Royal HaskoningDHV
Enhancing Society Together

The sustainable energy-efficient route to advanced digestion

Introducing RHDHV's Helea® technology

HELPING YOU ON THE ROUTE TO NET ZERO 2030

Hosted by Barry Oliver (RHDHV) and Stephen Riches (Anglian Water Services)

TODAY'S SPEAKERS

Paul Lavender
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AGENDA

- Introducing Helea®
- Technology development & performance
- Energy balance, cost benefits, & combining Helea® and Ephyra ®
- Q&A




WHO WE ARE

We are **independent** international consulting engineers leading the way in sustainable development and innovation since 1881.

We take responsibility for having a **positive impact** on the world and we constantly challenge ourselves and our clients to develop sustainable solutions to local and global issues.

By **combining** engineering, design and consultancy with software and technology, we are delivering more added value to our clients. Enhancing Society Together!

#37 in Engineering News-Record's ***Top 225 International Design Firms***

6,000+ ***colleagues***

working from **50** ***offices*** worldwide

on projects in **100+** ***countries***

Leading technologies in
sludge treatment & resource recovery

Helea®

by Royal HaskoningDHV

‘The sustainable energy efficient route to advanced digestion’

Helea® sludge pre-treatment technology is a three-step process combining heat recovery, pasteurisation and biological hydrolysis.

UNIQUE PARTNERSHIP

Anglian Water developed this technology to deliver a safe, reliable and sustainable Advanced Anaerobic Digestion route for their biosolids.

Through a unique partnership with Royal HaskoningDHV, the proven benefits of the award-winning Helea® technology is now available worldwide.

HELEA® OPERATIONAL EXPERIENCE

Four Helea® reference sites operational since 2013-14

Basildon
10,300 TDS/yr
Commissioned 2013

Cliff Quay (Ipswich)
15,000 TDS/yr
Commissioned 2014

Colchester
15,000 TDS/yr
Commissioned 2014

Pyewipe (Grimsby)
17,500 TDS/yr
Commissioned 2014

These sites have operated with 100% process availability and 100% safety record, consistently producing >1MWh$_e$ / TDS through CHP

HELEA® ADVANTAGES

An established technology, with a proven track record, Helea is a truly sustainable energy efficient route to advanced digestion, providing:

Significantly higher biogas yield than conventional anaerobic digestion

Competitive CAPEX and significant OPEX savings

Operational carbon savings

A safe, reliable and easy to operate process

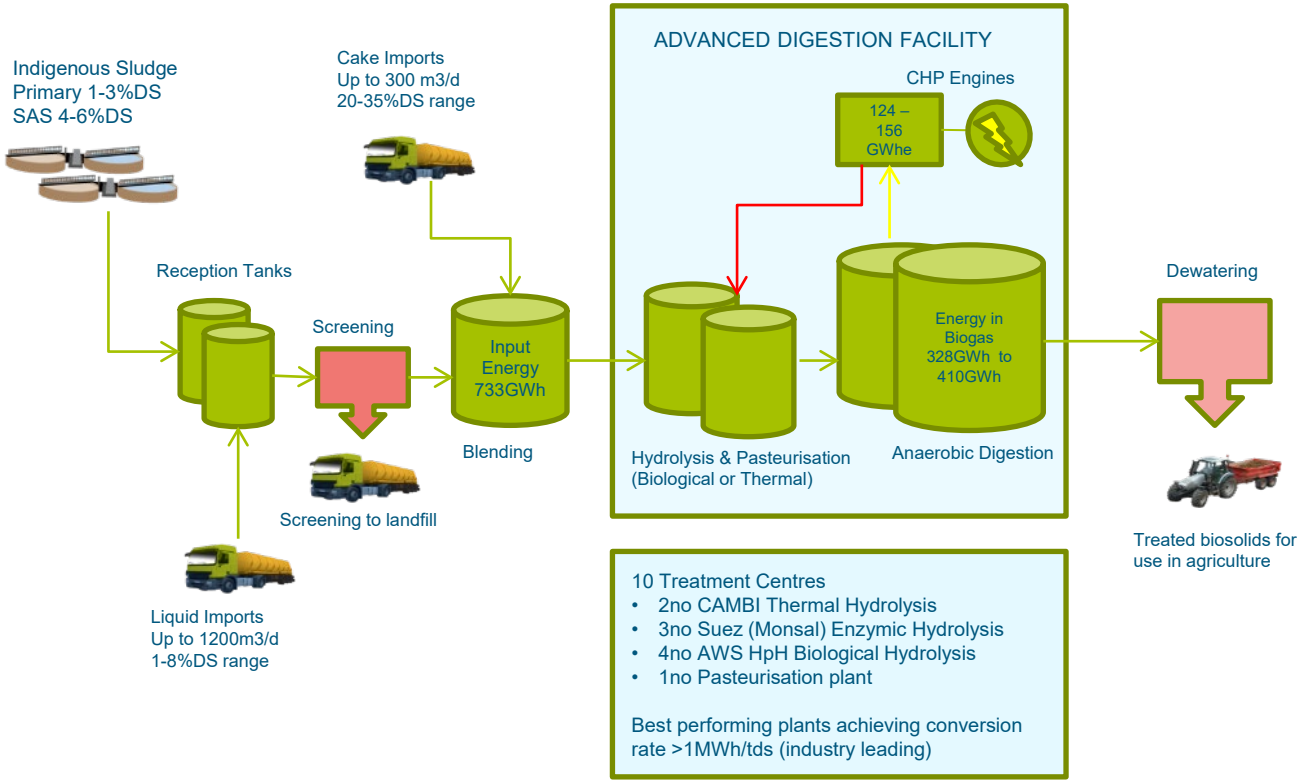
Pasteurised enhanced quality biosolids for safe recycling to agriculture

Easily hidden, minimum impact

BIORESOURCES TREATMENT AT ANGLIAN WATER

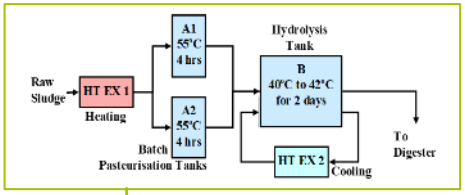
- Biosolids strategy is to treat all of our raw sludge production to an enhanced treated standard by **advanced digestion**
- Approximately **150,000** raw tonnes dry solids produced per annum from over **1,100** water recycling centres. Sludge is treated in **10** main sludge treatment centres (STC's)
- All treated biosolids fully complaint with the **Biosolids Assurance Scheme** (BAS)
- Treated product sold to farmers as a soil conditioner and a branded product, **Nutri-bio**. (www.Nutri-bio.co.uk)
- Maximise renewable electricity generation - **over 114 GWh** in 22/23

