RENEWABLE ENERGY POLICIES IN GERMANY: ANALYSIS OF ACTORS AND NEW BUSINESS MODELS AS A REACTION TO THE REDESIGN AND ADJUSTMENT OF POLICY INSTRUMENTS

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Overview

The transformation of the electricity system upon condition of sustainable development and an accelerated nuclear phase-out is one of the crucial challenges currently facing the German economy. Due to effective policy support to date, electricity generated by renewable energies already accounts for a relevant share - 20.1% - of the German electricity supply (cf. BMU 2012). As a result, enforced market integration and a more demand-oriented feed-in of electricity from renewable energies are considered crucial next steps in the process of transformation.

In the process, recent years have seen the development and discussion of new regulation mechanisms aimed at facilitating a smooth transition for renewable energy power plant operators from guaranteed feed-in tariffs to a deregulated electricity market. A variety of actors have been involved, both in this development process and in the actual process of market integration. These actors' goals, strategies and options have formed the focus of two interdisciplinary research projects[1]. The goal of the projects is the development of an agent-based simulation model as an instrument to analyse possible actions and interactions of the relevant stakeholders, as well as their effects on the overall system under different regulatory frameworks. An important prerequisite for the set-up of the agent-based model was the thorough analysis of the relevant actors: how are they influenced by the regulatory framework? How do they develop business models and routines, and how have they tried to reshape formal institutions in order to meet their goals? This actor analysis and its results will be presented in this paper.

Keywords: Actor analysis, Direct marketing, Market integration, Renewable energy sources, Agent based simulation model,

Background

Germany's electric power system

Traditionally the electric power system in Germany has been characterised by highly centralised structures and large fossil fuel power plants. Furthermore, price fixing has been common. Due to huge subsidies for coal and nuclear energy technologies on the one hand, and the externalisation of environmental and social costs on the other, incumbent actors and fossil energy technologies have profited from non-transparent prices and asymmetric competitive advantages (cf. Milborrow 2002: 32). Incumbent energy technologies have received direct and indirect subsidies for decades (cf. Jacobsson/Bergek 2004: 210). This had led to the establishment of a seemingly permanent centralised electricity infrastructure. National grids have been tailored to suit the requirements of large fossil fuel power plants. And the long-standing electricity generation system provides a perfect example of co-existence between nuclear power plants serving the base load, coal-fired plants serving the mid-load, and gas-fired plants for the peak. The ideal interplay of existing technologies and surrounding infrastructures

[1] The AMIRIS projects are funded by the German Federal Ministry for the Environment, Nature Conversation and Nuclear Safety (BMU) and by the Helmholtz Alliance "Energy-Trans". Project partners of the first project are the German Aerospace Center (DLR) – Institute of Technical Thermodynamics – Systems Analysis & Technology Assessment, ZIRN – Interdisciplinary Research Unit on Risk Governance and Sustainable Technology Development at the University of Stuttgart, Kast Simulation Solutions, and the Institute for Future Energy Systems (IZES). Project partners of the Energy-Trans-project are CIRIUS – the Stuttgart Research Center on Interdisciplinary Risk and Innovation Studies, maintained by the University of Stuttgart and DLR.

demonstrated a strategy-dependent mode of development which, in turn, could hardly be challenged from outside without political support.

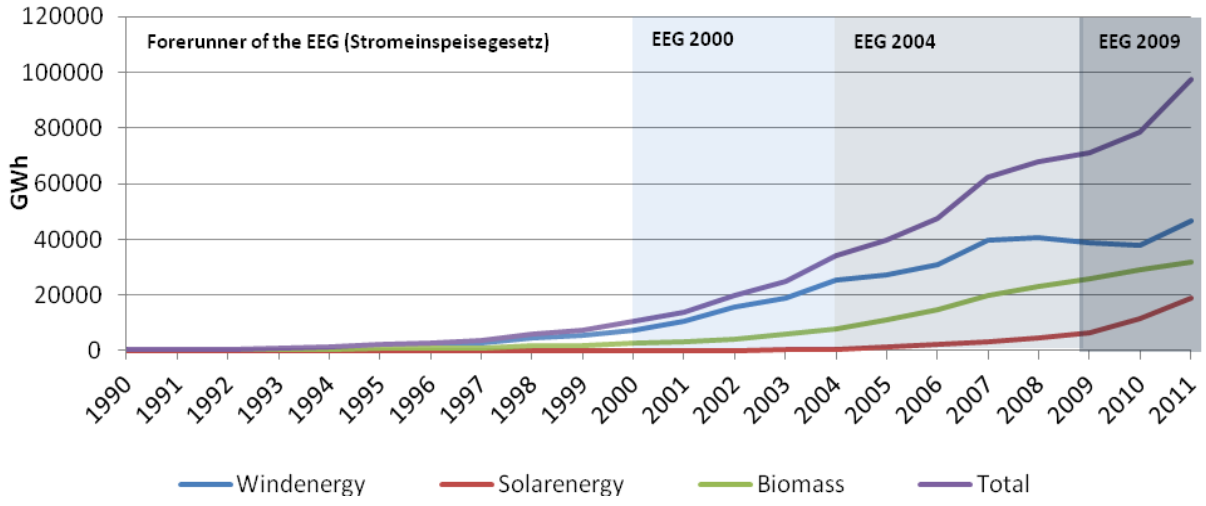
Even though alternative electricity generation technologies such as wind farms or photovoltaics had been developed concurrently, there were several reasons why they were barely able to compete with incumbent technologies: a) electricity generated in renewable energy plants was too expensive; b) electricity derived from the renewable sources wind and sun tends to fluctuate and cannot serve a specific load; c) these new technologies followed a decentralised antithetical logic and did not easily fit into the established infrastructures (cf. Stern 2006: 355).

New actors, new policy instruments, and the expansion of renewable energies

Alternative technologies had been developed by new actors, since the incumbent actors had been very hesitant regarding the development of and investment in new electricity generation technologies. In the past their expenditure on R&D had been low, and technological developments in the electricity system only occurred in reaction to the announcement of new political regulations, such as stricter environmental standards for CO_2 emissions, among others. In the 1990s EU deregulation targets and climate change mitigation policies at a global, EU and state level provided the first window of opportunity for restructuring the German electricity system. Technological developments in photovoltaics, wind turbines, biogas technologies etc. had been advanced by environmentally-driven scientists in young research institutes, by new firms and environmental groups, and by lead users, also driven by green ideas and therefore supportive of renewable energy technologies (cf. Jacobsson/Lauber 2006; Ohlhorst 2008; Fuchs/Wassermann 2012).

Parallel initiatives also managed to convince political actors that innovative policy instruments were needed in order to create a sheltered niche market for these new technologies. Throughout the 1990s associations, local groups and societies were founded with the aim of improving and enhancing political support for the infant technologies and their commercialisation: it was a coalition of various, mainly new actors that managed to influence the federal government to develop innovative policy instruments designed to support the expansion of renewable energy technologies (cf. Fuchs/Wassermann 2009; Ohlhorst 2008). Political instruments and mechanisms in this realm were manifold, ranging from publicly funded R&D programmes to market stimulation programmes and soft loans for end consumers investing in renewable energy technologies. Nevertheless, it is widely acknowledged that the key building block of the German renewable energy policy strategy, ultimately responsible for the success story of the expansion of renewable energy power plants in Germany, was the "Act on Granting Priority to Renewable Energy Sources" – the Renewable Energy Sources Act (EEG) in 2000. As shown in Figure 1, policy instruments, and the EEG in particular, were successful in substantially raising the contribution of renewables to the German electricity supply. The overall contribution of renewables to the German electricity supply is currently around 20% (cf. BMU 2012).

