Governing Energy Transitions:
strategic challenges of local utility companies in the Swiss energy transition

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Governing Energy Transitions: strategic challenges of local utility companies in the Swiss energy transition

Editorial Introduction by the Guest Editor

Many countries are currently firmly committing to a transition towards a more sustainable energy system, each facing their own unique challenges. The Swiss energy transition is particularly challenging due to a combination of commitments: (1) a gradual phase-out of nuclear energy, currently about a third of the country's electricity production, is expected by 2034, (2) construction of new renewable energy sources such as solar PV, wind and micro-hydro, (3) electrification of heating and transportation, (4) energy saving, and (5) stringent CO2 emission targets.

Utility companies play an important role in the realization of the Swiss energy transition, but are also facing numerous strategic challenges as a consequence of a rapidly changing playing field. The commitments necessary to transition towards a more sustainable energy system are not necessarily aligned with the current operations of local utility companies. For example, the lack of incentives for energy efficiency programs, market opening, smart grids and renewable energy has utilities looking for new business models.

This issue of Network Industries Quarterly (NIQ) is linked to the Certificate of Advanced Studies (CAS) in Governing Energy Transitions, a continuing education program organized by the Chair Management of Network Industries at the École Polytechnique Fédérale de Lausanne (EPFL). The program has a strong practical component, embedded in an academic framework of multi-level governance. Participants of the program were invited to contribute to this issue, sharing their insights on the strategic challenges of local utility companies in the Swiss energy transition.

The following are the themes included in this issue of NIQ:

- An overview of strategic responses of urban utility companies to the energy transition: comparing Swiss and German utilities.
- Implementation of a local demand-side management program in Switzerland.
- An international perspective on demand-side management programs, and policy-recommendations for a Swiss governance model.
- A broader identification of new business opportunities for utility companies, arising from the ongoing energy transition.

Guest editor: Dr. Reinier Verhoog (postdoc, Chair Management of Network Industries, Institute for Technology and Public Policy, College of Management of Technology, École Polytechnique Fédérale de Lausanne).

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dossier

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"A particular species" urban utility companies in Germany and Switzerland

Susan Mühlemeier*

This article presents the characteristics of urban utility companies in Germany and Switzerland and examines their challenges and strategic actions in the context of energy transition. In so doing, it explores a particular actor type in a communal infrastructure service organisation.

Introduction

Urban utility companies represent a particular actor type in the German and Swiss energy sector. Due to the federal organisation of these two countries, the cities traditionally have the legal and financial autonomy to organise their infrastructure services – electricity, gas, water, public transport, telecommunication, waste – on the communal level[1]. For this purpose, cities run their own utility companies which provide a varying breadth of infrastructures to a city. As such, they are communal firms and at the same time large companies[2] ["They function like large corporations. If you look at their turnover, they are large corporations. However, through their communal structure they are still also very bureaucratic and political" DE2][3] . Thus, the urban utility companies (UUC) are key players in the national energy sectors in Germany and Switzerland and play an important role for its transition. At the same time, they present an interesting example of how large cities (self-) organise their infrastructure services on a communal level in the context of the energy transition, which is yet rarely considered in scholarly and public debates.

To approach this particular actor type, the article provides an overview on characteristics of the UUC in Germany and Switzerland and their current situation, by examining their challenges and strategic actions in an indicative manner.

Methodically, this article is based on an explorative expert interview series, focussing on the energy division of some of the biggest UUC in Germany and Switzerland (by turnover): Munich, Cologne, Hannover and Zürich, Geneva, Basel and Bern. In 2017, 40 experts as well as the CEOs and members of the UUC strategy units were interviewed – including CEOs of middle-sized UUC for a more complete picture (Table 1).

	Large UUC	Middle-sized UUC	Research	Consultancies, service provider	Sectoral association	Environmental association	Politics
GER	4	1	5	7	2	1	
CH	4	3	4	4	3		1

Table 1. Overview on interviewees per country and group
Source: Author's elaboration

In a one-hour semi-structured interview, the experts were asked about their personal perspective on structural and cultural characteristics of the UUC; current political, economic, technological and organisational challenges as well as the strategic actions of the UUC to face these challenges. The interviews were transcribed and analysed through a semi-structured coding process in MAXQDA: Under the predefined codes "characteristics", "challenges" and "strategic actions", the statements were grouped according to categories, emerging from the interviews.

1 This also holds true for the Austrian energy sector, however, this study only focusses on the Swiss and German case.

2 In their energy division they belong to the biggest energy suppliers in both countries (StromMagazin n.d.).

3 Original Language of the interview quotes is German and French. They have been translated and anonymised by the author. DE stands for interviewees from Germany. CH stands for interviewees from Switzerland

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Characteristics: public enterprises in federalist states operating network infrastructures

The key task of the UUC in Germany and Switzerland is the provision of infrastructure services to "their" city. Depending on the individual city, the organisational form of these infrastructure services varies: most of the UUC cover energy and water services and sometimes the fibre-optic grid within one firm. Transport, waste and sometimes public housing are organised in "sister"-firms which are owned by the city (varying horizontal integration). As in any company, the horizontal integration plays an important role for risk allocation and diversification opportunities.

Regarding the legal form of the UUC, there is a major difference between Germany and Switzerland. While in Germany the UUC are independent firms under private law, in Switzerland most of the UUC are independent firms under public law (Basel, Bern, Geneva) – only Zurich is an exception, where the gas supply is organised in a corporation under private law, but the electricity and telecommunication services are still part of the city administration. Among the interviewees, there was disagreement, whether the legal form of the UUC influences their entrepreneurial opportunities. ["The legal form is not so decisive; it is more about the personalities. As long as the administrative board influences the firm's strategy, there is control." DE8; "every legal form has its means"DE6; "the legal form makes the difference. It influences the flexibility, the financial resources, the mind-set, the profit orientation" CH16].

Despite the enormous variety among the UUC, all interviewees agreed on two aspects, which make UUC unique: they are multi-utility (provide several types of infrastructure services) and multi-energy companies (supply several types of energy) (Figure 1). This differentiates them from large energy providers like RWE or EON, but also from ["regional providers like Romande Energie or Groupe E in Switzerland, who are mainly active in electricity" CH 8].

Another common characteristic is their vertical integration ["From the plant to the socket, they can cover all" CH16]. The UUC are typically fully integrated firms, producing and trading electricity, gas and water but also owning and operating the distribution grids for electricity, gas, water and sometimes district heating, respectively public transport and telecommunication. They also directly supply a broad range of customers and offer a broad range of energy related services. As such, they are at the same time monopoly and market actors. The grid operation is a natural monopoly - production, trade and retail, however, can be organised through markets. There are again two important differences between Germany and Switzerland. While German UUC are fully embedded in the European market and operate their grid "unbundled" from production and retail, the unbundling regulation does not apply for the Swiss UUC and so they cover the distribution grid operation, production, trade and retail all together in one firm. Additionally, Swiss UUC still have a monopoly in gas and electricity supply for households in their local territory, since the Swiss electricity market is only partly liberalised (for large consumers – more than 100.000 kwh/a).[4]

Another distinct characteristic of the UUC in both countries is the public ownership of the city while being corporatized firms. Consequently, they are expected to act according to the public interest and fulfil public service tasks for the urban system. At the same time, they should make profit for the city administration, in order for the city to finance non-profit services. The particular situation of the UUCs makes it, that the city does not only encounter them as their owner (shareholder), but also in different roles as political representative of the cities´ citizens (stakeholder). In Germany, the public service task for the UUC is focussed on the monopoly, which means the provision of equitable access, quality and prices for the network infrastructure services to the citizens, which are financed through taxes and fees. For the supply of energy, however, the guarantee of the public service is within the national responsibility of the regulator, the Bundesnetzagentur. In Switzerland, the public service is (still) the city´s responsibility and due to the monopoly for household supply also holds true for part of the retail, such that the cities define the "equitable price" for electricity and gas for their citizens. Moreover, being non-unbundled, the Swiss UUC can

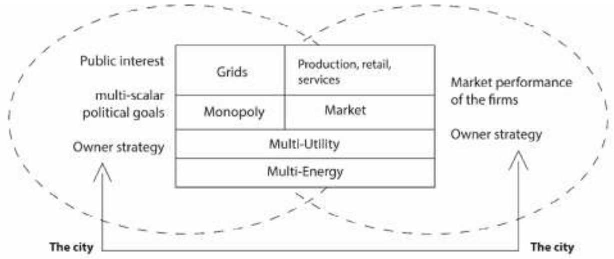

Figure 1. Overview on characteristics of UUC
Source: Author's elaboration

cross-finance their different infrastructure services ["The non-separation in grid and production facilitates that the retail losses due to efficiency can be compensated by the grid revenues" DE14]. They ensure the public service of all infrastructures for the city on the city level.

4 Switzerland is not a political member of the EU and thus does not need to implement the EU unbundling and liberalisation regulation. However, this particular Swiss situation is part of the current bilateral negotiations among the EU and Switzerland and might change in a near future.

Challenges

Global challenges

For a long time, the energy sector in Germany and Switzerland used to be very stable and static regarding both, production and distribution technologies as well as the overall regulatory frame. However, for the last 20 years, successively, three large change processes were ongoing. First, the political integration in Europe which caused liberalisation and subsequent re-regulation of the energy, and respectively the electricity sector. Today, the created markets still need to be designed and re-regulated ["Five years ago energy market design was not even a term in the discourse, so this shows how things change" DE8]. The UUC encounter more and more diverse competition ["Start-ups, energy retail platforms (e.g. verivox) but also Google, Telecom, actors who are able to deal with data" DE9] as well as more individualised customer demands. Second, the political goal change on energy production technologies: decarbonising energy supply and phasing out nuclear power plants (energy transition). Subsequently, Germany, as many other European countries, launched subsidiary schemes for renewable technologies, which caused a decisive increase in decentral production capacity, volatility of supply and bi-directionality in the electricity grids, decreasing electricity prices as well as an enormous increase in actors involved in the sector. Third, the general trend of digitalisation and "smartness" in the energy sector. The decisive acceleration in information exchange changes not only energy trading and retail but also provides new grid monitoring and management opportunities, with which the UUC need to catch-up. These three global changes cause at the same time a regulatory openness and speed of regulatory change, which the sector did not encounter before as well as a fundamental technology change in decentral production, storage and grid management.

