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The Influential Mechanisms of Power Actor Groups on Policy Mix Adoption: Lessons Learned from Feed-In Tariffs in the Renewable Energy Transition in Iran and Germany

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Abstract: The Energy transition is fiercely competitive. The incumbents of fossil-based energy are in conflict with the advocate coalitions of transition in energy policy changes. Such changes do not occur as sudden punctuation via an external shock, but rather incrementally and over time, by incorporating power insights such as lobbies, coalitions, and campaigns. This article provides a framework grounded in theoretical power theories and draws additional insights from policy mix studies. It investigates how focusing events and feedback loops shape the coalition of interest groups in policymaking through implementations of power mechanisms. Our framework is tested through two different power stories of energy transition in Iran and Germany. Our findings reveal that the centrally planned economy of Iran leaves society with a negligible or passive role in the energy transition. The passive role of society in the energy transition is mainly caused by subsidizing energy. In addition, the financial and economic crisis resulting from other macro-economic challenges, such as sanctions, may exacerbate the minor involvement of civil society in the slow expansion of renewables in Iran. By contrast, as a robust economy with a corporatist tradition, Germany has made a strong advocacy coalition of energy transition that resulted in political incentives for substantial renewable energy deployment. Regarding the theoretical question of the power dynamics in divergent countries' energy transitions, the proposed framework based on the interest group coalitions and power mechanism offers an understanding of the social character of energy transitions.

Keywords: actor groups; advocacy coalition; energy transition; feed-in tariffs; Germany; Iran; policy mix; power mechanisms

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1. Introduction

After the Paris agreement at the end of 2015, by acknowledging the reduction of greenhouse gas emissions, the energy transition has become urgent in all countries. Energy transitions are defined as structural changes in energy generation, distribution, and consumption. While transitions are inherently complex, uncertain, and difficult to govern, there is a wide-ranging agreement that various policy instruments are needed to foster such transitions [1]. A mix of social and policy responses to stimulate sustainable transition goes beyond a single policy domain and needs comprehensive changes in innovation and market policies [2]. Some critical requirements for better response to these policies are experimental, adaptive, and multi-scale changes, for which policies play a crucial role [3].

A historically dominated top-down energy system is not appropriate in response to these complexities. These energy systems are more on the influence of powerful energy

incumbent actors and changes of governments which cannot provide appropriate solutions for emerging challenges of transition. To better deal with the concerns of the multifaceted nature of sustainability transition, widespread support from community-based supporters and political advocacy networks are required to challenge the expertise of the conventional energy system [4,5].

Power actor groups of energy transition actively attempt to influence governments' policy development and implementation. Through individual and collective actions, interest groups make practical ways to build potential changes under the influence of lobbying groups, coalitions, accessibility to authorities, and campaigns. Renewable energy advocacy prepare the ground for political conflicts and reversing or contributing reactive consequences to transform the direction of policies that advance the cause of the nascent communities of energy transition [4,6].

On the contrary, power actor groups of incumbent energy system make an effort to reduce the policy support of transition through reversing or eliminating changes necessary for the transition progress. Due to influential actors' potential with conflicting interests in the decision-making process and policy adaption, analyzing the dynamics of power impact is a crucial feature of sustainability transition studies [3,4,7].

In environmental policy studies, scholars are beginning to highlight how decentralizing energy transitions are reshaping political power structures and policy outcomes [4] or how civil society exercises power in transitions concerning other actors [7]. In transition literature, power is defined as means which accelerate shifting innovations and technologies from a niche level (protected spaces for innovation) to a regime level (collections of institutions developed around particular social and technological practices) among the pressures from the landscape level (the cultural, geographic, and demographic variables within which regimes operate) [4].

While it is evident that all governance structures involve uneven power dynamics, different scholars only conceptualize and define power relations in transition studies. They have not been integrated into explaining the power mechanisms on policy mix adoption. In this regard, significant gaps in explaining power dynamics, analyzing the role of power, mainly influencing the policy mix development and policy experimentation, have remained [3,4,8]. Several questions are left open, including:

(1) How can event factors, contextual conditions, and various resources shape different modes of power?
(2) What are the mechanisms of contributing power actors on policy mix changes or adoption?
(3) How would the positive or negative policy feedback of current policies make conscious efforts of power actors?

This article provides a framework grounded in power theories in the resource, nature, and manifestation of power and draws additional insights from policy mix studies to address the above questions. This approach is helpful in the empirical application of political power and structuring power analysis across comparative cases. Therefore, two different power stories of the energy transition in two different countries are analyzed: The first country is Iran, being at its first stage of the energy transition. The second country is Germany, a leading country in the energy transition. The Islamic Republic of Iran is the second-largest country in the Middle East. In 2019, Iran's population was about 82.8 million with a GDP of 440 billion US$ and CO_2 emission of about 579.6 Mt [9]. The Federal Republic of Germany is a European country with over 83.08 million inhabitants in 2019 with a GDP of 3.861 trillion US$ and CO_2 emission of about 659.1 Mt [10,11].

Fundamental economic and technological differences in Iran and Germany are apparent. Nevertheless, the argument for selecting these two cases is their similarities in the energy transition policy through Feed-in-Tariff (FiT) abstraction, but their differences in policy implementation. This research aims to study the sustainable transition from a power perspective by implementing this framework. It examines the impact of power as a function of how actors apply in pursuit of consequence policy outcomes in different

energy transitions. This perspective will help illuminate the main reasons for the diverging development paths in Iran and Germany from the political power perspective and its complex articulations.

In addition to secondary data from scientific literature, position papers, and press release by important actors, primary data is collected by conducting 11 expert interviews (six in Iran and five in Germany). The interviewees included representatives from various stakeholders from ministries, NGOs, business associations, private industries, and think tanks. Interviews were recorded and transcribed, and the finalized transcripts were coded in ATLAS.ti [12]. For the sake of transparency and simplicity, the interview parts in Sections 3 and 4 are presented in a separate paragraph.

These interviews offered essential insights into the power struggles over the energy transition in both countries. The interviews were supported by a set of guidelines and aimed to identify the strategic actions of different stakeholders in their struggle over domination in Iran's and Germany's energy politics. Furthermore, the interview data were triangulated with primary and secondary sources to ensure their reliability. The focus of this paper lies in the developments until 2020. Also, the paper only analyzes the shift to renewable energies in the electricity sector and focuses on the renewables' share in total electricity consumption.

The rest of the article is structured as follows: a brief overview of the theoretical framework is presented in the next section. In the Sections 3 and 4, energy transition in Germany and Iran, respectively, are explained. Section 5 compares and discusses economic and power factors in the energy transition in Germany and Iran. Section 6 concludes the paper.

2. Framework for Influential Mechanisms of Power Actor Groups on Policy Mix in the Energy Transition

The approach presented in this section focuses on power and its relation to policy development. An improved understanding of power in the policymaking of energy systems can clarify power imbalances and conflicts of interest. It diagnoses asymmetry of law enforcement, the inconsistency of financial resources, and probable resistance to sustainability goals. It can explain how the risk of policy implementations will redistribute to vulnerable populations and inhibit or reinforce a government's capacity to act under different types of power mobilization [3].

The central focus of this framework is the analysis of manifestations of power and the ways and mechanisms which influence the process of policy mix development in the progress of energy transition. The framework combines relevant insights from a theoretical perspective in power and policy mix to provide novel insights into whether and how power mechanisms influence the decision-making process of the policy mix in the energy system [4].

These insights provide essential guides for analysts and policymakers in the pursuit of three objectives:

(a) Exploring events, contextual factors, and the nature of power and resources, leading to power manifestations.
(b) Explaining the ways or mechanisms through which the power manifestations lead to the policy mix.
(c) Exploring the policy outcomes and occurring policy feedbacks.

2.1. Initiation of Policy Changes

Some reasons for changing policy mixes on sustainable transition may be generated through feedback from existing policy exercises, contextual factors, and focusing events. During implementing a policy, the public assesses outcomes of the policies on how they will impact their real world. Previous policies' positive or negative feedback can influence the formation of coalitions supporting or opposing policies aimed at energy transition.

These coalitions may evolve along with the policies they initially supported or may form to oppose existing policies [13].

The initiation of policy changes is also strongly connected to contextual factors. Some obvious contextual factors affecting changes to sustainability transition are economic structures, national technological infrastructures, and political institutions [14]. Based on the configuration of political, institutional, and economic structures, levels of support around new coalitions of interest can mobilize to accelerate changes [13]. Focusing events may be a driver for enhancing or prohibiting existing policy effects. More precisely, when awareness of a problem in existing policies rises, the public makes a press for policy changes by political and economic forces. In light of such awareness, mobilization will initiate through broad coalitions of interest groups, political parties, or social movements [8].

2.2. Actor Groups and Power

The second component of this framework addresses the role of actors in policy changes. Much of the existing literature on energy transition have ambiguity in categorizing actors. The most common agreement on an actor's definition in such literature is the requirement for diverse actors that have a substantial influence on leading policy transition [15].

As an actual process of the energy transition, policy changes provide conflicts of interest, where different actors struggle to dominate their specific goals [5]. While in the literature of transition studies, researchers conceptualize the relations of actors (incumbent and niches) and power (as a general meaning of control over resources) to influence policy outcomes [16], the dynamics of influential measures done by interested actors remains understudied [7,17,18].

This research applies the advocacy coalition framework (ACF) to examine the dynamics of linkages and coalitions of like-minded actors who affect policymaking processes to fill this gap. Based on this view, various actors with shared beliefs and values aggregate and shape an advocacy coalition [18,19]. Such advocacy coalitions—spanning interests from industry, private firms, civil societies, and public organizations—influence rulemaking when collective actions align with shared actors' incentives and organizational capacities [20].

