



Sustainable small-scale biogas production from agro-food waste for energy self-sufficiency

Live-Webinar, 12th November 2014

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IrBEA Executive

Hosted by RENAC



IEE/13/477/SI2.675801

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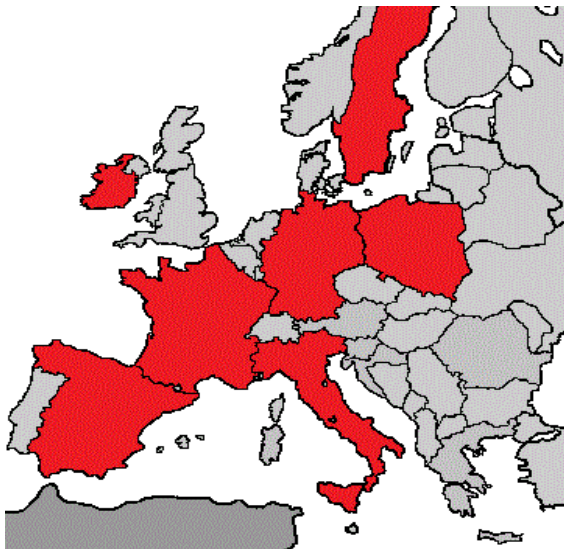
About BIOGAS³

- Implemented within EU-programme Intelligent Energy Europe
- Aims to promote renewable energy supply
- Small scale agri-food biogas production
- Using agricultural waste and food processing waste
- Producing energy for self-consumption



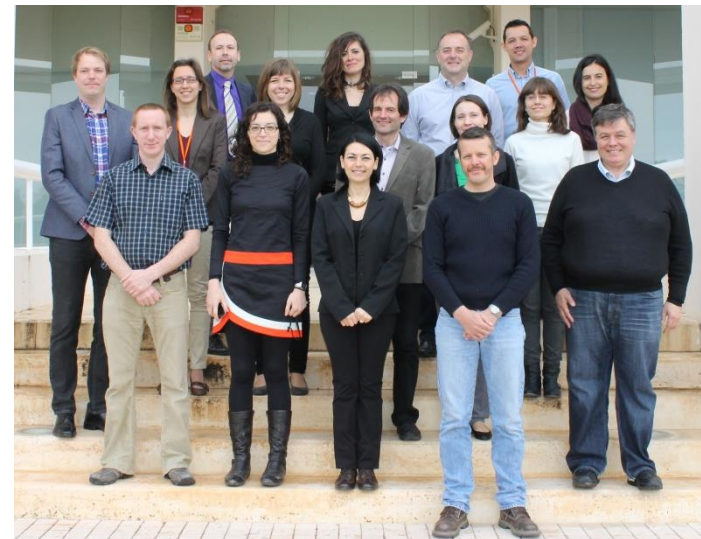
Contribution to secure, sustainable and competitively priced energy for Europe by promoting new and renewable energy sources and supporting energy diversification.

The team of BIOGAS³



Partner Organisations:

AINIA, FIAB (Spain)
 ACTIA, IFIP (France)
 TCA, DEIAFA (Italy)
 RENAC (Germany)
 FUNDEKO (Poland)
 JTI (Sweden)
 IrBEA (Ireland)



