DiBiCoo, Web Seminar
17th of November 2020

Fachverband BIOGAS
German Biogas Association
Association Allemande du Biogaz
Asociación Alemana de Biogás
www.biogas.org

Sustainability of biogas

Frank Hofmann, Consultant International Affairs
Fachverband Biogas e.V., German Biogas Association

Content

- **Sustainability**
- The role of biomass in climate change
- Life Cycle Assessment (LCA) for biogas
- Recommendations for biogas plant design and operation

What is sustainability?

- According to the Brundtland Comission of the United Nations, sustainability is:

"Development that meets the needs of the present

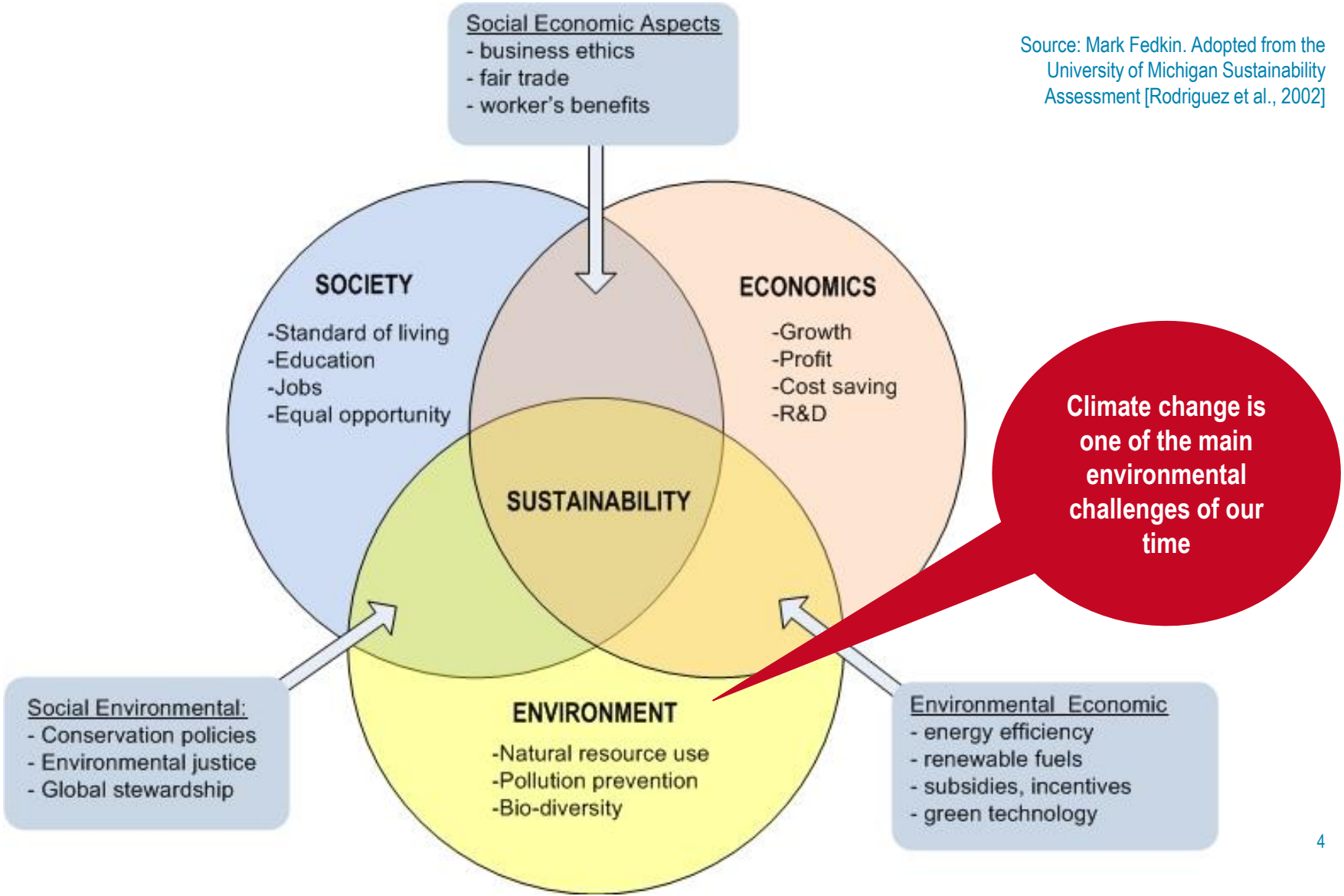
without compromising the ability of future generations to meet their own needs."

