

CAM3



NEW ENGLAND WATER ENVIRONMENT ASSOCIATION

NEWWEA

WORKING FOR WATER QUALITY



Use of Thermal Hydrolysis to Enhance Options for Co-Digestion

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Landfills emit

15.1%

of all the methane generated in
the United States*

* US EPA, 2018



80
billion
lbs per year

40% of the food produced in the
United States is wasted

**41 million Americans face
food insecurity**

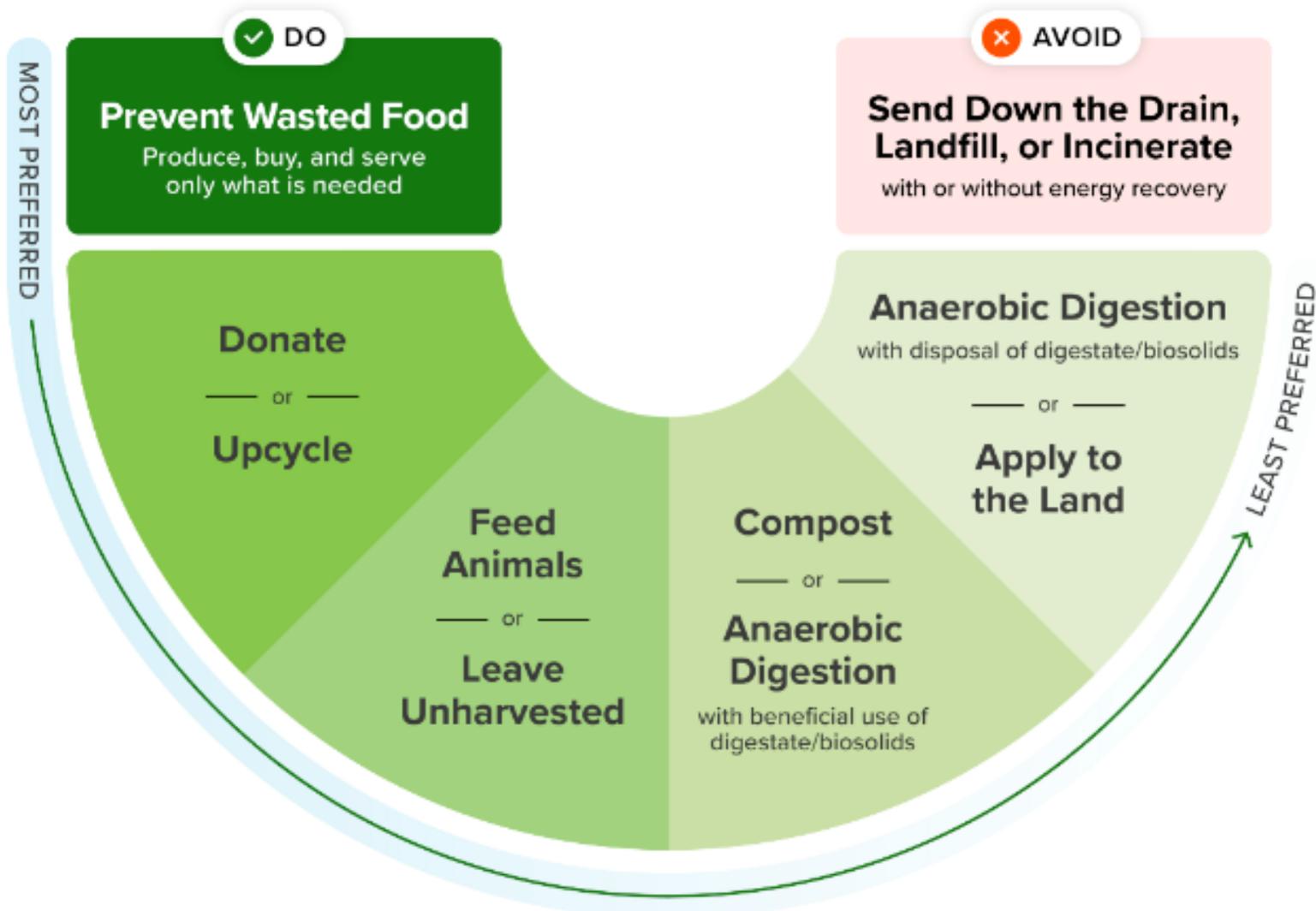
Sources: Food and Agriculture Organization of the United Nations;
Food Waste in the USA – Statistics and Facts; National Conference of
State Legislators NCSL

Should we
co-digest this
food waste?

