

Recovering heat from wastewater in food and beverage production.

March 1, 2024
Online

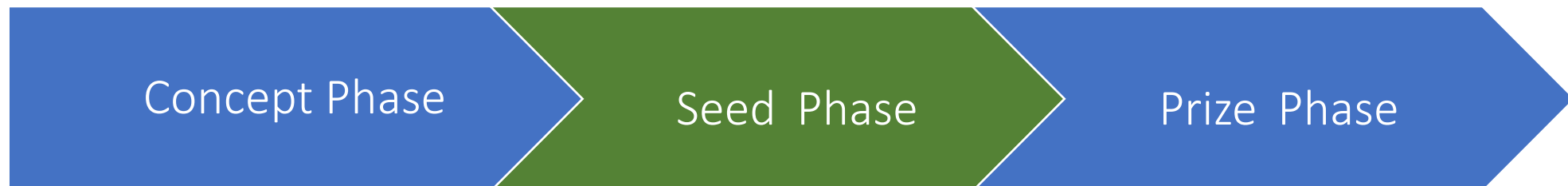
Welcome and Workshop Etiquette

*Session Chair: Dr. Godfrey Hampway
Southern African Institute for Policy & Research*

- **Please mute your microphone & switch off cameras during the presentation**
- **This session will be recorded**
- **Please put your questions in the chat – we will answer them at the end**
- **Please ensure your name and organisation are indicated in your profile**

About the REHEATZ project journey

- Aiming to develop and demonstrate wastewater heat recovery technology in Zambia
 - Measuring the scale of wastewater heat resources available in Zambia
 - Designing and developing a heat recovery system for the Zambian context
 - Demonstrating a working pilot plant at Zambeef facilities
 - Understanding the potential social impacts of wastewater heat recovery in Zambia
 - Supporting a Zambian-led venture and supply chain into the future



The Team

Zambia Core Team

Dr. Godfrey Hampway (Team Leader ZA)

Ms. Mangiza Chirwa Chongo (Societal Impact Champion)

Mr. Derrick Bwalya (SAIPAR)

Irish Core Team

Prof. Aonghus McNabola (Team Leader IE) – Engineering

Prof. Pádraig Carmody (Team Co-Leader IE) – Development Geography

Prof. Paul Coughlan (Team Co-Leader IE) – Green Process Innovation Management

Research Team

Dr. Danny Museteka (formerly Zambeef)

Dr. Madhu Murali (TCD)

Dr. Roberta Bellini (TCD)



