



Case study

Biogas solutions in Norrköping

and implementation of AD in the pulp and paper industry

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Reflections from the workshop series

Biogas solutions in Norrköping

Aims

Deepened knowledge about conditions for implementation of biogas solutions in a local setting

Possibility to identify and develop biogas solutions through collaboration

Analyse how biogas solutions can contribute to municipal goals for climate, environment, gas market development and new companies

Norrköping

Industrial tradition

Pulp and paper

Logistic hub

Recycling industry

Ethanol production

Municipality of Norrköping

Land area: **1 496 km²**

Water area: **552 km²**

Population: **140 927**

Population density per km²: **94,2**



Biogas increase regional resource efficiency already in Norrköping



- Landfill - electricity
- Sewage sludge digestion to vehicle gas, electricity and biofertilizer
- Water cleaning - ethanol, cardboard production
- Co-digestion plant – vehicle gas and biofertilizer
- Fuel for buses and cars
- Food waste treatment



Workshop series Norrköping

- 13/12 Workshop 1 information gathered about actors, quantitative information and present state in Norrköping
 - Potential and market study
- 7/2 Workshop 2 presenting potential study. Barriers, opportunities and key actors discussed
 - Potential and market study completion and analysis of critical factors for implementation
- 22/3 Workshop 3 deeper analysis of the list of critical factors.
 - Final report and dissemination

Workshop series

Participants (15-20 per meeting)

Municipal organisation

Sustainability Strategist

Waste and wastewater

Business office

Paper mills

Biogas producers'

