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DWHR IN COMMERCIAL KITCHENS: THE CASE OF PENRHYN CASTLE, WALES

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Llywodraeth Cymru
 Welsh Government



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INTRODUCTION

- Hospitality and food services is a large water consumer:

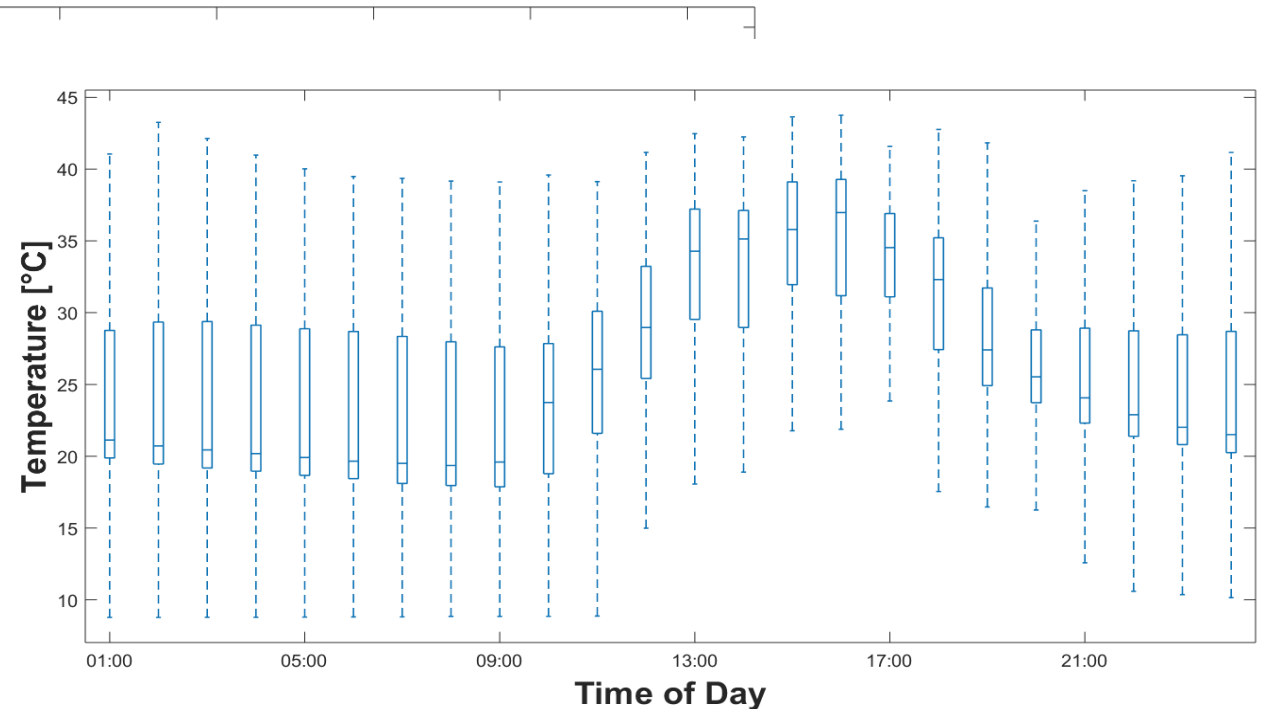
	Water consumption (M m ³ /yr)	Energy consumption (TWh/yr)
Hospitality and Food services in the UK	153.7 – 158.8	16.2
Total food and drink industry in the UK	347.3 – 366.4	37

- How much heat is still embedded in the drain water leaving the kitchen
 - How much of this heat is recoverable in a financially attractive way.
 - What would be the benefit of recovering this heat:
 - * Financially
 - * Environmentally

