

SWITZERLAND

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1. OVERVIEW OF THE REGION

Characteristics of the Region

International importance and local independence, economic dynamism and congeniality, passion and pragmatism, cultural and scenic variety, the bundled energy of the metropolis and the blissful peace of unspoilt nature: these contrasting qualities are hallmarks of the Canton of Zurich, which regularly receives top rankings in international quality of living surveys (AWA, 2010).

Zurich is a canton of Switzerland. Whereas Switzerland per se is already a small country, it is a Confederation comprising as many as 26 member states, i.e. the cantons. Some areas, such as defence and foreign policy, are in the hands of the Confederation. Other areas, such as infrastructure and education, are within the remit of the cantons. The communes (municipalities) are the smallest units. Just like every modern state, the Canton of Zurich has three levels of authorities: The (executive) government, the (legislative) parliament, and the (judicial) authority.

The Canton of Zurich has a population (as of 31 December 2012) of 1,406,083 and covers an area of 1,729 km². The canton is located in the North East of Switzerland (north of the Alps) and the city of Zürich is its capital. Its neighbouring cantons are Schaffhausen to the north, Aargau to the west, the cantons of Zug and Schwyz to the south and the cantons of Thurgau and St. Gallen to the east. Cantons

cooperate on inter-cantonal issues. The official language is German. Most of the land is cultivated, but the canton of Zurich is not considered as an agricultural area. The lands to the north and east are more agricultural, but in every part of the canton manufacturing predominates. The canton of Zurich is noted for machinery. Silk and cotton weaving were important in the past, but have now ceased to be of importance. There is a large paper industry. Small and middle sized companies are important contributors to the economy of the canton of Zurich. The city of Zürich is a major banking centre, and insurance is also of importance.

As of 2011, Zurich had an unemployment rate of approximately 3% and a GDP of €75,078 – per capita.

Energy demand and supply of the Region

The Statistical Office is the Centre of Excellence for public statistics in the Canton of Zurich. Following key data on energy consumption in the Canton of Zurich is taken from its Statistical Yearbook 2012, the share of energy sources for electricity production is provided by the Swiss Federal Office of Energy in 2011 and all information is valid for the year 2010:

- total energy consumption (including domestic, commercial, industry, transport): 38.8 TWh total energy consumption; 9 TWh electric power (not itemised by users);
- total energy consumption by fuel (%): 6.174 TWh – approximately 42%;
- share of energy sources for electricity production (%).

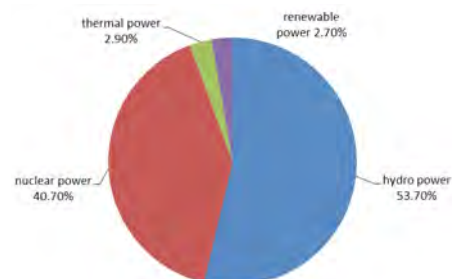


Figure 1 – Distribution of energy sources for electricity production in the Canton of Zurich

The GHG emissions per kWh delivered electricity from grid (low voltage) for the year 2009 amounts to around 0.024 kgCO₂eq/kWh for the Swiss power generation (Frischknecht et al., 2012). Imported electricity of unknown origin (approx. 80%) as well as power from known sources (produced in fossil-thermal power stations, approximately 10%) from outside Switzerland are responsible for a major contribution towards the national GHG emissions of 6.05 tonnes per person and year. Specific energy related technologies present in the region are: Hydropower, Solar, Biomass, District heating (Waste), Geothermics.

2. CURRENT SITUATION: TARGETS RELATED TO ENERGY POLICY

The long term energy policy of the Canton of Zürich aims on maintaining respectively enabling a high, but eco-friendly standard of living. By 2050 CO₂ emissions are to be reduced from today's levels of 6.05 tonnes per person and year down to 2.2 tonnes.

By 2034, all remaining nuclear power plants in Switzerland, some of which are the oldest in Europe, will be taken off the grid which is in accordance with the new political decision taken by the Swiss Federal Council in the wake of the Fukushima disaster. The overall target is therefore to transform the energy supply from nuclear and hydropower based to a more sustainable, renewable one. Security of supply is often identified as one of the principle challenges in this context. For all these aspects, support and promotion of innovation beyond R&D is of key relevance as well.

Part of the efforts lie in replacing fossil fuel energy sources with renewables and promotion of energy efficiency measures. These goals are to be achieved by means of a domestically generated, sufficient and reliable energy supply with economical competitive pricing.

Transforming the European energy system is imperative for reasons of climate, security and the economy. The European Energy 2020 strategy underlines the need to rebalance energy actions in favour of a demand-driven policy, empowering consumers and decoupling economic growth from energy use. In this respect, increased energy efficiency and higher shares of renewable energy sources are in line with the Swiss energy policy.

