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Policy selection in renewable energy transitions

Acceptance and resistance in Switzerland

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"Taking a new step, uttering a new word, is what people fear most."
Fyodor Dostoevsky, Crime and Punishment

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Content

1 Introduction

1.1 Research question and relevance

When the Swiss people supported the new energy act in May 2017 it cleared the path to embark on a journey to restructure Switzerland's energy system. The energy act constitutes of a ban on constructing new nuclear power plants, targets to increase renewable energy production, and to decrease general energy consumption. Whereas the latter two targets are common among similar industrialized countries, the decision to phase out nuclear power is a unique reaction to the events of Fukushima (Joskow & Parsons, 2012). With the exception of very few other nations such as Germany, no other country has done the same so far.

The decision puts a lot of pressure on Switzerland because currently nuclear power constitutes more than a third of domestic electricity production (Swiss Confederation, 2013). By 2035 all nuclear power plants will be off the grid as they reach the maximum running time in what they can be operated securely. The gap in electricity production will have to be replaced with other energy sources such as water, solar, wind or geothermal power (Swiss Federal Office of Energy SFOE, 2017a). More generally speaking, Switzerland needs to change the general structure of its energy system in order to comply with the newly adopted targets. This thus raises the general question *how and with what means can Switzerland achieve such a restructuring of its energy sector?*

Literature describes such dynamic long-term changes to the structure of an energy system as 'transitions' (Geels, 2002; Markard, Raven, & Truffer, 2012). However, multiple factors impede structural change towards a cleaner energy production. On the one hand, the energy sector is prone to time inconsistency problems or commitment problems meaning that investments are very long term. Once made, investments in for instance dams or electric power grids bind utilities for an extensive amount of time. If investors do not have appropriate reason to believe that they will receive an adequate return on investment, they will refrain from using their funds for the construction of renewable energy infrastructure (Lodge & Wegrich, 2012). On the other hand, path-dependency also hinders the transformation of the energy system. Well-established technologies such as large-scale hydropower have formed strong institutions that support and maintain their dominant position in the market (Geels, 2002). Examples for such institutions are the Swiss water use tax that spills large funds into public accounts or the complex ownership structures for utilities among cantons and private companies. Both hinder a swift transformation because the lower the

incentives to push new technologies onto the market the slower the actual increase in energy production with new renewables (Lutz, Fischer, Newig, & Lang, 2017).

Furthermore, technological barriers keep the current energy system from evolving. Technology development has been following trajectories that are hard to change as industry and utilities innovate along these habitual lines (Dosi & Nelson, 2016; Huenteler, Schmidt, Ossenbrink, & Hoffmann, 2016). Breaking up such lock-in effects may thus constitute room for more radical and groundbreaking innovations (Rogge, Kern, & Howlett, 2017).

The just described hurdles show that the energy system needs an impulse from outside to achieve the targets set in the new energy act. Experts, as well as political actors[1] involved in renewable energy policy, mostly agree that the system needs some sort of state intervention to overcome the aforementioned issues. The state has a wide array of measures, or so-called policy instruments, available that can intervene in the market and break up path-dependencies or lock-in effects. These instruments range from soft interventions such as information campaigns, to economic incentives or more coercive minimal standards (Howlett, 2005). Policy instruments can target different aspects of the hurdles described above. For example, financial support for research or pilot- and demonstration projects allows the development of technologies that otherwise would not have been researched by purely private initiatives. This measure thus challenges industry's and utilities' technology trajectories that they have embarked on. Information campaigns and minimal standards may on the other hand convince consumers to reflect on their choice of energy source and thus slowly change institutions surrounding established technologies. The two examples show that policy instruments target specific aspects of a policy problem. However, transitions, and the Swiss energy transition in particular, are much more complex than these 'one problem, one instrument' approaches (Knudson, 2009). Transitions require more than one targeted intervention. In reality, elected officials and state agencies in various policy domains often combine instruments to so-called policy mixes. They thus account for the fact that it is often not enough to address one aspect of an issue to solve the problem as a whole. At least in theory, state actors can integrate policy instruments into any combination to address different aspects of a complex problem. Such policy mixes have thus become more and more prominent in recent developments of academic literature and among practitioners (Flanagan, Uyarra, & Laranja, 2011; Ingold, Stadelmann-Steffen, & Kammermann, 2018b; Rogge et al., 2017; Varone & Aebischer, 2001). These combinations of policy instruments

[1] In this introduction, 'actors' are defined as collective entities involved in the political process.

evolve over time and can have crucial impacts on how transitions develop and what directions they take (Edmondson, Kern, & Rogge, 2018).

The present introduction and the subsequent research articles take up on this fact and follow recent developments in the academic debate that put a heavy emphasis on well-designed combinations of policy instruments (Howlett & Rayner, 2007b; Rogge et al., 2017; Rosenow, Kern, & Rogge, 2017). Depending on the specific research interest, the publications take a broader or narrower approach to policy mixes. However, all papers have in common that they consider policy mixes as combinations of policy instruments that support the transition towards a clean energy supply.

Despite this recent interest in policy mixes, it remains unclear how and why certain instruments are added or removed from the mix (Kivimaa & Kern, 2016b). Sovacool (2014), for example, finds that there is a lot of knowledge on policy content in social science research about energy policy. However, the actors and processes leading to this specific content have not yet found considerable attention. Fraune and Knodt (2018) similarly state that our current age of post-truth politics, populism and local resistance raises the conflict level in energy policy by making politics more polarized. These new developments may challenge decision-making because established patterns of finding consensus among relevant actors and citizens may not work anymore.

As policy selection in a transitional setting is a dynamic process that involves multiple actors who need to accept and sometimes actively support policy instruments or the policy mix as a whole it is central from a societal and research perspective to shed light on the factors that lead to a desirable policy output. Besides this actor-centered perspective, different contexts or institutional settings may also affect the design of the policy mix that supports the Swiss energy transition. To shed light onto this crucial aspect of energy transitions, the overarching research question of this dissertation is thus *what drives policy selection in the context of the Swiss renewable energy transition?*

This dissertation tackles the research question by adopting multiple perspectives on the issue. As previously described, multiple actors and stakeholder groups are involved in Swiss energy policy and the transition (Fischer, 2015; Kammermann & Strotz, 2014; Kriesi & Jegen, 2001). This comprises, on the one hand, of actors such as political parties, economic associations, environmental NGOs as well as administrative entities, cantons, or utilities who are directly involved in energy policy making. Agenda setting, and policy formulation involves a multitude of these actors that try to push their targets and ideas on the agenda and through into regulation (Kammermann & Angst, 2018). During the actual decision-

making phase, political parties become the central actors due to their formal decision-making power. Administrative entities on the federal and cantonal level are furthermore in charge of drafting and implementing new regulation and have thus a high level of influence on policy selection (Kammermann & Ingold, 2018a). On the other hand, general citizens are also concerned when they have to approve a policy proposal in a popular vote (such as the popular referendum on the new energy act) or a specific project proposal near the community they live in (e.g., the local wind energy project that needs the approval at a town hall meeting). They thus become an important veto player that may swiftly advance or block the transition as the Swiss people did by adopting the new energy act. However, if citizens lack confidence in the transition or prioritize other goals then they may also drastically slow down progress (Wolsink, 2010).

Furthermore, the market plays a central role during a transition. New clean and sustainable technologies can only thrive if the market accepts them. If there is no such acceptance, innovative technologies may be stuck in the labs that develop them and society does not benefit from the developments.

These three perspectives can be subsumed under the term of *social acceptance* (Dermont, Ingold, Kammermann, & Stadelmann-Steffen, 2017; Wüstenhagen, Wolsink, & Bürer, 2007). In the context of energy policy, social acceptance is a concept that finds use in a variety of disciplines. Examples are political science and psychology but also in natural sciences such as geography try to explain why elite actors, citizens or the market are in favor of or opposed to certain policy instruments, projects or technologies (Batel, Devine-Wright, & Tangeland, 2013; Stadelmann-Steffen et al., 2018).

This dissertation thus uses the concept of social acceptance for especially two reasons: On the one hand, it allows a distinct operationalization of why elite actors or citizens are for or against a specific proposal by differentiating between passive acceptance and active support for a proposal. More specifically, a differentiated application of the concept of social acceptance helps to distinguish of what actors/citizens need to accept what type of proposal (e.g., legal act, project proposal etc.) in a certain phase of the decision making process (Dermont et al., 2017). On the other hand, the concept is flexible enough to capture different processes such as policy selection in a legislative process but also more straightforward decision-making processes regarding a specific renewable energy project in a local community

The concept of social acceptance serves as a overarching framework for the three research articles in this dissertation. The first article takes a broad approach to social acceptance and

assesses contextual factors that drive acceptance for a strong policy mix in the hydropower sector of the Swiss cantons (Kammermann, 2018). The second paper compares two dimensions of social acceptance: the elite and the citizens' perspective regarding the nuclear phase out and specific instruments (Kammermann & Dermont, 2018). The third paper solely focusses on different elite actor groups' acceptance of policy mixes promoting renewable electricity production (Kammermann & Ingold, 2018b). The following section contains short overviews of the three research articles that will later flow into the general conclusions drawn in this dissertation. With this diverse and dynamic approach, the dissertation integrates a cantonal perspective (first and third article) and a national perspective (second article) and combines it with a diverse array of research methods.

1.2 Empirical findings

1.2.1 Contextual factors driving instrument selection

This first paper, Kammermann (2018), tackles the general research question of this dissertation by looking at different context factors that may affect the development of a specific policy mix. It seeks to explain the large variance among the policy mixes implemented for the promotion of hydropower in the 26 Swiss cantons. Whereas some cantons established extensive combinations of instruments ranging from information, to coordinated approval procedures with other policy domains and financial support, other cantons put almost no effort into promoting hydropower. By applying a QCA (qualitative comparative analysis) approach, the paper finds that two scenarios foster an extensive policy mix: First, cantons who already produce large amounts of hydropower and thus majorly benefit from a tax imposed on water use. Second, cantons with a more left-green leaning political landscape that have implemented ambitious CO_2 reduction targets. The paper shows that it is important that countries and subnational states not only benefit from the ecological aspects of a cleaner energy production but also from more economic or financial factors such as tax revenues. Policy mixes that can address both aspects may thus be promising for countries that currently struggle to attain their clean energy targets because their acceptance might be high among different actors groups that usually have diverging preferences regarding regulation such as e.g. economic associations and environmental NGOs (Kammermann, 2018).

1.2.2 Citizens' and the elite's beliefs driving instrument selection

The second research article, Kammermann and Dermont (2018), takes a less contextual, but more actor centered approach to policy instrument selection. It assesses what beliefs drive elite actors' and citizens' resistance to policies that foster an energy transition in the context of the popular vote on the energy strategy 2050 in 2017. The paper conducts hierarchical cluster analysis for the elite level and structural equation modelling on the citizens' level. As previously described, both the elite and citizens have important roles during policy design and selection and may thus accelerate or slow down a transition. The paper finds that especially climate change skepticism has a negative effect on the support for clean energy policies on both the elite and citizens' levels. More importantly, elite actors also pass their climate skeptic positions on to their voters and may thus majorly influence citizens' decisions heuristics in a potential popular vote. Elite actors and especially political parties thus are crucially important for the selection of policy instruments to support a clean energy transition because they are able to affect the outcome of a popular vote with positions they take during a campaign (Kammermann & Dermont, 2018).

1.2.3 The elite's acceptance of current instrument mixes

The third research article, Kammermann and Ingold (2018b), follows up on the finding that elite actors are crucial for instrument selection for a clean energy transition. The paper adopts a purely elite perspective and asks what principles of instrument selection the current instrument mix mirrors. More precisely, it questions whether technocratic principles, elected official (democratic principles) or newer governance arrangements involving a larger number of public and private actors are represented by the current instrument selection. The paper thus compares currently implemented clean energy policy to the preferences of four actor groups (the public administration, elected officials, environmental NGOs and utilities) and to technocratic principles of policy design such as resource intensiveness or targeting precision in three Swiss cantons. We conclude that all three dimensions are represented in the three cantons' policy mix, but depending on specific regional contexts, specific actors' acceptance diverge significantly. In the canton of Bern all actor groups preferences resemble strongly the current policy mix. However, in the cantons of Thurgau and Lucerne the environmental NGOs or the utilities are less favorable towards implemented policies. These findings might come about because the canton of Bern has a long lasting tradition of integrating various stakeholders' interests in the domain of renewable energy policy. This tradition is less obvious in the other two cantons. Furthermore, we

conclude that other contextual factors such as the presence of environmental threats to flora and fauna due to the construction or modification of structures for the production of renewable electricity may affect what actors accept specific instruments.
These contextual findings link the third paper back to the first research article presented in this introduction. It thus seems highly promising to opt for policy instruments and policy mixes that score high with all three, technocratic, democratic and governance, principles. Again, such policy mixes might have a higher acceptance with different actor groups involved in clean energy policy making because they can comply with different requirements (Kammermann & Ingold, 2018b).

1.3 Conclusions

The different approaches of this dissertation show that instrument selection in the Swiss energy transition is a highly complex and dynamic process. The three contributions show that contextual factors such as the institutional setting in the hydropower sector, beliefs and values of elite actors and citizens as well as sets of criteria that follow different principles (technocratic, democratic or governance) have a high power to explain and sometimes predict instrument selection in a transitional setting. This general finding is the starting point for this section that elaborates further on the findings and conclusions already presented in the three research articles. The section puts a focus on three aspects: first, policy makers can anticipate potential conflicts in instrument selection and their combination in policy mixes in a transitional setting. Second, local characteristics and context are crucial for achieving an energy transition. This holds true for regulation as well as specific local projects. Third, policy makers can and should anticipate potential issues between instruments in the policy mix even though they might never design the 'optimal' instrument mix.

1.3.1 The anticipation of resistance by different stakeholders

The results of this dissertation show that different factors can trigger resistance against the promotion of a clean energy transition in general or against specific instruments in the policy mix. Such aversions can arise, for example, when political parties convince their voters to oppose actively a proposal in a popular vote as seen in Kammermann and Dermont (2018). But maybe also when a policy instrument does not meet the selection criteria of a specific elite actor (Kammermann & Ingold, 2018b); or when they do not accept the introduction of new policy instruments to the current mix (Ingold, Stadelmann-Steffen, & Kam-

mermann, 2018b). These insights allow researchers but also actors actively involved in instrument selection to anticipate potential conflicts in future policy processes, for example by designing a policy instrument that complies with the selection principles of a crucial actor group. Depending on the process stage and the object of acceptance, various actors (or citizens) may become relevant, as they constitute different veto points (Stadelmann-Steffen et al., 2018). By knowing why and how specific actors and citizens might react to a policy instrument resistance can be anticipated and possible failures in parliament or at a public poll due to lacking support can be avoided.

1.3.2 Local characteristics and contexts

As already described in the previous conclusion, different actors involved in energy policy constitute different veto points for policies promoting clean energy transitions. These veto points often depend on regional specialties and contexts and may thus change from country to country and regionally from canton to canton (Kammermann, 2018; Kammermann & Ingold, 2018b). The Swiss political system is generally sensitive to such conditions, and energy policy is no exception given the fact that in Switzerland authority splits between the national and the cantonal level depending on the issue. For instance, the promotion of renewables is mainly organized on the national level whereas the building sector is almost uniquely controlled by the cantons (Rieder & Strotz, 2018).

The three research articles show that the acceptance of instruments and policy mixes varies across cantons. It is thus essential to constitute that there is no 'one solution fits all' approach to regulating the Swiss energy transition. In some cases, it may make sense to implement instruments at the national level as for example in the case of the feed-in tariff system that can only unfold its full potential with a broad national approach. However, regional characteristics such as the discrepant potential for energy sources, cultural sensibilities between different parts of the country but also financial dependencies (such as the importance of the water use tax for local communities in the Alpine region of the country) force policy makers in each canton to choose alternate policy mixes that fit their contexts best. Whereas this finding is primarily relevant for practitioners actively involved in policymaking, it is also of importance for researchers who should avoid formulating recommendations about the use of policy instruments if they are not familiar with the local contexts.

1.3.3 The anticipation of potential issues within the policy mix

This dissertation's insights about selecting policy instruments that a majority of actors and citizens accepts might give rise to the impression that policy makers can design the 'optimal' policy mix. Such a policy mix addresses every relevant aspect of a problem and finds support of most or even all elite actors and citizens. In the case of the Swiss energy transition, this would encompass support along the entire innovation chain, targeted interventions in the market, information for consumers, instruments optimizing Switzerland's position in the international energy market and so on. As this example shows, such interventions need to be very far reaching and may cause resistance because they are that extensive even though they might technically be perfect.

In reality, the policy mix will always neglect certain actors' or citizen groups' needs. At the same time, it will fail to disentangle aspects of the issue it is supposed to solve. An example of such a misconceptualization is the large deadweight effect inherent to the Swiss feed-in tariff system regarding renewables. Estimates show that up to thirty percent of solar panels would have been built even without support from this support scheme (Rieder, Bernath, & Walker, 2012). This neglect might be willful or based on other constraints such as time, resources, knowledge or political will. In complex and dynamic settings such as the Swiss energy transition, all of these restrictions may even be more relevant than in less conflictual policy domains.

However, policy makers can optimize instrument selection by identifying relevant actors and especially knowledgeable actors and citizens' who usually cannot voice their concerns. This strategy may reveal and thus anticipate problems of the current and potential failures of the future policy mix. Such an 'optimization' prior to the actual decision making may convince more actors and citizens to support new regulation if they know that the measures they are about to adopt meet their target effectively and efficiently (Ingold et al., 2018b).

If implemented correctly, the three concluding recommendations presented above can foster acceptance and support for future policies that are supposed to generally enable or even accelerate a transition towards a more clean energy system. It depends, however, again on the situation, which one of the three should receive the most attention. Anticipating and integrating actors in the policy process that may later challenge or veto a decision may be the solution in one particular situation whereas optimizing policy instruments themselves or adjusting them to local contexts may be more central to raise acceptance in others. The three recommendations thus have in common that they can all foster social acceptance for policy instruments and thus facilitate the achievement of the targets the Swiss people set

with the adoption of the new energy act, and more broadly speaking the realization of a new global energy system that fits the COP21 targets.

1.4 Limitations

The concepts and conclusions presented in this dissertation have their inherent limitations. First, a central assumption of this dissertation is that policy instruments and their combination in policy mixes are of crucial importance for the Swiss energy transition and transitions in general. However, regulation is only one part of a transition. Low citizens' acceptance may compromise the effectiveness of policy instruments. It would thus be shortsighted to conclude that regulation by itself will enable a transition towards a more clean energy system. Individual citizens as well as collective actors involved in energy policy will have to comply with the new regulation in order to take effect (see e.g., Ingold et al., 2018b).

Second, all three articles included in this dissertation take a static approach to policy mixes and social acceptance. In order to draw further conclusions, a more dynamic approach to analyzing policy instrument selection in policy mix situations may be suitable. Analyses with multiple points in time allow more distinct causal conclusions that are central for anticipating and stirring future policy instrument selection (see e.g., Haas et al., 2011; Schmidt & Sewerin, 2018).

Third, this dissertation focusses mainly on the national or subnational level of Switzerland's energy policy. Even though it compares in two research articles either three or all cantons, a cross-sectional approach on the national level with similar industrialized countries would be fruitful for generalization of the presented results (see e.g., Reiche & Bechberger, 2004).

1.5 Future research questions

The dissertation also opens new pathways for academic research. First, the articles put their focus either on actors' and citizens' acceptance or on contextual factors to explain policy instrument and policy mix selection. Nevertheless, what are other dynamics besides actors' acceptance and contextual factors behind policy selection in a policy mix situation? One approach would be to focus more thoroughly on actors' beliefs to explain policy instrument choice (see e.g., Kammermann & Angst, 2018). Beliefs and values are central concepts in public policy to explain policy instrument choice and may thus offer contrasting explanations to social acceptance.

Second, and passing on to the next step of the policy process, it would be fruitful for future research to assess how instruments and policy mixes are implemented. What are the differences in implementing single instruments to policy mixes? And how does implementation differ in complex transitional settings like the Swiss case to policy domains where current developments are less ground breaking? These questions with a focus on the *actual outcome* of the selected instrument mixes will offer insights into what specific measures administrative actors will implement after decision makers have adopted a specific combination of policy instruments.

Finally, a more evaluative approach to the present results will be crucial for understanding policy mix dynamics and their actual impact on society. Are policy mixes generally more effective than single instrument approaches? Are instrument mixes truly more effective when acceptance among relevant stakeholders is high? Whereas these questions do not cover all possible future research trajectories, they offer a first overview.

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2 Factors driving the promotion of hydroelectricity: A qualitative comparative analysis

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Abstract

In the wake of the COP21 conference in Paris, the transition to a low-carbon energy supply remains a central issue on the political agenda. The deployment of renewable energies is often challenged by multiple issues (e.g., public acceptance, landscape protection etc.). Political actors try to overcome such challenges with various measures, however, the policy instruments used vary greatly in their strength. This paper questions what factors lead to the adoption of strong policy instruments promoting hydroelectricity. Explanatory factors are derived from Kingdon's Multiple Streams Framework (MSF) and are analyzed with fuzzy-set qualitative comparative analysis (fsQCA) within the Swiss cantons. The findings show that the strength of policy promoting hydroelectricity depends on the conjunction of mainly two factors: ambitious climate targets and an already well-established hydroelectricity sector that generates large tax revenues for the cantons. Depending on the context, the strength of left-wing and green parties as well as the current level of exploitation play an important role with the afore mentioned factors.

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2.1 Introduction

Energy transitions involve a variety of economic, societal, and cultural factors (Reiche & Bechberger, 2004). However, most studies analyzing the development of renewable energy focus on market processes and price levels of alternative energy sources. Authors therefore emphasize the need for a more in-depth analysis of the interchange between socio-political factors and regulation on renewable energy development (Kuhlmann, Shapira, & Smits, 2010). Recent studies find that low-carbon transitions are largely influenced by regulatory politics (Yi & Feiock, 2014b), but they do not specify what factors, or what combinations of factors, lead to a particular regulatory output. Exceptions are Delmas and Montes-Sancho (2011) and Lutz et al. (2017), who analyze factors which lead to the adoption of renewable energy policies in American states and in the German regions, or Feiock and West (1993), who look at explanations for the implementation of policies in the domain of waste management. Furthermore, some studies consider instruments after their implementation with regard to their comprehensiveness (Iychettira, Hakvoort, & Linares, 2017) and/or effectiveness (Menz & Vachon, 2006; Persson, 2006; Shrimali & Kniefel, 2011; Yin & Powers, 2010).

This paper helps further filling this research gap by specifically looking at the link between socio-political factors and the promotion of hydroelectricity. Hydroelectricity is currently one of the most established renewable energy sources, but still has largely unexploited global potential (Koch, 2002). It is an interesting case regarding other renewable energy sources that are not yet well-established, or for so-called niche-technologies. It can highlight the interchange between socio-political factors relevant for deployment of these new technologies where the process of regulation and promotion may be less advanced.