Figure 1: Contribution of renewables to the German electricity supply



Source: BMU 2012

Although the EEG is the prime policy instrument for renewables in the electricity system, it remains the subject of on-going discussion and amendment. It regulates the priority connection of installations for the generation of electricity from renewable energies to the general electricity supply grids. Furthermore it also regulates the

priority purchase and transmission of this electricity and, last but not least, it specifies a consistent tariff to be paid by the grid operators for this electricity, generally over a 20-year period (cf. BMU 2012a: 24). Due to a rollover mechanism, also regulated in the EEG and modified in one of the amendments, the guaranteed feed-in tariffs – the so-called "EEG-surcharge" – are ultimately paid by the power consumers. The EEG, which came into force in 2000, now has a long history and has been revised several times in the meantime. Amendments have mainly aimed at adjusting the feed-in tariffs which led to mean rates of remuneration paid per technology each year as shown in Table 1.

Table 1: Evolution of mean rates of remuneration per technology between 2000 and 2012

	Biomass [ct/kWh]	**Wind energy [ct/kWh]**	**Solar energy [ct/kWh]**
2000	9.62	9.1	51.05
2001	9.51	9.1	50.79
2002	9.49	9.09	50.43
2003	9.38	9.06	49.11
2004	9.7	9.02	50.83
2005	10.8	8.96	52.96
2006	12.27	8.9	53.01
2007	13.58	8.84	51,96
2008	14.24	8.78	50,2
2009	16.1	8.79	47,98
2010	16,86	8,85	43,57
2011	17,48	8,85	37,71
2012	17,18	8,83	36,51

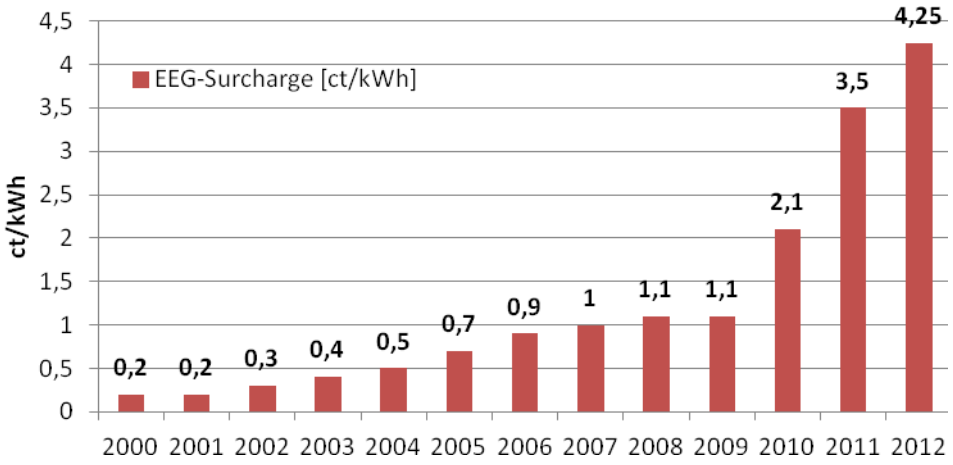
Source: BDEW 2012

Due to economies of scale and technological innovations which led to higher efficiencies and improved production processes, the cost of renewable energy technologies decreased; consequently, electricity generated by renewable energies could theoretically have become as competitive as power generated in fossil fuel power plants. Because the marginal costs associated with renewable energy generation - especially wind and solar energy - are very low, an increase in renewable energy on the spot market lowers the average spot market price, displacing more expensive energy plants. Research has shown that renewable energy leads to a reduction of up to 36€/MWh in hours of peak demand. In 2006 the average market price decreased by 7.83€/MWh (cf. Sensfuß/Ragwitz/Genoese 2008). As the EEG-surcharge compensates the difference between the specific market value of a renewable technology at the Energy Exchange (EEX) and the fixed feed-in-tariff for the technology, this positive decreasing effect on the average market price leads to an increasing EEG-surcharge. Furthermore decreasing wholesale market prices lower investment incentives of all generation technologies. On the contrary, a further reduction of power prices increases incentives of marketing-strategies for renewable energies outside the wholesale power market, e.g. by local/regional direct marketing.

But due to the EEG mechanism which guarantees fixed feed-in tariffs, the majority of producers of electricity generated in renewable energy power plants do not act as real market actors. As a result, common market mechanisms such as demand-oriented electricity generation do not affect the behaviour of renewable energy producers: even when market prices are very low, they produce and feed in electricity; as one consequence the EEG surcharge has risen in recent years[2]. Furthermore there is the threat that an increasing supply of electricity generated in renewable energy power plants might cause overproduction during off-peak hours.

[2] But it should be mentioned that the increase was also triggered by factors such as the exclusion of energy-intensive industries from the EEG-surcharge – resulting in higher payment shares for the rest of the customers.

Figure 2: EEG surcharge trend



Source: BMU 2011, BDEW 2010

An increase in the EEG surcharge is directly linked to rising electricity prices for consumers[3]. Politicians, not to mention various actors in the renewable energy scene - such as electricity producers, scientists and associations - are becoming increasingly concerned about this correlation. They are afraid that the traditional high acceptance of and public support for renewable energy in Germany may decrease as a result of rising energy prices. This has therefore marked the beginning of discussions on the development of new regulatory mechanisms aimed at ensuring a smooth transition for renewable energy power plant operators from guaranteed feed-in tariffs to a deregulated electricity market.

Market integration can be seen as an important next step on the road to transforming the electricity system as it is pronounced and propagated by the German government, supported by the wider German public. As mentioned above, new actors, technological innovations and innovative policy instruments have laid the foundations for a transformed electricity system consisting increasingly of more decentralised structures, renewable energy technologies, and heterogeneous actors and actor constellations. In line with this perspective, new technologies, services and routines relating to direct marketing are also innovations that can help to transform the electricity system. Marketing electricity derived from renewable energies directly requires completely new business models and actor cooperation; this holds especially true for electricity generated by fluctuating energy sources such as the wind and sun.

Regulatory mechanisms for market integration

Once a few pioneers had developed some initial strategies for the direct (hourly) marketing of electricity derived from renewable energies in 2006, powerful incumbent actors used their political influence to ban hourly marketing from 2008 on. Then in 2009 another amendment to the EEG supplied the first regulation on direct marketing on a monthly basis: §17 EEG 2009. Due, however, to low electricity prices on the spot market caused by the financial crisis, direct marketing under §17 was not considered an attractive business model by producers of electricity generated in renewable energy power plants (cf. Krewitt et al 2011).

