



Collective efforts to support the energy transition in North Rhine-Westphalia

Current and future work by the Virtual Institute „Transformation – Energy Transition NRW“

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Dear readers,

The Paris Agreement has created an important framework for the transition to a climate neutral world in the 21st century. This framework must now be fleshed out. The required transformation of the energy system is one of the greatest social challenges – especially for North Rhine-Westphalia as a major energy and climate protection region in Europe. In the process, a secure energy supply that is as cost-effective as possible and our federal state's competitiveness are key targets for the energy transition.

As Germany's primary industrial centre, we have taken on this task and the associated challenges of climate neutrality, decentralisation and the digitisation of the energy system. The transformation is stimulating innovation and is therefore presenting economic opportunities. At the same time, it is bringing about major systemic changes that require both technological and social renewal. On the one hand, technical aspects of the energy system need to be updated. On the other hand, commercial and socio-political processes need to be adapted.

The Virtual Institute "Transformation – Energy Transition NRW" assists and supports the sustainable restructuring of the energy supply system in North Rhine-Westphalia. The think tank's research focuses on the socio-economic and socio-cultural implications of the energy transition, taking particular into account of the circumstances specific to North Rhine-Westphalia. This example demonstrates that the transformation of the energy system requires the scientific community to adopt a different perspective and a different way of working. Research must not only be interdisciplinary, but also take a transdisciplinary approach to working with civil society and business from all of the federal state's regions to shape the future energy system.

This booklet presents the organisation's partner institutes, provides insights into the research findings and discusses the main challenges of the energy transition.

I hope you find it a stimulating read.

Prof. Dr. Andreas Pinkwart

Ministry of Economic Affairs, Innovation, Digitalization and Energy of the State of North Rhine-Westphalia (MWIDE)

Much has been achieved, and even more learned: Energy transition in NRW can only be accomplished together!

By Dr. Steven Engler, Institute for Advanced Study in the Humanities (KWI), Essen, and Prof. Dr. Manfred Fischedick, Wuppertal Institute for Climate, Environment and Energy (WI), coordinators of the Virtual Institute "Transformation – Energy Transition NRW".

For Germany's number one region for energy and industry, the energy transition signifies far-reaching changes to an energy system that has evolved over many years. The social perception of the energy transition is a decisive factor in determining the prerequisites for its implementation and helps to define the conditions for its success or failure. Conversely, the transformation of the energy system in North Rhine-Westphalia (NRW) is itself triggering social change; for example, when members of the public generate their own energy through renewable energy technologies and thus become directly involved in the transition.

Participatory and reflexive processes are required in order to meet the complex challenges of the energy transition in NRW. On the one hand, stakeholders from politics, business, society, associations and the scientific community need incentives to participate in realising the energy transition. On the other hand, they need clear direction provided by a consistent regulatory framework that is adaptive and adaptable. Accordingly, an effective mix of instruments combines regulatory, communicative-participatory, incentive-oriented and planning measures as well as adequate monitoring processes aimed at measuring the progress achieved.

The transformation of the energy system in NRW requires a comprehensive innovation process, which must take place at different levels in the state's various regions. On these levels, the energy transition is happening at different speeds and intensities, with different intentions, in different directions and with the support of different stakeholders. The transformation of the energy system in NRW is therefore very different with regard to its development and the respective regional manifestations, reflecting the federal state's heterogeneity.

The Virtual Institute "Transformation – Energy Transition NRW" has taken on the challenge and is addressing the non-technical questions raised by the energy transition in NRW. By pooling the expertise of participating research institutes in North Rhine-Westphalia, a spotlight is shone on topics that go beyond issues of technical implementation. In addition to the economic aspects of the energy transition, which are of course closely linked to the technical questions, the Virtual Institute is also researching further topics. The central issues involve democratic participation in the energy transition, individual approaches to the energy transition and the transformation of industrial infrastructure. In the future, greater attention will be paid to the interplay between the energy transition and priority issues such as megatrends, for example urbanisation and an ageing society.



The Virtual Institute also pays special attention to the involvement of partners active in the worlds of business, politics and administration. Its work equally addresses members of the public and sets out the roles they play in the collaborative project that is the energy transition, whether as electricity consumers, when shopping or in relation to transport. However, members of the public are more than just consumers. The Virtual Institute attaches great importance to opening up opportunities for people to participate so that they can develop their own roles in the implementation of the energy transition independently and responsibly. The creativity of the public must be harnessed if the energy transition is to evolve into a collaborative project. Democratic participation and creative involvement in shaping the energy transition are essential for its sustainable implementation by the public and also by stakeholders from industry, administration and politics. After all, the transformation of the energy system is and will remain a collaborative effort.

One of the Virtual Institute's central tenets is to awaken interest in and, ideally, enthusiasm for sustainable and future-oriented forms of business, ways of running our homes and coexisting, create networks and provide information via suitable narratives. Secondly, the institute aims to offer an analytical perspective on the energy transition in NRW and the question of where further

action is needed to build upon the efforts already made by the various stakeholders in order to achieve the ambitious climate protection goals. The Virtual Institute has made initial contributions to this in recent years, but the complex circumstances involved in shaping the energy transition are still not fully understood. When it comes to answering important questions, some of the methods are breaking new ground, not least because the lack of a blueprint for such processes means that specific requirements only emerge in concrete terms during implementation.

The German term "Energiewende" has become a loanword in numerous languages to denote the energy transition. Now more than ever, the term must be given substance and convincing answers provided in order to align this understanding with social norms and values and drive the process of transformation forward together. As the originator of this loanword, the "German Energiewende" has taken on the responsibility of setting an example. This applies in particular to the number one energy region, NRW. We want to contribute to tackling this challenge through the research conducted under the auspices of the Virtual Institute "Transformation – Energy Transition NRW".



Cluster EnergieForschung.NRW: Research as a driver of innovation

When it comes to energy research, North Rhine-Westphalia is top of the league with more than 30 universities, 20 leading research institutes and numerous industrial research departments. Cluster EnergieForschung.NRW (NRW Energy Research Cluster, CEF.NRW) supports this process so that new technological and socio-economic findings can quickly find their way into business and society. Consequently, CEF.NRW is contributing to the improved visibility and strengthening of North Rhine-Westphalia as a location for innovative energy research. The cluster also serves as a central point of contact for networking the federal state's research and scientific institutions and commercial practice.

In addition to numerous flagship projects, such as the German Aerospace Center's (DLR) solar tower in Jülich, the high-voltage direct current transmission test rig at

the Technical University of Dortmund, and the "Carbon-2Chem" research project coordinated by the Max Planck and Fraunhofer societies, socio-economic research also plays a leading role in Germany. This is of particular importance for North Rhine-Westphalia as a research location. After all, the transformation of energy systems can only succeed if, on the one hand, technological innovations are created and, on the other hand, the needs and expectations of society are adequately reflected.

In a number of instances, the Virtual Institute "Transformation – Energy Transition NRW", initiated by CEF.NRW in cooperation with the federal state's government, has already succeeded in generating stimuli to successfully link technological, economic and social issues. We are therefore delighted to provide you with an overview of the Virtual Institute's research work in this booklet.



The Virtual Institute "Transformation – Energy Transition NRW"

A network for the non-technical aspects of the energy transition in NRW

By Dr. Daniel Vallentin, Wuppertal Institute

The Virtual Institute "Transformation – Energy Transition NRW" is a network of ten research institutes from North Rhine-Westphalia that was founded in 2013 on the initiative of the federal state's government. In addition to the NRW state government, the institute is also supported by the Mercator Foundation and coordinated by the Institute for Advanced Study in the Humanities (KWI), Essen, and the Wuppertal Institute for Climate, Environment and Energy (WI).

The Virtual Institute's purpose is to analyse the non-technical aspects of the energy transition in NRW with the help of innovative research designs and to actively involve stakeholders from politics, business and civil society in the process. The non-technical challenges presented by the energy transition include, among others, socio-economic and socio-cultural questions. For example: How does the expansion of renewable energies affect existing industrial sectors in NRW? What is the public's perception of the energy transition, and how do they want to shape it for their own benefit? Which of the thought patterns that have evolved over time in NRW's regions are influencing local perceptions of the energy transition?

To investigate these and similar questions, the Virtual Institute's members collectively developed a research agenda, which they update regularly. In doing so, they are building on their expertise and a joint research agenda. The central themes of the research agenda are then translated into interdisciplinary research projects and worked on in project teams. These projects always focus on the specific and diverse circumstances of the energy transition in North Rhine-Westphalia and its regions.

