Discussion OF ENERGY POLICY GOALS with THE TARGET-CIRCLE-CONCEPT

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Summary

We provide an overview of the ongoing discussions on the objectives of the energy transition in the form of a conceptual framework, intending to facilitate the search for the most viable options for a successful transformation of the energy system. For this purpose, we examine the development of energy policy goals in Germany in the past and present, whereby we give an overview of objectives and assessment approaches from politics, economics, and science. Moreover, we then merge the different views into a common framework and analyze the central conflict between the wholeness of a hypothetical target circle and the simplification in favor of a hypothetical target point in more detail.

1 The Overall Context of Energy Policy Objectives

In Germany, the national goals of climate protection and the cessation of nuclear energy use drive a rapid shift to renewable energy. Political actors strive for a sustainable energy system in all sectors and at all system levels (technology, economy, society, environment). The German energy transition moves in a multi-dimensional area of tension, which has to take into account the main transformation trends in the energy sector, a large variety of actors, as well as numerous heterogeneous objectives and conflicting goals (see Figure 1).

Figure 1: Overview of core topics and challenges of the energy transition

Even with a clear target, its implementation would be challenging. On the one hand, every socio-technical system is subject to path dependencies due to various social, economic, and technical barriers to path-change. Therefore, it needs the external support of policies to reach set goals. On the other hand, it is not possible to thoroughly analyze the complex interplay of interacting system levels, system interventions, and actor systems. It is necessary to elaborate on these systemic relationships. In a first step, such a concern requires a systematic overview of the discussion about energy transition objectives. This paper has developed such an overview in the form of a conceptual framework to facilitate the search for the most viable options for a successful energy transition.

2 Energy Policy Goals in the Past, Present, and Future

2.1 Development of energy policy goals in the 20th and 21st centuries

In a historical retrospect of the last century, we observe an overall expansion of the explicit target dimensions. Several demands from social groups - particularly notable were environmental and consumer protection movements as well as the debates on market regulation and Sustainable Development as a whole - were increasingly included in the official target canon of the German Energy Act ("Energiewirtschaftsgesetz"). Thus, security of supply, affordability, consumer-friendliness, efficiency, environmental friendliness, supply with electricity, supply with gas, and expansion of renewable energies are the official target dimensions in 2019. This increase could aptly be described as a modern target polygon. The more scientific magic quadrilateral of energy policy, whose dimensions of economic efficiency, security of supply, environmental friendliness, and social compatibility have gradually been added since the mid of the last century.[1] But the legitimacy of social compatibility and social acceptance as targets has not yet been generally established. On the one hand, several publications still speak of a target triangle of economic performance, security of supply, and environmental friendliness.[2] On the other, the Energy Act does not contain any explicit target formulation on social compatibility that would satisfy its progressive advocates. They argue that a lack of distributional and participatory fairness is impeding a successful energy transition.[3] Nevertheless, the number of politically formulated individual goals has grown to the highest level in the history of Germany´s Federal Republic. The progressive expansion of objectives is considered useful by some actors.[4] And again criticized by other actors for over-classifying the system or overloading the system with targets. This overload would further exacerbate already existing goal conflicts and would make it even harder for political decision-makers to rule.[5] The relative and absolute significance of these classical and modern target dimensions will continue to influence the debate on energy economics in the 21st century and

[1] See Czakainski 1993, pp. 18.

[2] See Buchholz et al. 2012/2013, Frank et al. 2012, Pittel/Lippelt 2012, Pittel 2012.

[3] See, for example, Hauff et al. 2011, IASS 2013, or Renn 2015.

[4] See Hauff et al. 2011 and Knopf et al. 2012.

[5] See Buchholz et al. 2012 and Umbach 2015.

will determine the orientation and design of the ongoing transformation of the energy industry and energy system. A problem-appropriate discussion of the objectives, therefore, requires the addition of a systemic paradigm, in which the different target dimensions are captured in their changing meaning and their specific context, thereby overcoming the problem of non-systemic target goals.[6]

2.2 Hypotheses for the future development of energy policy goals

From the past and present discussion, in which numerous actors participate, the ongoing development of the energy policy objectives becomes clear (Table 1).

