Urban waste for biomethane grid injection and transport in urban areas

Project No: IEE/10/251

Checklist on the business agreements for Waste-to-Biomethane projects

WP 6 – Task 6.5 / D 6.4

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Contents

Abbreviations

AD – Anaerobic Digestion

CBG – compressed biogas

CHP – combined heat and power

MSW – municipal solid waste

RDF – Residue Derived Fuel

WtB – Waste to Biogas/Biomethane

WWT – waste water treatment

Introduction

The objective of UrbanBiogas project is to stimulate the set-up of Waste-to-Biomethane (WtB) plants in five project target cities – Abrantes (Portugal), Gdynia (Poland), Graz (Austria), Valmiera (Latvia) and Zagreb (Croatia). Waste-to-Biomethane (WtB) supply chain as addressed by the UrbanBiogas project is provided in Figure 1.

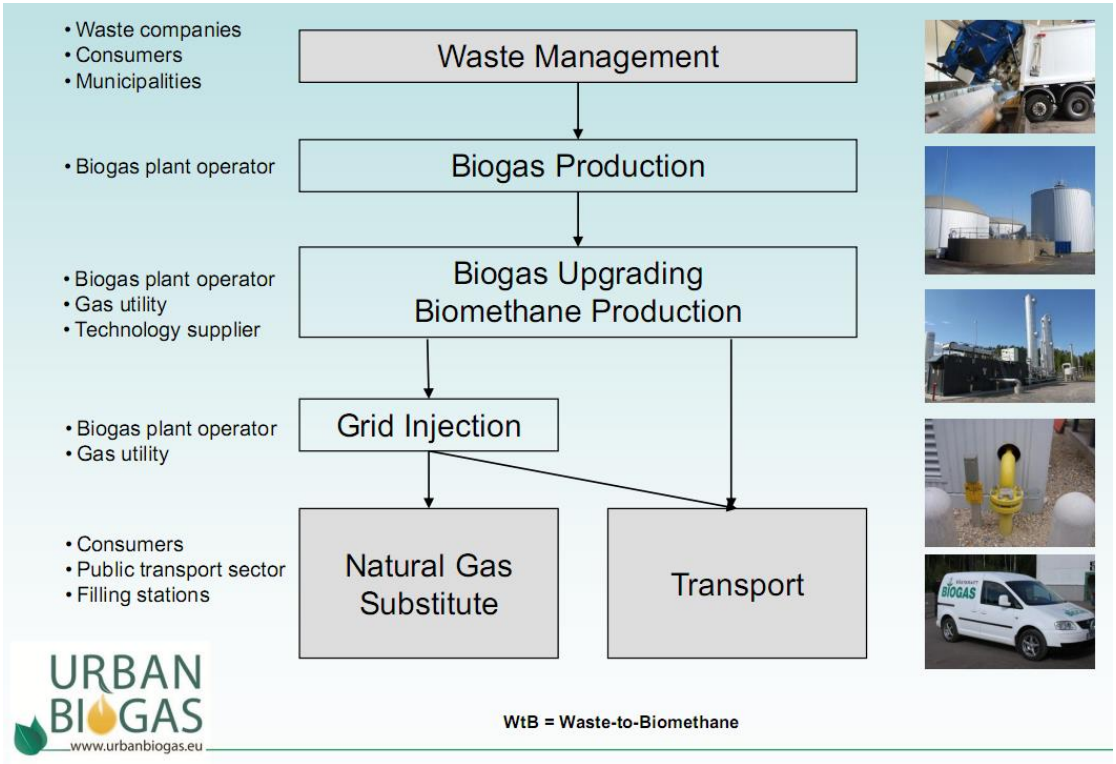

Figure 1: Waste-to-Biomethane supply chain (Rutz D., 2011)

Upgrading biogas to biomethane in some cases is more beneficial than generating the biogas alone. Biomethane is better option in case of the lack of the heat energy consumer in the vicinity of the plant, compressed biomethane can be used for as fuel for the transport or can be injected into the natural gas grid and used as substitute for natural gas. However, the drawback of biomethane projects is that they usually require large investment and mostly are economically feasible for larger biogas plants. If for the biogas production concepts mostly the biogas plant owner (farmer or the waste management company) and several feedstock suppliers are involved, then for the biomethane concept the involved business partner structure is more complex. Usually this results to setting-up a separate company or operational unit for implementation of WtB project.

