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Title of the paper

Technology-related actors and diffusion of renewable energy policy: The case of the Swiss and German feed-in tariffs

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Abstract

Policies to mitigate climate change have seen large global diffusion. While the specific mechanisms responsible for this diffusion have been extensively covered in the literature, how and why policy instruments and their specific design are accommodated in the receiving country remains underexplored. Here, we analyse the role of technology-related actors in the process of the adoption and accommodation of the Swiss renewable energy feed-in tariff, specifically for the two technologies biomass and solar PV. In our preliminary results, we find that these technology-related actors are key in determining which policy instrument elements are directly transferred from a donor country and which are first accommodated to the local context. We hence contribute to the policy diffusion literature by adding a perspective on technology-related actors and policy design.

Keywords: Policy diffusion, policy transfer, feed-in tariff, Switzerland, biomass, solar PV, technology users, technology suppliers

1 Introduction

Climate change mitigation requires implementation of innovative policies in order to increase deployment of low-carbon energy technologies and incentivise innovation in such technologies. Frontrunner countries have therefore started experimenting with different policy instruments and designs as early as the 1990s in order to effectively support the diffusion of renewable energy technologies. Since then, many policy instruments have successfully diffused to numerous other countries (REN21 2016).

The policy diffusion literature and the policy transfer literature study how and why policy innovations spread across borders and are adopted by different jurisdictions. With climate change and related environmental issues becoming more pressing, literature on environmental policies and their diffusion has seen substantial additions (e.g. Biesenbender & Tosun 2014; Holzinger et al. 2011; Tews et al. 2003). These papers' main focus lies on macro-level characteristics and processes, such as the type of instruments that diffuse (Stoutenborough 2008; Stadelmann & Castro 2014), the drivers for the diffusion of specific instruments (Schaffer & Bernauer 2014; Busch & Jörgens 2005; Matisoff 2008; Tews et al. 2003; Chandler 2009; Tews 2005; Strebel 2011; Matisoff & Edwards 2014), and the instrument characteristics fostering its diffusion (Busch et al. 2005). However, these studies remain unclear about the specific *design of the instrument* (Jordan & Huitema 2014). In other words, how micro-level policy instrument design diffuses or is accommodated to the local context is underexplored (Biesbroek et al. 2010; Biesenbender & Tosun 2014). This is particularly surprising as the innovation literature shows that the *policy instrument design*, i.e. the specific policy elements consisting of instrument settings and calibrations (Howlett & Cashore 2009), is often decisive for the policy to be effective (Kemp & Pontoglio 2011; Lipp 2007). Biesenbender and Tosun (2014) are the only ones to address this gap by analysing the adoption and subsequent modifications of NOx emission standards in OECD countries and find that different diffusion mechanisms are at play when a policy is newly adopted and when it is accommodated. They also show that parliamentarians and their party affiliation have an effect on the willingness to adopt a new policy.

We build on this but aim at expanding the understanding of the influence of actors on the adoption and subsequent accommodation of diffused policies by analysing not only the role of parliamentarians but also of other actors active in the policymaking process, such as interest groups. We follow Biesenbender and Tosun (2014) and define policy accommodation as "[…] a process of adapting a policy innovation to a domestic institutional and policy context" (Biesenbender & Tosun 2014, p.424). While the role of interest groups in policymaking, including the implementation of environmental policies, makes up an entire branch of literature (e.g. Cheon & Urpelainen 2013; Markard et al. 2016; Jacobsson & Lauber 2006; Dumas et al. 2016), their influence on the specific instrument design as well as the role of *policy diffusion* is underexplored with Stokes (2013) being an exemption.

Here, we intend to fill this research gap by analysing how and why the design of a diffused policy instrument is accommodated upon and after its adoption. Specifically, we study the influence of local technology-related actors, namely technology suppliers and technology users, on the process of designing the policy instrument. We put the focus on technology deployment policies[1] because they are a type of environmental policy considered greatly

[1] Technology deployment policies, such as feed-in tariffs or renewable portfolio standards, have the goal to create demand for novel technologies, such as renewable energy technologies, by increasing the incentives for investments in these technologies (Schmidt et al. 2016). A distinct feature of deployment policies is that they also act as industry policy and may be used as driver for local, innovative businesses (Schmidt & Sewerin 2017).

effective in incentivising investments in renewable energy technologies (Couture & Gagnon 2010) and because technology-related actors are highly important.

We analyse the case of the Swiss feed-in tariff which was transferred from Germany. In particular, we compare the specific instrument designs for the two renewable power generation technologies solar photovoltaics (PV) and biomass. The focus on one country but two technologies enables a comparative case study with variations only in the policy design and in the presence of technology-related actors, whereas all other factors, such as political institutions, are equal for the two cases. Note that the results of this ongoing study, specifically for the question of why the design of the Swiss feed-in tariff was accommodated, are only preliminary.

The remainder of this paper is organised as follows: In Chapter 2, we will deepdive into the literature on policy diffusion and policy transfer and introduce our initial research framework, as well as present the literature on actors and interest groups in policy change. In Chapter 3, we will summarise the research design including the case selection and the applied methods. Chapter 4 will consist of the results starting with the implementation of the overall feed-in tariff in Switzerland and in Germany, followed by two sections with a more detailed analysis of the two technologies. In Chapter 5, we will discuss the results, and conclude in Chapter 6.

2 Theory

2.1 Review of policy diffusion and transfer literature

We draw from policy transfer literature as well as from policy diffusion literature. The two are closely related in the way that they both analyse how policies spread across jurisdictions (Newmark 2002; Marsh & Sharman 2009) (see Figure 1a). Policy diffusion literature focuses on the quantitative analysis of the drivers of policy spread often across many jurisdictions, particularly studying structural factors, such as domestic institutions, political system, and economic circumstances (Jordan & Huitema 2014; Berry & Berry 2014; Marsh & Sharman 2009). Policy transfer literature qualitatively analyses the process in which experiences from and knowledge about a policy in one jurisdiction influences policymaking in another jurisdiction mainly moderated by transnational or domestic agents (Benson & Jordan 2011; Dolowitz & Marsh 1996). The policy diffusion and transfer literatures overlap at the intersection of the structural factors and the involved agents which are interdependent and exert influence on each other (Marsh & Sharman 2009).

Both literatures define and draw from diffusion mechanisms. These may be voluntary and internal to the adopting country, or coercive and come from external sources (Dolowitz & Marsh 1996). In the past, the adoption of a renewable energy deployment policy in Switzerland was voluntary[2]. This is why we focus on the internal mechanisms which include learning, emulation, as well as competition. In the following, we will go into detail of these internal mechanisms.

