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NETWORK ANALYSIS OF THE COMPETENCE NETWORK ON DISTRIBUTED ENERGY TECHNOLOGIES (DEENET) IN NORTHERN HESSE

Abstract

The significance of renewable energy resources is commonly recognized. The challenges are there to create cooperative bodies, which would impose certain solutions to make the idea not only well known, but also understood and implemented. The example of such cluster initiative is deENet, which is presented below. The goal of this article is to present the scheme of cooperation within a cluster body and present the results of deENet operation's analysis.

Keywords

cluster, renewable energy, renewable energy resources, OZE, deENet, bioenergy, network

Introduction

The significance of renewable energies (RES) is growing worldwide. This introduces new challenges, which German companies in particular are well-prepared for. In Northern Hesse, a wide spectrum of companies and institutions exist that are active in the field of RES, including several market and technology leaders. Especially the industry showed itself as robust even during the recent economic crisis and has sustained positive growth rates. Therefore it can be seen as the economic growth engine of the Northern Hesse economy. In combination with the research and development, the education sector, high levels of employment and economic potential are some of the results. The stakeholders are well networked, as evidenced by a number of regional initiatives, company networks, and research collaborations. This networking creates significant synergy effects. The Northern Hesse example for such kind of a trans-sectoral network is the Competence Network Decentralized Energy Technologies (deENet).

The project "Bioenergy for the Region - development of cooperation network between science and economy in terms of renewable energy sources in the Region of Lodz using the solutions of German network deENet" aims at elaborating and implementing an effective cooperation network model based on information and knowledge transfer in RES industry, between entities acting in the field of research and industry in the Voivodeship of Lodz using solutions of the German partner network deENet. Therefore it is essential to gain knowledge about the functioning of the deENet network and its cooperation between science, industry and education.

In order to give an overview of the specific characteristics of the deENet Network, the following article is based on a network analysis of a Master's thesis¹ comprising expert interviews. An additional survey of the members of the network was conducted in the study "North Hesse 2020: Distributed energy and jobs". Significant parts of the article are therefore based on the content and/or structure of these two analyses, especially regarding the overall network analysis, the interaction matrices, the network graphs and the analysis of partial networks, as well as future tasks and challenges.

Distributed energy technologies in Northern Hesse

The Region of Northern Hesse consists of the city and county (Landkreis) of Kassel, as well as the counties Waldeck-Frankenberg, Schalm-Eder, Hersfeld-Rotenburg and Werra-Meißner (see: figure 1).

¹ H. Gieselmann, Dezentrale Energietechnologien – Innovationen in der Region? Untersucht am Fallbeispiel deENet in Nordhessen,

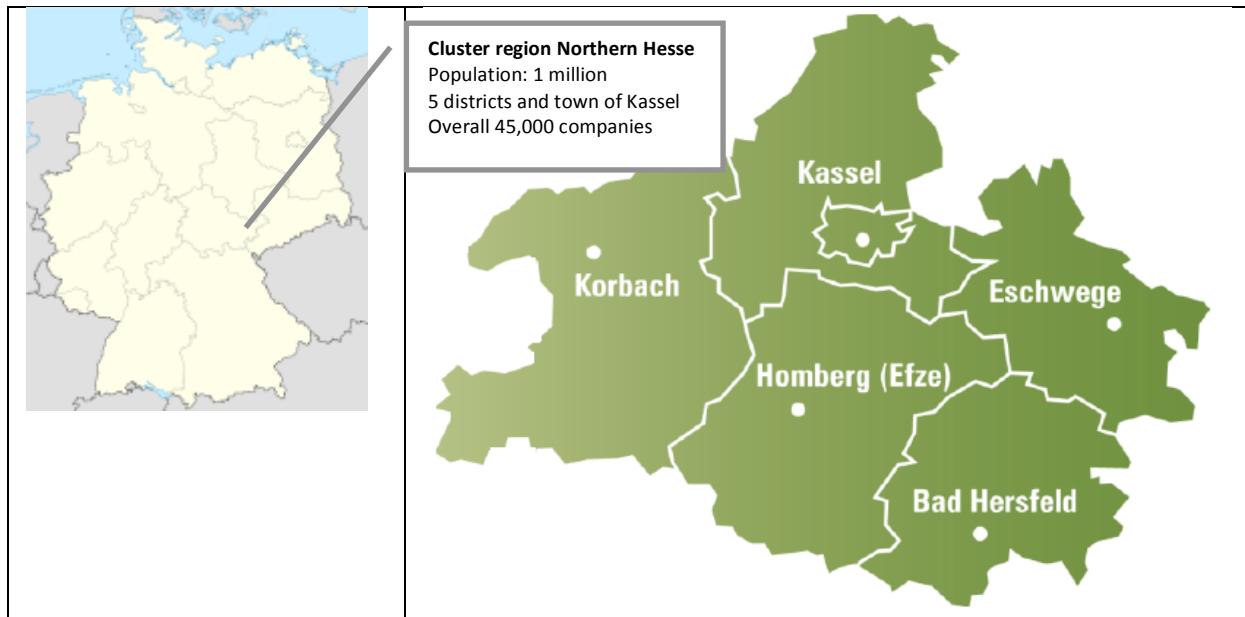


Figure 1. Counties and the city of Kassel in Northern Hesse.
 Source: own study.

The total population sums up to one million inhabitants, of which approximately 200,000 are living in the city of Kassel, the single urban center of the region. Vast areas of the Northern Hesse Region are predominantly rural and the medium-sized regional centers comprise of not more than 30,000 inhabitants. In the coming years, negative demographic development is expected with declining population figures.

