

Energy- and non energy impacts of a Demand-side Management Program

Case Study of the Program éco21, Geneva, Switzerland

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Abstract

éco21 is the demand-side management (DSM) program initiated in 2008 by the Services Industriels de Genève (SIG), one of the largest multi-utility company in Switzerland. The first mission of éco21 is to stabilize the electricity consumption of Geneva. Since 2013, éco21 has a second mission related to greenhouse gases (GHG) reduction, with an objective of 825'000 tonnes equ. CO₂ cumac by 2020.

éco21 DSM program is composed of 7 action plans focusing either on electricity savings, or on GHG reduction, or on both. These action plans target several types of clients (e.g. households, municipalities, large and medium-sized enterprises). They combine “pull” and “push” interventions such as financial incitation, training, supports, direct install, market transformation and others.

The results of electricity savings and GHG emission reductions, related to éco21, are to-date 80 GWh/y and 7'000 t-equ CO₂, respectively. The average costs to utility per kWh saved are roughly 0.04 €/kWh and 18 €/t-equ CO₂.

SIG has evaluated at what level the program impacts the local economy, other than only reducing the electricity bills and GHG emissions. A global assessment shows a positive and significant impact on jobs creation, additional income generated for different businesses and tax revenues. A detailed assessment will be conducted by Geneva's University by a PhD student who's starting a research.

This article aims at presenting éco21 DSM program, the quantitative energy savings, the financial mechanisms and the impacts on the local economy.

Introduction

In 2008, the Services Industriels de Genève (SIG)¹, one of the largest public multi-utility company in Switzerland, started éco21, the first demand-side management (DSM) program in Switzerland. éco21 is completely coherent with the Swiss sustainable development strategy as its missions are to stabilize the electricity consumption and to reduce the greenhouse gases emissions (GHG) of the state of Geneva. Furthermore éco21 participates in the development of the local energy efficiency market while contributing to convey the innovative skills of SIG.

The objective of the paper is to provide a feedback on éco21 experience. In this paper, we will first describe the background for energy efficiency policies in Switzerland and the specificity of Geneva (local context and interactions between stakeholders). Then we will define the motivation for promoting energy efficiency from the utility perspective and present the approaches used to design the action plans (our three pillars approach). Afterward we will present the results obtained since 2008 and how we monitor and evaluate them. Finally we will discuss about the non-energy benefits, and their added value from the utility perspective.

¹ SIG is a public company owned by the regional government, the State (Canton) of Geneva (55 %), and the local governments, the City of Geneva (30 %) and all other municipalities (15 %). SIG's mission is to supply the Canton of Geneva with water, gas, electricity, district heating, as well as to treat and recycle water and waste. Besides supplying fluids, SIG has developed services in the field of optic fiber, audits and energy performance contracting. SIG counts 1700 employees and has an annual turnover of € 800 million (1 CHF billion).

Background for energy efficiency policies and programs in Switzerland and in Geneva

Energy consumption in Switzerland and perspectives

In 2012, Switzerland consumed 245 TWh of final energy and the Swiss citizens paid for it 26.9 billion € (32.8 billion CHF). This represents about 6% of the GDP of the country². Furthermore, oil, gas and fuel represent 70% of the total costs. We are therefore highly dependent to exporting countries and to the volatility prices of fossil agents and, from 2007, to the European electricity market³. Electricity is mainly generated with hydroelectric (around 55%) and nuclear (around 40%) powerplants.

Swiss authorities planed a new strategy towards energy, climate and resources from the early 2000, following a concept called *2000 watts society* (Balthasar and Rieder, 2000). This first strategy for sustainable development started in 2001. It assumed a maximum permanent power of 2000W and maximum GHG emissions per inhabitant of 1 ton CO₂ per year. The target to achieve this transition was then 2050. After having ratified the Kyoto Protocol in 2003⁴, Switzerland planed in 2012 to reduce its GHG emissions by 20% compared to 1990 during the 2013-2020 period.

After Fukushima accident in March 2011, Swiss authorities decided to get over with the use of nuclear plants by 2034, and consequently developed a long-term energy policy, the so-called *Energy Strategy 2050*. The goal of this concept is to restructure the Swiss energy system by 2050⁵, by a significant energy consumption reduction and an ambitious development of new renewable sources. The main quantitative objective is to reduce the total energy consumption of Switzerland of 13% by 2020 and 43% by 2035 (year of reference is 2000). Therefore, 2020 final energy consumption has to be below 213 TWh⁶.