Farmers' organisation

Zoo

Waste treatment company

Organisations for fossil free transport

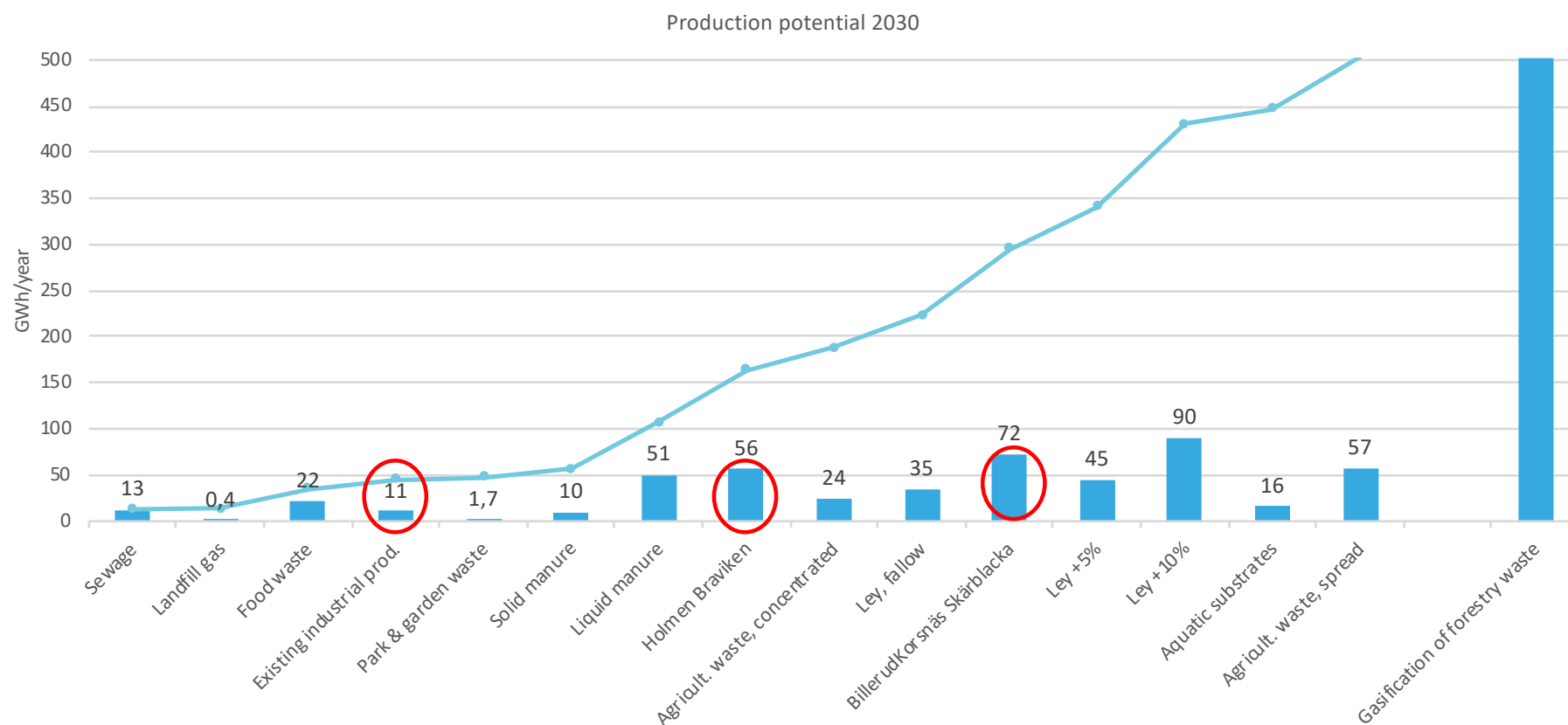
Biofertilizer company

Researchers from several disciplines

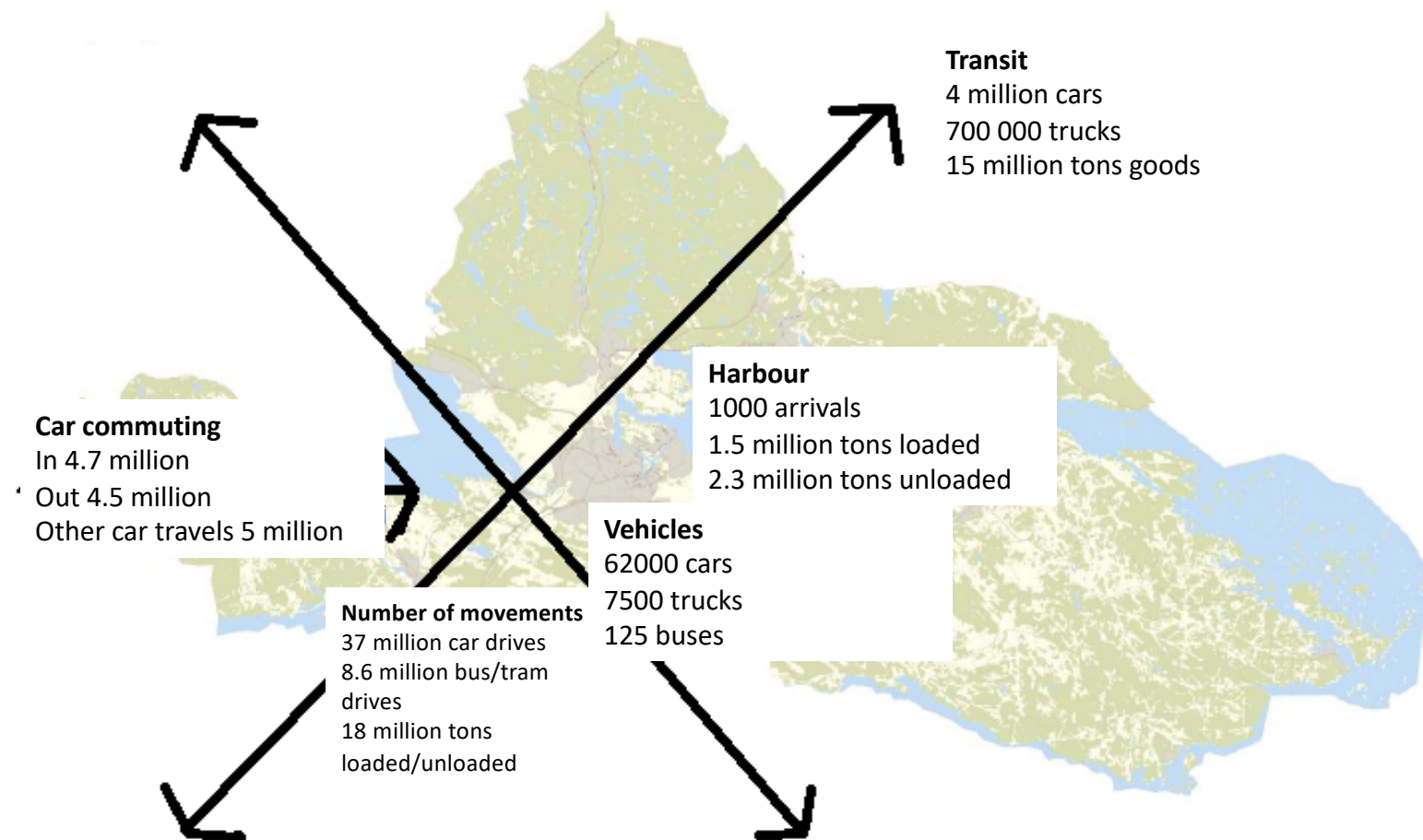


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Production potential 2030

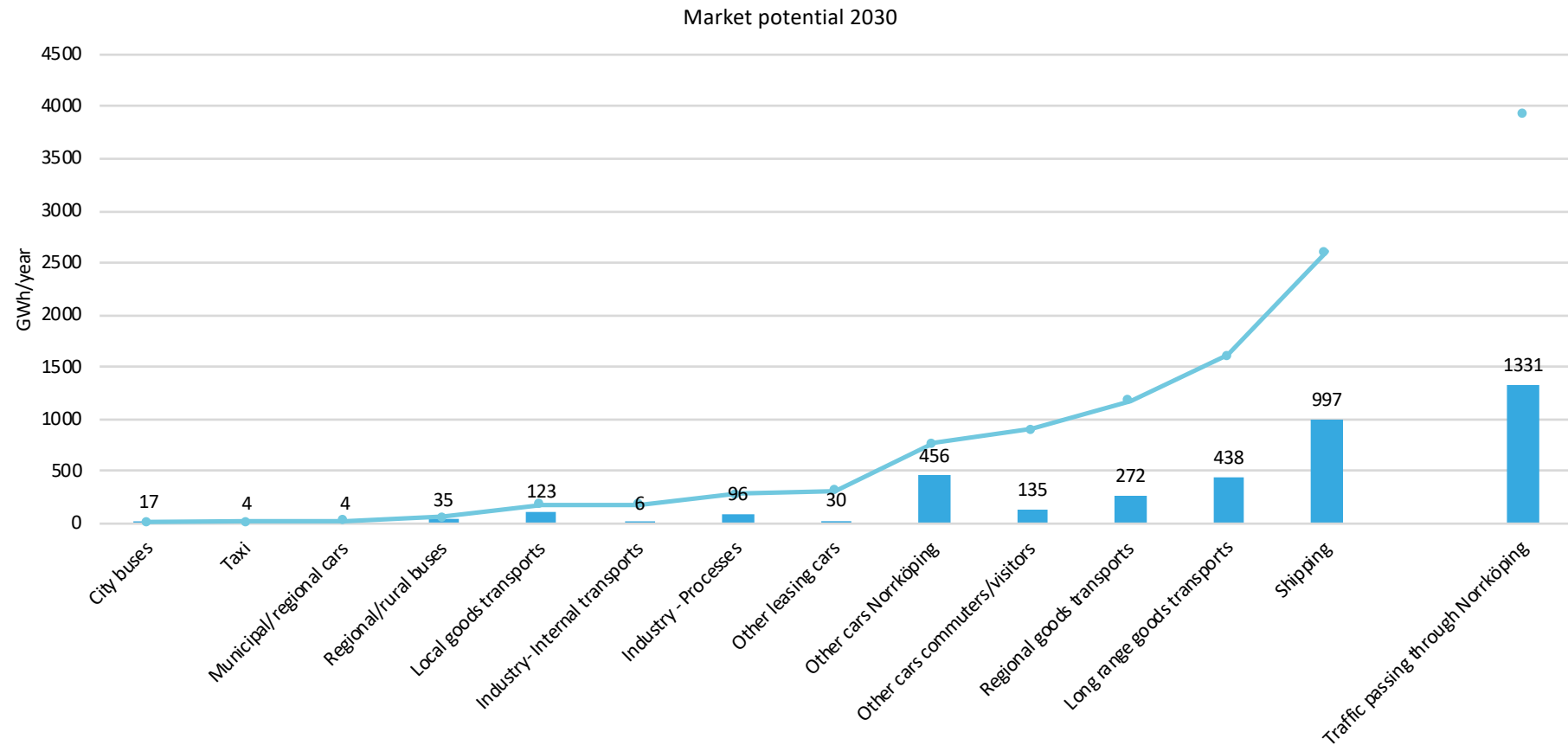


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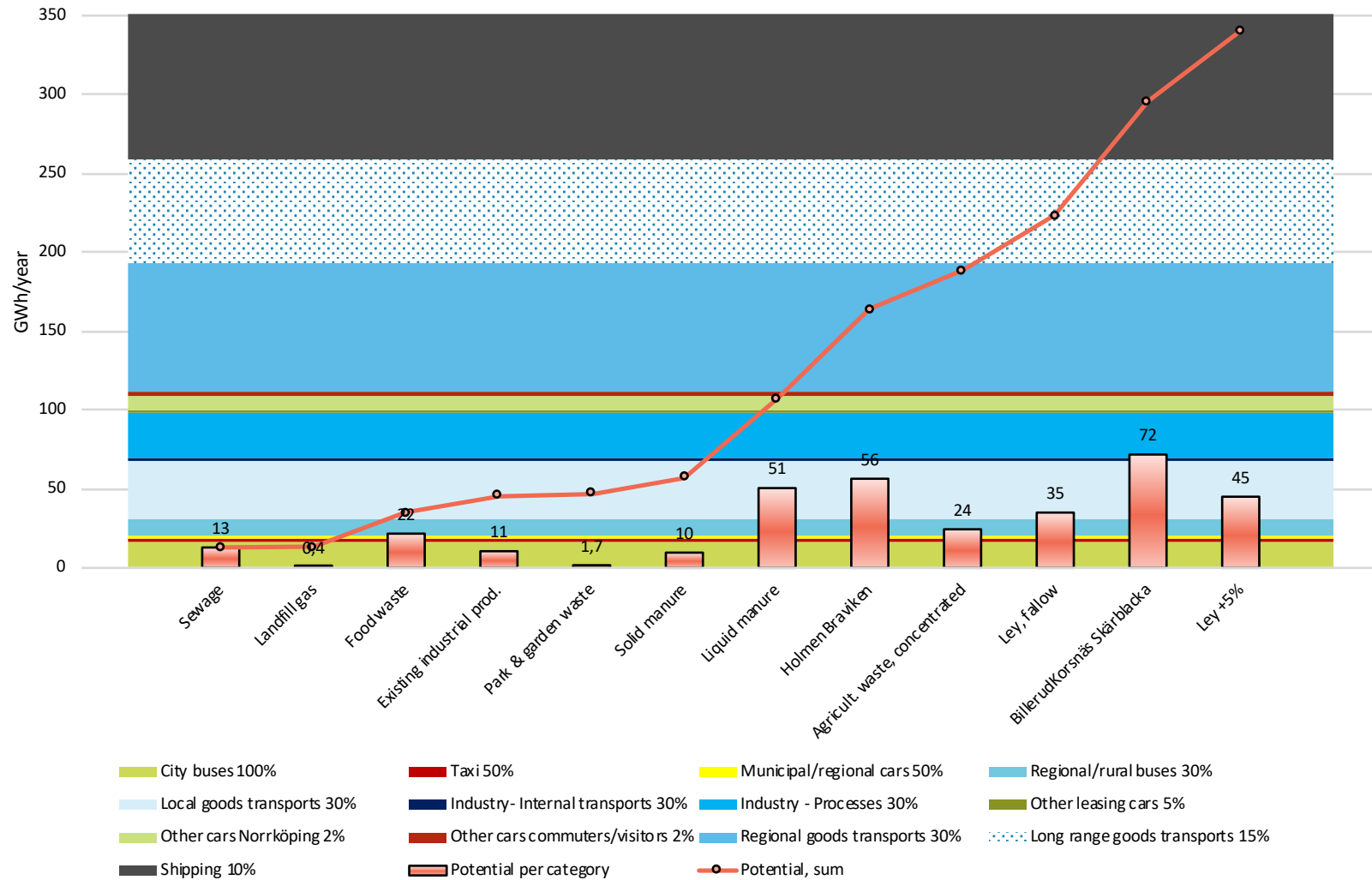
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Market potential 2030



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Production and market potential 2030



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Most interesting potential

- Process water from pulp and paper industries
- Manure
- Grass as ley crop
- Haulage
- Public transport buses
- Cars
- Industrial use

Critical (f)actors

Pulp and paper industry

- ☐ Business model that distribute risk and possible gains
- ☐ Long-term stability in the market
- ☐ Collaboration to reach critical mass for upgrading/liquefaction