As a business location, the Region of Northern Hesse is in a weaker position than the southern parts of Hesse; however, growth rates of the gross domestic product per capita are higher than for the state overall. Figure 2 shows the spatial distribution of the members of the network:

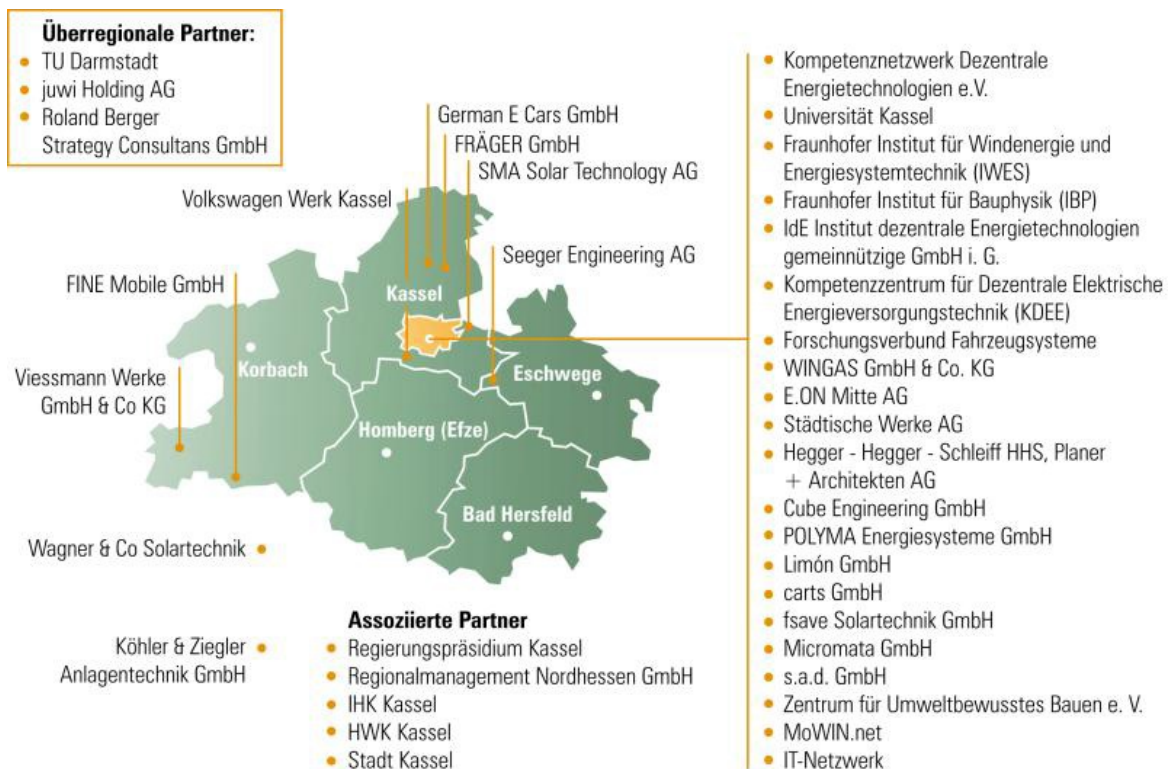


Figure 2. Overview of spatial distribution of deNEet Partners.
 Source: own study.

Also the unemployment rates declined during the same period and continuously fall short of the national average. Since 2003, several projects for cluster development have been initiated in the region, focusing on the fields of mobility, health, tourism and distributed energy technologies.

The Competence Network for Distributed Energy Technologies (deENet)

As a joint initiative, the Competence Network Distributed Energy Technologies (deENet) deENet was co-founded by a number of companies, the regional development agency, and the University of Kassel in 2003. In the following years, deENet succeeded with making the network known nationwide and internationally with application-oriented research and pilot projects. Today more than 120 companies are united in deENet, comprising research and development, planning and design, production, operation & service as well as education & training, (see: figure 3). Operational activities are carried out by the employees at the head office in Kassel, whose task it is to carry out applied research projects with members, as well as the networking of members among each other.



Figure 3. Overview of the different areas of activity of deENet Members.
Source: own study.

Thus deENet constitutes a unique concentration of university, institutes and innovative companies covering the complete supply chain – from research and development to planning, designing, production, and from operation to education and further training. The network members are active in such different green fields as solar energy, wind energy, bioenergy, water power and geothermal energy, efficiency concepts for residential buildings and for industry, combined heat and power (CHP)-construction and regional development. Some of the most important subjects nowadays are concepts for regional value creation through decentralized energy systems and strategic consulting for municipalities to develop integrated climate protection concepts. In cooperation with researchers and municipalities, deENet is providing several projects, whose content ranges from common strategy development to feasibility studies and concepts for carbon neutrality. Apart from many regional and national projects linked to these fields and provided together with several members, deENet is also the driver behind more and more international projects. In these projects, a strong focus is put on sustainable regional development and exchange of experience and best practices between clusters and regions. 20 of the network members are consulting engineers, architects, associations and agencies and engaged private persons.

Furthermore, municipalities, utilities and grid operators as well as educational and research institutions are members. The remaining members are producers of distributed energy installations, consulting engineers for innovative building technology, consulting engineers for energy efficient processes, planners on energy concepts, suppliers in the field of electric mobility and solar vehicles as well as service providers. A certain concentration among the members of the network is to be found in the area of photovoltaics as well as in the area of bioenergy. Overall, however, the network members represent almost all areas of distributed energy technologies.

Also, the business sizes vary greatly among members, from one-man companies to companies with several thousand employees. The network members are either located in the region of Northern Hesse, or have a center of business activities in the region.

Network activities in the area of decentralized energy

Within the broad field of distributed energy technologies, the central challenges within deENet are networking activities such as the exchange of information and pursuit of common interests. Cooperation between actors within single technological subfields is unproblematic, but a wider exchange between different actors occurs more rarely. The goal of a network must be to define an overall theme across technologies, without becoming too general. Between focused technical exchanges, informal exchange can be helpful to build confidence between actors in order to build common viewpoints. Both are fundamental prerequisites for successful cooperation. Not only in the field of distributed energy technologies, such an exchange is best facilitated via a neutral organization such as a cluster-network, in order to dispel any competition concerns.

Network analyses on organizational and cooperative structures of deENet

The goal of a network analysis is to clarify the characteristics in the network and the relations between the actors within it, in order to identify the gaps and sub-groupings. The analysis determines whether interactions between single actors take place, and at what level these are connected to each other. Other sources need to be taken into consideration in order to clarify the nature of the relationships and the motivation behind them. The Network analysis does not tell us, whether the actors are actually cooperating in order to contribute to innovation, and what role the regional proximity plays. This information is collected via a written questionnaire, which is used in this report as an addendum to the network analysis. Furthermore, surveying the member network can clarify the needs, strengths and limitations of the companies. This secures that measures derived will have direct significance to the member companies. Furthermore, the need for intensifying the cluster dialogues can be assessed.