Energy efficiency policies in Switzerland

The *Energy strategy 2050* will be articulated around seven different axes^{7,8} and to implement it, Swiss authorities have to completely review the actual federal law on energy (LEne⁹ is under consultation) and other laws. But before leaning on the new LEne, the Confederation already uses different taxes and subventions. For example, all industries have to pay a CO₂ taxes regarding their fossil energy consumption, but if they perform energy efficiency measures and reduce their emissions, they can be exempted from it. Vehicles importers have to pay a CO₂ penalty if the average GHG emissions per km of all new vehicles they import in Switzerland is above a threshold fixed by the LEne (actually under consultation). A significant part of the global objectives is related to the buildings. Indeed, their GHG emissions have to be reduced by 40% by 2040 (reference is 2000). And the Confederation delegates this mission to the Cantons. Therefore Cantons have to find a way to accelerate building refurbishments, but only few of them have already adapted their law on energy to be more restrictive. Consequently the mains actions are cantonal subventions for the use of

² <http://www.admin.ch/opc/fr/federal-gazette/2013/6771.pdf>

³ Loi sur l'approvisionnement en électricité, LApEl, RS 734.7

⁴ <http://www.bafu.admin.ch/dokumentation/medieninformation/00962/index.html?lang=fr&msg-id=52619>

⁵ <http://www.uvek.admin.ch/dokumentation/00474/00492/index.html?lang=fr&msg-id=50123>,

<http://www.admin.ch/opc/fr/federal-gazette/2013/6771.pdf>

⁶ <http://www.news.admin.ch/NSBSubscriber/message/attachments/31928.pdf>

⁷ <http://www.uvek.admin.ch/dokumentation/00474/00492/index.html?lang=fr&msg-id=50123>

⁸ <http://www.news.admin.ch/NSBSubscriber/message/attachments/31928.pdf>

⁹ The actual law : <http://www.admin.ch/opc/fr/classified-compilation/19983485/index.html>. The law under consultation : <http://www.news.admin.ch/NSBSubscriber/message/attachments/31936.pdf>

renewable energy and for building refurbishments^{10,11}. Some Cantons adapted their legislation in order to force energy efficient measures for new and existing buildings. Geneva was one of the first to implement a restrictive law on energy in 2010.

Geneva's energy efficiency policy

The main stakeholders of energy in Geneva are the energy office of the Canton (OCEN), the municipalities and SIG. One of the missions of OCEN is to set up all measures taken in the cantonal law on energy¹² (LEn). It has to manage large scale plans such as *cantonal energy master plan*¹³, or *territorial energy concept (CET)*¹⁴ and a number of smaller scale considerations such as delivering accordance for technical facilities.

Even if directions are centralized at the OCEN level, the municipalities also play a role in the energy management in their territory (e.g. many of them are *cite de l'énergie* and act as a relay to the collectivity, furthermore they could perform CET at the municipal scale).

One of the missions of SIG is to sell and distribute energies (electricity, gas and district heating) over the territory of Geneva. SIG has to develop and maintain the electricity, gas and districts heating grids.

Finally, private actors such as architects, engineers, skilled craftsmen (and others) and their relative associations play an important role in the energy domain. They are generally the first contact lines with the client for energy solutions.

Energy consumption profile in Geneva

In 2012, the total energy sales in the state of Geneva represented approximately 10 TWh/y¹⁵ (i.e. electricity, gas, oil and fuel) the corresponding GHG emissions are approximately 2,035 Mtons equ. CO₂. Figure 1a) shows that prior to éco21, in 2008, Geneva consumed nearly 3 TWh/year of electricity with an average increase of 1.9 % per year (based on the values from 2000 to 2008).

Regarding its energy consumption per economic sectors, Geneva shows a typical profile of tertiary oriented economic place¹⁶. Indeed, the tertiary and the residential sectors count for 88% and 95% of the electric and gas sales, respectively (cf. Figure 1c) and d)). Furthermore, nearly half of the total energy consumption is dedicated for space heating. This represents approximately 2.6 TWh and 2 TWh for gas and heating oil, respectively. For gas and heating oil, the related GHG emissions are 1.2 million tones equ.CO₂ per year. These statistical data indicate that energy savings potentials are mainly related to the building management facilities. Therefore, action plans have to be designed to reach a maximum number of clients to gather this diffuse energy saving potential.

In parallel, one of the SIG goals is to increase the electric auto-production ratio¹⁷, by both energy efficiency and renewable electricity generation.

¹⁰ e.g. for Geneva : <http://ge.ch/energie/actualites/le-cheque-batiment-energie-subventionne-vos-travaux>

¹¹ <http://www.dasgebaeudeprogramm.ch/index.php/fr>

¹² http://www.geneve.ch/legislation/rsg/f/s/rsg_12_30.html. The LEn determine all measures ensuring a rational and economic use of energy and the development of the exploitation of the new renewable energies.

¹³ Plan directeur cantonal de l'énergie

¹⁴ <http://ge.ch/energie/concept-energetique-territorial>

¹⁵ Statistic data for to-date energies consumptions are not yet available.

¹⁶ Tertiary and secondary sectors count nearly 85% and 15 % of the total employees of the state, respectively. With less than 1%, the primary sector is negligible.

¹⁷ SIG produces about 25% of the consumed electricity with new renewable energy (i.e. hydroelectric, solar plants and waste incinerator). The 75% other are bought in both national and international electricity market.