Instead, direct marketing pursuant to §37 EEG 2009 (called the 'green electricity privilege') became viewed by pioneers as an increasingly attractive business model. The 'green electricity privilege' "…means that utility companies can be exempt from the EEG surcharge if at least 50 percent of the electricity they provide is renewable electricity pursuant to the EEG. The exemption applies to the whole electricity portfolio, including electricity from non-renewable sources" (BMU 2011a). Originally this 'green electricity privilege' had been included in the EEG to support green electricity providers offering exclusively green power. But over the course of time the 'green electricity privilege' was increasingly seen to be causing windfall profits (we will come back to this point later; see chapter "Intermediaries") and discussions began on ways in which to modify §37.

Moreover, discussions concerning the further development of new regulatory mechanisms for a better market integration of renewables were still on-going. Relevant changes and reforms to support direct marketing were introduced in the new amendment of the EEG 2012: requirements for the use of the 'green electricity privilege' are now regulated under §39, which is far more restrictive than the previous §37. Exemption from the EEG

[3] The EEG-surcharge is not the only factor, which is responsible for increasing electricity prices. As a fact, electricity prices have been continuously rising even before the EEG came into force.

surcharge (2011: 3.53 ct/kWh) is now limited to a reduction of the EEG surcharge by not more than 2 ct/kWh. Furthermore, the 'green electricity privilege' can only be used by those actors who meet the additional requirement that at least 50 % of their electricity is generated in EEG plants, and at least 20% of the portfolio is derived from fluctuating energy sources (wind or sun). This requirement must be met in average throughout the whole year and additionally in eight out of twelve months of the year.

Besides this modified 'green electricity privilege', direct marketing is now explicitly encouraged and flanked by a new support mechanism called the 'optional market premium' (§ 33g EEG (cf. Sensfuß/Ragwitz 2011)). It transfers the duties of selling the renewable energy directly to the energy markets from the transmission system operator to either the renewable plant operator or an intermediary respectively. Furthermore, a 'flexibility premium' mechanism has been introduced for the operators of biogas plants who switch into direct marketing. The premium can be claimed for the provision of additional installed capacity for on-demand use (§ 33i EEG).

Further options for direct marketing, which are not explicitly promoted by a regulative support mechanism – e.g. offering the power plant capacities on the reserve markets – are called "other forms of direct marketing" (§33b, Nr. 3 EEG). Other options are for example local direct marketing. This means that electricity is sold to a supplier who connects the power plant (e.g. the wind farm) directly to end consumers, thus avoiding the electricity tax (§9, Abs. 1, Nr.1. StromStG) i.e. selling local green 'citizen power'. Local initiatives and innovative actors have developed this additional way of direct marketing. They complain that the EEG does not explicitly encourage this form of direct marketing.

Theory

When it came to the actor analysis, the leading question was how these new regulatory mechanisms would influence actors' behaviours, strategies and routines. How would they develop new business models and cooperation strategies?

As its starting point the analysis took assumptions derived from the sociological theory of strategic action fields, as well as from neo-institutionalist concepts of organisational sociology. The theory of strategic action fields (SAF) "…hold[s] the view that strategic action fields (…) are the fundamental units of collective action in society. A strategic action field is a meso-level social order where actors (…) interact with knowledge of one another under a set of common understandings about the purpose of the field, the relationships in the field (including who has power and why), and the field's rules" (Fligstein/McAdam 2011: 3). The theory offers a specific viewpoint by interpreting society as a complex web of strategic action fields (cf. Fligstein/McAdam 2011: 2). In this context the German electricity system can be understood as an encompassing strategic action field, consisting itself of multiple strategic action fields, since "…SAFs look a lot like Russian dolls: open up an SAF and it contains a number of other SAFs" (Fligstein/McAdam 2011: 3). Furthermore it is surrounded by SAFs, because the broader field environment itself consists of SAFs (cf. Fligstein/McAdam 2011: 8).

Those fields typically consist of three types of actors: incumbent actors, challengers, and governance units. The roles and strategies of the actors depend on the actual state of a field, which can be a) rather unorganised and emergent, or b) organised, stable and only slightly changing, or c) organised, unstable and open to transformation (cf. Fligstein/McAdam 2011: 11).

The on-going transformation process of the electricity system in Germany can be interpreted as a strategic action field in the latter state: it consists of incumbent actors who are trying to defend the status quo and who have traditionally established close coalitions with governance units that are now increasingly being challenged. The challengers try to create and establish new rules "…*and therefore either will build a new political coalition based on interest or create a new cultural frame that reorganizes interests and identities*" (Fligstein/McAdam 2011: 18).

In order to understand these competing interests and identities we need to refer to neo-institutionalist organisational theories. Seen from this perspective, formal institutions, actors, and routines are mutually constitutive and influence each other. In order to understand the behaviour of economic actors, sociological concepts have developed alternative approaches to the typical neo-classical understanding of actors as homo economicus. Typically economic actors' behaviour is efficiency-oriented, but is nevertheless also led by external expectations and sometimes non-economic requests, and is thus shaped by dominant institutions in the specific organisational field (cf. Scott 1995; Hasse/Krücken 1996: 98). This means that actors and organisations as collective actors do have the ability of goal-oriented and purposeful action, but in order to pursue their goals, they also depend on the expectations, institutions and routines in their environment. For this reason, different actors from differing backgrounds and environments develop different strategies with regard to goals, as well as with regard to those strategies and measures required to reach their specific goals.

As mentioned above, SAFs consist of multiple other SAFs, meaning that the actors, interactions, and coalitions in the German electricity system also take place in various sub-fields, as well as in fields within the broader environment. With relation to the direct marketing of electricity from renewable energy sources, actors, interactions, coalitions, business models and policy instruments may be interpreted as phenomena of an emergent strategic action field within the encompassing strategic action field of the electricity system. An emergent field may be characterised as an unstructured social space. In such a state no well-established routines exist and competing rules are developed by various actors, although the actors do not have much knowledge of each other, the roles of incumbents and challengers and governance units have yet to be clearly allocated, and none of the actors is able to predict future developments. So if we perceive new business models, new actor cooperations and the discussions about new regulatory mechanisms in support of direct marketing as actions and interactions taking place in an emergent direct marketing SAF, what are the theses which have guided our analysis of the various actors in this newly emerging field? As mentioned above, in order to analyse different actor strategies, interests, and identities, we referred to neo-institutionalism in organisational sociology. This approach casts organisations as collective actors (i.e. incumbents, challengers, governance units) trying to pursue their goals, but a) in order to do so, they also need immaterial resources such as legitimacy, which is understood as "…a condition reflecting cultural alignment, normative support, or consonance with relevant rules or laws" (Scott 1995: 45), and b) the goals of an organisation are also shaped by the expectations and dominant institutions in their environment. Different actor goals may be explained by differences in the origins of the actors. For example the actions of new firms with close links to the environmental scene differ from large utility companies traditionally used to centralised structures. Thus in the emergent field of direct marketing, actors coming from the traditional electricity system of fossil fuel-generated electricity production and sales will try to shape the newly developing rules in the field of direct marketing accordingly, hence they will support those rules and mechanisms which best suit their traditional way of acting and associated business fields. In general, they will aim to support those rules which most closely match the existing centralised structures of the electricity system. On the other hand, actors originating from the environmental scene will tend to support decentralised structures and renewable energies, including many aspects related to them, such as public acceptance, etc.