Table 1: Number and content of the target dimensions depending on the preferences and the treated questions

Target dimensions		Source
Number (at least)	**Dimensions**	
3	Environemtal friendliness	Buchholz et al. 2012/2013 Frank et al. 2012 Pittel 2012 Pittel and Lippelt 2012
	Profitability/affordability	
	Security of supply	
4	Climate protection and environmental friendliness	Czakainski 1993 Hauff et al. 2011
	Profitability/affordability	
	Security of supply	
	Social acceptance / social compatibility	
5	Climate and environmental compatibility	BDI 2014
	Profitability/affordability	
	Security of supply	
	Acceptance	
	Innovation	
6	Climate protection and environmental friendliness	Umbach 2015
	Profitability/affordability	
	Security of supply	
	Resource conservation	
	Social compatibility and acceptance	
	Global responsibility	
6 (or 3)	Climate protection (environmental friendliness)	Ausfelder et al. 2015
	Resource conservation (environmental friendliness)	
	System stability (security of supply)	
	Available energy resources (security of supply)	
	Affordability for end-consumers (profitability/affordability)	
	Competitiveness of the industry (profitability/affordability)	
8	Climate protection	Knopf et al. 2012
	Security of supply	
	Social aspects and cost distribution	
	Profitability and competitiveness	
	Research and innovation	
	Avoidance of unilateral import dependencies and export opportunities in the field of renewable energies	
	Natural reserve and environmental protection	
	Energy transition as a joint effort	
9	Security of supply	Energy Act § 1, section 1 (version: 2019)
	Affordability	
	Consumer friendliness	
	Efficiency	
	Environmental friendliness	
	Wired and piped transportation	
	Supply with electricity	
	Supply with gaseous energy carriers	
	Supply with renewable energies	
10	Effectiveness (climate protection)	Quitzow et al. 2018
	Cost efficiency / total costs	
	Resilience	
	Environment and resource conservation	
	Protection of human health	
	Promoting social cohesion	
	Economic planning security and contribution to social welfare	
	Legality	
	Legitimacy	
	Ethical acceptability	

[6] See Vester 1999 and Göllinger 2012.

In these and other publications on target discussions, the structure of the target dimensions is generally not substantiated qualitatively or quantitatively, which means that hardly any statements can be made about the background of clustering. While many goals for the more differentiated variants can be assigned to the standard target dimensions, attribution and hierarchization prove to be increasingly tricky for aspects such as *innovation* or *research and innovation*, *export opportunities in the field of renewable energies*, and *global responsibility*. Therefore, by extrapolating the historical trend of an increasing number of goals, one could conceive of representing energy policy goals as a *target circle* in the future. It could, for example, consist of prioritized overall goals and a large number of sub-goals (see Figure 2).

Figure 2: Trend of energy policy objectives

The increase in targets in the face of multiple requirements evidently stimulates the quest for a practical or overseeable, necessarily simplified number of goals as well as for a presentation of results that is as intuitive as possible.[7]

3 An Architecture for an Integrative Energy Policy Framework

3.1 Challenges in developing a framework

It is essential to present the target dimensions - where possible - in a holistic approach that takes into account all direct and indirect target indicators, intended and unintended, desirable and undesirable system states, internal and external effects of system interventions, and the diversity of actors. With a scientifically supervised monitoring process, an important step was taken towards this holistic approach.[8] However, the formulation of an integrative framework for the target architecture faces some difficulties when it comes to current publications:

1. The target dimensions can be clustered in different ways. A cluster logic depends, in particular, on the question posed by the authors. For example, the target system of Rösch et al. 2017 for the energy transition points to the sustainability goals of the United Nations.[9]

[7] See, e.g., Knopf et al. 2012, p. 3, or Rösch et al., 2017, p. 4.

[8] See, e.g., BMWi 2016.

[9] See Rösch et al. 2017.