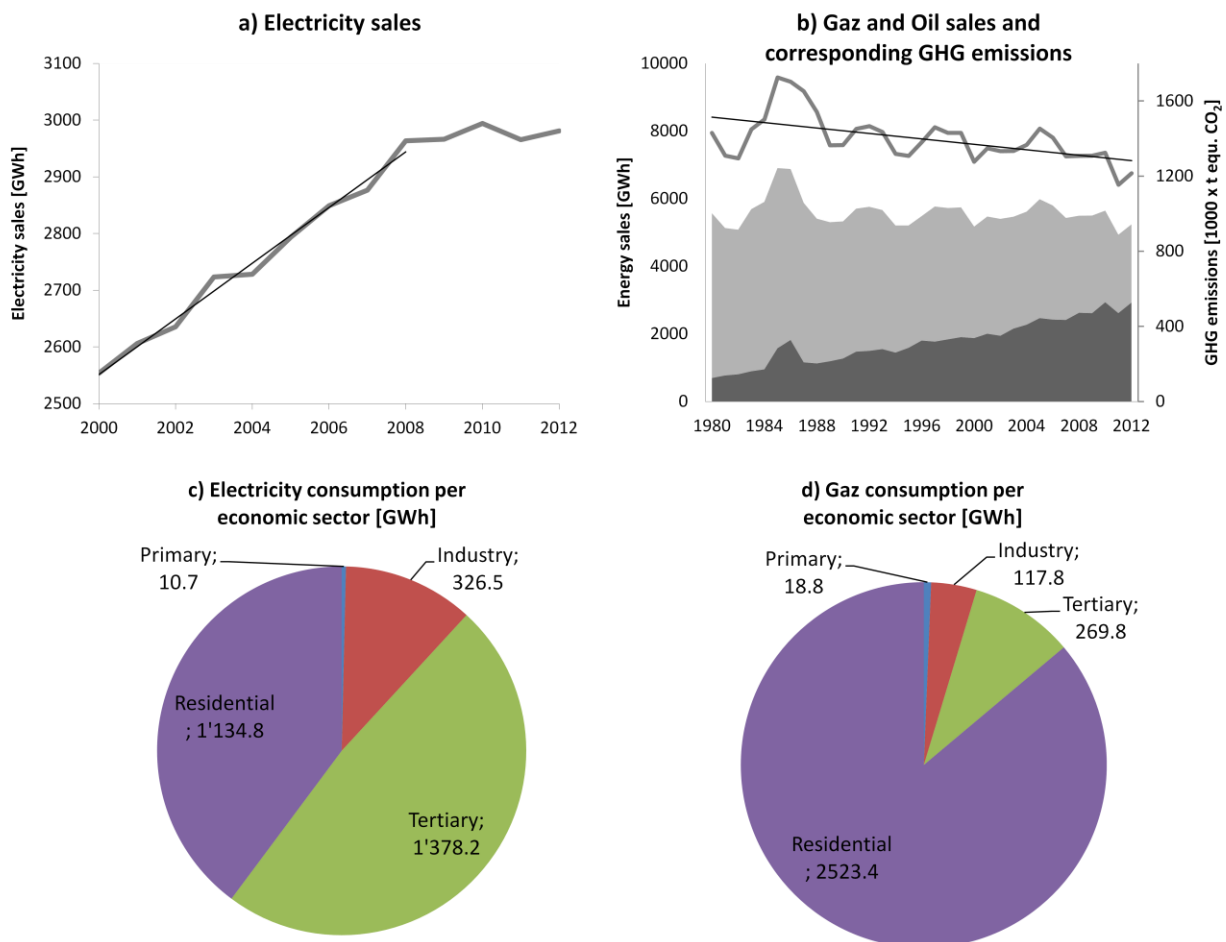


Figure 1 All numbers are related to year 2012. a) Electricity sales in Geneva between 2000 and 2012, b) Gas and Oil sales, and the corresponding CO₂ emissions in Geneva between 1980 and 2012, c) Electricity consumption for each economic sector and d) Gas consumption for each economic sector (Source OCSAT T08.02.01, T08.03.1.01, T08.03.2.01, T08.03.2.01, T08.03.2.02, T08.03.3.02). OCSTAT does not compile statistics on the oil consumed per economic sectors; therefore we assumed that the repartition is as for the gas.

The éco21 program

At its origin in 2007, éco21 was launched by a political decision of Geneva’s authorities. At that time, a budget of 17.5 M€ had been given, as an alternative option to meet the regulator's requirement to reimburse the customers for too high prices during some periods.

In 2009, SIG decided voluntarily to add 26.5 M€ in the program. This decision followed a redefinition of the company strategy in the direction of energy transition (with high investments in renewable energies, energy efficiency and renewable district heating systems). This new strategy was meant to meet the objectives of the energy strategy of our authorities, and to reduce SIG energy dependence rate¹⁸.

The total budget of 44 M€ was planned to last till end of 2013, and to deliver electricity savings up to 150 GWh/y by end 2013. The main action plans began in 2009 and took a certain time to succeed, so that the objectives had to be lowered.

The new objective is to reach 125 GWh/y by end 2015, with a total budget of 66 M€. In addition,

¹⁸ Although these orientations were taken at a period when the market showed high energy prices, they have been kept later, when energy prices have fallen dramatically

GHG emissions should be reduced by 825'000 tonnes equ. CO₂¹⁹ by 2020.

Electricity and GHG savings : two distinct financial mechanisms

The financial mechanisms for the electricity and the GHG reduction programs are significantly different.

éco21 electricity savings programs are fully funded with the budget mentioned above.