Even though hydroelectricity is already well-established, it also faces multiple challenges: the conflict between hydroelectric power production on one side and landscape and environmental protection on the other has intensified (Abazaj, Moen, & Ruud, 2016; Wolsink, 2010), and new technologies become more and more relevant (Fouquet, 2013; Gaudard & Romerio, 2014). Additional factors such as the public acceptance of infrastructure projects or the economic profitability hinder a quick expansion of hydroelectric energy (Dermont et al., 2017; Wüstenhagen et al., 2007). In order to overcome such issues, governments use policy instruments to promote hydroelectricity (Lodge & Wegrich, 2012). There are big variations among the implemented measures and their strength that remain puzzling and highlight the need for a better understanding of the connections between socio-political factors and regulation concerning energy transitions. It is assumed that such factors unfold their effect not alone but only in combination with other factors, depending on the specific context. This paper therefore asks

the question: *what combinations of factors lead to the adoption of strong policy instruments promoting hydroelectric power generation?*

Based on Kingdon's (1984) multiple streams framework (MSF), this study derives drivers from the problem, politics, and policy stream: the problem stream contains elements that push an issue onto the political agenda and through to the decision phase. The interests of different actors, such as the state governments, legislative bodies, and interest groups, are covered by the politics stream. The paper also includes the legal feasibility of energy promotion with current climate and environmental policies and path dependencies due to the current energy mix in the policy stream. A specific output occurs through a combination of factors within the mentioned three streams (Howlett, McConnell, & Perl, 2015; Zahariadis, 2014). By applying the MSF, the paper tries to shed light on the different combinations of socio-political factors affecting instrument choice in the field of energy transitions and compares them across multiple cases.

Additionally, the paper tries to clarify two aspects of the MSF, which have been questioned by scholars. First, theoretical applications of the MSF have often been criticized for putting too little emphasis on the nature of the output and treat the output ambiguously (Ackrill, Kay, & Zahariadis, 2013; Herweg, Huß, & Zohlnhöfer, 2015; Jones et al., 2016; Zahariadis, 2008). Most studies therefore analyze the factors and combinations of factors leading to an output. However, they often stop with the analysis at this point and do not consider the nature of the output any further. In the present paper, this problem is dealt with by explaining a specific policy output and by identifying combinations of conditions that lead to it.

In addition, the MSF has often been criticized for neglecting political institutions (Olsen, 2001; Zahariadis, 2016). In the context of this paper "*[i]nstitutions* are defined as systems of formally or informally embedded social rules that may constrain or enable policy-making" (Zahariadis, 2016, p. 3). The mentioned critique is overcome by complementing the model with two institutional factors that are expected to have an effect on the adoption of strong policy measures promoting hydroelectricity: the degree of decentralization in the water domain, as well as the current production of hydroelectricity in a canton.

So far, the MSF has mainly been applied qualitatively (Jones et al., 2016), whereas renewable energy developments have mainly been studied quantitatively with an economic perspective (Yi & Feiock, 2014b). Thus, this paper tries to bridge the application of the MSF and the analysis of renewable energy development by using a method between the qualitative and quantitative approaches: the fuzzy-set qualitative comparative analysis (fsQCA) (Ragin, 2014). Fur-

thermore, the choice of method is justified by the combinatorial nature of the research question that is interested in the interactions between the problem stream, the policy stream, and the politics streams as well as the institutional factors. fsQCA is an appropriate choice of method because it enables us to identify complex causal patterns of factors without having a large amount of cases (Schneider & Wagemann, 2012). Thus, a set-theoretic perspective is adopted that entails the assumption of *conjunctural causality*. This implies that a single element in the three streams does only unfold its effect in combination with other factors. This corresponds to the basic presumption of the MSF that the streams need to be combined in order for an effect to take place. In this regard, fsQCA captures this aspect better than the more frequently used quantitative approaches. Another general assumption in fsQCA - *equifinality* - also complements MSF and entails, depending on the context, different combinations of factors leading to the specific output.

In the Swiss case, hydroelectricity is even more important because it currently accounts for more than half of the country's electric power and a new strategy was accepted by the public in May 2017 with a target to increase its production. Because the 26 cantons (sub-national states) are the main implementing force in the domain of energy policy, due to the principle of subsidiarity, they allow an adequate comparison of the implemented policies and the driving factors. Furthermore, Switzerland also experiences a strong climate mitigation policy since the beginning of the 20th century (Ingold, 2008b, 2011). This might create an overall favorable context for the promotion of a low-carbon energy supply. In addition, after the Fukushima incident, the Swiss government decided on a nuclear phase-out which puts even more pressure on the cantons (Fischer, 2015; Swiss Confederation, 2013a).

The remainder of the paper is structured as follows: in section two, the object of interest and the multiple streams framework that forms the theoretical background are presented. Afterwards, the research design including a short introduction to fsQCA, the calibration for outcome and conditions, and the results are explained. The next section will discuss the results with regard to some specific cases. In the final section, the findings will be summed up and discussed with regard to future research and policy implications.

2.2 Theoretical background

2.2.1 Policy instruments promoting hydroelectricity

Policy instruments are measures implemented by state actors in order to achieve a certain target or solve a specific problem (Howlett, 2007, 2017). They differ in type and how they

operate. Windhoff-Héritier (1987), for example, suggests five different types of policy instruments: rules and limits; incentives; state offers; information and education, as well as the state being a role model for the public and other actors. Vedung (2007) focusses on the degree of coercion exerted by state actors and separates policy instruments in what he calls sermons, carrots, and sticks. These different types of instruments address a problem from different perspectives. Therefore, most policy instruments are generally substitutable with each other (Hill & Varone, 2017; Landry & Varone, 2007). In principle, policy makers have a 'tool-box' of instruments for every problem they want to address (Flanagan, Uyarra, & Laranja, 2011) even though they hardly ever have the choice between all of those instruments due to path-dependency (Thelen, 1999), restrictions based on policy preferences (Jenkins-Smith, Nohrstedt, Weible, & Sabatier, 2014; Sabatier, 2007), or time and budget restraints (Howlett & Mukherjee, 2017; Howlett & Ramesh, 1993). Policy instruments of different types are often dynamically combined. Together they constitute the so-called policy mix that is supposed to resolve a problem from multiple angles (Howlett, 2007; Howlett & del Rio, 2017; Howlett, Mukherjee, & Woo, 2015; Sorrell, 2003).

The outputs of interest in this paper are policy instruments that promote hydroelectricity and their strength in particular. These measures are put in place in order to overcome capital cost disadvantages when compared to fossil power sources (Enzensberger, Wietschel, & Rentz, 2002), to foster public acceptance of infrastructure projects (Wolsink, 2012), or to diffuse a new technology that has yet to be established (Dewald & Truffer, 2012). Should a nation-state, or any other political entity, decide the expansion of renewable electricity production is a goal that has to be pursued, then this goal is often supported by strong policy instruments (Schreurs, 2012). This holds especially true as long as fossil power sources are still relatively cheap in comparison to renewables. Policy makers should therefore target multiple aspects of renewable energy generation by implementing instruments in policy mixes that simultaneously target (e.g.) energy demand, spatial planning, or environmental protection (Carley, 2009, 2011; Yi & Feiock, 2012). Following this argumentation, the strength of policy instruments promoting hydroelectricity is conceptualized as follows: Knill et al. (2010) suggest two dimensions that try to assess how such a policy mix is attuned: regulatory density and regulatory intensity. Density measures the amount of regulatory activity usually operationalized by counting the number of policy instruments employed in a specific policy field. Intensity refers to the depth or rigorousness of those policy mixes and is usually measured by sizing up the amount of employed resources (e.g., budget for feed-in remuneration at cost) by the number of targets or by the level of state regulation (e.g., energetic minimal standards for new

buildings). Especially the regulatory intensity allows comparisons across cases (Knill et al., 2010). It is thus adopted as the key-indicator for the output because it gives us an understanding of how strongly a canton promotes hydroelectricity.

2.2.2 The Multiple Streams Framework

The Multiple Streams Framework (MSF) (Kingdon, 1984) is one of the most widely recognized political process theories and has been applied in a broad range of policy fields (Cairney & Jones, 2016; Jones et al., 2016; Sabatier & Weible, 2014). Many MSF applications deal with policy outputs in terms of instruments and measures altered within one policy field or political program (for policy measures in Swiss alcohol prevention see Sager and Rielle (2013); for policy-making in Canadian municipal emergency management see Henstra (2010); for the adoption of policy instruments in German climate policy see Brunner (2008); for policy change altering the status of school sport and PE see Houlihan & Green (2006); for a change in Canadian educational programs see Stout and Stevens (2000), etc.).

The MSF is an appropriate framework to explore the relationship between socio-political factors and the regulation of energy transitions, hydroelectricity in particular, because the adoption of policy instruments is a complex procedure that is influenced not only by political actors, but also by the specific nature of the issue and by the predominant regulation that was in place before the adoption of any new instruments. MSF assumes that specific outputs are produced by a combination of factors derived from three streams that cover political actors, but also emphasize specific elements that address the nature of the issue and its limitations for change due to path-dependency. Additionally, this paper tries to clarify two aspects of the MSF that have been questioned by scholars: first, the MSF has often been criticized for putting too little emphasis on the nature of the output and treating the output in an ambiguous way (Herweg et al., 2015; Zahariadis, 2008, 2015). Most studies do not consider an output after it was identified. In other words, they analyze if there is a policy output after a political process. Yet, what this output looks like and its attributes are given secondary attention (Ackrill et al., 2013; Jones et al., 2016). This paper deals with this ambiguity problem by explaining a specific policy output (strong promotion of hydroelectricity) and by identifying specific conditions which lead to this specific output. This consideration should, however, not be confused with the fact that political actors often pursue strategies which contain multiple ambiguous solutions in order to achieve their specific targets (Zahariadis, 2003, 2014; Zohlnhöfer & Rüb, 2017). Second, the MSF has been challenged for neglecting political institutions or treating them as

exogenous (Cairney & Jones, 2016; Olsen, 2001; Zahariadis, 2016). The MSF is therefore complemented with an institutional dimension, which includes the degree of decentralization in the water sector and the size of the already existing hydroelectric power generation industry. These additional factors will be discussed in detail later in this paper.

The MSF draws from Cohen, March, and Olsen's (1972) garbage can model of organizational choice and conceptualizes the policy process as three different streams that are generally independent from each other (Zahariadis, 2003). In order for policy change to happen, these three streams need to converge in a 'window of opportunity' which is "an opportunity for advocates of proposals to push their pet solutions, or to push attention to their special problems" (Kingdon, 1984, p. 173). Since the events in Fukushima, energy policy has been one of the dominant subjects in Swiss politics on the national as well as on the cantonal level (Sager, 2014). This period includes the decision to phase out all nuclear power plants, an extensive consultation procedure including multiple committee hearings, open debates in parliament, as well as the acceptance of the new Energy Strategy 2050 at the polls in May 2017. The paper therefore considers this dynamic phase to be an open window for policy adoption (Sager & Thomann, 2016; Zahariadis & Exadaktylos, 2016).

As mentioned, the MSF categorizes different factors driving political change in three streams: the problem, policy, and politics stream. The major role of the problem stream is to put an issue on the political agenda and keep it there until a final decision has been made (Henstra, 2010). This happens if there is a discrepancy between the intended and the actual state of certain issues within the public sphere (Kingdon, 1984). Policy makers are sensitive to these discrepancies because the public might retaliate with low support during the next election should they not address these problems accurately (Zahariadis, 2003). In the problem stream, the impulse-giving element has traditionally been a focusing event (Birkland, 2010) or an incident with a large impact on public opinion (Zahariadis, 2008). However, Kingdon (1984) has also contemplated less 'extreme' events, such as changes in indicators, can function as triggers (see also Lehtonen, 2015). Sager & Rielle (2013) for example conceptualize the problem stream in their study about the adoption of alcohol policy programs by measuring the amount of people who drink alcohol more than once a day and interpreted this as the actual problem pressure. Another example are new scientific publications in the domain of climate change that entered public debate in Germany (Brunner, 2008).

Kingdon (1984) further conceptualizes the policy stream as a 'primordial soup' with many different solutions for a problem floating around. All solutions, which are considered for im-

plementation, need to fulfill certain 'criteria for survival': technical feasibility or value acceptability. The criteria of technical feasibility relates to how easily an instrument can be implemented in the current legal framework. This depends (implying path-dependency) on the previously implemented instruments from the same or related sectors.

The politics stream mainly consists of political actors and their preferences. Political actors are considered to be relevant if they are able to influence the policy process during the drafting of the proposal (decisional approach) or the final decision phase (positional approach) (Magill & Clark, 1975a; Pappi & Henning, Christian H. C. A., 1998). The most relevant actors for the model are the cantonal parliaments. They decide on policy proposals and are therefore crucially influential on which policy instruments are implemented. Since the members in parliament represent political parties, they are going to support proposals which correspond with their political beliefs (Sabatier, 1988, 2007). For instance, green and left-wing parties are generally going to opt for a higher amount of financial support for renewable energies and energy efficiency, whereas more conservative or liberal parties will do so to a lesser extent (Freitag & Vatter, 2015). Therefore, the parliaments of the Swiss cantons are an important explanatory variable for the strength of policy instruments in each canton.

Additionally, in the case of Switzerland the potent cantonal administrations have to be considered as important players in the decision-making process. The cantonal administrations are entrusted with the detailed implementation of the respective canton's energy policy goals. Since all cantons have integrated the promotion of renewable energies and energy efficiency to a certain degree, the administration needs to take an active stance. Resourceful energy divisions might therefore have an impact on the level of renewable energy promotion.

Another frequent element in MSF theory are so-called entrepreneurs who strategically try to steer the political process into their desired direction (Zahariadis & Exadaktylos, 2016). However, the main analytical interest of this study focusses on the actual combination of factors that lead to a certain output and not on the specific moment of the coupling. Following Sager and Thomann (2016) and other scholars (see Cairney & Jones, 2016), the paper does not directly include entrepreneurs in the QCA analysis, however, the potential influence and role of policy entrepreneurs is discussed in two short case studies following the analysis section. The exclusion of one of the general elements of MSF is done rather frequently and does not hinder the application of MSF as long as it can be justified with the research interest of the analysis (see also Howlett, McConnell, & Perl, 2017).

2.2.3 Institutions

The MSF has repeatedly been challenged for neglecting an important element of policy processes: political institutions (Olsen, 2001). "*Institutions* are defined as systems of formally or informally embedded social rules that may constrain or enable policy-making" (Zahariadis, 2016, p. 3). Those formal and informal rules and norms thus structure how decisions are made because they distribute power between actors and influential actors' interpretations of situations (Ostrom, 2005; Sager & Rielle, 2013, p. 3). The energy sector is a policy field that is heavily structured and contains many such institutions (Koch, 2002). They are therefore expected to have an impact on policy outputs and instrument choice when a policy window is present (John, 2012). The focus is primarily put on two aspects: the degree of decentralization in the water domain, as well as the current production of hydroelectricity in a canton. The formal legislation for the promotion of hydroelectricity takes place on the cantonal level. However, cantons show differences in the distribution of competences concerning more practical matters such as granting concessions for the use of water bodies. On the grounds that a canton has an interest in steering actions not controlled by itself, cantons with a high level of decentralization are expected to have stronger policy instruments promoting hydroelectricity (Taylor, 2007). Second, cantons that already produce large amounts of hydroelectricity have established an institutional setting which generally favors infrastructure projects (Sager, 2014). This is especially the case for cantons with an alpine landscape because hydroelectricity requires usually large infrastructure projects such as dams or run-of-river power stations. This leads to a setting where the public and public officials are well acquainted to such projects and infrastructure (Wolsink, 2012). This, in turn, may lead these cantons to promote hydroelectricity with more extensive strategies. However, on the other hand, cantons that already produce large amounts of hydroelectricity may also refrain from further promoting this technology and move to other sources. From this perspective, a two-sided hypothesis about the effect of the current production seems to be most appropriate.

2.3 Context and case selection

Switzerland is a federalist country with 26 sub-national states (so-called cantons) which vary in their administrative, as well as their socio-political and geographic, structure (Vatter, 2016b). General targets in the domain of energy policy are issued on the national level by the federal government. However, the implementation of these targets is, due to the principle of subsidiarity, mainly in the cantons' competence (Sager, 2014). The cantons' main activities in recent years have involved the domains of renewable energy promotion and energy efficiency

in buildings. In the energy efficiency sector, the cantons coordinate their policies and standards. However, the 26 cantons have put different effort in the realization of the proclaimed energy turnaround. Their current actions include the general information of the public and a more specific professional audience, as well as coordination, subsidies, tax reductions, all the way to regulation and standards. One major instrument for the promotion of hydroelectricity is, however, the use of feed-in rates. In Switzerland, a national scheme levies taxes on direct electricity consumption. Cantons refrain from implementing a similar system on the local level due to financial constraints and potential legal conflicts with the national level (Sager, 2014; Vatter, 2016b). However, the general array of instrument types, and how many of these instruments are employed, is broad.

This specific setting makes Switzerland and its 26 cantons an ideal case study to investigate what different factors and combinations of factors might explain differences in the promotion of hydroelectricity. More generally, the Swiss case is relevant for several reasons: first, Switzerland follows a strong climate mitigation policy since the beginning of the 20th century (Ingold, 2008b, 2011). This might create an overall favorable context for the promotion of a carbon-free energy supply. Second, after the Fukushima incident in 2011, the Swiss government decided on a nuclear phase-out (Swiss Confederation, 2013a). This decision may give a low-carbon energy supply in general, and hydroelectricity in particular, a boost because one of the three main pillars of the new so-called Energy Strategy 2050 is the expansion of hydroelectric power generation (the other two are to increase energy efficiency and the promotion of other renewable energies (notably wind, solar, geothermal & biomass)). The strategy was proposed by government and parliament and survived a popular referendum in May 2017.

In Switzerland, hydroelectricity has always constituted a major portion of the domestic electric power production. Before the construction of the nuclear power plants, its share was close to 100 percent. Its dominant position is primarily due to two factors: path-dependency and Switzerland's lack of natural resources. Additionally, other renewable energy sources such as solar, wind, or geothermics do not have such massive capacities. An expansion is still somewhat challenging because it already accounts for more than ninety percent of the renewable share (Swiss Federal Office of Energy SFOE, 2017b). Furthermore, the hydroelectric power production is challenged by currently low prices for electricity in Switzerland. These factors illustrate the need for policy interventions which are common for the energy sector and is generally acknowledged by most actors (Howlett, 2009b; Lodge & Wegrich, 2012).

2.4 Research design

2.4.1 Qualitative Comparative Analysis

In recent years, Qualitative Comparative Analysis (QCA) found increased popularity among scholars in political and other social sciences (e.g.,Emmenegger, Kvist, & Skaaning, 2013). QCA belongs to the so-called set-theoretic methods and tries to analyze causal relations with a small or medium amount of cases (Ragin, 2014). More concretely, QCA operates with membership scores of elements in sets and attempts to identify combinations of necessary and sufficient conditions for a certain outcome (Schneider & Wagemann, 2012, p. 8). This combinatorial aspect captures the MSF's core assumption that elements of the three streams need to be combined in order to produce an output. Following the principles of Boolean algebra, and using logical minimization, irrelevant conditions are excluded and necessary and sufficient conditions can be identified. These necessary and sufficient conditions are then combined to paths, which lead to a certain outcome. This paper aims at identifying necessary and sufficient conditions for strong policy instruments promoting hydroelectricity.

As preparation for the analysis, cases are divided up into different sets in which the cases share a certain condition. The calibration of fuzzy-sets relies on extensive case knowledge or is based on the structure of the data (Schneider & Wagemann, 2010). In fsQCA cases are calibrated on a continuous scale from 0 to 1. Each case has a certain degree of membership in every condition included in the model. A case with a value 0 in a condition is considered to be fully out of a set and with a value of 1 to be fully in a set. All of the possible combinations of conditions are then collected in a truth table that forms the core of every QCA analysis. Table 1 reports the data table of the present analysis. Every observed case (the 26 cantons in this instance) can then be attributed to a certain degree to one specific row that corresponds to the characteristics of the case's conditions. The truth table rows where no real world case can be attributed to are so-called logical remainders that are later used for logical minimization (Schneider & Wagemann, 2012). In this paper, logical remainders are included if they have a higher raw consistency value than 0.9 (Ragin, 2008). Given the various possible constellations of conditions, fsQCA accounts for the causal complexity behind the appearance or absence of an outcome crucial for the explanation of policy processes (Fischer & Maggetti, 2016). It therefore also accounts for three assumptions made when applying QCA: *equifinality*, *causal asymmetry,* and *conjunctural causation*. *Equifinality* implies different constellations of conditions can lead to the same outcome (Berg-Schlosser, Meur, Rihoux, & Ragin, 2009). *Causal asymmetry* means if a certain condition (or combination of conditions) leads to a certain out-

come, the absence of this condition does not imply the absence of the outcome. Lastly, *conjunctural causation* implies a condition present in a path leads to a certain outcome only in combination with other conditions. The condition by itself, however, does not lead to the outcome. This aspect of fs QCA captures the essence of MSF that says only a combination of factors from the three streams can lead to a specific outcome. All three concepts correspond to the assumptions made in the MSF where different elements from the three streams might lead to a certain policy output.

2.4.2 Outcome and calibration

The intensity of regulation in a policy field (here: the promotion of hydroelectricity) can be assessed (among others) with two measures: the scope and the level of a policy mix. The scope refers to the number of actors targeted by the instruments. The regulatory level relates to the amount of resources (e.g., financial commitments, services provided by the canton, etc.) deployed for an instrument (Knill et al., 2010). Regulatory intensity is therefore conceptualized as follows: The intensity of the promotion of hydroelectricity (WATERPROM) varies greatly among cantons. Multiple cantons implemented strong water strategies that contain multiple promotional measures explicitly coordinated with other policy domains such as environmental protection, spatial planning, and construction law. Other cantons use multiple instruments promoting hydroelectricity less well-coordinated and have less far-reaching impacts than the strategies. Another group of cantons implemented only soft instruments such as a hotline for questions or simple information material. Furthermore, some cantons do not employ any policy instruments at all. Since the accumulated information about the 26 cases is vast, but the nature of the data is not identical across cases, the outcome condition is calibrated with a four-value scheme (Ragin, 2008). The 'point of maximum indifference' (Schneider & Wagemann, 2012, p. 30) is passed when a canton promotes hydroelectricity with more effort than just by simply distributing information. Therefore, the calibration of the cases for the WATERPROM condition is as follows: a strong strategy that contains multiple coordinated instruments, receives the value (1); multiple instruments that are not as intense as the strategy, are considered to be more in than out of the set (0.67); soft instruments (e.g., information) receive the value (0.33); and cantons with no instruments promoting hydroelectricity are fully out of the set (0). The information about the various policy instruments in the different cantons has been collected through the annual publication 'state of energy policy in the cantons' provided by the Swiss Federal Office of Energy (SFOE) and the Swiss Conference of Energy Directors EnDK (2015) as well as through additional research.

2.4.3 Conditions and calibration

The calibration process is crucial for the later analyses (Schneider & Wagemann, 2012). Therefore, the calibration of all conditions is ideally based on in-depth case knowledge that allows clearly defined thresholds between the different degrees of set-membership (Yamasaki & Rihoux, 2009). Case knowledge has been obtained through an analysis of the regulatory frameworks and policy mixes in all 26 cantons as well as with semi-structured expert interviews. The interviews have been conducted with the directors of several cantonal energy departments as well as with representatives of the Swiss Federal Office of Energy and NGOs. The choice of the thresholds is therefore based on strong case knowledge obtained through the above-mentioned methods, or based on natural gaps in the data. The following section contains information about the theoretical bases of the conditions, the expectation of their influence on the outcome, their operationalization, and their respective calibration. The analysis contains six conditions that may explain the outcome. Overly complex solution paths that would make the theoretical interpretation of the results challenging are thereby avoided (Schneider & Wagemann, 2010). The conditions and their specific calibration with thresholds and crossover points are displayed in Table 1.

