



IEA Bioenergy Conference
Vienna, Austria - November 14th 2012

Availability and viability of small on-farm biogas plants

Nathalie BACHMANN

Task 37 – Energy from biogas

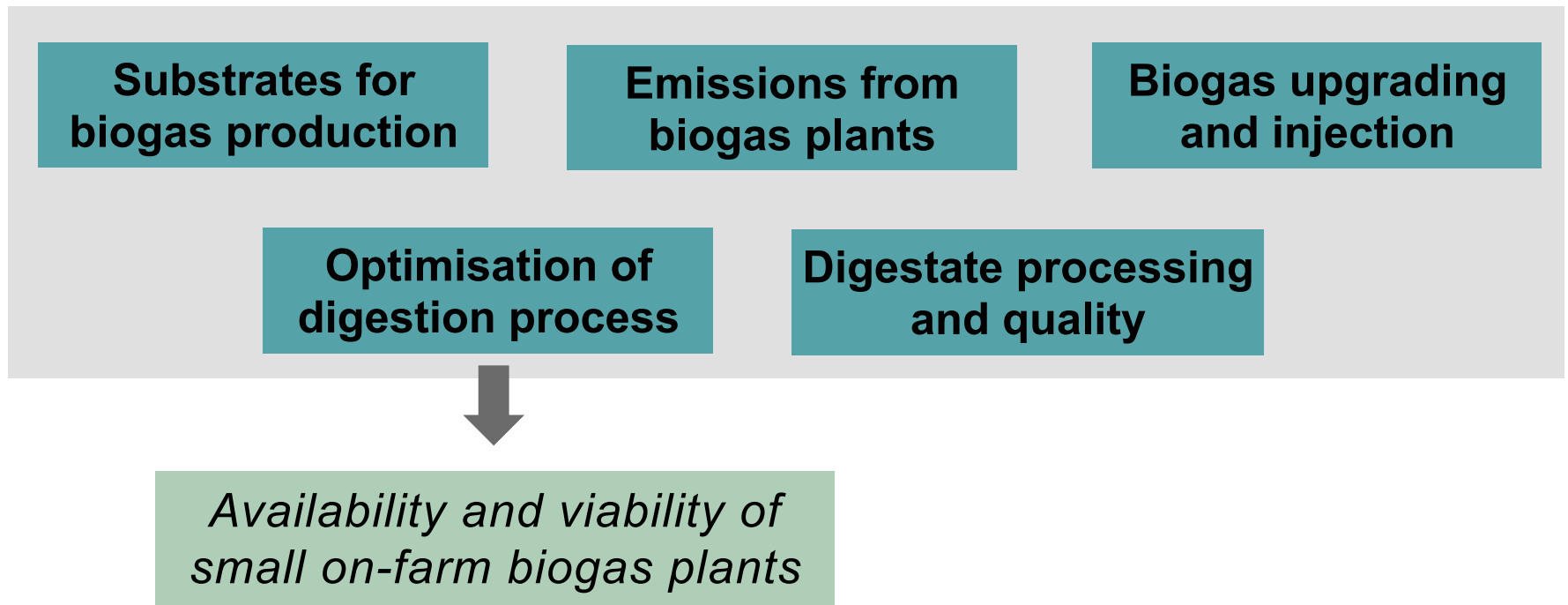
EREP SA | Chemin du Coteau 28 | 1123 Aclens

Switzerland

nathalie.bachmann@erep.ch

Overview

Task 37 – Energy from biogas



Context

Estimated feedstock potential for biogas production – EU 27:

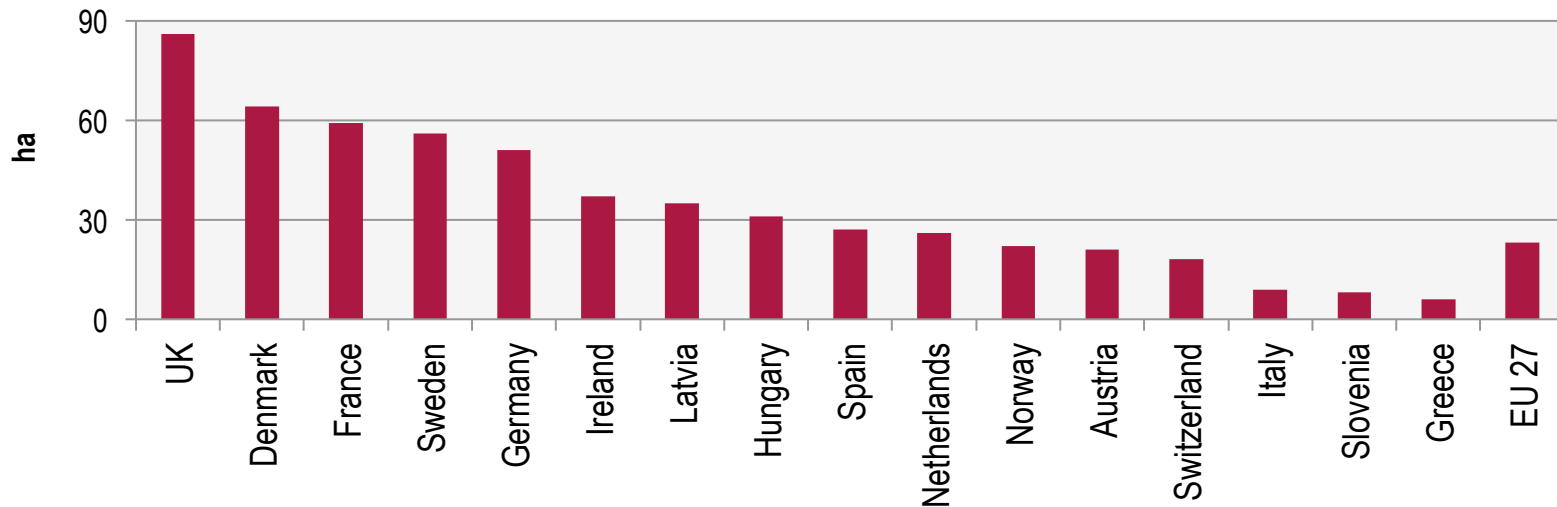
Origin	Theoretical potential [Mtoe]	Used until 2020 [%]	Realistic potential [Mtoe]
Agriculture			
Agricultural crops	23.3	100	23.4
Agricultural by-products (straw, manure, ...)	27.2	28	7.9
Waste			
Biodegradable fraction of municipal solid waste (including biowaste), landfill gas	8.6	40	3.4
Biodegradable fraction of industrial waste (including paper, pallets, ...)	2.6	50	1.3
Sewage sludge	5.1	66	3.4
Total	66.8	59	39.5

(Based on AEBIOM, 2009)

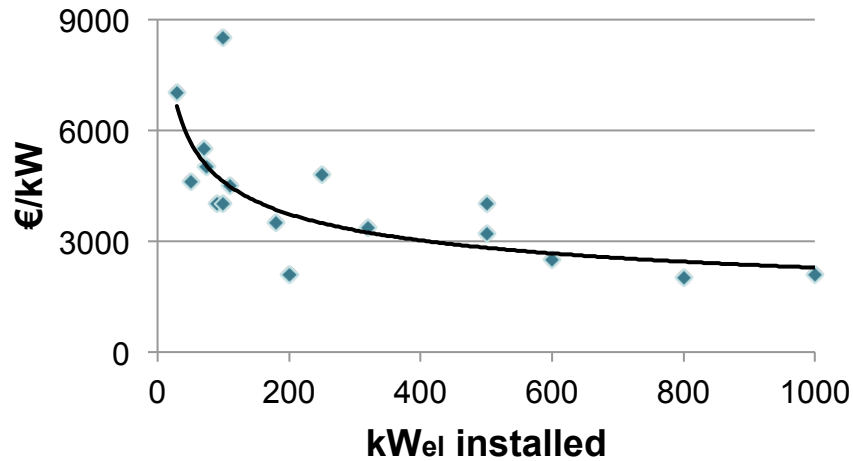
Context

Average farm sizes

(Based on EUROSTAT)



Investment costs for biogas plants



Objectives

Illustrate availability and viability of small on-farm biogas plants (≤ 100 kW)

-Technological options and possibilities to reduce costs

-Necessary and favourable framework conditions

-Management and operation to improve economic viability

→ More successful small-scale biogas projects - new agricultural branch, rural development, improved waste and fertiliser management)

→ Renewable energy production and reduction of GHG emission - exploitation of the huge agricultural potential

Biogas upgrading technologies –
developments and innovations

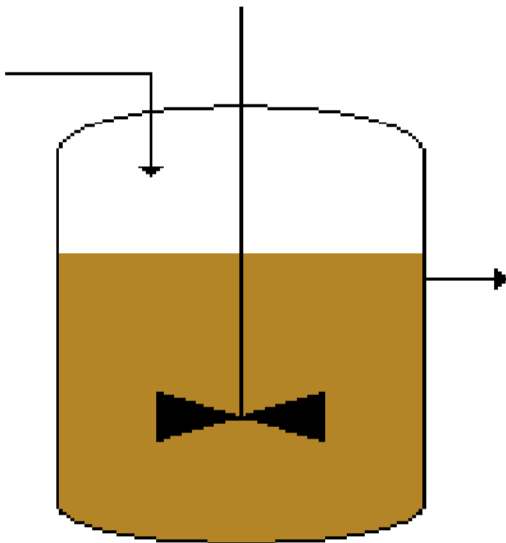
Anneli PETERSSON
Arthur WELLINGER



IEA Bioenergy

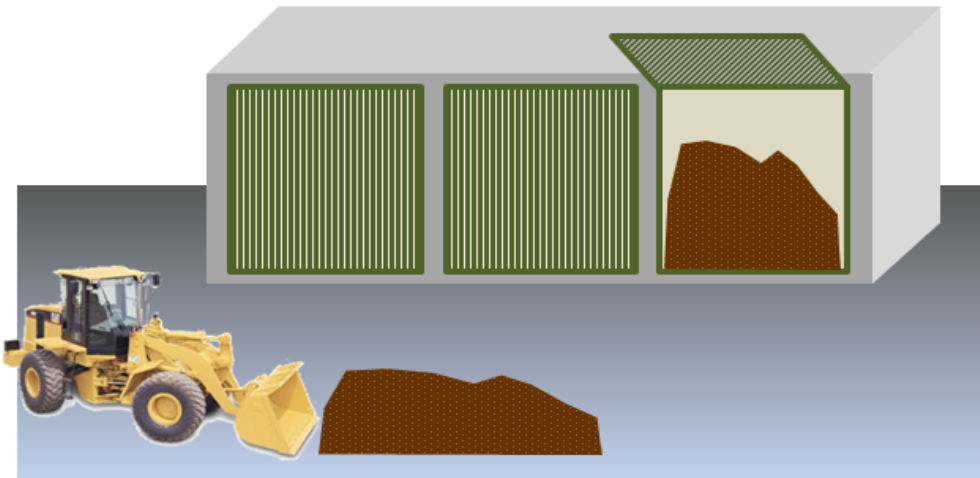
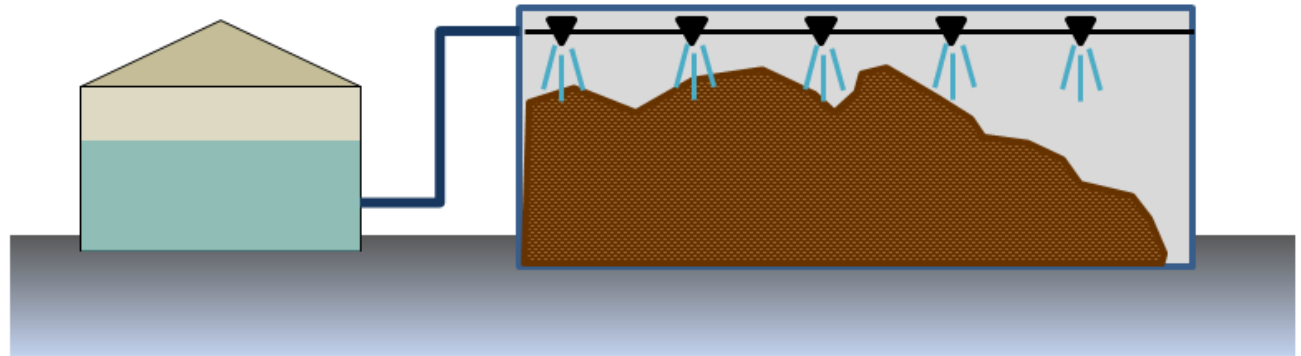
Principal small-scale concepts

CSTR – Continuously Stirred Tank Reactors



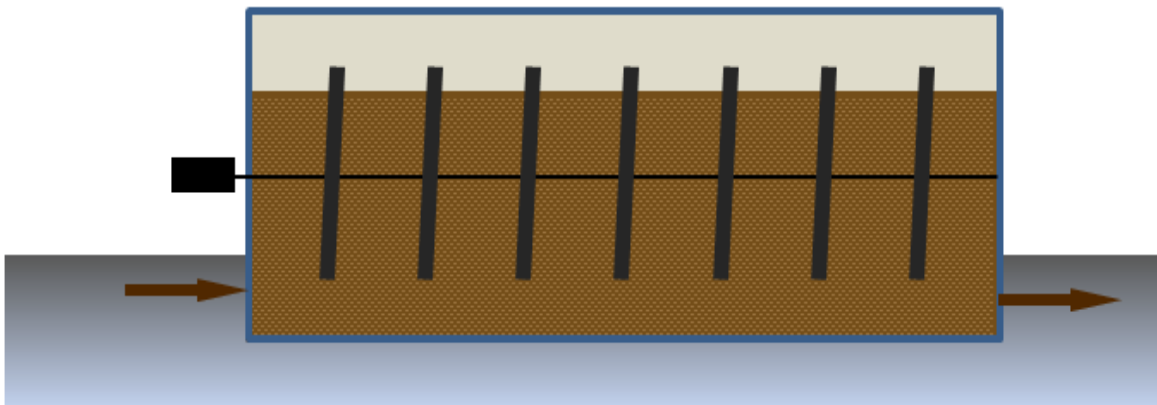
Principal small-scale concepts

Garage reactors



Principal small-scale concepts

Plug-flow reactors



How to choose?

