

Energy Issues in Building and District Assessment Schemes and Benchmarking Systems

Matthias Haase

(Prof. Dr. Matthias Haase, ZHAW, Am Gruental, Waedenswil, Switzerland, Matthias.haase@zhaw.ch)

1 ABSTRACT

In the Canton of Zurich an increasing number of customers in their business area for building energy solutions have been identified who have their properties certified with sustainability systems. They have to create regular reports or use benchmarks to optimise their properties with regard to energetic aspects.

A large amount of detailed information is available on the use and differences of rating and certification systems. For stakeholders in the energy market sector, however, it is important to have the necessary information available on energy monitoring data and GHG (greenhouse gas) emission reporting for value creation. One promising concept is the 2000-Watt-Area.

A 2000-Watt-Area (200WA) is a new form of settlement. It has achieved a reputation for energy efficiency, renewable energies and climate friendliness and reflects the values of a responsible society.

In this work we try to find answers to the following questions:

- Which evaluation criteria are the basis for the 2000WA?
- How much can these urban areas lower their GHG emissions?
- What role do the instruments of energy efficiency and renewable energies play in this?
- What is the relationship between these and what statements can be made with regard to mobility?
- How can the Facility Manager help to transform successfully into 2000WA?

The paper is based on literature research and three interviews with stakeholders in the Swiss construction sector (a district representative, an energy consultant, a technology provider). The findings qualify the concept of 2000WA and put it into a wider international context of certification and benchmarking systems.

It was found that 39 2000WA are in operation, implementation and transition in Switzerland. From the experience gained from these districts it can be seen that the 2000WA concept is trying to include important aspects of a sustainable transition of districts. While many districts were new developments (34), only 5 were districts in transformation. The number of districts in transformation need to increase considerably if the GHG emission reduction goals in Switzerland are to be met. Facility managers can play an important role in this transition. But they need to enhance their skills and responsibilities in order to fulfil their roles as transition managers. Evaluating the 2000WA can be a key to this and has the potential to enhance the reduction of GHG emissions in districts and cities.

Keywords: 2000-Watt-Site, benchmarking system, certification system, energy monitoring data, greenhouse gas emissions

2 INTRODUCTION

2.1 Renovation and transformation

Climate change challenge the ambitious goals that regulators have put in place by setting more and more aggressive building and community energy-related requirements based on the Sustainable Development Goals of the UN. The concept of Energy Master Planning (EMP) can help to initiate a better planning and implementation process to fulfil these goals. In the EU, reaching for the climate gas reduction goals of the Paris Agreement, stakeholders on all geographical and organisational levels from nations, regions, cities and communities are challenged. Following bottom-up approaches for energy planning on the neighbourhood level is a promising attempt to reduce energy demand, increase energy efficiency and lower the carbon footprint in a multi-stakeholder approach.

In the context of the 2012 EU directive (EED 2012), several important measures have been adopted throughout the EU to improve energy efficiency. These include national long-term renovation strategies for the building stock in each EU country, mandatory energy efficiency certificates accompanying the sale and rental of buildings, the preparation of national energy efficiency action plans (NEEAPs) every three years,

minimum energy efficiency standards and labelling for a variety of products, as well as obligation schemes for energy companies to achieve yearly energy savings of 1.5% of annual sales to final consumers. However, Member States have yet to fully implement the Directive and additional support in building capacity and know-how is needed (EPBD 2018). Significant additional energy savings, reduced emissions, and increased energy security can be realised by considering holistic solutions for the heating, cooling and power needs of communities, on neighbourhood and district scale, comprising collections of buildings. As a result, considerable literature has become available including both guidance and assessment tools aimed at EMP at the neighbourhood and district level as e.g. campuses (DOE 2013; Huang et al. 2015; EnergyPlan 2019; BREEAM 2019; DGNB 2018). But the existing guidance and tools do not seem to be fully solving the challenges. The energy planning consists in determining the optimal mix of energy sources to satisfy a given energy demand. The major difficulties of this issue lie in its multi scales aspect (temporal and geographical), but also in the necessity to consider the quantitative (economic, technical) but also qualitative (environmental impact, social) criteria (Schiefelbein et al. 2017).

