Business model & value chain innovation to commercialize micro-scale production of biomethane

Dr.ir. Annet Jantien Smit
Project leader and researcher of Groningen Gist / Senior lecturer

share your talent.
move the world.
New technology: It can be built! Should it?

Technology: proof of concept  Business opportunity?

share your talent. move the world.
New technology

Circular value chain: closing loops

Should it: Where does it create value?

Food waste

Growing plants on organic fertilizer: Food

Transform digestate into organic fertilizer

Produce biomethane and digestate

share your talent. move the world.
World population is growing
→ More need for natural resources and energy
  → Increasing efficiency is not enough
    → We need to re-use, re-cycle, and up-cycle
      → We need more circular value chains
→ Circular economy: - 70% green house gas emission

And what can we do in Groningen?
→ We can close the waste 2 energy 2 food loop

share your talent. move the world.
Circular value chain: A business model portfolio

All processes of the value chain have different business models to create, deliver and capture value.

- Collecting food waste
- Growing plants
- Exploiting biogas, digestate & green CO₂

*share your talent. move the world.*
How to earn money by closing loops?

Results so far:

• Producing biogas with existing technology: € 1.35 / m³
• High payback period: 24 years

3 different business models for exploiting biogas, digestate & green CO₂

Business model for swill collection

Business model for garden or greenhouse

Be your talent. Move the world.
Unlock the circular value chain: Capture the value created for all

Waste 2 energy 2 food loop creates value for:

- Circular restaurants: Corporate story telling
- Municipalities: Urban policy goals
- Power balance: Power2gas creates flexibility and storage
Value circular restaurants: Corporate story

Our local case study: Progress Events
Micro-scale digester:
• Produces biomethane & fertilizer

Circular restaurant:
• Uses biomethane for cooking
• Uses green CO2 for beer brewing
• Serves plants as food
• Produces food waste
Value for cities: Realizing policy goals

Closing the waste-energy-food loop adds to urban policy goals

- Enlarge local job market
- Increase urban farming
- Reduce food miles
- Reduce waste transportation
- Reduce urban congestion
- Reduce urban noise levels
- Reduce $\text{CO}_2$ emissions
- Increase renewable energy production and consumption
- Increase organic fertilizer production
Value for cities: How much?

Reduced CO₂ emissions by digesting food waste: 19.266 kg CO₂ / year

Reduced CO₂ emissions by waste transportation by e-bike: 71 kg CO₂ / year

Transform digestate into organic fertilizer

Growing plants on organic fertilizer: Food

Produce biomethane
Value for the grid: flexibility and storage

Power balance:
Many stakeholders
Research @ EnTranCe

Overflow of solar power …
…produces green hydrogen

Overflow of biomethane is fed into gas grid

Transform digestate into organic fertilizer

Food waste
Growing plants on organic fertilizer: Food

Produce biomethane

H₂

CH₄
Value created & captured by all:
Let’s create EnTranCe in the City
City of Groningen:
• Educating people & raising awareness
• Showcasing local inventions
EnTranCe & power grid stakeholders
• Energy balance & storage
• Pilot plant in real-life context
Circular restaurant
• Applying biomethane technology
• Story telling, story doing
Questions & ideas to contribute to realization?

Dr. ir. Annet Jantien Smit → a.j.smit@pl.hanze.nl

Thanks to

My student research team 2015-2019:
Feye Postma, Wietze van Dijk, Frens Hartgers, Tatiana Ivanciuc, Tom Schipper, Saskia Esmeyer, Maurice Buitenkamp, Rogier Koopmans, Steven Zwerver, Koen Gerlsma, Dennis Riemmeijer, Freek Buijs, Marvin Altena, Rémon Prakken, Rick Kooistra, Jelmer Bekius, Ferdi van der Spoel, Harrie Verjans, Robert Bos, Hedser Wijbenga, Sophia Boersma.

Groningen Gist Research consortium: