



**BIOGAS TRANSPORT GRIDS,
CASE STUDY “PROVINCE OF WEST-FLANDERS”**

Evert Jan Hengeveld

Title and Co-authors

BIOGAS TRANSPORT GRIDS, CASE STUDY "PROVINCE OF WEST-FLANDERS"

Co-authors

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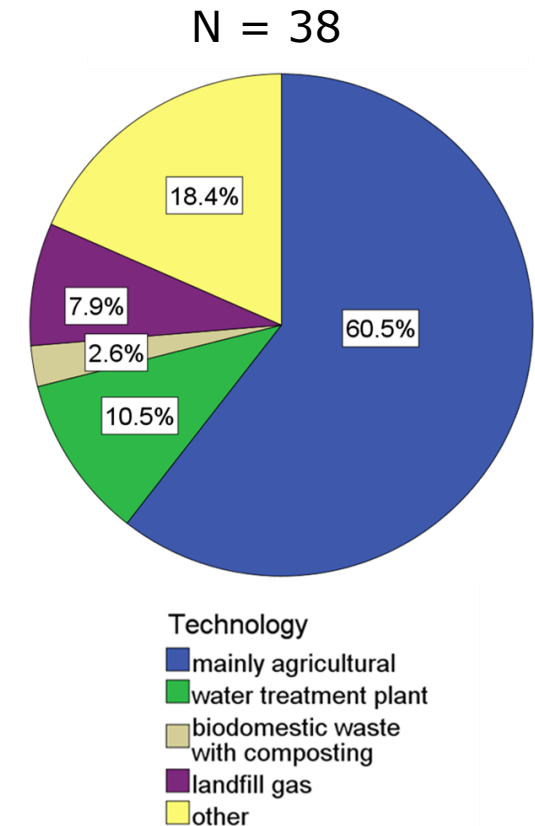
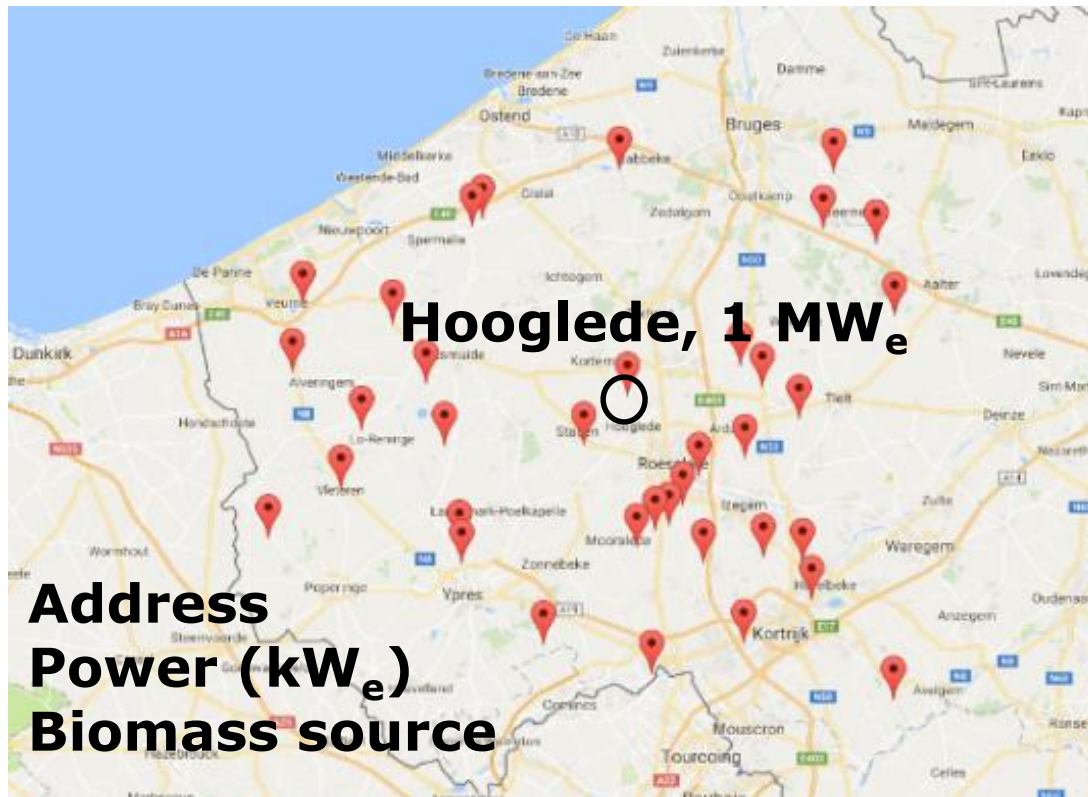
This presentation:

- Introduction
 - Digesters in the Province of West-Flanders
 - Biogas transport grid
 - Combined Heat and Power, efficiency
- Method
- Results
- Conclusions



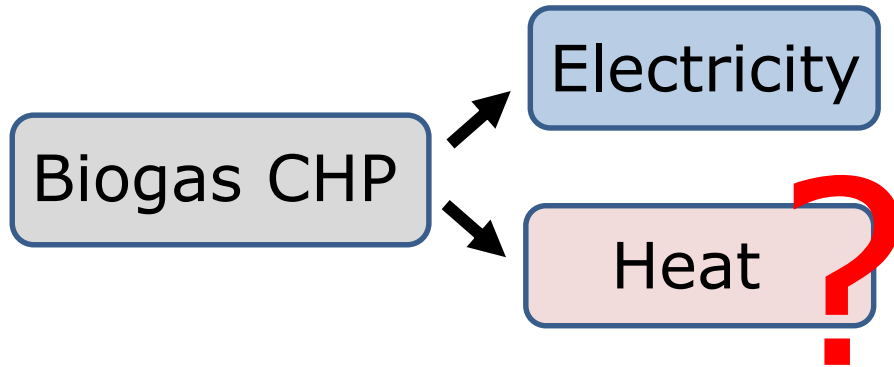
Intro, Digesters in West-Flanders

38 digesters in the Province of West-Flanders, Belgium



Intro, Digesters in West-Flanders

Farm site digester and biogas CHP



Heat is often used to dry the digestate before the digestate is transported

Other ways of digestate treatment may not need the heat at the farm site.....