Survey among the members of deENet in the framework of the Project "Bioenergy for the Region" The survey questionnaire for the survey within the "Bioenergy for the Region" project was sent out via email to all members of deENet. The questionnaire consisted of 27 questions in total, surveying cooperation between research and business, information exchange, business support measures as well as obstacles and success factors of the network. The survey was finalized in the end of June 2012. Less than 10% of the network members returned the questionnaire, and of these, some were incomplete. Therefore, no representative or statistically significant conclusions can be drawn from this survey; nevertheless, selected answers are taken into consideration in this report, taking into account their non-representative nature. Therefore, this report is primarily based on two *other* surveys.

1. Member survey within the Master's thesis of Ms. Heike Gieselmann

For her survey, Heike Gieselmann sent out a questionnaire to all business members of deENet, as well as of selected private person members.² In total, 102 members were contacted as part of her Master thesis research. Of these, 50% returned their questionnaire completed. Around 60% of planners, architects and "others" have responded, and 50% of producers and grid operators, whereas the response rate of municipalities, communication agencies as well as research – and educational institutions was lower than 50%. Therefore, the firstly mentioned group's replies tend to be over-represented. The majority of questionnaires were filled in by managing directors of the surveyed entities. Only organizations within the deENet network were surveyed; relations to non-members were not analyzed. The questionnaire asked about the nature of the relationships of the business/the organization to the listed deENet members, considering a time frame of the past 3 years. The reply options were:

- Our business / our organization has no relation to the member (no relation);
- There are supplier relations to the mentioned member. Input products or services are bought from or sold to the company / the organization, (supplier relation);
- We work with the member on common products, but no direct supplier relations exist (e.g. architect and electrician working on the same house) (Common projects);
- Our company /organization exchanges technical information within a formalized setting (e.g. via cooperation in research projects, working groups, industry forums etc.) (Knowledge exchange).

² H. Gieselmann, Dezentrale Energietechnologien...op.cit.

In parallel to the survey for the network analysis focusing on network interaction, further questions were posed on innovation activities of the members as well as general reference questions. The answers provide valuable information on the role of regional contacts of the network. The data collected in this way was then analyzed with the software program UCINET 6 and Vision.

2. Member survey in the framework of the study "North Hesse 2020: Distributed energy and jobs"

The study "North Hesse 2020: Distributed energy and jobs" describes the specific economic opportunities of the North Hesse Region in the areas of distributed energy and energy efficiency. By defining concrete actions and milestones for their implementation, a future roadmap is sketched out, which relates to the further development and design of the network as a cluster organization. The central statement of the study is: "In North Hesse, 20,000 jobs can be created in the area of distributed energy and energy efficiency." With these new jobs, this field would have a similar economic significance in the region as the car industry has today. In order to levy the high employment potential, the "further development of the existing cooperation- and cluster structures" is identified as of strategic importance. The survey was conducted in two parts. In 2006, the University of Kassel interviewed all businesses. In the framework of the Roadmap 2020 study, a second round of interviews was conducted in 2007 in order to identify the particular features of the cluster. This "energy cluster", which represents the member companies of deENet, includes all energy relevant companies from the areas production, service and research & development in the Northern Hesse Region - of these 73 participated in the survey. Selected results especially relevant to action recommendations for the management of clusters are selected for this report.

Results of the deENet-Network analysis

1. Actors within deENet

deENet unites different organizations, businesses and private persons who are active within the field of distributed energy technologies. However, the borders between members and non-members of deENet do not play a role in practice, since most events of the association are open towards nonmembers, too, and non-members often partner in projects as well. Also the activities of the members go beyond the activities within the association. Thus, not all relevant actors in the region are represented Northern Hesse. However, it can be assumed that from the perspective of key stakeholders in the cluster management deENet network many are active.

2. Goals of actors within deENet

In the survey of member companies according to their views on the key objectives of the network the aspects of joint projects and the development of cooperation between academia and industry were most frequently mentioned. For large equipment manufacturers within the network the "development of new joint projects" is of crucial importance, while large service companies rather see their goals in the "development of cooperation between science and industry". For smaller companies in the engineering, planning and consulting sectors, however, both aspects are considered to be of equal importance.

The biggest obstacles are seen to arise out of time constraints of the members. Due to bureaucratic requirements and differing interests in the network, there is concern that they may affect the optimum functioning of the network (deENet 2012).

3. Actor based value chains in the deENet network

It is possible to differentiate between the actors in deENet based on different value chains of energy supply through decentralized energy technologies. The key areas are identified as: research, manufacturing of machines for energy and water conservation, plant design and installation and operation of the plant and the distribution and marketing of the energy produced. For these areas we can distinguish three main value chains, which are characterized by different constellations of actors, activities and spatial relationships. These are: plant production, plant design and installation and operation.

The following statements are based on the member survey conducted in June 2012 and are not representative of the entire network (due to the low response rate). They, however, portray, despite the small number of responding companies, their priorities. However, these different value chains naturally have intersections and influence each other.

Plant production

In the field of manufacturing facilities, there are numerous independent value chains, such as the production of photovoltaic, solar thermal, wind power, or combined heat and power plants. Broadly speaking, these value

chains are not technically associated and cooperation between the different areas of the plant production is thus unlikely. It is therefore not expected to encounter more complete value chains in the field of plant production in a region.

Planning and Installation

In the design and installation of equipment, it is of crucial importance that decentralized energy technologies ultimately provide the same products. For instance, among the systems installers, there is still a very extensive separation of concerns along the individual technologies, but for example, the responsibilities of plant designers and project planners can or must include multiple technologies. With regards to production it thus seems that largely independent value chains clearly overlap in the aspects of planning and installation. The occurrence in this area is highly dependent on how the business models of the actors define the planning and installation. Therefore in this area of the value chain comparatively long-term cooperation relationships between different companies can be expected due to the variety of skills required and the wide range of customer requirements. In particular, the proximity of the actors to each other is relevant because while on the one hand, a common interpretation of the background is important, on the other hand, a physical co-presence and low transaction costs play a role as well.

Operation

In the area of the operation of power-generating equipment the first step is the management of a surface on which the primary energy is recovered. This is then converted to a corresponding investment in end-use energy technology, which is traded on an exchange, and distributed through the network until it is finally led to the end customer. With the increasing distributed use with rather small units it is to be predicted that many actors are involved in energy production, especially as land and asset ownership.

