The Sustainability of Decentralized Bioenergy Production

- Case Study: The 'Bioenergy Village' Bollewick

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The Sustainability of decentralized Bioenergy Production

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Abstract: The concept of Sustainable Development is an interdisciplinary science. Transcending various academic fields the concept shows paths how the needs of present and future generations can be met through economic development on a finite natural resource base. Global warming and rising sea levels are just two of a series of phenomena that are directly attributable to human-induced increasing greenhouse gas levels in the atmosphere as consequence of the combustion of fossil fuels. Therefore, reducing greenhouse gas emissions through the use of renewable resources such as bioenergy are of vital importance if detrimental environmental effects are to be mitigated. The production of biogas in a decentralized context is receiving much attention in Germany as a means to reduce greenhouse gases and to counteract correlated negative environmental effects, respectively. In addition, socio-economic benefits such as local employment creation have the potential to empower rural communities. Subsidised by the German Renewable Sources Act and its various remuneration schemes, two 500kW_{el} CHP biogas plants are producing through anaerobic digestion of maize silage and manure electricity and heat in the East German village Bollewick, which is the case study. The sustainability of this decentralized system is analyzed by applying a set of indicators. Socio-economic benefits for the population, economic efficiency of the digestion process and impacts of substrate costs on the profitability, greenhouse gas emissions due to land use change and biodiversity loss being some of these indicators. The thesis concludes that none of the sustainability indicators are sufficiently fulfilled in Bollewick. Especially the cultivation of the energy crop maize has despite crop rotations immense negative environmental effects. Therefore, the decentralized biogas production in the rurally coined village Bollewick is not sustainable.

Keywords: Sustainable Development, decentralized, biogas, EEG, CHP, anaerobic digestion

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The Sustainability of decentralized Bioenergy Production

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Summary: The concept of Sustainable Development is an interdisciplinary science. It seeks to balance environmental concerns with the needs of present and future generations and economic development, respectively. The combustion of fossil fuels is producing greenhouse gases, which is increasing global temperatures. Using renewable energy sources to produce energy reduces the amount of greenhouse gases and can therefore counteract negative environmental effects. The production of biogas in a decentralized context as a means to reduce greenhouse gas emissions is becoming increasingly important in Germany. The German Renewable Energy Sources Act is subsidizing the generation electricity from renewable energy sources. Two biogas plants in the East German village Bollewick, the case study, are entitled to these subsidies and are producing electricity and heat from biogas. The social, environmental and economic sustainability of biogas production in Bollewick was analyzed by applying a set of indicators. The thesis concludes that these indicators are not sufficiently fulfilled in Bollewick and therefore the overall sustainability of the biogas production in Bollewick is not given.
1. Introduction

In light of a changing climate due to the combustion of fossil fuels and the gradual depletion of natural resources, the generation of electricity and heat from renewable resources has gained a lot of attention in recent years. To counteract adverse effects of unsustainable energy generation and to considerably reduce the amount of climate active greenhouse gases, Germany has launched the Renewable Resources Act (Erneuerbare Energien Gesetz – EEG) in 2000.

Compared to other types of renewable resources bioenergy has a distinct position in the German energy sector. On the one hand, raw materials are available in large quantities and at relatively low costs. On the other hand, energy from biomass can be utilized not only for electricity and heat production, but also for transportation. Therefore, bioenergy has in its gaseous, liquid and solid form the largest share of renewable energy sources in Germany. Particularly for East German federal districts with the predominant agricultural sector the investment in bioenergy projects is an opportunity to reduce their dependency on fossil fuels and to produce environmentally friendly energy, respectively. However, the increased implementation of large- and small-scale bioenergy projects in Germany is subject to an ongoing debate whether or not such practices are sustainable.

This thesis will pick up this discussion with special regard to the sustainability of decentralized biogas production. The sustainability will be analyzed in terms of the social, environmental and economic dimension of the concept of Sustainable Development. The village Bollewick, which is situated in the East German federal district Mecklenburg Western-Pomerania is the case study of this thesis.

First, the concept of Sustainable Development will be introduced, defined and discussed. In a subsequent step the concept’s connection to bioenergy will be shown. After outlining the methodological part of this thesis and introducing the case study a brief overview concerning the functioning of biogas plants will be given. Thereafter, the German Renewable Energy Sources Act and its meaning for the biogas sector will be introduced and discussed, respectively. The main part of this thesis is the in depth analysis of the sustainability of the biogas production in the village Bollewick. Lastly, concluding remarks will be given.

The goal of this thesis is to find out whether or not the production of biogas from maize and manure in Bollewick is sustainable. To accurately judge the sustainability of decentralized biogas production in Bollewick a set of social, economic, and environmental indicators is applied.

2. Sustainable Development: Definitions

The following section will explore and define the concept of Sustainable Development by using a variety of quotes from pertinent literature. By doing so, the reader gets a glimpse of the diversity of scientific literature that is addressing Sustainable Development.

The second part of this section will discuss issues and supposedly inherent contradictions of the concept by pinpointing these with topics that have been brought up in the first part.

Since its emergence in the 1980’s, the term ‘Sustainable Development’ has been subject to heated discussions and various interpretations by scholars and politicians alike. Given the vast variety of definitions and counter definitions that is offered by the literature, we shall go back to the “first major breakthrough in conceptual insight” (Mebratu 1998, p.501) of the term, made by the International Union for the Conversation of Nature (IUCN) in 1980.

Seven years later, in 1987, the World Commission on Environment and Development (WCED), also known as the Brundtland Commission, published the report ‘Our Common Future’ which entails the up to date most cited and most widely accepted definition of the concept, elevating it on the international political agenda.

The report defines ‘Sustainable Development’ as development that “meets the needs of the present without compromising the ability of future generations to meet their own needs.” (WCED, 1987)

Basic human needs are conventionally defined “in terms of adequate food, water, health care, shelter and minimum education.” (Hediger 1999, p.1134)

According to Elliot (2009, p.117), “it is generally acknowledged that […] the report did much to bring the term ‘Sustainable Development’ into the popular consciousness and onto public agendas”. By “referenc[ing] to the centrality of [human] needs” (Redclift 1992, p.395) and combining this thought with the idea that the environment has limited capabilities, i.e. limited natural resources, to support present and future generations “the Commission underlines the strong linkage between poverty alleviation, environmental improvement, and social equitability through economic growth.” (Mebratu 1998, p.501 et seq.)

As the previous quote implies, the concept of Sustainable Development is transcending a variety academic of fields, making it an interdisciplinary science. The interdisciplinary character of the term is often portrayed as the so-called three pillars of Sustainable Development, namely the Environment, the Economy, and the Society. The underlying idea of this construct is the interdependency between the three pillars with the ulterior motive, or objective of Sustainable Development being “to maximize the goals across all three systems.” (Elliot 2009, p.118)

Since the concept of Sustainable Development is aiming to establish a holistic and interdisciplinary framework “very extensive systems are considered, which include the entire economy and society of the world, as well as the interacting ecosystems.” (Klauer 1999, p.115)

The following figures are illustrating the notion of the three pillars of Sustainable Development and their interdependencies.

![Diagram of Sustainable Development](image)

**Figure 1:** The Objectives of Sustainable Development (Elliott, 2009)

While Figure 1 illustrates Sustainable Development and its goals in a triangular way, Figure 2 displays the previously mentioned interdependency between the three systems in a circular fashion.
As the arrow indicates, Sustainable Development is achieved within the area where all three systems are overlapping, meaning that “sustainability is situated at the intersection of environmental protection, economic growth, and social justice.” (Beauregard 2003, p.72) This area, respectively intersection “conjoins human demands of the Earth without endangering the systems on which survival depends” (Elliot 2009, p.119) meaning that “sustainability is equated with the preservation of [these] systems, or of certain characteristics of [these] systems.” (Klauer 1999, p.115)

2.1. Capital Theory Approach to Sustainable Development

Closely linked to the construct of the three pillars of Sustainable Development is the Capital Theory Approach (CTA) to Sustainable Development. According to De Wit and Blignaut (2000, p.112), “the CTA is based on the idea that the maintenance of a stock of capital over time is prerequisite for Sustainable Development.” Mebratu (1998, p.509) puts it more bluntly by stating that the neoclassical approach of the capital theory means “[turning] the environment into a commodity that can be analyzed just like other commodities.” Nevertheless, the CTA to Sustainable Development has the potential to define “relatively simple indicators for sustainable development”, which policy-makers can use when it comes to questions concerning “the operationalisation of sustainable development.” (De Wit/Blignaut 2000, p.112)

Costanza and Daly (1992) are distinguishing between three types of capital, namely natural capital, human capital and manufactured capital, which are roughly “corresponding […] to the traditional economic factors of production of land, labour, and capital.” (Costanza/Daly 1992, p.38) Since human and manufactured capital both largely depend on natural capital we can consider it as the most important one of all three and shall therefore start off by defining this term.

2.1.1. Natural Capital

In order to get a basic idea of what natural capital entails we shall first consider the definition of this term given by Miller and Spoolman. According to them (2009, p.9), natural capital includes all “natural resources and natural services that keep us and other forms of life alive and support our economies.” In Costanza’s and Daly’s rather functional view (1992, p.38), natural capital is “a stock that yields a flow of valuable goods or services into the future.” ‘Services’ hereby refer to “functions of nature, such as purification of air and water, which support life and human economies.” (Miller/Spoolman 2009, p.9) The (environmental) functions stated in the previous definition of services can be understood as “the capacity of natural processes and components to provide goods and services that satisfy human needs.” (Ekins et al. 2003, p.169)

As indicated by this quote, the centrality of the satisfaction of human needs, which we have already established discussing the Brundtland Commission’s definition of Sustainable Development, seems also to be crucial in conceptualizing the CTA.
In addition, natural capital provides different types of environmental functions, which we already came across earlier in this section and which are especially relevant concerning production processes. On the one hand, the functions of natural capital are providing resources for the production process itself. On the other hand, “the absorption of wastes from production, both from the production process and from the disposal of consumption goods” (Ekins et al. 2003, p.167) is a function of natural capital that is crucial for humanity. In essence, the concept of natural capital can be understood as a “metaphor [. . .] [indicating] the importance of elements of nature (e.g. minerals, ecosystems and ecosystem processes) to human society”, i.e. providing goods and services for humanity. (Ekins et al. 2003, p.169)

The following table sums up the main characteristics of natural capital with special consideration of its functions.

<table>
<thead>
<tr>
<th>Media</th>
<th>Main characteristics determining functioning of the (ecosystem)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>Atmospheric properties and climatological processes (e.g. air quality, precipitation, temperature, wind)</td>
</tr>
<tr>
<td>Water</td>
<td>Hydrological processes and properties (e.g. water reservoirs, runoff, river discharge, groundwater table, water quality)</td>
</tr>
</tbody>
</table>
| Land  | – Bedrock characteristics and geological processes (e.g. minerals, tectonics)  
|       | – Geomorphological processes and properties (e.g. weathering, albedo)  
|       | – Soil processes and properties (e.g. texture, fertility, biological activity) |
| Habitats | – Vegetation characteristics (e.g. structure, biomass, evapotranspiration)  
|        | – Flora and fauna (e.g. species diversity, dynamics, nutritional value)  
|        | – Life-community properties (e.g. food chain interactions, decomposition)  
|        | – Conservation values/integrative aspects (e.g. integrity, uniqueness) |

In regard to the topic of this thesis, the sustainability of decentralized bioenergy production, Costanza’s and Daly’s distinction between two broad types of natural capital is important. One the one hand, there is renewable natural capital, which “is active and self-maintaining using solar energy” (Costanza/Daly 1992, p.38), i.e. ecosystems providing for example biomass, food and fodder, which in turn can be harvested. In addition, as the term ‘renewable’ implies, renewable natural capital has the capability of renewing itself, producing “both ecosystem goods […] and ecosystem services […] using its own capital stock and solar energy.” (Costanza/Daly 1992, p.39)

On the other hand, there is non-renewable natural capital, of which “fossil fuel[s] and mineral deposits” (Costanza/Daly 1992, p.39) are the classical examples.

For now we shall not go more into detail concerning different types of renewable and non-renewable natural capital. We will discuss this topic in depth, especially regarding the provision of renewable energy and its sustainability later in this thesis.

Now we want to turn our attention briefly to the other two forms of capital, namely human and manufactured capital.
2.1.2. Human Capital

The second type of capital that is conceptualized in the capital theory is human capital. Broadly speaking, human capital "comprises all individuals' capacities for work" (Ekins et al. 2003, p.163) and can also be referred to as "the stock of education, skills, culture, and knowledge stored in human beings […]" (Costanza/Daly 1992, p.38)

Knowledge, skills and the like are "acquired through schooling, training and experience and are useful in the production of goods, services, and further knowledge." (Kumar 2006, p.153) Being “a factor of input in production function[s]” (Kumar 2006, p.154) it was widely believed that human capital is capable of generating long-term sustained growth. (Cohen/Soto 2007) In contrast to this interpretation of human capital, advocates of neo-classical economics “described human capital as an ordinary input unable to generate endogenous growth”, therefore being vastly overstated in regard to economic growth.

Worth mentioning is that social and organisational capital often appear as connected to human capital. These comprise "the networks and organisations through which the contributions of individuals are mobilised and coordinated." (Ekins et al. 2003, p.163)

2.1.3. Manufactured Capital

The last type of capital we shall consider for the Capital Theory Approach to Sustainable Development is manufactured capital. It “comprises material goods [such as] tools, machines, buildings, [factories and] infrastructure, [which makes it] fundamentally different from environmental resources.” (Ekins et al. 2003, p.167/168) These and “other physical artefacts [are] usually associated with the term ‘capital’”. (Costanza/Daly 1992, p.38) In opposite to natural capital “the destruction of manufactured capital is very rarely irreversible.” (Ekins et al., p.168)

Speaking in general terms regarding the CTA to Sustainable Development we can state “each type of capital may […] be associated with a type of sustainability.” (Ekins et al. 2003, p.167) Any decline in the capital stock can be regarded as unsustainable, meaning “a declining capital stock is an unambiguous indicator of unsustainability in the flow of goods and services that derive from it.” (Ekins et al. 2003, p.167) This means in turn, that if a capital stock can be quantitatively or qualitatively maintained or enhanced over a certain period of time, the capital stock is sustainable. A question that comes to mind in this regard is whether the different types of capital can, at least theoretically, act as substitutes for each other.

As we have established before, sustainability depends on the maintenance of certain stocks of capital. Especially in regard to natural capital the question is whether the capital stock, respectively certain components of it, “are non-substitutable, i.e. [do] they contribute to welfare in a unique way that cannot be replaced by other capital components”? (Ekins et al. 2003, p.167)

2.2. Strong and Weak Sustainability

The substitutability of the different types of capital and its components is described by the concepts of strong and weak sustainability.

These two concepts are either based “on an ethical premise of keeping the general production capacity of the economy constant, or maintaining essential functions and capacities of the environment intact over time.” (Hediger 1999, p.1121)

2.2.1. Strong Sustainability

The concept of strong sustainability originated from ecological economics. It considers the economy as an “open subsystem of the finite and non-growing global ecosystem, [namely] the environment.” (Hediger 1999, p.1123) It is based on the laws of thermodynamics, which requires “that certain properties of the physical environment must be sustained.” (Hediger 1999, p.1123)
“Strong sustainability regards natural capital as providing some functions, [labelled as ‘critical natural capital’], that are not substitutable by man-made [(manufactured)] capital.” (Gutés 1995, p.147) Ekins et al. (2003, p.168) state in this context that the environmental characteristics that are contributing in a unique way to welfare, such as “irreversibility, uncertainty and the existence of ‘critical’ components of natural capital are seriously limiting the “substitutability of manufactured for natural capital.” ‘Critical natural capital’ in this sense refers to “natural capital, which is responsible for important environmental functions and which cannot be substituted in the provision of these functions by manufactured capital.” (Ekins et al. 2003, p.169)

Strong sustainability is a concept of environmental conversation. Therefore, it “is generally formulated in keeping some aggregate of environmental assets, or natural capital constant over time.” (Hediger 1999, p.1125)

Since the production of manufactured capital is mostly dependent on natural capital, “it can never be a complete substitute for resources.” (Ekins et al. 2003, p.169)

2.2.2. Weak Sustainability

Opposite to strong sustainability is the concept of weak sustainability. This notion of sustainability “is an economic principle which is founded within the body of neoclassical capital theory” (Hediger 1999, p.1122) and “can be presented as a direct application of the savings-investment rule from growth theory with exhaustible resources.” (Gutés 1995, p.148)

In contrast to strong sustainability, which generally considers the different types of capital as non-substitutable, the concept of weak sustainability regards this substitutability to be possible, where appropriate. “The assumption underlying weak sustainability is that there is no essential difference between different forms of capital or between the kinds of welfare which they generate.” (Ekins et al. 2003, p.168)

In this line of thought weak sustainability seeks to put monetary value on the different kinds of capital and the services they provide. Following the assumption of weak sustainability, namely that all types of capital are interchangeable, this monetisation makes sense out of an economic point of view. In practice, however, the above-mentioned monetisation of different types of capital and the services they provide is very difficult to achieve as well as the attempt of making it operational. In any case, the numbers that can be obtained from the monetisation of capitals are only capable of showing whether or not weak sustainability has been achieved, meaning whether or not the overall welfare has been maintained. In turn, it is not possible to judge whether or not the assumption of substitutable capitals is viable in the first place. Since weak sustainability disregards any differences from the beginning the importance of such differences is neglected from the start.

This brings us back to the human-centred bias of the concept of Sustainable Development, which also applies to weak sustainability. It implies that “there is no need to fundamentally alter the predominant narrative of a human-centred view of nature or the existing discourse on what constitutes economic progress.” (Elliott 2009, p.119)

Conclusively, Connelly (2007, p.265) criticizes the extreme positions, especially the one of weak sustainability, by saying that they have hardly anything to do with Sustainable Development anymore. According to him, this “typology [is] reduced to two contrasting positions characterized as ‘weak’ and ‘strong’, bracketed by a purportedly unsustainable, traditional economic paradigm at the weak end and a model of ideal of an ideal Green society at the other.”

2.3. Concluding remarks concerning the definition of Sustainable Development

We shall suffice by concluding that “the level of admitted substitution between natural and man-made [(manufactured)] capital dictates the strength of sustainability: the stronger it is, the more complementary different forms of capital are considered.” (Quental et al. 2011, p.260)

As we have seen from this brief attempt to define Sustainable Development and its accompanying concepts, it is truly an interdisciplinary field of study. Because of its interdisciplinary character it is hard to find a definition on which all scientific fields engaged in it can agree. Connelly (2007, p.262)
argues in this context that trying to pin down an exact definition of Sustainable Development, meaning statements like “sustainable development is such-and-such”, are not of any help in regard to the understanding of how Sustainable Development “is actually developed and used as a concept […] [and that such statements] should often be seen as rhetorical claims.”

Instead he offers an approach to the definition of Sustainable Development given by Haughton and Counsell (2004, p.72-73). They state that “rather than to focus on a definitive meaning of ‘sustainable development’ … it is necessary to recognise the multiplicity of sustain-abilities and to analyse ways in which these are shaped and mobilised in political discourse.”

Therefore, we shall not go further into detail in defining the term but suffice for the time being by saying that “Sustainable Development can best be described as a complex, dynamic system.” (De Wit/Bliiognut 2000, p.117) It is a “global challenge, which calls for envisioning both conversation and change.” (Hediger 1999, p.1138)

2.4. Sustainable Development: Issues

When reading about Sustainable Development, one often comes across words like ‘cliché’, ‘conceptual ambiguity’, ‘vagueness’, ‘confusion’ and the like. The following section sets out to analyze and discuss the criticism surrounding the concept of Sustainable Development, especially regarding the definitions that we have come across earlier.

The central objection towards the definition of Sustainable Development is its anthropocentric bias (Sachs, 1999), particularly meaning the emphasis, which the Brundtland Commission put on “meeting human needs, rather than the protection of nature or the biosphere.” (Redclift 1992, p.395) In this understanding the environment must be utilized in such a way so it can sustain the well being of present and future generations, providing natural resources for long-term economic growth and prosperity. In this view, Sustainable Development calls for the conversation of development, not for the conversation of nature, meaning that “it is not the environment which needs to be sustained, above everything else, but present and future levels of production and consumption.” (Redclift 1992, p.397)

As we have established in the first part of this section, the Brundtland Report was able to highlight the strong linkage between poverty alleviation, environmental improvement, and social equitability through economic growth (Mebratu 1998), which “[brought] […] the term ‘Sustainable Development’ into the popular consciousness and onto public agendas” (Elliot 2009, p.117).

With economic growth being a central objective of Sustainable development, growth can be understood as “a quantitative increase in physical scale, while development is a qualitative improvement or unfolding potentialities.” (Daly 1990, p.1)

It is questionable though whether or not an expanding and therefore growing economy and environmental sustainability is an oxymoron in light of the previously mentioned anthropocentric notion of Sustainable Development and further, out of a human point of view, if the environment is worth sustaining, even if it does not necessarily need to generate welfare for humanity. In Ekins et al. (2003, p.173) view, environmental sustainability “means maintaining the environment’s natural qualities and characteristics and its capacity to fulfil its full range of functions, including the maintenance of biodiversity.”

At first sight it seems that in the Commission’s and in most economists’ stance, the maintenance and protection of biodiversity and therefore the environment is only worthwhile because of the important ecological functions it provides in terms of developmental concerns. Its intrinsic value seems to play a subordinate role.

It is on the other hand of course debatable whether “an essentially romantic sensibility that conceives Nature as a moral and spiritual force” (Robinson 2004, p.377), aspiring to sustain the environment because of its intrinsic value really contributes practical insights to the discussion, how we, and the concept of Sustainable Development can reduce severe poverty without accepting a certain amount of environmental degradation.
Nevertheless, there are certain statements in the report itself that lack an element of sensibility regarding nature’s intrinsic value:

“The sustainability of ecosystems on which the global economy depends must be guaranteed”, (WCED 1987, p.23) This shows that ecosystems, i.e. the environment, is mainly worth protecting because it provides natural capital and natural resources for humanity. In this view, the environment is economically utilized in order to sustain human welfare and is not protected because of its intrinsic value. In line with the anthropocentric view on Sustainable Development the report understands environmental degradation as a problem that has to be managed in order to guarantee further economic growth for present and future generations.

Although “the report was underpinned by a strong ideology that nature and the Earth could be managed through reviving economic growth” (Elliott 2009, p.122) it still appears that environmental degradation becomes a management problem when the environment is incapable of providing a steady resource base for humanity’s economic growth aspirations. As stated in Redclift (1992, p.396), Rees (1990, p.18) underlines the previous thought by saying that “our mechanical perception of the biosphere is dangerously superficial and our continued belief in the possibility of sustainable development based on growth-orientated assumptions of Neo-Classical economics is illusory.”

Neoclassical economists oppose this critique by defining “the objective of development as [an] ‘increase in social welfare’” (Lélé 1991, p.609), equating it with growth in GNP and measuring it, inter alia, in per capita consumption. By measuring “social welfare in terms of economic output” they are pointing out, that “economic growth does not necessarily mean growth in physical throughput, thus ‘proving’ that there is no contradiction between sustainability and development.” (Lélé 1991, p.609)

In case of developing countries there might be some truth to this claim since a lot of people living in these areas have in some cases no other choice than to exploit their surrounding environment and the resources it provides unsustainably in order to guarantee their short-term survival. In other words, “many environmental problems in developing countries originate from a lack of development, that is from the struggle to overcome extreme conditions of poverty.” (Lélé 1991, p.612) So in this point of view, the main objective of Sustainable Development is the reduction of “the absolute poverty of the world’s poor through providing lasting and secure livelihoods.” (Redclift 1992, p.396)

Therefore, the Brundtland Commission put much of its “attention on social and economic conditions in developing countries, and their connection to environmental degradation,” focussing especially on ecological sustainability, which can in the Commission’s point of view not be “achieved if the problem of poverty is not successfully addressed around the world.” (Robinson 2004, p.372)

Achieving a certain level of development, meaning an increase in GNP could lead to improved environmental sustainability, for instance through technological solutions. With a higher level of per capita income, people in developing countries might not have to fight for survival on a daily basis, meaning that they might not have to use the natural resources at their disposal in an unsustainable way. The Brundtland Commission argues in this regard that “ecological sustainability cannot be achieved if the problem of poverty is not successfully addressed around the world.” (Robinson 2004, p.372)

For the sake of visualisation, the generic ‘mainstream’ perception of the link between poverty and environmental degradation is portrayed in Figure 3.