In terms of power definition, there is also a lack of clarification in the energy transition studies. In its most basic definition, studies implicitly or explicitly define power as a capacity of social groups or actors with conflicting goals and interests to mobilize resources to attain their targets and interests [3,7]. Power is defined as the capacity of different actors that influence policies' goals, processes, and outcomes. The degree of influencing power actors largely depends on mobilizing different resources, including human, mental, monetary, artefactual, or natural resources; for example, some actors may exercise economic power, while others may exercise ideological or geo-political power [3,7].

Nevertheless, power in transition studies goes beyond solely competencies and capacities of agents and includes processes by which different actors trigger institutional transformation [21]. Consequently, three main features emerge from studies that focus on power in transition. First, the typology of power exercise is the central feature of existing power studies in the transition. This strand of studies aimed to define different types of power integrated with different levels of association (agents, structures, and systems), considered a vertical typology of power. However, besides the vertical approach of power, a horizontal understanding of power is required to analyze who exercises relational power and how embedded power in a particular group of actors is configured across different actors [22]. Different power relations make different modes of power capacity, including "power over", "power within", and "power with" [23]. Moreover, each type of power relation can have various manifestations, ranging from mutual dependence, one-sided dependence, and independence to cooperation, competition, and coexistence [7].

The second strand of power studies focuses on the nature of power and proposes a distinction between reinforcive, innovative, and transformative ones. Reinforcive power is defined as the ability of actors to reproduce existing structures, while innovative power

captures the capacity of actors to create new resources. Transformative power develops new structures and institutions [24].

The third strand points to how power can operate in policy processes. Firstly, power dimensions in such mechanisms are instrumental, highlighting who wins in policy contests. Secondly, they are structural, considering the specific political and economic characteristics that establish power in a given context. Moreover, thirdly, they are discursive, which is concerned with the logic of dominant values, norms, and ideals in a given context and how they align with decision-makers and other influential actors [25].

However, a power concept must go beyond analyzing its nature, empowering agents, and typologies in the energy transition context. Power analysis in the energy transition should importantly explain the mechanisms that lead to the transformation of policy mixes or adoption through many interest groups associated with initial resources and capacities. In this regard, the framework in this paper employs three dimensions based on the work by Brisbois (2019) [4] to organize the mechanisms by which power can operate (see Table 1). See Brisbois (2019) [4] for more details, including sample indicators of power dimension. The three power dimensions have inherent overlap, and they can make meaningful categories that break the power down for a better analysis.

Table 1. Three power dimension mechanisms on policy change.

Power Dimension	Influential Mechanisms
Instrumental power	• Actors influence outcomes by coercion, manipulation, lobbies, and resource imbalances.
Structural power	• Actors position based on inclusion, exclusion, and coalition, or • Structural justification of market structure, political and electoral system, or • Actors influence on relevant information, knowledge rule, and agenda-setting/problem-framing.
Discursive power	• Actors influence on the policy process through competing political discourses and discursive tools.

2.3. Policy Mix in the Energy Transition

Policy mix in an energy system combines several instruments and processes by which the instruments emerge and interact. Interaction is the central focus of the policy mix definition and reflects the policy mix's dynamic nature, which evolves and incrementally develops over the years [26]. However, this definition solely goes beyond its own interactive and dynamic nature and typically is impacted by the struggles of different interest groups.

Their degree of unity, the resources they can capture, and the appropriateness of their strategies can enhance the power of coalitions. Then they lead to changes in government rules, industry policies, and social norms and beliefs [27]. Thereby, such changes are reflected in how policymakers design policy mixes in the playing field of advocates or opponents [5].

This paper discusses how actors receive support from the government and influence political decision-making. Such mechanisms build on lobby within the association, contacting influential decision-makers, public campaigns, organizing political events, offering technical solutions, and winning over dual or uncommitted actors [6,27]. Figure 1 organizes the above explanations of influential mechanisms of actor groups on a policy mix in the energy transition.

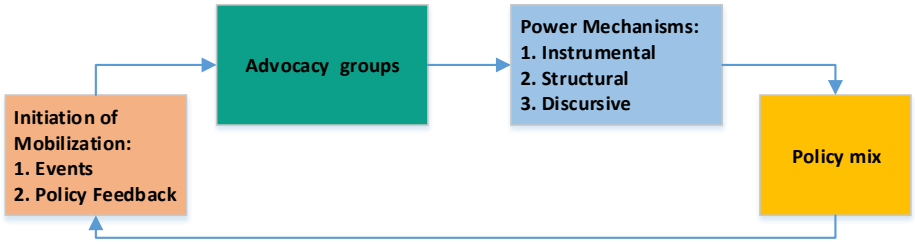

Figure 1. Influential mechanisms of power actor groups on a policy mix in the energy transition.

3. Dynamics of Power Actors' Influences on Germany's Energy Transition

3.1. The 1970–1990 Episode

In September 1973, shortly before the first oil price crisis, the first steps towards Energiewende (energy transition) took place in the Federal Republic of Germany. The reactor catastrophe of Chernobyl also drove attention to renewable energies. This event directly influenced the decreasing use of nuclear power in Germany. Also, after the wake of the second oil crisis, the term "Energiewende" appeared in the scientific literature on the future of the energy supply in Germany [28].

3.1.1. Ecological Movements and the Foundation of Green Capital Associations

The primary involvement of civil society in Germany emerged from the ecological movement in the 1970s. These movements paved the way for the phase-out of nuclear energy and the development of renewable energies [29].

There were very early movements, ranging from environmental private people to researchers and engineers who worked for privately funded research institutes. Research institutions also developed an alternative picture of fossil fuel for the future (Interview 4).

In the 1980s, the social-liberal Federal Government presented a comprehensive energy program that included goal orientation for all energy resources. In this program, the importance of nuclear energy was emphasized for reducing the further expansion of mineral oil [28]. Although the Green party, represented in the Bundestag since 1983, asked for the immediate shut down of all nuclear facilities, after the Chernobyl disaster, the situation changed dramatically [28].

In 1986, after the Chernobyl incident, social democrats shifted over to anti-nuclear, while before that (the Chernobyl incident), there was only the green party, the young party, which was anti-nuclear. In addition, within conservative parties, some more involved people were skeptical or against nuclear after the Chernobyl incident (Interview 5).

Within two years, the share of nuclear opponents rose to over 70%, while approval declined to 10%, and all nuclear power plants in Germany should be closed within ten years [30].

And this (the Chernobyl incident) led to a situation that alternatives suddenly became interesting. And when the wall came down and unification happened, there was a clear chance for upgrading power station sectors in both countries (East and West Germany) (Interview 5).

The government supported the development of wind and solar power through research and development funding and later by demonstration of the construction of wind turbines [8]. Parallel to the development and growth of the renewables sector, green capital associations like the BEE (Bundesverband Erneuerbare Energien), BWE (Bundesverband Windenergie), or BSW (Bundesverband Solarwirtschaft) were founded in the 1980s and 1990s [29].

3.1.2. Policy Mix: Initiation of Feed-In Law

In 1990, as a Parliament initiative in the form of the Stromeinspeisungsgesetz (StrEG), the Feed-in Law for electricity from renewable energy sources was implemented in Germany. According to this law, utilities must buy generated electricity from renewable energy providers, with 90% of the retail rate for wind and solar electricity and 75% for biomass

and hydropower [8]. Figure 2 organizes the above explanations of influential mechanisms of power actor groups on the energy transition of Germany in 1970–1990.

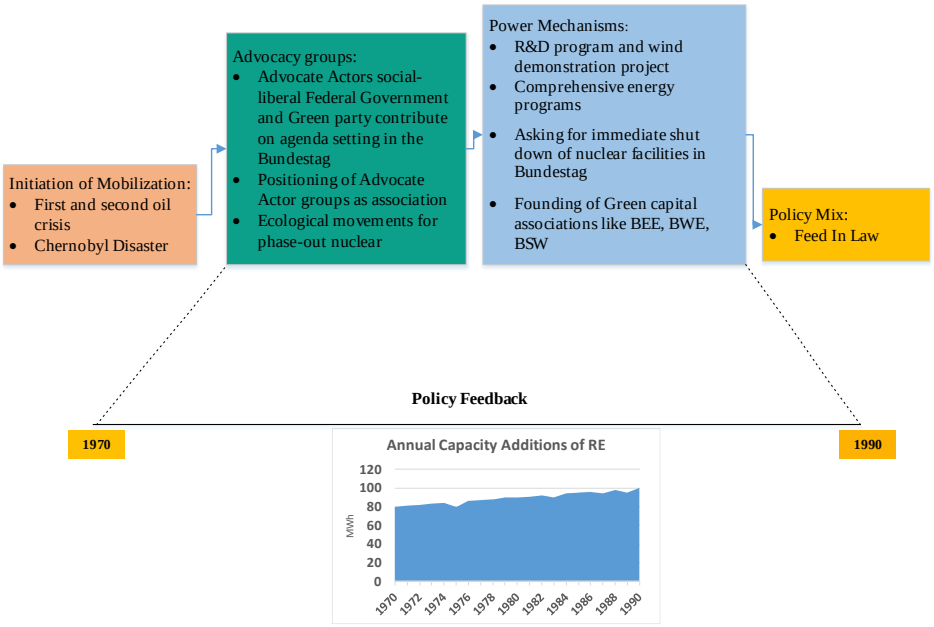

Figure 2. Influential mechanisms of power actor groups on the energy transition of Germany in 1970–1990 (data from https://www.bmwi.de/Redaktion/EN/Textsammlungen/Energy/working-group-renewable-energy-statistics.html, last accessed 26 March 2022).

3.2. The 1990–2000 Episode

In the 1990s, the European Commission introduced a new directive for electricity market liberalization. This directive considered FiT as a market distortion and led to a draft law in 1997, which aimed to cap payments and reduce tariff rates only to wind power sectors. However, the commission backed away from effects to reduce feed-in law rates, and in 2001, it adopted a directive focused on renewable energy target achievement [31].