Linkages between the value chains

The interactions between the different value chains lie firstly in the application, i.e. the cooperation between design and installation, and operation of facilities. It is critical that mechanisms be created to allow the planner to see their projects in the context of the overall system in order to create a coordinated and effective system. Actual interactions between plant designers, installers and operators are likely even today, in the long term there is an even greater need for coordination in the development of strategies to be expected. Furthermore, it might also be useful to allow feedback between the *scope* and manufacturers because plant designers and installers can provide valuable information about the practicality of the products, ideas, or the end user's own optimization suggestions. In summary, convergence and interdependence of the supply chains occurs in the structure of the value linkages in the field of decentralized energy technologies.

4. Identifiable sub-networks of deENet

On the basis of the framework of the final work requested during business survey three areas of interaction are distinguished in the network analysis of the competence network deENet: interactions along delivery networks (supply network), interaction with product development (project network) and interactions through exchange of knowledge (knowledge network). In the graphs, the individual members of the network are shown as points. A dash between two members means that one of the two in the survey confirmed a relationship to the other (e.g. "Yes, there are business relations with the said member").

The supply network of deENet

When looking at the graph of the supply network (see: figure 4) the key actors can be identified by the size of the circles: the regional transmission and distribution system operators (in dark blue), and a large manufacturing company (in brown).

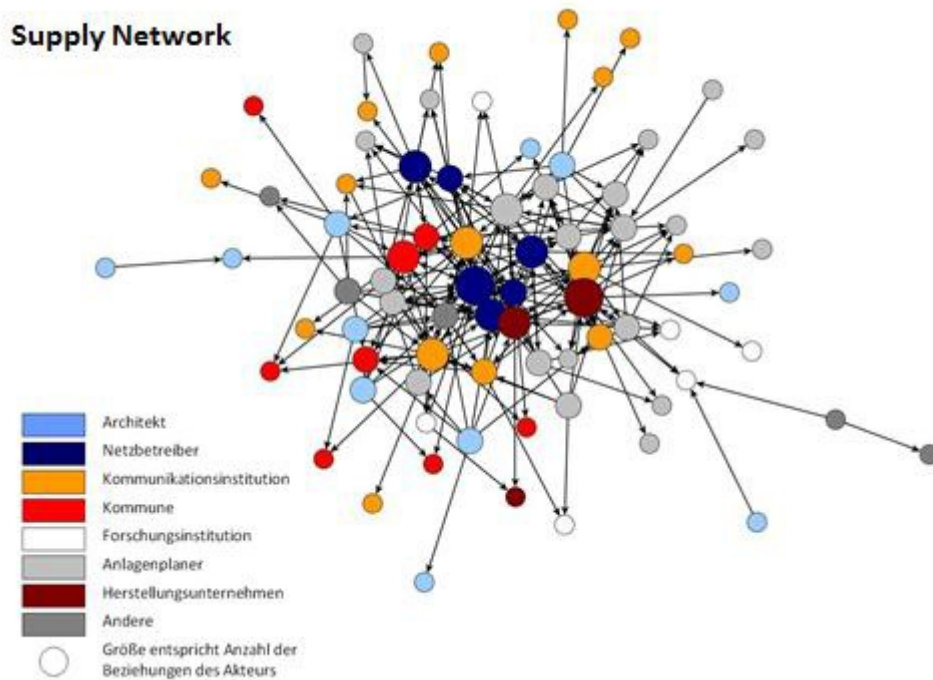


Figure 4. The supply network of deENet. Translation of legend, starting above: architect; grid operator; communication bureau; municipality; research institution; installation planner; production enterprise; others. Size of circle corresponds to the number of rel.

Source: own study.

The next size class includes another large firm of the network in the area of plant production, three operators, three "communicators", a local authority and a system designer. It is thus clear that the deENet manufacturers and network operators - as well as some communication bureaus – are very important players, while plant designers and architects in particular play a rather peripheral role at the edge of the network, even though they were a slightly above-average proportion of respondents. The network edge consists of roughly equal proportions of communication bureaus, architects and municipalities.

The project network of deENet

The project network, which was investigated for the joint work on projects or joint product development, can be found in the graph (see: figure 5) as some of the same actors who were already pointed out in the supply network as central. The two major companies in the region of Northern Flesse in the manufacturing of equipment and components as well as the vast majority of operators in the region. Furthermore, within the project network a lot more communication institutions have a large number of relationships with other network members, as was the case in the supply network. In addition, several research institutes and municipalities are part of the better connected region of the network.

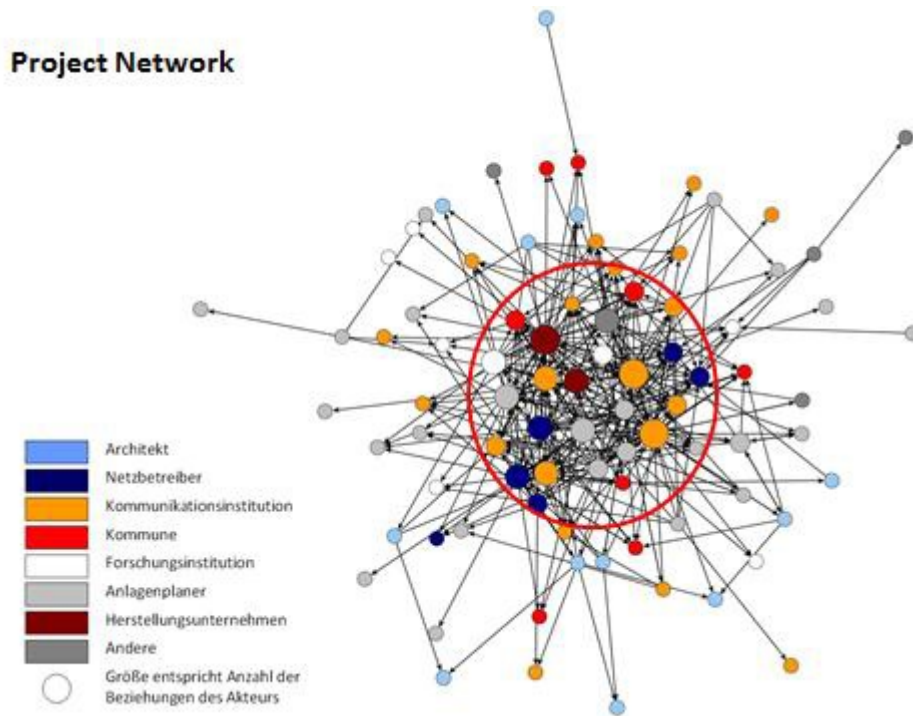


Figure 5. The project network of deENet. Size of circle corresponds to the number of relationships of the actor.
Source: own study.