Figure 3: The mainstream perception of the link between poverty and environmental degradation (Lélé, 1991)
Since environmentally sound poverty alleviation can be considered as one of main operational objectives of Sustainable Development, the underlying question here is how the concept, respectively its proponents, intend to reduce poverty while sustaining the environment and its resources.

Here the question of basic human needs, with economic growth being a tool to satisfy these needs comes into play again. According to the report ‘Our Common Future’, meeting basic human needs “depends in part on achieving full growth potential, and sustainable development clearly requires economic growth in places where such needs are not being met.” (WCED 1987, p.42)

With development being “a process of directed change” Lélé (1991, p.609) objects that Sustainable Development mostly focuses on a set of techno-economic measures as a means of steering economic development and meeting human needs in developing countries in a certain direction. The previously mentioned measures include: “designing for efficiency, proper resource pricing, managing common resources, and building management capacity.” (Lélé 1991, p.613)

The critical objectives of Sustainable Development in regard to developing countries are given in Figure 4:

![Figure 4: The critical objectives of sustainable development (Elliott, 2003)](image)

Although the Brundtland Commission states that “[economic] growth by itself is not enough” and that in order to develop sustainably, “societies [have] to meet human needs both by increasing productive potential and by ensuring equitable opportunities for all” (WCED 1987, p.42), it is according to Robinson (2004) still problematic to assume that developmental issues and poverty resulting from it can be solved solely by economic growth and technological solutions. He states that “even if significant economic growth were possible without running up against ecological or socio-political limits” (Robinson 2004, p.377) the “conceptualization of the objectives of development […] [and the] characterization of the problems of poverty and environmental degradation” (Lélé 1991, p.613) are still major weaknesses of the formulation of Sustainable Development, which makes it ”a classic case of a technological fix, which will perpetuate the underlying disease by treating only the symptoms.” (Robinson 2004, p.377)

So if economic growth is neither capable of removing poverty, nor sustaining the environment “there is no reason to have economic growth as an operational objective of SD.” (Lélé 1991, p.614) “If a sustainable style of development is [despite the previously mentioned critique] to be pursued, then both the level and particularly the structure of demand must be fundamentally changed” (Lélé 1991, p.611)

But does changing the structures of demand also apply to future generations and is this future demand “to be determined by the existing distribution of resources and patterns of consumption?” (Redclift 1992, P.397) Having the unequal distribution of wealth and present resource consumption between North and South in mind, “it is unlikely that future development can be sustainable.” (Redclift 1992, P.397)

For now we have to conclude that “since the human economy is a subsystem of a finite global ecosystem, which does not grow, even though it does develop, it is clear that growth of the economy cannot be sustainable over long periods of time.” (Daly 1990, p.1)

The last issue we want to discuss in this part is the alleged definitional vagueness of term Sustainable Development.
As we have established before, a variety of scientific fields and their respective proponents coin the concept of Sustainable Development. These define the term, its goals and its conceptualization depending on their prevailing field of study. The problem arising from differently coined definitions is not so much the variety itself, but their various interpretations. Therefore, “one of the most striking characteristics of the term sustainable development is that it means so many different things to so many different people and organizations.” (Robinson 2004, p.273)

Consequently, the discussion about the meaning of Sustainable Development rather reflects the “political and philosophical position of those proposing the definition more than any unambiguous scientific view.” (Robinson 2004, p.273 et seq.)

Although there might be some attractiveness to the lack of definitional precision of the term, i.e. “leaving it somewhat open just exactly is meant by the term sustainable development (Robinson 2004, p.274) “the absence of a clear theoretical and analytical framework […] [and] the absence of semantic and conceptual clarity is [nevertheless] hampering a fruitful debate” (Lélé 1991, p.607 et seq.) how an environmentally and socially sound form of development can be achieved. Connelly (2007, p.260) underlines this criticism by stating that “as long as sustainable development is viewed as ‘everything and nothing’ it is weakened as a policy goal.”

Although Sustainable Development might have a vague core meaning and is therefore subject to various interpretations and criticism, we should not neglect the fact that its value lies in its integrative character. Integrating social dimensions of sustainability with biophysical ones was the crucial message of the Brundtland Commission, and is also of significant importance today.

Since “it is only possible to judge ex post whether a certain development has indeed been sustainable” (Klauer 1999, p.117) the planning and implementation of the concept can only be achieved when all societal actors work together and “agree upon the necessary measures” (Klauer 1999, p.118) to actually reach ‘our common future’.

So in order to actually achieve a sustainable future, whatever it may look like, the challenge of the Concept Sustainable Development “is to do planning and decision making while balancing three tensions: (1) maintaining scientific credibility, (2) assuring practical saliency, and (3) legitimizing the process to multiple participants.” (Joyce 2003, p.340)

3. Bioenergy and Sustainable Development

A central issue in the Brundtland Commission’s report ‘Our common future’ is the sustainable provision of energy. It mostly stresses the fact that “the burning of fossil fuels puts into the atmosphere carbon dioxide, which is causing gradual global warming” (WCED 1987, p.12), which is most commonly referred to as the Greenhouse Effect. “The combustion of fossil fuels is the largest source of health-damaging air pollutants, as well as being the major source of Greenhouse Gas (GHG) emissions.” (Kaygusuz 2007, p.73)

Due to “increased [non-renewable] resource use” the Greenhouse Effect is a “threat to life support systems” (WCED 1987, p.33) thereby threatening economic development, which is, as we have established before, a crucial objective of Sustainable Development. “Although energy is itself is not a human need, it is critical for the fulfilment of all needs.” (Kaygusuz 2007, p.73) Having in mind that the combustion of non-renewable sources of energy is releasing carbon dioxide (CO₂) into the atmosphere, the question is how economic development can be sustained without further increasing the Greenhouse Effect.

Since “societies’ access to energy” is of high importance “for wealth creation and sustained development” (Buchholz et al. 2007, p.6084), renewable energy sources have the capability of mitigating the impacts of climate change. Their provision is in most cases carbon neutral; therefore they do not increase the Greenhouse Effect.

“Bioenergy is generally considered to be a carbon neutral source of energy, as during conversion and combustion roughly the same amount of CO₂ is emitted as was absorbed during the feedstock growth.”
“Unlike fossil fuels, biomass is renewable in the sense that only a short period of time is needed to replace what is used as an energy resource.” (Acaroglu et al. 2005, p.252)

To find out at what scale and under what circumstances this proves to be true and can therefore be considered sustainable is the central subject of this thesis.

The sustainability of bioenergy systems depends on various factors. Generally these “include requirements for reduction of greenhouse gas emissions compared to fossil alternatives, criteria for sustainable land use and criteria for social sustainability.” (Schubert/Blasch 2010, p.2798)

The previous quote implies a connection to the three pillars of Sustainable Development, namely the Environment, the Economy and the Society, which we have elaborated and discussed in the first part.

In order to assess the sustainability of decentralized bioenergy production a detailed literature review was undertaken. To complement the literature review methodologically, the author has conducted several interviews with various actors engaged in the field of bioenergy. Thematically the interviews capture the three pillars of Sustainable Development in regard to the decentralized production of bioenergy.

The social dimension is covered by questions concerning participation processes before and during the implementation of the biogas plant in the so-called “Bioenergy Village” Bollewick in Mecklenburg-Western Pomerania. The profitability of small-scale biogas plants is topic of the questions regarding the economic dimension. And last but not least, the environmental sustainability of decentralized bioenergy production represents the environmental dimension of Sustainable Development.

In order to get an idea of the various application possibilities of bioenergy, Figure 5 gives an overview of the bioenergy feedstock, bioenergy products and type of end use.

The Bioenergy Village Bollewick, which we will shortly introduce later on, produces heat and electricity out of biogas, which is in turn obtained from maize and manure. Since the village is the case study of this thesis we will only assess the sustainability regarding this one branch of bioenergy with the end use being electricity and heating.

Before we assess the sustainability of decentralized bioenergy production in depth, we shall turn our attention to the methodology used for this thesis.
4. Methodology

The methodological approach to the sustainability of decentralized bioenergy production was taken in form of qualitative interviews. To be more precise, a mixture of guided, problem-orientated and expert interviews was conducted in advance to the writing of this thesis.

According to Reuber et al. (2005, p.133) problem-orientated interviews have the advantage of being open to the interviewee, meaning that there are no pre-determined answers given by the interviewer. Instead the interviewee has the possibility to openly answer the questions in a conversation-like fashion. The questions are also semi-structured so that the interviewer can flexibly react to the course of the conversation.

The guided interview is in so far different to the problem-orientated one as it is structuring the conversation thematically. (Reuber et al. 2005, p.135)

Expert interviews count as a methodology of gaining special knowledge from ‘experts’. They have the specific role of being a source of special knowledge concerning the topic of interest. (Gläser et al. 2009, p.12)

Depending on the interview partner and based on the reviewed literature the author prepared questions in regard to the several topics of interest and the interviewee’s respective special knowledge.

Applying the concept of the three pillars of Sustainable Development to the sustainability of decentralized bioenergy production, the above-mentioned topics of interest are the following:

- Participation Processes in the Bioenergy Village Bollewick before and during the implementation of the biogas plant and possible socio-economic benefits for the villagers and the consequential possibility to overcome structural weaknesses like unemployment in rural areas
- Funding of the biogas plants in Bollwewick
- Feasibility of the ‘Energy Transition’ to Renewable Energy Sources aspired by the German government
- Profitability and efficiency of biogas plants depending on scale and the degree of capacity utilization
- Functioning of biogas plants
- Impacts of the German Renewable Energy Law (Erneuerbare Energien Gesetz – EEG) and its amendment in 2009 on biogas production in general and on its profitability in detail
- Impacts of a possible subsidy reduction on the bioenergy sector
- Negative environmental impacts of bioenergy production, such as:
  - threat of monocultures (‘maize deserts’) and consequential biodiversity loss
  - over-fertilization
  - increased water usage / groundwater depletion
- Consequences of the EEG’s so-called ‘manure bonus’ on maize cultivation and land consumption
- Land Use Change

This overview only gives a general impression about the different subjects of the interviews. Hence, all interviews can be found in transcribed and translated form in the appendix. Since not all of what was being said by the different interviewees is directly relevant for the topic of this thesis and will therefore not be quoted, some of the interviews are not completely translated. In case a citation refers to parts of an interview that has not been translated, the paragraph in question is translated so the reader understands the context of used quote. In general, the author tried to translate the interviews as close as possible to the German wording and the interviewee’s way of talking.

This also applies to the transcription of the interviews. According to Reuber et al. 2005, p.155), the aim of a transcription is to make an interview permanently available on paper for scientific analysis. Although transcripts can always be seen as selective constructs, the author made sure to always write down and translate the exact wording so that theses made by the author can be substantiated with quotes.
The people that have been interviewed for this thesis have different occupations and backgrounds and have therefore different stances in regard to the sustainability of decentralized bioenergy production. This is in so far relevant for the following chapters as the quotes that will be used from the different interviews and the argumentation resulting from it should always be seen in correlation with the different perceptions and opinions but also occupations of the various interviewees. In order to be able to reflectively judge the sustainability of decentralized bioenergy production the author will contrast the reviewed literature with statements from the interviews.

The following table lists the interviewees, their occupation and the broad topic of the respective interview.

Table 2: List of interviewees

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Occupation</th>
<th>Interview Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bertold Meyer</td>
<td>Mayor Bollewick Village</td>
<td>Introduction “Bioenergy Village” Participation Processes, Funding, EEG, Feasibility, Land Use Change, Added Value</td>
</tr>
<tr>
<td>Henk van der Hamm</td>
<td>Farmer, Biogas Plant Operator</td>
<td>Working Biogas Plant, Land Use (Change), Crop Rotation</td>
</tr>
<tr>
<td>Gerd Hampel</td>
<td>Renewable Energy Consultant, Spokesman of the nation-wide professional association Biogas, Engineer</td>
<td>Profitability, Capacity Utilization and Efficiency of Biogas Plants, EEG, Feasibility, Centralized compared to Decentralized Bioenergy Production, European Emission Trading Scheme, Added Value</td>
</tr>
<tr>
<td>Gundolf Schneider</td>
<td>Engineer, Junior Research, Eberswalde University for Sustainable Development</td>
<td>Profitability, Capacity Utilization and Efficiency of Biogas Plants, EEG, Participation Processes</td>
</tr>
</tbody>
</table>

In addition to the interviews in Table 1 the author had the opportunity to interview two participants of an international Renewable Energy Conference held in Berlin. One interview was conducted with Anne Athiainen who is working for ‘Valonia Southwest Finland, sustainable development and energy-related service’. The other interview was held with Bernd Grabers who is working for the ‘Energieakademiet Samso’, Denmark. Both interviews were mostly about the comparison between the respective municipalities Mrs. Athiainen and Mr. Garbers are engaged in and the Bioenergy Village Bollewick. These interviews can also be found in the appendix.
5. Case Study – The ‘Bioenergy Village Bollewick

The following part will introduce the village Bollewick and will briefly show how it became a so-called Bioenergy Village. In addition, we will state what kind of bioenergy the village is producing and what output its biogas plants have. The sustainability of decentralized bioenergy systems in terms of public participation, environmental impact and economic efficiency will be analyzed later on in this thesis. The case study should be understood more as one example of decentralized bioenergy production, which helps judging the sustainability of this type of energy provision.

But before we introduce Bollewick itself we shall say a few words about Mecklenburg Western-Pomerania (MWP) in Northeast Germany, the federal district the village is situated in.

Figure 6: The village Bollewick

Figure 7: Mecklenburg Western-Pomerania
Due to a lack of industry, MWP is coined more than other German federal districts by the agricultural sector, meaning that comparably more land area is used for agricultural production. According to the Mecklenburg Western-Pomeranian Statistical Office (StatA MV, 2011) 4.725 farms were cultivating 1,351 Million ha of land in 2010 (MWP: 23.193km²).

The average area of land that is cultivated per farm in MWP amounts to 286ha. Compared to the German average of only 56ha of cultivated land per farm it becomes clear that the agricultural sector is of great importance in MWP. This becomes even more apparent considering that 8,1% of the agriculturally cultivated land in Germany is in MWP.

An important source of income in MWP is tourism. Especially the federal district’s coastal areas and the national park “Mecklenburgische Seenplatte”, which is a landscape with big lakes and a unique flora and fauna, are popular holiday destinations. According to StatA MV (2011), more than six million tourists spent their holidays in MWP in 2010.

The lack of industry, high unemployment rates and the exodus of young and well-educated strata of the population are problems that a lot of East German federal districts are facing. Since urban agglomeration centres like Berlin and Hamburg are neighbouring Mecklenburg-Western Pomerania, especially problems like population loss and an aging population are more severe in MWP than in other East German federal districts.

In recent years the MWP federal state government attempted to overcome the above-mentioned structural weaknesses by investing in renewable energy technologies. In 2007, already 20% of MWP’S total primary energy consumption was covered by renewable energy sources. The most important ones are biomass, biogas and wind energy. (StatA MV, 2011)

As we have established in Chapter 1, investments in new technologies are often believed to generate sustained economic growth, thus creating new jobs, new financial circuits and socio-economic effects of which the population benefits.

In light of the strong agricultural sector in Mecklenburg-Western Pomerania, the utilization of energy crops and agricultural wastes such as manure in terms of their capacity to provide sustainable energy gained a lot of importance over the last years. Here, the concept of an energy self-sufficient village comes into play. The rural village Bollewick has approximately 400 inhabitants. In addition the district Kambs has approximately 260 inhabitants. The village stretches along a North-South axis, which is typical for the region.

The previously mentioned structural weaknesses were also noticeable in Bollewick. According to mayor Bertold Meyer, “the enormous exodus of money” (Interview Meyer 2012, p.1), which was occurring due to high oil and gas prices, first appeared in the mid 1990’s.

After attending an excursion to Germany’s first bioenergy village Jühnde in Lower Saxony in the mid 2000’s, Mr. Meyer was interested in analyzing Bollewick’s potential to locally produce its own renewable energy, thereby decreasing the village’s dependency on oil and gas and trying to counteract high unemployment rates and other demographic disadvantages.

Since there is no strict definition of a bioenergy village, “every village has to analyze its own potentials very thoroughly.” (Interview Meyer 2012, p.1) According to Mr. Meyer, the potentials that had to be analyzed were saving potential, production potential and purchase potential that emerge when switching to renewable energy sources. In order to analyze these potentials the mayor, two local farmers and engineers founded a working group called ARGE. With support of the municipality and the federal district, they developed the concept Bioenergy Village and “formulated an application to the municipality.” (Interview Meyer 2012, p.2)

After collecting money and getting a “subsidy from the community hall” (Interview Meyer 2012, p.2) they analyzed the above-mentioned potentials in 2007/2008. “After this analysis of potentials was finished we saw the opportunity to do something and decided to become a bioenergy village.” (Interview Meyer 2012, p.2) Parallel to the decision of becoming a bioenergy village a series of photovoltaic roof installations were built, inter alia on the so-called ‘big barn’, which functions as the community hall of the village. In addition, all street lights were changed to LED in order to further decrease the village’s energy consumption.
Since the potential analysis brought to light that the heating system could not run efficiently in light of the low demand back then, it became clear that “the access was a biogas plant and the useful and waste heat was the most efficient solution.” (Interview Meyer 2012, p.2)

By the end of 2010 the decision was made that two agricultural family businesses would build biogas plants and would carry the investments for these themselves. The farmers invested 1.9 and 1.8 Million Euro, respectively. In exchange for building the biogas plants the municipality was carrying the costs of the construction of the local heating network and “decided to cover all communal buildings with photovoltaic installations, at least the ones where it makes economic sense.” (Interview Meyer 2012, p.11) “All in all, by the end of the year [2012] the village Bollewick – the municipality, not the village – the municipality will have invested 1,4 million Euro in renewable energy plants.” (Interview Meyer 2012, p.2) Including energy efficiency measures like the above-mentioned LED street lights, the total investment in becoming an energy self-sufficient village “amount[s] to 5.4 Million Euro” (Interview Meyer 2012, p.11)

Today both biogas plants are in operation and are feeding the grid. One plant is operating since May 2011, the other one since February 2012. They are utilizing maize silage on the one hand and manure on the other hand to produce biogas. According to farmer van der Ham, the ratio between maize and manure that is used for the production of biogas in his plant is 50-50. For efficiency purposes both plants are utilizing the heat that is generated during the biogas production process and supply the village’s heating network with it. This type of energy utilization is called combined heat and power (CHP). It “integrates heat and power (electricity), in one single, highly efficient process […] and generates electricity whilst also capturing usable heat that is produced in this process.” (2012) The German Renewable Energy Sources Act (Erneuerbare Energien Gesetz – EEG) alongside its benefits for and impacts on bioenergy production, which we will also assess in the course of this thesis, entails an additional subsidy for CHP plants. For this reason and for efficiency purposes the municipality decided to install two CHP biogas plants. Since the heating network is still under construction, only calculated values for the plants’ heat generation are available at the moment.

In order to supply the biogas plant with the required substrate farmer van der Ham is cultivating approximately “120ha [maize as a substrate] for […] [his] biogas plant.” (Interview van der Hamm 2012, p.1) Another 120ha is according to him used for the cattle. This is well above the German average of 56ha of cultivated land per farm. With a total size of approximately 240ha, Mr van der Ham’s farm is slightly under Mecklenburg Western-Pomeranian average of 286ha. According to Mr. van der Ham, 120ha are sufficient enough to supply the village with electricity and heat and even produce surplus. So there is no need to expand the acreage. To prevent negative environmental effects such as soil erosion and mineral leaching Mr. van der Ham is also “cultivating intermediate crops, like green rye.” (Interview van der Ham 2012, p.2) According to Mr. van der Hamm no artificial fertilizers are required. “Fertilizers we have on our own because of the biogas plant – the substrate is the [organic] fertilizer.” (Interview van der Hamm 2012, p.2) Transportation distances are very small, so the accompanying CO₂ emissions are within acceptable boundaries.

Both biogas plants have an electric output of 500 Kilowatt (kWₑ) and a thermal output of 500kW (kWₜ). Kilowatt is a unit of power, meaning that power is the rate at which energy is generated or consumed. The energy that is generated by the biogas plants over a certain period of time, on the other hand, is measured in Kilowatt-hours (kWh). A strategy paper published by the municipality Bollewick in 2009, states that the plants will be capable of producing five to six Million kWh electricity per year. Unfortunately the municipality Bollewick has not released any current figures regarding the actual electricity production until now. In order to find out the actual energy consumption in Bollewick a short telephone interview was conducted with engineer Olaf Schätzchen, who is a member of the previously mentioned ARGE working group. According to him, the biogas plants are operating 8000 hours per year. Multiplying these 8000 operating hours with the electric output of 500kW equals four million kWh of produced energy. Since the heating network is still under construction, the four Million kWh heat that the biogas plant is capable of producing can only be seen as a calculated value. To verify the electrical production capacity Mr. Schätzchen states, another telephone interview was conducted with Jürgen Dettmann. He is also an engineer and is working for the municipality Teterow, a small village that is also situated in MWP. Mr. Dettmann, who has a profound knowledge regarding biogas plants states that the production capacity of four Million kWh is realistic. According to the previously

1 http://www.chpa.co.uk/what-is-chp_15.html
mentioned strategy paper, Bollewick’s 100 households are consuming 250,000 kWh per year. The ‘big barn’ is also consuming 250,000 kWh electricity per year, although in light of the photovoltaic installations on its roof, it does not use as much electricity generated from biogas. To verify the total consumption of Bollewick’s households, Mr. Dettmann recommends multiplying the annual electricity consumption of an average 4-person household with the total number of households in the village. Since the municipality Bollewick aspires to supply all of its 100 households with renewable electricity produced by the biogas plants, we shall include this value in the calculation. The German average 4-person household consumes 4430 kWh per year. Multiplying this value with Bollewick’s 100 households equals a total annual energy consumption of 443,000 kWh. The difference compared to the amount of 250,000 kWh stated by the municipality Bollewick might be attributable to the fact that in Bollewick not in every household four persons are living. This calculation has the purpose of verifying that Bollewick is actually capable of exporting surplus electricity to urban agglomeration centres, as stated by the municipality. Comparing these figures shows that besides supplying the whole village with electricity, Bollewick can export a great share of electricity the biogas plants are producing.

All in all, the aim of the Bioenergy Village Bollewick is to supply the municipality and its households with electricity that is locally produced and solely gained out of the renewable energy source biogas. The same applies to the heating network, as soon as it is finished. “The preliminary goal [in this regard] is to connect as many people as possible to the local heating network, so the processes’ efficiency increases.” (Interview Meyer 2012, p.11)

By investing in new technologies and producing its own energy, the municipality Bollewick aspires to create added value and new financial circuits that stay within the village and are thereby benefiting its citizens. The energy surplus the biogas plants are producing will, according to the municipality’s strategy paper, be sold to urban agglomeration centres, which will also be a source of income for the village.

In light of the high investments that had to be made, the villagers have no direct profit participation at the moment. “For now they have cost reductions due to use of renewable energy.” (Interview Meyer 2012, p.12) Due to these cost reductions Bollewick’s citizens are saving 300 to 400 Euro per year, according to Mr. Meyer. These savings will grow with further increases in oil and gas prices. So the villagers have more money at their disposal, which they are spending locally, which ultimately stabilizes the local economy and helps overcoming structural weaknesses.

6. Biogas Plants – Overview

As we have established in the introduction of the case study, Bollewick produces biogas out of maize silage and manure in order to supply the village with electricity and heat. Since a basic understanding of how a biogas plant works is essential for the assessment of the sustainability of bioenergy production, the following part will briefly explain the functioning of a biogas plant.