3.2.1. Mobilization of Opponents of Feed-In Law

In 1990, private electricity utilities underestimated the potential impact of the new law, and after seven years, renewable energy rapidly grew from 55 megawatts to 2089 megawatts, aided by the payments guaranteed by law. This increased cost due to the wind power boom directly impacted the utilities and their customers. These large privately owned utilities became more concerned about the impact of the FiT on losing their market share to independent power producers [8].

When the parliament adopted the feed-in law, the second chamber and Laender were in favor of similar support for small-scale combined heated power plants. Before that (the feed-in law), wind turbines were a hobby and not regarded as a business. However, this changed about the middle of the 90s , and a boom for credits for wind turbines was created. Then, the utilities became aware that more than five percent of electricity was generated by wind turbines or renewables. Then, utilities tried to stop the feed-in law based on the European codes, but they failed (Interview 5).

Renewables did not align with the monopoly of the utilities' business model, which benefited from a supply contract with the municipalities. Also, Grid-Feed-In Law, which obliged utilities to buy electricity from renewable sources, offered no financial and legal incentives for them [32]. In 1997, mobilization of oppositions was created by increasing problem awareness of feed-in law.

The conservative side in Bavaria (Christians Socialists' Union) was very against the feed-in law. They were advocates of small hydropower plants that were also the main

concern of utilities. Because of introducing feed-in law, there was no money for reparation and maintenance of combined hydropower plants. Therefore, they had to shut down their hydropower plants (Interview 5).

The oppositions of feed-in law encompassed three main actors in large utilities, energy-intensive industry, and officials in the Economics Ministry, which has the responsibility for the energy. At that time, this ministry was supported by a major business association and was close to carbon companies (Interview 3).

In the social democrat parties, there was an inside fraction of coal advocates who wanted to save the coal industry in mining. They were in opposition to the feed-in law at that time and were able to stop other people who were proponents of such a feed-in law in the social democrat party in the parliament (Interview 5).

However, their efforts failed to influence the reduction of the feed-in Law rate and the resistance of the leading ministry of economics, with the initiative forces for this law failed [33].

3.2.2. Campaigning and Coalition of Advocate Groups of Feed-In Law

The core of the advocates' coalition consisted of associations in renewable energy and environmental organizations. In a crucial move, four to five thousand people in September 1997 participated in an organized demonstration in Bonn. They included turbine and solar energy suppliers, the German farmer associations, environmental and religious organizations. Under pressure from this broad advocacy coalition, Bundestag deputies backed away from the government's measure for reducing FiT [8].

In the northern part of Germany, the feed-in law was prepared by the Christian Democrat and two Green Party members who favored renewables in general (Interview 5).

The Green Party made coalition negotiations with the SPD, resulting in the first red-green coalition in 1998. The reason for this alliance was the close ties of Social Democrat Parties to trade associations, including miners, and its ability to break oppositions from the coal interests by introducing new FiT in favor of mine gas [32].

3.2.3. Policy Mix: Renewable Energy Source Act

In 2000, the German red-green Federal Government replaced the Grid Feed-In Law with the Renewable Energy Sources Act (EEG 2000) in spite of resistance from the BMWi (Federal Ministry of Economy) [34]).

RE Act was written in detail and precisely. Because the people in the German parliament realized that they have to define everything, not to give any discretionary to the ministry—otherwise, the ministry would reduce the discretionary charges to inhibit the deployment of further renewables (Interview 3).

The law guaranteed priority FiT for renewable energies and a fixed remuneration for each kilowatt-hour produced [35]. The EEG provided a FiT for renewables and mine gas from coal mines. The 2000 law significantly increased payments for solar photovoltaics, from about 8.5 to 51 cents/kilowatt-hour (kWh) [8], and the EEG tariffs differentiated between technologies depending on the energy source, capacity, and/or location of the plant [8,32].

The target set by EEG was to increase the share of electricity generated from renewable sources from 5 to 10 percent by 2010. According to an agreement over 20 years, producers would get a fixed rate of return from the initiation of a project to achieve this target. Although the concept of gradually annual reduction rates was introduced, due to technological development and decreasing production cost [36]. Besides, after 20 months of negotiations, the red-green government agreed on the prohibition of construction of new nuclear power plants and reprocessing of nuclear fuel [28].

3.2.4. Policy Feedback

The effort by renewable energy opponents to reduce or eliminate this policy support failed in 1997, and a noticeable amount of wind power (around 1700 MW) by the late 1990s

was installed. Grid Feed-in law encouraged the shaping of small, decentralized energy generation involving citizen initiatives and individuals (Interview 3).

Citizen initiatives and individuals benefited from personal decentralized small energy generation, creating jobs and boosting tax income [32]. The remarkable results of this system led towards reforming and expanding the Renewable Energy Sources Act by 2000. It intended to sustain the boom in the wind energy sector while at the same time providing stimulus for the use of biomass, solar, and geothermal energy [37]. Figure 3 organizes the above explanations of influential mechanisms of power actor groups on the energy transition of Germany in 1990–2000.

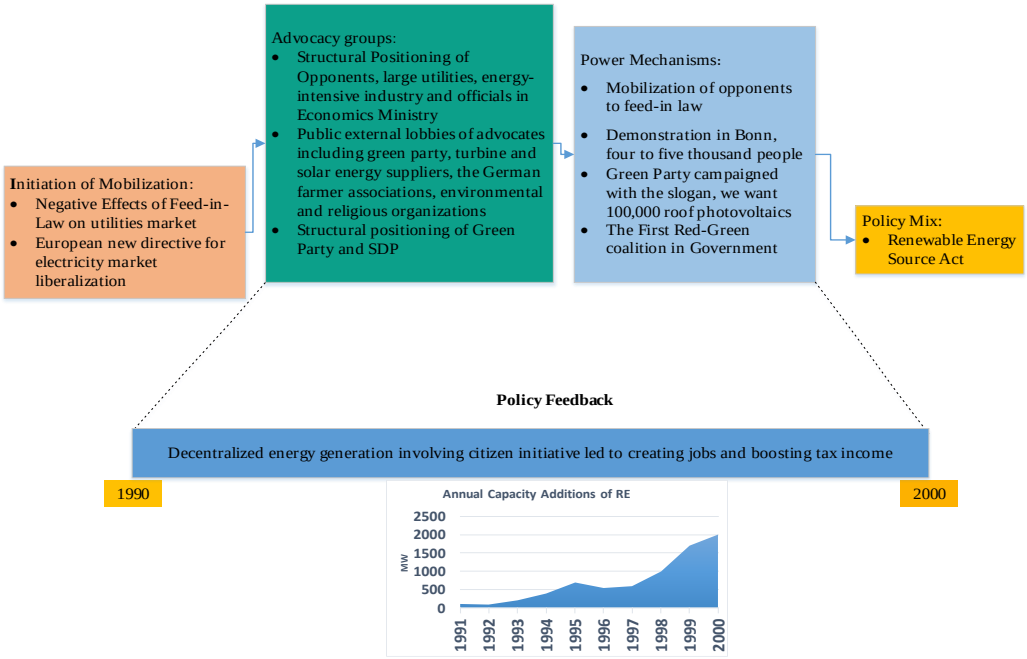

Figure 3. Influential mechanisms of power actor groups on the energy transition of Germany in 1990–2000 (data from https://www.bmwi.de/Redaktion/EN/Textsammlungen/Energy/working-group-renewable-energy-statistics.html, last accessed 26 March 2022).

3.3. The 2000–2010 Episode

In 1998, a dramatic reduction in companies occurred in the German electricity industry. These changes aligned with the revision of the EU Energy Industry Act, which adopted the energy market directive. Several energy companies at various power, gas, and supply levels merged and resulted in the Big Four companies: E.ON, RWE, EnBW, and Vattenfall. While new and independent firms took advantage of FiT, the Big four companies paid less attention to investment in renewables because of the meager return rate. They find it more profitable to invest in coal and nuclear [38].

3.3.1. Skepticism towards Energiewende

During the implementation of EEG, some concerns were created about excessive burdens for the industry, increasing electricity prices, and imposing higher costs on consumers [39].

FiT created enormous market momentum that caused the costs to explode, visible in the households' and industries' electricity bill (Interview 2).

Then, the industry said it was very expensive for them and started to negotiate for surcharge exemptions (Interview 3).

The industrial interest groups and power suppliers wanted exemptions for industrial consumers to support German firms in the global market. Accordingly, following an

initiative from BMWi, the Bundestag (Germany federal parliament) decided that the energy-intensive industry would be exempted from the EEG surcharge [32]. Nevertheless, criticism of the EEG arose continually among utility companies, the Minister of Economics, and the Free Democrat Party. They disagreed with the FiT and argued that the rates were too high and that the EEG broke market rules [40].

Some large companies did not let the newcomers in this field, and they tried to counteract any renewable energy law (Interview 4).

3.3.2. Grand Coalition of Advocates of Renewable Development

After introducing EEG in 2000, the government delegated responsibility for the EEG to BMU (Federal Ministry of Environment). Traditionally, this ministry has had a greater affinity with renewable energies [30]. This transfer brought greater awareness of renewable energy in the German governmental association and strengthened the support for the FiT [32].

For the federal election of 2005, an election campaign was formed with all parties, including CDU (Christian Democratic Union of Germany), SDP (Social Democrat Party of Germany), Grüne (The Greens), FDP (Free Democrat Party), and Linke (The Left). These campaigns called renewable energy as part of the country's energy mix but opposed nuclear energy phase-out and the current mechanisms of supporting renewable energy (Interview 1).

After the election, SPD and CDU made a grand coalition under Angela Merkel as the chancellor, with Sigmar Gabriel as the Minister of Environment [32].

