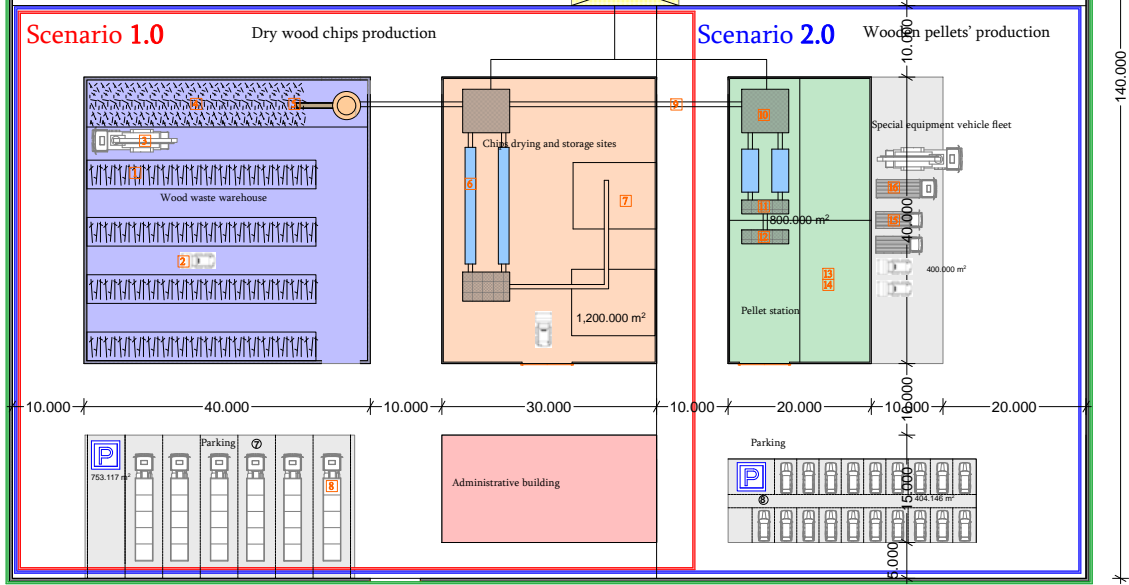
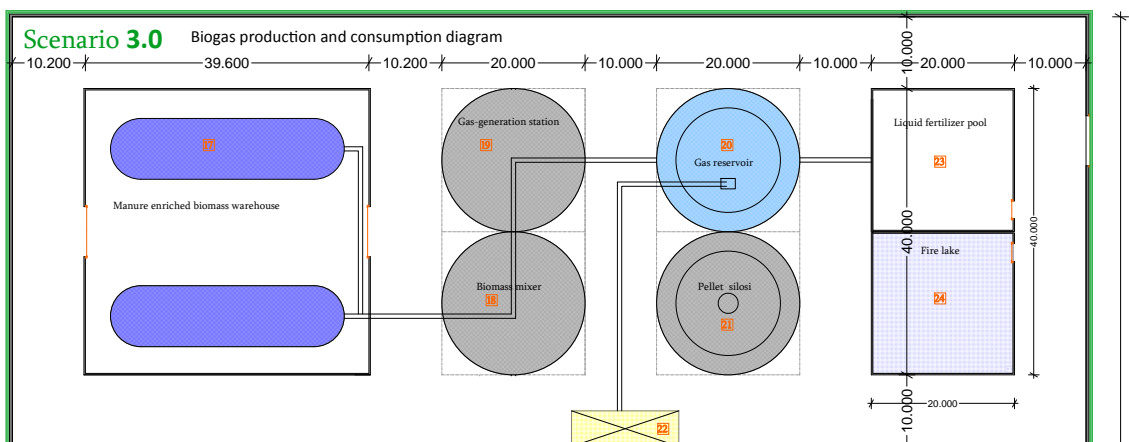
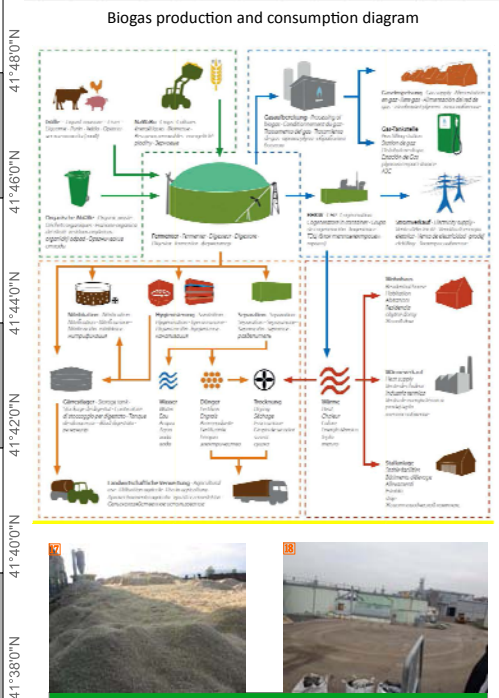
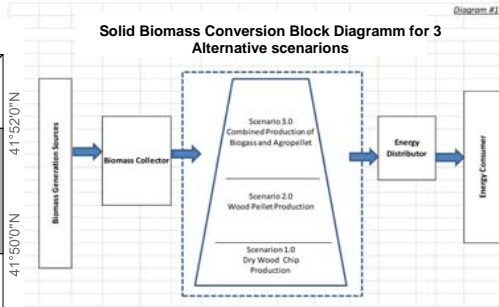