About this webinar and the Engagement Programme

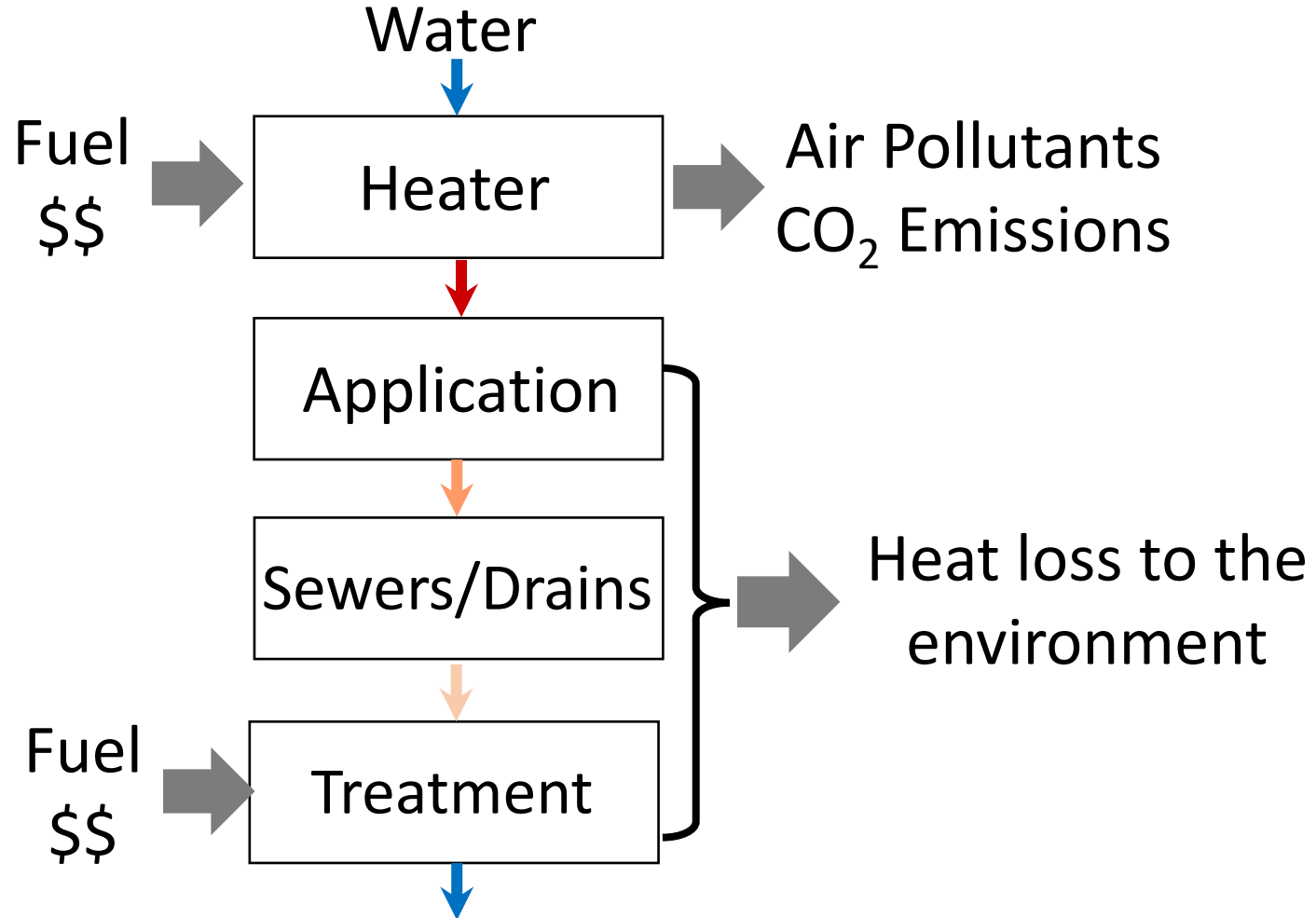
- Progressive development of awareness and a commitment to action
 - 9 On-site assessments & 96 Stakeholder interviews
 - First formal in-person event took place on 30th Nov 2023 in Lusaka with a selected number of industry leaders
 - Second formal engagement today (online), for a wider number of industry members to appreciate the planned actions of the leaders and to prompt their interest
 - In the third engagement (in person) to demonstrate on-site at Zambeef the installation of the energy recovery system (**23rd April 2024**)