As can be seen in Figure 1, WtB chain involves several stakeholders and actors. Successful cooperation among involved parties is crucial for WtB project implementation. In this document several examples on WtB business concepts are given and a checklist of business agreements is provided.

Two examples of biomethane business models are given in Figure 2 and Figure 3. The one in Figure 2 is more related to the biomethane use for substitute of the natural gas (German case), the model described in Figure 3 is describing a relationship model for biomethane use in transport.

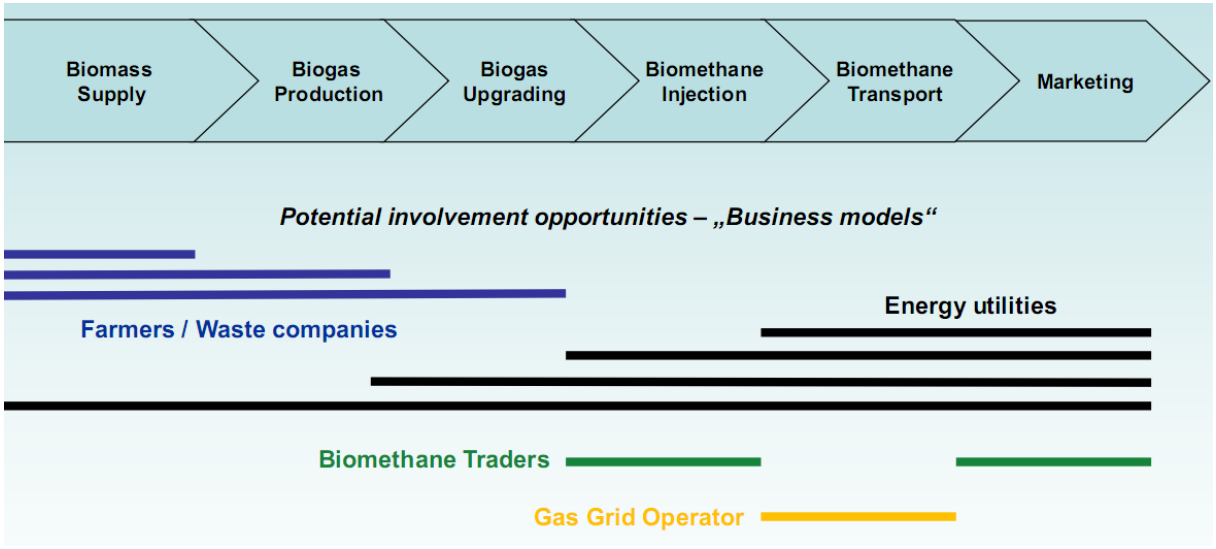

Figure 2: "Typical" Business Concept for Biomethane Projects in Germany (Rutz D., 2012)

In a biomethane gas grid injection model the involved parties are mostly farmers, waste management companies, biomethane traders, gas grid operators and energy utilities. In the transport model suppliers of raw feedstock material, biogas producers, gas distributors, vehicle providers, national, regional and local administrations are identified as the main players.