All traditional energy companies face these fundamental challenges, however, the UUC are also confronted with some particular challenges, which are related to their characteristics presented above.

Particular challenges

The two major trends of liberalisation and political goal change for a more sustainable energy supply system (energy transition) cause contradicting expectations for the UUC, which are of particular relevance due to their public ownership (see figure 1). ["Cities are more than just owners, they are stakeholders – they have political expectations and they are in a double-role: owner and political actor, so they claim political goals as owner" DE10; "earning money is the main expectation from the politics. Of course, they always say please think also about the energy transition but still the main claim is, it needs to be profitable" DE18]. In comparison to private energy companies, where the political goals and the societal interest are external to the company, in UUC the political goals are often directly formulated in the owner strategy and goals and can contradict the economic interests. Furthermore, in the federalist states, the UUC are located in the communal political level and so they encounter several levels of political interest – communal, cantonal/Länder, national and European interest at the same time. And the political goals can vary a lot among the levels as well as among the different cities, which additionally complicates the situation of the UUC.

In both countries, the clash of public and private (economic) interest is also reflected in controversial opinions on which profiles and competences should be included in the administrative board of the UUC. The public interest argues for a democratic representation of the citizens, the private interest argues for entrepreneurial, and sometimes for technological expertise. Consequently, the composition of the administrative board varies among the cities in both countries and causes additional challenges in the management of an urban utility company ["Who is sitting in the administrative board of UUC? Local politicians."DE3; "In the administrative board it depends, who are the politicians? Experts in the energy field or in politics or more knowledgeable citizen?" DE12].

The global challenges mentioned above also require a decisive change in the firm culture, as well as in the individual profiles and competences of the employees in all areas. Entrepreneurship, risk affinity and innovation capacity, acceleration of decision making processes, competences in marketing, customer relations, new ways of management and working modes as well as new competences in smart technologies are required. The UUC used to be characterised by an administrative and engineering mind-set and culture which allowed them to provide the public services and manage the cities infrastructure systems ["UUC are characterised by a particular type of employee. An engineer who is focussed on technology while thinking in social dimensions. He is not primarily interested in profit for the UUC but in facilitating the life of the city" DE16]. This mind-set changes slowly, but still the UUC are expected to fulfil these public services in a constant and reliable manner. At the same time, they should also perform as successful companies in uncertain and volatile market conditions. Thus, one of their major challenges is the incorporation of all necessary competences and the implementation of an organisational change with a constant public and private performance.

A second major field of challenges is related to the mismatch among the regulations caused by the liberalisation (e.g. unbundling) and the technological requirements of productions technologies form renewable energies - especially for the UUC in Germany. In order for the utility companies to include and manage decentral, dispersed and volatile renewable production, storage technology and flexibility mechanisms are central tools to ensure the supply security. Questions of whether production or storage capacity for balancing the grid is financed under the monopoly or market scheme still need to be regulated. ["Integrated resource planning is really complicated with unbundling - even when there are contracts of data exchange. The classical full integrated firm could decide: do we want to install LED or do we want to build a new plant" CH10]. On a more general level, the regulatory frame for liberalisation and the regulatory frame for the Energiewende (energy transition) are partly contradictory and thus cause challenges for the strategic orientation and investment decisions of the UUC. ["The whole unbundling regulation was made before the energy transition and the digitalisation and it hinders it right now. The utility companies get no feedback on the needs and the reaction of the customers – this is still designed for the uni-directional system and need to be revised in the future" DE3; "if somebody has the responsibility, he should also have the possibility to interfere" DE12].

Strategic actions: adapt to the market logics and valorise particular characteristics

In the context of the vast array of challenges, the UUC strategic actions in both countries can be grouped in two areas: the adaptation to market logics by taking over strategic behaviour from private industry and the strategic utilisation of their particular characteristics.

Adapt to market logics

Although the liberalisation in Germany is already further advanced, interviewees in both countries mentioned a recent strategy refinement and subsequent organisational and cultural changes as main strategic actions in the context of liberalisation. Interviewees mentioned the implementation of innovation process management as well as the establishment of an innovation culture, including new profiles and competences in the firm as well as establishing new management cultures and working modes ["Recently an employee of an UUC told me, that she does not have business cards anymore, because she does not want to order new ones every year. She prefers to wait until she knows, in which department of the firm she will finally be located" DE16; "You design quicker products, innovation circles and beta versions, which are improved on the go" CH3]. Topics like customer orientation, increasing cost efficiency the exploration of new business models - close or more distant to their core business area, the design of new products in retail and services as well as the investment in renewable production capacities beyond their city territory, were mentioned in almost every interview in both countries ["Reduce the costs and look for new business opportunities are the main two topics, we have" DE2; " … but there is not yet an UUC which has a completely new business model" DE17].

For this purpose, the UUC in both countries buy IT and engineering firms, which allow them to incorporate the necessary competences. Moreover, they also cooperate with established and new players from other industries (IT, telecommunication, car manufacturers), especially for new business model development ["If you can't beat them, join them" DE14]. The UUC in Germany additionally emphasised the increasing importance of the cooperation with other UUC (inter-city cooperation) but also with the "sister" firms in the same city (intra-city cooperation). ["We want to create 'experience worlds' for our customers – plus-offers based on digitalisation, e.g. bundling e-mobility and smart home, therefore cooperation with our communal sister" DE10].

Utilise particular characteristics

While the UUC in both countries adapt to the market logics and take over strategies from private industry, they also strategically use their characteristics of being network infrastructure providers and multi-utility and multi-energy companies. On the one hand they strengthen their monopoly position and invest in grid concessions, respectively invest in new grid infrastructure like fibre optic grids and district heating grids ["They all do fibre optic, which is infrastructure and close to the core business" DE12; "The new business areas are heat and telecommunication – therefore they invest in district heating and fibre optic grid" CH17]. On the other hand, they invest in grid convergence through combined heat power plants in district heating networks or power-to-X solutions by using their gas grid infrastructure. Based on these investments, especially the German UUC offer new supply package products and technology management packages for prosumers, city districts, large buildings and companies. ["There should be a modular design of products – packages where the customer can add and delete parts … as much as possible we want to offer ourselves – to get the most out of it. And before amazon starts to sell electricity, we want to sell services" DE10].

They also explore options for sector coupling by cooperating with their "sister"-firms or subsidiaries in telecommunication and public transport. Based on their diverse infrastructure assets, they try to diversify their products to ensure the revenue stream and economic performance, at the same time they also use the diversification to improve their system management functions and ensure their public service performance. ["Sector coupling is an opportunity, we have all the grids and can jointly optimise it." DE10].

Furthermore, in both countries the UUC also build on their particular characteristic of being locally embedded public enterprises, pushing for their interests through their political representatives, in addition to being part of sector associations (e.g. Swisspower, VSE in Switzerland or 8KU, VKU Germany) and individual lobbying on the national and European levels. Only in Switzerland, the interviewees explicitly mentioned cooperating with local politicians and citizens ["Local parliament and local society are the daily and first partners, which they aim at first" CH4]. In both countries, the stakeholder involvement and close collaboration with "their citizens" was emphasised to strengthen the customer relation and improve the innovation management. ["We collaborate with our customers and do design thinking workshops to develop pilot products, try things out, experiment and become quicker" CH3].

Overall, the UUC in both countries face similar challenges and thus some of the strategic actions are similar. However, the large strategic lines differ. The UUC in Germany focus actively on economic growth strategies and push for the further implementation of the Energiewende ["we can grow. We need to look beyond the region for making our business" DE9]. At the same time, they emphasised the re-orientation towards the commune and the local level, aiming for a network builder role in their "traditional territory" ["To cooperate still in a good way with the city and the communal structure to position themselves as infrastructure service provider in the communal environment and remain visible" DE11). The UUC in Switzerland, however, strategically aimed at becoming quicker and more flexible and at engaging more in "do-it-yourself" strategies. ["Try to establish agility, to enable change while respecting the tradition, reliability and long-term orientation, which can be an asset in the digital age" CH11]. Additionally, some of the Swiss interviewees stressed that the UUC engage in "double-side" strategies pro and contra the national energy transition strategy ["From the civil society, they are seen as a strong actor for the energy transition, but at the same time, they need to get their business done and ensure their profits in the future - so there are two heads in the companies" CH19].

Discussion: typical challenges of public enterprises in network industries

The results presented above mirror the particular situation of the UUC in Germany and Switzerland. However, they also reflect some of the major issues discussed in scholarly literature on public enterprises and network industries.

The political control is a key challenge for the UUC as public companies. Contradictory 'public' and 'private goals' in the owner strategies or the disagreement on the competences needed in the administrative board, reflect the problem of how to ensure and design the public control on the company. In scholarly literature on public corporate governance (Schedler et al. 2011; Schedler & Finger 2008), the so called principal-agent theory is often cited to explain this problem. The theory describes the problematic, that the owner (principal) is not the operator of the firm (agent) and thus lacks information on its performance. Consequently, the principal tries to establish different control mechanisms (e.g. political representatives in the administrative board) to overcome this gap. This can restrain the entrepreneurial activities, and it is an important challenge in (public) corporate governance to balance the (entrepreneurial) freedom and the (democratic) control.