- ☐ Environmental permits, esp COD
- ☐ Braviken location - harbour, roads - potential for LBG

Pulp & paper
industries

BRC

Gasum

Scandinavian
Biogas

The city

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Critical (f)actors

Industrial use of gas

- ☐ Early adopters risk
- ☐ Target fossil-free production
- ☐ Economic implications
- ☐ Predictable quality
- ☐ Security of supply

Large industries

Händelö cluster

Gas sales
companies

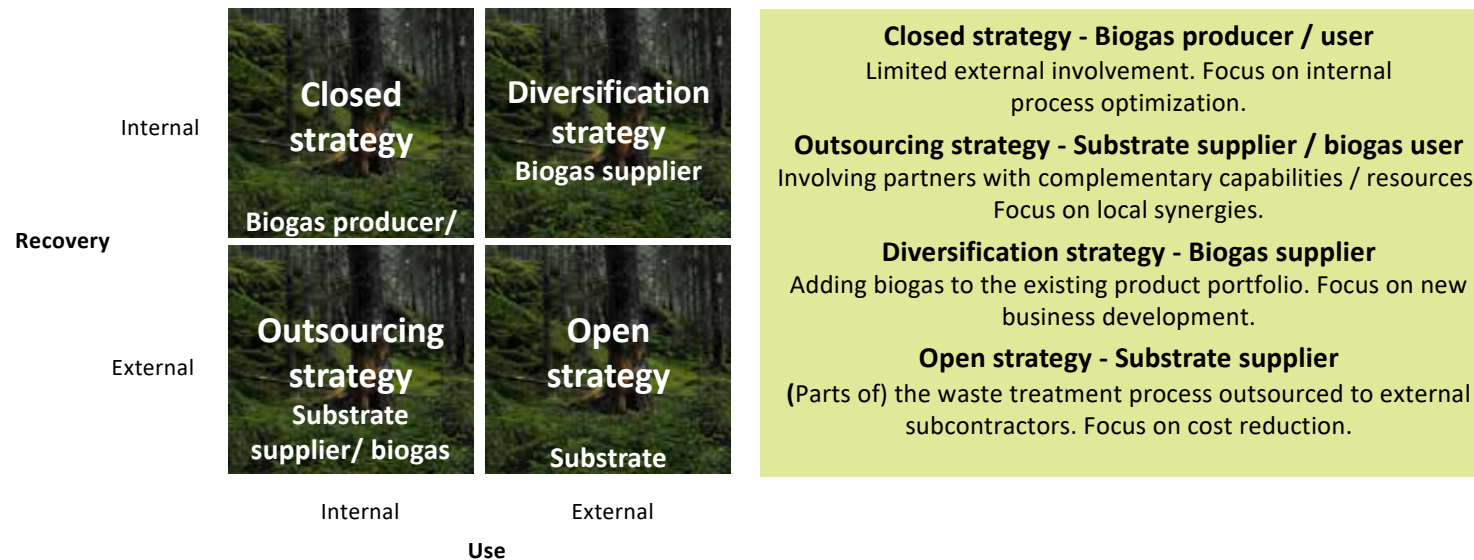
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Four alternative strategies for forest firms/mills

Domsjö (Aditya Birla, Sverige)
Fiskeby
Heinola (Stora Enso, Finland)
Sarpsborg (Börregard, Norge)

Saugbrugs (Norske skog, Norge)

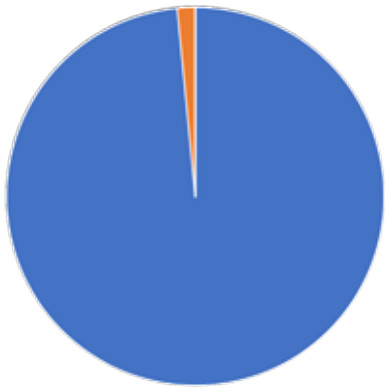
Developed by and based on:
Hans Andersson, Mikael Ottosson and Thomas Magnusson
Biogas in the Nordic forest industry
Industrial Efficiency 2016 - Berlin, September 12-14



Skogn (Norske Skog, Norge/ SBF.)
Äänekoski (Metsä, Finland/ EcoEnergy SF
Nymölla (Stora Enso / Gasum

