

**Project: BiG>East**  
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# *Assessment Studies for Specific Biogas Sites in Latvia*

**Deliverable D 6.3**



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# Contents

- Summary ..... 3**
- Results within Step 1: Selection of the Region..... 4**
  - Description of the selected regions for potential Biogas Sites ..... 4
    - Biogas Site 1: Çekava parish ..... 4
    - Biogas Site 2: Sesava parish..... 6
    - Biogas Site 3: Zaube parish..... 8
  - Biomass supply ..... 10
    - Biogas Site 1: Çekava parish ..... 10
    - Biogas Site 2: Sesava parish..... 12
    - Biogas Site 3: Zaube parish..... 12
  - Biogas Digestate Utilisation..... 14
    - Biogas Site 1: Çekava parish ..... 14
    - Biogas Site 2: Sesava parish..... 14
    - Biogas Site 3: Zaube parish..... 14
- Results within Step 2: Selection of the biogas neighbourhood..... 15**
  - Sale of energy in the neighbourhood of the biogas plant..... 15
    - Biogas Site 1: Çekava parish – poultry farm “Çekava”..... 15
    - Biogas Site 2: Sesava parish – RZS ENERGO biogas plant..... 16
    - Biogas Site 3: Zaube parish – Zaube biogas plant ..... 18
- Results within Step 3: Selection of the Biogas Site itself..... 22**
  - Requirements towards the biogas plant site ..... 22
    - Biogas Site 1: Çekava parish – poultry farm “Çekava” biogas plant ..... 22
    - Biogas Site 2: Sesava parish – RZS ENERGO biogas plant..... 24
    - Biogas Site 3: Zaube parish – Zaube biogas plant ..... 26
- Results within Step 4: Optimising the soft requirements for selected sites ..... 29**
  - Biogas Site 1: Çekava parish – poultry farm “Çekava”..... 29
  - Biogas Site 2: Sesava parish – RZS ENERGO biogas plant..... 29
  - Biogas Site 3: Zaube parish – Zaube biogas plant ..... 29

## Summary

Those site assessment studies were elaborated by national project partner of the BiG>East project (Biogas for Eastern Europe) which is supported by the European Commission under the Intelligent Energy for Europe Programme. This document consists of three site assessment studies for Latvia, presenting specific sites suitable for biogas production and utilization. To assess the suitability of the location, Site Selection Guideline (please see BiG>East deliverable 6.1) was used.

The first site is located in Ķekava parish in Rīga district. As potential biogas site poultry farm “Ķekava” were selected. Poultry manure, slaughterhouse waste, meat processing waste and energy crops are available for biogas production. Potential size of biogas plant is 530 kW<sub>el</sub> of electrical and 590 kW<sub>th</sub> of thermal capacity. The planned biogas production is 1,93 million m<sup>3</sup> per year and biogas could be used in CHP unit for electricity and heat production. There is a possibility to feed-in electricity in general grid, and heat can be used in farm production processes instead of heat produced from natural gas.

The second site is located in Sesava parish in Jelgava district – at the border to Lithuania. As potential site for biogas production a location near to the biggest animal farm “Rudeņi” is selected. Cattle manure, cattle dung and maize silage are available on site for biogas production. Potential size of biogas plant is 540 kW<sub>el</sub> of electrical and 600 kW<sub>th</sub> of thermal capacity. Planned biogas production is 2,05 million m<sup>3</sup> per year and biogas could be used in CHP unit. Electricity could be sold in general grid. Concerning the use of heat, there are several alternatives – heat could be used for farm “Rudeņi” self-consumption, for grain drying, for district heating in settlement located near the farm or even the new business possibilities like building of greenhouses are under discussion.

The third site is located in Zaube parish in Cēsu district. A place close to Zaube cooperative slaughterhouse and charcoal production plant is selected as a potential biogas site. Cattle dung, animal waste and grass silage are available for biogas production. Potential size of biogas plant is 420 kW<sub>el</sub> of electrical and 450 kW<sub>th</sub> of thermal capacity. Planned biogas production is 1,65 million m<sup>3</sup> per year and biogas could be used in CHP unit. Electricity could be sold in general grid. There are several alternatives for heat utilization – heat could be used for operation of slaughterhouse or could be sold to charcoal producer. One more alternative under consideration is transportation of produced biogas to near located village where it could be used for electricity and heat production. Then heat will be used for district heating.

All three selected sites have very good potential for fulfilling the soft requirements – political support, public acceptance and active people interested in project development. Moreover, potential project developers has visited several biogas sites in EU and started consultations with Latvian experts and biogas experts and technology providers in other countries.

## Results within Step 1: Selection of the Region

### *Description of the selected regions for potential Biogas Sites*

During the implementation of site assessment studies three different regions in Latvia for potential Biogas Sites were selected. Location of selected regions in territory of Latvia is given in Figure 1.

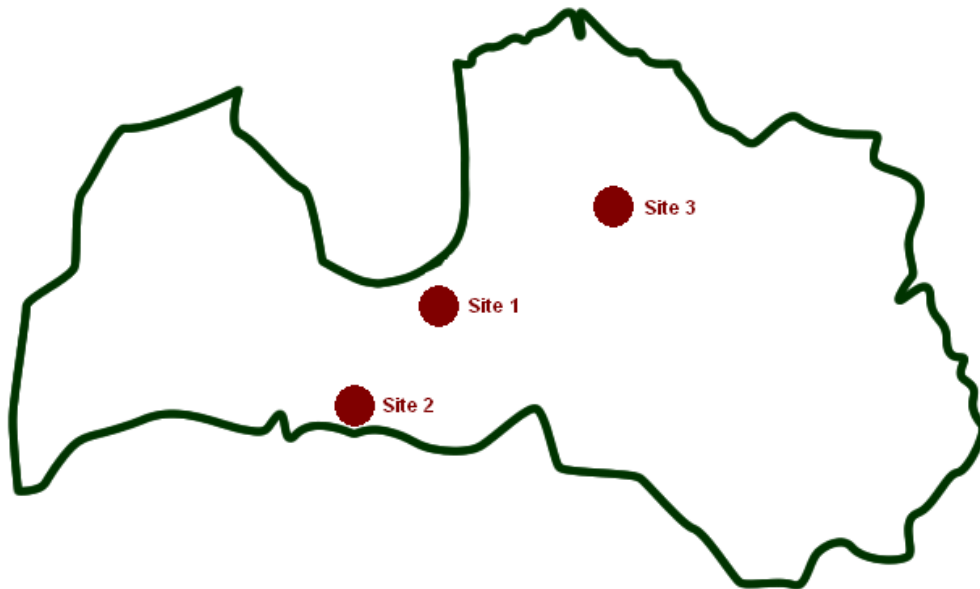


Fig.1. Location of selected biogas sites in territory of Latvia

Regions were selected using Site Selection Guideline (BiG>East Deliverable 6.1), based on methodological procedure taking into account available biomass resources, possible use of digestate, utilization of produced biogas, etc.

Main criteria for selection of those sites were biomass availability, as well as possibility to fulfil soft requirements for potential biogas plant – having political and public support and interest for biogas project development.