Other Regional targets, barriers and drivers

The 2000 Watt Society is the vision of a society in which the world's raw materials are used in a sustainable and fair manner. Spreng et al. (2001) outline this vision not as waiving of today's life-standard and comfort, but the facilitation of a modern lifestyle based on technological solutions, management concepts and social innovations, which increase energy efficiency.

In comparison with the rest of the EU, energy prices in Switzerland and in the Canton of Zurich are very moderate. These prices are, among other factors, possible due to lucrative energy trading (pump storage power plants) and favourable contracts with neighbouring countries, particularly France. With the expiration of these contracts by 2020 and a general increase of the energy demand, electricity prices are likely to rise.

In addition, the liberalisation of the Swiss electricity market is only a matter of time because the EU presupposes this step if Switzerland wants to participate in future in energy trade. As mentioned earlier, the remaining nuclear power plants are to be de-commissioned by the year 2034. This framework is likely to promote and support the long-term energy goals in Switzerland and respectively in the Canton of Zurich, but at the same time it also poses new challenges with respect to the gradually rising energy demand.

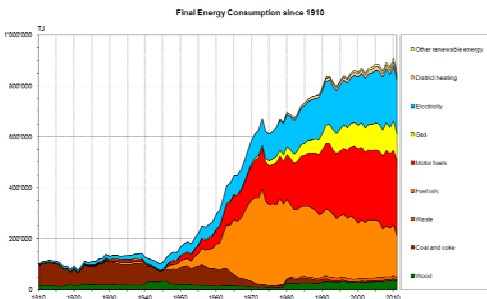


Figure 2 – History of the final energy consumption in Switzerland since 1910 (www.bfe.admin.ch).

Another possible obstruction for these goals might be the fact that the Canton of Zurich is one of the shareholders of the AXPO Group, a major power utility company in Switzerland. Technical innovation is expected in the areas of photovoltaics and wind energy. MINERGIE® is a sustainability brand for new and refurbished buildings. It is mutually supported by the Swiss Confederation, the Swiss Cantons along with Trade and Industry and is registered in Switzerland and around the world. Specific energy consumption is used as the main indicator to quantify the required building quality. In this way, a reliable assessment can be assured. Only the final energy consumed is relevant within the assessment. An increase of renewable energies as well as of energy efficiency is expected due to efforts made by the new energy policy “Energy Strategy 2050”.

Mobility related energy consumption is a significant part of the total energy demand. The effectiveness of the mobility system is at the same time recognised as an important condition for the economic development of an area. The mobility strategies in the Canton of Zurich in general and in the city of Zurich (the centre and key traffic generator of the canton as well as of the whole Switzerland) are based on a two-level approach. A very strategic and rather softly defined “top down” approach, combined with a rather simple, still coherently implemented, “bottom up” approach. The idea is to disaggregate the main “problem” defined by the long-term vision into more manageable, sometimes very local climate-friendly mobility measures. The sum of little steps in the right direction will result in a big step towards the main goal, among them are:

- bicycle promotion programmes in the cities;
- extension of the transportation services (ZVV) and infrastructure;
- car Sharing (Mobility);
- measures and means to support non-motorised traffic in urban areas including parking fees and penalties.

An example for bicycle promotion programmes are for instance efforts made in Zürich (Züri rollt) or discussions held in Winterthur for the introduction of a “Bicycle Highway”.

The Canton of Zurich recognises that mobility plays a leading role in the efficient development

of the built environment of the area. At the same time it states that the traffic shouldn't be seen as an independent problem but on the contrary, land-use and landscape planning should be synergically used to model mobility demand and habits.

The canton of Zurich is characterised by a very dense public transport network characterised by an effective combination and integration of mid and long-term systems including train, regional train / S-Bahn with short distance diffused distribution systems, local buses and trams. The actual planning tools and instruments (agglomeration program, parking policies, etc.) clearly push the development further in this direction. This results in a rather constant growth of the public transport passengers flows. The trend is clearly readable by the analysis of the traffic flows towards the centre of the canton (the city of Zurich) where the regional train passenger flows show an increment of about 220% in 20 years, whereas the car traffic on the same direction remained more or less constant.

Switzerland has one of the highest broadband penetration rates in Europe (allowing in 2012 for 85% of households with access to Internet). Broadband access replaced dial-up telephone communications as the main growth area, and Digital Subscriber Line DSL networks have overtaken cable Internet access as the principal technology for broadband access. Strong growth in mobile broadband has added to the mix.