(March 20th, 1987)

The three pillars of sustainability

Fachverband BIOGAS

Source: Mark Fedkin. Adopted from the University of Michigan Sustainability Assessment [Rodriguez et al., 2002]



Content

- Sustainability
- **The role of biogas in climate change**
- Life Cycle Assessment (LCA) for biogas
- Recommendations for biogas plant design and operation

Greenhouse gases

- There are four main naturally occurring greenhouse gases:
  - Water vapour,
  - Carbon dioxide,
  - Methane and
  - Nitrous oxide
- Gases have the ability to absorb heat, this ability is called ***global warming potential*** and is expressed as a factor of carbon dioxide (whose GWP is standardized to 1).

Greenhouse gas	Pre-industrial concentrations*	2008 concentrations	Human source	GWP 100 years
Carbon dioxide (CO_2)	278 ppm	365 ppm	Fossil fuel combustion, land use changes, cement production	1
Methane (CH_4)	700 ppb	1745 ppb	Fossil fuels; rice paddies; waste dumps; livestock	25
Nitrous oxide (N_2O)	270 ppb	314 ppb	Fertiliser; industrial processes; fossil fuel combustion	298
Hydrofluorocarbons (e.g. HFC-23)	0	14 ppt	Liquid coolants	14,800**
Perfluorocarbons (e.g. CF_4)	0	80 ppt	Refrigerant; electronics industry and aluminium industry	6,500
Sulphur hexafluoride (SF_6)	0	4.2 ppt	Insulator in electronics and magnesium industry	22,800

* ppm, parts per million by volume; ppb, parts per billion by volume; ppt, parts per trillion by volume.

** This figure was changed in 2007 from 11,700 to 14,800.[25]

Source: IPCC 4th Report (2007)