In order to be able to apply principles of a holistic approach to neighbourhood and districts, often coined community energy planning in the literature, and to provide the necessary methods and instruments to master planners, decision makers, and stakeholders, it is essential to identify and frame the constraints that bound the options towards an optimised energy master planning solution (Haase and Lohse 2019). Existing master planning guidance available indicates that identifying and establishing project goals is a critical first step (Jank, 2017).

In a new initiative of the European Commission, Positive Energy Districts are envisioned as "are energy-efficient and energy-flexible urban areas or groups of connected buildings which produce net zero greenhouse gas emissions and actively manage an annual local or regional surplus production of renewable energy. They require integration of different systems and infrastructures and interaction between buildings, the users and the regional energy, mobility and ICT systems, while securing the energy supply and a good life for all in line with social, economic and environmental sustainability." (JPI UE 2020).

In many cities, the necessary legal and strategic frameworks for the realisation of PED/PENs are not yet in place. Very often, there is also a lack of a planning culture in city administrations or the personnel resources available might be insufficient. In particular, the transformation of large (brownfield) areas to climate neutral city districts has a big potential for the development of PED/PENs but needs cooperation between administration, industry, and research. Especially in case of heterogeneous ownership structures, cooperative planning processes are indispensable. Far less common in EMP guidance and related literature is information on the identification of constraints that limit energy technology options and how stakeholders influence the decision-making process. Literature in this area mentions options analysis or prioritization, or optimization analysis (EED 2012; Jank, 2017; Fox 2016; Zhivov et al. 2014; Robinson et al. 2009), yet, options analysis or optimisation is clearly influenced by project energy-related constraints. Sharp et al. (2020) compared EMP in several countries and analysed these constraints (Sharp et al. 20120). The results show that successful energy master planning is highly dependent on a thorough understanding of framing goals and constraints, both local and regional, and their associated limitations that will dictate the optimum master planning design. Haase and Baer (2021) pointed out that as more and more countries push to improve energy efficiency, environmental impact, and the resilience of their buildings and neighbourhoods, the need for early and comprehensive energy master planning on neighbourhood and district level is critically important. In addition, certification schemes could help to enhance the improvement of our cities and districts.

Therefore, it was interesting to explore what has been developed in Switzerland (Energie Schweiz). In particular, the concept of the 2000-Watt society seems a valuable contribution to the discussion of further implementation of PEDs.

2.2 2000-Watt-society

The 2000-Watt Society is a vision for a liveable future (2000-Watt-Society). People in such a society care for a high quality of life that meets the goals of sustainability. They appreciate the resources the earth provides, use them sensibly and share them equally around the globe. The 2000-Watt Society gathers interested people who know that quality of life is not inextricably tied to a constantly higher material standard of living. This vision is based on the view that a future society should represent a sustainable and socially just society. For every person on earth, 2000 W of continuous power (primary energy) are available. This must be enough to

ensure prosperity and a high quality of life. Today, the primary energy consumption per capita worldwide is on average 2500 W – with enormous country-specific differences. At present, each Swiss inhabitant uses about 4700 W. The CO₂ emissions caused by this level of energy consumption must not exceed 1 tonne per person per year (2000-Watt-Society).

Thus, drastic climate change can be actively counteracted. The goals of the 2000-Watt Society are scheduled to be met between the years 2050-2100. A rescheduling of these goals towards 2040-2050 is currently under development. One tool to achieve this vision in by the introduction of a certification scheme, 2000-Watt-Sites. This certification scheme is in place since 2008 and thus some experiences could be gained already.

2.3 2000-Watt-Sites

The development of districts requires a distinct understanding of the situation now as well as a vision of the future district to be able to develop suitable pathways for this transition. In order to be able to do that a district needs to be modelled that consists of several buildings, sufficiently described so that the future district can actively manage their energy consumption and the energy flow between them and the wider energy system. The energy master planning process requires an analysis of different scenarios, which include new construction to different levels of energy efficiency, major renovation of all or some buildings comprising building stock under consideration with Deep Energy Retrofit of these buildings, minor renovations with energy-related scope of work, or demolition of some old buildings. Such analysis requires building energy modelling.

A 2000-Watt-Site (200WS) is a new form of settlement (2000-Watt-Areal, 2000-Watt Areal in transition). It has achieved a reputation for energy efficiency, renewable energies and climate friendliness and reflects the values of a responsible society. The core idea of the 2000-Watt Site is an ongoing evaluation process of a site's sustainability in terms of energy in development, planning, implementation and operation. Certificates are issued for a limited time period and must be renewed periodically. They are awarded in two stages: As a «site under development» until at least half of the total living space is in use, and after that as a «site in operation» (2000-Watt society, 2000-Watt Areal in transition).