The framing and identity of biogas solutions in the pulp and paper industry

Alyssa Blumenthal and Mats Eklund



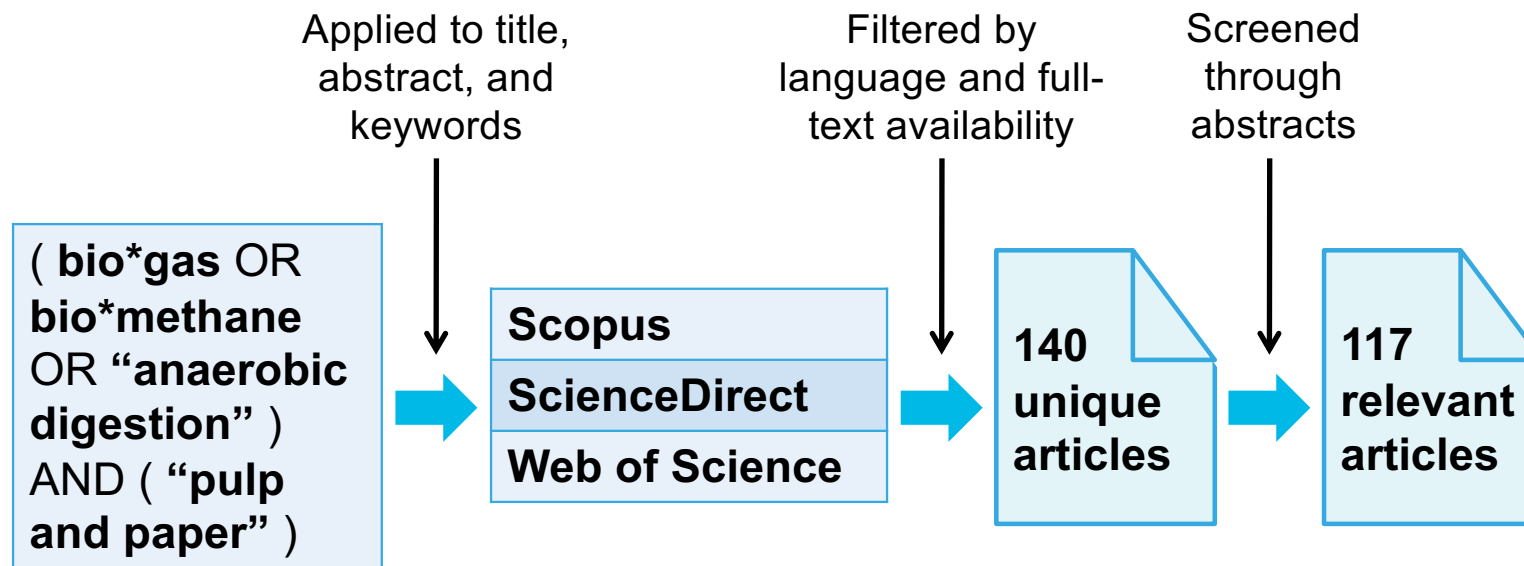
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Anaerobic digestion in pulp and paper industry

CEPI, 2015; Thompson et al., 2001; Pokhrel and Viraraghavan, 2004; Meyer and Edwards, 2014, **Habets and Driessen, 2006**

- Lesser sludge production, lower chemical consumption, and lower energy demand in comparison with aerobic methods
- In 2006, industry professionals declared that AD had “**found a widespread application in the pulp and paper industry**” and that it could be considered to be a “**proven and well-established technology.**”
- Fewer than 10% of all pulp and paper (P&P) mills incorporate an anaerobic process in their waste treatment or energy recovery strategy
- Feasibility and reactor optimization studies are still important research areas, but they alone not enough to gain a larger systems-level perspective on this technological adoption