### **Biogas Site 1: Ķekava parish**

Ķekava parish is located in the central part of Latvia in Rīga district. During its historical development Ķekava parish has become one of the biggest parishes in Latvia. Beginning at Rīga city border it lies along 20 km next to Rīga-Bauska highway in comparatively narrow lane. Ķekava parish territory is bordering with Salaspils rural territory in northeastern part, with Daugmale parish in east, with Baldone rural territory and Iecava region in south and with Olaine parish and Baloži city in west and northwest (see Figure 2).



Fig.2. Location of Ķekava parish in Rīga district

The eastern part of Ķekava parish is located along the river Daugava and along the left side of river's branch – Dry Daugava. Few other small rivers are crossing the territory of Ķekava parish – Ķekava, Misa, Olekte, Titurga, Tāmurga, Bērzene, Dobupīte and Sūnupīte. All those rivers were adjusted, straightened and adjusted for drainage needs. During the Soviet times an artificial irrigation canal were built connecting Daugava and Misa rivers, however, at present this canal is not functioning and work only like dike for collecting and disposing the drainage water.

The distance from Ķekava village to Rīga is 15 km. The total area of Ķekava parish is 20 091 ha. About 10 thousand ha from total land area is forest and about 9 thousand ha are agricultural land. Territory is included in nitrogen vulnerable zone, therefore rather strong limitations for manure management and fertilization procedures have to be encountered: maximum application – 170 kg nitrogen per ha/year, storage capacity for manure 7 month, spreading prohibited from November 15 till March 1.

Ķekava parish is the biggest parish in Latvia by the number of population. In the beginning of 2008 there were a bit more than 14 000 inhabitants.

According to data of State agency “Agricultural data centre” there are totally 331 farms with animals registered in parish territory. Most of them are with very small activity (with 1-5 animals), with small amounts of produced biomass.

Totally there are 240 cattle located in 86 farms. Of that 75 farms with 1-5 animal, 7 farms with 6-10 animal and only 4 cattle farms with 11-20 animal.

There are two pig farms with 119 pigs in total, 8 sheep farms with 46 sheep, 10 farms with goat and 6 farms with horses. No registered sheep. There are registered minor amounts of goats and horses.

The most significant animal breeding activity in Ķekava parish is poultry farming. There are 12 farms with poultry in region with more than 90 000 poultry by the end of January 2009<sup>1</sup>. The biggest poultry meat producer in Latvia poultry farm “Ķekava” is located in Ķekava parish. The annual breeding amount in poultry farm “Ķekava” is more than 11 million chickens per year having a place for 2,03 million chickens at the same time.

According to the Ķekava parish development program, the most significant animal farming companies in Ķekava parish are:

- JSC “Putnufabrika Ķekava” – poultry breeding and poultry meat processing
- Ltd “Rāmava-2” – cattle breeding
- Ltd “Krūklī” – pig breeding

There are 7 companies in Ķekava parish related to vegetable and fruit production and crop farming:

- farm “Velna purvs” – vegetable production
- Ltd “Migliņi” – crop farming
- Ltd “Ķekavas dārzs” – crop farming
- Ltd “Ķekavas dārzeni” – vegetable production in greenhouses
- Ltd “Kronis-93” – greenhouse plants
- individual company “Elmus” – greenhouse plants
- farm “Virškalni” – growing decorative plants, roses

There are three wastewater treatment plants in Ķekava parish:

- Ltd “Ķekavas nami”
- JSC “Putnufabrika Ķekava”
- Ltd “Olekte”

## **Biogas Site 2: Sesava parish**

Sesava parish is located in the central part of Latvia, Zemgale lowland, Southern part of Jelgava district. Bordering territories are Eleja, Platone and Vircava parishes in Jelgava district, as well as Bauska district and Lithuania in Southern part. Distance from Sesava parish to district centre Jelgava is 28 km and 65 km to the capital of Latvia Rīga. Location is indicated in Figure 3. Region is not characterized with scenic countryside, while quality of agriculture land is evaluated as one of the highest in country ~ 63 points.

Sesava parish territory is 9913 ha, 8162 ha or 82,3 % of mentioned is agriculture land; forests 1025 ha or 10,4 %.

Parish is crossed by 1.grade state level road Dobeles – Bauska (P103). There is good developed network of local 2.grade roads.

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<sup>1</sup> This is an official number of poultry in Ķekava parish, however, not all animals are included in this register, e.g., the register does not include number of the biggest poultry meat producer in Latvia – poultry farm „Ķekava”

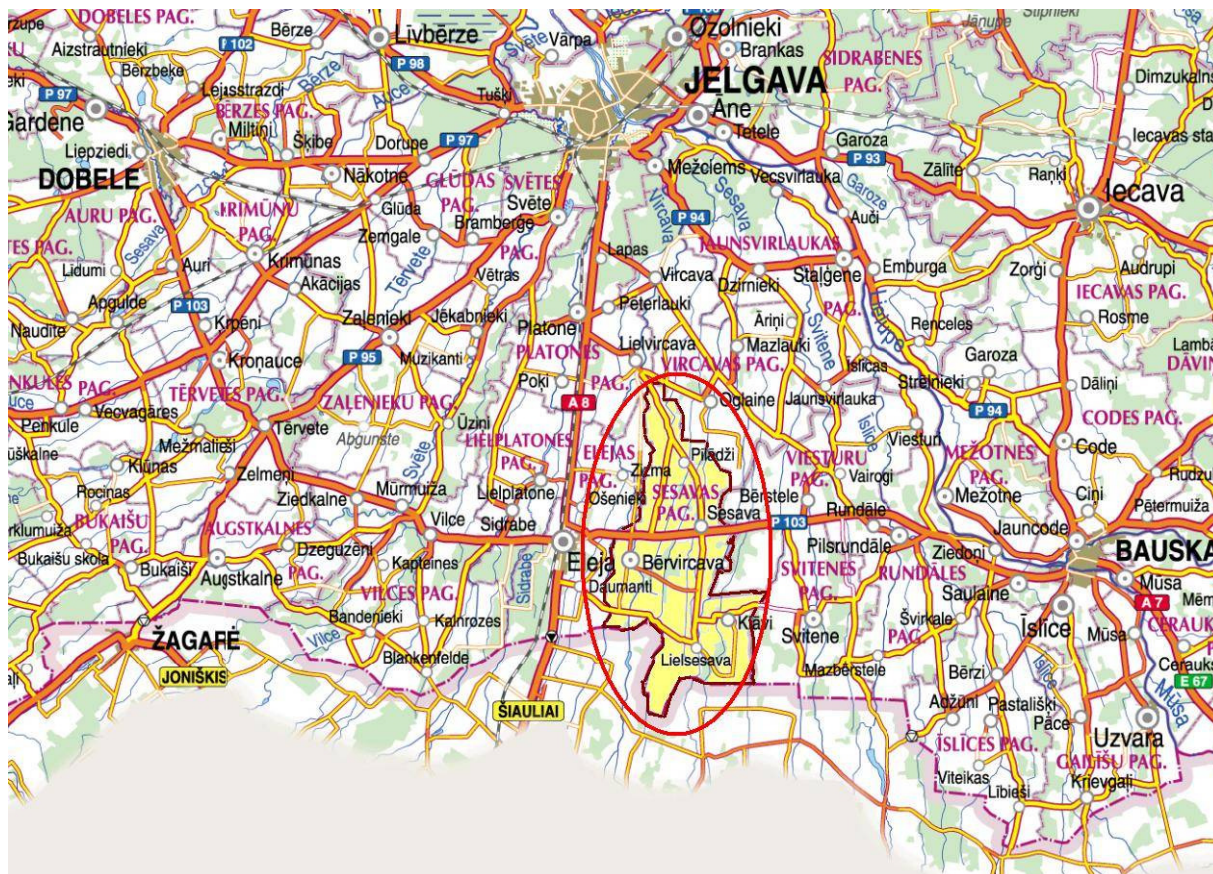


Fig.3. Location of Sesava parish in territory of Jelgava district

9 rivers and brooks are crossing the territory. They are Lielupe basin left side rivers. The most important are:

- Vircava (45 km in Latvia, parish territory – 18 km);
- Sesava (39 km in Latvia, parish territory – 8 km).

