What if We Adopt a Resilience Thinking Approach in the Urban Governance for Emission Reduction?

What if We Adopt a Resilience Thinking Approach in the Urban Governance for Emission Reduction? Observations from a University Campus Case Study

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ABSTRACT

In recent times, the contribution of technology and standard energy indicators in urban governance for a wiser use of energy resources has been called in debate, emphasising the potential role of traditional ecological knowledge, individual lifestyles, and in general a wider long-term thinking about the sustainability goal of policy makers. A resilience perspective may help in exploring the contribution of community resilience when dealing with human factors and energy consumptions trends. The paper analyses these relations by observing a special portion of city represented by university campuses. In particular, energy data from the Sustainability Office of the Hokkaido University, in Japan, coupled with surveys with campus users in the effort to reduce their energy consumption, are red under a resilience lens. Results showed that although collective responses did produce sparkling and virtuous outcomes, there were not enough to reach the targets fixed by the national government in terms of electric and thermal energy percentage reduction. Conclusions outline the possibility of systematic efforts to break through the current curricular paradigms in reducing public building energy consumption, using new ways to foster cultural identity protection and resilience thinking in urban governance action toward a low carbon society.

Keywords: *Sustainability Assessment, University Campus, Community Resilience.*

INTRODUCTION

The exploitation of innovation and information technology and its integration in building energy measurement and tools have been at the very centre of almost every energy efficiency policy in urban governance. Massive economical effort have been devoted to make our cities smarter, where each technical or architectural green solution had to be systematically evaluated with range of criteria (environmental, technical, financial, social) as part of an integrated assessment aimed at ranking performances and the building efficiency. Current business strategy with regard to sustainability, too, is dominated by an eco efficiency (EE) approach, defined as the "increasing of productive output while using fewer resources" [Schmidheiny, 1992; Welford, 1998] or units of value generation per unit of environmental influence [Brattebo, 2005; Huppes and Ishikawa, 2005]. The result is almost universally seen as advantageous to both the economy and the environment, as well as encouraging sustainability. From a strategic business perspective, the EE approach allows measurable objectives that are consistent with a continuous improvement philosophy or quality-focused management culture; EE is therefore convenient within the frames of current theory and magnitudes of business economics (for example, the carbon footprint index).

However, optimisation, efficiency and waste reduction are the watchwords that lead the current policies and campaigns for sustainable consumption. Everyone seems to support - with more or less vehemence - the need to pursue these objectives. Unfortunately, this commonality of intents is not enough: translating these slogans into concrete results is proving far from easy.

Despite all the benefits of EE, EE improvements may bring price reductions that in turn may provoke increased consumption. In the field of environmental sustainability, it is the well known "rebound effect", i.e. the phenomenon by which improved efficiency on an intensive (or per product) basis creates new demands for products that adversely impact the environment on an extensive basis (total consumption). From a broader systems perspective, EE may have counter intuitive effects regarding long term sustainability [Alcott, 2005]. Life Cycle Assessment (LCA) and/or a resilience thinking approach can represent more suitable tools for complex systems (urban) observations, ranking some processes as poor in terms of eco efficiency, but supportive of a systemic and wide sustainability goal that envisages the human factor as crucial [Korhonen & Seager, 2008].

In the following paragraphs, a framing of the resilience concept within the built environment is presented, followed by the application of that lens at university campus level and the observation of community response to climate change in the Hokkaido University Campus in

Japan. Finally, results outline the opportunities coming from reasoning in resilience terms. The overall sustainability performances of a small portion of a city can nevertheless tell us something interesting about the complex functioning of urban links, policy effects on community-based systems, and the counter intuitive role of high-tech and external control in the energy management. Opportunities coming from a different stream of practices of self-organised actions towards community resilience to emissions reduction are at the conclusion of our contribution.

1. RESILIENCE

1.1 Socio-ecological and urban resilience

The resilience concept was introduced by Holling [1973] who later defined it in ecological terms [Holling, 1996] to describe the amount of perturbation or disturbance an ecological system can absorb without transitioning to an alternate state or condition. The concept of resilience derives from the observation that a given ecosystem can exist in multiple stable states as systems evolve and adapt through time [Zell & Hubbart, 2013].

