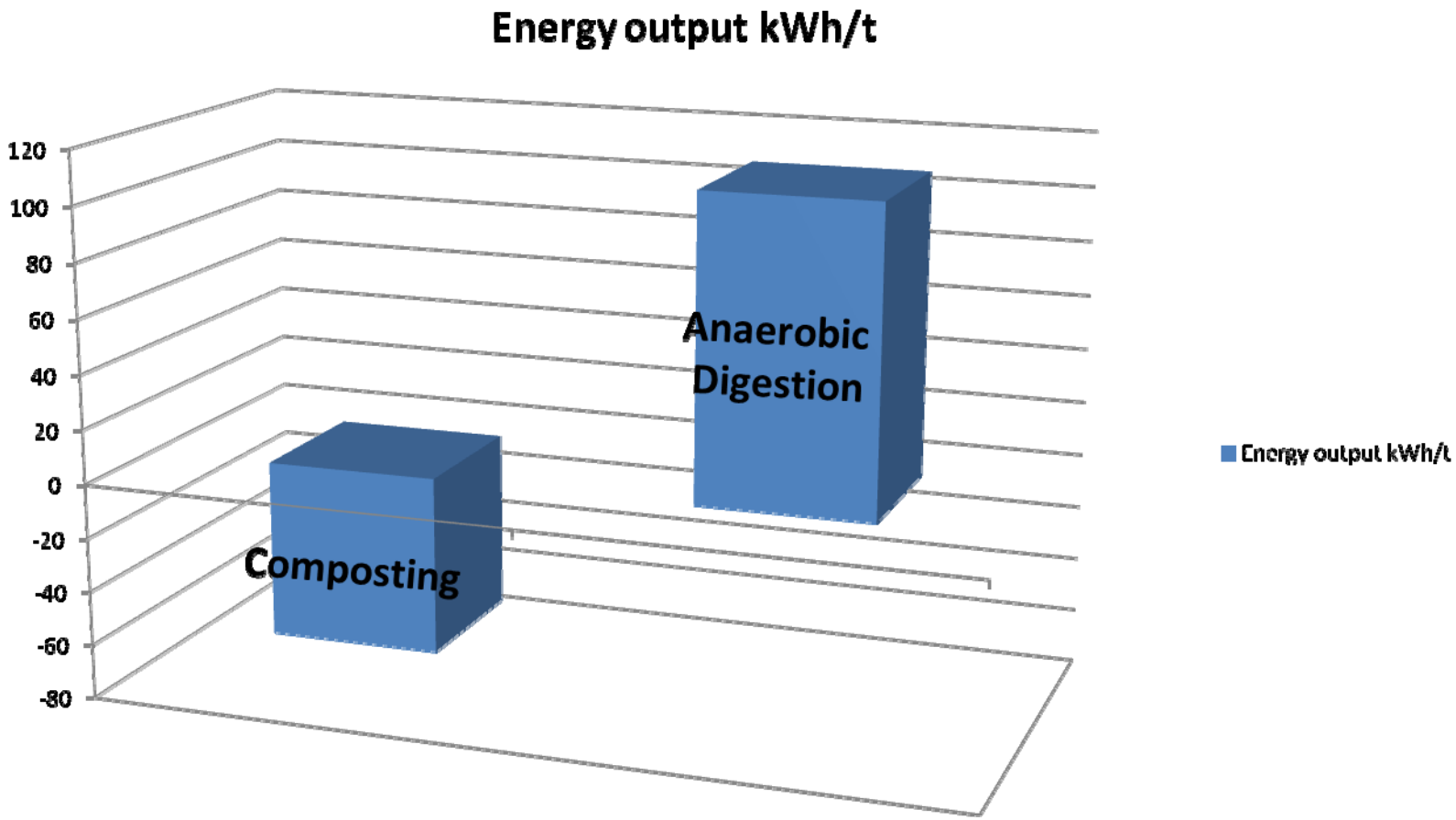
Anaerobic Digestion



What are their relative efficiencies?



Energy efficiency:
AD versus Composting



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How can we achieve excellence in Scotland in optimising our resources?

- Do we just tick boxes for “job done” or do we tick the box “excellence achieved”?
- What are the economic implications?
  - AD versus Incineration –
  - £50-£60 per tonne versus £80-£120 per tonne

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Conclusion

- Make the right decisions based on science not expediency
- Oil at $200 per barrel within 3 years – Adam Smith again – the Laws of Supply and Demand. ***Eddie O'Connor, Airtricity***
- Get some plants built
- Build it and they will come!

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Thanks for the invitation

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