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Tools for companies' competitive position maintenance and sustainability image building

best Sustainable Bioenergy Solutions for Tomorrow

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Summary

Engagement in the bioenergy field globally requires careful attention to local circumstances. These circumstances and the social dynamics that have to be accounted for vary between countries and situations. In this document, we analyze three very different countries to highlight the pressures to bioenergy investments from social and political dynamics at countries in different stages of development. We analyze a highly developed country, Germany, a post-socialist transition country, Poland, and a developing country, India. The analyses presented are based on document analysis and literature review, with the goal of identifying the specific challenges to running a socially sustainable bioenergy business in each country.

The current document should form a basis for thinking about how one’s bioenergy projects fit in with the variety of global social dynamics, whether in the case countries we have analyzed here, or in countries in similar situations. This analysis is general and would need to be adapted to work for an actual project. We suggest that bioenergy decisions by companies should be accompanied with and supported by a project-specific social sustainability analysis. This would likely require the involvement of local stakeholders, at least as information providers through interviews on-site, but very likely as experts with unique capability in identifying how the local dynamics are likely to work in their community. The methodology is available in various public engagement and public deliberation traditions.

Espoo, May 2014

Content

1 Introduction

Engagement in the bioenergy field globally requires careful attention to local circumstances. These circumstances and the social dynamics that have to be accounted for vary between countries and situations. In this document, we analyze three very different countries to highlight the pressures to bioenergy investments from social and political dynamics at countries in different stages of development.

We analyze a highly developed country, Germany, a post-socialist transition country, Poland, and a developing country, India. The analyses presented are based on document analysis and literature review, with the goal of identifying the specific challenges to running a socially sustainable bioenergy business in each country.

The results are presented within the context of these three countries, but the dynamics identified are general and bioenergy business anywhere faces a mixture of the three types of pressures: the practical infrastructure issues (that are most evident in developing countries), the local community issues, and the social competition. In this document, we identify these issues and offer some suggestions on what companies should do to mitigate them to remain socially acceptable partners for local actors and be able provide bioenergy services in a sustainable manner.

The case studies follow a slightly different form: the situation in India is described in more detail and looks at the Indian specifics, with focus on the use of agricultural side products for bioenergy production. Reasons for failures of the four rural bioenergy development projects analyzed in the literature are summarized. These together with the other bioenergy related challenges found in the literature are then used to generate tools that reveal which factors companies should at least take into account when planning a sustainable bioenergy project in rural India. The European cases focus on the understanding and learning opportunities from these countries. The goal of the analysis focusing on Germany is to show how the current policy climate came to be, and the political and social dynamics behind it. Since the German economy is the current driving force in EU and it has chosen a more radical path towards renewable energies than EU in general it makes an interesting case study. The analysis focusing on Poland looks at the social dynamics at the cross-link between two modernizing sectors, agriculture and energy. Poland is interesting for this study, because it is a EU country that is highly dependent on agriculture (with 4 times more workers involved in the sector than the EU average) and thus has considerable amount of biomass available as side products.

2 India, Important Agricultural Sector and Challenges of Bioenergy Projects

2.1 Renewables in India

Large share of the extreme poor of the world population live in India (Olinto et al., 2013). In 2012, about 20 % of the population lived below the extreme poverty line (Government of India, 2013a) and 80 % of this in rural areas. Nearly 50 % of the rural population has no access to electricity. Those with the access often need to cope with poor and erratic availability of electricity (and other fuels) (Government of India, 2011). At the same time, India is the fourth largest energy consumer in the world (U.S. Energy Information Administration, 2012). With 41%, coal is India's primary energy resource, followed by petroleum (23 %) and solid biomass and waste (23 %) (CSE, 2014). Demand set to India's energy resources by its economic growth, combined to its dependence of the imported oil and likely increasing dependence on imported coal (Government of India, 2011) could make energy security as one of the key driving force for the bioenergy.

The installed electricity capacity in 2011 was 211 GW (U.S. Energy Information Administration, 2012). For the basic lighting of households the main energy source is electricity with 67.25% and kerosene with 31.43% (CSE, 2014). Lack of electricity in rural areas leads to increased kerosene consumption (Government of India, 2011). Because of the kerosene subsidy system, this results in enormous costs in addition to the increased dependence in import.

Replacement of fossil fuel use, increased access to electricity/lighting in rural areas, and increased share of the renewables in the total energy mix (up to 6 % by 2022) all belong to mission of the Ministry of New and Renewable Energy (MNRE) (Government of India, 2011). MNRE view is that renewable energy should be seen as a key part of the solution to the nation's energy needs. One of its important functions is fostering international cooperation in the sector. Markets and consumers are seen as needed drivers for the renewable energy.

Total cumulative target set for grid interactive renewable power by the end of 2017 through biomass/agri waste is 1525 MW and through bagasse cogeneration 3216 MW. Total cumulative target set for off-grid renewable applications include for example 5.6 M family biogas plants, 8000 remote villages covered with electricity, 1000 rural villages covered with biomass gasifiers, and 780 MW_{eq} by industrial waste to energy (covers biomethanation of liquid effluents; combustion/gasification of biomass and rice-husk).

Biomass power/bagasse cogeneration as grid connected renewable power is mature and commercially viable, but deployment is limited by local resource availability, logistics and environmental conditions. Competitive local use of traditionally available biomass is seen as a limiting factor for biomass/agri waste power, while overall surplus power generation potential of 5000 MW from existing sugar mills is seen as limiting factor for bagasse cogeneration (Government of India, 2011)

Off-grip applications are seen as a way to reduce fossil fuel consumption as rural lighting replaces use of kerosene, biogas plant could replace scarce cooking gas etc. In more general, renewable energy technologies are seen as methods that help to ensure that India is able to contribute to climate change mitigation, that are likely to generate significant amount of jobs (at local level), but also as a key tool for ensuring energy security.

In addition to global price of crude oil, national subsidies to diesel, kerosene and furnace oil affect the development of renewable energy off-grid solutions. Cost reduction and efficiency improvements are those factors that affect the development of grid connected renewable energy power. Possible decline in power shortages might reduce (utilities) desire to buy higher costing renewable power.

Compared to grid connected power, decentralized energy production is seen as having to battle against greater barriers when it comes to up-scaling of renewable energy deployment. Access to capital, technology development and adaptation, innovation induction, and strategies to up-scale deployment are areas that are in need of improvement.

Based on the assessment commissioned by the MNRE, current weaknesses of the renewable energy sector in India are: absence of conducive policy and regulatory framework in some States, high cost of certain technologies, current acceptability of end-users, inconvenience of use of certain renewable energy based applications compared to conventional means, quality and therefore reliability of equipment (particularly for decentralized applications), lack of availability of adequately skilled technical manpower, lack of adequate transmission infrastructure in states for evacuation of renewable power, lack of implementation infrastructure, general lack of awareness of end-users, and lack of adequate distribution and service network. Conducive policy and regulatory framework at central level, good resource potential, growing technology maturity in certain sectors (such as grid connected wind power), emergence of indigenous manufacturers and developers, ability of renewable energy technologies to offer off-grid/decentralized energy solutions are considered as current strengths of the sector.