Main ecosystems are forests, riversides and marsh.

Protected areas in the region are one forest sector, protection zones around watercourses and communication networks.

Territory is included in nitrogen vulnerable zone (whole Zemgale region), therefore rather strong limitations for manure management and fertilization procedures have to be encountered: maximum application of 170 kg nitrogen per ha/year, storage capacity for manure 7 month, spreading prohibited from November 15 till March 1.

Agriculture is the main business sector for region. There are 48 large grain production farms operating in parish territory. Main produced crops are grain, rape. Till 2007 this was important sugar beet production region. Biggest farms:

- farm „Ivulla”
- farm „Sniedzes”
- farm „Akācijas”
- farm „Birztales”

Several farms beside plant production are involved in animal production, mainly milk production and piglets breeding.

According to data of State agency “Agricultural data centre” there are totally 473 farms with animals registered in parish territory. Most of them are small activities, with 1-2 cows and few pigs. Therefore we will concentrate only to the farms that can produce reasonable amount of animal biomass.

Totally there are 1537 cattle in parish. Of that 4 farms with 51- 100 animals, 2 farms with 101 – 200 animals and only 1 farm with 201 – 500 animals.

There is one pig farm with ~ 200 sows. No registered sheep. There are registered minor amounts of goats and horses.

Biggest animal producers are:

- Ltd „Sesava”
- farm „Rudeņi”
- farm „Rožkalni”
- farm „Rozes”
- farm „Saulstari”
- farm „Salvijas”

There are no vegetable or fruits production and processing in reasonable amounts in parish territory.

Farmers cooperative Latraps, which is one of the biggest grain producer’s organizations in Latvia, is located in Eleja, ~ 5 km from Sesava parish. Main operations of cooperative are grain and rape production support to the farmers as well as storage, drying and trading of grain and rape. Therefore, leftovers from grain and rape draying and treatment are collected. Currently this biomass is sold to the wood pellets producers, and characterizes with high demand.

There are no other agriculture products processing companies located in region, therefore no availability of animal slaughter waste or other types of materials for biogas.

There are no large-scale wastewater treatment plants in vicinity; therefore wastewater sludge is not available. Largest towns are Eleja with ~ 2000 people and Sesava with ~ 1300 people.

### **Biogas Site 3: Zaube parish**

Zaube parish geographically is located in central part of Latvia, at the southwestern part of Cēsis district. Neighbor territories are Rīga and Ogre districts. Zaube parish has borders with Nītaure, Skujene, Kaive, Taurupe, Mazozolu, Ķeipene and Mālpils parishes. The location of Zaube parish in territory of Cēsis district is given in Figure 4.

Distance from Zaube to the capital of Latvia Rīga is ~ 80 km, to district centre Cēsis ~ 50 km, Sigulda ~ 40 km. State level 1.grade road Līgatne-Skrīveri crosses parish territory.

Territory of parish is 162,8 km<sup>2</sup>, of which 34,27% is agricultural land and 55,68% forest.

Parish territory is located at the western part of Vidzeme highland. Hilly relief is reason for beautiful landscapes that are treasure of territory, attraction for tourists. However, uneven relief reduces competitiveness of plant production farmers in region. In many cases fields have irregular forms and steep slopes. Mentioned obstacles cause difficulties in land cultivation, harvesting operations. Relief creates special conditions also for roads management.



Climate conditions are traditional for central highland of Vidzeme. Cold season starts about 2 weeks earlier as in other territories of Latvia. Winters are longer and amount of precipitations higher if compared with rest of Latvia. Conditions are hard for plants cultivation; short vegetation period reduces yields and products quality. Period without frosts lasts about 122 days per year. Snow cover stays for about 140 days per year. Weather conditions are not stable; therefore, attention should be placed on selection of cultures for cultivation. Due to colder conditions, heat energy demand is higher as in the rest of Latvia.



Fig.4. Location of Zaube parish in territory of Cēsis district

Number of population in Zaube parish is about 1070. Population density is only 6,5 people per km<sup>2</sup>. Zaube village with 506 inhabitants is the biggest populated area in territory of parish. Besides, there are 3 small villages Anna village, Bērzu village and Kliģene village.

Cultural and nature heritage of parish includes Anna manor with park, Park with ponds in centre of Zaube village, two churches, Zaube oak and Zaube castle ruins.

There is no big, high importance watercourses located in parish territory. Largest water reserves are lakes Lejas ezers and Augšezers, rivers Bērzupe and Mergupe. There are not any special legal environmental restrictions set for the territory.

Main economical activities in Zaube are related to agriculture – beef, milk production, biological farming (biological tea, beef, wild horses). Biggest enterprises are: “Zaubes kooperatīvs” slaughterhouse with meat processing, SIA “Ozolaines kokogles” charcoal production plant, tourism, and retail shops. There are two tourist locations in parish territory – recreation place “Līcupe” and country house “Atēnas”.

Totally in parish territory 858 cattle, 64 pigs, 91 sheep are registered. Biggest farms are 4 cattle farms with average of 51 - 100 animals in heard. There are no large farms of poultry or horses located in Zaube. Dung with straw bedding is available for biogas production from mentioned herds.

## ***Biomass supply***

### **Biogas Site 1:  ekava parish**

There are four types of biomass available in region:

#### **1) Poultry manure ~ 1300 t/year**

Poultry farming is the main agricultural activity in  ekava parish. According to the information from poultry farm “ ekava” (the biggest farm in  ekava parish) the available amount of poultry manure in poultry farm “ ekava” is 5 t per working day or 1300 t per year. This is pure poultry manure without litter, collected from the sheds of laying hens. Currently manure is sold as fertilizer for vegetable farms.

#### **2) Waste from slaughterhouse, 2<sup>nd</sup> and 3<sup>rd</sup> category animal waste ~ 5000 t/year**

By the end of 2006 the new slaughterhouse of poultry farm “ ekava” were built. The maximum slaughterhouse output is 48 000 chickens per working day (8 hours). There are two kinds of waste material resulting from slaughterhouse operation:

- poultry blood ~ 4,45 t/working day and 1200 t/year
- other slaughterhouse wastes – guts, intestinal canal contents, chicken heads and legs ~ 14,69 t/working day and 3800 t/year

The amount of blood depends from number of slaughtered chicken per working day. This number could vary starting from a few thousands up to 42 000-44 000 of chicken per day. Given blood amount 4.45 t/working day is calculated at slaughter amount of 40 000 chicken/working day. Slaughter amount is substantially dependent from market demand. Theoretically the maximum blood amount could reach 6,3 t/day (at slaughter amount of 48 thousand chickens per working day).