[2] The electricity mix in Switzerland consists of roughly 60% hydropower, 35% nuclear power, as well as small shares of conventional thermal power and new renewable power (SFOE 2016). Consequently, the Swiss electricity sector is almost CO2-free and does not fall under the pledges of the Kyoto protocol.

Learning. The mechanism of learning is particularly prominent in the policy transfer literature (Marsh & Sharman 2009) and is widely considered to be the major driver for policy diffusion (Makse & Volden 2011). It refers to policymakers studying foreign policy experiences in order to produce efficient and effective policy outcomes (Shipan & Volden 2008; Berry & Berry 2014; Gilardi 2010). This can lead to complete or partial policy transfer[3].

Emulation. Emulation, also called mimicry or imitation, refers to the process of policymakers directly copying foreign policy and is driven by normative, rather than rational or functional, considerations to keep up with the socially or morally desirable and progressive behaviour of leading countries (Marsh & Sharman 2009). Disregarding local differences, emulation may lead to inappropriate and ineffective policy choices (Shipan & Volden 2008; Berry & Berry 2014).

Competition. Economic and regulatory competition can lead to policy transfer with the desired effect of gaining economic advantage over other jurisdictions or economically keeping up with other jurisdictions. Particularly in the field of environmental policy, competition can lead to a so-called race to the bottom with countries converging on low regulatory standards in order to gain economic advantages (Holzinger & Knill 2005; Shipan & Volden 2008; Meseguer & Gilardi 2009). However, economic competition may also lead to the diffusion of support policies for the local industry (Schmidt & Huenteler 2016; Schmidt & Sewerin 2017; Meckling et al. 2015).

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[3] In the literature, it is debated whether learning only refers to strictly rational decision-making or whether bounded rational policy diffusion patterns can also be attributed to learning (Marsh & Sharman 2009; Meseguer 2006; Berry & Berry 2014). In fact, the degree of rationality present in the diffusion process defines if the mechanism is learning or emulation (Marsh & Sharman 2009). Therefore, the delimitation between these mechanisms is rather ambiguous.

Policy diffusion literature and policy transfer literature mainly focus on why and how specific policies spread across borders. The unit of analysis often consists of high-level policy goals and, more importantly, policy instruments. We bring in a new perspective by focusing on the micro-level transfer of instrument design and the domestic actors involved in the accommodation of this design.

2.2 Actors and policy accommodation

Figure 1b) shows the preliminary research framework. It is largely based on the focus of the policy transfer literature on the role of actors in policymaking. However, we add the perspective of policy accommodation, i.e. we analyse how actors influence modifications of the policy instrument transferred from a different jurisdiction.

Actors are important in policy change and have been the subject of an entire literature branch. They form coalitions on the basis of their beliefs and policy preferences in order to bring about policy change in their favour (Jenkins-Smith et al. 2014; Sabatier 1988). In the field of renewable energy policy, technology-related actors have been shown to take an important part in the implementation of technology deployment policies (Jacobsson & Lauber 2006; Laird & Stefes 2009; Howlett & Lejano 2012). However, literature focuses on the influence of actors on the instrument choice, while little is done on how the instrument design comes about and develops over time (Stokes 2013; Schmidt et al. 2016; Jacobs 2014). Schmidt et al. (2016) hypothesise that advocacy from technology users and technology suppliers is different in terms of policy design with respect to application specificity and technology specificity. Also, Buen (2006) finds that actors who are located further up the supply chain will not take part in the policymaking process. Based on these studies, we argue that domestic technology-related actors are key in influencing which design elements of the policy instrument are directly adapted from other jurisdictions and which first undergo accommodation. Here, we define technology-related actors as technology users or technology suppliers organised in (industry) associations and, by this mean, taking part in the political process. However, we broaden the scope by also including politicians and bureaucrats who may be member of such associations or are otherwise influenced by these associations.