Possible threats for the development of renewable energy sector include for example variation of political support at State Government/institutions level (power authorities do not bother much about renewable energy), lack of interest by other (than MNRE) Ministries, continuation of high subsidies for diesel, kerosene and cooking gas, readiness of financial institutions to take a risk, resistance from local community/end-users towards use of certain technologies, and infrastructure bottlenecks. Opportunities are seen for example in increasing price of oil, increasing energy demand-supply gap, increasing pressure on availability of conventional fuel sources, lacking access to grid power within several regions, potential for employment, increasing awareness of climate change concerns, decreasing domestic coal allocations, conducive legal framework (such as Electricity Act, National Energy Policy, National Tariff Policy), National Action Plan on Climate Change, Kyoto Protocol and new Global Climate Protocol.

An external stakeholder consultation process was undertaken as a part of the MNRE's Strategic Plan formulation. According to this, climate change, technological development/innovations, and price of oil were seen as the key external factors that will impact the renewable energy sector in India. Policy and regulatory environment, R&D, and technology innovation and transfer were seen as the key internal factors. Large scale deployment and cost reduction were ranked as number one desired outcomes from the renewable energy sector by majority of the respondents, followed by reaching desired levels of investment and capacity installation. Technology innovation was ranked as number one desired strategy for the sector by the majority of the respondents, investments facilitation being the next factor followed by identification of new deployment models for commercialization.

Weak points of the current system can also be pointed out from the Sector-specific Implementation Plan as those factors that are promoted on the Action plan of the Implementation Plan. Considering energy production from the agricultural/crop residues these include absence of sustainable fuel linkage systems (biomass collection, densifying processing and storage facilities) and long-term fuel supply. Considering biomass gasifiers these include skills of the technicians and entrepreneurs. Absence of awareness of target industries is the weak point of the bio-energy in industry sector, while absence of awareness of urban local bodies concerning the advantages, potential and prospects is the weak point of the urban wastes to energy sector.

In many of the States, renewable energy has not gotten a high priority. Therefore the process for allotment of sites and statutory clearances, including land acquisition, forest clearance, irrigation clearance etc., is very time consuming. The actual implementation of the Ministry's programs is through the State Nodal Agencies. These on the other hand, can affect for the local self-government institutions (such as Municipalities and Panchayats). Ministry of Power, Ministry of Petroleum and Natural Gas, Ministry of Finance, Ministry of Environment, Ministry of Urban Development, Ministry of Education (Department of Women & Child Development), and Ministry of Tribal Affairs are those other relevant Ministries of Government of India when it comes to development of renewable energy.

2.2 Bioenergy potential in agriculture

India is an agricultural country. About half of the population is working in the agricultural sector (Government of India, 2013b). Through the amount of agriculture in India there is a huge potential for bioenergy. Where agriculture is, there is agricultural waste or crop residues which can be transformed into bioenergy. These residues produced vary greatly from one kind of crop to another. In addition, a certain amount of the residues produced annually is used locally for example as a fodder for the animals or fertilizer. India produces annually about 686 MT of gross crop residue biomass (Hiloidhari et al., 2014). From this about 234 MT are estimated to be a surplus for bioenergy generation purposes (~34 %). This accounts for a total of 4.15 EJ, which is ~17% of the total primary energy consumption of India.

As the amount of each crop which is farmed varies between the different states, bioenergy potential of the state's varies as well. Uttar Pradesh, most advanced state concerning the agriculture as well as the most populated state, has a bioenergy potential of 743.15 PJ with 121 MT surplus residues available. The least advanced state is Mizoram with a bioenergy potential of 0.84 PJ and only 0.21 MT surplus residues available.

2.3 Implementation of bioenergy production systems in India

2.3.1 Summary of the case study

In order to find out how to make the bioenergy project successful, it is necessary to gather information of the reasons for success or failure of the previous projects. Therefore, short summary is made of the article written by Romijn et al (2010), in which the four biomass development projects in rural India were discussed. Focus on the summary is on the main successes and failures of the projects, and reasons behind them.

Aim of the four projects was to provide electricity, and water as a result, to the villagers of Karnataka, southern India. None of these systems were anymore in operation at the time of the research The four projects were a biogas system in Pura, a vegetable oil system in Kagganahalli and surrounding villages, a biogas system in Mavinakere and a producer gas system in Hosahalli:

Pura community biogas plant

The aim was to supply the village with biogas for cooking and water heating. It was done with two village scale biogas plants which transformed dung collected by the villagers into biogas. The remaining sludge was redistributed among the dung providers for use as fertilizer.

- The dung supply was insufficient, because collection of dung of the free-ranging cattle was time-consuming and unrewarding, and dung providers thought they were not given the agreed amount of sludge fertilizer.

Kagganahalli vegetable oil system

The aim was to supply electricity for illumination and pumping drinking and irrigation water to a cluster of villages. Plantations of Pongamia, indigenous oilseed-bearing trees, were established. The oil, pressed from the seeds, was filtered and used in generators, which produced electricity.

- The project involved different agencies and large numbers of persons, which made it organizationally complex. In addition, people who provided seeds or had a bore well on their land started to demand more rights than other villagers.

Biogas system in Mavinakere

The project consisted of a biogas plant, generator set, and electricity and water distribution system. The system was similar to the system in Pura. Supply of electricity and water were limited for certain hours of the day, based on the agreement. Since 2000, it had been used only for pumping drinking water.

- Although the engine should have been running on dual fuel mode, the flaw in the generator resulted in that the utility was running only on diesel. Occurrence of major engine problems resulted in system shutdown for about two weeks. In addition, competing government-sponsored water supply scheme appeared.

H*osahalli and Hanumanthanagara producer gas systems*

In Hosahalli village, a biomass gasification system using wood chips was first aimed at providing supply domestic illumination. It was later expanded to water pumping and flour milling. Similar system was later installed in nearby village Hanumanthanagara. The producer gas was used to fuel a diesel generator in dual fuel mode. The power generator capacity in Hosahalli was initially 3.7 kW, but was later increased to 20 kw. The plantation of fast-growing trees of 2.5 ha was later increased by

1.5 ha. A wood gasifier system in Hanumanthanagara was 20 kW, while energy plantation was 8 ha.

- The system experienced many technical problems. In addition, gathered fees were not sufficient and intra-village conflicts over the utility occurred. The reason was that farmers who had a bore well on their land started to demand compensation. Furthermore, competing grid-based electricity and state-subsidized water supply appeared eventually.