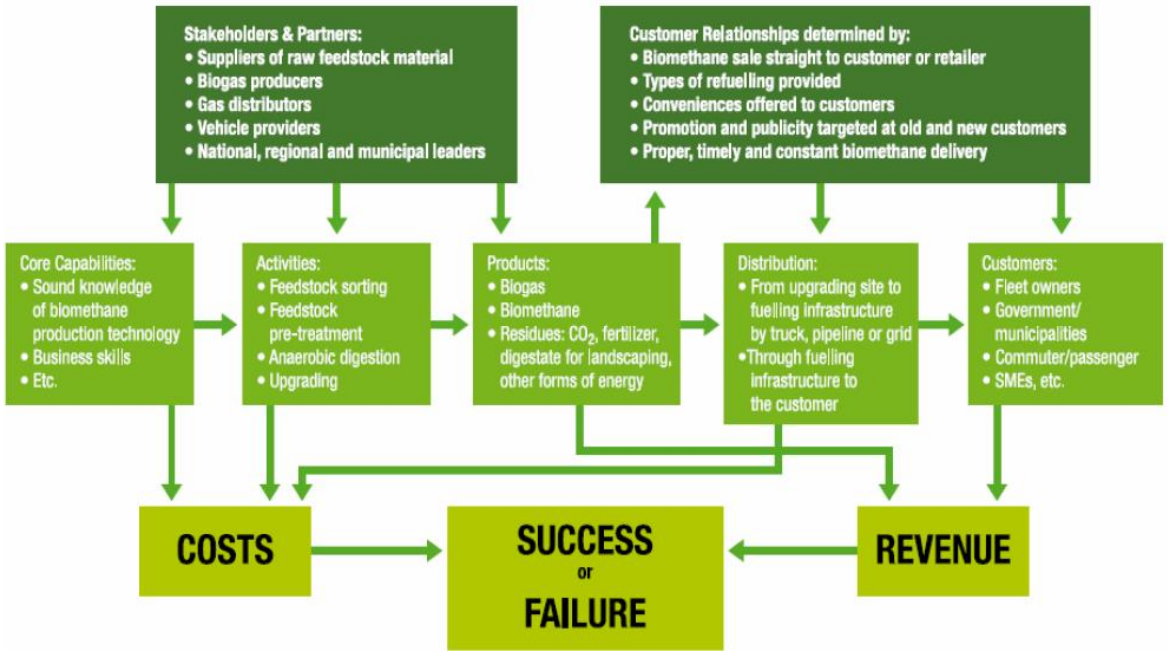

Figure 3: Biomethane business model (biogasmax, 2009)

Further sections of this document describes the main involved parties and their function in WtB chain under the vision of UrbanBiogas project and can be used as checklist while developing the own concept or business model for concrete project.

Involved parties and their function

The following parties can be identified in WtB chain:

☐ City council/municipality

☐ Public Utility Company owned by the city council/municipality

☐ Public Transport Company (optionally owned by the city council/municipality)

☐ Waste Collection Company

☐ Waste Treatment Company

☐ Waste processing company

☐ Landfill operator

☐ Biogas producer (biogas plant)

☐ Biomethane producer (biogas upgrading plant)

☐ Biomethane trading company

☐ Natural gas grid operator

☐ Fuel Distribution Company

City council/municipality is responsible for organisation of the waste collection, providing good living conditions to their inhabitants (environmental, social and health conditions), doing spatial and development planning and developing infrastructure and public services (including public transport) in their territory.

Public Utility Company is owned by the city council/municipality and is institution acting in between residents and service providers (e.g., waste collection company, water supply, and waste water treatment companies). Sometimes the utility company itself can be a service provider. Usually the public utility company is responsible for contracting the service providers (e.g. waste collection company), ensuring a good service (in case if the public utility company is a service provider), billing the residents for received services (waste, water, housing management services and other).

Public Transport Company is a company providing public transportation services. This is be a company providing public transportation services within the city or/and regional transportation services. Sometimes the company is owned or co-owned by the city council/municipality. The public transport company is responsible for keeping and maintaining their fleet and providing public transportation services.

Waste Collection Company is contracted to collect waste in the territory of the city/municipality.

Waste Treatment Company is a company receiving and treating waste (e.g., mixing, conditioning, removing impurities). Usually this function is integrated in the operation of waste processing company, however, in WtB chain waste treatment can be considered as a separate part of the process.

Waste processing company is receiving (optionally pre-treated) waste and turning them into valuable raw materials (recycled materials (plastic, paper, glass, metal), RDF, organic fraction). Part of the waste that can not be recycled or recovered is sent to the landfill.

Landfill operator is a company operating municipal solid waste landfill.

Biogas producer is a company owning and operating biogas plant. In WtB chain the main feedstock for biogas plant operation is pre-treated organic waste. In some cases additional substrates and feedstock (e.g., agricultural residues, energy crops, waste water sludge, industrial organic residues) might be used. The end products of the process are generated biogas and digestate (organic fertilizer).