Distribution map of solid biomass and allocation of potential consumers (municipal enterprises) of bio-fuels produced from it in the municipal area.



**Scenario 1.0: Wood Chip Production**  
 Wood chip production represents lowest stage of development in the hierarchal pyramid and requires least capital investment. In this case ready products are represented by Wood Chips and Wood Chips augmented by manure. Conversion of this biomass into energy required specific burning cameras. Wood chips with manure require additional equipment to utilize gases generated during burning process. In case of wood chips its consumer must be equipped with proper technical boiler and silo and should be able to receive and store right amount of biofuel. Therefore for an average size (500 sq. m building) kindergarten establishment of such systems (including boiler and necessary peripheral infrastructure) require capital investment around 10,000 - 30,000 Euro. In addition it is noteworthy that operation of this type of systems requires proper technical supervision and specific conditions of maintenance. For establishment of wood chip production plant 0.5-0.7 ha of land is required. As for approximate investment capital for a production of 2000 tons annual capacity it is around 650-750k Euro. Apart from this efficient collection and distribution systems require additional investment of 200-250 k Euros.

**Scenario 2.0: Wood Pellet Production**  
 Wood pellet production represents second stage development of the hierarchal pyramid. Transportation and storage of this type of fuel is more cost-efficient compared to wood chips, therefore much bigger geographical area can be supplied with pellets. Conversion of pellets into energy does not require specific boiler and existing gas boilers used for heating can be augmented by a special sub and installation of burning block. In comparison to scenario 1.0 operation of such equipment does not require installation of silo and even 1-2 m³ bunker would be sufficient. Wood chips with manure from poultry bedding can be converted into so call agropellet. This product can be used as fuel; however cleaning gases after burning of such fuel require cleaning which as a result leads to increase of cost of generated thermal heating. Installation of such equipment requires a capital investment (for 500 sq. m. heated area) from 5,000 to 10,000 Euros, which is substantially lower than the scenario 1 budget. Investment capital required for establishment of production is 20-30% more than in scenario 1 and is estimated at 1.2-1.3 ml Euros. In case of considering heating of 10 kindergartens total investment cost is 20-25% lower than in scenario 1.

**Scenario 3.0: Combined Production of Biogas and Bio-Pellets**  
 This scenario represents logical development of previous stage. Its implementation will enable generation of most thermal energy. This case is based on chemical transformation of biomass before the mechanical processing aimed at generation gas that will be converted to electrical and thermal energies through co-generation aggregate. Below depiction provides information of all cycles of such production. It is worth to note that there is an extra product for this scenario which is agropellets that can be used as fertilizer for farming activities. Budget of such production is 70% higher than its predecessor and amounts to 1.8-2.0 ml Euros due to high level of energy generation (biogas production and utilization scenarios are illustrated on the diagram). Cost of production pellets and chips in this scenario is lower by 15-20% compared to previous scenarios due use of self-produced electrical and thermal energy in production of solid biofuels. In addition surplus energy can be sold for profit as well as biogas can be used to shift biomass collection and distribution vehicles from diesel reducing costs further.