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ABSTRACT

In the paper a 4th Generation Low Temperature District Heating (LTDH) in rural area is being developed. A case study Lubań includes design of biogas plant with cogeneration, renewable energy sources and heat storage to be used for heating of communal buildings

Introduction

Effective utilization of waste heat states great challenge for highly efficient cogeneration systems based on biogas. Among the proposed solutions best known are related to district heating systems, heat transfer to nearby companies, drying of agriculture products, use of heat for pellet production as well as growing vegetables, mushrooms or fishes (see Fig. 1). Wegner (2015) and Ritz (2015) discussed the issue of heat utilization and a broad variety of bottlenecks, including issues of awareness, capacity, social acceptance, legal and political questions.

In this paper possibility for high efficient co-generation with biogas installation 250 kWe (Fig. 3), where main heat receiver would be LTDH in a village or municipality with central heating system is discussed. As a case study agricultural village Lubań is presented (see Fig. 2).

Fig. 2. Village Lubań with manor house, farm and communal buildings



Fig. 3 Scheme of biogas installation

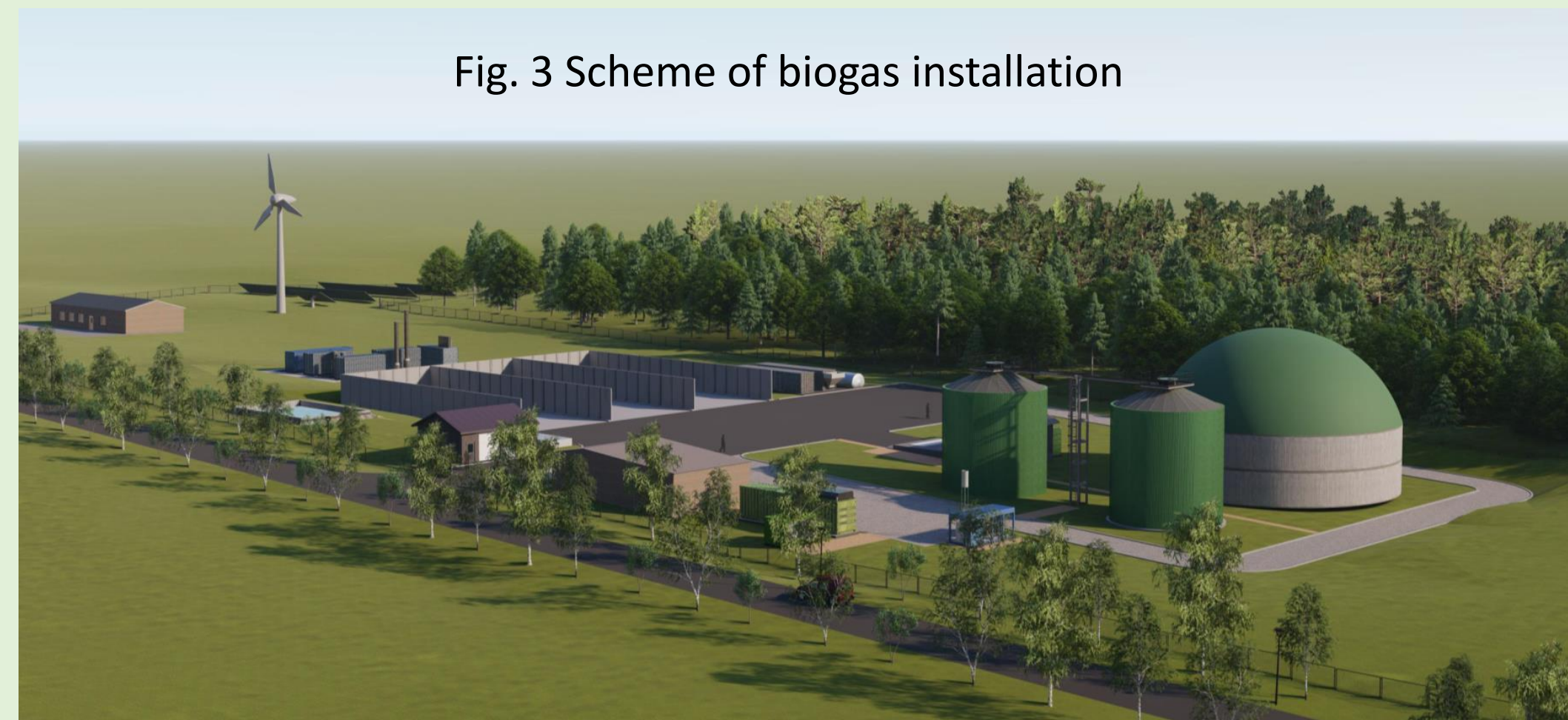
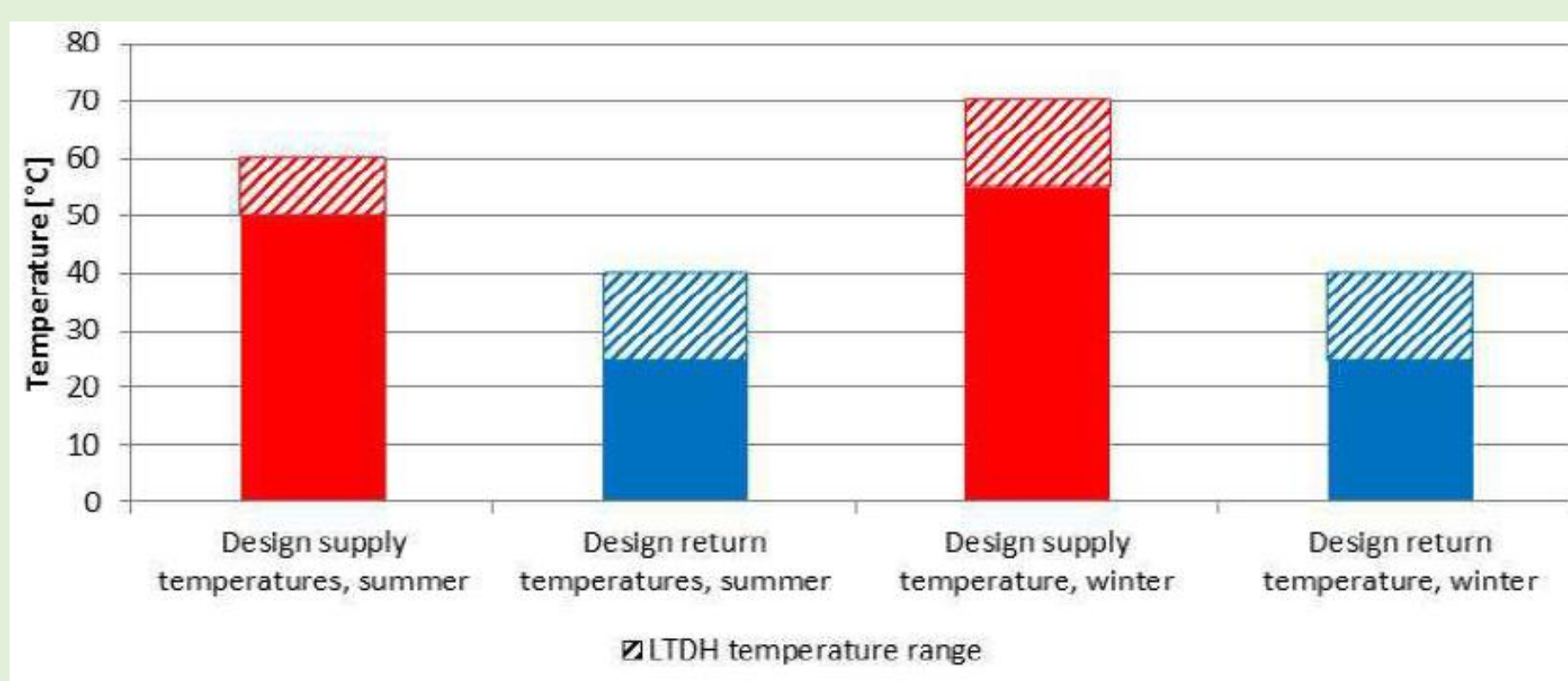


