SYNERGY CONCEPT FOR DEEP BIOMASS and BIOWASTES PROCESSING INTO VALUE ADDED PRODUCTS and ENERGY

Re, non verbis

Consortium of companies from Ukraine, The Netherlands and France

Joint engineering effort to do more for less

Re, non verbis

By doing, not by talking

Maguin
A Moret Industries Company

Maguin Company has 150 years of construction experience of more thann 1000 facilities and team of 1000 engineers, that are developing technologies with minimal energy consumption, company supplies 15-40% of equipment and gives license to «UTC» for equipment production during construction of bioethanol factories and fuel granules facilities.

OPURE
zuiver advies

Opure company from The Netherlands, specializing in pilot scale biological processes modeling for digestion of problematic and heavy materials to biogas. Company solves problematic cases of industrial waste streams utilization and cleaning. Company is a lieder in this segment in Europe

ADVERIO
ENGINEERING

Adverio is a company from The Netherlands that is specializing in engineering services for biogas and biomethane production, cellulosic materials conversion and digestion, ammonia reach materials digestion, effluent sanitation and utilization. Company has office in Ukraine. Company is a technical advisor for financial organizations that are financing projects of alternative energy production.

УМК

Over 20 years of experience «UTC» got the experience of near 100 facilities construction in biogas, bioethanol and disposal facilities. Company has machine-building plant, project office, construction team, maintenance department. Company engineers, including 7 PhD in chemistry and biology, develop project and working documentation and adopt European engineering to Ukrainian norms. Company support and modernize their projects after commissioning.

Consortium advantages

Consortium implements best available technologies and constantly modernize them, resulting following technological results:

- Rate of biological conversion of organics to biogas – 85%. Working analogs have this rate on the level of 70%
- Energy consumption for technological needs – 5%. Working analogs have this parameter on the level - 10%
- Steam consumption for production of dekaliter – 18 kg. Working analogs have this parameter – 30 kg/dal
- Rate of sugar material conversion to bioethanol – 99%. Working analogs have this parameter on level – 50-90%
- 50-60% of Equipment produced in Ukraine
- CAPEX reduction to 1,5 million Euro per 1 MW electrical power produced from biogas with described efficiency parameters.

Goal of Yuzefo-Mikolaevska biogas facility

Concept of biogas facility development strongly depends of available feeding raw materials. First stage– sugar beet pulp and washing department wastes. Second stage – beet pulp and molasses after distillery stillage.

Experience of other bioethanol producers shows - waste utilization goes first, then bioethanol facility, that will save a money for steam generation and waste utilization department construction.

Beside molasses company also plans to use in ethanol production waste of grains, defective, burned and other low quality grains.

Next year Company plans to attract credit money to invest in electrical generation expansion and further to bioethanol factory construction.

Raw Material and Feed

Technology starts from Raw Material quality

Easy to digest materials - C/N/P balanced no need for hydrolysis :

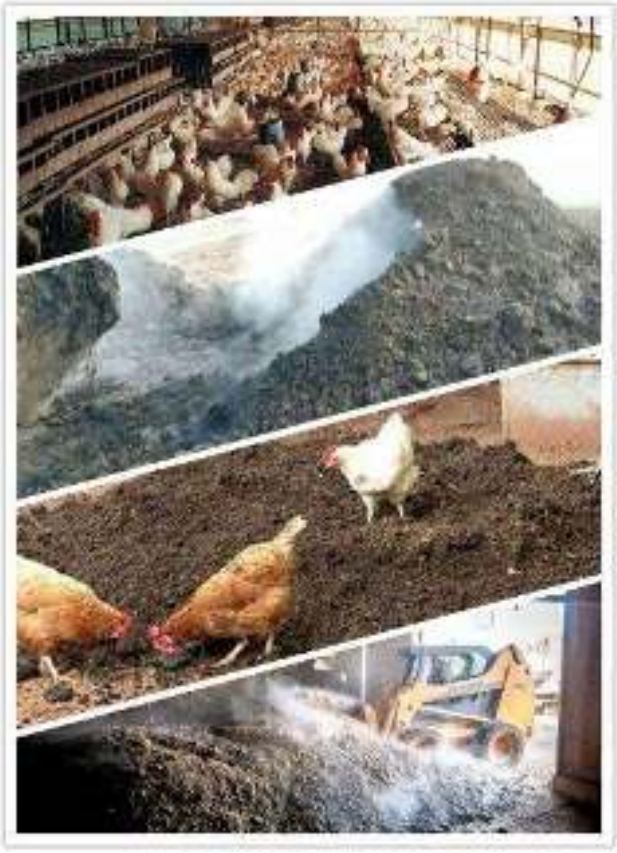
- **Pulp of beets and fruits/vegetable in juice production**
- **Beet and vegetable leafs, tales, pieces – green and juicy**
- **Field leftovers, rotten and non-conditional vegetables and animal feed**
- **Food leftovers and spoiled food products**
- **Liquid organic wastes from food industry**
- **Cow manure**