WWHR Technology and Opportunities in Zambia

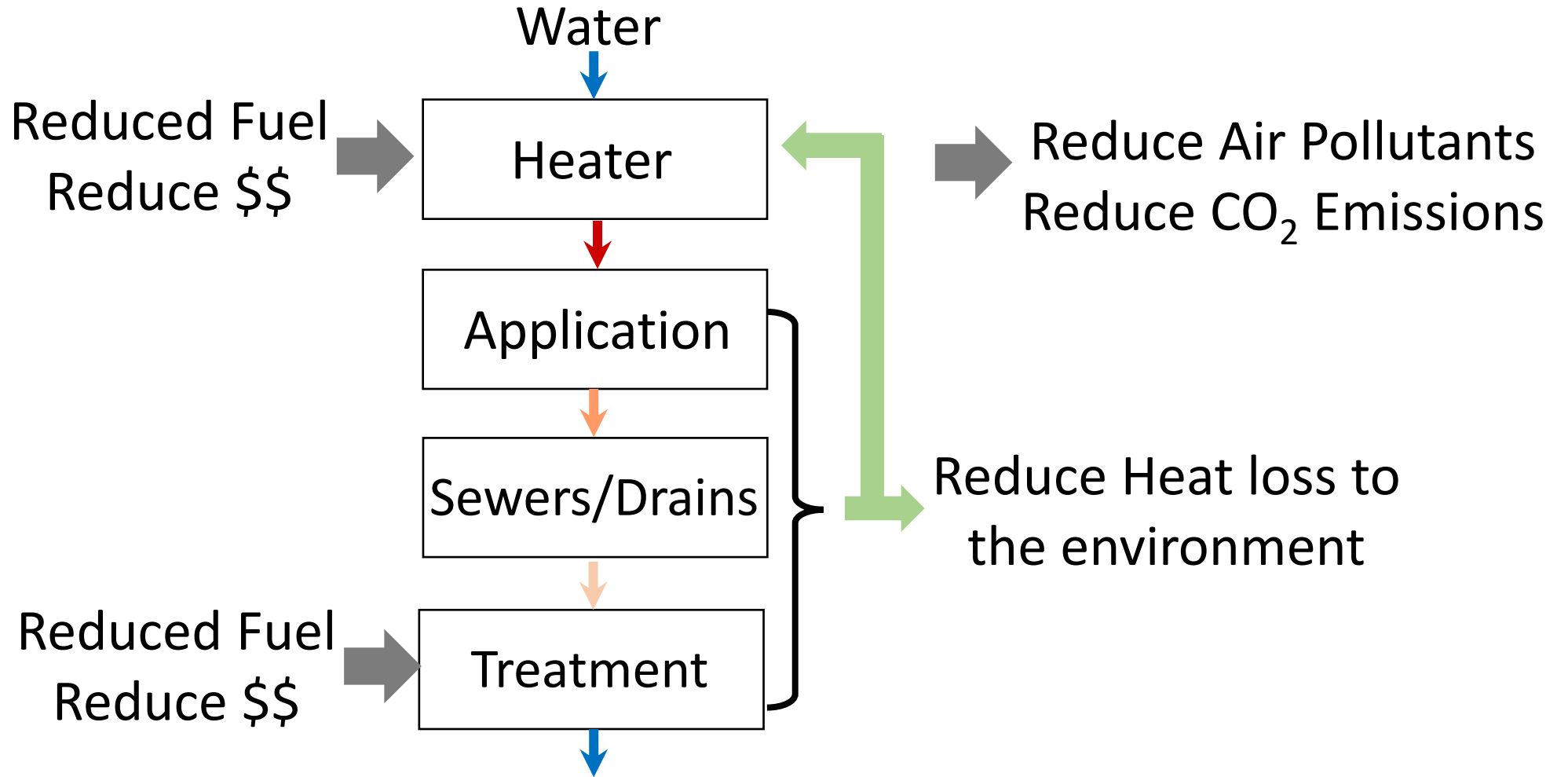


Dr. Madhu Murali, Prof. Aonghus McNabola & Prof. Paul Coughlan

What happens to water after we heat it?



What we would like to happen



Initial Findings in Zambia

Survey methodology consisted of site visits/audits, in-situ temperature measurement, and temperature measurement for weeks/months.

Significant waste heat found from:

- Boiler blowdown (70-90°C)
- Cleaning in Place (CIP) (50-60°C)
- Cooling Processes (40-70°C)
- Ambient water temp (23-27°C)

Baseline survey conducted of suppliers & employees conducted to assess environmental attitudes & perceptions