Biogas is “gas generated from organic digestion under anaerobic conditions by mixed population of microorganisms.” (Balat 2009, p.1283) “Mixed bacterial populations degrade organic compounds, thus producing, as an end-product, a valuable high energy mixture of gases (mainly CH₄ and CO₂) termed biogas.” (Lastella et al. 2000, p.64)

Suitable substrates that can be used for the anaerobic digestion process in biogas plants are energy crops such as maize, animal manures and organic wastes. Concerning the utilization of energy crops for biogas production, maize is the most dominant one since it “is considered to have the highest yield potential of field crops grown in Central Europe.” (Amon et al. 2007a, p.174) Maize is also “the most competitive crop for biogas production due to its high yield of methane [CH₄], easy integration into existing farming systems and good suitability for storage of biomass.” (Grieder et al. 2011, p.132) The quality, i.e. the potential methane yield of maize and other energy crops used for biogas production is already determined on the field.

In general, the potential methane yield of energy crops and manure “depends on their content of substances that can be degraded to CH₄ and CO₂.” (Amon et al. 2007a, p.174) Key influence factors for the methane yield from maize and manure are composition and biodegradability. A maximum methane

http://www.swu.de/privatkunden/energie-wasser/strom/stromspartipps/stromverbrauch.html
yield is crucial for the economic efficiency of a biogas plant because the production costs have to be covered by it.

The following figure illustrates the influences on biogas production from maize along the production process.

![Figure 8: Influences on biogas production from maize along the production process (Amon 2007a)](image)

![Figure 9: Schematic overview of the biogas pathway (Hennig/Gawor, 2012)](image)

Figure 9 is a schematic overview of the biogas pathway. Maintaining the water content of the substrate above 50% is necessary to make it suitable for the fermentation process. In general, the different substrates that are being used for the production of biogas have different requirements and therefore different technologies have to be applied. “These technologies can be classified by the type of reactor into wet fermentation reactor (up to ~15% dry matter content) and dry fermentation reactor (25-50% dry matter content)”3 In Germany, “approximately 70% of biogas plants […] are based on wet digestion process whereby, besides liquid manure, digesters are also fed with other organic co-feedstock.” (Poeschl et al. 2010a, p.1786)

The following figure shows a typical agricultural biogas CHP plant with an electric and thermal output of 500kW.

---

The solid substrate (maize silage) is stored in a storage unit, i.e. an airtight silo. Manure, the liquid fraction of the substrate is stored in a tank from where it is “pumped into the digester using the central pumping station, which is also needed to carry the digestate to the filling station.” (Pfeifer/Obernberger 2007, p.1865) For better control of the feed-rate the maize silage is fed into the digester by automated screw conveyors. The fermentation of the substrates takes place in the digesters, the end products being biogas and digestate. The digestate is in turn stored in another tank and since it “contains considerable amounts of nutrients […] [it] can be used as a fertiliser on agricultural fields which favours a sustainable closed cycle economy within the course of biogas production.” (Pfeifer/Obernberger 2007, p.1865)

Before the biogas is used in the gas engine to produce electricity and heat it is stored in the in the gasholder, dried and pre-heated, if necessary. Here, also desulphurisation takes place, which is accomplished by injecting air in the gasholder. Removing hydrogen sulphide (H$_2$S) from the biogas through the process of desulphurisation is crucial since this compound has a high toxicity and is causing corrosion when it reacts with steel. Even low concentrations of H$_2$S cause damages in the conversion technology, which drastically reduces the life span of a biogas plant.

As we can see from Figure 10 the digestion takes place in a two-stage anaerobic digestion system, which is predominant in Germany. Separating the “hydrolysis from the other stages of the methane generating process […] allows for [a] more efficient digestion process and for safety.” (Poeschl et al. 2010a, p.1786)

The following figure conclusively illustrates this two-stage anaerobic digestion process with the occurring reactions.
7. Germany’s Renewable Energy Sources Act – Erneuerbare Energien Gesetz (EEG)

The most important tool to increase the share of renewable energy sources in Germany is the Renewable Energy Sources Act (EEG), which came into force on the first of April in 2000. It was “in turn […] further improved in amended versions which came into force on 1 August 2004 and, […] on 1 January 2009.” (Büsgen/Dürrschmidt 2008, p.2536)

“The purpose of this Act is to facilitate a sustainable development of energy supply, particularly for the sake of protecting our climate and the environment, to reduce the costs of energy supply to the national economy, also by incorporating external long-term effects, to conserve fossil fuels and to promote the further development of technologies for the generation of electricity from renewable energy sources.” (EEG 2008, p.4)

In order to achieve the purpose stated above, the Act’s legally binding core is “to increase the share of renewable energy sources in electricity supply to at least 30 per cent by the year 2020 and to continuously increase that share thereafter.” (EEG 2008, p.5) The reference year is 1990.

Table 3 gives an overview of the contribution of renewable energy sources to electricity generation in Germany. (Units in GWh)

Table 3: Contribution of renewable energy sources to electricity generation (Büsgen/Dürrschmidt)

<table>
<thead>
<tr>
<th>Year</th>
<th>Hydro-power</th>
<th>Wind</th>
<th>Biomass*</th>
<th>Photo-voltacs</th>
<th>Gas-thermal</th>
<th>Total electricity generation from renewables</th>
<th>Share of gross electricity consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>17,000</td>
<td>40</td>
<td>1422</td>
<td>1</td>
<td>0</td>
<td>18,463</td>
<td>3.4</td>
</tr>
<tr>
<td>1991</td>
<td>15,900</td>
<td>140</td>
<td>1450</td>
<td>2</td>
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<td>1000</td>
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To create incentives for energy providers to invest in renewable energy technologies, the EEG offers a variety of bonuses and remuneration schemes, the most important one being feed-in tariffs. According to Couture/Gagnon (2009, p.955), they “are increasingly considered the most effective policy at stimulating the rapid development of renewable energy sources (RES).” “The central principle of feed-in tariff policies is to offer guaranteed prices for fixed periods of time for electricity produced from […] RES.” (Couture/Gagnon 2009, p.955) These fixed prices are offered for every kWh of electricity produced. In the EEG, the timeframe in which fixed prices are guaranteed “after commencement of
operations of any new plant (Bechberger/Reiche 2004, p.52) is 15 to 20 years, depending on the RES technology.

Uncoupling the remuneration system “from the average utility revenue per kWh sold” and replacing it by the above-elaborated feed-in tariffs “for the whole amount RES electricity generated” (Bechberger/Reiche 2004, p.52) is one of the most important structural elements of the EEG. In addition, grid operators have an obligation to favour RES power when purchasing electricity. Also, “a Germany-wide equalisation scheme was adopted for the costs grid operators incur as a result of the different amounts of RES each region feeds into the power grid, which leads to an even distribution of the RES power amounts and extends remuneration to all energy supply companies and ultimately to all end-consumers.” (Bechberger/Reiche 2004, p.52) Another important structural element of the EEG is that it entailed provisions regarding the financing of grid extensions and grid connections.

Especially the EEG’s amendment in 2009 entails several bonuses concerning the RES biomass. As we established before, the feed-in tariff is the most important subsidy tool. The tariff for bioenergy plants with an electrical output between 150 and 500 kilowatts is 8.91 cents per kilowatt-hour in 2012. (EEG 2009, p.21) According to §20, clause 2 “the compensations and bonuses for power generated from biomass are decreased by 1 percent per year.” For a bioenergy plant, in our case the biogas plant in Bollewick, with an electrical output of 500kWel, the following tariff reduction will take place over the next few years.

Table 4: Basic compensation Granted by the EEG (BMLEV, 2012)

<table>
<thead>
<tr>
<th>Performance share</th>
<th>Basic compensation in Cent/kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2009</td>
</tr>
<tr>
<td>&gt; 150 kWel to 500 kWel</td>
<td>9.18</td>
</tr>
</tbody>
</table>

Apart from the basic compensation for bioenergy, there are a number of other bonuses that additionally apply to this type of RES. In short, these are (BMLEV 2009, p.13)

- Bonus for observing the corresponding formaldehyde limit values
- Bonus for power generation with innovative technologies (Technology Bonus)
- Bonus for the use of renewable raw materials or slurry (NawaRo Bonus)
- Bonus for the power production in cogeneration (KWK (CHP) Bonus)

Especially the bonus for renewable raw materials and slurry (NawaRo bonus) is interesting in regard to biogas production. Often referred to as the ‘manure bonus’ it grants 1ct/kWh (for 500kWel plant) “for electricity from biogas (new and existing facilities) if at least 30% farm manure is used.” (Büsgen/Dürreschmidt 2008, p.2542) For plants with an electrical output of 150kWel, the bonus is 4ct/kWh. In the EEG’s latest amendment “the NawaRo bonus is increased by 1-7 ct/kWh” (Büsgen/Dürreschmidt 2008, p.2542), again for biogas plants up to 500kWel.

Increasing efficiency in energy production and therefore making it more sustainable is also an important topic in the EEG. Therefore, the combination of utilizing both heat and power is also subsidized by the Act. For a biogas plant with an output of 500kW, the bonus is 2.94 ct/kWh.4 This means that a 500kW biogas plant like the one in Bollewick is entitled to subsidies approximately between 14ct/kWh and 19 ct/kWh.

As a consequence of the variety of bonuses that are granted for bioenergy production, a sharp increase in the number of bioenergy plants was noticeable after the EEG’s amendments in 2004 and 2009. “Electricity generation from gaseous and liquid biomass has shown a strong upward trend in Germany

since 2004” (Büsgen/Dürreschmidt 2008, p.2542) This can be illustrated by the following figure, which shows the energy supply (electricity&heat) from RES in 2010. As we can see, the bioenergy share is the highest with heat generated from biomass having the highest percentage.

**Energy supply from renewables 2010**

*Bioenergy share approx. 71 %, equivalent to 7.7 % of final energy consumption*

[Figure 12: Energy supply from renewables 2010 (FNR, 2012)]

Continuing the expansion of renewable energies in Germany’s electricity sector is one of the EEG’s primary goals. Since the electricity that conventional power plants produce is still cheaper than electricity from RES, this expansion “will initially lead to a further increase in the differential costs of the EEG and the ensuing EEG surcharge payable by consumers.” (Büsgen/Dürreschmidt 2008, p.2543) Subsidizing RES is in so far essential for their expansion as it increases their price competitiveness on the energy market. In 2006, the above-mentioned differential costs were 3.3 billion Euro and are expected to almost double to 6.2 billion Euro by 2015. “The increase in the differential costs is proportionally less than the increase in the amount of electricity produced within the scope of the EEG, however, which by then will have more than doubled from 51.5 to 130TWh.” (Büsgen/Dürreschmidt 2008, p.2543) After 2015 the differential costs will fall since RES will become increasingly price-competitive compared to conventional energy sources, which allows for the remuneration schemes and bonuses to progressively fade out. In light of increasing oil and gas prices renewable energy will become even more economically viable and therefore also more competitive. Although the individual consumer’s surcharge for RES will increase from 0.75ct/kWh in 2006 to 1.5ct/kWh in 2016, thereafter they will steadily fall again. Considering that “for reasons unrelated to the EEG […] residential electricity prices increased by around 5ct/kWh in the 2000-2006 period alone” (Büsgen/Dürreschmidt 2008, p.2544), the surcharge for electricity from RES seems bearable in light of the accompanying CO₂ emission reductions. Between 2000 and 2010 the electricity bill of an average household has risen by 27€, only 3€ of this price increase are attributable to the EEG.

Including macroeconomic factors such as job creation, (external) cost reductions, energy exports and the like into the economic analysis of RES systems, a very positive picture emerges concerning the benefits of the implementation of the EEG. As an example of these macroeconomic benefits the number of people employed in all of the renewable energy sectors can be deployed. The number of people employed rose from 160.000 in 2004 to 250.000 in 2007. “About 60% of these jobs were created as a result of the EEG.” (Büsgen/Dürreschmidt 2008, p.2539) In 2011, this number increased

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4 http://www.erneuerbareenergien.de/kosten-und-nutzen-des-eeg/150/491/29227/
according to the Federal Environment Agency (Umweltbundesamt - UBA, 2012), to 381,600 people working in the renewable energy sector.

But the benefits that emerged due to the EEG can also be measured in terms of its contribution to climate protection, i.e. the reduction of Greenhouse Gas (GHG) emissions. In fact, “no other instrument has resulted in similar CO₂ reductions in Germany.” (Büsgen/Dürreschmidt 2008, p.2538) According to the UBA (2012), renewable energies reduced the emissions of CO₂-equivalents (CO₂ eq.) by 130 Million tonnes in Germany in 2011. 70 Million tonnes CO₂ eq. of this total reduction are attributable to EEG compensated electricity.

The following table shows the GHG avoidance accomplished by the bioenergy sector in 2010.

| Solid biofuels* | 12,779 | 33,642 | n/a | 46,421 |
| Liquid biofuels | 1,084 | 1,135 | 4,987 | 7,206 |
| Biogas** | 8,850 | 1,577 | n/a | 10,427 |
| **Total** | 22,713 | 36,354 | 4,987 | 64,054 |

As we have seen from this brief overview, the German Renewable Energy Act was like no other governmental energy policy before, able to increase the share of RES in the domestic energy generation. The success of this Act speaks in so far for itself, as all GHG reduction targets were met and even surpassed in some years, especially after the improvements brought on the way through the amendments in 2004 and 2009.

The EEG stimulated growth in new technology sectors and created thousands of new jobs. For this trend to continue, it will be in light of the steadily growing share of renewable electricity essential to “facilitate the modernisation of the energy system towards [more] sustainability.” (Büsgen/Dürreschmidt 2008, p.2544) Especially new grid systems, which are accompanied by immense infrastructural programmes, will be required to better integrate electricity that comes from renewable sources.

In what way the EEG can help to improve the sustainability of the biomass sector, and, where it does not or is in this regard even counterproductive will be illustrated in the following chapters.

8. The Sustainability of Decentralized Bioenergy Production

Due to benefits in production efficiency and economies of scale, centralized production systems are predominant in Germany. Concerning the energy sector, this mostly applies to large-scale power plants that are utilizing non-renewable resources for the generation of electricity and heat. In light of an increasing demand for renewable alternatives, these “large scale production systems have, however, been criticised for hiding social and environmental costs of production by distancing their activities from the consumers […] and, thereby increasing the potential for unsustainable practices.” (Mangoyana/Smith 2011, p.1286)

Although bioenergy generally counts as a renewable energy source, its sustainability does in fact depend on its scale. Since large-scale bioenergy production requires immense amounts of substrates, maize being the most widely utilized one, “monocultures and the related [negative] environmental
impacts” (Mangoyana/Smith 2011, p.1286) are issues that are directly linked to the sustainability of this type of RES and its scale. Therefore, producing electricity and heat from biomass in a small-scale and decentralized context might present itself as an opportunity to enhance the sustainability in respect to all three dimensions of the concept of Sustainable Development. Ideally, “a sustainable energy system balances energy production and consumption, with minimal negative impact on the environment, coupled with inherent opportunities for implementation of social and economic activities.” (Poeschl et al. 2012, p.185)

In general terms, the advantage of decentralization is the “localisation of ownership, management, production, and marketing of bioenergy and related products. (Mangoyana/Smith 2011, p.1286) These effects are in turn driving forces of local economic development, which, as we have seen in the methodology part, can be an opportunity for the rurally coined federal district Mecklenburg Western-Pomerania to reverse negative demographic trends. In addition to economic and social advantages, “decentralized bioenergy systems could reduce the need for large agricultural monocultures and the related environmental problems.” (Mangoyana/Smith 2011, p.1286)

The following pages set out to analyze the social, environmental and economic sustainability of decentralized bioenergy systems by referring to the case study of the Bioenergy Village Bollewick and pertinent literature.

8.1. Social Sustainability of Bollewick’s Biogas Production

8.1.1. Public Participation

In energy projects that ought to be implemented on a local scale it is of vital importance to include, inform and consult the local community at all stages of the planning and implementation process. Since the citizens will be positively as well as negatively affected by the respective energy project their consent is crucial if, in our case a biogas plant, is to enter the construction phase. “For a technical system [i.e. a biogas plant] to be deemed socially sustainable, it should at minimum enjoy wider social acceptance.” (Assefa/Frostell 2007, p.65) A well-designed public participation process can help to achieve such social acceptance of an energy project by, as we have already mentioned, informing and consulting affected people and other stakeholders involved. Although the public participation process may be a “difficult and costly process, […] [enhancing] local participation in energy planning may lead to [a] more widely acceptable outcome.” (Ribeiro et al. 2011, p.4364) Since “measuring sustainability and quantifying the social dimension of sustainability are difficult tasks” (Assefa/Frostell 2007, p.65) we shall use the public participation process that was conducted in Bollewick to create social acceptance as the first indicator in analyzing the social sustainability of decentralized bioenergy production.

As cited in Glasson et al. (2005, p.159 et seq.) the United Nations Environment Programme lists five interrelated requirements that have to be met for a public participation process to be effective. These are:

1. Identification of the groups/individuals interested in or affected by the proposed development;
2. Provision of accurate, understandable, pertinent and timely information;
3. Dialogue between those responsible for the decisions and those affected by them;
4. Assimilation of what the public say in the decision; and
5. Feedback about actions taken and how the public influenced the decision

According to Mr. Meyer, stakeholders in Bollewick are the farmers operating the biogas plants, the municipality and vestrymen. When the decision was made that Bollewick should become a Bioenergy village in 2009, an initial town hall meeting was conducted to inform the villagers about these plans. Apart from the “understandable scepticism concerning this process” (Interview Meyer 2012, p.4) it became clear pretty quickly that on the one hand the villagers were principally interested in the idea but demanded more specific information. On the other hand, the most important concerns expressed by the citizens regarded safety issues of biogas production, prices for heat and electricity, smell pollution and supply security. The citizens also expressed ecological concerns regarding the so-called ‘maize deserts’ as a consequence of biogas production.
In order to offer accurate information about the plans and to uphold a transparent dialogue between the municipality and its citizens, Mr. Meyer and the engineer Olaf Schätzchen offered individual professional consulting. This consultation was also crucial for the detailed planning of the local heating network, since the respective annual energy consumption of the households in Bollewick had to be known, and for reasons of technical feasibility, the kind of heating installations the respective houses have. The families who wanted to be a part of the network signed the necessary contracts. Getting the families to sign the contracts was also of vital importance because the municipality would not have gotten the funding clearance otherwise. Getting the citizens on board meant walking from door to door for Mr. Meyer, which was very time consuming. “A very personal and direct approach is important.” (Interview Meyer 2012, p.5)

After the planning phase the village entered the solicitation phase. “With the solicitation phase comes the leaflet. The ones who signed the contracts are directly addressed right now, which is the next step.” (Interview Meyer 2012, p.7) A leaflet was sent to the villagers and the people who signed the contracts for the connection to the local heating network. There will also be another town hall meeting where the citizens give suggestions and objections.

Based on Mr. Meyer’s description of the possibilities the citizens and other stakeholders had to participate in the planning, solicitation and implementation phase of the biogas plants, it was a transparent process. During this process most of the villagers came to accept the plans of the municipality. Therefore, a minimum criterion of social sustainability is fulfilled.

Although some of the villagers are still rejecting the road taken by the municipality, they were fully informed and involved by the municipality over the whole process. Mr. Meyer did not extensively elaborate why he and the other initiators were not able to convince this group of people of the benefits of decentralized energy production, instead he mentioned that because it is still not clear whether everything will work out as planned, “the scepticism is still pretty high.” (Interview Meyer 2012, p.10) As the production of decentralized energy is taking place close to the consumer, it is therefore “possibly present in his [/her] daily life.” (Ribeiro et al. 2007, p.4365) A reason for the categorical objection of some of the people living in Bollewick might have its roots herein, which is described by the term NIMBY (Not In My BackYard). Although the people who are objecting might indeed generally agree (due environmental concerns) with decentralized biogas production, they oppose when a biogas plant is built in their direct proximity.

8.2. Socio-Economic Considerations

8.2.1. Employment

Despite the fact that a transparent public participation process is important for socially sustainable energy projects in a decentralized context, there are other parameters that have a greater impact on the overall social sustainability and the acceptance of affected people. According to Domac et al. (2005, p.98) “the essence of sustainability of bioenergy projects from a social aspect is how they are perceived by society, and how different societies benefit from this activity.” These socio-economic benefits of decentralized bioenergy projects for rurally coined communities translate into the number of jobs created, “contribution to regional economy, [profit participation] and income improvement.” (Domac et al. 2005, p.98)

Mangoyana/Smith (2011, p.1293) state in this context that “the opportunity for local ownership in small scale decentralized bioenergy systems is widely believed to empower the local communities” and could therefore “help to stem adverse social and cohesion trends (e.g., high levels of unemployment, rural depopulation, etc.)” (Domac et al. 2005, p.99)

Especially the potential prospect of decentralized bioenergy systems of creating new jobs and therefore halting or even reversing rural outward migration can be seen as a major motivation for the construction of the biogas plants in Bollewick.

In general, there are two different types of employment regarding bioenergy systems, namely direct and indirect employment. On the one hand “direct employment results from operation, construction and production.” (Domac et al. 2005, p.102) Indirect jobs created by a bioenergy system on the other hand are “jobs generated within the economy as a result of expenditures” (Domac et al. 2005, p.102)
related to bioenergy production and also jobs that are generated in supporting industries. Examples are “the farming community and local/regional renewable energy providers, installers and service providers.” (Domac et al. 2005, p.100) As a result of direct and indirect employment that is generated by decentralized bioenergy production “the agricultural economy will [allegedly] recover and promote a sustainable regional development, which will [supposedly] help to improve the social and economic cohesion within a community.” (Karpenstein-Machan 2001, p.4)

Employment that was directly generated in Bollewick logically concerns the farmers operating the plants. But since their farms are quite small and they are cultivating a relatively small area to produce the feedstock necessary for biogas production there is no need to hire any additional personnel, at least to the author’s knowledge. In addition, since the farmers were cultivating their land prior to the construction of the biogas plants, only for different purposes, it is questionable whether or not their employment status is exclusively attributable to the construction of the respective biogas plant, respectively, if they did in fact count as unemployed before the plants were built. As the definition of direct employment states, the construction of a biogas plant also generates direct employment. Since the village lacks the required know-how to build biogas plants regional companies constructed them.

Although the interview that was conducted with Mr. Meyer did not cover the number of indirect jobs that were created in Bollewick as a consequence of the biogas plant construction, one could argue that the construction of the local heating network and the house connections had to be done by local and regional craftsmen. These jobs in the supporting industry might have not been newly generated, but the construction of the local heating network and house connections did in fact contribute to the local economy, which might also have come along with an income improvement.

Being directly asked if the transition to biogas did actually create new jobs in the village and whether the people are doing noticeably better Mr. Meyer answered that the transition to renewable energy is not “immediately binding jobs in the village” but that one has to “consider the different levels of added value”, (Interview Meyer 2012, p.17) often also referred to as ‘regional added value’. In essence, creating regional added value means generating an “additional benefit apart from classical economic benefits” (Hoffmann 2009, p.2420), when implementing a regional or decentralized development. The idea of generating regional added value by using regional biomass in regard to the case study mostly concerns the farmers selling locally produced resources, i.e. electricity and heat from biogas, to the villagers.

“The farmer in the village […] is using his own resources and is selling them to the villagers. The money and material flows coming into the village from the outside are partially – or for the most part – gone and because of this the material flows and therefore the financial flows are local.” (Interview Meyer 2012, p.17) The revenue that is generated by renewable energy production is supporting the communal fund, which means that there is no profit participation for the villagers at the moment. “For now [the villagers] have cost reductions due to the use of renewable energy. That is also profit participation […]” (Interview Meyer 2012, p.12)

8.2.2. Competition between food production and Energy Crop Cultivation

An issue that is often brought up discussing the social sustainability of bioenergy systems is the competition between energy crops cultivation and food production. According to Mangoyana/Smith (2011, p.1293), “losing land previously used for food production to fuel production is one of the most widely debated social threats of bioenergy systems.” This is, however, not the case in Bollewick. According to Mr. van der Ham, he was cultivating crops as cattle fodder before he was cultivating maize for biogas production. “We are no market-orientated food business.” (Interview van der Ham 2012, p.2) Generally, this issue has definitively to be considered in the context of developing countries, where such a conversion can be seen as a serious social threat. In Germany, problems in this regard might arise from large-scale bioenergy systems, which require a lot of feedstock and therefore a lot of acreage. In small-scale decentralized bioenergy systems, however, the loss of land previously used for food production for energy crops production is not a pressing issue. In Mr. Hampel’s view, the competition between food production and the cultivation of energy crops should not be considered as a problem in Germany, since “agriculture is the only ‘industrial sector’ which has shown an increase in efficiency of 1,8% per annum for more than 50 years.” (Interview Hampel/Schneider 2012, p.2)
According to him, this means that the corresponding area of land has become available and can therefore be used for purposes other than food production.