MEASURED DATA IN THE HOSPITALITY SECTOR



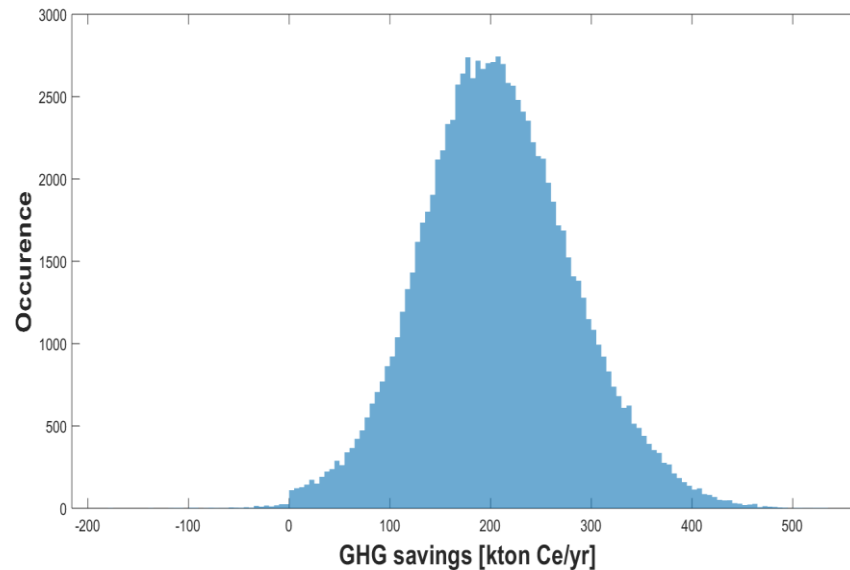
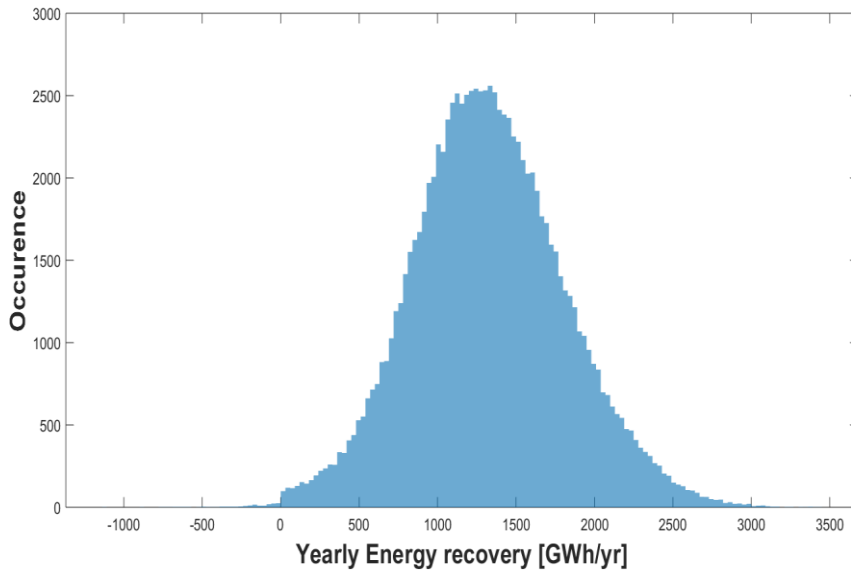
Measured at Penrhyn castle, Wales



TOTAL POTENTIAL IN THE SECTOR

Total potential in the food and services sector in the UK

	Water consumption (M m ³ /yr)	Heat recovery potential (TWh/yr)	Potential Ce savings (k tons/yr)
Hospitality and Food services in the UK	153.7 – 158.8	1.32 – 1.37	206-213

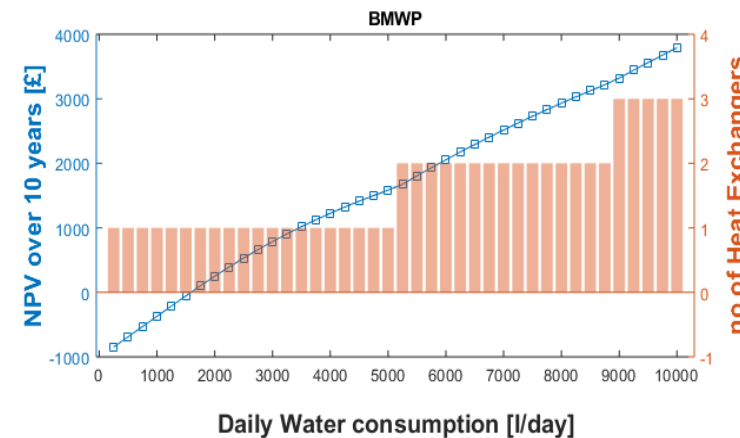
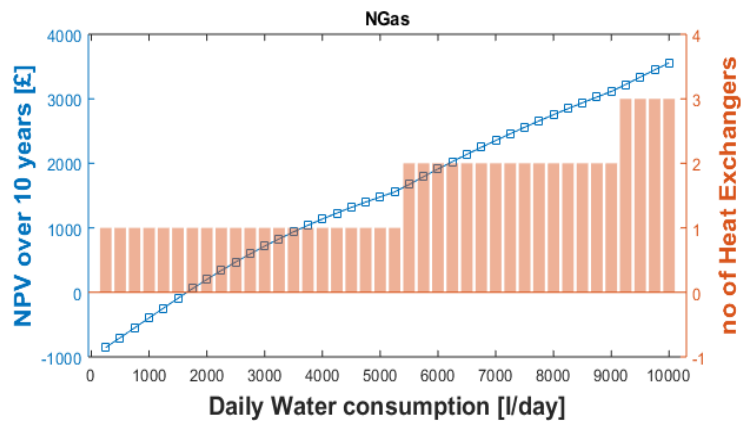
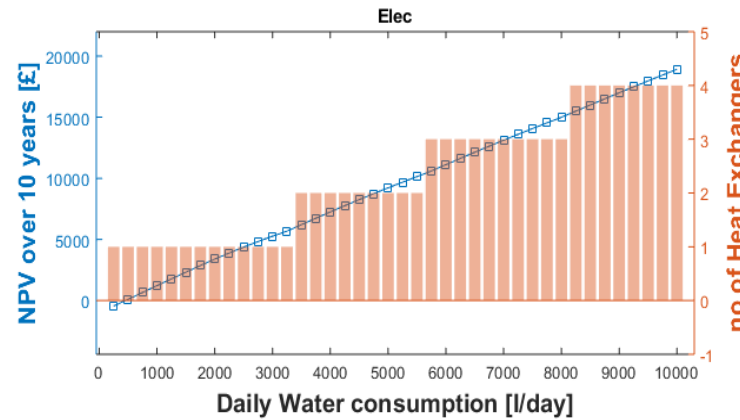
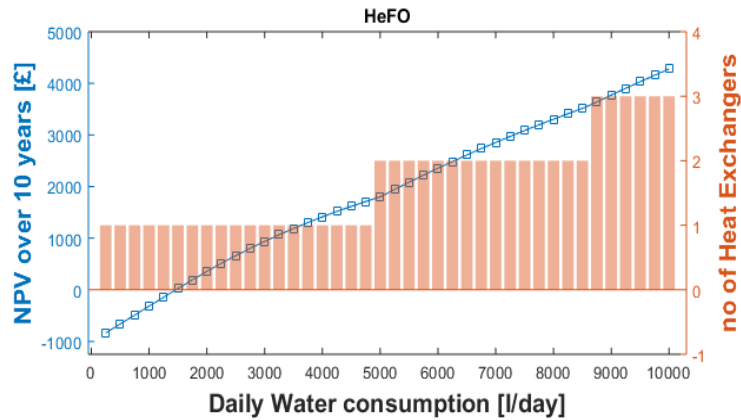


