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The Incumbents' Conservation Strategies in the German Energy Regime as an Impediment to Re-Municipalization—An Analysis Guided by the Multi-Level Perspective

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Abstract: After two decades of privatization and outsourcing being the dominant trends across public services, an inclination towards founding new municipal power utilities can be observed. In this article, the authors examine the preservation strategies of the German energy regime following the transition approach developed by Geels. From the multi-level perspective, it can be stated that innovations take place in niches and have to overcome the obstacles and persistence of the conventional fossil–nuclear energy regime. Through an empirical analysis, it can be concluded that the established regime significantly delays the decentralization process required for a transformation of energy structures on local electricity grids. Furthermore, it is shown that municipal utilities (Stadtwerke) are important key actors for the German Energiewende (energy transition) as they function as local energy distributors and they meet a variety of requirements to promote fundamental structural change. The trend towards re-municipalization and the re-establishment of municipal utilities reveal the desire to further strengthen the scope of local politics.

Keywords: transition research; energy transition; re-municipalization; municipal utilities; local politics

1. Introduction

In recent years, the multi-level perspective of Geels (2002) has gained further importance in the framework of transition research [1]. Many projects have been presented, addressing structural changes in the German energy economy and in the role of municipal utilities; several papers regarding these issues have been published, showing a reflection of generic political and economic factors [2,3]. Against this background, this paper aims to show how these findings can be analyzed by the multi-level perspective. Here, the preservation strategies of the German energy regime are at the center of interest, as they present an obstacle for municipal energy transition. Re-municipalizations face strong resistance from private operators, who are using a variety of strategies to maintain their positions and to delay such local aspirations [4–7]. As an influential and powerful "triopoly" in the established energy sector, large energy corporations represent a collective market power and develop a strong preservation impact for the existing regime in different business areas. In this context, it is important to note that many local authorities strive for achieving greater municipal democracy and to reassert local state autonomy by pursuing an active re-municipalization strategy [5]. Re-municipalizations can

be divided into two types: Those driven by a "remunicipalization of the profits", and those that understand themselves as a movement for "citizen value" [8] (p. 16). Despite different interests and motives, re-municipalized utilities, alongside social and environmental justice, are a clear step away from the common market logic and business-focused value in the energy industry [5] (p. 87). Our approach—reflecting on the role of municipal utilities—is based on the assumption that, the municipal level holds strong importance in the implementing of the energy transition [2], since the largest untapped potentials for energy efficiency, the expansion of renewable energies as well as decentralized cogeneration of heat and power can overwhelmingly be realized in municipalities [9,10]. In that sense, also Ostrom argues that it is important to encourage, governance efforts to reduce the risks associated with the emission of greenhouse gases ([11] (p. 237); [12], (p. 550)). The term "polycentric governance" refers to the delegation of responsibility to diverse decision-making centers, which can relate to one another, as well as to central institutions or conflict resolution mechanisms [13]. In our opinion, services of general interest, and the provision of energy in particular, would benefit from stronger democratic legitimation, co-determination, and decentralized participation. Experiences over the last ten years show that a multitude of projects for the implementation of energy demand can flourish beyond the market and central state. Ostrom says: "Instead of a single best design that would have to cope with the wide variety of problems faced in different localities, a polycentric theory generates core principles that can be used in the design of effective local institutions, when used by informed and interested citizens and public officials" [14]. In other words, self-organization is the key, even if it is effectively not present in classical economic theory.

Polycentric governance, thus, recognizes the creative potential of non-governmental organizations, voluntary initiatives, and organizations outside the market. Furthermore, polycentric governance provides more incentives to support the commitment of these initiatives and organizations as an equally-necessary and beneficial part of the overall process of energy transition.

