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Stakeholder Dialogues and Virtual Reality for the German Energiewende

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ABSTRACT

The German energy system is in a complete overhaul. In the future energy will mainly derive from renewable sources. While in general this is largely socially accepted, new long-range power-lines, needed to distribute that energy, disquiet local communities and lead to political friction. Using stakeholder dialogues, responsible authorities and transmission operators try to direct escalating debates back onto a constructive track. This Article describes the inclusion of public participation in the recently adopted grid expansion acceleration act (NABEG) and a best practice stakeholder dialogue for a high voltage d.c. link. It contextualizes those efforts into the broader debate over citizen participation surrounding large infrastructure projects in Germany. Finally, it gives an outlook on how virtual reality technologies can further facilitate such dialogues through preparing complex issues—like the planning of new energy grids—in a comprehensible manner.

I. INTRODUCTION

Germany seeks a substantial transformation of its energy system, called the *Energiewende*. By 2025 renewables should generate up to 45 percent of the country's energy production and up to 60 percent in 2035. Part of the plan is to phase out all nuclear power plants by 2022.[1] The underlying rationale for this system overhaul is at least threefold:[2]

- To cut down greenhouse gas emissions by 40 percent in 2020 and by 80-95 percent in 2050 (compared to 1990);
- To avoid risks from nuclear energy production; and
- To be more independent from energy and raw material imports

The roots of the current energy policy go back to the seventies and eighties of the last century, which witnessed the first mass protests against nuclear energy and

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1. DIE BUNDESREGIERUNG, ENERGIEWENDE, https://www.bundesregierung.de/Webs/Breg/DE/Themen/Energiewende/Fragen-Antworten/8_Kernkraft/_node.html;jsessionid=2E549C6CAA0931E241D86DA6349FC285.s6t2 (last visited Nov. 13, 2017).

2. *See, e.g.*, Lukas Hermwille, *The Role of Narratives in Socio-Technical Transitions - Fukushima and the Energy Regimes of Japan, Germany, and the United Kingdom*, 11 ENERGY RES. SOC. SCI. 237 (2016); *see also* Fabian Joas et al., *Which goals are driving the Energiewende? Making sense of the German Energy Transformation*, 95 ENERGY POL'Y 42 (2016).

the increased momentum of the debate over the effects of greenhouse gases.[3] The latest boost for the transformation of energy sources was the Fukushima nuclear disaster in 2011.[4] Since then, the general outline of the Energiewende is a consensus between all parties in the German parliament (Deutscher Bundestag) and widely accepted among the general public.[5]

The Energiewende is a complex and not always self-consistent task. In the past, the German energy system was characterized by high energy consumption in the highly industrialized states in the west and south, and a few big nuclear and coal power plants close to those areas. The main goal of the Energiewende is to build wind turbines in the northern and eastern part of Germany where it is most efficient (onshore and offshore) and, with a smaller share, photovoltaic systems in southern Germany.[6] A result of this is a geographic imbalance of energy production and consumption. To prevent energy shortages in southern Germany, grid overloads and a reduction in bottlenecks, there is a need for an extension of the energy grid, called *Netzausbau.*[7] In 2015 the German parliament passed the current *Bundesbedarfsplangesetz*, which mandates 2500 Km of new construction for energy grids and 3100 Km of upgrades to the existing power grids. In the exclusive jurisdiction of the federal states, another 1800 Km need to be built.[8] The grid extension includes three large high-voltage d.c. links from north to south (Ultranet, SuedLink, SuedostLink) and several smaller a.c. and d.c. grids.[9]

II. ENERGIEWENDE IN PUBLIC OPINION

In a representative survey from 2017, 95 percent of Germans thought the Energiewende is an important or very important political project. However, there is fairly strong protest on a local level against construction projects like energy grids and wind mills. This is also reflected in the quoted survey, where only 57 percent stated they would approve the construction of wind turbines in their neighborhood[10] – a phenomena also known as NIMBY ("Not in my backyard").[11] Similar numbers apply for energy grids. In the last years, many citizens' initiatives were founded across the country to organize opposition. For example, the Federation of Citizens'

3. Mario Neukirch, Protests Against German Electricity Grid Extension as a New Social Movement? A Journey
Into the Areas of Conflict, 6 ENERGY. SUSTAINABILITY & SOC'Y 4 (2016).