On-site Wastewater Heat Resource Assessments



Initial Findings in Zambia

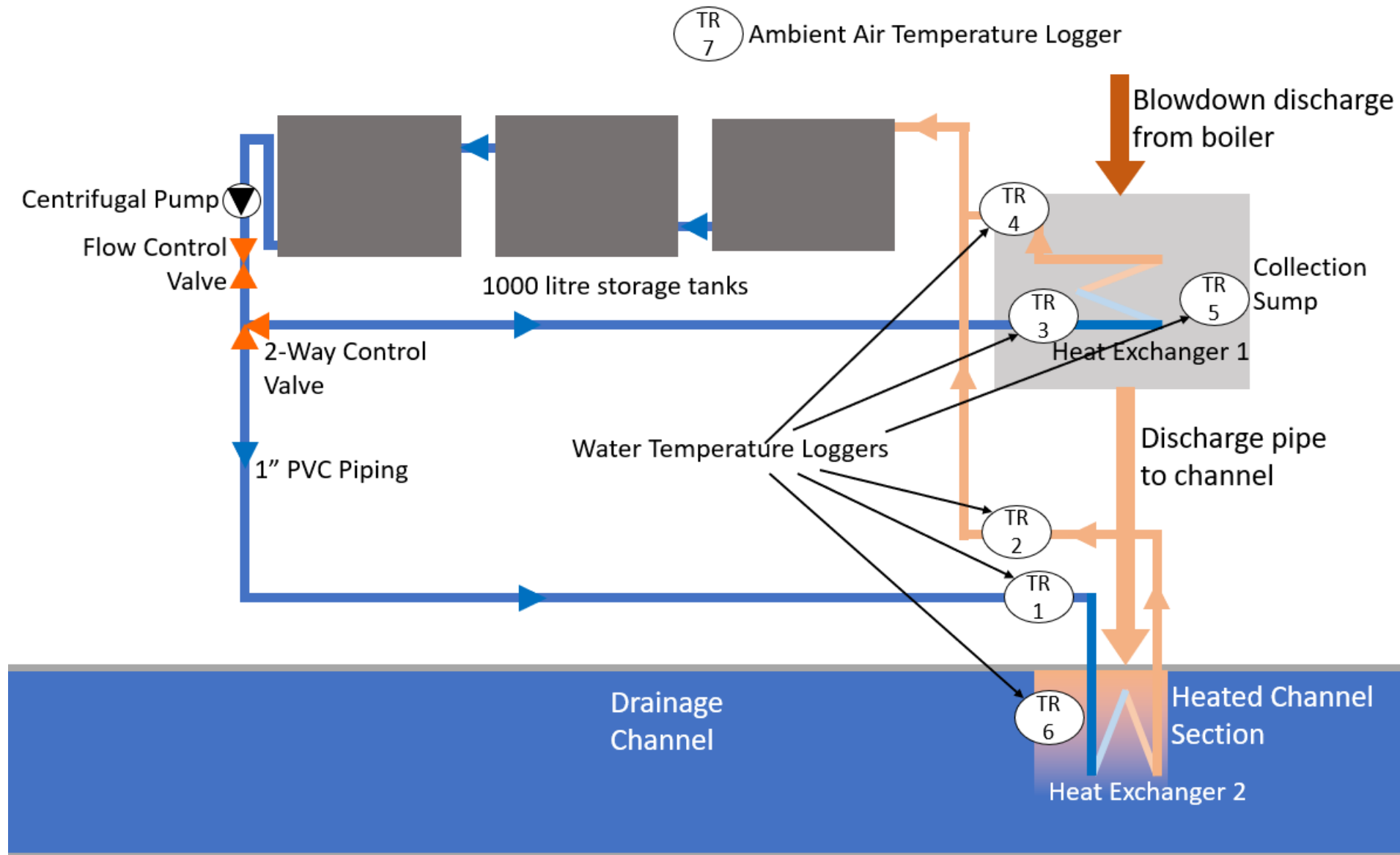
- High wastewater temperatures at the blowdown hot well and the subsequent rainwater drain were found at Zambeef's Huntley Farm.
- This location is also well placed to recover the heat from as there is a ready heat source in the cold water going into the boiler.
- With agreement from Zambeef, we decided to design a pilot wastewater heat recovery system for Huntley Farm.



Pilot Heat Recovery System at Zambeef

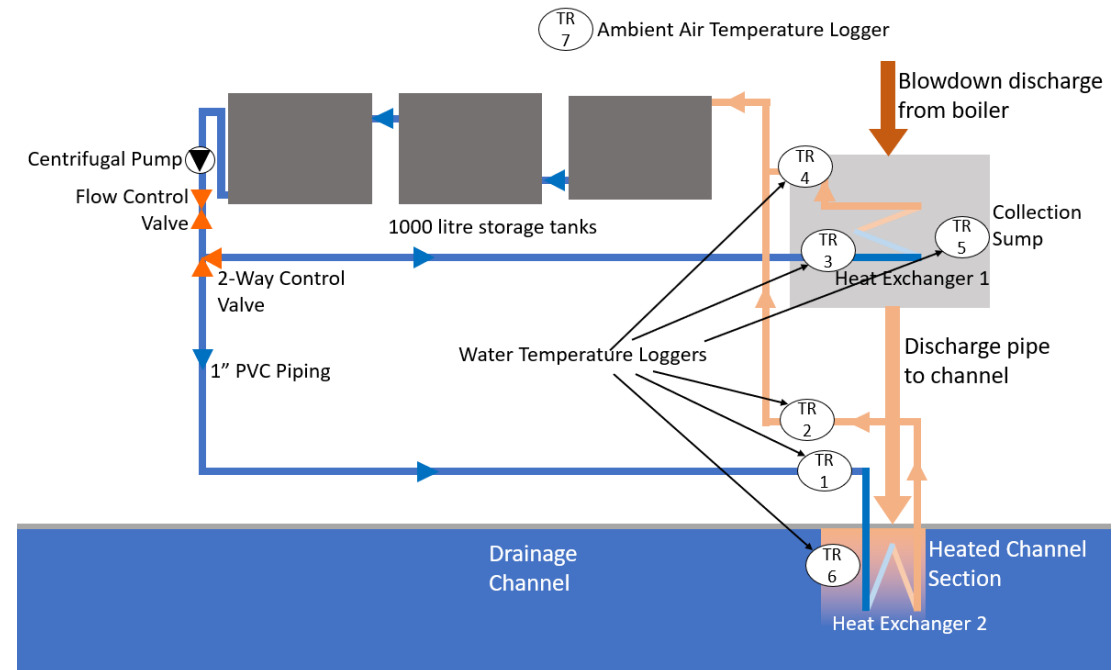
- Two heat recovery lines were proposed for the trial system: to the hot well and to the rainwater drain.
- The pilot system will be independent of the existing system to reduce piping and potential interference with boiler operations.
- Water temperatures will be measured across the system to determine the heat recovery performance
- Aiming to assess if a 10% reduction in coal use is possible using WWHR in the Zambia context