Other approaches are clustered based on the individual target energy policy polygons.[10] Again, the fifth monitoring report on the energy transition is geared more towards the relevant technologies and thematic complexes in the energy sector.[11] Besides, there are structuring attempts with several reference points.[12]

2. The goals, subject areas, and indicators may be given different names in the respective publications, although the direction the content aims at partly corresponds quite strongly. This circumstance prevents easy assignment or delimitation of the target dimensions and indicators.
3. Different indicators may be useful pointers for several target dimensions.[13] An assignment of these indicators to a single target dimension is therefore difficult.
4. In previous publications, *social compatibility* and *social acceptance* are almost always used interchangeably. The legitimacy of this equation must be critically examined.
5. Several publications have introduced additional target dimensions that go beyond the standard triangle/square of energy policy goals. These include, for example, *global responsibility*, *resource conservation*, *research and innovation*, or *energy transition as a joint effort*. The introduction of these topics or target dimensions is only explained rudimentarily.
6. The same applies to some indicators, which are often assigned to the target measure of cost-effectiveness and represent regulatory rather than energy-related goals (e.g., market power). Therefore, it seems appropriate to discuss an independent target category for regulatory policy in the energy transition.

These aspects represent further general and specific research-, clarification-, and, if necessary, further development- needs for the established energy transition monitoring.[14] For satisfying this need, an expandable target circle architecture is proposed and discussed in the following sections.

[10] See BDI 2014, Flues et al. 2012, Knopf et al. 2012.

[11] See BMWi 2016.

[12] See BMWi/BMU 2010 and UBA 2016.

[13] See, for example, UBA 2016, Table 4/6/8/10/12.

[14] See BMWi 2016.

3.2 Proposal of a target circle architecture

1) **Policy areas as a framework:** Due to the potential use of the target circle framework in policy advice, the implemented classification is oriented towards policy areas (e.g. national regulatory, economic, industrial, educational, research, security, climate, energy, environmental, health, social, domestic and foreign policy as well as international/global sustainability policy). For this structuring logic - as in all previous structural attempts - dealing with the overlapping areas between the policy areas is challenging, but hardly avoidable for a holistic concept. The target circles are, therefore, differentiated according to the proximity of the policy areas to the energy transition. After all, political measures can influence other policy areas through indirect impacts, which implies that an integrated understanding of politics is essential to avoid interdependent intervention spirals (between policy areas).

    - Energy transition target circles in the narrower sense (direct concern)
        - Regulatory target circle for energy policy
        - Energy policy target circle
    - Target circles, in a broader sense (secondary matter), can be supplemented for all other policy areas.

2) **Target group orientation in cluster formation:** The individual target circles can be appropriately classified or clustered according to the thematic coherence of the different goals (including the hierarchy), the degree of congruence of the target formulations, the weighting of the individual goals or a mixture of these criteria. The formation of clusters should be based on good communicability with the respective target group. High adaptability unfolds when the target formulations can connect to the typical pre-knowledge and understanding of terms prevailing in the group.

3) **Energy policy target circle:** For its systematization, a reference to the (classical) energy policy goals seems appropriate if the target groups are politicians or scientists. At least, the target circle has four overall target dimensions:

    - security of supply
    - economic performance
    - environmental friendliness
    - social compatibility

Mainly, therefore, a techno-economic axis (security of supply and economic performance) and a social-ecological axis (social compatibility and environmental friendliness) can be distinguished. These dimensions can be either narrow or broad and may be subdivided. The addition of further target dimensions is possible if an assignment to the four standard objectives - even with a broad interpretation - or other target circles is not a viable option. For example, it would be necessary to decide whether target areas such as legal compatibility and compatibility with democracy would be a goal of their own or could be grouped into a broad concept of social compatibility.