Biomethane producer is a company owning and operating biogas upgrading plant. The company is receiving biogas from the biogas plant and using the upgrading technology is producing biomethane and CO_2. Biogas upgrading plant can be an independent entity or can be a part of the biogas plant (owned by the same company).

Biomethane trading company is an organisation providing transportation and trade of biomethane through natural gas grids.

Natural gas grid operator is a company operating the natural gas grid.

Fuel distribution company is a company owning and operating a fuel filling station(-s).

General WtB organisational model

WtB organisational model can be assessed from several points:

1) Legal relationships among the involved parties
2) Monetary relationships – cash flows
3) Raw-material and product flows

In Figure 4 the legal relationship model of the WtB project actors is given. The following relationships between actors can be identified:

- City council/municipality ↔ Public Transport Company

  City council or municipality is usually organising public transport services. The city/municipality is planning and developing the network of the public transport services and is managing the use of financial resources for public transportation purposes.

- City council/municipality ↔ Public Utility Company

  Public Service Company is fully or partially owned by the city council/municipality.

- City council/municipality ↔ Waste Collection Company

  Municipalities have to organise the waste management services according to the national and regional waste management plans.

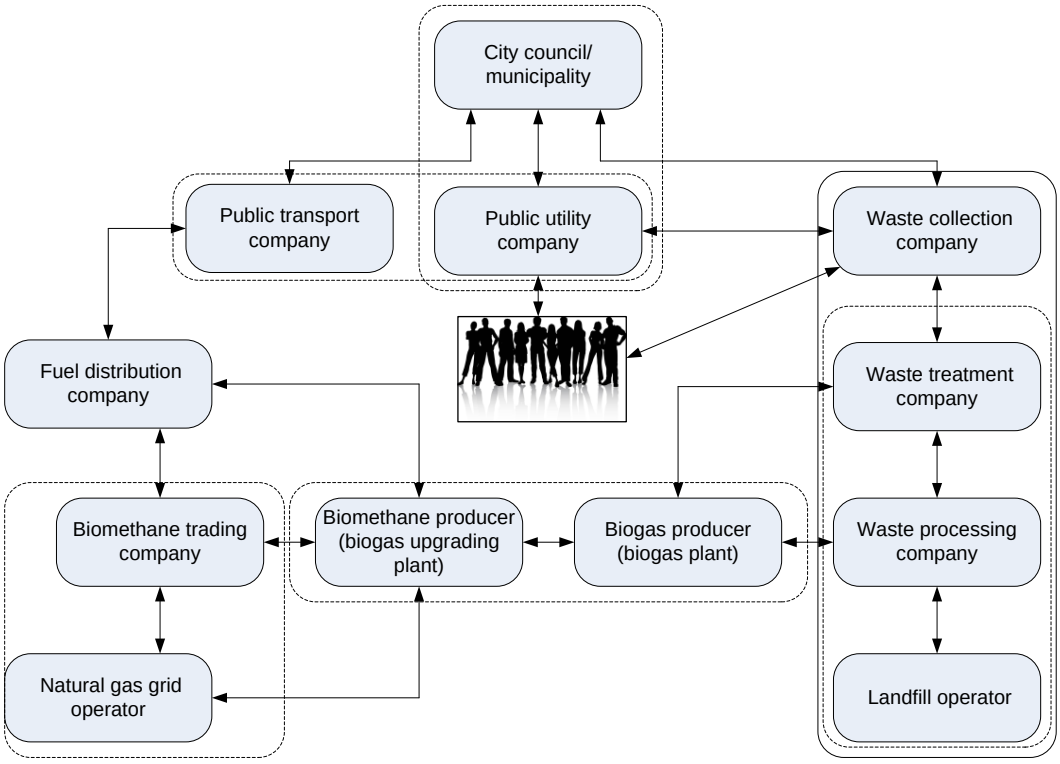

Figure 4: Legal relationship model of the WtB project

- Public Utility Company ↔ Waste Collection Company

  Waste Collection Company is going into agreement with a Public Utility Company and providing the waste collection services to residents.

- Public utility company ↔ Residents

  Residents disburse for public services and Public Utility Company provides residents with respective services.

