

# Assessment of the Ecological and Energy Awareness of the Citizens in Rural Communes

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## Abstract

*This study was performed due to a concept of building a biogas network connecting two agricultural biogas plants. It was concerned with the ecological and energy awareness amongst the citizens of two communes located in the Lubelskie Voivodship. Moreover, their interest in being connected to the local biogas network has been studied. The interviewees declared that they are familiar with different sources of energy. Solar energy was the most well-known. It has been noted that the level of information about how agricultural biogas plants operate is low, which is known both from verbal expressions and the responses to questions concerning inhabitants' interest in becoming connected to the network. The citizens are afraid of burdens resulting from producing biogas, mostly the unpleasant smells. It has been noticed that most of the decisions upon which the environmental attitude may be assessed stem from the economic reasons. The need to raise the level of knowledge about producing biogas and using it as energy is very high.*

**Keywords:** biogas network, ecological awareness

## Introduction

The environmental awareness is a construction composed of many elements, such as views, knowledge, notions about the environment as well as established attitudes and behaviour in relation to the natural surroundings. Three levels of ecological awareness analysis may be distinguished. The global one, which is shaped by the global economic and technical processes along with political decisions (international protocols, laws and environment pollution resulting from global economy) is first. The influence of individual people on these processes is very low. It remains in the hands of decision-makers and changes appear spontaneously, without anybody's intervention. The second level is created by an intermediate structure between the smallest unit and the highest level. It is composed of the environment which is closer to the given individual unit (neighbourhood, commune). It has a bigger influence on its ecological condition. The third level is the awareness of individuals (Sidorczuk-Pietraszko and Zawistowska 2011).

Energy awareness, which is rarely a subject of separate research, is one of the components of ecological conscience. There is very little information on this matter, mostly coming from literature. It reveals that the knowledge of Poles about energy usage stems mostly from their everyday experience. Perception of more complex problems is stereotypical and based on common knowledge. Research carried out by TNS OBOP shows that Poles do have misconceptions of many cases connected with energy use.<sup>1</sup> The interviewees say, for instance, that industry uses more energy than

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1. See: Badanie „Polacy o oszczędzaniu energii” [Poles on saving energy] przeprowadzone przez TNS OBOP na zlecenie Rockwool Polska na reprezentatywnej grupie 1005 mieszkańców Polski w wieku 15 i więcej lat, w dniach

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households. A large percentage is also wrong while estimating the share of energy costs in the total household expenses. Only a couple percent is correct in stating that heating is the biggest of all household costs. 25% cannot estimate at all how much energy is used in their homes. However, it is worth noting that nationwide research show that Poles see the improvement of the environment quality, which took place over the past years.<sup>2</sup>

## 1 The concept of building a separate biogas network

Thanks to a project of building a biogas plant using biomethane as an energy source in one of the farms, local authorities of two communes: Urszulin and Sosnowica, both located in the Lubelskie Voivodship, made a decision to build a network. This network was supposed to be created with active cooperation of the local community, which could participate in its building, managing and then benefit from it. The concept of such investment needs identification of the interest of potential recipients in becoming connected to the network and the interest of citizens in participating in its construction, management and financing. These issues should be considered taking into account the level of awareness of renewable energy sources of the citizens and their acceptance of the concept of building the biogas plant.

An agricultural biogas plant is a complex of buildings and appliances used to produce biogas. It is a mixture of gases, with a domination of combustible methane. Sources needed for producing biogas come from agriculture and food processing (Kowalczyk-Juśko 2013; Podkówka 2012). Amongst 61 agricultural biogas plants functioning at present in Poland<sup>3</sup> every one exploits the produced biogas in cogeneration units producing energy (connected into the energy network) and heat, used for heating housing estates and utility buildings, as well as for different technological processes. There is a possibility to use biogas, after its purification, as car fuel or gas fuel introduced into the natural gas network. Powering the network is possible when such a system is available. In other cases it is justified to build a separate network, independent from the PGNiG (the leader on the Polish natural gas market).