The available amount of other slaughterhouse waste also varies depending from slaughterhouse load. The given amount of 14,69 t/working day comprises of alimentary and intestinal canal and its contents, heads, legs (only paw without shank) and without free water. This amount was calculated by considering percentage of live weight of each component. Amount of slaughterhouse waste is in average of 27,5% resulting from live weight, including 6% of pile and 5% of blood. This number includes only associated water (reflected in chickens live weight). Free water is not included in this calculation. In practice water is used for waste transportation to utilization plant and before utilization (preparation of bone-meal) the transportation water is separated from waste flow. It is assumed that waste transportation flow consists of 75% water and 25% waste. About 40-50% of free water remains in waste flow after the separation. In the next step wastes are filled in utilization camera, heated, dried/cooled and as a result having bone-meal produced. Piles are transported separated from other waste.

### 3) Waste from poultry meat processing ~ 390 t/year

Poultry farm “Ķekava” is the biggest poultry meat producer in Latvia. There are two kind of organic waste left after the poultry meat processing:

- waste from sausage production – meat leftovers and minced poultry bones – at least 0,6 t/working day and 150 t/year
- waste fat and oil from wastewater filter settlers ~ 240 t/year

50% of waste from sausage production could be relatively called “poultry meat” (since this material consists of tendons, cartilages, marrows etc.) and dry matter could be about 30%. Other 50% from this feedstock is minced bones. This feedstock is resulting from meat-bone mechanical treatment; after all useful parts are mechanically extracted. The consistence of this feedstock is something like minced meat. There are some seasonal fluctuations in this kind of biomass availability – more is available in summer. The ratio winter: summer is 1:2. The ratio given is valid for this year 2008. In future both available amounts and winter: summer ratio could change. This is due to planned meat processing plant reconstruction works with aim to increase production output. This feedstock is currently used for bone-meal production.

Waste fat and oil from filter settlers are periodically cleaned 3 times per week. Fat and oil accumulates in fat filter settlers installed in waste water collecting system. This is also technically possible to install fat cutters to separate fat from wastewater flow. If this will be found economically feasible, there is a possibility that this kind of equipment could be installed. This waste product is currently delivered to other company for utilization.

### 4) Sludge from biological wastewater treatment ~ 25 t/year (dry matter)

There are three biological wastewater treatment plants in Ķekava parish. According to the water database of the State agency of “Latvian Environment, Geology, and Meteorology Agency” the annual amounts of wastewater treatment sludge are:

- poultry farm “Ķekava” ~ 410 t/year (8,2 t/year of dry matter)
- Ltd “Ķekavas nami” ~2 t/year (0,018 t/year of dry matter)
- Ltd “Olekte” ~ 70 t/year (17 t/year of dry matter)

However, considering the comparatively small amounts of wastewater sludge, due to the special legislation that restricts the use of sludge as fertilizer, it is not economically feasible to include them in biogas production.

To ensure the optimal nitrogen and sulphur content during the digestion process, it is necessary to add about 5000 t/year of energy crops (maize or grass silage) to this biomass. The possibilities for purchasing additional energy crops must be further investigated.

#### Planned amounts of biogas are following:

Type of biomass	Amount of biomass, t/year	Dry matter	Biogas yield m <sup>3</sup> /t	Biogas yield, m <sup>3</sup>	Methane content, %	Methane amount, m <sup>3</sup>
Poultry manure	1300	min 15%	56	72 800	55	40 040
Slaughterhouse waste	5000	25%	180	900 000	60	540 000
Meat processing waste	390	70%	378	147 420	60	88 452
Energy crops	5000	30%	162	810 000	53	429 300
<b>TOTAL</b>	<b>11 690</b>			<b>1 930 000</b>		<b>1 097 792</b>

The information about available biomass for Ķekava parish was collected during interviews with potential project developer – project analyst of the poultry farm “Ķekava”. Information about biomass availability in the region also was collected from the information materials available about Ķekava parish, territory development plan, from the State agency “Agricultural data centre” and the State agency of “Latvian Environment, Geology, and Meteorology Agency”.

## Biogas Site 2: Sesava parish

For biogas site following types of biomass are available:

- Manure from new stable of farm “Rudeņi”, which will be finished in spring 2009. Total planned amount of cattle manure ~ 9000 t/year.
- Cattle dung (with straw) – 3600 t/year.
- Maize silage produced on ~ 200 ha. Planned amount ~ 40 t/ha, totally 8000 t/year.

The main supplier of biomass will be farm “Rudeņi”, which could be also a co-owner of the biogas plant. Access roads and biomass storage infrastructure will be constructed and finalized together with new stable (spring 2009). There is good road system for delivery of maize from fields for silage production. Silage will be prepared and stored in piles near to the stable and biogas plant. Farm “Rudeņi” has all necessary machinery for silage production.

### Planned amounts of biogas are following:

Type of biomass	Amount of biomass, t/year	Dry matter	Biogas yield m <sup>3</sup> /t	Biogas yield, m <sup>3</sup>	Methane content, %	Methane amount, m <sup>3</sup>
Cattle manure	30 t x 300 animals = 9000	8%	26	234 000	60	140 400
Cattle dung	12 t x 300 animals = 3600	Min 15%	60	216 000	60	129 600
Maize silage	8000	33%	200	1 600 000	52	832 000
<b>TOTAL</b>	<b>20 600</b>			<b>2 050 000</b>		<b>1 102 000</b>

The information about available biomass for particular plant was collected during interviews with possible project developer – manager of the farm “Rudeņi”. Information about biomass availability in the region also was collected from the same person, as well as from the information materials available about parish Sesava, territory development plan, during interviews with other local entrepreneurs and from the State agency “Agricultural data centre”.

## Biogas Site 3: Zaube parish

There are several types of biomass available in region:

### 1) Cattle dung with straw bedding ~ 832 t/year

This feedstock is available from Zaube cooperative export storage of animals and from farm “Kalna Berzini”.

Currently cattle dung from export storage of cooperative is collected and stored. Cooperative does not have land where to take out dung. There is an interest from co-operative to give away the dung for somebody who would be interested to take it. At the moment there is no payment planned for the dung from cooperative. Storage is located 30 m from planned biogas site.

Farm “Kalna Bērziņi” as potential co-owner of biogas plant will be interested to deliver dung for processing. Farm is located 1,8 km from the potential biogas site. Road infrastructure is satisfactory. 1,8 km gravel road is available. Currently dung is collected in piles on field. It is planned to construct storage for 1-week dung capacity. From farm dung will be delivered to the biogas site directly for filling in reactor. Dung will be delivered by farmer. There will be no payment requested from biogas plant.

## 2) Waste from slaughterhouse, 2<sup>nd</sup> and 3<sup>rd</sup> category animal waste ~ 42 t/year

There are about 20 animals slaughtered per week in co-operative slaughterhouse. Currently animal waste is collected by specialized company. Slaughterhouse waste is collected in underground storages ~ 20 m<sup>3</sup>, located 70 m from planned biogas site. Transportation vehicle could be used to deliver animal waste to bioreactor. It is planned that 1<sup>st</sup> category waste and bones will still be delivered to the animal waste collection company.

## 3) Sludge from biological wastewater treatment ~ 70 t/year

Sludge from Zaube village wastewater treatment plant is available for biogas production. Biological treatment facilities are located 800 m from planned biogas site. Concerning sludge treatment in bioreactor agreement with local municipality should be achieved. At the moment municipality does not have solution for sludge disposal.