Biogas and climate change

Fachverband BIOGAS

Avoids uncontrolled methane emissions from open air storage of organic material

Methane is a very effective GHG

Generation of renewable energy. Substitution of fossil fuels

GHG performance is highly depending of feedstock

Production of biofertilizer – substitution of mineral fertilizers

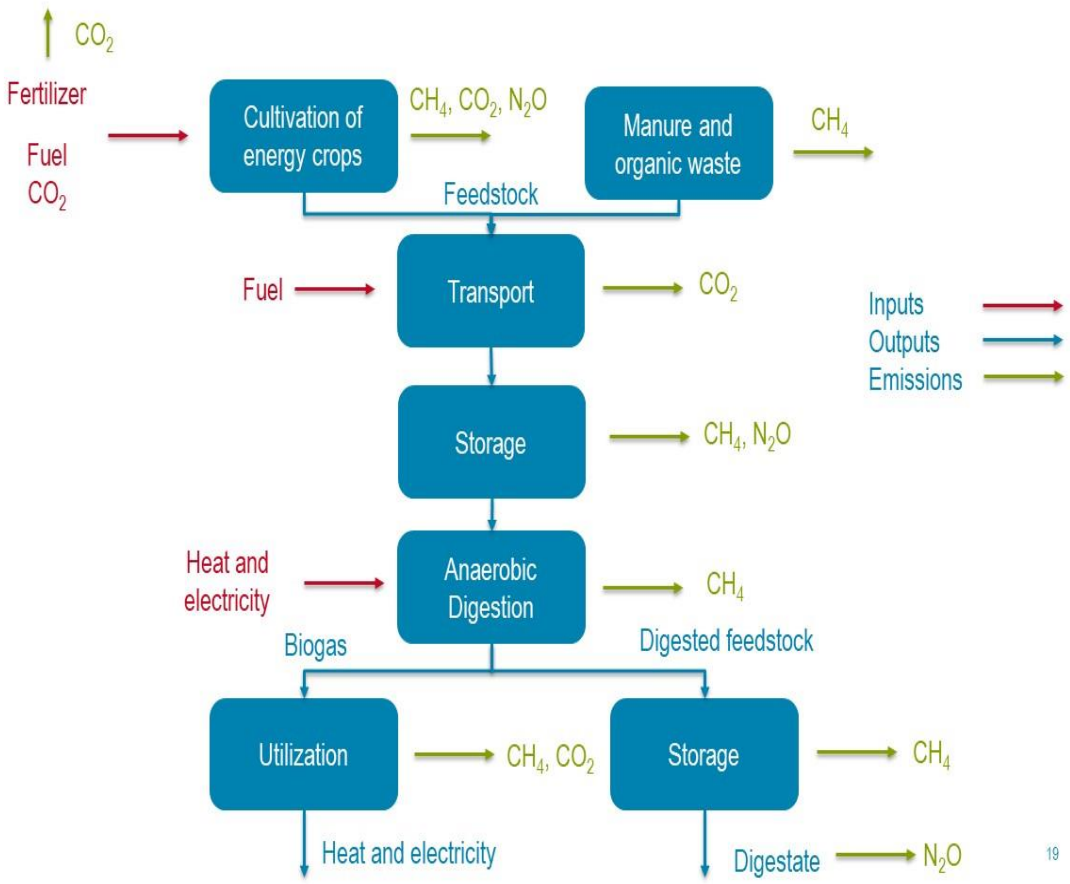
Content

- Sustainability
- Climate change
- The role of biomass in climate change
- **Life Cycle Assessment (LCA) for biogas**
- Recommendations for biogas plant design and operation

Life-cycle Assessment (LCA)

LCA is a technique to assess environmental impacts associated with all the stages of a product's life from

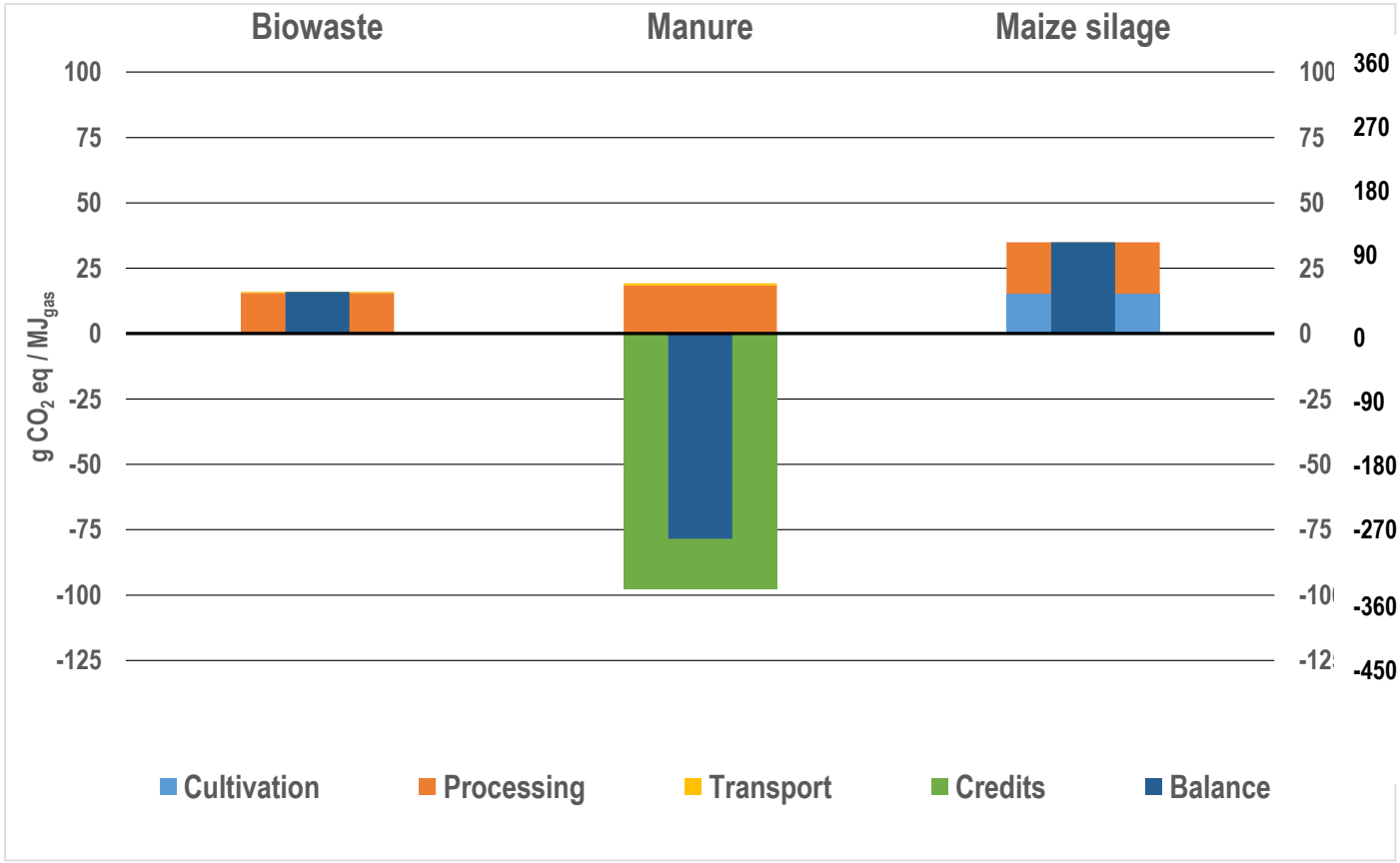
- raw material extraction through
- materials processing,
- manufacture,
- distribution,
- use,
- repair
- maintenance, and
- disposal or recycling.