Numerous practical examples in Germany show that polycentric dynamics in the energy sector have rapidly gained importance. New institutional and innovative approaches such as regional energy networks, bioenergy villages, 100% renewable energy communities, newly-founded energy cooperatives, renewable energy plants with citizen funding, etc., demonstrate that spatially-separated autonomous developments, also called a transformative nucleus, can be used in niches to promote the ideas of energy transition in terms of content, as well as in terms of time. Within the framework of multidisciplinary cooperation, municipal utility companies can proactively integrate the different actors associated with the new institutional settings at the local levels in their corporate strategies, integrate them in terms of content, institutionally and culturally, and, thus, become the most important local driver of local energy transition. Multidisciplinarity here means, briefly, interdisciplinary assessment of practice issues with relevant actors [15]. In many parts of the local civil society, the establishment of municipal utility companies, as well as the re-communalization projects of local decision-makers are assessed positively, all the more, as municipalities are perceived as being "particularly close to civil society" [16].

National competence for the energy transition process remains at the federal level. It is, therefore, a governmental task to politically enable such fundamental change of the paradigm of the energy and industrial policy in the course of a polycentric governance [17]. An ambitious target to create appropriate framework conditions, and to balance the interests of energy policy among industry, politics, science, and civil society, between countries and municipalities, remains the task of the federal government. An offensive commitment by the federal government and the federal states to a polycentric understanding of governance is necessary, so that the decentralized policy model can be perceived as an integral part of energy transition.

Most studies exploring the conditions for the energy transition in local politics draw on theories from political science, but have not yet made use of the transition theory. Few examples incorporating transition-theoretical concepts into urban studies exist, such as Bulkeley et al. (2014) and Hodson and Marvin (2010) [18,19]. However, the existing scientific work has mostly addressed urban mobility,

transport, urban land use, and transport infrastructure so far (e.g., Næss, 2012) [20]. Our contribution is inspired by transition theory and deals with the incumbents' conservation strategies in the German energy regime preventing a sustainable energy transition.

2. Methods

Methodologically, a historical analysis of the developments in the energy economy will be conducted based on the multi-level perspective of Geels (2002) [1]. The relationships, actors, and framework conditions of the local distribution grid level for electricity and gas are at the center of this analysis. On the one hand, it is shown how pressure to change has affected the existing structures in recent decades. On the other hand, it is analyzed which methods the established regime has built in order to preserve existing power structures.

Using a multi-level model, the perspective separates transformative developments into technical niches, regimes, and landscapes. At the lower level, niche innovations possessing the potential to incentivize ground-breaking changes are taking place [21] (p. 400). The incumbent system is represented by the socio-technical regime at the second level, which is a network of established, dominant institutions and players, with regulative and normative capabilities to preserve the structures and routines of the conventional system [21] (p. 400). The third level is represented by the socio-technical landscape and contains exogenous factors that are difficult to influence, e.g., climate change and urbanization. However, rules and institutions, such as international law and the United Nations, also induce developments and exert pressure on the existing system [22] (p. 49).

MLP is an instrument to stress the interdependencies between the different levels. This method also implies that transformation to a sustainable economy is driven by changes in key sectors, such as the energy sector [22] (p. 45). In this sense, niche actors that early-on anticipate these development trends and use windows of opportunity are "pioneers of change" [15] (p. 10). Nevertheless, these pioneers do not necessarily become actors at the regime level, which is why transforming the energy system means more than enforcing niche innovations. In this paper, we illustrate—using the example of the German energy transition—that the resistance of the regime with its adaptation and preservation strategies should be more intently considered in transition research. Using MLP, the numerous influencing factors, as well as the complex interdependencies of various actors in German energy transition, can be illustrated in a structured way.

In the context of energy transition, with its elements of decentralization and the resulting shifts in politics and society, MLP, and also strategic niche management, have been criticized for not sufficiently addressing spatial issues, particularly in relation to the processes of transition at the regional or local levels [23]. Coenen et al. (2012) criticize the shortcomings in transition theory literature concerning how transitions take place in spatial contexts [24]. This is a particular limitation of the MLP model since the role of local action cannot be used synonymously with niches [25]. The local processes of institutional change in the energy sector are complex. They can sustain or hinder local energy transition, yet they are rarely analyzed. For this reason, there is a need to explore local energy transition processes in a more comprehensive way [23]. Our focus here is, therefore, not so much on spatial conditions, but, rather, on a regime analysis as the object of transition, substantiating a critique of the political economy. In particular, we take the diversity of actors and the different subsystems involved into account in order to have a better understanding of local energy transition processes and conservation strategies hindering these developments.