→ What share of this heat is recoverable in a financially attractive way?

→ What are the benefits of recovering this heat?

FINANCIAL FEASIBILITY IN THE SECTOR

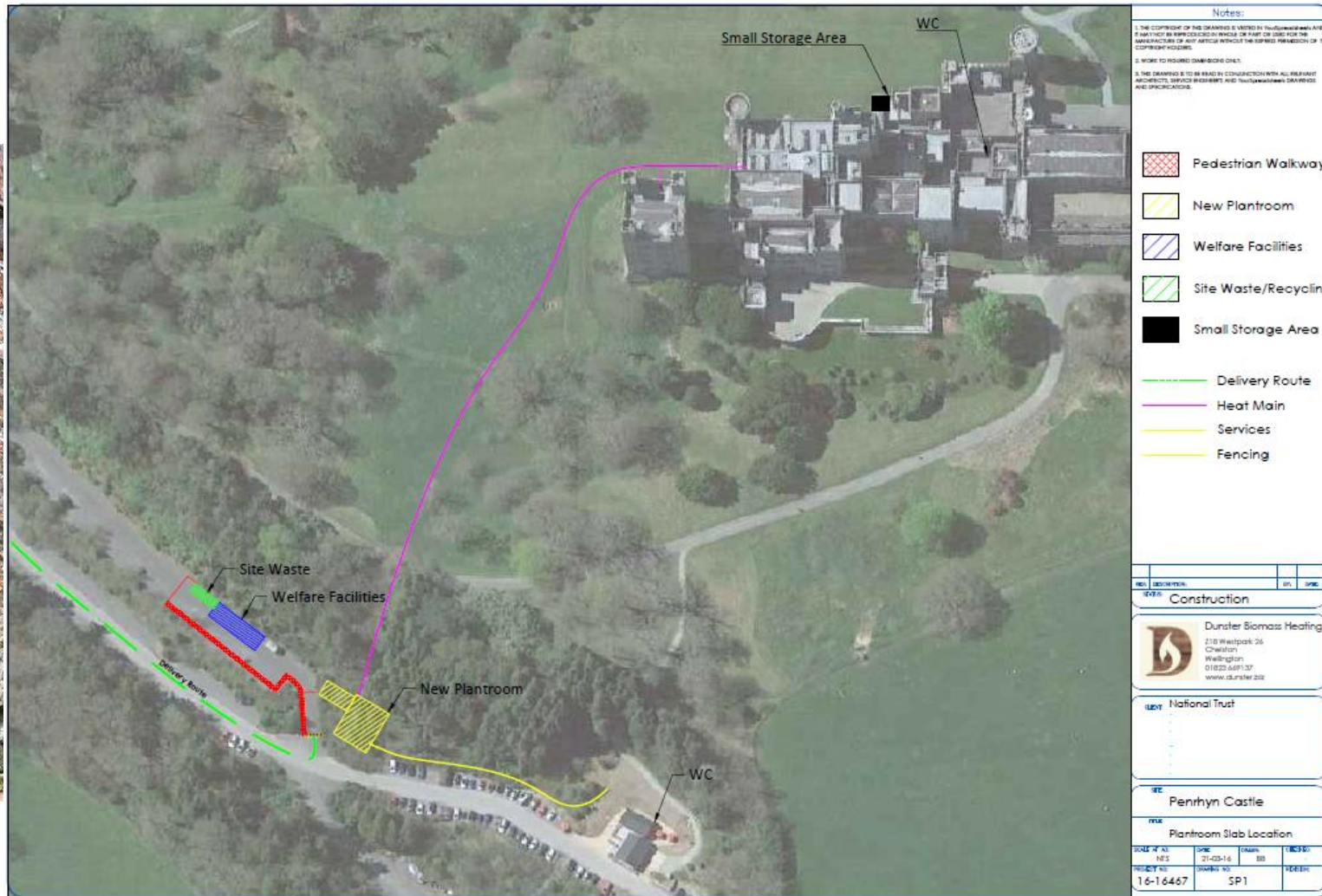
Financial feasibility of DWHR in hospitality and services