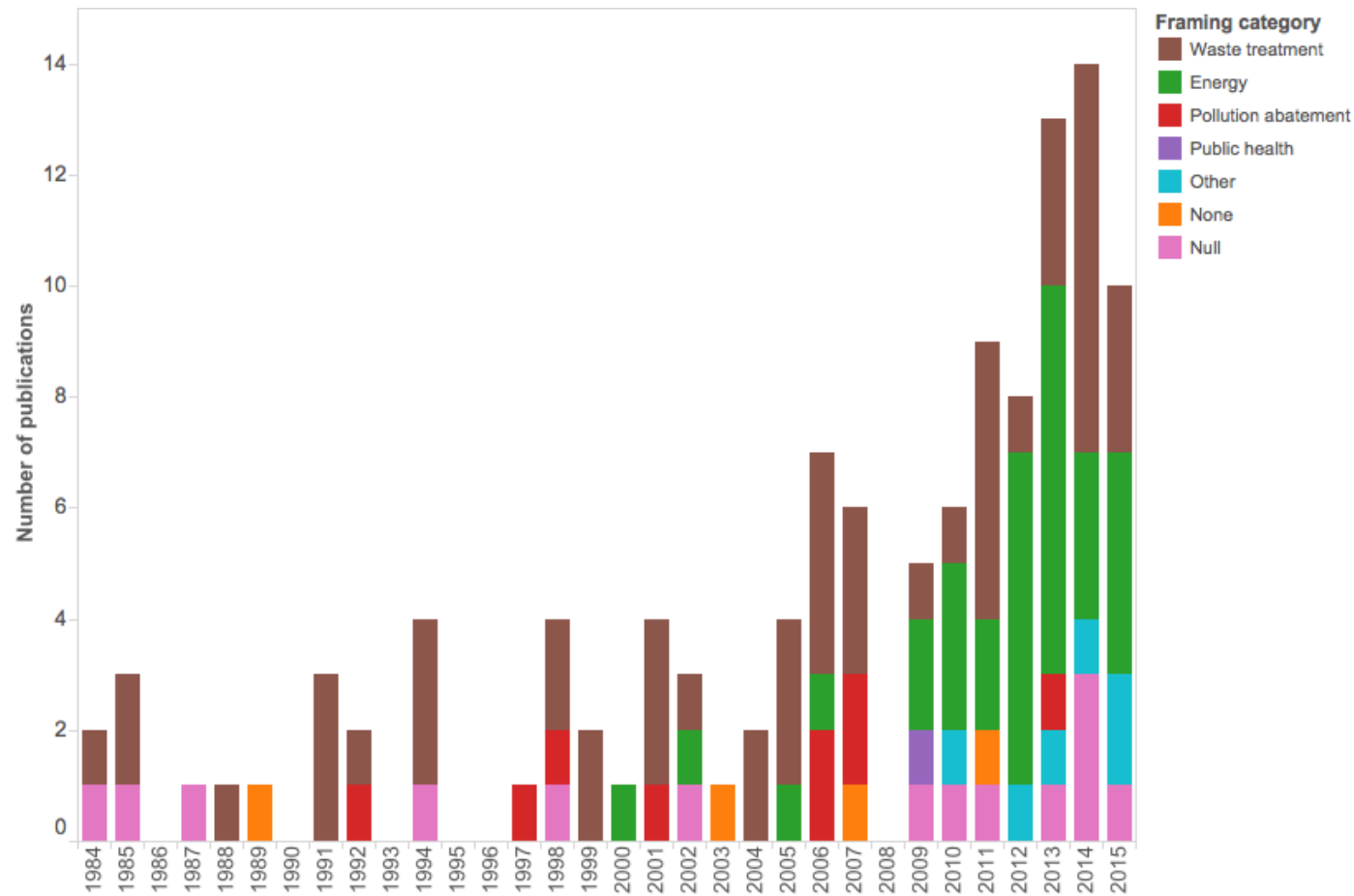
Methodology



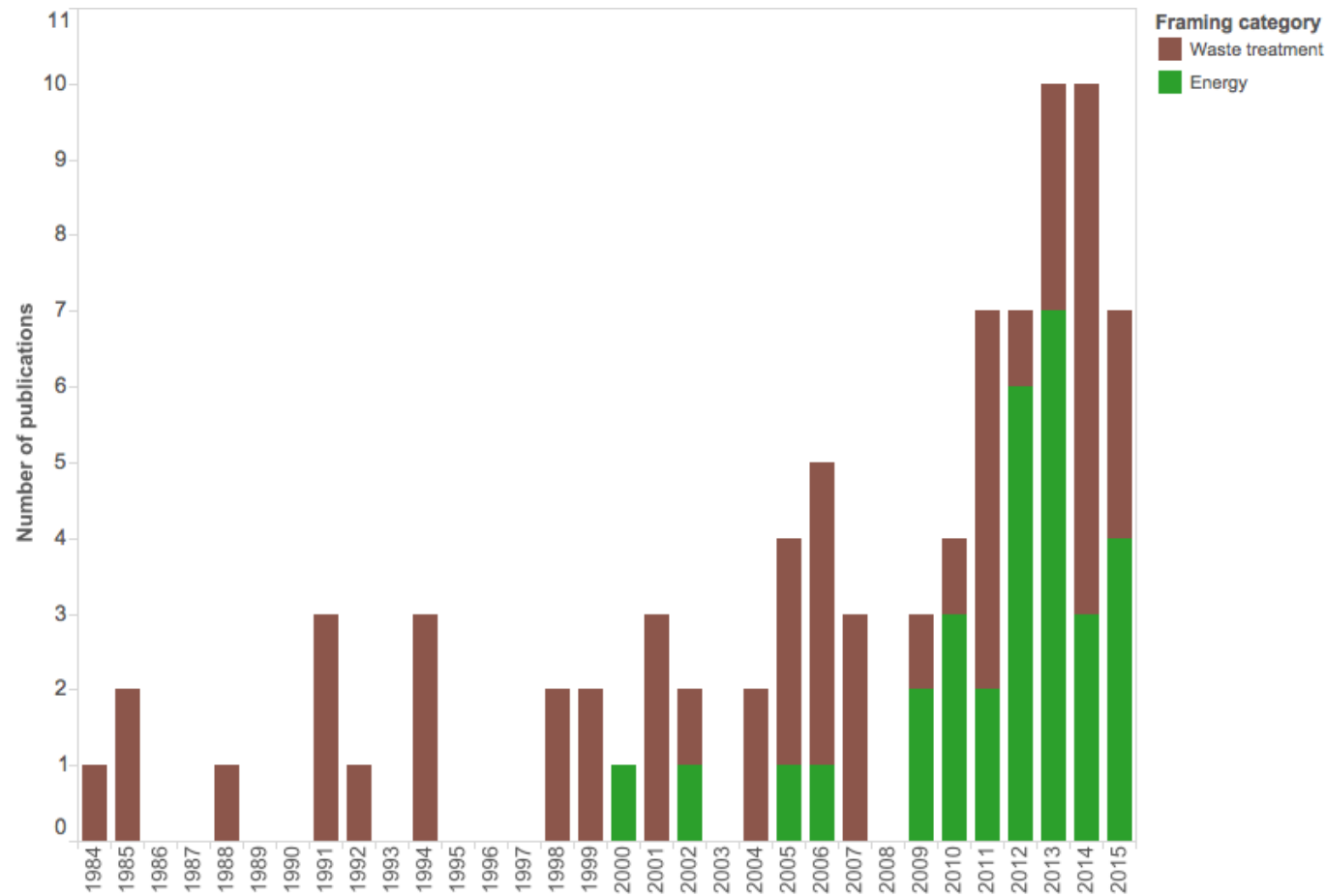
Methodology (cont.)

- Framing categories (classification of the primary role of AD):
 - Waste treatment
 - Energy
 - Pollution abatement
 - Biorefinery development
- Scope categories (analysis level and/or reach):
 - Process
 - System
 - Society