In the following section, the developments in the electricity market and its actors are analyzed from the point of view of MLP (Section 3). Subsequently, important basic relationships are presented, namely the importance of municipal energy transition, the role of municipal utilities as key actors of energy transition, and the meaning of polycentric governance in relation to the German energy transition (Section 4). In Section 5, the preservation strategies of the German energy regime are described in detail and considered in light of transition research, followed by a conclusion (Section 6).

3. Historical Analysis of Energy Market Developments from the Multi-Level Perspective

In order to demonstrate the latest structural change at the local distribution grid level for electricity and gas, MLP is applied [1]. It is a multi-level model to divide transformative developments into socio-technical landscapes, regimes, and niche innovations, and enhances the interdependent relationships between these levels. The so-called niche actors who anticipate these development trends and use windows of opportunities act as "pioneers of change" [15] (p. 10).

The regime of the local distribution grid level for electricity and gas is characterized by monopolistic structures, since the acquisition of a grid concession creates a natural regional monopoly. The present structure of local grid operation is dominated by three large energy corporations: E.ON Societas Europaea (SE), Innogy SE (the former Rheinisch-Westfälisches Elektrizitätswerk AG, RWE (Essen, Germany)), and Energie Baden-Württemberg AG (EnBW) (Karlsruhe, Germany). More than 50% of all local distribution grids for electricity and gas are under the ownership of these three companies [6]. One of the reasons for this development is the increasing concentration of energy supply after World War II. As safety of supply and favorable price conditions were the two leading principles, large power plants and stable distribution grids were developed. This was connected to a process of de-municipalization, in terms of local energy production. Between 1955 and 1971, the number of energy supply companies more than halved, from 3000 to 1378. Indeed, these developments mainly affected municipal utilities and local associations [26] (p. 186).

In terms of the niche innovations relevant to the developments in the energy sector, especially the anti-nuclear movement of the 1970s—which started with political resistance to the planned nuclear power plant in the German village of Wyhl am Kaiserstuhl—needs to be mentioned. With this early political awareness of the anti-nuclear movement, that nuclear power represents a high risk potential, proposals for an alternative energy future joined the discussion. One of the most famous is the study "The energy transition is possible" of the Freiburg Öko-Institute in 1985 [27]. The scientists called for a new energy policy for the municipalities, and proposed breaking up the monopolistic market power of large energy corporations by means of a nationwide re-municipalization strategy. Successful electricity grid takeovers of the past—which took place in Schönau, for example—and the foundation of civil energy associations, also need to be mentioned in terms of niche innovations. The third level of the MLP—namely the socio-technical landscape—is characterized by occurrences like the oil price crisis in the 1970s, the proceeding climate change, and natural catastrophes, such as nuclear accidents in Chernobyl and Fukushima. Further favorable processes like the expiration of many concessions (A concession is a contract under private law between a municipality, as the grantor of concessions, and an energy supply company, as the concessionaire. It enables the concessionaire to utilize public roads, streets and spaces for the operation of the distribution grid. In principal, the duration is not to exceed 20 years in Germany, and has to be awarded again after the expiration date.) for electricity and gas, between 2010 and 2016, and the energy program of the German government, also belong to this level.

In Figure 1, the most important actors, occurrences, regulations, and relationships are presented on a timeline. Here, the structural change in the energy sector, and the local distribution grid level for electricity and gas, are shown in time slots for five decades. It is reasonable to assume that events related to the socio-technical landscape continuously act upon the regime. Niche innovations have also exerted strong pressure on the regime in recent decades. The pressure on the socio-technical regime made it increasingly unstable, but also led to the emergence of preservation strategies to maintain the power.