A clear "inner circle" can be identified, within which the actors are assembled with high centrality, connected closer to each other than with actors outside of the circle. From the return analysis of the survey it is clear that this inner circle consists mostly, but not exclusively, of players who answered the survey themselves. Flowerer, a total of 84 network members are in this range, so that the close ties not only result from the response structure but also from the fact that the players are particularly well connected in this area.

The knowledge network of deENet

In consideration of the knowledge network (see Figure 6), in which the question of information exchange from network members was raised ("Our company/organization communicates with the member technical information in a formal setting (through collaboration in research projects, workshops, industry forums, etc."), it can be stated that the actors are very well connected in total (out of 102 listed members, 98 were named by one single company).

In the presentation of the relationships originating from the actors (outdegree) no specific substructures can be identified for the knowledge network of deENet. Therefore, it makes sense here, to represent the centrality of the actors on the basis of "incoming links" (indegree), i.e. not from the outgoing relationships.

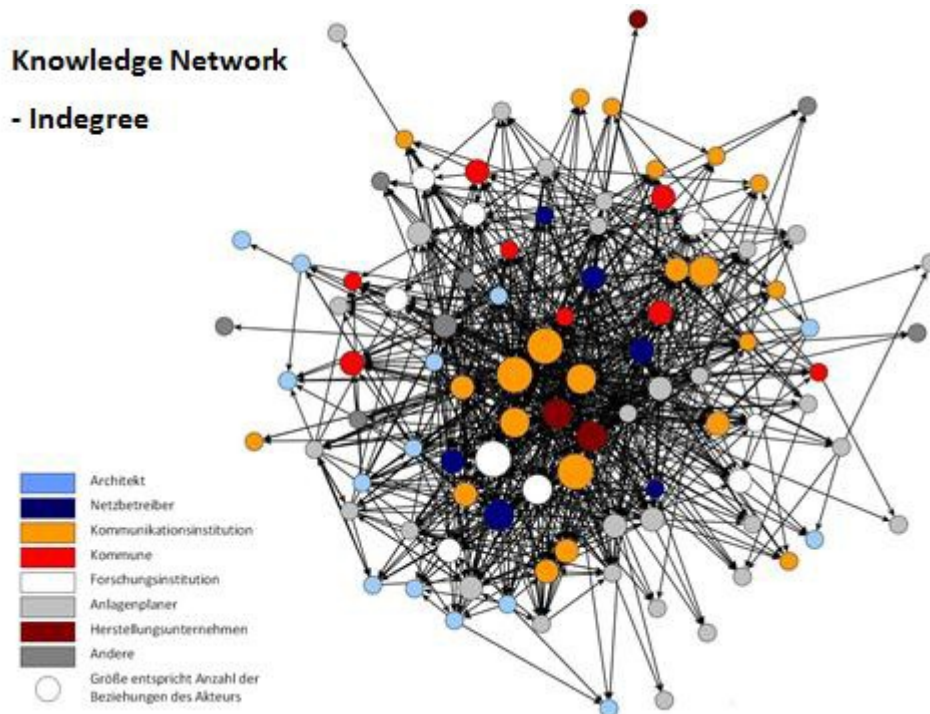


Figure 6. Knowledge network of deENet.
Source: own study.

In this illustration, the four key players are a research institute in the field of electrical technology and three institutions of communication. In the next category, two major companies can be identified in the fields of system and component manufacturing, one a photovoltaic system designer, an energy provider and a service provider; and a centrality class lower than almost all educational and research institutions. Over and above are the remaining operators, some local and regional institutions, service providers and smaller consultancies. Overall, this display also shows that large companies and the usual communication institutions are also quite important in the knowledge network, but pause for educational and research institutions as well as the system operator positions highlighted.

Subgroups in deENet network

The goal of the identification of the closely connected subgroups or partial networks, called "cliques" is to find actor constellations associated intensively with one another. Only in the supply network can one see distinct cliques forming in the areas of solar thermal and photovoltaic (see Figure 7), while for the project and knowledge network no cliques are found. All other technology areas don't appear to be internally interconnected, but links are found with people from other areas of technology; cross-technology collaborations are otherwise important as internal technology cooperation.

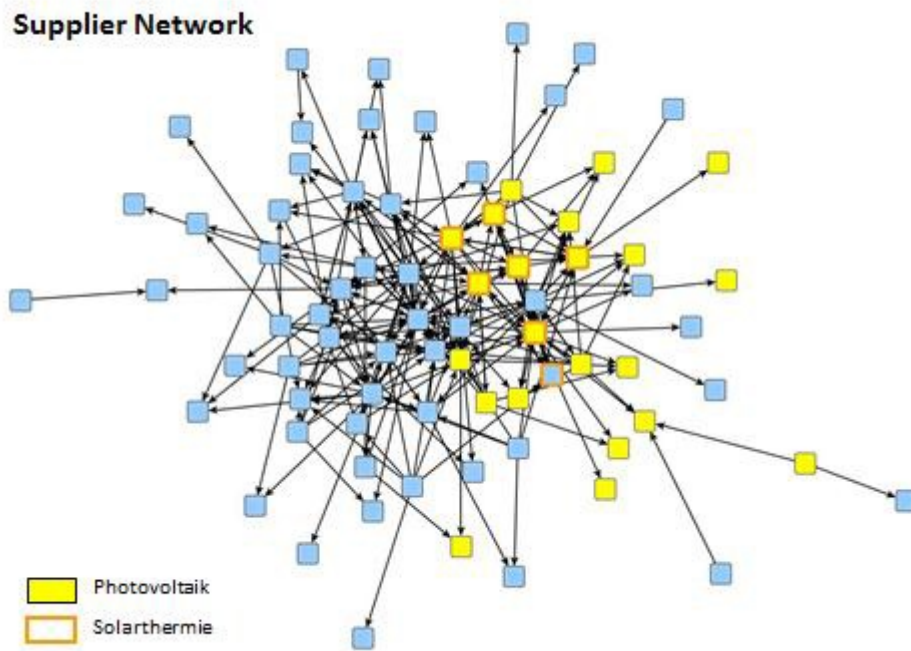


Figure 7. Sub-groups in the supplier network of deENet. Translation of legend, starting above: photovoltaics; solar thermal.
Source: own study.