The concept of building a biogas network assumes that local resources of biomass will be processed by means of anaerobic fermentation to the form of biogas. Biogas, after its purification will be distributed as biomethane to individual recipients and institutions. Biomethane may be used in a similar way as natural gas—for heating water, preparing meals, heating households and other buildings. It is also possible to install small cogeneration engines producing energy for individual recipients or public utilities. Both communes were assessed as areas with few capabilities of connecting to energy networks of large agricultural biogas plants.<sup>4</sup>

## 2 The area of study

The communes participating in the project are situated in the Lubelskie Voivodship, in Parczew country (the commune of Sosnowica) and Włodawa county (the commune of Urszulin). The area of both communes is 34 376 hectares, out of which 17 214 hectares is taken by Urszulin commune and 17 162 by Sosnowica commune. Despite similar size, the specifics of the communes are very different. Urszulin is an agricultural commune, where farmlands make up 54,1% of the area, whereas the commune of Sosnowica has a 42,8% share of such areas.<sup>5</sup> Forests take up 44,9% of Sosnowica commune and 26,9% of Urszulin commune. Both units have many areas of environmental significance,

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5–9 lipca 2007 r., [[:]] <http://6paliwo.pl/wp-content/uploads/2012/02/6paliwo-raport-1.pdf>.

2. See: *Ekologiczna świadomość Polaków. Komunikat z badań* [The ecological awareness of Poles]. BS/161/2000, CBOS, Warszawa, [[:]] [http://www.cbos.pl/SPISKOM.POL/2000/K\\_161\\_00.PDF](http://www.cbos.pl/SPISKOM.POL/2000/K_161_00.PDF).

3. State for 30 June 2013, according to The registry of agricultural biogas producers, the Agricultural Market Agency.

4. See: *Uwarunkowania lokalizacyjne i proces inwestycyjny budowy biogazowni rolniczych w województwie lubelskim* [Conditions for localisation and investment process of building agricultural biogas plants in the Lubelskie province]. Wydanie trzecie zaktualizowane, Biuro Planowania Przestrzennego w Lublinie, Lublin, 2010, [[:]] <http://www.bpp.lublin.pl/oprac1/biogazownie/biogazownie.pdf>.

5. [In the journal European practice of number notation is followed—for example, 36 333,33 (European style) = 36 333.33 (Canadian style) = 36,333.33 (US and British style).—Ed.]

which are protected by various means. Protected areas take up 65,6% of Urszulin commune and 84,3% of Sosnowica commune. These conditions influenced the development of both areas. Urszulin is an agricultural commune with 1 203 farms, 254 business entities and a population of 4 125. Due to a large share of forest areas and a large percentage of low-class quality soils (mostly rye complexes), conditions for agriculture in Sosnowica commune are limited. This administrative unit is of more touristic character, there are 572 farms, 149 business entities and the population is 2 668.<sup>6</sup>

### 3 Research methods

The main source for assessing the environmental and energy awareness of the communes' citizens, as well as their attitudes towards the construction of the biogas plant, were surveys carried out amongst the residents of settlements located along the proposed route of the biogas network. The amount of completely answered question sheets was 166, which is ca. 5% of the inhabitants of these settlements. Men composed 51,2% of the respondents and women 48,8%. The biggest share of the interviewees were owners of individual households (45,2%), then farm owners (28,9%), people living in block apartment complexes (13,8%), small business owners (10,2%) and the owners of summer houses (3,0%). The research has been carried out on adults, the youngest respondent was 18 years old, and the oldest 79. The biggest age group amongst the interviewees was 36–50 (39,2%), then 51–60 (29,5%). The youngest age group took 22,3% of the total number and the oldest 3,0%. The education of the respondents was varied. 35,5% had secondary education, 31,3% higher education, 28,3% vocational education and 4,8% primary education.

Identifying the connection between stated opinions of the interviewees and their actual attitudes was a methodological problem. It is really important to reconstruct this relation in the case of a questionnaire being the main tool for the study. All the conclusions are drawn from the given responses, not from the direct observation of the respondents' activities. Hence, there is an area of uncertainty as to whether the answers do reflect their actions. It is not assumed, however, that the interviewees gave untrue answers. What is questioned is how much the answers are influenced by the generally accepted standards and possible attempts to comply with them.