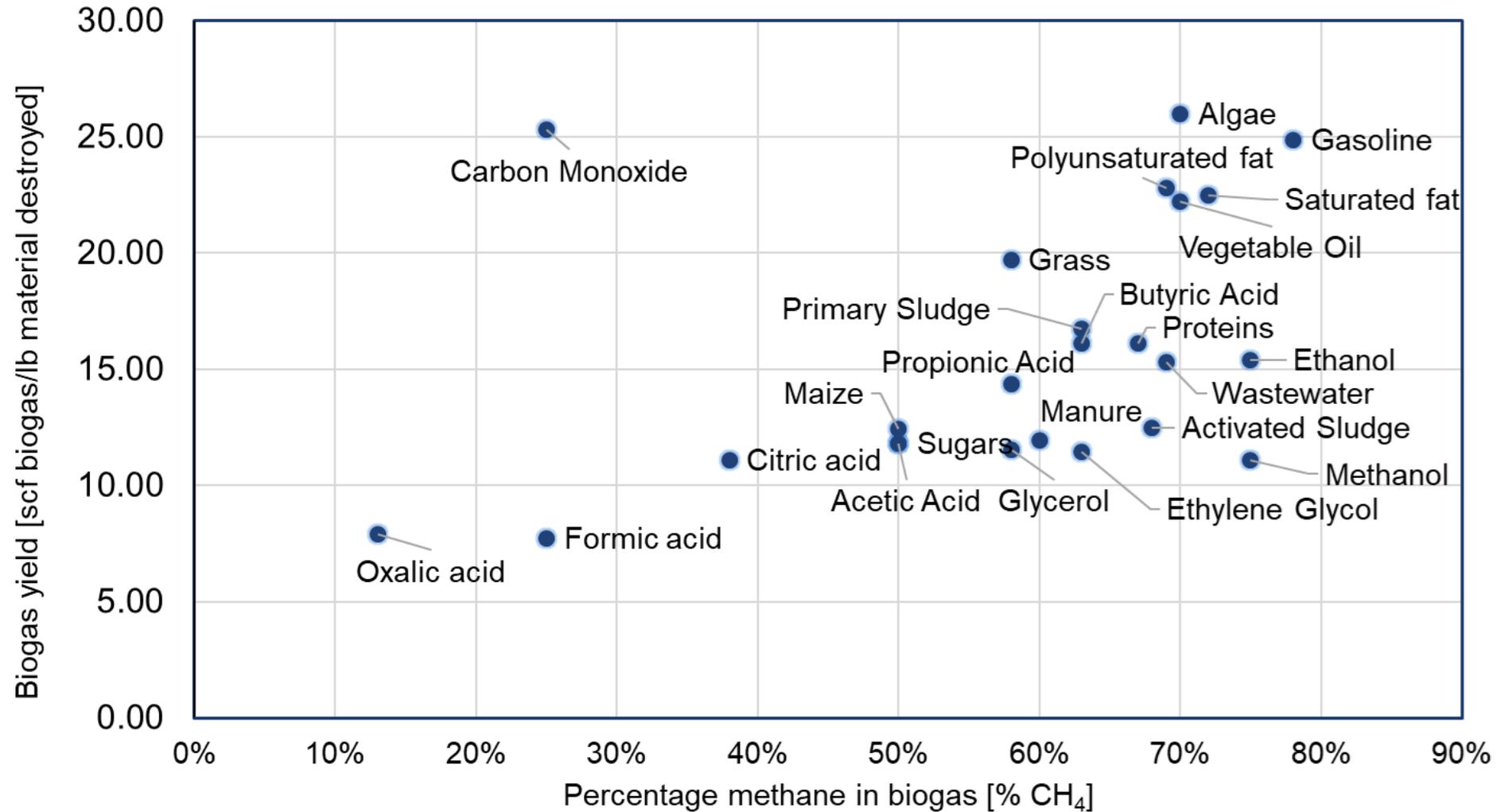


Wasted Food Scale

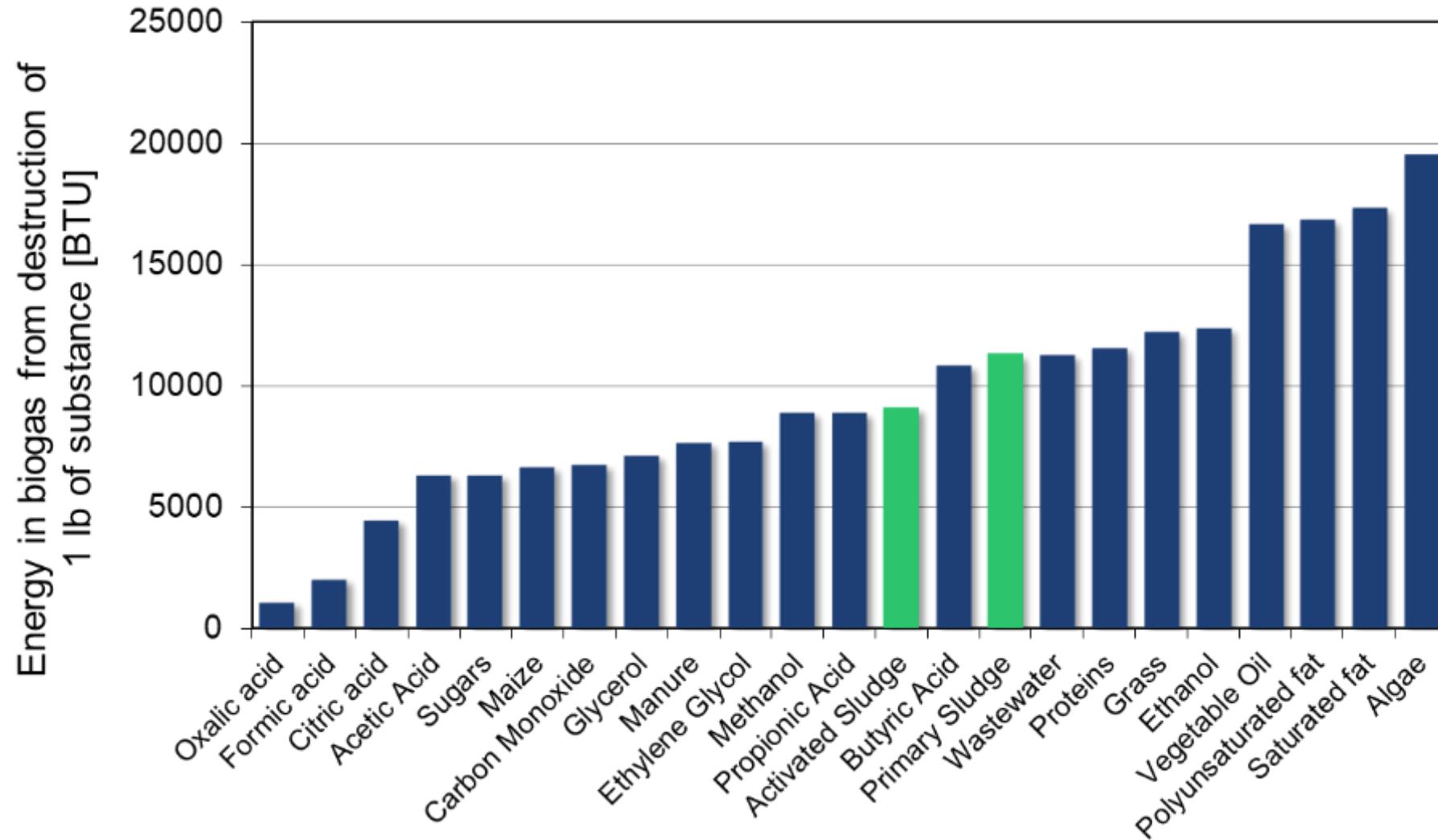
How to reduce the environmental impacts of wasted food