Actors can only be successful if they manage to enter supporting coalitions with governance units. In this way actors are enabled to co-design market structures and institutions in the emergent field. Coalition formation and institutionalisation processes are closely connected with the successful implementation of new products, business models, and routines in the emergent field. Hence it is of crucial importance which actors are successful in doing so at which stage, and to what extent incumbent actors in associated fields are hesitant, or whether they manage to gain control over the emergent field. Hence any analysis of an emergent field must begin by identifying and describing the relevant actors according to their origin, history, and traditional links, as well as according to size, power, and control. As we have already claimed, organisations are not only efficiency-oriented, but also cope with environmental expectations, developing various legitimacy strategies in the process (cf. Hasse/Krücken 2005). Usually, legitimacy-related aspects are more crucial for well-established organisations than for new actors, because they traditionally have more external links and often have to cope with various, often conflicting expectations. Based on this theoretical consideration, actors' strategies not only differ according to their origin but also according to their size and age.

Method

During the first stage those general theory-led assumptions and propositions were substantiated according to the objectives, strategies and interaction patterns of the different actors in the new action field of direct marketing. Then they were developed further on the back of document analysis and expert interviews. The assumptions were then tested and reassessed in interviews with representatives from the most important actor-groups, as well as in the context of an actor workshop.

Since the eventual aim of the actor analysis was the set-up of an agent-based simulation model, the empirical findings of real actors and their behaviour were then generalised and subsequently transformed into a formalised model language where heterogeneous agent types were defined. The aim was to set up an agent-based model as realistic as possible. For this reason the information collected empirically about different actor-types, their respective goals, strategies, and business models, was a crucially important prerequisite.

The actor analysis was complemented by further research data relating to trends, forecasts, and price developments. Finally propositions were formulated on how different actors would react to the new regulatory framework, which actors would profit from the new regulatory incentives, and which would be negatively affected.

Document analysis and expert interviews

Having characterised existing activities with regard to direct marketing under EEG 2009 and the assumed changes following the 2012 amendment, the actor groups requiring closer analysis were identified. The necessary data was collected by document analysis (association's position papers, scientific articles and presentation documents), expert discussions within the project group and external expert interviews. On this basis guideline questionnaires for semi-structured interviews with representatives of the most important actor groups were formulated. In order to identify the most relevant actors, common selection criteria well-known from network analysis (cf. Jansen 1999:52) were used: for instance geographic boundaries (only actors from the German electricity market), participation in the issues at stake (the implemented or planned direct marketing of electricity from renewable energy sources) and problem-orientation (degree to which actors are affected by and their opinion of the new regulatory framework). Furthermore, as is common in network analysis, the examined and interviewed actors were asked to reveal any other actors actively taking part in the field of direct marketing who should therefore also be investigated and interviewed.

The interviews were recorded and subsequently transcribed and analysed. The goal of the analysis was a) to develop an initial proposition concerning actors and agents, general market structure, and the anticipated effects of the newly established regulatory framework. Beyond that the goal was b) to develop a detailed questionnaire for a subsequent actor workshop.

Workshop

In order to achieve further validation of the results, a participatory actor workshop was organised. Participants in the workshop were the previously interviewed representatives from the relevant actor groups and other experts. A structured variant was chosen for the workshop, similar to the group delphi method (cf. Schulz/Renn 2009). To this end the participants were separated into two working groups. Each group was asked to provide group answers to the detailed questionnaire which had been developed in advance on the basis of the interviews. The questionnaire included statements (partly contradictory), assumptions, propositions, and open questions relating to actor typologies and the regulatory frameworks EEG 2009 and EEG 2012. The topics were as follows:

I Market structure and actors

II Future development of the market – independent of the regulatory framework

III Regulatory framework: market premium model and effects

IV Regulatory framework: 'green electricity privilege' and effects

V Design of business models (contracts etc.)

VI Alternative design of the regulatory framework

VII Forecast, quality and future development

An important focus in the workshop was on issues of contradictory viewpoints, which had already been identified during the interviews. Furthermore open questions on potential future development were discussed. The goal was to reach consensus on the issues at stake; nevertheless divergent voting was possible. Afterwards the questions which failed to produce a consensus in one group, or which produced divergent judgements between the two groups were discussed in a plenary session.

The result of the workshop was a typified description of the objectives, behavioural and interaction patterns for all relevant actor groups, as well as providing an appraisal of future market development with regard to the new regulatory framework subject to the EEG 2012 amendment. For some issues which evoked great insecurity among the members, the actor analysis was complemented by further data research. Afterwards, the results were then translated into the formalised language of an agent-based model, simulating the behaviour of producers of electricity from renewable energies and intermediaries of this electricity in Germany, as well as the impact of the regulatory frameworks at stake on both the agents' behaviour and on the overall system.

Results

The investigation focused on the development of new business models and new forms of cooperation by new actors in the field of direct marketing. Genuinely new actors responsible for new business models and activities relating to direct marketing are so-called "intermediaries", since they are actually the ones who develop new services and try to convince renewable energy power plant operators to opt out of the fixed EEG remuneration and sell the electricity on the open market instead. Furthermore it is this actor group that consistently aims to forge coalitions with governance units, scientists, as well as with producers in order to a) develop business

models and b) influence the regulatory framework. In our understanding of the emergent field of direct marketing, the central market actors - and hence the entrepreneurs who advance the market and develop innovative services - are the intermediaries. By contrast the actual producers of electricity generated in renewable energy power plants, are the consumers of those innovative services, mainly playing the role and fulfilling the function of passive acceptance. It is worth mentioning, however, that some of them do behave as lead users and are engaged and involved in the co-design of services and business models. Before we offer a more detailed description of the intermediaries, here is a brief overview of power plant operators and their function within the emergent field.

Renewable energy power plant operators

The action field of renewable energy power plant operators is traditionally shaped and influenced by the EEG. Typically, the function and business of plant operators has been the generation and feeding-in of electricity from renewable energy sources. The operators differ in terms of plant ownership and technology. Table 2 shows the different operator types and their respective share of the German electricity market.

Table 2: Operator types

		Ownership							
		Privates	Farmers	Banks + Funds	Project developers	Municipal utilities	Industry	4 major utilities	Others (contractors, internat. utilities)
Technology	Wind	51,5	1,8	15,5	21,3	3,4	2,3	2, 1	2,2
	Biogas	0,1	71,5	6,2	13,1	3,1	0,1	0,1	5,7
	Biomass	2,0	0	3,0	6,9	24,3	41,5	9,6	12,7
	PV	39,3	21,2	8,1	8,3	2,6	19,2	0,2	1,1

Source: trend: research 2011

Interestingly over 50% of installed wind turbine capacity and nearly 40% of installed photovoltaic capacity is run by *private operators*. *Farmers* are also extremely active in the field of renewable energies, calling themselves "energy owners" as well as "landowners" and receive wide-ranging support from their associations. Some 20% of installed photovoltaic capacity and 70% of installed biogas capacity is operated by *farmers*. But renewable energy power plants are now also being run by *municipal utilities*, as well as by the *four major German utility companies*. Hydro plants and more recently offshore wind farms have traditionally formed the focus of investment for the latter group. Their active involvement in onshore wind, photovoltaics and biogas is very new, but their activities in these areas are not of the same scope as those of other operators. Many *municipal utilities* have entered the field of renewable energies as operators of large (20 MW) biomass plants. Some *municipal utilities* also run hydro plants, some invest in offshore wind farms, with some making recent moves in the direction of onshore wind and photovoltaics, though they too remain far less active than other operators. Due to the fact that the EEG guarantees a save return on investment, *banks* and *funds* also operate renewable energy power plants. They are especially involved in photovoltaic ground installations and are increasingly interested in onshore wind farms. *Industry* is yet another type of operator which should not be overlooked. Here we can differentiate between industrial actors such as the timber industry, which operates biomass plants as part of the key business, and industrial actors which run renewable energy plants, especially photovoltaic installations, generally for reasons of prestige and extra revenue.