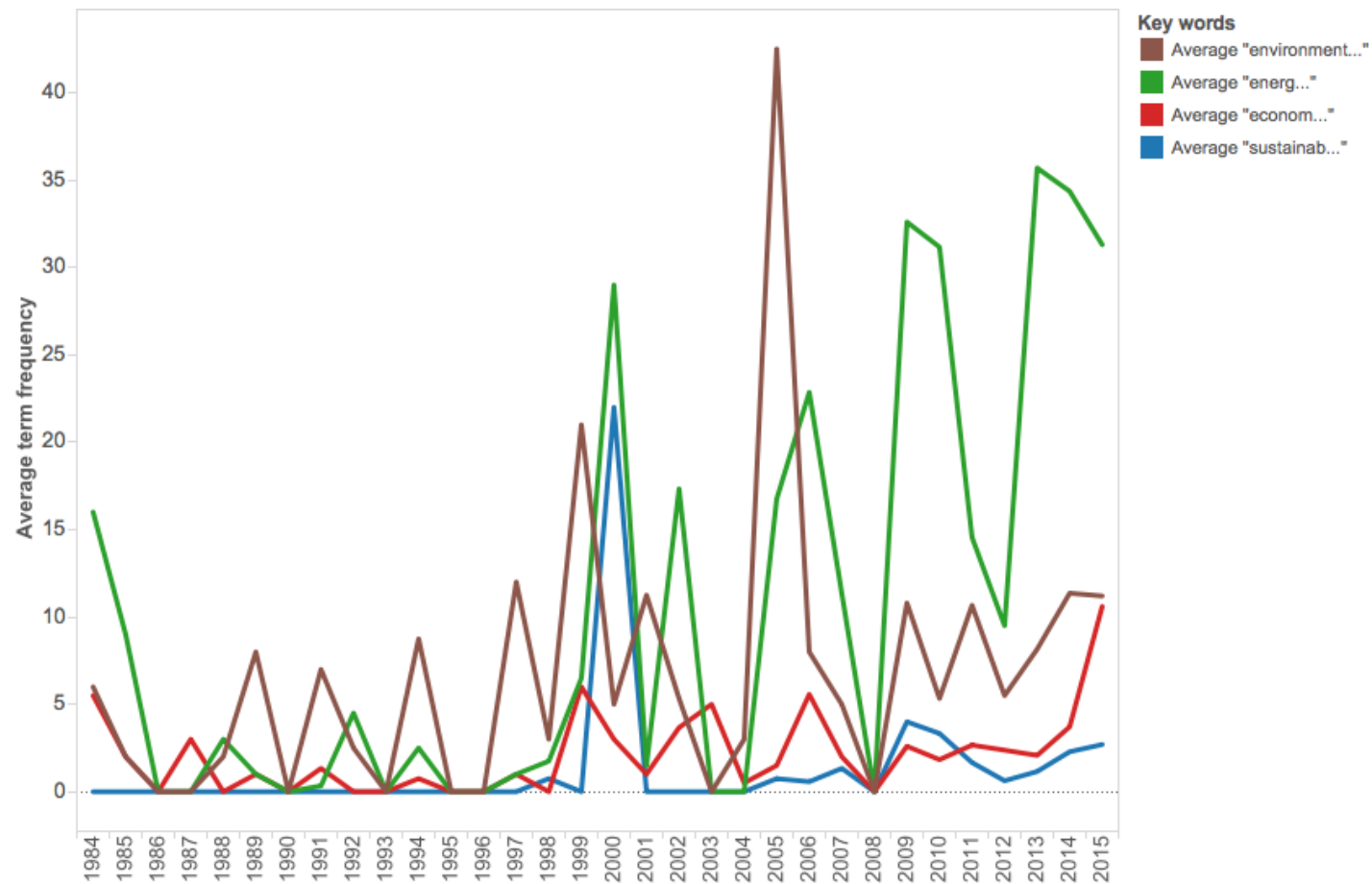
Number of articles per framing category



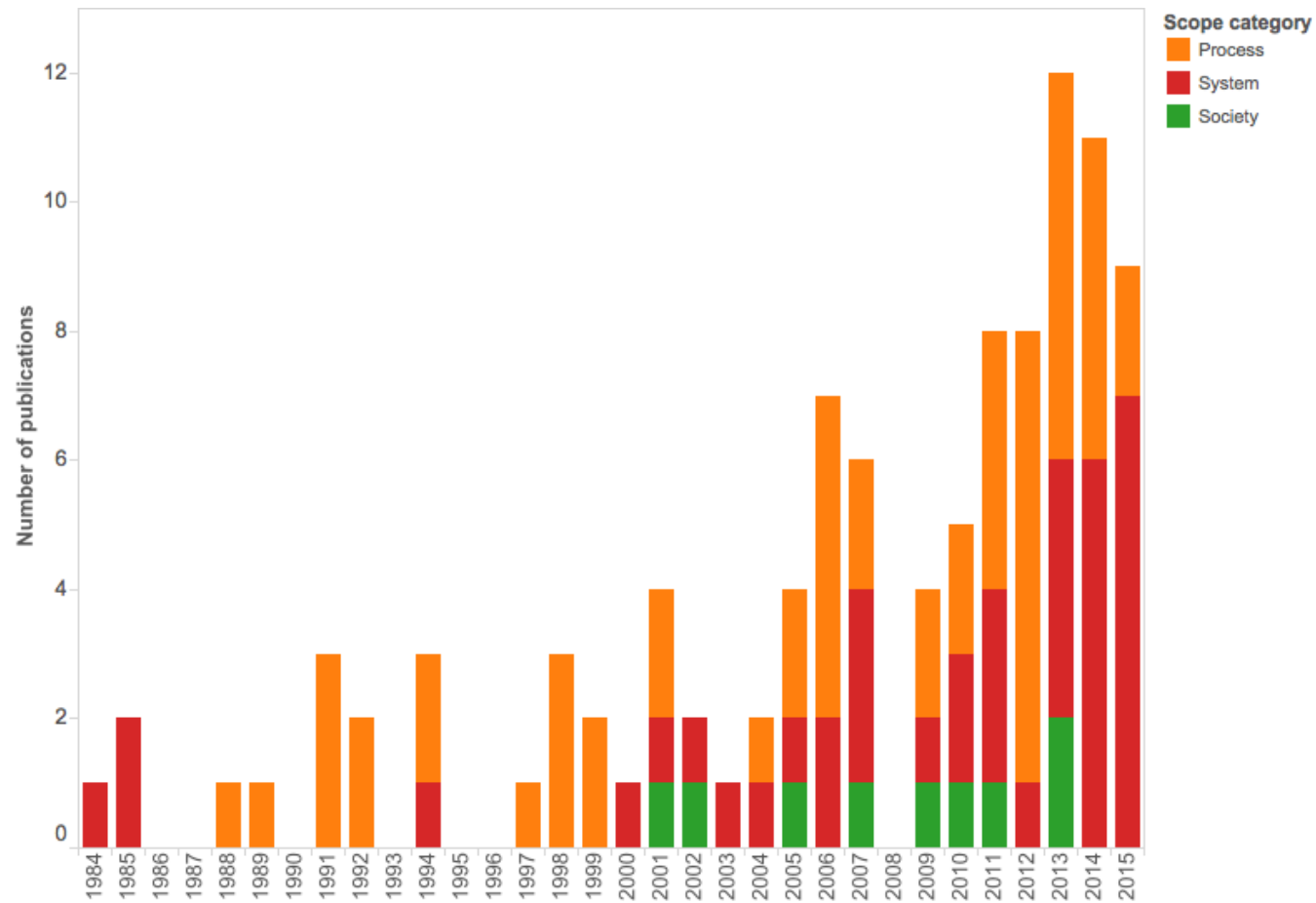
Number of articles in the waste and energy categories



Average term frequency



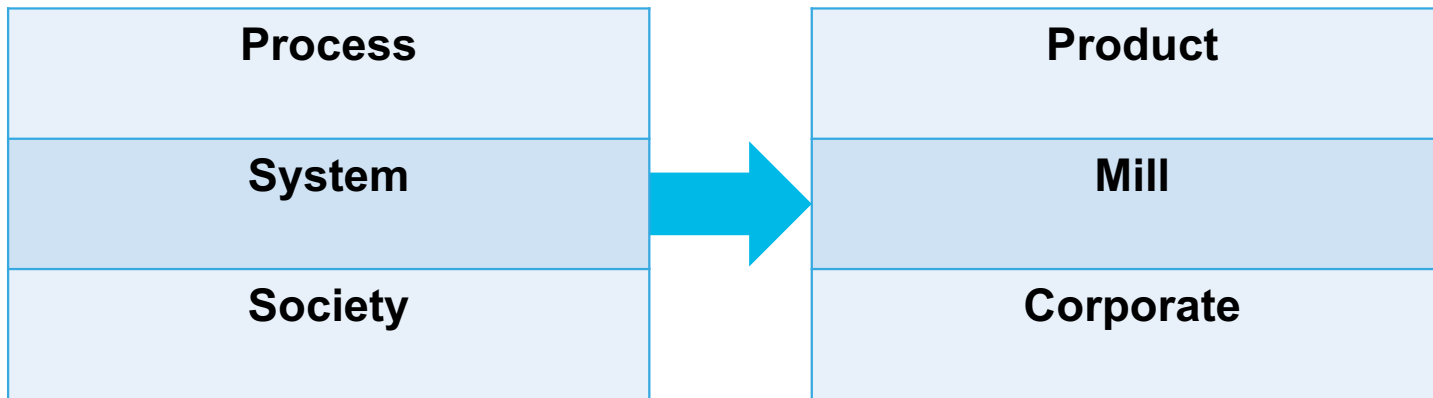
Number of articles per scope category



From Braviken
papermill pre-study

	Existing system – without AD	Theoretical system – with AD
Final sewage discharges		
COD (t/d)	5.5	4.0
SS (t/d)	0.7	0.7
Total P (kg/d)	9.0	9.6
Total N (kg/d)	220	160
Biogas generation		
Energy content (GWh/year)	-	43
Sludge production		
Total sludge (TTS/year)	64.4	50.1
Sludge solids (%)	28	35
Estimated costs and revenues		
Net economic impact (million SEK/year)	-	2-11

Source: ÅF-Company AB, 2012



Mill-level

- Better treatment capacity and decreased emissions
- Reduction needs and costs for nutrients
- Easier to comply with environmental regulations and permits
- Sludge volume reduction
- Economic diversification and can enable growth

Product level

- Improved product performance
- Environmental product declaration

18-11-15

paper profile

HOLMEN

Product	Holmen UNIQ
Company	Holmen Paper AB
Mill	Braviken Paper Mill

Information gathered from 2017-01-01 to 2017-12-31
Date of issue 2018-05-14

Environmental product declaration for paper

Environmental Management

Certified environmental management system at the mill and the wood procurement org. ISO 14001

Company systems ensure traceability of the origin of wood ☒ yes ☐ no ☐ 100% recovered paper

40% Chain-of-custody certified fibres with CoC certification at the mill

Copies of certificates can be found at <http://www.holmen.com>

Environmental parameters

The figures are based on methods and procedures of measurement approved by the local (or national) environmental regulators at the production site. The figures include both paper and pulp production.