On the one hand, a wide range of measures have been developed, which considerably expands the knowledge on the energy transition requirements and potential regime alignment, such as the design of climate protection concepts at municipal and federal level. Inter alia, these concepts include energy and CO_2-accounting analyses, the identification of CO_2-emission reduction potentials, participatory action plans with policy recommendations, (rough) calculations of regional added value, forecasts of expected costs for investment and energy, a concept for a controlling system in the implementation

phase, and guidelines for dissemination activities. On the other hand, the incumbent concessionaires of the distribution grids for electricity and gas have developed diverse methods and strategies in order to preserve their market power, as will be shown in Section 5.

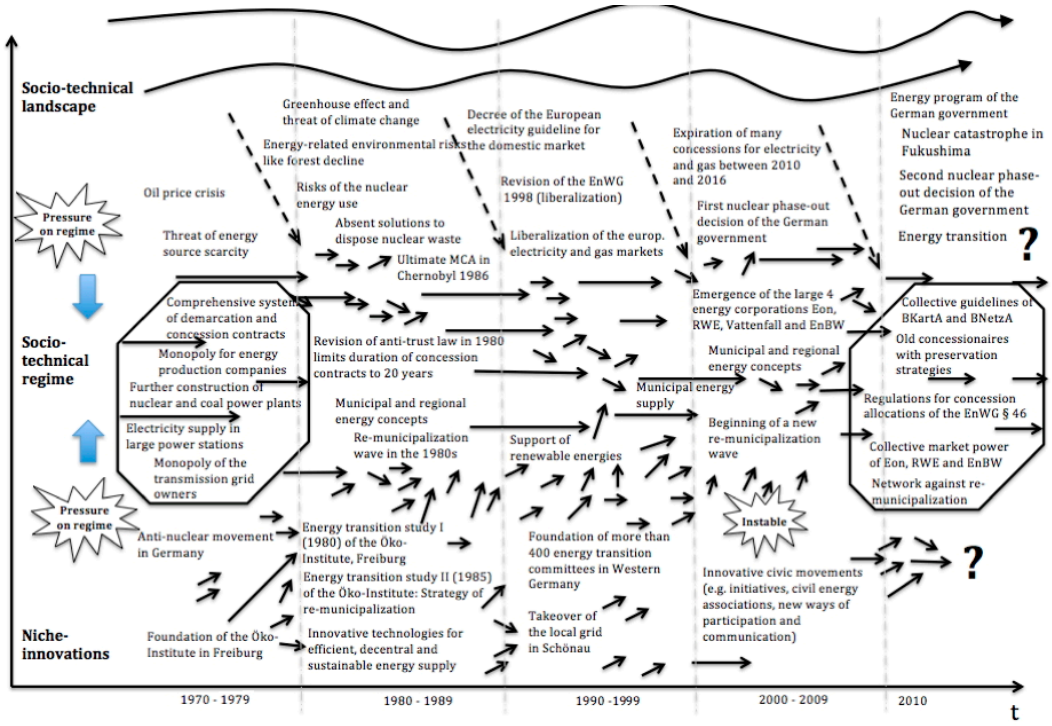

Figure 1. Structural change in the energy sector and the local distribution grid for electricity and gas, presented through the multi-level perspective according to Geels. Depiction based on Geels (2002) [1].

4. Municipal Utilities as Key Actors of Energy Transition and an Important Component of Polycentric Governance

Climate change has been acknowledged as an important societal challenge by many local authorities. Therefore, climate change policy and local climate actions have gained increasing significance. The reasons for this development can be found in numerous targets and decisions at the national and international levels, as well as in the reporting of the media based on these developments. Furthermore, the incident in Fukushima, and the decision of the German government to phase out nuclear energy, have resulted in a broad political orientation towards energy transition and climate protection. Although decisions at the national and international levels are important, ambitious targets for climate protection cannot be achieved without committed municipalities. Crucial key actors in the implementation of a municipal energy transition are municipal utilities (Stadtwerke). They enable communities to exploit renewable energies and the decentralized, on site cogeneration of heat and power, as well as the building of an infrastructure aligned with climate protection objectives [10]. Furthermore, municipal utilities contribute to the improvement of local added value, the creation of jobs, and the democratization of energy supply because they are closer to the local citizens and clients with respect to their competence in solving problems, directly, on site [10,28].