2.3.1.1 Main problems

Failures that resulted in the shutdown of the four projects were not mainly technical, but financial, political, social and organizational/institutional in nature. Although the long-term objective of the projects was to provide less expensive and/or more reliable energy than the grid, this did not happen. Poor families had also difficulties to pay for the services and the projects did not manage to generate extra income for local people. People's desire to pay for the services was decreased as the projects' services were found to be unreliable.

Living standards, especially of poor women and marginal farmers, were improved during the projects' operation, but some of the richer villagers felt that their energy preferences were not fulfilled. Furthermore, some, with political connections and power, even started to lobby for grid connection and discontinuation of the projects as they lost their privileged access and had to share more equally with poorer villages. This for example, resulted in of the Hosahalli system, even though it was quite competitive with government-supplied services.

Projects did not succeed in empowering local people to take over the management of the utilities in the long-term. Effective local management was complicated due to financial problems and socio-political disagreements between local groups.

Systems were vulnerable to price fluctuations as they all continued to use fossil diesel in addition to renewables. Although renewable resources used were mainly local, some had to be brought from outside the project area. Furthermore, overuse of biomass resources had been reported.

2.3.2 Challenges facing bioenergy projects in India

Some of the socio-economic challenges regarding implementation of bioenergy production systems in India are mentioned in Harrison (2011). These include for example a) motivation limitations due to lack of training and skill development, b) mistrust of new technologies and outside influence of some cultural groups and c) relatively high capital costs related to purchase of feedstock and low purchasing power of potential users. Furthermore, gaining agreement from various different departments, who all have their own interests, can also be challenging. When possible stakeholders, and their participation, are considered, it is important to include women as they usually have the practical responsibility and knowledge regarding agricultural activities. Even though, they often have less power (for example fewer legal land rights).

In the article written by Amezega et al (2013) it is stated that the rapidness of bioenergy's expansion and tendency to focus heavily on certain bioenergy source has been the reason for many of the problems. Every time there is a switch from one source to another (for example from Jatropha to palm oil) there is "a rush to develop new resources and prove new technologies often without the necessary forethought and policies in place."

In Asia, production for local markets appears to be more important than export (Borman et al., 2013). The actual realizable bioenergy potential is dependent on practical issues such as its alternative use as fodder or raw material for industry, efficiency of the biomass collection, availability of waste lands, weather conditions, water availability, and geographical conditions (Ravindranath and Balachandra, 2009).

In the article written by Ravindranath and Balachandra (2009) following barriers are attributed for the slow rate of spread of the bioenergy technologies:

1. Limited capacity to assess, adopt, adapt and absorb technological options
2. Inadequate information to assess the technological needs
3. Weak institutional infrastructure for diffusion
4. Lack of access to financing
5. Limited R&D funding
6. Subsidies
7. Lack of motivation and incentives

8. Difficulty in mainstreaming environment into development plans
9. Lack of direction and transparency
10. Lack of private sector participation

First one of these may lead to magnification of the general resistance to change. It is common that other development priorities precede environmental ones, which leads to eight one of the reasons. In india, the multiplicity of institutions and their overlapping roles further act as barrier. One of the misconceptions needed to be changed is stated to be commercial unviability of bioenergy technologies. Suggested approach is market transformation i.e. change the types of products(services offered in the market.

Pramod Aggarwal, Regional Program Leader (South Asia) CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)) has pointed out few problems (Hakala, 2014). Use of residues for bioenergy might threat quality of soil, which should be looked in the light that farmers already use residues for various purposes (such as for livestock feed) against the common wish. In addition, field area for growth of biomass is competing with the food production i.e. if India wanted to be self-sufficient in food production, no field is left for bioenergy purposes. His personal view is that if there were land available suitable for bioenergy purposes, these lands would also be suitable for food production; thus so called waste lands are not suitable for crop production. He also thinks that Jatropha was propaganda.

According to research made by Kärki and Leinonen (2013), issues in the bioenergy sector in India are:

- Inefficient technologies and applications
- Resources are available in the rural underdeveloped regions
- Unregulated biomass market leading to fluctuating prices
- Crop failures leading to irregular biomass supply
- Lack of proper infrastructure and structured policies
- Lack of coordination among various organizations

2.4 Tools for successful bioenergy projects in India

2.4.1 Marketing

It is good to keep in mind that in addition to environmental advantages bioenergy is likely to be seen as the way to enhance energy security. Therefore, when company is aiming to market its bioenergy project in India, energy security should be highlighted as one of the key benefits. Furthermore, MNRE sees renewable energy technologies as mean to generate significant amounts of jobs at local level, thus job opportunities should be highlighted as well during marketing.

2.4.2 Competing alternatives

Diesel, kerosene and furnace oil are all subsidized in India, thus their price can be expected to fluctuate a lot. This can create a risk for the aimed project, as the service it provides (such as electricity for lighting) might suddenly become less tempting (more expensive than the alternative) for local customers. Some of the local customers might anyhow have problems for paying services due to lack of money. It should also be considered that at some point the village where the project is aimed at might get an access to grid-based electricity, which can reduce willingness to use the company's service if it is seen as an alternative.

2.4.3 Complex policy and regulatory framework

The assessment commissioned by MNRE revealed that regulatory and policy frameworks of some of the States in India do not necessarily promote renewables. It is quite clear that implementation of bioenergy project in State which policies and regulations do not support renewables is more difficult (~ time consuming) than in the State that does. This emphasizes the importance to get acquainted with current legislations and policies of the aimed State. Besides, getting agreement from all the institutions/departments needed is challenging as their roles might overlap and they all have their own interests which are likely differ from those of the company's.

2.4.4 Changing requirements in long-term

Company should ascertain that both parties of the contracts, made between the company and any of its stakeholders, are well aware of the issues that the contract obligates them to. Company should still be aware that new requirements might be presented later on. Furthermore, stakeholders who are providing the biomass for the project might underestimate the time and effort needed for the collection etc, which might eventually result in problems with availability of the biomass.

2.4.5 Infrastructural problems

Company must be prepared for lack of prober infrastructure as adequate transmissions and implementation infrastructure as well as distribution and service network might be missing. Sustainable fuel linkage system (biomass collection, densification processes, storage facilities) is likely to be absent as well. Of course this might as well be an opportunity if the company can provide them. Use of bioenergy in industry is not necessarily a common thing, thus if the project aims at providing bioenergy services to industry, this needs to be taken into account as well.

2.4.6 Lack of technical manpower

Availability of adequately skilled technical manpower is not a certain matter in India. However, if this challenge is solved by bringing in existing company workers or migrant workers, less jobs for locals are created, which is likely to increase resistance from locals (who might feel that they have been betrayed). Cultural differences could lead to disagreements between immigrants and locals, further worsening the situation. Therefore, it might be wise to consider training of local population for the needed technical skills if just possible.