Water	COD	4,5	kg/tonne
	AOX	0,0008	kg/tonne
	N _{Tot}	0,09	kg/tonne
	P _{Tot}	0,006	kg/tonne

Air	SO ₂	0,02	kg/tonne
	NO _x	0,14	kg/tonne
	CO ₂ (fossil)	26	kg/tonne

Solid waste landfilled 0,4 BDkg/tonne

Purchased electricity consumption

/tonne of final product	2830	kWh
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Product composition

This product contains biomass carbon, equivalent to 1450 kg of CO₂ per tonne of paper.

More information

Contact person Leonard Dahlberg

Address Holmen Paper AB, Braviken Paper Mill
601 88 Norrköping, Sweden

Phone +46 11 236160

E-mail Leonard.dahlberg@holmenpaper.com

More information about paper profile can be found on www.paperprofile.com

Corporate level

- Fossil-free
- Climate positive
- Contributing to sustainable development goals



DATA SHEET FOR CALCULATING THE CARBON FOOTPRINT OF
PRINTING/WRITING PAPER BASED ON THE 16 TOOLS OF CEF FRAMEWORK

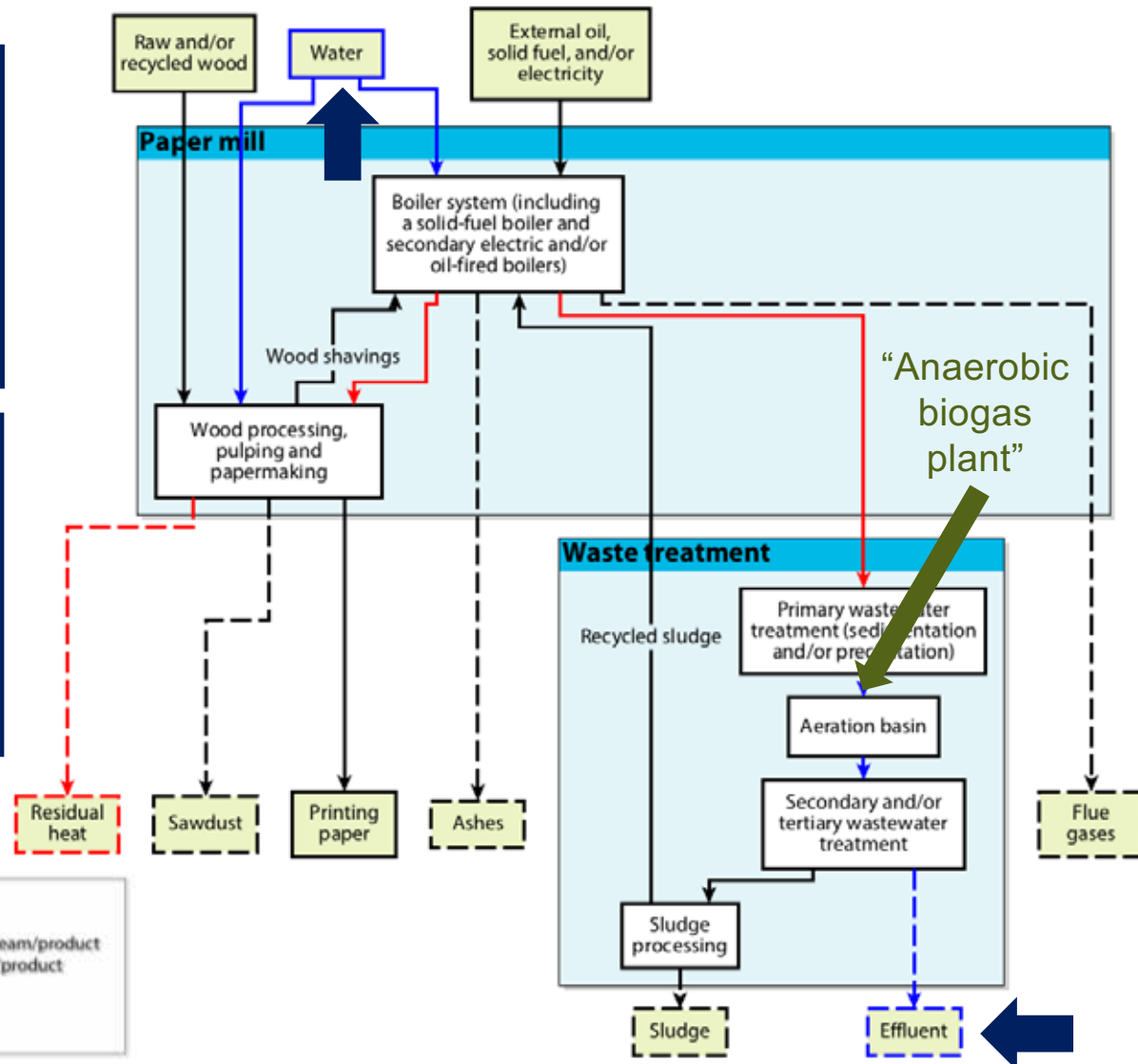
Company: Holmen Paper
M&M: Braviken Paper Mill
Reporter's name and email: Katarina.grand@holmenpaper.com
Paper quality: Holmen UNIQ
Period for validity of data: 2017