Since 2013, éco21 integrates a new GHG reduction program with an innovative financial mechanism. This program is partially (around 50%) financed by the incomes resulting of the sale of CO₂ emission reductions (SIG's CO₂ offsets). SIG's CO₂ offsets are sold through a new gas product line launched by SIG in 2013 and called *Gaz Vitale*²⁰. By choosing these products for their heating needs, SIG's customers voluntary support local GHG reduction projects. As éco21 programs cannot provide enough CO₂ offsets at time, CO₂ offsets are also bought in the international GHG voluntary market²¹. SIG's CO₂ offsets follow a GHG verification standard established in partnership between OCEN and SIG. This standard follows ISO 14064-2. The annual GHG reduction objective of éco21 is therefore established by the sales volumes of *Gaz Vitale*.

Whatever the financial mechanisms used, éco21 has to pay particular attention in cost management. The average cost per kWh saved is used as a financial indicator to ensure that costs are under control. These financial analyses are not only performed at the action plan level, but also at the program level. This allowed some flexibility to build various action plans with low and high average cost per kWh saved, as indicator include other criteria than costs (i.e. social impact on low-income households, etc.).

Determination of energy saving potential

To assess the electricity savings potential, éco21 contracted, in 2008, a consultancy agency (Apogee, P. Le Strat 2008) to perform an analysis of the energy consumption per economic sectors. The objective of this study was to generate a map of the electricity saving potentials. The analysis focuses on 19 sectors and 10 usages (i.e. types of electricity consumption). The energy saving potential was assessed firstly from a technical point of view (i.e. changing to efficient technology currently available in the market), then by introducing financial criteria (e.g. ROI below 10 years) and finally by taking into account socio-economical constraints.

Based on this study, the overall potential amounted to about 800 GWh/y (cf. Figure 2). According to the analysis of the context for the Geneva area, this study identified the largest potentials in i) lighting (tertiary sector such as building, shops, recreation complex and residential sector), ii) ventilation/ air conditioning (for offices and stores) and iii) electronic devices (households and offices). Significant potentials are identified on electrical thermal uses (i.e. circulating pump for heating, as direct electric heating is now forbidden). For the industry sectors, easy-to-activate saving potentials do not come out as straight forward as for the other sectors, but our experiences show that they are mainly on the buildings. Even if energy savings on process exist, they are hardly reachable due to exploitation constraints.

¹⁹ This number is expressed in cumac (cumulated over a period of time and discounted at a specific rate)

²⁰ <http://www.sig-ge.ch/clients/particuliers/les-energies/gaz-naturel-chaleur-cuisson/les-produits-gaz/gaz-vitale>

²¹ SIG only buy VER (Verified Emission Reduction) or VCS (Verified Carbon Standard) *Gold standard* CO₂ offsets.

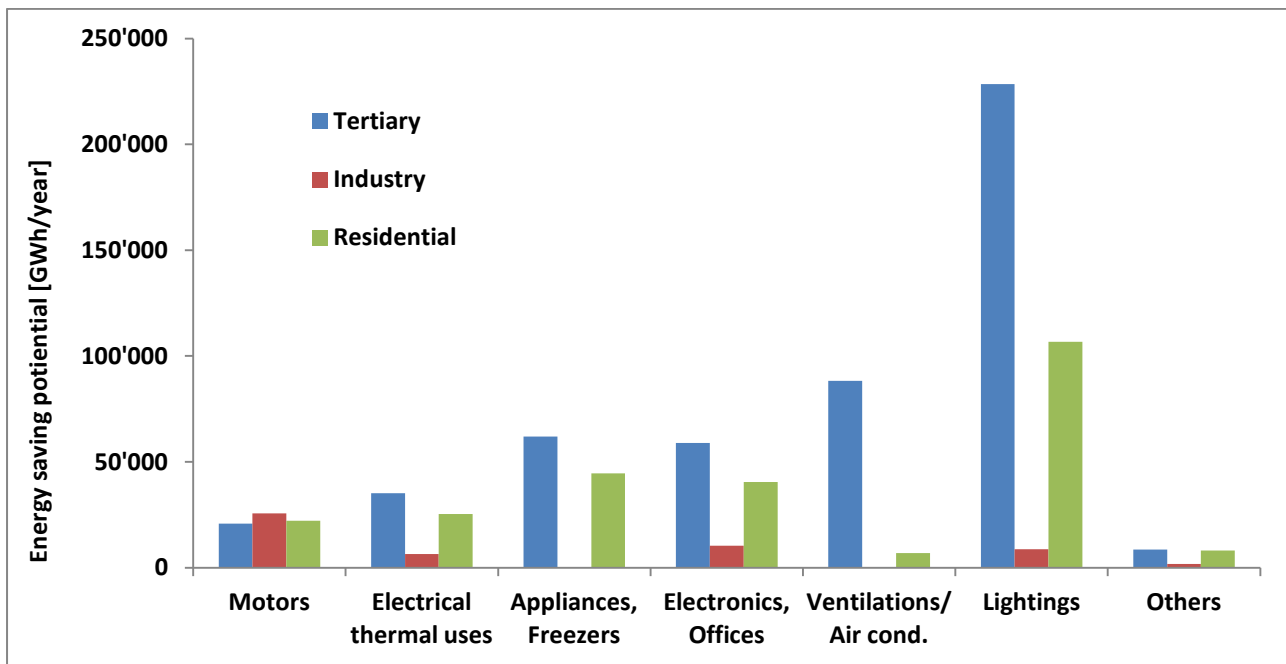


Figure 2 Electricity saving potential in the state of Geneva

For the GHG reduction action plans, similar analyses were performed. As nearly half of Geneva's energy consumption is used to heat buildings, conclusions exhibit large potentials mainly in building refurbishment, optimization of heating process, and transition from fossil (i.e. heating oil and gas) to renewable energy (heat pumps, solar, biomass and others).

