

German energy turnaround and transmission line development: The willingness-to-pay of private households for underground cable employment. An empirical study based on the Contingent Valuation Method (CVM)

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Motivation and objectives

Development plans for the German transmission network (“Netzentwicklungsplan”) based on overhead lines are met with resentments in and around many designated construction areas. As several studies on the social acceptance of the energy turnaround suggest, a more acceptable alternative to classic transmission line layout lies in underground cables. This study aims to test the hypothesis, underground cables are a means to increase social acceptance of network development and serve to deescalate respective conflicts. This paper presents the *determination of private households’ willingness-to-pay for underground cable projects based on a contingent valuation approach* conducted in November and December 2012 in four regions of Germany that are influenced by network development in different ways. Specifically, focus is put on the question whether and in what form consumers’ willingness to accept higher prices for electricity is dependent on a possible encroachment by local transmission line constructions. Additionally, other social and demographic variables are tested to influence social acceptance of underground cable projects. This method is superior to other survey methods in that the core question “overhead versus underground cable” is put into an evaluation and decision frame that is highly concrete and strictly quantified following the economic logic of identifying individual preferences.

Methods

As opposed to so called revealing preference methods, e.g. hedonic price method, the Contingent Valuation Method aims at stated, directly expressed preferences in assessing environmental goods by asking households for their willingness-to-pay for the improvement of environment through a concrete project (see for instance Mitchell and Carson 2005). The method’s foundation lies in the construction of hypothetical markets or evaluation and choice scenarios, respectively, which set the rules and limitations for individual (hypothetical) decisions. This allows for a direct determination of a households’ willingness-to-pay, which is interpreted as a consumer’s surplus for the variation of the environmental good examined. In consideration of statistical effects the subsequent extrapolation of individual willingness’s-to-pay ultimately leads to a measure of total welfare provided by the environmental good expressed in monetary units. Using Contingent Valuation to measure preferences in the problem of transmission line construction is particularly desirable for a variety of reasons:

- Discussion of transmission network development is perceived as *meaningful* and *relevant* by population near to and far from existing and projected transmission lines.
- Overhead- and underground cables are two clearly distinguishable alternatives of equivalent effect to energy economy. Realization of one of the alternatives is highly likely, which renders a referring evaluation scenario highly credible and realistic.
- Advantages and disadvantages as well as physical properties of both alternatives are easily distinguished and pictured. Respective social and local relevance is obvious.
- A payment-vehicle (Euro per kWh) is already established as part of yearly electricity billing („Netzentgelte“). This further increases study comprehensibility and credibility.

The questionnaire consists of several informative elements. Initially the energy economic situation and the necessity of network development in Germany are described. Then an example of transmission line construction is given with Kreiensen, Lower Saxony, Germany. Adjacently, the referential scenario (usage of overhead cable) and evaluation scenario (employment of underground cable) are provided. This includes a neutral and illustrated overview of advantages and disadvantages of both alternatives as well as their relevant environmental properties. Next, payment-vehicle and two underground cable projects, regional and superregional, are introduced. Finally, preferences for both projects are determined in two separate sections. The complete questionnaire consisted of 16 DinA4 pages, bound and wrapped. Every questionnaire also included an envelope addressed and stamped to increase return rates. In total 21.500 questionnaires were distributed via means of regional newspapers, independent from possible newspaper subscriptions in four different regions in Germany.

Results

On principal the results of this study mirror the findings of other surveys on underground cables showing that a clear majority of participants (around 60 per cent of respondent households) favours underground cable over conventional overhead cables. Though a significant majority of households states to support underground cable projects only 50 per cent of these households declare to have a positive willingness-to-pay. Striking is the fact that this relatively high share of households not willing to pay for underground cables cannot be explained via net-income or any other demographic variables. Neither do general mindsets regarding energy politics serve as explaining factors. The share of households that support the energy turnaround for instance is similar in the group of households with positive and negative/non-existent willingness-to-pay, respectively. Influencing factors are instead normative opinions on matters of network development such as favoured means of financing (tax funds versus network remuneration) as well as distance to existing transmission lines and place of residency. Free-riders over proportionally insist on financing networks via taxes, while households with positive willingness-to-pay prefer network remuneration. The significant observation that support of underground cables in combination with a positive willingness-to-pay increases with rising distance to existing transmission lines can be interpreted as a habituation-effect. Households residing relatively close to transmission lines perceive less of a visual and sanitary impact from overhead lines than households relatively far away.

This study was conducted simultaneously in four regions in Germany that are affected by the energy turnaround and consequent network development very differently. An influence analysis that focuses solely on participants' places of residency shows that support for underground cable project is much higher in Kreiensen, a city directly impacted by transmission line construction and used as study example, than in any of the other regions examined. However, the strength of preferences measured as quantified via willingness-to-pay is much less distinctive than would be expected due to a large amount of free-riders: The comparatively low support for underground cable projects and an equally low willingness-to-pay in urban Braunschweig can be related to the city's large distance to existing and projected transmission lines. The same can be said about Viechtach, another region mostly unaffected by transmission network development. Interestingly willingness-to-pay in Kreiensen does not match its leading position in underground cable support, which is due to a large share of free-riders in the region. Willingness-to-pay instead peaks in Niebüll, a community in northern Germany that has developed into a major wind power station site as a result of the energy turnaround. An explanation for this observation can be found both in the positive relation to the energy turnaround and a comparatively low share of free-riders in the region. Another possible reason lies in the hypothesis, population in Niebüll considers underground cables an instrument to increase social acceptance of transmission lines more than in the other regions this study was conducted in. Yet accepting this hypothesis is highly questionable as even here only one third of households stating a positive willingness-to-pay for a regional underground cable project are willing to pay for superregional projects of the same kind. Similarly the fact that 60 per cent of Niebüll sample value regional and superregional projects identically points to the conclusion that underground cable employment on a larger scale does meet broad social acceptance.

Conclusions

The results on an analysis of willingness-to-pay of German households for realization of underground cable projects based on the Contingent Valuation approach presented in this paper need to be put into perspective of the social acceptance of the energy turnaround in Germany. The promotion of "green energy" has led to an increase of costs and prices on the energy market that opened questions of high social relevance. While it remains undecided whether additional costs should be fairly spread or simply cut (see Agentur für Erneuerbare Energien 2012) a new discussion has risen on problems associated with network development. Considering the sample utilized in this paper is not representative for the entity of Germany, no final statement can be made about the question whether and under what circumstances German energy consumers are willing to accept an even higher increase in prices that results from extensive underground cable employment. However, even though a majority of households promotes underground cable technology it is doubtful that this vote constitutes a sufficient basis for the hypothesis underground cables serve as means of regional conflict resolution and can thus be implemented to provoke consensus in conflict scenarios.

References

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