Plant operator motives range from more or less ecological to monetary reasons. Originally, the investment-activities of pioneers had a more environmental background. Those actors were part of the environmental scene which not only aimed at supporting renewable energies, but also wanted to contribute to the complete transformation of the energy system. In the meantime, however, investments in renewable energy power plants guarantee safe returns, and hence the majority of operators are now monetarily driven. The results of the expert interviews, as well as the interviews with intermediaries, clearly revealed that the idea that renewable energy plant operators are mainly driven by ecological reasons must be rejected. Instead, all types of operators, including the private ones, are increasingly influenced by economic motives; the majority of them would not be led by ecological motives when it came to taking direct marketing action and decisions (especially when choosing cooperation partners). Nonetheless, exceptions do exist, as some interview partners stated. Some operators would refuse to cooperate with one of the *four major utility companies*, especially those project developers who retain close links with or are part of the environmental scene. But in general it must be stated that, along with the process of professionalization among all types, even among *private operators*, economic calculations are increasingly the decisive factor when it comes to choosing future marketing partners.

Since the German renewable energy incentive schemes have introduced new regulatory mechanisms with the aim of supporting and encouraging direct marketing, this possibility could theoretically have presented an attractive new business area for operators of renewable energy power plants. But in practice almost none of them has the expertise to do so. Only those operators with roots in the conventional electricity market, used to buying and selling electricity on the market, and equipped with the necessary infrastructure - such as access to the European Energy Exchange (EEX) - are in a position to build up the expertise required. This can be only asserted in the case of the *four major utility companies* and a handful of *municipal utilities*. For the majority of the operators, however, direct marketing can only work via intermediaries. This is why we did not consider the operators as crucial actors in the field of direct marketing – after all, it was the function and role of the *intermediaries* – and their ideas, strategies and business models respectively, which formed the focus of our investigation. But intermediaries, regardless of type, can only be successful and the field of direct marketing can only develop, if more and more operators can be convinced to leave the sheltered niche of the EEG and opt for direct marketing. This decision is highly dependent upon an operator's readiness to take risks and his orientation with regard to return on investment. These differences were surveyed in the workshop and evaluated afterwards. According to our findings, readiness to take risks and orientation with regard to return on investment tends to be low for *privates* and *prestige-oriented industry actors*; they are on a medium level for *farmers, banks and funds, project developers, municipal utilities* and the *four major utility companies*, and high for those *industrial actors* for whom operating renewable power plants is part of their core business.

For less professional operators such as *privates* and *prestige-oriented industrials* there is evidence of contradictory behaviours and strategies: on the one hand their orientation with regard to return on investment is rather low, but their actions remain motivated by monetary thinking. As a consequence, risk-avoiding actor types in particular are not willing to opt out of the EEG in favour of direct marketing if only low additional returns can be expected. Furthermore, the forecast quality of these low-risk operators is rather poor, and until now they have made little effort to build up the respective knowledge and expertise. For this reason, were they to decide in favour of direct marketing such operators would be particularly reliant on the respective services offered by intermediaries. At the same time, they represent the most unattractive customer types for intermediaries, because their plants are typically of small scale and low capacity and poorly equipped with regard to the infrastructure necessary for direct marketing.

Banks and funds, project developers, farmers, municipal utilities and the *four major utility companies* occupy the medium range when it comes to their readiness to take risks and their orientation with regard to return on investment. This means these actors are more likely to opt out of the EEG and decide in favour of direct marketing, because they expect higher revenues as a result. At the same time – since they are either highly professionalised or receive professional support by associations – they are good at negotiating attractive tariffs and contracts. This especially holds true for *project developers*, the *four major utility companies*, and *banks* and *funds*, since these actor types often operate plants on outstanding (windy or sunny) sites. Furthermore, due to their professional management, forecast expertise, and the existence of the infrastructure necessary for direct marketing, such actors are regarded as attractive partners by intermediaries.

Industrial actors demonstrate the highest readiness to take a risk and a pronounced orientation with regard to return on investment. This means these actors are more likely to opt out of the EEG and decide in favour of direct marketing, because they expect higher revenues as a result. They are just as professional in terms of management, forecast quality and infrastructure as the medium level types, but due to their strong monetary-led orientation, they manage to negotiate higher tariffs.

Intermediaries

Intermediaries offer their direct marketing services to renewable energy power plant operators. This is the central role of this actor group. *Intermediaries* buy the electricity generated by the renewable energy power plant operators and decide on their behalf whether to sell the electricity on the market or to stay in the sheltered EEG niche. Services offered by *intermediaries* encompass a wide range of tasks. They undertake technical and organisational tasks like forecasting wind and sun, or purchase external forecasting services in order to enhance site-specific forecasts for their consumers, and make forecast projections according to respective future electricity output. In addition, forecast-related technical services are offered, such as the electronic interconnection and monitoring of plants. Usually intermediaries are also responsible for schedule communications with the grid operators, as well as for the purchase of balancing energy.

According to our analysis, the following types of intermediaries can be specified: the major utility companies (we differentiated between the *four major German utilities* and *international utility companies*), *municipal utilities* (which were further sub-divided into "*large*", "*pioneer*" and "*small*"), *green electricity providers* (which were also sub-divided according to their consumers into "*end consumer-type*", "*business consumer-type*" and

"local direct-selling type") and finally *intermediaries with focus on the EEX* (also sub-divided into "*start-ups*" and "*major utility company spin-offs*").

For all types it can be asserted that their company strategies, business models, and choice of cooperation partners are clearly legitimacy-oriented and characterised by institutional conditioning.