2.4.7 Acceptability issues

Acceptability of the end users is also considered as a current weakness of the renewable energy sector in India. Possible reasons for this are suggested below, but important thing from company’s point of view is to realize that this is an issue that needs to be taken into account, as it might lead to such a high resistance that can cause a project failure.

It is likely that end users are used to using certain energy services such as kerosene for lighting, thus there might be a resistance for alternative services (such as use of electricity for lighting). Previous experience with certain new equipments (or services) that have resulted in any kind of failure, are likely to decrease reliability (and thus acceptability) for the future ones as well. In addition to this, if the company fails to provide service it has promised for even a short while, service might be seen as unreliable and willingness for pay for it decreases. Furthermore, since women usually have the practical responsibility for agricultural activities, they should somehow be included in the process.

Acceptability issues might arise from the earlier disappointments for example Jatropha was first considered as highly promising plant for biomass production but eventually did not live up to its expectations. Any new plant for bioenergy purposes or advantages of bioenergy in general that the company presents might be seen as propaganda.

While cast-system has officially been forbidden in India, the gap between rich and poor is still very alive. Since the local powerful people are likely to ascertain services they are accustomed to for themselves as well as to maintain their status in society, the project that is aiming for social sustainability is likely to face resistance. This has to be taken into account already during the project's planning state for example by including all the stakeholders into the planning process and by carefully listening their needs and expectations for the project's services in order to enable customization of the services for various needs of local people.

2.4.7.1 Availability of biomass

Availability of biomass resources is clearly a disputed issue. The production of bioenergy from biomass that has been cultivated for bioenergy production will most likely face severe uncertainty due to competition with food production and other issues with environmental and social sustainability (Kainiemi et al., 2014). These issues can result in negative publicity, consumer boycotts and financial losses. In this report focus is therefore on crop residues. However, crop residues have also purpose for the local people, since they are generally used as a fodder for the animals or fertilizer. It has been estimated that about 234 MT of crop residues are available for bioenergy after local use is taken into account. This of course is divided unequally between States. Project specific availability of the biomass is of course an issue than can only be solved locally.

3 Germany, *Energiewende*, Exogenous Shocks and Energy Transitions

3.1 Why look at Germany?

Germany is a regional and global leader in solar and wind power, but not in biomass use. Yet, the German experience is influential on actors who wish to think about the future of European bioenergy, as the political processes and social debates in the renewables field are similar to those in any European country. The goal of this analysis is to provide the reader with an understanding of how social and political factors are shaping energy markets in Germany, up to the current debates on changing the Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz, EEG), and to provide tools for accounting some of the key social and political uncertainties in the sector.

Germany is a key country for the bioenergy sector in Europe, not just because it is the largest economy and a driver of the content-wide economic developments, but also because it has chosen a more radical path towards renewable energies than EU in general. German economy is the current driving force in EU and especially for the Euro area, making energy policies decisions reverberate even more in neighboring countries and across EU. Thus, even if individual projects cannot expect to have political influence, we map the political developments that are essential to be accounted for to guarantee sustainable participation in the bioenergy sector, whether as an investor, technology provider, or in another business role.

The original EEG from 2000 pushed for a radical boost in renewable energies with a program of feed-in tariffs, fixed but scheduled to decrease, with costs pushed onto consumers directly on the energy bill. The policy also opened up the market with grid access for small and medium enterprises and cooperative and household production. EEG was very successful in increasing renewables share, and has often been seen as a key learning opportunity for other countries. But social problems with how the costs are shared, how the tariff system pushes for innovation and so on, have led to a major reorganization in the policy frame into EEG 2.0. The amendment was adopted by the German cabinet early April 2014 and is now in the parliamentary process, expected to be in force by August 2014.

The goal of this analysis is to show how the current policy climate came to be, and the political and social dynamics behind it. It is organized in the following sections: 1.2 is a short overview of the German energy system and the 30-year history of the energy transition in Germany. 1.3

presents policies currently in force and the debates that led to the overhaul of the policy system, discussed in 1.4. Three key social dynamics are identified in the policy debates and analyzed in the following sections: 1.5 looks at the reactions to a direct surcharge visible to every consumer in their energy bill, 1.6 analyzes the dynamics of a political battle between the Federal state, regions, and localities, and 1.7 analyzes the how the decentralization initiatives of EEG have played out in society and how EEG 2.0 is seen to change the opportunities in small-to-medium scale renewables production.

3.2 History of the Germany electricity system

The German electricity system has historically been based in coal-fueled power plants, supplemented by nuclear since the 1980s. Since 2000, renewables have entered the market with force, but absolute fossil fuel amounts have not decreased significantly, with the exception of nuclear after the Fukushima nuclear accident prompted policy-makers to start phasing nuclear plants out faster than they were scheduled to. The industry was heavily fragmented, with heavy local or regional public ownership in utilities, until 1990, when rapid centralization through mergers led to ownership share of over 90% by the so-called big four utilities (Stenzel & Frenzel 2008). These four are still the key actors in fossil fuels, but their share of the emerging renewables has been small so far.