Furthermore, the particular UUC challenge of operating infrastructure networks, producing and supplying energy in a liberalised scheme, plus the political decision to push for a "decarbonising" technology change, reflect two typical problems of network industries: first, discussions on liberalisation and the subsequent re-regulation of network industries, second, the problem of lacking coherence among the current regulatory framework and the technological development(s). In a scholarly literature these two topics are widely discussed (Finger et al. 2005; Finger & Jaag 2015; Finger & Künneke 2011; Florio 2017) and are also relevant to other network industries, like the railway sector. However, the problem, that the regulatory frame caused by liberalisation hampers the actions needed to foster technology change towards a more sustainable energy supply system, is a particular debate in the energy sector and here latest, Germany and Switzerland, could profit a lot from the others experiences.

To sum up, the UUC are indeed particular actors, however, they represent an interesting case of urban self-organisation of infrastructure services in federalist states and question the common liberalisation paradigm, which could be interesting from an international perspective and should be subject to further research.

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The Story of the First 22 Months of a Local DSM Program Implementation

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This article provides a detailed account of the development and implementation of an urban utility energy efficiency program. This provides a unique perspective from an urban utility company on demand-side management (DSM) program implementations in a partially liberalized market within the broader European context.

Introduction

This is a detailed account of the creation and the implementation of a local demand-side management program inside the distributed electrical territory of the Lausanne utility, better known by its name *Services Industriels de Lausanne* (SiL). The mission of SiL is to supply the city of Lausanne and a large number of other municipalities with electricity, gas, district heating and multimedia services, in accordance with the principles of sustainable development and public service values. Moreover, SiL accomplishes this mission by raising awareness of energy efficiency by implementing an energy efficiency program named *équiwatt*, the SiL demand-side management program. Indeed, in the context of facilitating the Swiss energy transition (BFE 2018), it is not sufficient to produce energy in the cleanest manner possible. Giving incentives and making people aware of their energy consumption through communication and education are also important actions to take in order to alter consumers' behavior (Gillingham & Palmer 2014); the sum of these actions are the goals that a demand-side management program wishes to reach.

To be implemented in the territory in which SiL distributes electricity – Lausanne and five other communes (townships) – the program aims benefit the public as well as enterprises both large and small. An overall budget of 4.2 MCHF was allotted to the program for three years, for the period from January 1, 2016 to December 31, 2018. The initial budget came from the energy efficiency fund by way of introducing a tax of 0.25 cents taken on each distributed kilowatt-hour of electricity. Although *équiwatt* aims at reducing electricity consumption, it also focuses on thermal energy and water consumption.

Multi-level context

The two things important for implementing demand-side management are context and organization. Context is best understood in the following terms. First, at the international level, the energy sector was and still is in full transformation due to decentralization of production, scarcity of fossil fuels, advent of renewable energy, new market entrants, increasing amounts of regulation, and market opening. Second, at the national level, although long talks were held in the parliament on the introduction of measures to oblige utilities to diminish energy consumption in their territory, these obligations were finally not undertaken. Still, energy efficiency remains one of the pillars of the energy strategy. That there are more than 700 electricity supply companies makes the well-known Swiss consensus more difficult to reach. Third, at the local level, some states and municipalities, such as Geneva and Lausanne, for political or other reasons, have shown a desire to implement an ambitious strategy to restrict their emissions of $CO2$. This context played in favor of launching a DSM program in Lausanne.

An important point of note is that, although SiL works as a company completely integrated in the Lausanne municipality, the geographic distribution of its services and products (electricity, gas, district heating, and multimedia) goes beyond Lausanne. For implementing *équiwatt*, the author's team, including herself, worked in an intra-entrepreneurial way, with a great deal of liberty and with rapid decision process in an entity regarded as partly slow functioning and bureaucratic.

To put in place *équiwatt*, the example of Geneva's éco21 program was inspiring, and *équiwatt*'s team interacted with éco21's officials to design the program. While their advice was beneficial, the *équiwatt* team soon realized that the ground realities differed across locations. For example, the potential to reduce electricity consumption in the buildings' common areas in Lausanne was much lower than in Geneva, where a law obliged them to keep all lights on 24 hours a day, an obligation that did not exist in the canton of Vaud, of which Lausanne is a part.

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Challenges and opportunities for DSM programs

The *équiwatt* team faced many different challenges when it came to implementing the DSM program. Not the least of these was to make the company's internal colleagues understand the importance of a DSM program – in the opinion of some of them, while helping clients in reducing their energy consumption, *équiwatt* was nevertheless also contributing to reducing the sales revenue. This required putting a great deal of effort into communicating internally about the benefits of a DSM program.

Another challenge was to propose a DSM solution to all the clients, to help them reduce their energy consumption. This meant the creation and adaptation of action plans for small and medium enterprises, big enterprises (that consume a lot of energy), students, people with small revenues, and for all citizens. In addition, as a public enterprise, it was important to be fair and treat all consumers equally.

The third challenge was to put in place the different action plans in collaboration with the professionals in the energy domain. Indeed, as a public company, it is important to be vigilant in not doing the job of privately owned engineering offices and energy services companies, to avoid becoming their competitor. Thus, these companies were and are considered to be partners. While financially helping the clients reduce their energy consumption, the program counts on the partners to accompany them technically. Technological changes in daily equipment have a direct impact on the efficiency of such programs that may also consider the technology actors to be partners.

The fourth challenge, which is as yet unresolved, is how to financially perpetuate this program, knowing that the Swiss Energy Strategy 2050 currently does not give a solution to finance DSM programs. There are some possible solutions under analysis — asking for contributions from national programs such as Prokilowatt, for example — that help DSM programs put concrete actions into place, taking contributions from the local fund for energy efficiency (although it will not be possible to have as much financial help as when launching the program), continuing the discussion with the energy department of the Canton of Vaud, and working on new business models for funding such a program.

The fifth challenge is to make the authorities understand that the results of DSM programs are long term, because educating and involving people takes time and continuous effort.

As an institutional actor, the fact that Lausanne is a left political municipality has probably been an advantage for *équiwatt*, although political positions are not heavily marked on energy efficiency in this township. However, this also means that the continuity of this program could depend on the political color of the City. As the scheme of the network industry perspective shows, the market actors are growing in quantity and must be taken into account when designing the program. These market actors should be considered partners by the program, and these actors should see the program as an enabler of concrete energy performance actions. The joint work can only function well with this positive collaboration. Putting in place a DSM program without considering the network industry perspective scheme, i.e., the market and technology actors, and the business models (from an institutional actor's perspective), cannot make the program a success.

The political context

Indeed, Energy Strategy 2050 imposes no obligation on the transporter/distributor system operator (TSO/DSO), nor on the producers, to reduce the quantity of electricity sold. However, the fact that the councilors governing Lausanne drive more ambitious programs to accelerate the energy transition in a bottom-up fashion (Verhoog & Finger 2016), such as with the local *équiwatt* program, highlights that local stakeholders have the potential to align their goals and accelerate the energy transition.

The electricity domain has seen a marked reinforcement in its regulation. With the opening of the market for big electricity consumers, the utilities have to innovate so as not to let their revenues diminish too much. Indeed, the regulator must ensure that the tariffs for captive clients are coherent with those of market clients, i.e., the former do not pay higher tariffs to allow market clients to have much lower electricity prices.

Partial market opening has the consequence of changing the interaction among integrated utilities, from partners to competitors. What makes it more difficult for DSM programs is that while collaboration among utilities is essential to mutualize the cost, some of these integrated utilities are partners and competitors at the same time. Indeed, the integrated utilities have a monopolistic role to plan for distribution services and are in competition with other market players for energy production, trade, sales, and services. In many European countries, the complete market opening of electricity has had at least one advantage of ushering in a clarity of interaction among utilities: competitors. The Swiss context makes the interaction among utilities difficult (competitors versus partners) and the huge number of electrical companies in such a small country makes the decision-making process much more complex.

The evolution in technological development has given more equity levers to DSM programs. Indeed, the advent of domotics, the rise of home devices performance, the advent of electrical cars, and the development of storage will not only ease people's daily lives but will also have a huge effect on CO2 emission results. The fact that SiL is an integrated utility has the advantage to allow energy reduction to be addressed in a holistic manner, including electrical and thermal energy. Although water belongs to a different municipal organization, *équiwatt* also takes water into account whenever possible for designing projects. This holistic approach allows SiL to leverage its unique position to develop and implement synergistic solutions across different domains in the energy and water sectors, which are often treated in isolation.

Finally, finding a suitable business model for a DSM program is the key for encouraging utilities to put in place such programs that can affect company revenues. One way to finance a DSM program could be add 0.X cents/kWh to the cost of electricity. Another possibility would be to gain multilevel financial support — for example, from the confederation, the state, and the municipality. This support should then have clear criteria for determining which level helps DSM actions. However, having hundreds of electricity companies, some of which only manage a network, whereas others are electricity suppliers, in addition to some being publicly owned and others being privately owned, has its own complexity. A third possibility, in the future, could be that the confederation obliges the energy companies to undertake actions in order to reach energy savings.