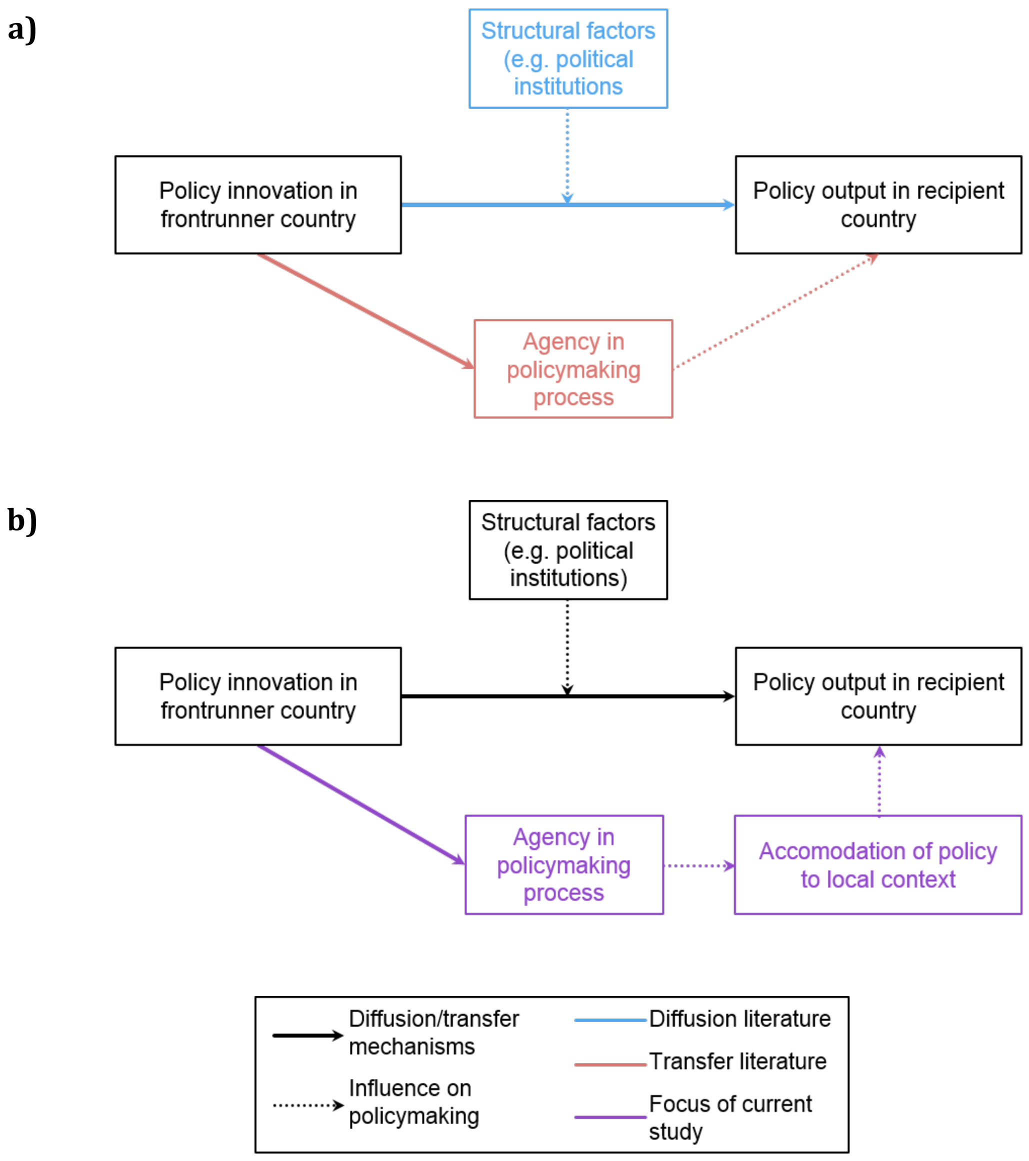

Figure 1. a) Main research foci of the policy diffusion literature (in blue) and the policy transfer literature (in red). Based on (Marsh & Sharman 2009). b) Initial research framework of current study (in purple).

3 Research Design

We use inductive qualitative case study research in order to unpack the design elements of the Swiss and German feed-in tariff and to analyse the policy transfer mechanisms from Germany to Switzerland as well as the accommodation mechanisms (Eisenhardt 1989).

3.1 Research case

We conduct an in-depth analysis of the Swiss feed-in tariff comparing the cases of the two renewable power generation technologies solar PV and biomass[4]. Specifically, we study how the feed-in tariff instrument has diffused from Germany to Switzerland, and how and why its design has undergone accommodations due to the influence of technology-related actors.

These cases are particularly suited for several reasons: First, the feed-in tariff is a deployment policy instrument presenting clear differentiation between technologies and the respective actors. It offers renewable power producers guaranteed grid access, cost-covering reimbursement of the produced electricity, and long-term contracts (Jacobs 2014; Stokes 2013). Compared to other deployment policy instruments, such as renewable portfolio standards, the feed-in tariff is the most specific instrument since it can easily be tailored to differentiate between technologies or applications by offering them different tariffs (Schmidt et al. 2016). By analysing the feed-in tariff design for

[4] In our analysis, we only look at biomass power generation from resources, such as wood, agricultural waste, etc. In Germany, resources included in the biomass feed-in tariff are listed in the Ordinance on Biomass (Biomasseverordnung). In Switzerland, we analyse the feed-in tariff for "other biomass" (übrige Biomasse) which includes power generated from any "organic material which has been produced by direct or indirect photosynthesis and which has not been modified by geological processes" (EnV 2011, p.42). Hence, we exclude the feed-in tariffs provided for power from waste incineration, and landfill and sewage gas.

different technologies, we can perform a comparative case study with different actors involved in the policymaking process *ceteris paribus*.

Second, Germany was the first country to introduce a technology-specific feed-in tariff in 2000 to trigger deployment of renewable energy technologies which reimbursed different technologies on a cost basis, offered long-term contracts, and guaranteed grid access (Jacobs 2014). In the following, the instrument has diffused to different countries (Jacobs 2012; REN21 2016). Switzerland has implemented its feed-in tariff only in 2009 and is believed to have largely drawn from frontrunner countries, such as Germany. Moreover, both countries already implemented a technology-neutral feed-in tariff in the 1990s, mainly to trigger the construction of small hydropower plants, and had therefore had equal opportunity to learn from this early version of the later policy instrument. Yet, besides these institutional similarities, the specific design of the technology-specific feed-in tariff has proved to be different in Germany and Switzerland in terms of application specificity and sub-technology specificity.

Third, the rationale for the technology selection is based on the different initial industry and technology user environments in Germany and Switzerland allowing for the analysis of different actor bases. While in the field of biomass the two countries have shown similarities in terms of technology suppliers, fuel suppliers, and technology demand to make use of agricultural residues already before the implementation of the deployment policy, this was different for solar photovoltaics. In the 1990s, several firms were already active in solar PV cell production in Germany (Jacobsson & Lauber 2006), leading to a share of 30% of solar PV cell production in Europe by 2000 (Schmela & Kreutzmann 2001). Additionally, German firms have also been highly active in solar PV module production. Switzerland, on the other hand, has never been host to a substantial solar PV cell production industry, and, before the implementation of the feed-in tariff, only a few firms were active (IEA 2009). Yet, these existing firms were predominantly manufacturers of building-integrated PV (BIPV) modules.

Fourth, the policymaking process in Switzerland includes a public consultation process (Vernehmlassungsverfahren) during which interested associations, interest groups, as well as individuals and firms may comment on the draft of every new law or ordinance. The ministry in charge of the proposed policy then compiles a report summarising the concerns and approval of the participants of the consultation process. These documents are publicly available and add to the good availability of data on the policymaking process in Switzerland.

3.2 Method and sampling

For our analysis, we proceeded in two steps. In the first step, we conducted comprehensive desk research scanning academic literature and policy documents, such as draft and final versions of the German Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz, EEG), the Swiss Law on Energy (Energiegesetz, EnG) and the corresponding Ordinance on Energy (Energieverordnung, EnV), transcripts of parliamentary debates, reports on decisions by the parliamentary energy commissions, statements on the public consultation process, and public and technical reports cited during the parliamentary debates. In total, we analysed 230 pages of parliamentary debate transcriptions, 127 pages of policy drafts, 1859 pages of final Swiss and German laws and ordinances, 1419 pages of statements and reports of the consultation process, as well as numerous other reports and policy documents.

In the second step, we conducted interviews with bureaucrats, parliamentarians, and representatives of industry associations in order to gain insights on not publicly available processes. We interviewed a sample of ten persons who were involved in the Swiss policymaking process and who are summarised in Table 1. We used theoretical sampling to identify relevant interview partners (Eisenhardt 1989) who were then contacted via e-mail. The interviews were conducted in person or by phone, lasted between 30 minutes and 120 minutes, and were transcribed.

Table 1. Overview of interviewee sample.

Technology	**Category**	**Description**	**Interview code**
Biomass	Policymaker	Bureaucrat in the Ministry of Energy responsible for the biomass feed-in tariff design	BIO1
		Bureaucrat in the Ministry of Energy responsible for the biomass feed-in tariff design	BIO2
	Representative of industry association	Head of biogas association	BIO3
	Representative of user association	Head of agricultural biopower association	BIO4
Solar PV	Policymaker	Bureaucrat in the Ministry of Energy responsible for the solar PV feed-in tariff design	SPV1
	Representative of industry association	Head of solar PV industry association	SPV2
Other	Policymaker	Member of the Swiss National Council (Upper house of parliament)	IND1
		Bureaucrat in the Ministry of Energy responsible for the electricity grid	IND2
	Member of the agency responsible for the allocation of the feed-in tariff	Head of renewables section	IND3
		Head of feed-in tariff section	IND4

4 Evolution of feed-in tariff design in Germany and Switzerland

This chapter summarises the preliminary results of this study. We start with the implementation of the feed-in tariff as policy instrument to support renewable energy technologies in Germany and Switzerland in section 4.1, followed by sections 4.2 and 4.3 which present the more detailed results on the two technologies biomass and solar PV, respectively. All sections are subdivided into two parts presenting how and why the feed-in tariff design came about.