Financial Feasibility depends on:

- Current heating fuel
- Water consumption of the kitchen

THE CASE OF PENRHYN CASTLE

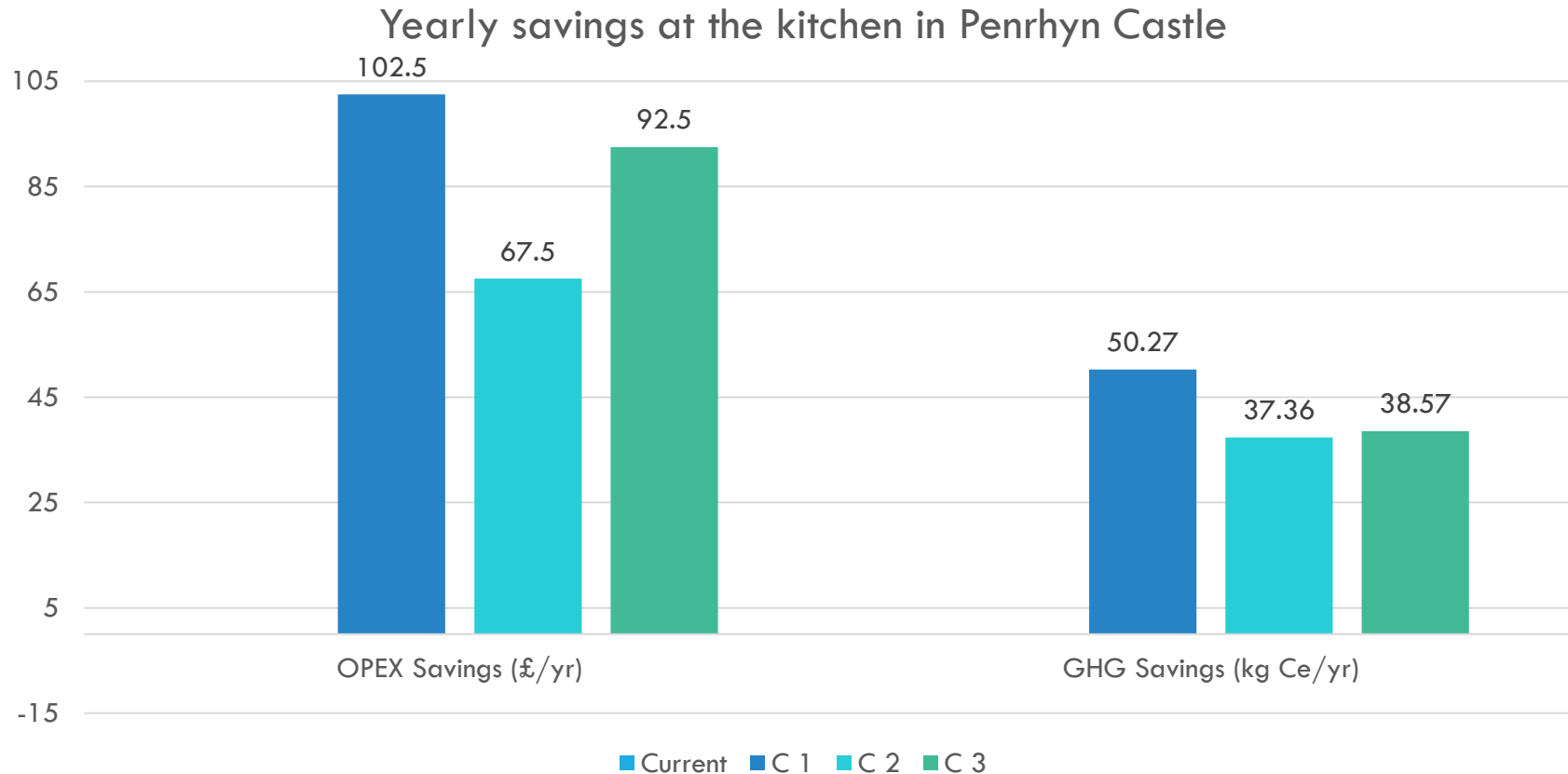


- Direct Heat recovery from the kitchen drain.
- Height: 2.1 m
- Drain water temperature up to 50°C.
- Average daily flow: 652.5 l/day
- 3 proposed heat recovery systems.