Over the past three years, three collaborative projects have been carried out by members of the Virtual Institute. Further projects will follow from 2018 onwards. The Virtual Institute's collaborative projects are organised in three thematic clusters.

Governance and Participation cluster

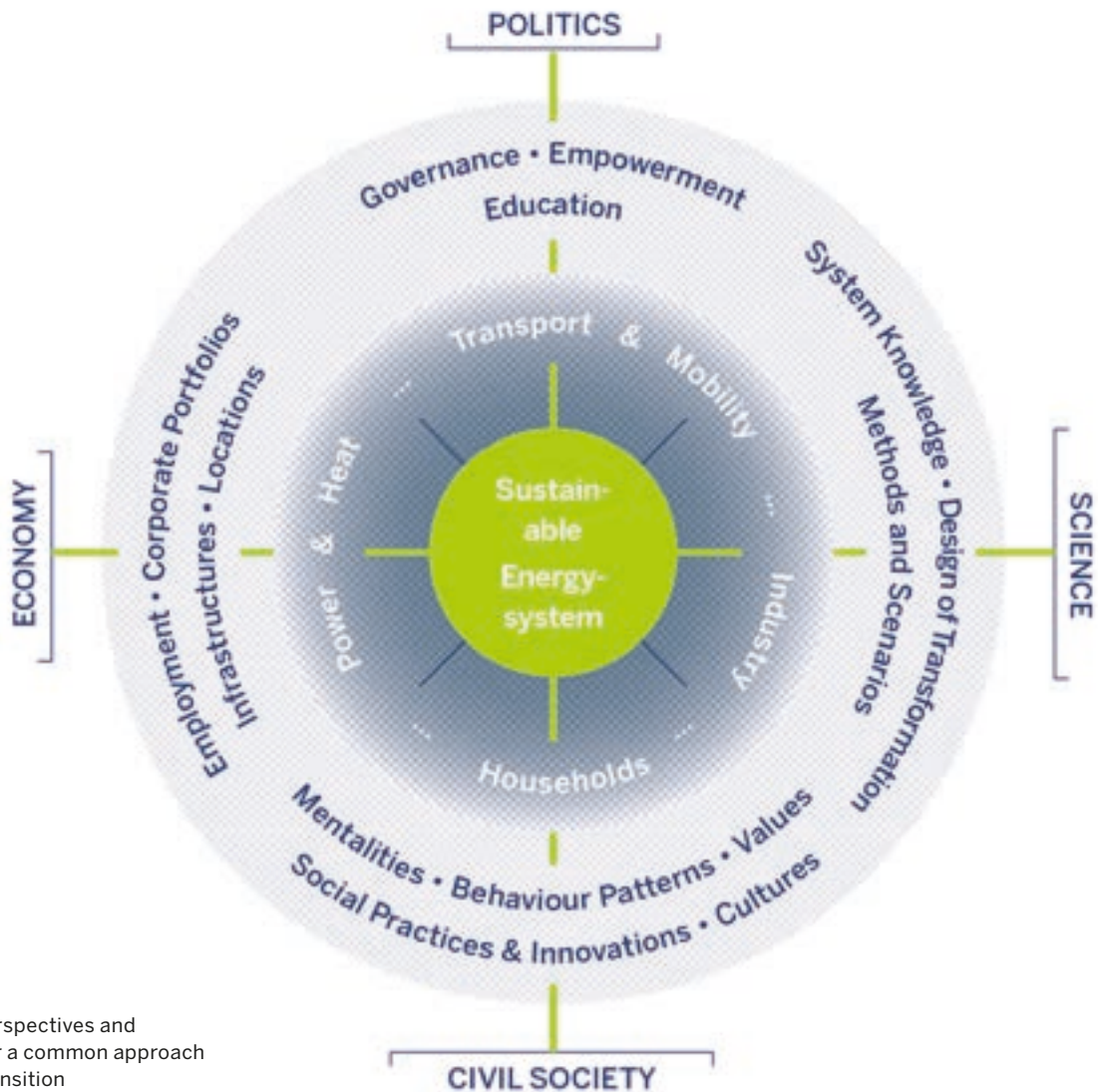
The focus here is on the question of how a broad socio-political discourse on the right goals and strategies for the implementation of the energy transition in NRW can be organised. To this end, the Virtual Institute develops participatory and innovative instruments and researches processes and prerequisites that form the framework for these instruments. In this way, the Virtual Institute provides policymakers with concrete proposals for establishing a new culture of education, communication and participation.

Mentalities and Patterns of Behaviour cluster

This cluster deals with thought, awareness and behaviour patterns that have evolved in society over time, and with the question of how these affect the implementation of the energy transition in North Rhine-Westphalia. It analyses which measures change these patterns of thought and behaviour in relation to the transformation of the energy system, and what role the media or educational establishments, for example, are playing in this process.

Transforming Industrial Infrastructures cluster

This cluster addresses the existing industrial infrastructures in NRW and investigates how industry in the state can develop and shape the process of transformation into a climate-friendly energy system in a beneficial manner. On the one hand, the goal here is to create an understanding of the economic implications of the energy transition in North Rhine-Westphalia and its regions. On the other hand, it aims to understand how industrial transformation processes in regions and companies can be organised and shaped as innovation processes.

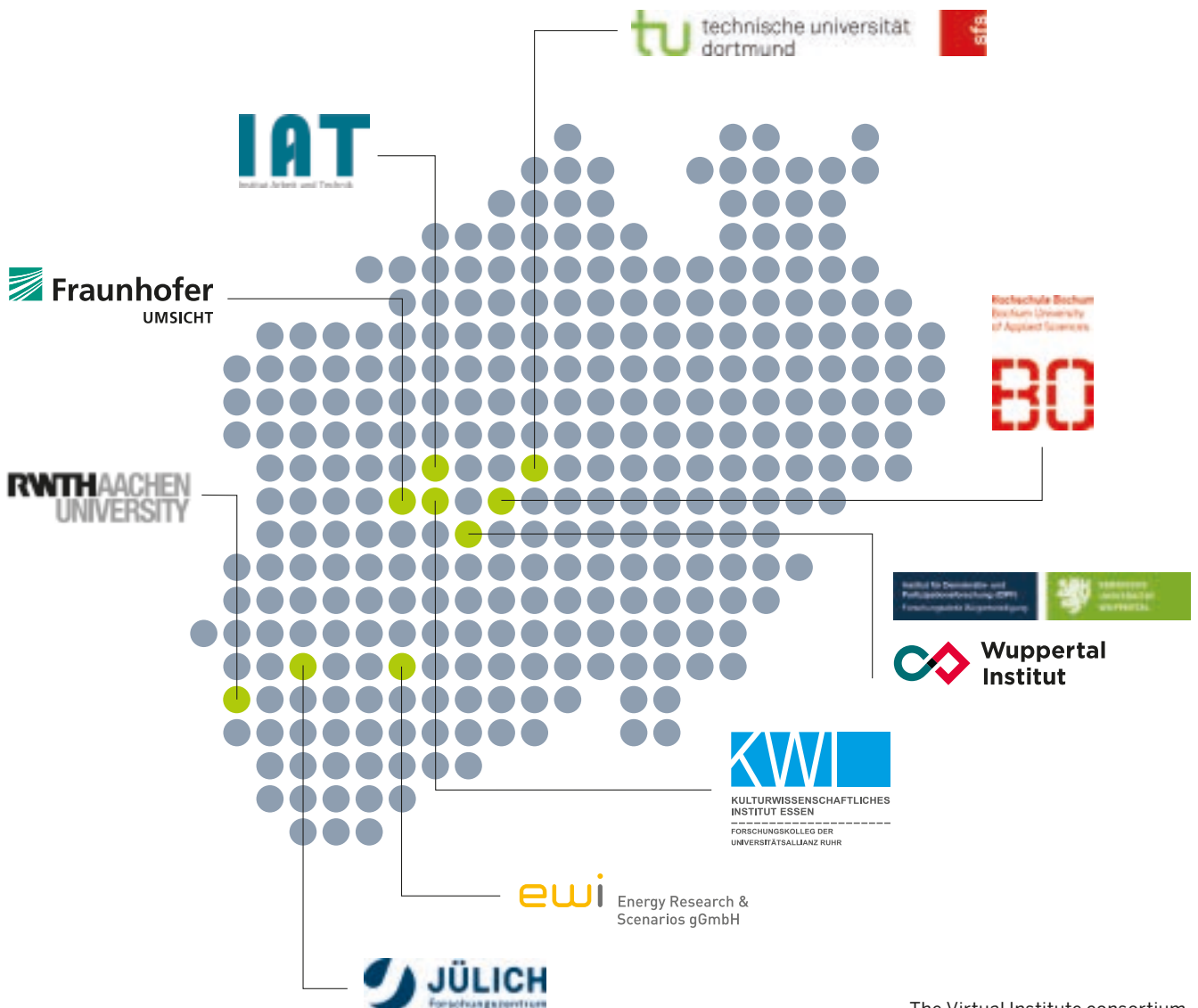


Society's key perspectives and requirements for a common approach to the energy transition