éco21: a role of facilitator for energy efficiency

To ensure efficient energy savings in projects, local authorities, clients and key actors of energy have to work closely together and to stay on tracks. On the one hand there are the legal and normative frameworks with rules, laws and energy strategy. If they are too restricting, it could affect the cost-effectiveness of energy efficiency programs and therefore makes their deployment difficult. On the other hand target customers (i.e. households, owners, enterprises, municipalities and others) have to be motivated²² to perform energy efficiency actions. In between are the actors of energy efficiency, who are as well key targets for energy efficiency policies. These actors are multiple and they have to collaborate efficiently to ensure the smooth running of energy efficiency solutions²³.

éco21 is therefore not positioned as a particular actor in the chain for energy efficiency, but acts as a facilitator or as a market organizer, interacting with all actors. To play such a role, we have to understand i) the market place of the energy efficiency solutions, ii) the way business is performed locally, iii) the links between the different stakeholders (clients, authorities and actors), and iv) their specific constraints. The dedicated programs must suit with local markets and customers' needs.

In conclusion, éco21 does not sale any product, does not realize any project, but proposes realistic alternatives to business-as-usual solutions, by optimizing interactions between project owners and local professionals involved in energy efficiency. The solutions proposed by éco21 allow customers to comply with legal obligations, and to overpass them.

For example, legal and normative frameworks impose thresholds of heating consumption for large

²² This includes profitability.

²³ For example, to build a high energy performance building, not only architects and engineers have to work closely together to ensure that the project is correctly sized and planned, but also all the other skilled workers have to be involved and well aware (i.e. heating & ventilation specialists, bricklayer, electrician ...).

buildings (HCI in MJ/m², heating consumption index). Owners are free to find appropriate solutions, and can involve any energy actors (i.e. engineers and skilled workers). Based on that, éco21 made a wide barrier analysis and consulted both energy actors and building owners to determine the best way to comply with legal obligations. In parallel, strong interaction with the OCEN ensures that the proposed solutions fit the legal and normative frameworks. The solution found was an energy performance contracting with the owners to optimize the regulation of the heating process (boilers and distribution). Heating craftsmen in charge of the optimization sign a convention with éco21 and follow particular trainings. However, they keep a direct link with the owners. éco21 is in charge to prove energy savings and, through the performance contracting, we take some of the financial risk in case of underperformance.

A program built on three pillars

As many energy efficiency programs, we perform barrier analysis in order to define our actions plans. Nearly all our programs are built on three main pillars (cf. Table 1).

Table 1 : Description of the three pillars.

<i>Financial incentives</i>	One of the key barriers is definitely the financial aspects. As a direct lever, éco21 propose financial incentives proportional to the amount of energy saved. We also found that, energy actors do not systematically present clear financial plans allowing comparing available solutions in the market. Actually, they mainly focus on the investments and direct energy costs, but they do not give to the client cost-effectiveness calculations allowing comparing different scenarios (e.g. they do not include indirect costs, such as maintenance, subventions, taxes reductions, éco21 financial incentives ...). Therefore we develop web tools, or methods, available to clients and energy actors to perform efficient financial calculations.
<i>Trainings/ advices/ supports</i>	Another very important barrier is the abilities of energy actors to propose solutions (or innovative solution) that are different to their business as usual. For example, when heating craftsmen have to change an oil boiler for an individual house, they usually replace it with a new oil or gas boiler. Very few of them propose alternatives such as a heating pump or others. Therefore we propose training programs to improve their technical abilities, and technical web tools to compare different solutions.
<i>Communication and Awareness</i>	The last, but not the least barrier is the lack of trust and awareness of the clients in efficient solutions. The two above mentioned pillars participate in addressing this barrier but, in addition to that, we developed marketing and commercial strategies to push our actions plans into the market.

We segmented the consumer targets into 3 distinct types of macro sectoral target: i) Households (e.g. inhabitants choosing the type of electronics they use at home, but not necessarily the heating process of the building); ii) Enterprises (i.e. large- and small- to medium-size) and municipality; and iii) Buildings: the tertiary sector and the owners of large buildings (i.e. these clients choose the technical facilities used in the buildings, but they do not necessarily live in those).

The content and intermediate results of éco21

The program is based on action plans tailored to their target. As each macro sectoral target has its own specificity (i.e. a particular spectrum of energy consumption with associated potential energy benefits and a proper relation with the local market), the proposed action plans have to fit to their needs. This means that the three pillars are applied according to the analyses of specific barriers and levers to ensure that the solution is market oriented. Table 2 details seven different action plans

developed by éco21. This summary shows that, as for many DSM programs, we combine market transformation, “pull” and “push” interventions. Table 2 highlights how the 3 pillars were defined for each specific target. The distribution of the quantitative objectives was based on the assessment of energy savings potential (end of 2013). In April 2014, UNIGE (Geneva University) validated 60GWh/y of electricity savings.