4. *See* Hermwille, *supra* note 2.

5. Agentur für Erneuerbare Energien, REPRÄSENTATIVE UMFRAGE: 95 PROZENT DER DEUTSCHEN WOLLEN MEHR ERNEUERBARE ENERGIEN (Aug. 8, 2017), https://www.unendlich-viel-energie.de/themen/akzeptanz-erneuerbarer/akzeptanz-umfrage/akzeptanzumfrage2017 .

6. T. Pesch, H.-J. Allelein & J.-F. Hake, *Impacts of the Transformation of the German Energy System on the Transmission Grid*, 223 EUR. PHYSICS J. SPECIAL TOPIC 2561 (2014); Bundesnetzagentur, Bestätigung Netzentwicklungsplan Strom 2012 (Nov. 25, 2012), https://data.netzausbau.de/2022/NEP/NEP2022_Bestaetigung.pdf.

7. *Id.* at 2569.

8. Bundesbedarfsplangesetz, July 23, 2013 (BGBI. I S. 2543; 2014 I S. 148, 271), *amended by* BGBL I S. 1066, art. 11, July 21, 2014, *amended by* BGBL I S. 2443, art. 7, December 30, 2015.

9. *Id.*

10. *See* Agentur für Erneuerbare Energien, *supra* note 5; Valentin Bertsch et al., *Public Acceptance and Preferences Related to Renewable Energy and Grid Expansion Policy: Empirical insights for Germany*, 114 ENERGY 465 (2016).

11. *See* Marcus Menzl, *Nimby-Proteste – Ausdruck neu erwachten Partizipationsinteresses oder eines zerfallenden Gemeinwesens?*, *in* STADT UND SOZIALE BEWEGUNGEN 65 (2014).

Initiatives against SuedLink lists nearly 50 associated action groups on its website.[12] Local protests frequently gain media attention and disrupt policy processes. Disputes surrounding projects drive a wedge between local/regional politicians and the federal level, and often slow down approval processes. Among the most popular arguments against the Netzausbau are:[13]

- New power grids may jeopardize the decentralized extension of renewable energy;
- The grids may not only transport renewables but also energy from coal power plants in the states of Nordrhein-Westfalia, Saxonia, and Saxonia-Anhalt; and
- The energy grids endanger precious landscapes and the health of residents

The lack of acceptance with resulting political discrepancies is one of the main reasons why the construction of the main energy grids currently is delayed by at least three years.[14]

III. CITIZEN PARTICIPATION AND THE GRID EXPANSION ACCELERATION ACT

To counter protests and gain wider acceptance for the Netzausbau policy, significant public participation is needed. Although it has a longer tradition in the context of urban development, public participation has played a minor role in the case of large energy projects and has been restricted to specific public interest parties such as environmental associations. In 2011, the Bundestag passed the Grid Expansion Acceleration Act (*Netzausbaubeschleu nigungsgesetz – NABEG* for short) which sought first to centralize the approval process for large grids (those crossing state borders), making it more efficient as well as transparent, and second, to extend the scope of public participation.[15] The latter was influenced by experience with the large-scale infrastructure and urban development project, Stuttgart 21. In 2010, tens of thousands of people demonstrated for weeks against it.[16] After violent clashes between police and demonstrators, supporters and critics of the project agreed to a kind of public arbitration, which helped to ease the polarization of the conflict. It was followed by a national discussion of how larger infrastructure projects can be aligned with public participation, and how consultation procedures can garner agreements and increase acceptance.

The NABEG specifies five steps for the approval of new energy grids (which have to be repeated in defined periods).[17] In most of them the competent authority, the *Bundesnetzagentur* in Bonn, has to include the wider public:

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12. Bundesverband der Buergerinitiativen gegen SuedLink, JA ZUR ENERGIEWENDE, NEIN ZUR STROMAUTOBAHN SUEDLINK, http://bundesverband-gegen-suedlink.de/ (last visited Sep 6, 2017).