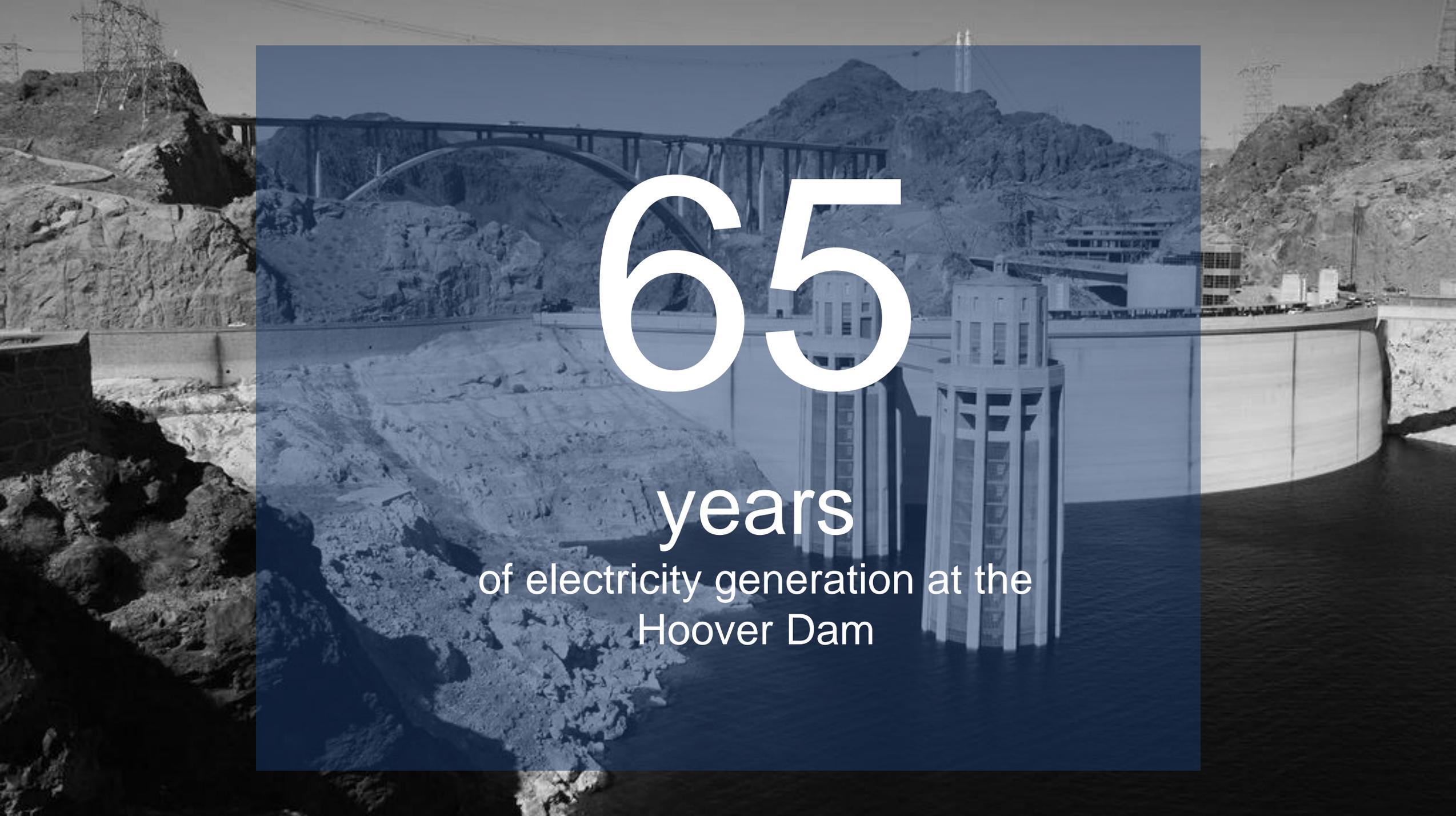


Biogas yield from various substances



Energy potential in biogas from various substances



A photograph of the Hoover Dam and Lake Mead, with a semi-transparent blue overlay. The dam is a large concrete structure with a curved spillway. In the background, there are mountains and a bridge. The foreground shows the rocky terrain of the dam's construction site.

65

years
of electricity generation at the
Hoover Dam

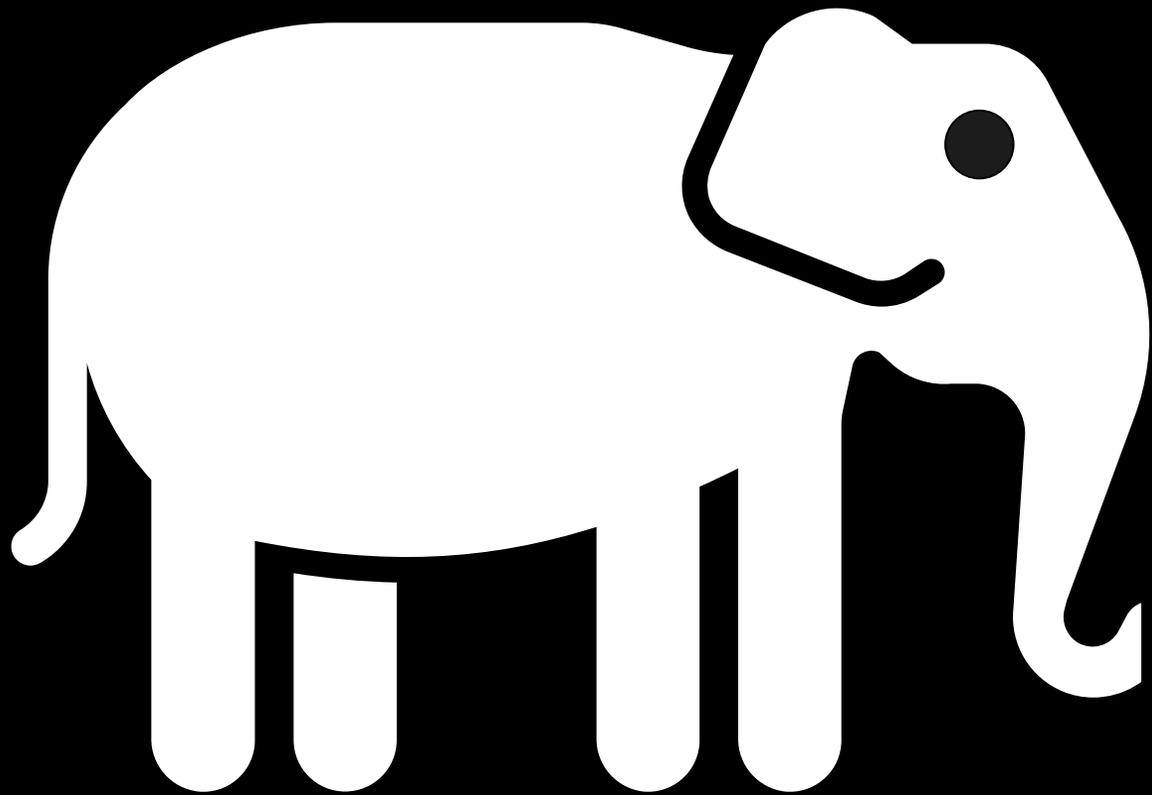
An aerial photograph of a large industrial power plant, likely a coal or nuclear plant, featuring several tall cooling towers and a prominent smokestack. The plant is situated in a valley with mountains in the background. The image is overlaid with a semi-transparent blue rectangle containing white text.

More energy generation than the

10

biggest power plants in the
United States

combined



PFAS

What is thermal hydrolysis?