2.4.4 Drivers of the problem stream

The first condition captures the problem prevalence of the promotion of hydropower in each canton. Multiple cantons perform well in the domain of hydroelectricity and cover an already large share of their total potential for hydroelectric energy. However, some cantons have neglected said potential. A low exploitation of the hydroelectric potential is therefore interpreted to be a problem for the canton and cantons with a low level are expected to put more effort in the promotion of hydroelectricity in order to catch up with the frontrunners. The maximum potential for the production of hydroelectricity was evaluated in every canton with a study conducted by the Swiss Federal Office of Energy. Based on this information and the presently produced amount of hydroelectricity the level of exploitation was calculated for every canton (QUOTA). The obtained ratios are rather high for most cantons and range between 52 and 99 percent with two cantons producing no hydroelectricity at all.

2.4.5 Drivers of the politics stream

According to the MSF, legislative actors are crucial in the decisional phase of the political process because they try to push solutions that correspond with their preferences and beliefs

(Herweg et al., 2015). Traditionally, green and left-wing parties in Switzerland put a high emphasis on environmental and renewable energy issues, whereas more liberal and conservative parties are more averse to state intervention and regulation (Kriesi & Jegen, 2001; Sager, 2014; Vatter, 2016b). An important consideration, which needs to be made, is the fact that hydropower plants can have different impacts on the environment based on their size. On the one hand, huge dams, especially in the alpine regions, account for substantial amounts of electricity; on the other hand, small-scale hydro plants only produce a fraction of the total electric power generation. In Switzerland, hydropower generally enjoys a very high level of acceptance among the public, the political elite, and even among left-wing and green parties (Stadelmann-Steffen & Dermont, 2016). Interestingly, the support for large-scale projects is even higher than for small-scale power plants because of the ratio between environmental impact and electricity production. In other words, the Swiss follow a 'let's go big or go home'-logic. The paper assumes the bigger the influence of left-wing and green parties in the cantonal parliaments the more dominant the presence of their respective interests. Parliaments with a large share of left-wing and green parties are expected to foster a strong promotion of hydroelectricity, while center and right-wing parties are more sceptic toward regulation and redistribution (Vatter, 2016b). The strength of left-wing, green, and green-liberal parties in the cantonal parliaments is therefore included in the model and summed up in the LEFT-condition. The last condition belonging to the politics stream is the administrative capacity (WORK). Administrative capacity is crucial for multiple stages of the policy process (Rieder, Balthasar, & Kissling-Näf, 2014; Sabatier & Mazmanian, 1980). When a new policy proposal is drawn up, the administration provides vast technical and legal knowledge and oftentimes participates actively in the preparation of the proposal (Vatter, 2016b). This knowledge is especially crucial in complex and technical domains such as energy policy (Dewald & Truffer, 2012; Sager, 2007). It is therefore assumed that a sufficiently staffed energy department favors a strong promotion of hydroelectricity. Additionally, it is assumed that cantons lacking the necessary administrative capacity in the energy domain are not able to create a comprehensive strategy or multiple instruments for the promotion of hydroelectricity. According to expert opinions, there are significant differences in the capacities of the different cantons' energy departments. A ratio for each canton has been calculated that corresponds with the total number of full-time equivalents in the energy department in relation to the canton's population. The values calculated this way do not carry any interpretable information. Independently from these calculations, the experts agree on which cantons put many resources in the staffing of their energy department.

		Stream	Measurement	Calibration
Outcome				
WATERPROM	Promotion of hydro-electric power		Strength of policy instruments promoting hydro-electric power	1 = strong strategy for the promotion of hydroelectricity 0.67 = multiple instruments, but less strong than strategy 0.33 = few instruments (mainly information) 0 = no instruments
Conditions				
QUOTA	Amount of exploited potential	Problem	Level of exploitation (GWh/a) relative to the total potential for hydro-electric power in a canton (GWh/a); in %	fully in = > 95% crossover point = 87% fully out = < 80%
LEFT	Strength of left-wing and green parties in the state parliament	Process	Share of social-democratic, green, green-liberal and far-left parties in the state parliament 2015	fully in = > 40% crossover point = 30% fully out = < 20%
WORK	Resources of the department of energy	Process	Amount of full-time equivalents in the energy section relative to the state population 2015 / 100'000 inhabitants	fully in = > 8 crossover point = 3 fully out = < 1.5
CO2	Rigorousness of the CO2 legislation in a state	Solution	Strength of climate targets on the state level	1 = ambitious short term goals 0.67 = ambitious long term goals 0.33 = general goals with no temporal indication 0 = no targets
DECENT	Degree of decentralization in the water sector related to hydroelectricity	Institution	Distribution of competences within the hydro-electric sector (e.g., distribution of operating permits)	1 = fully under local / communal control 0.67 = mostly under local/ communal control 0.33 = mostly under state control 0 = fully und state control
HYDRO	'water castle'-variable	Institution	Amount of hydro-electric power produced in 2014; measured in GWh/a.	fully in = >1400 GWh/a crossover point = 700 GWh/a fully out = < 100 GWh/a

Table 1: Calibration of outcome and conditions

Switzerland is a consensual democracy where governments consist of members from multiple parties. Therefore, the individual party affiliations of the respective heads of the energy department play a less important role than in democracies with stable coalitions or one-party majorities (Vatter, 2016b). Thus, the cantonal governments are omitted from the model.

2.4.6 Drivers of the policy stream

Switzerland knows a strong climate mitigation policy since the beginning of the 20th century (Ingold, 2008b, 2011). The targets are set on the national level. However, due to the principle of subsidiarity, the cantons are responsible for their implementation (Jegen, 2009; Sager, 2014). Since ambitious CO2 targets can only be achieved through adequate measures, cantons often adopt intense instruments promoting hydroelectricity (Schreurs, 2012). There is great variation among the specific targets set in the 26 cantons. The most common goal is the 2000-watt society. One group of cantons is ambitious and targets to reach this goal by 2035. Another group wants to do the same by 2050. Some cantons have not set a specific date or envision the 2000-watt society as a long-term target (e.g., target is to be reached by 2100). A last group of cantons has not set any targets at all (by June 2016). Therefore a four-value scheme suggested by Ragin (2009) is applied for the CO2 condition.

2.4.7 Drivers concerning the institutional setting

In the MSF, institutions are often neglected (Olsen, 2001; Zahariadis, 2016). This paper tries to overcome this critique by including two institutional conditions. Cantons which already produce large amounts of hydroelectricity have established an institutional setting that generally favors infrastructure projects (Sager, 2014). The so-called 'Wasserschloss-Kantone' (water castle cantons) contribute more than sixty percent of the total amount of hydroelectricity produced in Switzerland and have a big interest in a competitive hydroelectricity sector because they profit heavily due to a taxes charged on the use of water. It therefore appears to be plausible they would promote hydroelectricity with comprehensive strategies. In some cantons up to 40 percent of the budget is generated through this specific tax. Additionally, public officials and especially the cantonal administration have vast experience with regulating and coordinating hydroelectric projects. Therefore, cantons that already have a large production of hydroelectricity are expected to implement more comprehensive instruments promoting it. However, the large production of hydroelectricity might also move cantons to promote other technologies because production cannot be increased infinitely. For the HYDRO condition,

this paper therefore follows a two-sided hypothesis. Hence, HYDRO corresponds to the absolute amount of hydroelectricity produced in a canton in 2014 measured in GWh/a. The condition is calibrated based on case knowledge. The absolute amount of hydroelectricity produced in a canton is further influenced by the size and the geographic conditions.
The degree of decentralization (DECENT) in the hydroelectricity sector is then integrated with the final condition of the model. Cantons show differences in the distribution of competences when it comes to more practical matters such as granting concessions for the use of water bodies. Cantons with a high level of decentralization are expected to have stronger policy instruments promoting hydroelectricity. The truth table with all applied calibrations is presented in table 2.

2.5 Results

2.5.1 Necessity and sufficiency

The following section presents the test results of necessary conditions for a strong promotion of hydroelectricity (WATERPROM) and continues with the analysis of sufficiency.
Ragin (2009) calls first for the designation of potential necessary conditions for the outcome. According to Schneider and Wagemann (2010), the consistency threshold is set in good practice at 0.9 or higher. In this model, none of the conditions passes the threshold for the positive outcome. The highest scores in the consistency value are obtained for QUOTA (0.80) and CO2 (0.73).
In order to assess sufficiency for the positive outcome, two different solutions are produced: the 'complex' or 'conservative' solution, which uses no logical remainders and the 'intermediate' solution, which incorporates all logical remainders that correspond with the theoretical assumptions. Only the intermediate solution is discussed in depth because it is generally considered to be superior to the other (Ragin, 2008; Schneider & Wagemann, 2010).
The intermediate solution term for WATERPROM is depicted in Table 3 and should be read as follows: the combination of a large production of hydroelectricity, a high level of exploitation, and ambitious climate goals in a canton is a sufficient condition for strong instruments promoting hydroelectricity. The same is the case for the combination of a high level of exploitation, strong left-wing and green party presence, and ambitious climate goals. Finally, another path with a resourceful energy department, strong left-wing and green parties, strong decentralization, and ambitious climate goals seems to lead to a strong promotion of hydroelectricity.

Canton	WATERPROM	HYDRO	QUOTA	WORK	LEFT	DECENT	CO2
Argovia AG	1.00	1.00	0.99	0.07	0.41	0.33	0.66
Appenzell Inner-Rhodes AI	0.00	0.03	0.00	0.27	0.00	0.33	0.00
Appenzell Outer-Rhodes AR	0.00	0.03	0.00	0.60	0.00	0.00	0.00
Berne BE	1.00	1.00	0.93	0.02	0.86	0.00	1.00
Basle-Country BL	0.33	0.58	0.99	0.09	0.98	0.00	0.66
Basle-City BS	0.00	0.03	0.00	0.84	0.99	1.00	0.00
Fribourg FR	0.66	0.39	0.93	0.20	0.85	0.00	1.00
Geneva GE	0.00	0.53	0.90	0.72	0.85	0.66	0.00
Glarus GL	0.00	0.73	0.90	0.54	0.28	0.66	0.00
Grisons GR	1.00	1.00	0.86	0.77	0.24	1.00	1.00
Jura JU	1.00	0.04	0.75	0.66	0.97	0.33	1.00
Lucerne LU	0.66	0.04	0.00	0.02	0.21	0.33	0.00
Neuchâtel NE	0.66	0.08	0.90	0.51	0.98	0.00	0.66
Nidwald NW	0.33	0.06	0.00	0.04	0.03	0.33	0.00
Obwald OW	0.00	0.16	0.50	0.10	0.01	0.00	0.00
St. Gall SG	0.33	0.43	0.75	0.01	0.17	0.00	0.00
Schaffhouse SH	0.66	0.03	0.01	0.71	0.85	0.66	1.00
Solothurn SO	1.00	0.36	0.99	0.09	0.65	0.00	0.66
Schwyz SZ	0.33	0.40	0.99	0.03	0.01	1.00	0.00
Thurgovia TG	0.00	0.04	0.00	0.12	0.29	0.00	1.00
Ticino TI	0.66	1.00	0.98	0.03	0.16	0.66	0.00
Uri UR	1.00	0.95	0.59	0.98	0.02	0.66	1.00
Vaud VD	0.66	0.82	0.59	0.06	0.92	0.00	1.00
Valais VS	1.00	1.00	0.98	0.09	0.00	1.00	1.00
Zoug ZG	0.33	0.04	0.40	0.01	0.29	0.33	0.00
Zurich ZH	0.66	0.42	0.96	0.02	0.97	0.33	0.33

Table 2: Data table

Causal paths	inclusion	PRI	raw coverage	unique coverage	Cases covered
HYDRO*QUOTA*CO2	0.96	0.94	0.46	0.19	AG; VS; BL, VD; GR; BE; UR
QUOTA*LEFT*CO2	0.91	0.88	0.41	0.12	FR, SO; NE, JU; BL, VD; BE
WORK*LEFT*DECENT*CO2	1.00	1.00	0.10	0.05	SH
CO2(QUOTA(HYDRO+LEFT)+WORK*LEFT*DECENT) → WATERPROM	0.94	0.93	0.65	-	

Table 3: Intermediate solution for the positive outcome (WATERPROM) Multiple covered cases: 3; operators for Boolean algebra: * = AND; + = OR; → = sufficient for; CAPITAL letters = presence of condition; lower case letters = absence of condition

The solution, which is a combination of the three paths, shows a high consistency value of 0.94. It covers twelve of the fifteen cases that are considered more in the set of WATERPROM than out. The results are reported in Fig. 1. The results were also tested for their robustness. A discussion of these tests can be found in section 0 in the appendix.

2.6 Discussion

The model identifies three paths for the presence of the outcome (WATERPROM) that correspond to two distinct groups of cantons. The results are discussed with regard to details specific to the context of the two groups and single cantons. The most reliable being the combination of a high production of hydroelectricity with highly exploited potential and strong climate mitigation targets (HYDRO*QUOTA*CO2) that covers seven cases. This combination contains elements from the policy and problem streams and an institutional factor. Interestingly, this path encloses five out of the six 'Wasserschloss' cantons (Uri, Argovia, Grisons, Berne, and Wallis), as well as the cantons of Vaud and Basle-Country. Information collected from expert interviews confirms the assumption made earlier that cantons with an already large hydroelectric industry are well-accustomed to its needs and to its large infrastructure. Additionally, their large and longtime experience with hydroelectricity has led to a comprehensive strategy in all five cantons. Vaud does not belong to this unofficial group, but shows similar traits. Furthermore, these cantons all profit heavily from hydroelectricity due to taxes levied on the use of water (so-called 'Wasserzins'). Almost all companies producing hydroelectricity in Switzerland are fully or partially owned by the cantons.

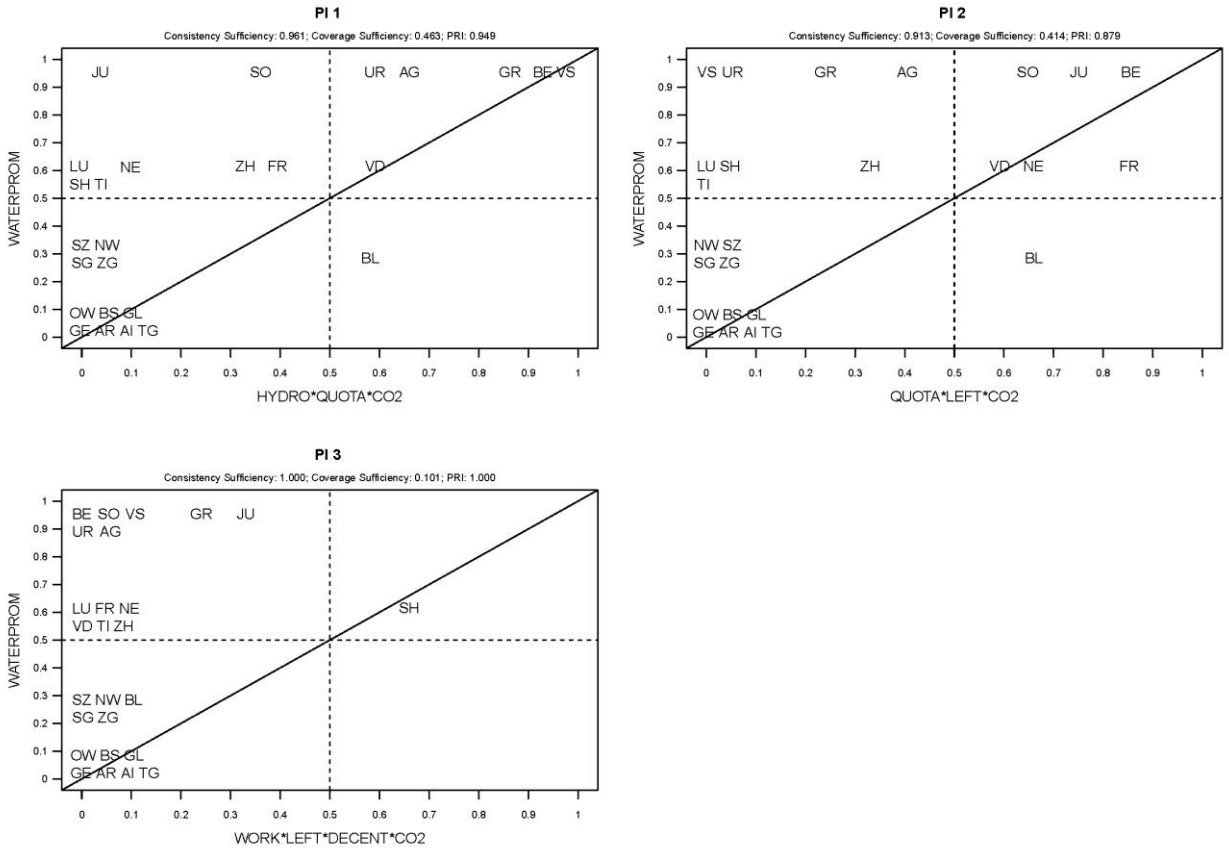

Figure 1: Fuzzy-set memberships in outcome and conditions for WATERPROM

These special interest relations are mirrored by the automatic appointment of cantonal public office holders to the companies' board of directors (e.g., members of the cantonal government or members of the Council of States). It is therefore plausible these cantons have a big interest in providing ideal conditions for companies operating hydroelectric power plants. The high level of exploitation complements this assumption. Furthermore, in this specific group the cantons themselves can be classified as policy entrepreneurs because they have a great interest in a flourishing hydro-sector and multiple experts confirm they dominantly promote such solutions in their respective jurisdictions. The last of the 'Wasserschloss' cantons (Ticino) is not covered by this path because the canton has yet to implement climate related targets.

Getting back to the original data table, Basle-Country is more out of the set of strongly promoting cantons than in (0.33), although, it is still part of the HYDRO*QUOTA*CO2 subset (see Fig. 1). This is because this canton has put its focus on other low-carbon technologies such as solar and wind and politically does not support the further deployment of hydroelectricity in its territory.

The second path also covers seven cases (Solothurn, Jura, Berne, Vaud, Neuchâtel, Fribourg, and Basle-Country), which shows the combination of a highly exploited potential, strong left-wing and green parties in parliament and rigorous climate targets (QUOTA*LEFT*CO2). The conjunction between the three factors corresponds with the classic MSF assumption that the problem, policy, and politics streams need to be combined. All seven cantons are located in the same geographic area, the Swiss plateau. They are all characterized by a high exploitation level, although their total hydroelectric potential is lower than in the 'Wasserschloss' group. This is due to the fact that the geographic landscape is flatter than in the mostly mountainous 'Wasserschloss' cantons and large-scale hydropower is only an option for larger running waters. The cantons covered by the second path also share the feature of rather strong left-wing and green parties in the cantonal parliaments. The influence of these parties on the implementation of promotional instruments can be observed through the larger share of adopted motions in this particular policy domain compared to the other cantons (Vatter, 2016b). The relative strength is further illustrated by the fact that all of the seven cantons are currently represented by a member of the social-democratic party in the national Council of States. In this second group, the left-wing and green parties can often be identified as policy entrepreneurs. For example, in Fribourg, the Social-Democrats and Greens were able to convince the largest party (the center-right Christian-Democrats) to pass a bill with more extensive measures for the promotion of renewables in general and hydro in particular.

The third path (WORK*LEFT*DECENT*CO2) reaches a consistency of 1.00 and covers only one case: the canton of Schaffhouse. This path is interpreted to be an artifact of the model since there is no information that would specifically explain this combination of conditions.

2.7 Conclusion

This paper investigated the causes for a strong promotion of hydroelectricity in order to shed more light on the connection between socio-political factors and regulation of renewable electricity generation. The promotion of hydroelectricity was conceptualized with the strength of the policy mix currently implemented in the cantons of Switzerland. Kingdon's (1984) Multiple Streams Framework was used as a theoretical framework and complemented with institutional factors. The paper systematically compared the cantons by applying fsQCA. Two relevant paths were identified for the presence of a strong promotion of hydroelectricity. The combination of an already large production of hydroelectricity, a high level of exploitation,

and ambitious climate goals in a canton is a sufficient condition for strong instruments promoting hydroelectricity. The same is the case for the combination of a high level of exploitation, strong left-wing and green parties, and ambitious climate goals.

This paper shows there is no simple link leading to a strong promotion of hydroelectricity. The paths are complex and mediated through multiple aspects within the three streams of the MSF. It is therefore not possible to identify a driver that single-handedly fosters the promotion of hydroelectricity. This finding supports the general assumption of the MSF that specific outputs can only be explained by combinations of factors derived from the three streams (Herweg et al., 2015; Kingdon, 1984; Sabatier, 1988; Zahariadis, 2008). The findings seem to be promising for the explanation of regional differences in the promotion of hydroelectricity: some states have a big interest in a competitive hydroelectricity sector because they profit heavily due to taxes put on the use of water. It therefore appears to be plausible that they promote hydroelectricity with comprehensive strategies. Additionally, the condition CO2 is present in both paths, explaining a strong promotion of hydroelectricity. CO2 is a so-called INUS condition, which is an "insufficient but necessary part of a condition which is itself unnecessary bur sufficient for the result" (Mahoney, Kimball, & Koivu, 2009, p. 126; Schneider & Wagemann, 2012). Hence, there seems to be a strong relationship between CO2 targets and the promotion for hydroelectricity. However, this result has to be taken with caution. It is crucial to consider which of the two (CO2 targets or promotion) was implemented first for every case because it is easier and less risky for cantons to reach challenging CO2 targets if they already have a large share of renewable energies in their portfolio. This would then reverse the assumption about the positive effect of CO2 targets on the promotion of hydroelectricity. The causal relation would then rather be that the strong hydroelectric sector leads to ambitious CO2 targets. Among the cases presented in this paper, both patterns can be observed. Furthermore, the close relationship between the two might also be due to the promotion of hydroelectricity and other measures being part of the same umbrella climate mitigation strategy.

The question of which was first is also relevant in relation to the methodological approach: fsQCA is not sensitive to those dynamic temporal aspects (Fischer & Maggetti, 2016). Some authors suggest multiple options to overcome this problem, such as the application of a temporal QCA (TQCA) that is only recently being developed in the field (Hino, 2009; Thiem & Duşa, 2013) or the separate analysis of multiple points in time where QCA models are calculated for every relevant point in time, followed by a comparison of the solutions. Both options might be suitable for further exploration of the links between climate targets and renewable energy promotion.