4.1 Feed-in tariff implementation

4.1.1 How was the feed-in tariff implemented

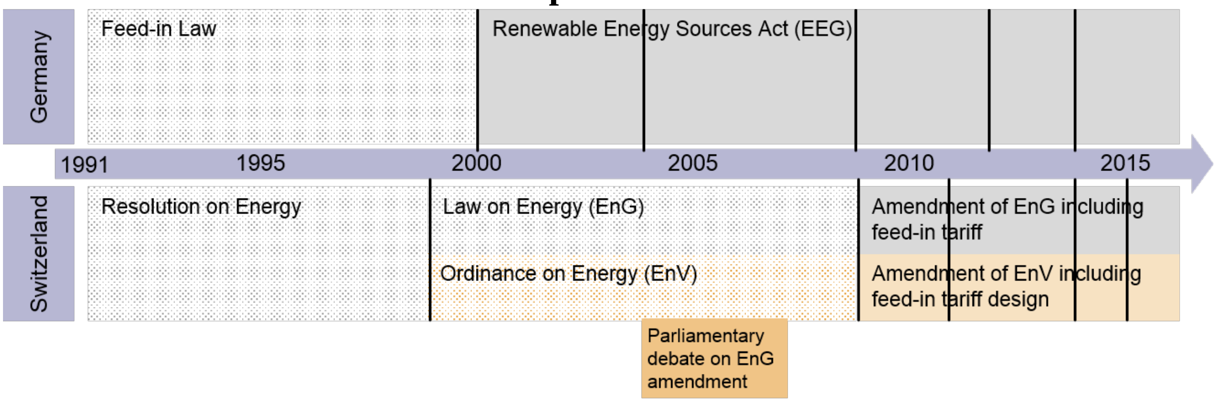

Figure 2. Timeline of policy evolution in Germany (top) and Switzerland (bottom). The dotted areas represent the periods of technology-neutral feed-in tariffs. The vertical black lines disclose the major amendments of the EEG and EnG/EnV.

Switzerland and Germany both independently implemented a first version of a feed-in tariff in 1991 (see Figure 2). The Resolution on Energy in Switzerland and the Feed-in Law in Germany were both designed to support deployment of small-scale hydropower. However, they offered guaranteed grid access for all renewable energy technologies. The tariffs were based on the cost for new conventional power generation. While in Switzerland, they were equal for all renewable technologies, Germany differentiated between a tariff for hydropower and biomass, and a tariff for solar PV and wind. These early feed-in tariffs were not intended to trigger comprehensive renewable energy technology deployment, i.e. they were (almost) neutral regarding the renewable energy technology, and also did not do so. After the similar early experience with feed-in tariffs, the policy paths of the two countries started to diverge.

Overall feed-in tariff in Germany

In 2000, Germany implemented the Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz, EEG) including a technology-specific feed-in tariff not only guaranteeing grid access to all renewable electricity but also offering cost-covering tariffs and long-term contracts. The EEG was later amended four times in 2004, 2009, 2012, and 2014 (Figure 2, top) (see Hoppmann, Huenteler, and Girod (2014), Jacobs (2012) and Jacobsson and Lauber (2006) for more details on the political processes leading to the introduction and amendments of the EEG).

Overall feed-in tariff in Switzerland

In 1999, the Swiss parliament implemented the Law on Energy (Energiegesetz, EnG) following the addition of the Energy Article to the Swiss constitution by public vote which requires the federal government "[to] establish principles on the use of local and renewable energy sources and on the economic and efficient use of energy" (Federal Constitution of the Swiss Confederation Art. 89 §2 1999, p.26) (Figure 2, bottom). The EnG replaces the earlier Resolution on Energy incorporating the principle of supporting renewable energy with guaranteed grid access and a tariff reflecting the cost for electricity from new conventional power production. Requests by a minority of members of the Social Democratic Party (SP) and the Green Party (GP) to offer a cost-covering remuneration for solar PV and wind power were dismissed.

In 2002, the majority of Swiss voters declined a framework law for the total liberalisation of the Swiss electricity market against which the labour unions and a few SP parliamentarians had taken the voluntary referendum. After the vote, the European Union however continued to push for electricity market liberalisation in Switzerland. This is why it was again debated in the two chambers of parliament starting in 2005 (Figure 2, brown box). In the context of the market liberalisation, the parliament also discussed a support scheme for renewable energy technologies.

Finally, the amendment of the EnG including a technology-specific feed-in tariff for renewable energy generations was approved by the federal parliament in 2007 and implemented in 2009 (Figure 2, bottom). Unlike Germany, the surcharge imposed on the electricity consumers per unit of electricity was initially capped to 0.6 Rp./kWh (EnG Art. 15b 2009), which therefore limited the number of installations that could be supported with the feed-in tariff. In addition, the share of support for individual technologies was limited to 50% for small hydropower and 30% for other technologies (EnG Art. 7a 2009). The share of solar PV, however, was linked to its cost and varied between 5% and 30% (EnG Art. 7a 2009).

The specific design of the instrument was left to the Federal Council[5] who defined them separately in the Ordinance on Energy (Energieverordnung, EnV) which only had to be approved by the Federal Council upon amendments. While the new EnV was implemented together with the amended EnG in 2009, works on it started much earlier in 2006, in fact before the EnG was approved by the parliament. The subscription process for installations to receive the feed-in tariff opened in April 2008, and the surcharge cap was reached within 6 months, i.e. before the feed-in tariff had become active (SFOE 2008). The consumer surcharge was therefore increased several times since the implementation of the EnG in 2009 in order to reduce the number of projects on the waiting list.

[5] The Federal Council is the government of Switzerland consisting of seven members.

4.1.2 Why was the feed-in tariff implemented

The implementation of the feed-in tariff in connection with the electricity market liberalisation was mainly due to GP and SP parliamentarians, backed by renewable energy industry associations, seizing the window of opportunity which had opened with the rejection of the first law on market liberalisation by the Swiss voters. The left-wing parties claimed this victory and, thanks to complementary developments on the energy markets, the parliament was responsive to their requests. As a policymaker stated, "[…] various things happened that increased the scepticism towards the market liberalisation, including, for instance, those blackouts in California and the ever increasing oil price since 2003. […] There was this prevailing mood and they [the centre and right-wing parliamentarians] decided at one point to give in" (IND1). On the one hand, the left-wing and green parties called for increased support of renewable energy technologies mainly due to ideological reasons. As Geri Müller (GP National Councillor) stated during the debate in 2005, "It is important to realise that we are at a turning point in the energy matter. We do not have endless energy at our disposal" (Amtliches Bulletin 2005b).