Heating of sludge
>330°F



... to change
properties



... to
optimize
processing

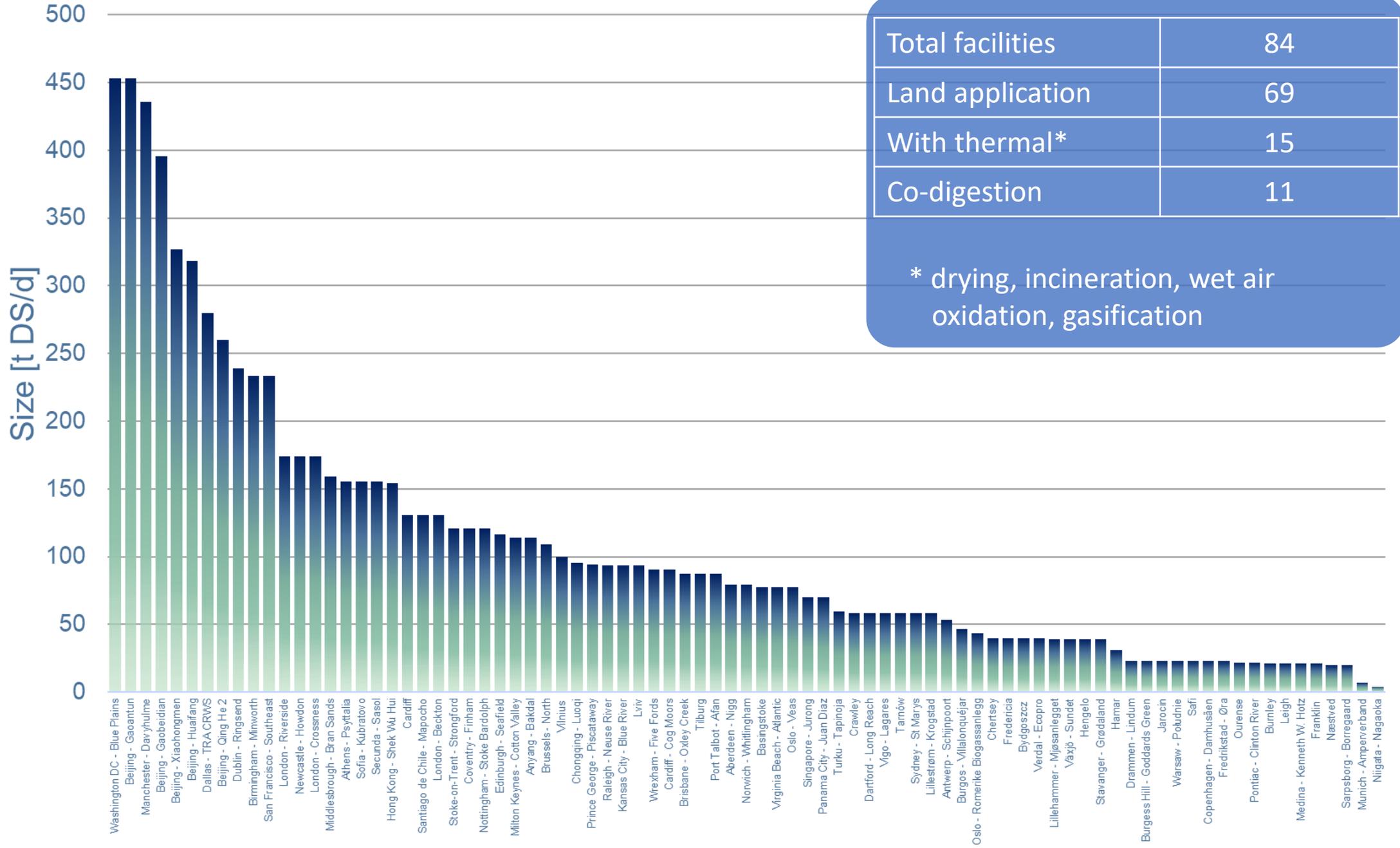


Full-scale thermal hydrolysis plants treating
up to 20 tDS/d

Influence of thermal hydrolysis



Cambi References



United States References

76 reactors

17 trains

1,350
tDS/d

6% of USA

Blue Plains, DC Water



Atlantic Plant, HRSD, VA



Neuse River, Raleigh, NC



Franklin, TN



B12

[> 90 tDS/train]

B6

[< 90 tDS/train]

B6 2P2F

[extended availability]

B2

[< 25 tDS/train]

TRA, Dallas, TX



Piscataway, WSSC, MD



Kenneth W Hotz, Medina, OH



San Francisco, SFPUC, CA



Kansas City Blue River, KCMO, KA



Pontiac, Auburn, MI



Challenges

Liquor Treatment



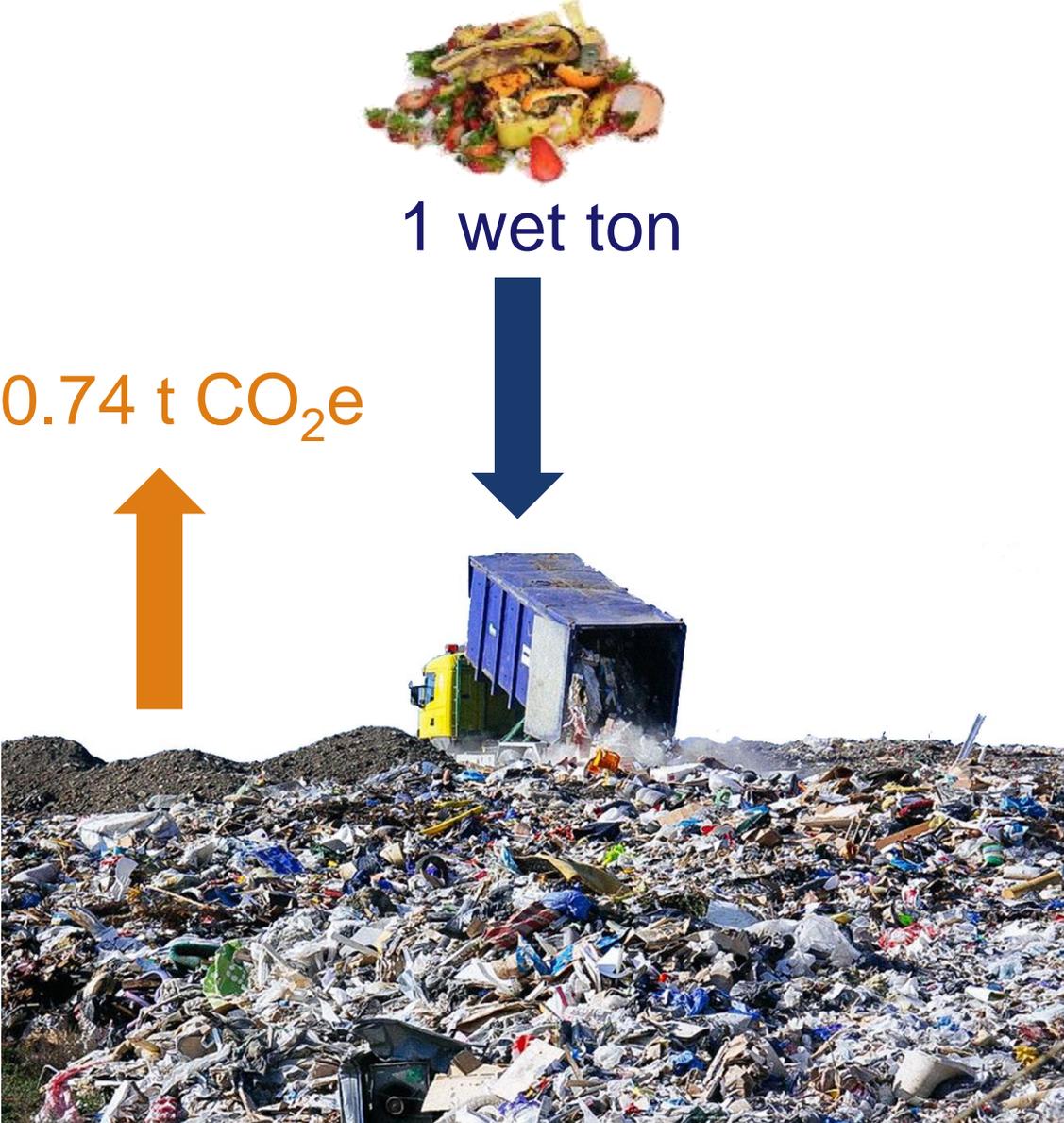
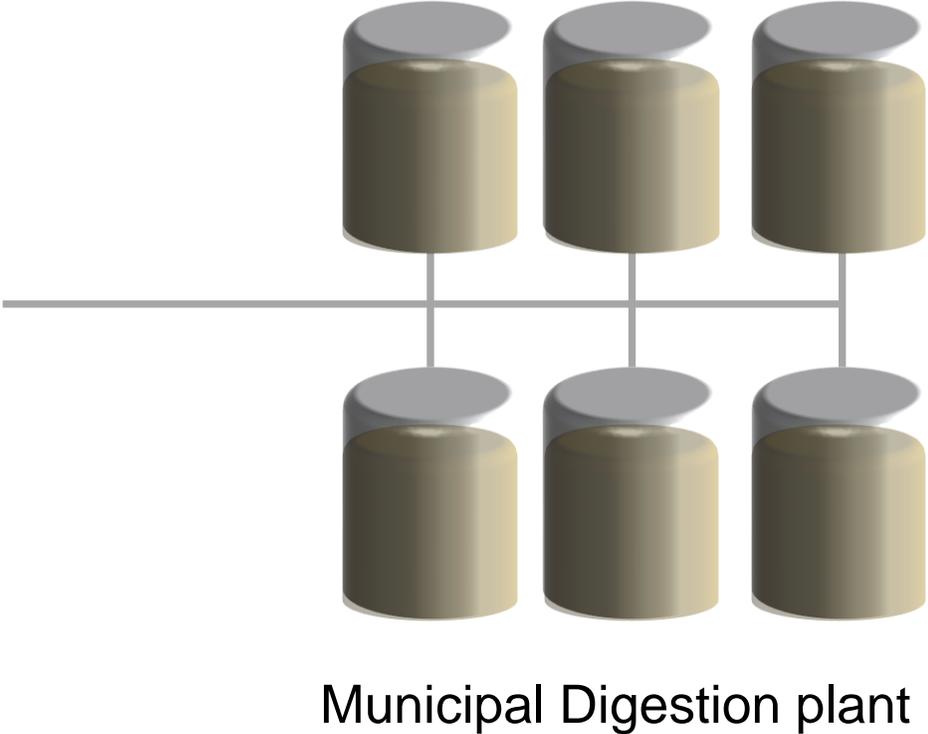
Louis Camille
Maillard
1878 - 1936