Pioneering in the field of direct marketing was the actor type *green-electricity provider for end consumers*. This actor type has close links with the renewable energy scene and reflects the fundamental principles and ideology of the environmental movement. The aim of this actor is to become a green utility and actively contribute to the German 'Energiewende'. For this reason this actor type has successively expanded activities in all relevant sub-fields of the energy system. Having started with purchasing and selling green electricity, the actor is now highly innovative with regard to developing new products and services related to a wide range of fields, including the field of direct marketing. For this actor type, as well as for many other protagonists from the renewable energy scene, market integration has become especially important, because it is seen as a crucial instrument in maintaining or even enhancing public acceptance of renewable energies still further. Early niche activities in the field of direct marketing were supported by the 'green electricity privilege' pursuant to §37. Originally this 'green electricity privilege' was included in the EEG to support green electricity providers who offered exclusively green power. These pioneer actors aimed to offer a portfolio which featured as much electricity as possible generated in German EEG power plants (at least 50%). The rest was topped up with non-EEG green electricity, usually electricity from Austrian or Norwegian hydro power plants, but with the on-going aim of increasing the German share (Naturstrom 2012). In itself this business model of deliberately exceeding the regulatory requirements demonstrates that these green-oriented actors developed new products and services of their own accord and not in reaction to new regulatory frameworks or a shift in demand. This represents typical challenger behaviour (cf. Fligstein/McAdam 2011). Challengers needed to find market niches where they could advance and promote innovations such as pioneering direct marketing business models using the 'green electricity privilege'. This business model was then copied by incumbent actors, who adjusted it to their needs. After a short time of co-existence, the entire business model came under criticism, especially when major utility companies began imitating the business model, founding their own small companies to offer a portfolio which consisted of 50% of electricity generated in their own EEG plants (mainly hydro or biomass), topping up the rest of the portfolio with grey power. Windfall profits became the focus of complaints – on the part of both environmentalists and politicians (cf. Hummel 2012; EWS Schönau/Greenpeace Energy/Naturstrom 2011). Since January 2012, under the stringent new requirements for the use of the 'green electricity privilege', the business model has once more been forced back into the market niche. Even though green-electricity providers and other renewable energy scene actors and associations had agreed on the need to develop the 'green electricity privilege' further, they were harshly critical of the new conditions, estimating that the 'green electricity privilege' would be no longer a profitable business model under the 2012 amendment (cf. EWS Schönau/Greenpeace Energy/Naturstrom 2011; BEE 2011; BWE 2011). Moreover they had not managed to forge sufficiently strong coalitions with governance units, and therefore were unable to get §37 amended in such a way that it would still support this business model, while banning windfall profits. And despite great efforts to persuade policy-makers that a well-adjusted 'green electricity privilege' would be the best means of promoting market integration (cf. EWS Schönau/Greenpeace Energy/Naturstrom 2011, Clean Energy Sourcing 2012).

Nevertheless, even with the tightening up of EEG 2012 §39 conditions, this actor type still manages to meet the requirements. Thanks to ideological motivation and a commitment to 100% green electricity, and because this actor exceeds the originally required share of 50% from EEG plants (with a disproportionately high share of fluctuating energy sources due to the fact that he refuses to cooperate with the four major utility companies, and therefore has only limited access to hydro-EEG-plants, the latter being mainly operated by the market leaders), this business model still works for him. It is however a model which is now once more confined to niche activities. By contrast the market premium model is specifically designed to make direct marketing more attractive and to shepherd it out of the niche. But of all intermediary types it is this innovative actor who is disadvantaged by the market premium. Firstly green electricity providers cannot draw upon existing infrastructure, typically prerequisite for stock exchange activities. Hence they do not have access to the EEX etc. Furthermore the 'green electricity privilege' business model is not as competitive as the market premium model, so intermediaries who try to hold on to it could lose cooperation partners among plant operators (cf. Hummel 2012).

The situation is completely different for *green electricity providers for business-consumers*. This actor type has aimed and indeed managed to build up medium-sized structures on the consumer side as well as on the side of his plant cooperation partners, such as *municipal utilities* etc, at the same time retaining close links with the decentralised renewable energy scene. Furthermore he has experience with and access to the EEX. For this reason he is well prepared for further expansion in the field of direct marketing and the newly created regulatory instruments. He is optimistic and eager to pursue both business models. Firstly, because he has been successful with the green electricity business model in the past, while at the same time being well-prepared for the market

premium model. Secondly, he expects to profit from pursuing both models, because he can afford to be flexible, deciding which plant is best sold in which model, according to time and prices.

Apart from these models, this actor type additionally offers local direct marketing as another business model. He has been one of the first actors to contribute to the development of this form of direct marketing using virtual power plants. In this instance, 'citizen wind farms' receive support through the direct selling of their generated electricity to local communities and then – at times when power demand exceeds the locally generated electricity supply – through the addition of electricity from hydro and biomass plants.

Intermediaries of the *local direct selling* type focus on this type of business model. This actor type originates from the periphery of project developers aiming to boost local acceptance of a wind farm or photovoltaic ground installation project. In the first place, therefore, this actor type has developed local direct marketing as an instrument for boosting acceptance and hence improving his actual core business. As with the intermediary of the type *"green electricity provider for end consumers"*, this actor type is motivated and led by the idea of strengthening decentralised structures in the electricity system. Thanks to close links with the renewable energy scene, he aims to contribute actively to the transformation of the energy system. As a result this actor type emphasises the positive effects of the business model favoured by him as being of specific value in order to achieve the goal of renewables market integration. He therefore complains that local direct marketing is not supported more strongly by the EEG 2012 and he explicitly disapproves of the market premium model, describing it as an instrument to strengthen centralized structures (cf. Willenbacher 2012, Clean Energy Sourcing 2012).

Apart from these rather new, but on the other hand already active actors in the field of renewable energies, there are also two types of intermediaries who are *truly new actors*. Compared with the behaviour of all other actors, they tend to be efficiency-oriented and led solely by economic motives. They can pursue such a strategy because they are small and new and their links to the environmental scene are not dominated by ideology. So their legitimacy-orientation is concentrated and focused on their project partners. Their business model is limited to the market premium model (complemented by the 'flexibility premium model') because these offer the highest revenues and return on investment. And due to the fact that they are not active in other associated strategic action fields, such as the generation or provision of green electricity, they are not interested in those forms of direct marketing which additionally contribute to other goals (such as raising acceptance or supporting decentralised structures). Although this efficiency orientation is characteristic for all intermediaries of this type, they differ according to knowledge and expertise. It is therefore necessary to distinguish between two sub-types: on the one hand, there are the genuine *start-ups*, and on the other the *spin-offs from the major utility companies*. Compared with the *start-up type*, the *spin-off type* is significantly more advanced in terms of expertise owing to his experience gained in the various power markets. He is also better equipped and has a higher equity base.

Having described the challengers coming either from areas associated with renewable energies or emerging as genuine new actors, we would like to conclude by describing the incumbent actors of the traditional electricity market, who in the meantime have also become active in the field of direct marketing.