8.3. Conclusion Social Sustainability

In regard to the case study Bollewick and its social sustainability we should keep in mind that the village is still in an early stage of the transition process. Because of this we cannot rely on a wide range of empirical data when assessing the social sustainability of this type of decentralized bioenergy production. As we have seen above, the mayor and the municipality put great importance on letting the citizens participate in all stages of the process in order to create wide social acceptance. Although some of the villagers could not be convinced of the benefits of biogas production, a minimum requirement of social sustainability in Bollewick is still met.

Concerning socio-economic benefits and the overall empowerment of the community a different picture has to be drawn in the author’s view. No new jobs have been locally created due to the construction and operation of the biogas plants. Of course, this has also to be seen in relation to the short period of time the biogas plants are actually running but in light of the fact that a distinctive feature of decentralized bioenergy systems is supposed to be the creation of new employment opportunities in rural communities, this issue has to be listed as not fulfilling social sustainability requirements.

Domac et al. (2005, p.98) regard income improvement as another socio-economic benefit by which the social sustainability of decentralized bioenergy systems can be assessed. During the interview with Mr. Meyer he mentioned several times that due to the use of renewable energy Bollewick’s citizens are saving 200 to 300 Euros per year, depending on the oil price. In case that this proves to be true, it can be seen as a relative income improvement since the people have more money at their disposal.

Other terms that were brought up several times in the interview were added value and the emergence of new financial circuits that benefit both the municipality and its citizens. It is reasonable to say that money that is spent for locally produced energy instead of imported energy stays within the community and can therefore “be spent for buying goods and services inside […] the region.” (Hoffmann 2009, p.2420) Added value in this context means that by using regional biomass the regional market participants, in our case the villagers, are enabled “to spend money for the same service (e.g. a warm house […] within the region.” (Hoffmann 2009, p.2420) Although the cost reductions in energy prices can be seen as a socio-economic benefit, it is nevertheless unclear how the local community is empowered by the biogas production in Bollewick and how greater social cohesion is obtained through it. Especially in light of Mr. Meyer’s statement that the villagers still are not really convinced of the idea of being a bioenergy village.

The social sustainability of Bollewick’s biogas production was assessed by a qualitative approach, namely in form of participation processes and socio-economic benefits for the population. The public participation process was conducted extensively in order to create social acceptance and has therefore to be high lightened in regard to the overall social sustainability. But since the socio-economic benefits weigh more in the author’s perception, the municipality Bollewick has to put greater emphasis on these for the biogas production to be socially sustainable.

8.4. Economic Sustainability of Bollewick’s Biogas Production

The economic sustainability of decentralized bioenergy systems mainly depends on the economic efficiency and the economic viability of a respective project. According to Mangoyana/Smith (2011, p.1291), “small-scale decentralized bioenergy systems [are often] facing economic viability challenges due to high operation costs.”
8.4.1. Economic Efficiency

The economic efficiency of CHP biogas plants and therefore their competitiveness compared to non-renewable energy sources on the energy market depends on a variety of factors. “Key project variables in […] biogas models are investment costs, price of feedstock, biogas yields, subsidy levels […] and disposal costs of digestate.” (Gebrezgabher et al. 2010, p.29) In addition to these parameters, transportation costs of feedstock are also influencing the economic efficiency performance of biogas plants.

8.4.2. Methane Yields

As we have established earlier, farmer Mr. van der Ham is using maize silage and manure, which is both digested in the absence of oxygen for biogas production. The economic efficiency of this process depends on the methane yield, which “is especially important with the digestion of energy crops as these (in contrast to animal manures or organic wastes) have production costs that have to be covered by the methane production.” (Gebrezgabher et al. 2010, p.27) Methane yield is measured “in norm litre per kg of volatile solids (lₙ kg⁻¹ VS)” (Amon et al. 2007b, p.3205) Methane yield per hectare is measured in norm cubic metre (mₙ ha⁻¹)

Apart from climatic conditions and time of harvest, methane yields of maize generally depend on the type of maize that is cultivated and its vegetation stage, i.e. its ripeness at harvest. A study conducted by Amon et al. (2007b, p.3206) found that the “average specific methane yield [of the maize varieties they analyzed] was 398 lₙ kg⁻¹ VS.” Medium ripening maize varieties show a higher biomass yield per hectare and therefore a higher methane yield. “The highest methane yields per hectare [were] 12 390 mₙ ha⁻¹.” (Amon et al. 2007b, p.3206)

Since Mr. van der Ham was not questioned in detail concerning maize yields and the consequent methane yields in the first face-to-face interview in February, a short telephone interview was conducted in order to obtain these values. In February Mr. van der Ham stated that he was cultivating 120ha of maize. Due to beneficial price developments he is currently cultivating approximately 240ha of land with the energy crop. Although he could not state the total annual maize harvest, he said that he is harvesting approximately 20 tonnes of maize per day, which theoretically translates into 7,300 tonnes of harvested maize per annum, if harvest was possible during winter. This feedstock is used for the production of biogas on the one hand and as fodder for the farm’s 400 cattle on the other hand. Considering that a farm with “an agricultural area of 300ha operating a 500kW biogas plant [will have] problems supplying the plant with feedstock in the long-term” (Interview Hampel/Schneider 2012, p.4) and having in mind that Mr. van der Ham is also feeding his cattle with the maize he is harvesting, the ratio of 50-50 between the two different types of feedstock he stated in February is questionable if his plant is to operate efficiently in an economic sense.

In order to have a reference point, we shall consider an example calculation conducted by the ‘Fachagentur Nachwachsende Rohstoffe e.V.’. According to their calculation, a 350kWₐ biogas plant requires 5,5000t of maize silage per year, which corresponds to 125ha of cultivated land. In addition, an annual amount of 3000t of cattle manure (150 cattle) is used. Either Mr. van der Ham’s cultivation method is highly inefficient or he uses a considerably higher fraction of manure to produce approximately four million kWh of electricity per year, a value stated by the engineer Mr. Schätzchen and approved by Mr. Dettmann (see Chapter 5) A higher fraction of manure would make sense insofar, as 400 cattle logically produce more manure than 150. Although maize has the higher energy content compared to manure and can therefore be used more efficiently, the production costs of manure do not have to be covered by the methane yield. Therefore, Mr. van der Ham’s biogas can potentially operate efficiently in an economic sense in this regard.

8.4.3. Investment and Operating Costs

http://www.biogasportal.info/daten-und-fakten/faustzahlen/
An important tool to increase the share of renewable energy sources in the energy mix and making them more competitive compared to fossil fuels is subsidies, since “the generation of heat and/or electricity using biomass combustion or gasification systems is not competitive under the existing market conditions in Europe without financial support.” (Rösch/Kaltschmitt 1999, p.348) As we have seen earlier, the Renewable Resources Act (EEG) regulates the financial support in form of subsidies and remuneration schemes in Germany. As elaborated in Chapter 7, a 500kW CHP biogas plant like the one Mr. van der Ham is operating, is entitled to subsidies in the range of between 14ct/kWh and 19 ct/kWh. This means that Mr. van der Ham is approximately receiving between 560,000€ and 760,000€ remuneration annually for the four million kWh of electricity he is producing per year.

In order to evaluate this amount of subsidies in light of the total investment and annual operation costs of a 500kW biogas plant we shall consider the following figure.

Table 6: Investment costs of a 500kW biogas plant (Walla/Schneeberger, 2008)

<table>
<thead>
<tr>
<th>Size</th>
<th>500 kWel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity production in 1000 kWh</td>
<td>3500</td>
</tr>
<tr>
<td>Substrate amount (tonnes year⁻¹)</td>
<td>10,246</td>
</tr>
<tr>
<td>Substrate production area (ha year⁻¹)</td>
<td>228</td>
</tr>
<tr>
<td>Electrical efficiency (%)</td>
<td>38.0</td>
</tr>
<tr>
<td>Investment costs (€)</td>
<td>1,851,522</td>
</tr>
<tr>
<td>Capital costs (€ year⁻¹)</td>
<td>220,710</td>
</tr>
<tr>
<td>Substrate costs (€ year⁻¹)</td>
<td>184,428</td>
</tr>
<tr>
<td>Labour costs (€ year⁻¹)</td>
<td>39,550</td>
</tr>
<tr>
<td>Other costs (€ year⁻¹)</td>
<td>50,000</td>
</tr>
<tr>
<td>Total costs without transport (cents kWh⁻¹)</td>
<td>14.1</td>
</tr>
</tbody>
</table>

Walla/Schneeberger (2008) calculated these values for a biogas plant operating 7000 hours per year. Although the biogas plants in Bollewick are operating 8000 hours annually, we can assume that the investment and operating costs were similar in Bollewick. The initial investment costs of approximately 1.8 million Euros stated in Table 5 are almost exactly the same as the amount of money Mr. van der Ham invested in his biogas plant. Since Mr. van der Ham is operating the biogas plant and is also cultivating the feedstock on his own we can exclude labour costs in the calculation of the annual expenses. The other costs listed in the lower part of Table 5, excluding transportation costs, amount to annual expenses of 457,138€.

Based on this calculation, Mr. van der Ham can cover the costs he had and has to invest to produce electricity by the EEG’s subsidies. Depending on the actual amount of remuneration he is receiving through the EEG, these might actually exceed his annual investment costs. Although the economic efficiency of biogas plants is supposed to increase with plant size and “substrate costs per kWh hour fall as plant size increases” (Walla/Schneeberger 2008, p.552), Walla/Schneeberger (2008, p.557) state nevertheless that “only plants with a size of 100 or 250kWel can cover their costs through sales of electricity.” Since the biogas plants in Bollewick are producing a considerable amount of electricity surplus, the question is if Mr. van Ham can cover his cost or even turn profits by selling the surplus to the national grid. In addition, this calculation only considered the sales of electricity. By including the sales of heat in the calculation and considering the efficiency of CHP plants, the profitability of Mr. van der Ham’s biogas plant will most likely further increase.

8.4.4. Technological Efficiency

As Mr. Hampel and Mr. Schneider stated, the efficiency of biogas mostly depends on their workload and not necessarily on the plant size per se. Mr. van der Ham stated during the short telephone interview that his biogas plant is operating at an efficiency rate of 99%. The ‘Fachagentur Nachwachsende Rohstoffe e.V.’ states that a CHP biogas plant reaches an overall efficiency of 85%. It
is therefore questionable on what Mr. van der Ham is basing the value of 99% he stated. If this nevertheless proves to be true, his biogas plant might in fact operate economically. After all, he certainly would not have invested in his biogas plant if he had not seen the opportunity to earn money with the production of biogas.

Since Mr. van der Ham is using the substrate of the biogas plant as fertilizer on his fields, he does not have to purchase artificial fertilizers. Hereby the commercial viability is improved since “the waste of one process [(anaerobic digestion)] is used as an input” (Mangoyana/Smith 2011, p.1292) in the maize cultivation. This is referred to as a closed loop system. Another saving potential lies in the short transportation costs of small-scale farms. “Cutting down on transportation and marketing distances […] provide not only environmental benefits […] but also economic and social benefits” (Mangoyana/Smith 2011, p.1294) and can therefore be seen as a strength of decentralized bioenergy systems.

8.5. Conclusion Economic Sustainability

Based on the reviewed literature and the interviews that have been conducted, it is in the author’s point of view difficult to accurately judge the economic sustainability of biogas production in the village Bollewick. The interviewees Mr. Hampel and Mr. Schneider stated several times that the profitability of biogas plants largely depends on the question if the plant is adjusted to the conditions of a small-scale farm. These conditions refer to feedstock availability and the type of substrate, size of the farm and the cultivated area, climatic conditions, utilization pathways, initial investments, operating and substrate costs and the like. This assertion is generally confirmed by most of the literature. Mr. Hampel regards a “modular setup” of biogas plants as the most reasonable choice. “This means, that we are trying to find the best components for the respective case and build the plant accordingly.” (Interview Hampel/Schneider 2012, p.8)

Although one can argue that in Bollewick a modular approach was taken, meaning that the engineers analyzed Bollewick’s energy potentials and found that the most efficient solution for Bollewick was to build CHP biogas plants and a new local heating network, a general scepticism by Mr. Hampel and Mr. Schneider towards the viability of the concept of the bioenergy village Bollewick, its economic, but also its overall sustainability was noticeable during the interview. Considering that large farms cultivating large areas of land are predominant in Mecklenburg Western-Pomerania, Mr. Hampel and Mr. Schneider are of the opinion that supplying a whole region with bioenergy makes more economic sense than picking out one village and calling it ‘bioenergy village’.

As mentioned earlier, the municipality of Bollewick and the farmers operating the biogas plants invested 5.4 million Euros in total to become a bioenergy village. Being asked if this investment is economically viable in light of the comparably few households that are actually connected to the local heating network, i.e. if the investment will turn profit, Mr. Hampel answered “No, that does not work. […] According to my calculations this cannot be operated [economically] sustainable.” (Interview Hampel/Schneider 2012, p.28)

Mayor Meyer, farmer van der Ham and engineer Schätzchen are opposing this view. They are particularly highlighting the efficiency advantages of the CHP technology, the profits that are generated by selling the electricity surplus to the national grid, the heat that is being utilized to supply the village’s households and the emerging cost reductions the villagers have due to this utilization. Since the local heating network is still under construction and the amount of heat (in kWh) the biogas plants are capable of producing are still only calculated values, the highly praised efficiency gains and therefore the economic profitability still has to be proven. In addition, the controversial and not verifiable statements and values given by farmer van der Ham concerning maize yields, acreage, ratio between utilized maize silage and manure for biogas production and so on do not make the impression as if his biogas plant is operating economically – especially in regard to the figures stated by Walla/Schneeberger and the “Fachagentur Nachwachsende Rohstoffe e.V.”.

In contrast to the assertion above, based on the calculation of the subsidies Mr. van der Ham is receiving, his biogas is operating economically viable and is even turning profits. In light of the gradual decrease in remuneration granted by the EEG the future will show if the profitability of Mr. van der Ham’s biogas plant will remain. Decentralized bioenergy systems can generally be economically viable.
without heavily depending on subsidies, if the above-mentioned criteria are met. As shown in Mangoyana/Smith (2008) a successful example of a decentralized bioenergy system is the village Jühnde in North Germany.

8.6. Environmental Sustainability of Bollewick’s Biogas Production

Energy generated from various types of biomass can serve as a strategy to mitigate climate change and other negative environmental effects associated with the combustion of non-renewable resources. Considering that “renewable resources such as wind and solar radiation energy [are] discontinuously available” (Karpenstein-Machan 2010, p.2), the formidable availability of biomass on national and regional scales and bioenergy’s different application possibilities, namely converting it to gaseous, liquid and solid energy carriers is believed have several advantages compared to other renewable energy sources. Nevertheless, “there is a disagreement regarding whether bioenergy systems contribute or ameliorate environmental problems such as depletion of nutrients in soil, erosion, runoff of nutrients and toxins, consumptive water use, greenhouse gas build up, biodiversity loss, air pollution, and productivity loss.” (McBride et al. 2011, p.1278) In other words, “the use of bioenergy does not automatically imply that its production, conversion and distribution are sustainable.” (Buchholz et al. 2009, p.586)

How serious the above-mentioned impacts are depends as we have established earlier in this chapter to a large extent on the scale of bioenergy systems. This part therefore sets out to analyze the severity of these negative environmental impacts in a small-scale decentralized context and will conclusively judge the environmental sustainability of decentralized biogas production.

8.6.1. Greenhouse Gas Emissions

The major driving force of the utilization of biomass and other RES is their potential to reduce the emissions of carbon dioxide (CO2) and other Greenhouse Gases (GHG). “Central to the advocacy of biomass energy is the argument that it is ‘carbon neutral’; it releases that carbon back to the atmosphere which was earlier plucked out from the atmosphere in the act of photosynthesis.” (Abbasi/Abbasi 2010, p.931) Although this statement is valid for the growing period of biomass and its subsequent harvest, the GHG balance of the end product biogas is influenced by a variety of other factors that have to be taken into account.

8.6.1.1. Greenhouse Gas Emissions of Feedstock Transportation

For the cultivation and transportation of feedstock tractors are required. Since they run on fossil fuels, CO2 is emitted into the atmosphere. How much CO2 is emitted depends on the hauling distance and therefore on the scale of the farm. As Mangoyana/Smith (2011, p.1291) state, the advantage of decentralized bioenergy systems in this regard are “shorter transportation distances in acquiring raw materials, […] [which] could translate into reduction of life cycle greenhouse gas emissions when compared to longer distances in centralised production systems.”

According to Mr. Meyer (Interview Meyer 2012, p.13), the electricity generation in Bollewick is not completely carbon neutral, since the “diesel the tractors operate on” has to be considered. “It is not 100 percent [carbon neutral] but there are significant reductions.”

8.6.1.2. Greenhouse Gas Emissions due to Direct and Indirect Land Use Change

GHG emissions and therefore the environmental sustainability of agricultural systems are also influenced by land use change. Since soil functions as a carbon sink, altering it releases CO2 into the atmosphere. A distinction is made between direct land use change (dLUC) and indirect land use change (iLUC). dLUC refers to the “human modernisation of Earth’s terrestrial structure”7, meaning

7 http://www.eoearth.org/article/Land-use_and_land-cover_change
that “emissions and removals of greenhouse gases [are] resulting from direct human-induced land use.”

“The basic concept of iLUC [on the other hand] is that natural ecosystems elsewhere might be converted to croplands to replace crops (either ‘animal feed’ or ‘food’) that are lost due to biofuel production.” (Kim/Dale 2011, p.3236)

In general, “CO₂ emissions form LUC are a function of the extent to which bioenergy induces LUC, the carbon content of plants and soils in uncultivated relative to cultivated ecosystems, the extent and timing of the reversion of cultivated land when the biofuels program ends, and how one treats future climate change impacts relative to present impacts.” (Delucchi 2008, p.2338)

Although most “food-or-fuel” discussions surrounding iLUC focus on the negative impacts of the replacement of food crops by energy crops as a consequence of the introduction of bioenergy programs, Kim/Dale (2011) consider the replacement of animal feed by energy crops in their definition of iLUC as well. Although Mr. van der Ham did not cultivate food crops but only “crops for the cattle” (Interview van der Ham 2012, p.2) prior to the construction of his biogas plant, iLUC did according the definition above in fact take place on his farm and therefore negatively impacts the overall environmental sustainability.

Concerning dLUC and the general carbon balance of bioenergy production, Haberl et al. (2012, p.19) criticize that a general error has been made in GHG accounting. According to them, current carbon calculations are failing to take into account that “if bioenergy were not produced, plants not harvested would continue to absorb carbon and help to reduce carbon in the air.” Therefore, the alleged carbon neutrality of bioenergy production is their view compromised. Although this logic is comprehensible to a certain extent, strictly following the suggestion of Haberl et al. (2012) would mean to stop all agricultural activities, not only the cultivation of energy crops. Especially in a rural region such as Mecklenburg Western-Pomerania this can neither be considered feasible nor socially sustainable.

Concerning dLUC and its consequent CO₂ emissions in Bollewick, one has to assume that before any type of cultivation was undertaken the land area was uncultivated. Consequently, carbon was released into the atmosphere. Since no information is available regarding the time and magnitude of the initial dLUC in Bollewick, we cannot state any quantifiable data in this regard. In order to have an approximate value concerning CO₂ emissions due to direct land use change, Butterbach-Bahl et al. (2010) state that one tonne of carbon per hectare is released to the atmosphere over a time period of 15 to 50 years. In light of the reduction of CO₂ that has already been accomplished in Bollewick within one year, the above stated value seems bearable.

8.6.1.3. Greenhouse Gas Emissions due to the Use of Fertilizers

In addition to CO₂, the greenhouse gas nitrous oxide (N₂O) has to be considered in the GHG balance of bioenergy systems. In the agricultural sector N₂O emissions emanate from nitrogen fertilizing. “Agricultural soils are major sources of atmospheric N₂O.” (Kavdir et al. 2007, p.175) Although N₂O emissions from agricultural practices are generally lower than the emissions of CO₂, considering that based on a timeframe of 100 years the “global warming potential of N₂O is 296 times more powerful than CO₂” (Kavdir et al. 2007, p.175), the reduction of this GHG is essential and potentially contributes to the overall environmental sustainability of bioenergy systems.

In order to be economically worthwhile, energy crops require considerable amounts of fertilizers, approximately 50kg per hectare and year. (Börjessen 1999, p.141) Although food crops generally require more nitrogen fertilizer, this amount of required fertilizer is nevertheless problematic considering the efficiency of nitrogen fertilizing. According to Butterbach-Bahl et al. (2010, p.8), only 50 per cent of nitrogen fertilizers accumulate in the plants, the other half accumulates elsewhere in the

8 http://www.canadiangeographic.ca/glossary/definition.asp?word=LandUse,Land-UseChangeandForestry&id=76
9 http://www.spiegel.de/international/germany/biogas-subsidies-in-germany-lead-to-modern-day-land-grab-a-852575.html
biosphere. Apart from the above-mentioned impact of N₂O on the atmosphere, aquatic systems are also negatively affected, e.g., eutrophication.

In contrast to large-scale bioenergy systems, decentralized ones logically do not have to use as much fertilizers and are emitting less GHGs due to the comparably small acreage that is cultivated and altered, respectively. In addition, large-scale plants often have to apply large quantities of artificial fertilizers, which is according to Mr. van der Ham not the case for his farm. Instead, he is able to use the digestate of the anaerobic digestion process to fertilize his fields, which is accompanied by lesser environmental impacts. These attributes of decentralized bioenergy production have a positive impact on its overall environmental sustainability.

8.6.2. Biodiversity Loss and Monocultures

As we have established earlier in this thesis, Germany has been experiencing a stark increase in the number of biogas plants over the last couple of years. Especially in East Germany this increase entails an expansion of the land cultivated with energy crops, which not only alters the type of land use, but also puts pressure on the local flora and fauna as well as on farmland biodiversity. In general terms we can state that with the growing demand for biomass and its related energy products, the demand for land has increased in the past and will even more so in the future, thereby causing detrimental effects on biodiversity.

Therefore, another important issue in regard to the environmental sustainability of bioenergy systems is the loss of biodiversity as a consequence of feedstock cultivation.

“The Convention on Biological Diversity (CBD) defines biodiversity as ‘the variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and ecosystems.’” (Slootweg et al. 2006, p.18)

Since maize has the highest energy content, i.e. the highest methane yield of the substrates used for biogas production and is therefore most profitable, its increased cultivation especially in large-scale systems is believed to promote the expansion of monocultures. The term “monoculture refers to the cultivation of a single crop on the same field, year after year and usually over a long time period, without rotating with other crops (i.e. neither market crops nor cover crops).” (Mudgal et al. 2010, p.38) Apart from the above-mentioned profitability advantages of maize monocultures crop rotations farmers might not adopt crop rotations in their agricultural practices since they need to additionally diversify their farm activities, which come along with need for more diversified agricultural equipment and additional storage facilities. Monocultures have the most negative impacts on biodiversity “due to a high level of soil disturbance and chemical use and lack of diversity of cultivated crops.” (Mudgal et al. 2010, p.51) Maize monocultures are like no other type of energy crop a serious threat to biodiversity since the “enormous cultivation areas destroy habitats for animals and plants, with the result that biodiversity is rapidly lost in agricultural regions.” (BIOPRO, 2012)

8.6.3. Crop Rotations

A means to at least partially combat the expansion of monocultures and their negative environmental impacts is rotating different kinds of crops on a field over the course of the year. “Crop rotation is the practice of alternating annual crops grown on a specific field in a planned pattern or sequence in successive crop years so that crops of the same species are not grown without interruption on the same field.” (Mudgal et al. 2010, p.20)

As cited in Mugdal et al. (2010, p.21), crop rotations have several advantages. These are:

- Preventing rapid soil depletion
- Maintaining soil fertility and balancing fertility demands of different crops

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• Reducing soil erosion
• Controlling insect/mite pests
• Reducing reliance on synthetic chemicals
• Reducing the pests’ build-up
• Preventing diseases
• Helping weed control
• Improving plant resilience to adverse weather conditions

It is important to acknowledge that no amount of artificial fertilizer and pesticides, respectively, is capable of fully compensating for the environmentally beneficial effects of rotating different kinds of crops over the course of the year.