Source:
https://sftool.gov/plan/400/life-cycle-assessment-lca-overview

LCA for biogas plants

- GHG emission of biogas production

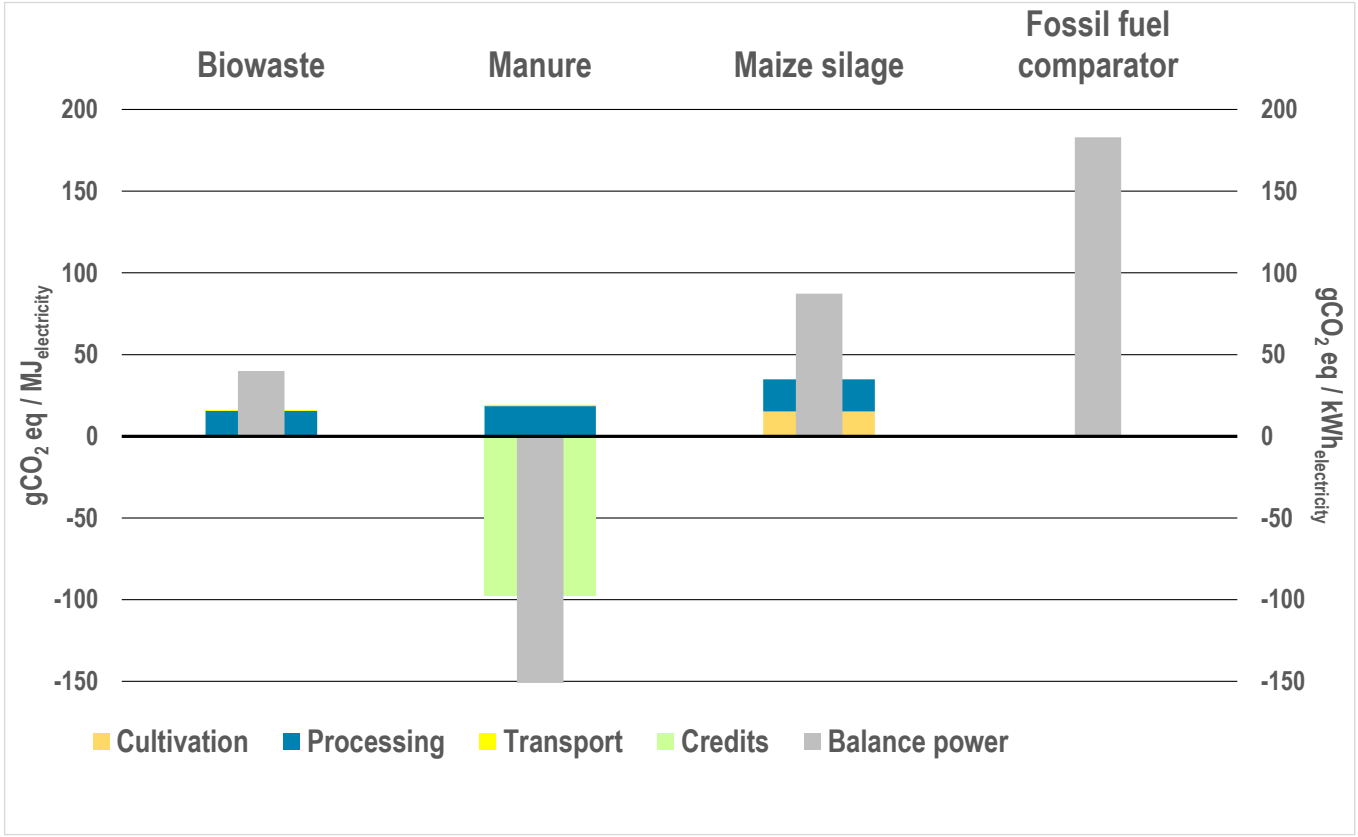


Source: FvB 2017 with figures from RED II

Figures are for closed digestate storage tanks!