Resilience, for social-ecological systems, is then related to (i) the magnitude of shock that the system can absorb and remain within a given state; (ii) the degree to which the system is capable of self-organisation; and (iii) the degree to which the system can build capacity for learning and adaptation. Management can destroy or build resilience, depending on how the social-ecological system organises itself in response to management actions [Ernstson et al, 2010]

More resilient social-ecological systems are able to absorb larger shocks without changing in fundamental ways. When massive transformation is inevitable, resilient systems contain the components needed for renewal and reorganisation. In other words, we may define socio-ecological resilience as the capacity of a system to cope with change, either trough persistence, adaptation or transformation.

The first assumption at the basis of this statement is that socio-ecological systems are linked: one impacts upon another and society is depending on the environment. The second assumption is that socio-ecological systems are complex adaptive systems. There is no certainty of determined outcomes and the behaviour on the long term is unpredictable; expertise can help in putting attention to observable thresholds, but it is not sufficient to infer the cause-effect relation. The resilience approach is critical to build redundancy into a certain interpretative model, as it comes with the classical adaptive cycle, encouraging to look at the whole figure (reorganisation, conservation, release, exploitation) of the system.

In this perspective, urbanisation could be seen as a way of human life following the climate stabilisation / permanent agriculture / permanent settlement, in the scale up of the manipulation of nature, rather than coping with its dynamic challenges. The rapid technology advancement made humans incredibly adapting, but here comes the paradox of urban resilience: cities have been designed to remove or minimise environmental disturbances [cfr. Alberti et al, 2004] . The benefits of urban inhabitants and cities derive from ecosystem processes including, for instance, improved water and air quality, storm protection, flood mitigation, sewage treatment, micro climate regulation, recreation and health values [Collier, 2013]. Such “ecosystem services” are inextricably linked to ecological processes [Harvey, 1996], whose negative outcomes, though, are often externalised, by expelling the local environmental impacts due to the production/disposal phases, or by addressing the external cost to unequal financial instruments.

The resilience approach demonstrates the importance of living with disturbances when a city is likely to be unpredictably tackled by climate change effects, and therefore favour the blooming of self-organised tools and measures to face the quick change.

In medicine, the study of body resilience and the effect of omitted drug treatments is a totally new field of investigation, but still interesting result are undergoing. In early 2014, a study by two theoretical biologists [Roy & Wodarz, 2014] showed the effect of viral infections on tissue homeostasis. It was found out that protection against tissue pathology increases vulnerability to cancer. Mathematical models were used to study the consequences of viral infections for the dynamics of feedback regulation in otherwise healthy tissue. In particular, they described how the design of regulatory circuits affects the protection against pathology. The models suggest the presence of an important tradeoff: if the regulatory mechanisms are designed to provide maximal protection against virus-induced tissue destruction, this can lead to increased levels of stem cell proliferation, which can promote the development of cancers.

This paper wants to infer that, like the human body, when an urban system is viewed as a complex system able to act as a responsive community, it may react better to external stresses, as it may offer an homogeneous and spontaneous response to unforeseen swings. Indeed, urban resilience can be summarised as the capacity of reacting to change before it lead to a different city, and the ability to understand the feedbacks that teach the community how to be self-organised. When the urban community is well self-organised, and can rely on traditional knowledge about coping with changes without external help, resilience increases and disaster/emergency response gives better outcomes. During the "Asia Adaptation Forum" 2013, the Urban Resilience panelists were asked about how urban climate changes resilience building. Dr. Thongchai Roachanakanan, from the Dept. of Town and Country Planning and Public Works of the Ministry of Interior at the Royal Thai Government, showed evidence that rural areas react better than big cities to climate change. Good cooperation, good way to stand up together were seen as a fertile ground for policy response, while big cities were characterised by conflicts, both among groups of people and versus public administrations.

1.2 Community Resilience and University Campuses

Usually, scientific terminology has confused and used randomly the terms "community" and "society". For this reason, a few introductory remark may explain the inherent contrast between them and explain why we adopt the term of community when dealing with university campuses, taken by Tönnies [Tönnies, 1957]: "All intimate, private and exclusive living together (…) is understood as life in *Gemeinschaft* (community). *Gesellschaft* (society) is public life, it is the world itself. In (…) *Gesellschaft* as contrasted with the *Gemeinschaft*, we find no actions that can be derived from an a priori and necessarily existing unity; no actions, therefore, which manifest the will and the spirit of the unity even if performed by the individual; no actions which, in so far as they are performed by the individual, take place on behalf of those united with him".