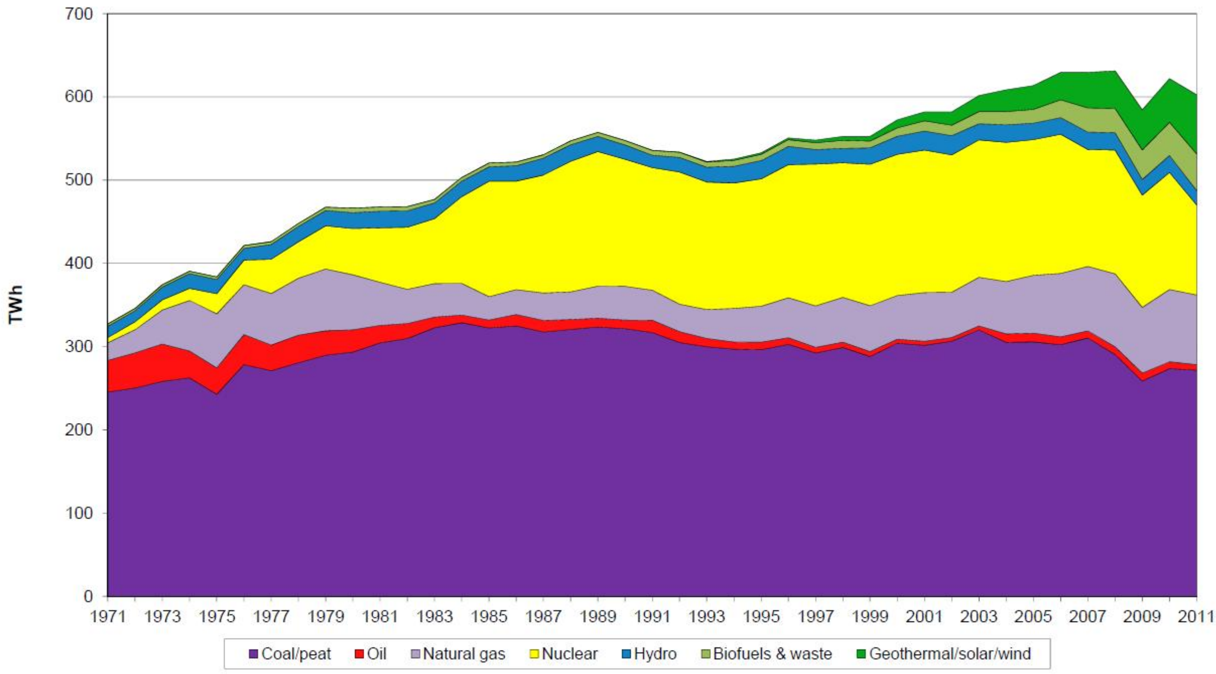

Figure 1. Electricity generation by fuel in Germany. Source: IEA Energy Statistics

Electricity production has been under social debate in Germany for decades. The current German *Energiewende* or Energy Transition has a long history as a concept, going back to the 1980s and the work of the think tank Öko-Institut. Social movements have challenged policies and utilities even longer than that: the German post-war generational conflicts since the late 1960s brought up many environmental themes and the peace movements and student movements quickly joined with the anti-nuclear movement. These movements were not very prominent in decision-making as German legal corporatism favors extensive cooperation with established groups and quasi-public organizations for public consultation.

However, these ideas and movements set the stage for the push for renewables later on, both by generating an ethos of small-scale cooperative ways of doing things, as well as through establishment into the political system, for example through formation and popularity of the Green party. Both successes and problems of EEG and the *Energiewende* should be seen in this social context: at the same time, government maintained close relations with established interests, including large utilities, often publicly owned and granted monopolies, and societal actors were discussing radical change through a more open debate. In 1998, the electricity market was opened and this was followed by the EEG in 2000.

The transition triggered by these policies is evident in market share of different fuels, but the ongoing social and economic transition is and will be even larger. Even though the amount of coal energy did not decrease, the infusion of solar and wind with grid preferred access into the market changed how utility companies do and can do business. The business models of large utilities focused on fossil fuels are already changing towards energy services and slowly towards renewables.

As for nuclear energy, the transition was triggered by a key shock in the form of Fukushima nuclear accident. Planning for the transition was already ongoing before, with the key plan published by the government in September 2010 (Bundesregierung 2010), but Fukushima prompted a radical change in the government's attitudes towards nuclear power that resulted in the shut-down program that would have Germany nuclear-free by 2022.

The transition has started, but it has not been unproblematic, with high energy prices for consumers and feed-in tariffs creating paradoxical incentives in the market. This case study explores the institutional effects of rapid energy sector transitions triggered by external shocks. The goal is to identify strategies that are resilient to the rapid change of institutions.

3.3 Energy policy in Germany

Germany has expanded its use of renewables five-fold since 1990 (to 2011), starting with a mainly hydropower and expanding with almost all types of modern renewables. This has happened with a push from a legislative framework favorable to renewables. First feed-in tariffs date back to 1990, but the main current legislation is the Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz EEG), originally from 2000 but revised and amended multiple times. The key principles of the legislation are preferential grid access, feed-in tariffs that vary by technology, budget neutrality by putting the cost of the tariffs directly on consumers' electricity bills as the EEG remuneration fee. The fee is calculated from the energy mix in use. Currently, the fee is 6.24 cents per kWh. The feed-in tariffs are guaranteed but decrease over time to hopefully support innovation. Current feed-in tariffs for renewable energy are mandated by this law by a complex system of tiered tariffs that vary by technology, plant size, current building rates and so forth. Biomass and biogas rates vary by plant size at 75, 150, 500, 750, 5000 and 20 000kW in decreasing amount, with no tariff above 20MW. There are also different rates for biomass and biogas from different sources, like landfill and sewage gas, and bonus systems such as for biomass gasification. The goal of the legislation is to internalize the externalities from fossil fuel energy production and not act as a subsidy per se. The tariff rates should theoretically track the difference between harm to environment and health from conventional and renewable sources. Early experience suggested that this is the case (Krewitt & Nitsch 2003), but these estimates are highly sensitive to climate change pricing assumptions.

However, lately there have been vocal criticisms for the rising monetary cost of energy to consumers, even though the externality calculations show that when avoided pollution and greenhouse gases are accounted for, the policy is beneficial, even to the current population (Krewitt &Nitsch 2003). Further controversy comes from the practice that industry consumers are exempt from paying the EEG remuneration. Especially in connection with the 2013 election campaign, various aspects of EEG and renewables were criticized, both in public (the feed-in tariff is paid for by a surcharge on the electricity bill, making it a clear cost-of-living increase) and by parties from different sides of the political spectrum and for a variety of reasons. These included the argument that EEG is stifling innovation by offering a fixed feed-in tariff that does not reward better systems, an argument made by Commission of Experts on Research and Innovation, an advisory body to the government. Also, currently, the conservative Bavarian state government is demanding a cap to be set on the amount of the surcharge.

Besides the EEG, there are also other mandates like the Renewable Heat Energy Act that sets minimum requirements for the use renewables in heat generation for new buildings, and market incentives such as Market Incentive Programme for Renewable Energy that gives grants and offers subsidies. Small-scale biomass plants (below 100kW) like pellet boilers are the key target of this programme. Various other incentives exist at both federal and state levels, but their effects are much lower on investment decisions, mostly supporting individual technologies at household and small-scale.

3.4 Current policy developments: complete revamp of the renewables act

The German federal government is currently working on another amendment of EEG, and considerable changes will likely be put into effect – the proposal is called EEG 2.0, an indication that the criticisms and problems are taken seriously and the policy will change radically. The key goals are to lower the costs laid on the consumer and prevent too quick proliferation of specific renewables technologies, as this has resulted in large cost increases. The goal is to reduce the average support across all technologies from 17 ct/kWh to 12 ct/kWh for new installations to stabilize the consumer surcharge at current level. This amendment will be presented to the Federal Council and the Parliament in May/June 2014, and should be in force August 2014. Whatever happens with EEG 2.0, it will shape the future of technological trajectories in Germany. The following paragraphs are based on the current draft legislation.

First, EEG 2.0 introduces technology-specific “corridors” that define maximum rates of growth supported. The mechanisms for control are also technology-specific: quantitative maximums for off-shore wind, flexible caps for onshore wind, solar energy and biomass. The proposals under consideration now include changes in regulation for every single technology as well as a lower average level of support for new installations. For biomass, the focus will be on waste-to-energy, and the goals for annual growth are fairly modest at 100MW per year, compared to 2500MW per year for solar and wind. (Lang & Mutschler 2014.)