These materials are mostly shredded and homogenized till pumpable conditions and separated from hard and heavy inclusions before entering reactors for conversion to biogas


AVITO

Hard to digest materials – needs conditioning before digestion: cutting, hydrolysis (thermal, enzymatic, chemical), Silaging, Ammonia and FOS removal, nurience balancing:

- Cellulosic reach materials: Straw, Corn stalks, dry grass, wood shavings, bedding material, paper
- Municipal sludge and organic fraction of MSW
- Manure of egg laying and meat poultry



Food security

Our consortium has restriction on using organic materials that can be used as a feed for animals and human or grown on agricultural land as prime culture.

- Corn silage can be replaced by corn stalks or remontant corn secondary biomass
- We digest after distillery stillage after molasses fermentation to bioethanol – not molasses.
- We do not digest after distillery stillage after corn fermentation to bioethanol – DDGS as it is animal feed despite its good degradability.
- We recommend to use as a feed production byproducts, secondary biomass, harvest leftovers, problematic and unwanted wastes to reach feasibility.

References in Ukraine

Biogas

1. Globino Sugar factory
2. Bashtanka cheez factory
3. Bobruysk bioethanol
4. Yuzefo-Mikoyivska biogas company (ongoing project)

Bioethanol

1. Gnidava sugar factory
2. Fastiv factory of organic liquids
3. Pannonia Ethanol
4. Uzin sugar factory
5. Himax
6. Zarubinsky alcohol factory
7. Kramatorsk factory “Olimp”

WOOD Pellets

1. Malinsky fuel granules factory 50 000 t/year

BIOMASS Burners

1. Near 100 MW of installed Capacity

Production facility in Kazatin

Raw Material and Feed

Synergetic use of industrial wastes, heat\electricity excess from one factory as a raw material and energy source for another production facility inside one industrial park is a base for sustainable, feasible and environment friendly principle of making business with lower self-coast and foot print.

Synergy principals in business "know hows" We will describe connections among four main processes of:

White Sugar production

White sugar production besides sugar produces few side products - molasses and beet pulp. For bioethanol production, it supplies molasses. For Pectin production, it supplies part of beet pulp. For biogas production, it supplies beet pulp and washing department wastes as well as low quality beets and leafs. Sugar factory in Ostrog has large territory available for rest of facilities construction.

Bioethanol production

Bioethanol production also generates the significant amount of waste - after distillery stillage. Bioethanol used for Pectin precipitation from water solution and after pectin separation by filtration it can be recovered from water solution on rectification column and returned back in process. Stillage is utilized by anaerobic fermentation in biogas facility.