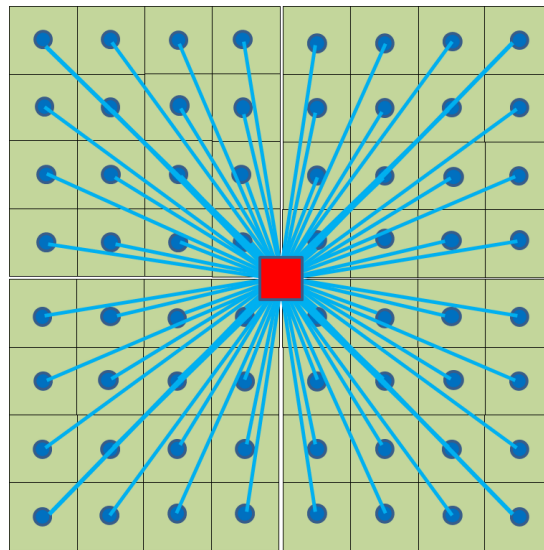
Therefore, production of electricity and heat off site may be more profitable



Intro, Biogas transport grid

Recent work:

Collection of biogas to a hub, using pipelines,
costs and energy use of biogas transport to a hub



Compressor at the digester sites. ●

Hub at the centre of the region ■

Pipelines to connect /

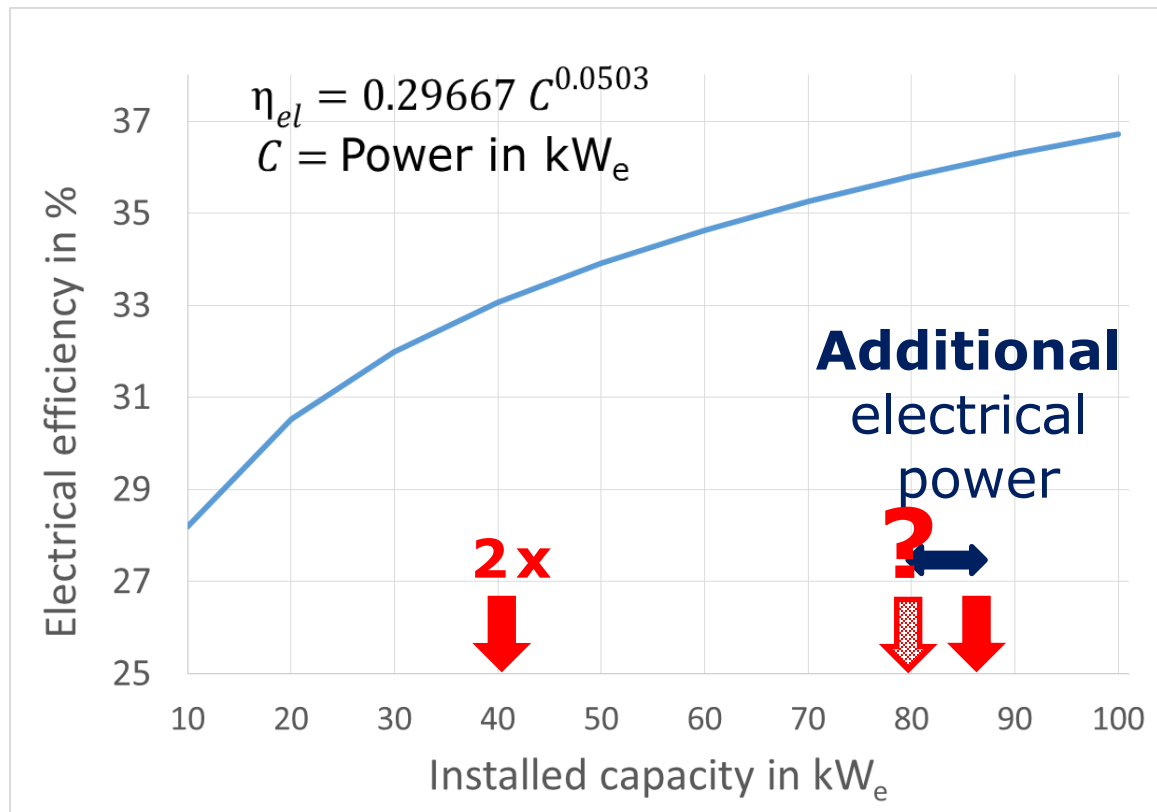
Biogas infrastructures from farm to regional scale, prospects of biogas transport grids.
E.J. Hengeveld c.s., Biomass & Bioenergy, 2016



Intro, CHP efficiency

Biogas CHP, scale dependency electrical efficiency

Example: range 10 kW_e – 100 kW_e



BHKW-Kenndaten
2014/2015. Report,
Berlin: ASUE e.V. ;
2014

Intro, Summary

Biogas-CHP produces electricity and heat; heat may not be needed at farm sites

CHP location moved from farm site to a hub to match heat supply and demand; use of a biogas grid.