Development of the *équiwatt* program

With the budget acquired, the name chosen, and the team formed, the first thing was to design the program. The action plans were created and adapted once the program was designed in collaboration with the expertise of Geneva's eco21. Moreover, two of the action plans, in existence for greater than ten and twenty years in Lausanne, were integrated in *équiwatt* with the goal of creating coherence among all DSM action plans. Implementing such a program with over a dozen projects in 22 months was a challenge. Not only was there a need to explain the importance of such a program inside the company, but a great deal of effort was put into communicating the contribution that *équiwatt* could have in helping people reduce their energy consumption, and thus, their bills. *Équiwatt* not only contributes financially to helping people or companies that have taken actions to reduce their energy consumption, but it also contributes to educating and sensitizing employees and citizens about their energy consumption. Indeed, it is difficult for people to understand why a utility would help them diminish their energy consumption in the first place, while their consumption itself is a source of revenue for that company. This apparent paradox was at first not understood by some colleagues, who viewed this in the form of a DSM team going against the objectives of the company; their point of view has changed since then. That is why communicating, giving the big picture, and educating people on the energy transition is important.

One of the key elements in implementing *équiwatt* is the quality of interactions with the different stakeholders. One of the main parts of the job is convincing stakeholders to work together as partners, showing them that together, we are complementary. The stakeholders with whom *équiwatt* has contacts are diverse: politicians, technological players, umbrella organizations, associations, schools, electric device companies, other utilities, energy auditors, energy engineering companies, other municipalities, the state of Vaud, other business directions of our own municipality, and so on. Inside of SiL, not only is the *équiwatt* team working on the program, but communication experts and jurists also take part in its implementation. *Équiwatt* started only 22 months ago, during which time some months were dedicated to mounting the team, program, and projects, and the cost of each kilowatt-hour saved has been important but is expected to go down with time. Therefore, not only the cost of kilowatt-hour is not adequate for a young program like *équiwatt*, but some projects bring no direct reduction. Indeed, some projects are designed to sensitize people and students, actions that have results only in the long term.

Currently there are five employees working on the team, including the manager. Dozens of projects have been implemented, focusing citizens, small/medium/big companies, and schools. The creation and design of the program done, the two remaining main challenges facing us are the simplification of some action plans (in process) and the quest for financial support for pursuing the program after 2018. New action plans can now easily be created under the *équiwatt* umbrella. Concerning the financial challenge, the problem of subsidized renewables is a huge barrier for DSM programs; the energy prices being so low put into question the use of such programs. However, DSM programs have a role to play in contributing to attainment of the 2000-Watt Society (Schulz et al. 2008), thereby reducing the energy requirement per person. Indeed, the 2000-Watt Society aims at reducing the average energy consumption of each citizen to 2000 watts (in power) by the year 2150. Major potential lies in building retrofit, which requires a large investment (Pfeiffer et al. 2005).

There are many opportunities, and one is to better know our customers and gain relevant information on their habits. Big data (Zhou et al. 2016), a relatively new concept and therefore still underused, shows promise with regards to the extent of knowledge one can get when the data are processed and analyzed in an intelligent manner. Another requirement is a macroeconomic analysis allowing for quantifying the money put into the program and the investment amount it has been able to leverage. Depending on the results, it can, with some other factual results, help in illustrating the use of *équiwatt* for the community. Referring to the Geneva's éco21 program experience, for each franc invested by éco21, participants invest twice as much, allowing them to save 3 CHF on their electrical bill on the lifespan of their energy efficiency measure (Jeanneret 2010). This shows that a DSM program can well contribute to the local economy. Given this Geneva experience, it is difficult to apply the same cost saving assumptions for *équiwatt*, SIG getting this result after having implemented éco21 during many years, which is not the case for Lausanne's *équiwatt*. The SiL program, being newly implemented, has a high overhead ratio, which should go down with time. Moreover, SiL has implemented projects with the goal of sensitizing, but not to directly contribute to saving energy; thus, these projects have a cost today but will have impact in the long term. For illustration purposes, the program reached around 1.5 GWh of electricity saved at the end of 2017 and has injected around 300'000 CHF in the local economy ; it is important to mention that the results are to be considered from September 2016 to December 2017 (the program being built during the first half of 2017). There is still a lot that needs to be done in this program, it is only the beginning. The program, if it pursues, can attack one of the big energy reduction potential, the building retrofit domain.

Discussions with the canton of Vaud are ongoing for getting a financial contribution from them in order to pursue *équiwatt*. Indeed, Lausanne being the biggest city of the state, the launch of *équiwatt* and its positive impact had the consequence of implying that the state must contribute more concretely to this program and also encourage other smaller municipalities to come forward and put in place their respective energy efficiency programs. With Lausanne having an experience in the field, the goal would be to mutualize funds and competencies inside the state. *Équiwatt* took the initiative at starting this discussion with the canton of Vaud, in which the SIG also took part as expert. The canton of Vaud is now looking for a business model and reflecting on how their contribution to the DSM program can be given a more concrete form. The reflection is ongoing and thus, depending on the result, may be part of the solution for pursuing *équiwatt* after 2018. In this case, the role of politics is important because in the end, the decision will come from the political chief of the cantonal energy department. The canton of Vaud has these last legislatures had an equilibrated political orientation, this one being slightly left leaning. That the canton has in principle agreed to detail the concept further is a good step in the right direction. It is important to highlight that the canton of Vaud has formalized that in its legislature 2017–2022 program (Canton de Vaud 2017). Although there are different ways by which *équiwatt* can be financed, the window of opportunity for a decision is until mid 2018. After that, *équiwatt* will be dimensioned based on the financial support that would have been decided. *Équiwatt* has opted for a bottom-up solution, where the local (city) and regional (canton) financial support has been solicited within a limited national policy support.

Conclusion and recommendations

Although the program has nearly two years of life, it should be only the beginning of its story, hoping that a solution is found to finance it. The importance of energy efficiency, as one of the pillars of the Energy Strategy 2050, has already been proven.

The first recommendation for other DSM program managers when designing their program is to integrate, at an early stage, the different stakeholders and to communicate the advantages of energy efficiency measures, not only to potential clients but also internally. Educating students and people on energy, as *équiwatt* tries to do, is a long-term process; results of such a program should not be expected quickly. The return on investment should be calculated not only in saved kilowatt-hours or the cost per kilowatt-hours, but these criteria should be completed with qualitative ones. However, there is no doubt that macroeconomics analysis also gives some interesting input.

The second recommendation for the program manager is to establish a multidisciplinary team. With technical and energy competencies not sufficient, soft skills are compulsory, because a lot of work is needed to convince people and build partnerships. For a program launched by a public company or a municipality, knowledge of the way decisions are undertaken in politics is a great advantage.

Finally, this author would incite the program manager to launch a program in collaboration with other municipalities, utilities, or local companies. Indeed, designing and implementing a DSM program and focusing it on a very restricted geographical area does not allow for finding synergies and required competencies and moreover does not give the scale benefit. However, having a wider region for a DSM program to function would permit a professional team of experts and generalists, with cost sharing among different companies or utilities, and a mutual synergy when implementing different measures.

Implementing energy efficiency measures is indeed a goal at the national, state, and local levels. Reaching the target in the built environment will be a challenge with the renovation rates being low. DSM should thus be considered by the multilevel governance (national, state, local) as one of the answers to reach the energy efficiency goal and get adequate financial solutions. Moreover, implementing a DSM program locally (with a sufficient number of companies and citizens) has a great advantage: the advantage of proximity.

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Negawatt or Copper: What framework to give electricity grid companies the choice?

Theophile Haoyou Vernhes*

Market failure and barriers such as asymmetric information, split incentives, externalities and irrational behaviors create an implementation "gap" for energy efficiency measures. Electricity grid companies are in an ideal position to bridge the gap through energy efficiency programs, but traditionally their business model includes a prohibitive throughput incentive favoring unit sales over cost savings. This study employs public policy process conceptual models on case studies to derive a potential Swiss utility managed energy efficiency framework.

Introduction

When looking at worldwide energy consumption, it is expected to increase by 28% from 2015 to 2040 (Conti et al. 2016) due to a high correlation between energy consumption and economic growth (Kalimeris et al. 2014). However, in view of the environmental impacts from such rise and the limited resources available, decoupling energy consumption from economic growth has become a priority in most of the developed countries. Most of the OECD countries have formulated an energy transition strategy from fossil fuel to renewable sources and have considered energy efficiency a priority.

However, there is a gap between regulations and reality, as the value of increasing energy efficiency is often underestimated. This phenomenon is referred to as the energy efficiency gap. Although more efficient products are cost effective, they seem to enjoy limited market success (Jaffe & Stavins 1994). Literature shows that this energy efficiency gap is due to market and non-market failures comprising principal-agent problem, asymmetrical information as well as the bounded rationality and irrational behaviors of consumers (Schmidt & Weigt 2013).

Utility energy efficiency programs can be a solution to overcome market failures by providing information and financial incentives to invest in energy efficiency (Gillingham & Palmer 2014). Electricity utilities have an interest to invest in energy efficiency programs as it can reduce their investment cost in generation capacity, distribution capacity, and electricity losses (Baatz 2015; Lazar & Baldwin 2011; Lazar & Colburn 2013; Neme & Sedano 2012). Amory B. Lovins came up with the concept of *Negawatt*, representing an amount of electrical energy which is saved and remains unused. He stated that: "customers don't want kilowatt-hours; they want services such as hot showers, cold beer, lit rooms, and spinning shafts, which can come more cheaply from using less electricity more efficiently" (Lovins 1990). From a customer approach utilities should therefore provide services instead of simply selling electricity.

However, the idea of electricity as a service is still an emerging concept and most of the utilities have the traditional business model of selling kilowatt hours to consumers. In this context, the intensity with which utilities engage in energy efficiency activities largely depends on the market structure of the electricity industry.