Even though the explicit goal of EEG 2.0 is to simplify the legislation, feed-in rates will still vary by a fairly complex system – there are still four tiers for biomass plant size (150kW, 500kW, 5MW, 20MW), extra systems for fermentation of biowaste, and so on. The current system does not provide support for co-firing biomass in large-scale coal power plants and no changes are currently foreseen for this (Hoefnagels 2012).

Second, EEG 2.0 replaces the guaranteed feed-in system with market exposure in the form of market premiums, previously a voluntary option under EEG 1.0. There is a default seller option buying at 80% of the tariff in case producers are not able sell their energy directly. Only small plants (<100kW) can opt for the feed-in tariff in full after a phase-in period. In 2017, part of renewable expansion will also happen through an auction procedure.

Third, under EEG 2.0 self-consumption by producers will no longer be exempted from the EEG remuneration fee, except for certain exceptions. EEG 2.0 is also supposed to deal with the capacity problem from increased renewables, but there are no new measures to create a capacity market. Wind and solar are changing the structure of the market already, as evidenced by deeply negative wholesale electricity prices at peak production. Backup capacity is not currently rewarded adequately through the market and when renewables share reaches the planned 35% the problem will get even worse.

3.5 Social dynamics: General population and the electoral effects of an open price tag

The socio-political dynamics of renewable legislation and support in Germany are complex and represent issues beyond the immediate scope of the policies. In the times of economic crisis and the emergence of populist parties, a green policy with an explicit price tag (not coming out of the state budget and general fiscal income but charged as part of energy bill) becomes a target of campaigning that does not necessarily have much to with the properties of the policy itself.

However, the federal elections of 2013 resulted in big changes to the Bundestag composition, but in the direction of favoring renewables. From the previous government, Angela Merkel's Christian Democratic Union/Christian Social Union in Bavaria (CDU/CSU) did well, but the coalition partner Free Democratic Party (FDP) failed to reach the vote threshold of 5%, and lost all of their seats. Social Democrats (SPD) increased their representation, while the Left and the Greens lost some seats but were comfortably above the threshold. The result meant a return to the grand coalition government of CDU/CSU and SPD that also governed from 2005-2009. Pre-election, 2035 goals for renewables share were 50-55% for CDU/CSU and 75% for SPD – the coalition compromise is 55-60%.

So, consumer electricity prices were not a deciding factor in this election, but they will remain on the political agenda in the future. But the issue will remain on the agenda and success in changing the EEG to maintain the remuneration at a reasonable amount and make the benefits to consumers more transparent will be necessary.

Fossil fuel plants still remain an important question in German energy policy, as the phase-out of nuclear launched an uptick in coal use, but gas and hard coal plants are now competing with renewables and are only operated at full capacity when electricity spot prices are especially high. There are also great societal effects from this shift – for example, German coal workers are already organizing to campaign for national protection systems for coal plant jobs (Morris 2014).

3.6 Social dynamics: Federal state, regions and localities in competition

Second, the nature of Germany as a federal state with considerable decision-making power with the states and their council means that discussions over the Energiewende are also reflections on the power dynamic as a whole. Industries are concentrated in the southern and western parts of the country, and especially in Bavaria these interests combine with those supporting traditional values, generating political campaigns against ugly windmills and suggestions for regulating their size. In the northern parts of the country, states are setting even more ambitious renewables goals than the national goals, to get the economic opportunities from the subsidies and in some cases to replace nuclear production on a phase-out schedule. At the extreme, the state of Schleswig-Holstein plans to generate 3 to 4 times its own energy consumption with renewables, mainly, wind as the state is located on both the North Sea and Baltic Sea coast.

This competition between states, both economically and with the values represented, is exemplified by the current debate on the Südlink, a long distance transmission corridor connecting south of Germany with the North Sea Coast. Südlink is one of the largest grid expansion projects and will be necessary to secure supply after Bavarian nuclear plants are phased out in 2023. But surprisingly, after the 2013 elections, Horst Seehofer, the Bavarian leader of CSU – Merkel’s sister party – changed track and announced that the state cannot accept the project. The reason is the need to protect the local countryside and landscapes in general, with no reference to particular localities or plans. (Hockenos 2014.)

Thus, not-in-my-backyard phenomena are not restricted to actual projects and the immediate community around it, but they are also representative of the political debate between different government levels – it is even possible to support one project at the national level but reject it locally, as is the case with Seehofer's CSU policy. Energy policies and plants are embedded in larger social systems, where the meanings associated to them emerge. Any energy project will need to be ready to deal with the emergence of opposition that superficially protects the economic and environmental status quo, but at a deeper level works to protect a set of local values.

3.7 Decentralization in German energy production

Another aspect of the *Energiewende* is the decentralization of energy production. With renewables, the choice to support smaller facilities was already made, and the decision to abandon nuclear has made this even more important. However, the current technology based trend towards decentralization has not fundamentally changed grid-based supply, as the key driving factors in economic and political boundary conditions, including general economic health and research support (Karger & Markewitz 2011). In Germany, alongside micro-scale renewables such as domestic biomass heating systems, municipal utilities are changing their business models and organizational structures to more involved with small-scale renewables. This is changing the actor structure of the energy regime in the system.

Existing utilities, backup power, and the need for a capacity market are on one side of this transition, locally-owned renewables projects that can supplement economic feasibility with social support and public funding schemes on the other. Traditional generation and decentralized renewables coexist because the of early market niche protection from government policy, such as the EEG has provided. But effective socio-technical "niche regimes" (Smith, Sterling & Berkhout 2005) also need a functioning network of organizations that shares an institutional framework or has similar ideas on what the techonology means and how it will fit the social system. A key factor to EEGs success was that it's structure provided favorable conditions for differentiation and professionalization of innovation networks around the various technologies. Each technology has a distinct constellation of communication and cooperation between plant operators, plant manufacturers, owners, landowners, and connection to local society. Solar, wind and biogas in Germany each went through a cycle of learning by doing, where the way of producing energy at the small scale requires subtly different practices around it, and these practices are built by the users without direct government support. (Mautz 2007.) This could also be the reason why traditional utilities have not picked up renewables as part of their portfolio at the rate some would have expected them to do: their business models were not adapted for these particular innovation networks.

3.8 Tools for companies

What can we learn about the developments in the German energy markets? Energy developments are always connected to other societal developments, and investment decisions should be aware of this. Many of these are deeply embedded in the fabric of society, and changing them is not a project-level goal. Often, companies rely on information provision and hope that changes opinions and views on their project. We suggest that this is not sufficient, and projects should instead aim to understand the local social situation at an early stage to enable upstream decisions that align the project with local beliefs and social structures.