→ Selection must be made based on savings compared to the current heating system

THE CASE OF PENRHYN CASTLE

3 Different configurations



- GHG savings are small due to the low conversion factor of Wood pellets.
→ Compared to coal, annual savings can lead up to 784.8 kg Ce/yr
- Uncertainty remains on the drain water flow.
- Temporal mismatch remains possible within the 5 minute calculation interval.

PENRHYN CASE: ENVIRONMENTAL IMPACTS

packaging



fixings



fittings



cyclone



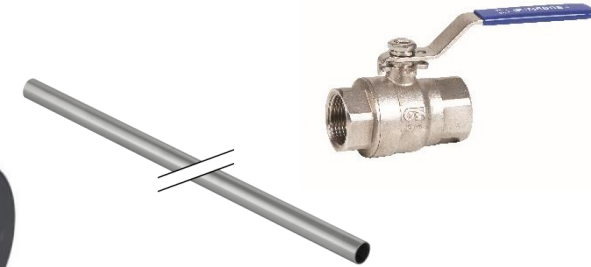
copper pipe



Configuration 1



pipework



pumps

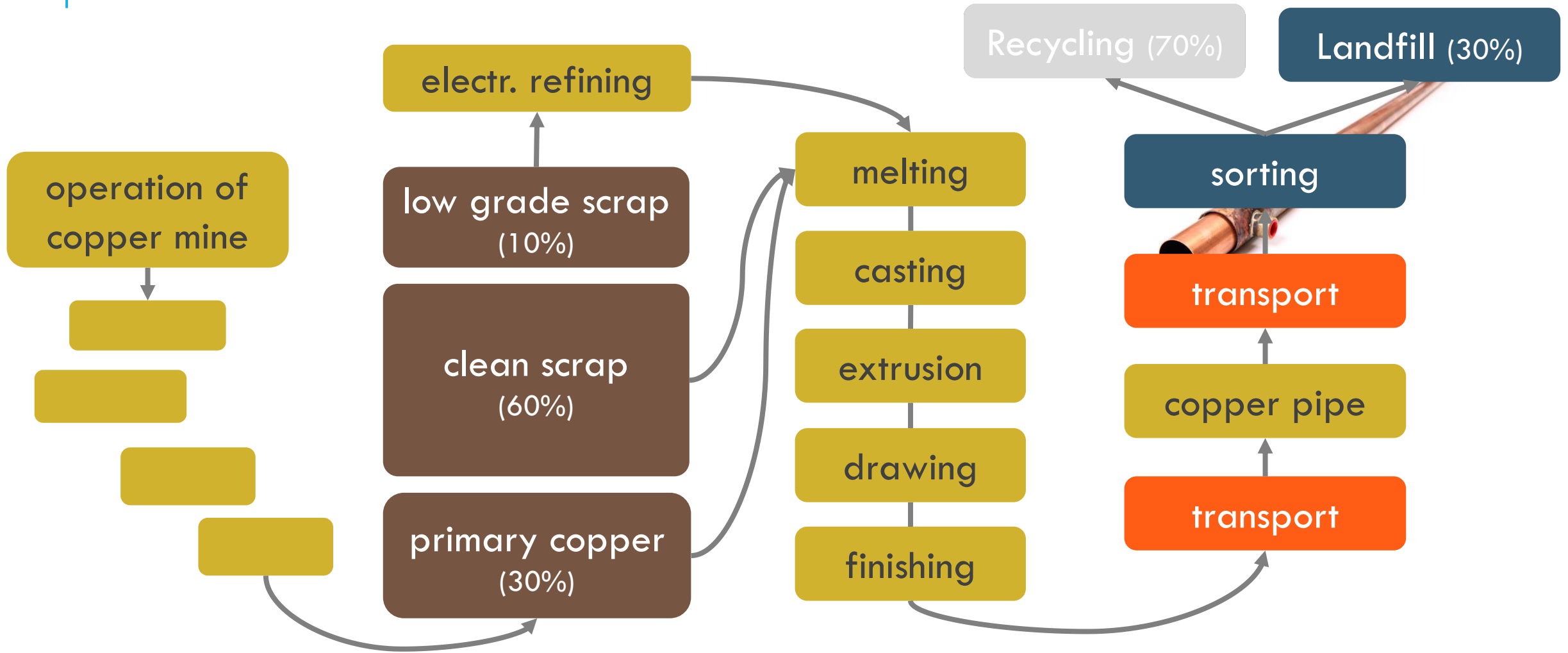
valves