The Virtual Institute's partners

The Virtual Institute's partners include select universities, (university-affiliated) institutes and research institutions from various academic disciplines. The following institutions are current members of the Virtual Institute alongside the Institute for Advanced Study in the Humanities (KWI), Essen, and the Wuppertal Institute (WI):

- The Institute of Energy Economics (EWI) at the University of Cologne,
- The University of Wuppertal Civic Participation Research Centre (Forschungsstelle Bürgerbeteiligung),
- The Fraunhofer Institute for Environmental, Safety, and Energy Technology (UMSICHT),
- The Gelsenkirchen Institute for Work and Technology (IAT),
- Institute of Energy and Climate Research – Systems Analysis and Technology Evaluation (IEK-STE) at Forschungszentrum Jülich,
- The Integrative Institute for Sustainable Development (IINE) at Bochum University of Applied Sciences,
- The School of Business and Economics, especially energy economics, at RWTH Aachen University and
- The Centre of Applied Social Research (Sozialforschungsstelle) at TU Dortmund University.



The transformation of the industrial location of North Rhine-Westphalia

Research results of the "Transforming Industrial Infrastructures" cluster

By Dr. Daniel Vallentin, Wuppertal Institute

An initial two-and-a-half-year joint project carried out within the Virtual Institute's "Transforming industrial infrastructures" cluster was financed by the Stiftung Mercator foundation. The project, which consisted of several stages, focused on the transformation of the energy and industry-dominated state of NRW: it analyses the economic effects of the energy transition in NRW and identifies success factors and design options for industrial transformation processes. The key findings of the project are summarised in the following sections.

Economic effects of the energy transition in NRW

An **input-output analysis** shows that the expansion of renewable energy has a positive value-creation effect for NRW as a whole, explained primarily by contributions to the installation of plants generating renewable energy. However, NRW is not benefiting as much as many other German states from the expansion of renewables. As a result of its role as a traditional industrial state with energy supply structures based largely on fossil fuels, NRW is particularly affected by negative (contractionary) value-creation effects in the context of the expansion of renewable energy, for example the loss of investment in conventional production structures such as coal mining.

The **regional distribution of value-creation effects** for the steel, chemical and mechanical engineering sectors was examined in detail. While the positive effects for the

mechanical engineering and plant construction sectors are widely distributed across the region, for the chemical industry they are predominantly concentrated at the sites of major chemical parks. In the case of the steel industry, the positive effects are observed mainly in the eastern and south-eastern parts of the Ruhr Area and the neighbouring Bergisches Land region. Therefore, specific policy approaches are necessary to ensure that the sectors focus more strongly on ecologically-oriented future markets such as renewable energies. These range from instruments with a strong regional focus aimed at a small number of companies (the steel industry), to instruments for integrated sites and their interlinking (the chemical industry), right up to funding approaches for a heterogeneous industry structure that is widely distributed across the region (mechanical engineering and plant construction).

In the power generation sector, the **flexibilisation of the remaining fossil fuel power plants** is a key challenge. In a real options analysis, for example, the costs of two measures aimed at reducing the minimum load of a lignite-fuelled power station in NRW to 40% were investigated. To some extent, the measures involve high reinvestment costs (up to 30% of the investment costs of a new power plant). For this reason, the current subsidy structure for lignite mining and use has a decisive influence on whether measures for the flexibilisation of lignite power stations are economically viable and if so, which measures are most suitable. Without the subsidies, neither of the two measures considered would be economical.



Success factors for transformation processes

At regional and company levels, for example, industrial transformation processes were investigated that show in which stages specific factors and instruments are crucial for the success of the stage. Here, the focus was on collaboration between companies in different sectors at the regional level. The following stages can be identified.

Initiation/niche: For many transformation processes there is an initial condition, such as a changed policy framework or a clearly identifiable common interest on the part of influential stakeholders. In the initiation/niche stage of innovative collaboration structures, social aspects are of great significance, such as trust between corporate decision-makers and the presence of influential

individuals who promote innovation on their own initiative. This can lead to initial niche activities, which address the specific interests/expertise of the stakeholders involved.

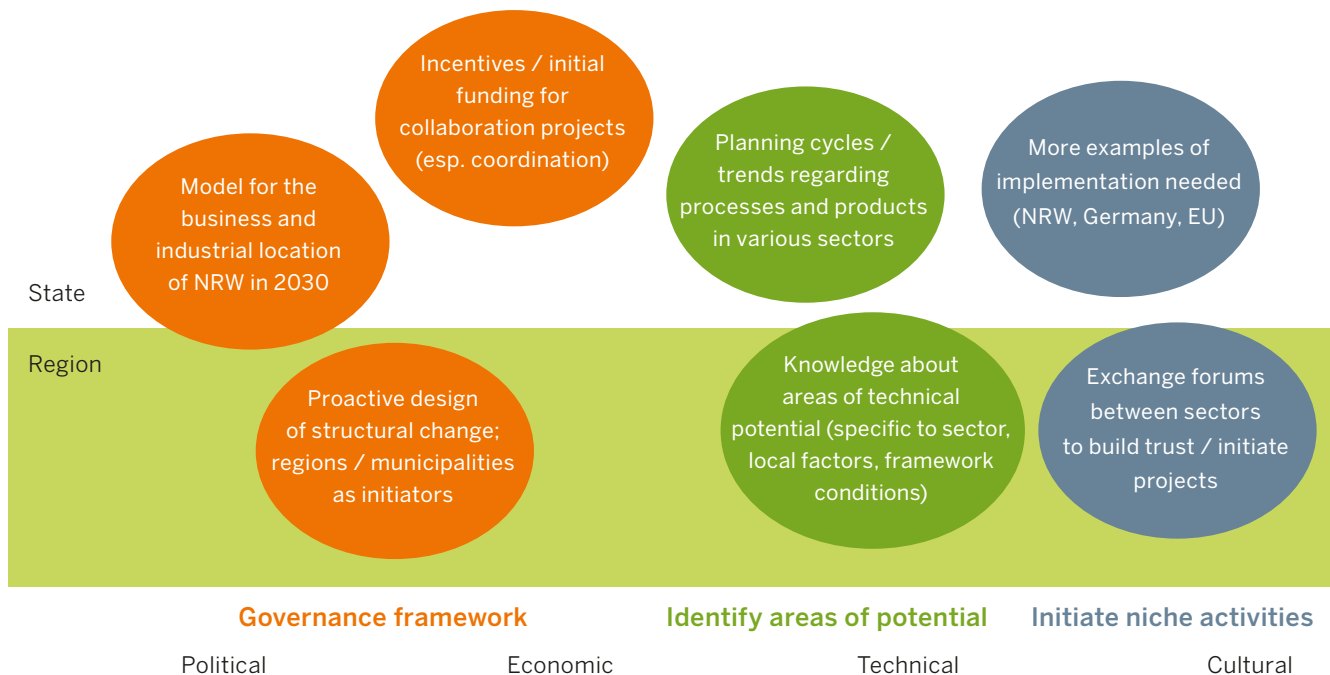
Consolidation/diffusion: In this stage, the collaboration structures that were previously established are increasingly institutionalised through a continuous and steady exchange between the stakeholders involved. As previously, the focus remains on a defined range of themes and stakeholders, with further stakeholders being integrated in a targeted way. A key prerequisite for consolidation/diffusion is that clear added value from the collaboration for the stakeholders involved was quickly identified in the previous stage as a result of the exchange and initial niche activities.

Designing transformation processes

Expansion: During this stage, the innovative and collaborative activities are broadened, both in terms of the stakeholders involved and the thematic focus. Diverse individual activities are integrated to form an overall strategy which is backed by a professional institutional framework intended to consolidate the collaboration and create the conditions that enable the strategy to be further developed in a flexible way in order to cope with future challenges.