In order to prevent biodiversity loss and particularly soil erosion Mr. van der Ham is cultivating “intermediate crops, for example green rye.” (Interview van der Ham 2012, p.2) Cultivating intermediate crops as a means of counteracting soil erosion and nitrinate leaching is of great importance since row crops like maize “have a low protective function in general.” (Mudgal et al. 2010, p.65) Since Mr. van der Ham is rotating different crops he is thereby both counteracting the loss of biodiversity on his fields and mitigating adverse environmental effects of maize cultivation. Along with the other advantages of crop rotations stated above, one can assume that Mr. van der Ham is in this regard cultivating his fields in an environmentally sustainable manner.

8.6.4. Water Usage of Energy Maize

Another negative attribute of maize is its high water demand. In other words, maize is “very water intensive” (Interview Hampel/Schneider 2012, p.11) which negatively affects the environmental sustainability of biogas plants using maize as substrate in large quantities. This is especially problematic in light of the climatic conditions in East Germany with its dry and hot summer months. “Maize has the highest water demand in the northern hemisphere in July and August with at least 1.000m³ per hectare per month.” (Haberl et al. 2012, p.31) In order to achieve economically viable yields for biogas production, maize has to be irrigated quite intensively during the summer, which results in a declining groundwater table. “Irrigating maize in East Germany – it cannot get any worse than this.” (Interview Hampel/Schneider 2012, p.20)

Considering that the gradual depletion of groundwater tables as a consequence of increased irrigation seems to be a general problem in the East German agricultural sector, the question is if decentralized biogas systems have the major impact in this regard. Especially small-scale farms that are cultivating comparably small areas with maize do not have to irrigate as much as their large-scale counterpart. Although high water usage can be considered unsustainable, Mr. Hampel contradicts himself in regard to the quote above by saying earlier in the interview that biogas plants with an output capacity in the range of megawatts (MW) can, under the right conditions, also be operated sustainably, which also entails water usage for maize cultivation. Regardless of the scale of maize cultivation, high water usage and therefore aquifer depletion in the East German agricultural and bioenergy sector is becoming a more and more pressing issue. In light of the steadily increasing number of biogas plants in Mecklenburg Western-Pomerania, this is a serious threat to environmental sustainability. According to Mr. Hampel, a way to mitigate this issue would be abandoning agriculturally cultivated areas and instead reforest them. This would not only be beneficial for the stabilization of the local hydrologic cycle but also in terms of the accompanying CO₂ saving potential, which we have discussed earlier.

8.7. Conclusion Environmental Sustainability

As we have seen from this overview of selected indicators, the environmental sustainability of decentralized biogas production depends on a variety of interrelated factors. Although negative environmental impacts are generally less intensive in a small-scale context, maize as the most widely utilized feedstock for biogas production has detrimental environmental effects that are also noticeable in a decentralized system. Especially the loss of biodiversity and the high irrigation requirements of this energy crop must be viewed critically, particularly in its large-scale cultivation, but also in a smaller context. The use of manure as an additional substrate for the digestion process of “multi-feedstock technologies […] provides a more sustainable system that reduces adverse land use changes
and the need to divert land use and food crops to fuel production” (Mangoyana/Smith 2011, p.1295) and also reduces the use of the substrate maize. By using the multi-feedstock technology in the biogas plant and adhering to crop rotations, farmer van der Ham is counteracting biodiversity loss and therefore increases the environmental sustainability of his farm and the biogas production.

As stated in Chapter 7 the GHG avoidance of the biogas sector alone was approximately 10.5 million t CO₂ eq. in 2010. Although this value should speak for itself, especially Butterbach-Bahl (2010) and Haberl et al. (2012) argue that when the overall GHG emissions per unit of energy are accurately accounted for, bioenergy is in fact not carbon neutral and might even show higher emissions than the combustion of fossil fuels does. This is according to Haberl et al. (2010, p.19) the case because “(i) biomass contains less energy per unit of carbon than petroleum products or natural gas do and (ii) biomass is usually burned with lower efficiency than fossil fuels.”

In this context, applying the CHP technology can substantially increase the efficiency and therefore the environmental performance of bioenergy systems. Here the heating sector plays a crucial role since the major part of energy consumed in Germany is attributable to heating. “The replacement of fossil energy in the heating sector is the most efficient step for protecting the environment and managing global warming.” (Karpenstein-Machan 2001, p.2) Insofar, the plans to connect as many people as possible to the local heating network in Bollewick in the years to come will be beneficial for the village’s environmental sustainability.

Based on the review above, the environmental sustainability of Bollewick’s biogas production is given in most regards. Although more data and an in depth analysis of a broader spectrum of indicators could potentially correct this assertion, in the author’s view the decentralized biogas production in Bollewick is more environmentally sustainable than energy generation from the non-renewable counterpart. The following figure conclusively gives a schematic overview of all three sustainability dimensions, their influencing factors and interdependencies in respect to a bioenergy system.

Figure 13: Sustainability domains, issues and processes (Mangoyana/Smith 2011)
9. Concluding Discussion

The village Bollewick invested a considerable amount of money to cover its energy needs with the renewable energy source biogas, with the aim of gradually decreasing its dependency on fossil fuels. By constructing two biogas plants that operate on the local energy carrier biomass, installing photovoltaic installations and investing in efficiency measures to decrease the village's total energy consumption the municipality clearly votes for a sustainable energy production and the accompanying benefits in a decentralized context. As we have seen from the previous assessment of the different sustainability indicators, the overall sustainability of such a decentralized bioenergy system depends on a variety of interrelated factors.

For the subsequent concluding discussion we have to keep in mind that the complete transition to renewable energy in Bollewick did take place only one year ago. Therefore, the emerging sustainability benefits might not be fully noticeable yet, but might emerge in the future. In addition, neither the municipality nor other involved parties have released any reliable information or data concerning the progress of the village in regard to its bioenergy production, financial situation and the like. This intransparent information policy considerably complicated the verification of the claims the municipality states in regard to its sustainability performance. Nevertheless, we should judge the sustainability in regard to all of its three dimensions based on what we have found out in the previous chapters and on the current situation in the village, respectively.

The social sustainability of Bollewick’s bioenergy production was analyzed in terms of participation processes and socio-economic benefits for the citizens. Although the villagers were extensively included and fully informed before and during the planning and implementation process, socio-economic benefits for the citizens, except cost reductions due to the use of bioenergy, are either non-existent or not noticeable until now. In addition, these cost reductions can be expected to melt down in light of the costs for Germany’s switch to renewable energies. On October 15th, “Germany’s four leading electrical grid operators […] announced […] that they would be hiking by 47 percent the charge to consumers that goes into financing subsidies for producers of renewable energy.” For the consumer this means that the surcharge for renewable energy will rise to 5.5 ct/kWh in 2013, compared to 3.6 ct/kWh in 2012. “For an average three-person household using 3,500 kWh a year, the 47 percent increase amounts to an extra €185 on the annual electricity bill.” This means that if the cost reductions the people living in Bollewick will supposedly have will almost be outweighed by the additional surcharge for renewable energy, their general scepticism Mr. Meyer mentioned during the interview is likely to further increase. Hence, social acceptance, which we have listed as an indicator of the social sustainability of a bioenergy system, will be negatively affected. Although a general increase in energy prices for non-renewable energy sources also took place in recent years (see Chapter 7 - EEG), most “Germans are more interested in affordable electricity” than protecting the climate.

Overcoming structural weaknesses such as the outward migration of young and educated people by creating new jobs in the region was another important factor that influenced the municipality’s decision to become a bioenergy village. Considering that due to the construction of the biogas plants no new jobs were created, the village did not gain attractiveness for young people. Therefore, the trend of an aging population is not counteracted and the demographic composition of Bollewick has not changed. The current situation in Bollewick can for the reasons stated above and in Chapter 8.1 – 8.2 not be called socially sustainable.

The competitiveness of renewable energy sources and therefore their economic viability compared to their non-renewable counterpart is as we have seen earlier still heavily dependent on subsidies and remuneration schemes granted by the EEG. Especially small-scale biogas plants in a decentralized context would in most cases not be able to operate economically without these subsidies. In addition, the economic efficiency is dependent on the technical efficiency of the biogas plant. Using the CHP technology in a biogas plant increases the overall efficiency. In this regard, the economic viability of the biogas production is given in Bollewick.

Substrate costs are particularly in small-scale biogas plants another crucial factor that influence their profitability. As we have established earlier, the substrate costs of maize have to be covered by the

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11,12,13 http://www.spiegel.de/international/germany/consumers-bear-brunt-of-german-switch-to-renewable-energies-a-861415.html
methane yield. With a consistent technical efficiency this is especially problematic, since maize is subject to price fluctuations. The greater the share of maize in small-scale biogas plants, the more sensitive their economic efficiency will react to price increases. This is due to the fact that in small-scale biogas plants substrate costs are higher in relation to the total operating costs than in larger ones. So increasing the share of manure in the co-digestion process can potentially stabilize the economic viability of small-scale biogas plants. Although the statements of Mr. van der Ham concerning the ratio between maize and manure he is using to produce biogas have been criticized earlier, if 50% of the substrate is in fact manure, he is able to buffer price fluctuations and can therefore operate his biogas plant more efficiently.

The interviews that have been conducted to assess the economic sustainability of the biogas production in Bollewick have been contradictory. Mr. Hampel and Mr. Schneider can in light of the high investment costs not imagine that the biogas plants in Bollewick can operate profitable. Especially Mr. Hampel is basing this assertion on his experience and the calculations he has conducted for comparable projects. Mr. Meyer, Mr. Schätzchen and Mr. van der Ham on the other hand refer to the efficiency of the digestion process and the CHP technology and are mostly highlighting the surplus electricity that the municipality is selling to the national grid. Therefore, the biogas production in Bollewick is in their view economically profitable, especially once the construction of the local heating network is finished. Other saving potentials that might contribute to the economic profitability of Mr. van der Ham’s biogas plant have been elaborated earlier.

Considering the contradictory statements of the interviewees but also of the literature, the author cannot accurately judge the economic sustainability of biogas production in Bollewick to the best of his knowledge. One can assume that the subsidies Mr. van der Ham is receiving at the moment are used to cover his initial investment costs and the operating costs of the biogas plant. Once the initial investment costs are paid off and the subsidies that are granted by the EEG faded out completely, an accurate evaluation of the profitability can be made.

The German Renewable Energy Sources Act was able to increase the utilization of renewable resources, which came along with a series of environmental benefits. By decreasing the combustion of fossil fuels and increasing the share of renewable energy sources in the electricity mix, energy production in Germany has become more environmentally friendly and therefore more sustainable. The most important reason for the large-scale implementation of RES is the reduction of greenhouse gases.

That the carbon neutrality and therefore the potential to reduce GHG emissions of bioenergy, is highly debated has been established before. It was also elaborated, which factors and practices are influencing the GHG balance of the bioenergy sector and should therefore not be repeated in detail. In addition, we have also established, that the GHG avoidance due to the use of biogas alone was approximately 10.5 million tonnes of CO₂ equivalents in 2010, which should, including alleged accounting errors, count as a clear advantage of producing heat and electricity from biogas. In particular decentralized bioenergy systems are believed to be environmentally sustainable and have lesser detrimental effects on surrounding ecosystems, especially in contrast to large-scale bioenergy plants in the range of MW. Although this assertion is valid if we look at a single decentralized 500kWₑₚ plant producing biogas, we also have to consider the sum of these plants and the area they are cultivating. According to Poeschl et al. (2012, p.185), “the number of biogas plants in Germany has increased by about 90% (2300 plants) in the last five years, with an average capacity of 500kWₑₚ”. We can assume that most of the farmers operating these newly constructed plants are cultivating a comparable area of land as Mr. van der Ham, namely approximately 300ha.

According to the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV, 2011), energy maize was grown on 530,000ha in Germany in 2010. Current figures indicate that this area has expanded to 810,000ha in 2012. This trend has even lead to a competition between food production and the cultivation of energy maize in some regions, rising food prices being the consequence. To counteract the further expansion of land cultivated with energy maize, the German government is considering amending the EEG once more.

15,16 http://www.spiegel.de/international/germany/biogas-subsidies-in-germany-lead-to-modern-day-land-grab-a-852575.html
The negative environmental effects of energy maize cultivation such as biodiversity loss have been mentioned earlier. The Nature and Biodiversity Conversation Union (NABU16), “estimates that growing corn releases 700 grams of carbon dioxide into the atmosphere for every kilowatt hour it produces.” Assuming that half of the electricity Mr. van der Ham is producing annually (2,000,000 kWh), is attributable to the maize he is cultivating, the carbon emissions would amount to approximately 1.45 million tonnes of CO₂ per year. Now the total GHG avoidance stated above and the overall environmental sustainability of decentralized bioenergy production has to be seen in a different light, at least in terms of GHG emissions.

Based on the previous assessment we have to state that biogas production in general but also in a decentralized context is in most regards not sustainable. This conclusion can be drawn due to the various negative environmental effects that emerge from the intensive cultivation of the energy crop maize.

For rurally coined communities such as the village Bollewick the generation of renewable energy from biogas presents itself as an opportunity to utilize existing local structures and making energy production more sustainable. Nevertheless, based on the assessment that was conducted in the course of this thesis, the aspired sustainability gains of decentralized biogas production in regard to all three dimensions of Sustainable Development are not existent or not noticeable in Bollewick at the moment. Mr. Schneider underlines this assessment by stating, “Mecklenburg-Western Pomerania and the bioenergy villages are not proving that regional […] management plans are indeed leading to an actually noticeable and sustainable, or positive development.” (Interview Hampel/Schneider 2012, p.26)

Although CHP biogas plants do increase the environmental and economic sustainability of such a system, according to the BMELV, “the promotion of biogas production should not be continued in its current form […] because [this promotion] of biogas is not convincing in terms of climate policy due to very high carbon avoidance costs and because the resulting cost reductions are very limited.” (Haberl et al. 2012, p.26)

The goal of this thesis was to accurately judge the sustainability of the decentralized biogas production in Bollewick. In order to achieve this goal, a set of social, economic, and environmental sustainability indicators concerning decentralized biogas production was chosen. As we have established in the beginning of this chapter, the biogas plants in Bollewick are only operating a comparably short time, which is why the municipality has in most cases not disclosed any verifiable information and data in regard to most of the sustainability indicators that have been applied in this thesis. Therefore, we could not rely on a broad range of empirical data for the sustainability assessment. This circumstance was counteracted by a variety of interviews and an extensive review of pertinent literature. Although some of the interviewee’s statements were contradictory, by discussing and weighing the influencing factors that have been chosen to assess the sustainability of decentralized biogas production we were nevertheless able to fulfill the goal of this thesis.

10. Conclusions

This thesis concludes that the decentralized production of biogas in Bollewick is not sustainable. Although some of the chosen criteria point to the opposite, the overall sustainability performance of the village’s energy production is still negative.

The social sustainability is fulfilled in regard to the public participation process the municipality Bollewick and other stakeholders conducted in order to create social acceptance in the population. Since socio-economic benefits such as employment creation are not noticeable for the villagers and structural weaknesses such as an aging population have not been overcome Bollewick’s biogas production is not socially sustainable.

Electricity generation from biogas is under the current level of remuneration schemes granted by the EEG profitable in Bollewick. The CHP technology and the utilization of the waste heat for the local heating network are both factors that increase the efficiency of the production process and are therefore theoretically positively impacting the economic sustainability of the biogas plants in Bollewick. Since the heating network in Bollewick is still under construction the waste heat of the production process
cannot be fully utilized at the moment. Therefore, and in light of the gradual decrease of subsidies, the economic sustainability cannot be judged accurately at the moment.

At first sight, biogas production in Bollewick is environmentally sustainable. This assertion is based on the fact that the local farmer is not solely using maize for biogas production and is adhering to crop rotations in order to buffer negative environmental impacts of the energy crop. On the other hand, the high water usage of maize and the GHG emissions that emerge from its cultivation are counteracting the environmental sustainability of Bollewick’s biogas production.
11. Literature


Delucchi, M., 2011: A conceptual framework for estimating the climate impacts of land-use change due to energy crop programs. Biomass and Bioenergy 2337-2360.


Literature


Dear Mayor Meyer, as an introduction could you please give a general overview about the development of the bioenergy village Bollewick and the implementation process respectively? What are you doing in your role as the mayor?

That is a question concerning motivation. Since the mid 1990’s the enormous exodus of money, I am putting it like this, has been bothering me. It migrated so to speak for the oil and the gas we had to buy in order to heat our houses. My curiosity was increasing because I saw projects already back then, which engaged in analyzing their own energy potentials in more detail. But due to a lack of time I started to be more engaged in this topic in the mid 2000s. But then, around 2006 I experienced an infection so to say because of a conference that massively opened my eyes to think about what can be done locally. I did not know that at that time. But when I realized that, I started to talk to my representatives and citizens if it makes sense to look for our own possibilities to, at least partially, abandon our dependency on oil one day. To begin with we went on an excursion to the alleged bioenergy village Jühnde – the first one in Germany so to say. It was a small group of six to seven people and the enthusiasm was relatively high. The majority of the participants then thought: “We can also do this.” In the end we were looking at a good example and said: “Alright, we can also do this.” That it was not that easy and still is not, depends on many factors. I realized relatively fast that you cannot just say: “OK, let’s do it exactly the same way.” No, it has to be analyzed specifically. Today I can say in general, that every village has to analyze its own potentials very thoroughly. I always distinguish between saving potential, production potential and purchase potential. You have to explicitly analyze what is out there. After the excursion to Jühnde we met up with farmers who also participated in this excursion and decided that we want to tackle this concretely and founded a working group. After founding this working group it was obvious that the analysis of potentials has to be funded, it costs money. A layperson is not capable of doing so, experts and engineers have to do that. This is why we all joined forces and collected money from ourselves so to say. But the money still was not enough. These six people who founded the working group, the one I am also part of, formulated an application to the municipality. Which is technically also me, the mayor. We wrote that we would like the municipality to support this application because it is for its own good. Well, something like that. To cut a long story short, after this analysis of potentials was finished we saw the opportunity to do something and decided to become a bioenergy village. At least partially, we already were that until 2008. A communal solar power system was already in operation. But also a number of citizens started to build photovoltaic installations on their roofs. In 2009 the next big step, apart from the ongoing planning, was that we built another photovoltaic installation on the big barn, which has been described earlier. A relatively large roof installation because the roof is quite big and the detailed planning – although you cannot say detailed planning just
yet – the result of the rough planning was that a biogas plant is required. To supply the heating system with wood chips was at such a low demand not efficient enough. So the access was a biogas plant and the useful and waste heat was most efficient solution. And this is not planned easily. One biogas plant costs approximately two million Euro. And the remaining question was who should be running this plant. Are we as a municipality doing this together with the farmers? Are maybe the farmers doing this with each other? Or is every farmer doing it individually? This was constantly going back and forth. Almost one year passed until the decision was made: Two agricultural family businesses each build one biogas plant and the municipality is taking care of the local heating network. This was the official statement in 2010. Today, both biogas plants are feeding the grid. One plant is feeding the grid since the middle of last year, the other one since 14 days and we are going to build this local heating network. All in all, by the end of the year the village Bollewick – the municipality, not the village – the municipality will have invested 1,4 million Euro in renewable energy plants. Concerning the farmers: One farmer invested 1,9 million Euro, the other one 1,8 million. When you summarize this amount, a little bit more than five million Euro have been invested for this bioenergy village to get under way. That is a lot of money for a village. Here you can see how important initial professional planning is. You also have to exploit the corresponding financial resources. These are: Credits of course, which means profitability has to be proven. The same applies for certificating subsidies. […] All of this had to be accomplished first, which took a long time – I am saying this in advance – because in this form it has not been tested here. I believe that in a sense we were pioneers.

What kind of biomass and renewable energy sources are being used for electricity and heat production? Are they as you have mentioned before, those would be photovoltaic, wood chips, maize and manure.

Wood chips not in communal investment. We do have a forest manager in the village who has invested a lot for his own good and who also has a good market position, but he does not know what to do with the term bioenergy village. He is a classic entrepreneur, who is doing his own thing and does not integrate in the structure. The farmers are different that way. They are part of the bioenergy village Bollewick of course. We do have a forest manager, but for the village’s internal supply we do not consider this target-aimed. Because for the citizens the biogas plant’s waste heat makes more sense, also long-term. I know that you have a couple of questions concerning public participation.

Yes I do. Analyzing public participation methods concerning small-scale bio energy projects is an important part of my Master Thesis. This is why I would like to ask you about the participation process you have conducted on your way to the implementation of energy self-sufficiency.

How did you initially inform the villagers about your plan of becoming a bioenergy village?

Well, when we initially decided [to become a bioenergy village] we convened a town hall meeting and generally explained what we wanted to do. But also in detail what we think something like that could look like. Approximately 60 citizens attended that meeting. The village has 400 citizens in total. We do have different districts, which is why I am referring to the central district of Bollewick. That is not necessarily very much, but if you subtract children and elderly it is an acceptable first number. What became clear pretty quickly was the understandable scepticism concerning this process. In have to add, that this all happened three years ago. Back then the oil and heating oil price was 30 cent less, the pain was still bearable so to say. But they listened interested. What we did hear over and over again was: “If you are not specific we can’t say anything to this.” So we started approaching the citizens and offered advice. We also offered individual consultation, which required a lot of time. So we were able to find out: What kind of heating is standing in the different basements? How high is the energy consumption? This was also very important for our detailed planning. We had to know: How many kilowatt-hours do you need? You cannot walk from door to door – although that is what we have mostly done – but nevertheless we did not get everything from the citizens. They were not specific. Because one takes his bill but, what do I know, the tank is still full and he does not calculate for that. Everything was very subjective. But we knew, those are only approximate values we got. It was very rare that someone said: “I take my bill over five years and divide these with five years and then I get an approximate value.” That was not the case, so the engineers had to fix the values a little bit. But it still remained very general.

Another question that was raised quite often was: “Is that safe? Is the supply safe?” The price played a very important role. Another topic was of course: “Can such a biogas plant explode?” Everybody had heard about such horror stories. And another question that was frequently occurring concerned those “maize deserts”. But also the increased transportation and so on. “Is the stuff that comes out of there
toxic? That’s all bacterially contaminated.” So a lot of different questions but the most important ones were about the price and security of supply.

Who was responsible for conducting the public participation process?

I was. No doubt. I will illustrate this with the following example: We offered that professionals are directly consulting. Engineers, in this case it was Olaf Schätzchen, or someone from the centre for consumer protection offering direct personal consulting. But the citizens probably perceived that as too technical, this absolute technology – also not grasping it – was too cold for them so to say. They wanted to see the mayor at least that is my reflexion. Because of this I could not do anything else but to walk from door to door and get the people to sign the contract personally. I was pretty tired after that. How can I illustrate this? Per family the consultation plus phone calls takes at least two hours. Multiply that with 40 and you know how time consuming that is. In addition it was voluntary work, because you also have to work. By now I am also consulting mayors. I tell each one of them: You have to do that otherwise you probably will not succeed. Maybe it will get easier due to oil price increases over the next years but also because of good examples: “Now we also want something like they do.” Either we are the pioneers who had to go through with it or they also have to do it. A very personal and direct approach is important. It does not matter whether it is the mayor or someone else who wants to sell something the scepticism is the same. Some say: “You only want to…” As if anybody wants anything. I experienced quite funny stories. But in the end there was one crucial insight. What I experienced as particularly exhausting, means on the other hand: Once again I had to – what does again mean, I am always talking with my citizens – but not so intensive, I had to talk with everybody. To a certain extent those were personal conversations. Some were very happy to see me again. Figuratively speaking: To get someone into your net, which is warming all of us, you have to conduct warming conversations in advance. That is a very important factor. I see the transition from fossil to renewable energy as a cultural change anyway. And a cultural change has to be communicated. It is rather a communicational problem than it is a technical one. That is the first thing you have to do when – and that is what we are all hoping – it is supposed to lead to actual positive effects. Then the warming conversations become reality and thereby trust evolves. Something better cannot happen to you in a village. A very important aspect is the social dimension.