The services provided by municipal companies are crucial for societal and economic development for several reasons [29]: They contribute to climate protection policies at the local level by leveraging synergies with other sectors such as mobility, waste and water, and mobilize endogenous potentials on site regarding renewable energies, cogeneration of heat and power, and energy efficiency linked to local production processes and services. Furthermore, they may restrict the expansion of oligopolistic structures and reduce the market-dominant positions of large energy corporations. To achieve

a sustainable and comprehensive quality assurance of energy supply, decentralization is often seen as an outstanding guiding principle and the expansion of decentralized energy infrastructure is a vital foundation. In addition, the federal system of Germany offers significant opportunities to develop social and institutional innovations for energy transition in rural regions ([28] (p. 6); [29] (p. 48)). The principal of decentralization and the expansion of renewable energies offer alternative perspectives for the future, including the opportunity to combine tradition and progress [16] (p. 11).

To achieve a successful statewide energy transition, the autonomous opportunities to act from the German states ("Bundesländer"), regions, and municipalities have to be included by polycentric governance. This means the delegation of responsibility to many centers of decision-making, which can relate to each other, or to central institutions or mechanisms of conflict resolution [13]. Especially, public and private services of vital significance like energy require democratic participation and decentralized co-creation. Accordingly, polycentric governance acknowledges that the creative potential of non-governmental organizations, voluntary initiatives, and other non-economic organizations, offer more incentives, and support their commitment as a necessary and conducive part of the whole energy transition process. Municipal utilities are able to involve these actors at the local level in a pro-active manner, and integrate them in terms of content, institutions, and culture, which make them an important local driver of energy transition. In polycentric governance, the national responsibility of processes remains a task of the federal state. Therefore, it is the government's responsibility to guide the partly-radical change of patterns in energy and industrial policies [17] (p. 2). Ambitious targets, appropriate framework conditions, as well as the settlement of antagonistic interests in terms of energy policy, among the various actors in energy industry, politics, science and civil society, federal states ("Bundesländer"), and municipalities will be a task for the government. An affirmation of the polycentric governance principle, by both the government and the states, is necessary for this decentralized policy model to be perceived as an integral part of energy transition.

Previous work undertaken by the authors has uncovered benefits of re-municipalization [30]. The investigation of newly-established public utilities indicates that most municipalities do not want the incumbents to be involved in their municipal energy companies via corporate investments [28] (p. 16).

Figure 2 highlights that most of the new companies are mainly or completely in possession of the municipalities. When it comes to joint ventures, other public utilities nearby are often involved and are also preferred as partners. The motives for this vary, but, usually, it is about the know-how of the partners, dissatisfaction with the incumbents' energy policy, improvement of inter-municipal collaboration, and horizontal partnerships [28].

For a sustainable and comprehensive quality assurance in energy supply, decentralization can be a guiding principle. In addition, the federal system in Germany offers many opportunities to develop social and institutional innovations for energy transition at the municipal level [31,32]. Constitutionally-guaranteed municipal self-administration is the basis for an active local energy policy [33]. In the sense of this principle of local provisioning, municipal utility companies, with their decentralized structures, are particularly important actors. If the socially and politically desired energy transition is to be successful, the framework must allow municipal utility to cope economically with these tasks in a competitive environment. Thus, the energy supply of the future will increasingly be determined by decentralized technologies (such as wind, solar, cogeneration of heat and power), which make it possible to economically tap the local energy efficiency potentials; to very efficiently convert energy carriers into heat and/or electricity; to use local capabilities for renewable energies to flexibly react to the fluctuating feed-in of renewable energies, thus, making a greater contribution to CO_2 reduction and climate protection. The principle of decentralization and the development and promotion of renewable energies offer good prospects and the chance to combine tradition with progress, especially in rural regions [16].