## 4) Grass silage ~ 875 t/year (dry matter)

Climatic and agro technological conditions are not suitable for maize growing. Grass silage is produced for animal feeding; extra amount will be produced for biogas. Totally 350 ha are available for silage production in radius of 12 km around planned biogas site. For 9900 t calculations areas of radius on 15 km are encountered. Two neighbors are interested to rent fields for green biomass production.

5) If needed, possibilities to attract **additional biomass from other companies** slaughter house in Cēsis, Mālpils dairy can be discussed.

### Planned amounts of biogas are following:

Type of biomass	Amount of biomass, t/year	Dry matter	Biogas yield, m <sup>3</sup> /t	Biogas yield, m <sup>3</sup>	Methane content, %	Methane amount, m <sup>3</sup>
Cattle dung	832	Min 15%	45	37 440	60	22 464
Animal waste	42		180	7 560	60	4 536
Wastewater sludge	70	Min 15%	35	2 450	57	1 397
Grass silage	9 900	30%	162	1 603 800	52	833 976
<b>TOTAL</b>	<b>10 844</b>			<b>1 651 250</b>		<b>862 373</b>

Information about available biomass amounts was provided by potential project developer – owner of farm “Kalna Bērziņi”, as well as collected from discussions with other sector specialists in region, information published by State agency “Agricultural data centre”, information published in Cēsis region development plan and Zaube parish information materials.

## ***Biogas Digestate Utilisation***

### **Biogas Site 1: Ķekava parish**

Digestate could be utilized as fertilizer. Already now poultry farm “Ķekava” has contracts with other farmers and vegetable farms about sale of poultry manure as fertilizer. At the moment special storages for digestate are not available. They will be constructed during the project implementation. The calculated amount of digestate is 10 200 m<sup>3</sup>/year.

### **Biogas Site 2: Sesava parish**

The farm “Rudeņi”, which will be the main biomass supplier, currently operates more than 500 ha agriculture land. Operations are organized in radius ~ 15 km around potential biogas site. Therefore digestate will be used for fertilization of farmland. Farm premises are located near to the planned biogas site. The new farm lagoon type manure storage with capacity of 6000 m<sup>3</sup> is constructed. Lagoon will be later on used for digestate storage. The calculated amount of digestate is 17 900 m<sup>3</sup>/year.

### **Biogas Site 3: Zaube parish**

The farm “Kalna Bērziņi”, which will be the main green biomass supplier, currently operates more than 120 ha of agriculture land. Also several neighbour farmers are interested to rent their fields for biomass production. Digestate will be used for fertilization of mentioned fields, in the radius ~15 km around biogas site. Operator at the moment does not have special machinery for liquid manure disposal. Technique will be obtained during the project implementation phase. Special storages for digestate will be the part of biogas plant project. From planned biomass amount about 8600 m<sup>3</sup> of digestate will be produced per year.

However, planned biomass has high dry matter content. There could be necessity to add water, whey or other material to balance the biomass. In this case the amount of digestate will increase.

## Results within Step 2: Selection of the biogas neighbourhood

### *Sale of energy in the neighbourhood of the biogas plant*

#### **Biogas Site 1: Ķekava parish – poultry farm “Ķekava”**

Since most of the biomass will be delivered from poultry farm “Ķekava”, this farm is selected as potential site for biogas plant. Location of poultry farm in the territory of Ķekava parish is given in Figure 5.

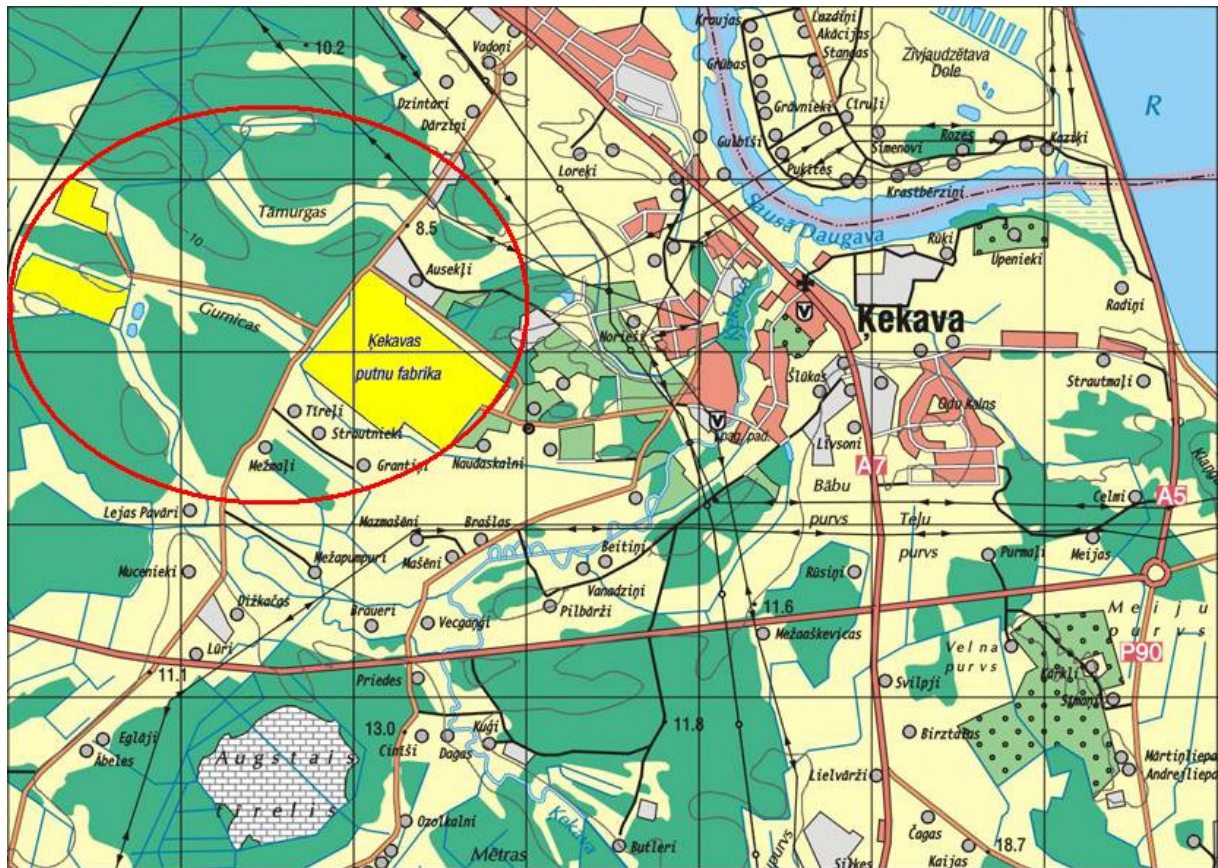


Fig.5. Location of poultry farm “Ķekava” in Ķekava parish

In next step the possibility for sale of energy in this case is investigated.

Based preliminary calculations it was assumed that “Ķekava” biogas plant could have an output of:

- Electrical capacity 530 kW<sub>el</sub>
- Heat capacity 590 kW<sub>el</sub>

#### ***Sale and Purchase of Electricity:***

Technically and legally it is possible to sell electricity by connecting to grid. Probably there will be need for transformation station.