- Residents ↔ Waste Collection Company

  Residents are paying to Waste Collection Company for collecting waste and then ensuring their treatment and processing.

- Waste collection company ↔ Waste Treatment Company

  Usually waste collection companies also deal with the waste treatment and waste processing.

- Waste treatment company ↔ Waste processing company

  Waste treatment company can be a separate unit or to be a part of the waste processing company.

- Waste processing company ↔ Landfill operator

  Sometimes waste processing company is the same legal entity as the landfill operator, but those two entities might be separated.

- Waste processing company ↔ Biogas producer

  Waste processing company is delivering organic waste to the biogas plant based on supply agreement. Sometimes waste processing company can be itself a biogas producer.

- Waste treatment company ↔ Biogas producer

There can be a legal relationship between biogas producer and waste treatment company directly.

- Biogas producer ↔ Biomethane producer

  Biogas producer provides Biomethane producer with biogas. Biomethane producer use biogas for the upgrading to biomethane.

- Biomethane producer ↔ Natural gas grid operator

  Biomethane can be injected to the natural gas pipeline thus ensuring cheaper and environmentally friendly heating for citizens.

- Biomethane producer ↔ Biomethane trading company

  Biomethane trading company is buying biomethane from the producer.

- Biomethane producer ↔ Fuel Distribution Company

  Biomethane producer can sell biomethane to the fuel distribution companies.

- Fuel distribution company ↔ Biomethane trading company

  Fuel Distribution Company may buy fuel – biomethane from the biomethane trading company if there is one operating in the market.

- Fuel distribution company ↔ Public Transport Company

  Fuel Distribution Company provides Public Transport Company with the necessary fuel.

- Biomethane trading company ↔ Natural gas grid operator

  Biomethane trading company might have a contract with a natural gas grid operator for biomethane distribution through natural gas pipes.

Besides the legal relationship, it is important to understand the cash flows among the involved parties. Sometimes it is not so easy – especially concerning the waste management part (see Figure 5). In waste management services in some cases biogas producers are paying for the waste to be delivered to the biogas plant, in other cases they are being paid because of taking the waste for utilisation. This situation must be assessed very carefully and depends from case to case.

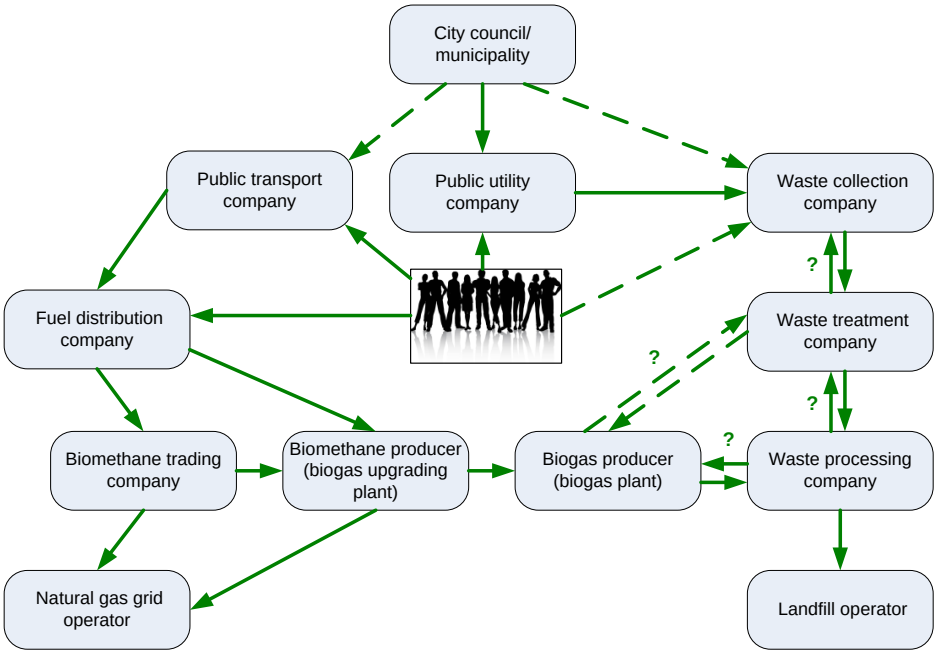

Figure 5: Cash flow model of the WtB project

Finally the raw-material and product flows must be understood. The typical material and product flows model is given in Figure 6.