	Key parameter	Options
Reactor type	Dry matter content of feedstock	<ul style="list-style-type: none"> - CSTR for liquid substrates - Plug-flow or batch digester for solid substrates
Reactor temperature	Risk for pathogens	<ul style="list-style-type: none"> - Mesophilic temperature when no risk for pathogens - Thermophilic temperatures when risk for pathogens (organic house waste)
Number of phases	Composition of substrates, acidification risk	<ul style="list-style-type: none"> - One phase systems when no acidification risk - Two-phase system for substrates with a high content of sugar, starch or proteins
Agitation system	Dry matter content of feedstock	<ul style="list-style-type: none"> - Mechanical agitators for high solids concentration in the digester - Mechanical, hydraulic or pneumatic agitation systems for low solids concentration in the digester

Viability of small-scale plants

Framework conditions

Local framework:

Farm infrastructure
& surroundings

Legislative framework:

Administrative procedure,
state support

Institutional framework:

Plant constructors,
engineering offices, banks

Plant management

Feedstock
management

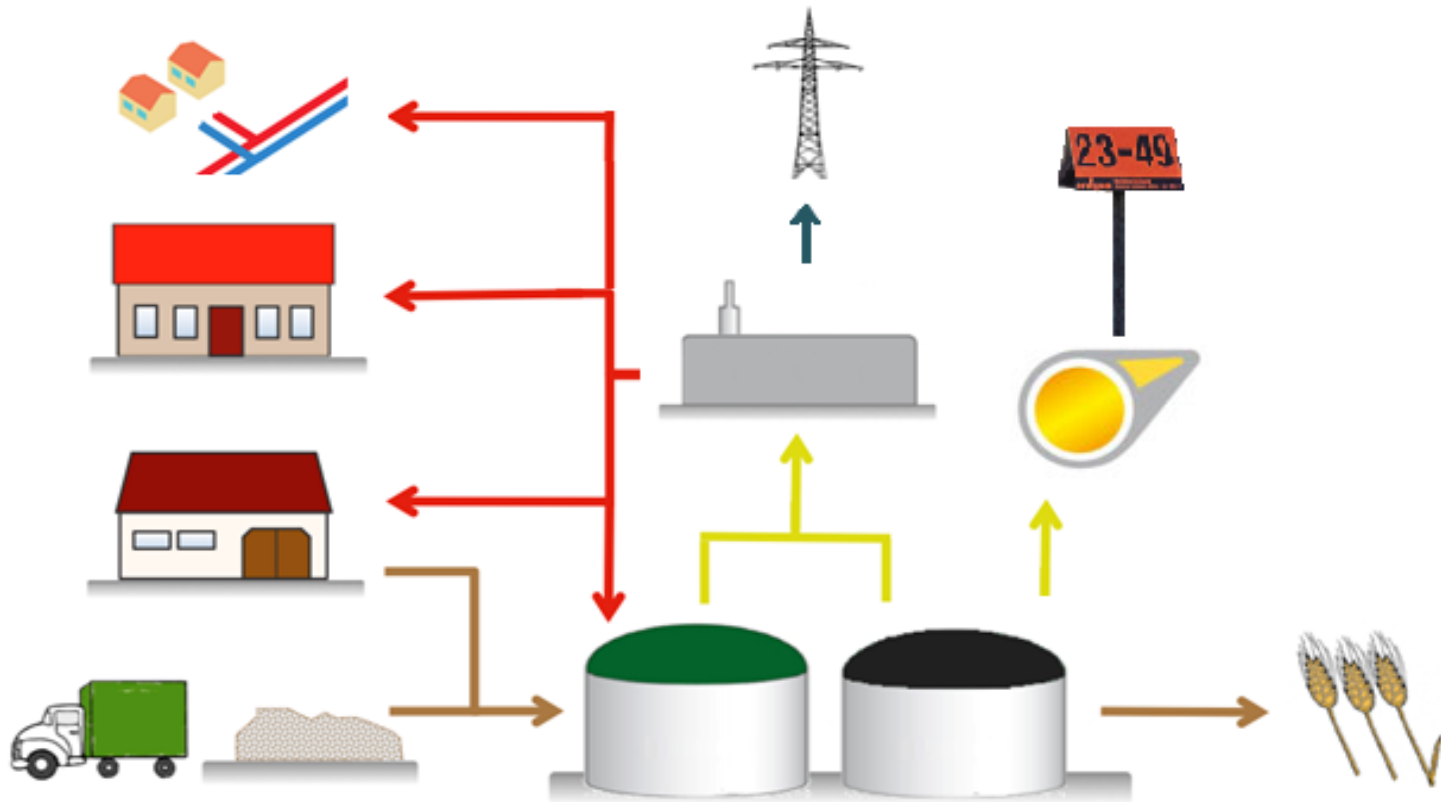
Operation
control

Digestate
management

**Viability of
small-scale
plants**

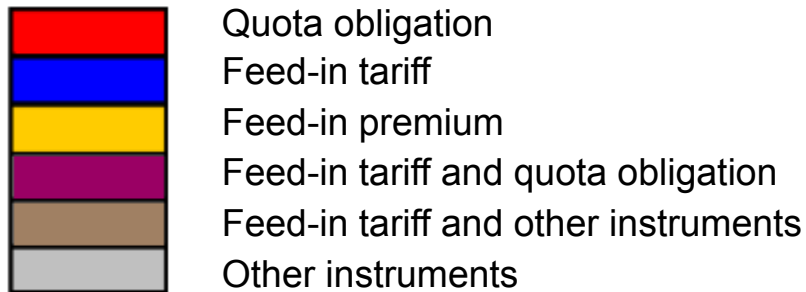
Local framework

The farm and its surroundings

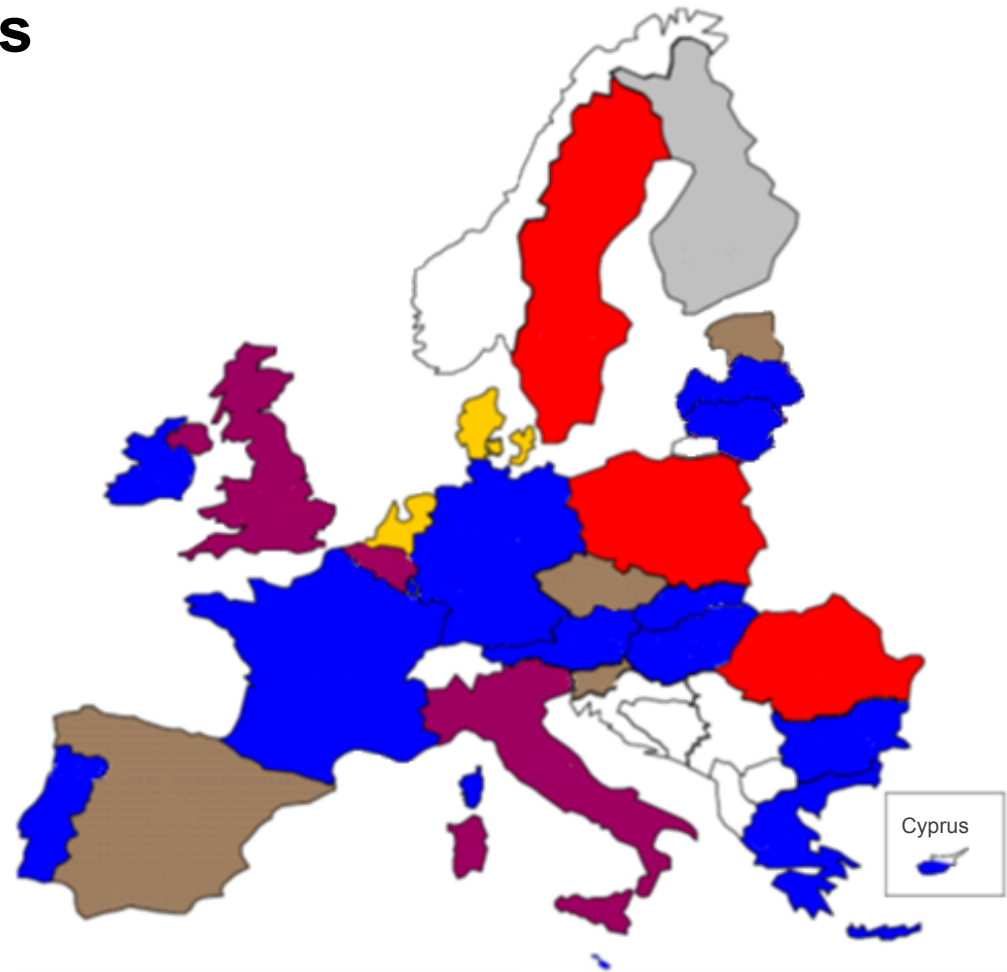


Legislative framework

State support instruments



Investment grants, tax exemptions and fiscal incentives are not included

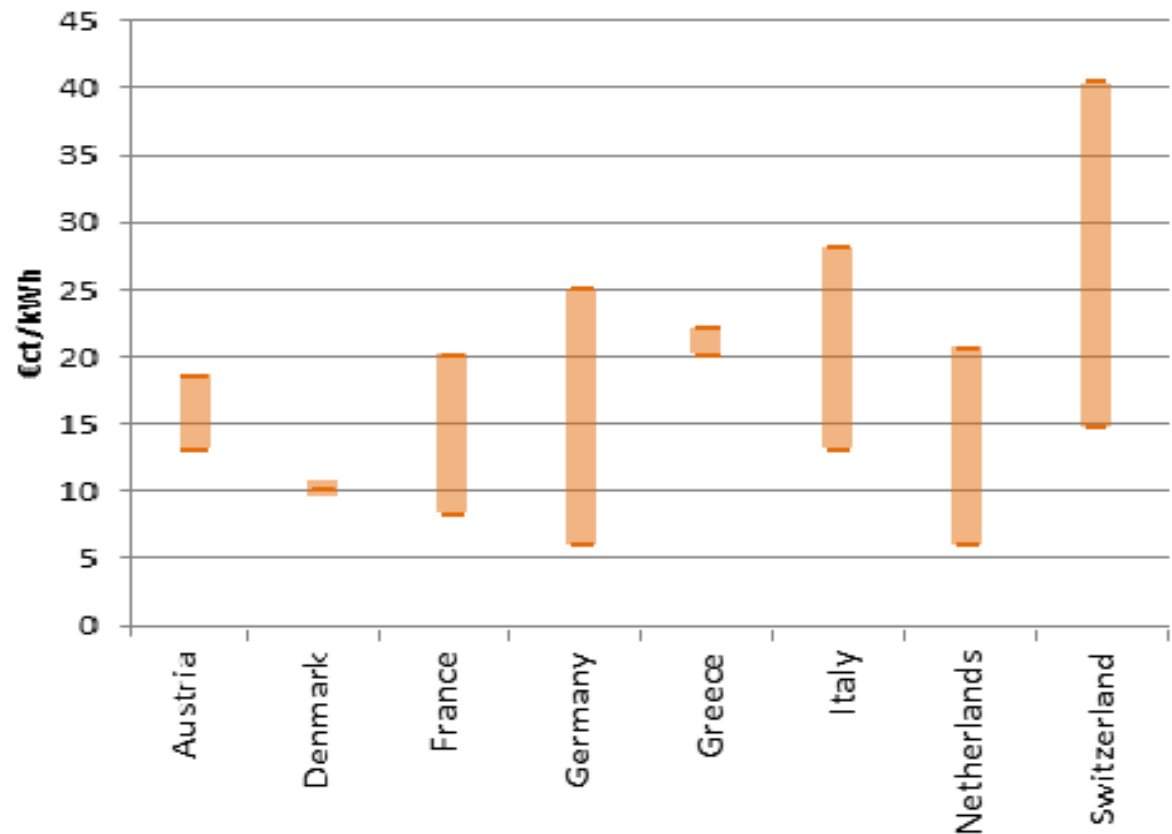


(Source: based on Ecofys 2011)