## 4 The outcome of the research

### 4.1 The ecological awareness of the citizens

An assessment of the perception of the environmental state has been performed. It was connected with the pollution caused by low emissions, the attitude towards burning waste in heating boilers and knowledge of renewable energy sources. The air pollution caused by heating boilers has been estimated as high by a large share of respondents (39,2%). 28,9% declared it is low, 12,7%—very low, 8,4%—very high and 10,8% could not form an opinion (fig. 1). It is worthy mentioning that the issue of low emissions is noted in the strategic documents of the communes as an important problem, mostly in relations to the touristic and recreational functions of those areas and concerns

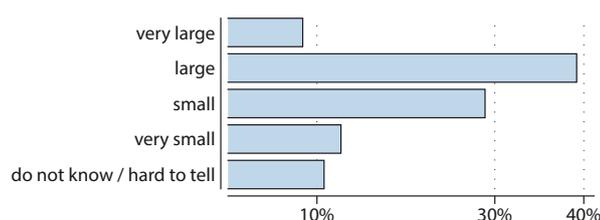


Fig. 1. The assessment of the air pollution level

the quality of the environment, which is protected in many places.<sup>7</sup>

6. Data published by Central Statistical Office of Poland at Local Data Bank site (<http://stat.gov.pl/bdlen/>) in 2014.

7. This problem is noted in: The strategy of balanced development of the commune of Urszulin 2008–2020; The strategy of developing tourism in the commune of Urszulin; The strategy of development of the commune of Sosno-

A vast majority of respondents (70,5%) answered that they know it is illegal to burn waste in heating boilers. However, almost 20% see this activity as justified in some situations. Only three interviewees said that burning waste is always admissible. 7,8% did not have an opinion on this matter (fig. 2). This may mean that it is necessary to educate local societies, as the amount of the people accepting the procedure of burning waste in an illegal way shows that it is socially acceptable in some way. Additionally, the result of the answers to this question could be distorted because of its touchiness. Burning waste in boilers is not a socially accepted activity and many people are aware of this fact. The respondents, trying to show that they adhere to standards could have answered in line with the expectations, not with their actual behaviour.

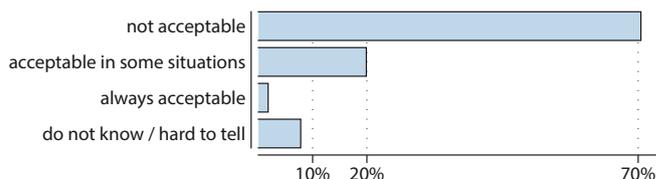


Fig. 2. Permissibility of burning waste in household heating

The smoke from the household heating boilers is harmful to health according to 64,5% of the respondents. 45,8% noticed the decline of well-being and comfort because of this reason. 11,4% state that the smoke is not harmful and 40,0% that it does not affect their comfort. The opinions on the effect of the smoke on tourists' interest in the region were very divided. 30,7% of the interviewees claimed it is a factor discouraging tourism, 27,1% did not see this kind of connection. 42,2% did not have any opinion (fig. 3).

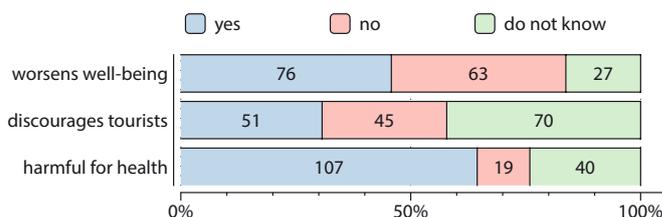


Fig. 3. Perception of the air pollution effects due to low emission

Respective renewable energy sources were known to the respondents in a various degree. Most of them (86,1%) mentioned solar energy, 69,9% wind energy, 43,4% hydropower, 41,6% biomass energy and 31,9% geothermal energy. Such distribution of answers may stem from the fact that in both of the communes there are solar collectors and there are plans to apply for aid for further such investments. Knowledge of wind energy may be an effect of numerous discussions and broad range of information in the media. Hydropower is not currently used in two communes, however there are two structures raising the level of water in the commune of Urszulin, which have been chosen for potential energy usage. Biomass is relatively less well-known. However, this source of energy is said to be the most important one for Poland, both currently and in the future, according to many experts (fig. 4).