The study has its inherent limitations. In Switzerland, the instruments employed for the promotion of hydroelectricity vary greatly between the national and the cantonal level. Targets concerning renewable energy production, energy efficiency, and energy consumption are determined on the national level. Whereas the cantons are free to develop their own strategies for achieving these targets. However, they mostly employ policy instruments that focus on regulation or information and complement them with some very specific subsidies or tax reductions. This is because there is a cost-covering feed-in tariff installed on the national level that subsidizes renewable energy. Most cantons therefore waive the implementation of similar instruments due to financial restrictions or struggles of competence between the two governmental levels (Sager, 2014). Future research would benefit from a case study with no such system installed on the national level and where sub-national entities are freer in their instrument choice (for an in-depth study of potential other instruments promoting renewable energy see Park (2015)). Switzerland might be an interesting case because a transition from the promotion system in place to a steering system is currently discussed on the national level.

There is one further condition which is usually crucial in MSF applications for the adoption of policies: the public mood (Kingdon, 1984). Potential policies are evaluated in the policy stream if they correspond to the public's norms and values. If they do not correspond then a policy proposal has significantly lower chances of being implemented. The beliefs of the public concerning the promotion of hydroelectricity can be evaluated based on their acceptance for hydroelectricity in general and through the public's acceptance of promotional instruments (Dermont et al., 2017; Sabatier, 1988). Recent survey data among Swiss residents shows that the acceptance of hydroelectricity (small and large-scale projects) and its promotion is unanimously high and that there is hardly any variance between the cantons (85% to 95% approval). This affirmative attitude toward hydroelectricity might constitute a generally positive setting for the promotion of hydroelectricity (Stadelmann-Steffen & Dermont, 2016).

In sum, this paper has shown the strength of policy instruments can be explained by combinations of socio-political drivers that unfold their effect only in combination with each other. It seems most relevant for the adoption of strong policy mixes that countries or their subnational states not only benefit from the positive effects of a lower level of carbon emissions, but also profit financially from the deployment of hydroelectricity, or from renewable energies in general. The Swiss hydroelectricity case with its water tax model might therefore be an interesting option for other countries trying to adopt stronger policies promoting renewables. Furthermore, the apparent combination with strong climate goals seems to support the efforts made with the COP21 agreement.

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2.10 Appendix

Robustness tests

This section tests the results and the sufficient conditions in particular for their robustness. Schneider and Wagemann (2012), as well as Skaaning (2011), call for the following checks to be conducted before the interpretation of the different solution terms: the calibration decisions, the conditions used, and the cases included in the model need to be reconsidered and the consistency and frequency thresholds need to be reevaluated.

The analysis uses a consistency threshold of 0.9. When lowering this threshold to the acceptable minimum of 0.75 (Ragin, 2008) the model produces two paths. The first one reflects the presented results: a combination of large production of hydroelectricity, a high amount of exploited potential and strong climate goals (HYDRO*QUOTA*CO2). The second path with the lower consistency threshold shows considerably lower consistency and coverage values than the paths found with a 0.9 consistency threshold. Therefore, the choice of threshold in the original models is appropriate. Furthermore, altering the frequency threshold is not a suitable option because it would exclude almost all truth table rows. .

There are no theoretical or contextual factors that would support the exclusion of one or multiple cases. However, one could argue that small cantons do not have the administrative capacity to implement a full-scale strategy promoting hydroelectricity (Vatter 2013). It is thereby unlikely to find one of those cantons in the set of WATERPROM. This problem is bypassed by integrating a condition (WORK) into the fsQCA that covers the administrative capacity in the energy domain. The model was rerun without four small cantons (Appenzell Inner-, and Outer-Rhodes; Nidwald, and Obwald) and the solution did not differ from the original term.

The model has been also run with less than six conditions. This smaller amount of conditions can be justified because it reduces the amount of logical reminders in the fsQCA (Schneider & Wagemann, 2010). The model has been recalculated with the following modifications: First, the degree of decentralization (DECENT) is removed. When omitting this condition, the third path of the original model is lost. The other two paths, however, remain unchanged. Since institutional concepts are oftentimes absent in MSF applications, their removal might be justifiable from a strict policy process perspective. On the other hand, the MSF and other garbage can concepts have repeatedly been heavily criticized for neglecting the institutional component of policy processes. The exclusion of the climate targets (CO2) is likewise not an option since it would remove the policy stream completely from the model. This leaves us with the two conditions that focus on the production of hydroelectricity: the 'Wasserschloss'-variable

and the degree of exploitation (HYDRO & QUOTA). The removal of either one of the two conditions returns more complex solution paths.

Lastly, the calibration thresholds discussed in section 3.4 are reevaluated. According to Maggetti and Levi-Faur (2013) the calibration of conditions is prone to errors that may distort the results of a QCA. Skaaning (2011) therefore suggests checking the robustness of the calibration. However, "the scope for setting alternative calibration thresholds is limited if the calibration procedure is based on deep qualitative evaluations" (Ide, 2015, p. 67). Hence, the focus on the conditions that are calibrated is based on the structure of the data. The condition containing the strength of left-wing and green parties in parliament (LEFT) was calibrated in such a way cantons with more than 40% of left-wing or green seats in parliament are considered to be fully in the set. One could argue cantons should only be considered to be fully in the set where left-wing and green parties constitute the majority and are able to easily push their proposals through. In Switzerland, however, no canton has a left-wing majority that makes such a calibration obsolete from a case centered perspective. Another possibility is lowering the thresholds for the LEFT condition. This alternative does not return different paths. It just lowers the coverage scores for the sufficient conditions to some extent. The only other condition mainly calibrated based on the data structure is QUOTA. Further, raising and lowering the thresholds did not return relevant changes. In the current model, the maximum threshold is set at 95% of exploitation. An adjustment to 90% does not return different results. On the other hand, a more demanding maximum threshold of 98% (and the respective other thresholds at 90% and 85%) would only leave cantons fully in the set that have hardly any unexploited sites left to produce additional hydroelectricity. This adjustment completely removes the QUOTA condition from all paths and significantly lowers the coverage values for sufficiency.

3 How beliefs of the political elite and citizens on climate change influence support for Swiss energy transition policy

Lorenz Kammermann *& Clau Dermont*

Abstract

This paper analyzes factors that lead to opposition towards policies in Switzerland that promote a clean energy transition. During legislative processes, both the elite and general citizens can develop resistance towards such policies. The article considers those two perspectives and determines, on both levels, factors that explain opposition. We also specifically take into account whether climate change skepticism, i.e., questioning that climate change is real and human-induced, is a key factor that leads to opposition. Furthermore, we employ structural equation models to account for interactions between the elite and general citizens. The results show that political actors who reject the idea of man-made climate change also oppose the promotion of a clean energy transition, and more generally that elite actors influence how citizens think about the issue. At the citizen level, an increase in climate change skepticism has a negative impact on levels of support for clean energy policy. The link is mainly determined by party affiliation. We conclude that potential strategies for achieving a clean energy transition should focus on motivating citizens because they generally seem to be less polarized and partisan, and thus less opposed to new solutions, than the elite, who tend to be more constrained in their actions.

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3.1 Introduction

Most nation states need to adopt ambitious policies and substantially increase low-carbon energy production to achieve their climate goals and to reach a more sustainable long-term energy supply. Many experts of the field view state intervention as necessary for enabling a renewable energy transition because market failures as well as commitment and time inconsistency problems have thus-far limited the transition towards clean energy in areas without government support (Kern & Howlett, 2009; Lodge & Wegrich, 2012). Another factor impeding the transition to renewable energy includes the fact that parts of the political elite (political parties, E-NGOs, administrative offices, interest groups etc.) oppose policies that promote or implement clean energy, especially if they find clean energy neither desirable nor necessary (see also Fraune & Knodt, 2018 in this special issue [Fraune, Cornelia & Michèle Knodt. Sustainable energy transformations in an age of populism, post-truth politics, and local resistance. Energy Research and Social Science 2018: 43]). Moreover, on a systems level, scholars find that well-established socio-technical (Bijker, Hughes, & Pinch, 2005; Geels, 2002; Sovacool, 2016; Sovacool & Geels, 2016) and regulatory systems (Stirling, 2014; Thelen, 1999), like the ones governing energy production and use, tend to be stable and hard to change over time. Finally, political actors and citizens alike are often unsure about what specific policies to implement, because of the diversity of options and the lack of clarity about policy outcomes (Kern & Howlett, 2009). All these factors may lead to substantial delays in the implementation of promotional measures and the deployment of new technologies, which could mean that countries struggling with these issues miss their respective climate and clean energy targets (Karlstrøm & Ryghaug, 2014; Kuzemko, Keating, & Goldthau, 2016).

Transition studies have paid considerable attention to the stability of socio-technical systems. Public policy and environmental economics have mostly explored the uncertainty in policy selection. However, few studies explicitly analyze why certain groups of citizens or elite actors oppose policies supporting the transition towards a more sustainable energy system. The paper therefore asks: W*hat drives elite actors and general citizens to oppose policies that support a clean energy transition?*

To achieve a clean energy transition, it is crucial that states and governments develop and work towards goals that include targets for clean energy production or lower greenhouse gas emissions. Simultaneously, researchers investigating reasons for success or failure of energy transitions need to focus on studying specific policies to better understand where opposition or support from the public comes from, similar to the value-action gap regarding the local siting of technologies (see also Graff et al., 2018 in this special issue [Graff, Michelle et al., 2018.

Stakeholder Perceptions of the U.S. Energy Transition: Local-level Dynamics and Community Responses to National Politics and Policy. Energy Research and Social Science 2018: 43]; Bell, Gray, & Haggett, 2005). This paper, therefore, focuses on understanding the opposition to clean energy policies and uses it as a proxy for understanding support for the idea of a clean energy transition more broadly (Kern & Howlett, 2009). This study adopts an actor-centered perspective and considers the beliefs and preferences of both the political elite as well as general citizens because both play important roles in the legislative process as well as in the later implementation of clean energy policies, as (e.g.) Delina and Janetos (2018) or Komendantova, Riegler, and Neumueller (2018) show. We thus consider the previous findings and expand the literature by explicitly combining research on both the elite and general citizenry. Understanding the root of opposition towards a clean energy policy is important to identify hurdles and solutions for states in achieving or reformulating their targets in accordance with the preferences of the political elite or citizens. Moreover, even when a productive policy does pass, when the public or political elite do not support it, compliance can still be low and undercut the policy's efficacy (see also Trotter & Maconachie, 2018 in this special issue [Trotter, Philipp Andrew & Roy Maconachie, 2018. Populism, post-truth politics and the failure to deceive the public in Uganda's energy debate. Energy Research and Social Science 2018: 43]; Dermont, Ingold, Kammermann, & Stadelmann-Steffen, 2017; Ingold, Stadelmann-Steffen, & Kammermann, 2017).

By exploring the root cause of opposition to clean energy policies from both the public and political elite, we expand current social science research on energy transitions. Stokes and Breetz (2018) as well as Carley, Evans, and Konisky (2018), for example, assessed the attitudes and culture specific to people affected by the expansion of RE and the decline of conventional power sources. They found that both attitudes and culture could drive people's opposition to policies that promote sustainable energy. To develop a unique perspective on the subject, we combine their insights with literature on climate change skepticism (see e.g., McCright, Marquart-Pyatt, Shwom, Brechin, & Allen, 2016; Reiner et al., 2006; Tranter & Booth, 2015), which also seems to be a driving factor in determining whether the public and elite actors oppose a clean energy transition. Climate change skepticism is the belief that climate change either is not as problematic as the scientific community says it is, an altogether denial of anthropogenic climate change, or somewhere in between. Therefore, people can use their skepticism as grounds for rejecting tangible solutions to solving climate change, including supporting a clean energy transition. In addition, political parties and thought-leaders can continue fostering this skepticism by exploiting growing public distrust towards the scientific community

and the government for political gain. Therefore, rhetoric that promotes the distrust of scientific facts and sows doubt in anthropogenic climate change can play into a populist mindset. If the frame used by the opposition is that "the government" and "scientists" are trying to force "the people" to live their lives a certain way with no true benefit to them, the result can be deep-seeded antagonism (Mudde, 2004) and further distrust not only of climate change but also of the government and scientific community more broadly. In Switzerland and other countries, the right-wing and populist parties tend to promote climate change skepticism and harbor deeper opposition towards clean energy than their more progressive counterparts. Populist parties, therefore, could be exploiting skepticism to further undermine public and political support for clean energy policies (Tranter & Booth, 2015).

By combining insights from these strands of research, this paper expands on the current debate and increases the understanding of the complex and multi-level participatory processes concerning the clean energy transition. This paper focuses on Switzerland, which is ideal for three reasons: first, Switzerland is often seen as a laboratory for popular votes. This paper thus offers insight for other countries and regions that may rely on similar participatory processes involving both elite actors and citizens, especially when these processes are generally new or specific to the energy sector (Linder, 2010; Szulecki, 2017). Second, Switzerland's direct democratic system allows citizens to actively participate in the political decision-making process regarding the deployment of low-carbon technologies. There is a balance of power between the political elite (e.g., parties, interest groups, or environmental non-governmental organizations (E-NGOs)) and citizens. That, in turn, allows us to investigate the political relevance and relative influence of both entities (Vatter, 2016). In our case, the elite is mainly in charge of the drafting phase, however, the citizens are later able to express their opposition or support for the new energy strategy in a popular vote. Third, the pressure to transition the electric power supply towards more low-carbon technologies is high in Switzerland because, in 2017, the country set ambitious short-term policy measures to support the transition (Swiss Confederation, 2016). By voting in favor of the 2017 energy act, the Swiss people accepted two primary policies regarding the production of electricity: a ban on constructing new nuclear power plants, and a gradual increase of taxes levied on electricity consumption to be used for subsidizing RE (among the more general goals within the policy were to increase RE production and energy efficiency). In order to achieve these goals, however, Switzerland needs to adopt additional policies. Because this first slate of policies, as well as the idea of bringing on additional policies, is both controversially discussed, Switzerland is an ideal test-case for exploring opposition towards the clean energy transition.

On the theoretical level, we consider the attitudes and policy preferences of both elite actors and the citizenry as they pertain to clean energy policies (Converse, 1964). We also consider literature on social acceptance (Dermont et al., 2017; Jegen & Philion, 2017). For the elite actors, we apply cluster analyses (Everitt, Landau, Leese, & Stahl, 2011; Murtagh & Legendre, 2014). Cluster analyses allow us to identify not only single actors and their opposition to the promotion of energy transitions, but also the attitudes of whole groups of actors based on their central beliefs. On the individual level, we apply structural equation modeling to assess and identify the factors that influence opposition to clean energy policies (Beaujean, 2014; Rosseel, 2012). The data used for the analysis is based on a survey conducted among elite actors in the energy policy domain as well as on data from a nationally-representative survey questioning citizens about their preferences regarding RE policy. By combining both sources, we present a comprehensive account of why elite actors and citizens alike often oppose clean energy policies.

3.2 Theory

3.2.1 Policy supporting energy transitions

This paper focuses on the drivers behind opposition to renewable energy policy by both the political elite and general public. Most experts agree that a clean energy transition can only be successful when supported by state intervention (Kern & Howlett, 2009; Lodge & Wegrich, 2012). The range of policy options to accomplish such a goal is broad: they range from highly regulated, like banning nuclear power or implementing a feed-in tariff scheme, to those that are less prescriptive and more targeted such as subsidizing research and development of clean energy options (for an extensive list of measures see Sovacool, 2009). Public support, as well as the support of the political elite, is a central prerequisite for success. Political parties, interest groups, and E-NGOs play an important role in the drafting phase of most energy policies, as do administrative entities and local governments. Political parties make the final determination about policy selection, unless a policy makes it to a public vote (at least in the Swiss case under investigation in this study). Although policy selection and a potential public vote are sequentially independent from each other and follow different rules, they are interrelated (Vatter, 2016). For instance, policymakers are susceptible to public opinion, and political parties play a role in shaping public opinion by providing heuristics (Kriesi, 2008).

Most studies that have attempted to analyze the development of clean energy policy have been conducted under the frame of "social acceptance." Dermont et al. (2017) further empha-

size the political nature of social acceptance, since most processes used to promote clean energy policies are inherently political in nature. Policy decisions follow the rules of political institutions such as parliaments, citizens' assemblies, or popular votes (Jegen & Philion, 2017; Scherhaufer, Höltinger, Salak, Schauppenlehner, & Schmidt, 2017). Elite stakeholders are crucial during the process of designing policies, but citizens become important actors later in the process when, in a direct-democratic setting, a public vote is triggered on the issue.

3.2.2 Opposition by elite actors

The policy preferences of elite actors are determined by two major factors (among others): their beliefs (e.g., Converse, 1964), and the preferences of the people or entities they represent (especially their political parties) (e.g., Schneider & Ingram, 1993). The beliefs of elite actors build the basis for their actions, influence with whom they collaborate, and determine what policies (if any) they choose for solving a problem (in this case the promotion of clean energy) (Converse, 1964; Weible & Sabatier, 2005). Their policy preferences – more detailed expressions about what specific policies should be used and which shouldn't, as compared to whether or not any renewable energy policies should be pursued in the first place – tend complement these beliefs (Weible & Jenkins-Smith, 2016). Weible (2006) showed, in an empirical study, that even when political players are making choices about protecting marine areas, their decisions are impacted by their more general beliefs outside of the conservation realm. Kriesi and Jegen (2001) further show that beliefs also play a crucial role in the selection of energy related policies in the consensus oriented system of Switzerland. The paper thus adopts this hierarchical beliefs structure and considers actors to be boundedly rational in line with other frameworks such as the Advocacy Coalition Framework (Weible, 2006).

Other factors besides beliefs and preferences also influence the decisions of political elite. For instance, political elite may express opposition to a policy as a quid-pro-quo exchange with other actors (e.g., Ingold, Fischer, & Cairney, 2016), or because of other political priorities in tight budgetary situations (Howlett & Lejano, 2012). While we acknowledge the importance of these other aspects, however, this paper focuses primarily on the two previously described factors.

3.2.3 Opposition by citizens

Many studies have analyzed citizen support for environmental issues at the polls, both in Switzerland (Bornstein & Thalmann, 2008; Stadelmann-Steffen, 2011), and in the U.S. (Deacon & Shapiro, 1975; Kahn & Matsusaka, 1995). Those studies offer insights into the factors that

affect public support for clean energy policies. For instance, the public is generally sensitive to whether or not they will be personally impacted by a certain policy. In direct democratic processes, citizens can directly influence policy outcomes by voting against such policies, therefore asking to consider the specific context of popular votes if interested in the reaction of citizens towards the policies implementing (Dermont et al., 2017). Similar to elite actors, the individual attitudes of citizens influence their voting behavior. For example, if a citizen values environmental protection and public goods, they are more likely to vote for conservation-minded policies. In California, Deacon and Shapiro (1975) and Kahn and Matsusaka (1995) found such findings and reported that alignment with the Republican Party depressed voter support for conservation policies. By contrast, in Switzerland, a left-green ideology has been shown to significantly increase the probability that a citizen will vote in favor of an environmentally-friendly proposal (Bornstein & Thalmann, 2008; Sciarini, Bornstein, & Lanz, 2007). Similar results were found for more general environmental attitudes as well (Stadelmann-Steffen, 2011).[2] These insights from literature referring to popular votes inform us about possible determinants of reactions by citizens towards proposals by the government where they have a say in voting decisions, and therefore quite explicit political process of acceptance, which does not necessarily reflect the multitude of determinants to other forms of acceptance in the literature (Dermont et al., 2017; see also Bell et al., 2005; Huijts, Molin & Steg 2012; Fast, 2013). Besides the focus on such political decisions for individuals, the next subchapter introduces a new perspective towards votes not discussed in the literature on voting on the environment so far, that is gaining in urgency and trending in political debate, as new aspect.

3.2.4 Climate change perception

In recent years the research community has honed in on the fact that climate change skepticism – and especially doubt in anthropogenic climate change in particular – is very likely to correspond with an individual's view that a clean energy transition is unnecessary (Capstick & Pidgeon, 2014; Engels, Hüther, Schäfer, & Held, 2013; Lee, Markowitz, Howe, Ko, & Leiserowitz, 2015; McCright et al., 2016; Shi, Visschers, & Siegrist, 2015). As aforementioned, both the political elite and citizens are likely to evaluate an issue like a specific energy policy based on their pre-existing beliefs, political ideologies, and environmental attitudes. Notably, a person's perception and knowledge of climate change significantly impacts their judgment about

[2] In the following, we use 'beliefs' for the elite level and 'attitudes' for the citizens' level.

the importance of phasing out conventional energy sources and investing in renewable energy, as well as their willingness to support environmental policies (Lee et al., 2015; Shi et al., 2015). Most importantly, as Shi et al. (2015, 2194 & 2197) found in Switzerland, the more citizens recognize the causes and impacts of climate change, the more likely they are to support and accept climate-friendly policies. Moreover, public opinion on climate change is heavily influenced by the political elite, as Brulle, Carmichael, and Jenkins (2012) have shown in the U.S. In fact, compared to several other factors like the prominence of extreme weather events and more scientific information, cues from the political elite, like policymakers, advocacy groups, and the media, are the most prominent drivers of public opinion on climate change issues (Brulle et al., 2012, p. 182). The political elite, therefore, are a relevant factor in determining public opinion and thus public support (or lack thereof) for clean energy policies (see Kriesi, 2008 for direct democratic voting heuristics). This is even truer given that recent research demonstrates that simply stating that climate change is man-made is likely to increase opposition from individuals who doubt the scientific consensus (Bolsen & Druckman, Forthcoming). A similar reaction is conceivable for skeptic political actors when presented with additional scientific information (Cairney, 2016).

Therefore, an individual's pre-existing attitudes towards the environment and climate change are strong factors as to whether or not they will support specific clean energy policies, for both the political elite and the general citizenry (Shi et al., 2015). Brulle et al. (2012) show that the political elite influence public support for climate change issues, and beg the question of whether or not political parties deliberately use climate skepticism to reinforce opposition to clean energy policies. As climate change skepticism refers to questioning scientists and their work, it also reflects a skepticism or distrust towards "the elite" and "the educated". This distrust of the elite or a group different from the own, in this case highly educated scientists, reflects the essence of populism establishing an antagonism between the people and an elitist group (Mudde, 2004). In this analysis, we will therefore take a closer look at how beliefs in climate change, both for the elite and for the general public, influences thinking around energy policy, and how this new explanation fares in comparison to older explanations.

3.3 Hypotheses

Based on the theoretical understandings, we formulate three assumptions that guide our analysis (see *Figure 1)*. Multiple studies show that general beliefs about an issue influence the policy preferences of both the elite and the citizenry (Kriesi & Jegen, 2001; Weible, 2006). Recently, research also highlights that beliefs, attitudes, and concerns about climate change have an

effect on the public's support and acceptance of policies supporting a clean energy transition (Capstick & Pidgeon, 2014; Engels et al., 2013; Shi et al., 2015; Tranter & Booth, 2015). Therefore, our first hypothesis is that for both the elite and for citizens, climate change skepticism drives opposition to renewable energy policies:

H1a: For political elite, skepticism about anthropogenic climate change coincides with opposition to clean energy policies.

H1b: For general citizens, skepticism about anthropogenic climate change coincides with opposition to clean energy policies.

We also take into account that political actors and citizens have different tasks to accomplish during a political process (Dermont et al., 2017). Political actors, and especially political parties, are in charge of drafting policy and formally adopting them in parliament. If a referendum is later triggered, citizens have to vote on that policy. However, we recognize that those two processes do not develop independently. Rather, political parties and citizens *interact* during both the policy development and a public vote (Brulle et al., 2012; Kriesi, 2008). With this in mind, and acknowledging that political ideology and heuristics about climate change impact support for new policy, we will test two additional assumptions: First, we assume that the political elite, namely political parties, influence how citizens perceive climate change; hence, H2 supposes that political parties skeptic about climate change transfer those beliefs to their voters. Second, we assume in H3 that political parties influence their voters' opposition to clean energy policies by offering decision heuristics.