Collaboration between companies in different sectors (primarily at the regional level) offers huge but currently under-exploited potential in terms of the transformation of industrial structures. In order to initiate this kind of collaboration, common interests on the part of influential stakeholders first need to be mapped out and key players to promote the collaboration need to be identified. Themes in the pre-competition domain with a long-term strategic focus are a recommended starting point. Furthermore, it is important to establish stable forums of exchange for the stakeholders involved under the guidance of a universally accepted moderator. This is a prerequisite in order to attract public funding and/or obtain funds from the participating companies themselves and thus to promote the institutionalisation and professionalisation of the collaboration.

The final results of the joint project have been summarised in a brochure produced by the project team. This brochure is available to download at no cost from the website of the Virtual Institute (<http://www.vi-transformation.de/>).



Aspects discussed on the topic of cross-sector collaboration

Innovative action in the community

Citizens shape the transformation of the energy system in NRW

By Nora Freier, Institute for Democracy and Participation Research, University of Wuppertal (BUW), Stephanie Lübke and Jürgen Schultze, Sozialforschungsstelle (Institute for Social Research) TU Dortmund University, and Katja Pietzner, Wuppertal Institute

Regular energy discussions, urban gardening, bioenergy villages, carrot mobs, energy crowdfunding ... the list of civic activities already making a contribution to the transformation of the energy system in NRW can be continued with a variety of examples. The energy transition has been accepted by many citizens in NRW and people are clearly interested in helping to implement it in a range of different ways. The contribution they are making to the transformation of the energy system is not insignificant, as demonstrated by many projects and activities in NRW.

The project has illustrated that the success of the energy transition can be further expedited through the joint efforts of citizens and stakeholders from the fields of politics, administration, business and science. This is demonstrated in the following examples of findings from the project.

Social innovations inspire the energy transition

Social and institutional innovations contribute just as much to ensuring a sustainable transformation of the energy system as technical innovations do. The transformation needs to be translated into business logic and transposed into the world in which people live, in order to clarify the issues of how, where and when manufacturers and consumers need to behave differently or adopt new approaches. Energy coaching, for example, can lead to a change in behaviour that will reduce electricity and heat consumption in the same way as technical efforts to improve efficiency.

However, few strategies currently exist to systematically integrate and disseminate new practices and activities into people's everyday lives, which would contribute towards solving the problems and challenges of handling the energy transition. Important steps are thus missing on the way towards configuring a holistic, collaborative and sustainable energy transition.

In the course of the project, under the lead management of the Sozialforschungsstelle (Institute for Social Research) of TU Dortmund University, good examples of social innovation were identified, such as the electricity saving check (www.stromspar-check.de) or the Eifel climate tours (www.klimatour-eifel.de). The examples were all assessed in terms of their effectiveness for the energy transition and as regards their scope and transferability. Particularly effective social innovations are designated as cutting-edge innovations. The aim of this overview is to further develop and disseminate the social innovations that already exist in NRW in order to deploy them to a greater extent to promote the energy transition.

In order to reach a new level of transition, the concept of supplements was further developed as part of the project. It focuses on preventing rebound effects, which many people are barely aware of.

Rebound effects result in the fact that the savings in energy and resources that are theoretically possible are not realised or only partially realised. They occur, for example, when a new, more efficient car is driven more frequently than the previous inefficient one (direct rebound) and the energy saving effect therefore fizzles out. An indirect rebound effect arises when the money saved by an energy conservation measure is spent in another area on a new product or service that consumes energy.

If the cutting-edge innovations result in resources being freed up in everyday activities, for example through savings in the use of energy for heating purposes, the supplements should serve as an incentive for them to be used more sustainably. One might therefore describe supplements as a "reward system" intended to prevent rebound effects. In collaboration with a partner on the practical level, a supplement for the low-income

households group was developed as part of the project; this target group is more inclined than others to see itself as one of the losers of the energy transition in NRW. One possible supplement is that the money freed up by joint savings made in a housing community with low income households (savings initiated by an electricity saving check) could be used to purchase an energy-efficient washing machine for communal use or tickets for bus and train travel. The idea behind this is that of empowerment and self-determination in terms of resource gains, which could result in a concrete benefit for individuals and the community and ideally promote identification with the energy transition.

Social innovations are a potential result of a social process, which has an influence on the implementation and design of the energy transition. There are other methods of organisation or negotiation which could also contribute to the transformation and envisioning of our energy system. These include the diverse forms of participation and participatory behaviour in the energy transition that were also researched as part of the project.



Work in small groups in Münster

More than just a mouthpiece for citizens – High-level negotiation of a socially just energy transition

The fundamental transformation of the energy system can only be successfully implemented if civil society helps to shape, pursue and support it. The project therefore also focused on research into participatory behaviour and transferable models of participation for the implementation of a participatory energy transition.

The Open Access Database is a platform which offers a convenient overview of civil participation processes in energy policy in NRW. The grassroots survey for this includes all the participatory activities that were recorded in the course of a newspaper analysis for NRW from 2011 to 2015 inclusive, carried out by the Forschungsstelle Bürgerbeteiligung (Research Centre for Civil Participation) at the University of Wuppertal. The design of the database allows constant updating of the record of activities as a result of what is called the Citizen-Science Interface. This enables interested citizens and other stakeholders to extend the database themselves by adding their own participatory activities in NRW. The database can be accessed and extended online via the link http://www.vi-transformation.de/db_overview/.

Aspects such as the type of participation, the stakeholders involved, the locations and size of the municipalities, the type of energy (for example, solar energy or biomass) or the level of civic participation can be accessed via the search function of the database.

An evaluation of the basic material demonstrates that most citizen participation initiatives between 2011 and 2015 were on the topics of wind energy (39%) and solar energy (23%). The vast majority of participation was

based in NRW's large cities (65%). Alongside political stakeholders (14.2%), citizen's action groups and associations also took part (18%), as well as individual citizens, who represented the majority (58%). A look at the type of participation shows that it was not only a case of formal forms of participation (54%), including, for example, planning permission procedures, but that the stakeholders also use informal (26%) and financial (20%) opportunities for participation and that these activities are often organised from the bottom up. Moreover, the analysis demonstrates that the processes are predominantly open to those interested and/or involved; a targeted participant selection process only occurred in 18% of the activities. Although 42% of the cases involved participation in a situation of conflict, 60% of the citizen participation initiatives were successful in terms of their initial cause and only 9% of the processes failed in terms of the issue involved.

Alongside the empirical assessment, the design of the project aimed to develop a concrete model of participation. The research project was intended to introduce an expanded and at the same time transferable perspective on the design of socially coherent and integrative participatory and governance processes in the energy transition. Through what is known as the participatory real-world lab, a highly inclusive and at the same time experimental civil participation process for the local level was developed in the course of the project. Its origins are in the participatory instrument of the planning cell of the Forschungsstelle Bürgerbeteiligung (Research Centre for Civil Participation) at the University of Wuppertal.



Participatory real-world lab in Waldbröl – plenary session



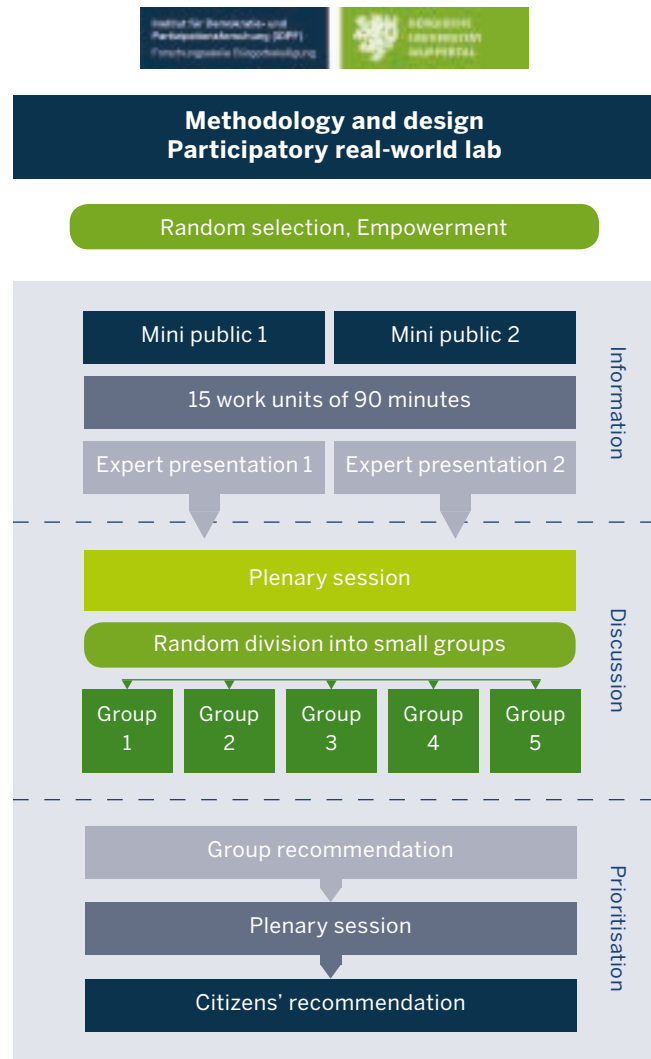
Participatory real-world lab in Waldbröl – expert presentation