3.3.3. Policy Mix: EEG Amendment and Energy Policy Summit Discussions

An amended version of the EEG was introduced on the first of August 2004. A differentiated tariff structure according to better match the economic viabilities of the technologies was introduced, and tariffs for biomass, photovoltaics, and geothermal energy were increased. Federal Chancellor Angela Merkel convened the first energy policy summit in April 2006. The second summit discussion between the Federal Government and energy industry representatives took place in October 2006, and the third meeting was held in July 2007 [28].

3.3.4. Policy Feedback

In 2004, during the economic crisis, the electricity demand decreased, and the financial situation of the big four companies began to deteriorate. The electricity generation for these companies reduced from 90% in 2004 to 77% in 2010 [32]. The revision of EEG in 2000 led to the increased tariffs for PV and a solar boom in 2004.

"There was a solar boom in 2004. And, this was the time that we still have the red-green government on the federal level. They opposed wind and renewables in the other parts of the renewable sector but not about solar. And, this was the time that solar energy in Germany jumped. Germany went from nobody to a leading country in the world, at least at this time period" (Interview 5).

The number of FiTs peaked in 2010, and the market effects of EEG became clearer. With the phase-out of eight reactors, the big-four utilities faced a crisis [30,32]. While these movements to shut down the nuclear power plants pushed for renewable energy deployment, the movements impeded long-term decarbonization targets by removing one of the essential climate change mitigation instruments (nuclear energy) [41].

Figure 4 organizes the above explanations of influential mechanisms of power actor groups on the energy transition of Germany in 2000–2010.

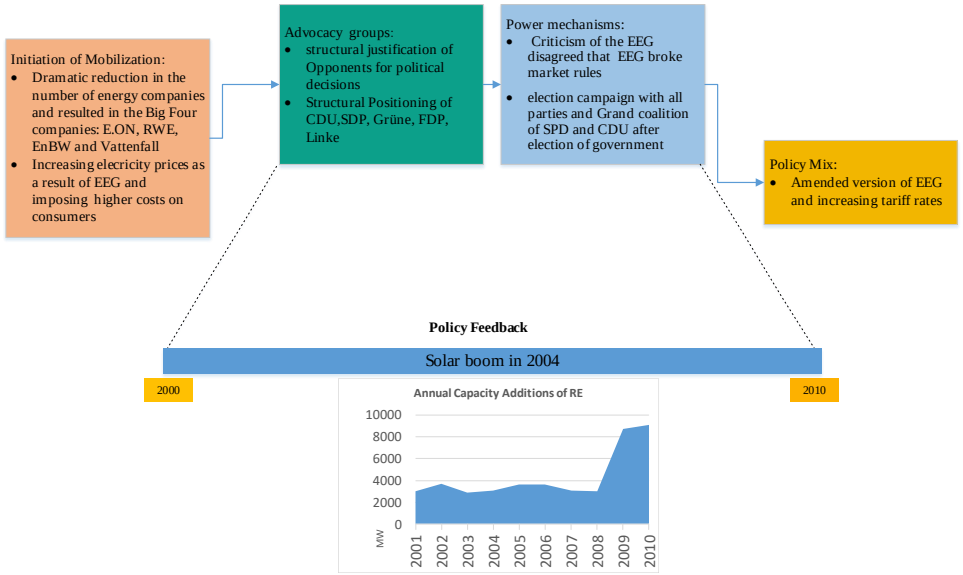

Figure 4. Influential mechanisms of power actor groups on the energy transition of Germany in 2000–2010 (data from https://www.bmwi.de/Redaktion/EN/Textsammlungen/Energy/working-group-renewable-energy-statistics.html, last accessed 26 March 2022).

3.4. The 2010–2014 Episode

The Bundestag election in September 2009 resulted in a shift from the Grand coalition to the Conservative-liberal coalition. Since the FDP was one of the long-term opponents of renewables and now gained control of the BMWi, they had more opportunity to push for the cut of FiT (Interview 1).

Meanwhile, the disaster in Fukushima in March 2011 promoted a broad anti-nuclear consensus in Germany and strengthened commitment to renewable energy by Chancellor Merkel. Almost all social groups, churches, government, and opposition parties, agreed on the call for an "exit as soon as possible" [8,34].

3.4.1. Campaign and Lobbies to Stop EEG

In 2012, Germany had a CDU/CSU-FDP government that was generally favorable to cutbacks in renewable energy supports. Liberal FDP was really hard and did not agree with subsidies for carbon emission reduction (Interview 2).

However, the September 2013 Bundestag elections led to forming a grand coalition between the CDU and SDP. This change in government might lead to a decline in opposition to the cost issues, which was a crucial topic in the federal election campaign in September 2013 and prevented further cuts to renewable energy supports [8]. In the new government, all the responsibilities of renewable energy were transferred to the Ministry of Economics [32].

However, after this shifting, the emphasis on costs increased. The head of BMWi, shifted from supporting renewable energies to opposing them by joining the Christian Democrats in the amendment of the Renewable Energy Act 2014 [37].

"Sigmar Gabriel was the environment minister and was working for renewable energy during the financial crises of 2008 and 2009. He was supportive and, in that duration, was an advocate. Then he became the minister of economics in a semi-huge ministry. I found that this ministry is very difficult to fund because it expands a wide range of economic questions, and people also were discussing whether Germany needed an energy ministry" (Interview 4).

In its beginning, RES was a "harmless" niche technology that seemed to deserve very generous support. A combination of guaranteed tariffs and prioritization of FiTs in most federals made proper support for the niche of renewables. Hence, their expenses impact could no longer be neglected. Nonetheless, a debate was started on expensive EEG and

its threat to the competitiveness of the German industry. During the 2012–2014 period, household costs, driven by large electricity utilities, gained a focus from certain interest groups and governing political parties. The surcharge rose from 2.1 cents/kWh in 2010 to 3.6 cents in 2012, 5.3 cents in 2013, and 6.2 cents in 2014 [8].

In October 2012 and October 2013, the electricity utilities announced that increases in the surcharge forced them to raise prices for their customers and social welfare associations (including the Social Association VdK and the Parittischen Gesamtverband). The electricity utilities argued that the costs of households from FiT were high, especially for low-income households [7].

The EEG has been turned from supporting the instruments into blocking the instruments. The EEG surcharge was very expensive. All kinds of costs related to the exemption of industries' surcharges were supposed to cover by households (Interview 1).

"The question was how you refinance the feed-in tariffs by surcharge, and of course, that was a very regressive tool. Because for poor households, the electricity bill was a more disposable share of their income than for rich households. So that was so-called "energy poverty" in Germany" (Interview 4).

"On the other hand, there were the fossil fuel lobby organizations, which partly became organizations of the energy industry. There were large companies at this part, very strong, very powerful, with a lot of money and a lot of influence. They successfully ran several campaigns against RE surcharges and trained it as very expensive and socially unfair that only the rich would profit and the poor must pay for it. One of the most successful lobbying organizations were the Intentive Freie Neue Social Market (InSM). And, from the other side, there are the organizations supporting free markets, who run campaigns posed in the cities at newspapers and journals, and they were paid by the coal industry against renewables" (Interview 1).

However, when these associations raised their voices on the cost issue, they remained supportive of the energy transition. They made many proposals to distribute renewable energy costs evenly through, for example, tax financing of some of the costs [8]. Also, a public campaign of "Stop EEG, make the Energiewende" was conducted by New Social Market Economy in 2012 and 2013. This campaign aimed to slow down the energy transition and integrate renewables into the market [35].

3.4.2. Advocacy Coalition for Decentralization of RE Development

While CDU/CSU-FDP government was generally interested in cutbacks in support of renewable energy, the politicians from the Green Party, Environment Minister, and Linke (left-oriented party) advocated decentralization of renewable energy production and criticized direct marketing [32].

So it was about alignment and realignment of environmental and commercial interest. It became clear that the commercial companies had a commercial interest that made a profit. Certainly, the association of wind energy producers was fully represented of environmental interest. I think it was a strong alignment, the alignment between this commercial side and political side of stakeholders with the environmental objectives (Interview 3).

The Social Democrats, renewable energy associations, and Federal Environment Agency (UBA) largely defended the FiT against its critics [8,32].

Some coalitions in favor of RE industries were established among some branded powerful organizations in 2010 and 2014 (Interview 2).

Around ten years ago, like from 2009 to 2011 or 2012, there was a great campaign by German NGOs to prevent the building of new coal power stations. It was successful and prevented companies from building coal power plants. At least 10 or 12 coal power plants actually were not built because of that—an outstanding success (Interview 1).

3.4.3. Policy Mix: Amendment of FiT

The Conservative-Liberal parliament under Chancellor Merkel in the 2010–2011 period passed three laws: the 2010 Photovoltaic Act, the 2011 Photovoltaic Interim Act, and the

2012 Renewable Energy Act. The first two photovoltaic Acts considered the rapid cost reduction of solar production due to global technological changes and adopted an energy concept aiming at over 80% RE supply by 2050 [30,42]. The 2012 Renewable energy Act sought to advance the dynamic expansion of renewable electricity generation while adhering to the principles of a feed-in system. In this scheme, the intention was to align electricity prices with the market. The plant operators were responsible for marketing electricity in the market, while, in the prior FiT scheme, operators of the transmission network managed to sell the electricity on the market [32].

When the conservative-liberal government came into the office to prolong the running times of nuclear plants, they calculated how much revenue was meant for the utilities, and then they wanted to track about half of the extra revenues for the fund for renewable transition. This decision created an extreme revival of anti-nuclear movements in Germany among very young people and those who had been already active since the Chernobyl incident. So, they built a broad range of the population against nuclear power plants. Also, all parties in governments were against the nuclear plant for the first time. The first amendment of nuclear came into force on the first of January, and two months later, the Fukushima incident happened. Then, the seven oldest nuclear plants were shut down immediately. After that, the parliament, government, and the Laender decided on a new amendment, which was really the end of nuclear (Interview 5).