H2: The political elite, namely political parties influence how citizens perceive climate change.

H3: Political ideology influences the public's support or opposition to clean energy policies.

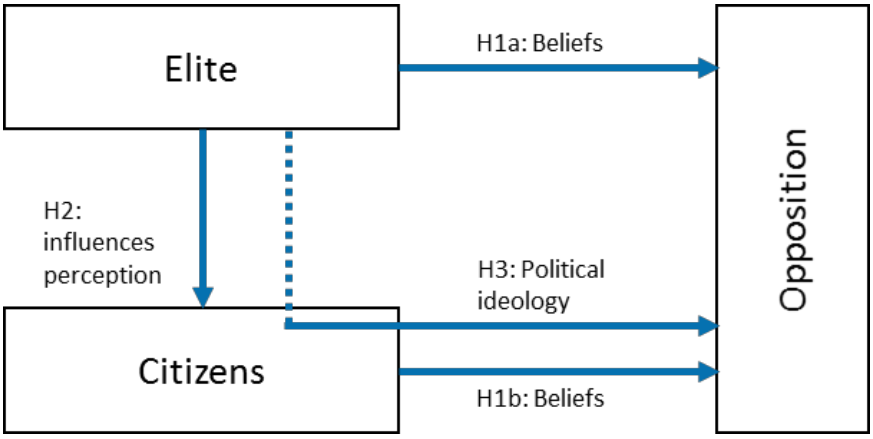

Figure 1: Graphic presentation of the hypotheses. H1 symbolizes the connection between the elite's and citizens' beliefs and opposition towards policies supporting an energy transition; H2 indicates the connection between the elite (especially political parties) and citizens' perception; H3 indicates how the elite (especially political parties) influence citizens' opposition through party ideology.

3.4 Research design

3.4.1 Case

Since the early 2000s, Switzerland has had a strong climate mitigation strategy that was reinforced when they signed the COP21 treaty (Ingold et al., 2016). In 2017, Switzerland adopted an ambitious new energy strategy that contained additional goals regarding renewable energy production and energy efficiency standards. From a policy perspective, the most impactful piece of the new energy act is a ban on new construction of nuclear power plants, which was first proposed shortly after the Fukushima incident (Sager, 2014; Swiss Confederation, 2016). This ban effectively prevents energy companies from replacing their current nuclear power plants and is equivalent to a nuclear phase-out by 2035. The other major piece of the new energy act is an increase in the tax levied on electricity consumption, which then goes towards funding renewable energy promotion (feed-in tariff). Further implementation is partly delegated to the sub-national level (cantons) due to the federal setup (Sager, 2014; Vatter, 2016). The investigation both on elite and individual level is embedded in this context of the new energy act and its further implementation. Thus both the elite (drafting) and the citizens (popular vote) are confronted with the issue of the Swiss energy transition.

3.4.2 Data

We collected data for this paper by two means. First, we conducted a survey among the political elite after the completion of the consultation for the new energy act. The consultation procedure is a process where all political actors (parties, cantons, E-NGOs, economic associations

etc.) can formally issue their support or opposition for a specific legal act and suggest modifications to the proposed legal text. To structure this process, the federal department in charge of the respective consultation procedure distributes a preliminary version of the new act among all actors relevant to the process and requests the actors to respond. Based on the participants in the consultation process, 42 actors were selected for the survey based on the approaches (reputational, decisional & positional) suggested by Pappi and Henning (1998): First, we assessed all actors participating in the consultation procedures whether they were in a formal position during the decision process and were able to actively vote on the output (positional approach) and whether they tried to enter their ideas and interests into the decision process (i.e. participation in the consultation procedure; decisional approach). Furthermore, with the questionnaire we asked all actors who they consider important in the process (reputational approach). We then cross-referenced all three approaches and received a final list of relevant actors.

In the survey, elite actors were asked to express their general beliefs and preferences about how to achieve a more sustainable energy system.[3] The survey participants included all political parties that were able to form a faction in the national parliament on their own in 2014 (at least five representatives are needed), relevant economic interest groups and interest groups specific to the energy sector, E-NGOs and utilities, and actors from science and administrative entities. The response rate to the survey was 79 percent. Actors that did not answer the survey responded that they did not have an official position towards the new energy act or had their interests represented by another actor.[4]

Second, we gathered data from the public using a representative survey conducted in spring 2016 in Switzerland in three languages (German, French and Italian). Individuals were invited by postal mail to participate in an online survey, whereby 8,287 individuals accepted the invitation (42.7% response rate). From this group, a random subsample of 1,985 respondents were prompted to answer questions about policy measures they would support to help the cantons implement the newly adopted energy targets. These measures ranged from financial support for renewable energy production, to restrictions on non-renewable energy sources, to supporting information and consultation opportunities, to no measures at all. The measures are detailed in *Table 3* in the Appendix. The survey sample populations did not deviate from the general population in demographic, structural, or political composition, which is likely due to the high-quality representative sample provided by the Federal Office of Statistics.

[3] A list of all survey items is included in *Table 3* in the Appendix.
[4] A list of all participating actors including their actor type is depicted in Table 2 in the Appendix.

3.4.3 Methods

Elite level

First, we used a cluster analysis to identify actor groups with shared beliefs. Actors are divided into clusters that within themselves are as homogeneous as possible, whereas the different clusters should be as heterogeneous as possible (Murtagh & Legendre, 2014). Cluster analysis is well suited to capture different groups of actors within the sector based on their beliefs and preferences. With clustering, we are furthermore able to distinguish between subgroups of actors that may oppose or support policies for a clean energy transition based on different reasons. We thus applied agglomerative hierarchical clustering using the complete linkage method. Even though the data is not strictly hierarchical, we believe that hierarchical clustering is an adequate approach because it is a good system for handling small data sets. Moreover, hierarchical clustering generates a 'tree' (displayed in a dendrogram) that allows for a comprehensive assessment of the structures within the clusters.

We preferred the complete link method over single links because the former is less prone to outliers that occur due to actors' distinct beliefs regarding a single subject (Fonseca, 2012). The stems/heights of the hierarchical model are unweighted because the selected beliefs are considered equally relevant for the differentiation of the clusters. We determined the final number of clusters based on case knowledge (Everitt et al., 2011). We then tested cluster validity by partitioning the data in subsets to check whether the clusters stay the same with less actors, and by checking whether single variables disproportionately affected the assignment of specific actors to any given cluster (Halkidi, Batistakis, & Vazirgiannis, 2001). We later aggregated specific beliefs and policy preferences by cluster in order to assess what beliefs about renewable energy the actor groups were trying to assert. We also briefly discuss the validity of the clusters using different approaches. The supplementary material includes more detailed information regarding the internal and external validity and robustness of the analyses.

Citizen level

On the individual level, we estimated opposition towards policies that support a clean energy transition, including tax reductions, subsidies, bans on non-RE, public interventions, or information dissemination. We used structural equation modeling to analyze both how political ideology impacts beliefs and attitudes towards nature and climate, as well as how those impact an individual's support (or lack thereof) for corresponding policies (Beaujean, 2014; Ros-

seel, 2012). A structural equation model allowed us to estimate two things. First, the estimation of latent variables based on several observed items. For example, climate change skepticism, which is a score compiled from four items reflecting several aspects of climate change skepticism, is such a latent variable representing a theoretical construct measured through four items. The same approach applies for opposition towards the promotion of energy transitions (six items) and environmental attitudes (two items). Second, a structural equation model runs multiple regressions at the same time, thereby allowing us to simultaneously analyze the influence of ideology on climate change skepticism, and the influence of those two concepts on opposition towards policy.

We fully documented the empirical analysis in the supplementary material, in which we also listed additional measures of the validity of items, comprehensive model results, and test scores in detail.

3.4.4 Operationalization

The dependent variable for the elite as well as the citizenry is opposition towards clean energy policies. The measures included in this paper were selected based on a qualitative analysis of the policy process that led to the adoption of the new energy law. During the process of the new energy law being adopted, multiple policies were discussed, including a nuclear phase-out, increasing support for energy research, increasing a pre-existing electricity tax, or putting in place a CO2-tax compensation. The most relevant measures were then included in the elite survey, in which actors were able to specify whether they agreed, rather agreed, rather disagreed, or disagreed with the adoption of a policy. On the individual level, respondents were asked which policy should be introduced in order to promote a clean energy transition, and they had the option to check all policies of which they approved.

The beliefs used for clustering the elite actors were compiled by asking them whether they agreed, rather agreed, rather disagreed, or disagreed with certain statements regarding the transformation of the electricity sector. The statements included those that corresponded with the following values: economic efficiency, free market, social justice, environmental concerns and prioritization of RE over landscape protection, security of supply, and energy independence. The beliefs/values were then coded on a scale from 1 to 4 where 1 corresponded to 'disagree' and 4 to 'agree.' The preferences of each actor were then aggregated for each previously-identified cluster. A full list of beliefs used for clustering can be found in *Table 3* in the Appendix.

For the individual data, the models considered party preference, i.e., the party the individual voted for in the 2015 election, climate change skepticism and general environmental attitudes as main independent variables. The model included several control variables such as age (both linear and quadratic), gender, language, region, education, and income. The variables are described in more detail in *Table 4* in the Appendix. For more details on the operationalization conducted in this paper, see the extended documentation.

3.5 Analysis

3.5.1 Opposition on the elite level

Our first analysis sought to understand whether opposition to policies supporting a clean energy transitions from members of the elite coincides with climate change skepticism. We used the complete linkage method and agglomerative hierarchical clustering to identify four clusters among the elite actors working in renewable energy policy in Switzerland. The first cluster includes a rather large group of actors centered on the center-right Christian Democrats (CVP), the Social Democrats (SPD), and the Green-liberal Party (GLP). Also included in the cluster are the responsible ministry of Environment and Energy (UVEK) as well as most actors representing science and parts of the RE industry. This group of actors has been supportive of a clean energy transition but also showed restraint in that they did not promote particularly strict policy instruments during the drafting or advocacy process ('pro' cluster). The most supportive group of actors came from the Green Party (GPS) and all questioned E-NGOs, as well as the business association representing the solar industry (SSOLAR). These actors mostly favored an extensive promotion of clean energy and a rather short-term nuclear phase-out ('very-pro' cluster). The dendrogram identifies another rather large group of actors led by the Liberal Party (FDP) that contains the major electricity producers (BKW, VSE) and the largest economic interest association, economiesuisse (ECON). Most of these actors were split on the matter of promoting a clean energy transition, as well as on whether to support the final version of the new energy act. The FDP came very close to opposing the act during the referendum, whereas economiesuisse stayed neutral, as it was not able to identify a position that satisfied a majority of its members. Both organizations remained skeptical of the policy and opposed major parts of the act during the parliamentary phase, primarily due to their economic concerns ('semi-anti' cluster). The fourth cluster contains the populist right-wing Swiss People's Party (SVP) and actors from the nuclear energy sector. These actors were the most likely to oppose the nuclear phase-out, the promotion of renewable energy, and more generally the transition towards a more sustainable energy sector ('anti' cluster). This last cluster is

also the only group of actors that did not believe that climate change is man-made, although they did not question the idea that the climate is changing, per se. All other groups of actors consider anthropogenic climate change to be real. The different clusters identified are depicted in *Figure 2*.

Choosing four clusters for analysis allowed us to be the most accurate both theoretically and contextually. Raising the number of clusters to five or six would have artificially complicated the interpretation because the additional clusters would not have been clearly distinguishable from the four we presented. Similarly, if we had lowered the number of clusters to three or two, important contextual differences between actors would have been omitted. We also tested the clusters for their validity by randomly splitting the actors into two different subsets and conducting the same analysis (see supplementary material for documentation). Furthermore, beliefs were removed one-by-one from the model in order to check whether a single belief was able to alter the assembled clusters. Neither checks for validity returned significantly different results.[5]

The analysis showed that only one cluster of the four prescribed to the idea that climate change is not caused by human activity. This 'anti'-cluster also opposed most measures promoting a clean energy transition. As depicted in *Figure 3*, the anti-cluster is the only group of actors that clearly opposes a nuclear phase-out, whereas all other groups of actors fully or partially support a phase-out. The second major measure adopted within the new energy act was the increase of a tax levied on electricity used for a feed-in tariff for renewable energy. Here the preferences of the semi-anti cluster differed in comparison to their preferences for the nuclear phase-out; the semi-anti cluster opposed a raise of the current tax, in sharp contrast to the two pro-clusters. No other distinct preferences could be identified that separate the clusters as starkly as did these policies.

Based on our analyses, we were able to validate Hypothesis 1a, which assumes that, on the elite level, climate change skepticism coincides with opposition towards a clean energy transition and related policies. We also determined that other beliefs, such as economic concerns (especially in the case of the semi-anti cluster) might also have an impact on opposition to clean energy policies.

[5] More detailed information regarding the internal and external validity as well as further checks for robustness such as (e.g.) item sampling, and the use of different clustering algorithms can be found in the supplementary material.

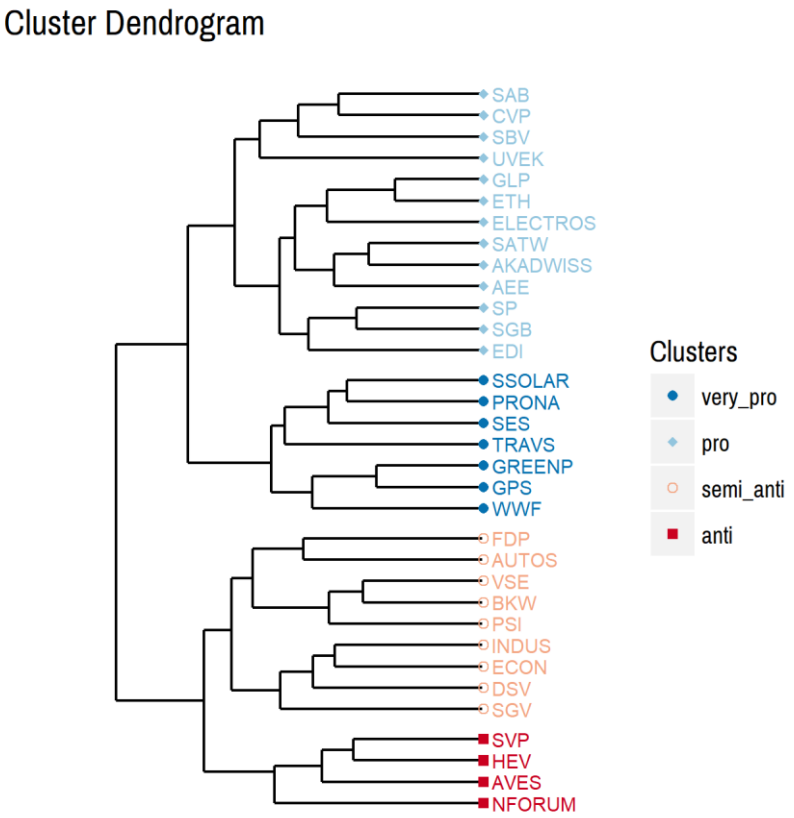

Figure 2: Elite actor clusters based on hierarchical agglomerative clustering. A list of actors is presented in Table 2 in the Appendix.

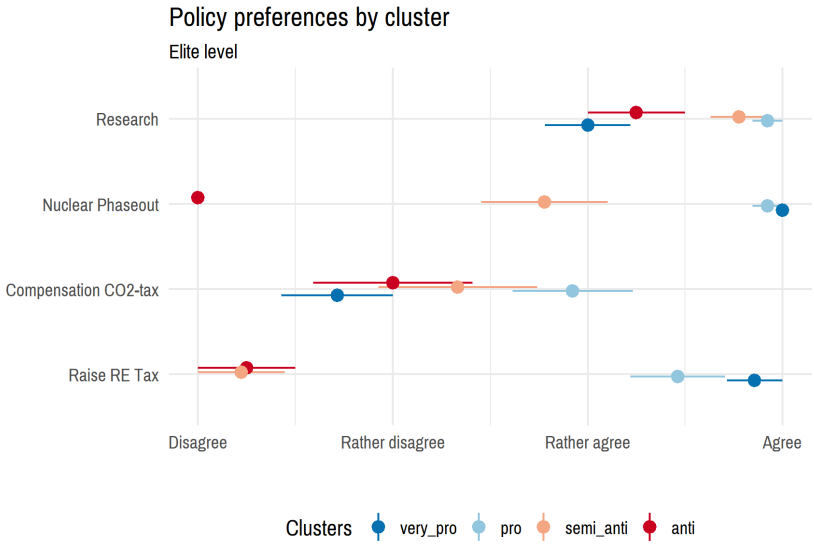

Figure 3: Elite preferences for policies considered in the new energy act including standard deviations. Reading example: The "anti" cluster of the elite completely disagrees with nuclear phase-out, but supports research on renewables, with some actors more in favor than others are. The point denotes the group mean, the interval the mean +/- the standard error per group.

3.5.2 Opposition on the citizen's level

In this section, we first analyze whether the elite do, in fact, have an influence on the public's perception of climate change (H2). Second and third, we assess whether climate change skepticism and political ideology influence the public's support or opposition for renewable energy policies (H1b & H3).

Before addressing these hypotheses, we must answer the question of whether or not the elite and individuals share the same preferences regarding energy policies yet to be developed. Based on the clusters presented in section 4.1, individuals are grouped in the same clusters based on the party they voted for in the last national election. *Figure 4* shows their support for four main policies, which were a part of the new energy act. Notably, *Figure 4* shows that agreement with the policy goals is relatively consistent with more environmentally-friendly beliefs by elite clusters. Therefore, individuals and the elite are exhibiting similar and parallel preferences. However, in direct comparison with Figure 3 in section 4.1, individuals show less opposition towards policies across the board than the elite, and are generally less polarized than their elite counterpoints. Therefore, individuals seem to exhibit more willingness to compromise and recognize both the benefits and drawbacks of energy policy as compared to the political elite.

However, does elite positioning on subjects such as the environment and climate change also influence how individuals perceive these issues, such as Brulle et al. (2012) find for the U.S. and as stated in H3? To answer this question, we estimated a structural equation model, which also addressed how political ideology influences beliefs and attitudes about the environment generally and climate change more specifically. *Figure 5* demonstrates how the model was constructed (without control variables). Structural equation modeling allows for multiple simultaneous regressions, considering that some variables are both dependent and independent variables in those regressions. For example, in the present analysis, climate change skepticism is regressed on party preference and environmental attitudes, while also serving as an independent variable in a regression estimating opposition.

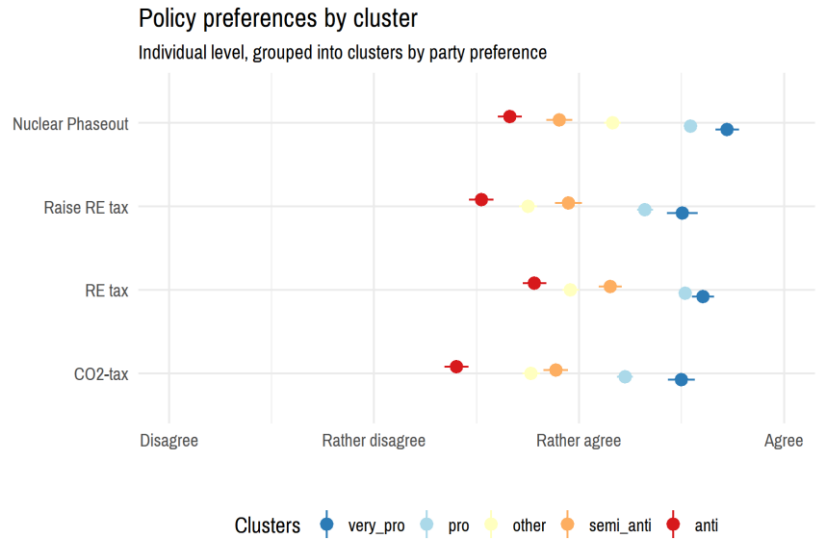

Figure 4: Policies in the new energy act and support by individuals, grouped by clusters based on elite belief. Reading example: see Figure 3. The point denotes the group mean, the interval the mean +/- the standard error per group.

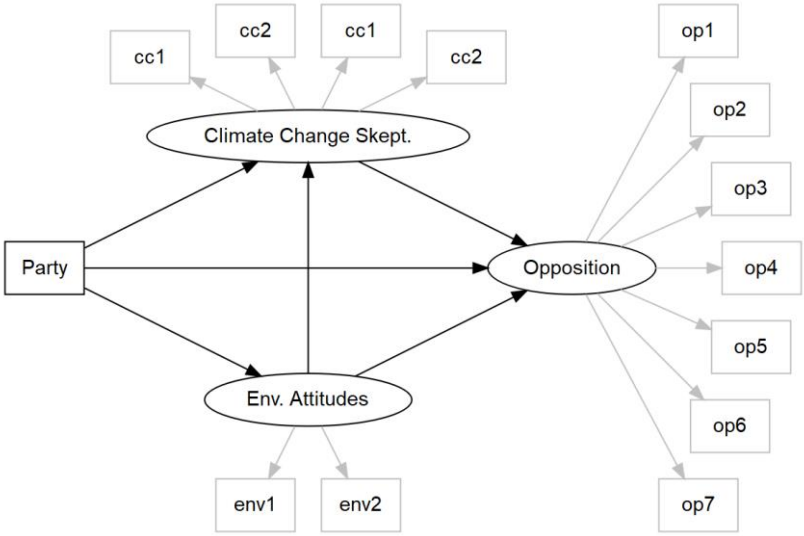

Figure 5: Setup of the structural equation model, including the latent variables (ellipses) and the observed values (rectangles). Reading example: climate change skepticism, a latent variable as per the elliptic representation, is estimated by four items, represented by the four rectangles cc1-cc4. Climate change skepticism is considered a dependent variable in a regression, with party preference and environmental attitudes as independent variables (the incoming arrows), and is considered an independent variable in a regression estimating opposition.

The results are documented in *Table 1, Table 5* in the Appendix, and depicted in Figure 6. The indicators (RMSEA = .032, SRMR = .032, CFI = .908) suggest a satisfactory fit of the model. Regarding the results of the model, first, political ideology reflected through party preference correlated with all three latent variables - environmental attitudes, climate change skepticism,

and opposition. Compared to the reference category without party preference, Left-Green political ideology (preference for SP, GPS or GLP) is positively correlated with higher concern for the environment, while liberal and conservative respondents (FDP, SVP) have lower levels of conservation-mindedness. Preference for the CVP, currently the leading party in energy policy as they hold the office of the energy minister, does not coincide with environmental attitudes significantly different from the general population. Both party preference and environmental attitude are linked with climate change skepticism: again, Left-Green political ideology goes hand in hand with lower climate change skepticism. On the other hand, respondents with a preference for the SVP have significantly higher climate change skepticism. Conservation-minded and pro-environmental attitudes are negatively correlated with climate change skepticism.