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TECNOALIMENTI

FundEko

irbea | irish
 bioenergy
 association

ifip

ACTIA

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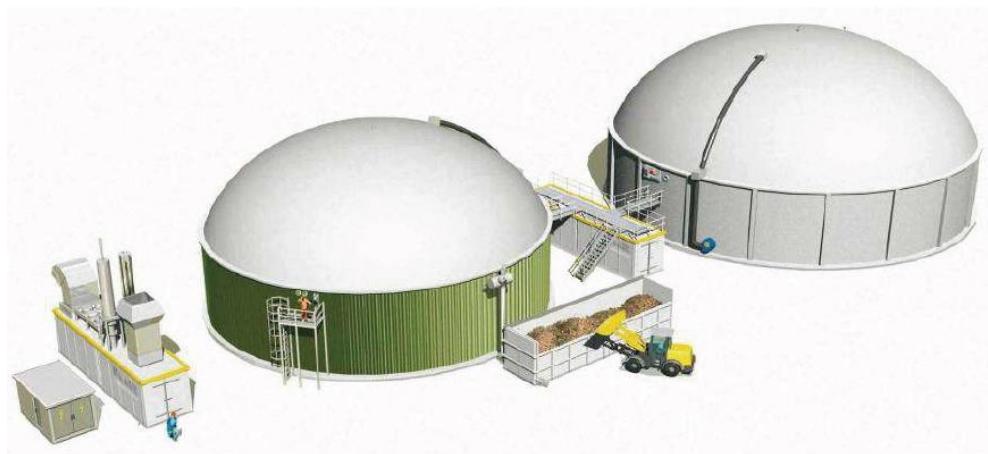
Co-funded by the Intelligent Energy Europe
 Programme of the European Union

www.biogas3.eu

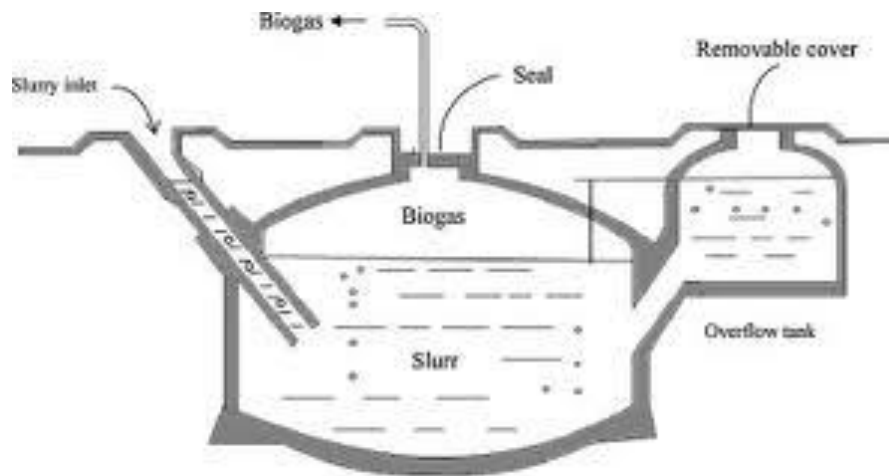
EVENT NAME. Place, xx/xx/xxxx

Typical Industrial scale Biogas Plant

- 250kwe – 5MWe scale
- Capital Expenditure of €4-5m / MW
- Feedstocks: Energy Crops
- Feedstocks: Waste Materials
- Feedstocks: 10,000 tonnes to 200kt
- Currently 2 in operation in Ireland
- 3 under construction
- Potential for “a few dozen”



Developing World Digesters



Genesis of BIOGAS³

- Biogas plants to suit farms and food processors – without effecting current operations
- Using cow slurry to provide gas onsite for milking operations (hot washing, milk cooling)
- Converting food processing waste (whey, off spec product etc..etc..) to biogas for process heating / cooling / electricity

Which materials can produce biogas?

- **Agricultural waste & Products**

- Animal slurries
- Harvest residues
- Grass / Maize / Cereals

- **Food processing waste**

- Meat/fish processing waste
- Dairy waste
- Brewery spent grains
- Vegetable waste
- Waste from prepared food factories
- Sludge from waste water treatment plants