Following the Fukushima disaster, Chancellor Merkel announced a temporary shutdown of the nuclear extension plan. The German Federal Government, the Bundestag, and the Bundesrat (German Federal Council) prolonged the Energiewende. The Bundestag voted to shut down eight nuclear power plants and phase out the remaining nine by 2022 at the latest [43].

3.4.4. Policy Feedback

The market shares of private utilities decreased around 6 percent from 2010 until 2013, and the total electricity generated of the four utilities decreased by 16 percent. In contrast, the renewables market share increased by 25.8 percent in 2014, increasing competition in the power market [32].

After the decision to shut down nuclear power plants, the support of renewables was getting more and more attention. Evidently, in the last years, feed-in law had been a very good instrument for the start of the renewable industry (Interview 5).

This growth was accompanied by a surge in electricity and heat generation from renewable sources and simultaneously two challenges: the first was a lack of grid infrastructure for transferring electricity from Germany's northern states to the southern states, where there was a demand for more energy [5]. The latter was the side effect of the takeover of solar energy, which was resulted in the reduction of technological innovation of solar panels. While China became the largest producer of solar panels by 2012 (around 70 percent of global production), Germany's solar industry collapsed due to the entrance of Chinese firms in this sector. While Chinese producers gained more experience in making solar panels, the technology produced by Chinese firms was not changed compared to five decades ago [29,41].

Figure 5 organizes the above explanations of influential mechanisms of power actor groups on the energy transition of Germany in 2010–2014.

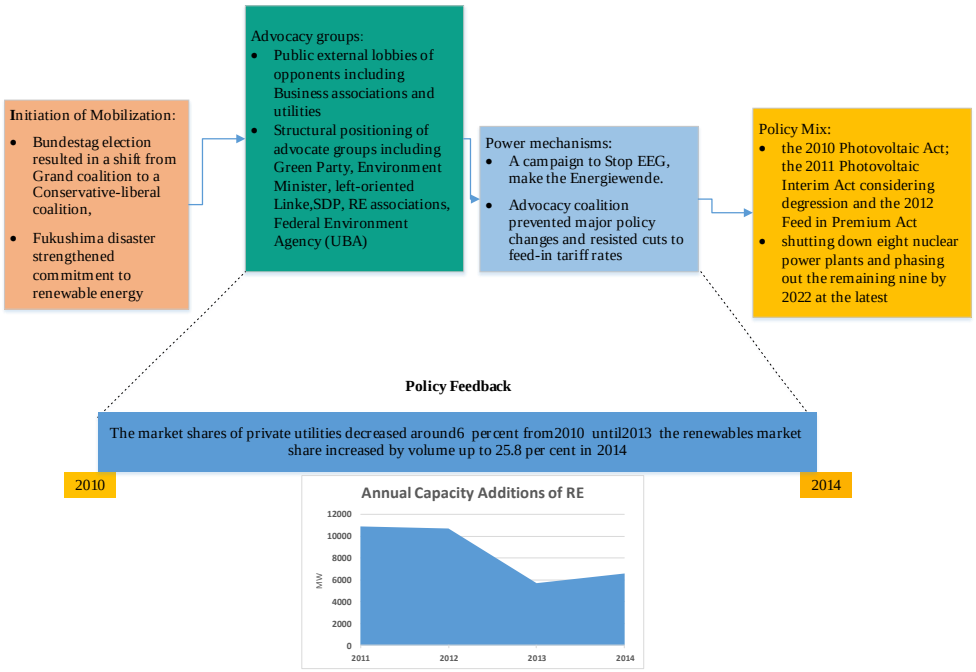

Figure 5. Influential mechanisms of power actor groups on the energy transition of Germany in 2010–2014 (data from https://www.bmwi.de/Redaktion/EN/Textsammlungen/Energy/working-group-renewable-energy-statistics.html, last accessed 26 March 2022).

3.5. The 2014–2017 Episode

As negative feedback on surcharges increased, the CDU and FDP criticized overly generous payments to renewable energy producers and called for reductions in FiT rates and caps on expansion. The FDP, with the collaboration of the Economics Minister, made the household electricity prices an excuse for reducing the level of supportive renewable energy development policies and pressured for more market-oriented policies. This mobilization drove through utilities, governing parties, and politicians and caused news and media to cover the issue of household costs [8].

3.5.1. Weak Position of RE Advocates in front of Surcharges

The Social Democrats and Greens mostly opposed caps on wind and solar and argued that the increase in electricity price is rooted in industrial exemptions. They suggested the redistribution of renewable energy surcharge from household to industry. Despite such support of FiT, the growth of the opponents in household cost explained why SPD shifted in position after the September 2013 Bundestag election. Most Social Democrat politicians were advocates of the FiT policy during the campaign, but after the election, the results made little sense for keeping this approach [8]. Nevertheless, the leader of Social Democrats repeated concerns about the warnings of rising electricity prices and thereby called for renewable energy producers to market forces [44].

3.5.2. Policy Mix: Flexible Cap

After the EEG amendments in 2012 and under the Grand Coalition between CDU, CSU, and SPD in 2014, incentives for cutting back on energy transition increased by turning away from guaranteed FiT [28]. The coalition agreement introduced measures to control the development of renewable energy. A quantitative target for the yearly installed capacity of each renewable energy technology, a so-called "flexible cap", was introduced into the act.

If a target were met during a given year, the FiTs for that technology would be reduced. The more the targets were exceeded, the more the incentives would decrease [37]. In

2014, the renewable Energy Act demanded that the renewable energy installation be based on auctions rather than the FiT system from the beginning of 2017. The auction system provided the payments, which were set by the highest winning bidder rather than FiTs were set by parliament [32].

3.5.3. Policy Feedback

German government followed up its intentions to test tendering procedures in practice. The first auctions were held in 2015 to test the applicability of auctioning for determining support levels. In a pilot program, auctions were used for ground-mounted photovoltaics in 2015 and 2016 [35].

The first auction was decided before 2014. The small installation had more difficulty being awarded in processes. The other issue debated about was the cap or limit of auctioning before 2014 (Interview 2).

Figure 6 organizes the above explanations of Influential mechanisms of power actor groups on the energy transition of Germany in 2014–2017.

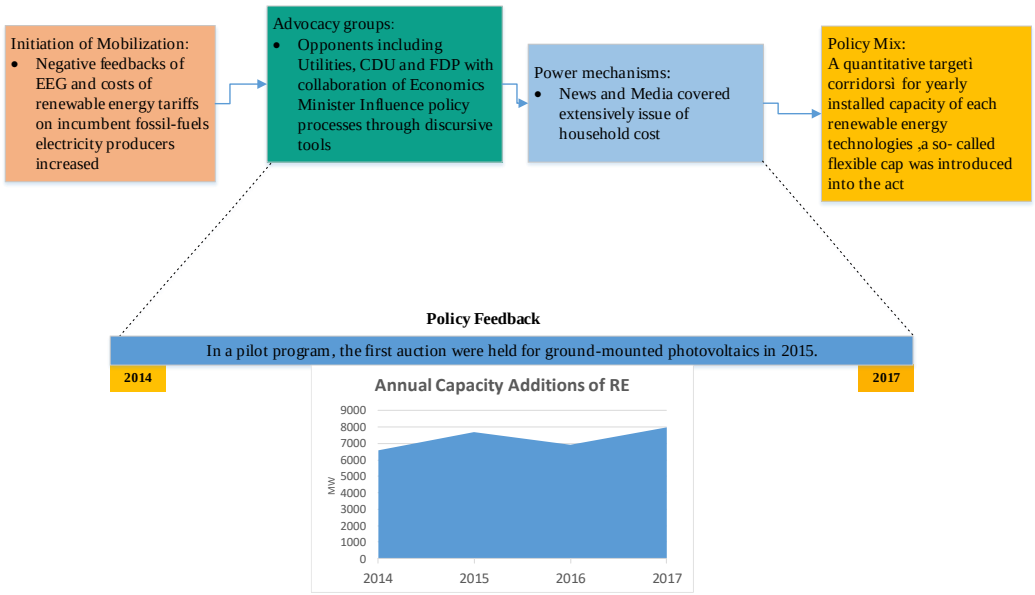

Figure 6. Influential mechanisms of power actor groups on the energy transition of Germany in 2014–2017 (data from https://www.bmwi.de/Redaktion/EN/Textsammlungen/Energy/working-group-renewable-energy-statistics.html, last accessed 26 March 2022).

3.6. The 2017–2020 Episode

The 2017 Renewable Energy Sources Act introduced a paradigm shift toward competitive funding rates, leading to substantially more cost-efficient development of renewable energies. Germany has multiple goals for the implementation of the energy turnaround:

1. Cost-effective annual quantitative steering
2. Actor diversity to bring renewable energies closer to the market
3. Supporting development extension for renewable technologies (wind onshore and offshore, photovoltaics and biomass)

Since the first of January 2017, the level of funding has been determined by auctioning [28]. The replacement of fixed FiTs by a technology-specific and volume-based auction system introduced by the German Bundestag, not by a regulator, represents a fundamental change in the funding regime of the EEG [33]. The fulfillment of cost-efficient power supply and diversity of power producers helped to gain acceptance for the large-

scale transformation with high transition costs and new technologies emerging all over the landscape.

3.6.1. Opponents of the Auction Process

Opponents of tenders via auction had worries about the cooperation of local populations in the energy transition. The main concerns were that a few people benefited from the tendering system, and the resistance to wind turbines and solar facilities grew. The evidence showed that total investment in ground-mounted PV facilities has reduced since the shift to tenders. Opponents argued that tenders make sense only for large-scale projects to bring about cost efficiency for large plants, while FiT must be maintained as a promoting mechanism for small and medium-sized projects up to 40 MW. Also, through tenders, transnational corporations would be benefited rather than local companies, and as a result, tenders would lead to negative attitudes towards the energy transition development [45].