You just mentioned the villagers as an important stakeholder group. Are there any other stakeholders involved in the project “bioenergy village Bollewick”? What criteria did you use identifying them?

Definitely the farmers I think that is clear, also vestrymen. But the citizens do not consider themselves stakeholders.

They probably see themselves as affected people.

They consider themselves, well, ’let’s see what they have to offer’. But they are becoming stakeholders. It is becoming their topic whether they realize it or not. Some are aware of this and I can tell you one thing, it has nothing to do with intelligence. It is also not a question about school education. Surprisingly you are visiting people of whom you think: “Well, if they even understand what I am telling them. They do not want to know about it.” But they are saying: “What you are doing is alright. I am counting on you and it’ll better work!” And the others that have a very good education or three degrees are fobbing you off. That is very unique through all strata also. So absolutely the agricultural sector, they are of course interested. When they are building their biogas plants they of course have a higher profitability when they are also selling the generated heat obviously. I even think that in that phase – back then I couldn’t even imagine if they would have built it [biogas plant] if we wouldn’t have said: “Take the heat.” And they [biogas plants] are in place and running today. We approximately invested four million Euro and they [the farmers] wouldn’t have went through with it if they hadn’t seen any participation for themselves.

Concerning the practical implementation: You mentioned that you had to go from door to door. After the first phase in which you had to do a lot of convincing, how did you design the public participation process in practice? Questionnaires, town hall meetings, information brochures?

Concerning the questionnaires: What kind of heating installation do you have? Are they generally interested? The last part of this path was very long, meaning the direct consultation and the signing of the contracts. I have 40 signed contracts. Otherwise I would not have gotten the funding clearance.
That was the last thing to do for now. Now we are in the solicitation phase and are preparing the leaflet. The leaflet says for example: “In March we are starting to install the local heating system. Therefore technicians will come to your homes. They will ask you where you want to have the heat transfer station.” All those questions that have to be considered. They have to say where they want to have the plumbing so nothing breaks and all those questions. The engineer who has done the detailed planning is preparing the orders for the network planner and the underground engineering planner now. Every square centimetre is mapped out and planned for. That is an important part of the local heating network. A lot of permits have to be obtained. Where is another pipe? Who is the owner of this area? That is a lot of effort. But that is all finished and the solicitation phase is in place now. With the solicitation phase comes the leaflet. The ones who signed the contracts are being directly addressed right now, which is the next step. And I think before we are completely switching [to the new local heating network] we will have another town hall meeting with the people who are affected. And I am hoping that once we started installing this network more interested citizens will join. That would be good insofar because we have a certain profitability – a calculated profitability. That is a calculated profitability aligned with the price. Let’s say that 10 more houses are joining then there is a relatively high probability that profits are generated. We will not allocate these profits otherwise but we will try to invest into new components. Maybe then more people will try to join or we will be able to further increase efficiency [because of the new components]. We just talked about efficiency recently. Parallel to investments in production and forwarding plants we converted the entire street lightning to LED’s. That is also an investment. For all districts that was 50.000 Euro. Although it was subsidized by the state, it is still a good thing because we are saving a lot energy costs. We are not only producing more energy we are also saving. The slide we just looked at on which it said that we are producing seven million kilowatt-hours and we are only using one million. This means that Bollewick is producing electricity above its own need for 2200 households. That is a small city.

I will come back to the required investments and financing later on. You have already mentioned this earlier but how did the people living in the village and other stakeholders react, when they heard about the plan to become a bio energy village for the first time?

Well, the contract design was a problem. “Why do I suddenly have to pay basic fees?” That was such a thing. We had to repeatedly make it clear that the network we are building right now is the most expensive part and it has to be ensured. Some people were strictly against it without any arguments. That is subtle and biogas stinks and the whole manure stinks and all these “maize deserts”, those were the arguments. I forgot one thing. I think that this is rooted therein, that some say: “Well, if that’s really kosher? I will have a look at it first.” The thing is that they cannot be looking too long because the transition to renewable energy systems is relatively well funded by the state and the federal district. Once we activated the network the people have one year to make use of the according subsidies. They can still do it then but they have to invest themselves – they will have to pay the full price for the connection to the local heating network. The calculated price without subsidies is 3.800 Euro at the moment. From this amount subsidies from the Credit Institute for reconstruction [KfW development bank] and subsidies from the federal district are subtracted. Therefore the transition is made relatively easy. But if they wait too long they have to pay the full price. That is why I am positive that the one or other will come around.

The “no” votes you just brought up. Did you or the organisers in general offer any compromises or mitigation measures? Or did you do more explanatory work? Something like: Biogas does not smell as bad as people think. Or what have you done?

No, actually not at all. You cannot get these objections out of everybody’s head. Some people are simply against it. It is not a compulsory event. The building law – or what do I know which state law covers this – you cannot force a decision. We did not consider this very democratic so we did not do it. Some people just do not want to. It is what it is. They did not argue they just do not want to.

Did the stakeholders have the possibility to object or to give suggestions during the implementation process?

Yes definitely, especially because of the events. It was like this: “If you want to do this and that, you have to consider...” It was rather friendly advice. But I forgot to talk about public relations. Of course we organized an excursion once. We ordered a bus for approximately 30 villagers and went to another bioenergy village. That is pretty close. It was not organized communal it rather was a private
investment. But for us it was primarily about that they [the participants] have conversations with the farmers and that they could have a look at house connection stations. So we have done that.

*Were all the stakeholders equally empowered to vote democratically concerning the project during the whole process? Or did they elect a group of representatives who will be able to decide for all stakeholders?*

No, that was solely the local council’s decision. I think it is different from town to town. I want describe it like this: There is – maybe there is also a different East/West relationship, maybe there are also different approaches – but I don’t think that’s the case anymore. In my point of view there are different villages that have a very broad and interested citizenry that wants to be part of the discussion. If they cannot take part they are upset because they were not asked. There also villages where the citizenry is not interested and rely on the local council. That is rather the case in our village. “They’re gonna fix it anyway.” Or: “I don’t like what they are doing, I am not participating in this.” But that is just the way it is here. I cannot call it anything else it is just like that.

*Now we want to turn our attention to some positive aspects of the participation process. What were the most positive reactions to the project?*

I didn’t say anything negative [laughs]. Everything was positive wasn’t it?

Well, nobody was euphoric and that is still the case. That is this Mecklenburg West-Pomeranian coolness. But I do think that those who signed the contracts and now see how the oil price is increasing, that their certainty is growing that they made the right decision. But since they do not know if everything will work out the scepticism is still pretty high. I think we should talk about this again in a year. Then I could say something different.

*Are there any noticeable socio-economic benefits? If that is the case, did the stakeholders give suggestions on how to use these benefits generated by project? For instance, using the revenue to build new infrastructure?*

No, I think I’ll give the same answer here. We have to test this first. We have photovoltaic installations running and that revenue is going into the communal fund. People do not realize that, but this revenue is supporting our [municipal] budget, which is important. That is also the case regarding the economy. “I have a little bit of money, therefore we can support the kindergarten or the sports club for example.” The rest will show. Look, when families that have relatively little money can save 300 to 400 Euro per year because of this and are able to spend this money on something else because the energy price is so much less, then those people have an advantage. I even doubt that they are realizing this. Because when they have that money at their disposal they are spending it. And if they do not have it they are not able to spend it. It’s that simple. It does not matter whether they are realizing it or not, but it is like that.

*Let’s focus on financing now. I can imagine that financing a bio energy village means jumping over a lot of hurdles. Especially building a biogas plant is to my knowledge very expensive. Could you introductory explain how the financing was accomplished in Bollewick? Who and how was the capital requirements covered? Who are the main investors?*

I think I already mentioned this in the beginning but I’ll gladly repeat it. There are a number of investors. On the one hand it is the municipality that decided to cover all communal buildings with photovoltaic installations, at least the ones where it makes economic sense. If I remember correctly that accounts for 570.000 Euro. Of course also supported by credits – financed with credits and supported by subsidies. Subsidies that have been available back then, but that is no longer the case. The second thing is that after we conducted the analysis of potentials we decided to effectively use the waste heat generated by biogas plants. This decision to invest in biogas plants was made by the farmers and the municipality ensured to take care of the required local heating network and is investing in this local heating network. The network costs approximately 820.000 Euro and the construction of the biogas plants costs around 1,8 / 1,9 million Euro. So approximately four million Euro. So the total investments

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12 This question refers to the bioenergy village Jühnde in West Germany, where the stakeholders elected a group of representatives
including investments in energy efficiency, namely LED street lights, amount to 5.4 million Euro until 2012. What is going to happen after that I cannot judge yet. But once we finished these investments the question will be: “Do we want to continue on this road?” The preliminary goal is to connect as many people as possible to the local heating network, so the processes’ efficiency increases. At the moment we do not know to what extent the federal district government wants to focus on the expansion of wind energy. But something is announced. Supposedly they want to increase the onshore areas by 50 percent. Hence the question is if we will be enabled to build wind turbines or just one wind turbine. That is currently not possible because we are not declared as a suitable location. If something like that is realized the question is – what we will definitely think about it in the next few years is: What can we do with the energy surplus during the summer months? We don’t need the biogas plants’ waste heat during the summer. It is warm so the waste heat is blown into the air and cannot be in principle. Because of this we are thinking about using drying processes in terms of added value. Or even preserve combustible material for the winter months for those houses that are not connected to the local heating network. Those are the questions to come. I also want to mention another thing although it is not specifically about the village, but we will have to think about mobility connected to renewable energy.

We just talked about overproduction and energy surpluses respectively. Are there any plans of letting the villagers participate in profits?

No, at the moment there is no profit participation. For now they have cost reductions due to use of renewable energy. That is also profit participation if you want to look at it that way. Always in relation to what is happening on the energy market. Because of Bollewick’s special structure, because the people are the way they are as I described before, we have not formed any democratic procedures for example a cooperative yet. We said instead that we are doing this over the municipality. If the situation changes to the effect that there is a great satisfaction and we want to involve people more, then we can imagine – at least I can imagine – talking about the topic cooperative again. That is discussed more and more in the federal district Mecklenburg-Western Pomerania. That is also a topic within the Academy for Sustainable Development. We supported this process to the effect that there are a couple of municipalities that are going this way from the beginning. But that means: Confident people who believe in cooperatives have to campaign for these. If that is not the case then it does not make sense at the moment. But I can imagine it very well for the future.

Questions concerning cooperatives would have been next on my agenda. But you have already answered them. Therefore I would like to ask more general questions now.

Is the energy production in Bollewick completely climate neutral? Do you know of significant CO₂ reductions?

I would not call it neutral. I cannot state the number. You would have to ask an engineer how much it is. But substantial CO₂ reductions are definitely given due to the biogas plants. That process is almost completely neutral. But we have to realize that fossil fuels are also being burned. Take the diesel the tractors operate on when they are collecting the substrate. So it is not 100 percent but there are significant reductions, also because of the photovoltaic installation.

The following question refers to the cultivation of energy crops in Bollewick. I read that the ratio of energy and heat production out of biomass is 60% manure and 40% maize.

That is not completely true. 60% manure and maize is certainly the main culture, but to my knowledge grass and rye plants are also utilized for the silage. So these are also components but maize plays the crucial role for the farmers. This is a delicate topic and the only thing I am saying to this is that we are discussing to increase sugar beet cultivation with the farmers. But in order to utilize sugar beets a certain technology is required, which can be sorted out. But the way I understood it is that the conservation is still a problem, because you have to be able to conserve them for the winter. Sugar beets contain a lot of water, but what do I know how this should be organised. But the farmers are thinking about it.

Not only in Bollewick, but in general these so-called “maize deserts” are criticised. And another question I have been asked a lot is: “Do we have enough land to produce food in the future?” That is also a question asked over and over again and maybe you also have it on your sheet.
I am interested in the present situation. The ratio between food cultivation and energy crops cultivation. Are areas that have formerly been used for food production or have been important for the regional biodiversity now being cultivated with energy maize?

I don’t know the exact hectare. You will have to ask my farmer tomorrow. He can surely estimate this. But it is a general question. It is always a snapshot. I think these kinds of questions have to be asked and answered honestly. Talking about food is certainly an important question. But when we say we are cultivating energy crops you also have to question: Why are we throwing away 20 billion on food? [scale unclear] That has to stand right next to it. The next question concerns meat consumption: Is the meat consumption we have in Central Europe appropriate to sustain public health? That means keeping less cattle, because cattle ranching is a very uneconomic way to exploit plants. These are the questions. I don’t want to answer 100 percent, I can’t. But I want to encourage a discussion so that this is debated in public.

Furthermore I want to tell you my personal opinion. Building up efficiency – alleged efficiency – and then industrially producing food only to send it to threshold and developing countries destroying the local agriculture. And all of that is highly subsidized. This is not a round thing anymore and so it belongs into this question. Therefore it is not that easy and most of the time only regular’s table talk. I react allergic to that but when people are asking me questions like this I do very clearly say what I think. There are all these itinerant preachers shouting their paroles and the alleged nation is following, beaming with joy and is also saying these paroles. So there has to be a general discussion. The other thing is that we are just starting with the energy transition so in the end you always have to ask: What kind of land are we giving away? That has to be added. We are in Berlin right now, if you think back 100 years. Who do you think was moving the trams? Generally horses. What did they eat? Oat. This oat grew on land, which we are allegedly using for cattle fodder, food and energy today. That is also a matter of energy. So that is idle, do you know what I mean? It is a snapshot.

I probably should have added organic food production.

Of course. My motto is completely different. I don’t see any justification in buying Russia’s, or Iran’s oil from Mr. Ahmadinedschad and exporting money there so mischief can be done with it. And we are just flimsily talking about that we are not producing food anymore. It is necessary that we are reasonably supplying ourselves with food – no question. It is necessary that we are supplying ourselves with energy and subsequently think about what is left, and send that into regions of the world where it is needed. Whether the Americans or the Europeans do it. Our taxes are financing this and the Africans don’t know where to get it from, destroying their own agriculture. You see how this goes: Now China is buying half of Africa and it only gets worse. Unfortunately. It’s odd that we are getting from a village to world politics. But it has to be like that.

Local to Global.

Assuming that newspaper articles are trustworthy – one of the main reasons for the transition to bioenergy in structurally weak rural areas is the attempt to stop the withdrawal of young and educated population strata. Were these trends noticeable in Bollewick and were they stopped? Or even reversed? Was or is this the situation of the municipality?

Yes, that is the case in whole Mecklenburg Western-Pomerania. It is the case in my own family. Both of my kids are living in big cities today. My daughter lives in Leipzig and my son in Hamburg and a lot of young people from Bollewick are doing the same. I don’t find that so bad. The way we politically acted the last 20 years, partially aware of it, partially politically wrong? Of course young people are going where they have economic success, where they are earning money and where they can start a family – that’s obvious. I have a different opinion concerning this, which might raise new questions. Does a high income necessarily mean having a good life and being happy? With good health or something else? Isn’t it a little bit the Zeitgeist that drives people towards this? “When you want to make something out of yourself then leave this place!” The following requests are just evaporating into thin air: “Engage yourself locally! Maybe you can relinquish on the 1000 Euro, you need more in the city anyway because life in the city is way more expensive.” But nobody listens to that today, that is mainstream. That’s the way it is. And when I hear politicians saying: “We have to get these people back!” Then that’s already wrong, they already thought wrong. I think when we try to create opportunities and that is what we are trying right now in cooperation with the Academy for Sustainable Development with the project “Garden of the Metropolises.” Rural areas have a future. Just think about
the oil prices. The price for heating oil is not 90 cent but 1,50 Euro. Three or four years ago people would have said about this scenario: “He’s crazy!” Today people can imagine that and these are not some crazy people. You have to ask scientists they are predicting this scenario. What opportunity does a townspeople have to get rid of his bill? I believe only a few. And now look at the bioenergy village Bollewick, maybe then – and our heating oil price is seven cent per kilowatt hour and the other would 1,50€ per kilowatt hour – then I can imagine that people would say: “I want to live in a bigger house. It’s not so bad living in a village, the Müritz is close by, that’s a recreational area.” Then it can turn pretty quickly. And these are examples all visible throughout history. Pompeji also perished and Bavaria once was a very poor federal district. Does Mecklenburg Western-Pomerania have to be Germany’s poorest federal district or can it also flourish? I think if we don’t talk about the negative side all the time but try to improve situations because we are trying to look at the big picture, then we can create charming biographies. I am talking about pioneers that move out of the agglomeration centres Hamburg and Berlin and move to rural areas where they buy an old little cottage and renovate it and invest in it. And after two or three years they are saying: “I’m tired of commuting. Actually it’s way nicer here, we are staying.” And those are the realities I am talking about today and that is my circle of acquaintances by now. People I always had around me. On the weekends they are bringing their children and children’s children. I am working on a project of which I really hope that it will work out. But some landowners are against it. The project we want realize is called 55+. They are saying: “I want to have my own home instead of a retirement home. I am 55 years old or older and I want to build a house that: is energy efficient and only uses renewable energy for heating. That is why we are coming to Bollewick where we want to spend the last period of our lives together and in solidarity with each other. Also transcending generational borders.” People are coming from South Germany, West Germany, East Germany and we even have a family from New Zealand following this concept. That means that it is hard to get something done. They struggle everyday – I also struggle everyday with things that I do. But when this struggle is over and it’s working then these are little light houses also attracting other people. Because these people know other people. These people know their own networks, namely children, grandchildren – but they also invite their friends: “Look, how nice we are having it here! That’s great isn’t it? I might want to have something similar.” Because of this, whole new processes can emerge and a modern energy supply is part of that. Respect for nature, animals and everything that belongs to that. And from there it is a short way to topics like regional food and a healthy diet. All of this plays a role in this regard. That this is not paradise and that people are making mistakes in the process of cultural change I think can be expected. That is why I am describing it like that.

Although Bollewick has just recently implemented bioenergy, are there noticeable changes? Are the citizens doing better? Were new jobs created?

No, but we have to consider the different levels of added value. Some aspects of the conversion [transition] are happening relatively quickly, that something is accumulating. Building photovoltaic installations for half a million Euro. Then this half million is budgeted for and built but unfortunately increasingly the value creation is in China, because most of the solar panels are from there by now. Nevertheless, the services stayed here to a certain extent. Next is planning the biogas plants. 4.000.000 Euro is a very large sum to be invested, which is not immediately binding jobs in the village – because we don’t have the know-how – but in the region and the regional economic circuit. It doesn’t matter that the pumps are built in Bavaria or the Ruhr region or wherever. I can’t build all of this in my own shop. But very important value added [value creation] chains are emerging. On the next level of value creation is the farmer in the village who is using his own resources and is selling them to the villagers. The money and material flows coming into the village from the outside are partially – or for the most part – gone and because of this the material flows and therefore the financial flows are local. When the citizens are saving one third because they don’t have to spend so much [for energy] then that is value creation – that is also stabilizing. It is maybe 200 or 300 Euro per year but when I see that we are only getting 20 or 30 Euro tax reduction, [then 200 Euro is a lot]. And the politicians believe that these are big numbers because they are calculating them [20€] for 80.000.000 citizens, then it is billions of course. But the individual does not get that much. Insofar saving 200 or 300 Euro per year – those are not any horror statistics. Especially considering older people.

Conclusively I would like you to take a look into the future. What are in your opinion the most important areas that have been addressed or improved?

13 big lake scenery and recreational area
Like I said before, the energy efficiency has to be improved. And also managing houses especially the communal houses. And we have to motivate people to think about saving energy. Because there is absolutely no point in changing to renewable energy and making it affordable but the people continue to waste energy. That does not match. Because of this we are planning to look deeper into managing communal buildings. There are not that many buildings because it is a small village of course.

Another important topic that I have already mentioned earlier concerns the energy surpluses generated by the biogas plants. Either we are organizing drying processes ourselves or we let someone else organize them – that doesn’t matter. Or to bring new production into the village. There are also enquiries – whether or not that will come true I can’t say at this time because it is a long way to go. But there are more and more young people from Hamburg who want to invest in organic farming or processing and are looking for preferably cheap energy. The question is if we can combine that in this framework because during the winter we need the energy that is warming us for ourselves and during the summer we are generating surpluses. So if we could adjust the production, also seasonally adjust it, that would be an advantage of course. I thought of something although I haven’t gotten far with it. What about laundry shops that are doing the laundry for hotel and so on? They require energy. What if they would pump hot water into the washing machines instead cold? I am saying this as a layperson. But they would save a lot of energy. When then the energy almost doesn’t cost anything – I am saying this in quotation marks – or is very cheap, then something could be done. That would be a seasonal business, because the hotels have a lot of guests during the summer months because it is a tourist region. But I don’t know. Questions, questions, tasks for the future.

And now my last question: More and more municipalities are following the example of Bollewick and other bioenergy villages. Do think that because of this the frequently invoked climate neural energy transition in Germany can be realized in the short- and long-term?

For that there has to be far more political will. Let me describe it like this: I think the people in the villages will realize the necessity very quickly if the prices continue to increase – no question. But when I hear that photovoltaic installations are doubted because the energy transition should be left to the large energy suppliers, although we know that renewable energy is best in a decentralised context. If one is able to understand what decentralized means, namely that the communal level – the lowest political level – has to be strengthened but you realize that one is consciously politically deciding against it, then I am getting the cold dread what is happening there. Then you are standing there and I am a glowing representative of the rural area – that is simply where I am from und I am experiencing this for 20 years now that people are repeatedly saying: We have to strengthen rural areas. But the reality is that municipalities have less and less money at their disposal and do not see any scope anymore. Up to the point where nobody is doing voluntary work anymore because he is saying: “If I don’t have any money here where I can act politically, then I don’t need to do voluntary work.” Because of this we are loosing a piece of democracy year after year, but everyone is watching with closed eyes. Big capital is working in completely different ways and a lobbyism was built that the municipalities do not have. And still you can hear the sentence over and over again: “We are strengthening voluntary work and will support rural areas.” I think there is a lot of hypocrisy; I really have to say it like that. That is the way I feel by now. And I am reluctant with my words. I can only tell you that when you are joining one of these mayoral round tables, they are talking in a completely different way by now. What is being done there right now is harmful to democracy. At least that is what people are telling. But what got us in this situation is at least harming us equally. But you don’t catch the perpetrators.

Thank you very much for the interview Mr. Meyer!
Dear Mr. van der Hamm, you are a farmer and you are cultivating biomass for the municipality Bollewick?

Correct.

Could you tell me what exactly you are cultivating?

Yes. We are cultivating maize for the biogas plants. The plants are chaffed for the silage – we are ensiling the plants in the silo. The silage stays there for half a year because it has to be stored so it can fully ensile and then we are utilizing it as a renewable resource together with the manure. 50-50 so to say.

Can you estimate how much energy maize you are cultivating for the biogas plant?

You mean the cows and the farm together?

Yes, but also proportional. How much land are you cultivating with maize and how much land does the cattle ranching require?

Well, one half of our land is for the biogas plant and the other half is for the cattle.

So how much land is that explicitly?

It is approximately 120 hectare for the biogas plant.

Did you previously cultivate food on this land?

No, we only cultivated crops for the cattle and now we are also cultivating maize. We are no market-orientated food business.

Are you rotating different kind of crops in order to prevent soil erosion and mineral leaching? Or are you using fertilizers instead? If so, how much?

In order to prevent soil erosion we are cultivating intermediate crops, for example green rye. And when that’s green during the winter then there is no leaching. That is what we are doing against soil erosion. Fertilizers we have on our own because of the biogas plant – the substrate is the fertilizer. That’s the beautiful thing: the other farms have to buy a lot of fertilizer, artificial fertilizers, and we have our own substrate.

So that is organic fertilizer?

Yes exactly.