13. *See*, Olaf Kühne & Florian Weber, *Conflicts and Negotiation Processes in the Course of Power Grid Extension in Germany*, 6397 LANDSCAPE RES. 1–13 (2017); *see also* Neukirch, *supra* note 3.

14. MATTHIAS KURTH, WAS VERZÖGERT DEN BAU VON STROMLEITUNGEN? (2011).

15. Netzausbaubeschleunigungsgesetz, August 5, 2011 (BGBL I S. 1690); *See also* BUNDESNETZAGENTUR, LINE PROJECTS, https://www.netzausbau.de/leitungsvorhaben/de.html (last visited Sep 6, 2017).

16. *See* STUTTGART 21 - EIN GROßPROJEKT ZWISCHEN PROTEST UND AKZEPTANZ, (Frank Brettschneider & Wolfgang Schuster eds., 2013).

17. *See* Netzausbaubeschleunigungsgesetz, *supra* note 15.

1. The scenario framework: It is developed by the four transmission system operators and describes a variety of likely development paths in installed capacity of energy plants and energy consumption in ten and twenty years. The scenario framework has to be approved by the Bundesnetzagentur.

2. NEP: Based on the scenario framework, the transmission operators calculate the demand for the extension of the energy grids and connected operation equipment (e.g. inverter) in the next ten and fifteen years. The result is specified in the Electricity Network Development Plan (*Netzentwicklungsplan – NEP* for short), which also has to be approved by the Bundesnetzagentur. Linked to it is the environmental report (*Umweltbericht*). It contains the results of the strategic environmental assessments each listed project has to undergo. The consultation process for the NEP is threefold: First the transmission operators have to publish the draft online and give the public the opportunity to submit comments. This participation step is in the direct control of the operators, which is a novelty in German planning law. Second, the Bundesnetzagentur directs the public to its assessment of the NEP online and offline. It presents the drafts in several discussion meetings across the country and integrates the results of the consultation into the assessment. Third, the Bundesnetzagentur reviews the public strategic environmental assessments. The final judgement of the NEP is only contestable by the transmission operators.

3. The NEP and the Umweltbericht lay the groundwork for the Federal Requirement Plan Act (*Bundesbedarfsplangesetz*) passed by the Bundestag. It contains a detailed list with necessary grid extensions, upgrades, and their grid connection points. The authority's findings are non-binding for the Bundestag.

4. The transmission operators work out potential route corridors (500 – 1000 m) and alternatives. For the large state cross-border corridors, the Bundesnetzagentur approves them within the federal grid plan (*Bundesfachplanung*). This centralized procedure should ease and accelerate the planning approval process, which in the past was often characterized by frictions between the different responsible state authorities. Now state authorities are only responsible for inner-state grids. Before opening the Bundesfachplanung, the transmission operators are encouraged to combine their planning with a wider regional consultation process. After sending the application documents to the Bundesnetzagentur, the latter conducts an application conference to discuss the scope and methodology of the impact assessment with bodies of public affairs. It may also be attended by the general public without right to speak. After the transmission operator finishes the final planning documents and impact assessment, the Bundesnetzagentur consults bodies of public affairs as well as the general public (everyman's right; a concern has not to be shown).

5. Finally, the operators work out specific grid routings within the approved corridors. They are approved by a planning approval procedure, again with public consultation.

Up until September 2017, the Bundesfachplanung for several large energy grids has started. Some aspects are worthy of notice:

- The more concrete the planning, the more objections and political opposition are raised during the planning process. Objections in advance and during the Bundesfachplanung are higher than while proceeding with the NEP.[18]
- Fierce political opposition at the state level freezes the planning and approval process. For example, the state of Bavaria opposed the energy grids SuedLink and SuedOstLink until an agreement was reached that both grids will be conducted as underground cables (which are several times more expensive).[19] The alternative to the basic political agreement is a prerequisite that the transmission operators and the Bundesnetzagentur enter constructive dialogue with the public.[20]
- The explanation of the demands and parameters of the Energiewende is very difficult because it is an equation with many variables.
- A key success factor for public acceptance is a comprehensive and transparent consultation process directed by the transmission operators while planning the route corridors.[21] A positive example of this is outlined below.

IV. A BEST PRACTICE? CONSULTATION PROCEDURE SUEDOSTLINK

After the last nuclear power plants are shut down, the State of Bavaria has to import up to 40 percent of its electricity demand. The energy grid SuedOstLink plans to then bring electricity from the wind-rich areas in northeastern Germany to the grid connection point Isar, where it will be fed into the regional distribution net. TenneT, the trasmission operator, is tasked with working out a preferred option for a corridor through Bavaria. To gain public acceptance and relieve the Bundesfachplanung, TenneT supports the planning with public consultation. These dialogues in the context of larger infrastructure projects are increasingly popular in Germany. They can usually be characterized as follows:[22]

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18. *See* Bundesnetzagentur, *supra* note 15, at 174

19. Thomas Schmitt et al., *Alles nur Wutbürger / Nimbies? Eine Analyse der jüngsten Konflikte zur Neuplanung von Stromtrassen in Bayern*, MITTEILUNGEN DER FRÄNKISCHEN GEOGR. GESELLSCHAFT 83 (2016).

20. *See* Kurth, *supra* note 14.

21. *cf.* Ortwin Renn & Marion Dreyer, *Risiken der Energiewende: Möglichkeiten der Risikosteuerung mithilfe eines Risk-Governance-Ansatzes*, 82 VIERTELJAHRSHEFTE ZUR WIRTSCHAFTSFORSCH. 29 (2013); Pia Johanna Schweizer et al., *Public Participation for Infrastructure Planning in the Context of the German "Energiewende,"* 43 UTIL. POL'Y 206 (2016); Henning Banthien et al., *Infrastructure and Participation: How Formal and Informal Participation Methods Can Be Interlinked*, *in* THE GOVERNANCE OF LARGE-SCALE PROJECTS: LINKING CITIZENS AND THE STATE 132 (Andrea Römmele & Henrik Schober eds., 2013).

22. *See* F Brettschneider, *Richtig kommunizieren.„Stuttgart 21 "und die Lehren für die Kommunikation bei Infrastruktur-und Bauprojekten*, *in* AKZEPTANZ IN DER MEDIEN-UND

- They are informal and non-binding: The project developer is not legally obligated to conduct a dialogue and to adhere to the comments and proposals. The project developer is only bound to the decisions in the formal approval process. This process should not be confused with joint dispute resolution or arbitration bound to lawsuits. Nevertheless, the competent authority has to request the project developer to take adequate measures to secure public acceptance through early public participation[23] (see § 25(3) VwVerfG).
- These dialogues act as an important information source to work out planning solutions with lesser impact on human and nature. Through exchanging geospatial and societal information, the transmission operator may integrate significant local knowledge into the planning process and may avoid legal disputes. Generally, those agreements do not obstruct the possibility to file a suit against the approval decision.
- The dialogues act as a channel of information to distribute comprehensible information to nonprofessionals and provide opportunities for face-to-face conversations.
- The process also works as symbolic communication to reduce the "projection screen" if the project developer shows convincingly that it follows principles like fairness and transparency.

Conducting dialogues in the often-polarized atmosphere surrounding large infrastructure projects is very demanding. Most people do have a critical, sometimes hostile, attitude, and monitor the project developers closely.[24] Moreover, some politicians look to making such projects a campaign issue. In the case of SuedOstLink, the transmission operator TenneT conducted a comprehensive dialogue on various levels to meet the high demands. It followed several important dialogue principles[25]:

Principle I: Address different groups of stakeholders separately but in temporal proximity

With a high range energy grid like SuedOstLink many stakeholders are concerned. These are, inter alia, representative of different authorities (state and district authorities for environment, economy, building and construction), state, district and local politicians, or interest groups (environmental and trade associations, citizen groups, etc.). Each of them has its own behavioral logic and strategic interest. They also differ regarding the type and form of information they need. To provide a substantial discourse it is therefore necessary to address similar types of stakeholders in the same arena. It has to be secured that politically influential stakeholders are addressed briefly before information is communicated at public events to citizens and media. If they are addressed too far in advance, there might be leaks and