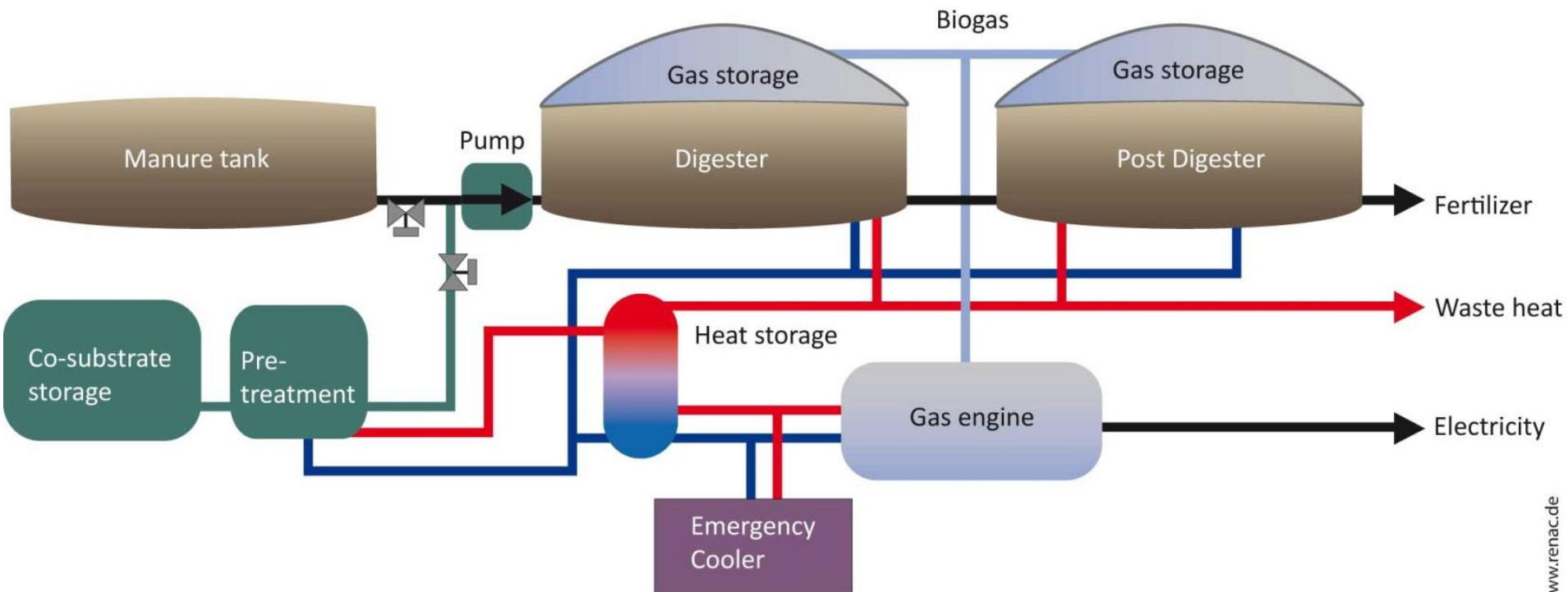
- **Waste Management / Sludge Management**



Potential Substrates

Substrate	Dry matter	Biogas	Methane Content	Net Energy	Heating value	Electricity	Electric value
					90% efficient	35% efficient	19c/kwh
	[%]	m ³ /ton fresh weight	%	kWh / Tonne	@8c/kwh	[kWh el./ton]	(not including heat value)
Cattle Manure	8	25	60	162	€ 11.70	57	€ 10.80
Pig manure	6	20	60	130	€ 9.36	45	€ 8.64
Milk whey	8	58	53	333	€ 23.97	117	€ 22.14
Brewers yeast (pressed, cooked)	25	152	62	1021	€ 73.48	357	€ 67.87
Potato pulp	19	108	50	585	€ 42.11	205	€ 38.89
Slaughterhouse waste (rumen)	15	60	55	357	€ 25.73	125	€ 23.77
Bread and baking residues	77	570	53	3272	€ 235.57	1145	€ 217.57
Corn silage	35	216	52	1216	€ 87.58	426	€ 80.89

Biogas Technology



Biogas Technology

How can Biogas technology support agro-food companies?