This article presents three case studies on demand-side management (DSM) programs by electricity utilities in Denmark, Massachusetts and Switzerland. Denmark and Massachusetts are both considered best practices. Denmark inspired article 7 of the European Energy Efficiency Directive mandating electricity industry stakeholders to engage in energy saving measures, while Massachusetts is considered a top performer on the ACEEE energy efficiency scorecard. Comparison of the Danish and Massachusetts scheme with Switzerland, where proposed utility energy efficiency regulations failed to reach consensus during parliament debate, allows us to identify what success factors Switzerland lacked for a smooth implementation. The following questions are answered:

How did states in Europe or in the US adapt their regulatory framework to make their electric utilities invest in electricity saving programs?

What lessons learned are relevant to integrate such measures in the regulatory framework of Switzerland?

Methodology

As the goal of a case study is to allow the investigator to generalize theories (Yin 2013), the use of a comparative case study between Massachusetts, Denmark and Switzerland allows us to confront the recommendations derived from best practices represented by Massachusetts and Denmark to the case of Switzerland. The framework used for comparing these three cases is derived from Varone's study for policy design (Varone 1998) and Harmelinks' (2008) study for policy implementation.

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The second question supposes an analysis of best practices and the proposition of a new Swiss utility energy efficiency framework model. First, information is gathered on the political context of Switzerland on climate and energy policy from the academic studies on Swiss public policy. Second, the parliament's commission debate protocols as well as the minutes of the 2050 Energy Strategy package parliament's debate are reviewed for the information on utility energy efficiency frameworks. Third, semi-structured interviews with Swiss energy stakeholders are conducted, asking their opinion on key features of the Danish and Massachusetts model.

The advocacy coalition research done by Markard et al. (2016) was used to select ten most relevant to the topic stakeholders. Interviewees include representatives from the biggest political parties in Switzerland (Socialistes, Verts, Parti Démocratique Chrétien and Libéraux-Radicaux), representatives from the cantonal office of energy, representative of the energy agency OFEN, and representatives from the electricity industry through utility associations (AES, SwissPower).

Analysis

Energy Efficiency Scheme Results

Looking at the results, between 2013 and 2015 the savings volume equaled 2.4% of the annual final electricity consumption in Massachusetts and 1.05% in Denmark (Figure 1). When comparing with similar schemes in Switzerland, and in particular with éco21 operating in the canton of Geneva, the achieved savings were lower from 2010 to 2012 and is progressively catching from 2013 to 2015. These percentages represent the volume of savings, but do not accurately illustrate the electricity consumption trend which is also influenced by multiple factors such as climate or economic growth. It is therefore crucial to measure the additionality of the network companies action but measuring this factor is tedious and there seems to be no clear methodology to estimate it in a precise and systematic way.

Evaluation

Country	Denmark	Massachusetts
Cost	6.1 € cents/kWh first year savings Administration cost: 5% of total budget	40 $ cents/kWh first year savings Administration costs: 4% of total budget
Additionality	20% residential 45-55% Commerce & Industries	80% residential 86% Commerce & Industries
Benefits/Cost Ratio	< 1 Residential >1 C&I	>2 Residential >3 C&I
Residential Bill Impact	0.23 €cents/kWh 0.8% of the rate	1.3$cents/kWh 6.6% of the rate

Table 1. Model evaluation
Source: Author's elaboration

Denmark leaves great program scope flexibility to its grid companies on technology, activity sector, area or even on energy where electricity grid companies can make savings in other energy types than electricity. However, in Denmark the implementation of the measures is submitted to stricter rules as electricity grid companies cannot implement the measures by themselves and must enter an agreement with market-based third parties. In Massachu-

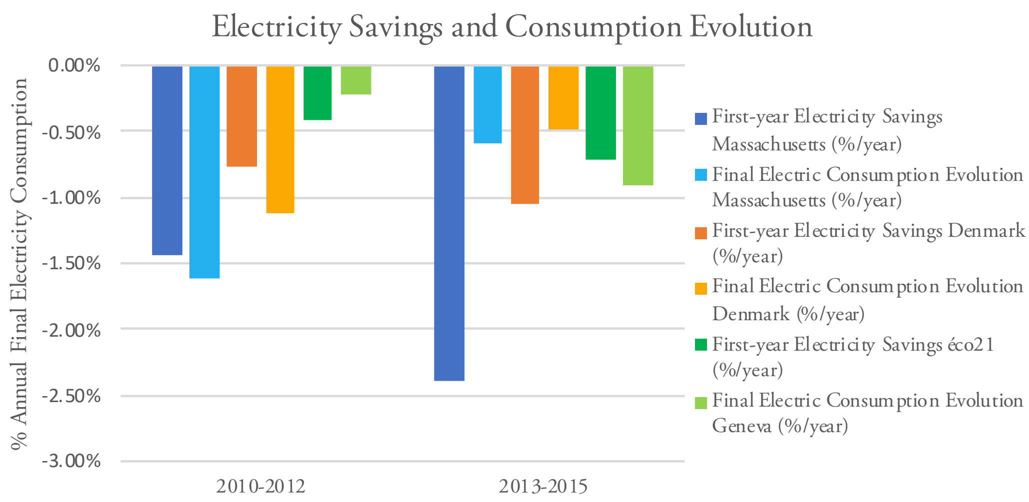

Figure 1. Energy efficiency scheme results

Source: Author's elaboration

setts, there is less program scope flexibility as the electricity grid companies are required to limit their programs to their service area and invest at least 10% of their budget in low-income residential energy efficiency programs. Although not required by law, the electricity grid companies also concentrate their efforts on electricity savings and not on other energy types. In Massachusetts, electricity grid companies have a greater flexibility in terms of implementation as they are not required to implement their measures through market-based third parties, though they are strongly recommended to do so.

Evaluating both models, we could assume that the great flexibility of Denmark's energy efficiency obligation schemes fosters competition which in turn leads to very lows costs in terms of implementation and impact on the residential bill (Table 1). However there seem to be a problem of equity where the business and industrial sector is largely favored compared to the residential, which has little information and little benefit to engage in such programs (benefit/cost ratio <1). In Massachusetts, looking at the cost-effectiveness, although the business and industrial sector being once more favored, there still seem to be a net benefit for the residential (benefit/cost ratio >1). Furthermore, there seems to be much greater additionality of action in Massachusetts than in Denmark where the free-ridership rate is assumed to be very high.

Policy Implementation Success Factors

Harmelink (2008) evaluated twenty energy efficiency policy instruments across Europe, Japan and the United States using a theory based policy evaluation methodology. From this study she derived four success factors for energy efficiency policy instruments (Table 2).

Success Factors	Denmark	Massachusetts
Clear Objectives for Utilities	+	+
Involvement of Stakeholders	+	++
Flexibility	++	+
Development and Adjustment	++	++

Table 2. Policy implementation success factors
Source: Harmelink (2008)

Grid companies in both areas have clearly stated and ambitious energy saving targets in their program. However, although having clear objectives there seem to be some confusion around the implication of energy saving goals. Targets expressed in terms of annual electricity final consumption percentage does not imply a consumption reduction in the next year.

Regarding stakeholder implication, both perform quite well. In Denmark, the saving targets are set through a negotiated agreement between the Danish Energy Agency and the utility companies' representatives. Grid companies have therefore an opportunity to raise their concerns and opinions on the different energy efficiency plans. It is the same in Massachusetts, where utilities are coming into agreement with the Department of Public Utilities on three-year energy efficiency plans. However, we could give a slight advantage for Massachusetts as their plan elaboration involve a larger scope of stakeholders with non-utility parties such as NGO's and consumer associations.

Regarding flexibility, Denmark performs better than Massachusetts. Denmark leaves it up to the grid companies to choose which sector, technology and area to implement energy saving measures. In Massachusetts, grid companies are still required to act in their service zone and must dedicate at least 10% of their budget to the low-income residential sector. A question one could ask is if the degree of flexibility in Denmark is, in the end, beneficial for society. The cost-effectiveness calculations in Denmark showed that industries were advantaged to be compared to residential consumers. Massachusetts might have found a better balance between flexibility and equity for consumers.

In Massachusetts, as in Denmark, the planning is done through a collaborative process implicating many stakeholders. Through this collaborative process, views, opinions, and feedback from various stakeholders find their way to policy makers, who consider their recommendations and adjust the energy efficiency plan.

Policy Design Success Factors

Varone (1998) derived from the literature four hypothetic success factors influencing policy instrument design (Table 3). He then applied his hypothesis on case studies looking specifically at energy efficiency labelling policy instruments and showed that in two third of the cases his hypothesis were verified. Danish and Massachusetts case studies are evaluated against his framework.

Success Factors	Denmark	Massachusetts
Degree of constraint compatible with partisan ideology of the majority.	++	++
Pre-existing administrative institutions.	++	+
Already tested with success in other areas or countries.	++	°
No opposition from target groups.	++	++

Table 3. Policy design success factors
Source: Varone (1998)

In both cases, the hypothesis by which a left-wing government would be much more in favor of implementing constraining regulations is verified. In Denmark the first policies obliging utilities to engage in demand side management programs were done under a left-wing Parliament coalition in the early 90's (Hvelplund 2013). For Massachusetts and even for the U.S, in general, the hypothesis is verified. Massachusetts has long been a Democrat bastion and in the early 80's when the governing institutions tightened their regulations on DSM, the governor and the State Senate were both democrats. Furthermore, the Public Utility Regulatory Policies Act (PURPA) ,voted in 1978 incentivizing utilities to invest in DSM was passed under a Democrat administration.

For Varone (1998), the fact that policies are implemented through pre-existing administrations allows to reduce the costs of implementation by ensuring that policy stakeholders already have the technical resources for implementation. This is especially true for Denmark where no additional institutions were created, and monitoring, evaluation, and oversight of the energy efficiency obligation scheme are distributed between the Danish Energy Agency, the Danish Energy Regulatory Authority and the industry associations. This is less true for Massachusetts where the Energy Efficiency Advisory Council was created in 2008 with a role of oversight and consulting over utility energy efficiency programs. However, the Department of Public Utilities which has the power of decision by validating energy efficiency plans had existed long before the utility energy saving activities started.