PROTESTGESELLSCHAFT 281 (Gary Bentele et al. eds., 2015); *see also* Arne Spieker & Marko Bachl, *Sonderfall statt Prototyp: Eine prozedurale und empirische Analyse der Schlichtung zu Stuttgart 21*, *in* THE GOVERNANCE OF LARGE-SCALE PROJECTS 244 (Andrea Römmele & Henrik Schober eds., 2013); Schweizer et al., *supra* note 21.

23. Gesetz zur Verbesserung der Öffentlichkeitsbeteiligung und Vereinheitlichung von Planfeststellungsverfahren, May 31, 2013 (BGBl. I S. 1388).

24. *See* Thomas Schmitt et al., *supra* note 19.

25. *See*

information gaps to the public, which can in turn lead to rumors and misunderstandings. If political stakeholders are addressed too late, they may feel a lack of appreciation and will not be able to share information with their own stakeholders. Because of this, TenneT established separate forums for state and district politicians, for state and district authorities, and held public events for local representatives and citizens. The latter events did not take place more than two weeks later after the former.

Principle II: Step by step approach

Procedural legitimation means that only comprehensible and accepted procedures make for legitimate outcomes.[26] The planning of large energy grids is a complex task that has to be split into "issue portions." Too much at once is counterproductive because (1) it would appear as if everything is settled despite the fact that some or many important parameters are not certain yet, and (2) the stakeholders would be overwhelmed with too much information, which affects the comprehensibility of significant information as well as the feedback quality. Therefore, TenneT split the dialogue into three rounds: in the first round it shared basic parameters of the project and the planning principles (e.g. demand and capability, underground cable, grid connection points, planning area) based on the stipulations in the NEP and Bundesbedarfsplangesetz.[27] It also explained the methodology of identifying possible route corridors in order to make as little impact as possible. Part of the dialogue was to establish channels where stakeholders could transmit feedback with specific spatial information. In the second round, TenneT presented preliminary results of the corridor detection with several possible alternatives. An important part of this round was to explain in detail why those corridors were identified and get feedback regarding possible spatial barriers (e.g. local land-use planning). In the third round, TenneT presented adjusted route corridors based on the input received. These corridors were then made part of the application documents for the Bundesfachplanung.

Principle III: Get personal

In the case of critical infrastructure projects, public hearings often escalate. This is particularly the case when project developers choose classic settings: speakers up front at a podium, hundreds of people in the back.[28] This setup hinders effective dialogue and encourages fierce opposition brought by smaller groups in the audience. TenneT therefore chose a different format: many smaller hearings along the possible route corridors with a maximum of 70 people, short presentations, and a format where people could get into personal contact with planners at information stands. The dialogue partners were authentic technical planners with substantial

26. *See generally* NIKLAS LUHMANN, LEGITIMATION DURCH VERFAHREN (6th ed. 2001).

27. BUNDESNETZAGENTUR, LINE PROJECTS, https://www.netzausbau.de/leitungsvorhaben/de.html (last visited Sep 6, 2017).

28. *See* Kerstin Freiberger, *Gelächter und Buhrufe bei Infoveranstaltung von Amprion*, NORDBAYERN (Jan. 29, 2014), http://www.nordbayern.de/region/pegnitz/gelachter-und-buhrufe-bei-infoveranstaltung-von-amprion-1.3425618.

knowledge of the project supported by the staff in charge for citizen participation. The latter stayed in constant contact with the stakeholders outside of events.

Principle IV: Neutral and fair moderation

A skillful moderation is a key success factor for public hearings. The moderator has to establish easily understandable rules of discussion, follow them consistently, and offer everyone equal speech opportunities within the established framework. Most importantly, they have to appear independent from the project developer, yet still have essential knowledge of the issue. For the SuedOstLink, an independent and experienced bureau for environmental moderation was assigned.

