



Methane to Markets

The Kindersley Centre, Berkshire

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defra

Department for Environment
Food and Rural Affairs



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**Co-digestion of wastes with sewage sludge
including farm wastes**

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Sewage Sludge Production

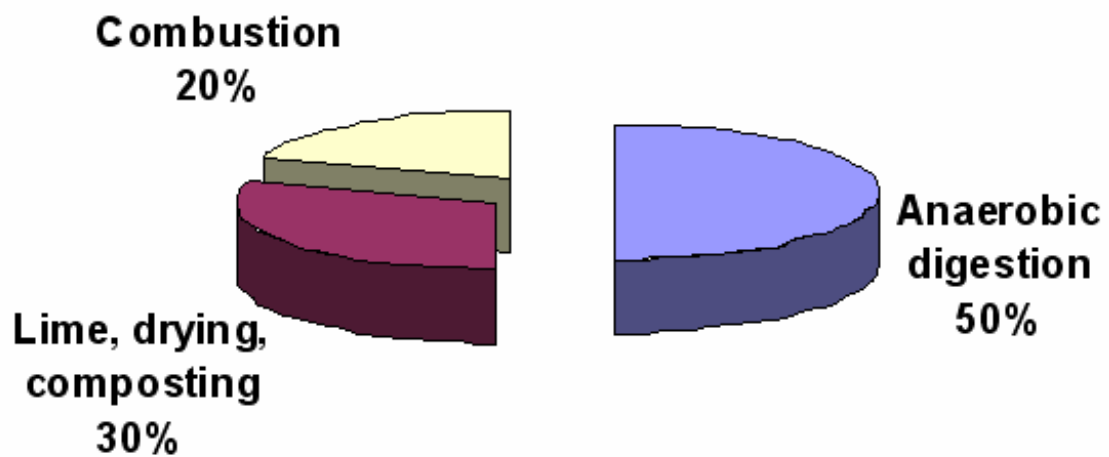
- Volume of wastewater per head per day: 200 litres
- Residual solids per head per day: 80 grams
- Sewage sludge to be treated in the UK: 1.8 million tonnes dry solids per year
- Sewage sludge agricultural recycling: 5% of organic material applied to land in the UK*

*Source Water UK

Capacities and Plants

- Several thousands of sewage treatment works in the UK
 - Over 3000
- Fewer number of sludge treatment centres
 - eg., Thames Water: 350 STWs but only 35 sludge centres
- Sludge centres receive
 - tankered sludge from smaller local sites
 - dewatered cake
 - some receive industrial wastes (food waste, landfill leachate, MSW)

Sludge Treatment Processes



Digestion Assets in UK

- ~ 150 sites utilising anaerobic digestion
- Plant sizes from 60,000 to several millions population equivalent

– Small plant:	60,000 pe.	2,000 tds/a	100 m ³ /d
– Medium size:	160,000 pe.	5000 tds/a	250 m ³ /d
– Large plant:	700,000 pe.	22000 tds/a	1200 m ³ /d

Arial view of an anaerobic digestion plant



Various Plants



Sludge import tank



Import screens



Mechanical thickening



Digestion plant

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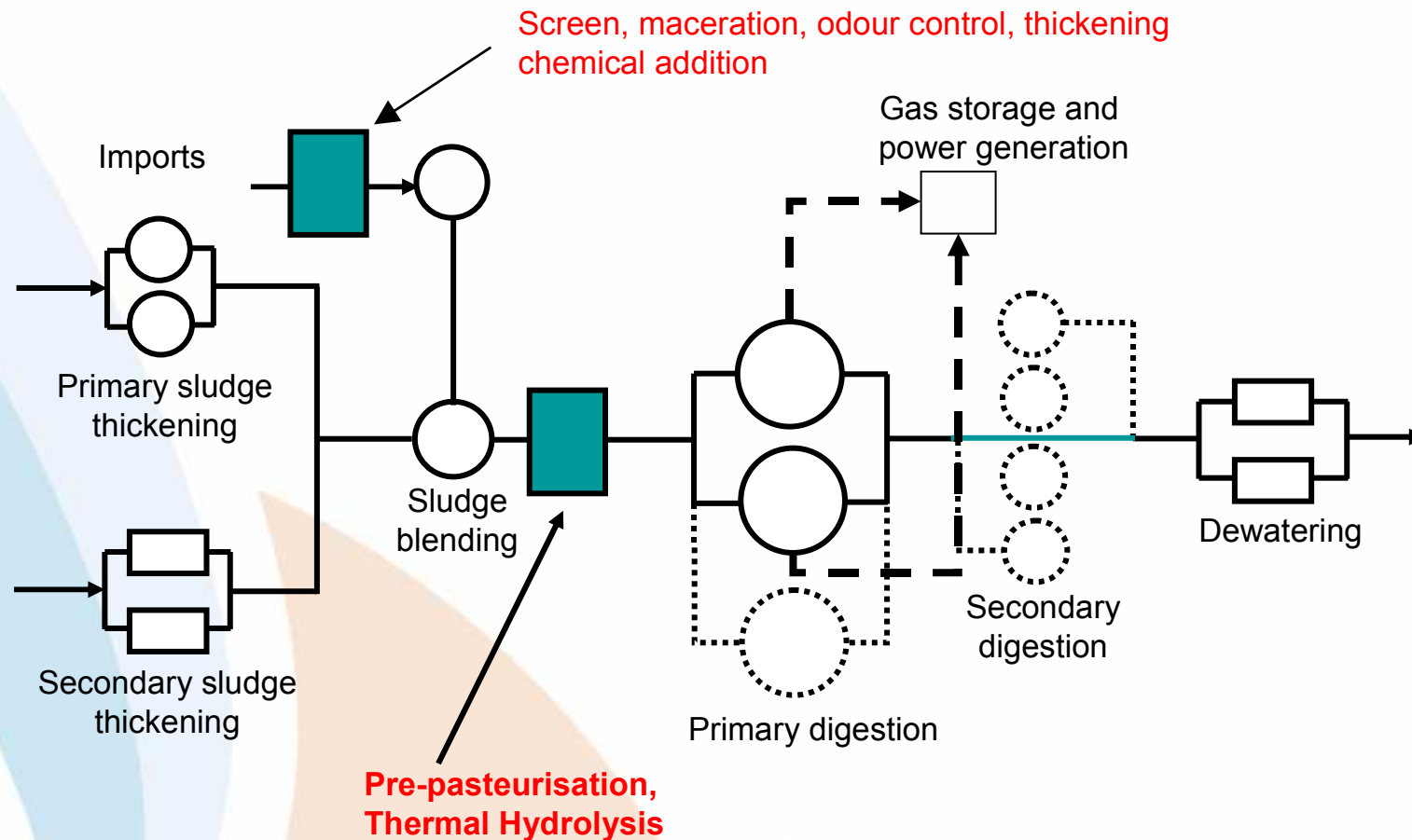
Challenges for Co-digestion