On the other hand, supportive centre and right-wing parliamentarians, particularly those with relations to technology users or technology suppliers, were concerned of the Swiss industry losing market shares. As Hansjörg Walter (National Councillor of the Swiss People's Party (SVP), head of the farmers' union) stated during the debate in 2005, "We have already lost a lot compared to Germany and Austria where the support of alternative energies, particularly for biomass, is high" (Amtliches Bulletin 2005e). Yves Christen (National Councillor of the Radical Democratic Party (FDP), president of solar PV industry association) stated during the same debate, "In Germany, roughly 150,000 jobs have been created since the introduction of the cost-based feed-in tariff. This is the last moment for us to enter this market by creating a domestic market and by favouring the access to renewable energies" (Amtliches Bulletin 2005a). Werner Messmer (FDP National Council, head of the construction companies' association) stated, "I find [the support for renewable energy technologies] good because not only know-how will thereby be developed in our country, but also the product development and hence the added value will remain in Switzerland. How often have we done excellent research, and other countries have capitalised on it?" (Amtliches Bulletin 2005d). We conclude that the adoption of a support mechanism for renewable energy technologies was to a large extent driven by economic *competition* as well as ideology depending on the party affiliation of the parliamentarian. In the first draft of the new Law on Energy which actually included the support for renewables, the government offered different instruments which should have been implemented in the case voluntary measures would not have been successful. During the public consultation process for this draft, the coalition in favour of a feed-in tariff included left-wing parties (i.a. SP, GP), five rural cantons (BE, FR, AI, TI, VS), environmental groups, renewable energy associations, the farmers' association, and consumer associations (SFOE 2004). As several of these associations stated during the public consultation process, "The cost-based feed-in tariff is evidentially (see example of Germany, etc.) the only truly effective instrument for the promotion of renewable energies" (AEE 2004; HES 2004). The coalition against a feed-in tariff consisted of the majority of the parliamentary commissions for energy (UREK), the remaining 21 cantons, the cities, liberal and conservative right-wing parties (i.a. SVP, FDP), trade and industry associations (i.a. economiesuisse, Swissmem, etc.), the electric utilities and their associations (SFOE 2004). Most actors in this coalition supported a more market-based instrument, or as FDP stated during the public consultation process, "In general, the solutions inspired by the German model do not seem to be appropriate for the specificities of the Swiss market. However, a quota system follows an entrepreneurial logic that we support" (FDP 2004). Finally, the parliament opted for the feed-in tariff as opposed to other possible instruments thanks to the experience in other countries. As Martin Bäumle (National Councillor of the Green-Liberal Party GLP) stated during the parliamentary debate, "The feed-in model is an internationally well-proven model, and the majority of our neighbouring countries and competitors in this technology sector have this model"(Amtliches Bulletin 2005c). Werner Messmer (FDP National Council, head of the construction companies' association) stated, "If we are serious, […] it is not about simply constructing a fig leaf, but we need to draw the consequences from the experiences in Europe and in other countries" (Amtliches Bulletin 2005e). We conclude that the instrument choice was largely determined by *emulation* from other countries, particularly Germany.

4.2 Specific design of biomass feed-in tariff

4.2.1 How was the biomass feed-in tariff design accommodated

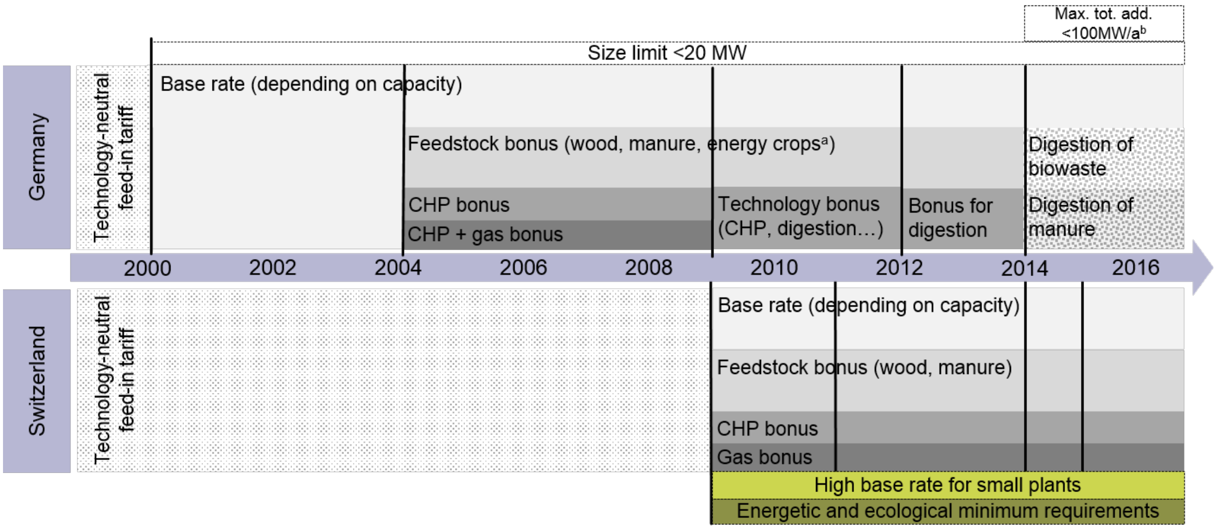

Figure 3. Design elements of the biomass feed-in tariff in Germany (top) and Switzerland (bottom). The elements that only appear in the Swiss design are coloured in green. The vertical black lines disclose the major amendments of the EEG and EnG/EnV. [a]Energy crops (nachwachsende Rohstoffe, NaWaRo) are crops specifically grown for power production; [b]The total gross additions are limited to 100 MW and the tariffs provided to biomass installations adapted in order to achieve this goal.

Supporting biomass was never contested in either country due to the strong lobby of the farmers and the relatively centralised and dispatchable nature of biomass power production. As a Swiss policymaker stated in the interview, "This may sound exotic today, but at that moment, biomass, biogas, and geothermal power formed the majority [for the feed-in tariff]" (IND1).

Biomass feed-in tariff in Germany

With the implementation of the EEG in 2000, biomass power production at first obtained one tariff depending on the installation's electric capacity for all feedstocks and technologies (Figure 3, top). However, a maximum capacity of 20 MW was implemented for all biomass installations which persisted throughout all subsequent EEG amendments (dashed box at top of Figure 3).