TYPICAL ANGLIAN WATER STC FLOW SHEET



FROM CONCEPT TO FULL-SCALE

New process flow sheet developed



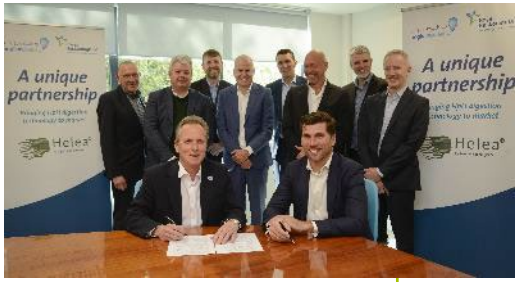
Pilot Plant

10 years of successful operation
From 2013 >

Laboratory Testing – Prove Concept

Full scale design & build x 4

Patent granted in 2016



2005 2010 2015 2020

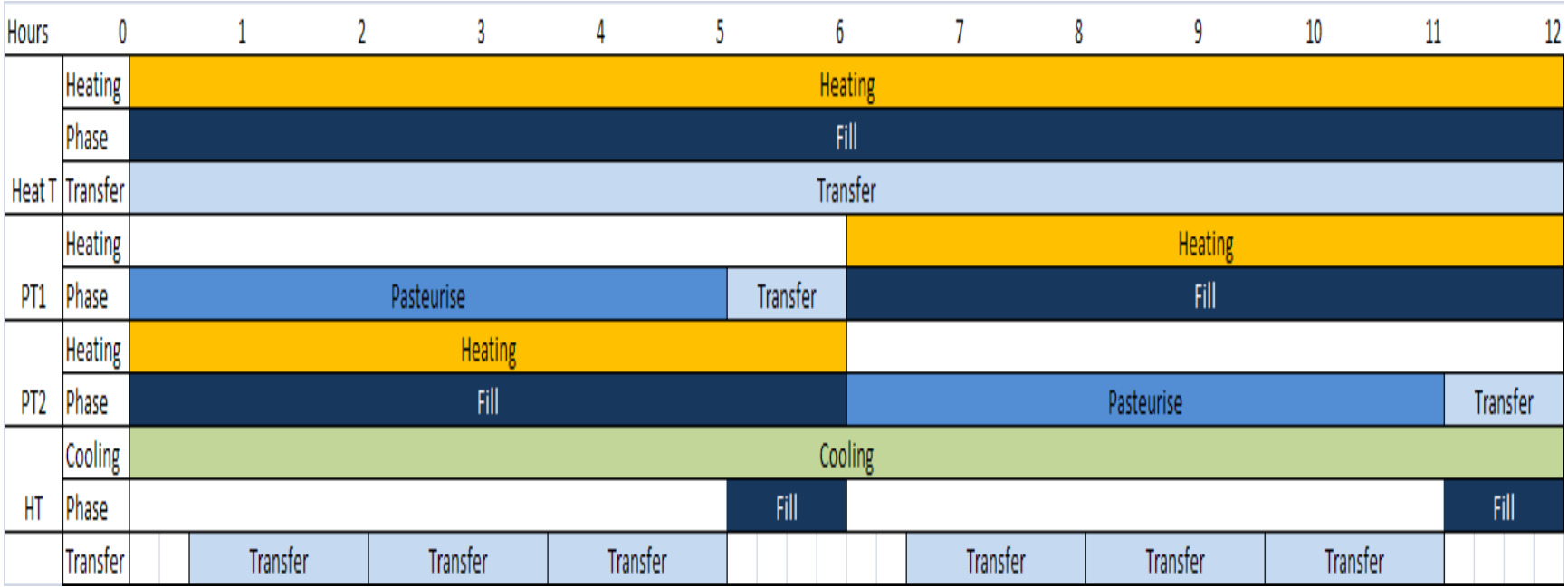
OUTLINE DESIGN DEVELOPMENT

As the process concept developed, process enhancements were made to the initial flow sheet including:

- **Steam heating** selected for pasteurisation to mitigate the risk of vivianite scaling
- The addition of a **pre-heating tank** at the beginning of the process to ensure all the available heat from the CHP engine jacket system could be used by the heating tank
- Arrangement of the plant transfer, filling, and heating sequences to give a **continuous, uninterrupted flow** from the heating tank through the two pasteurisers and onto the hydrolysis tank