This would be through a project-specific review, posing the questions 1) what are the political meanings associated with such projects locally and nationally? and 2) what are the social meanings associated with the project, and how would the project challenge established social connections? Current methodologies are well-established for assessing economic and regulatory decisions, but these questions are harder to quantify. Still, we encourage 1) qualitative, interview-based assessment on the questions, and 2) development of indicators for how well a given project aligns with local social and political conditions.

4 Poland, a Modernizing Agricultural Sector and Growing Bioenergy Share

4.1 Why look at Poland?

In Poland, the share of bioenergy has been very low, but has started to grow as the country first met the EU accession standards and now has further obligations as a member state. Still, even after accession bioenergy accounted for 4% of primary energy use, and hard coal and lignite were used to produce 97% of electricity (Nilsson et al. 2006). Poland has large coal deposits in the country, and pressures to lessen dependence on Russian natural gas have made coal even more appealing. Poland also wants to explore the fracking and use of shale gas. The pressure to switch away from fossil fuels largely comes from outside the country and from less influential interest groups. Within the country, renewables could be more appealing for reasons pertaining to local economies and livelihoods in communities, rather than large scale structural change as the driving factors. Polish energy policy cannot be separated from general geopolitical goals, specifically the European and Polish orientations towards dependence on Russian natural gas (Roth 2011). Poland has been willing to protect its coal power industry from renewable energy imports (Parkinson 2013) and is even planning new lignite mines (Hockenos 2013). Coal power plants bring with considerable centralization, and biomass policies will have to account for this.

Poland is very rural. Poland is highly dependent on agriculture, with 4 times more workers involved in the sector than the EU average. Agriculture is only now modernizing, in tandem with a growing bioenergy sector, where biomass is the largest player. This development points to a possible synergy between the two sectors from the considerable amount of biomass available in cereal straw (Bioenergy Promotion) that is currently used in traditional agriculture but might not be in the future. Land freed up from a more efficient agricultural system could also be used for energy crop cultivation, as the government seeks to develop rural areas for multifunctional purposes instead of just raw materials. Still, the government defines food production as the primary task of the sector and energy only to by-products, residues, and surpluses (Ministry.. 2010).

Thus, this analysis looks at the social dynamics at the cross-link between two modernizing sectors, agriculture and energy. The goal is to understand where win-win situations might be generated in the future: renewable energy situations that would be profitable for investors and local communities. We conclude with a suggested model for agribioenergy in the local communities that should be useful for companies to use themselves or help their local partners adopt. The agri entrepreneurship model will help align bioenergy goals with local community goals, simultaneously helping with issues such as stable supply of fuels.

4.2 History of Polish energy system

Polish electricity production has always been based in coal. Natural gas and biofuels have relatively larger shares in heating. Recently, renewables options have been explored, and biomass energy production has picked up somewhat.

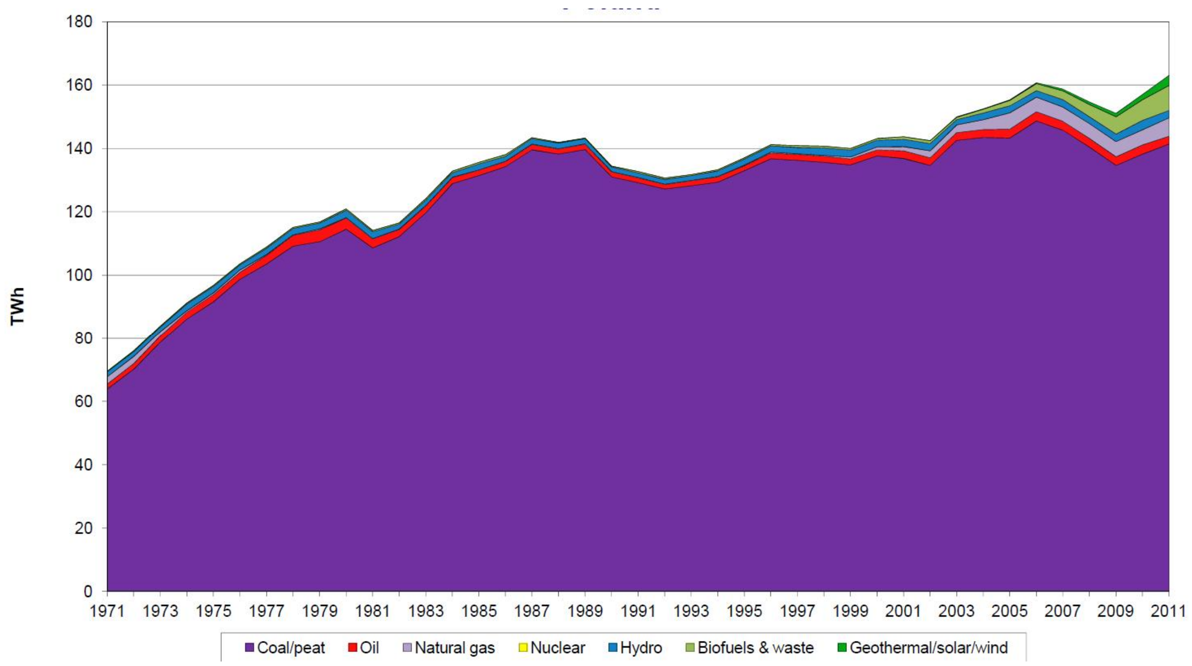

Figure 2. Electricity generation by fuel in Poland. Source: IEA Energy Statistics

4.3 Energy policy in Poland

Energy security is the key concern for Poland, and accordingly, policy goals focus on coal and nuclear. Poland's Energy Policy until 2030 (Ministry.. 2009) sets renewables goals at 15% for 2020 and 16% for 2030, nuclear at 10% (from current zero), and the rest from fossil fuel production. As current coal plants are aging, the stock will need to be almost completely rebuilt by 2020. Poland is planning to use Carbon Capture and Storage methodologies as key climate tool.

Poland's role in European energy politics is clearly exemplified by the recent letter to Financial Times (Tusk 2014). Tusk called for an energy union, mostly in the context of energy independence from Russia. The proposals include strong financial support (75% from EU) for pipelines and storage capacity, a single-buyer system to strengthen the negotiation position against Gazprom, free use of locally available fossil fuels, including coal and shale gas. The letter does not call for investments into renewables or support for increased gas independence through energy efficiency, for example.