Table 2 : Description of the éco21 action plans. The first column indicates the name of the action plan, the second the consumers target, the third details the description and the three pillars, the two last column detail the energy saving objectives for 2015 and the actual energy saved.

Action plans	Consumer target	Market positioning and		Energy saving	
		Description	2015 objectives	real gains at end 2013	
Double éco	Households	Description: Financial incitations to induce energy efficiency in households Training/ advices/ support: - Communication: Mass media Financial incentives: SIG pays twice the price of the electrical kWh saved by the consumer		19 GWh	5 GWh
écosocial actions	Households	Description: Direct install of energy efficient equipments for low-incomes peoples Training/ advices/ support: Training of people in rehabilitation to realise direct install efficient equipment Communication: Municipality / mass media Financial incentives: Total cost of the operation is split between SIG and the municipality		3.8 GWh/year 5'000 t equ. CO2	2.5 GWh/year 1'150 t equ. CO2
Renewable energy in building heating	Households Buildings	Description: Facilitating new renewable energies for house heating Training/ advices/ support: Training heating craftsman until certification / web tool for renewable technologies and financial simulations Communication: Targeted mailing / professional media / websites Financial incentives: 25 CHF /tonnes equ. CO2 / energy contracting solutions (in study)		20'500 t equ. CO2	5'000 t equ. CO2
Efficient distributors	Households Industries	Description: Market transformation Training/ advices/ support: Workshops for vendors Communication: Mass media / distributors Financial incentives: Prime for energy efficient equipments (e.g. SIG pays 3 CHF per new bulb as far as the distributor double the sales bulbs)		4.1 GWh/year 300 t equ. CO2	-
Negawatt	Industries	Description: Implementation of energy management process in large-size enterprise Training/ advices/ support: Coaching for energy efficiency actions/ training for engineers / IPMVP training / plug and plays energy efficiency workshops / Communication: Targeted mailing / professional media / websites Financial incentives: 0.8 ct CHF/kWh saved / 40 CHF/ t equ CO2 saved		50 GWh 23'000t equ CO2	44 GWh 8'700 t equ CO2
Optiwatt	Industries Buildings	Description: Primes to electric efficiency with direct install solutions for small- to medium-size industry and buildings Training/ advices/ support: Web tool to performed energy saving and financial analyses / free energy audit / training to skills workers Communication: Targeted mailing / professional media / websites Financial incentives: between 1.1 to 1.4 ct CHF/kWh saved / 40 CHF/ t equ CO2 / Third part financing solutions (in study)		48 GWh 1'000 t equ. CO2	17 GWh/year
Heating production optimisation	Buildings	Description: Optimisation of the heating production and distribution without majors investments Training/ advices/ support: Training for heating craftsman until certification / coaching to craftsman / web tool to follow building energy consumption / Standardized contracts for stakeholders Communication: Targeted mailing / professional media / websites Financial incentives: Energy performance contracting (share saving)		4'400 tCO2	3000 t equ CO2

Market positioning and strategy.

éco21 program strategy and market positioning is based on valuing non-energy benefits. Actually, it is hard to monetize or quantify the side-benefits beyond energy savings and bill reductions. From the utility perspective, the return on investment is not only reduced exposure to energy prices

volatility and lower operating and capital cost, but also a greater brand enhancement, productivity and health. In order to reach these transversal benefits, the éco21 program is positioned within SIG global strategy as an « energy efficiency cluster ». The projects are conceived and carried out in strong and constant interaction with Marketing, Communication and Legal Departments. This interdisciplinary approach leads to greater work-related knowledge and optimal market positioning. This has in particular been put into practice to analyze the specific barriers for each éco21 target, and thus to identify relevant benefits to promote or use as driver for action.

Marketing department has developed a logical four step methodology in order to identify leverage actions to enhance the effectiveness of action plans. The method consists of an awareness phase, followed by a transitional phase of stimulation. The next step is implementation phase, which consists of behavioral advice and is usually paired with devices. The final evaluation phase is part of the process to ensuring the long-term conservation of energy efficiency actions and, therefore, of building the éco21 program's commitment.

Evaluation and framework

Energy savings evaluation and validation

Our DSM program has two levels for the savings evaluations (cf. Table 3):

- i) An internal evaluation performed by éco21. The evaluation is performed at the project site, then aggregated at action plan level, finally at the éco21 program.
- ii) An external and independent ex-post evaluation²⁴.

An annual validation report is provided for both parts of eco21 programs. The monitoring allows:

- to justify the program costs and to document any spending, as éco21 is funded with public funds;
- to follow the cost-effectiveness of each action plans and identify any deviation of them;
- create a kind of *Deming wheel* to constantly improve the quality of the DSM program;
- identify the impact of the program on the Cantonal energy consumption.

²⁴ This validation is performed by UNIGE regarding electricity savings, and by a professional validation organism regarding GHG reduction programs. The difference between electricity and GHG savings is due to the fact that GHG savings are sold to our customers through the *Gaz Vitale* line of products, which implies particular features.

Table 3 : Description of the evaluation of the energy savings and the economic and social impact.