The results suggest that climate change skepticism is influenced by political ideology, as argued by Brulle et al. (2012). In addition to the influence of political ideology, individuals with lower educational background and income are more skeptical about climate change. Lastly, respondents from the French-speaking part of the country are more skeptical about anthropogenic climate change than those from German-speaking areas (see Table 1).

Having established a relationship between political ideology, represented by party preference, and climate change skepticism, the next step is to look at how both could be heuristics that inform attitudes towards clean energy policies. As the results in *Figure 6* also show, climate change skepticism does indeed increase opposition towards new clean energy policies. In fact, the final regression suggests that climate change skepticism is significantly correlated with higher opposition to these policy instruments, corroborating Shi et al. (2015). How individuals think about climate change and whether they believe in it is related to their opposition for pro-renewable policies; the more skeptical the respondent, the more strongly opposed they were to clean energy policies. Although anthropogenic climate change is scientific fact, respondents' beliefs still coincide with their readiness to oppose renewable energy, which suggests that climate change skepticism influences voting behavior on these issues.

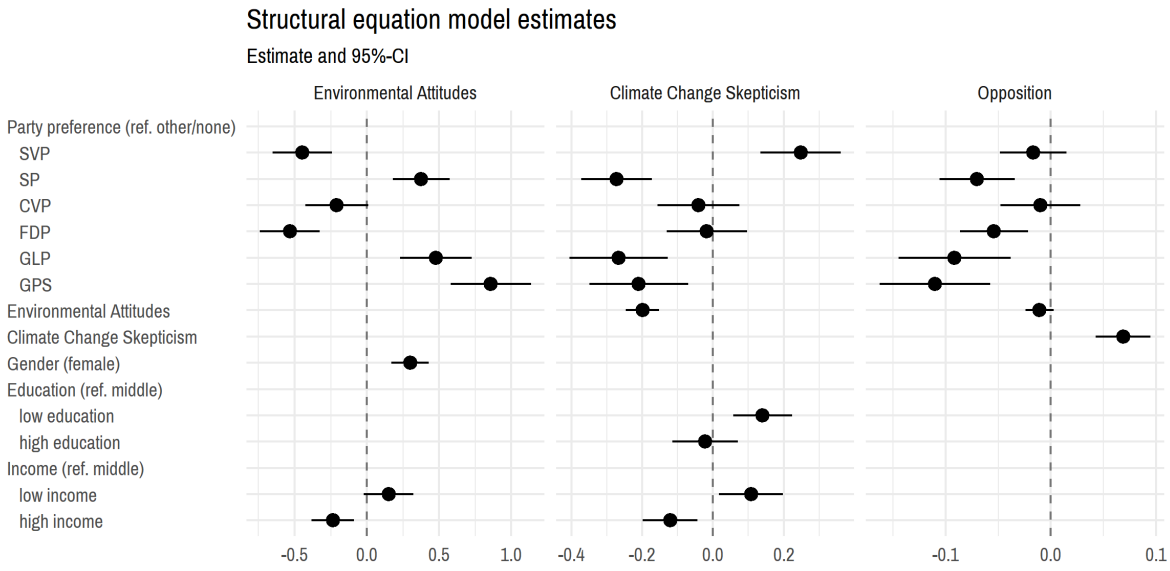

Figure 6: Regression results of the structural equation model estimated with lavaan (Rosseel, 2012), with each column of results representing one regression within the structural equation model with the dependent variable denoted at the head. Full results in *Table 1,* and *Table 5* in the Appendix. Reading example: the last column depicts the estimation of opposition towards clean energy policies. The mean effect, depicted as a point, in the regression for climate change skepticism on opposition is at .069 and therefore demonstrates a positive correlation between higher skepticism and more opposition towards clean energy policy. The line represents the 95% confidence interval.

We noticed one distinct discrepancy, however, while more closely examining the relationship between party predisposition, climate change skepticism, and support for clean energy policies: for the populist right, party preference and opposition towards renewable energy policy did not correlate, i.e., no direct correlation. Respondents who preferred the SVP did not differ from the general citizen in their support for energy policy. However, we did find that those respondents are more skeptical about climate change, which is linked with a significantly higher opposition, i.e., an indirect correlation. Climate change skepticism, which is strongly influenced by the political elite, according to Brulle et al. (2012), could thus serve as a tool for this party to incite opposition to renewable energy policy. On the other side, though, a pre-existing belief in climate change can benefit the Left-Green party and reinforce an individual's support for both the party and clean energy policy.

To summarize, the political parties and their voters share similar attitudes towards environmental policies intended to mitigate climate change. Moreover, the results of our analysis suggest that political ideology shapes how citizens perceive climate change and its causes, corroborating the findings of Brulle et al. (2012) for the Swiss direct democratic context. Generally, we can assume that climate change skepticism does not influence which political party individuals associate with, but rather that party affiliation influences the strength of climate change skepticism or the belief in anthropogenic climate change.

Regressions	Estimate	Std. Err	z-value	P > |z|
Environmental Attitudes ~				
Party preference *(ref. other/none)*				
SVP	-.447	.105	-4.261	.000
SP	.376	.100	3.752	.000
CVP	-.209	.111	-1.882	.060
FDP	-.532	.106	-5.024	.000
GLP	.479	.127	3.781	.000
GPS	.858	.142	6.057	.000
Gender *(female)*	.299	.065	4.585	.000
Income *(ref. middle)*				
low income	.151	.087	1.731	.084
high income	-.236	.075	-3.147	.002
Climate Change Skepticism ~				
Party preference *(ref. other/none)*				
SVP	.248	.058	4.292	.000
SP	-.272	.051	-5.331	.000
CVP	-.041	.059	-.700	.484
FDP	-.017	.058	-.295	.768
GLP	-.266	.070	-3.781	.000
GPS	-.209	.071	-2.949	.003
Environmental Attitudes	-.199	.024	-8.299	.000
Education *(ref. middle)*				
low education	.140	.042	3.322	.001
high education	-.021	.047	-.456	.648
Income *(ref. middle)*				
low income	.108	.046	2.329	.020
high income	-.121	.040	-3.041	.002
Opposition ~				
Party preference *(ref. other/none)*				
SVP	-.016	.016	-1.020	.308
SP	-.070	.018	-3.814	.000
CVP	-.010	.019	-.511	.609
FDP	-.054	.017	-3.247	.001
GLP	-.091	.027	-3.371	.001
GPS	-.110	.027	-4.097	.000
Environmental Attitudes	-.011	.007	-1.569	.117
Climate Change Skepticism	.069	.013	5.199	.000
N				1’627
Degrees of freedom				180
P-value (Chi-square)				.000
Robust Comparative Fit Index (CFI)				.908
Robust Root Mean Square Error of Approximation (RMSEA)				.032
Standardized Root Mean Square Residual (SRMR)				.032

Table 1: Structural equation model, regressions. Note: estimated in R with lavaan (Rosseel, 2012). Latent factors are presented in Table 5 in the Appendix. Full results in the supplementary material.

There are two reasons for this argument – because parties and affiliations with them are older than specific concerns about climate change, and because of the multi-issue reality of politics and voter concerns. For example, voters who associate with the Swiss Peoples’ Party, who

show the strongest climate change skepticism, prescribe to a party that built its strength on immigration issues, not environmental concerns. In short, hypothesis 2, which suggests that the political elite influence how citizens think about climate change, can be supported in accordance with Brulle et al. (2012), and is most evident in the case of the populist right which is sowing skepticism about both climate change and science more broadly.

Our research also validates hypotheses 1b and 3, which line up with the conclusions of prior research as well. Skepticism about the man-made nature of climate change, as postulated by Shi et al. (2015), does indeed correlate with opposition to clean energy policy, the result being that the most skeptical people are also the most oppositional to climate action, which supports hypothesis 1b. Political ideology itself, as suggested in hypothesis 3 and represented through party preference, is also directly linked with opposition, most evidently in the reduced opposition to clean energy policy for those that associate with liberal or Left-Green ideologies.

3.6 Discussion

The models reveal that beliefs and attitudes, and climate change skepticism in particular, are important factors in explaining opposition to clean energy policies for both the political elite and citizenry. For the elite, this can be attributed to the belief that an RE transition is not desirable or necessary because climate change is not the top priority, or a priority at all, among actors voicing opposition. In Switzerland, the populist Swiss People's Party SVP is the only major party skeptic of climate change, and is the sole outspoken party opponent of the new energy act. The nuclear industry and the Swiss Homeowner Association (at the time of the survey presided by an MP of the SVP) are the other strong opponents of the policy. All other major political actors, including the current electricity producers and free-market FDP, accept human-made climate change as a fact and support a general transition towards RE. However, the results have to be taken with caution, as the analysis applied to better understand the political elite does not allow for direct causal conclusions.

For individuals within the citizenry, the results suggest that the political elite do influence notions regarding climate-change skepticism, which in turn influences the public's support for environmental policy. Moreover, climate change skepticism does seem to be a tool that the political elite can use to depress support for clean energy policy. The political elite, and especially those with close ties to industry, are very cautious to support policies that may affect the economy. This conclusion is well illustrated by the 'semi-anti' cluster's general approval of a nuclear phase-out but its rejection of a tax increase on electricity consumption. Because

economic arguments against renewable energy may not be as impactful in discouraging support for climate policies, political actors within the elite are able to spread doubt about the necessity of clean energy by spreading doubt about climate change as a concept.

The findings suggest that elite actors not only influence how citizens think about climate change, but also that political ideology is an important heuristic as to whether or not citizens reject clean energy policy more broadly. This suggests that climate change skepticism serves as a proxy influenced by political ideology, most substantially for the populist right. Speaking to the necessity of an energy transition and questioning the reality of climate change emotionalizes the debate and allows the party to not only undermine scientific consensus but also to push for less or no state-intervention at all. In this sense, nurturing climate skepticism pushes the public's attention away from policy options to treat climate change, and instead focuses it on questions about whether climate change is even real in the first place.

Given our results, more thorough investigations into the link between a party position with regards to climate change and its influence on the respective voters need to be conducted. The approach with an SEM establishes this link and also suggests, together with the theoretical discussion and insights from earlier literature, the influence of parties on climate change skepticism. However, the data structure at hand and the model can not go into the depths or the mechanisms of the relation between a parties' position and a voters' attitudes. As such, more research with regards to this relation could built on interviews with voters to highlight how this process of perception and attitudinal alignment works.

3.7 Conclusion

This paper investigates factors that explain opposition in both the political elite and the public towards policies clean energy policies that support a renewable energy transition. The paper furthermore questions whether the attitudes of the political elite, notably political parties, influence the way citizens support climate and energy issues. In the analysis, climate change skepticism is identified as a sufficient but not necessary condition for the rejection of policies supporting clean energy. We also show that elite stakeholders project their beliefs and specifically their aversion to RE onto their voters and are an important source for decision heuristics. The paper's findings are important to understanding the steps necessary to transition to a primarily renewable energy system. The public relies on cues received from elite actors (most notably parties). This gives the elite a major opportunity to influence public opinion and, therefore, votes. Moreover, climate change skepticism has been a trending issue within populist parties on the right (but not only, according to Brown, 2014). With the denial of climate

change, populist parties are thus able to rally opposition against clean energy policies, similarly to the way in which they established political strength on immigration issues. Climate change skepticism can thus become an important and strong tool for political parties and elite to transfer their opposition to clean energy to voters.

Because elite actors play a central role in policy selection and influencing public opinion, they can be a massive hindrance towards pursuing a renewable energy transition. Elite actors and especially political parties that oppose the promotion of clean energy and promote climate skepticism are probably one of the most important hurdles to overcome if we are to transition to renewable energy. More generally, and independently from the Swiss direct-democratic system, some political actors seem to be exploiting climate change skepticism to incite public opposition to clean energy policy. It is, however, highly questionable whether these actors nourishing skepticism can be convinced to stop. In order to facilitate the process, political actors clearly in favor of a RE transition need to rethink how they approach citizens and what arguments they use to convince citizens that do not have strict preferences (see e.g., Stoknes, 2014). Motivated reasoning could potentially provoke a backlash and further promote distrust in the government and in climate change (Bolsen & Druckman, Forthcoming). At the same time, scientists also need to rethink how they present evidence for anthropogenic climate change to political actors. Time and resources to process information are almost as limited for the political elite as they are for the public, and its possible scientific evidence may not make its way into political debate (Cairney, 2016).

The differing results of our analysis for the elite and citizens illustrate how opinion is more ideologically polarized for the elite than for individuals. This might be because political actors and especially political parties need to have very distinct positions in order to capture citizens' attention and support. Individuals, however, do not need to develop clearly distinguishable beliefs and are often more ambivalent regarding a specific issue unless they are immediately impacted by it. This conclusion suggests that solutions addressing climate change could be supported by individuals even if some elite actors categorically reject the idea.

Lastly, it is important to acknowledge the interests and preferences of actors included in the 'semi-anti' cluster. As the somewhat platitudinous label for this group already indicates, these actors will probably oppose policies they consider too drastic. However, this paper also demonstrates that while the actors may oppose specific policies, they are not principally opposed to clean energy across the board. They are more likely to define their support or opposition depending on the selected policy and its specific implications. For states advocating for

a clean energy transition, it is therefore essential to gain the support of this cluster of actors, in contexts both with and without direct-democratic options.

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3.10 Appendix

Acronym	Organization	Actor Type
AEE	Organization for Renewable Energy and Energy Efficiency	Interest group (energy)
AKADWISS	Swiss Academies of Arts and Sciences	Science
AUTOS	Swiss Automobile Association	Interest group (economy)
AVES	Organization for Responsible Energy Policy Switzerland	Interest group (energy)
BKW	BKW AG	Utility company
CVP	Christian Democratic People's Party of Switzerland	Political party
DSV	Swiss Association for Distribution System Operators	Interest group (energy)
ECON	economiesuisse	Interest group (economy)
EDI	Federal Department of Home Affairs	Administration
ELECTROS	Association for Electrical Engineering, Power and Information Technologies	Interest group (economy)
ETH	ETH Board	Science
FDP	FDP.The Liberals	Political party
GLP	Green Liberal Party of Switzerland	Political party
GPS	Green Party of Switzerland	Political party
GREENP	Greenpeace Switzerland	Environmental NGO
HEV	Swiss Homeowner Association	Interest group (economy)
INDUS	ScienceIndustries - Swiss Business Association Chemistry Pharma Biotech	Interest group (economy)
NFORUM	Nuclear Forum Switzerland	Interest group (energy)
PRONA	ProNatura	Environmental NGO
PSI	Paul Scherrer Institute	Science
SAB	Swiss Working Group for Mountain Regions	Regional association
SATW	Swiss Academy of Engineering Sciences	Science
SBV	Swiss Farmers Union	Interest group (economy)
SES	Swiss Energy Foundation	Interest group (energy)
SGB	Federation of Trade Unions	Trade union
SGV	Swiss Association for Small and Medium-sized Enterprises	Interest group (economy)
SP	Social Democratic Party of Switzerland	Political party
SSOLAR	Swiss Trade Association for Solar Energy Swissolar	Interest group (energy)
SVP	Swiss People's Party	Political party
TRAVS	Travail Suisse	Trade union
UVEK	Federal Department of the Environment, Transport, Energy and Communication	Administration
VSE	Association of Swiss Electricity Companies	Interest group (energy)
WWF	WWF Switzerland	Environmental NGO

Table 2: List of elite actors

Belief	Variable	Min.	Max.	Mean	Stdev	Var
Energy strategy 2050 in general	stratsupport	1	4	2.848	0.870	0.758
General nuclear phase-out	besupport	1	4	3.030	1.185	1.405
Lower energy and electricity consumption	useredu	2	4	3.455	0.711	0.506
Increase share of renewables	renewincr	2	4	3.606	0.609	0.371
Sustaining Swiss access to international markets	maccess	2	4	3.515	0.566	0.320
Reconstructing energy grid	netwreconstr	2	4	3.455	0.617	0.381
Support for sequential nuclear phase-out	phaseout	1	4	3.273	1.126	1.267
Increase international competitions	intenscollab	1	4	3.515	0.755	0.570
Banning construction of new nuclear power plants	constrban	1	4	2.667	1.407	1.979
Introduction of white certificates for utilities	efftargets	1	4	2.182	1.044	1.091
Explicit right for own use of electricity for individuals	legalanchor	2	4	3.515	0.712	0.508
Limit duration of feed-in tariff per installation	kev	1	4	3.424	0.792	0.627
Increase electricity tax for individuals	cap	1	4	2.667	1.362	1.854
Partial exemption of CO2 tax for utilities	chargerelief	1	4	2.394	1.116	1.246
Increase energy research	research	2	4	3.606	0.556	0.309
Ensure security of supply	guarantsuppl	3	4	3.758	0.435	0.189
Ensure international independence of Swiss energy sector	sectautono	1	4	2.909	0.765	0.585
Prioritize economic efficiency of the energy mix	economix	2	4	3.182	0.808	0.653
Ensure competitiveness of energy sector	intcompet	2	4	3.727	0.517	0.267
Ensure equal access possibilities for all individuals, independent from their social status	equalaccess	1	4	3.121	0.857	0.735
Ecological risk of prolonging permits for nuclear power plants	lifespanext	1	4	2.424	1.324	1.752
Prioritization of RE production over increasing energy efficiency	renewpref	1	4	2.545	0.938	0.881
Necessity to adapt to & mitigate climate change	climtargets	1	4	3.394	0.864	0.746
Free choice of electricity products for consumers	consumchoice	1	4	3.273	0.911	0.830
Energy mix should be determined by free market	meconomix	1	4	3.030	1.015	1.030
Explicit right for own use of electricity for individuals	govparlmix	1	4	2.152	0.939	0.883
Nuclear phase-out is implementable in 30 years	phaseoutimpl	1	4	3.242	1.062	1.127
Urgency of energy transition is high	reconstr	1	4	3.152	1.034	1.070
Safety of current nuclear power plants is given	ppcond	1	4	2.727	1.153	1.330
Energy transition should be implemented subsidiarily	implcomp	1	4	2.303	0.883	0.780

Table 3: List of survey items included in cluster analysis. Support for different beliefs regarding the new energy act were measured with a four-point scale from 1 = 'fully disagree' to 4 = 'fully agree'.

Variable	Values
Party Preference	
Greens	6.6%
SP	15.3%
GLP	5.3%
CVP	9.2%
FDP	14.0%
SVP	18.9%
other	30.8%
Environmental attitudes, scale 0-5 in the form of a semantic differential	
Economic welfare <-> Environmental protection	66.7% prefer protection
Use of natural resources <-> Protection of nature and landscape	65.6% prefer protection
Climate change skepticism, scale 0-3 from "disagree" to "agree"	
I'm unsure if climate change really happens	27.2% skeptics
Climate change is primarily caused by humans (rec)	11.7% skeptics
The consequences of climate change are exaggerated	37.2% skeptics
Climate change is an excuse to patronize or tax people	23.5% skeptics
Opposition, multiple choice, tick if supported	
Tax reductions for operators of renewable energy plants	37.6%
Subsidies for building renewable energy plants	45.6%
Bans on building electricity plants for non-renewable energy sources	27.2%
Public tendering to find investors for building renewable energy plants	34.9%
Public investments in the production of renewable energy	37.2%
Energy companies shall be instructed to build renewable energy plants	25.5%
More information, consultation and education for people considering building renewable energy plants	38.5%
None of the above, renewable energies should not be promoted	2.6%
Age	continuous
Gender	49.1% women
Education	
Low	47.6%
Middle	22.3%
High	30.1%
Income	
Low	24.5%
Middle	41.4%
High	34.1%

Table 4: List of survey items included in the structural equation model. Original questions in German, French and Italian. Values and proportions reported for the full considered sample of n = 1'985 respondents.

Factor loadings					
LHS	Op	RHS	Estimate	Std. Err	P > |z|
Opposition	=~	Ban on non-renewables	1.000	.000	.000
Opposition	=~	Tax reductions	.940	.151	.000
Opposition	=~	Subsidies	1.187	.162	.000
Opposition	=~	Public tendering	1.069	.152	.000
Opposition	=~	Public investments	1.038	.142	.000
Opposition	=~	Instruction energy companies	1.063	.139	.000
Opposition	=~	Information, consultation, education	1.323	.167	.000
Climate Change Skepticism	=~	Unsure if climate change happens	1.000	.000	.000
Climate Change Skepticism	=~	Primarily caused by humans (rec)	.615	.046	.000
Climate Change Skepticism	=~	Consequences exaggerated	1.118	.056	.000
Climate Change Skepticism	=~	Excuse to patronize/tax	1.055	.053	.000
Environmental attitudes	=~	Environmental protection	1.000	.000	.000
Environmental attitudes	=~	Protection of nature and landscape	.843	.049	.000

Table 5: Structural equation model, regressions. Note: estimated in R with lavaan (Rosseel, 2012). Full results in the supplementary material.

4 Going beyond technocratic and democratic principles: stakeholder acceptance of instruments in Swiss energy policy

Lorenz Kammermann *& Karin Ingold*

Abstract

This paper is about stakeholders' acceptance regarding regulatory instruments in energy policy. We expect that today's introduced instruments not only correspond most to technocratic principles and what elected officials prefer, but that they correlate with the preferences of a wider number of public and private actors in policymaking. We therefore compare the already introduced policy instruments to instrument preferences of the public administration, elected officials, but also NGOs, and utilities. In doing so, we contribute to the question of whether or not the instruments already introduced today correspond to technocratic or democratic principles, or to the preferences of the larger governance arrangement involving other public and private actors. We compare three cantons in Switzerland and gather data through a systematic literature review, expert interviews and surveys. The comparison of the data suggests that the currently selected policy instruments correspond to technocratic principles, but that they also and often correspond to the preferences of public and private actors. More concretely, whereas in one canton NGO preferences align with the introduced instruments, in another canton, this is the case for utilities. In the third canton, all different actor types display similar preferences very much in accordance with the currently employed instrument mix. We thus conclude that depending on the region, the current policy mix reflects different principles and preferences.

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4.1 Introduction

The selection of policy instruments is a core task of political decision-making, and a key element in policy studies. Policy instruments are the "public" tools available to steer and govern, with the aim of changing a target groups' behavior and to reach political goals (Howlett, 2009a; Landry & Varone, 2005). Traditionally, the selection of policy instruments was in the hands of either technocrats/ the public administration, elected officials, or both. Today's research shows that a broad array of actors can be involved in policy instrument selection (Howlett & Lejano, 2012). Thus, when interested in what ideologies are reflected in today's policies, the study of a variety of stakeholders as well as the values and worldviews they have seems crucial (Weible, 2005). New institutional arrangements emerge, such as collaborative or governance networks, in which policymaking is characterized through self-organization and collective cooperation (Berardo & Scholz, 2010; Bodin & Crona, 2009). There is actually an ancient debate as to whether technocratic or democratic principles should dominate policy design (see also Gilley 2017). We try to go beyond this debate and ask if the policy instruments introduced today reflect technocratic or democratic principles, or if they correspond to the preferences of a wider set of actors involved in the larger governance arrangement. (e.g. technocrats/public administration; elected officials, but also NGOs or utilities).

This question is important because if we find evidence that today's instruments do not correspond anymore to the preferences of a large number of politically involved actors, policy may change in the future and current instruments be abolished or suffer correct implementation. And differently, if many stakeholders prefer instruments that are not yet introduced, then new measure might have a real chance to get into the future mix.