The political setting in Poland has only given intermittent support for bioenergy in general. A particular worry has been the competition between agriculture and energy production from biomass. Modelling efforts for policy suggest that there is a trade-off in how efficient the policy in reducing CO_2 and N_2O emissions and how much unwanted competition between agriculture and energy it generates, but that a well-designed tax can avoid much of the competition (Ignaciuk et al. 2006). As of yet, the biomass policies have not been designed in this manner, nor for an aggressive push. Agribioenergy has started at the local level with small-scale heating plants and district heating systems utilizing straw, but the macro-level political factors within the country are mostly holding development back. Local coal and electricity generated with it is cheap, especially in the southern regions, where the coal mines and power plants are located. The political development of renewables use started with the 1997 Energy act, where development was to be driven by straight-forward obligations to electricity suppliers and municipalities (Nilsson et al. 2010). In 2005, a trading certificate scheme was put in effect to encourage investment in renewables. However, the system is quite unpredictable and has no technology specific systems, and so development has focused on co-firing in coal plants, landfill and sewage gas plants, and agribiomass use has remained low (Budzianowski 2012). It has been claimed that agribiogas could provide a key component in the future in Poland, but a technology specific support framework similar to that in place in Germany is needed (Budzianowski & Chasiak 2011).

Thus, renewables policy will develop in the shade of fossil fuels in the foreseeable future. The International Energy Agency (2011) recommended various policy measures to ensure that renewables developments are at least not held back by policy and administration. The key recommendations were to make clearer regulations for grid integration, lessen the administrative burden to renewable projects and consider additional support mechanisms for specific technologies.

4.4 Societal dynamics of rural renewable energy in Poland

Polish socio-political and socio-economic challenges for renewable energy represent changes in the sector in countries facing two major macro-level system changes: first, the transition from a planned economy into a market economy and second, the accession to EU. The latter puts heavy exogenous pressure on the social system already shaken by the first. Biomass expansion thus has to fit the social setting. In the planned economy, regional development was driven by national authorities and local authorities and societies worked within very limited boundaries. In order to succeed, the current EU and national government incentives have to able to incorporate local economic development in the rural communities. Even in advanced economies, the combination of top-down renewables policies with a feasible and sustainable agriculture where rural entrepreneurship transforms agriculture into modern agribusiness has been hard (Snäkin et al 2010). Agrobioenergy change in Poland should learn from these experiences both at the macro-level policy level as well as individual project level.

Polish agriculture is still characterized by small farms, even though the EU accession and opening of the markets demonstrated that the Polish sector is competitive, as exports grew rapidly. Still, improvements and modernization were dependent on public support systems, mainly from EU instruments such as the Rural Areas Development Programme. Simple technical modernization measures show progress: tractor deliveries were up 70% in 2007. But this has not been without social cost, as over two million people have been displaced from the sector and unemployment in the countryside remains high. Entrepreneurship programmes for rural diversification have received considerable funds to deal with this problem. (Mickiewicz & Mickiewicz 2010). These programmes can be dominated by local elites and disregard endogenous capacities of local communities, as has been found to be the case in Poland (Furmankiewicz et al. 2010).

In this social and political context, any investment decisions should take a bottom up –approach, meaning that any power production should be made appealing to local communities and agriculture actors, benefitting from the regulatory and political support community renewal projects receive. In the next section, we discuss the Polish situation in one context, the agricultural entrepreneur model of Snäkin et al. 2010 (see fig 3).

4.5 Tools for companies: Agribusiness entrepreneurship models for Poland

Even in countries with a highly modern agricultural sector such as Finland, bioenergy decisions in the agricultural sector are hindered by a mismatch between national and regional goals (Snäkin et al. 2010). We suggest agricultural modernization in Poland should deal with these problems by policies and individual projects supporting an agricultural entrepreneurship model, where farms transform to businesses that get their income from multiple services, including offering eco-system services and energy production alongside food production.

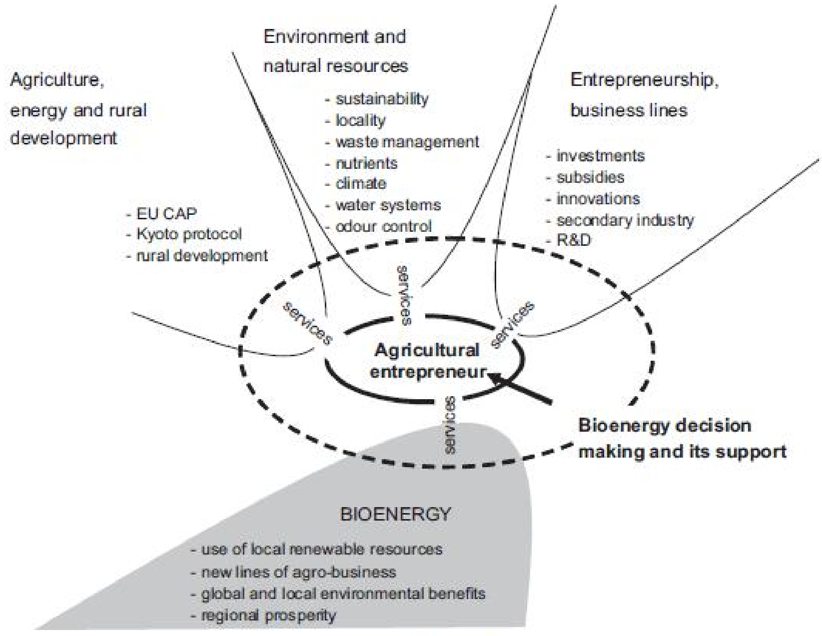

Fig. 1. Bioenergy as a remedy for challenges in farming.

Figure 3. Agricultural entrepreneur model from Snäkin et al. 2010.

That is, successful agrobioenergy depends on giving single farmers the tools for running their farm as a business that gets it revenues from multiple activities that have to support each other. Even large-scale projects that use a wide area to collect fuel materials, i.e. agricultural residues, should base their buying models in local support systems. These would include education on entrepreneurship issues and investment, involvement of the local community (i.e. support for creating local business model for collection of the fuel and developing potential products), and social connections to avoid the potential controversies from agrifuels and fears of replacing food production with fuel production.

We suggest that companies who wish to participate in biomass energy production with energy sources in agriculture or related to agriculture should fully engage with the local community, and start building support mechanisms like the agricultural entrepreneurship model to ensure social and political sustainability.

5 Conclusions

In this document, we have explored the different social dynamics that bioenergy solutions face in various types of communities. The goal of the analysis was to help companies that wish to engage in bioenergy projects, in whatever capacity, to recognize how projects and the actors involved come to be seen as socially sustainable partners that provide positive services in line with where local actors see their community developing the future.

The current document should form a basis for thinking about how one’s bioenergy projects fit in with the variety of global social dynamics, whether in the case countries we have analyzed here, or in countries in similar situations. This analysis is general and would need to be adapted to work for an actual project. The analyses here are based on existing literature. We suggest that bioenergy decisions by companies should be accompanied with and supported by a project-specific social sustainability analysis. This would likely require the involvement of local stakeholders, at least as information providers through interviews on-site, but very likely as experts with unique capability in identifying how the local dynamics are likely to work in their community.

The highest quality information would be guaranteed by an iterative process, where locally sensitive interview data would be analyzed and then evaluated with the local stakeholders. The methodology is available in various public engagement and public deliberation traditions.

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