HELEA® PROCESS CYCLE

Filling, heating and transfer cycles

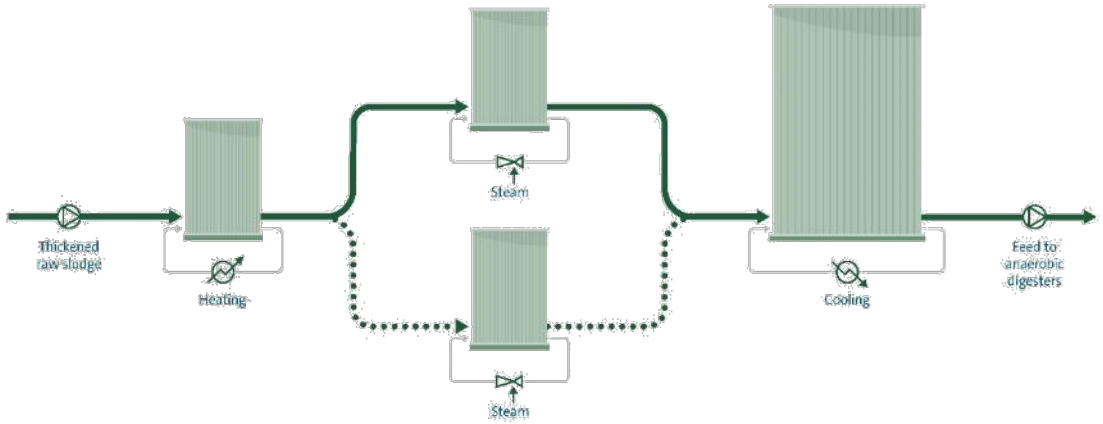


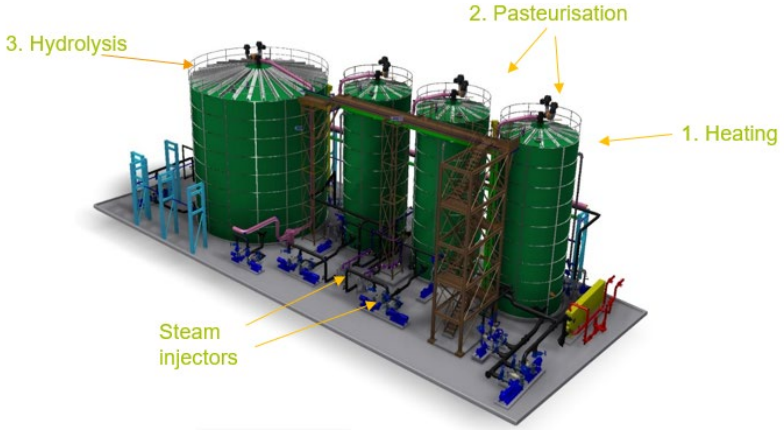
DETAIL DESIGN DEVELOPMENT

Incorporated learning from the operation of our other advanced anaerobic digestion systems. This includes;

- Duty / standby **dual overpressure and anti- vacuum relief valves** on each of the Helea tanks
- **‘Foam buster’** within tank mixing systems
- **Operator-focused** fully automated and integrated control system
- In-built **flexibility** within the control system to deal with variations in load, volume and sludge quality;
  - Helea process allows the operator to set the **retention time** and **temperature** in the hydrolysis tank
  - The level control is **dynamic** to maintain a consistent retention time within the hydrolysis tank
  - Allows the process to be tuned to **specific site conditions**

THE HELEA® PROCESS





1 Heating
Temperature 40-45°C

2 Pasteurisation
Heat to 55°C and hold for 5 hours, alternating fill, hold and drain

3 Hydrolysis
Temperature 42°C 1-2 days HRT, variable level to optimise performance

HELEA® PERFORMANCE

- The Helea plants continue to operate safely and reliably
- Local teams have continued to optimise performance
- Pyewipe is the best performing plant with;
  - 9-10% feed DS
  - Hydrolysed sludge VFA concentrations of 10,000 mg/l
  - All heating demand satisfied by the CHP plant
  - Power output at 1MWh$_e$/t DS treated
  - Enhanced quality Digested sludge cake recycled to local farmland
  - Plant availability at 100%

ANGLIAN WATER PERFORMANCE DATA

ANGLIAN WATER PERFORMANCE DATA

HELEA® DESIGN EXAMPLE & ENERGY BALANCE 50 tDS/d

Process	50 tDS/d		
Feed DS Target	**8-10%DS**		
Feed Flow	**550 m^3/d**		
Heating tank	**400 m^3**		
Pasteurisation	**2x400 m^3**		
Hydrolysis	**1,100 m^3**		
Anaerobic digesters	**3x3,000 m^3**		
VS destruction	**~57%**		
Biogas production*	~21,500 m^3/d	**5.4 MW**	
CHP	~21,500 m^3/d	**5.4 MW**	
Power		**2.3 MWe**	
LTHW		**1.4 MW**	Required = 0.7 MW (~55%)
Steam		**1.0 MW**	Required = 0.6 MW (~60%)