Uncertainties

- Aiming to assess if a 10% reduction in coal use is possible using WWHR in the Zambia context
- Zambia is much hotter!!
- Long term performance unknown
- Content of the hot-well unknown



Pilot Heat Recovery System at Zambeef

- Installation was complete on the 16th February.
- Main challenge was installing heat exchangers into the hot well.
- Hot-well comprise a 2m³ volume containing very hot wastewater, steam and rocks
- Temp is 70-90°C & >90°C when activated



Pilot Heat Recovery System at Zambeef

- Main challenge was installing heat exchangers into the hot well.
- Initial results from the hot well line are very promising, with the heat exchangers heating the water from 27°C to 61°C.
- 900 kWh per day generated in saving
- Equivalent of 50 tonnes of coal per year from just two heat exchangers (two weeks supply)



360 Pictures of Pilot Plant

Overview:

<https://cdn.pannellum.org/2.5/pannellum.htm#panorama=https%3A//i.imgur.com/DNDEq3U.jpeg&title=Overview>

Hot well:

<https://cdn.pannellum.org/2.5/pannellum.htm#panorama=https%3A//i.imgur.com/DYJYEy8.jpeg&title=Hot%20Well>

Boiler: <https://cdn.pannellum.org/2.5/pannellum.htm#panorama=https%3A//i.imgur.com/4hafJ5V.jpeg&title=Boiler>

Pump and Tanks:

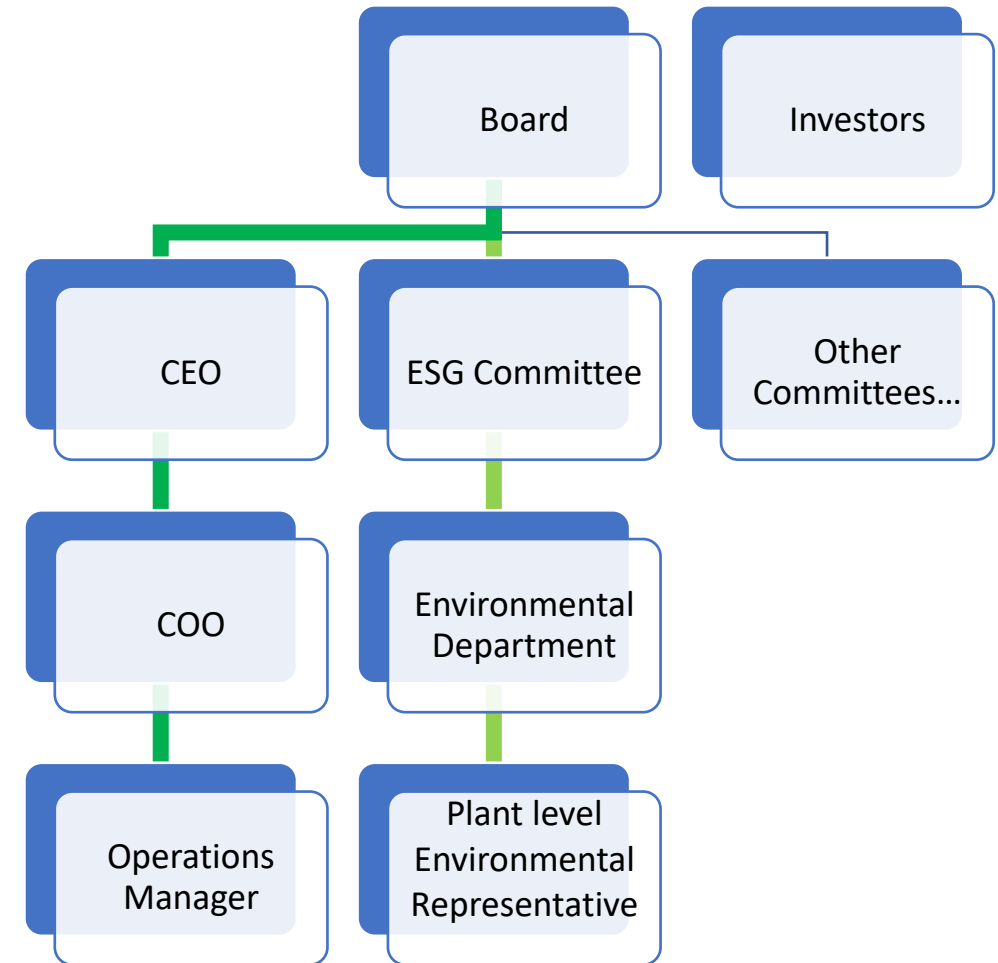
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Gates: <https://cdn.pannellum.org/2.5/pannellum.htm#panorama=https%3A//i.imgur.com/H3Umqni.jpeg&title=Gates>