The concept of the participatory real-World lab was put into practice in 2016 in the city of Münster and in the town of Waldbröl (in the rural Oberberg district). Under the motto "The energy transition in NRW – shaped by its citizens", a total of 100 citizens participated in the real-world lab process which lasted several days. Among other things, the aim was to develop socially robust knowledge for the process of transforming the energy system in the two municipalities and the surrounding area. Key to its success was the random selection of participants. This approach brought together a colourful mixture of people of various ages and from different social, cultural and ethnic backgrounds, forming a representative mini version of the population of the respective city.

On four consecutive days, the participants worked together to compile qualified statements and recommendations for the goals and course of the energy transition in NRW. The basis for this was a fixed work programme that gave structure to the proceedings from thematic and methodological points of view. The central factor was a comprehensive, thematically focused process of dialogue and negotiation, which involved citizens and stakeholders on an equal basis. Cooperation and deliberative consensus-building were given priority. This formed the basis for the computerised voting process, which the participants used to set priorities for the implementation of the energy transition and formulate their recommendations. The result of the real-world lab is a citizen's report that summarises the proceedings and the results.

The report was handed over to political decision-makers so that the citizens' views can be included as recommendations for action in further political decision processes and contribute to the design of socially sustainable concepts.

As part of the research activities in the collaborative project, they offer an insight into the social narratives of civil society and thus allow for a more diverse range of knowledge about the different perspectives on a socially coherent energy transition in NRW.



The many aspects of the energy transition in NRW

Research results of the "Mentalities and Patterns of Behaviour" cluster

By Moritz Rüller, Bochum University, Martina Schmitt, Wuppertal Institute, Hendrik Schmitz, RWTH Aachen University, Diana Schumann and Karin Schürmann, Forschungszentrum Jülich, Petra Schweizer-Ries, Bochum University of Applied Sciences, and Esther Trost, Institute for Advanced Study in the Humanities, Essen

The point of departure for the "Mentalities and Patterns of Behaviour Concerning the Energy Transition in North Rhine-Westphalia" project was the widespread phenomenon that people's actual everyday behaviour with regard to resource and energy use often deviates from their attitudes concerning environmental and climate protection as well as energy consumption. As a result of this phenomenon, the potential for saving energy by means of technical innovations remains unexploited or may even be reversed.

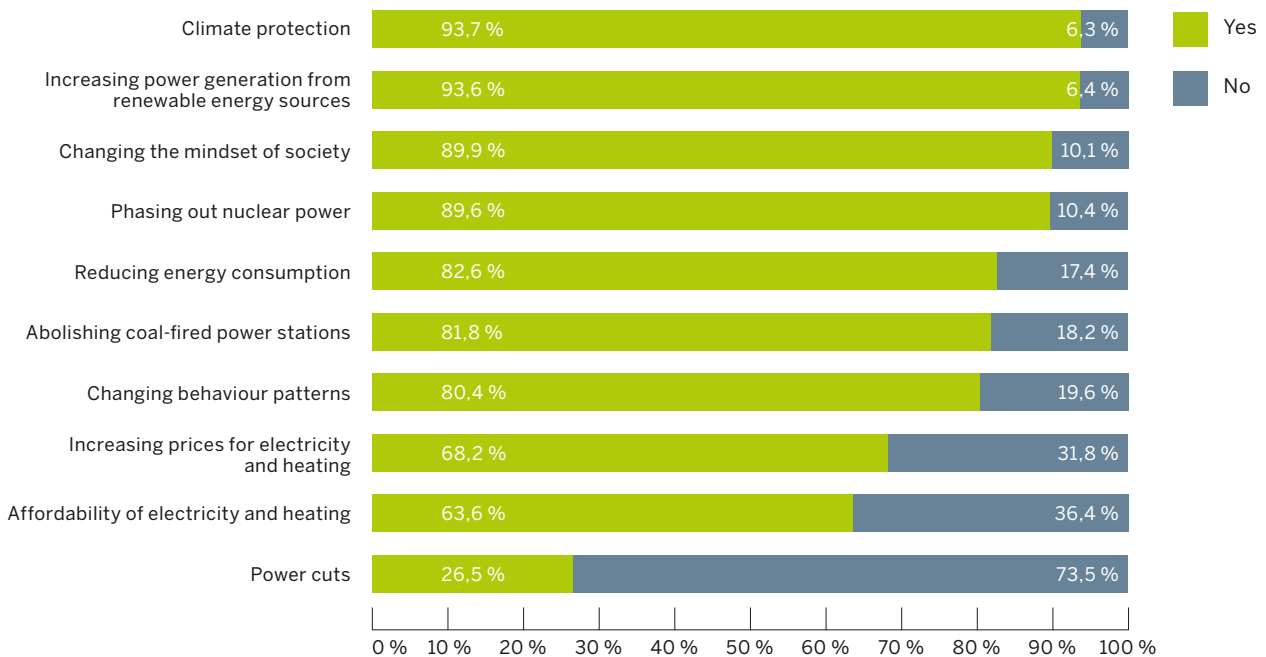
By combining social, economic, culturological and psychological perspectives, the project therefore aims to systematically investigate the mentalities, patterns of behaviour and social practices that are relevant to resource and energy use in NRW. In the process, to some

extent the researchers also worked in a transformative way, meaning that they aspired to actively promote sustainability-oriented thinking and action in the population.

The project included three components: **System Understanding, Envisioning** and **Transformation**. The System Understanding component of the project was devoted to analysing the current situation in terms of mentalities and patterns of behaviour regarding energy as well as the regional and socio-cultural differences that existed in this respect. In the course of the **Envisioning** process, research was carried out into how people in NRW envisage the energy system of the future. During the **Transformation** component, researchers investigated how to achieve the objectives of the **Envisioning** phase and what means were needed to do so.

Understanding of the energy transition

Question: "What do you associate with the energy transition?"



Source: IEK-STE M&P Survey 2016; including only respondents who had already heard about the energy transition (n=951)

System Understanding

A central element of the "System Understanding" component was the implementation of an exploratory study examining the mentalities and patterns of behaviour with regard to resource and energy use in NRW. Within the framework of the project, this study took on the role of a qualitative preliminary study, the results of which served as the basis for designing a representative baseline study. During the preliminary study, one of the aspects that became clear was the fact that the use of energy is frequently only considered justified if it involves a tangible benefit. Therefore, various interviewees avoid using the standby function of electronic appliances, for example, by using power socket strips that can be switched on and off, or by consistently turning off the appliances themselves. Furthermore, it appeared that some interviewees see the subject of saving energy in a larger context and link it with aspects of sustainable consumer behaviour, for example.