The following EEG amendments changed the previous single tariff to a system with a base rate and bonuses for specific characteristics of the installations (darker shaded boxes at top of Figure 3). In 2004, bonuses for specific feedstocks, combined heat and power (CHP) technologies, as well as the use of gas in CHP were implemented. The following EEG amendment in 2009 maintained the resource bonus but joined the different CHP and biogas bonuses into one technology bonus. This technology bonus was abolished again in the 2012 amendment with the introduction of a bonus for digestion only. Finally, the most recent amendment in 2014 revoked the previous system with a base rate and bonuses. The new system provides higher tariffs for installations using anaerobic digestion technologies and either biowaste or manure feedstocks, and lower tariffs for any other biomass installation. Additionally, an automatic tariff degression path was introduced in order to limit the total capacity additions to 100 MW.

Biomass feed-in tariff in Switzerland

In Switzerland, work on the design of the biomass feed-in tariff started in 2006 with the finalised tariffs implemented in the context of the EnV amendment in 2009 (Figure 3, bottom). The Swiss tariff structure is similar to the structure in place in Germany. It consists of a base rate depending on the electric capacity of the installation complemented by bonuses for more costly feedstocks, CHP technology, and the electrification of biogas. In Switzerland, the base rate differentiates between capacities lower than 50 kW and capacities between 50 kW and 100 kW and is considerably higher than in Germany where the base rate is equal for all installations below 150 kW (Figure 3, light green box). The tariff structure has persisted throughout all amendments of the EnV even though some actors have made advances to add a high bonus for entirely manure-based installations. Additionally, the biomass installations supported by the feed-in tariff have to fulfil minimum energetic and ecological requirements, such as the use of the process heat for feedstock drying and the exclusion of primary renewable feedstock of the support scheme (Figure 3, dark green box).

4.2.2 Why was the biomass feed-in tariff design accommodated

Transfer of biomass design elements

The design of the Swiss biomass feed-in tariff displays striking similarities to the German design in place at the time when the Swiss feed-in tariff was drafted. As a policymaker stated during the inteview, “We said, let’s do something for biomass according to the [German] system with a base rate and bonuses”, and “The deadline was so short […], we did not need to reinvent the wheel. So we looked across the border […] mainly to Germany” (BIO1), and “We looked at the EEG specifications […] and decided to take [them] and see how they can be adapted to Switzerland” (BIO1). We therefore conclude that the core design of the biomass feed-in tariff was transferred from Germany via *learning.*

Accommodation of biomass design elements

The design of the Swiss biomass feed-in tariff features two main differences to the German design. First, biomass installations need to fulfil energetic and ecological minimum requirements to be eligible for support. This is due to the increasing number of installations in Germany directly using primary renewable energy crops for electricity production. Such installations led to decreasing social acceptance for biomass installations in Germany and to the implementation of these minimum requirements in Switzerland. As a policymaker stated, “Those installations using energy crops, we did not want to support those. […] We wanted to introduce ecological minimum requirements to prevent these [installations] which do not fulfil those requirements” (BIO1). A representative of a user association stated, “[Energy crop plants] are meaningless in Switzerland. In Germany, the point was to avoid a surplus of certain grains. […] We don’t have that in Switzerland”[6] (BIO4). We conclude that energetic and ecological minimum requirements were introduced thanks to *learning* from the German experience complemented by the domestic factor of little availability of agricultural land as compared to the German case.

Second, small installations receive considerably higher base rates. As a policymaker stated, “The Germans had different classifications. They also had larger installations. We felt that those did not fit for Switzerland” (BIO1), and “According to the renewable energy statistics, the existing installations were […] mostly 30 kW, 50 kW, 80 kW” (BIO1). This is confirmed by an industry representative who, however, states that small plants expand

[6] Swiss agriculture supplies only 64% of its gross food consumption (Walser 2013).

their capacity nowadays and newly-built plants are all above 200 kW. We conclude that, in the case of high tariffs for small-scale biomass installations, domestic factors, i.e. existing installations, were decisive and no diffusion took place.

4.3 Specific design of solar PV feed-in tariff

4.3.1 How was the solar PV feed-in tariff design accommodated

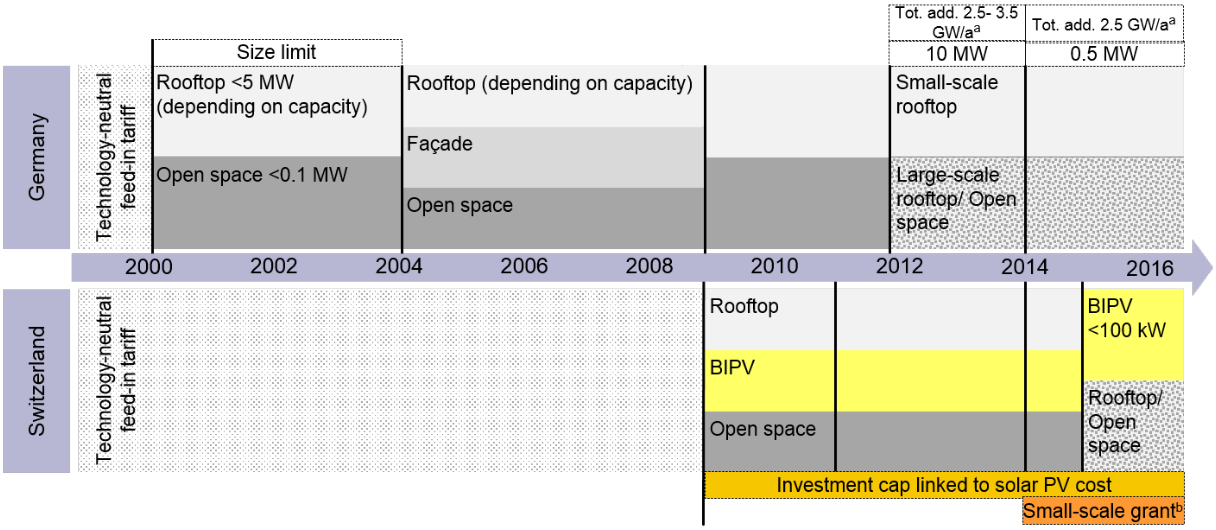

Figure 4. Design elements of the solar PV feed-in tariff in Germany (top) and Switzerland (bottom). The elements that only appear in the Swiss design are coloured in yellow and orange. The vertical black lines disclose the major amendments of the policies in Germany and Switzerland. [a]The total gross additions are limited to 2.5-3.5 GW and 2.5 GW respectively and the tariffs provided to biomass installations adapted in order to achieve this goal; [b]Since 2014, solar PV installations below 10 kW do not obtain a feed-in tariff but a one-off investment grant consisting of a base rate and a capacity-dependent rate. Owners of installations between 10 kW and 30 kW have the choice between the feed-in tariff and the investment grant.