- Recycling organic residues → time and cost savings
- Providing company with own produced electricity and heat
 - Covering energy demand of company and contributing to energy self-sufficiency of company
 - Improving company's energy efficiency
 - Independence of energy providers and market prices (e.g. feed-in tariffs)
 - Reduction of energy costs
 - Sustainability of processes

Example of a farm small-scale biogas plant

Dairy farm, Gießen (Germany)



Small-scale biogas plant (installed capacity 75 kW).

Feedstocks: cattle slurry (10.950 m³/year)

Energy use: heat for self-consumption, electrical energy is fed into local power grid.

Digester: 600 m³ concrete tank

Biogas valorisation unit: 75 kW boiler.

Energy production : 630 Mwhel/a; 740 MWhth/a

Investment: 500,000€

Estimated payback period = 6 years

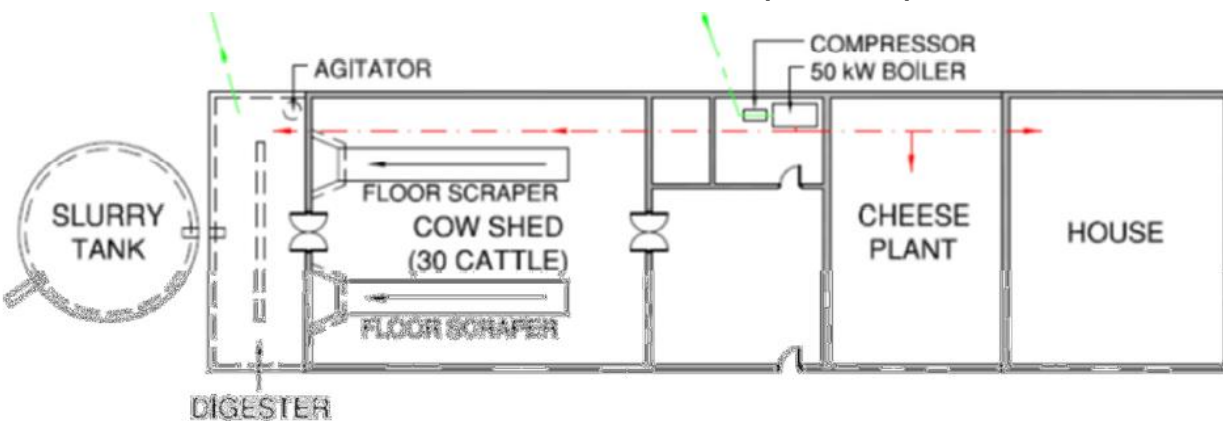
Data obtained from a report of Bio4Gas GmbH

Example of a farm small-scale biogas plant

Fahringer farm, Rettenschöss (Austria)



Small-scale biogas plant (self-built, low-cost).
 Feedstocks: cattle slurry, whey, pig slurry
 Energy use: heat for the housing and the cheese plant.
 Digester: 150m³ concrete tank
 Biogas valorisation unit: 50kW boiler.
 Gas production : 150-180m³ biogas/day
 Investment: 35,000€
 Annual Maintenance cost (estimate 5% CapEx €1750)
 Gas value €6570/yr
 Payback 7 years



Data obtained from a report
 of the BIOREGIONS project
 (www.bioregions.eu)
 compiled by Patrick Daly

Methanogen, Waterford



- Built 1992 – running ever since
- 2 x 70m³ insulated concrete tanks, Fibreglass top
- €35,000 Initial investment
- 50kw Heat output

Example of a food waste small-scale biogas plant

University of Southampton Science Park (UK)

Data from SEAB energy (seabenergy.com)



Small-scale biogas plant, containerized, by SEab Energy Ltd (Model Muckbuster®)
 Feedstocks: 410 L/day of kitchen food waste, cooking oil and spent alcoholic drinks.
 Energy use: electricity and heat used in the business park offices and research labs.
 Biogas valorisation unit: 8kW CHP engine.
 Biogas production: 46m³/day
 Electricity production: 35MWh/year
 Investment: 120,000 €

Annual operation and maintenance costs: 6,000 €

Energy savings: 3,380 €

Heat savings: 1,810 €

Waste management savings: 12,470 €

Digestate value: 1,170 €

Payback period: 4 years (with feed-in tariffs). Estimated in 9 years without feed-in tariffs.