[The recording device surprisingly stopped working for a while during this interview. During this interruption Mr. van der Hamm was talking about monocultures in relation to biomass production. In his opinion it is very important to produce biomass locally and in a decentralized context. He is stating the example of two other farmers in the region, both cultivating approximately 4000 hectare of land solely with energy maize. He views this scale very critically because according to him there is a great threat of biodiversity loss due to the expansion of monocultures. Such an industrialized production of biomass Mr. van der Hamm considers counterproductive and decidedly rejects it. According to his information these farmers are using great amounts of artificial fertilizers resulting in air and soil pollution but also the pollution of surface water and groundwater. The recording starts again, when Mr. van der Hamm is talking about nuclear power plants.]

[…]

If you look at it the following way: We here in Germany are replacing one nuclear power plant with our biogas plants and I think that is a success. How many nuclear power plants does Germany have?
Six? Seven? Look, when we are replacing one of those, then that’s quite something. [Replacing them] with our biogas plants. Of course you need land for this, that’s true – and manure. But I think it is utilized the right way.

In order to get your previous statements on tape – could you please repeat what you were saying about monocultures? You think that in this decentralized and rather small framework there is no problem concerning monocultures?

I wouldn’t say that but I don’t like that such big biogas plants are built. The really big ones which are only operating on maize. I am absolutely against that. But a biogas plant like ours – I am only speaking for myself of course. We have cattle and we are using the manure in addition to maize. Half of the input is manure the other half is maize. I think that is a good thing. But when the really big plants are singularly using maize, I don’t think that’s OK. So when only biogas plants are built that are operating on maize – I am against that. That is monoculture, that’s not OK. During the first years 2004/2005 30 – 33 percent of the acreage was canola. That is also a monoculture. But everybody likes these flowers, these yellow fields. Nobody is saying anything against those.

Is it possible to produce more energy out of canola or is maize the better option?

Biogas is not produced out of canola. You produce bio fuel with it. You take maize for biogas. You have to have biomass, you need plant mass. Beets are also suitable. Sugar beets for example can be used very well. There you also have biomass; but not canola.

Can you think of anything else you want to say about your farm?

Well, not in regard to monocultures. I really can’t think of anything else. It is in one’s own best interest to have crop rotations. Because of this some day we will also use sugar beets in order to have a [more diverse] crop rotation. Now we are in our first year, we are operating for a year now. We are operating on manure and maize – that is the easiest for now. You don’t have to make it more complicated than necessary for yourself. If something should go wrong you can always make one step after the other. We are not trying to force it. You can always change something in order to get greater crop rotation.

Are there any plans of expanding your acreage or is the current size sufficient?

The fodder we harvested last year – last year was a good year. We harvested so much, that it principally is still too much. So we definitely do not need more acreage. It’s enough.

The biogas plant was completed last year?

We started operating in May 2011. It will be one year soon.

You are not solely responsible for the electricity supply of Bollewick are you? There are two other farms correct?

That’s why we are feeding into the grid. We are selling to the regional energy supplier and they are feeding it into the grid. So in case my plant is malfunctioning, Bollewick still has electricity. Someone else is supplying the municipality in case my supply collapses. So I am not the only one responsible. In case we can’t deliver the lights are still burning.

You are burning biomass. Are you also utilizing the waste heat?

At the moment the waste heat is used to heat up the tanks or keeping them warm. Otherwise it’s cooled down with the cooler and since we are a bioenergy village the houses here in the village are heated with it. But until that is not finished we can only do it this way.

Thank you very much for the interview!

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14 There are 9 nuclear power plants operating in Germany. 16 are in the process of decommissioning (http://www.bfs.de/en/kerntechnik/ereignisse/standorte/karte_kw.html)
12.3. Interview Gerd Hampel und Gundolf Schneider

11.06.2012 Eberswalde

Sehr geehrter Herr Hampel, sehr geehrter Herr Schneider, könnten Sie einleitend kurz beschreiben, womit Sie sich in Ihrer Arbeit und Forschung beschäftigen? Vor allem im Hinblick auf dezentrale Bioenergie.

Gundolf Schneider:

Gerd Hampel:

Darauf komme ich nachher noch zu sprechen.

„Da kommen wir nachher noch mal darauf. Aber das sind so die Beweggründe. Und dann haben wir auch anhand der Energieverbräuche mal genauer guckt was da eigentlich los ist in den ländlichen Regionen und festgestellt, dass da eigentlich so eine Art pauschalisierter Aussage überhaupt nichts nutzt. Wenn man dort guckt, ist es immer so, dass die meiste Wärme oder die meiste Energie für Wärme draufgeht. In diesen ländlichen Regionen ist es so, dass fast die gleiche Menge Energie für Mobilität drauf geht und kostenmäßig ist es noch extremer. Da geht nämlich mehr Geld für Mobilität


Gundolf Schneider:
„Also wenn man sich Biogasanlagen gerade in solchen Regionen wie hier anguckt, dann ist die Wirtschaftlichkeit erstmal davon abhängig, ob die Anlage an die Verhältnisse des Betriebs angepasst sind. Also wenn ein Betrieb mit 300 ha landwirtschaftlicher Fläche sich eine Biogasanlage [anschafft] mit 500 kW, dann habe die erstens Probleme langfristig die Biomasse ran zu kriegen, weil sie müssen sie von umliegenden Landwirten zukaufen, die alle mit dem - oder vom globalen Rohstoffmarkt abhängig sind und ihrer Biomasse in Jahren wo gute Preise gezahlt werden natürlich nicht an die Biogasanlage geben werden. Es sei denn der Vertrag schreibt es so vor. Zum Anderen ist die Frage der Wiederausbringung der Gärreste ein Problem, wenn die Anlage zu groß dimensioniert ist. Also die Anlage muss passen in ihrer Größe und auch in der Nutzung der Wärme die abfällt. Also wenn die Anlage irgendwo auf einem Acker steht fern ab von jeglicher Wärmennutzungsmöglichkeit, dann ist da schon der größte Hemmschuh der Wirtschaftlichkeit gesetzt.
Wenn diese Verhältnisse alles stimmen, dann ist sicherlich die Auslastung eine wichtige Frage.“

In Bollewick hat der dortige Bauer eine Fläche von 120 ha und verwendet zur Biogasgewinnung 60% Mais und zu 40% Gülle. Jetzt versucht das Dorf alle Haushalte an das Nahwärmenetz heran zu kriegen. Der Landwirt meinte, dass die Biogasanlagen jetzt schon zu viel Strom produzieren. Also zu 100 Prozent kann das Dorf seine Stromkosten decken und zu 75% ihre Heizkosten.

Gerd Hampel:
„Was heißt decken?“

Dass das Dorf keine fossilen Energieträger mehr braucht um ihren Strombedarf zu decken.

Gerd Hampel:
„Als Ort oder Landwirtschaftsbetrieb?“

Gerd Hampel:
„Ein schlechter Einschub.“

Ok, vielen Dank!

Gerd Hampel:
„Da gibt es mehrere Faktoren. Öko-Institut und Deutsche Umwelthilfe. Also die Deutsche Umwelthilfe hat mal im Auftrag […] der NawaRo AG eine Untersuchung gemacht [zu] kleinen und großen Biogasanlagen und die verglichen. Dabei haben sie erstmal so von einem Gutachten geredet, was sehr schnell zu einer Studie wurde und nach unserer Kritik war es auf einmal eine Vorstudie. Hintergrund ist einfach Penkun als damals größte Biogasanlage der Welt. Da wurde eben gesagt, dass die nachhaltig betrieben werden kann. Das kann aber nur jemand machen, der sehr blauäugig an die Sache herangeht und dann die Untersuchung praktisch auf Grund der Aussagen der NawaRo AG gemacht hat. Die schlicht und einfach behauptet hat alles im Umkreis von 25km ran zu karren - und parallel dazu wussten wir aber, weil wir die Ausschreibung kannten wohin die Speditionen fahren. Und wenn die 260km in Polen rumfahren, dann frage ich mich: ’Wie kommen da 25km zustande?’ Wenn die Gülle aus der Prielignitz kommt, das sind 100km, ist es äußerst fragwürdig.

Aber wenn man die Aussagen einfach mal pauschal glaubt und sagt: ’Ja, dann wird eben alles aus einem Radius von 25km kommen.’ Und macht dann den Vergleich, das sieht dann wahrscheinlich ganz gut aus - was es ja auch getan hat. Faktisch stimmt daran eigentlich nichts, bis auf die pauschalen Berechnungen. Es ist klar, dass ich mit einem LKW günstiger transportiere wie wenn ich einen Traktor anschmeiße. Aber wir haben im Gegensatz dazu eigentlich immer […] hofangepasste Biogasanlagen [vertreten]. Hofangepasst heißt aber nicht, dass es eine Grenze nach Unten meinetwegen 50 oder irgendetwas – oder nach oben mit MW. Das können völlig unterschiedliche Anlagen sein, die dann aber auch wirtschaftlich und nachhaltig betrieben werden können. Also unserer Kalkulation nach ist es so, dass wir in der Region über die wir jetzt hier reden – Barnim und Uckermark – Anlagen bis zu 2MW eigentlich betreiben können, wirtschaftlich. Und wenn die noch dazu an die Betriebe angepasst ist, ist das auch wunderbar.

Reststoffen, die der Betrieb hat. Ob das dann Festmist, Gülle und ähnliches ist. Oder wir haben hier auch Betriebe im Bereich Grünlandnutzung. Wir haben Betriebe, die haben 270ha Grünland, brauchen aber für ihr Vieh […] Der Viehbesatz pro Fläche ist hier so gering wie fast nirgendwo. Es sind zwar größere Einheiten, also wir reden dann durchaus mal über 400 Milchkühe aber eine Betriebsgröße [von] 1700ha. Wenn ich das wieder rückwärts rechne, ist ja dieser Besatz sehr sehr niedrig. Trotzdem passt dann eine Biogasanlage sehr sehr gut auf diese Fläche. Die Betriebe haben dann erster Schnitt, zweiter Schnitt für das Vieh und der Rest kann in die Biogasanlage, was durchaus sinnvoll ist. Ohne jetzt über Intensivgrünlandnutzung zu sprechen.


Gundolf Schneider:
„Die kommen aber eben nicht von der Stange.“

Gerd Hampel:
„Nein.“

Gundolf Schneider:
„Das sind nicht die Anlagen, die EnviTech kurz mal hinbaut – sprichwörtlich – sondern die werden geplant von…“

Gerd Hampel:
„Wir nennen das „modularer Aufbau“ der Biogasanlagen. Das heißt wir gucken, dass wir die besten Komponenten für den jeweiligen Anwendungsfall finden und so die Anlage herstellen oder errichten.“

Also direkt zugeschnitten dann?

Gerd Hampel:
„Ja.“

Sie hatten das EEG gerade angesprochen. Dazu würd ich Ihnen gerne auch eine Frage stellen.


Wie beurteilen Sie diese Entwicklung?

Gerd Hampel:
„Das ist eine einzige Katastrophe. Also die Ursprünge der Biogasanlagentechnik ist ja eigentlich darauf ausgerichtet gewesen die Gülle optimal zu verwerten und damit mindestens 95% der Emissionen einzusparen. Aber das EEG hat damals einfach falsche Anreize gesetzt. Diese falschen Anreize haben ja dann auch letztendlich zu solchen Anlagen wie Penkun, wo 40 Anlagen a 500 kW auf einem Standort stehen, was völlig absurd ist. Da sind wir gar nicht auf die gekommen, dass jemand so etwas machen könnte. Aber das kann man nur machen, wenn man ehemals Sony Entertainment Europe Chef ist und ein paar Juristen dabei hat, dann kann man solche Anlagen planen. Aber diese Anlagen sind nicht wirtschaftlich zu betreiben und schon gar nicht nachhaltig zu betreiben.

Gülle hing anfangs so ein bisschen. Ich brauche für die Betriebe hier in Ostdeutschland – ja, nehmen wir als Beispiel Dedelow wo 6000 Viecher rum stehen. Es sind Anlagendimensionen, die sehen ein bisschen anders aus. Also da kommt aus fast nur Gülle und ein bisschen Mais dazu, 825kW. Aber das sind Anlagen, die sind einfach riesig und gigantisch und mit der zweiten Novellierung ist ja dann eigentlich auch diese – eigentlich war es in der ersten schon größtenteils drin – aber die Lagerkapazität

15 http://www.envitech.de/


Diese jetzigen Kleinanlagen – also die neuere Novellierung des EEG, die auch wiederum den Güllebonus für Kleinanlagen im Auge hat, ist eben genau in diese Fälle rein geschnürt, dass eben mit den abgedeckten Endlager die Anlagen zur Zeit eigentlich viel teuer sind. Also keiner kommt auf die Idee dann noch eine Anlage zu bauen. Man muss sich das wirklich mal auf der Zunge zergehen lassen: Die ersten Anlagen in Bayern, wo die Landwirte die Anlagen größtenteils selbst gebaut haben. Die sind gebaut worden für 500 bis 1000 Euro pro kW installiert. Wenn ich heute eine Standardanlage für Gülle kaufen will im kleinen Leistungsbereich bin ich bei 6000 Euro aufwärts [pro kW]. Also wer mit Sicherheit gut verdient, ist der Planer. Der Landwirt eigentlich nicht mehr.”

Wir hatten es gerade ja schon von Maiswästen und Monokulturen. Problematisch sind in erster Linie hohe Düngerausbringung, Biodiversitätsverlust und verstärkte Bewässerung. Vor allem in sommertrockenen Regionen im Nordosten Deutschlands kann die Bewässerung ein Problem darstellen. Wie hoch sehen Sie allgemein die Gefahr von Monokulturen und deren negativen Umweltauswirkungen in Deutschland?

Gundolf Schneider:
„Also gerade heute stand in der Zeitung, der Landwirtschaftsminister hat angemahnt oder zumindest bemerkt, dass das ein Problem ist, zunehmend. Dass also auf immer mehr Flächen Mais angebaut wird, immer mehr auch zu energetischen Zwecken. Und da ist dann auch aufgesprungen, nach einer Naturschutzprofessorin der Hochschule [für Nachhaltige Entwicklung], die das auch ökologisch eben bedenklich findet. Gerade diese Maiskulturen sind, wie wir vorhin schon gesagt hatten, sehr wassereinsparig. In diesem Artikel stand sogar drin, es werden im Vergleich zu anderen Kulturen weniger Pflanzenschutzmittel eingesetzt, nur gedüngt werden muss hoch. Das ist also ein zunehmendes Problem. Dieses Jahr gab es das Problem, dass vielen Landwirten das Wintergetreide in der ersten trockenen Periode eingegangen ist. Dass die also umgebrochen haben und jetzt also noch mal mehr Mais angebaut haben. Es gab zu der Zeit auch kaum oder nicht genügend Saatgut und andere Fruchtarten. Deswegen auch noch mal mehr Mais.“
Und keine Fruchtfolge wahrscheinlich?

Gundolf Schneider:
„Ja, also das stand auch drin. Die Fruchtfolgen werden stark eingeengt eben auch dadurch. Also es ist ein großes Problem das stimmt.“

Gerd Hampel:
„Wo war das dann jetzt? Brandenburg?“

Gundolf Schneider:
„Das stand – Brandenburg, Vogelsänger da.“

Gerd Hampel:

Ausschlaggebend für die Wirtschaftlichkeit von Biogasanlagen sind unter anderem die Substartkosten. Eine gute ökonomische Effizienz wird erreicht, wenn diese gleich bleiben oder sinken. Trotz regional steigender Nachfrage bleibt die Gewinnmarge bei Energiemais vergleichsweise gering, da dieser wie eine Marktfreude gehandelt wird und sich somit am Weltmarktpreis orientiert.
Was bedeutet das?

Gerd Hampel:
mehreren Jahren ein Spekulationsobjekt. Das heißt, der Weizen wird drei bis vier Mal gehandelt bevor er überhaupt irgendwo aufschlägt und mittlerweile ist eben dieser Preis – früher hat man eben einen direkten Zusammenhang hergestellt: Energie- und Weizenpreis. Heute kommt dazu, was ich jetzt noch sagte, dass eben diese Spekulation eben noch zusätzlich oben drauf kommt. Das macht es natürlich für alle möglichen Marktteilnehmer schwierig abzuschätzen, was eigentlich sinnvoll ist und was nicht sinnvoll ist. Aber generell ist eigentlich immer die Kopplung zu sehen [zwischen] Getreide und Mais. Der nächste Faktor ist eben, dass jetzt entgegen der Meinung von vielen der Landwirt überhaupt nicht weiß, ob sein Getreide oder Mais in einer Biogasanlage landet oder ob das als Futter oder Nahrung dient. Weil das wird aufgekauft von regionalen Getreidehändlern oder von Agravis und also den Konzernen und wohin die das liefern, weiß eh kein Mensch.“

Ist dann der Preis gar nicht daran gebunden ob der Mais verfeuert oder tatsächlich zur Nahrungsmittelproduktion verwendet wird?

Gerd Hampel:

Also mit sehr guten Biogasanlagen kommen wir pro Jahr auf über 50.000 kWh Energie pro Hektar. Es gibt Investorengruppen, die sagen einfach: alles was über 50.000 kWh pro Jahr geht, ist für Investoren interessant. Dementsprechend gehen sie in die Fläche, das heißt sie kaufen; weil sie wissen – mit den Landwirten dauerhaft Verträge, wir reden da über 10-20 Jahre – es geht nicht mehr. Das macht kein Landwirt mehr mit. Es gibt zu schlechte Erfahrungen. Das hat letztendlich zu dieser enormen Preissteigerung geführt. Wir haben es mal ausgerechnet: Mit normal landwirtschaftlichen Produkten, die am Markt verkauft werden, sind weitgehend Böden – also man muss immer aufpassen. Wenn ich hier über meinetwegen 15.000 Euro pro Hektar spreche, rede ich über 25er Böden und nicht über 60er oder bayrische Verhältnisse, sondern es sind hier diese Böden. Mit den Böden kann ich maximal wenn ich das umrechne etwa 7000 Euro pro Hektar bezahlen um noch irgendwie wirtschaftlich auf diesem Hektar arbeiten zu können. Und bei 15.000 ist da Feierabend, da kann ich keine normale Landwirtschaft mehr betreiben.“

Bevor wir zu Partizipationsprozessen bei dezentraler Energiegewinnung kommen, möchte ich einen kurzen Ausflug zu den Auswirkungen des europäischen Emissionshandels auf Bioenergie kommen.

Emissionshandel soll idealerweise den Wettbewerb um emissionsarme Technologien stimuliieren. So könnten gut ausgearbeitete Emissionshandelskonzepte die Nutzung von (klimaneutraler) Bioenergie fördern. Dennoch müsste der CO2 Preis bedeutend höher liegen, um Anreize für den Bau neuer Biogasanlagen zu schaffen.

Sehen Sie trotzdem prinzipiell eine Möglichkeit, wie der EU-ETS der nachhaltigen Ausweitung von Bioenergie behilflich sein könnte?

Gundolf Schneider:
„Das spielt eben wieder für diese großen eine Rolle.“

Gerd Hampel:

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16 http://www.agravis.de/hauptnavigation_agravis_de/home/
„Es spielt für die normalen Landwirtschaftsbetriebe überhaupt keine Rolle. Diese Diskussion wird wirklich nicht geführt.“

„Nachhaltig“ ist dann vermutlich das falsche Wort, wenn es sowieso nur für die sehr großen Betriebe in Frage kommt.

Gundolf Schneider:


Gerd Hampel:
„Sagen Sie selber doch etwas zu dem Thema.“


Ob das richtig ist oder nicht, das dürfen Sie mir jetzt sagen.

Gundolf Schneider:
„Wir beteiligen uns, wenn man jetzt für Deutschland spricht, an einem EU-weitem System und sind ja da eher diejenigen, die mehr emittieren, weil wir eben sehr energielastige Industrien haben. Dazu gehört ja nicht nur der Energiebereich. Diese Preiskontrolle führt ja auch dazu, dass viele mit ihren energieintensiven Technologien dort hingehen wo Arbeitskräfte billiger sind, um sich dann eben wieder auch diese Zertifikate leisten zu können. Das heißt, irgendwo beißt sich dann die Maus wieder in den eigenen Schwanz.“

Das ist doch genau das Ding, dass die Landwirte oder eben auch Investoren einen sehr langen Planungszeitraum gesichert haben müssen, um die Entscheidung treffen zu können in eine Biogasanlage zu investieren. Und wenn das jetzt nicht der Fall ist, also wenn die Politik keine Anreize schafft, beispielsweise über einen festen Zeitraum Subventionen zu garantieren dann die Energiewende ja nicht funktionieren.

Gundolf Schneider:
„Naja, wir hängen im Landnutzungsbereich natürlich stark – also wenn wir Biomasse produzieren für was auch immer. Ob es für Futtermittel, für Lebensmittel oder für Energie ist, dann hängen wir in der Landnutzung einfach daran, dass wir unter dem Druck der globalen Märkte hängen oder stehen. Es gibt da keinen Ausweg.“

http://www.cicero.de/berliner-republik/mehr-planwirtschaft-wagen/49620
Gerd Hampel:
„Ich formuliere es mal ganz anders herum: Es gibt eine Untersuchung, die ist vor vier oder fünf Jahren in Österreich gemacht worden. Da hat man mal geguckt, was würde der Landnutzer machen, wenn es überhaupt keine Subventionen gäbe? Also es hängt zusammen eben mit den Spezialitäten Österreich und Schweiz. Diese berühmten Alpentäler, die nicht unbedingt einen ebenen Boden bedeuten. Was kann man da überhaupt machen?


Gundolf Schneider:
„Also angenommen man würde zu realen Preisen diese Landwirtschaft ohne Förderung betreiben: Das würde einfach dazu führen, dass wir hier wie in südamerikanischen Verhältnissen nicht mehr 20% unserer Einkommen für die Ernährung verwenden, sondern eben 60,70,80%. Wir haben einen wahnsinnig hohen Lebensstandard, geben aber nur 200 Euro oder weniger im Monat für Essen und Trinken aus. Das ist völlig unrealistisch. Wir kriegen also unsere Landwirtschaft gefördert, leben sehr „billig“, ernähren dann noch global noch ganz andere Regionen mit unseren Rohstoffen, machen dort durch unsere eigenen Subventionen ganze Strukturen kaputt. Das bleibt ja nicht bei der Landwirtschaft oder bei der Lebensmittelproduktion, sondern das geht in die Baumwollproduktion, das geht in die Ölproduktion. Da geht es dann soweit, dass wir für unsere „nachhaltige“ Mobilitätsgewährleistung die Biomasse dann von dort wieder holen – so billig, dass es sich bei uns rechnet. Kommen dann auf die Idee, wir müssten ja auch zertifizieren. Dann stehen wir wieder auf dem hohen Ross und zertifizieren den Anbau in unsere Kolonie – nein, Kolonien haben wir ja nicht mehr. Das sind dann wieder unsere Kolonien, weil sie ja gar nicht anders können und unser wahnsinnig hoher Eiweißverbrauch, den wir da haben, um unser Vieh dann auch wieder zu füttern, der ist abhängig von einigen wenigen Ländern, die das für uns zu diesen Preisen produzieren. Das ist ein selbstgemachtes Problem.“

Gerd Hampel:

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Gundolf Schneider:

Gerd Hampel:
„Es muss eine andere Denkweise her. Wir haben dieses Thema mit den Landwirten diskutiert und die Landwirte sind von sich aus jetzt also wirklich ohne uns schlaue Wissenschaftler und sonst so etwas auf die Idee gekommen doch bitteschön etwas zu tun. Und zwar in diesen ausgeräumten Landschaften quer zur Hauptwindrichtung schlicht und einfach kurz Umtriebsplantagen, die in dieser unterschiedlichen Höhe praktisch auch als Windbrecher funktionieren können. Die Landwirte sind selber bereit dazu die Flächen, die man dazu benötigt, „raus zu rücken“ und wenn sie noch dazu über Kurzumtrieb bezahlt werden können, ist es noch schöner, weil sie sagen: „Die Flächen, die dahinter liegen, gewinnen an Wert.“ Sie haben aber ein Problem damit bei unserer Art von Politik, die immer in 4 Jahresdenkweisen oder Scheiben funktioniert, dass dann wenn das fünf Jahre in Betrieb ist keine landwirtschaftliche Fläche ist, sondern Forstwirtschaft; dass das ganze dann unter Naturschutz gestellt wird, weil irgendeine seltene Insektenart plötzlich und unerwartet da angekommen ist. Also ein sehr sinnvolle Diskussion ist eben entstanden, was natürlich wieder ins Eigentumsrecht eingreifen würde, weil quer zur Windrichtung hört sich alles verdammt logisch an. Aber wenn jetzt ein Landwirt selbst die Fläche dort bearbeitet – und wir reden da über Streifen [von] fünf, sechs Kilometern immer, dann habe ich da unter Umstanden 50,60 unterschiedliche Besitzer von irgendwelchen Flurstücken, die da liegen. Jeder müsste sich einverstanden erklären, der bürokratische Aufwand wäre einfach nur gigantisch und von einem privaten Landwirt gar nicht zu betreiben. Also die Landwirte selber wissen eigentlich was gut wäre, scheitern aber an Eigentums- und Bürokratieverhältnissen, die nicht praktikabel sind im Sinne des Klimaschutzdenkens.“

In meinem Interview mit Herrn Meyer, dem Bürgermeister des Bioenergiedorfes Bollewick, habe ich unter Anderem über Partizipationsprozesse und deren Gestaltung gesprochen.
Trotz zahlreicher Informationsveranstaltungen und Hausbesuchen gab es bei einem Teil der Dorfbevölkerung weiterhin Ressentiments gegenüber dem Bau der Biogasanlage, Stichwort Geruchsbelästigung.
Herr Schneider, könnten Sie Ihre Erfahrungen mit Partizipationsprozessen und Wissenstransfer bei der Implementierung von Energiegewinnungsprojekten schildern? Welche Möglichkeiten gibt es Ihrer Meinung nach, mit Ablehnung seitens der Bevölkerung umzugehen?