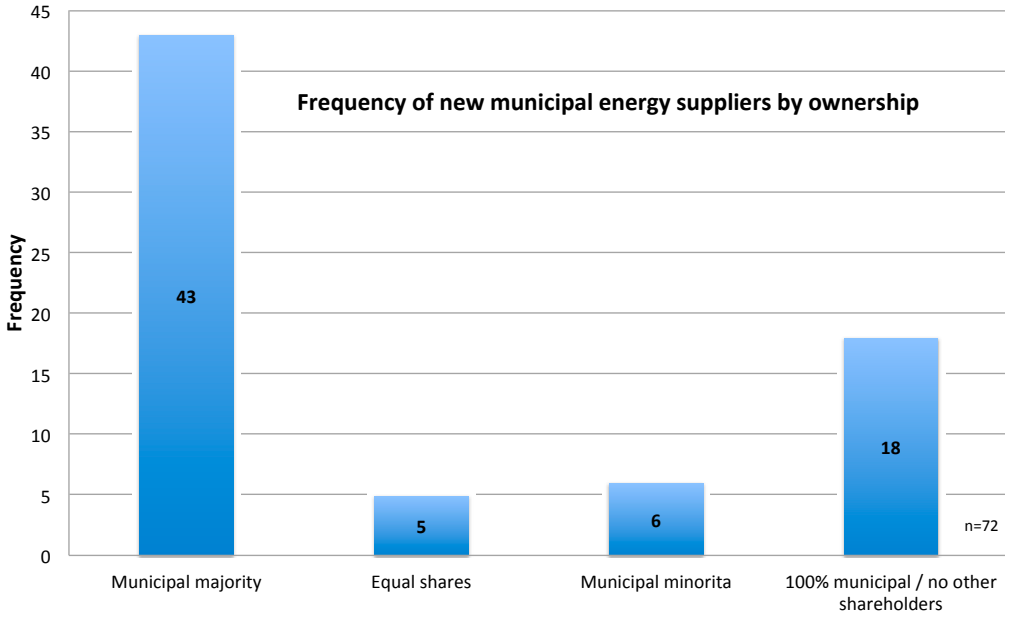

Figure 2. Structure of shareholders of newly-established public utilities [28].

5. Preservation Strategies of the Energy Regime at the Local Distribution Grid Level from the Multi-Level Perspective

There are reasons to doubt the notion that the regime is able to adapt proactively to changing external conditions and requirements in terms of energy transition [34]. Indeed, large energy corporations in Germany and Europe have positioned themselves against the overarching political consensus for a necessary energy transition, ignored important technological and institutional niche innovations, impeded actors in various ways, and downright missed out the adaptation measures needed [35] (p. 265). In this context, the electricity sector is a good example of a particularly stable regime [36] (p. 72). The regime was carried by an "outbalanced system of interests [...] that has been solidified by diverse contracts between regional monopolists, the involvement of political actors and little influence of consumers" for more than 50 years [15]. Moreover, political actors and large industrial customers—which could push the regime to act in a more environmentally-friendly way—are also deeply involved in these structures through memberships in boards of directors or equity investments [36] (p. 73).

In the context of transition research, four regime elements can be identified that unfold a strong preservation impact for the existing monopolistic structures in the energy sector [7,11,37]:

First, a "triopoly", comprising E.ON, RWE, and EnBW, dominates the business of distribution grids for electricity and gas by owning more than 50% of all concessions. Due to their know-how and their long-term ownership of more than 10,000 distribution grid concessions, they are superior to cities and municipalities when it comes to the allocation of new concessions. Moreover, these allocations are encouraged by the "triopoly" with incentives, such as sponsoring [6]. Thus, the regime succeeds in defending the dominant structures, cultures, conventions and routines, and preserves its power [22] (p. 48).

Second, these corporations know diverse methods to hamper the intentions of re-municipalizations [6]. For example, they claim excessive grid prices from new concessionaires, refuse to provide relevant data about the grid, refuse the handover of grids, and warn against the loss of jobs in the municipality. Thus, they create an asymmetric competition forcing most of the municipalities to ultimately leave the concessions to the "triopoly".