Despite the fact that the atmosphere in the area had been very polarized during the political conflict between the state of Bavaria and the federal government (between the years 2012 to 2015), the SuedOstLink consultation process shows, to date, (currently the grid has entered the formal approval process in the Bundesfachplanung), to be very constructive with only minor fundamental opposition. Although hard empirical evidence is lacking, this is likely due to (1) more positive surrounding conditions related to the political agreement for underground cables, and (2) a comprehensive and authentic dialogue approach. [29]

V. A BROADER LOOK: PUBLIC DIALOGUES FOR LARGE INFRASTRUCTURE PROJECTS IN GERMANY

The SuedOstLink dialogue reflects conclusions of the VDI Richtlinien 7000/7001.[30] These are recently published guidelines of the VDI (Association of German Engineers) for early participation and communication regarding large infrastructure projects. They are a novelty, since traditionally the VDI publishes widely recognized technical engineering-related guidelines. It underlines the increasing significance of communication issues for infrastructure in Germany. Accordingly, the guideline VDI7001 states:

> "Thus, communication and public participation are not 'soft' issues anymore, but 'hard,' success-critical factors for infrastructure and industrial projects. Project sponsors, planning and executive engineers and other stakeholders should therefore engage in the intensive exchange with the social environment already during the development phase of infrastructure

29. *See* Roland Menges & Gregor Beyer, *Energiewende und Übertragungsnetzausbau: Sind Erdkabel ein Instrument zur Steigerung der gesellschaftlichen Akzeptanz des Leitungsbaus? Eine empirische Untersuchung auf Basis der Kontingenten Bewertungsmethode*, 37 Z ENERGIEWIRTSCH 277 (2013); *but cf.* Margot Hurlbert & Joyeeta Gupta, *The split ladder of participation: A diagnostic, strategic, and evaluation tool to assess when participation is necessary*, 50 ENV'T. SCI. POL'Y 100 (2015); Felix Rauschmayer & Heidi Wittmer, *Evaluating Deliberative and Analytical Methods for the Resolution of Environmental Conflicts*, 23 LAND USE POL'Y 108–122 (2006).

30. *See* VEREIN DEUTSCHER INGENIEURE, VDI 7000 FRÜHE ÖFFENTLICHKEITSBETEILIGUNG BEI INDUSTRIE- UND INFRASTRUKTURPROJEKTEN (2014); *see also* VEREIN DEUTSCHER INGENIEURE, VDI 7001 KOMMUNIKATION UND ÖFFENTLICHKEITSBETEILIGUNG BEI PLANUNG UND BAU VON INFRASTRUKTURPROJEKTEN (2014).

> projects and face a serious dialogue […] The 'legitimation through parliamentary' procedure must be supplemented to include the 'legitimation through communication and participation.'"[31]

The VDI-Guidelines distinguish between three levels of communication: information, consultation and participation. On the information level, the goal is to explain the project objectives, the status of the planning, future steps, and raise understanding for the framework conditions.[32] From the very beginning, project developers must know and address the urgent issues for the public. On the consultation level, concrete proposals are discussed, and ideas and recommendations for adaption and improvement are developed. The direct interaction between owners and the public therefore can be characterized as advisory. The objective is to exchange knowledge and involve diverse perspectives in the design. On the level of participation, the goal is to reach a win-win solution, which satisfies the interests of the different groups. As a prerequisite, the involved parties should clarify disputed facts to gather common ground. In most cases, involved parties only reach compromises on some parts of the issues.[33]

Each level has different communication needs and requires appropriate tools. The appropriate level to emphasize depends on the surrounding communication conditions, such as conflict and escalation potential, the value of the project as perceived by the public debate, existing constraints, remaining flexibility for change, and available financial resources.[34] To decide, a thorough analysis in necessary. The VDI7001 provides ten fundamental recommendations ("Basic Rules") for conducting dialogues in the several planning phases of a project (subdivided along the service phases of the Official Scale of Fees for Services by Architects and Engineers / HOAI). They are outlined as follows:[35]

