

Combined Biomass Solar System

realised in KIC InnoEnergy Project *Bio-Eco-Matic*

Poster prepared by: MSc eng. Pawel Wajss* (KIC PhD student); wajss@agh.edu.pl

Under supervision of: Dr hab. eng. Mariusz Filipowicz*; filipow@agh.edu.pl

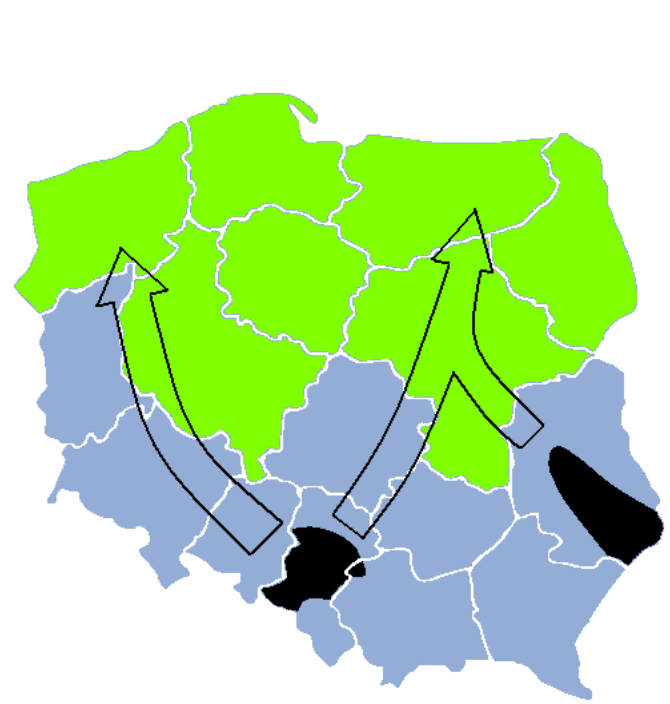
*AGH University of Science and Technology; Faculty of Energy and Fuels,
al. A Mickiewicza 30, 30-059 Krakow

INTRODUCTION

Biomass and solar energy potentials are the largest sources of renewable energy in Poland. Consequently, their utilization for energy purposes should be promoted in order to achieve the best possible environmental and economical effects. Contrary to solar energy, which resources depend on the weather conditions, season and occupied area only, biomass resources are very limited by a multitude of possibilities of their use: production of food and forage; furniture, paper and chemicals (or other products of different industry sectors); solid, gaseous and liquid fuels, which then can be utilized to obtain heat, electricity or drive.

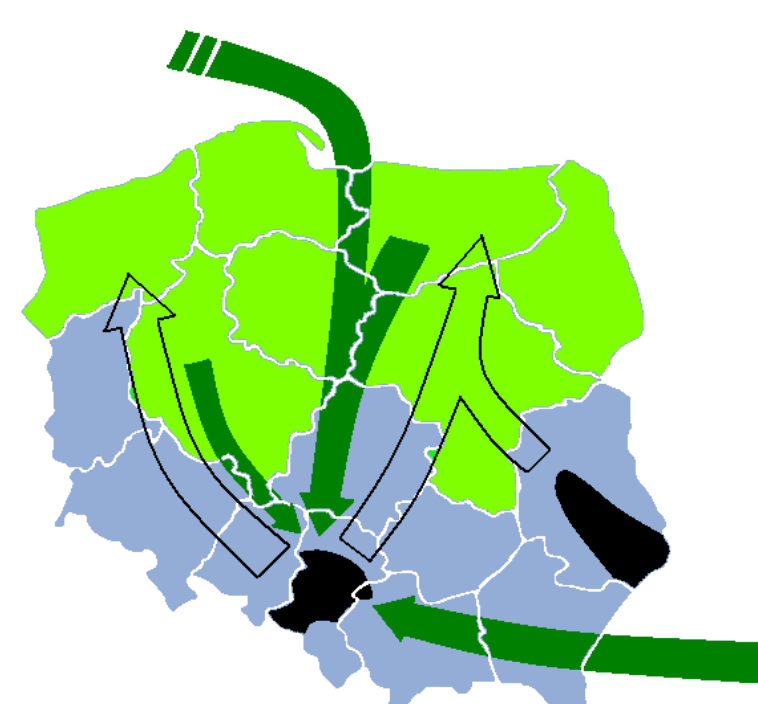
Unfortunately, due to strictly political decisions, the biomass market has evolved towards providing fuel to the process of co-firing biomass with coal in existing power plants. Meanwhile, hard coal is the basic fuel used within residential sector for heating purposes, due to its relatively low price. Such situation has arisen due to EU Directive 2001/77/EC for promotion of electricity production from renewable energy sources. Poland was obliged to produce „green” electricity with the share of total electricity production from 5 to 10% in 2011. Due to lack of available biomass dedicated for energy purposes in Poland, it has been imported from different neighboring countries (eg. Ukraine) and even shipped from other continents.