Site name: poultry farm “Çekava”	Figure	Comments
Distance to the general electric grid in meters:	<2 km	Located on farm’s border
Voltage of the general electric grid nearby in kV:	20 kV	2 lines
Space for transformation station on-site in m <sup>2</sup> :		Space is available

### *Use of Heat:*

Heat will be used for self-consumption. Currently heat is produced using natural gas. Biogas production could reduce fuel costs for heating. Higher heat demand is in winter when heat is used for heating of premises.

	kW	Brief description of heat use (incl. temperature demand)	Distance to heat customer in meters
Planned plant size in kWel	530		
Heat Supply Total in kWth	590		
Heat Supply Summer	566		
Heat Supply Winter	389		
Heat Demand in Summer	3330	chicken breeding	up to 2 km
Heat Demand in Winter	25000	chicken breeding, heating	up to 2 km
Remaining Heat Load Summer	-2764		
Remaining Heat Load Winter	-24611		

Since poultry farm “Çekava” has stable heat load during the summer, all heat from biogas plant could be used for chicken breeding.

### **Biogas Site 2: Sesava parish – RZS ENERGO biogas plant**

As potential site for biogas project development, a location near to the biggest animal farm “Rudeņi” is selected.

Farm “Rudeņi” was established at 1995 with specialization in milk production and grain production. Till sugar reform at 2007 important sector was also sugar beet. Farm is operating more than 500 ha land, organized in rather big fields. Soil quality is high. Production buildings and fields are located close to good quality access roads. Electricity is supplied by State owned electricity operator Latvenergo. Communication providers are Lattelecom and LMT.

Number of cattle is more than 300, including 120 dairy cows. Constructing of new stable for cows is going on, with 300 places. It is planned to raise total number of animals till 600, including dairy cows and young stock.

For biogas project development recently separate company is formed Ltd. “RZS ENERGO”, where shareholders are farm “Rudeņi” and board member of farm “Rudeņi”.

Location of potential biogas plant RZS ENERGO is marked near to the production premises and stables of farm “Rudeņi”. Location is indicated in Figure 6.





Fig.6. Location of potential RZS ENERGO biogas plant in Sesava parish

Initial calculations of energy production:

Site name: RZS Energo	Amount of biogas, m <sup>3</sup>	Energy production coefficients kWh	Total produced energy, kWh
<b>Total energy</b>	2 050 000	5,5	11 275 000
<b>Electricity</b>	2 050 000	2,11	4 325 500
<b>Heat</b>	2 050 000	2,34	4 797 000

Planned operation per year: ~ 8000h.

Installed electrical capacity: ~ 540 kW

**Sale and Purchase of Electricity:**

Site name: RZS Energo	Figure	Comments
Distance to the general electric grid in meters:	200	
Voltage of the general electric grid nearby in kV:	?	Farm “Rudeņi” has 400/230V 3 phase electricity connection. It is planned to use same infrastructure for biogas site.
Space for transformation station on-site in m <sup>2</sup> :	15	Transformation station already exists, since it was constructed together with farm. Distance to the planned place of digester ~ 300 m.

### ***Use of Heat:***

	kW	Brief description of heat use (incl. temperature demand)	Distance to heat customer in meters
Plant size in kW <sub>el</sub>	540		
Heat Supply Total in kW <sub>th</sub>	600		
Heat Supply Summer	576		
Heat Supply Winter	396		
Heat Demand in Summer	0		
Heat Demand in Winter	150		
Remaining Heat Load Summer	576		
Remaining Heat Load Winter	246		

There are no clear decisions concerning heat applications. However several alternatives are undergoing discussions:

***Alternative 1:*** Potential biogas site is located ~ 1 km from village Bervircava where it could be possible to provide heat for apartment houses. However, during last years district heating system among residential houses is destroyed and population has established individual wood heating premises for each building. Also financial situation in this region is weak, which creates high risks for economical feasibility of alternative.

***Alternative 2:*** Part of heat will be used for farm “Rudeņi” self-consumption. Since important activity of farm will be milk production, hot water will be needed for sanitation of milking and milk storage facilities. There are no clear calculations made for hot water consumption, however, this could be a realistic alternative for heat consumption in summer and winter.

***Alternative 3:*** To use heat for grain draying. Farm “Rudeņi” is also a grain producer. It would be possible to establish a grain drying unit. However in this case heat consumption would be ensured only for few months, during harvest season.

***Alternative 4:*** Is to look for new business possibilities, which could be developed near to the biogas site. Currently fish production or greenhouses are discussed, however no detailed calculations are started.

### **Biogas Site 3: Zaube parish – Zaube biogas plant**

Agriculture cooperative „Zaubes kooperatīvs” is operating since 1998. Currently there are 134 members, dairy and cattle farmers, 7 from Zaube parish. Cooperative is dealing with resource supply as well as sales and marketing activities for member’s needs. Cooperative is operating slaughterhouse. “Zaubes kooperatīvs” Slaughterhouse has permission for slaughter of cattle, sheep and goats. Cooperative is successfully managed by one of the farmers, owner of biological farm “Kalna Bērziņi”. Main types of biomass available for biogas from cooperative are:

- Waste from animal slaughtering
- Dung with straw bedding from export storage

For biomass production most important agriculture and processing enterprises in neighbour territories are following:

- Mālpils dairy (“Mālpils Piensaimnieks” Ltd.) that produces cheese and butter is located about 26 km from Zaube village. Whey is available upon agreement.
- Cēsis slaughterhouse (JSC “Ruks” Cēsu gaļas kombināts), one of the biggest and most important meat processing enterprises in Latvia. Located about 50 km from Zaube, animal waste is available upon agreement.

- Slaughterhouse “Senlejas” Ltd. in Keipene parish is located about 11 km from Zaube village.

For Zaube village biological wastewater treatment plant with capacity of 25,543 th.m<sup>3</sup>/year is constructed.

The only electricity provider in parish territory is state company “Latvenergo”. Telephone communications is provided by JSC “Lattelekom” and JSC “LMT”.

Zaube village boiler house is heated with sawdust. Due to the reduction of economical activities (wood processing) in region, problems with sawdust supply have started. The main consumers of DH system are school, administration buildings, and apartment houses.

There is no national gas grid available in region.

Drinking water sources are boreholes and wells. Water quality is negatively influenced by high iron content in underground water.

A place close to Zaube cooperative slaughterhouse and charcoal production plant is selected as a potential biogas site. This site is located 1,5 km from the center of Zaube village, 2,5 km from boiler house and 1,8 km from farm “Kalna Bērziņi”.

Location of potential biogas plant near to Zaube village is given in Figure 7.