Abroad experiences allow to draw lessons from previous scheme implementation and can help diminish the risks of failure at home. This hypothesis is valid for Denmark where during the 90's, regulators tried to implement an integrated resource planning (IRP) approach for their utilities and took states in the U.S as examples (Sandholt & Nielsen 1995; Sønderhousen & Gram 1995). This resulted in IRP being incorporated in the energy law by 1994. This is, however, less the case for Massachusetts as it has always acted as a leading state in the energy efficiency demand-side management programs sector by launching its measures in the early 80's (Raab & Schweitzer 1992).

Varone (1998) states that an instrument is chosen if there is no organized opposition by the groups targeted by the policy. The primary actors of utility energy efficiency programs are network companies. However, these programs also have an impact on market players who implement measures and consumers who are targeted to change their behavior. From the case studies, there doesn't seem to be any opposition by any of the policy impacted groups. This absence or resistance is easily explained by the collaborative process integrating all stakeholders in the energy efficiency programs design.

Switzerland

Swiss Electricity Industry Regulators

Because Switzerland is a federal state, the energy policy of the country is split between the federation and the 26 cantons. The energy policy act of 1998 strengthened the power of the federal state, giving the confederation responsibility over ensuring energy security of supply plus norms and labels on installations, vehicles, and appliances. Energy-building regulation remained under canton authority; however, they consented to harmonize regulations and standards (IEA 2012). Le Département de l'Environnement, des Transports, de l'Energie et des Communications (DETEC) is the equivalent of a Swiss Ministry of Energy and Environment. Within the DETEC, in charge of the day-to-day management of the policy there is L'Office Fédérale de l'Energie (OFEN).

In Switzerland the electricity market is partially liberalized meaning that only large electricity consumers spending more than 100 MWh per year can choose their electricity provider on the market. Swiss Federal Electricity Commission (ElCom) acts as a market regulator.

Finally, the cantons are always consulted during federal energy policy design process and have a lot of freedom to implement their own energy laws, policies and measures within the bounds of the federal legislation.

Political Context

The ultimate measure of relevance for innovative regulatory framework solutions is their applicability to different locations or circumstances. Theoretically, the cases of Denmark and Massachusetts could be easily adapted to other countries to align electricity network companies' business models with energy saving measures. However, in Switzerland this type of regulatory framework could be seen as a threat to the free-market and considered as state interventionism rationing the economy. In Switzerland, research has shown the presence of two impermeable coalitions: pro-economy conservative coalition and pro-ecology coalition (Ingold 2011; Kriesi & Jegen 2001). On the matter of energy policy, little consensus could be reached between both camps and the conservative coalition successfully opposed measures proposed by the pro-ecology coalition as they had a political majority (Ingold 2011). In 2016 Markard et al. showed a slight change of position due to the external pressures exerted by the Fukushima disaster and the increasing cost-effectiveness of renewable energy technologies (Markard et al. 2016). However, this positional change was not sufficient for the implementation of a utility energy efficiency framework as measures regulating utility energy efficiency programs were taken out during parliament debate on the 2050 Energy Strategy. It is therefore interesting to see if Varone's hypothesis could help to explain this development (Table 4).

Success Factors	Switzerland
Degree of constraint compatible with partisan ideology of the majority.	--
Pre-existing administrative institutions.	+/-
Already tested with success in other areas or countries.	+/-
No opposition from target groups.	--

Table 4. Failure factors in Swiss policy design
Source: Varone (1998)

First, the degree of constraint compatible with the partisan ideology of the majority criteria was a success factor in Denmark and Massachusetts but a failure factor in Switzerland. Switzerland's pro-economy majority coalition, proposing binding objectives for grid companies in energy efficiency, created a great resistance.

Second, there are pre-existing governmental institutions in Switzerland such as OFEN or ElCom. However, during the elaboration of the 2050 Energy Strategy first package propositions, the responsibilities and actions of both institutions weren't explicitly mentioned, and this blur around their role led to fear for an extensive bureaucracy cost to manage the proposed schemes. Furthermore, the federalist structure of Switzerland wasn't considered when reflecting on utility energy efficiency governance schemes, which lead to the opposition from the cantons.

Third, utility energy efficiency schemes have been tested in other areas with the example of Denmark and Massachusetts. However, there seems to be limited knowledge of them by the Swiss policy makers. The work is divided between policymakers within specialized commissions leaving therefore very few people with a good understanding of the topic.

Finally, there was strong opposition from the grid companies on the schemes proposed in the first 2050 Energy Strategy package. There is, therefore, a need to reach a consensus on the matter, and policy makers should take example on Massachusetts and Denmark. who have a collaborative process where obliged parties are implicated in the design and implementation of the schemes. On the other hand, such collaboration seems difficult to achieve in Switzerland as there are more than 650 grid companies for the electricity alone.

Potential Model in Switzerland

Interviewees from Swiss political parties and Swiss energy stakeholders were asked their position on schemes implemented in Massachusetts or Denmark and if such models could be implemented in Switzerland. Three important points were mentioned during the interviews: there should be a collaborative process between governing institutions and grid companies to determine energy-saving targets, the federalist structure of Switzerland should be taken into account, and a voluntary system should first be implemented and should be extended then to other energy networks rather than electricity.

Considering the interviews, a model mixing both Denmark and Massachusetts governance systems is adapted to the Swiss context by integrating cantons in the scheme (Figure 2). Cantons would collaborate with their grid companies to create energy efficiency plans adjusted every three or five years. The cantonal plans would then be submitted to OFEN for a review. OFEN would also be in charge of monitoring the actions of grid companies and ElCom in charge of monitoring their costs.

Grid companies in Switzerland would have the same flexibility as in Massachusetts, where the most cost-effective actor should implement the energy efficiency measure. In terms of scope, the network companies would be first limited to their service area and would have budget allocation obligation in the resident sector. This is a good way to ensure equity between activity sectors. Once most savings are achieved, we could think of a more flexible system in terms of scope to foster competition and ensure cost effectiveness. In terms of technology, grid companies would have the freedom to choose the most cost-effective to implement savings. Finally, in exchange for having targets, grid companies would be allowed to recover their costs through the grid tariff.

Such a model could easily be implemented in a voluntary manner, where at first, utilities willing to engage in energy efficiency programs would be allowed to do so only if target and energy efficiency plans are elaborated in collaboration with the canton and validated by OFEN.

Conclusion

The design and implementation of such governance took around fifteen years for Denmark and more than twenty years for Massachusetts, since the start of the first electricity grid company energy efficiency DSM activities. The factors leading to the success of implementation of such schemes are well explained using Harmelinks' study for policy implementation and Varones' hypothesis for policy design.

Looking at Switzerland, we see that the main success factors hypothesis of policy design described by Varone were failure factors, as none of them checked out when proposing the white certificate model in the 2050 Energy Strategy first package of measures. Through interviews and reviewing parliament energy commission protocols, I proposed a hypothetical Swiss regulatory model that might reach more consensus in the political debate. From this model I derived several recommendations for Swiss policy makers.

- Before implementing an obligation scheme, an incentive model should first be in place to reach a consensus with the pro-economy coalition.
- Before proposing a regulatory framework, it must be ensured that it has support from the target-groups (grid networks and cantons).
- The federalist structure of Switzerland should be considered and cantons should not be left out of the framework as they can act as intermediaries between the numerous grid companies in Switzerland and the confederation.
- A similar collaborative process as in Denmark and Massachusetts between OFEN representatives, Cantonal energy offices and grid companies should be in place to establish energy saving plans for every canton.
- The OFEN and ElCom roles should be clearly specified in the governance scheme design.
- A national measurement and evaluation framework should be developed to ensure the monitoring of the scheme and complementarity of the actions.

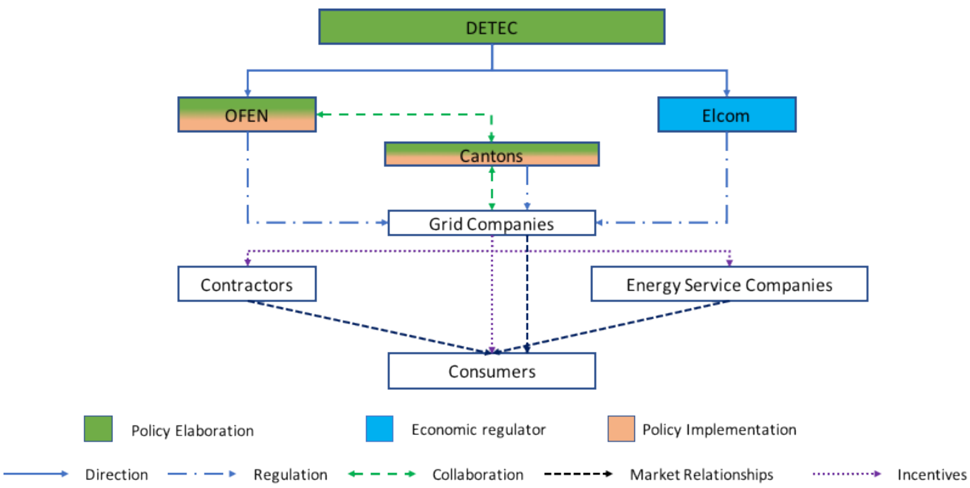

Figure 2. Potential Swiss scheme governance

Source: Author's elaboration

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Eleven Business Opportunities emerging from the Energy Transition

Emanuele Facchinetti*

Traditional energy market players face a challenging situation, dismissing their long-established business models to instead embrace one of the multiple business opportunities emerging from the energy transition. This contribution builds on both the research work performed in the frame of the Swiss Competence Center for Energy Research, "SCCER FEEB&D," and the executive training in Governing Energy Transitions (GET) to provide a structured overview of business development axes and business opportunities characterizing this phase of the energy transition. Based on a scientific literature review, market screening and collaboration with a Swiss utility company, eleven business opportunities, referring to independent value creation mechanisms have been identified and discussed.