HELEA® COST ANALYSIS

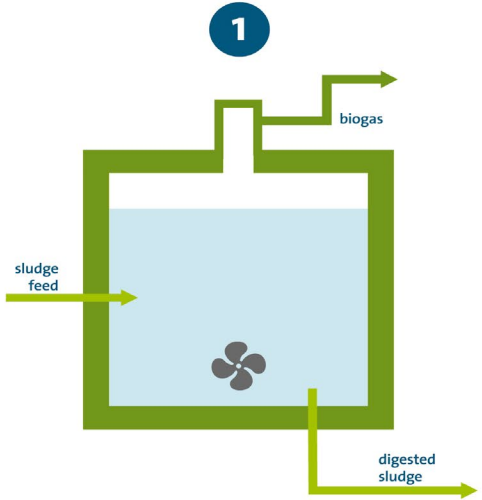
Capital Cost	**25% lower than comparable THP plant**
Operating Cost	**£50-60/tDS lower than THP**

No support fuel
Higher power generation
Lower liquor treatment costs
Lower maintenance costs
Slightly more sludge recycled to local farmland
Higher availability

But there’s more…let’s combine

WHAT'S EPHYRA®

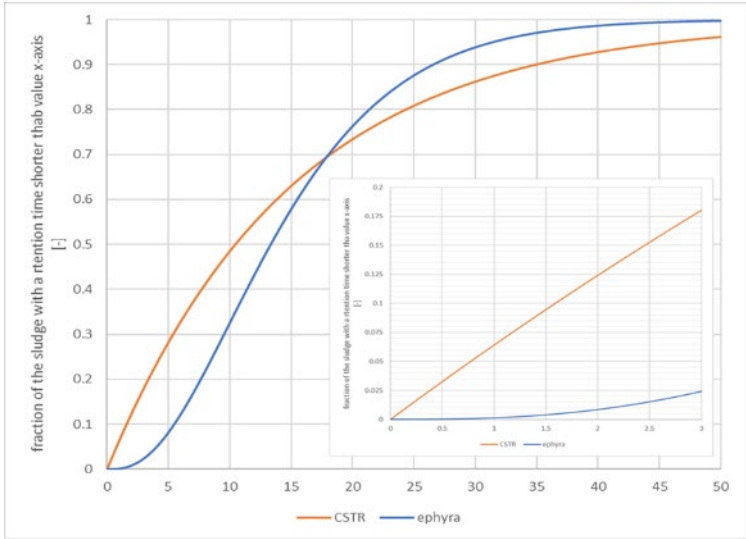
Conventional Anaerobic Digestion site

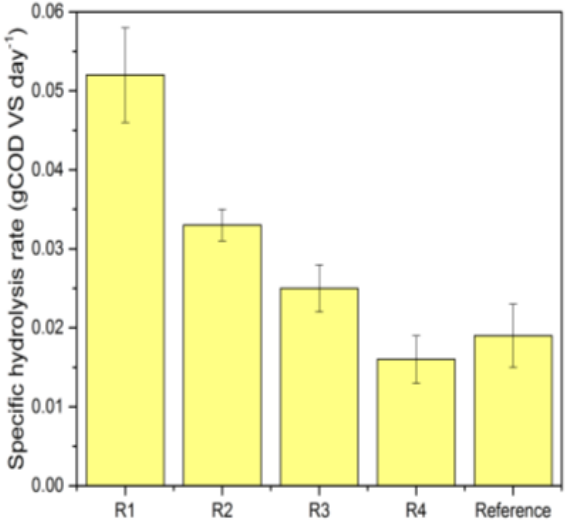


WHY DOES EPHYRA® PERFORM BETTER?