The *four major utility companies* - incumbent actors of the electricity system responsible for shaping and dominating the market in many strategic action fields closely associated with the field of direct marketing, are late arrivals to the direct marketing scene. It was only as they became aware that the 'green electricity privilege' pursuant to the former §37 would offer them windfall profits, did they enter the market. They either founded their own small companies or commissioned a respective service provider to offer a portfolio consisting of 50% of electricity generated in their own EEG plants (mainly hydro or biomass), topped up with grey power. Compared to their core business areas, direct marketing using the 'green electricity privilege' was negligible. As a result they did not invest in acquiring specific expertise in this field. Their attitude and strategy changed when it became apparent that the amendment to the EEG 2012 would include the market premium model. They suddenly started actively promoting and supporting the implementation of this new regulatory framework, forming coalitions with governance units and traditional electricity system associations. The position of the energy sector towards the 'optional market premium' was twofold: while the energy and water industry association welcomed the new premium, the renewable energy sector faulted the premium as an "inappropriate instrument" (cf. BEE 2011: 11). They specifically criticized the 'optional market premium' as too complex and costly; they either refused to introduce the premium (cf. Greenpeace 2011, BEE 2011) or imposed the condition that no additional costs should be incurred as a result (cf. BWE 2011, BEE 2011). Whereas the renewable energy scene feared that the market premium model would cause additional costs for end users of electricity and would therefore be counterproductive when it came to public acceptance of renewables, the major utility companies saw the chance of becoming stronger players in the field of direct marketing without the need for far-reaching organizational changes. The accepted opinion was the major utility companies would have difficulties handling the small and decentralised structures as they exist in the field of renewable energy. But with the help of the market premium model it would now be easier for them to operate in this field. They acknowledge being late,

but are confident of establishing the necessary organisational structures and expertise, since the business model related to the market premium tallies with the existing organisational structures and activities in associated fields.

Moreover, due to their very high equity base, they are likely to profit quickly from economies of scale, thus making up for the lack of experience and expertise. This assessment is backed up by the fact that the ownership of renewable energy plant operators has altered considerably. As mentioned earlier, the majority of these operators are not motivated by environmental reasons and do not necessarily refuse centralised structures in the electricity system anymore. As a result the quantity of potential cooperation partners should not be underestimated. Major landowners, funds, etc. could be attracted by attractive tariffs offered by the major utility companies.

In addition to the four *major German utility companies*, there is also an *international utility* type active in the field of direct marketing. Contrary to the German type, this type can be considered as having been among the pioneers in the field of renewable energies. This actor therefore entered the direct marketing business early on. On the one hand the *international utility* stresses belonging to the renewable energy scene and being motivated in favour of the further expansion of renewables. On the other hand, however, he is critical of high public subsidies. This actor emphasises the need for market integration as a crucial prerequisite to on-going success in related renewable energy fields in future. This actor type began direct marketing pursuant to §37 EEG 2009 no later than 2009. In doing so, he has built up the necessary expertise in forecast, technologies etc. and also has managed to establish cooperation structures with renewable energy power plant operators. From 2012 on, however, he will be focusing on the new market premium business model because it appears to be the best instrument for market integration on a larger scale and over a relatively short period of time. Even though this actor type is characterized as being highly active in the fields of renewables and led by the motivation to contribute to their further expansion and therefore market integration, we still consider him to be an incumbent actor of the traditional electricity system. This assessment is derived from the fact that his background is in huge (centralised) non-EEG hydro and gas-fired power plants. Only recently have his activities relating to German EEG plants developed to become a core business area.

Besides the *major utility companies*, *municipal utilities* may also be considered incumbent actors. These actors clearly emphasise their medium-sized structures and origin, and against this background they express their commitment to supporting said structures to the benefit of operators of renewable energy power plants. In terms of acquisition activities they refer to this argument of common medium-sized structures. For this actor type the market premium model offers the chance to either enter or to expand existing activities in the field of direct marketing. The pioneer type among the *municipal utilities* in particular has been very successful in recent years building up close links with medium-sized operators, and especially with privates and project developers. Hence the ‘green electricity privilege’ has not only been used to create windfall profits but to prepare future activities in close cooperation with the renewable energy scene. Other types of community utilities have been hesitant, lagging behind with regard to cooperation partners and more specifically in the acquisition of expertise such as forecast, technologies etc. They too however have also expressed a wish to gradually enter the market.

It remains which business model will be the most successful, and how the strategic decisions of one actor will influence the chances of success for the competition, a typical characteristic of emergent SAFs. Agent-based simulation is a method specifically suited to the analysis of complex systems and to modelling interdependencies between multiple entities. For this reason we decided to use the knowledge gained from the actor analysis to model an agent-based simulation, where the different types of actors are represented by different classes of agents, parameterized according to divergent policy frameworks.

Agents

The actor analysis showed how regulation mechanisms influenced actors’ goals, strategies, and options. In a final step all these results were translated into a formalised model language in order to be integrated into the agent-based model AMIRIS (see Figure 3, see also Reeg et al. 2012 for a more detailed description).

Intermediaries in AMIRIS now pursue different business models, have different levels of knowledge and expertise, varying trade volumes and capital stocks and, as a result, they also have individual cost structures for trading electricity. They offer different types of contract to the plant operators and can focus on one or two of five distinct strategies of trading electricity:

1. Continuing to sell energy to the transmission system operator and receiving the same fixed feed-in tariff plant operators would get according to the EEG.
2. Disposing of energy on the day-ahead market, and thus receiving the market premium, including the management premium

3. Selling energy to a supplier via the 'green electricity privilege', and thus avoiding the EEG surcharge
4. Selling energy via local direct marketing, and thus avoiding under certain circumstances the EEG surcharge, electricity tax, not to mention network charges.
5. Offering the power plant capacities on the minute reserve market.

Different levels of knowledge, expertise and trade volume are translated into different search costs associated with contacting plant operators and into different abilities regarding the power prognoses of their portfolio: intermediaries with low search costs can contact 20 percent of all plant operators each year in order to offer them a contract, intermediaries with high search costs can only contact 10 percent of the plant operators; once an intermediary has made contact with a plant operator, he is added to the intermediaries address book and automatically receives offers in all the years to follow. Regarding the ability to predict the electricity produced by all plants under contract, intermediaries' normalized root-mean-square error (NRMSE) for forecasts varies between 15 percent (good prognoses) and 25 percent (poor prognoses). The error is further reduced by one percentage point for each GW of installed power to model the smoothing effect. Higher prognosis accuracy is associated with higher costs: a good prognosis is three times as expensive as a poor prognosis. Furthermore, size of portfolio has a considerable influence on the price of the prognosis: for small portfolios the price per MW of installed power is three times higher than for large portfolios.

The actor analysis identified ten different ideal types of intermediaries with distinct combinations of business models, capital stock, search costs and forecast abilities shown in Table 3; the dates in the columns representing the different business models indicate when this type of intermediary was able to pursue a specific business model in AMIRIS for the first time.