Gundolf Schneider:

Die haben dort den sogenannten „Runden Tisch der Ingenieure“ beauftragt, wie Sie gerade sagten, Berechnungen auszuführen, um den Leuten sagen zu können: „So und so viel müsst Ihr investieren. So und so viel bekommt Ihr an Zuschüssen.“

Gundolf Schneider:
„Also das muss vorher wirklich kalkuliert sein und die Vor- und Nachteile müssen den Beteiligten auch klar sein.“

Dort ging es eben auch um die Installation. Da ist dann der Herr Meyer eben von Haus zu Haus und hat den Dorfbewohnern alles erklärt und ließ sich zeigen wo eben die Kessel sind. Er hat offensiv dafür geworben, dass das Nahwärmenetz ausgebaut wird um eben die Effizienz zu steigern. Aber ich denke einfach, dass wenn jemand prinzipiell dagegen ist, dann lässt sich ja eigentlich auch nicht mehr so viel machen. Trotz Infoveranstaltungen, schönen Flyern und Hausbesuchen.

Gundolf Schneider:
„Also bevor man feststellt, dass alle dagegen sind oder dass 70% dagegen sind, ist glaube ich der erste Schritt wirklich die Information. Information und zeigen wie es woanders geht.“


Gundolf Schneider:
„Es wird oft einfach falsch angegangen. Die Leute werden vor vollendete Tatsachen gestellt und damit werden die Ängste geschürt und nicht aus dem Weg geräumt.“

Gerd Hampel:

Gundolf Schneider:
„Das hätte jetzt eigentlich in Mecklenburg-Vorpommern mindestens 50 Bollewicks geben müssen. Also das war ja das Ziel. Das Ziel war eigentlich 500 Bollewicks hätte es geben müssen. Es gibt jetzt ein Bollewick, dann gibt es noch ein Dorf, in dem etwas passiert ist. Es gibt einige Dörfer, wo tatsächlich ein kleines Nahwärmennetz jetzt entstanden ist, aber Mecklenburg-Vorpommern und die Bioenergiedörfer beweisen nicht, dass nachhaltige regionale Stoff-Stromfluss Managementpläne wirklich zu einer nachhaltigen oder zu einer wirklich erkennbar positiven Entwicklung führen. Wenn es dann wirklich passiert, dann liegt das wirklich auch daran, dass in einem Ort die Netzwerke wirklich funktionieren, dass die richtigen Leute angesprochen werden, dass die dann auch wieder die Bürger mitziehen. Man kann ja auch angucken in Treuenbrietzen oder hier in Brandenburg Feldheim – da hat es eben auch geklappt, weil dort die besten Bedingungen zusammen gekommen sind."

Gerd Hampel:

Da sind wir jetzt dran. Wir haben dort oben in der Region zwei Standorte ausgeguckt: Kasekow und Garz. An beiden Standorten ist es, dass es in direkter Nachbarschaft eine Kläranlage gibt, Biogasanutzung und auch offene Güllebehälter im Bereich der Viehwirtschaft und dieses zusammen zu bringen und dort oben eine Biogasanlage zu installieren, die mehrere Möglichkeiten bietet. Also wir nennen das ganze „Multifunktionalen Energiezentren“ und das bedeutet: In der Region alle organischen Reststoffe zu nutzen und daraus unterschiedliche Produkte herzustellen. Man kann da in diesen Mehrstoffzentrum, so wie es uns vorschwebt auch an die stoffliche Verwertung der Biomasse denken,

*In Bollewick wurden für zwei Anlagen und das Nahwärmenetz über fünf Millionen Euro investiert. Damit sich so eine Investition rechnet, muss das ja wirklich Jahrzehnte laufen oder?*

Gerd Hampel:
„Ja, das geht nicht. Also das ist so ein bisschen der Widerspruch. Klar, wir haben auch da, wo das die Bevölkerung wollte – aber wenn ich das durchrechne – das ist nicht nachhaltig zu betreiben. Wir reden da nicht über Grundstücksgröße wie jetzt in Bernau meinetwegen, die neu ausgewiesenen Baufelder mit 300m² oder 500m² pro Grundstück. Das sind 1000m² aufwärts und die Häuser stehen weit auseinander und die mit Fernwärme – das ist mir immer ein bisschen schleierhaft wie das nachhaltig zu betreiben sein soll.“

Gundolf Schneider:
„Man kann die Energieträger für Mobilität viel besser für Wärme nutzen, als dass man die Wärmestrukturen so nutzt, dass man auch Mobilität betreiben kann. Gerade in solchen Regionen ist das ja der bessere Aufhänger.“

*Neben einer nachhaltigen Energiewinnung war vor allem die Aktivierung regionaler Wertschöpfungs- und Finanzkreisläufe für die Entscheidung Bioenergiedorf zu werden, entscheidend. Dezentrale Energieversorgung als „Strukturmotor“ – funktioniert diese Gleichung Ihrer Meinung nach?*

Gundolf Schneider:
Bioenergiedorf als Strukturmotor.’ Das funktioniert nicht. Das ist am grünen Tisch konstruiert und das funktioniert nicht allein.“

Also sollte man doch wieder eher über die Mobilitätsschiene gehen, damit neue Anreize geschaffen werden?

Gundolf Schneider:
„Das hängt natürlich wieder davon ab, ob man im stadtnahen Bereich ist. Also im Speckgürtel Berlin kann man das wieder völlig anders sehen. Da geht es dann auch wieder um Mobilität, natürlich, aber es ist dann eher wieder die E-Mobilität, die aber sicherlich nicht über riesige großdimensionierte Holzheizkraftwerke gewährleistet werden kann, wie das jetzt gerade Vattenfall plant. Die nicht wissen wo sie die Biomasse herkriegen aus der Region.“

In Neustreelitz haben wir ein Holzheizkraftwerk besichtigt. Dieses Kraftwerk bezieht sein Holz aus einem Umkreis von 250km und dann geht die Gleichung ja auch fast auch nicht mehr auf. Das Holz wird vorgetrocknet, was natürlich auch wieder mehr Energie verbraucht.

Gerd Hampel:
„Also man kann pauschal sagen: Durch Biogasanlagen in Landwirtschaftsbetrieben, wenn es Milchviehbetriebe sind, werden die Betriebe stabilisiert. Sie können im Winter auch die Beschäftigungsstrukturen aufrecht erhalten, sie haben hochwertigere Arbeitsplätze. Dazu kommt eine mögliche Nutzung zur Wärme. In manchen Gegenden wird sehr sinnvoll überlegt – in Mecklenburg-Vorpommern gibt es jetzt mehrere Beispiele auch als Genossenschaft organisiert – und zwar Fischzucht als Abwärmenutzung. Das ist sehr sehr sinnvoll und das passt dann auch wiederum zum gesamten Landwirtschaftsbetrieb wenn das Viehbetriebe zum Beispiel sind. Diese Füllungsprozesse der Fische und alles passt wirklich idealerweise zusammen. Also wenn es afrikanische Wälze sind und nicht Krabben oder sonst so etwas. Wenn so etwas geschieht, ist es auch sehr sinnvoll und das wird auch von der Bevölkerung akzeptiert. Also die Bevölkerung beharrt jetzt bei Biogas nicht darauf ‚Ich will Wärme haben!‘, sondern – ich kenne das aus Diskussionen auch hier rund um Eberswalde – da ist es eher so: „Naja, wenn Ihr Biogas zu Erdgas aufbereitet, dann könnt Ihr doch für die Leute, die hier sind das Erdgas doch ein bisschen billigerr anbieten.‘”


Also wir haben da eine Infrastruktur, teilweise öffentlich gefördert, wie dieses Gasnetz. Das gehört jetzt zwar einem Privatmann, der aber selber sagt: ‚Das ist nicht wirtschaftlich zu betreiben.‘ Man könnte es anders betreiben um mal ein Modell für die Energiewende zu schaffen. Wie könnte man ein Gasnetz mit Erneuerbaren Energien betreiben? Also dort in der Region. In Gartz ist es ja auch so, dass ein Mehrfaches an Energie erzeugt wird wie die Region verbraucht. Rein werbetechnisch könnte man sagen: […] Also da stehen gigantische Windkraftanlagen und es kommen noch welche dazu. Wie gesagt es wird ein Vielfaches an Energie erzeugt wie dort verbraucht wird, aber trägt dann nicht unbedingt dazu bei, von hoher Wertschöpfung zu sprechen. Obwohl die Firma, die dort hauptsächlich tätig ist in der Uckermark auch sitzt, aber im Bereich des Amtes Gartz hat es nicht unbedingt die Folge, dass dort jetzt die Arbeitskräfte sind, die dann für diese Windparks zum Beispiel arbeiten. Auf der anderen Seite sind das natürlich enorme Gewerbesteuereinnahmen, aber regionale Wertschöpfung nur über Gewerbesteuern zu betrachten – haben wir auch Beispiele hier in der Region. Ein Nachbardorf Trampe, die müssen im Sinne des Brandenburger Haushaltes eine Reichensteuer bezahlen, so wird das genannt. Also das sind ein paar Dörfer in Brandenburg, die eben das Glück oder Unglück hatten, dass sie funktionierende Firmen haben und dass sie Gewerbesteuereinnahmen haben. Die sind hoch. Und
schon kommt das Land Brandenburg auf die Idee: „Das ist eigentlich zu hoch. Das steht und zu.” Und die Gemeinden müssen wirklich eine Abgabe zahlen. Also es ist sehr schwierig manchmal Bürgermeister davon zu überzeugen, dass es sehr sinnvoll wäre, doch eine sehr große Wertschöpfung vor Ort zu erzielen. Führt zum Gegenteil. Das ist kein Scherz, was ich jetzt gesagt habe. Also es gibt viele Gemeinden in Brandenburg, die müssen diese Steuerabgabe an das Land Brandenburg zahlen. Also es ist wirklich so. Wir waren völlig überrascht, dass manche Dörfer die Glückseligkeit sich davon versprechen, Gewerbeeinnahmen. Kommt man ins Nachbardorf, dann sagt der Bürgermeister: „Bleib mit vom Hals mit diese Gewerbesteuer!”

Da habe ich auch etwas darüber gelesen, dass die Gewerbesteuer magischerweise für die Biogasproduktion Anreize schaffen soll. Aber das ist dann doch eher nicht der Fall.

Gerd Hampel:

Aber es muss nachhaltig sein.

Gerd Hampel:

Gut, dann muss man eben den Bürger sozusagen in die Bringschuld nehmen und wie Sie gerade meinten: ‚Ihr müsst so und so viel nachhaltige Energie bereit stellen, jetzt könnt Ihr Euch überlegen, was Ihr wollt‘. Dann können die Bürgermeister vielleicht auch mit mehr Motivation rechnen. Dann würde ich jetzt noch meine beiden letzten Fragen stellen:

Wenn im Rahmen der Energiewende Strom bezahlbar bleiben soll, denken Sie, dass erneuerbare Energie auch ohne massive Subventionen und diverse Boni eine Zukunft hat? Was muss Ihrer Ansicht nach getan werden, damit die Energiewende in Deutschland gelingt?

Gerd Hampel:
„Ganz klar, weiter so!“ [lacht]

Gundolf Schneider:
„Es ist möglich, auf jeden Fall ist es möglich. In manchen Bereichen zeigt sich, dass es möglich ist. Wir haben hier ein Holzheizkraftwerk, das einen Wirkungsgrad von 40% hat – also schlecht. Die konnten ab 2010 ihren Strom frei verkaufen ohne EEG. Es geht also. Mit zunehmenden Energiepreisen werden sicherlich in Zukunft wird der Strom, auch der erneuerbare Strom, sicherlich auch ohne Subventionen produzierbar sein.“
Gerd Hampel:

Hinweis:
Da das eigentliche Aufnahmegerät nach einer Zeit von ungefähr 1h 34min keine Speicherkapazität mehr hatte, musste der Interviewführende den Rest des Gespräches mit seinem Mobiltelefon aufzeichnen.
Aufgrund der verheerend schlechten Tonqualität wird die Transkription an dieser Stelle abgebrochen, da die Wiedergabe des genauen Wortlautes der Interviewpartner und somit die wissenschaftliche Repräsentativität nicht mehr gewährleistet werden kann.
Zahlreiche Versuche die Tonqualität digital zu verbessern, blieben erfolglos.

12.4. Bernd Garbers: Energieakademiet Samsø

Berlin, 16.02.2012

Dear Mister Garbers, thank you for meeting me.

Hello, you’re welcome!

*Based on what you have heard today about the bio energy village Bollewick, what would you say are the main differences to Samsø?*

Well, I think they have good possibilities with their condition right now because actually you don’t have to invent the renewable energies new again because the renewable energies they are working right now. But you have to assemble the people, you have to talk with the local people to start up like we did on Samsø. But they are on a good way because they already have the contact to the local people and I think they have very good possibilities and they are very good in organizing. That is also very important for such a project.

*Let’s move to public participation. From your presentation today I got the impression that Samsø is quite a unique example of implementing bio energy and letting the public participate. Could you tell me how the people on the island were initially informed and consulted about the plans to implement bio energy?*

Well, the first thing is [that] they used the principle that – in Denmark in general people do a lot of work in groups and having meetings and they like to have meetings. It’s not only about the issue, it’s also to meet each other. It’s kind of the Scandinavian way of life. If [when] they started the project they were asking the people: “what can we do?” So they could decide [and] give ideas to the project. We continue actually in this way because we have a new challenge for the island Samsø to be fossil-free during the next years. So we were asking the people what to do. What are their ideas? And the new project we have we want to erect quite [a] quite big offshore wind park. But this is not only a Samsø project this is also a project together with the mainland. But the first we did we invited the people. We invited the people. “What is your opinion? Are against it or how do you think about that?”

*Who was responsible for conducting the public participation process?*

Well, actually the local actors who took over the project. Because the project was actually – the idea came from Copenhagen from the government. So the idea was to find the local people so that not an
engineer or some guy is coming from Copenhagen and decides what to do on the island. Because otherwise it couldn’t work. So there were some guys, local farmers, local entrepreneurs and then we were also lucky that we had a good guy called Sören Hermanssen, he is a local guy, he knows all the farmers and he knows how to handle the whole project. He is still working for the project and it’s kind of his life so he was very interested so he was the turning key for the whole project. But there were also a lot of other people [like] farmers, local people involved in the project.

*That was actually my next question. Who identified the stakeholders? You presented that there was a strong initiative coming from the farmers to implement renewable energy systems on Samsø.*

Well, it was not to identify it was actually to ask them if they would join some energy groups you know. They could join maybe a kind of solar campaign; they could join a campaign for district heating. So they had kind of a responsibility for that. So it was not just to choose them it was kind of they came from themselves. But of course to have a lot of meetings; to go to the meetings; to go to the people and this was only some three or four guys who did that.

*How did you design the participation process in practice? Via questionnaires, town hall meetings or information brochures?*

The easy way in such a small community is to invite them to a cup of coffee or a bottle of beer. So that was the main part to invite them so there is coffee and beer for free and then you are going to talk. What is going on on the island? What is the idea for the future? Because at that time there were a lot of people unemployed because an old slaughterhouse closed and there were around 100 people employed. And for a small island like this it is a lot of employees who got [became] unemployed. So there was a kind of you know negative, very negative – actually opinion by the people and actually they said: “OK, maybe it’s a chance for us.” And there are some equals [similarities] together with all through the area here in East Germany. People leaving the countries but there are still some people left who want to do something.

*You just mentioned a few examples. But what did people reject most or what was disputed the most and did you manage to implement mitigation measures?*

What do mean by mitigation measures?

*Well, people are complaining for example concerning biogas plants that it stinks. A mitigation measure would be to build the plant further away from the village so that the inhabitants are not bothered by the smell. I guess with wind parks it is mostly about visibility and noise.*

Actually it was quite easy because the island is shared by the Northern part and the Southern part. The Northern part is protected and they were not allowed to erect the turbines. But then a lot of farmers they want to have the turbines on their own land, on their own area because then they could make money. But then they said: “OK, we are going to hire a landscape architect.” So he was designing the places of the turbines, he was designing also the type and they chose that it should actually be only one type of these eleven turbines [turbine models]. Because then the landscape is a little bit more, we said quiet you know. If you have different kind of, different sizes and different types it’s more disturbing the people. But the main point was that people could join the project without having money. They could buy some micro-shares, which were actually prepared by the local banks. Two local banks they prepared everything. And that was actually the main point of it.

*Lastly, let us turn to positive aspects: What were the most positive reactions to the project by the farmers and other stakeholders?*

The people who joined the project from the beginning they had a kind of positive opinion. They were active, positive because they used the chance. But in the beginning there were also a lot people complaining because Samsø is a tourist island and people were afraid that the tourists wouldn’t come if they had the turbines. But after a while they could see, well, this island is getting more and more famous now because of the energy project and it’s not famous in Denmark it’s actually famous in whole Europe and the whole world right now. So now we can only say positive things about that also people were negative. They would like to buy shares right now of the wind turbines, but the can’t
because every share is sold. Well, this is of course – they were also a little bit lucky but they took also the risk. So they said: “OK, we go for it!”

My next question is about socio-economic benefits and whether the stakeholders are entitled to participate in the revenue. But I guess if they invested in it from beginning, of course they will see the revenue afterwards when it is economically profitable.

Well, of course the people on the island – the island is very good in doing calculations because they suffered a lot also in First World War and Second World War. The island you know, they were farmers and sometimes they were suffering. So they are used to this. So they make quite good calculations and the good thing in that case [is that] they tried to do calculations about doing some cooperation plans. Not only buying the micro-shares [but] also doing some cooperation plans and this worked quite good. They made the calculation and people said: “OK, it’s not so much money in this calculation but I’m joining the project.” And right now people try to join new cooperation projects and that will be maybe some big solar plans on the island, which are producing electricity. There will be a lot of people – are asking for it to buy some micro-shares in new solar systems.

OK, that was it actually.

Great! I hope I could help you with my information.

In just have one more question concerning your presentation. You were saying that the Danish government does not subsidize renewable energy.

That’s right.

But how come that Denmark is the world leader in wind turbines and wind energy?

Well, they did it. Bow they don’t do it any longer. They did it and then we had a political change in 2001 and after that they cut everything. That year actually the wind turbine business there was money in it. The wind turbine business actually was built up with subsidies like in Germany with solar systems. So they did it in the Seventies they were quite good to support small companies to build up this industry right now.

Thank you very much!

You’re welcome!

12.5. Interview Anne Athiainen

The transition of small villages to bio energy is mainly taking place in structurally weak rural parts of Germany. Realising this transition, the villages are trying to combat high unemployment rates and the increased movement of young and well-educated strata of the population. Counteracting climate change and the high dependency of fossil fuels are of course also of vital importance.

Can you illustrate the main reasons why your village chose to implement bio energy as its main energy source?

We have many municipalities in Southwest Finland that have changed to biomass because of the high price of oil. The small in SWF municipalities are very decentralized and district heating is in use only in the center village of the municipalities. Our two “Carbon neutral cities” have also had a climate change view in their decisions. http://www.ymparisto.fi/default.asp?node=22737&lan=en public procurement is a difficulty, because the municipalities want local entrepreneurs to use the heating plants, but because of the procurement it’s not always possible. Also it has been difficult to get local farmers to be active in the procurements.

Which kind of renewable energy are you mostly relying on?
in SWF mainly woodchips and wood pellets

After listening to Mr. Schätzchen’s presentation – where do you see the main differences between Bollewick and you bio energy village?

local peoples enthusiasm is so important, that’s something that we need more. Also in our small villages, the houses and farms are quite far from each other, district heating is not profitable

Public Participation

Analyzing public participation methods concerning small-scale bio energy projects is an important part of my Master Thesis. This is why I would like to ask you about the participation process you have conducted on your way to the implementation of energy self-sufficiency.

How did you initially inform the villagers about your plans of becoming a bio energy village?

one example is the centre area of Mynämäki (Carbon neutral city). They decided to build up a district heating net, first of all they connected all the public buildings to the net. Other customers could connect the net free of charge in the first year.

In what way have you consulted the villagers for the first time? Using information pamphlets, organizing a town hall meeting?

we don’t have many small villages that have their own energy production. So far they have been active themselves, for example three wind power plants (3x2MW) in small island of Högsåra (www.hogsara.eu). Island has only 45 inhabitants and around 200 summer guests. The project took 10 years.

To the bigger villages and municipality centres, usually the municipality itself has been active.

Who was responsible for conducting the public participation process?

municipalities themselves

What criteria did you use identifying stakeholders?

How did you design the public participation process in practice? Questionnaires, town hall meetings, information brochures?

How did the people living in the village and other stakeholders react, when they heard about the plan to become a bio energy village for the first time?

usually very positive, of course there’s always a little envy for those who are going to be the entrepreneurs for the biomass plant. So far there’s only one biogas plant that is established by 40 pig farmers in Vehmaa. Other biomass plants are usually owned by the municipality and used by a local farmer/forest owner. We call them “heat entrepreneurs”. There has been around 10 training courses, “how to be a heat entrepreneur”, during the last 10 years, but they have not been so successful as in other parts of Finland. People in SWF are not so excited to be entrepreneurs.

Which topics of the project were disputed the most between the stakeholders? What kinds of objections were raised the most?

the wind energy gets the most strongest objections, the not-in-my-backyard –thinking is very strong. Also we have a very unique coastal area with 20 000 islands and hundreds of thousands summer houses. Also in the mainland the objectives against wind mills have been very strong and the municipalities haven’t have the courage to start the town planning to the wind power parks.

How did you or the facilitator react to these objections? Were there any mitigation measures?

we have tried to give objective information about energy production
How were the stakeholders consulted during the implementation process? Were they still able to object?

usually there is an environmental impact evaluation (demand in the environmental law), which includes the hearing of the shareholders

Were all the stakeholders equally empowered to vote democratically concerning the project during the whole process? Or did they elect a group of representatives who will be able to decide for all stakeholders?

everyone has their right to tell their opinions

Now we want to turn our attention to some positive aspects of the participation process. What were the most positive reactions to the project?

environmental aspects, when replacing oil with biomass
more job opportunities to the local people
even some money to the local people

Did the stakeholders give suggestions on how to use socio-economic benefits generated by project? For instance, using the revenue to build new infrastructure?

not that I know, most of the new biomass plants are still so new that they are not been “paid” yet, so it has not been big money to spend so far.