- Technical
- Regulatory
- Economic

Challenges for Co-digestion - Technical

- Nature of feedstock: e.g.,
 - C:N ratio, ammonia, pH, VFA, feed solids, pathogen, odour
- Process/plant changes:
 - Solids handling: screens, maceration, thickening, chemical conditioning
 - ABPR implications: requires pre-pasteurisation
 - Available capacity: additional digestion, gas collection, power generation, dewatering
 - Alterations to process: improved feed blending, digester mixing, odour abatement

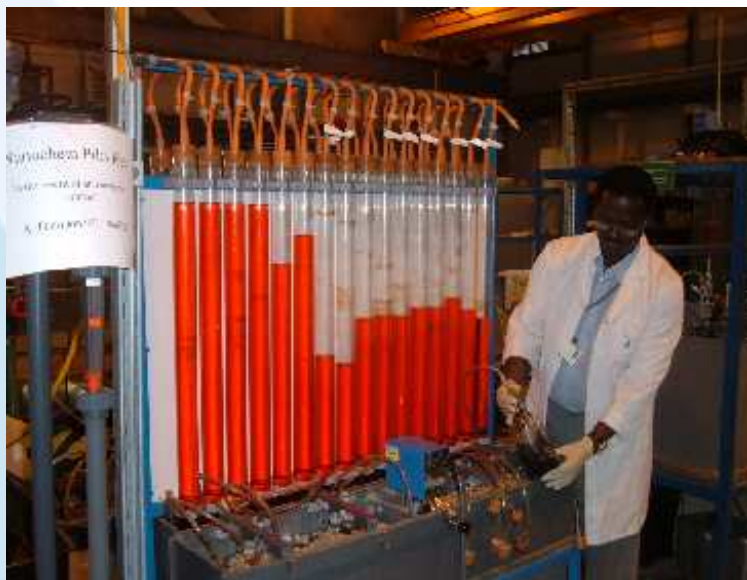
Treatment Process Variations Depending on Imported Waste



Typical Process Parameters

Feed characteristics	Sewage sludge	Imports
Dry solids, %	2-7%	5-30%
Volatile matter, %	70-80	70-95%
pH	5.5-6.5	>7?
Ammonia, mg/lit	500-1000	3,000-20,000
VFA	500-1000	5000-?
C:N	2-7	6-500
Process performance		
Volatile solids conversion, %	40-55	20-90
Biogas yield, m3/kg VS des.	0.8-1.1	0.03-0.6
Methane in biogas, %	60-66	55-80

Assessment of Treatability of Imports



Batch digestibility tests



Semi-continuous test

Challenges of Co-digestion – Regulatory/ Planning

- Sewage sludge: subject to Sludge to Land Reg., eg., Compliance is based on the Safe Sludge Matrix:
 - “Treated” product: 99% reduction of pathogen indicator microorganism (*E.coli*) across treatment process & $<10^5$ per gds in the product
 - “Enhanced” treated product: 99.9999% of *E.coli* reduction & $< 10^3$ Ecoli per gds and absence of *salmonella* in the product

Challenges of Co-digestion – Regulatory/ Planning

- Receiving Sewage Works may require Waste Management Licence
- ABPR: requires thermal pre-treatment or thermophilic digestion
- End product: may be classified as waste and therefore has to be recycled at licensed site
- Potentially higher concentrations of N, P and a lesser extent PTEs would have implications on where the product can be applied to
- Planning

Challenges of Co-digestion - Economics

- Sewage sludge: 2% of total flow to STW but cost up to 50% of total cost of treatment
- Typical OPEX
 - Digestion + dewatering + recycling: £65/tds
 - Raw dewatering + lime treatment + recycling: £80/tds
 - Digested cake + thermal drying: £110/tds
- CAPEX
 - of digestion, dewatering and power generation: £2000/tds

Closing Remarks

- STWs generally have good accessibility and are close to areas where other feedstocks are generated.
- Pre-treatment processes will be required to adequately handle and treat imported feedstocks.
- Existing Water Utilities' digestion assets are unlikely to have a lot of spare capacity to enable co-digestion due to their heavy deployment.
- There are opportunities for separate digestion of other wastes at STWs using redundant assets or more efficient bespoke digestion processes.

And finally, I'd like to have my sludge treated here please!



Photos, courtesy of Thames Water Utilities Ltd.