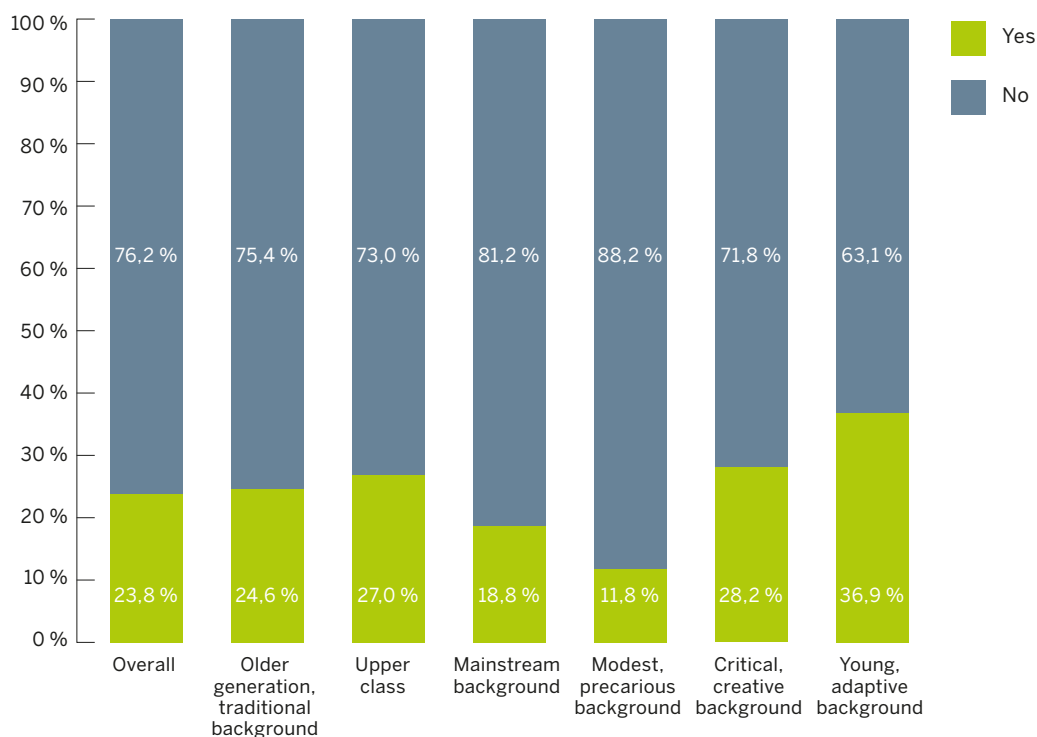
The evaluation of the energy transition given by the interviewees produced a contradictory picture: while some of them unreservedly support the energy transition or would even like to see it implemented more consistently,

others categorically oppose the energy transition or key aspects of it such as the phasing out of nuclear energy. It was also apparent that various interviewees perceive the energy transition as an unjust project that divides society into winners and losers.

On the basis of the exploratory preliminary study, the representative baseline study researched the question as to what attitudes and patterns of behaviour with regard to energy are prevalent amongst the people in NRW. It became clear that the subject of energy consumption does not play a significant role in peoples' everyday lives, but – as the preliminary study suggested – patterns of behaviour regarding saving electricity are widespread, such as using power socket strips to switch appliances off completely or switching off lights when leaving a room. Furthermore, the results of the baseline study showed that awareness of the energy transition amongst people in North Rhine-Westphalia is high and ranks above average compared to the national level of awareness. In this context, the majority of those interviewed understand the energy transition to mean not only climate protection, increasing electricity production from

Fairness of the energy transition according to social background

Question: "Do you think that the costs and benefits of the energy transition are distributed fairly?"



Source: IEK-STE M&P Survey 2016; including only respondents who had already heard about the energy transition (n=951)

renewable energy sources and phasing out nuclear power, but also changing the mind set of society and changing behaviour patterns. With regard to the evaluation of the energy transition, another finding of the preliminary study was confirmed: most people think that the costs and benefits of the energy transition are unfairly distributed, with people from modest or precarious backgrounds most frequently considering the energy transition to be unjust.

Based on the premise that a successful energy transition also requires the integration of sustainable development in transport, particular attention was paid to the research into the mobility patterns of people living in NRW. It once again confirmed that the car is the form of transport most often used in NRW in terms of getting to work, running errands and recreational travel. The car is most frequently used by members of the upper classes and people from mainstream and precarious backgrounds, if they do not live in inner city areas. Public transport is used mainly by young people and people from modest, precarious backgrounds to get to work or school. The results of the research make it clear that the energy transition can be boosted by tailoring public transport services to the needs of the various user groups. This holds true insofar as user satisfaction could potentially be increased and new users attracted to use public transport (for example dissatisfied car drivers). Affordable housing in inner city areas – particularly for people from mainstream and precarious backgrounds – could contribute towards reducing the use of cars or, in the case of younger people, have the effect of averting the (future) purchase of a car. By improving the infrastructure for bicycle traffic, particularly with regard to travelling to work (for example designated cycle paths) and cycling as a sport or leisure activity, incentives can be created to encourage people to switch to cycling. For running errands, making electric cargo bikes available for rent could provide an alternative to using the car.

Envisioning

Investigation of the rebound effect and research into awareness of the energy transition at the local level in NRW were assigned both to the **System Understanding** and to the **Envisioning** component. By investigating the rebound effect, it was possible to establish that, in the area of heating, there is a significant difference between tenants (47% rebound) and owners (18.3% rebound). This means that in the case of tenants only about half of the increases in efficiency result in savings, the rest is absorbed by increased consumption. In the case of home owners just over 80% of the technically feasible savings are realised. The number or gender of people in the household has virtually no influence. Rebound effects are greater in low income households than at higher income levels. One possible explanation is that households on a low income are financially limited in terms of their energy consumption. In addition, these households have to pay more attention to their energy costs as they represent a significant proportion of their consumer spending. This results in greater sensitivity towards changes in price and efficiency.

With regard to awareness of the energy transition at the local level, on the one hand it appeared that there were a large variety of stakeholders, themes and patterns of interpretation in relation to the energy transition in NRW and on the other hand locally specific differences. Coverage of the energy transition in the local press has been predominantly negative since 2013; the subjects of prices and costs are most prevalent. In 2011/2012, the phasing out of nuclear energy, which was evaluated positively, still represented an important subject, however. If one considers the landscape of the protagonists involved in the energy transition discourse (policy, administration, the business community and civil society), clear differences become apparent between the case studies in Duisburg and the Higher Sauerland District; the same applies to their external communication.

Local specifics seem to be reflected in different evaluations and interpretations of the energy transition. There are also differences between various stakeholder groups, however, that cross the boundaries of the case studies (for example environmental and conservation organisations vs. opponents of wind turbines, various parties). With regard to the thematic focus, the differences run through all phases of the analysis: in Duisburg, the thematic focus is on the potential threat posed by the energy transition to industry and energy companies. In the Higher Sauerland District, the focus is on the conflict about the expansion of wind power in the local area. This leads to the conclusion that the "one single energy transition" in NRW does not exist.

Transformation

Conducting public workshops was a central element both of the **Envisioning** component of the project and of the **Transformation** component: as was indicated in the representative survey, people support the expansion of energy from renewable sources in principle. Considerations of fairness and questions about democratisation and "the good life" are also linked to the subject of the energy transition. For example, decentralised expansion, namely numerous small-scale forms of producing, distributing and consuming energy, is something people wish to achieve.

This involves aspects such as strengthening local added value as much as increasing the scope for action at the community level. Ideas also include increased cooperative organisation of public utility companies and power generation facilities. In the thematically wide-ranging participation formats based on the concept of the future workshop, apart from concrete energy issues, there was also a desire for a greener and healthier living environ-

ment and for land sealing to be discontinued. In addition, in the area of business, a stronger orientation towards the Economy for the Common Good was advocated. It has become clear from the public workshops that mobility represents a field of action that is part of the energy transition and this area in particular is widely discussed in terms of its practical implications. There is consensus on the need for the quantitative, but more especially the qualitative expansion of both the cycle path network and local and regional public transport services, including better interconnections between environmentally friendly transport options. Reducing the dependence on cars is a concern for many people, although there are many different opinions or conflicting views on the subject of imposing concrete sanctions on car use, for example by creating car-free zones in inner cities or neighbourhoods. Experience from the public workshops has shown that participation is an important issue and, at the same time, that recruiting the most widely heterogeneous group of participants possible from different backgrounds represents a challenge, requiring particular effort to be made.

Furthermore, the **Transformation** component of the project was dedicated to carrying out a systematic investigation of the diffusion of innovative energy technologies using the example of biomass. The estimated maximum number of biomass plants in NRW in the long term is approximately 1,450. The number of new plants being built has been falling since 2011 and will probably continue to decline. The support for biomass through the German Renewable Energy Sources Act (EEG) has had a great influence on the number of plants and the installed capacity, but no significant impact on the structure of the plants. Likewise, a reliable planning horizon is relevant since it represents a predictable form and level of funding in the medium term.

Stories about the energy transition

Research results of the accompanying scientific project

By Stefan Schweiger, Institute for Advanced Study in the Humanities, Essen

How are narratives used in the energy transition?

Providing information on subjects that concern moral decisions is not usually based on strict logical rules or rational arguments. In fact, people conduct a sometimes more, sometimes less conscious negotiation process aimed at defining reality and truth using narrative means. These stories, which are also called narratives or narrations, follow certain recurring patterns that can be categorised in retrospect. There is the example of the narrative of social advancement or the victim narrative with their respective identified or identifiable roles. This requires heroes, rivals and supporters and a moral that can be identified. The stories may lead to a happy ending but may also have a tragic ending.