According to the most recent national and European legislation proposals, „green” heat should be promoted to the same extent as „green” electricity. In order to meet the present and future market expectations of Poland and other European and non-European countries a new, fully automatic, small to medium scale combined biomass solar heating system is proposed. Such integration leads to lower maintenance and operational costs, improves the efficiency of the system and saves the fuel (biomass) for a winter season.



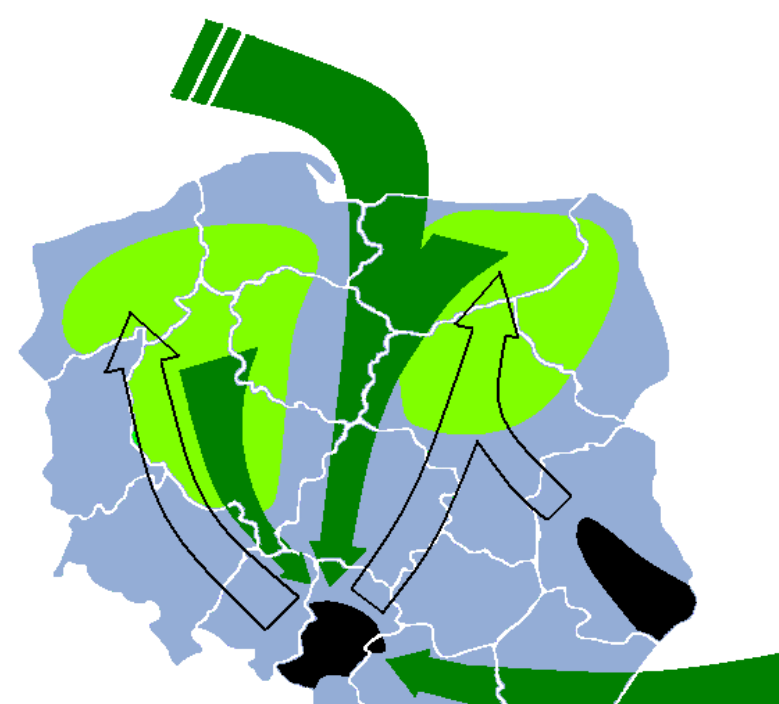
Past (till 2004):

- Lack of local biomass markets
- No financial incentives for electricity and/or heat producers
- No interest in producing biomass for energy purposes
- Small initiatives emerging (vide: heat station in Luban) due to low price of fuel (biomass)
- Residential sector (agricultural) heated by coal



Present (2004-2012):

- Lack of local biomass markets
- Financial incentives for electricity producers ONLY
- Interest in producing biomass for energy purposes due to increasing price of fuel (biomass)
- Heat stations are less interested in biomass due to lack of incentives and increasing fuel price
- Residential sector (agricultural) heated by coal



Future (Scenario 1: business as usual):