The present paper explores the nexus between criteria of technocratic policy design (e.g., resource intensiveness) (Bressers & O'Toole, 1998; Dahl & Lindblom, 1992; Henstra, 2016; Landry & Varone, 2005; Metz, 2017; Sovacool, 2009; Varone & Aebischer, 2001), of democracy (i.e., the acceptance of elected officials), and collaborative governance including stakeholder' instrument acceptance (Ansell & Gash, 2007; Feiock & Scholz, 2010; Nohrstedt, 2010). In this context, and in line with Peters (2002, 563), we test whether currently introduced policies correspond most to technocratic criteria for policy design, and if they are also legitimized by other stakeholders' acceptance.

Empirically, we study instrument mixes for the promotion of renewable energies in three Swiss cantons (i.e. subnational states). We take a comparative approach because depending on the regional context (e.g. how disputed renewables are, their impact on landscape or the

local economy, or best practice examples), there might be important differences in stakeholders' acceptance of policy instruments (typically green NGOs or utilities) and how much they correspond to the acceptance of the administration and elected officials. A comparison of cases furthermore allows a more thorough assessment of potential policy implications.

The Swiss case is ideal because the Fukushima crisis in 2011 constitutes a landmark in Swiss energy-related policymaking: it marked a radical shift away from nuclear power and towards plans for substantially greater amounts of renewables (RE) (Swiss Federal Department of the Environment, Transport, Energy and Communications DETEC, 2017). To achieve this target, new policy instruments for the promotion of RE are introduced or removed from the policy mix that aims to achieve the energy transition. Other studies about the energy transition mostly cover the impact of policies on the *outcome*, e.g., the production of renewable electricity or the decrease in carbon emissions (Yi & Feiock, 2014a). Or they investigate why specific renewable energy projects succeed or fail (Martin & Rice, 2015). We know much less about *policy instruments*, i.e., the policy *output* in such transformational settings and about the pathway towards the future policy mix. In this context, going beyond the "technocrats versus democrats" question is particularly interesting: on the one hand, RE strategies are often realized through local projects (e.g., wind farms). The realization of those projects tends to rely heavily upon the acceptance of neighboring communities and the local population, which implies that knowing the preferences of representatives of civil society and the local economy seems key for successful implementation of policy instruments (Wolsink, 2012a). On the other hand, if the energy sector is of strategic importance to the state, authorities such as the administration or elected officials might not want to give policy design out of their hands. However, we cannot make inference about what principle (technocratic versus democratic) or stakeholder groups impact today's policy mix or future instrument selection most. However, we can evaluate to what principles and stakeholder preferences today's instruments correspond most. This gives us then the chance to speculate about what instruments might have more or less support in the future.

Methodologically, we implement an innovative combination of approaches. First, we determine the currently implemented policy mix. Second, using three selected technocratic criteria, we evaluate policy instruments that the three Swiss cantons could use for the promotion of RE based on a literature review and expert interviews. To obtain a ranking, we employ multi-criteria methods (i.e., ELECTRE TRI) (Roy, 1991, 2016). The use of multi-criteria methods (MCA) in policy design has been repeatedly suggested in recent years in order to provide

scholars and decision-makers with more reliable empirical analyses (Howlett, 2004; Schneider, 2012). Third, to assess the stakeholders' acceptance of policy instruments (preferences of technocrats and elected officials, but also, NGOs and utilities) we collected extensive original survey data. The survey comprises of questions aiming to collect information about actors' preferences regarding current and potential future instruments that would enable a renewable energy transition.

4.2 Policy mixes and policy design

The range of measures available to overcome politically-identified problems is vast, and, generally, policy instruments can be used interchangeably ('tool-box' approach) (Landry & Varone, 2005). However, in recent years, scholars of policy design increasingly acknowledged the complexity of policy selection and shifted their focus from single instruments to multi-tool policy mixes (Gunningham, 2005; Henstra, 2016). Howlett and Rayner (2013), for example, state that policy instruments are rarely introduced on a 'clean slate', i.e., new policy instruments depend on older instruments that were previously implemented. Howlett, Mukherjee, and Rayner (2014) analyze policy design for multifaceted instrument mixes and call for a better evaluation of policy instruments in such intricate situations.

4.2.1 Technocratic and democratic principles in policy design

Policy design evolved during the last decades, and now includes several criteria for instrument evaluation, assessment, or selection (for an overview, see e.g., Metz, 2017). One can distinguish three different generations of instrument analysis based on different criteria:

The first generation of policy scholars strongly emphasized coercion as the main criterion regarding the evaluation of policy instruments (Lowi, 1972). This focus emerged from the ongoing debate between economists and political scientists regarding the interrelation between the state and the market, and how much state intervention versus market freedom was needed. This primarily economic approach centered on the resolution of specific market failures and searched for single policy instruments that were designed to solve one specific problem (Dahl & Lindblom, 1992). Furthermore, first generation political scientists tended to focus on what the state should have done, rather than what states actually did, thereby missing the empirical aspect of policy (Howlett, 2004, p. 3). The selection and design of policy instruments is, however, not a simple process in which a problem and its solution, as shaped by a policy instrument, have to be identified and implemented by a few decision makers.

Second generation scholars put a more distinct emphasis on the "policy" context, i.e, the broader portfolio of instruments that are already introduced and in what new instruments are embedded in (Bressers & O'Toole, 1998). The new focus on context illuminated the realization that the introduction or implementation of new policy instruments always depends on the pre-existing policy mix, which begs the question of whether 'optimal' policy mixes can ever be developed in the first place (Grabosky, 1994).

A third and most recent generation of scholars further considered the "political" context, i.e politics and the procedural elements in policy design (Howlett & Rayner, 2007a; Metz, 2017). Varone and Aebischer (2001, p. 618) mainly suggest four criteria by which political actors can choose and evaluate policy instruments: (1) Ideological constraints refer to the limitations placed on instrument selection due to existing political ideologies; and most importantly to ideological majorities in parliament. Technocrats will therefore try to opt for instruments that do not encounter ideological constraints and fit ideological majorities in order to effectively pass the political decision-making process (Henstra, 2016). (2) Resource intensiveness, which refers to the intensity of the costs required to operate an instrument - administrative personnel, monitoring, enforcement, infrastructure, etc. (3) Targeting precision, which refers to how precisely an instrument is aimed at its targets. Well targeted policy instruments are able to reach the identified target group (Metz, 2017; Schneider & Ingram, 1993), and induce "real" behavioral change within this target group. (4) Political risk, which is about how visible the instrument and its potential failure are. Decision-makers will avoid the risk of being identified as a supporter of instruments that are unpopular or as the actor that introduced an instrument that failed publicly (Henstra, 2016). The four criteria of Varone and Aebischer (2001) are considered to be universally relevant and very much in line with other typologies, independent from the specific policy field they are applied to (Bressers & O'Toole, 2005; Henstra, 2016; Howlett, 2015). While the first three criteria are most important to technocrats and concern their tasks in instrument design, implementation and evaluation, the last criterion of political risk is in line with the perspective elected officials adopt then selecting and advocating for instruments.

4.2.2 Towards a governance perspective in policy design

Different scholars (see for example Howlett and Mukherjee (2017); Enzensberger, Wietschel, and Rentz (2002); or Cheng and Yi (2017)) argue that the evaluation of policy instruments strongly depends on the actors that are involved during the policy process. This claim can be seen from a technocratic, a democratic, or a governance perspective:

From a technocratic understanding, policy design is restricted to the public administration. In this view, the administration decisively shapes policies by drafting proposals and re-formulating outlines (eventually with input from the government and parliament) (Sager & Rosser, 2009).

From a democratic understanding, elected officials represent the citizens and are thus the actor type to focus on when interested in policy design. If policies can be voted upon at the ballot, the mere design of public policies is mostly in the hands of collective actors having the resources (e.g. personnel, money, knowledge, access to information) to actively participate in that game (see Scharpf 1997). One exception are elected officials who have their party and sometimes their staff that helps them translate their ideologies into actual policy proposals.

Finally, from a governance perspective, policy design is in the hands of a broader network of actors interested in the same goal of addressing a societal problem (Kenis & Schneider, 1991). These actors represent different levels of decision-making and of implementation processes what contributes to the institutional complexity of modern governance (Hooghe & Marks, 2002; Lubell, 2013; Lubell & Edelenbos, 2013). One way to bridge fragmented systems is through collaborative arrangements where public and private stakeholders are brought together to engage in consensus-oriented decision-making (Ansell & Gash, 2007). In that regard, recent studies emphasize the criterion of stakeholder acceptance, in which the policy preferences of not just elected officials, but also of stakeholders, public, and private actors, are crucial (Dermont et al., 2017; Wüstenhagen et al., 2007). Research on policy acceptance focuses on the idea that policy instruments are more effectively introduced and later implemented when they are accepted, or even supported, by actors representing different groups, values, and worldviews in a community (Ingold, Stadelmann-Steffen, & Kammermann, 2018a).

4.3 Research design

In this study, we compare different instrument mixes for RE promotion in three Swiss cantons: First, we determine the currently introduced instrument mix in each canton. Second, we determine a policy mix based on the three technocratic criteria of policy selection as outlined in the section just above. Third, we identify the preferred instrument mixes of distinct actor groups (technocrats and elected officials, but also NGOs and utilities) relevant in the domain of RE policy. Before we outline methods used to analyze the data for those two approaches; we introduce the three case-study regions.

4.3.1 Selection of case study regions

The case of energy policy in federalist Switzerland is interesting for several reasons: first, after the Fukushima incident in 2011, the Swiss government decided to phase out the use of nuclear energy. This move arguably boosted the renewable energy market and required the introduction of new policy instruments to support it. Second, as part of a federalist country, the subnational entities, the cantons, are the strength behind implementing an energy transition and face significant challenges in reaching targets developed at the national level (Sager, 2017). It is also within the cantons, as well as at the local level, where RE projects will finally be implemented. The success of the projects, however, strongly depends on their acceptance by the private sector and local communities.

The paper specifically analyzes energy policy in the cantons of Bern, Lucerne, and Thurgau. Those cantons display interesting socio-economic and political differences that have an impact on how different public and private actor groups are involved in policy design. Bern is the biggest and most heterogeneous canton in terms of culture (German- and French-speaking parts) as well as in regard to the mix of mountains, lowlands, and urban areas. It is a canton with a long tradition of hydropower. Regarding its size, the strength of the left-wing parties (40% in parliament), and its experience with renewables, we expect to find a true "governance setting" where NGOs and the private sector are well organized. This then also means that the policy mix we observe today might be in line with all four actor group preferences (see below for details). Lucerne and Thurgau are more homogenous, smaller cantons, fully German-speaking. In Lucerne, there is some potential for wind energy and also some entrepreneurship promoting this. But all in all, the private sector is less well organized than in Bern and not locally anchored anymore (the main utility being a multi-regional). Thurgau is the wealthiest canton of all three, but also the most conservative with only 15% of left-wing seats in parliament. Different than in Bern for instance, there are not many landscape protection issues that mobilize green NGOs against renewable installations. So we expect differences in how the different actor groups align in their preferences with the currently introduced policy mix.

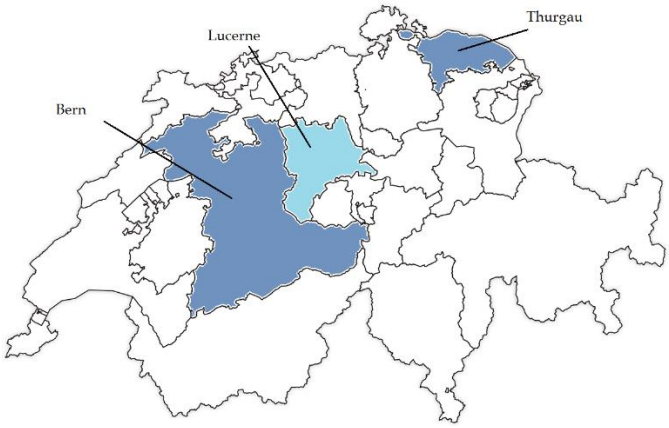

Figure 1: Geographic location of cantons; source: own illustration

4.3.2 The identification of relevant policy instruments within the RE promotion mix

The breadth of policy instruments available to decision-makers on the cantonal level is vast. In order to produce congruent results, the most relevant instruments for promoting renewable electricity need to be identified. This paper takes a two-fold approach to the pre-selection of instruments: first, we compiled a large list of instruments available to policy makers based on an extensive literature review. Second, we had experts on the Swiss renewable electricity sector (three heads of cantonal energy departments, one representative of the Swiss Federal Office of Energy, as well as one representative each of an NGO and of a utility) evaluate the list in six interviews. During these interviews, the experts were able to select all instruments that they recognized as both technically and legally feasible. Instruments that the experts considered to be fully unrealistic (e.g., a complete ban on non-renewable energies) or not compatible with the Swiss electricity system were removed from the list. The instruments considered for the evaluation are listed in Table 1.

We categorize instruments based on a simple typology that distinguishes between instruments that provide financial incentives and instruments that do not. Instruments that provide financial aid are further separated in such that actively offer subsidies for desired actions and such that allow tax reductions. We also distinguish instruments that work with other mechanisms than financial incentives between voluntary and coercive measures (Sovacool, 2009). This typology will allow a more structured and thorough discussion of results later on.

A feed-in tariff is obviously missing in the table; because Switzerland implemented a cost-covering feed-in tariff on the national level, none of the experts considered an additional cantonal feed-in tariff to be a realistic policy option due to jurisdictional constraints.

Instruments	Description
Non-financial support (voluntary)	
Information & education	Providing information to the general public and further education courses to an interested specialized audience by the canton
Demonstration	Prototypical function of the canton: e.g., cantons build their own buildings according to the highest energy standards and thus take a leading role
Non-financial support (coercive)	
Minimal investment ratio	Implementation of a minimal investment ratio for utilities
Partial self-supply (new buildings)	Newly constructed building are obliged to produce a certain amount of the used electricity (e.g., based on usable floor area)
Financial support (subsidies)	
Research	Financial support of energy research for public and private institutions
Pilot & demonstration projects	Financial support of private or public projects to facilitate market introduction after successful research
Subsidy construction	Financial support for construction of renewable electricity projects
Subsidy grid access	Financial support for the construction of a grid access
Public announcements	Cantonal call for tenders
Financial support (tax reductions)	
Reduction of capital cost	(Partial) cantonal coverage of interests for investment costs; this instrument would make the construction of new facilities cheaper and less risky
Tax reduction construction	The costs of construction of renewable electricity can be deducted from taxes
Tax reduction on selling RE	Tax exemption for the sale of renewable electricity up to 10'000kWh/a; this instrument would mainly target small private house owners that produce some of their electricity with (e.g.) PV panels. The limited amount of kWh/a would not be relevant for larger utilities.
No tax on selling RE	Total tax exemption for the sale of renewable electricity; because of the general exemption this instrument would mainly target large utilities who produce extensive amounts of (mostly) hydropower.
CO_2 tax compensation	Compensation of CO_2 tax for companies investing in renewables; this instrument would mainly target companies from energy intensive industries and the transportation sector that currently pay large amounts of CO_2 taxes

Table 1: Instruments for the promotion of renewable electricity

4.3.3 Operationalizing the technocratic criteria relevant for instrument selection

Deduced from the literature presented in section 2 above, we can retain three technocratic principles: ideological constraints, resource intensiveness, and targeting precision (Henstra, 2016; Varone & Aebischer, 2001). We scored the instruments in a two-step procedure: first, we assigned values based on a literature review that takes different instrument characteristics into consideration (see e.g., Henstra, 2016). The evaluation of the policy instruments is based on a literature review of previously conducted assessments of mostly Swiss but also international energy and climate policy. This is why this assessment does not consider the specific context (e.g. already introduced policy mix in or financial situation of the jurisdiction) in which the instrument will be introduced, but is a rather general assessment of the performance of each instrument. Ideological constraints are evaluated by judging the chance that their introduction might trigger conflict between the involved actors (Ingold, 2008a). For example the introduction of information campaigns will not cause actors to seriously oppose a

proposal. However, the potential refund of the CO_2-tax goes against some of the core ideologies of the green and left-wing parties and will therefore trigger major opposition during the policy process (Bygrave & Ellis, 2003). We then evaluate the instruments' resource intensiveness by assessing the administrative and financial costs of implementation, monitoring and operation. Again, an information campaign does not require large administrative engagement or incur major financial costs, whereas fully administering a new subsidy scheme could require both (Metz, 2017; Stavins, 1997). Targeting precision captures the selectivity of an instrument in regards to its impacts on potential target populations. Further education of practitioners, for example, is a highly precise instrument because only people working in the domain of renewable energy are targeted (Henstra, 2016). On the other hand, the obligation to partially self-supply new buildings targets a much broader group, from private house owners to companies to public organizations (Ingold, 2008a; Kellenberger, 2004).

In a second step, we discussed the scores with the same experts that already corroborated the list of instruments. The experts largely agreed with the previously determined scoring of the instruments. In the few occasions experts disagreed with an evaluation we prioritized their assessment over the literature review. We assigned a score of 1 for a 'low', 3 for a 'medium', and 5 for a 'high' performance on each of the three criteria. Scores of 2 and 4 are also possible in the case that an instrument does not directly fit into the low-medium-high scale. We consider a low performance to be 'good' for two criteria: ideological constraints and resource intensiveness. For targeting precision, we consider a high performance to be 'good'. We take this reversed directionality into account when ranking the instruments.

The ranking of the instruments is done based on ELECTRE TRI (Elimination and Choice Expressing Reality) which belongs to the so-called "outranking methods" of multi-criteria analysis (Figueira, Mousseau, & Roy, 2016; Roy, 1991, 2016). The method has already found some use in renewable energy policy and has been applied in domains such as operations research and energy planning in multiple studies (Beccali, Cellura, & Mistretta, 2003), or for the evaluation of policy instruments promoting the use of electric vehicles (Taefi, Kreutzfeldt, Held, & Fink, 2016). A particular advantage of this method is its flexibility regarding the inclusion of multiple qualitative criteria that are crucial for the assessment of the policy instruments presented in this paper.

ELECTRE TRI evaluates different options with a given set of at least three criteria (in this case different instruments are evaluated based on three selection criteria) and orders them according to their performance. The data used for the analysis is set on an ordinal or a weak interval

scale. Every score of every instrument is then pair-wise compared to the scores of other instruments for the same criterion so that the different alternatives can be ranked (Figueira et al., 2016). In order to understand the approach of ranking options, two main concepts need to be discussed briefly: thresholds and outranking. Generally, policy option A is better than option B when A scores higher on a specific criterion. However, it also matters how *much* better A is compared to B because minimal differences may not be relevant to political actors (e.g., it does not matter to decision makers whether the implementation of a new subsidy required an expenditure of $1 million or $1.01 million). ELECTRE TRI therefore uses the so-called *indifference threshold* that renders small differences in one criterion between two options as insignificant. On the other hand, ELECTRE TRI also employs a *preference threshold* that qualifies an option as strictly better than another when surpassed. A third threshold particular to ELECTRE TRI is the *veto threshold* that implies the opposite consideration as the indifference threshold. When an instrument scores significantly higher by one criterion than another instrument, it can be assumed to then veto the worse of the two options. All three thresholds need to be set according to the research interest and may vary across different criteria (Buchanan, Henig, & Henig, 1998). Based on these three thresholds, ELECTRE TRI compares every instrument with every other instrument (pair-wise comparison) and determines whether one is 'at least as good' or 'not worse' than the second another, i.e., whether it outranks the second instrument regarding one specific criterion. Those scores are then cumulated and transformed into a ranked list of options.

4.3.4 Operationalizing policy instrument acceptance

We evaluate the degree to which each instrument is accepted by different actor types (e.g., administrative entities, elected officials, but also NGOs and utilities). Again in line with the literature presented in section 2, we contrast the above evaluation with the actual preferences of the public administration. And following rules of representative democracy, we are interested in how elected officials assess the policy instruments and to what extent their preferences align with the current mix. And finally, and from a governance perspective, we also assess preferences of NGOs and utilities. We selected those two actor types because both have a special interest in renewables and their regulation. They were furthermore detected as the two most important actor groups following the reputational approach as outlined below. Even though most green NGOs are in favor of alternative energy, there is an increased conflict arising when it comes to landscape protection potentially being hampered or softened through renewable installations. This is not a trivial issue in Switzerland where over 80% of

the landscape is protected. And utilities in contrast are most often the ones who invest in those installations and have an economic interest in the issue. Data to assess the preferences of all those actor types were gathered through standardized surveys. As a first step, we identified the collective actors and organizations involved in RE policy design. Actors were selected according to the positional and decisional approaches for the identification of stakeholders and later confirmed with the reputational approach (see e.g., Magill & Clark, 1975b). In the first wave of contact (September 2016), all actors received a survey questionnaire by postal mail. A second and third attempt to reach actors (late October and December 2016) were then executed by email in which actors had to complete an editable pdf-file. We sent the survey out to all political parties represented in the cantonal parliament (i.e., elected officials); to the administrative offices involved in renewable energy policy (i.e., energy, environment, water, special planning and agriculture); as well as to relevant NGOs, utilities, business associations, as well as trade unions and other associations. The paper puts its focus on political parties in parliament for the assessment of elected officials and not on the cantonal governments because all cantonal governments operate under a consensual principle. The consensual character makes government solutions improbable that clearly reflect a specific parties priorities (Vatter, 2016a).

Table 2 shows how many actors per actor group were included in the survey. Response rates varied between 78% in Bern, 68% in Lucerne, and 65% in Thurgau. Whereas the response rates may coincidentally differ because of the small sample, we can attribute the varying response rates to different factors. Bern is by far the largest among the three cantons and its political actors are thus more professionalized and more resourceful than the ones in Lucerne and Thurgau.

In order to determine the most important actors and actor groups, the survey respondents were asked to indicate which actors they considered the most important in the domain of RE policy making. The respondents were able to make a selection based on the complete list of actors that we include in the survey and had the option to add additional actors they considered relevant. There was no limit on the number of actors that could be selected.

This question serves two purposes: first, it functions as a fail-safe in case important actors were missed during the initial identification process. Second, the question also determines the most important actors and actor groups within the policy process. The so-called reputation of an actor is considered to be a proxy for their total resources and hence for their influence in the process.

Canton	Political parties	Admin. Entities	Assoc. (public entities)	Assoc. (energy)	Assoc. (business)	Utilities	NGOs	Response rate
Bern	8	4	5	4	9	6	4	78%
Lucerne	7	3	3	7	10	3	4	68%
Thurgau	9	5	1	6	8	5	3	65%

Table 2: actors initially included in survey by actor group and response rate

For each actor, the amount of times they were mentioned as 'very important' in the process is counted and then divided by the total possible number of possible mentions (i.e., total number of returned survey questionnaires). Actors that receive a value of 1 are considered to be important by everyone, versus a value of 0.5, which infers that an actor is considered to be important by at least half of all responding actors. We used this question as a proxy for our actor selection; i.e. to select other actor groups besides elected officials and the public administration. We did restrain from including all actor types and only focused on those perceived as important, as some degree of power and resources is needed to decisively impact policy design (Carpenter, 2010; Carpenter & Krause, 2012). The reputational analysis returned four crucial actor groups: the public administration, the elected officials, environmental NGOs, and utilities. Other actor groups included in the survey received lower reputational levels (i.e., economic associations, trade unions, & renewable energy businesses) or did not return any questionnaires (i.e., science; and administrative entities in Lucerne) and are therefore not considered in the following analysis.