- Minimum short circuiting
- Higher hydrolysis rates

Higher VS destruction, higher Biogas production
Minimum methane emissions & lower recycling costs



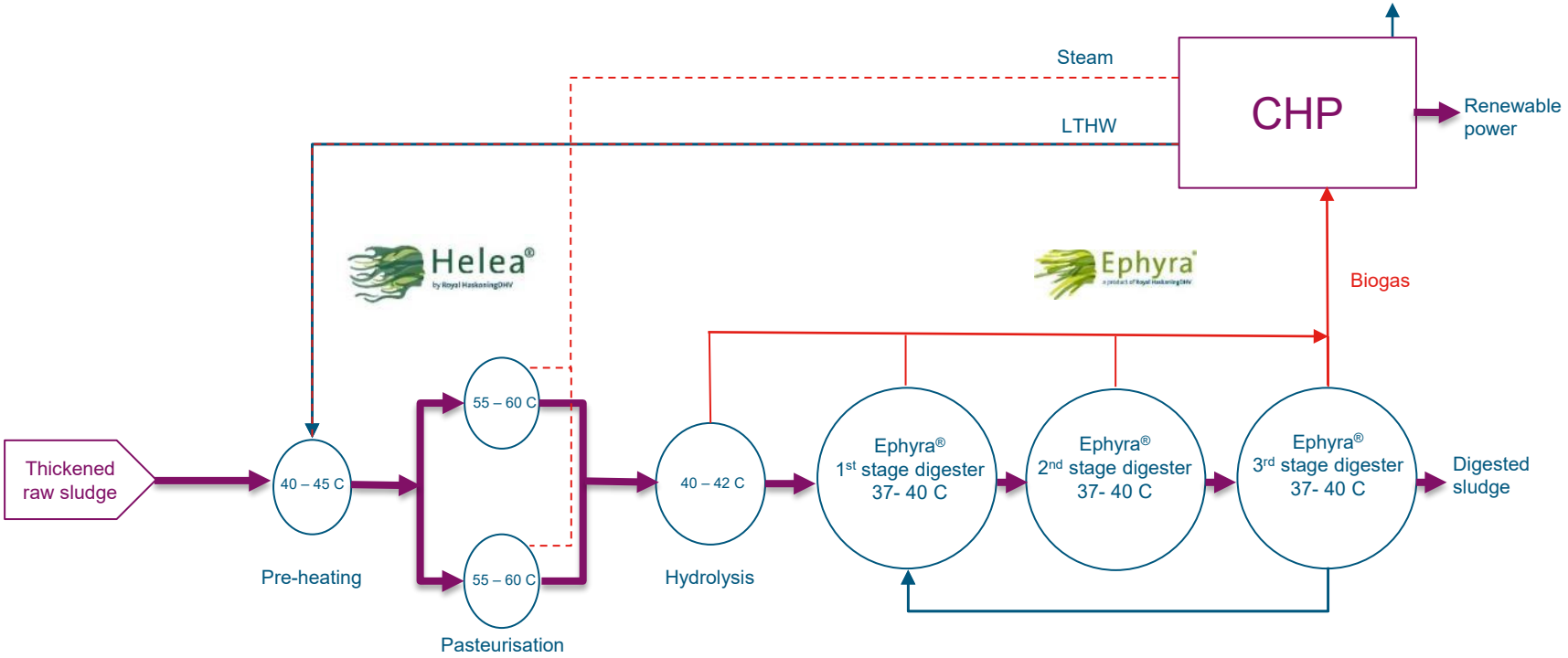


INTEGRATING HELEA & EPHYRA

