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

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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-

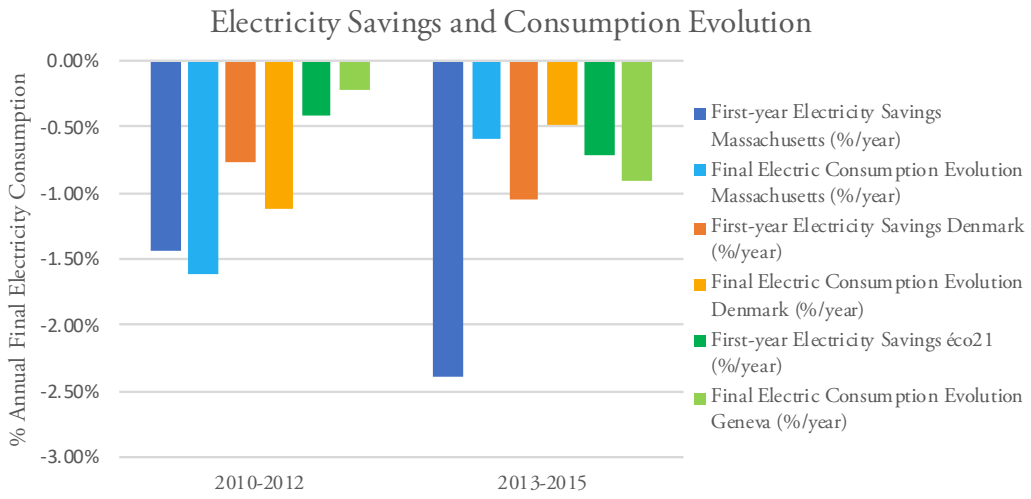

Figure 1. Energy efficiency scheme results

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 lim-

ited 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.

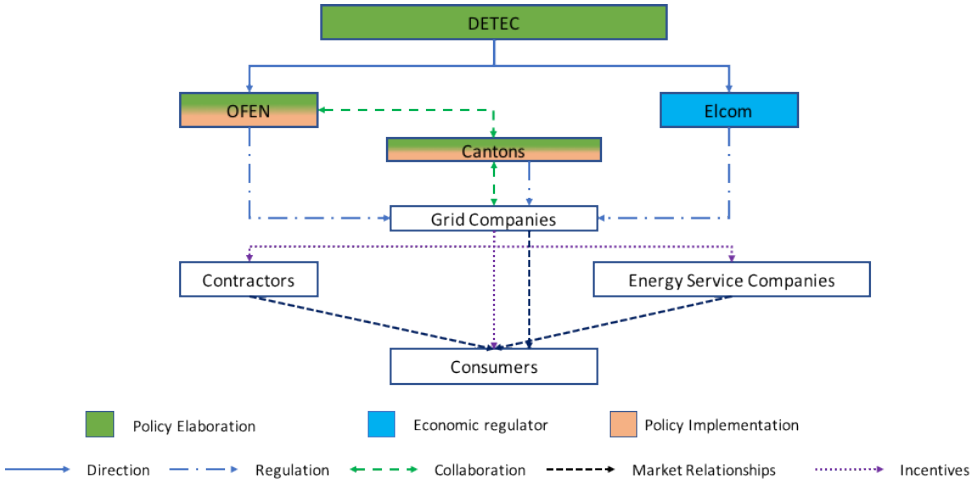

Figure 2. Potential Swiss scheme governance

Source: Author's elaboration

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