Impact evaluation (electricity savings)	Evaluations commissioned to the UNIGE, that has access to clients' electricity bills and therefore they used evaluation methods specific to each action plan ²⁵ (Bertholet et al., 2010).
Impact evaluation (GHG emissions)	SIG's CO2 offsets follow a GHG verification standard established by SIG in partnership with the local energy authority representative (OCEN). This standard follows ISO 14064-2 standard. A consultancy agency is mandated to perform that verification.
Global economic and social Impact assessment (local economic activity and jobs)	A PhD thesis research started in May 2014 at the UNIGE on this subject. The objective of this thesis is to assess the macro-economic impact of éco21.

Discussions

Energy savings impacts

Bottom-up evaluation

Since it was launched in 2007, the program has been monitored and surveyed by Geneva's University. As éco21 operates different kinds of plans dedicated to distinct targets, the professionals involved in its monitoring developed tailor-made methodologies to assess their impact on energy savings.

While *direct install* plans or *specific projects* are easier to assess, plans that are targeting households' behaviours can only be evaluated by statistical approaches which require data bases and precise methodologies. Thanks to plans' conception and surveying, double counting within éco21 can be avoided. However, combined effects of éco21 and other initiatives or energy law evolution have to be managed through the statistical treatment. Table 4 shows our main electricity savings results on the period from 2007 to 2013.

Table 4 : Electricity savings results (period 2007-13) (Source: SIG estimates)

Customers	Electricity savings (GWh/y)	Electricity savings (GWh) ²⁶	Financial savings (M€/y)	Financial savings (M€) ²⁷
Households	7.5	75	1.4	14.4
Independent and SMEs	17	255	2.4	36.1
Large companies	44	660	4.8	71.5
Total	68.5	990	8.6	122

After 6 years of activity, éco21 has reached a savings level of around 2.4% of Geneva's global electricity consumption.

²⁵ Negawatt use, for instance, IPMVP (international performance measurement and verification protocol) to validate some of the energy savings. For the direct install solution (e.g. lightning bulb) we first performed ex-post measurements on significant samples of bulbs changed. Once validated by the UNIGE, these results are then used as ex-ante data to assess the energy saving per action. To validate the energy saving, UNIGE compare the results obtained with the ex-ante approach with the data collected by the SIG's electricity meters.

²⁶ Cumulated over a period of time. No discounted rate is applied.

²⁷ Cumulated over a period of time. No discounted rate is applied.

Global effect on electricity consumption

As shown in Table 5, the global electricity consumption in Geneva region has been flat since 2009. From 2000 to 2008, the local trend was +1.9%/y, and from 2008 to 2013 it was -0,5%, while population is increasing around +1%/y. The consumption per capita is actually strongly decreasing.

Table 5 shows yearly evolution of electricity consumption and GDP in Geneva and in Switzerland since 2008. The movement observed from 2009 is not only due to éco21: for example, earlier this year a new Swiss legislation excluded from the market the electronic devices with more than 1W consumption in standby mode, and from 2012 the traditional incandescent light bulbs were prohibited. Of course the world recession during the financial and economic crisis had an impact too. But since 2010, the economic growth is positive in Switzerland and Geneva shows one of the strongest economy in Switzerland.

The comparison between Geneva's and Switzerland electricity consumption trends suggest that something different happens in Geneva that can be linked neither to the general national trend nor to the economic situation. So this particularity may be partly related to éco21. 2013 values are particularly significant, as a strong decrease – consumption reduction per capita of 2,4% - can be observed, while economic growth is strong, and as no other known criteria (meteorology, demography, impact of new regulations, etc.) can explain this feature. Switzerland's trend of -0,6% per inhabitant can be taken as a reference, as regulation on inefficient devices apply at the national scale.

Table 5 : Annual electricity consumption (total and per capita) and GDP evolution for Geneva and Switzerland, from 2008 to 2013

	Geneva						Switzerland					
	Annual electricity consumption		Annual consumption per capita		Annual GDP per capita		Annual electricity consumption		Annual consumption per capita		Annual GDP per capita	
	GWh/y	%	kWh/y/hab	%	Euros (€/hab)	%	GWh/y	%	kWh/y/hab	%	Euros (€/hab)	%
2008	2'851	-	6'289	-	88'037	-	58'728	-	7'625	-	61'368	-
2009	2'853	0.1%	6'235	-0.8%	84'048	-4.5%	57'495	-2.1%	7'385	-3.2%	59'218	-3.5%
2010	2'886	1.2%	6'222	-0.2%	86'805	3.3%	59'786	4.0%	7'597	2.9%	60'580	2.3%
2011	2'860	-0.9%	6'124	-1.6%	86'246	-0.6%	58'600	-2.0%	7'367	-3.0%	61'623	1.7%
2012	2'872	0.5%	6'105	-0.3%	86'682	0.5%	58'886	0.5%	7'325	-0.6%	61'675	0.1%
2013	2'837	-1.2%	5'960	-2.4%	87'769	1.3%	59'270	0.7%	7'284	-0.6%	-	-
2008-13		-0.5%		-5.2%		-0.3%		0.9%		-4.5%		