Third, the legal regulations for the allocation process of concessions create unfair competition, because Art. 46 and Art. 48 of the energy industry law (EnWG) contain regulations that strengthen

the market position of the incumbent regime. For example, the regulation to determine grid price in Art. 46 provides that an "appropriate compensation" has to be paid in the case of overtaking a grid. This vaguely-formulated regulation often leads to juridical contestations due to the old concessionaire claiming a much higher compensation as being appropriate, compared with the new concessionaire. Furthermore, Art. 48 enables the old concessionaire to stop the payment of concession duties after one year in the case of extending allocation processes. The current regulation of EnWG is particularly restrictive, only allowing the allocation of concessions under the application of strict selection criteria, defined in Art. 1. This makes it difficult for municipal utilities to award a concession contract in a manner that satisfies the courts' requirements. Even though the situation has somewhat improved over the last few years the requirements for a legitimate process are still very high and the demands on local authorities are far too complex to be fulfilled by mostly honorary local politicians [4].

Fourth, an influential network is working against re-municipalizations and municipal interests to regain local grids by using methods of "agenda setting" and "spin doctoring". For example, the incumbents state that re-municipalizations are related to a "dissipation and fragmentation" of the German distribution grid landscape and lead to inefficiencies [38,39]. Moreover, studies and assessments are commissioned to prove that re-municipalizations represent large financial risks for cities and municipalities [40]. Important networkers in this context include the Federal Cartel Office, the Federal Network Agency, the Monopoly Commission, the Federation of German Industry, many local chambers of Industry and Commerce, and the "New Social Market Economy" (INSM) initiative.

The multi-level model in Figure 3 analyzes the recent transition paths in the context of preservation strategies on the local distribution grid level for electricity and gas. Therefore, the regime faces a strong pressure to change, from both endogenous factors of the landscape (e.g., international climate change negotiations) and the socio-technical niche innovations (e.g., new foundations of municipal utilities). In terms of the latter, a study from the Wuppertal Institute showed that more than 70 municipal utilities were founded between 2005 and 2012 [28]. This is mainly due to the high number of expiring concessions in the electricity sector from 2010 to 2016, as mentioned in Section 3. Another danger for the regime is represented by new market actors in the supply of green electricity, such as Lichtblick, Naturstrom, and Greenpeace Energy.

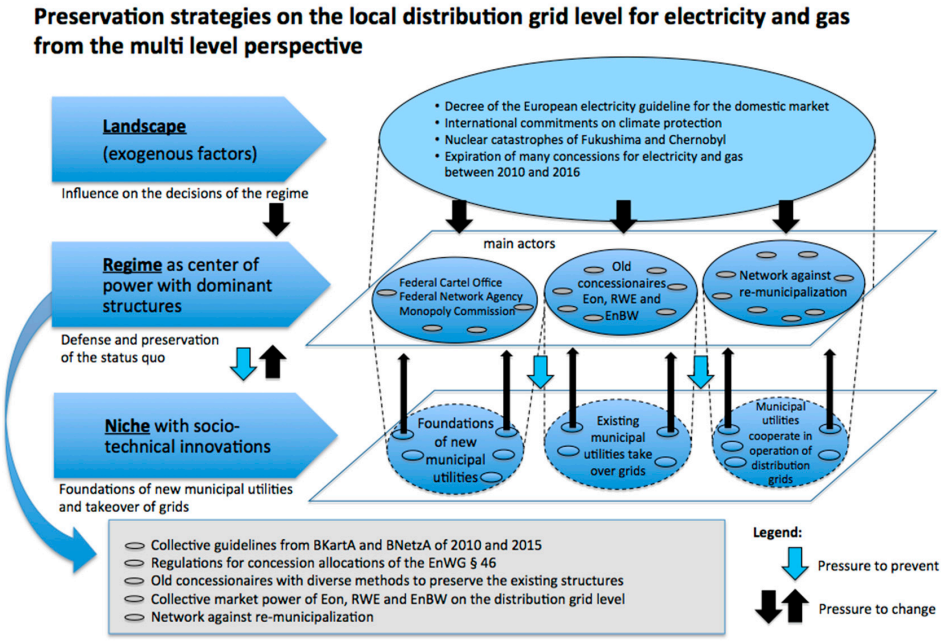

Figure 3. Multi-level model to illustrate the preservation strategies at the distribution grid level. Depiction based on Geels (2002) [1].