3.6.2. Policy Mix: Auction System

Since 2017, the government has brought the auction system into law, tailored for each technology (photovoltaics, onshore wind, offshore wind, and biomass). Small renewables installations of under 750-kilowatt (kW) capacity (in the case of biomass, under 150 kW) continued to receive FiTs. This exception resulted in more motivation for developers and citizen cooperatives to operate small projects of renewables plants. This exemption was also for small citizen energy projects [46].

There was a ceiling for the installation of PVs and for any renewables except for geothermal GEO. But the ceiling was obviously blocked for the private investors because they need some time for the bank loans and finances. And, they (private investors) did not know the ceiling was fulfilled by the kind of their particular sustained power plants on their rooftops. Then, they would not get any money, and so then they took the risk (Interview 4).

3.6.3. Policy Feedback

Citizens' energy companies were almost the significant segments awarded by the first tender rounds in 2017. According to observations, due to the advantages of citizen energy exemption, some professional investors applied under cover of citizens' firms. In 2019, two rounds of tenders were submitted, and totally, the level of competition was lower than before. In the first round in January, only 499 megawatts from a total volume of 700 megawatts were awarded. In the second round of May 2019, from 650 MW tender amounts, only 270 megawatts were covered to install wind turbines. The expansion of wind energy was dramatically declined because of unsolved challenges in the market and tendering process and the citizens' protest against wind energy. Furthermore, high penalties in the case of failed implementation were another important reason for lower cooperation in the tender process [47].

"In the last five years, the indicators showed what was really installed and generated within last five years (2015–2020). So what often mentioned in the literature was that the price auction was going down. But, there was no guarantee it was very well operated, so this is a different question" (Interview 5).

"In wind energy, there were auctions, which looked quite successful but not in the scales of big farms because somehow they (investors) are not familiar with the details" (Interview 4).

Figure 7 organizes the above explanations of influential mechanisms of power actor groups on the energy transition of Germany in 2017–2020.

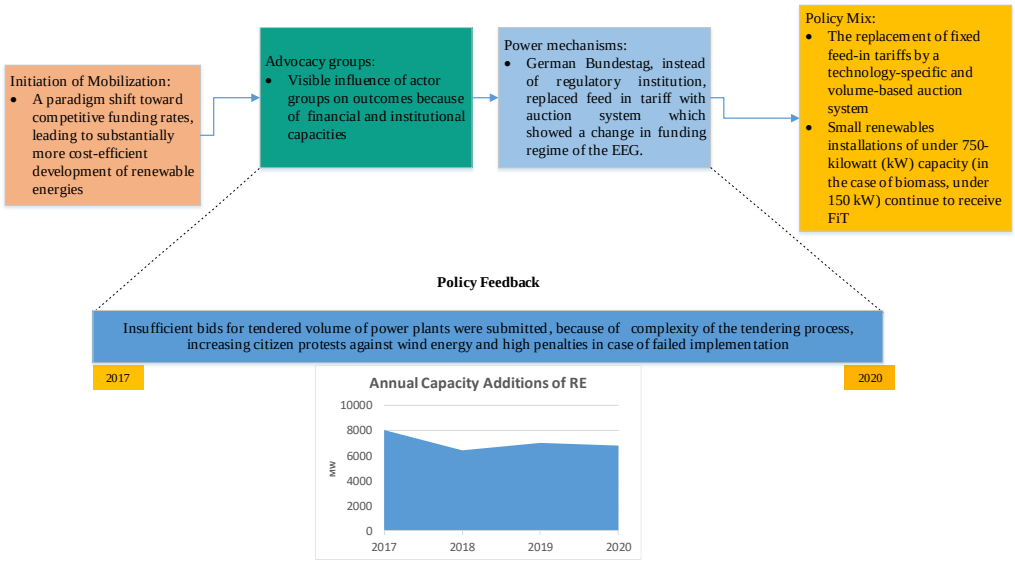

Figure 7. Influential mechanisms of power actor groups on the energy transition of Germany in 2017–2020 (data from https://www.bmwi.de/Redaktion/EN/Textsammlungen/Energy/working-group-renewable-energy-statistics.html, last accessed 26 March 2022).

4. Dynamics of Power Actors Influences on Iran's Energy Transition

Iran is in a hot and dry geographical area with long summer with 300 sunny days in more than two-thirds of its area [48].

The economy of Iran is more characterized by oil and gas production, agriculture, and services [49]. Fossil-based energy sources, particularly oil and natural gas, have been the major contributing fuels for the power sector in Iran. While Iran has committed to the Kyoto Protocol, it has a vision to implement a low-carbon economy and reduce GHG emissions by submitting Intended Nationally Determined Contributions (INDCs) shortly before the Paris Conference of Parties (COP21) was published [50]. The INDC contains unconditional and conditional reduction pledges of 4% and 12%, respectively. The unconditional pledge was versus international financial and technical support [51]. Akın-Olçum et al. (2021) indicate that fossil fuel exporter regions such as the Middle East may experience the greatest GDP loss if the Paris agreement is implemented by 2030 (the Middle East will lose about 3.1% of GDP) [52]. Khabbazan and von Hirschhausen (2021) show that Iran will significantly lose welfare (measured as a composite commodity of the private consumption) if Iran holds to its INDCs (Iran will lose about 3.8–4.2% of its welfare) [53].

4.1. The 2005–2013 Episode

The Ministry of Energy (MoE) is the central body accountable for regulating and executing procedures for Iran's electricity, renewable energy, water, and wastewater services. However, Iran is entirely dependent on fossil fuels for industrial, residential, and transportation sectors, and state-owned enterprises were the most influential players in the power sector. In (2001), based on the proposal of the Minister of Energy and approval of the Organization for Management and Planning of the country and the Ministry of Assets and Economic affairs, Tavanir organization was promoted to its present organizational level known as the specialized holding company liable for Management of Generation, Transmission, and Distribution of Electric Power in Iran [54].

4.1.1. Policy Mix: FiT Law

Through the fourth National Development Plan, Iran started the systematic planning for renewable sources production. Since 2005, the first drafts of renewable energy scenarios of Iran have been prepared. The projected goal was to produce 10% of the demanded energy of the whole country from renewable energy resources by the end of 2025 [48].

In this regard, the organization of renewable energy (SUNA), as a subset of Tavanir, became responsible for assessing Iran's renewable energy sector potentials and tried to lure private sector investors with a guarantee to purchase any renewable power production (Interview 6).

It was also responsible for implementing pilot renewable power plant projects funded through the governmental budget. The aim of these projects was the introduction of such alternative clean energies as a solution for tackling climate change and pollution concerns (Interview 8).

As of 2012, the ministry of energy passed a law on FiTs to incentivize private sectors to invest in renewable energy. The Budget for FiT was provided through Article 61 of the Law of Modifying Consumption Patterns (2011). It obligated the MoE to purchase electricity through long term contracts with guaranteed tariff; Article 133 (Paragraph B) of the Fifth Five-Year Development Plan (2010 to 2015) and its executive instruction was endorsed by the Council of Ministers (2010), which sets out the renewable targets; And, the National Development Fund (2010) (the 'NDF'), aiming to support projects via Iran's oil and gas earnings [55].

4.1.2. Policy Feedback

The tariff rates and the five-year length of guaranteed purchase payment were too low compared to renewable power plant installation expenses. It did not motivate private sectors to invest in this industry [51]. Figure 8 organizes the above explanations of influential mechanisms of power actor groups on the energy transition of Iran in 2005–2013.

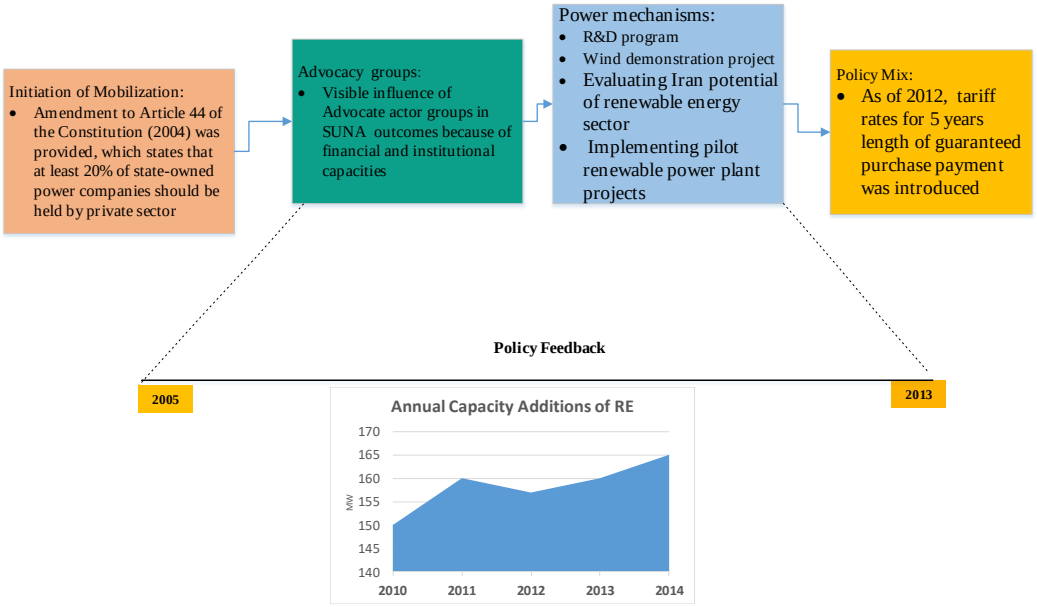

Figure 8. Influential mechanisms of power actor groups on the energy transition of Iran in 2005–2013 (data from http://www.satba.gov.ir/en/home, last accessed 26 March 2022).