Photo: HappyApple
on Wikipedia

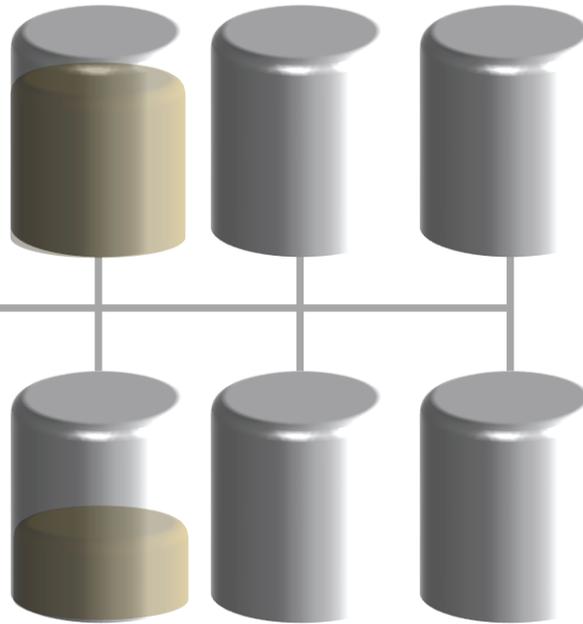
Biogas Infrastructure

Mjøsanlegget, Cambi
Thermal hydrolysis with
co-digestion plant, Norway

Landfill Example



Landfill Example

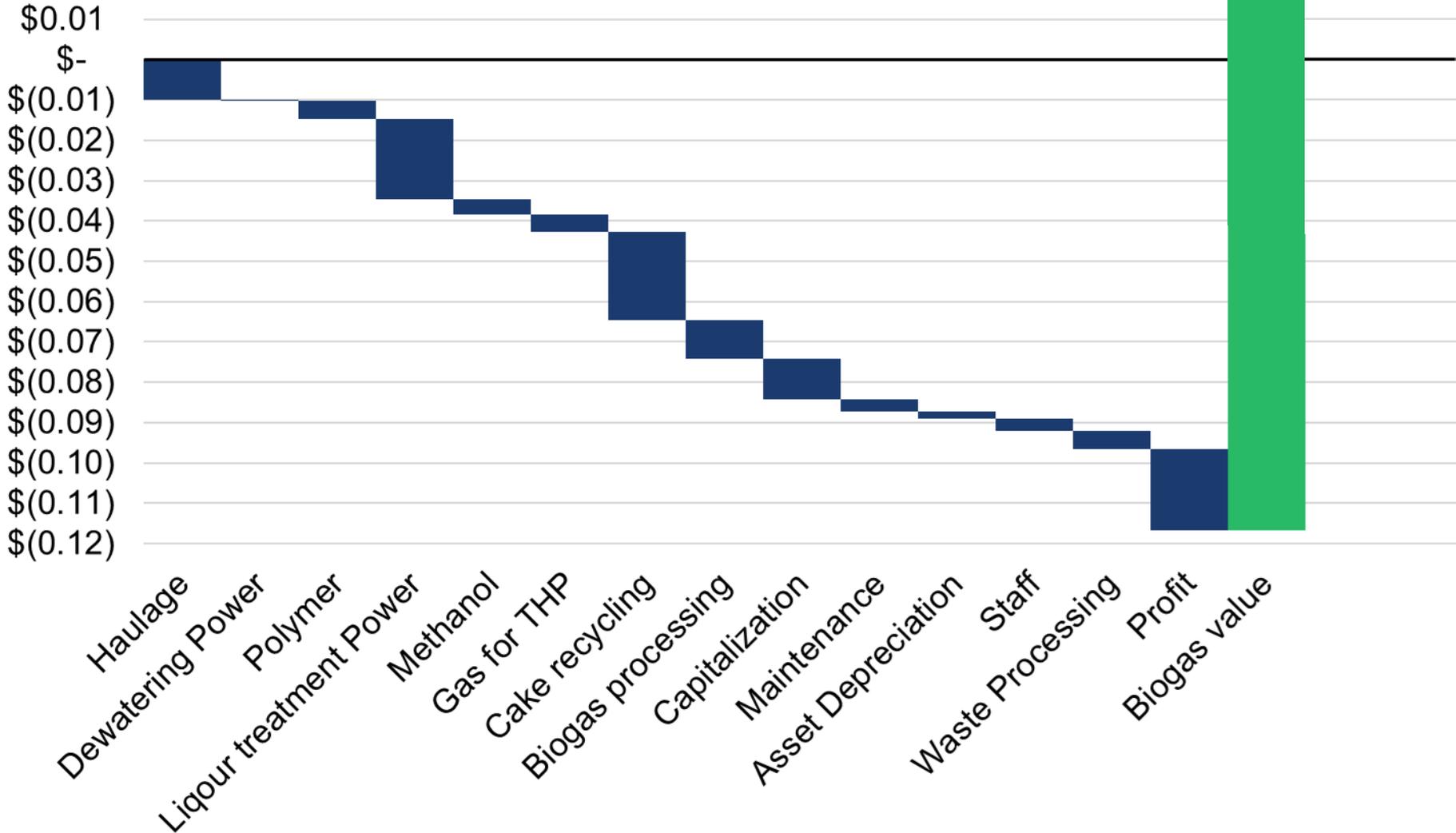


27 – 43 ft³ digestion capacity/t DS_{processed} for standard digestion

9 – 12 ft³ digestion capacity/t DS_{processed} for THP with digestion