The 2000-Watt Site certificate creates added value for all stakeholders – for investors, planners, users, law enforcement agencies and authorities: users enjoy a high standard of housing and living. They can live with the assurance that they are contributing to resource conservation and climate protection. Investors and owners are interested in value-preserving sites offering a high quality of living and working. The quality characteristics are useful for marketing and image-building. Due to the high level of acceptance, cooperation with authorities is much easier. It helps local municipalities to bring their concerns to bear at an early stage. The certificate is a guarantee of successful commercial implementation of their energy and climate-policy goals.

2.3.1 Criteria used in 2000-Watt-Sites

The subject areas of the criteria for evaluation of 2000-Watt-Sites are shown in Table 1. In the management system subject area a maximum of 110 points is possible, followed by the subject area site utilisation and urban planning with 100 points. In the subject areas buildings and mobility 90 points can be achieved, while in the subject areas communication, cooperation, participation an supply and waste disposal a maximum of 70 points can be achieved.

Subject area	Max. pts.
1. Management system	110
2. Communication, cooperation, participation	70
3. Site utilization and urban planning	100
4. Supply and waste disposal	70
5. Buildings	90
6. Mobility	90
Site total	530

Table 1: Subject areas of the 2000-Watt-Sites.

2.3.2 Research question

In this work we try to find answers to the following questions:

- Which evaluation criteria are the basis for the 2000WS?
- How much can these urban areas lower their GHG emissions?
- What role do the instruments of energy efficiency and renewable energies play in this?
- What is the relationship between these and what statements can be made with regard to mobility?
- How can the Facility Manager help to transform successfully into 2000WS?

3 METHODS

The paper is based on literature research and three interviews with stakeholders in the Swiss construction sector (a district representative, an energy consultant, a technology provider). The findings qualify the concept of 2000WS and put it into a wider international context of certification and benchmarking systems.

3.1 Literature review

There are several publications about 2000-W-Society and 2000-W-Sites available (2000-Watt-Society; Energiestadt 2021a, Energiestadt 2021b, Energiestadt 2021c). However, most of the literature is in German only. The 2000-Watt-Society published a number of documents that are downloadable from their website.

The programme “Energieforschung Stadt Zürich» (energy research of the city of Zurich) has conducted extensive accommodated research of all 2000-Watt-Sites that were realised in the city of Zurich in the past 15 years. Energy Research City of Zurich was a ten-year programme and focused on topics at the interface between social science research and the application of new or existing efficiency technologies, which are particularly interesting in an urban context. Focus was put on application-oriented research for more energy efficiency and renewable energies (Stadt Zurich, Stadt Zurich and ewz, SIA380). The research results and findings are generally publicly available and are available to all interested parties so that the City of Zurich Energy Research has the greatest possible impact - also outside the city of Zurich. Research has been carried out in two subject areas.

The topic of households started with the residents of the city of Zurich, who consume energy at home, at work and on the go and, as decision-makers, play a central role in the implementation of the 2000-Watt society in many respects. In particular, social science aspects that promote or prevent conscious use of energy were examined. In field trials with households in the city of Zurich, it has been investigated which obstacles in the city of Zurich are relevant in everyday life and which measures are used to overcome them.

The topic of buildings started with the building infrastructure, which is responsible for around 70 percent of the final energy consumption in the city of Zurich (Stadt Zurich). In scientifically designed and accompanied implementation projects, renovation strategies for buildings were developed and implemented together with the owners and other decision-makers in order to make a significant contribution to the renovation and renewal of the building fabric in the city of Zurich (Stadt Zurich). The focus was put on increasing energy efficiency in the heating sector and minimising electricity consumption. In addition, there exist a number of certification schemes in Switzerland (NNBS 2018), including the system of the Swiss Council for Sustainable Building (SGNI).

3.2 Interviews

The first interview was conducted in March 2021 a district representative near Winterthur, in the North of Zurich. The district consists of 51 living units in 8 row houses. The whole district was constructed in the 1970s and is due for retrofitting. The energy supply system was due for renewal a couple of years ago and in 2018 the oil boiler was renewed. This was a lost opportunity for a comprehensive energy retrofit and the interview was focusing on the process, the incentives and professional support from industry.