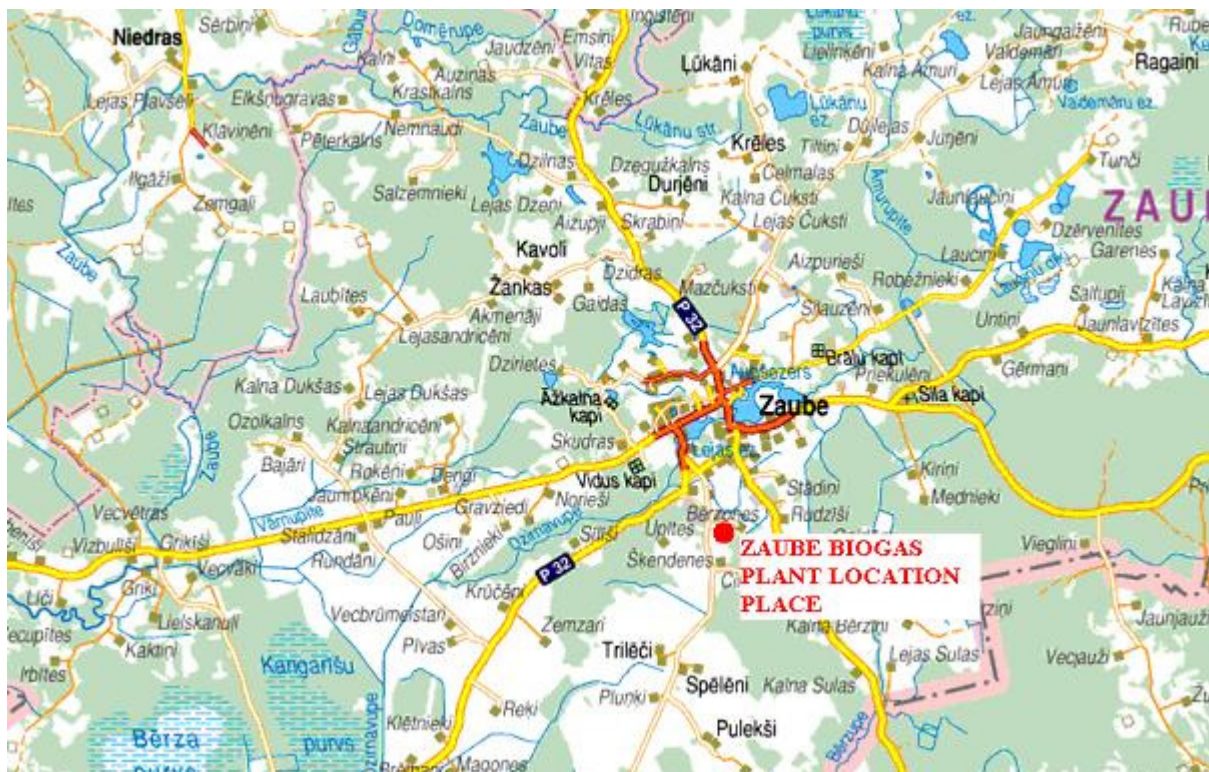


Fig.7. Location of potential Biogas plant in Zaube village

Initial calculations of energy production:

Site name: <b>Zaube biogas plant</b>	Amount of biogas, m <sup>3</sup>	Energy production coefficients, kWh	Total produced energy, kWh
Total energy	1 651 250	5,2	8 586 500
Electricity	1 651 250	2,03	3 352 038
Heat	1 651 250	2,18	3 599 725

It is planned to install 420 kW<sub>el</sub> CHP unit operating 8000 h/year.

***Sale and Purchase of Electricity:***

Site name: <b>Zaube biogas plant</b>	Figure	Comments
Distance to the general electric grid in meters:	200	Distance to the transformation unit
Voltage of the general electric grid nearby in kV:		Slaughterhouse has 400/230V 3 phase electricity connection. It is planned to use same infrastructure for biogas site.
Space for transformation station on-site in m <sup>2</sup> :		Transformation station is already constructed 200 m from biogas site (see Figure 8). Currently it is serving slaughterhouse. It is planned to achieve permission to use this transformation station also for biogas activities.



Fig.8. Existing electricity transformation station

### ***Use of Heat:***

	kW	Brief description of heat use (incl. temperature demand)	Distance to heat customer in meters
Plant size in kWel	420		
Heat Supply Total in kWth	450		
Heat Supply Summer	432		
Heat Supply Winter	297		
Heat Demand in Summer	0		
Heat Demand in Winter	150		
Remaining Heat Load Summer	432		
Remaining Heat Load Winter	147		

There are no detailed calculations made concerning heat consumption, however, several alternatives are discussed:

***Alternative 1:*** Heat energy could be used for hot water preparation and for cooling purposes in slaughterhouse. Slaughterhouse is located about 100 m from biogas site. Since these are related companies, this could be economically sound solution.

***Alternative 2:*** Heat could be sold to charcoal producer. Charcoal production plant is located about 100 m from biogas site. In this case heat demand is ensured for the whole year. Agreement should be achieved on cooperation conditions.

***Alternative 3:*** Transporting produced biogas to the village and installing a CHP plant in village. Electricity could be sold to JSC “Latvenergo”, but heat – for municipality. This is the most complicated model from the administration point of view.

## Results within Step 3: Selection of the Biogas Site itself

### *Requirements towards the biogas plant site*

#### **Biogas Site 1: ̘ekava parish – poultry farm “̘ekava” biogas plant**

As potential site for biogas production poultry farm “̘ekava” is selected. The territory of poultry farm is given below in Figure 9.



Fig.9. Territory of poultry farm “̘ekava”

The total farm’s area is ~ 100 ha (1 000 000 m<sup>2</sup>) and according to the information from representatives of farm there will be no problem to find a space for construction of biogas plant, including proper planning of environmental, transportation, communication and other aspects.

#### ***Available space***

Site name: poultry farm “̘ekava”	Figure	Comments
Space for Biogas Plant (in m2)	*	
Space for the storage of biomass on-site:	*	
Space for the storage of biomass at the producer	*	
Space for the sludge storage	4000	Space currently used for chicken litter storage

\* - total farm’s area is ~100 ha.

To have more detailed view on potential biogas plant location, in Figure 10 are given four pictures from poultry farm “Çekava” operation processes:



Chicken sheds



Chicken shed with natural gas boiler



Chicken litter storage



Local wastewater treatment plant

Fig.10. Pictures showing poultry farm “Çekava” operation processes

### ***Sufficient Road Access***

Site name: poultry farm “Çekava”	Figure	Comments
Distance to intersectorial road (in km)	2.5	Distance to Road A7

### ***Additional site requirements***

Site name: poultry farm “Çekava”	Yes	No	Comments
Site access for trucks possible	✓		
Soil contamination is unlikely	✓		
Soil is suitable for industrial construction	✓		
Planning instrument prohibits biogas plant on – site		✓	
Planning instruments foresees residential, cultural or nature protected areas nearby	✓		
Residential, cultural or nature areas exist in the proximity	✓		There are some existing residential areas around the farm (about 150 m from border) as well as farm is located in nitrogen vulnerable zone

### ***Ownership structure***

Site name: poultry farm “Çekava”	
Who is the owner of the selected site:	Partly JSC “Putnu fabrika “Çekava”” (poultry farm)
Will the owner also be the operator of the biogas plant	Yes
Is there a basic possibility to buy the land	Yes, if necessary

### **Biogas Site 2: Sesava parish – RZS ENERGO biogas plant**

#### ***Available space***

Site name: Sesava biogas plant, RZS ENERGO	Figure	Comments
Space for Biogas Plant (in m <sup>2</sup> )	10 000	Territory available for biogas production site – fermenters, gas storage, electric generator, auxiliary facilities, territories. Close dairy farm, infrastructure.
Space for the storage of biomass on-site:	Storage facilities are existing	Silage storage place is located near to the dairy farm. Silage will be produced and used for both objectives – animal feeding and biogas production. Silage storages are located ~ 150 m from planned digester site. For manure auxiliary storage of 100 m <sup>3</sup> is placed near to stable. This storage will be used also for manure storage before filling in digester. Dung will be stored near to the young stock farm before delivery to the reactor. Concrete storage available.
Space for the storage of biomass at the producer	---	---
Space for the sludge storage	Storage facilities are existing	For digestate storage lagoon type manure storages will be used. Lagoons are constructed as 6000 m <sup>3</sup> manure storages for dairy farm.