Innovative strategies/initiatives

In Switzerland, the 2000 watt society is on top of the agenda as a vision enabling the implementation of best practices in sustainable building design, construction and operation (in line with BREEAM for instance). The concept addresses not only personal or household energy use, but the total for the whole society, divided by the population.

The vision of the 2000 Watt Society calls for a continuous reduction in energy needs to 2000 watts per person. This target should be achieved as quickly as possible. By the year 2050, the amount of fossil energy sources can be cut in half from the current figure of 3000 watts to 1500 watts per person. There are

good reasons for the extended time horizon: the change requires rigorous adjustment of the infrastructure and an intelligent lifestyle (cf. Novatlantis, 2011), otherwise the 2000 watt society will remain merely a vision.

Another interesting approach having an impact on a regional scale is the smart city concept being not only multi-dimensional but also future-oriented in tackling energy consumption and CO₂ emissions. It follows an urban development strategy whereby focussing on how (Internet-related) technologies enhance the lives of citizens, empowering them for contributing to urban change and realising their ambitions.

CASE STUDY: WINTERTHUR

According to Caragliu et al. (2011, p. 70) a city can be declared “smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance”.

Promoted by Smart City Switzerland, a process has been initiated in the City of Winterthur bringing all relevant stakeholders (from the local administration, energy supplier, NGO and universities) together in order to identify potential areas of application, in which lighthouse projects (such as innovative living and mobility concepts, load shift approaches, infrastructure sharing systems, that have the potential to inspire adopters of these concepts) shall be developed to finally be successful implemented with the aim of reducing energy consumption (cf. Carabias et al., 2014).

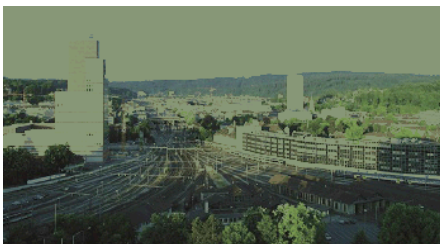


Figure 3 – Photo of the city of Winterthur
(source: www.statistik.zh.ch)

The city of Winterthur covers an area of 68.1 km² and counts in 2012 a population of 104,366.

Smart City Switzerland (www.smartcity-switzerland.ch), mandated by Swiss Federal Office of Energy, managed to bring together local stakeholders: different departments of the city of Winterthur, the local energy supply utility (Stadtwerk), the ZHAW Zurich University of Applied Sciences, local associations, as the regional energy cluster, local companies and real estate developer.

The energy supply in Winterthur is managed by “Stadtwerk Winterthur”, the local utility, owned by the municipality. Electricity in Winterthur still comes mainly from nuclear (57%) and hydropower (23%); 19% is generated in the local waste incineration plant and 1% by photovoltaics. The city of Winterthur bears since 1999 the label “Energierstadt” (European Energy Award), which was received from the Association “EnergieSchweiz für Gemeinden”. The label is a performance record for municipalities which take steps to convert their municipal energy policy into a more sustainable one. Measures include for instance promotion of renewable energies, eco-friendly mobility and efficient exploitation of resources. Thanks to these efforts, primary energy consumption and CO₂ emissions in Winterthur today are already lower than the Swiss average. The reason is mainly a good system of public transport and a high percentage of heat and electricity produced by the public waste incineration plant. But a few years ago the inhabitants of Winterthur voted for the target of a 2000 watt society to be part of the constitution.



Figure 4 – Elements of the smart city concept as elaborated in Switzerland
(source: www.smartcity-schweiz.ch).

Objectives and methods

The current political umbrella strategy of the city of Winterthur is to move towards a 2000 Watt Society (and a 2-ton-CO₂-society respectively) by the year 2050, which will require a reduction in energy consumption by a factor 2 to 3. In addition, in 2011 it was decided at federal level to phase out nuclear electricity at the latest by 2034. Both strategic decisions will require the promotion and enforced implementation of alternative and renewable energy sources such as hydropower, solar energy, wind energy, geothermal energy etc. The path towards a 2000 watt society is described in the energy concept for 2050 ("Energiekonzept 2050"). In the following three major fields measures have to be taken.

Retrofitting of buildings and implementation of heating and cooling systems based on renewable energy sources (e.g. enlargement of existing district heating system); Improving the efficiency of electrical appliances, improving efficient use of electrical appliances (e.g. pilot study with smart meters and feedback started 2012), ICT-based information systems to enable sharing of transport vehicles and other appliances, ICT-Tools and infrastructure to increase comfort of bicycle use (e.g. parking guidance system, bicycle fast lanes).

Long term focus

Lighthouse projects in the City of Winterthur will tackle issues at the intersection of the transport, energy and ICT sectors. They should forge strong partnerships with local leaders and municipal authorities to gain the vital support and visibility necessary to engage and empower citizens and local stakeholders to reduce greenhouse gas emissions and energy consumption and more widely to improve inhabitants' living conditions.