4.2. The 2014–2017 Episode

After the presidential election in 2012, all responsibilities of renewable energy were transferred to the Ministry of Energy, and noticeable changes in favor of energy transi-

tion occurred. Policy outcomes of past development methods and unsatisfied results for renewable energy generation necessitated a new configuration of development policies. In this way, the Ministry of Energy ensured that a cooperative model of state and public could be one of the efficient ways for attaining the target of 5% renewables share in the total installed power generation capacity by 2021. Therefore, the amendment of FiT law, including long-term guaranteed contracts with higher tariff rates for renewable resources, was introduced [56].

Besides, by the end of 2014, after a parliamentary approval, two separate institutions of renewable energy of Iran (SUNA) and energy efficiency of Iran (SABA) integrated. Accordingly, the organization of renewable energy and efficiency of Iran (SATBA) was established under the affiliation of the Ministry of Energy [57].

SATBA's responsibilities increased to include acting as the regulatory authority for developing policies, issuing licenses for renewable projects, and entering into power purchase agreements (PPAs) with developers (Interview 8).

In 2015, after Iran nuclear deal and an agreement on the Iranian nuclear program, the Joint Comprehensive Plan of Action (JCPOA), international sanctions against Iran were lifted. These sanctions were considered key barriers for domestic investors cooperating with experienced international companies. Therefore, JCPOA could pave the way for foreign investment in Iran [51,55].

4.2.1. Opposition of Influential Actors on RE Development

The cost of renewable energy development made a controversial debate on energy transition in Iran. Opponents referred to the high expenses in constructing renewable power plants and contrasted it sharply with subsidies for the fossil fuel power plants. The oppositions were followed by a period of incremental technological advances and declining unit costs of the renewable sector. They argued that expenditures for newly built power plants in the next 5 or 10 years would decline gradually due to technological development (Interview 7).

Considering these two arguments, the Plan and Budget Organization, responsible for strategic planning and monitoring the country's development, discussed about the low surcharges, which were one-tenth of the actual costs of power generation from renewables (Interview 9).

4.2.2. Justification of RE Advocates through Social Costs of CO_2 Emission

At first glance, the expenditures for constructing renewable energy power plants were around twice the number of fossil fuel power plants in 2013. The main argument for this difference was the 100-year subsidies on fossil fuels for non-renewable power plants in Iran (Interview 8).

The cost of renewable energy production might be even lower when implicit or explicit subsidies are included. The actual price of constructing a renewable power plant was quite competitive. It was half of fossil fuel ones in 2014 when considering short-term costs of mitigating greenhouse gas emissions and the social cost (Interview 7).

The mitigation of CO_2 reduction benefit is estimated with up-front costs and divided by the number of tons of carbon dioxide (or equivalent) emissions reduced. Also, the social cost quantifies the cumulative damage resulting from emitting a ton of carbon dioxide and other greenhouse gases into the atmosphere [58].

However, the rapid decline in the technology price of renewable equipment that would reduce the total cost over the future years should not be neglected (Interviews 6 and 7).

Renewable advocates, including the Ministery of Energy succeeded in justifying FiT opponents and increased the guaranteed purchase tariffs by explaining the environmental costs of fossil fuels and determining the cost-effectiveness of creating renewable power plants (Interview 7).

4.2.3. Policy Mix: Amendment of FiT

Through the 5th Development Plan (2010 to 2015), the Iranian government announced plans to install 5000 MW of renewable energy by incentivizing the private sectors (Interview 8). The amendment of FiT law, including long-term guaranteed contracts for renewable investors, was announced in 2016. The tariff rates prolonged the current contracts from 5 to 20 years, guaranteed contracts to purchase electricity generated through renewable sources, and prioritized energy purchases from the private and cooperative sectors [57]. The new tariff rates were announced annually by the MoE for each renewable source and project size.

The tariff rates were adjusted during the term of the PPA by a formula that inflation rate and the exchange rate fluctuation were taken into account (Interviews 2, 5 and 8).

Besides, the tariff rates defined an extra 30% as an incentive policy for implementing domestic equipment in newly installed power plants (Interviews 2 and 10).

4.2.4. Policy Feedback

The Iranian government encouraged private sector involvement in the renewable energy front, providing PPA long-term contracts and prioritizing energy purchases from the private and cooperative sectors. Together with the lifted sanctions, these measures resulted in a salient proliferation in renewable investments. The installed capacity of renewable power plants increased from 165 MW in 2013 to 700 MW by 2017 [56].

Although various elements of the policy framework for renewables development were put in place, some strategic challenges had slowed down the progress. Renewable projects in Iran faced financial challenges in the initiation phase. Financial markets for renewable energy investment were an obstacle, suffering from the high-interest rate in Iran. Iranian banks only offered high-interest loans of around 20% to investors. Due to the decline in the world oil prices, the National Development Found of Iran could only finance high-capacity projects of renewables. In addition, Iran's highly subsidized fossil-fueled energy made the fossil fuels market yet more interesting than renewables [51,56]. Figure 9 organizes the above explanations of influential mechanisms of power actor groups on the energy transition of Iran in 2014–2017.

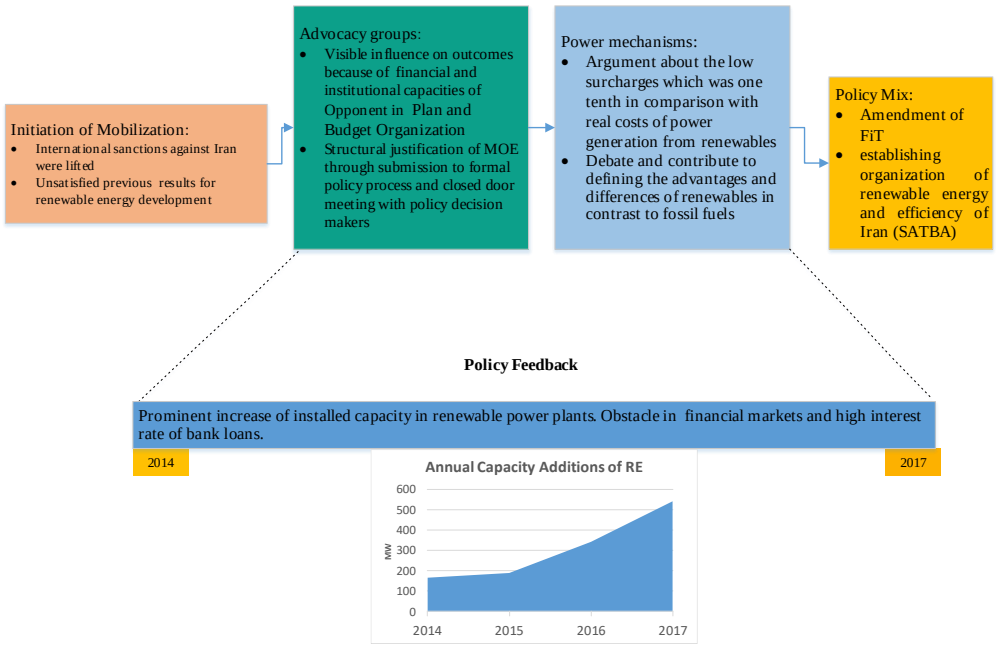

Figure 9. Influential mechanisms of power actor groups on the energy transition of Iran in 2014–2017 (data from http://www.satba.gov.ir/en/home, last accessed 26 March 2022).

4.3. The 2017–2020 Episode

In 2018, the US president, Trump, withdrew the US from the JCPOA and introduced American sanctions on Iran as part of a maximum pressure campaign against the Iranian regime [59].

In addition, in November 2019, the Iranian government increased the gasoline price as a subsidy reform which had an inflationary effect and contributed to Iran's growing budget deficit. Iran's macro-economic situation and external shocks of re-imposing sanctions mirrored a relatively unstable exchange rate and recurrent inflation, which slowed down the renewable energy development in Iran (Interview 6).

4.3.1. Alliances and Discourses of RE Development

After reforming SUNA to SATBA and promoting it to the Deputy Minister, its position in the Plan and Budget Organization was also strengthened. During this period, the attitudes of parliament and other organizations regarding the importance of renewable energy were significantly reformed. With the Electricity Tariff Law passage, parliament reassured investors that member of parliaments also have concerns about renewable energy (Interview 10).

As an initiative from the deputy of Energy in Science and Technology Vice Presidency, a strategic council for consensus on decision-making in renewable energy development organized. This council comprised various stakeholders from the state, public, and private sectors to address their challenges and reach a consensus on desired solutions (Interviews 8 and 9).

4.3.2. Policy Mix: Third Amendment of FiT

By the end of 2019, mirroring from an unstable exchange rate, the costs of installing and operating solar and wind power plants doubled. SATBA proposed an increase in guaranteed purchase prices of electricity to the Minister of Energy, and the third amendment of FiT was proposed. Accordingly, all base rates of guaranteed purchase of electricity for all renewable power plants increased by a fixed rate of 30%. The steps of guaranteed electricity purchase for all types of power plants are eliminated, and a single price is assigned for all power plants. The Ministry of Energy decided to introduce pilot auctions for wind energy upper than 10 MW to support a competitive market. By the end of 2020, according to the decree, the process of choosing investors for power plants with a capacity of more than 10 MW could only be possible through a tender system [57].

4.3.3. Policy Feedback

The current Sixth Development Plan (2017–2021) has targeted the installed capacity of the renewable power plant of 5000 MW and plans for an additional 2500 MW by 2030. By the end of 2019, re-imposing sanctions and the exchange rate increase affected upstream projects. Subsequent challenges were in purchasing power plant equipment, reducing foreign investment, the lack of expertise, and financial investment, which resulted in delays and, in some cases, cancelations of projects (Interview 11).

Figure 10 organizes the above explanations of influential mechanisms of power actor groups on the energy transition of Iran in 2017–2020.