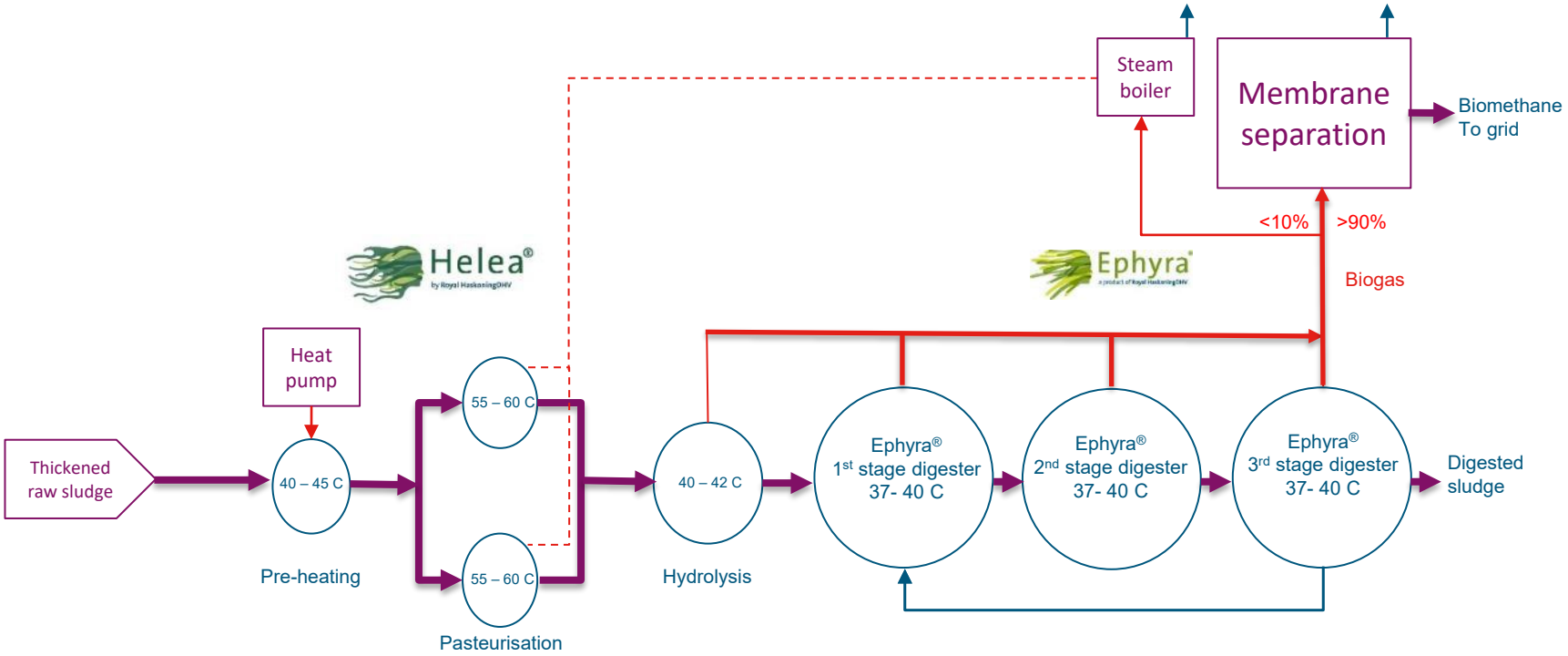
Achieves frontier performance;

- Higher VS destruction
- Higher Biogas production
- Less biosolids requiring dewatering & recycling to farmland
- Minimum downstream methane emissions