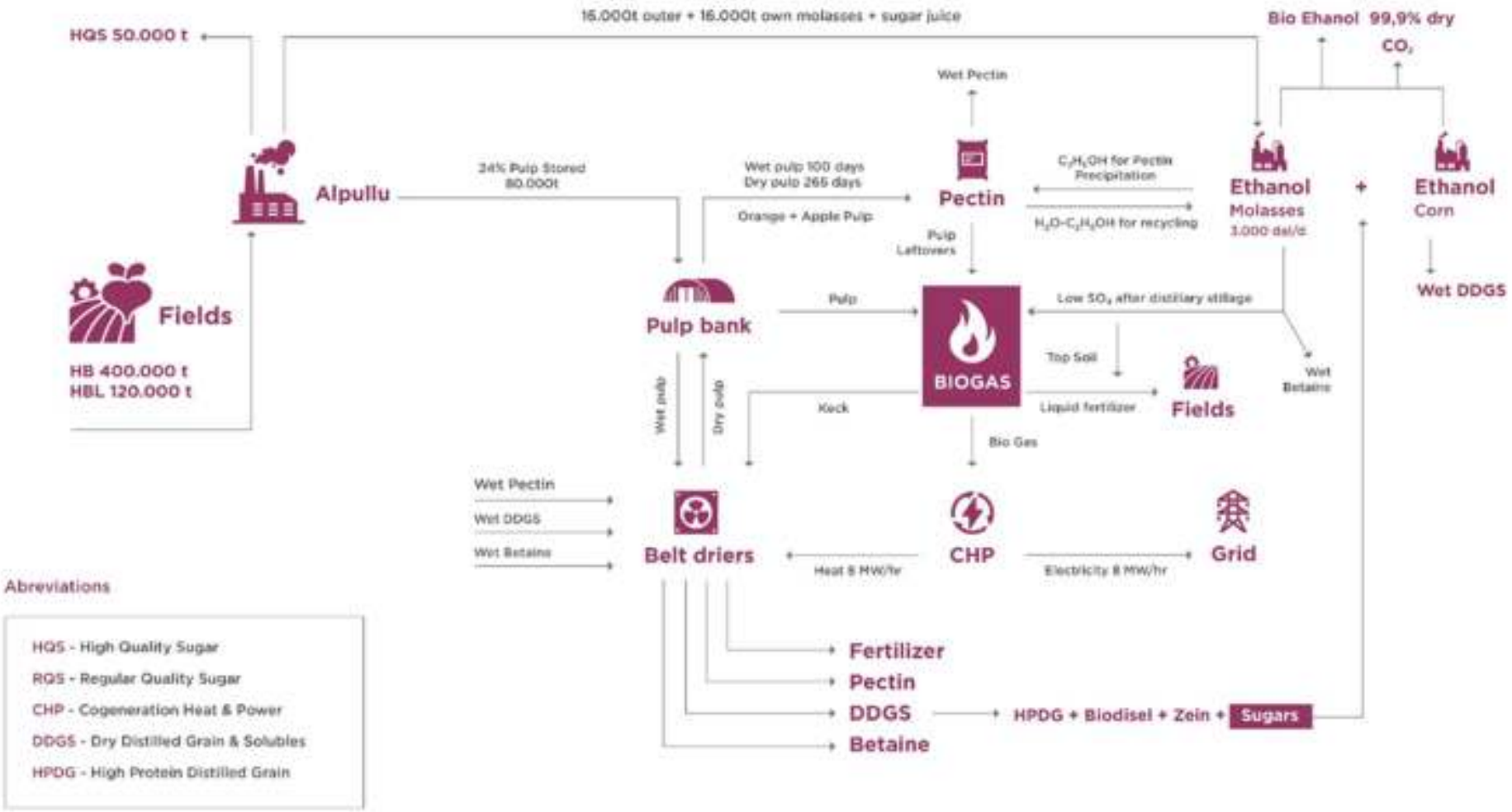
Pectin production

Production of pectin has main expenses in its process - water solution concentration after hydrolyses, big volumes of ethanol for precipitation and wastes utilization. These expenses are lowered significally (25%) by secondary heat usage and alcohol recycle. Besides that, acid used for hydrolysis is being re-used to partially replace sulfuric acid in bioethanol production while water/alcohol mix returns for alcohol recovery.

Biogas production

Biogas facility accepts waste streams from all factories and from produced biogas generates valuable 'green electrical energy' that is being sold to the grid. Besides electrical energy, facility produces almost equal amount of heat that can be used for steam, hot/drying air and hot water generation.