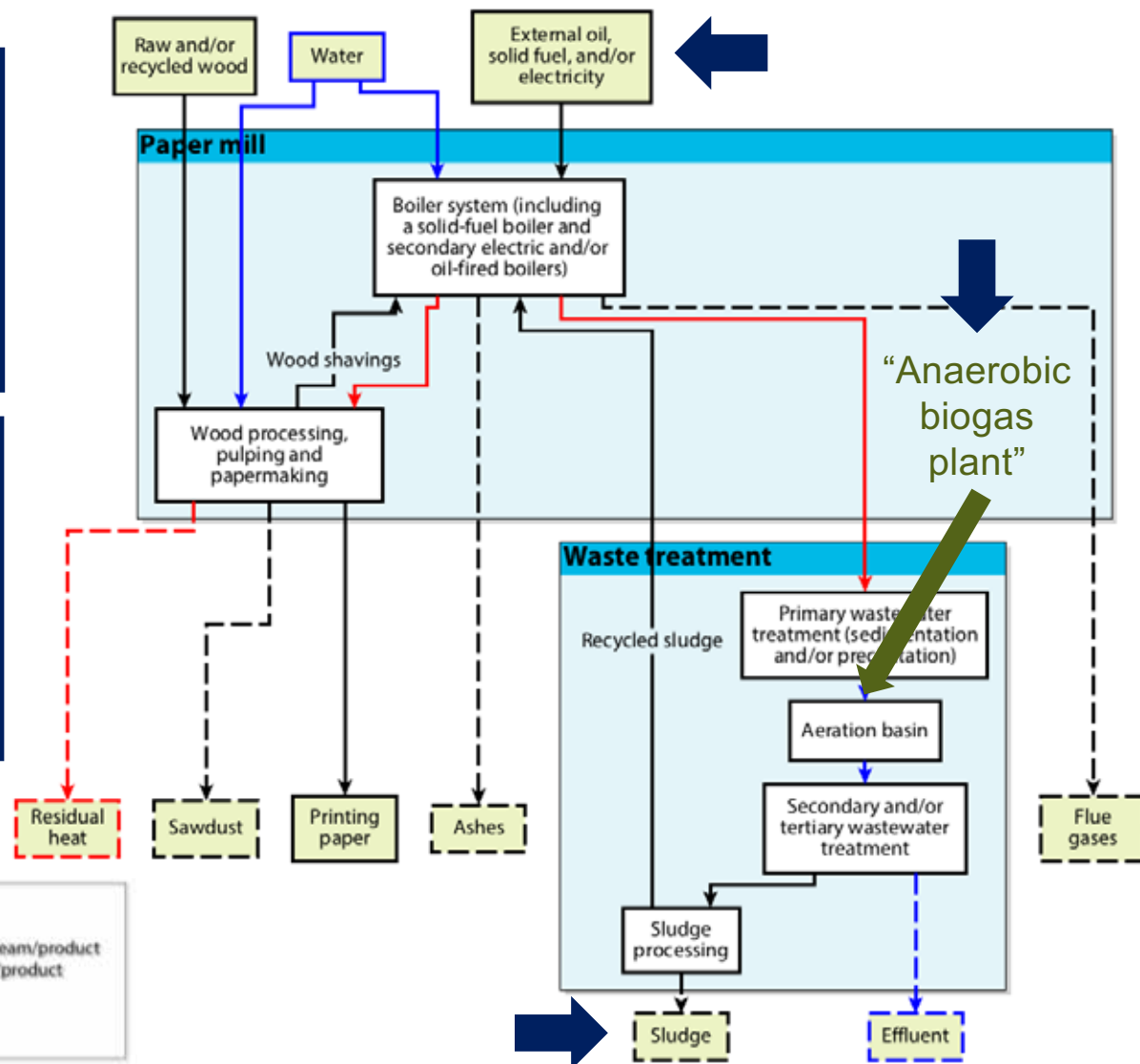
16 Tools of CEF Framework	Fossil CO ₂ (kg per tonnes paper)	Biogenic CO ₂ (kg per tonnes paper)
1. Carbon sequestration in the forest		
2. Carbon stored in the product		-1448
Net sequestration of biomass carbon		
3. GHG emissions from pulp and paper production	28.3	
4. GHG emissions associated with producing virgin or recovered fibre	25	
5. GHG emissions associated with producing other raw materials	17.7	
6. GHG emissions associated with purchased or sold electricity and steam	19.4	
7. Transport related GHG emissions	16.5	
8. GHG emissions attributable to product use (e.g. printing)		
9. GHG emissions attributable to end-of-life management of products		
10. Avoided emissions		
Total fossil CO₂ emissions	108.1	



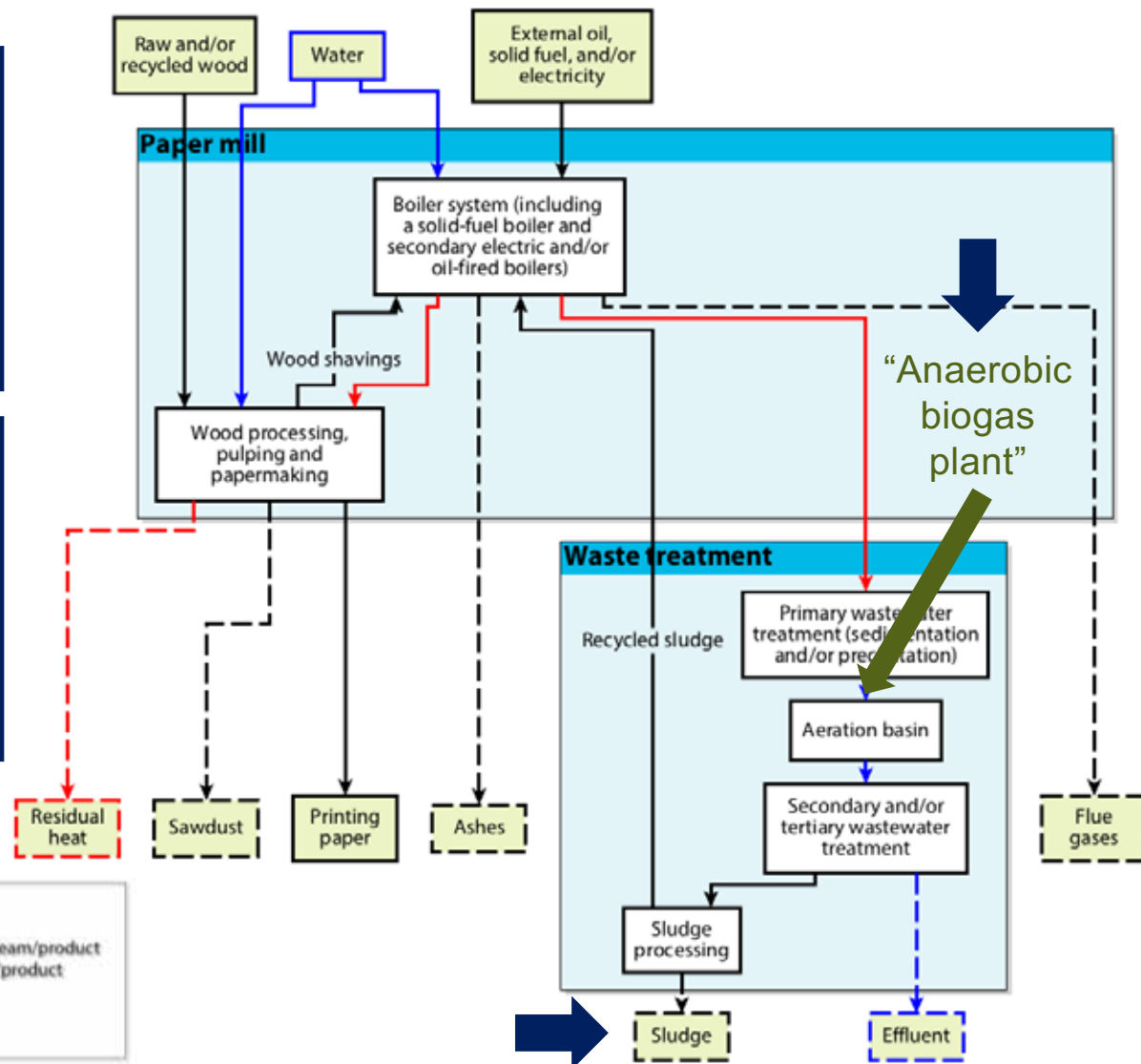
We challenge
conventional
packaging for a
sustainable future







**Biogas
Research
Center**

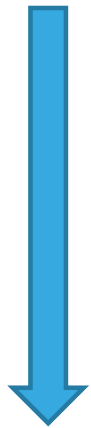


Conclusion

- The framing of biogas as an "energy" and "waste treatment" solution among the pulp and paper sector impacts the perception of this technology
- Anaerobic digestion systems are linked to larger environmental and sustainability performance of relevance on the mill, the product and the corporate level
- **"The way issues are discussed matters** in the political debate about business and sustainability/sustainable development; partly because it may help corporations' actions come across as legitimate or illegitimate, and partly because **such discourse may have a performative function in producing the effects that it names"**

Source: Ihlen and Roper, 2014

The framing and identity of biogas solutions



- Waste treatment – hygien focus
- Energy and climate – carbon focus
- Circular and biobased economy - local nutrient flows
- Sustainability strategies – direct and indirect effects in a larger system