The second interview was conducted in April 2021 with an energy consultant in the south of Zurich.

The third interview was conducted in May 2021 with a technology provider from a Swiss certification body. The interview was focusing on the tools and incentives in the Swiss market. The certification that forms the basis for the 2000WS was critically discussed with the interviewee.

4 RESULTS

It was found that 39 2000WS are in operation, implementation and transition in Switzerland. From the experience gained from these districts it can be seen that the 2000WS concept is trying to include important aspects of a sustainable transition of districts. While many districts were new developments (34), seven of these sites are in operation, while additional five districts were in transformation.

4.1 In operation and transformation

Table 1 summarises the 2000WS which are in operation or in transformation. A total area of 101265526m² is covered, certification was registered between 2017 and 2021. The areas can be found in Bern, Lenzburg, Zurich, Chur, Winterthur, Oberkirch (LU) and Lausanne.

Site	Location	Certification	Area size (m ²)	Achieved	Further information
«Erlenmatt West»	Basel	2017 (re)	25 600	66%	http://erlenmatt-west.ch/
«Stöckacker Süd»	Bern	2020 (re)	1 750 000	74%	http://www.stoeckackersued.ch/
«Burgunder»	Bern-Bümpliz	2017 (op)	7 660	61%	https://www.npg-ag.ch/projekte/siedlung-burgunder/
«Im Lenz»	Lenzburg	2018 (re)	61 400	63%	https://www.imlenz.ch/de/home
«Freilager»	Zürich	2018 (re)	7 050 000	74%	https://freilager-zuerich.ch/
«Hunziker Areal»	Zürich	2021 (re)	41 000	91%	https://www.mehralswohnen.ch/
«Kalkbreite»	Zürich	2021 (re)	6 393	89%	https://www.kalkbreite.net/
«Sihlbogen»	Zürich	2021 (re)	2 100 000	89%	https://www.bgzurlinden.ch/home
«City West»	Chur	2020 (tr)	26 500	57%	https://www.citywest-chur.ch/
«AXA»	Winterthur	2019 (tr)	32 000	63%	https://www.rwpa.ch/axa-gebaeude-g
«Campus Sursee»	Oberkirch LU	2019 (tr)	142 065	67%	https://www.campus-sursee.ch/2000-watt-areal/
«UNIL Dorigny»	Lausanne	2019 (tr)	90000000	65%	https://www.unil.ch/index.html
«Campus Mythenquai»	Zürich	2019 (tr)	22 908	68%	https://www.swissre.com/about-us/our-global-presence/campus-mythenquai.html

(op) in operation

(re) in operation, re-certified

(tr) in transformation

Table 2: Information about the certified 2000-Watt-Sites in operation (op, re) and in transformation (tr)

4.2 Evaluation criteria

A certification is an affirmation or a marketing strategy that companies, cooperatives, property owners or organisations adhere to specified standards or guidelines. Certification for a 2000-Watt-Site is carried out by independent certification bodies using a catalogue of criteria that must be met. The opinions and arguments for certifying or not certifying the area differ depending on the building owner. For sustainable companies, certification is a demonstration of their pioneering role. For cities, municipalities, universities and other training facilities, the role model role is completely at the centre. For settlements, certification brings further advantages, such as a certificate represents a high-quality development for the public and the community and higher rent can be charged. As fossil energies will become more expensive in the future, renewable energies and buildings will be subsidised depending on the location of the municipality or canton.

Buildings and areas can be certified after commissioning. The qualitative and quantitative requirements must simply be met and the evidence must be available. With the recertification, the quality assurance processes are periodically checked for the target direction of the area level and if so needs to be adapted to the latest development. Recertification is open to anyone interested in the new 2000-Watt area in transformation. Three sites are reported here in more detail as they were recently recertified as depicted in Table 3.