In this case, the power of the biogas plant is under-used. The plant has the capacity to produce 64MWh/year and it is only producing 35MWh/year. At full load, the payback period without feed-in tariffs would be reduced to 7 years.

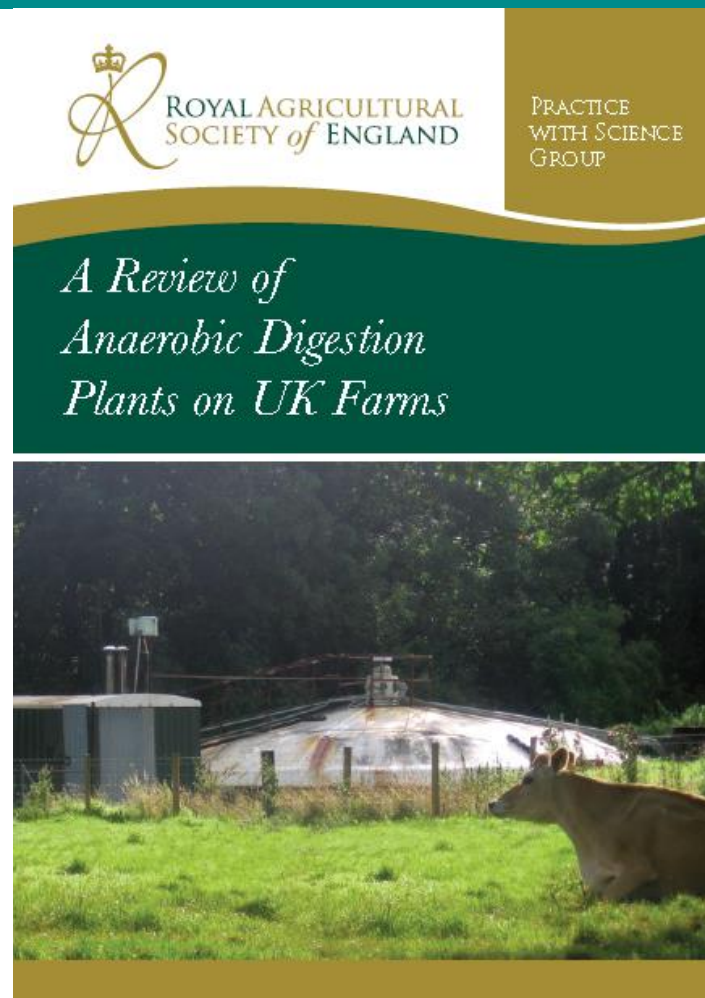
Digesters in Ireland

Digester	Location	Feedstock	Size (kw)	Energy Use
Roughty Valley Co-Op	Kerry	Pig Slurry	245	Heating
Campile Community	Kilkenny	Cattle Slurry +	200	Heating
Methanogen	Waterford	Cattle Slurry +	50	Heating + research
Ballyshannon	Wexford	Food waste, cattle slurry	300 heat 200 electric	Heating & Electricity
Green Gas	Limerick	Cattle Slurry, food processing waste	400 heat 250 electric	Heating & Electricity