With these premises, this paper assimilates the university campus as a self-organised community, where one can expect better result in terms of resilience building and pressure-state response to energy awareness calls.

This paper starts from the following community resilience definition:

"Communities (social, spatial, cognitive) working with local resources (information, social capital, economic development, and community competence) alongside local expertise (e.g. local emergency planners, voluntary sector, local responders) to help themselves and others to prepare and respond to, and to recover from emergencies, in ways that sustain an acceptable level of community functioning.” [Twigger-Ross et al, 2011]

Translating resilience from theory to practice [Twigger-Ross et al, 2014] and evaluate the factor affecting resilience itself in so many different systems [Birkmann, 2012] is not a trivial matter. Ewing and Synolakis wrote about a ‘Community Resilience Index’ in extreme events [Ewing and Synolakis, 2012)], while a similar disaster resilience index referred to coastal areas has been used to foster a community self-assessment and enhance their resilience to hurricanes and water-related risks (see [Sempier, 2010]). Others [Steiner and Markantoni, 2013] presented a model for unpacking community resilience through Capacity for change, mixing qualitative and quantitative methods.

The idea of using capacities to describe community resilience is very common in national strategic framework (see [Cabinet Office, 2011]). However, the general idea about that concept is always related to disasters response as a network of adaptive capacities that comprises “economic development, social development, information and communication, and community competence” [Norris at al, 2008]. Obviously, redundancy is crucial in models like that where each factor is influencing another and made of several attributes belonging to other factors.

Cutter et al. [2010] conceptualised flood disaster resilience through five ‘sub-components’: social resilience, institutional resilience, infrastructure resilience, economic resilience and community capital. However, this paper does not dare to transfer tout-court those methodologies and concept into the energy and the urban context, but it is using a more qualitative approach to measuring community resilience to energy consumption in university campus specifically. This project also collects qualitative data from semi-structured interviews, which will be used in conjunction with quantitative data to present a fuller picture of the communities’ resilience to energy reduction, but not the fullest. Further studies on the legitimacy of this step will have to by carried on.

The campus dimension appeared suitable to study some community resilience in urban areas since, recalling the ‘glocalization' concept by the Japanese ‘dochakuka’, meant as global process towards new ways of local enhancement, university campuses can be identified as a meeting space between global and local urban scale, and therefore a fundamental resource for territorial studies, a part from being a fitting case of community.

Another factor that lead us in choosing university campus as case study for urban resilience exploration is the wide availability and accessibility of data regarding energy consumption trends, functions and schedules, users' profiles, drawings and building data, and policy releases.

The collection of data across different university campuses (although in this study we present only the ones coming from the Hokkaido University in Sapporo, Japan) has been made possible thanks to the Uni-Metrics project (www.unimetrics.polito.it), which aimed at finding "value-based metrics" in the intersection between actors, buildings and cities, and integrating them in policy-making. The ultimate goal of the project was to reveal suitable sustainability metrics for University campuses and their management, and to exploit Japanese, Italian, Dutch and British metrics and policy documents for a mutual benefit, packaging the outcomes in a form that engages the practice and policy-makers in the wider urban context.

2. THE HOKKAIDO UNIVERSITY CAMPUS

With regard to this premises, the campus dimension in the Hokkaido University, in Sapporo, Japan, offered a suitable test bed for our hypothesis of crucial resilience contribution in energy consumption and sustainability evaluation, since:

- it may be said that the campus represents a valuable portion of citizens that chooses to be together, and therefore represents a community rather than a society;
- the role of traditional ecological knowledge in Japan is consistently more powerful in respect of its role in western cities; the Japanese energy use behaviour is very different to the EU for the concept of person heating (rather than space heating), and therefore the responsibility of individuals and their educational role towards future generation play a key role in the long-term view of resilience.
- the recent nuclear disasters can be pointed out as important disturbances factors to the equilibrium state;
- despite the previous baseline statement, the energy consumption in the Sapporo University has seen almost no improvements in the last 5 years. Therefore in the following 2.1

paragraph we try to understand the border condition of this non-intuitive performance and any eventual input throughout resilience perspective.