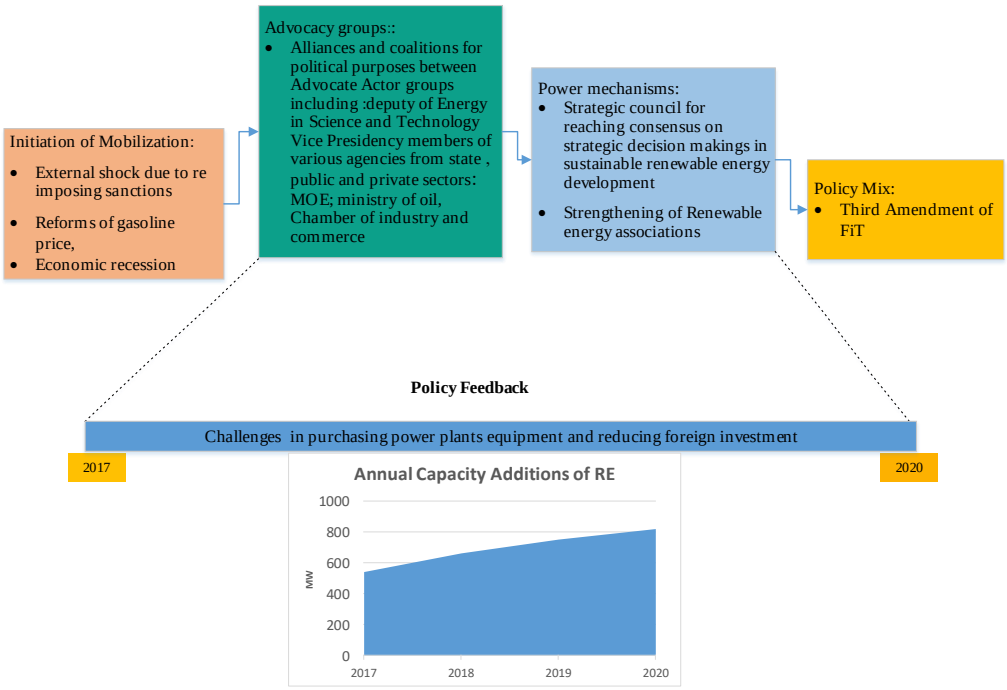

Figure 10. Influential mechanisms of power actor groups on the energy transition of Iran in 2017–2020 (data from http://www.satba.gov.ir/en/home, last accessed 26 March 2022).

5. Discussion: Comparing Economic and Power Factors in the Energy Transition in Germany and Iran

Energy transition pathways are deeply rooted in countries' political and economic contexts. The comparatively robust Germany's economy delivers a much more stable context for the track to renewables than Iran's economy. On the other side, Germany has a corporatist tradition with a higher level of consultation and a strong position as a legislative body. These features can lead to higher reliability in policy outcomes [29]. Iran's economy is centrally planned and is dominated by oil and gas production. In Iran, energy subsidization is a satisfying strategy from a social perspective, while it promotes waste of energy and energy inefficiency in industry. Significantly, international sanctions are damaging the Iranian economy [60–62], to the extent that Iran's oil export and GDP can decrease by more than 73% and 14%, respectively, upon the astringency of sanctions [61].

Although the energy regulation executive branch in Iran has a solid position in policy-making, the unsteadiness of the political system, combined with the economic crisis, has diminished the levels of trust to sustainable transition among investors. While Iran and Germany have fundamental differences in countries' political and economic structure, both countries have some similarities in the transition process. First, both countries established FiTs as the critical cornerstone of accelerating countries' move towards renewables. Second, some political actors in the fossil-nuclear energy regime resisted policy changes for the benefit of expanding renewables.

5.1. Coalition of Advocates of Transition Progress in Germany and Iran

The expansion of renewables had less involvement in society than in Germany. While Iranian society remained largely passive, the involvement of German society and strong social movements were reflected in political incentives for introducing EEG and nuclear phase-out.

After the Chernobyl disaster, which led to solid movements of nuclear opponents in Germany and the government failed to demonstrate a large wind turbine, smaller wind turbines deployed rapidly in the 1980s. This deplyment gave people a sense that renewables were a viable alternative. The new paradigm of decentralization energy supply

was guided by many actors linked to democratic forms of protecting climate change in Germany. It was the foundation of start-ups in the wind, solar sectors, and community-based energy provision.

In Germany, renewable energy advocates do not leave things to happen by chance. The green party in parliament put pressure on coordinating strategies of various interest groups and unified them under one federation of German Renewable Energy. Such civil society collaboration was continued, while in the mid-1990s, tens of thousands of energy transition advocates, including Green Party, renewable energy organizations, and church groups, came to the streets in the litigation against the attempts to cut down StreG [5].

As renewable energy companies anticipated the slow but sure penetration of wind energy in the market, they reinvest their profits in technological development and building up lobby professions [63]. After attempts of advocates of the energy transition in 2000, the Red-Green coalition government "overfunded" the clean energy and employed EEG for a fixed rate for renewable energy for 20 years. It caused a massive boom in renewable energy industries. Small investors such as citizens' energy initiatives, farmers, and private households owned almost 70% of the installed capacity in renewable energy [64].

In Iran, there was early support for research and development regarding solar and wind energy potential in Iran in the 1990s. However, since civil society organizations are still weak in Iran, no advocacy coalitions pushed the environmental issues. In contrast to Germany, Iran did not complement energy transition with further decentralization measures and effective technology development or policies for market formation. The most prominent support was FiT law which with some shortages in the investors payment and high expenses of RE power plant installation led to disappointment of new investments.

Taking a closer look, it gets relatively straightforward that FiT's policy design in Iran was the result of some political conflict (not as much as in Germany) with several moments of policies. Conflict of interests between ministries of energy and ministry of oil and planning budget organization in Iran tells the same story of political opponents of FiT legislation in Germany.

5.2. Alliance in Actor Groups of the Incumbent Energy System in Iran and Germany

In Germany, by the end of 2013, incremental changes in subsidization and institutional failures shifted the political dynamics back in favor of the old centralized energy system. The first reason was the costs of renewable energy production. Due to technological progress, the energy generation costs were reduced while FiT rates did not alter, and over-subsidization of solar energy occurred. The second reason was the requirement of building around 7700 km of new electricity lines due to renewable energy expansion. These changes resulted in the rise of surcharges for lower-income families [5].

Opponents of the energy transition launched a public campaign and attempted to change public opinion. They criticized EEG's surcharges as too expensive, potentially causing a blackout, especially for families. Furthermore, utilities engaged in training citizen groups with financial resources and expertise to demonstrate against wind turbines and electricity lines [6].

Although the incumbents' campaign has little impact on public opinion against energy transition, it positively impacts the political stage. In 2017, a public tender system was replaced with the FiT system by the federal government. This reconfiguration blurred the decentralization of electricity production and supported utilities modifying their market share.

In Iran, an auction system was introduced at the end of 2020. At this time, the total installed capacity of renewables was 750 MW and was dramatically lower than the projected target of 2500 MW by the end of 2030 [57]. While the increase in tariff rate system responded to the fluctuation of the exchange rate, the introduction of an auction system for power plants of higher 10 MW was an answer to the reduction of technology price.

6. Conclusions

Since energy transition will depend upon political support and social mobilization for niche development, a power-based analysis is particularly useful for examining the dynamics of energy transition.

In doing so, the power actors framework is applied to study German and Iranian energy transition to examine the many ways of power insights, including instrumental, structural, and discursive mechanisms that lead to policy changes in the energy system. This framework is valuable as an organizing tool to ensure that essential dynamics of energy transition from power and political perspectives are investigated.

This article suggests that the socio-political context is a policy lever of developing renewables. The policy change does not emerge immediately via an external shock but incrementally by comprising power insights, including lobbies, coalitions, and campaigns. The contribution of this article was to develop a more profound understanding of energy transitions by using political and social science theories in terms of power theories and advocacy coalition frameworks. It attempts to link the political power mechanisms into sustainability transition studies. Actors play a critical role in this model, as their coalition impacts the rulemaking and the feedback loops policies empower the redirection of policies from one path to another. The initiation of policy changes is also strongly connected to contextual factors such as Political structure and national technological infrastructures, and regulatory institutions, which are enhanced or prohibited by the national or international focusing events.

The comparison of Germany and Iran from the perspective of power actors and their influencing dynamics, despite economic and technological differences, allows us to learn lessons from one of the leading countries in energy transition and its implementation success factors during the transition process. Our findings reveal that Germany follows a bottom-up logic with an active society. German society, companies, and solid social coalitions are reflected in political incentives to introduce the renewable energy act (EEG) and nuclear phase-out. On the other hand, the centrally planned economy of Iran leaves a minor role for the society in the energy transition. Energy subsidization provokes a passive role for society in changes in energy resources.

However, due to subject restriction and space limitations, this paper can only focus on the main features of power actor groups and coalitions in the energy transitions in Germany and Iran. Future research could investigate at least three significant criteria by implementing the energy transition's political and power perspectives.

First, exploring the economic conditions and technological context and their interplay with policy adaptations would be beneficial. The economic context of each nation has significant impacts on the firms and civil societies that attempt to proceed or impede energy transition. Second, there is a need for a better understanding of the dark sides of power actor groups in energy transition, which empowers political interests that could weaken final targets of global decarbonization [41]. Coalitions of renewable energy influence governments to enact policies such as FiTs, and pay less attention to the equipment of carbon emission capture in fossil fuels power plants. Third, some authorized power organizations have been introduced during the transition process that formally monitor, evaluate, and suggest changes or adaptations to policies. Federal government monitoring processes or legal lobby organizations were some examples of the institutions that Germany has established through the energy transition. Therefore, analyzing the effectiveness and impact of such an organization on the proceeding transition would be fruitful.

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