CHP scale advantage in electrical efficiency; **additional** electrical energy produced

Costs of biogas transport



Intro, Research question

Research question:

How can the costs per kWh **additional** electrical energy be estimated, if a hub structure is implemented?

Sub-questions

What is the increase in electricity production?

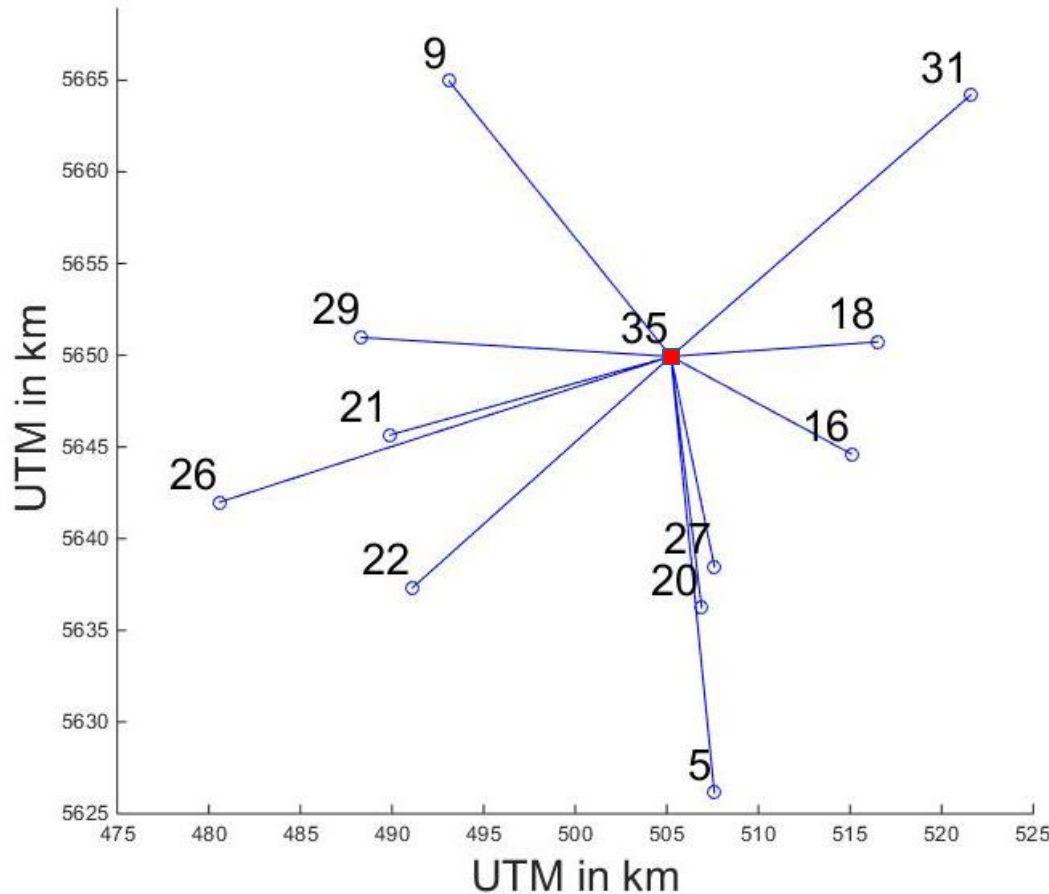
What are costs of transport of biogas to the hub?



Method

Digesters, mainly Agricultural feedstock ($> 20 \text{ m}^3\text{h}^{-1}$)