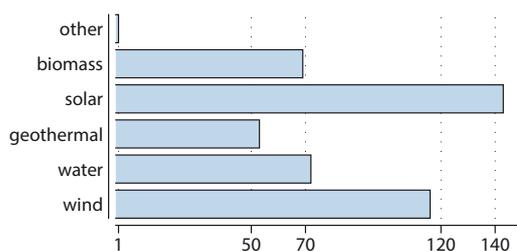


Fig. 4. Number of persons declaring knowledge of respective renewable energy sources

One of the ways of converting biomass for energetic purposes is anhydrous fermentation. This process creates biogas, composed of combustible biomethane. 42,2% of the respondents said they know how biomethane is produced in an agricultural biomass plant. What is interesting is that some of the interviewees declared such knowledge, while—at the same time—did not indicate biomass when questioned about renewable energy sources. This could show that the knowledge of this subject is superficial and possibly based on not very credible sources. This is further evidenced by the fact that 67,5% of the respondents declared the need for raising the level of knowledge of biogas plants.

The ecological awareness of the studied group has also been assessed in relation to the level of economic means. In one of the questions it was explained that biomethane is an ecological fuel, made from renewable sources. Next, a question was asked regarding whether the respondent would like to use biomethane, only because of environmental reasons, even though it would not lower the households costs. The dispersion of respondents confirming (31,9%), declining (32,5%) and not sure (35,5%) was very even. Most of the negative answers had a mostly economical basis. The causes for such answers were “high costs,” “the risk of unstable costs,” “I cannot afford it” and “biogas may become more expensive.” Two of the interviewees said they are against building the biogas plant, so the usage of this energy source does not interest them, irrespective of environmental effects.

It is worth mentioning that these answers reflect a problem which is indicated in the methodology. It is a problem of confronting general questions concerning environmental awareness with specific behaviours. The percentage of pro-ecological answers declines as the questions move from the most theoretical aspects to personal ones, here—the financial means of the respondents. A smaller group declares a pro-ecological stance when the questions mean that they have to face a situation when being pro-ecological means spending more money.

Social psychology indicates that views on specific matters do not always reflect actual actions. This difference may be caused by a couple of reasons. First of all, it becomes greater when the questions refer to different levels of detail. Secondly, involvement, awareness and “accessibility” of a certain attitude is important. Being in an ecological organisation, knowing a lot about ecology, or even being interested in such matters makes it more probable that declarations will be followed by actions. One of additional important factors is the time between the assessment of the respondent's attitude and his/her behaviour. The longer it is, the greater the difference may be.

Pro-ecological behavior is much more common amongst those people and societies which have satisfied their physical needs important for biological survival and development. Post-materialistic attitudes (including ecological stance which is opposed to consumption) are more apparent in wealthy countries already having a high level of life comfort. One of the examples are Scandinavian countries (Sidorczuk-Pietraszko and Zawistowska 2011).

Amongst German society the level of ecological awareness is very high. It became even greater when the government declared discontinuing nuclear energy in favour of renewable energy. Because of this fact, Germans have become involved in renewable energy projects because of ideological reasons and are willing to accept minimum financial benefits as a result. Another one of the factors influencing the amount of “prosumers” in Germany is the level of wealth of the society. This means that there is a relatively large group who have sufficient means for investing in renewable energy.<sup>8</sup> In Poland post-materialistic stances are only beginning to form slowly, their range is spread thinly and are expressed only by a part of our society.

The next question from the survey which could be categorised as a means of assessing the ecological awareness was the question of acceptance for building a biogas plant in a nearer or further distance from the respondent's surrounding. It was also directly connected to the concept of building the facility. The interviewees were strongly against building a biogas plant in their place of residence (fig. 5). The acceptance became greater as the distance of the investment from the respondent grew. Negative answers were explained by apprehension of odour, harmfulness to

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8. See: Analiza mająca na celu wdrożenie instytucji spółdzielni energetycznej do polskiego systemu prawa w oparciu o najlepsze praktyki państw Unii Europejskiej [The analysis for introducing the institution of an energy cooperative into the Polish law system based on the best practices of the European Union countries]. Wierciński, Kwieciński, Baehr Spółka Komandytowa, 2014, available at [www.oze.pl](http://www.oze.pl).

the people and the environment, lowering life conditions, noise, traffic, water pollution, the necessity of protecting the environment and a high cost of the investment.