- Local biomass markets diminished
- Financial incentives for electricity producers ONLY (sustained)
- Interest in producing biomass for energy purposes due to increasing price of fuel (biomass)
- No interest for heat stations in biomass due to lack of incentives and high fuel price
- Residential sector (agricultural) heated by coal



Future (Scenario 2: new incentives for „green” heat):

- Local biomass markets enlarging and new one emerging
- Financial incentives for electricity and HEAT producers
- Interest in producing biomass for energy purposes for own (mostly heat) demand
- High interest for heat stations in biomass due to financial incentives
- Residential sector (agricultural) heated by biomass and coal

GOAL

Development of a new sun tracking device and its integration with a new small-to-medium capacity biomass boiler for clean and efficient combustion of biomass for heating.

WORK PLAN

March, 2012 – start of the Project

Development of the filtering system 2012-2013

Development of the feeding system 2012-2013

Development of the new biomass boiler 2013-2015

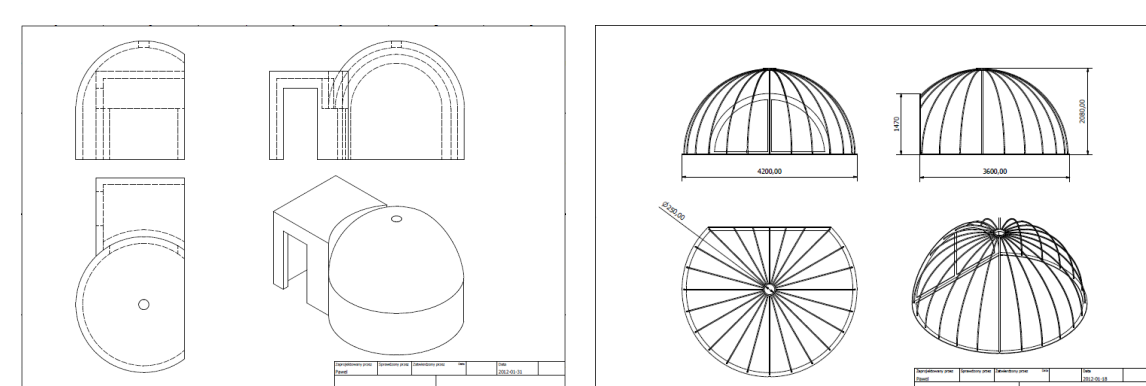
Development of the new sun tracking system 2012-2014

Intergration of the sun tracking and biomass boiler 2014-2015

July, 2015 – end of the Project



The research hall of AGH UST



The laboratory unit to be constructed in 2012 in order to conduct research on the sun tracking accuracy

PROJECT CONSORTIUM



MetalERG /PL/ as a leading producer of straw boilers in Poland, widely recognized in Europe and in countries outside UE (eg. Kazakhstan), will be responsible for constructing the new feeding and filtering equipment according to their own design. They will also build a series of boilers integrating the aforementioned systems and provide its production facilities in Olawa, know-how and labor of its engineering staff.

AGH University of Science and Technology (AGH UST) /PL/, is one of the largest Polish technical university. With its highly professional staff and experience, it will be responsible for measurements of the emissions and efficiency. Its research personnel will work on further improvements of those systems.

Deutsches Biomasse Forschungs Zentrum GmbH (DBFZ) /DE/, is one of the leading German research institutions working on optimization of biomass combustion processes. Its contribution will be essential in the design and testing phases. DBFZ will support the project by making available its knowledge and know-how in the area of optimization of biomass combustion process.

EXPECTED PROJECT RESULTS

It is expected that within Bio-Eco-Matic Project new, innovative filtering and feeding systems, as well as, a new boiler will be developed and constructed. To improve the efficiency of the biomass system a new sun tracking device will be introduced and combined with the aforementioned units. First prototypes have been already constructed and tested. The patents describing different parts of the system have been issued: *Control of the combustion process, baled biomass drying systems* PL patents # 194644, 198075, 202985, 208461, 209204, 388508 and EU patent # 06460035.6; *Sun tracking device* PL patent application # 395164.