Biogas grid; digesters in the Province of West-Flanders,

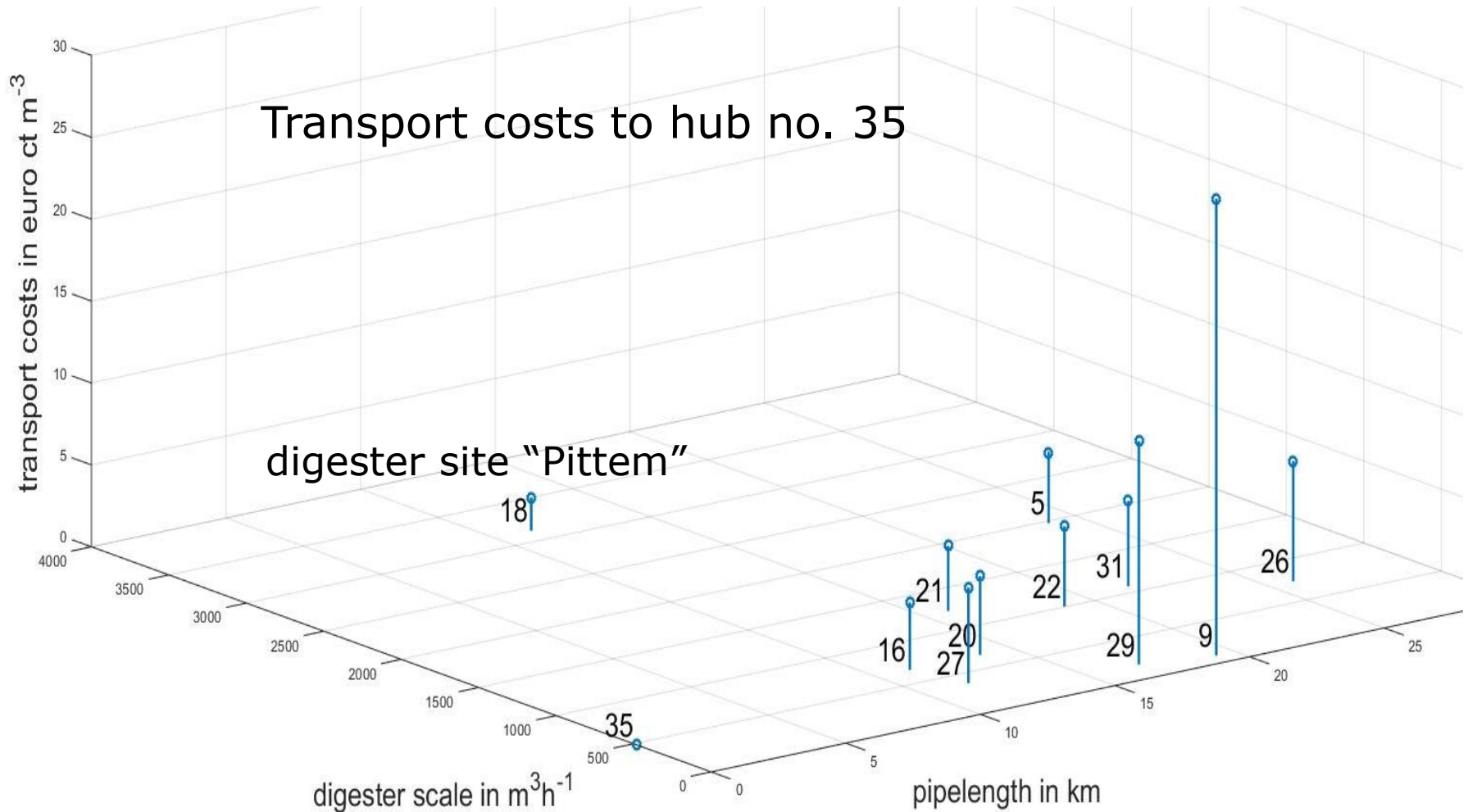


Example simulation:
hub at digester site
"Hooglede", no.35

Which digesters are
to be incorporated in
the grid?



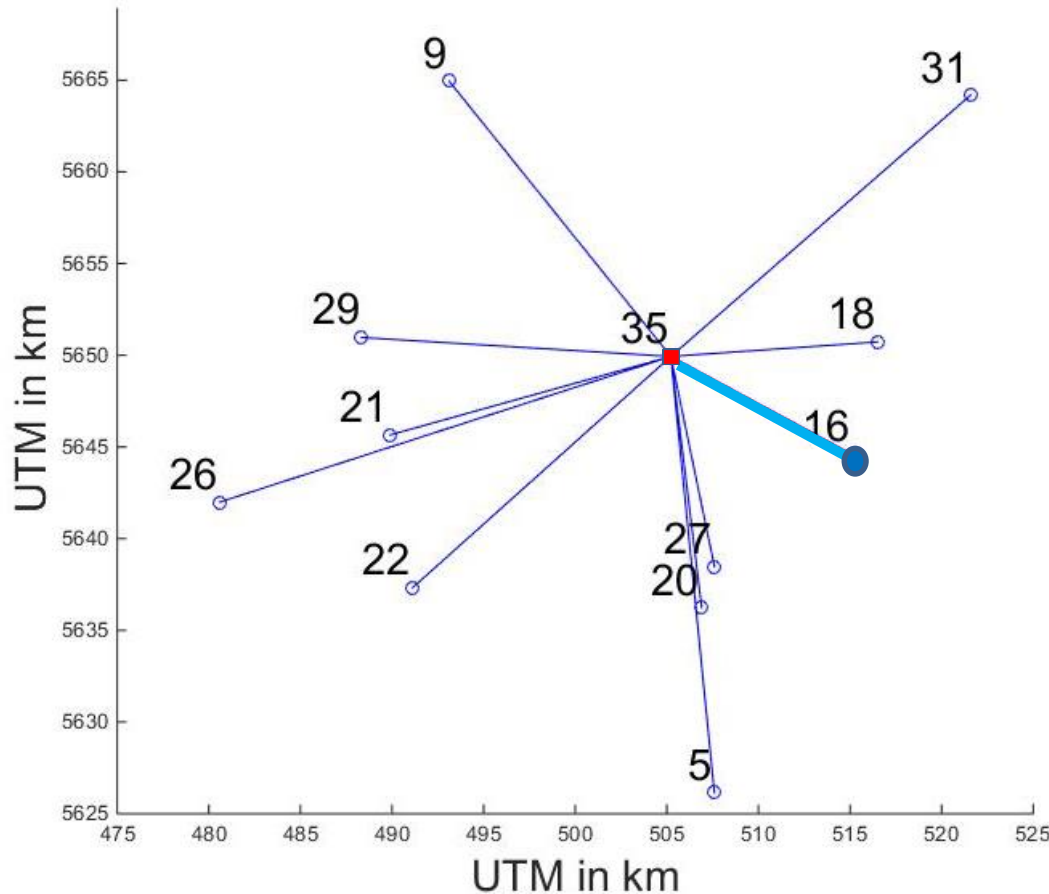
Method



Method

Digesters, mainly Agricultural feedstock ($> 20 \text{ m}^3\text{h}^{-1}$)

Biogas grid; digesters in the Province of West-Flanders,



Example simulation:
hub at digester site
"Hooglede", no. **35**

Include digester no. **16**
in the biogas grid;
assume a larger CHP
at the hub (with
increased efficiency)



Method

Digesters, mainly Agricultural feedstock ($> 20 \text{ m}^3\text{h}^{-1}$)

Additional electrical power as compared to no biogas grid:

62.1 kW_e (+ 2.4%)

Transport costs biogas:

219.3 k€ a⁻¹

Costs per kWh additional electrical energy:

0.44 € kWh⁻¹

Example simulation:
hub at digester site
"Hooglede", no. **35**

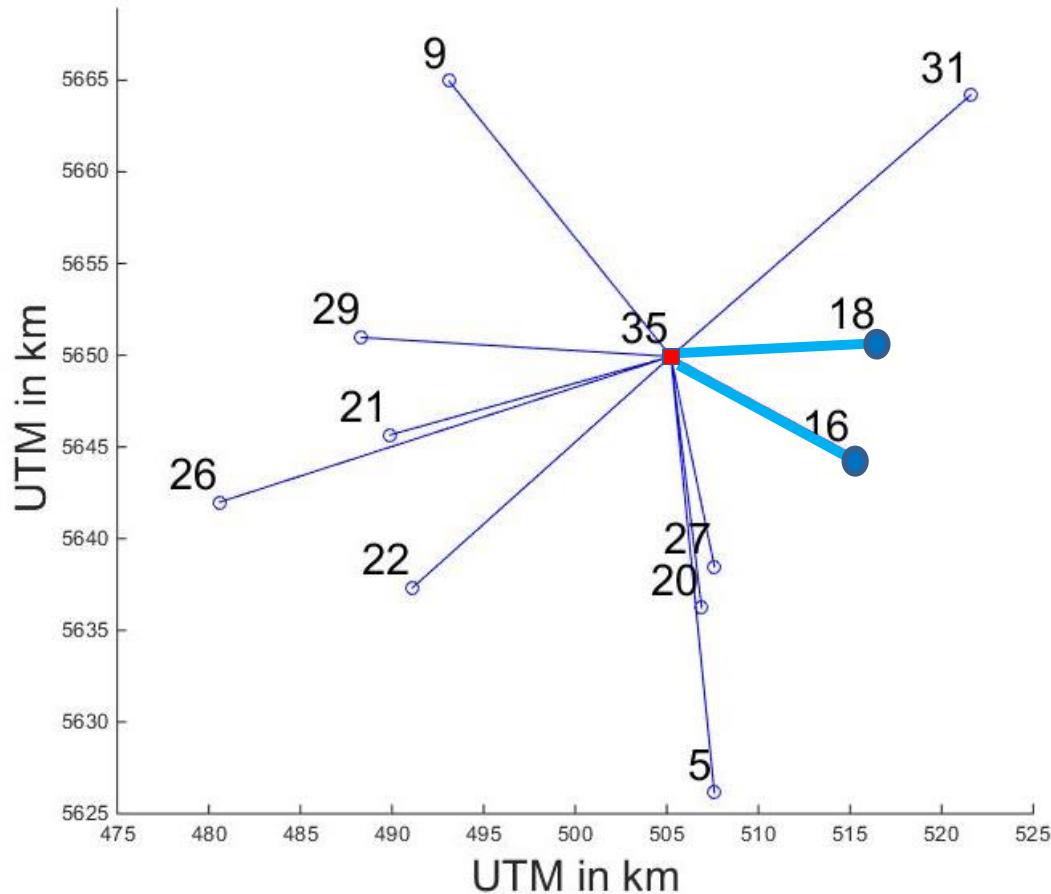
Include digester no. **16**
in the biogas grid;
assume a larger CHP
at the hub (with
increased efficiency)



Method

Digesters, mainly Agricultural feedstock ($> 20 \text{ m}^3\text{h}^{-1}$)

Biogas grid; digesters in the Province of West-Flanders,



Example simulation:
hub at digester site
"Hooglede", no. **35**

Include digester no. **16**
in the biogas grid;
assume a larger CHP
at the hub (with
increased efficiency)

Include digester no. **18**
in the biogas grid;
assume a larger CHP
at the hub.



Method

Digesters, mainly Agricultural feedstock ($> 20 \text{ m}^3\text{h}^{-1}$)

Additional electrical power as compared to no biogas grid:

279.2 kW_e (+ 3.0%)

Transport costs biogas:

725.4 k€ a⁻¹

Costs per kWh additional electrical energy:

0.31 € kWh⁻¹

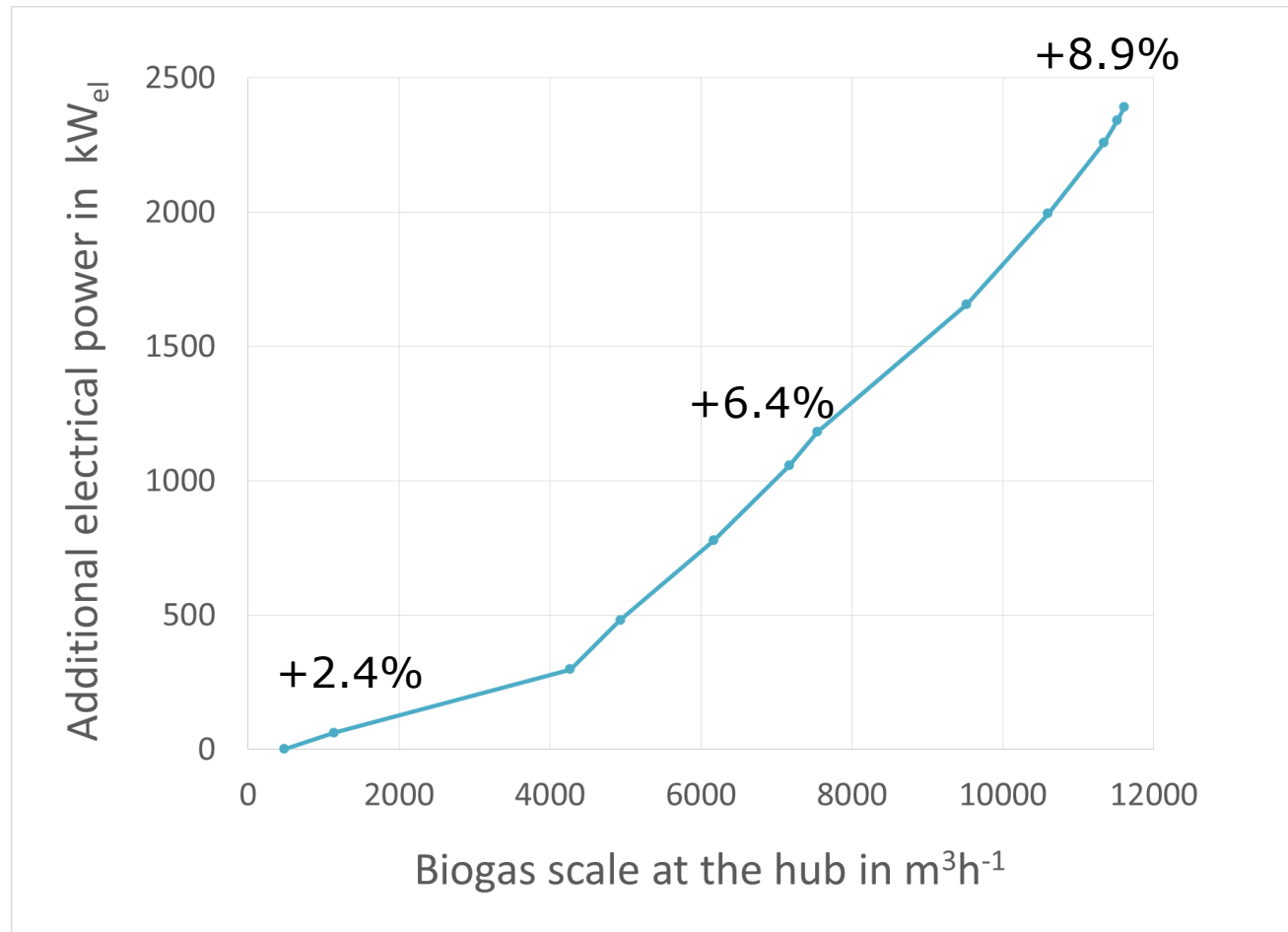
Example simulation:
hub at digester site
"Hooglede" (nr **35**)

Include digester nrs
16 and 18 in the
biogas grid; assume a
larger CHP at the hub
(with increased
efficiency)

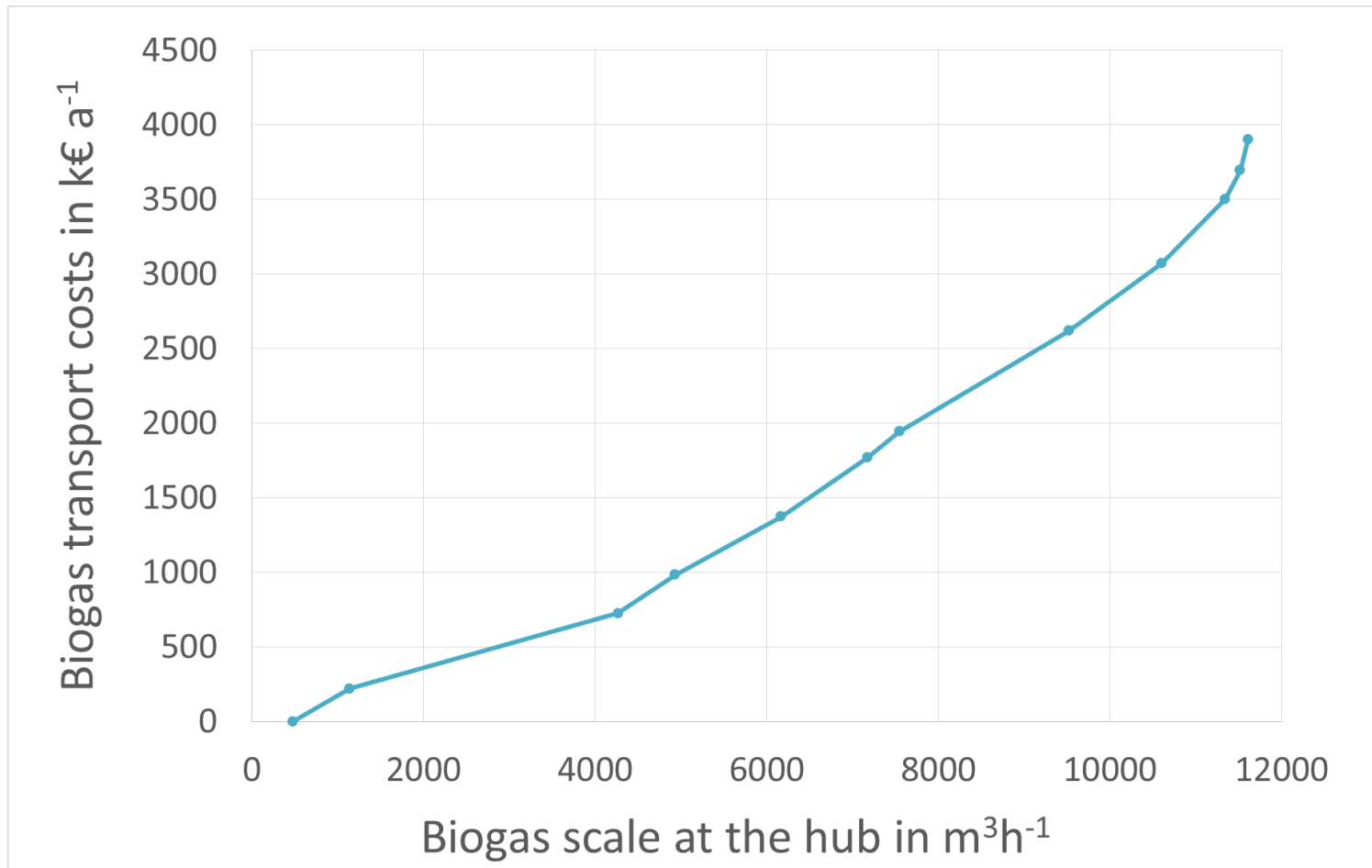
Etc.... etc....