These narrations serve to charge social debates with meaning and significance, thereby helping to determine what is good and evil.

Socio-scientific narrative research offers the opportunity of influencing discourse by feeding in stories that focus on sustainability, but also provides the chance to analyse discourse using scientific methodology. Embedding discourse on the energy transition into a narrative pattern can awaken an emotional response and a willingness to act. As part of the Virtual Institute "Transformation – Energy Transition NRW", therefore, the most prevalent stories on the energy transition were analysed, and this was combined with the question as to which stories might be conducive to a transformation leading to a successful energy transition. To this end, narratives from the fields of politics, civil society and the economy were mapped out in detail.



Positive quotations

An analysis of more than 300 articles in the weekly magazine "Der Spiegel" revealed that the energy transition as such is no longer called into question. The energy transition is primarily depicted metaphorically as a vehicle towards a destination that is not challenged, but where there are still a number of questions regarding speed, the passengers on board, the route taken and the roadworthiness of the means of transport.

Harmonisation of economy and ecology

The fundamental economic difference between profit and loss is vitally important in terms of harmonising the interests that underpin the energy transition and the objectives of energy-intensive companies. The analysis of nearly 200 articles from daily newspapers revealed that, unless they recounted tales involving savings or profit incentives, the stories within the economy relied on well-known narrative structures: in the field of discourse pertaining to the energy transition, the economic narratives fluctuated between economic power used in a heroic way and tales of the victims of political impotence. The companies are regarded as victims if they face the danger of financial loss and, on the other hand, stylised as heroes if it is a case of jobs being created, for example, or if national or regional strength can be demonstrated through key indicators. Ecological approaches either jeopardise the role of the hero or aggravate the position of the victim. Models such as Power-to-Gas offer a way out of this, allowing the narrative to be restructured, since they simultaneously make both economic profit and reductions in CO2 emissions possible.

Renunciation of "Eleventh Hour" stories

"Eleventh Hour" stories, which aim at persuading people to act by threatening them with a potentially endangered future, not only seem anachronistic, they can also have the opposite effect of that intended, even to the extent of encouraging fatalism. Narratives that show explicitly what action can be taken are more effective. In order to achieve a transformative impact, it is helpful to work towards a target with positive connotations instead of adopting a highly defensive attitude towards the impending danger. The question of how one wants to live in the future unleashes considerably more motivation and creativity, for example, than the normatively charged demand to organise one's life in a sustainable way in order to save the planet.

How do we want to live?

To discover the answer to this, we posed the question "How do we want to live in 2030?" for the city of Essen in the course of a joint research project within the Virtual Institute and visualised the stories about the future compiled there in a participatory manner. Visual stories serve as eye catchers. They even provide access to groups of people whose interest cannot be aroused by means of the written word and offer viewers the opportunity of making a wide range of associations.

Tragedy and conspiracy theories

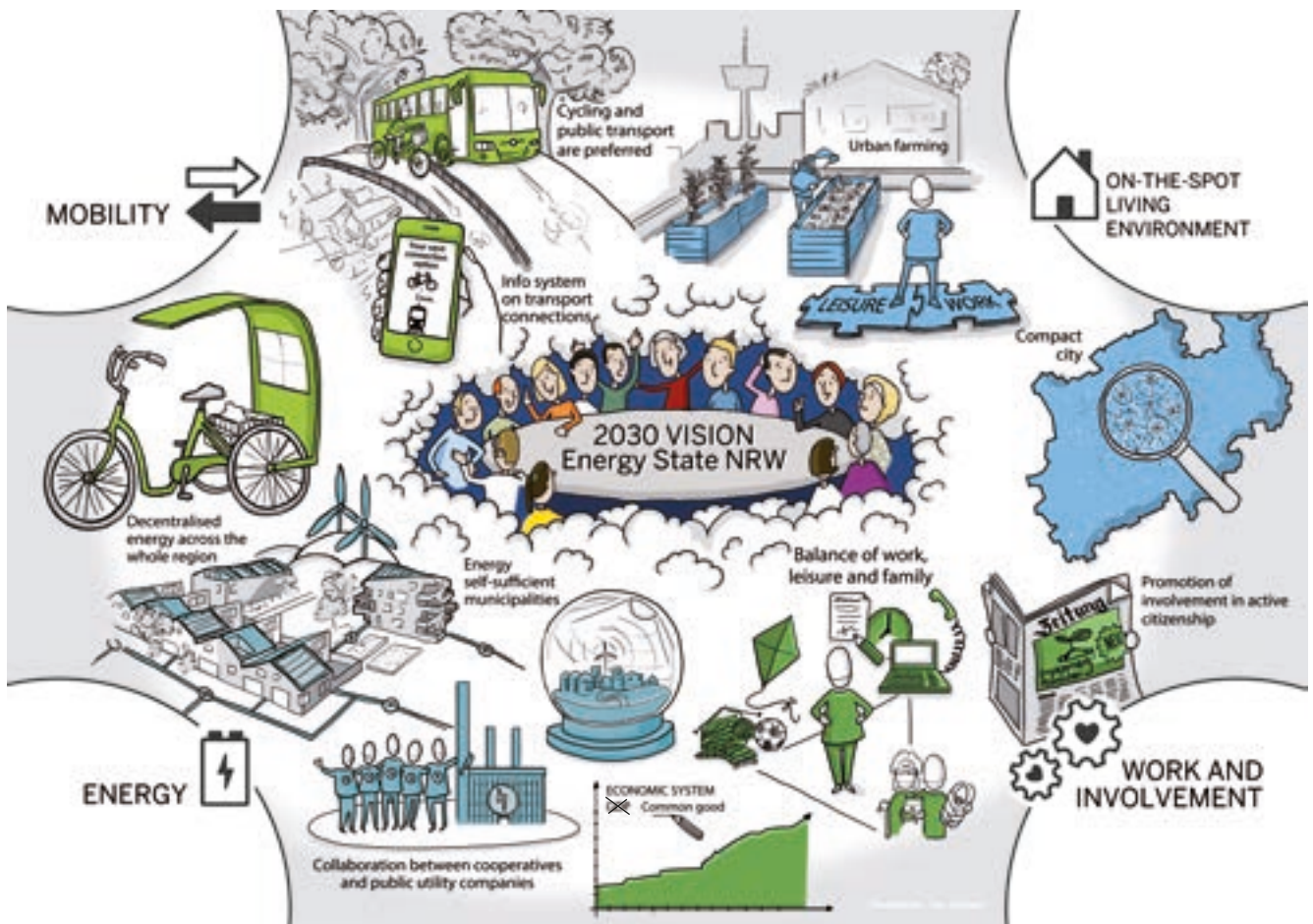
There are stories that are designed to convince readers that man-made climate change does not exist. The analysis of texts written by these climate change deniers reveals a two-stage narration strategy, which is used to discredit the major political project that is the energy transition. These stories often begin, for example, millions of years ago or even at the time of Creation. Climate change thus becomes a mere background story and anthropogenic causes are not mentioned. This creates a void in the context of the justification for a sustainable transformation of the energy system, which can be, and is, filled at will. Conspiracy theories are very frequently cited as the motivating factor for implementing the energy transition; these lend the energy transition a new rationale and a political strategy of an elite group is usually implied.

New energy landscapes

Until now, attempts have been made to minimise the changes to the landscape caused by the construction of technical facilities, for example wind turbines. The installations are intended to be camouflaged like chameleons through their ascending colour scheme of green merging into grey. In future, the general public may be given the option of proposing designs that would give the energy landscape a regional character. This would mean that **the** energy landscape would become our energy landscape – a real joint venture. It is conceivable that designs could include advertising for local companies, modifications inspired by local traditions and legends, right up to new artistic approaches, so that the energy landscape becomes a landscape that people are able to identify with. On the one hand, this will resonate with the viewing

habits of the modern age and, on the other hand, will provide new stimuli to achieve a different perception. The crucial thing is that further narrative is stimulated by these structures. Establishing the connection between wind turbine and electricity generation is a cognitive task. If this does not take place, one only sees the wind turbine spoiling the environment and nature. If the new energy landscapes are used for advertising purposes, for art or to present other visual information, they will be charged with meaning and significance and may thus even serve to provide regional identity. They would give a new response to the question: "Why is this thing here?" Other structures that have long since been subsumed under the general term of industrial culture, such as slag heaps, gasometers and mining headframes, have also undergone this development. Viewing the landscape purely in terms of economical or ecological factors ignores people's aesthetic needs. There is still a lot of development potential in this area for design proposals, participatory processes and the expansion of basic legal conditions.