Solar PV feed-in tariff in Germany

With the introduction of the EEG in 2000, the German policymakers offered a feed-in tariff for the two solar PV applications rooftop and open space (Figure 4, top). Maximum size limits were implemented at 5 MW and 100 kW for rooftop and open-space installations, respectively. Within the rooftop application, tariffs also differentiated between size categories. The following amendment in 2004 saw the abolishment of the size limit and an additional, higher tariff for façade installation. This façade tariff was again removed in the amendment in 2009. The amendment in 2012 saw considerable changes to the tariff structure. On the one hand, a size limit of maximum 10 MW was reintroduced for all installations as well as a maximum total addition limit of 2.5 to 3.5 GW per year. On the other hand, large-scale rooftop installations, i.e. capacities larger than 1 MW, receive the same tariff than open-space installations. Finally, the most recent amendment in 2014 reduced the size limit to 0.5 MW and limited annual maximum total additions to 2.5 GW.

Solar PV feed-in tariff in Switzerland

Support of solar PV was highly contested in the 2005-2007 parliamentary debate that led to the introduction of the feed-in tariff in Switzerland. Many parliamentarians advocated for exclusion of solar PV of the support mechanism. After many rounds of difference reconciliation between the two parliamentary chambers, the resulting compromise consisted of limiting the overall share of support solar PV could receive as compared to the other technologies. While small hydropower could receive a share of up to 50% of the overall resources available for the feed-in tariff and other technologies a share of up to 30%, the share that solar PV could receive was linked to its cost. It was capped at 5% if solar PV costs were higher than 50 Rp./kWh, 10% for costs higher than 40 Rp./kWh, 20% for costs higher than 30 Rp./kWh, and 30% for costs lower than 30 Rp./kWh. The Federal Council was assigned to define these total annual capacity additions for solar PV relative to its cost and the shares defined in the law.

In 2009, the specific design of the solar PV feed-in tariff initially differentiated between rooftop, open-space and building-integrated solar PV. The tariffs also varied with the installed capacity. The tariffs were continuously adapted to the solar PV price reductions. With the amendment of 2014, a one-off investment grant for small-scale rooftop installations was introduced. Since then, installations below 10 kW do not obtain a feed-in tariff but a one-off investment grant consisting of a base rate and a capacity-dependent rate. Owners of installations between 10 kW and 30 kW have the choice between the feed-in tariff and the investment grant. Finally, the most recent amendment in 2015 grants the same tariff for rooftop and open-space installations.

4.3.2 Why was the solar PV feed-in tariff design accommodated

Transfer of solar PV design elements

Similar to the German solar PV feed-in tariff design, the Swiss design differentiates between rooftop and open-space installations. This is intriguing since the support for open-space installations was in fact disfavoured. As a PV industry association representative stated, "Even more than today, we saw open-space installations as compromising the reputation" (SPV2), and "We did not have special interest in the open-space installations. I remember that the Ministry [of Energy] introduced it, and we thought, do it if you want to" (SPV2). We conclude that this design element has diffused from Germany to Switzerland by *emulation*.

In later amendments, both countries adapted the design to provide equal tariffs to (large-scale) rooftop and open-space installations. In Switzerland, the distinction between large-scale and small-scale was omitted in this case because of the very small-scale installations anyway not receiving a feed-in tariff anymore. The rationale of consolidating the two categories was the investment cost for the different installation types which had largely converged in the previous years and therefore did not require further tariff differentiation (SFOE 2014). We conclude that the *learning* mechanism was at play in this case.

Accommodation of solar PV design elements

The Swiss solar PV feed-in tariff design exhibits several differences to the German case. First, investments into solar PV were capped at low levels. The government defines annual total capacity additions, i.e. the total capacity of new installations, depending on the cost evolution. The cap resulted from the parliamentary debate during which many parliamentarians expressed their concern about the high cost for solar PV installations. Rolf Hegetschweiler (FDP National Councillor, head of homeowners' association) exemplarily stated during the debate in 2006, "The optimum benefit arises when minimum expenditures lead to as much energy from renewable sources as possible. Therefore we need to make sure that PV does not take away too much money from the little available resources" (Amtliches Bulletin 2006). The concern also originated from the German experience where the solar PV feed-in tariff had proven much more successful in terms of triggering PV deployment than expected. As a policymaker stated during the interview, "People saw that in Germany all hell was let loose and that they quickly ran into cost issues" (SPV1). In the same statement as cited above, Rolf Hegetschweiler (FDP National Councillor, head of homeowners' association) expressed his concern, "We should not be surprised if we experience the same than Germany, for instance: the experience that, even though [the electricity market] is liberalised, the electricity price finally increases because the surcharge is shifted to the consumers" (Amtliches Bulletin 2006). However, parliamentarians supportive of solar PV also drew from the German experience referring to the German success in generating solar PV deployment (IND1). We conclude that the implementation of the investment cap for solar PV installations is derived from the German experience through *learning.*

Second, the small-scale investment grant was introduced as reaction to the high number of small-scale, rooftop solar PV installations on the waiting list to receive the feed-in tariff. The waiting list was a direct results of the investment cap. This design feature hence originates from a domestic problem and is therefore attributed to *domestic learning.*

Third, unlike the German feed-in tariff, the Swiss solar PV feed-in tariff has always extensively supported BIPV installations. In fact, Switzerland was home of a small BIPV industry which emerged in the 1990s as a result of strong research and development support policies in this sector. This Jenny (SVP State Councillor) stated in a debate in 2007, "[The BIPV] market grows very quickly: The revenues increase every year by 45%. […] But sadly the [Swiss] products are only exported, sadly they only go abroad – we need a domestic market" (Amtliches Bulletin 2007). A policymaker stated in the interview, "If you never start to push [building-integrated PV], nothing is ever going to be developed. Therefore, we set this incentive" (SPV1). A PV industry association representative stated in the interview, "Our stance was always consistent in that we wanted the BIPV tariff. This is […] the USP [unique selling point] of the Swiss PV industry which was even an export good in the initial period of the feed-in tariff" (SPV2), and "The other argument was the social acceptance. Our position was to fulfil higher aesthetic standards, much higher than abroad" (SPV2). We conclude that this design feature was introduced for two reasons. First, the Swiss PV industry lobbied to include their main product, i.e. BIPV modules, in the policy scheme. Therefore, this design element originates from domestic factors that are path-dependent policymaking and the therefrom emerging actors. Second, this design feature was also introduced due to concerns about losing shares in the transnational BIPV market. Therefore, we conclude that the *competition* mechanism was also at play.