INDUSTRIAL SYNERGY SCHEME



Abreviations

HQS - High Quality Sugar

RQS - Regular Quality Sugar

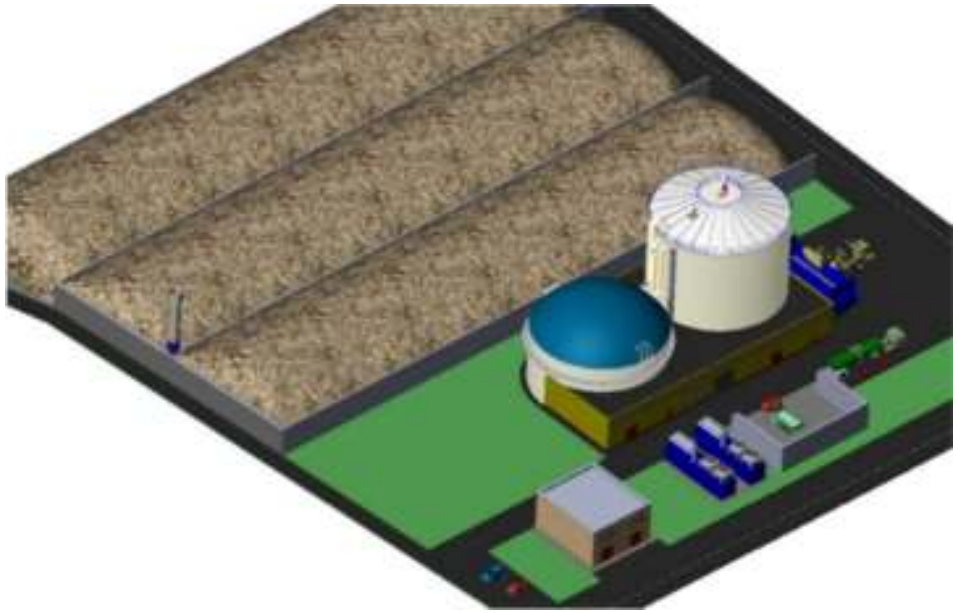
CHP - Cogeneration Heat & Power

DDGS - Dry Distilled Grain & Solubles

HPDG - High Protein Distilled Grain

Ongoing project

First stage -3 MW



Raw materials:
Beet pulp – 200 t/day

Pulp storage capacity 50 000 ton

Second stage – 5 MW

Raw materials:
Beet pulp – 200 t/day
After distillery stillage – 150 m3/day

Construction in progress

Industrial scale reactor - Diam=Hight 8000 m3

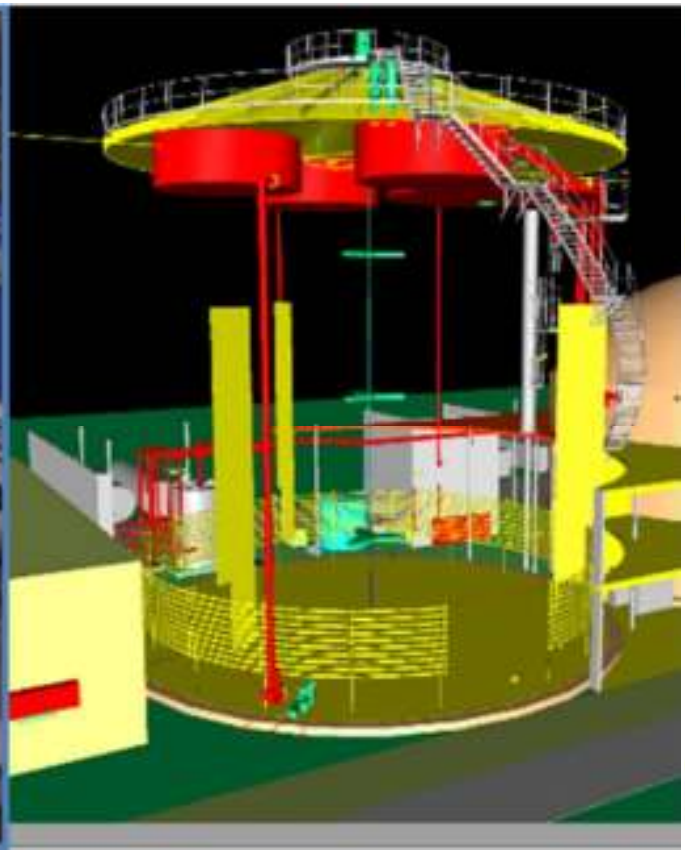
Organic load up to 10 kg/m3/d

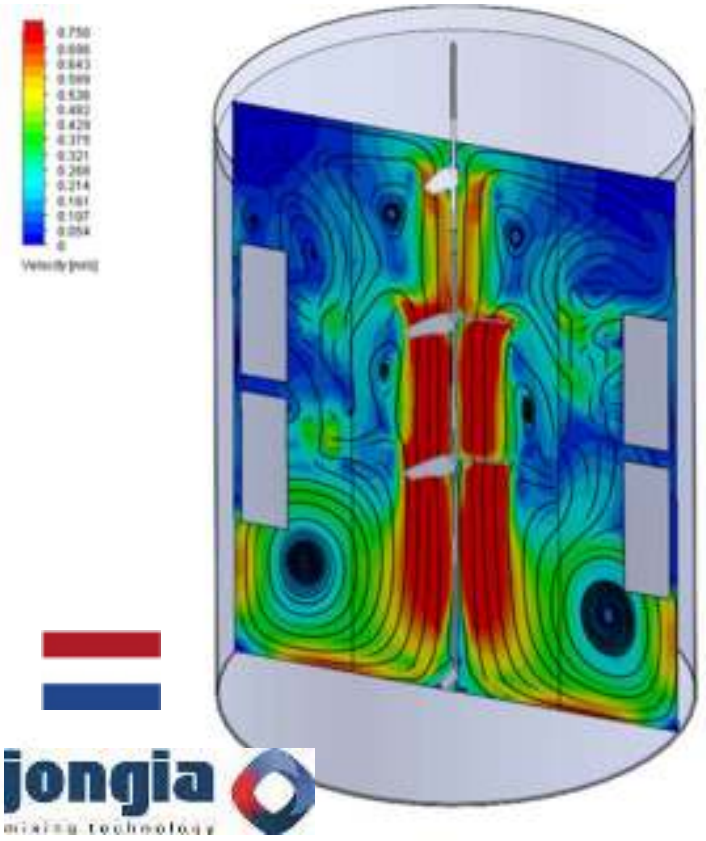
Lowest energy consumption for mixing – 15 kWt