Management Decision Making

At firm level:

- Recovering heat from wastewater is a green process improvement initiative
- It requires cross-fertilisation of knowledge to support prototype-driven problem solving
- The decisions to engage, support and evaluate cascade down through all levels and create a fit among organisational objectives, targets, and processes



Societal Impacts

- Arising **directly** through
 - Reduced coal consumption (& transport)
 - Reduced air pollution & GHG emissions
 - Reduced operating costs at plant level...
- Arising **indirectly** through novel & impactful CSR initiatives requiring
 - Building on the existing CSR allocation process
 - Ringfencing savings
 - Targeting critical areas
 - Developing a multi-stakeholder approach to the organisational CSR structure
- There is scope also for government incentivisation of green technology & green jobs to deliver Wastewater Heat Recovery systems



Source: Zambeef

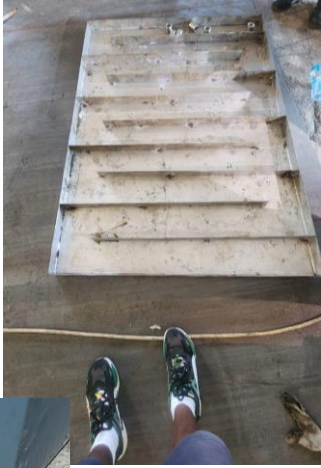


Source:USAID

The Emerging Business Case

- Potential to significantly exceed a 10% saving in emissions reduction, coal use and produce cost saving (\$20,000 @Huntley)
- Financial & Carbon Payback period of 1-2 years expected.
- Many Zambian enterprises using steam, and generating hot wastewater:
 - Meat processing
 - Dairy
 - Brewing
 - Mining
 - Grain processing
- Impact on job creation, local supply chain & new skills

Fabrication



Parts

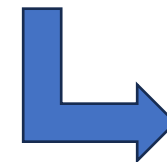
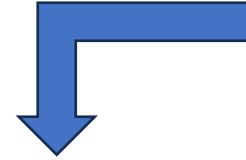


Labour



Next Steps

- Complete data collection from the pilot plant and determine the feasibility of a full-scale system.
- Using systems modelling to assess potential of full-scale system
- Produce the final report for funding bodies detailing these outputs.
- Host on-site visit (Demo site event) at Huntley farm for interested stakeholders (23rd April)



Future Work: Prize Phase

- Full-scale system with connections to the inlet water to the boiler at Huntley Farm.
- Investigate the feasibility of using a heat pump to extract additional heat.
- Implement pilot and/or full-scale systems at another industrial site.
- Build toward the establishment of Zambian spin-out company



ANY QUESTIONS?



Closing remarks and next steps

Dr. Danny Museteka

The next steps include...

- Progressive development of awareness and a commitment to action
 - After today, direct follow-up with individual industry leaders to progress monitoring
 - In the next engagement (in person) to demonstrate on-site at Zambeef the installation of the recovery system (23rd April)

Thank you for attending

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