Fig. 1. Surplus heat application [1] and characteristic temperatures of LTDH

Option	Heating	Drying	Cooling	Electricity production
Uses	<ul style="list-style-type: none"> • District heating • Heating of stables • Heating of greenhouses • Heating for aquaculture • Heat transport in containers • Other heating options 	<ul style="list-style-type: none"> • Drying wood, woodchips, and pellets • Drying agricultural products • Drying digestate and sewage sludge 	<ul style="list-style-type: none"> • District cooling • Cooling of buildings • Cooling of stables • Acclimatisation of food storage buildings • Process cooling 	<ul style="list-style-type: none"> • Additional electricity production with CRC, ORC or Kalina technologies



Method

EcoConstruction Sp. z o.o. (www.eco-construction.com.pl) company in cooperation with IMP PAN developed a concept and designed Pomeranian Ecoenergy Centre in Lubań with biogas installation which can supply surplus heat for several multifamily houses. The new system will substitute the very inefficient one with coal-fired boilers. The heat demand of the Lubań district heating grid is being assessed and multivariant analyses (with heat storage, heat pumps, gas and pellet boiler) is being performed.

CONCLUSIONS

The developed concept of LTDH in Lubań will contribute to improved economy and air condition in the village.

Results

The performer assessment proved that existing district heating system is very inefficient (coal boilers have average efficiency about 40%). Application of 4th Generation district heating, renewable energy sources and heat storages will significantly improve energy efficiency of the LTDH

Literature

1. Sustainable Heat Use of Biogas Plants, A Handbook 2nd edition, Ritz, D., (2015). http://www.biogasheat.org/wp-content/uploads/2015/03/Handbook-2ed_2015-02-20-cleanversion.pdf;
2. Adam Cenian, Tadeusz Noch, Low temperature district heating using waste heat from biogas plant, Eco-energetics: technologies, environment, law and economy, 2 (2019) 19 – 28 (ISSN 2657-5922)