buffer tank

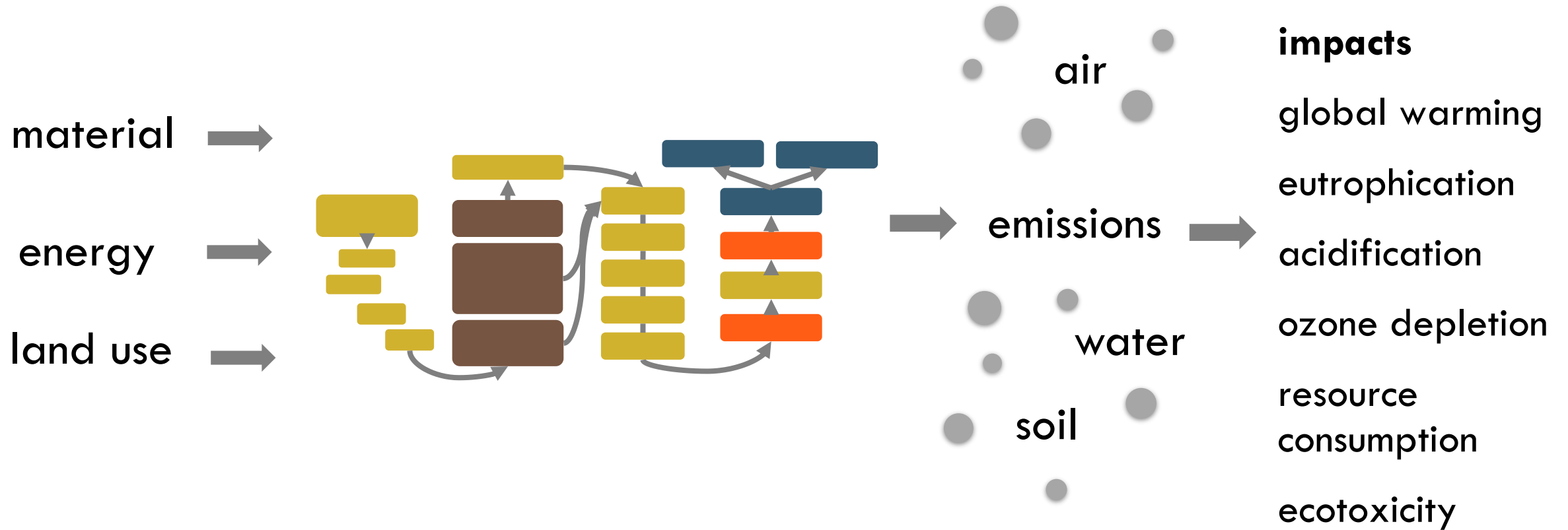
Configuration 2+3



PENRHYN CASE: LIFE CYCLE ASSESSMENT

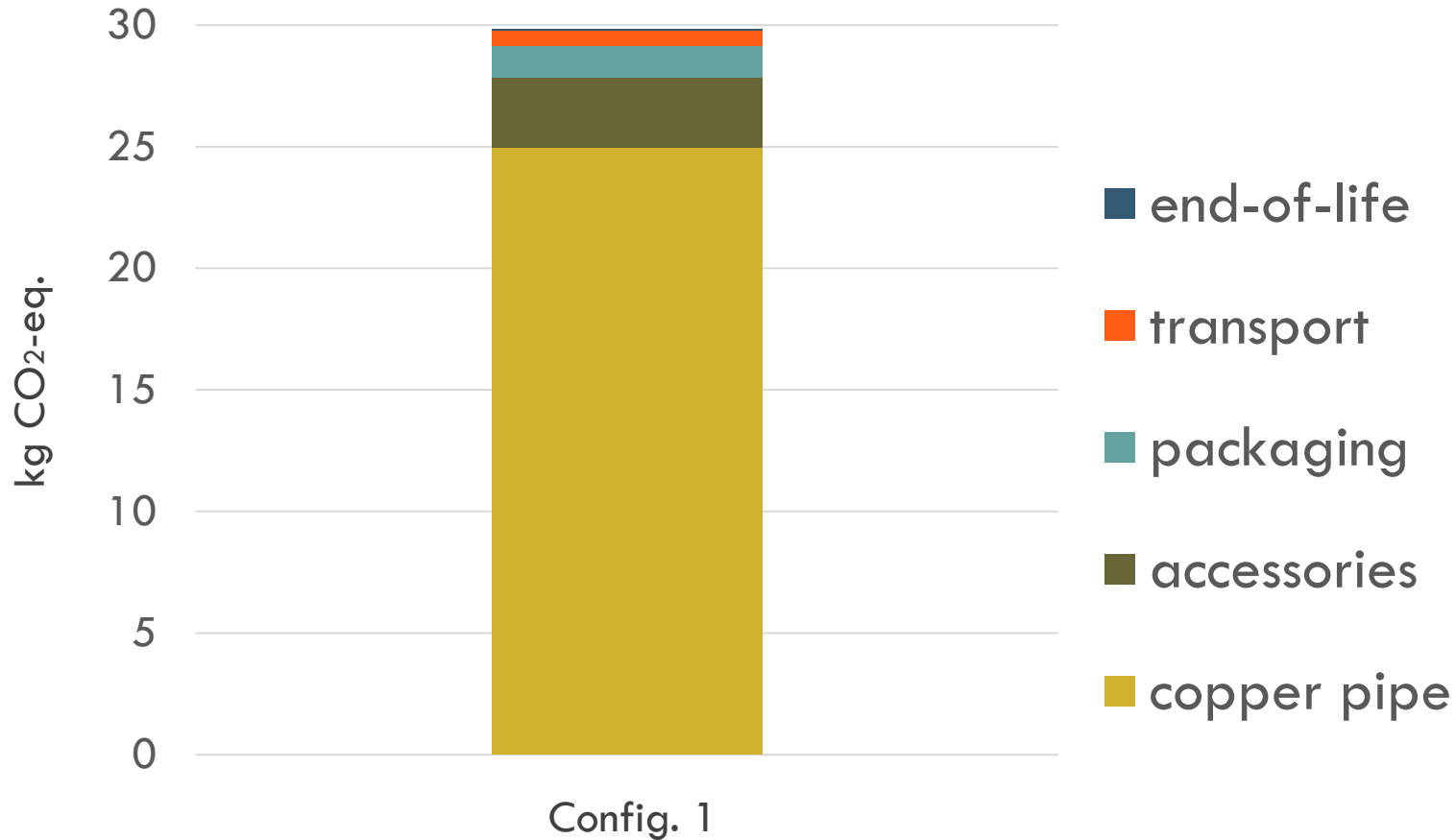


PENRHYN CASE: LIFE CYCLE ASSESSMENT



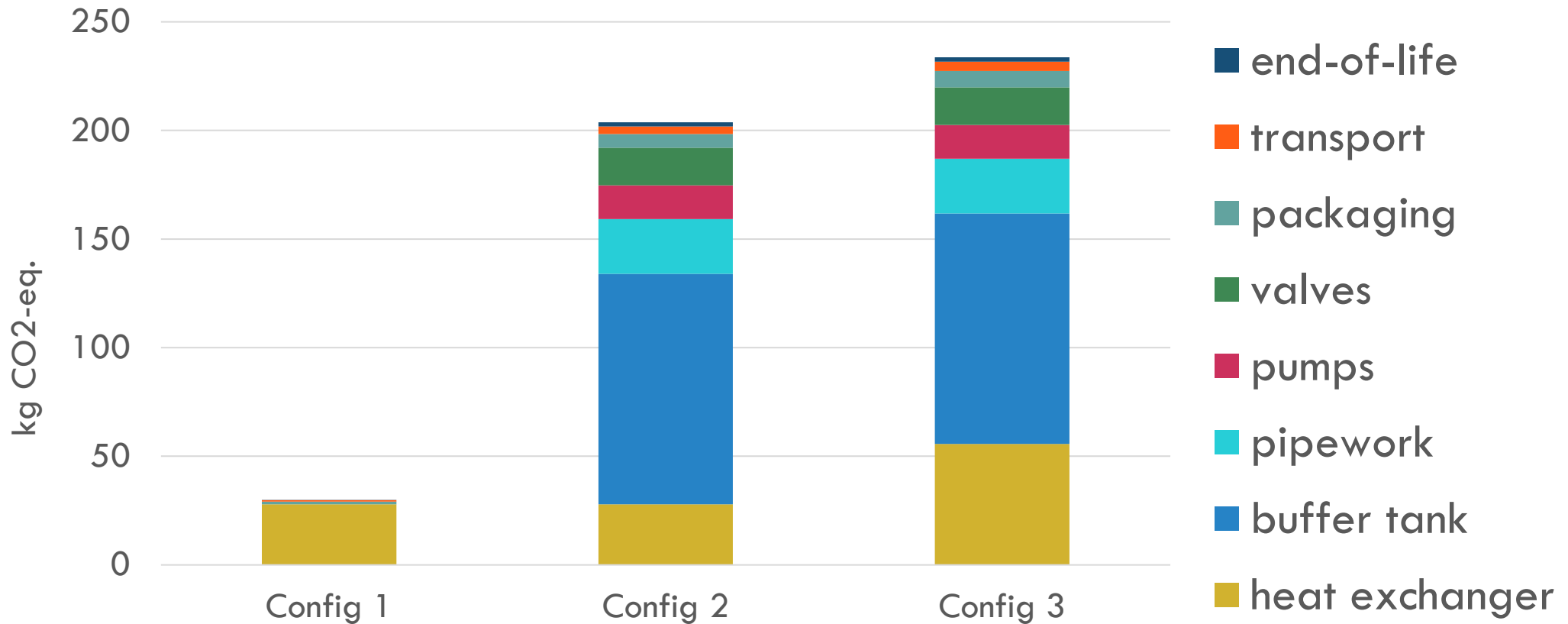
PENRHYN CASE: LIFE CYCLE ASSESSMENT

Config. 1: Global warming potential (GWP)