5 Discussion

Our analysis shows that agency is important not only for instrument adoption but also for its accommodation. Instrument innovations and designs in other countries spread across borders where, on the one hand, they influence agency and, on the other hand, are used by actors in justifying their arguments.

We find that the role of technology-related actors is important especially in the accommodation phase. The initially present actor bases, i.e. technology industry as well as potential technology users, in Germany and Switzerland were similar for the biomass technology. This is why the Swiss biomass feed-in tariff exhibits many similarities to the

German case. Slight differences are found for the fact that initial biomass installations were smaller in Switzerland and that energy crop installations had corrupted public acceptance for biomass installations in Germany. These differences, however, do not arise from technology-related actors. The Swiss solar PV feed-in tariff, on the other hand, exhibits a major difference from the German model in the form of comprehensive support for BIPV installations. We find that the existence of a BIPV industry in Switzerland has largely influenced the design in its favour and thus was crucial for the inclusion of this subtechnology.

Beyond the expected influence of technology users and producers on the policy accommodation, we observed strong impact from ideologists especially during the instrument adoption phase. Pro-renewable energy (RE) ideologists, i.a. environmental groups and left-wing parliamentarians, strongly support the instrument adoption. However, contra-RE ideologists, i.a. neoliberal groups and right-wing parliamentarians, are generally against the policy-induced support of renewable energy technologies.

Table 2 summarises the arguments of aggregated actor gorups produce in favour or against policy instrument and design transfer during the instrument adoption and the design accommodation phases.

As Table 2 shows, technology-related actors and ideology-driven actors are mainly active during different policy implementation phases and, to a certain extent, use different arguments when referring to other countries' policies. Technology-related actors focus on public acceptance arguments when learning from other countries' experiences. Especially when the public acceptance of a technology decreases in a country, adopting countries have an incentive to accommodate the policy in order to prevent the same experience. In

Table 2. Summary of arguments used by actors in favour of or against a policy transfer mechanism.

		Learning	Emulation	Competition
Instrument adoption	Technology users		(Success of policy in donor country)	Strengthen industry through domestic market creation
	Technology suppliers		(Success of policy in donor country)	Strengthen industry through domestic market creation
	Pro-RE ideologists		Success of policy in donor country	Strengthen industry through domestic market creation
	Contra-RE ideologists		Cost of policy in donor country	
Instrument accommodation	Technology users	Public acceptance		
	Technology suppliers	Public acceptance		Strengthen industry through domestic market creation
	Pro-RE ideologists			Strengthen industry through domestic market creation
	Contra-RE ideologists	Cost of policy in donor country		

terms of policy transfer from competition, technology-related actors mainly produce arguments relating to supporting the domestic industry and creating a domestic market. While technology users directly benefit economically from deployment policies, technology suppliers derive advantages from a domestic market through learning feedbacks (Nemet 2009; Huenteler et al. 2016). Interestingly, technology-related actors did not bring up arguments for emulation during the accommodation phase. We explain this by the fact that, once the policy is adopted, ideological actors become less involved. With emulation referring to rather irrational behaviour with normative considerations being important, technology-related actors, who have a good understanding of technologies and required policy design, will produce rational arguments and hence rather learn than emulate from other countries.

Unlike technology-related actors, ideology-driven actors almost exclusively use the effectiveness and efficiency of a policy in a donor country as arguments for policy transfer. This may be explained by the fact that ideologists have general preferences in favour or against technologies or group of technologies, as opposed to technology-specific preferences. They are more concerned about the choice of policy instrument than about the design accommodations of the instrument. Particularly in the adoption phase of the policy instrument, they hence produce arguments based on the success and cost of the policy in other countries. With such arguments not necessarily being rational, ideology-driven actors also call for and support direct emulation from other countries. Finally, with deployment policies also acting as industry policies, ideologists in favour of the deployment policy use the argument of supporting domestic industry with a local market against foreign competition to increase support for the policy.

Our findings show that, in the process of instrument adoption, competition and emulation are the prevalent transfer mechanisms whereas, on the instrument design accommodation, learning as well as competition play a big role. These results differ from the findings of Biesenbender and Tosun (2014) who find that learning is prevalent during policy adoption and emulation during policy accommodation. The differences may arise from the operationalisation of the diffusion mechanisms. Biesenbender and Tosun define learning as having access to transnational information exchange and emulation as increasing the stringency of a policy when similar peer countries have done so

(Biesenbender & Tosun 2014). On the other hand, here, we look at the debate and considerations by the policymakers leading to specific design elements and assess to what extent the diffusion happened rationally. These disparities between definitions arise from the fact that the diffusion and transfer mechanisms are not mutually exclusive and collectively exhaustive, i.e. it is difficult to draw a clear line between the individual mechanisms and clearly attribute a diffusion process to one or another mechanism (Marsh & Sharman 2009).

6 Conclusion

A considerate body of research has analysed how policies are transferred from one country to another. However, very few studies have examined how and why the design of a transferred policy is accommodated upon adoption. In this paper, we have addressed this research gap by exploring the role of domestic actors in the policy adoption and subsequent accommodation process. We studied the evolution of the Swiss feed-in tariff in general as well as its specific design for biomass and solar PV technologies. We find that the Swiss policymakers have drawn a lot from the experience with the feed-in tariff with Germany. While on the instrument level, the main diffusion mechanisms are emulation and competition, on the instrument design level, design elements diffuse thanks to learning and competition. For biomass, where similar technology users and suppliers exist in both countries, the design of the feed-in tariff was adapted to the Swiss context only to a limited extent. For solar PV, however, the design has been largely accommodated, on the one hand, due to learning from and competition with Germany, on the other hand, due to the different industry base present in both countries. Technology-related actors hence take a big role in the policymaking process. They do so mainly using the argument of domestic market creation and public acceptance. These arguments differ from ideology-driven actors who focus more on the success and cost of a policy. Our study complements existing literature on policy diffusion with a focus on instrument design and its accommodation upon adoption.

The contributions of our study are threefold. First, we unpack and analyse policy design elements of a deployment policy and their diffusion from one country to another and hence expand the focus of the policy diffusion and transfer literatures to these micro-level elements. Second, we show the influence of technology-related actors in policy adoption and accommodation with our focus on technology users and technology suppliers. These actors initially only emerge upon (early) technology deployment and therefore co-evolve with policy (Schmidt & Sewerin 2017). Third, we contribute to the literature on renewable energy policies with an in-depth analysis of the Swiss feed-in tariff, specifically for biomass and solar PV technologies.

Future research should expand our approach to other cases, i.e. more renewable energy technologies, other countries, or even other policy fields, in order to test our results. Quantitative studies could analyse to what extent our results are generalizable. This is however tricky since comparatively measuring the dependent variable, i.e. policy design output, is problematic (Schaffrin et al. 2015).

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