Non-energy benefits

Socio-economic impacts

Since it was launched, éco21 supported around 3500 energy-efficient actions. The total cost was about 35 M€, from which 50% (about 16 M€) were distributed to project owners in order to overcome financial barriers²⁸. As for each project, the financial incentives of éco21 represents about 20% of the total investment cost, we assume that around 80 M€ were spent on energy efficiency from 2007 to 2014, due to éco21 plans. Assuming that the ratio between material supply and working hours is about 50/50, around 40 M€ were payed to Geneva's companies, mainly to SMEs. The

²⁸ A PhD thesis research started in May 2014 at the University of Geneva on this subject. The PhD student will precisely assess the economic impact of éco21. The values given in this section are approximations and are presented to get an idea of the effect of such a program on local economy.

corresponding full-time equivalent jobs potentially created or retained in the private economy is then about 35, with 15 additional jobs of the éco21 team in SIG.

The investments and the jobs generated also induced tax incomes both for local and federal governments. The amount of these taxes has to be established by the University of Geneva. An estimation was done by éco21 and gave around 11 M€ in the period from 2007 to 2013, so about 1.6 M€ per year in average.

Furthermore, in this period, éco21 gave or supported numerous trainings (more than 730 are planned for 2014) to Geneva's skilled workers (electricians, heating craftsmen, etc.). The direct impacts are difficult to assess but a general improvement in project quality is noticed by the local authorities. A movement towards energy efficiency is growing in some companies, with some of them focusing on more efficient technologies (renewable energy for heating, intelligent lighting, etc.), as most of them were widely conservative and only used traditional solutions before.

Impacts for SIG

The satisfaction level of SIG's customers increased within éco21 development. Today the brand éco21 is known and appreciated by 58% of our clients and is Nr1 of all SIG's brands²⁹. In 2009 59% of our clients said that SIG was involved in energy efficiency, today 91% say it. Customers in total are 65% extremely and very satisfied by SIG and this indicator rises if the customer feels accompanied. The clients who feel a strong partnership on energy efficiency are 25% more satisfied: an important driver to reinforce loyalty of our clients and a strong differentiation advantage in a context of market liberalization.

As swiss electricity market could be completely liberalized by 2018, éco21 provides a pertinent illustration of SIG environmental engagement, and allows customers to considerate their global energy costs – including energy savings - rather than focusing on the kWh price itself, for which other companies could have cheaper offers.

éco21 also presents an impact on internal change management, as an increasing part of the employees support the new orientations of the company strategy. éco21 initiatives, as well as other investments in renewable energies (wind energy, solar energy, geothermic), gradually change SIG's branding, supports a pride feeling among the employees and reinforce the attractiveness of SIG as an employer.

However, the activity of éco21 also induces coherence interrogations between different activities of SIG, as the program is at the same time an element of Geneva's public energy strategy – and then viewed as a public initiative – and a way for SIG to improve its positive image for the public.

Key success factors

Some of the major features that have probably made éco21 a success from SIG point of view are given below.

Credibility and notoriety of SIG

For a century, SIG has been Geneva's only and public utility in the energy sector. The population trusts SIG when talking about energy, recognize the services quality and the company commitment on environmental issues. General confidence is here a central issue, as a DSM program success is linked to its capability to change habits and reassure customers and professionals regarding new technologies.

²⁹ Source : SIG customers satisfaction surveys (not public)

Positioning as a facilitator

To gain this confidence, the DSM program management needs to show a credible independence and a recognized neutrality relative to the market. Promoting heat pumps is not credible when the company acts as a heat pumps manufacturer or installer.

Implication of energy professionals at all levels

Private energy professionals are really key actors and should be involved upstream, at a very early phase of program design. They know the market and can provide key explanation of barriers or constraints that must be addressed. They often act in front office with final users, and have to be convinced to ensure the program success. DSM program should then network professional associations, arguing that they are particularly interested in its success, as these are business opportunities for them.

Market-oriented program design

Program should provide simple and plug-and-play solutions, as many customers are ready to undertake energy efficiency measures, but few of them will take proactive initiatives. Program design should be meant to limit their implication as far as just saying “Yes”... Program should also include other advantages for customers as a guarantee for them to comply with their legal obligation by joining the program, in order to avoid to manage with quickly changing and complex regulations.

Conclusions

At a local scale, éco21 shows a taste of how a greener economy could develop in Europe in the next years. After the first five years, éco21 shows interesting results although initial objectives could not be achieved. The program design and the growing implication of both public and private sectors suggest that its orientations were adapted to Geneva’s context.

Even if éco21 was first initiated by a political will from the local authority, SIG quickly adopted the approach and developed it voluntarily. A rapid evolution was observed, with éco21 becoming soon a main feature of SIG’s strategy and identity. Furthermore, a macroeconomic overview quickly shows that investments in energy efficiency are certainly more valuable than tariffs reduction.

In addition, it is notable that energy savings stimulate the local economy and create or retain local jobs. Moreover, it stimulates internal cohesion by joining forces around a strong company’s project, and reinforces SIG’s image and visibility from an external viewpoint, developing the customer attachment.

To sum up, the éco21 experience proves that local utilities can play an important role to achieve a massive activation of energy efficiency resources. This new role should be enhanced with new framework conditions defined by the authorities. This can be a strong contribution to drive society toward energy transition.

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