In order to assess the stakeholders' instrument acceptance, survey participants were asked to choose their preferred policy mix to support the expansion of renewable electricity production from the list of instruments presented above.[6] This question takes into consideration the fact that instruments are hardly ever implemented in an isolated way and makes sure that stakeholders answering the question are able to choose their preferred instruments in a policy mix setting (and not one by one in an isolated manner). In the actual survey, none of the actors chose an 'unrealistic' number of instruments. In other words, all respondents acknowledged that state resources are limited and that not all instruments could be implemented at the same time.

Actors were able to select the primary instruments they would like to employ (assigned value of 1) or, alternatively, in their preferred policy mix (assigned value of 0.5). Instruments they

[6] The exact wording of the question is as follows (translated from German): "In the following you'll find a selection of potential or already implemented measures that support the expansion of renewable electricity production in the canton of XX. Which of the following measures should, from the position of your organization, be employed primarily or secondarily by the canton of XX? You may add further measures on the blank lines on the bottom of the list."

did not choose at all received the value of 0. We selected the thresholds that indicate whether an instrument should belong to the primary instrument mix based on this coding. This implies that instruments whose score is close to 1 (here >= 0.7) should make part of the primary instrument mix. Instruments that receive a score close to 0 (here <= 0.3) should not be implemented. Instruments with scores in between the two thresholds (thus close to 0.5) should be given secondary priority. Furthermore, actors were able to add instruments to the list that they considered were feasible options for achieving the overarching target of increased renewable electricity production. However, this option returned no further relevant insights.
The preferences of the four actor groups are then aggregated. We weight the preferences of administration, elected officials, NGOs, and utilities according to their reputation, and the mean value was utilized as the acceptance indicator. In some cantons, the number of actors involved in renewable energy policy is very low, especially with regard to NGOs and utilities. For these cantons and actor groups, sometimes one single actor had to be taken as a reference.

4.4 Analysis

4.4.1 The current instrument mixes

In a first step, instruments that are currently implemented in the three cantons were identified and are depicted in Table 4. The canton of Lucerne has the most parsimonious instrument mix, which consists solely of two instruments: information & education, and the canton's prototypical function, i.e. voluntary non-financial support. In the canton of Bern, the current policy mix in the domain of RE promotion consists of information campaigns & advice from the canton to potential builders, opportunities for further education, financial support for research, pilot, & demonstration projects, tax reductions for the installation of renewable electricity production, as well as the canton's prototypical function in cooperation with the communes (lowest administrative level). This instrument mix thus adds instruments from the financial support through tax reduction category. The canton of Thurgau has the most all-encompassing policy mix regarding the expansion of renewables. Thurgau utilizes the same instruments as the canton of Bern but, in addition, grants subsidies for the construction of projects such as larger PV systems exceeding 30kWp. Further, it is about to implement a partial self-supply standard for building which would force home-owners and businesses to add renewable electricity production installations to their newly constructed buildings. Thurgau thus also adds instruments from the subsidy category.

4.4.2 Evaluation of policy mix with technocratic criteria

Each instrument could attain a score ranging from 1 (low performance) to 5 (high performance) for constraints, resource intensiveness and targeting precision respectively. The distributed scores that were then used for the instruments' pairwise comparison are depicted in Table 3. In order to conduct the MCA-analysis, the thresholds were set as follows: first, the indifference threshold is set at 1 based on the assumption that elected officials and other actors are indifferent or not able to actively distinguish between instruments that have very similar scores in one criterion. Furthermore, all instruments were evaluated qualitatively. An indifference threshold of 1 (compared a threshold of 0) prevents the model from assuming outranking relations between instruments that are purely based on coding decisions that might have gone one way or the other. Second, the preference threshold is set at 2, which corresponds to the increment from low to medium or from medium to high. This gap is large enough for actors to clearly distinguish the performance of two instruments without being so large that it would lead to continuous veto relations. Finally, the veto threshold is set at 4. After running the model, the ranking attained through ELECTRE is then converted to a scale of 0 to 1. Similarly to the preference scores, scores of 0.7 or higher mean that an instrument should primarily be employed in the policy mix. We transform the final ranking (scale from 0-1) onto the same scale as the instrument preferences actors could express in the survey (1 for primary importance of instrument in policy mix; 0.5 for secondary importance; 0 for that instrument should not be part of the policy mix). It is thus easier to compare results. We set the threshold at 0.7 because when splitting the scale of 0-1 into three sections, 0.7 (rounded up from 0.67) is the cut-off for the top tier whereas 0.3 (rounded down from 0.33) refers to the bottom tier. Table 4 (column 2) shows the ranking of the selected policy instruments following the MCA method.[7] The thereby identified technocratic mix is constituted primarily of the following instruments: persuasive measures such as information & education; the canton's prototypical function; support for research and pilot and demonstration projects; and tax reductions granted for the construction of renewable electricity systems.

[7] The MCA model is then evaluated for its robustness. The threshold of indifference is set at 1. Lowering the threshold to 0 would make the model more sensitive and in this way more vulnerable to small differences in the evaluation of the instruments that might be purely based on the qualitative assessment and coding. An indifference threshold set at 2 would, on the other hand, overstress the assumption that decision makers and other actors are somewhat indifferent about the differences between policy options that have similar attributes. The threshold of preference is set at 2 for all models. Lowering the threshold to 1 is not possible because it would overlap with the indifference threshold. Raising it to 3 is an option as long as the veto threshold is set at 4 or higher. When running, the model with a preference threshold of 3 does not return large differences to the original model. The order of the instruments does not change. The alternate threshold returns, however, a less distinct ranking.

Instruments	Ideological constraints	Resource intensiveness	Targeting precision
Non-financial support (voluntary)			
Information & education	1	1	5
Demonstration (prototypical function of the canton)	1	1	5
Non-financial support (coercive)			
Minimal investment ratio	5	5	1
Partial self-supply (new buildings)	4	4	1
Financial support (subsidies)			
Research	3	3	5
Pilot & demonstration projects	3	3	5
Subsidy construction	4	5	4
Subsidy grid access	4	5	4
Public announcements	3	4	4
Financial support (tax reductions)			
Reduction of capital cost	4	3	3
Tax reduction construction	3	3	5
Tax reduction on selling RE	3	4	3
No tax on selling RE	4	5	3
CO_2 tax compensation	5	4	3
MCA thresholds			
Threshold of indifference	1	1	1
Threshold of preference	2	2	2
Veto threshold	4	4	4

Table 3: Technocratic criteria scores. Legend: scores refer to: 5 = high; 3 = medium; 1 = low; reading example: the instrument of information & education has few ideological constraints and a low resource intensiveness. On the other hand, its targeting precision is high.

4.4.3 The preferred instrument mixes

Based on the survey results we hereafter present the accepted instrument mixes in the respective canton (Table 4, columns 3-6). In the canton of Bern, the administration prefers an instrument mix that focusses on persuasive measures such as information & education, pilot projects as well as the canton's prototypical function, tax reductions for the construction of RE projects, and the coercive requirement to partially self-supply new buildings. Elected officials have similar instrument preferences but do not support pilot and demonstration projects. The utilities support an instrument mix that additionally contains financial support for research as well as tax reductions for selling RE, which is of course their core business, and, similarly to all other actor groups, tax reductions for the construction of RE production installations. Environmental NGOs support the most extensive instrument mix, which, in addition to the previously stated instruments, includes financial support for pilot and demonstration projects, as well as a partial tax exemption for selling renewable electricity. All actor groups agree that information & education as well as demonstration should be employed and that the construction of installations to produce RE should be tax deductible. In the canton of Lucerne,

elected officials prefer a similar instrument mix as in Bern. However, they add public announcements to the mix, with a relatively high score of 0.8, but drop the obligation for partial self-supply. On the other hand, utilities are somewhat restrictive – they want the canton to solely inform and educate the interested public. The NGOs again support a rather comprehensive instrument mix that covers financial incentives for research and pilot and demonstration projects as well as the mandate that all newly built buildings produce a certain amount of their required electricity on their own. The canton where actors generally support the most extensive instrument mix is Thurgau: the public administration prefers a very comprehensive mix consisting of multiple persuasive and financial instruments as well as the requirement for the partial self-supply of new buildings. Elected officials are more reluctant to reductions of capital costs and taxes. Utilities, however, are more constrained and focus on the building sector with partial self-supply and on subsidies for the construction of such installations. NGOs mostly agree with this mix and, in addition, support subsidies for the construction of the grid access.[8]

4.5 Discussion

The paper asks if the currently selected instruments in the three cantons correspond to the instruments performing best following three technocratic criteria. We furthermore investigate whether preferences of four actor types, the administration (i.e., technocrats), elected officials, NGOs, and utilities align with the current and observable mix.

In all three cantons, the current mix corresponds to instruments that score highly when considering technocratic principles. In Bern and Thurgau, the mix includes the support of research that has a score of 0.7 what is only slightly above the threshold we consider necessary for high performance from a technocratic perspective. The only considerable exception consists in subsidies for the construction of renewables: this instrument makes part of the mix in Thurgau but receives with 0.1 a very low score following the three technocratic principles. It has a considerable targeting precision but comes with high constraints and is very resource intensive.

One intuitive expectation is that the actor group of the public administration might align the most with the instruments performing best following technocratic principles. It is true that most of the instruments preferred by the administration in Bern and Thurgau also score high

[8] Both in Lucerne and Thurgau the number of actors being part of the utility or NGO groups and being active in RE policy is very limited. We thus only have very few responses in the respective groups.

in regards of technocratic criteria. But this is not always the case (e.g. in Bern the administration supports partial self-supply and in Thurgau capital cost reductions, both not scoring high from a technocratic perspective) and also other actor groups have the general tendency to prefer instruments with high technocratic performance.

When comparing actors' preferences related to the already introduced mix across the three case studies, interesting insights can be gained: In Bern, the preferences of all three actor groups are very homogenous and align with the introduced mix. This might be the result of the fact that negotiations about renewables have a long tradition in this canton, and that civil society and business are both well organized and integrated in the larger governance arrangement responsible for public policymaking (see e.g., Gerlak, Heikkila, & Lubell, 2016). Thus actors have the tendency to interact with each other, and to seek policy compromise. In other words, the understanding of the situation, and what is needed in the canton regarding renewables and their regulation, is similar across the different actor groups.

This is much less the case in the other two cantons. In Lucerne, and with the exception of one instrument, NGOs prefer instruments that are not included in the current mix. Whereas in Thurgau, NGOs align much more in their preferences with the current mix than utilities. It is interesting to see that all actor groups find some of their preferred instruments in the current mix. There is no group that aligns systematically with what is introduced.

In what follows, we back-up the results with some more knowledge about the different cases and regional contexts. One interesting insight we gained from our analysis is that experience with an instrument seems to play a crucial role for the alignment of stakeholders' preference and introduced instruments: in the canton of Lucerne, for example, elected officials show major support for public announcements (0.9). Lucerne used to employ this instrument but phased it out due to budgetary restrictions. But in the other two cantons (that do not yet use this instrument), approval is very low (0.2 each). In our case, it can therefore be assumed that decision makers are especially open to instruments they are already familiar with and employ in their canton (Metz & Ingold, 2017). Generally, it can be further observed that elected officials prefer an instrument mix that consists of slightly less than the currently-implemented instruments. Furthermore, the canton of Lucerne demonstrated the largest discrepancy between what is currently introduced and what elected officials preferred. This can partially be explained by the tense financial situation in the canton, as well as by a failed total revision of the energy act that led to the absence of most instruments.

The NGOs are the actor group that showed the highest preferences for an instrument mix that is more coercive and broader than the mixes favored by the other two actor groups. This finding can mainly be ascribed to their core policy beliefs, which correspond with the idea that NGOs put a much stronger emphasis on issues such as environmental protection and climate change and are generally more favorable towards state intervention than the other two groups (Metz, 2017). This can be directly linked to their stronger support for market-based measures such as tax reductions in exchange for selling renewable electricity or direct subsidies provided by the canton. However, none of the NGOs were in favor of the strongest measure (the complete repeal of taxes on renewable electricity). The hesitation to support this instrument can be attributed to two factors. First, dropping all the taxes on selling renewable electricity would lead to a boom in the planning and construction of power plants (especially dams and wind turbines) in regions that do currently not have any significant infrastructure. NGOs are naturally reluctant to prioritize renewable electricity production over landscape protection. Hence, they also oppose large surges in the construction of power plants, especially in sensitive environmental areas such as near pristine rivers and undeveloped terrain. Second, the electricity industry is a major tax contributor especially on the cantonal but also on the nation level. These taxes are partially used for climate adaptation measures such as flood prevention, or for environmental restoration projects. NGOs therefore also have an interest in not shrinking these taxes.

Whereas the NGOs prefer a more all-encompassing instrument mix, utilities prefer less instruments overall. This finding is also not surprising because most instruments presented in this paper actually support ordinary citizens should they decide to build their own renewable electricity producing system, like rooftop solar. This additional power generation is able to help soften the peak electricity consumption times, which occur at noon. However, these new generation systems serve as a form of competition for the utilities, because they start to carve away at the utilities' historical monopoly on electricity production and distribution. Nevertheless, rooftop solar is not yet a fundamental threat to the monopoly maintained by utilities because most private homes that produce renewable electricity are not entirely self-sufficient and are still reliant on the power produced by large-scale power plants. However, this private production of electricity still results in a loss of revenue for the utilities, especially with regard to the current electricity prices and the major investments utilities need in their infrastructure. Furthermore, utilities are obliged by federal law to buy excess electricity and feed it into the grid, which again increases their administrative expenses.

Bern	Technocratic Principles	Admin (*n*=2)	Elected officials (*n*=7)	NGOs (*n*=4)	Utilities (*n*=4)	Current mix
Instruments	**MCA**	**Pref.**	**Pref.**	**Pref.**	**Pref.**	
Non-financial support (voluntary)						
Information & education	0.8	1.0	0.8	0.9	0.8	X
Demonstration (prototypical function)	0.9	1.0	0.8	1.0	1.0	X
Non-financial support (coercive)						
Minimal investment ratio	0.0	0.0	0.3	0.5	0.1	
Partial self-supply (new buildings)	0.0	1.0	0.8	0.9	0.4	
Financial support (subsidies)						
Research	0.7	0.3	0.5	0.5	1.0	X
Pilot & demonstration projects	0.7	0.7	0.5	0.7	0.9	X
Subsidy construction	0.1	0.5	0.4	0.6	0.4	
Subsidy grid access	0.1	0.3	0.3	0.5	0.4	
Public announcements	0.4	0.0	0.3	0.6	0.5	
Financial support (tax reductions)						
Reduction of capital cost	0.4	0.2	0.5	0.7	0.3	
Tax reduction construction	0.7	1.0	1.0	0.8	0.9	X
Tax reduction on selling RE	0.3	0.2	0.8	0.6	0.8	
No tax on selling RE	0.1	0.0	0.4	0.3	0.4	
CO_2 tax compensation	0.3	0.0	0.5	0.5	0.5	

Lucerne	Technocratic Principles	Admin (*n*=0)	Elected officials (n=6)	NGOs (*n*=3)	Utilities (*n*=1)	Current Mix
Instruments	**MCA**	**Pref.**	**Pref.**	**Pref.**	**Pref.**	
Non-financial support (voluntary)						
Information & education	0.8	NA	1.0	0.3	1.0	X
Demonstration (prototypical function)	0.9	NA	0.9	1.0	0.5	X
Non-financial support (coercive)						
Minimal investment ratio	0.0	NA	0.5	0.6	0.0	
Partial self-supply (new buildings)	0.0	NA	0.5	1.0	0.0	
Financial support (subsidies)						
Research	0.7	NA	0.7	0.6	0.0	
Pilot & demonstration projects	0.7	NA	0.6	0.9	0.5	
Subsidy construction	0.1	NA	0.6	1.0	0.5	
Subsidy grid access	0.1	NA	0.4	0.8	0.0	
Public announcements	0.4	NA	0.8	0.6	0.5	
Financial support (tax reductions)						
Reduction of capital cost	0.4	NA	0.5	0.6	0.5	
Tax reduction construction	0.7	NA	0.9	0.6	0.5	
Tax reduction on selling RE	0.3	NA	0.6	0.4	0.0	
No tax on selling RE	0.1	NA	0.3	0.0	0.0	
CO_2 tax compensation	0.3	NA	0.4	0.3	0.0	

Thurgau	Technocratic Principles	Admin (n=2)	Elected officials (*n*=7)	NGOs (*n*=1)	Utilities (*n*=1)	Current Mix
Instruments	**MCA**	**Pref.**	**Pref.**	**Pref.**	**Pref.**	
Non-financial support (voluntary)						
Information & education	0.8	0.9	0.9	1.0	0.5	X
Demonstration (prototypical function)	0.9	1.0	0.6	1.0	1.0	X
Non-financial support (coercive)						
Minimal investment ratio	0.0	0.5	0.6	0.5	0.5	
Partial self-supply (new buildings)	0.0	0.9	0.7	1.0	1.0	
Financial support (subsidies)						
Research	0.7	0.6	0.5	0.0	0.0	X
Pilot & demonstration projects	0.7	1.0	0.9	1.0	0.5	X
Subsidy construction	0.1	1.0	0.8	1.0	0.5	X
Subsidy grid access	0.1	0.1	0.8	1.0	0.0	
Public announcements	0.4	0.1	0.3	0.5	0.5	
Financial support (tax reductions)						
Reduction of capital cost	0.4	0.9	0.1	0.5	0.5	
Tax reduction construction	0.7	0.1	0.6	1.0	1.0	X
Tax reduction on selling RE	0.3	0.9	0.2	0.5	0.5	
No tax on selling RE	0.1	0.1	0.2	0.0	0.0	
CO_2 tax compensation	0.3	0.1	0.4	0.0	0.0	

Table 4: The current, technocratic and preferred instrument mixes. Legend: highlighted instrument scores show scores >=0.7 and indicate instruments primarily relevant for the policy mix. Reading example: In the canton of Bern all actor groups would select the instrument of information and education for their preferred policy mix. Furthermore, also the evaluation by technocratic criteria selects information and education for a potential policy mix.

4.6 Conclusion

This paper assesses whether previously selected instrument mixes correspond to technocratic criteria in policy design or to preferences of central stakeholders in the policy process. To answer this question, we compare the introduced policy mix to policy mixes derived from technocratic principles and survey data. In doing so, we try assess whether the currently introduced policy instruments correspond mostly to technocratic or democratic principles, or if they align most with the preferences of public and private actors integrated in the larger governance arrangement. We argue that this question is highly relevant, especially in the fields of energy policy and transition. Within these fields, the acceptance of new options not only depends upon the state's strategies, but also on the perceived legitimacy of the instruments, the broader political context, and preferences of a wide array of concerned actors (Ingold et al., 2018a). If the preferences of central actors do not mirror the currently implemented policy mix, they might challenge it in the future. By doing so, unsatisfied actors might destabilize current regulation and push to either introduce new instruments or remove old ones from the mix (Kivimaa & Kern, 2016a).

We empirically investigate policy instruments introduced in Swiss energy policy and focus on three sub-national entities, called cantons. We identify technocratic policy mixes by conducting a multi-criteria analysis (ELECTRE TRI) and assess actors' preferences as acquired through an elite survey in the cantons of Bern, Lucerne, and Thurgau. Generally, the instruments introduced score highly when it comes to their technocratic performance. But the picture is more complex than that. The general conclusion we can draw is that regional contexts matter. In the canton of Bern with the longest experience of renewable energy promotion, the different actor types including NGOs and utilities have all coherent and comparable preferences in how to regulate renewable energies in the canton. And those preferences largely align with the introduced mix. This is different in the two smaller cantons, with less experience and more conservative parliaments. In Lucerne, for instance, preferences of NGOs and utilities are almost not reflected at all in the current mix. These actors might thus push for the introduction of their preferred instruments such as extensive subsidies in the case of NGOs. In Thurgau, preferences of all actor types only partially match what is introduced. Here, we could speculate that the coercive instrument of mandatory partial self-supply in new buildings might be introduced because all actor groups (public administration, elected officials, NGOs and utilities) accept the instrument already. A fact that might hinder its introduction, is the instrument's low scores regarding technocratic principles.

Our result is thus very much in line with current research about the performance of so-called collaborative governance arrangements. Collaborative governance follows the assumption—and some existing empirical evidence—that the participation of affected, concerned, and responsible actors enhances the acceptance of decisions; which consequently supports implementation, and therefore improves the quality of outcomes (Macnaghten & Jacobs, 1997). Mainly in environmental policy studies, scholars show some evidence that deliberative, bottom-up ways of problem solving can improve outcomes (Berkes, Colding, & Folke, 2002; Christensen, Kornov, & Nielsen Holm, 2012; Newig, 2012). Our research is not going thus far, but shows some tendency that more homogenous preferences among different actor types can exist in settings with a longer, collaborative tradition in policy design. And such "negotiated agreements" (as it might be possible, for example, in the case of Thurgau with its self-supply regulation) might then also have an impact on the quality in implementation, and finally the policy outcome.

The study has its inherent limitations. The elephant in the room is the missing direct causal link between the currently introduced policy mix and the constructed technocratic and preferred instrument mixes. The paper does not assume that its analysis can be used to find direct

causal connections between the three mixes. However, what the paper is able to do is compare the three cantons and offer insights about what policy instruments have a high potential of being introduced in the future or removed from the policy mix (if already introduced but with low acceptance scores by key stakeholders).

Another important limitation of the study is that there are other factors which enable or restrict choices around policy instruments that have not been discussed in detail. These factors include, for example, path dependency and therefore the instruments that are already in place, budgetary limitations, etc. (see e.g., Öberg, Lundin, & Thelander, 2015). This paper is also an attempt to integrate MCA into policy design on a theoretical level. There are many sophisticated decision tools and therefore more criteria, that impact decision-making than this study analyzes (see e.g., Henggeler Autunes & Oliveira Henriques, 2016). However, the more theoretical design criteria have rarely been applied in the way that this paper does.

In sum, this paper shows that policy design criteria as well as actors' preferences are a valuable element of analyzing policy design and understanding current policy mixes. It seems most relevant for the adoption of future policy mixes which aim to foster the deployment of renewable electricity to focus on instruments that score well with all three, technocratic, democratic and governance principles. This is especially true for decision makers, as they are the primary actor group in charge of instrument selection and need to be aware of the factors that are often crucial for other actor groups. Elected officials need to consider the acceptance of other stakeholder or actor groups when making a final choice. This paper gives insights to elected officials, as well as to other actors, into how they might structure and justify their instrument selection in highly complex policy mix situations.

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Ich erkläre hiermit, dass ich diese Arbeit selbständig verfasst und keine anderen als die angegebenen Quellen benutz habe. Alle Koautorenschaften sowie alle Stellen, die wörtlich oder sinngemäss aus Quellen entnommen wurden, habe ich als solche gekennzeichnet. Mir ist bekannt, dass andernfalls der Senat gemäss Artikel 36 Absatz 1 Buchstabe o des Gesetzes vom 5. September 1996 über die Universität zum Entzug des aufgrund dieser Arbeit verliehenen Titels berechtigt ist.

Bern,2018-11-22 Lorenz Kammermann