Legislative framework

State support instruments

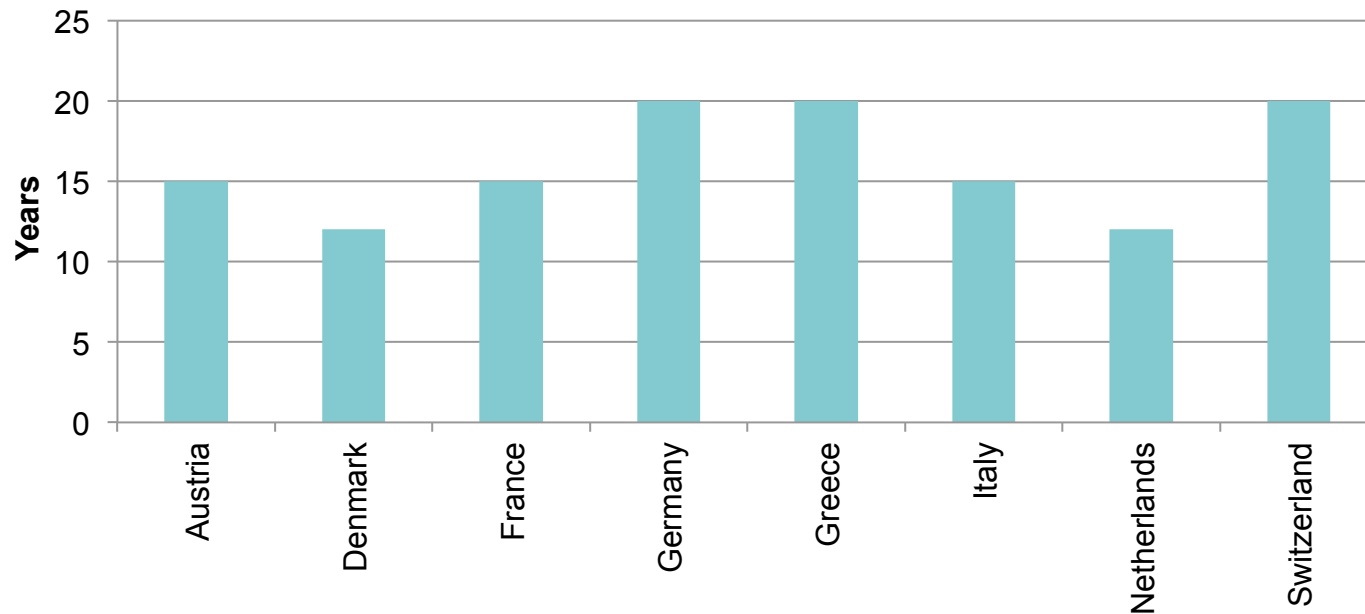
Guaranteed feed-in tariff



Legislative framework

State support instruments

Guaranteed payment period



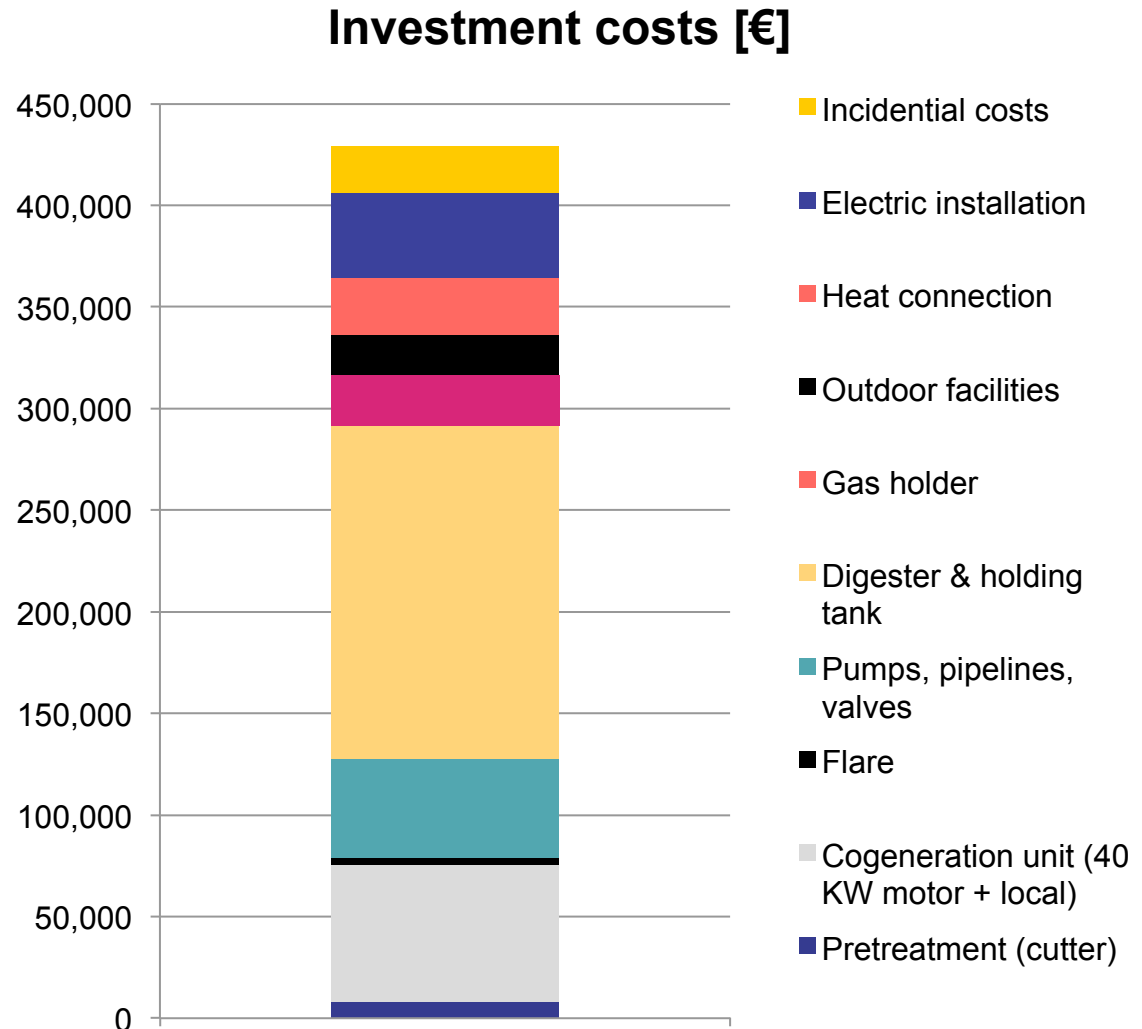
Example of economics

Investment costs

CHP 45 kWel

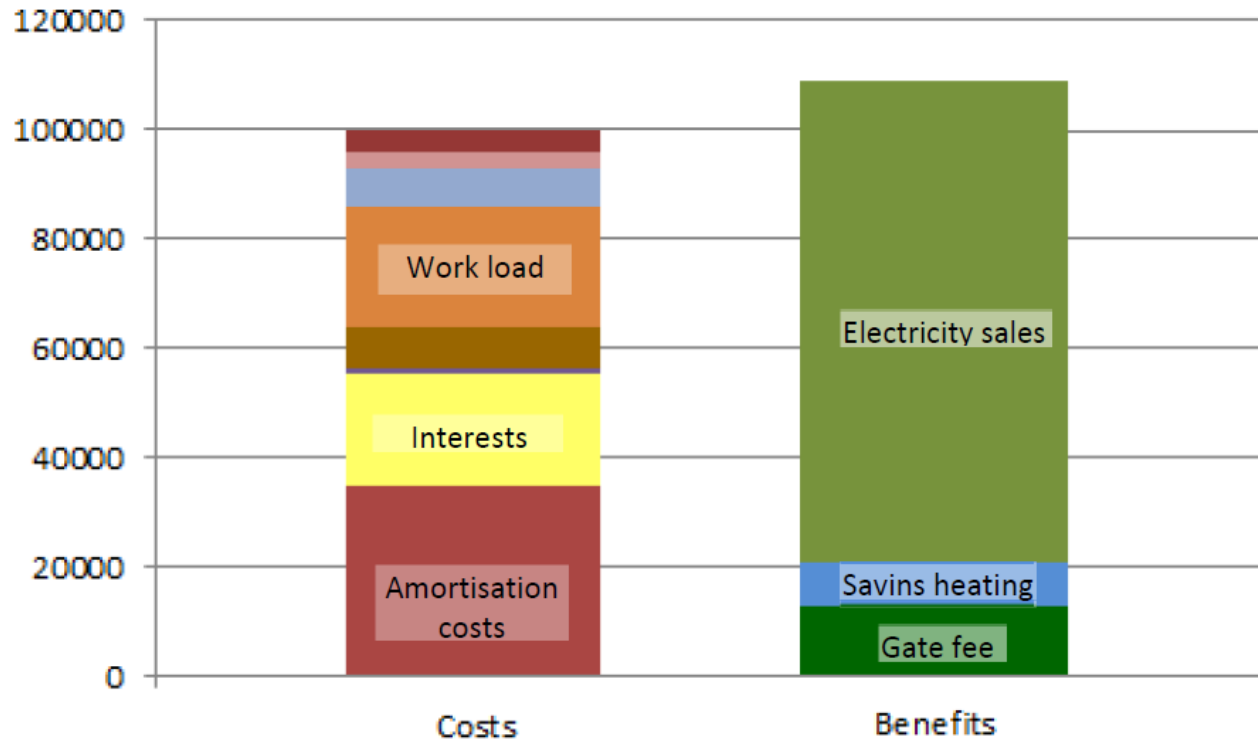
Total:
430'000 €

> 9'000 € / kW_{installed} !



Economics – operation costs

Example - CHP 45 kWel



Benefit:
9'000 €/a

Example from Switzerland

Conditions:

- 80% borrowed capital
- 4.5 % interest rate
- 60 CHF/t gate fee
- Feed-in tariff: 40 €ct/kWh

Conclusions

Availability

- Vast technological options*
- Many new plant suppliers – references must be checked carefully*
- Don't choose the cheapest option, but the most adequate for your situation*

Viability

- Good framework conditions are necessary*
- Careful evaluation*
- Full energy recovery - creative solutions are often beneficial!*

Thank you for your attention!