#### ***Sufficient Road Access***

Site name: Sesava biogas plant, RZS ENERGO	Figure	Comments
Distance to intersectorial road (in km)	4	Distance to the 1.grade state level road, asphalt paved
Distance to the local road (m)	200	Distance to the, 2.grade local level gravel road.

The picture of planned biogas plant site is given in Figure 11.





Fig.11. Planned biogas plant site with dairy farm (under construction) and manure lagoon

***Additional site requirements***

Site name: Sesava biogas plant, RZS ENERGO	Yes	No	Comments
Site access for trucks possible	✓		Road infrastructure is developed. It is already used for farm needs.
Soil contamination is unlikely	✓		Environmental regulations will be observed during planning and construction of biogas plant.
Soil is suitable for industrial construction	✓		Farm production buildings are located near to the planned site. Geological investigation will be made during planning phase.
Planning instrument prohibits biogas plant on – site		✓	Sesava parish territory development plan was approved in May 2008. Planned territory is assigned as agricultural production territory. Approval from local authorities should be requested and received before initiation of the project. Since this is formal procedure and biogas project would only improve situation of local territory, there should not be problems to receive approval of project.
Planning instruments foresees residential, cultural or nature protected areas nearby		✓	There are no residential, cultural or nature protected territories indicated near to the planned site. Territory is indicated as agricultural production and related processing territory.

Residential, cultural or nature areas do exist in the proximity	✓	Closest residential area is located in village Bervircava. Village border is located ~ 100 m from farm. River Vircava with protection area is located ~ 500 m and culture area manor “Nameja” ~1 km.
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#### *Ownership structure*

Site name: Sesava biogas plant, RZS EN-ERGO	
Who is the owner of the selected site:	Farm “Rudeņi” and one of the managers of farm “Rudeņi”
Will the owner also be the operator of the biogas plant	Yes
Is there a basic possibility to buy the land	The land is property of farm “Rudeņi”. Land rent contract for 20 year period is made.

### **Biogas Site 3: Zaube parish – Zaube biogas plant**

#### *Available space*

Site name: Zaube biogas plant	Figure	Comments
Space for Biogas Plant (in m <sup>2</sup> )	10 000	There is total land area of 1 ha planned for biogas site. Currently ownership for land is under clarification. If land will not be sufficient, extra m <sup>2</sup> could be acquired from farm “Kalna Bērziņi”.
Space for the storage of biomass on-site:		It is planned that biomass will be stored at producer sites (farm “Kalna Bērziņi”, slaughterhouse, wastewater treatment plant).
Space for the storage of biomass at the producer		Producers have already established places for biomass storage. Sizes are sufficient. It is not decided about green biomass (silage) preparation and storage technology – in piles or in round bales.
Space for the sludge storage		Digestate will be stored at biogas production site. Space is sufficient, therefore it is planned to develop lagoons for digestate storage. Investments in lagoons are lower than in concrete or steel storages.

#### *Sufficient Road Access*

Site name: Zaube biogas plant	Figure	Comments
Distance to intersectorial road (in km)	0,25	Gravel road Līgatne – Skrīveri.

A view from potential biogas plant to the cooperative “Zaubes Kooperatīvs” slaughterhouse is given in Figure 12.



Fig.12. View from the potential biogas site to the cooperative „Zaubes Kooperatīvs” slaughterhouse

***Additional site requirements***

Site name: Zaubes biogas plant	Yes	No	Comments
Site access for trucks possible	✓		Potential biogas plant site is located on cross-roads. There is a good road access constructed, since charcoal production site and slaughterhouse both are served by the same road.
Soil contamination is unlikely		✓	Precautions will be taken to avoid possible soil contamination from operations. Recommendations of regional environmental board will be followed during plant construction.
Soil is suitable for industrial construction	✓		Location is exhausted gravel excavation place.
Planning instrument prohibits biogas plant on – site	✓		Biogas production in parish development plan is pointed as one of priorities.
Planning instruments foresees residential, cultural or nature protected areas nearby		✓	Planned site is located in remote rural area. There are no planned residential, cultural or nature areas in close vicinity.
Residential, cultural or nature areas do exist in the proximity		✓	There are agriculture and production territories in direct proximity. Closest residential area is located ~ 250 m from planned site (farm house). Village houses ~ 2 km.

***Ownership structure***

Site name: Zaube biogas plant	
Who is the owner of the selected site:	At the moment there are 2 owners for site. Processes are started to hand over ownership to one person – owner of farm “Kalna Bērziņi”.
Will the owner also be the operator of the biogas plant	Yes, it is planned that farm “Kalna Bērziņi” will be one of the owners of biogas plant.
Is there a basic possibility to buy the land	Land will be leased to biogas plant company with long-term lease agreement. Also possibility to incorporate land as initial investment in new company is discussed.

## **Results within Step 4: Optimising the soft requirements for selected sites**

### **Biogas Site 1: Ķekava parish – poultry farm “Ķekava”**

- Poultry farm “Ķekava” is the biggest poultry meat producer in Latvia with more than 40 years of operation experience. Staff responsible for the development of poultry farm is very active and showing serious interest for proposed biogas project development.
- Poultry farm “Ķekava” is one of the main employers in Ķekava parish, therefore municipality and local inhabitants are interested in further development of poultry farm “Ķekava”.
- During the last few years when new residential areas around farm were built, some conflicts among inhabitants and poultry farm regarding odours arisen. Building a biogas plant could give significant contribution for solving this problem.
- Potential project developer has participated in biogas conferences, visited several biogas sites in EU and made an investigation of experiences of anaerobic digestion of poultry manure in other countries. Consultations with local representatives of biogas equipment suppliers are started.
- Know-how will be gained during seminars and also from equipment suppliers that will be selected during tender procedure.

### **Biogas Site 2: Sesava parish – RZS ENERGO biogas plant**

- Farmer, who will be developer of the project, has proved himself as active, open minded, successful agriculture producer and employer in region. Good relations with local population and administration are established.
- As substantial issue – positive attitude of the banks towards Sesava biogas project should be pointed. Project developer has good financing history. Therefore, during project idea presentation for bank representatives, confirmation was received about possible support. This is important point, since biogas project is capital intensive activity, which could cause difficulties for many companies at current Latvia financial situation.
- Potential project developer has visited several biogas sites in EU, developed by different equipment suppliers. Gradually know-how is gained. Also consultations with local representatives of biogas equipment suppliers are started.
- Concerning technical and economical issues, consultations of Research and training farm “Vecauce” biogas plant (60 km) and Latvia Agriculture University (28 km) specialists consultations are available.

### **Biogas Site 3: Zaube parish – Zaube biogas plant**

- The area where biogas plant is planned is remote rural region, with no highly developed business activities. Region has lowest possible development index in Latvia. Therefore support is possible as for development activities from different institutions. Usually grant application projects from low developed territories receive additional points during evaluation process.
- Potential project developer is active and successful business developer. He has good cooperation with local authorities, as well as state level institutions.

- Project developer has started cooperation with Latvia University of Agriculture. Tests for biogas yields of different local green biomass types are started. Results are not available yet.
- Know-how possibly will be gained during seminars and also from equipment suppliers that will be selected during tender procedure.