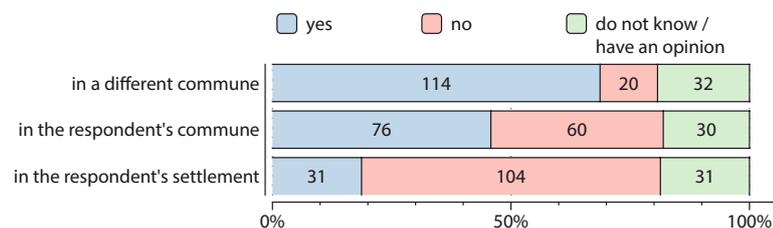


Fig. 5. The acceptance for the construction of the biogas plant, depending on its localisation

These attitudes, displayed by most of the respondents, are typical for people who are against specific investments in their close surroundings, yet do not deny that they are needed. These people support building such facilities, but at a greater distance from their homes. This attitude has its special name—NIMBY (Not in My Back Yard) (Wawer 2014).

#### 4.2 The interest in becoming connected to the biogas network

Respondents did not report nuisances related to breaks of energy distribution. 6% of them said these periods are frequent and very frequent. Most of the interviewees (68,1%) claimed they happen rarely. A great deal of respondents (80,3%) were happy with the current system of energy distribution and heating. Some of those who were unhappy stated the following reasons: high costs, inconvenience, environmental pollution and fluctuations of temperature. Despite high level of satisfaction regarding the current way of receiving energy, 63,3% of the respondents declared their willingness for becoming connected to a biogas network. Biomethane would be used for heating households, cooking meals, or heating water (fig. 6). Four entrepreneurs declared its use in their businesses enterprises.

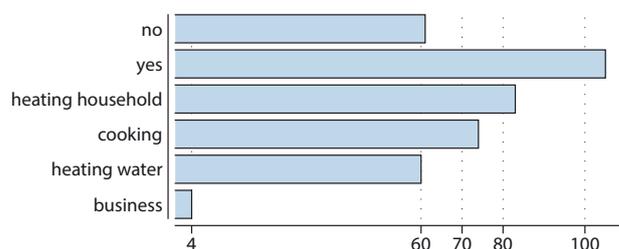


Fig. 6. Interest in becoming connected to a biogas network and biomethane use

36,7% of the interviewees were not interested in becoming connected to the network, Main reasons for this decision were economical. Respondents were afraid of high and fluctuating costs of biomethane, high cost of connection and the stability of producing gas. Denial was also justified by having one's own forest and access to cheap wood, low energy usage and lack of a need for gas fuel. Some other responses were "I am against building the plant," "The plant stinks" and "No information."

Biomethane may be burned in cogeneration engines of various size and scale in order to produce energy and heat. The respondents were asked if they were interested in producing energy for their own means by a generator fueled with biomethane. 23,5% of the interviewees gave a positive answer, 33,1% a negative answer and the rest did not have an opinion. However, amongst people who answered negatively and then justified this answer some lack of knowledge has been revealed. They said that they did not know the technology, did not have any information regarding this issue, "Nobody does that," "I do not have a generator," etc. Apart from sporadic answers "The plant stinks" and "I am against building the plant" most of the people who gave a negative answer in reality were not sure of it. This is another evidence for the need to raise the level of knowledge of the issue in the studied area.

### 4.3 Interest in participating in building and using biogas network

The project of building an independent biogas networks assumes that the citizens will participate in its creation, exploitation and management. Therefore it is important to assess the level of interest of the communes' inhabitants in these issues. It is important that the respondents know they may have a financial share, both cost-side and profit-side. It is also essential to inform that the functioning of the network may be connected with a risk of losses. Readiness to take up this responsibility also has to be assessed.