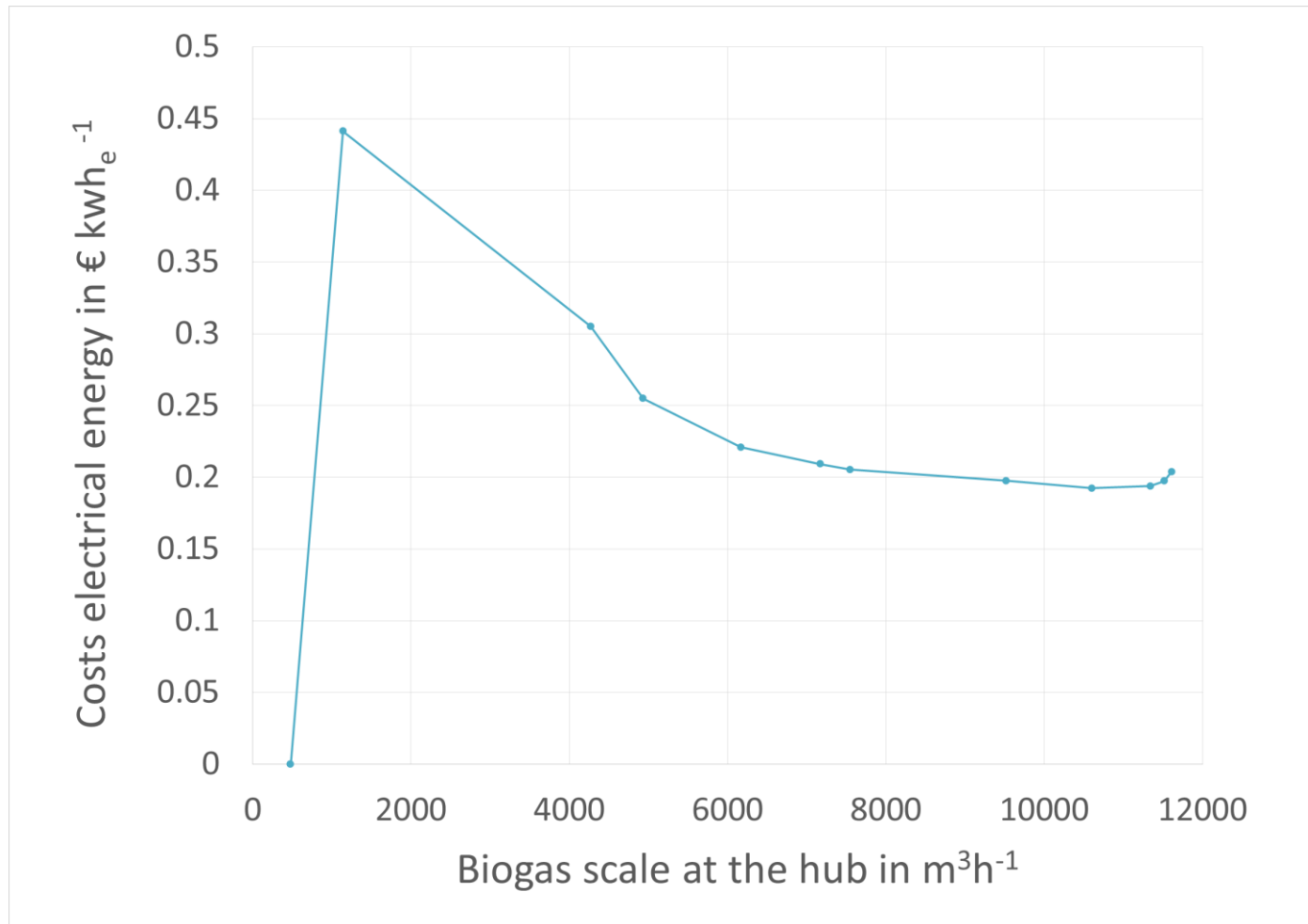
Additional electrical power



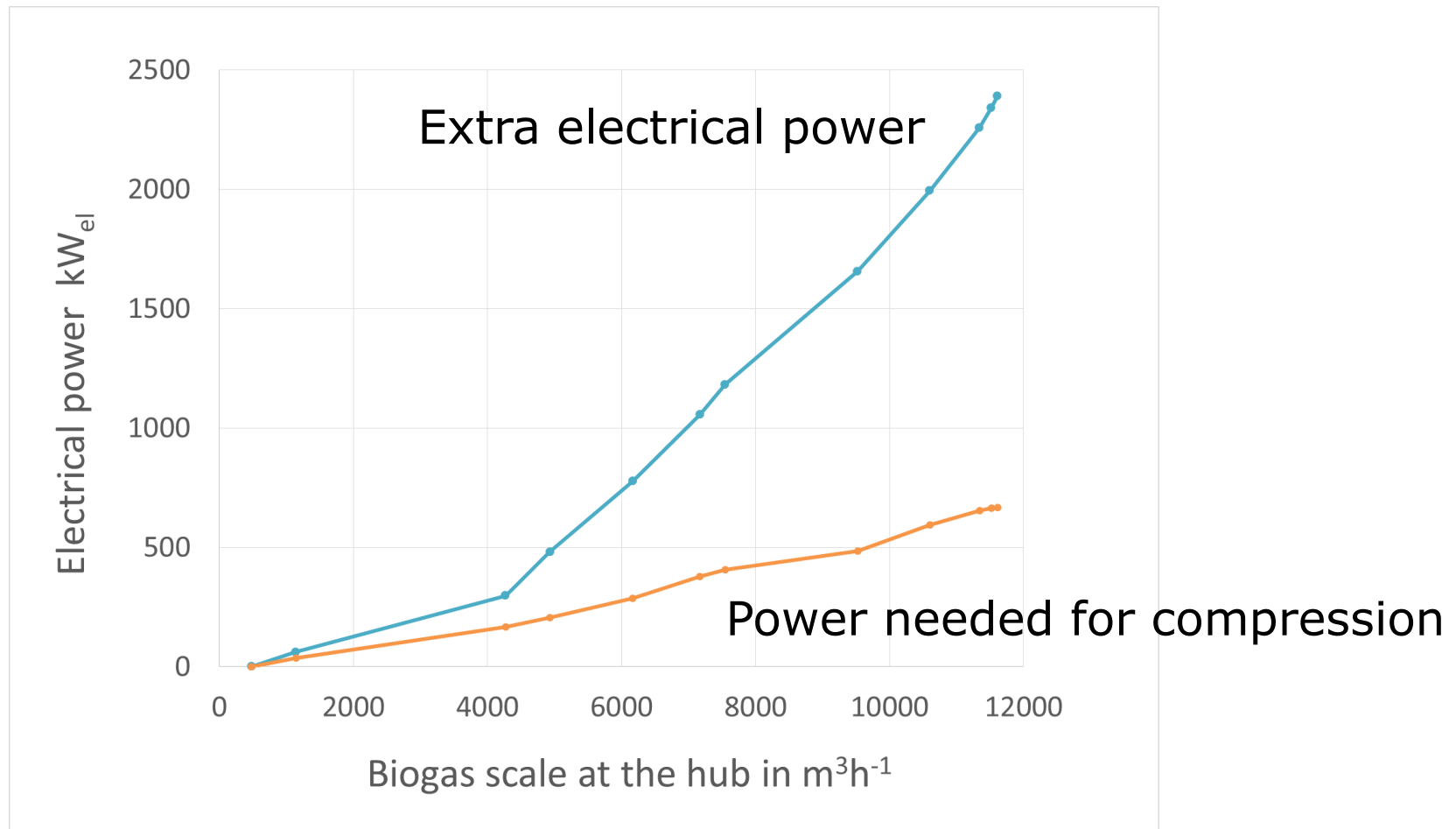
Biogas transport costs



Costs per kWh additional electrical energy



Electrical power needed in biogas transport



Conclusions

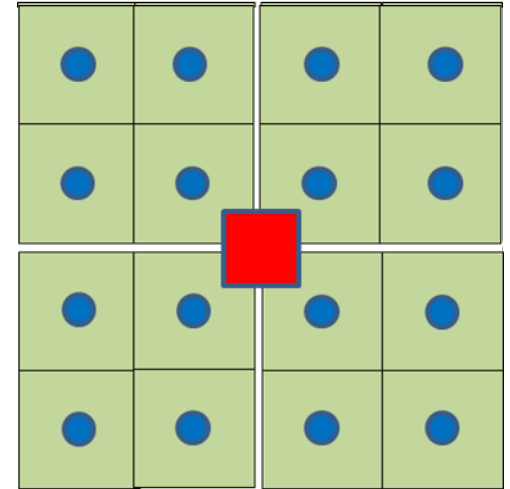
- Scale advantage in CHP efficiency may be a driver to collect biogas at a hub using a biogas grid
- Biogas transport costs are attributed to additional electrical energy (increased efficiency)
- Costs of additional electrical energy is in the range of 0.20 - 0.45 € kWh⁻¹ (in the example)
- Potential of matching heat supply and demand

Further research ...

- Identify heat sinks in the region to be used as hub
- Assess scale advantage investment costs CHP
- Improve biogas transport calculation; adapt costs of pipeline to local condition
- Legal aspects and subsidy regulations



Thank you for your attention.



Contact:

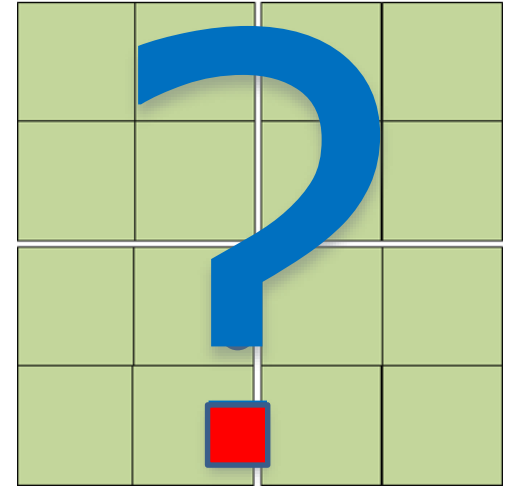
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Thank you for your attention.



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