«Hunziker Areal» Zürich
Rezertifiziert 2021



«Kalkbreite» Zürich
Rezertifiziert 2021



«Sihlbogen» Zürich
Rezertifiziert 2021

Table 3: Three example sites from Zurich

4.2.1 Hunziker area in Zurich, certified in 2017

Since 2015, the cooperative has been offering more than living space for 1200 people and 150 workplaces in the north of Zurich. Several housing cooperatives joined forces and in 2007 founded the cooperative “more than living”. They had the idea of living together and to adopt new structural innovations. In 2010, “more than living” took over the 41000m² Hunziker area - once a concrete factory that was getting on in years - from the city of Zurich under construction law. In the articles of association of the cooperative it was noted that the principles of the 2000 Watt society are practiced and lived in. The value of 30kWh / m² according to Minergie-P specifications is adhered to throughout the area. The waste heat is used for heating the entire area monitored by the neighbouring city data centre. The cooperative covers 20 percent of the electricity consumption via the photovoltaic systems on the roofs. The buildings are very striking due to their diversity, which were built by five architectural teams as part of the overall urban planning concept.

A total of 13 buildings were built. The Hunziker Areal is their first pioneering work of a holistic understanding of sustainability. The cooperative provides answers to new, changed housing needs and sustainable social change.

The Hunziker area was built for a long-term living cycle with various constructions and the latest building technology. For the 370 residential units, the area offers various typologies for different needs and budgets. A wide variety of offers, e.g. from studios to cluster apartments with larger communal areas enable a high mix of residents. There are occupancy regulations in the cooperative and residents do not have a private car. In the area, people live actively with one another instead of an anonymous neighbourhood. This principle means that numerous common ground floor uses and open spaces are available to residents for free use. There they celebrate together, plant vegetables and run their own workshop. Since the area was strictly planned and later also built according to the sustainability criteria of the 2000 Watt Society, the area achieved very good values in the certification. The area is one of a total of five pilot areas that were the first to receive the label for the operation phase and are allowed to pass it on. 2000-Watt area offers living perspectives with development potential for tried and tested and new forms of living. With the incentive to be able to combine several things, such as living, working, attractive business and participation processes, and the diversity of living realities, a social, sustainable and lively quarter was created. Thanks to the sustainable, energy-saving building, the consistent use of renewable energies and innovative technologies, many resources are saved in everyday life. Above all, giving up one's own car is exemplified. This shows that it works and that the goals of the 2000 Watt society can be met. A three-year research monitoring project was successfully developed to optimise the operating values and checked with the financial help of the Swiss Federal Office of Energy (SFOE 2008).

Briefly summarised it is the vision of the cooperative to continue to adhere to the goals of the 2000 Watt society. Building energy-efficient buildings, using the latest technologies and few cars or hybrid cars support an environmentally friendly lifestyle and save valuable resources. The “more than living” cooperative attaches great importance to high-quality architecture, good quality in construction and sustainability in the maintenance of the buildings.

4.2.2 Kalkbreite in Zurich, certified in 2017

The Kalkbreite Cooperative fulfils all the necessary Minergie-P-Eco-Bau requirements in terms of energy and ecology. The building only needs a little added heat, which is generated by means of a groundwater heat pump. 15% of the electricity required is produced by the company's own photovoltaic system on the roof. Although the buildings are equipped according to Minergie-P-Eco and have a healthy ecological construction method, they have to reveal the built-in grey energy. During construction there is a need for grey energy (SIA 2032).

The building can only achieve optimal energy savings when it is in operation. They depend on how the heating is used in the apartments, how often the residents ventilate and whether the lights are left on unnecessarily. Depending on this, the hot water also plays a major role, as it has to be heated up with energy first. Mobility is classified as the second largest energy consumer in our society. Mobility needs are very individual and it is difficult to influence them with sustainability, since everyone drives what they want. Kalkbreite has taken a number of measures to enable residents to use their mobility in a more sustainable manner. Charging stations have been set up for electric cars, which are charged by the photovoltaic system on the roof.

In the Kalkbreite area, the average space consumption per person, including the share of shared space, is 33.5m². This land consumption is much lower in the cooperative than in new buildings, where it is 45m² or more per capita. Since the Kalkbreite has large building parts of 16.5m and complex corner situations, due to the location, larger apartments were created during construction which made it difficult to achieve the objectives. The heating consumes less energy than the hot water preparation. The hot water is produced with heat pumps and stored in storage tanks on each stairwell. No solar panels are needed for hot water preparation. The electricity is generated with the photovoltaic system and covers around 20% of consumption.

The heating is operated sustainably and environmentally friendly and set to a comfort temperature of a maximum of 20 degrees in living and sleeping rooms. The bathrooms are heated to 21 degrees with an outside temperature of -8 degrees. Five times less energy is used in Kalkbreite than in an average house or ten times less than in an unrenovated house built between 1960 and 1980.