The energy transition is a progressive project of rational insight. It was initiated to eliminate negative consequences for people and their living environment or at least to minimise these impacts. For a long time it was assumed that one only needed to constantly repeat the arguments in favour of changes in mobility, power generation, lifestyle and other areas of the economy, private life and society as a whole in order to achieve acceptance. However, life does not just consist of cold logic, but also of emotions, aesthetic feelings and, most of all, pleasure. Reasoning without these elements is basically irrational, because it cannot satisfy people and their needs. The energy transition can also give pleasure, bring people together and be enjoyable; it is just as important to convey it in this way as presenting abstract figures, using moralistic undertones and dreary legislative proposals.



Identifying new trends – Recognising interfaces to the energy transition – Providing solutions

By Stefan Schweiger, Institute for Advanced Study in the Humanities, Essen, Dr. Daniel Vallentin and Katja Pietzner, Wuppertal Institute

There are trends that you can follow if you want to; they elapse and wait silently for a revival. Alongside these short-lived fads, social megatrends exist. These cannot be avoided; they influence the lives of the majority of people on this planet and have the potential to change the world in a sustainable way. Globalisation, increasing urbanisation, demographic change, increasing cultural and social disparities, the demands of a constantly changing world of work – due to ongoing digitisation amongst other things – these all shape societies, going beyond physical borders, economic sectors and generations.

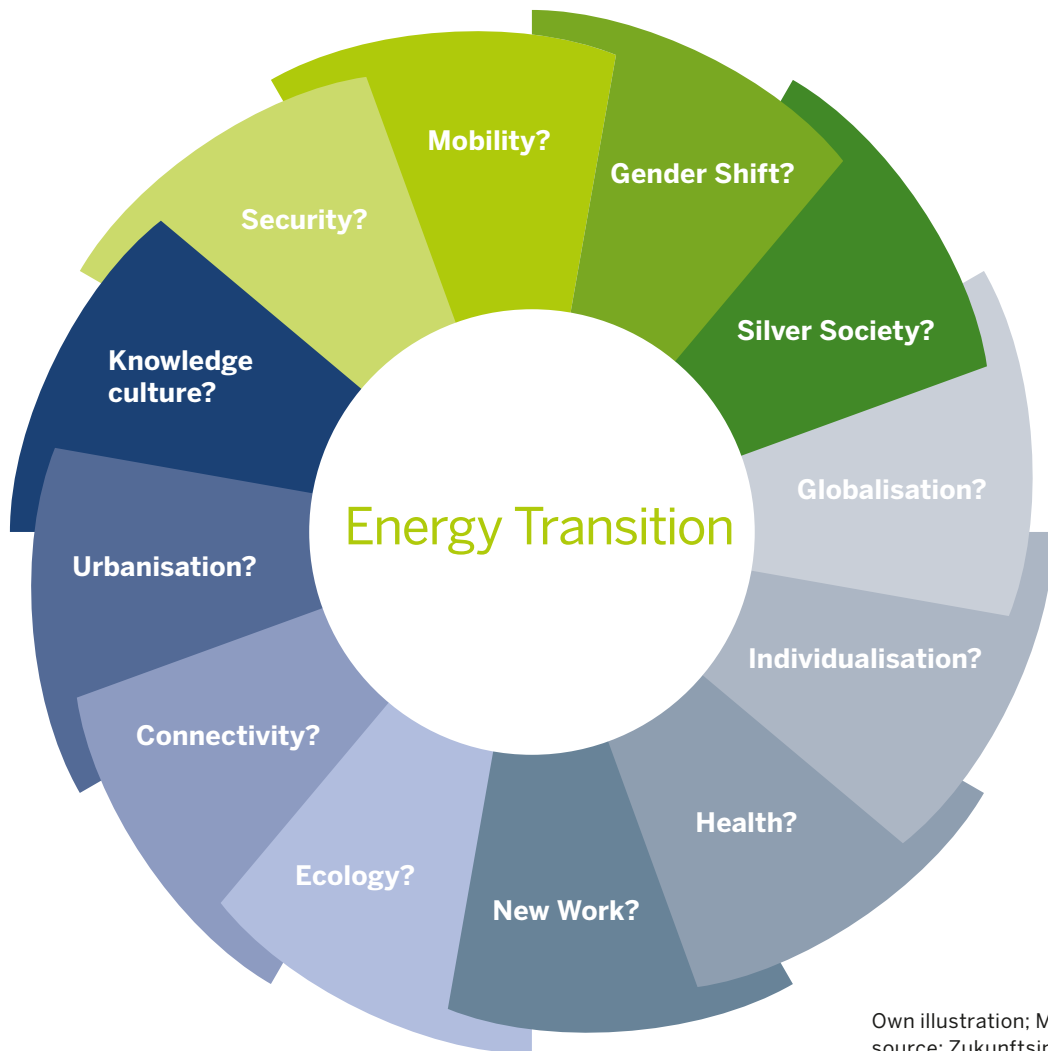
These kinds of interdisciplinary themes not only pervade almost all policy areas, but are also of great importance for the individual, ostensibly purely private sphere of life. In addition, they have lasting effects on the way goods can be produced and distributed. The large-scale energy transition project is also one of these interdisciplinary themes. However, the energy transition is not a trend, but a politically determined goal, which requires the active multi-sectorial collaboration of individuals, politicians and the economy in order to be successful.

The task now is to investigate what characterises a megatrend, which megatrends are relevant, especially in the regions of North Rhine-Westphalia, and which positive or negative impacts they have already had on the energy transition project and may potentially have in the future. A systematic and comprehensive discussion on the actual interfaces between these themes, with reference to the implementation of the energy transition, has not yet taken place. With its trans- and interdisciplinary-oriented expertise, the Virtual Institute can connect to the current research work on megatrends in NRW under ideal conditions and merge these into a new field of research focusing on the subject of the energy transition.

The need for research is made apparent quickly and simply by the contradictions megatrends reveal in the context of the objectives of the energy transition: digitisation, for example, can at the same time be the decisive factor for optimising energy infrastructures and accelerating the energy transition (buzzword: smart energy); on the other hand, however, this also requires huge amounts of resources and energy. At the same time, the energy transition itself influences global megatrends (for example e-mobility).

A mutual interdependence is thus apparently developing, which has not yet been scientifically analysed, or at least not to a sufficient extent. The manifold interdependencies that are observed between megatrends and the energy transition produce a range of new issues and research tasks, which the Virtual Institute is investigating within a new framework project. This applies to the following issues, among others:

1. Which megatrends are actually of particular importance for implementing the energy transition?
2. Which interdependencies are there between the megatrends, that is, between the exogenous drivers (landscape) of the energy transition and the endogenous development dynamics of the energy system?
3. How can we utilise the knowledge of the key megatrends of the energy transition and their interdependencies in order to help the energy transition succeed?
4. Which particular role does the state of NRW play in the search for holistic solutions? Which specific conditions prevail in NRW?
5. What different local and regional contexts are there in NRW and what impacts do the above-mentioned megatrends have on the energy transition in the regions of NRW?



6. What are therefore the regionally adapted approaches to take on and utilise the challenges and opportunities of the megatrends for implementing the energy transition in the regions of NRW?

Following these key questions, the Virtual Institute network will systematically analyse the interdependencies between global megatrends and the energy transition in NRW. The Virtual Institute does not limit itself to the classical scientific practice under which academic papers and their implications often remain restricted to the Scientific Community, for example. It will continue to take a transformative approach to its research and look for and find ways of presenting the energy transition in accordance with the changing forms of communication. To this end, it will reach out to universities and other educational

institutions, provide information for stakeholders and other interested parties and identify and offer options to people from different backgrounds on how they can get involved in the energy transition in a dynamic and changing world. In the first phase of the project, we concentrated on how to convey the message of the energy transition and on how people have participated in implementing it until now, or the form they would like this involvement and mediation to take in the future. In a second phase of the project, this basic knowledge will be linked with research into megatrends and their potential interaction with the implementation of the energy transition. Overall, the work of the Virtual Institute contributes towards making the energy transition a democratically legitimate, economically viable and ecologically effective transformation project.

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www.exzellenz.nrw.de

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