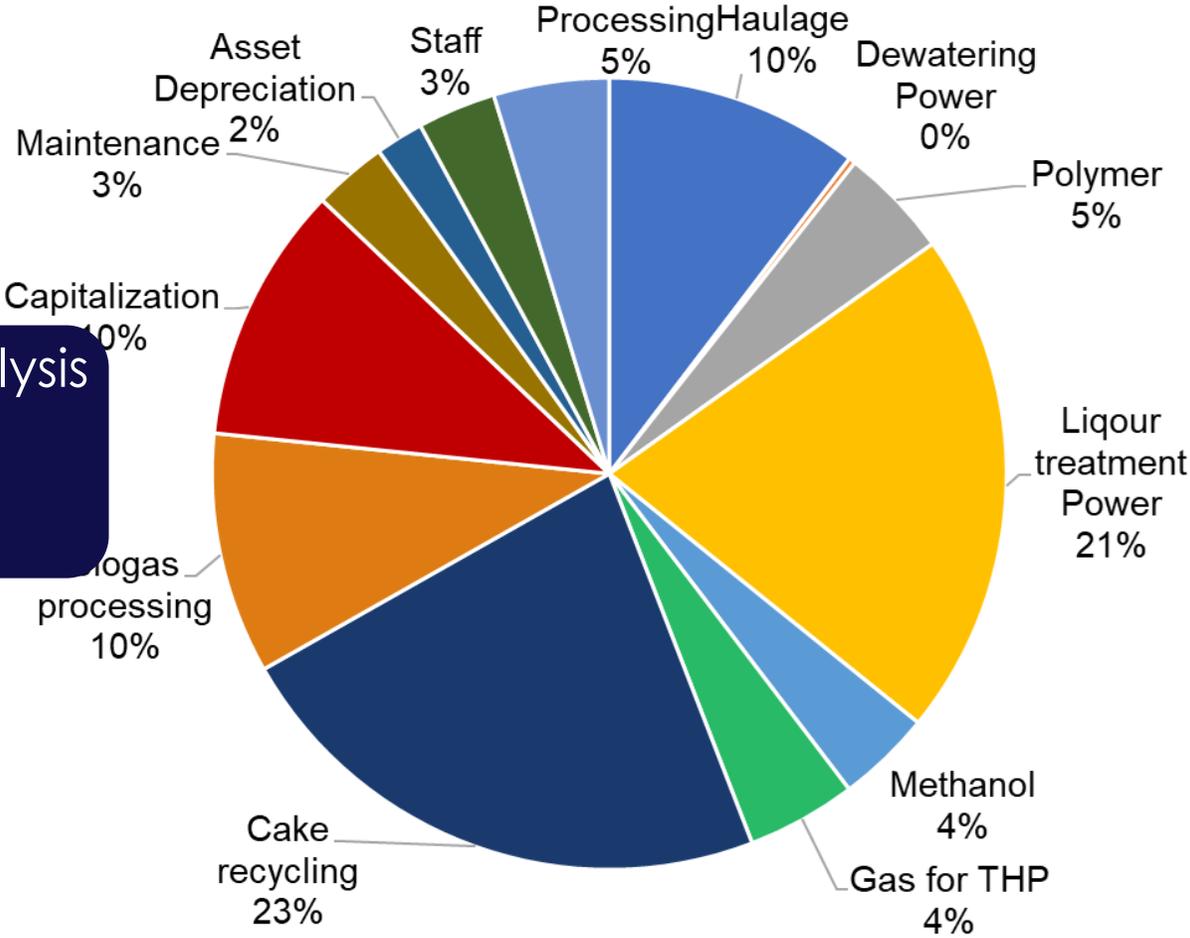


The economics of co-digestion

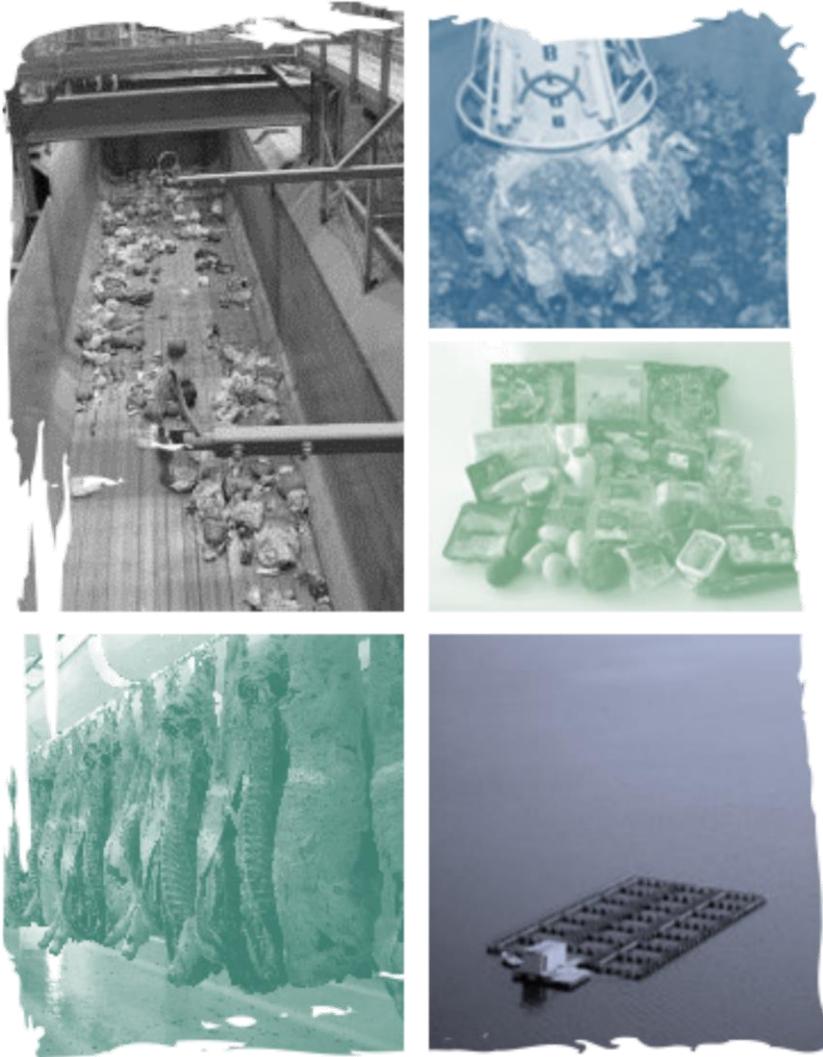


Typical cost breakdown of co-digestion with thermal hydrolysis

Costs of thermal hydrolysis <<10% of overall operating costs



Experience of combining thermal hydrolysis with co-digestion



Food, source separated, grocery store, animal byproducts, slaughterhouse fish-farm etc