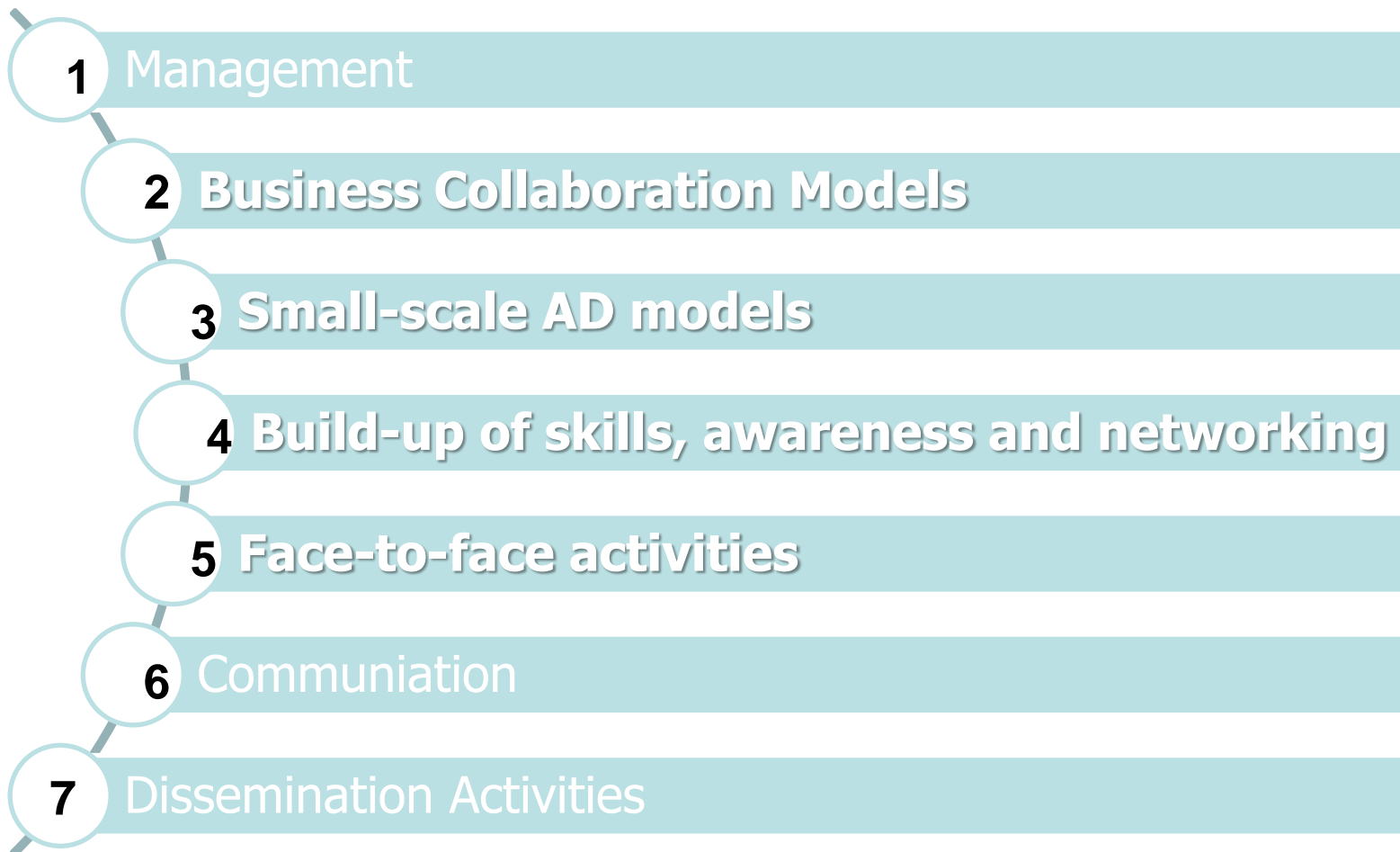
2 Digesters currently undergoing commissioning
 2 Digesters currently under construction

Recommended Reading

- RASE Report on anaerobic digestion



About BIOGAS³



What can BIOGAS³ do for me?