Introduction

In 2014, while developing the Swiss Energy Strategy 2050, the Swiss Confederation founded seven national competence centers for energy research (SCCER) with the aim of federating the main public and private actors of the Swiss energy sector and foster the development and implementation of innovative solutions enabling the achievement of the Swiss Energy Strategy 2050. The seven SCCERs address all domains of the energy transition investigating technological, social and economic aspects.

As a result of the collaboration between three competence centers, "SCCER FURIES" –focusing on the future electricity networks, "SCCER FEEB&D" –focusing on the future energy efficient built environment, "SCCER CREST" – focusing on the socio-economic perspective, a new project has been launched in 2017 to explore the coupling of the electrical grid at distribution level with other energy carriers (i.e. thermal and chemical). This project builds upon a pilot & demonstration project of smart grid solutions cofounded by the Swiss Federal Office of Energy and Romande Energie, one of the largest utility company and distribution system operators (DSO) in Switzerland. The smart grid demonstrator will be deployed within a district of a town in Switzerland between 2017 and 2020.

Responsible for the business model innovation activities within the "SCCER FEEB&D", we contribute to explore the socio-economic aspects related to the implementation of multi-energy systems and smart grid solutions. With the overall objective of establishing guidelines supporting potential multi-energy systems stakeholders in the development of new business models, in 2017 we focused on the identification and classification of the new business opportunities emerging from the coevolution of the energy and digital transitions. In this light, the comprehensive and coherent vision of the energy transition, as well as the access to a variety of relevant stakeholders, offered by the executive training program GET has been particularly beneficial to develop the conceptual representation of emerging business opportunities presented in this short paper.

The context

The ambitious transition towards a more sustainable and carbon-free global energy system requires an unprecedented radical reorganization of the whole energy sector. A more rational conversion of available resources in energy systems and an increased adoption of renewable energy are the two fundamental pillars on which the energy transition is based upon.

Across the last decennium, the long-established energy market has been exposed to a concurrence of new trends continuously increasing in momentum: the liberalization and unification of markets; the increasing market penetration of decentralised energy systems based on renewable energy or favouring energy efficiency measures; the consequent highly uncertain regulatory framework evolution; the impact of the digitalisation; and last but not least, the global economic crisis (Schleicher-Tappeser 2012; Viral & Khatod 2012; Allan et al. 2015; Brunekreeft et al. 2015).

As a consequence, the energy sector and its stakeholders stand today at the eve of a challenging and exciting revolution: the way energy services are generated, delivered and traded is expected to change completely in the coming years.

At present, utility companies, the main actors of the energy market, are constantly losing profitability, and they are, therefore, striving to find appropriate ways to adapt to the undergoing transition. Many of the largest European utilities, amongst others the German E.ON and EnBW, the French EDF, the Italian ENEL, and the Swiss REPOWER, in the last years announced important reorientations of their activities mainly due to the fact that traditional business models no longer allow them to be competitive on the market.

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Emerging business opportunities

At present, traditional utilities undertaking a reorganization, as well as new market actors, mainly orient their strategy towards four main business development axes: Energy Efficiency – the deployment of direct and indirect measures encouraging a more rational and/or sober use of energy resources; Electricity Markets – the exploitation of new opportunities arising from the transformation of the wholesale electricity markets; Smart Grids – the deployment of measures enhancing distribution grid flexibility, operability and controllability; Renewable energy – the exploitation of new opportunities arising from the market diffusion of renewable energy.

Based on a scientific literature and on a market review partly based on the insights provided by the GET program, each of the proposed strategic development axes has been analyzed and characterized by a number of new business opportunities emerging in the market. Each identified business opportunity is defined by a specific value creation mechanism and can potentially be exploited independently. An overview of the four business development axes and related business opportunities is depicted in Figure 1.

The identified business opportunities are formalized hereafter following the terminology and conceptualization proposed by Osterwalder and Pigneur (2010). Osterwalder and Pigneur defined a business model as "the rationale of how an organization creates, delivers, and captures value" and identified four main elements fully characterizing it: Value Proposition, Customers, Financial Viability, and Infrastructures. The analysis of the eleven business opportunities proposed below focuses in particular on the first three elements. Furthermore, as a result of the literature and market screening, for each business opportunity a list of references to relevant scientific publications and companies currently exploiting the business opportunity is presented. The market analysis focused on the European and US energy markets with the objective to spot innovative businesses emerging at the current stage of the energy transition and is partly based on the study recently accomplished in the frame of the "SCCER FEEB&D" (Facchinetti & Sulzer, 2016).

Energy Efficiency

Reduce Demand

Value Proposition	Support the customers in a direct or indirect (e.g. formation, consulting) way to reduce energy consumption
Customers	Privates, Enterprises, Public bodies
Financial Viability	Share the revenues from energy savings with the customers
Scientific references	(Yushchenko & Patel 2016) (Qin et al. 2017) (Sorrell 2007) (Fang et al. 2012) (Suhonen & Okkonen 2013)
Companies	Oracle Utilities (previously Opower) (Int) Nest (Int) Siemens Building Techonologies (Int) Alpiq InTec (CH)

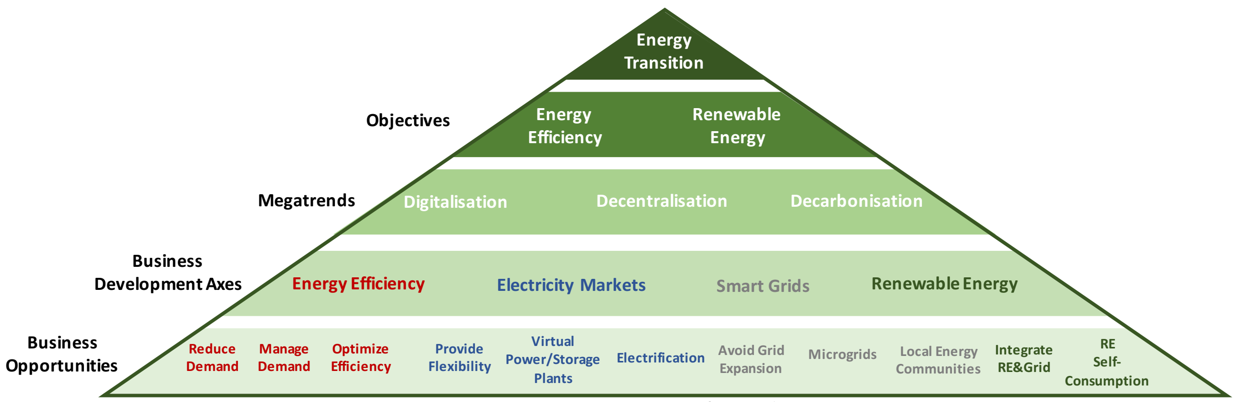

Figure 1– Business opportunities emerging from the Energy Transition

Manage Demand

Value Proposition	Support the customers in controlling and optimally shifting their energy demand
Customers	Privates, Enterprises, Public bodies
Financial Viability	Share the revenues from demand side management (reduce grid costs and capitalise on dynamic pricing)
Scientific references	(Goulden et al. 2014) (Behrangrad 2015) (Siano 2014) (Ali et al. 2017) (Martínez et al. 2015) (Good et al. 2017)
Companies	EnergyPool (Int) EnerNOC (Int) Entelios (DE) Itron (DE) Flextricity (UK)

Optimize Efficiency

Value Proposition	Optimize the energy conversion performance and capitalise on synergies on multi-energy systems
Customers	Privates, Enterprises, Public bodies
Financial Viability	Revenues from selling best practices and energy efficient solutions
Scientific references	(Mancarella 2014) (Capuder & Mancarella 2014) (Sepponen & Heimonen 2015)
Companies	EON (DE) NRG (US) Siemens Building technology (Int) Alpiq InTec (CH) Innowatio (Int)

Electricity Markets

Provide Flexibility

Value Proposition	Offer the opportunity to valorise customer's flexibility in the energy markets
Customers	Privates, Enterprises, Public bodies
Financial Viability	Share the revenues from the flexibility valorisation
Scientific references	(Eid et al. 2015) (Eid et al. 2016) (Stinner et al. 2016)
Companies	Tiko (CH) Flextricity (UK) Entelios (DE) EnergyON (CH)

Virtual Power Plants

Value Proposition	Offer the opportunity to valorise decentralised energy systems in the energy markets
Customers	Privates, Enterprises, Public bodies
Financial Viability	Share the revenues from the energy trading
Scientific references	(Loßner et al. 2016) (Pudjianto et al. 2008) (Mancarella 2014)
Companies	Lichtblick (DE) Next Kraftwerke (DE) SUNVERGE (US) Kiwigrid (DE)

Electrification

Value Proposition	Offer electricity based alternatives for product and services traditionally based on fuels
Customers	Privates, Enterprises, Public bodies
Financial Viability	Revenues from selling electricity-based carbon-free and energy efficient solutions replacing fuel based solutions
Scientific references	(Kannan & Hirschberg 2016) (Bohnsack et al. 2014) (Kannan & Hirschberg 2016)
Companies	SBB (CH) Tesla (US) Sono Motors (DE) NRG (US) Repower (CH)