Gas yield
0.3 – 1.3
 $\text{m}^3/\text{tDS}_{\text{fed}}$

Up to
85%
addition

65 – 85%
VSR

Co-
generation
and
biomethane

Reference list of some co-digestion plants

Site	Client	Country	Commissioned	TDSA	Feedstock	Product
Verdal - Ecopro	Ecopro	Norway	2008	8,000	Co-digestion	B12-2
Oslo - Romerike Biogassanlegg	Municipality of Oslo	Norway	2013	15,000	Biowaste	B12-2
Växjö - Sundet	Municipality of Växjö	Sweden	2015	8,600	Co-digestion	B6-2
Lillehammer - Mjøsanlegget	GLØR	Norway	2016	9,800	Biowaste	B6-2
Anyang - Bakdal	K-eco	South Korea	2016	33,500	Co-digestion	B12-4
Stavanger - Grødal	IVAR IKS	Norway	2017	22,600	Co-digestion	B6-2
Medina - Kenneth W. Hotz	Medina County	USA	2019	8,200	Mixed Sludge with organics	B2-4
Virginia Beach - Atlantic	HRSD	USA	2020	30,300	Mixed Sludge with FOG	B6-4
Chongqing - Luoqi	Chongqing Environment and Sanitation Group	China	2021	26,300	Co-digestion	B12-4