A new heating system fuelled by a baled straw and equipped with the feeding and filtering systems will be introduced to the market. Those systems in combination with the sun tracking device will increase its overall efficiency and reduce the particulates emissions.

EXPECTED PHD RESULTS



MSc eng. Pawel Wajss
KIC PhD student

It is expected that within the PhD studies a new sun tracking system will be developed and integrated with the biomass boiler into one system. Different combinations and arrangements of those elements will be examined and tested in order to obtain the highest possible efficiency and the lowest possible particulate matter emissions. New filtering systems based on different kinds of particulate filters, which then may be regenerated by high temperature heat obtained from concentrated solar radiation will be investigated. They should be characterized by: (i) fine filtration, (ii) minimum pressure drop, (iii) low cost and (iv) durability.

The sun tracking system may also be used during summer season as the (main) heat source, reducing the number of starts and stops of the biomass boiler and, consequently, reducing the PM emissions, maintenance costs and improving the overall efficiency of the system.



Prototype of the spherical shaped sun tracking device. To be developed in Bio-Eco-Matic Project

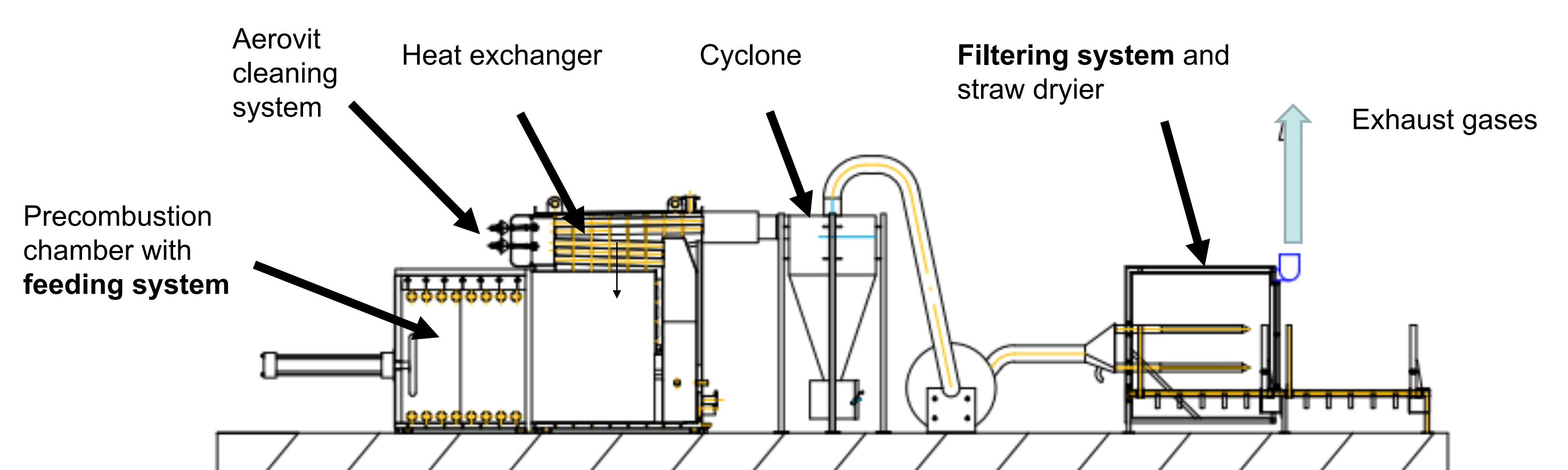


Solar mirrors to be tested within the sun tracking device

Technical parameters:
4,0 mm thick, parabolic, round
Focal length: 724,00 mm
Production average reflectivity:
>=93,5%
Diameter: 1200,00 mm



Prototype of the biomass drying system - to be developed in Bio-Eco-Matic Project



Schematic representation of the biomass integrated system with new feeding and filtering systems