Cohesion, density and balance of deENet network

Concerning cohesion of the individual members of the network, it is clear that 26 members in the supply network, 17 in the project network and 4 members in the knowledge network are isolated; thus no relationships with other members. The other members on the other hand are all connected with each other more or less so that no independent sub-networks exist. Here, the cohesion in the knowledge network is highest and lowest in the supply network. Those players who have connections in the network are also connected to all the other actors indirectly.

The density of the supplier and project network are characterized by intensive, often also repeated interactions. On the contrary, the knowledge network has a lower interaction threshold, such as the participation at working groups of deENet or similar events of other institutions. This confirms that the density of the network declines as the intensity increases, because the resources of actors are limited. In total, we can conclude that deENet network is surprisingly active, and there's no distinguishable fragmentation into separate sub-fields - especially taking into account the broad nature of the membership structure.

The centrality of the actors is measured via the sum of incoming and outgoing relationships (while mutual relationships only count once). If this sum varies greatly between network actors, this result points towards an uneven distribution of the number of relations between actors and corresponds to a low **evenness** of the network. For deENet, the mean value of the incoming and outgoing relations of actors is lowest in the supplier network and highest in the knowledge network. These values underline the high degree of interconnectedness in the knowledge network of deENet. Looking at the overall network, the distribution is particularly uneven in the supplier network, that is, the number of relations is very varying across actors, while the knowledge network has a much more evenly distributed relationship status.

5. Support options of the network members through deENet

The survey of the study "Northern Hesse 2020 – distributed energy and jobs" gives valuable hints on the importance of a cluster dialogue based on the locational factors and the strengths of the cluster. Furthermore, the companies were also asked directly on options for action options and on support possibilities in need. The central topic on support was the cooperation between businesses in the network - this was especially the case for service companies (see: figure 8).

Support of the energy cluster from political side was seen as necessary from 58% of respondents. This is almost evenly distributed among the three branches services, production and research. 38% of companies from the energy cluster wish for support from deENet when it comes to sales and marketing. Marketing is an important topic for research and service companies; production companies are less in need. Primarily for small and medium sized companies, marketing is an important point. Education has an equally high place value as marketing; it was termed important by 39% of respondents. This goes especially for companies with 11-100 employees (50%) and form 38% of the companies with more than 100 employees. Education is hence an important issue for medium sized companies from the production and service sectors. Research and development (R&D) is an important issue for medium sized companies too, the big and small businesses in the energy sector need less support in this field. Especially research institutions wish for support concerning R&D.

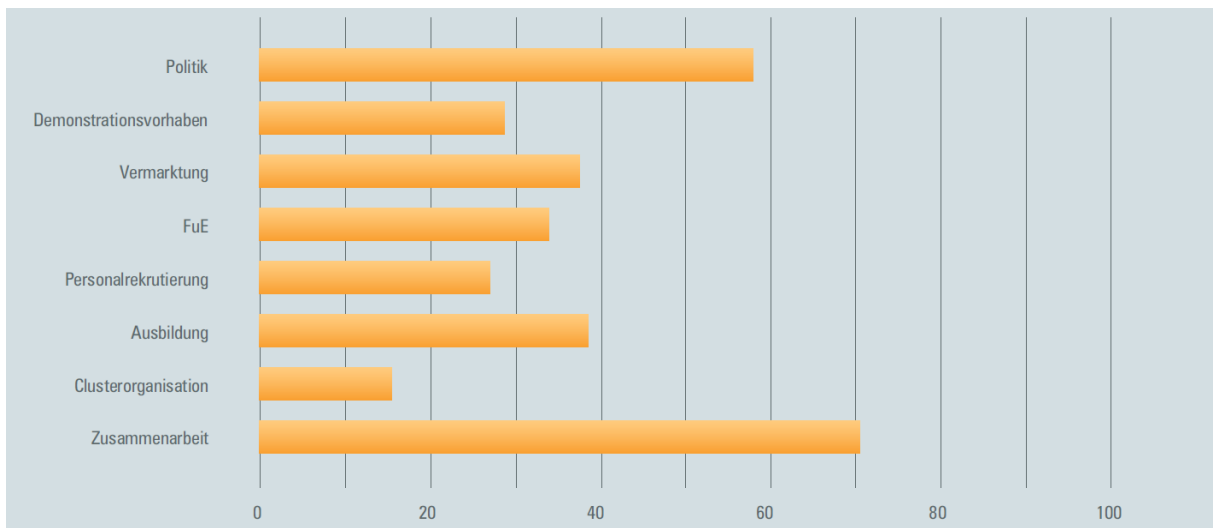


Figure 8. Support options sorted according to areas. Multiple answers were possible.

Source: University of Kassel. Translation of legend, starting from above: politics; demonstration projects; marketing; R&D, recruitment; education; cluster management; cooperation.

The cluster organization is especially important in research institutions: 50% of all responding businesses have replied accordingly, whereas only 10% of the service companies and 6% of the production businesses see this as an important issue. Seen in relation to the size of the business, especially small companies with less than 11 employees considered cluster management an important issue (25% in total). Furthermore, cluster management is also important for research entities.

Summary and conclusions

The composition of the competence network deENet corresponds to its application oriented focus, which is expressed in the very broad range of technology covered in the cluster. Interactions, especially in the area of application exist in the fields of planning, installation and operation, and these relationships are positively enhanced through the connection to the manufacturers.

The results of the study "Northern Hesse 2020: Distributed energy and jobs" equally underlines the great significance of the applications sector, in which interdisciplinary and application oriented research projects constitute the core of the network tasks, and which are carried out at a high academic level within a well working team of cluster members.

In total, members display a high degree of interconnection with each other and a good cohesion of the sub-groups as well as relatively high activity in the network. A formation of sub-groups within the network can only be detected within the solar technology branch. This means that the network is otherwise not fragmented, and that different technologies such as solar, wind, biomass, efficiency etc. are well connected.

Single actors, such as network operators and large companies in the manufacturing sector occupy central positions in all sub-networks, but also communication bureaus are very present in the project and knowledge network. It is rather surprising that architects and installation planners are take up less defining positions in the supplier- and project network.

The results of the network analysis further show that relevant actors are not only connected through the spatial proximity in the region, but also interconnected across technologies. Several challenges and improvement options result from the analysis carried out. These can be mapped out and summarized in the following SWOT-Analysis table (see: table 1)

Table 1. SWOT-Analysis of deENet.