Oslo



50% reuse
of waste
materials

No
production
of waste

- Curbside recovery
- Use of landfill gas



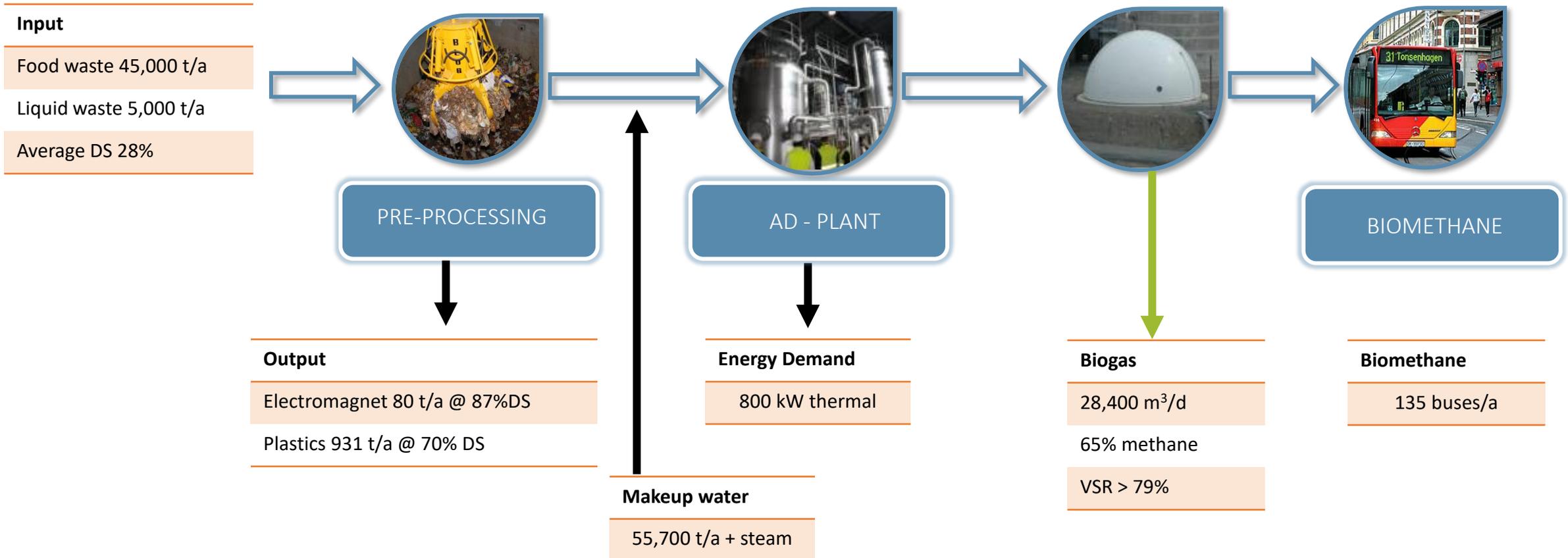
100%
standby
plant

Evaporator
for liquor
treatment



Biomethane
plant

Oslo



Ecopro Trondheim

Municipal
sludge
Food waste
Fish waste

Animal
byproducts
regulations

Plastics (bags)
and metal
contamination
removal plant

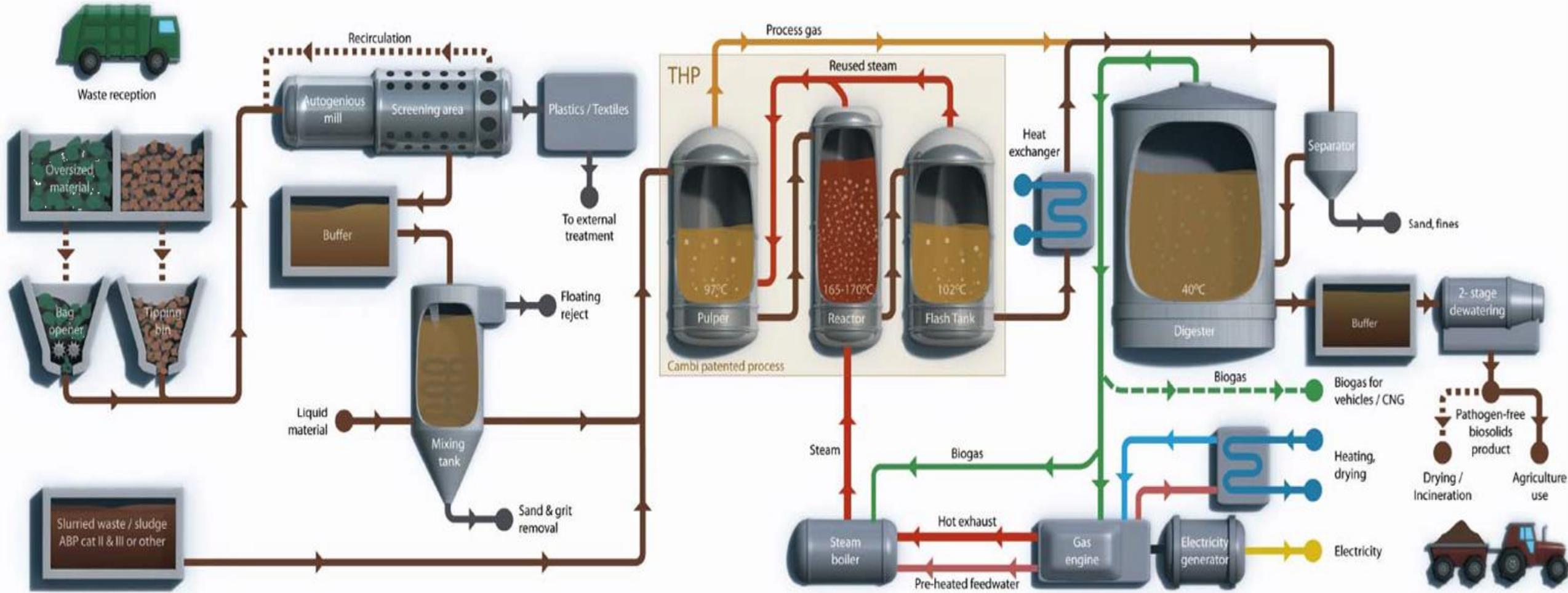


Mechanical
dewatering
(centrifuges)

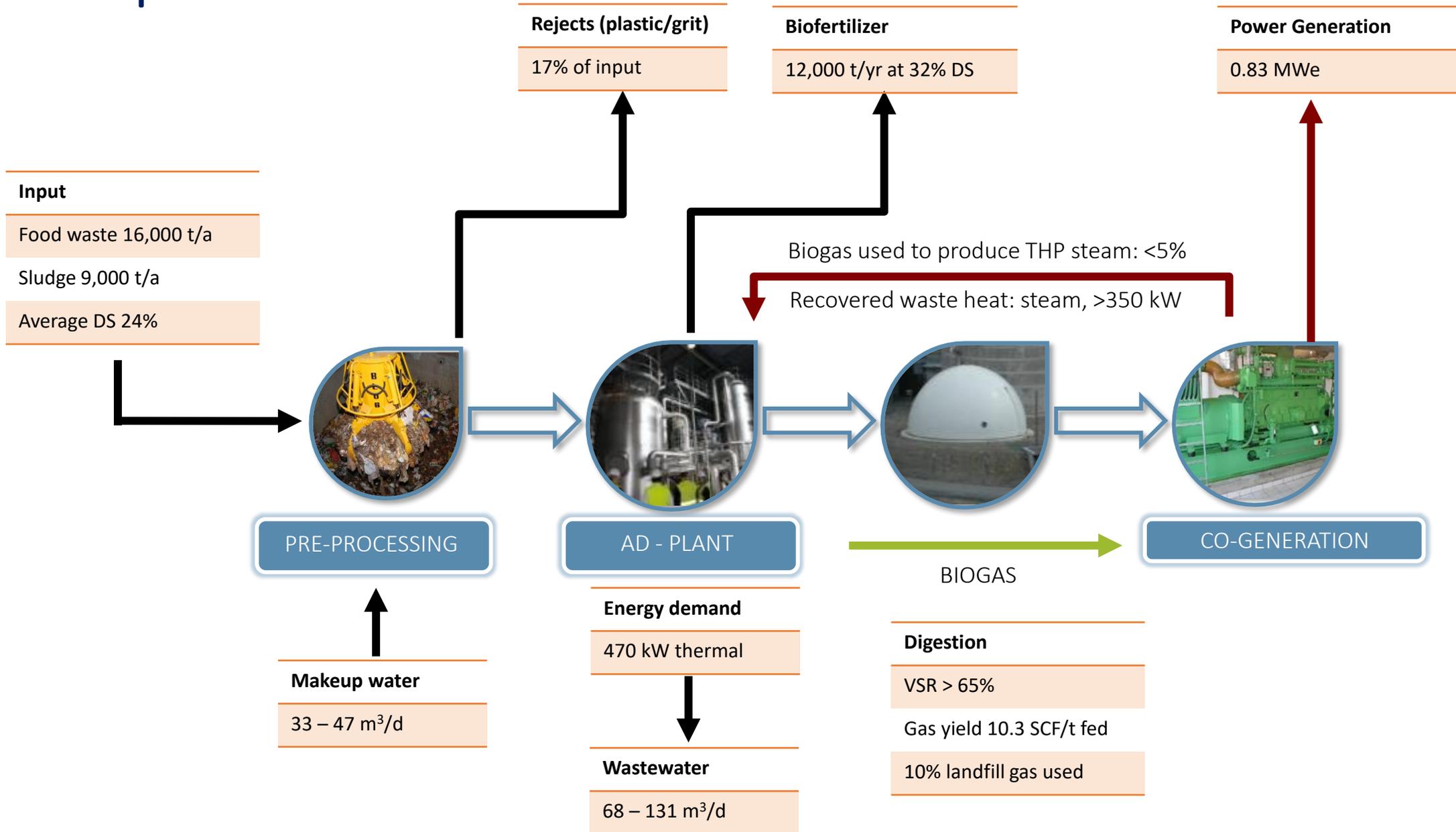
Upgrade
to existing
co-
digestion



Ecopro Trondheim



Ecopro



Ecopro



Start up 2008

70 wet tons/d

45% sludge with 55% foodwaste

HRT 11 days

Results 2016

VSR 65% (was 45 – 50%)

Biogas yield 10.3/tDS_{fed}

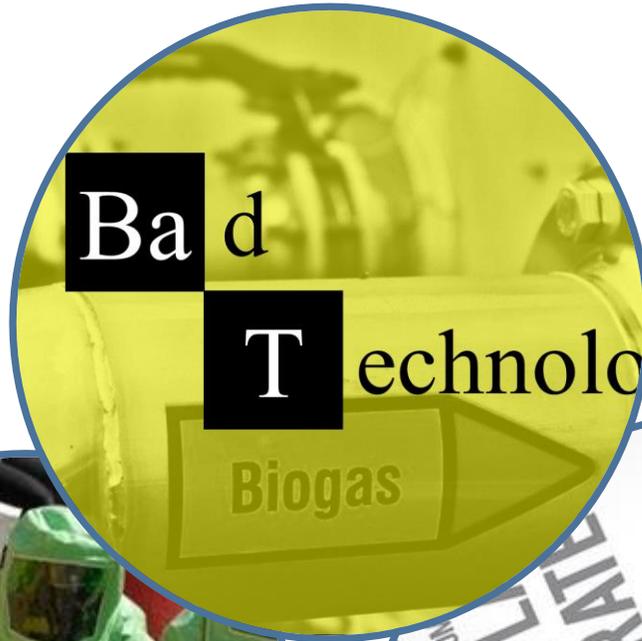
Cake dryness = 32% DS

Polymer consumed = 7.1 lb/t DS

Plant availability = 98+%



Lessons Learnt





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Thank you