2.1 The Campus

Hokkaido University (HOKUDAI, as named by locals) was founded in 1876 and it is located in the centre of the city of Sapporo (1.9 million population, 2011 census) on the northern Japanese island of Hokkaido. It encompasses of 31 schools (12 Undergraduate and 19 Graduate) and at the time of the survey, 2012, counted over 18.000 students (11.712 undergraduate school students, 6.515 graduate school students, 3.917 staff). The campus is situated in downtown Sapporo and covers an area of 1.776.249 m^2 with a floor area of 739.368 m^2.

Hokkaido University follows a series of sustainability initiatives in order to reduce its environmental impact and fulfil its goal for the creation of a 'showcase' sustainable campus. These initiatives could be categorised in four key groups consisting of the sustainable campus core schemes, sustainability programs, human resource development and education, leading Sustainability Networks and campus sustainability assessment schemes. The university runs periodical stakeholder meetings in order to bring expertise from outside the university regarding the implemented programs and feedback on areas requiring improvement. A series of voluntary student activities to enhance campus sustainability (e.g. Hokudai Genki project, Sustainable Campus Contest, Candle Night and Sustainable Campus tour, Hokkaido University Campus Visit Project) are held by different university departments and groups. Efforts are being made as well to cultivate human resources by fostering a series of sustainability programs among the student body [Dantsiou, 2012].

2.2 The Campus Energy Use Behaviour: a Survey Result

To understand the energy use behaviour and sustainability perceptions of HU campus users, a survey took place in the Institute of Low Temperature Science, interviewing 102 users. The Institute was one of the three faculties that took part in the energy reduction campaigns in February 2011, July 2011 and February 2012, which had an effect of 14% annual CO_2 reductions [Nakamura and Morimoto 2011]. Its position in the energy consumption ranking table, along with the availability of the campaign results and the option of a future data comparison, led to the final selection of it as case study building. As an indicator of respondents' pro-environmental behaviour and effect of university's sustainability campaign, the questionnaire was categorised in sub-sections. Initially, a set of questions about age, gender, type of working area, employment time and working schedule were asked to give a background of the sample's basic demographics. In the second section, it prompted the building users to comment on the environmental conditions and the comfort levels in their workspace. Important personal determinants that relate with participants' sustainability perception and related behaviour are key socio-demographic characteristics of the sample such as gender, age, education and employment situation. The current survey sample was male dominated, with the majority of the participants being students between 20-29 years old. A correlation of the findings with demographics could be suggested through the input of the different variables in a regression model. This could provide more clear indicators for these relationships in the studied sample (Fig. 1).