LCA for biogas plants

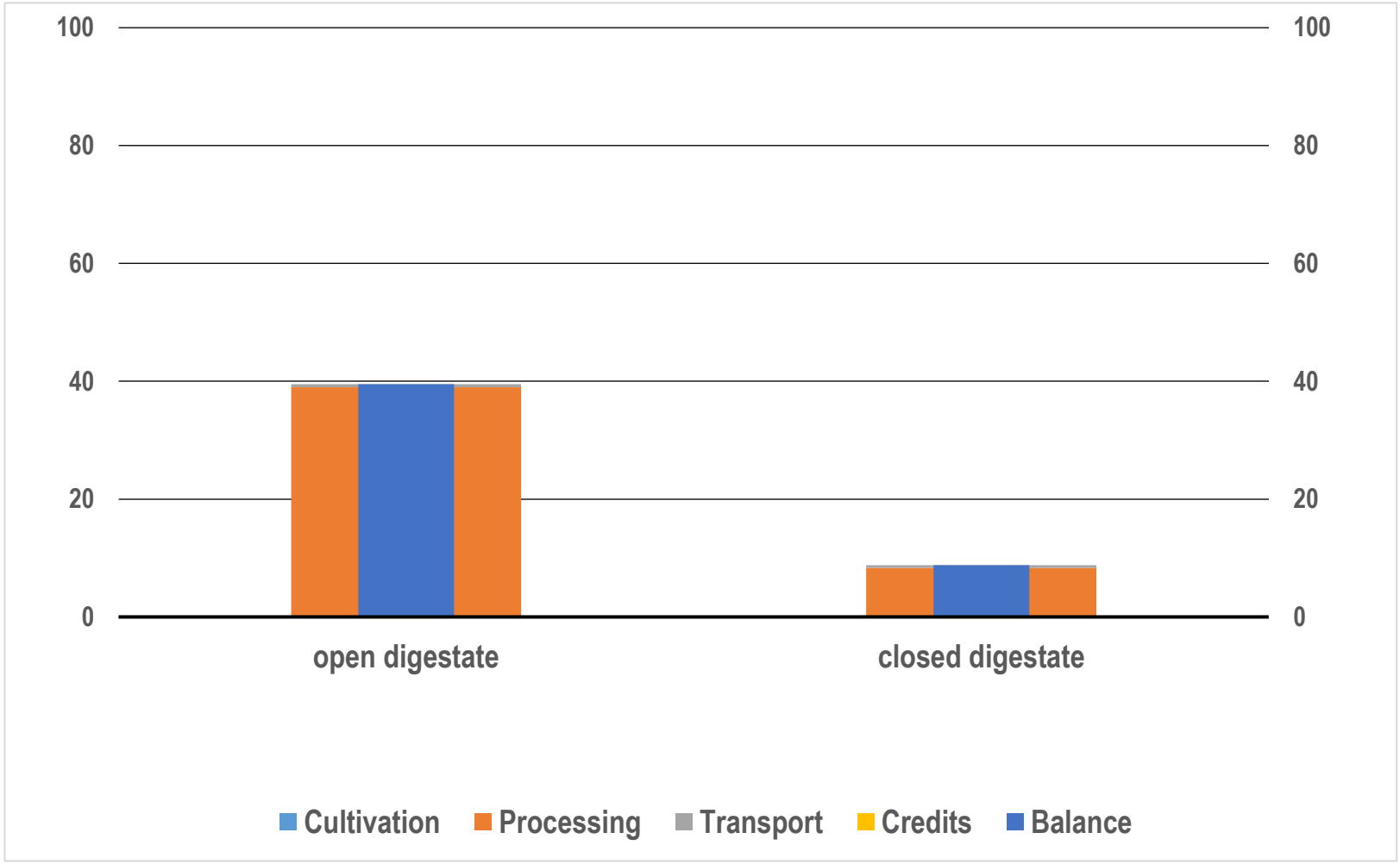
- GHG emission savings of biogas utilization for power generation with heat credit



Figures are for closed digestate storage tanks!