95% - homogeneity

Conversion ratio of organics to biogas – 75-80%

Floating layer prevention and even feed distribution





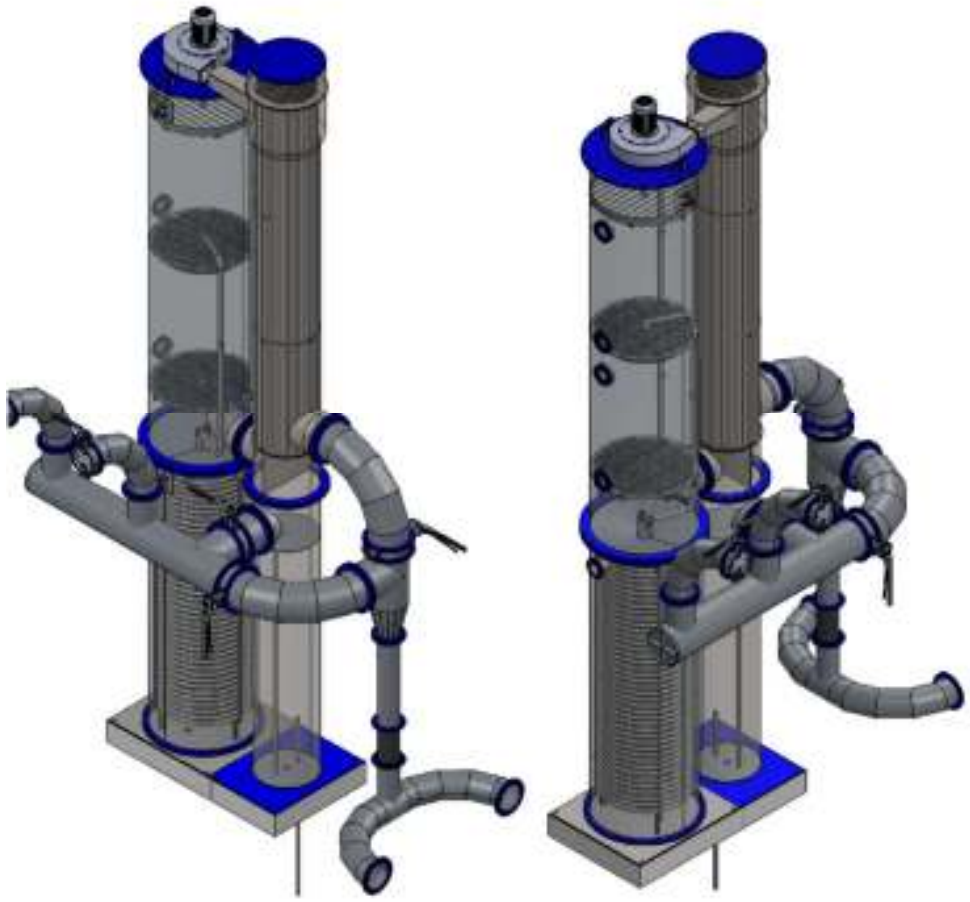
jongia
mixing technology

Biogas Desulphurization

Biogas desulphurization will take place in three stages:

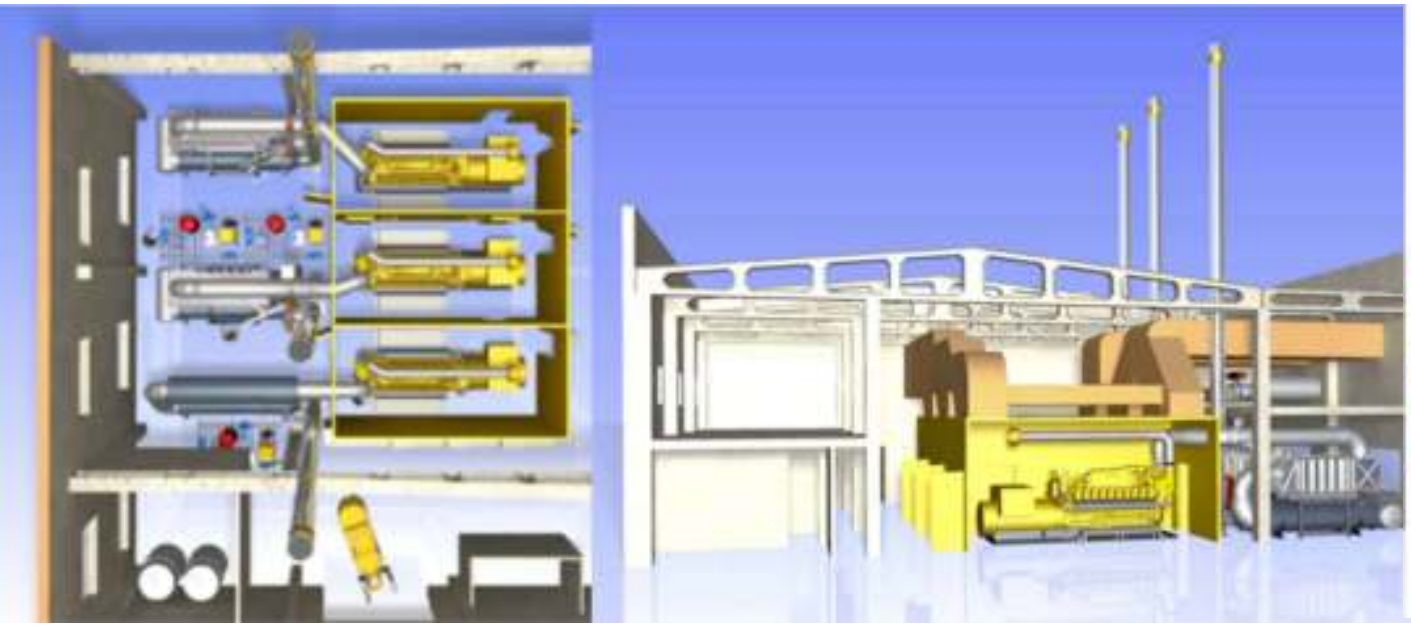
1. **Biological desulphurization on net inside post-digester**
2. **Chemical scrubbing of H2S and biogas cooling/drying**
3. **Polishing biogas from H2S traces on active carbon**

Resulting lowest OPEX for cleaning and extending oil change term



CHP – Catterpillar CG170 series

1. 1 stage – two engines Caterpillar 1,2 MW and 2,0 MW
2. stage 2 one extra 2,0 MW engine. Engines are installed in building
3. Reasons for selecting CAT:
   - High electrical efficiency – 42,9%
   - Low oil burning – 0,15 g/kw
   - Ukraine wide service net and engine repair facility in Komsomolsk



Cumulative economical effect of synergy

1. Modern anaerobic digestion technology allowing to convert 75-80% of organic to biogas.
2. Self-consumption of electricity is under 5% from production
3. Steam consumption for production of 1 dekaliter of bioethanol is under 20 kg and produced from CHP heat
4. CAPEX of bioethanol facility is 25% lower due to stillage utilization in AD
5. More then 50% of equipment produced in Ukraine and certified by chamber of commerce
6. Capex of facility is 1,5 million Euro per 1 MW of produced power
7. Due to local component rate is over 50%, facility is eligible for extra 10% to the green tariff (extra 300 000 Euro per year on first stage and 500 000 Euro on second)

BIOETHANOL PRODUCTION

Bioethanol from molasses

Factory "as shown" consumes around 200 t molasses per day.

Molasses quality:

- Sugars content - 48%
- Humidity - 25%

Bioethanol yield - 30 dal/t of molasses

Factory daily capacity – 6000 dekaliters

Operational 300 - 305 days a year on

As Example - 6 000 dekal./day of bioethanol Factory at Gnidava Sugar Factory

Annual Economic effect of synergy is in natural gas replacement by secondary heat from cogeneration plant

Ecological and technological effects of synergy is - utilized molasses after distillery stillage generates almost as much biogas as needed for that steam prod