- Free training courses & workshops
 - On-line and face-to-face
 - Choice of basic courses, specialised workshops, webinars...
- Personalised feasibility studies
 - With the software smallBIOGAS, to check if your feedstock and site are suitable for a small-scale biogas plant.
- Networking and one-to-one activities
 - Contact to specialised biogas plant technologists and technology centres that will help you to outline the best project
- Implementation of new small-scale biogas plants



BIOGAS³ publications

- Report small-scale AD in agro-food companies: potentials and barriers



BIOGAS³ publications

- Report small-scale AD in agro-food companies: potentials and barriers
- EU legislative and financial framework for the implementation of small-scale biogas plants in agro-food & beverage companies




BIOGAS³ publications

- Report small-scale AD in agro-food companies: potentials and barriers
- EU legislative and financial framework for the implementation of small-scale biogas plants in agro-food & beverage companies
- Small-scale AD Business Collaboration Models

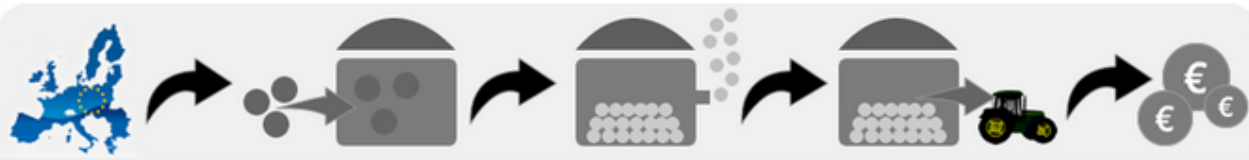


SmallBiogas Software Tool & Usage Guide

[New study](#) | [My studies](#) | [Logout](#)



New study



1 Where?

General data

Name:

Country: Ireland

Spain
 France
 Italy
 Germany
 Poland
Ireland
 Sweden

Administrative division

Munster

Annual average temperature (°C): 9,9

The results obtained from the use of the tool provide to the user an orientation about the viability of a small-scale biogas plant. For this reason, the authors recommend further consultation with expert centres before carrying out a project of biogas plant and are not responsible for any damages resulting from the use made of the tool smallBIOGAS.

☐ Accept conditions



[next >>](#)

2

3

4

5

Co-funded by the Intelligent Energy Europe Programme of the European Union

'smallBIOGAS'

Usage guide to use the software and interpret the results

BIOGAS³

Sustainable small-scale biogas production from agro-food waste for energy self-sufficiency

Date:
August 2014

Authors:
BIOGAS³ Consortium

DATA OF THE PROJECT: Programme: Intelligent Energy Europe (IEE) - ALTENER Key action: Promotion and dissemination projects Grant Agreement: IEE/13/477/S12.675801 Start / end date: 1 st March 2014 – 28 th February 2016	CONTACT: Coordinator: Begonia Ruiz (AINIA) Telephone: +34 961366090 E-mail: bruz@ainia.es Website: www.biogas3.eu
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Biogas³ Handbook

SUSTAINABLE SMALL-SCALE BIOGAS FROM AGRI-FOOD WASTE FOR ENERGY SELF-SUFFICIENCY



> HANDBOOK <

organic matter in the input materials: from 5 to 15%.
Main technical parameters:
• a rectangular, welded and air-tight carbon steel tank (inside dimensions: 2.5 x 2.5 x 12 m;

Nominal power (kW _{el})	Price range (€)	O&M cost (Euro/year)
10 kW	75,000 – 100,000	3,000 – 6,000

biogas³ 52



eGmina, Infrastruktura, Energetyka Sp. z o.o.
Established since: 2006
Złota 54, 45-643 Opole POLAND
Tel/Fax: +48 77 416 70 84
Mobile: +48 662 389 472
www.egie.pl
kontakt@egie.pl
Number of small-scale plants sold this far: < 5



> NITRATE LEACHING

EG91/676/EWG, Nitrates Regulation
Wasserhaushaltsgesetz (WHG, §2, 44, 47)
Oberflächengewässerverordnung (OGewV)
Grundwasserverordnung (GrWV)

> RISK OF EMISSION OF METHANE AND AMMONIA DURING APPLICATION

DüngemittelV (§6-Schadstoffgrenzwerte
Contamination limits)
Bundes-Immissionsschutzgesetz (BImSchG)

> ODOUROUS COMPOUNDS

Bundes-Immissionsschutzgesetz (BImSchG, §3)
Codice Civile (gute landwirtschaftliche Praxis)