Source: FvB 2017 with figures from RED II

The effect of digestate storage tanks, example waste



Content

- Sustainability
- Climate change
- The role of biomass in climate change
- Life Cycle Assessment (LCA) for biogas
- **Recommendations for biogas plant design and operation**

Recommendation for a low-emission biogas plant operation

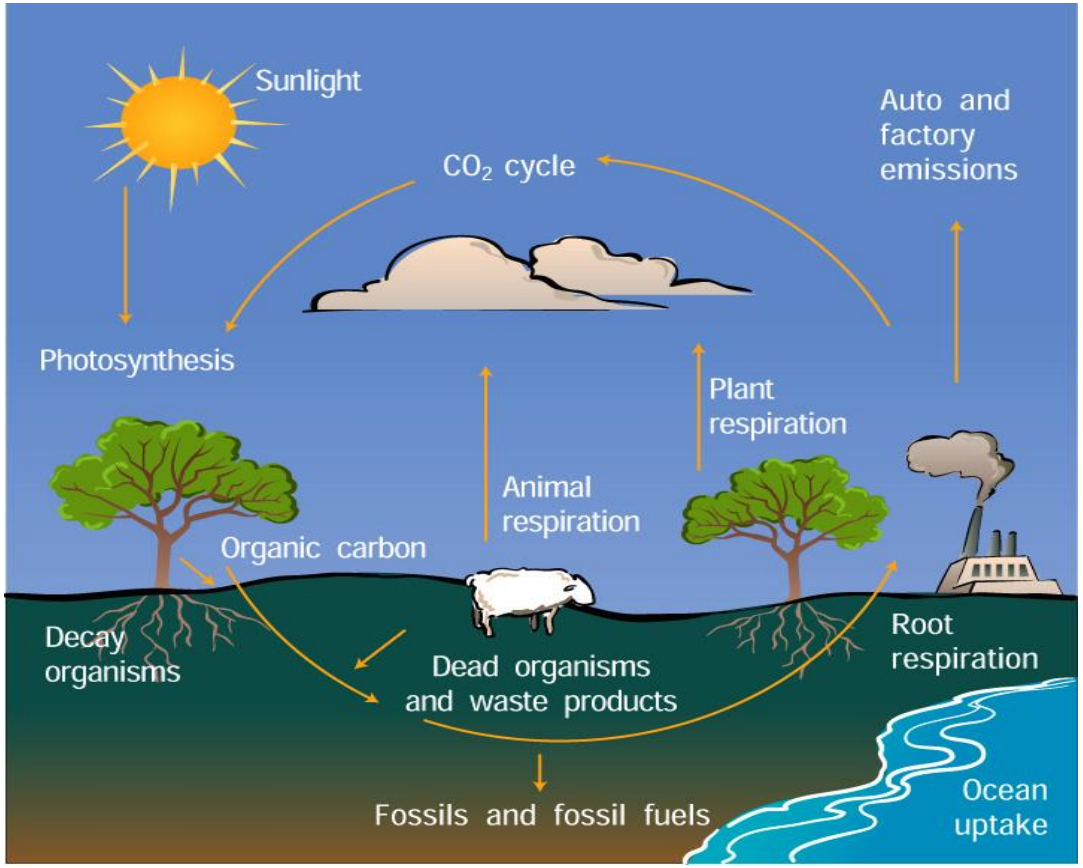
- Use of stored organic material, like manure
- Methane leakage should be avoided whenever possible.
  - Cover the digestate storage. Most methane emissions in a biogas plant arise there.
  - Install an automatic starting flare in the time the CHP is not operating. A CHP operates typically below 8,200 h/a. During CHP standstill times the produced methane must be flared.
  - Regular leakage control of the biogas plant.
- If CHP is installed, the produced heat should be used to substitute fossil fuel heat.
- Digestate should substitute synthetic fertilizer

GBA Publications

Contact: Frank Hofmann@biogas.org

Bioenergy in the climate change discussion

- Bioenergy is a nearly carbon neutral energy generation because
  - during the growth of plants carbon dioxide from the atmosphere is stored in the plant in form of carbon containing molecules (CO_2 reduction).
  - after combustion about the same amount of carbon dioxide is emitted which was originally extracted from the atmosphere (CO_2 neutral process).



Source: https://www.windows2universe.org/earth/climate/images/carboncycle_jpg_image.html