That is why the usage behaviour of the residents is decisive for achieving the savings potential. Incorrect ventilation can cause apartments to cool down. Then it needs energy again to reach the normal living temperature. When the sun is shining in summer and winter, residents have to use the sun protection correctly, otherwise the apartments may overheat. Since the rooms are very well insulated, the sun can heat the rooms strongly and dissipate excess heat poorly. In summer it is important to use the shading intelligently.

The Kalkbreite Cooperative has built in comfort ventilation, which ensures a constant, low exchange of air with filtered outside air. The heat exchanger extracts heat from the exhaust air and preheats the supply air. With this comfort ventilation, residents can sleep at night with the window closed without any problems and, if necessary, open and close the windows manually. Several data such as electricity, warm, cold water, heating and waste are measured in the Kalkbreite and clearly shown in the utility bill. This means that residents can see their consumption and thus motivate them to reduce it for the next year.

In order to maintain living comfort, a glass collection point was even set up within a few walking meters. The City of Zurich will provide additional waste collection points.

Those at the desk and carrying out housekeeping are at the heart of the Kalkbreite Cooperative. They serve several purposes, such as the reception for guests of the pension and tenants of the flex rooms and are also available as a contact person for various matters of the residents and commercial tenants. On the ground floor of the building there is a bicycle parking lot, which is equipped with a practical bicycle parking space, as well as a bar and a large tram hall of the Zurich public transport organisation (ZVV). In addition, the Kalkbreite Cooperative offers a subsidised youth apartment for shared apartments for young people from 16 to 25 years of age. The cooperative is very committed to a healthy mix of families and, above all, to sustainability for the sake of the environment.

4.2.3 Sihlbogen in Zurich, recertified in 2021

With the Sihlbogen development, the Zurlinden building cooperative has created a lively centre in Zurich Leimbach. Due to the proximity of the city and nature, this area offers a high quality of living and great access to public transport. The Sihlbogen consists of three buildings on two construction sites. The two residential buildings on site B were completed in 2013 and offer car-free living. The residential and commercial development on site A was completed in 2015. Site A takes on the role of a new district centre and offers several shopping opportunities and services.

The settlement includes 220 units, which consist of family and old people's homes and studio apartments and create a good mix, which contributes to a pleasant atmosphere in the area. The three buildings were designed to be compact, resulting in low resource consumption during construction and operation.

In site A, a conventional solid construction method was used, while in site B a load-bearing structure made of wood was used. The heat is generated through several sustainable channels: pellet heating, biogas heating, air-water heat pumps and the use of waste heat. Photovoltaic panels were set up on the roofs to produce electricity for their own use. The Sihlbogen location has excellent public transport connections. As a resident, one can live well without an own car. Since the residents of site B do not have their own car, they receive a Rail-Check voucher for public transport. The 2000 Watt society relies on car sharing. Two mobility cars and one rental electric car are available on the Sihlbogen area. The residents can use a self-produced app to communicate, which supports active social coexistence.

Since the beginning, the Sihlbogen development has been planned and built according to the goals of the 2000WS. In 2015, the Sihlbogen received the 2000WS in development certificate and was later duly certified in 2017. Before recertification in 2021, the cooperative received the 2000WS in operation certificate. As in Kalkbreite, the Sihlbogen was a pioneering project in sustainable construction and commissioning.

The Zurlinden building cooperative has been committed to sustainable building for more than 10 years. The strategy of the cooperative is based on the 2000 Watt society. The SIA norm 2040 is the most important instrument for the implementation. The architecture competition was based on the specification as early as 2015. Building an object according to the 2000WS means thinking holistically and, in addition to operation and grey energy, also considering mobility (according to SIA norm 2039), waste management and building technology.