HELEA® + EPHYRA® + CHP



HELEA® + EPHYRA® + BIOMETHANE



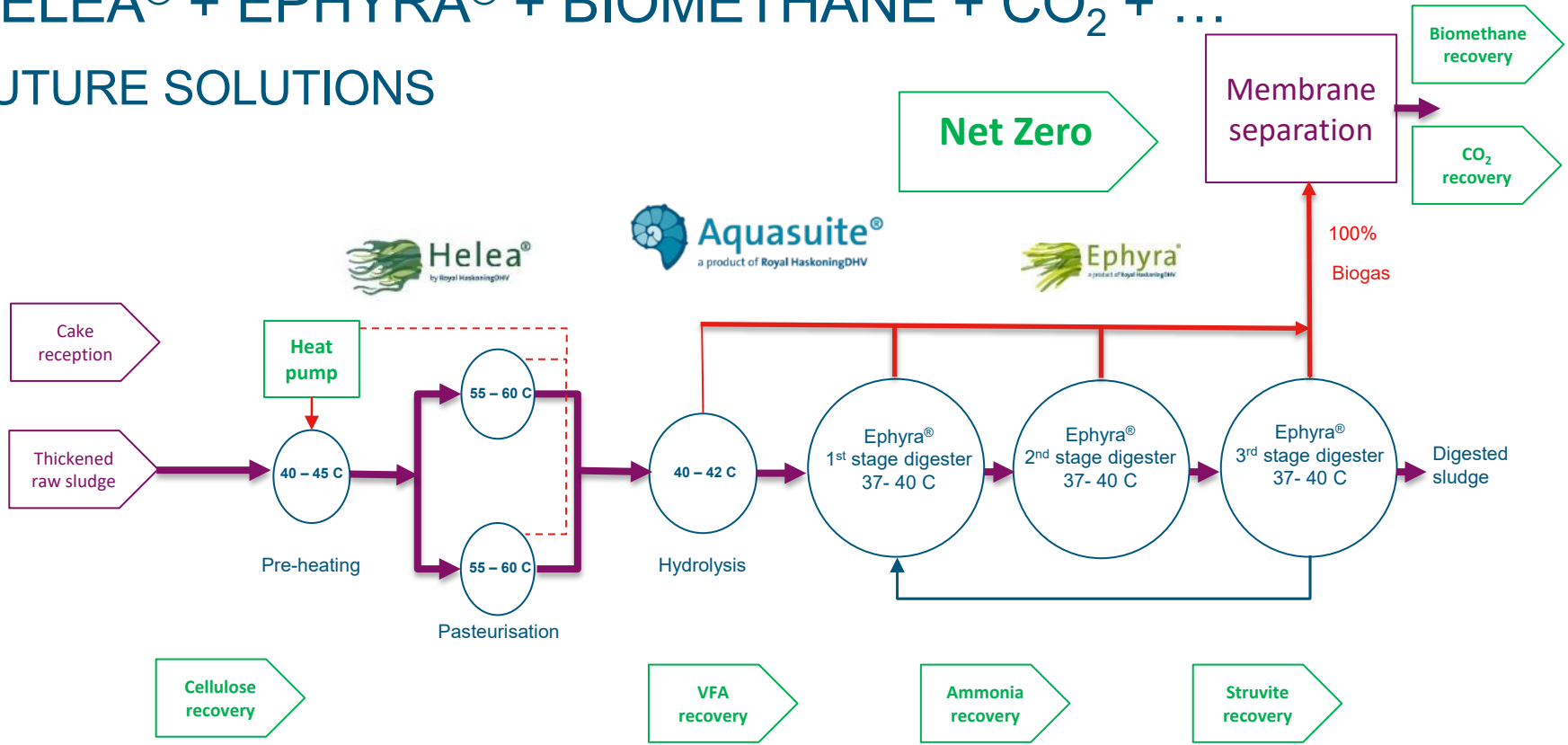
HELEA® + EPHYRA® DESIGN EXAMPLE 50 tDS/d

Process	50 tDS/d		
Feed DS Target	8-10%DS		
Feed Flow	500-625 m^3/d		
Heating tank	400 m^3		
Pasteurisation	2x400 m^3		
Hydrolysis	1,100 m^3		
Anaerobic digesters	3x3,000 m^3		
VS destruction	**~62%**		
Biogas production*	**~24,000** m^3/d	**6.5** MW	
CHP	**~24,000** m^3/d	**6.5** MW	
Power		**2.6** MWe	
LTHW		**1.6** MW	Required = 0.7 MW **(~45%)**
Steam		**1.1** MW	Required = 0.6 MW **(~55%)**

Helea+Ephyra increases energy recovery and minimises downstream methane emissions supporting Net Zero

HELEA® + EPHYRA® + BIOMETHANE + CO_2 + …

FUTURE SOLUTIONS



CONCLUSIONS

- Helea has proved to be Anglian Water's most efficient and best performing Advanced Digestion plants
- It's now available through Royal HaskoningDHV as part of a unique long-term partnership
- Now selected for the planned Cambridge WRC
- Helea provides capital savings and significant opex savings when compared to alternative technologies
- And we can go further. By integrating Helea and Ephyra plug flow digestion we can achieve industry-leading performance standards
- We believe Helea is a **safe, reliable, energy efficient and sustainable** route to Advanced Digestion and net zero.

THANKS FOR LISTENING!

Visit our website for more information:
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