4) **Regulatory target circle:** Regulatory policy plays a central role in the area of energy supply. For this reason, the Energy Act also sets regulatory objectives in addition to energy policy objectives. For example (see § 1):

   - Ensuring effective and undistorted competition in the supply of electricity and gas through the regulation of electricity and gas supply networks
   - Strengthening of free pricing for electricity through competitive market mechanisms
   - Enabling the balancing of supply and demand for power in the electricity markets

   The state intervenes as a regulator in the energy markets since various prerequisites of an ideal market are not fulfilled, and its functionality for the general good is thus impaired (including market power through natural monopolies). Although attempts have been made to incorporate these aspects into the classical energy policy goals, we feel that separation is appropriate. While the energy policy target circle primarily aims for acceptable or desirable results for society (secure, affordable, environmentally sound, and fair energy supply), the regulatory target circle focuses on the conditions and prerequisites for enabling these results. The conditions at this level, to no small degree, determine the final results, which is why they should also be given their own, higher-level target circle. The selection of target dimensions and indicators for this target circle mainly depends on the economic and other schools of thought of the potential users. In Germany, for example, the post-war regulatory policy was strongly influenced by ordoliberalism, which gained importance as a variant of liberalism.[15] The following (meta) target dimensions, which should still be underpinned with a corresponding indicator, are an expression of the efforts to grasp the regulatory

[15] For an introduction, see Goldschmidt/Wohlgemuth 2008.

framework of the energy transition as well as its actual state and to compare it with a desirable target state:

- delimitation, clarification, and guarantee of property rights
- transparency of the markets
- degree of liberalization/deregulation and competitive level
- the perfection of competition or extent of market power concentration
- share of private and public property
- degree of diversification of energy import
- degree of maximization of welfare
- level of path dependencies
    - amount of investment, learning and switching costs (irreversible costs)
    - technical life of plants (end of use as a window of opportunity for a technology change)

We are aware of the limitations that accompany such a presentation of target dimensions and indicators of the regulatory target circle. On the one hand, it cannot be avoided to prioritize some factors over others and thus to represent only part of the problem. On the other hand, it has been explicitly pointed out that the indicators and their thresholds are developed for the case of Germany and may not be transferable to other economies congruently.

5) **Role of social acceptance in the framework:** The goal of *social acceptance* concerns every indicator, every goal dimension, and every target circle. Every qualitative and quantitative determination of goals and their indicators as well as any deviation from the target state of an indicator can be tested for social acceptance. Therefore, it corresponds to a general *meta-indicator*, whereas *social compatibility* is understood as a specific target dimension of the energy policy target circle that includes all forms of social impacts. The concept of acceptance, in reality, has various aspects that can be represented as a four-field matrix with the distinguishing features *attitude* and *action*.[16]

6) **Flexibility through case-specific extensibility and reducibility:** It makes sense to first collect all aspects, whether target dimensions or indicators, that could (potentially) be

[16] See C.A.R.M.E.N. 2014, p. 8.

important and to integrate them into the target circles; this reduces the risk of overlooking essential aspects in each case. From the perspective of manageability, however, this procedure offers significant disadvantages. The approach should, therefore, be regarded as a flexible *backbone* for own target circle architectures, which can be extended or shortened according to the ideas of the user. A division of existing elements then corresponds to weighting and prioritizing the target dimensions and indicators among each other and in the overall context.

A visual representation of the framework is shown in **Fehler! Verweisquelle konnte nicht gefunden werden.** 3.

Figure 3: Framework of the target circle concept

3.3 Competition between the target point and target circle

In theoretical-conceptual considerations, the desire to simplify is repeatedly expressed, which ultimately aims to reduce the complexity to a single goal - in the language of geometry, to a target point. The discussion about energy policy goals between the target point and the target circle has similarities with other science disputes; for example, with the central conflict within the sustainability sciences regarding the question of equality of all or prioritization of specific sustainability strategies. As a compromise, individual target dimensions are ultimately explicitly or implicitly prioritized. The users prioritize on a case-by-case basis. The scientific discussion is not geared towards these idealized extremes but continuously struggles for the appropriate level of goal-orientation. The result of this prioritization usually depends quite heavily on the particular perspective that a specific actor takes as a representative of a discipline such as engineering, economics, social, political, and environmental science. Accordingly, discipline-centered arguments can be identified in the debate, whereby interdisciplinary and transdisciplinary dialogues are used to promote the understanding of disciplinary points of view. So far, however, no individual discipline has managed to establish their way of thinking as *the leading dimension* within the goal dimensions. Here, both the socially and the economically-centered views appear most promising since their instruments intend almost universal comparability of alternatives. Thus, in principle, from a classical economic perspective, the price would suffice as the only measure of valuation - at least in an *ideal* market economy which is characterized, among other things, by fixed property rights and private property, atomistic competition, complete information and the infinite speed of reaction of the market players. In such a world, the other goal dimensions, all of which have a collective nature,