Avoid Grid Expansion

Value Proposition	Offer competitive alternatives to avoid transmission and distribution grid expansion
Customers	Grid owners, grid operator, Enterprises, Public bodies
Financial Viability	Savings from grid expansion cost avoidance
Scientific references	(Bussar et al. 2016) (Good et al. 2017) (Poudineh & Jamasb 2014)
Companies	Landys+Gyr (Int) Schneider Electric (Int) Trilliant (US)

Microgrids

Value Proposition	Offer customised, stand-alone electricity grid solutions
Customers	Privates, Enterprises, Public bodies
Financial Viability	Revenues from selling customised grid solutions
Scientific references	(Giraldez & Heap 2015) (Lasseter 2011) (Adil & Ko 2016)
Companies	ABB (Int) Schneider Electric (Int) Siemens (Int) GE (Int) RENEMIG (Int)

Local Energy Communities

Value Proposition	Offer customised solutions for local energy communities
Customers	Privates, Cooperatives, Enterprises, Public bodies
Financial Viability	Revenues from selling customised solutions for local energy communities
Scientific references	(Van Der Schoor & Scholtens 2015) (Koirala et al. 2016) (Kunze & Vancea 2017)
Companies	Clean Energy Collectives (US) Mongoose Energy (UK) Engytec (CH) CfR (UK) Jouliette (NL)

Renewable Energy

Integrate Renewable Energy and Grid	
Value Proposition	Deploy renewable energy solutions and favour their integration into the distribution grid
Customers	Privates, Cooperatives, Enterprises, Public bodies
Financial Viability	Revenues from deploying renewable energy and/or enabling their grid integration
Scientific references	(Bussar et al. 2016) (Anaya & Pollitt 2015a) (Anaya & Pollitt 2015b) (Brunekreeft et al. 2015)
Companies	Younicos (Int) E ON (DE) Enel Green Power (Int) OMNETRIC group (US) Younergy (CH)

Renewable Energy Self-consumption	
Value Proposition	Deploy solutions promoting the self-consumption of local renewable energies
Customers	Privates, Cooperatives, Enterprises, Public bodies
Financial Viability	Revenues from offering self-consumption solutions and/or sharing cost savings from avoided energy supply from the grid
Scientific references	(Bussar et al. 2016) (Palizban & Kauhaniemi 2016) (Stinner et al. 2016)
Companies	Tiko (CH) Younicos (Int) Schneider Electric (Int) Tesla (US) SonnenBatterie (Int) Victronenergy (NL)

Combining business opportunities

The identified business opportunities can be combined in order to exploit potential synergies and thus create value propositions relying on multiple value creation mechanisms. The compatibility potentials between the identified business opportunities have been investigated on a qualitative basis considering the findings obtained from the literature review, the market screening and based on the collaboration with Romande Energie. In particular, two utility's managers responsible for business innovation activities have been involved in series of workshops and a semi-structured interview aiming to analyze and enhance the developed conceptual framework including the utility's perspective.

As a result of such qualitative analysis, the combination of business opportunities bearing a high level of compatibility have been grouped into clusters. The results of such assessment are presented in Figure 2: four different clusters of highly compatible business opportunities are presented with different colors.

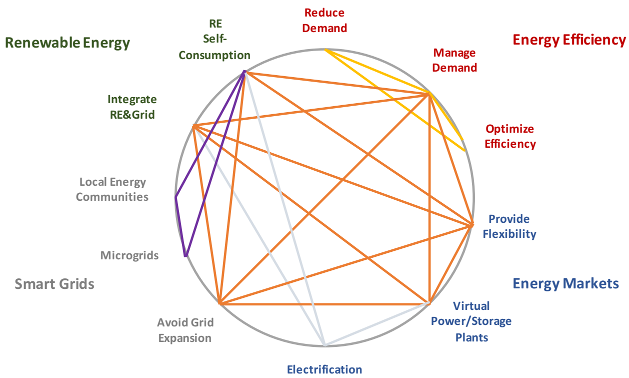

Figure 2 – Clusters of compatible business opportunities

Four clusters are named after the business opportunity, which characterizes the cluster in the best way: Optimize efficiency (yellow cluster), Provide flexibility (orange cluster), RE self-consumption (purple cluster), Electrification (light grey cluster). The clusters are briefly described below.

Optimize Efficiency

The focus of this cluster lies on the development of products improving the performance of energy systems by means of the following three integrated measures: energy efficiency optimization, integration of load control solutions, and demand reduction. This cluster is mainly oriented to the business development axe *Energy Efficiency.*

Provide Flexibility

Flexibility is a key aspect for the energy systems of the future and it is not a surprise if this cluster relates to all different business development axes. The electricity markets are expected to valorize in the future the flexibility potential related to the demand side (*Energy Efficiency* axe) and the decentralized renewable production side (*Renewable Energy* axe) by means of the available new flexible grid solutions (*Smart Grids* axe)

RE self-consumption

The increase of self-consumption of locally produced renewable energy is expected to have a crucial role in fostering energy transition. On the one hand, the combination of renewable energy production and energy storage solutions, and on the other one hand, new organizational forms, such as local energy communities and district level aggregators, clearly offer an interesting playground for the development of new products and services.

Electrification

This cluster mainly associates the business development axes *Electricity Markets* and *Renewable Energy*. The increased share of renewable energy generation in the future is expected to be mostly electricity-based (i.e. wind and PV). Combining this tendency with the trend towards the electrification of several sectors (e.g. home automation, mobility), innovative products and services are expected to flourish from this cluster of business opportunities.

Conclusions

Traditional energy market players are facing a challenging situation: dismiss their long-term established business models to instead embrace one of the multiple business opportunities emerging from the energy transition. This contribution builds upon both the research work performed in the frame of the Swiss Competence Center for Energy Research "SCCER FEEB&D" and the executive training GET to provide a structured overview of business development axes and business opportunities, characterizing this phase of the energy transition. Based on a scientific literature review and a market screening, eleven business opportunities, referring to independent value creation mechanisms have been identified. Furthermore, a qualitative assessment in collaboration with Romande Energie, a Swiss utility company, has been performed to investigate the most interesting combinations of such business opportunities in the perspective of creating innovative products and services fostering the energy transition and potentially successful in the market. The proposed conceptual framework aims to provide an orientation within the vast number of opportunities that is expected to characterize the energy markets in the forthcoming decades.

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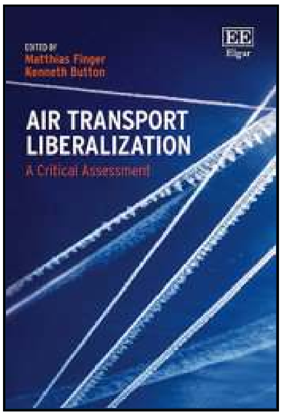
Air Transport Liberalization

A Critical Assessment



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Presentation of the next issue

Under the terms of *Internet of Things*, *Industry 4.0* and *Physical Internet* as well as several others, many automatization and digitalization trends are on the move for the transportation, supply chain and logistics sector. Many technology aspects are driving these developments, in line with economic aspects. But increasingly also questions of human perception, motivation and safety are entering the discussion, emerging as a crucial topical area for overall economic impact and success.

Regulation for technology developments in artificial intelligence and robotics are commonly seen as one of the important yet structurally neglected fields regarding the human perspective on increasing automatization. This was highlighted in 2017 by the European Parliament (EP) report and a public consultation, indicating that a vast majority of citizens in Europe is regarding those developments as positive innovation fields but where further safeguards and regulations are needed, see the EP Resolution on Civil Law Rules on Robotics, 2015/2103 (INL).

This issue is connected to an innovation workshop that took place on February 26 2018 at the Florence School of Regulation and directed at discussing the state of the art within the field of transportation, supply chain management and logistics. Furthermore, an evaluation regarding possible actions like regulation, agency- or industry-based approaches for establishing safeguards towards effective but risk-mitigating settings for this sector is aimed for.

Initial contributions collected here are directed at providing an interdisciplinary overview regarding the perspectives of industry and logistics actors, researchers in the economic, computer sciences, law and sociology domains as well as other interested parties from the field of political actors and associations. This shall enable the start of an open discussion what sorts of regulation are necessary in order to secure human trust and motivation in AI and robotics developments without placing too much of a burden to the economic development in the transportation, supply chain and logistics sector.

More information

The guest editor for the next issue of the Network Industries Quarterly is Dr. Matthias Klumpp (FOM University of Applied Sciences Essen and Fraunhofer IML Dortmund, Germany). Should you be willing to contact him regarding this publication, please send an email to matthias.klumpp@fom.de with cc to Ms. Irina Lapenkova FSR.Transport@eui.eu.

network industries quarterly

Open Call For Papers

Implementation of the liberalization process has brought various challenges to incumbent firms operating in sectors such as air transport, telecommunications, energy, postal services, water and railways, as well as to new entrants, to regulators and to the public authorities.
Therefore, the Network Industries Quarterly is aimed at covering research findings regarding these challenges, to monitor the emerging trends, as well as to analyze the strategic implications of these changes in terms of regulation, risks management, governance and innovation in all, but also across, the different regulated sectors.
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Article Preparation

The Network Industries Quarterly is a multidisciplinary international publication. Each issue is coordinated by a guest editor, who chooses four to six different articles all related to the topic chosen. Articles must be high-quality, written in clear, plain language. They should be original papers that will contribute to furthering the knowledge base of network industries policy matters. Articles can refer to theories and, when appropriate, deduce practical applications. Additionally, they can make policy recommendations and deduce management implications.
Detailed guidelines on how to submit the articles and coordinate the issue will be provided to the selected guest editor.

Additional Information

More Information

- *network-industries.org*
- *mir.epfl.ch*
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