Results

The Smart City Winterthur initiative is considered as Swiss partner in a tri-national DACH cooperation together with Karlsruhe (Germany) and Salzburg (Austria). So far six meetings have been held in Winterthur and the identified ideas for lighthouse projects have been clustered into promising implementation fields: mobility (i.e. electro-mobility, car-sharing, cycling), buildings (i.e. multi-generation houses,

smart retrofiting), power supply management (i.e. load management, behaviour change, patterns of energy consumption, energy hub). The DACH cooperation is intended to facilitate the exchange of knowledge and experiences towards energy efficient cities. First meetings between these three cities have shown many common topics and a huge potential to learn from each other.

Outcomes

So far, relevant stakeholders for transforming Winterthur into a Smart City have come together to form a working group, where potential lighthouse projects shall be identified with the aim to start their implementation in 2014. Further results are not yet available. Leading a smart city initiative requires a comprehensive understanding of the complexities and interconnections among social and technical factors of services and physical environments in a city. In Winterthur an important driver is that current activities (towards a smart city) are in line with the national energy efficiency directives, with the local energy masterplan as well as with research being undertaken at ZHAW Zurich University of Applied Sciences. Furthermore, the support of the local government could only be secured by confirming that no additional financial burden would approach the city of Winterthur by joining the DACH initiative on Smart Cities. On the contrary, the planned lighthouse projects shall be supported by the Swiss Federal Office of Energy.

In the current times of economic crisis, the city of Winterthur has lost important income necessary to support the activities of the local administration. Therefore, several administrative units have to reduce their activities and it is very difficult to initiate new ones. More effort had to be made to explain the long-term benefits of Smart City initiatives.

Technological innovation is a means to smart city, not an end. IT is just a facilitator for creating a new type of innovative environment, which requires the comprehensive and balanced development of creative skills and innovation-oriented institutions. The specific ICT-Tools will be developed in the projects itself.

Systematic interactions have been established on several levels. The www.smartcity-switzerland.ch platform is coordinating on behalf of the Swiss Federal Office of Energy the promotion of Smart City activities as lighthouse projects. In this context, the Smart City Winterthur initiative has enabled more regular meetings between relevant local stakeholders, such as energy, environmental, and city development departments, local energy supplier, NGO and research institutions. Furthermore, Karlsruhe and Salzburg will exchange information with Winterthur (DACH).

4. CONCLUSIONS

The smart city can be seen as the engine of transformation at regional level, a partnership with the objective to catalyse progress in areas where energy production, distribution and use; mobility and transport; and ICT are intimately linked and offer new interdisciplinary opportunities to improve services while reducing energy and resource consumption. The city is viewed as an integrated energy system, where space and energy planning converge, including coordination with energy supply and demand, energy efficiency in buildings and mobility at regional level. In this respect, the following potentials of the case study are promising for the whole region: reduction of energy consumption / emissions, extension of activities to whole region / other buildings types / sectors (comparison to the “Energy supply and demand of the region”).

The promoter of this project is Smart City Switzerland, which is part of a whole set of energy initiatives regarding communities and regions. Among them there is also a program “Energy Region”, which is being established at the moment. Results and lessons learnt from the Smart City project in Winterthur will certainly be integrated in the “Energy Region” concept. Furthermore it is essential to integrate also the region around the city. For example people from around the city, who are commuting to the city, have to be involved in mobility concepts. Smart energy production and storage schemes have to be created in collaboration with the surrounding communities, as they have other (natural) resources available. Only the intelligent

combination of different resources and services can lead to a smart city and therefore to a smart region.

The overall project targets are: i) developing and testing innovative solutions for integrating technical systems to improve energy efficiency while considering societal and economic constraints, ii) implementations of projects to interlink technologies and socio-economic structures in the areas of buildings, mobility, supply and disposal structures, and communication, iii) promotion of know-how and synergies between different stakeholders, iv) exchange of experiences and best practice examples among participants; v) development of participatory processes to realise a “smart project”; vi) information, awareness raising, and activation of the public.

The Smart city initiative aims at accelerating the deployment of innovative technologies, organisational and economic solutions to significantly increase resource and energy efficiency, improve the sustainability of urban transport and drastically reduce greenhouse gas emissions in urban areas. The purpose of lighthouse projects is to demonstrate good practices with regards to energy efficiency efforts and increase of renewable energy. It is therefore explicitly desired and envisioned to have a transfer of the case studies to other regions. As a large part of the region of the Canton of Zurich has an urban character, there is a large potential for knowledge transfer.

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