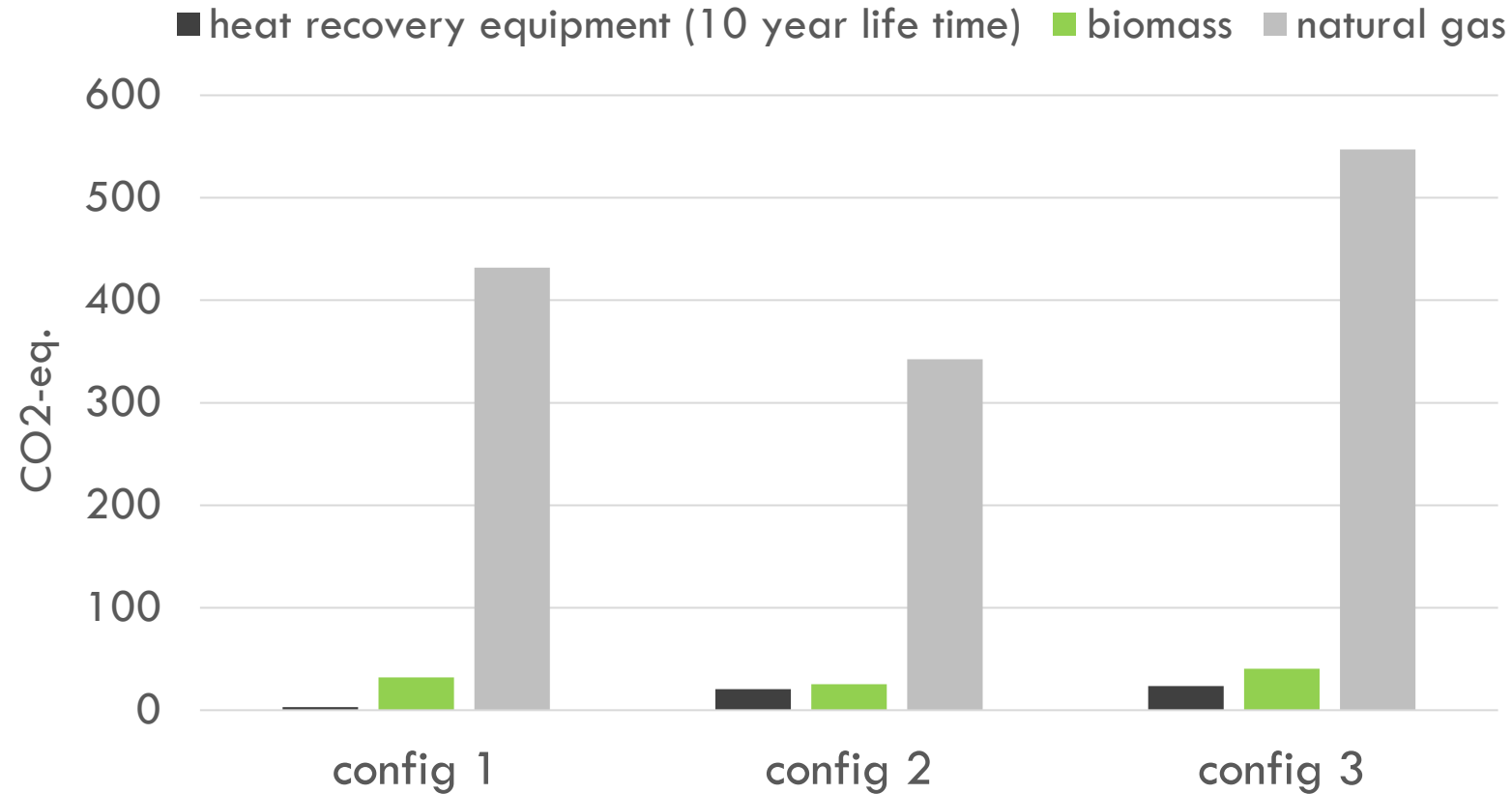
PENRHYN CASE: LIFE CYCLE ASSESSMENT

All configurations: Global warming potential (GWP)



PENRHYN CASE: LIFE CYCLE ASSESSMENT

All configurations: CO₂ payback time



CO₂ payback times:

Biomass:

1 – 8 years

Natural gas:

1 – 5 months

CONCLUSIONS

- Heat recovery as viable solution for GHG mitigation, configuration 1 preferred
- Life time of products exceeds the carbon payback time
- Choice of materials and use of recycled materials crucial to minimise footprint

	Heat recovery potential	Potential Ce savings	Potential OPEX savings
Kitchen at Penrhyn castle	1.68 – 2.27 MWh /yr	37.36-50.27 kg/yr	67.5-102 £/yr
Hospitality and Food services in the UK	1.32 – 1.37 TWh/yr	206-213 k tons/yr	93.16-96.69 M£/yr

PERSPECTIVES

Demonstrator

- Observing the actual operation of the system.
- Verifying assumptions, and verifying uncertainties on the measured data.
- Get information on mismatches of clean- and wastewater flow.

Overall sector

- Estimate the economically and environmentally viable heat recovery potential in the UK/Ireland.
- Address the ‘lost’ potential for kitchens with low water consumption.

THANK YOU!

Questions?

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