Strengths	Weaknesses
Comprehensive competencies in the area of renewable energy and energy efficiency within the network	Cooperation and communication of members can still be improved, for example, there are only few common events.
Long-standing successful cooperation between business and research.	Performance profile is not yet defined sufficiently concrete
Strong network through high number of members covering the entire value chain.	Goals, e.g. the expansion of renewable energy in Northern Hesse are still unclear - what ist o be reached together?
Credible positions and high motivation to get things done together	High degree of heterogeneity of members: Coordination is difficult and it is difficult to reconcile their different interests
Good support of the network in the political realm, administration and general population.	Prominence is yet too low - how does deENet benefit the general public?
Consensus between politics and population on the importance of the further support to this topic area in the region	Framework conditions for cooperation between office and members are not defined
High degree of prominence in research and the specialist public	Lack of opinion statements and positions to topical topics
Future market with growth markets and long term tasks	Lacking integration of crafts business

Source: own study.

Recommendations for the model of cooperation in science and industry in terms of RES

Running networks are primarily known for two properties (deENet 2009):

- Advantages through **vertical and horizontal cooperation** (value chains)
- Creation of an **environment stimulating innovation**

A complete network consists of companies in the region which cover all steps of the value chain, from "idea to product". This is the case in the area of the distributed energy technology. The **analysis of barriers** in this report is hence of particular importance for positive cluster management.

Furthermore, the following statements are valid for networks in the area of distributed energy technologies³:

- "Networking in the area of distributed energy technologies should be interdisciplinary and irrespective of specific technologies, but still as concrete as possible"
- "Several production units of different technology value chains cannot be expected within the same region (for example production of photovoltaic cells and wind turbines). Even if this would be the case, cooperation would be unlikely. However, if a region mainly hosts production of one specific technology, cooperation between the different business units can be expected. This is dependent on the degree of standardization of the technology in question."
- It can be advantageous also to unite the production with the planning and use in one region, because producers can benefit of feedback from the application.
- "User-producer-Interaction is especially important between planners, installers and installation and grid operators, in order to keep the different technologies compatible. Spatial proximity is a useful medium in order to bring down transaction costs.
- The overlap of value chains occurs mainly in the planning, installation and operation - less in the production. Applying the technologies in the regions is therefore a prerequisite for technologically broadly based projects.

Business cooperation in the deENet-Network itself is mentioned by 70% of the respondents as a central topic in which support is needed - this especially goes for companies in the service sector. "Political support for the energy cluster was considered necessary by 58% of respondents. These reply shares are almost equally distributed among the three business fields "service", "production" and "research".

Increasing consolidation of the network- and cluster management of deENet is to strengthen the cooperation structures in the coming years. The deENet activities will thereby have a **stronger regional impact** and **connect with the structural and industrial policies of the individual counties of the region**.

For the implementation of the Roadmap 2020 as foreseen for the Region of Northern Hesse, professional cluster management is indispensable. In order to create at least 20.000 jobs a sequence of concrete, strategic steps must be taken. By involving businesses, politics and important key actors, different measures such as the following have to be taken:

- Political and planning framework
- Knowledge, knowledge transfer and cluster management
- Access to capital
- Qualification
- Public relations, regional marketing
- Application in the region

"With these measures, the region can benefit disproportionately of the worldwide trend towards increased use of renewable energy and energy efficiency technologies, and hence position itself on the rapidly growing international markets" (deENet 2009).

This results in a series of action points for deENet, which are also applicable to the network development in the region of Lodz:

Building up cooperation structures through "Cluster-Dialogue"

The goal is the support of cluster actors in their development of new products and services as well as the development of research- and demonstration projects. Therefore, the research institutions and businesses are incentivized to an intensive information exchange. As singular initiatives in the area of knowledge transfer / cluster dialogue, deENet pursues the following activities (see figure 8):

Especially concerning the distributed supply systems, cooperation between network partners has resulted in new businesses that have significantly contributed to the growth of the revenue and job figures in the region. The deENet Network has **innovation potential in the area of research and development**. **Qualified personnel** are necessary in order to enable application and research in the region. A broad spectrum of education and

³ H. Gieselmann, Dezentrale Energietechnologien... op.cit.

training options have already been created in the area of distributed energy technologies, which have been positively received. Next to this, **demand side activities** such as market development are especially relevant since it constitutes the prerequisite for the development of further innovation in research projects. Therefore, it seems useful to expand on the market development activities in the framework of the work of deENet in relation with other organizations and to use the special advantages of spatial proximity.

At the same time, this offers a good opportunity also to integrate smaller companies like installation planners, architects and installers, and to live up to their expectations towards the association.

Table 2. Planned activities in the cluster dialogues of deENet. SME = Small and Medium sized Enterprises.

Name	Goals	Description/Actors	Time	Evaluation Criteria
Cluster Dialogue with SMEs	Supporting SME's in innovation and competition	Cooperation of small enterprises is to balance out weaknesses in innovation (according to survey). The goal is the development of new products and marketing channels → deENet, Cluster management	2009 and forward	Number of events per year and number of participants; new cooperation
Thematic cluster dialogue	Cooperation of businesses, e.g. in topics as research, services	Organization of thematic workshops within the network. Existing products and companies are to be further processed within the region → deENet, Network	2008 and forward	Number of events per year and number of participants; new cooperation → Energy efficiency round table
Regional Strategy with Utilities	The founding of regional energy suppliers in cooperation with existing utilities	Northern Hesse is the home of smaller utilities which can act on the market according to their own strategy. The interest for the returning utilities to municipal ownership is growing. Information events and dialogue on interests	2008 and forward	Number of events per year and number of participants; → Workshop with mayors and utilities
Strengthening of the research location Northern Hesse	Build up the research location, especially the University of Kassel and other institutions	The university research institutions as well as other establishments should conduct more projects in the region, especially in the areas of energy efficiency and distributed energy technologies. → University of Kassel, deENet, research sections within companies	2008 and forward	Number of events per year and number of participants; new cooperation agreements, research project applications, theses) 100% Renewable Energy Regions Project; → "KLIMZUG"-Project (on climate change adaptation)
Science Park	Realization of a knowledge based business park in direct proximity of the university	The building up of a business incubator connects the university of Kassel with young companies and spin-offs. → University of Kassel Knowledge Transfer Unit, City of Kassel, deENet, Spin-Offs of the	2008	Number of new research institutions and enterprises Number of new jobs created and new businesses founded

Initiation of "flagship cluster projects"

The goal is the strengthened regional anchoring of the cluster via local application of distributed energy and energy efficiency technologies. The goal is to reach regional self-sufficiency based on renewable energy; in order to reach this, flagship projects must be developed and carried out. It is the task of the cluster management to identify potential projects, bring together potential partners and clarify and bring about the framework conditions in order to realize the project. For the preparation phase, several studies are conducted by deENet, in order to create a technical and economic foundation, also with respect to the efficient combating of climate change.