would be priced and internalized.[17] The closer the real markets get to this theoretical state, the easier it would be to dismiss the remaining target dimensions in favor of a target point. In addition to this inadmissible assumption of *ideal* markets, the economics-centered perspective usually suggests that available alternatives for cost- and price-comparisons are *utility-equivalent*. However, as this is rarely the case in real markets, costs or prices are just one aspect (among many) that plays a role in decision-making processes. A socially centered perspective can, therefore, also offer acceptance as an essential benchmark to make different cost-benefit bundles comparable. But the enforcement of a single target point is unlikely because firstly, acceptance as a rather diffuse, elusive concept is confronted with various difficulties (measurability, contextuality), secondly, imperfection of the markets can never be overcome entirely, and, thirdly, the other disciplines face similar, if not even more severe challenges. The same applies to the target circle since practical experience shows that justifiable complexity reduction is always welcome in all disciplines. Although developments in the IT area support the preparation and visualization of growing amounts of data, the limitations of the human mind probably provide a natural limit to information processing. Nevertheless, at least a simplified target circle can facilitate inter-disciplinary communication.

4 Summary and Further Development of the Target Circle Framework

In the course of industrialization, an independent energy policy developed for the energy supply of modern societies, which is oriented towards a growing, democratically legitimized number of explicit and implicit goals. The historical genesis of the energy policy goals can be explained by the relative, context-specific scarcity of the respective target content. Given the current discussion about acceptance and social compatibility, this evolution of the goal dimensions does not seem to have been completed yet. But there are also lines of argumentation for reducing the goal dimensions to (in extreme cases) a single goal, through which all other targets should be sufficiently represented. From a conceptual perspective, the extremes of the spectrum of possibilities can, therefore, be posited as an energy policy target point on the one, and as a target circle on the other hand. In particular, the increasingly holistic understanding of the effects of human action speaks for a development towards the target circle. Therefore, it now seems more appropriate to talk about energy and regulatory target polygons or target circles rather than the energy policy target triangle (or target quadrilateral). Although this development

[17] See Umbach 2015, p. 12.

comes at the cost of a frequently desired simplicity, it clearly expresses the diversity and complexity of the goal of sustainable and (increasingly) systemically integrated development. In the course of this evolution, various challenges must be reassessed to realize this integration gradually, whereby the following research topics emerge, among others:

- **Use of additional criteria:** Overload due to extreme complexity is central to any holistic assessment approach. An examination of a *theoretical optimum* in the conflict between simplicity versus reality is still lacking in the scientific debate.
- **Indicator for successful regulatory policy:** While a wide range of indicators for the standard target dimensions of energy policy exists, the indicator systems for successful regulatory policies are still underdeveloped.
- **Analysis of interactions, conflicting goals, and intervention spirals:** Increasingly integrated political understanding in the course of sustainable development is essential. The disciplinary boundaries should disappear or blur not only in science but also progressively in politics. Side effects of energy policy in adjacent policy areas and conflicting goals must be considered right from the beginning to avoid intervention spirals.[18] Pre-assessment tools need to be developed for this purpose.
- **Phase model(s) of goal prioritization:** Over time, the perceived significance of the different target dimensions of energy policy seems to fluctuate considerably. Various socially inspired phase models can be formulated as to how the target weightings will develop in the future.[19] It is crucial to identify and verify the factors that are responsible for these fluctuations and oscillations.

[18] See, for example, Göllinger/Gaschnig 2016b.

[19] For an introduction to basic technical phase models of the energy transition, cf. Göllinger/Gaschnig 2016a, and 2016b.

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