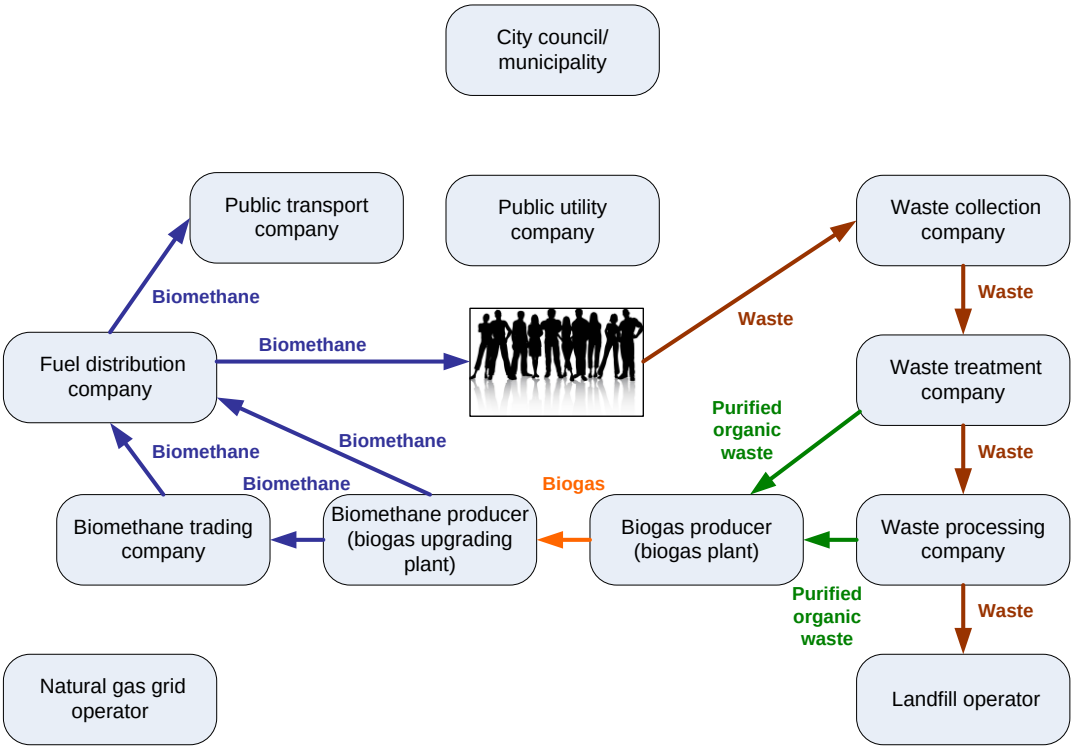

Figure 6: Raw-material and product flow model of the WtB project

Example: Applying the WtB organisational model to a real case study

This is an example about how to use the checklist for developing the WtB organisational model for a particular city. The example is made based on Valmiera city (Latvia).

Identification of the involved parties

☒ City council/municipality	**Valmiera city council** (municipality)
☒ Public service company	**Valmieras Namsaimnieks, Ltd** - 100% owned by Valmiera municipality - Responsible for house management and managing of green areas of the city **Valmieras Ūdens, Ltd** - 100% owned by Valmiera municipality - Water supply services - Domestic and commercial drainage services - Sewage reception and abstraction to biological treatment plant; treatment - Quality control of drinking water and wastewater
☒ Public transport company	**VTU-Valmiera, Ltd** - Owned by Valmiera municipality (47.33%) and other municipalities in Vidzeme region - Is providing public transportation within Valmiera city and as well providing intercity passenger transportation services
☒ Waste collection company	**ZAAO, Ltd.** - Owned by Valmiera municipality (44.04%) and other municipalities in North Vidzeme region - Is providing waste collection services within Valmiera city
☐ Waste treatment company	Not existing as a separate process. Waste treatment part is covered by ZAAO during the waste processing.
☒ Waste processing company ☒ Landfill operator	**ZAAO, Ltd.** - Owned by Valmiera municipality (44.04%) and other municipalities in North Vidzeme region - Is providing waste collection, processing and landfilling services within Valmiera city and whole North Vidzeme region - Waste processing is done by using mechanical treatment line
☒ Biogas producer	**ZAAO Enerģija, Ltd.** - 100% owned by ZAAO, Ltd. - Operating landfill gas recovery plant located at landfill site “Daibe” - Operating a CHP plant at landfill site “Daibe” using the landfill gas, electricity is sold for the feed-in tariff to the national electricity grid operator “Sadales Tikls”
☐ Biomethane producer	Not existing
☐ Biomethane trading company	Not existing
☐ Natural gas grid	**Latvijas Gāze, JSC**