The respondents reported their biggest interest in consultations during the stage of planning the network, its constructing, usage and setting the conditions of biogas delivery (36,7%). Amongst the 21,7% of the respondents who were not interested in these activities, 6 persons explained it with lack of knowledge and lack of time. Other answers were: "I am not interested," "I am not an investor," "I am against building the plant" and "Consultations do not matter, they will do whatever they want." 22,9% of the interviewees declared their willingness of financial participation in building the network and obtaining profits from its functioning. People who were against investing in the network (34,3%) justified it by economic matters, lack of interest in the network, lack of time, knowledge and their negative attitude towards the biogas plant. 24 persons (14,5%) declared willingness of participation in the management of the network. 31,9% said they did not want to take part in the managing because of their lack of knowledge, time, interest or general negative attitude towards the plant. It has also been suggested that specialists, not the citizens, should supervise the network. The option of taking responsibility for the effects of the functioning of the network caused the least interest. Only 11,5% of the respondents gave a positive answer to this question. Negative answers (45,8%) were explained by the apprehension related to the financial responsibility, lack of money, financial risk but also lack of knowledge, time and information and general negative attitude towards the plant.

It is worth mentioning the fact that almost half of the interviewees chose the answer "I do not know/I do not have an opinion" in each of those questions (fig. 7). It is an evidence of a big possibility to increase the number of potential co-sharers of the network. It requires, however, creation of a plan for involving the local community in the energy policy of the commune and for establishing the rules of the citizens' cooperation in the process of decision-making, financing and acquiring economic benefits from this project. An informative action concerning the concept of constructing the Polesie biogas network is also essential as some of the uncertain and negative answers stem from the lack of knowledge and information.

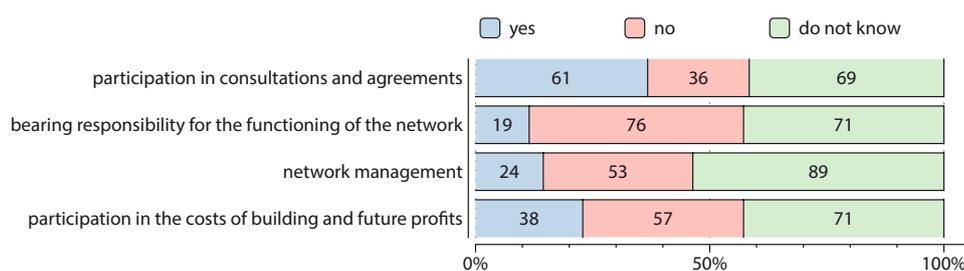


Fig. 7. Respondents' interest in respective actions related to construction and functioning of the biogas network

Germany is an example where energy communities function successfully. Local populations very often choose the form of co-op in order to accomplish prosumer projects. One of the reasons of such popularity of energy co-ops is a very high culture and tradition of cooperative movement. Co-ops are seen as a way of strengthening bonds within local communities and a means for achieving common goals, giving its members a sense of working for the mutual good. Energy co-ops involve not only their members directly, in this way lowering costs of undertaking projects, but also local businesses, which provide the necessary equipment and co-operative banks, which are the most frequent lenders. Due to this, energy co-ops help in the economic development of whole regions. Mutual forms of private persons investing in renewable energy sources are present in other European Union countries, such as Denmark, the Netherlands, Great Britain, Austria or Sweden.<sup>9</sup>

9. See: Analiza mająca na celu wdrożenie...

## Summary

The ecological and energy awareness of the studied communes' citizens is rather superficial. Inhabitants more often indicate pro-ecological attitude when asked for general matters. If the question relates to more detailed aspects, this behaviour becomes rarer. Confirming that one is interested in the state of the environment is not always reflected in everyday actions. This discrepancy stems from the fact that activities, unlike opinions, require bearing respective costs, both financial and non-financial ones. This may be especially burdensome for low-income inhabitants of small settlements. The participation of the local community in construction, functioning and management of the local biogas network requires preparing them for this role beforehand. With the current level of knowledge and involvement it is possible to include the residents in the process of local consultations. In the case of undertaking educational actions and creating clear rules of cooperation between all the participants of the project it is possible to include a part of the citizens in the investment process. Still, it is very difficult to predict the future development of the situation. From the inhabitants' point of view, the most important aspect of cooperation is the financial one. Ecological matters are less important. It is essential to raise the level of knowledge of the functioning of agricultural biogas plants, the potential energy use of biogas and biomethane and the functioning of the biogas network. It is important to inform the local community about all the taken decisions, conditions of the residents' cooperation and environmental, and the social and economic effects of building an independent biogas network.

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