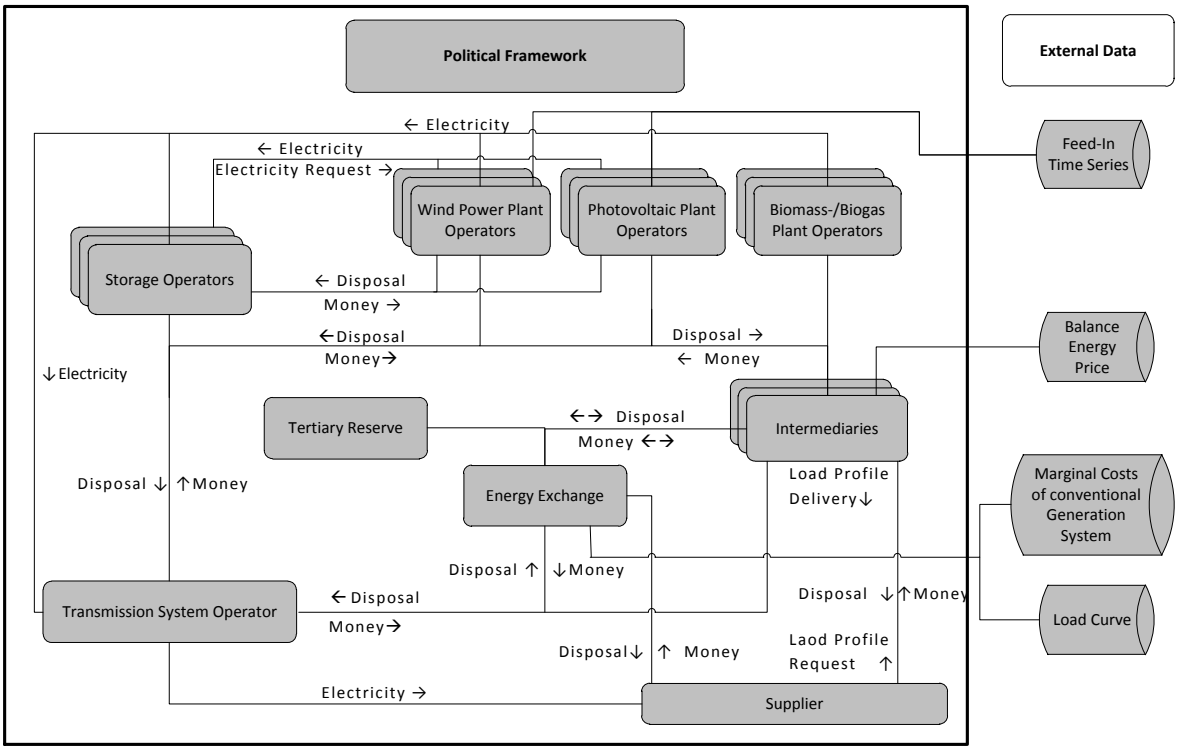
Table 3: Intermediary agents in AMIRIS

Type	Subtype	Capital stock	Local direct-marketing	'Green electricity privilege' (§37)	'Green electricity' privilege (§39)	'Optional market premium'	Quality of prognosis	Search costs
"Major four" German utilities		considerable	-	2011	-	2012	good	low
International utility		moderate		2009	-	2012	average	low
Municipal utilities	*Big*	moderate	-	2010	2012	2012	average	average
	Pioneering	moderate	-	7/2010	-	2012	good	low
	Small	low	-	-	-	2012	poor	average
Green electricity providers	*End-customers*	low	-	2008	2012	2012	good	low
	Business-customers	low	2012	2008	2012	2012	good	low
	Local direct marketing	negligible	2012	-	-	-	average	-
Intermediaries with focus on the EEX	*Start-up*	negligible	-	-	-	2012	average	high
	Spin-off	negligible	-	2011	-	2012	good	low

Plant operators are the other group of agents in AMIRIS, its make-up refined using the results of the actor analysis. To model the different groups of renewable power plants, they first had to be specified according to technology and year of construction, since such data defines their feed-in tariff according to the EEG. Furthermore, the actor analysis identified different groups of operators with different levels of risk avoidance and different expectations regarding their return on investment. As higher levels of risk avoidance in general go hand in hand with lower expectations regarding return on investment, we chose to model these differences using the premium an intermediary has to add to the EEG feed-in tariff in order to convince the plant operator to leave

the system of fixed feed-in tariffs and to enter direct marketing. The actor analysis showed that all plant operators – as well as the banks that financed most of the plants – will only agree to leave the fixed feed-in tariff provided by the EEG if intermediaries offer a premium on the EEG feed-in tariff. However, leaving the fixed feed-in tariff still holds the risk that the intermediary could go bankrupt, meaning the plant operator would have to wait at least one month before he could return to the fixed feed-in tariff. Therefore, leaving the fixed feed-in tariffs incurs costs for the plant operator equal to the risk resulting from a possible bankruptcy of the new intermediary plus the transfer costs of reading, understanding, and comparing the offer to other offers. We decided to capture these costs by taking the level of the premium on fixed EEG feed-in tariffs which is needed to convince the plant operator to move towards direct marketing. For operators with low risk aversion the premium is set at .3 €ct/kWh, operators with medium risk aversion demand at least .4 €ct /kWh, and operators with high risk aversion will only change contracts if they are offered a premium of at least .5 €ct/kWh. This threshold holds for all changes of contract – either from fixed feed-in tariffs to direct marketing, or from one intermediary to another, because in both situations the plant operator is leaving a working business constellation and taking a risk in order to raise revenues. As was stated in the interviews, most operators will estimate the risk of bankruptcy higher for new market players, meaning these intermediaries will have to pay higher prices to enter the market; based on the actor analysis we estimated this additional premium to be a maximum of .2 €ct/kWh for intermediaries entering the market no more than two years ago, disappearing completely following five years of successful market activity.

Figure 3 Model structure



Summary and Outlook

Results of the actor analysis were used in order to specify various actor groups. As its starting point, the analysis took assumptions derived from the theory of strategic action fields, as well as from neo-institutionalist concepts of organisational sociology. The assumptions were approved in a first step. It could be shown that challengers who were motivated by the fundamental principles and ideology of the environmental movement developed an innovative 'green electricity privilege' business model. Furthermore this business model was copied by incumbent actors, and adjusted to their needs. More hypotheses regarding future developments on the German electricity market - and representing the hopes and fears of different actors - were drawn from the analysis, such as that the market premium model was an instrument to strengthen centralized structures or that the 'green electricity privilege' would be no longer a profitable business model under the 2012 amendment.

In order to be able to test those assumptions on future developments, such as the profitability of different business models, we used the results of the actor analysis to develop an agent-based model of the German electricity market. For the investigation of complex network systems the approach of multi-agent modelling and

simulation is frequently used. These systems tend to follow an evolutionary path and thus diverge from the classical assumptions of the omniscient, utility-maximizing individuals of neoclassical economics that result in a series of general equilibriums (cf. Arthur 2005). Instead, the system behaviour of multi-agent models results from the behaviour of individual agents – called actors in the real world – and is not centrally controlled. The heterogeneous agents are modelled having individual states, actions and goals and they are situated in a dynamic environment, which they shape themselves through their own actions. In addition, the agents learn over the course of the simulation by gaining knowledge and therefore changing their basis of decision-making. By implementing goals and tactics it is also possible to model long-term action strategies (cf. Wooldridge 2002).

First simulation runs show that the introduction of the market premium will slightly raise the overall subsidiary costs compared to the old fixed feed-in tariff system (cf. Reeg et al. 2012). Although the macro-economic impact like the overall costs of the support mechanisms of different schemes might not always differ to a huge extent, the micro-economic impact on different actors can be huge. Just to give an example: about three months after the introduction of the 'optional market premium' there are many voices saying that the management premium – a component of the market premium to compensate for the additional expenses of the direct marketer for selling the energy on the energy exchange – only causes windfall profits for many actors without really endorsing the integration of the renewable energy into the energy market. With the AMIRIS model a tool has been developed for the specific analysis of such possible side effects of support schemes. Since the model follows an agent-based approach it allows boundless combinations of parameter settings. Results of different simulation runs to evaluate various support schemes and their effects on the different type of actors and on the overall system will be published in the near future.

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