In today's construction market, innovation is in demand, new building products are being researched and developed. Sustainable, environmentally friendly criteria such as system separation, interchangeability, life cycle costs, renewable raw materials and short delivery routes are in the foreground. With renewable energy, the energy costs are minimal, so that investment costs pay off over time. In this cooperative, a ZVV subscription is also included in the rental price to encourage the use of public transport.

subject area	Hunziker Areal		Kalkbreite		Sihlbogen	
1. Management system	83	75%	92	84%	107	97%
2. Communication, cooperation, participation	70	100%	70	100%	56	80%
3. Site utilisation and urban planning	100	100%	84	84%	88	88%
4. Supply and waste disposal	53	76%	60	86%	62	89%
5. Buildings	88	98%	76	84%	76	84%
6. Mobility	88	98%	90	100%	85	94%
Site total	482	91%	472	89%	474	89%

Table 4: Distribution of points in the three example sites

Table 4 summarises the results from the 2000WS certification and shows the distribution of points that each of the three example sites have achieved. The percentage of achievement, which must exceed 67% (according to the certification rules) has been achieved in all 2000WS (see also Table 2). Please note, that maximum achievable points differ for the different subject areas (as shown in Figure 1). All three example sites achieved 91% (Hunziker Areal), 89% respectively (Kalkbreite and Sihlbogen). The Hunziker Areal achieved 100% in two subject areas (communication, cooperation, participation and site utilisation and urban

planning). Kalbreite achieved 100% in two subject areas (communication, cooperation, participation and mobility).

Detail	Hunziker Areal	Kalkbreite	Sihlbogen
Type of use	mixed use	mixed use	mixed use
Energy standard	Minergie-P-ECO	Minergie-P-ECO	SIA 2040
Heat production	District heating system with server waste heat from the city data centre (heating and hot water)	Ground source heat pumps	pellets, heat pump, biogas, waste heat
Cold production	electricity	free cooling (ground water)	industry cold for large distributor
Electricity	-	PV, eco power tariff	PV, swiss electricity mix

Table 5: Energy supply details of three example sites

Table 5 shows the details of the energy supply of the different example sites. All sites build upon the efficient building energy standard which minimises energy demand. For heat and cold production, different systems are in use (heating solutions ranging from connection to district heating with utilisation of waste heat, GSHP, and pellets). Two sites have included PV systems on-site, which produce 15% (Sihlbogen) and 20% (Kalkbreite) of the energy need on-site.

In various cantons there are general restrictions on the use of new instruments in the energy sector or restrictions on instruments that move away from energetic building regulations in the direction of operating permits. In these cases, an additional tightening of the cantonal area regulations at the communal level is not permitted. The scope for action for new energy requirements must therefore be clarified on a canton-specific basis. At the municipal level, depending on the existing legal regulations, the legal basis for binding regulations must often first be created (successful examples exist. Additional agreements between the municipality and the site authority are always possible).

Three distinct advantages could be shown:

- (1) Proof of 2000-Watt compatibility: As part of the building application, the compatibility of the 2000WS with the goals of the 2000 Watt society is demonstrated.
- (2) Mobility concept: A mobility concept shows how systematic mobility management should be set up and operated in planning and implementation.
- (3) Monitoring / Controlling: Monitoring in the operating phase allows the municipality to gather its own experience with the real behaviour of the buildings and their users. Current practice ranges between a “monitoring light” (only for operating energy) and a more comprehensive monitoring / controlling concept for operating energy and the mobility caused by a site.

5 CONCLUSION

The number of districts in transformation need to increase considerably if the GHG emission reduction goals in Switzerland are to be met. It was found that 39 2000WA are in operation, implementation and transition in Switzerland. From the experience gained from these districts it can be seen that the 2000WA concept is trying to include important aspects of a sustainable transition of districts. While many districts were new developments (34), only 5 were districts in transformation. The number of districts in transformation need to increase considerably if the GHG emission reduction goals in Switzerland are to be met.

The proof of the concept and the need for monitoring and controlling results are demonstrated on sites where they are implemented and operate as planned. This is an important factor for the further replication of the concept. In many cities, the necessary legal and strategic frameworks for the realisation of PED/PENs are not yet in place. Very often, there is also a lack of a planning culture in city administrations or the personnel resources available might be insufficient. In particular, the transformation of large (brownfield) areas to climate neutral city districts has a big potential for the development of PED/PENs but needs cooperation

between administration, industry, and research. 2000WS can help to enhance the transition and decarbonise our cities and districts. There are several stakeholders that can play an important role in this transition. Facility managers can play an important role in this transition. But they need to enhance their skills and responsibilities in order to fulfil their roles as transition managers. Evaluating the 2000WA can be a key to this and has the potential to enhance the reduction of GHG emissions in districts and cities.

6 REFERENCES

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