1. Open-minded and respectful attitude
2. Clear framework conditions
3. Early involvement of citizens
4. Comprehensive fact finding
5. Integrations of different interests
6. Professional process design for fairness and transparency
7. Integrability of the results
8. Transparency in financing
9. Communicate to create understanding
10. Wide variety of communication tools

Of note is that similar rules have long been part of the literature regarding Alternative Dispute Resolution[36] and citizen participation,[37] but were hardly reflected in the field of engineering and architecture, at least in Germany. Only recently have

31. VDI 7001 KOMMUNIKATION UND ÖFFENTLICHKEITSBETEILIGUNG BEI PLANUNG UND BAU VON INFRASTRUKTURPROJEKTEN, *supra* note 30, at 3.

32. *Id.* at 6.

33. *See*

34. VEREIN DEUTSCHER INGENIEURE, VDI 7001 KOMMUNIKATION UND ÖFFENTLICHKEITSBETEILIGUNG BEI PLANUNG UND BAU VON INFRASTRUKTURPROJEKTEN (2014).

35. *Id*.

36. *See generally,* LAWRENCE SUSSKIND & JEFFREY CRUIKSHANK, BREAKING THE IMPASSE : CONSENSUAL APPROACHES TO RESOLVING PUBLIC DISPUTES (1987).

37. *See generally*, FAIRNESS AND COMPETENCE IN CITIZEN PARTICIPATION : EVALUATING MODELS FOR ENVIRONMENTAL DISCOURSE (Ortwin Renn, Thomas Webler, & Peter Wiedemann eds., 1995).

prominent project failures given such principles recognition and shown that early citizen participation may reduce costs and avoid stalling projects.

VI. FUTURE OUTLOOK: THE NEED FOR COMPREHENSIBLE VISUALIZATIONS

The comprehensiveness of technical information plays a critical role in communication and participation. Without a common understanding of the issues at stake, neither compromise nor consent are possible. Therefore, Basic Rule 9 of the VDI Standard 7001 states:

> "Fundamentally, clarity in all engineering design phases is important, above all however in the Design Development (Entwurfsplanung) and Permit Design (Genehmigungsplanung)' Phases. The language of the engineer is the drawing, but often these drawings are 'un-readable' for lay people. Therefore, these drawings must be 'translated' into more easily accessible visualizations."[38]

Visualizations can support communication and participation on all three levels of dialogue, for example:[39]

- Visualizations can contribute significantly to providing information and ensuring the necessary transparency. Especially for nontechnical professionals, pictures are easier to understand than textual explanations.
- At the consultation and participation level: Suitable visualizations contribute to representing and evaluating alternative designs and proposals from the public.
- Virtual models can be used for interaction in a public forum or planning workshop – a way to discuss variants effectively in real-time and facilitate decision-making processes.

How these visualizations should look, which visualization techniques owners, politicians, and local authorities should implement, and what impacts results, has not been studied closely. Despite this, the need for comprehensible communication tools, especially in complex issues like the Energiewende, is evident. Because of this lack of research, the University of Hohenheim and the Fraunhofer Institute for Industrial Engineering IAO initiated the research project, VisB+[40]. Its purpose is to analyze a broad scope of visualization techniques ranging from conventional architectural drawings to 3D digital models, and the use of virtual technologies. In this context, the term 'Virtual Technologies' of interactive visualization systems includes augmented reality (AR), virtual reality (VR) and mixed reality (MR) systems. Immersive, interactive 3D real-time surroundings are implemented to realistically and clearly represent complex space data, processes, or products. The main

38. VEREIN DEUTSCHER INGENIEURE, *supra* note 30, at 17.

39. *See, e.g.*, Kheir Al-Kodmany, *Visualization Tools and Methods for Participatory Planning and Design*, 8 J. URB. TECH. 1 (2001); Andrew Lovett et al., *Using 3D visualization methods in landscape planning: An evaluation of options and practical issues*, LANDSCAPE& URB. PLAN. (2015); Arne Spieker, Frank Brettschneider & Günther Wenzel, *Virtuelle Realität: Der Nutzen von 3D-Echtzeitmodellen im Bauwesen für die Kommunikation mit Bürgern, Nutzern und Experten*, BAUINGENIEUR (VDI JAHRESAUSGABE 2016/2017), 2016, at 100–104.