R&D cooperation and marketing

Helpful for the profiling of the cluster at national level is the acquisition of application oriented research projects in partnership with research institutions from the network and production companies of the region.

Expansion of "cluster information services"

The goal is to motivate the network partners to participate at events at which they are regularly informed about planned and completed activities of deENet.

Additionally, a transparent and strengthened presentation of the competences of the network partners is planned, whereby they are supported in the marketing and sales of their products and services. Therefore, an expansion or establishment of new information services is needed:

- Building up a new internet platform with a professional presentation of the competences of the network partners,
- The regular publishing of a "cluster newsletter",
- Intensification of media work.

Individual consulting of "cluster actors"

The goal is to intensify the individual counseling service towards member companies, municipalities and institutions within the Region of Northern Hesse through personal contacts and talks on site.

The relevant regional actors - especially also outside the urban center of Kassel - should be integrated more strongly in the active work of the cluster. In order to achieve this, eight consulting meetings with members per month are planned on the premises of the member in order to secure the activation of new actors in the network. Setting up a service hotline is planned in order to get timely development of requests.

Documentation of "Cluster development"

The goal of these activities is the presentation of the technical and economic development of the cluster through the publication of thematic publications and the publication of an annual report. This publication informs the members as well as all interested stakeholders of the network about the projects carried out and applied for, and creates the necessary transparency and acceptance for the activities within the cluster management. Such an annual report serves as an instrument for the presentation of the competences of the cluster of distributed energy technologies as part of its public relations.

"Cluster internationalization"

The goal of this measure is to support and promote the further internationalization of the cluster. Therefore, technical and organizational framework conditions must be created in order to support this process. First of all, deENet must develop an international version of its external presentation by making English language versions of its internet presence, brochures etc. To broaden the awareness within the international community on renewable energy of the activities of deENet, participation at conferences and events is needed in order to stir attention towards the activities and competencies of the network. deENet will use these contacts in order to build up an international network on distributed energy technologies with institutions abroad. The international activities will first of all be initiated at European level and then enlarge towards other regions in the furthering of the internationalization process. In order to coordinate these activities, a working group on "internationalization" will be established.

Recommendations for a model of cooperation between networks

Among the SMEs there's a growing awareness of getting possible profits as a result of being member of a cluster. Possibilities of fast development and being more competitive lead enterprises to join co-operational

connections. To more strongly and more effectively compete with other players in the international market clusters, and therefore also their members, should strive to work within the same or a complementary subject areas. International collaboration leads to obtain new ways of progression, increases flow of information and transfer of good experiences. New progress possibilities are open wide for clusters and their members thanks to execution of joint projects. Mutual inspiration, reinforcement and complementation lead to achieve more effective results.

Inter-cluster co-operation has positive influence on their members not only by making them broad-minded and allowing rapid exchange of information but also enhances their competitive potential and expanding market opportunities. Also, the cluster, cooperating with foreign partners, strengthen its position both domestically and internationally.

The initiation of common projects by clusters may encounter certain problems which may be solved in a particular way. These are presented in a table below.

Table 3. Barriers and suggested solutions for cluster projects.

Barriers	Suggested solutions
Financial	Knowledge of EU programmes and initiatives supporting internationalization of clusters.
Legislative	Developing a model of cooperation taking into account the legal obligations of partners.
Mental	Awareness of benefits which will come out of collaboration.
Culture and language	Proper selection of personnel – multilingual, open minded, positively oriented towards other cultures.

Building an innovative and knowledge-based economy (which is main goal in "Europe 2020" strategy) is not possible without the development of clusters. They are important elements in building competitive advantages of the regions.

EU promotes and supports development of a clusters and co-operational connections providing financial assistance.

Currently (as of July 2012) there are number of active programs dedicated to clusters presented in a table below.

Table 4. Active programs dedicated to clusters.

Programme	Financial perspective	Budget (billion Euro)
Competitiveness and Innovation Framework Programme (CIP)	2007-2013	3,6
7th Framework Programme for Research and Technological Development	2007-2013	51,0
Regional Policy (INFOREGIO)	2007-2013	347,0

Cluster co-operation simplifies internationalization of enterprises. Strengthen the position of domestic companies in international markets usually involves the search for foreign markets and the creation of export strategy. First phase of export could be irregular and spontaneous but later it is getting more organized by co-operation with standalone agents or establishing of branch offices. Expansion to foreign markets could be slowed down due to lack of knowledge of their economy, fear or legislative barriers. International dialogue between clusters may be the main reason to overcome those barriers by animating contacts between actors and to facilitate the expansion of business into new markets.

Co-operation between deENet Competence Network and Bioenergy for the Region Cluster opens new perspectives for both sides. Common area of clusters' activity allows to create number of joint initiatives. Defining strategic goals (which will be reached by realization of partnership projects) should be the first stage in building long term collaboration. Financial aspect is important as well – obtaining external funding will allow for more intensive development of cooperative ventures.

In times of globalization and fast progress the only chance for building competitive Europe is development of clusters. Their role will be crucial in achieving goals pointed in "Europe 2020" strategy –knowledge- based and innovative economy.

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Abstrakt

Znaczenie odnawialnych źródeł energii jest powszechnie uznawane. Wyzwaniem pozostaje jednak tworzenie instytucji sieciowych, które nie tylko upowszechniają wiedzę i technologie związane z OZE, ale także przyczyniają się do ich wdrożenia w praktyce. Przykładem takiej instytucji jest inicjatywa klastrowa deENet. Celem artykułu jest przedstawienie programu współpracy w ramach deENet.

Słowa kluczowe

klaster, energia odnawialna, odnawialne źródła energii, OZE, deENet, bioenergia, sieć