> TRANSPORT SYSTEM

Düngemittelverkehrskontrolle (DVK)
Verordnung über das Inverkehrbringen und Befördern von Wirtschaftsdünger (WdüngV)

> REGULATIONS RELATED TO USE OF HEAT

Kraft-Wärme-Kopplungsgesetz (KWKG-Gesetz, §3 Abs. 2; §4 Abs. 1, 4)
EEG 2014 (§23)

Bundes-Bodenschutzgesetz (BBodSchG)
Bundesnaturschutzgesetz (BNatSchG)
Düngegesetz (DüngeG)

I'm interested, how can I take part?

- Contact your local partner!



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I'm interested, how can I take part?

- Contact your local partner!



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Thank you for your attention



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EVENT NAME. Place, xx/xx/xxxx

Potential Substrates



Potential Substrates



Potential Substrates



Source: RENAC



Food left over



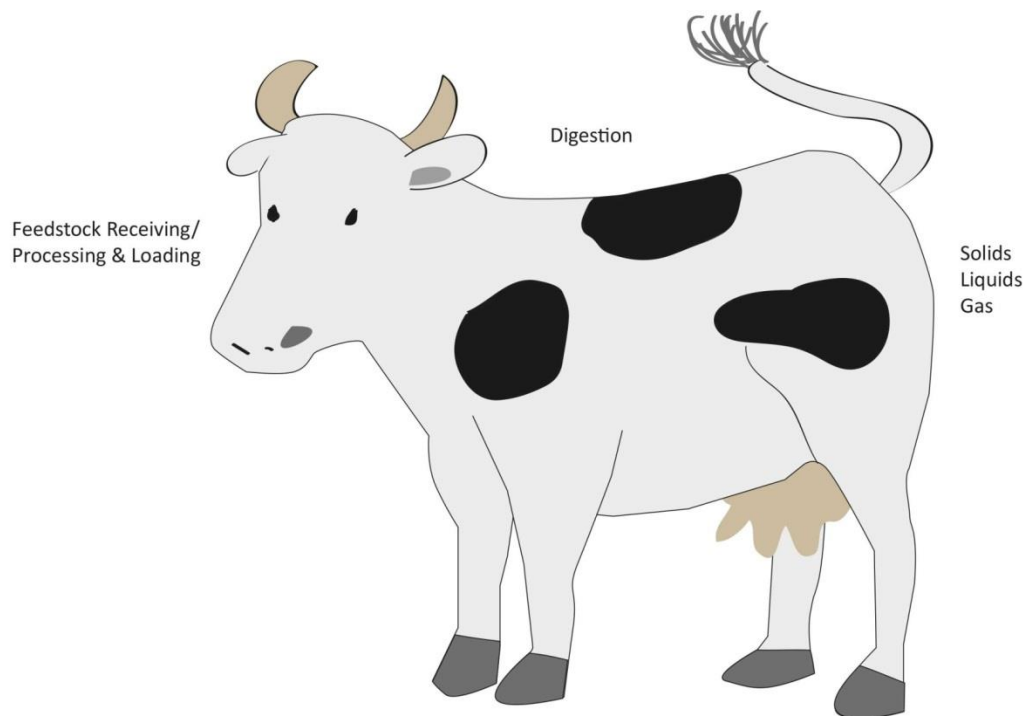
Fruits and vegetables



Meat

What is biogas?

- It is a fuel gas (similar to natural gas) obtained from microbial degradation of organic matter in absence of oxygen.
- It can be used to produce **heat**, **electricity** or be used as **vehicle fuel** after purification.



Biogas Technology

What is Anaerobic Digestion?

The basics:

- Conversion of organic material into biogas in the absence of oxygen
- A complex microbiological process with widespread natural occurrence (e.g. cow stomach, swamplands, rice plantations, etc.)
- The climate effect of methane is 21 times higher than that of CO₂ (biogas usually contains about 50 – 70 % methane)