40. Spieker et. al, *supra* note 39.

focus of the research is to investigate the visualizations' intelligibility, accurateness, and credibility, as well as usefulness for citizens. At the core of the project are workshops with practitioners and psychological experiments with randomly selected volunteer laypeople. The outcomes of the study will soon be outlined in a guideline for the use of visualizations.

Until recently, little information was collected about dialogues based on virtual reality technologies that include external parties such as users (see employee information in the reference project of the BMBF-New construction in Berlin or ZVE new construction) or the public (for example, presenting the new construction of Würth subsidiaries at the local council of Rorschach, 2011).[41] However, in these research projects we see anecdotal evidence that visualizations with immersive building prototypes could give lay people quick access to designs and therefore support informed and target-oriented discussions. Since there was no accompanying social research on these projects, gained experiences were not evaluated.

The results of VisB+ underscore this anecdotal evidence. New virtual technologies appear as a fruitful approach for gaining common ground in complex issues. The principal findings at a glance:[42]

- For lay people, practitioners' credibility and realism are the most important requirements for visualizations;
- Real-time models facilitate discussions about alternative designs. A moderator can fade in different variants within seconds, so that dialogue partners can easily estimate their effects. In the study, which looked at the real planning of an opera house as an example, citizens using real-time models quickly identified deficits of the design and made suggestions for improvement (e.g. lack of seating in the foyer);
- Older people and less technically experienced persons appreciated real-time models;
- The effect of stereoscopy was ambivalent: For some it eased the spatial sense of the planning model. Others stated physical uneasiness. Five to ten percent of the subjects reported slight or strong dizziness, especially older women; and
- Renderings scored below average in key variables. For example, the construction design was rated worse when presented in stills. In addition, the credibility and acceptance of stills was rated lower than the other visualization techniques.

The results of VisB+ show that immersive visualization technology can further facilitate dialogue regarding technically complex infrastructure projects. They are in particular practical for a comparison of alternatives and estimating effects on environment and neighborhoods. For sure, they cannot compensate for elementary mistakes in communication and a difficult political atmosphere. However, systematically integrated in substantial and serious dialogues, they support the understanding of significant information and the evaluation of alternatives. Therefore, they are promising tools for the further development of the Energiewende.

41. Günter Wenzel, *Effizientes Zusammenspiel*, Virtual Reality Losungen and 3D-Visualisierung im Bauwesen, 1 BAUEN AKTUELL 26, 26-28 (2014).

42. ARNE SPIEKER, GÜNTER WENZEL & FRANK BRETTSCHNEIDER, BAUPROJEKTE VISUALISIEREN - LEITFADEN FÜR DIE BÜRGERBETEILIGUNG (forthcoming 2017).

VII. CONCLUSION

The Energiewende is a mammoth task for politics and society. Disputes surrounding energy grids and wind power will remain for the next decade and possibly further slowdown the transition. Therefore, it needs substantial dialogue approaches for a sustainable grid planning. The Grid Expansion Acceleration Act leaves enough scope for the Bundesnetzagentur and transmission operators to conduct serious consultation procedures at each step of the NABEG. Past experiences show that successful planning relies heavily on the integrity of these procedures as well as on backing from federal and state politics. Although not completed yet, the SuedOstLink dialogue appears as good example for gaining acceptance also at a local level. Still, a burden for the communication of energy grid planning is their complexity. They reach distances of several hundred kilometers with large converter stations and are heavily intertwined with the German and trans-European energy network. In this context, new visualization techniques like Virtual Reality can further enhance citizen participation and communication. Recently, first transmission operators have started to experiment with these technologies. For example, TenneT opened the immersive lab TenneT Virtual Vision with interactive 3D-Models of critical infrastructure, milestones of grid planning and multimedia animated graphics of interdependencies in the German energy system. In the near future, we will get further witness of the practical benefits of advanced visualizations.