operator	- Will be given a function of the national natural gas grid operator - Currently the lack of legislative framework doesn't allow biomethane injection into the natural gas grids
☐ Fuel distribution company	There are several fuel distribution companies existing and operating in Valmiera region, however, none of them is distributing and selling compressed natural gas or compressed biomethane

Identification of currently weak parts of the WtB organisational model

- Currently organic waste is not source separated
- There are no biogas upgrading plants and no demand for biomethane as a product
- Biomethane injection in the grid is not possible due to the lack of appropriate legal framework conditions (natural gas market is still not liberalised)
- Non existing biomethane trade market
- Fuel distribution companies does not provide compressed gas fuel
- Public transport company does not have any bus in their fleet being able to run on compressed biomethane – new busses and/or re-building of the old ones are needed
- Residents do not have cars appropriate for CBG use

Proposed organisational model (operational unit)

Option 1 (see Figure 7): Collection of unsorted municipal solid waste, mechanical treatment at "Daibe" landfill site, using organic fraction of the waste for dry fermentation. Biogas is used for CHP or in 2020 – upgraded to biomethane and used for transport or injected into the natural gas grid.

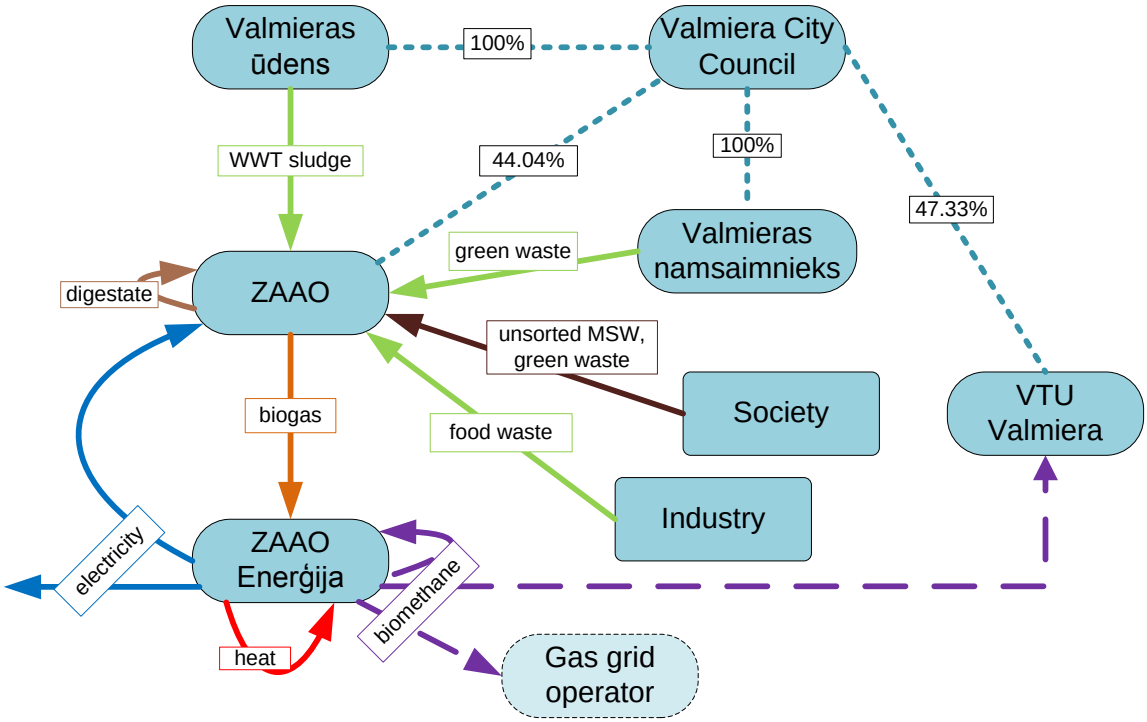

Figure 7: Dry fermentation organisational model for Valmiera – Option 1

The other proposed option is more complex, but also more sustainable (see Figure 8).

Option 2: Collection of source separated municipal solid waste, using them for the wet AD process. Biogas is used for CHP or in 2020 – upgraded to biomethane and used for transport or injected into the natural gas grid. This option allows installation of biogas plant closer to the city and saves on transportation costs, as well as to give more opportunities for heat use and later biomethane use in public transport.

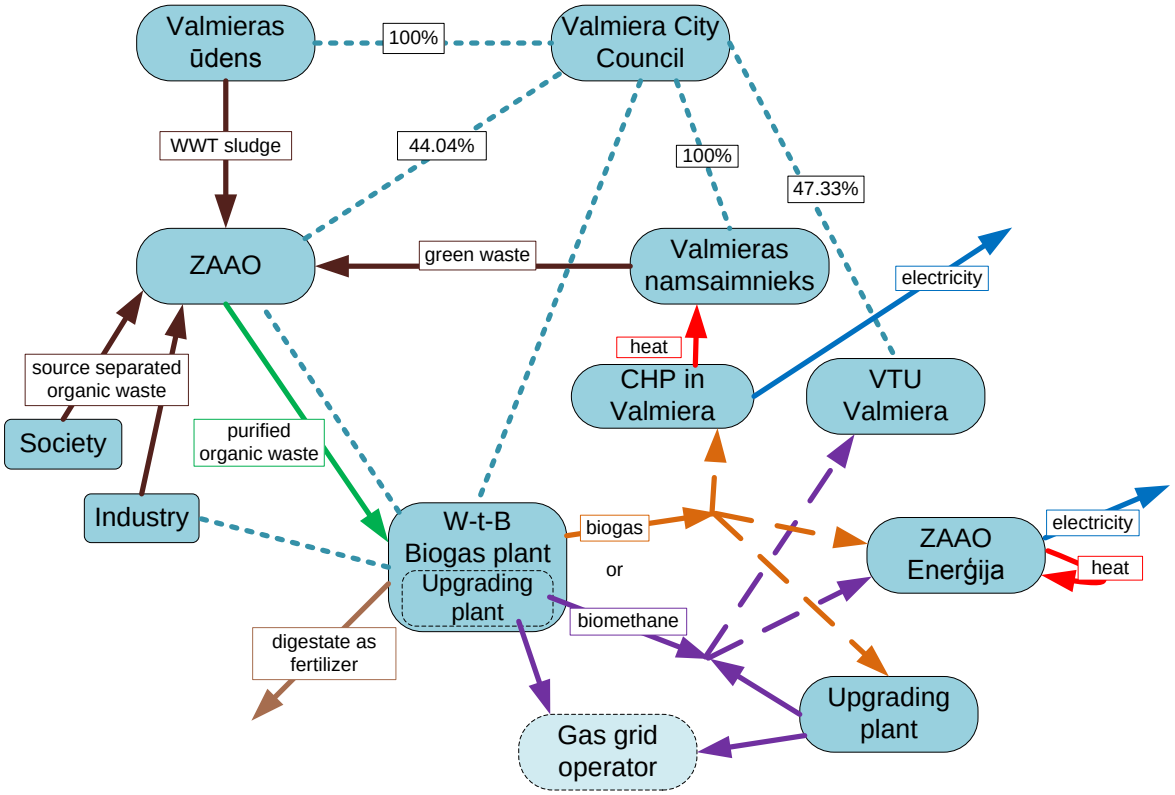

Figure 8: Wet AD organisational model for Valmiera – Option 2