This pressure can result in changes in the regime, by former niche actors becoming a part of the new regime structure, as argued by Strunz (2014) [41]. However, these processes of change are very diverse and also trigger reverse movements aiming at preserving the status quo. At present, it is not possible to state when this process of change will be completed, nor which actors will be the central part of a new regime. Nonetheless, evidence exists suggesting that an empowerment of decentralized actors could happen, because the degrees of centralization, service orientation, and interaction are the three dimensions at stake within these processes of change [36] (p. 102). Since established companies are very powerful, it is by no means certain that adaptable, decentralized, and service-oriented municipal utilities will be the winners of the German energy transition.

By contrast, large distribution grid operators are unable to adapt quickly enough, as they are not sufficiently experienced with the necessary changes. Additionally, they still operate old business models and are overcharged with the complex task of transformation. On the other hand, large energy corporations have recognized the end of the nuclear age and are beginning to change their business strategies [41] (p. 154). For example, E.ON has developed a strategy to separate the fossil–nuclear energies into a new company, named "Uniper" (Düsseldorf, Germany). RWE has also decided to bundle its business areas of renewable energies, grids and distribution in a new subsidiary called "innogy SE" (Essen, Germany), which addresses the requirements of a modern, decarbonized, and digital energy world, while the "bad assets"—in particular coal-fired and nuclear power plants—remain with RWE. Whether these late realizations are sufficient to maintain the influential structures of the regime will depend on the degree of centralization of future energy infrastructure [35] (p. 264). One cannot speak of a regime change yet, since a shift in power relations, away from the incumbent actors and market logics, has not arised; rather, the structural adjustments are primarily aimed at maintaining the market position of the economically powerful.

6. Conclusions

This paper shows that the obstructive factors of the preserving regime elements, in the context of the local distribution grid level, are diverse. The three large energy corporations still dominate the distribution grid market, but already face a highly-dynamic development of municipal utility foundations, re-municipalizations, and energy transition activities from civil society. Decentral niche innovations represent important elements for the energy transition process. Together, they are able to break up the established structures of the regime, push the necessary departure from central systems, and support a sustainable energy supply. Future energy supply will have to rely on decentralization, democratization, efficiency, energy services, renewable energies, and the decentralized cogeneration of heat and power. However, the capability of the existing regime to preserve current structures is not to be underestimated, as the regime actors slow down innovative developments and necessary change processes. Therefore, with its capability to resist and its preserving strategies, the fossil–nuclear regime represents a very large impediment for the transformation of energy supply [42] (p. 16).

As shown, it is not just necessary to promote niche innovations to reach the goals of German energy transition; rather, there is also a need to destabilize the existing fossil–nuclear energy regime. In their case study about the British coal industry, Turnheim and Geels highlighted that pressures in the economic environment were direct causes of the full destabilization. Socio-political pressures acted as mediating factors "that shaped the vulnerability of the industry to economic pressures" [43] (p. 1765). Future studies could analyze the destabilization of the German energy regime, analogous to Turnheim and Geels, by describing the interactions between the following three processes [43] (p. 1764):

(1) The accumulation of external pressures on industries
(2) Increasing performance problems (financial or legitimacy)
(3) Weakening of the commitment of energy actors to established industry regimes

Such an approach would allow for a better understanding of the transformation process by taking into account the changes and interactions in the socio-technical regime. In the socio-political

environment, stronger crucial pressures have to be exerted by government policies to support the destabilization of the existing fossil–nuclear energy regime. As a first step, subsidies for fossil fuels have to be progressively reduced to start a fossil fuel phase-out, including a decommissioning of the operating fossil fuel-fired power plants.

To summarize, it can be stated that the self-preservation character of the socio-technical regime requires external actors to break up the existing structures, as the current system is not forcing its own transformation from the inside [44] (p. 321). For this purpose, a socio-political commitment for a confrontation to established energy corporations is essential [42] (p. 16). Although the developments and approaches at the local distribution grid level are raising hopes, it should not be forgotten that a legal framework needs to support these niche innovations much better in the future.

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