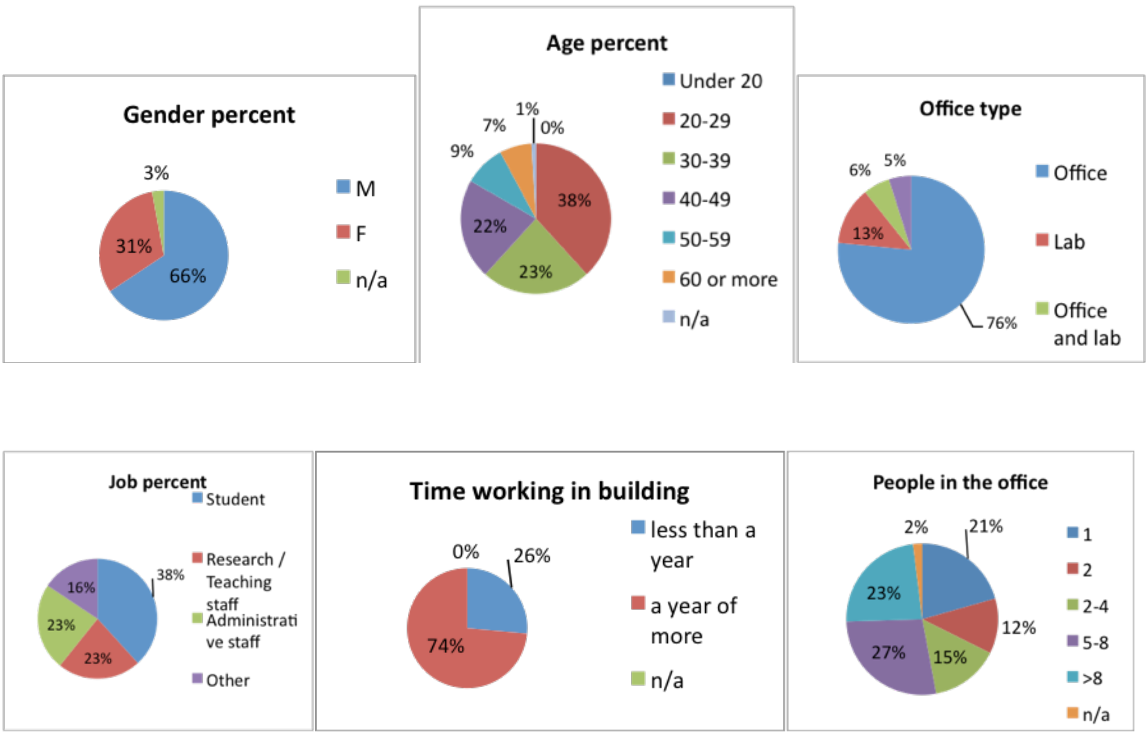

FIGURE 1. Background demographics - from [Dantsiou, 2012]

2.2.1 Heating profile

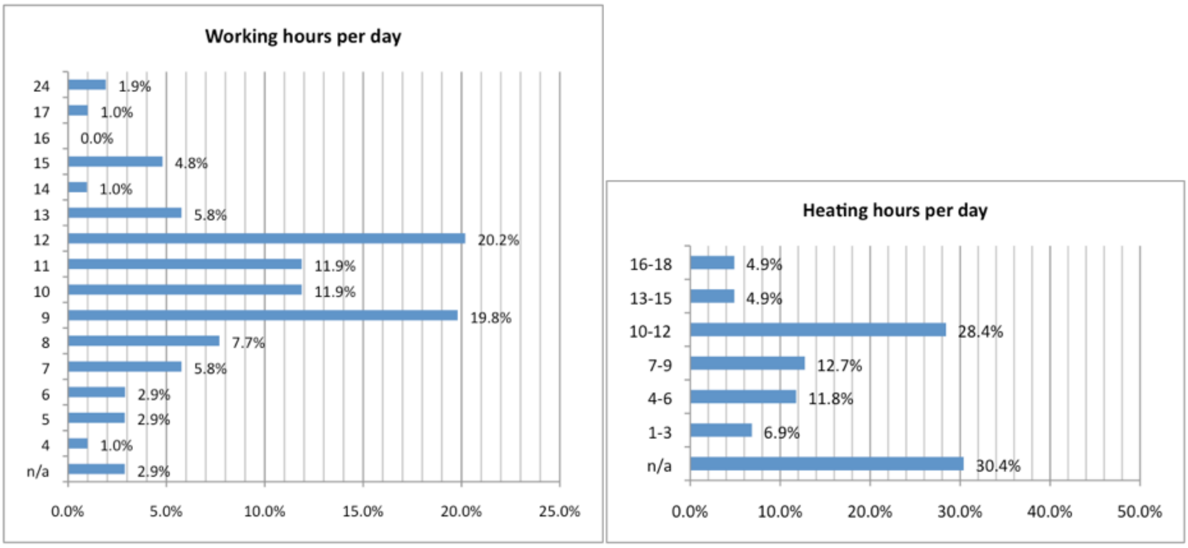

FIGURE 2. Working /heating hours per day. [Dantsiou, 2012]

In terms of the heating hours per day, a fourth of the respondents seemed to keep the heating on for 10/12 hours reflecting their daily working pattern. Interestingly enough, there was a significantly high percentage (30.4%) that did not answer to this question (Fig. 2). In addition, a third of the sample stated that they do not turn off the heating when they leave their room because it is either set on automatic mode or they do not know how to do it. The most common heating temperature setting was between 20°C and 22°C, counting 30% and 25% respectively. A fourth of the participants (23.5 %) used additional heating equipment such as radiative heaters and floor mats indicating some inadequacy of the heating system or very high individual comfort levels.

2.2.2 Comfort During Winter

The building users were asked about their comfort perception within the building in relation to the air temperature and quality, lighting and level of personal control. The overall impression during winter was moderate with several comments on the dryness of the air and the feeling of cold to the lower parts of the rooms due to the lack of hot air circulation.

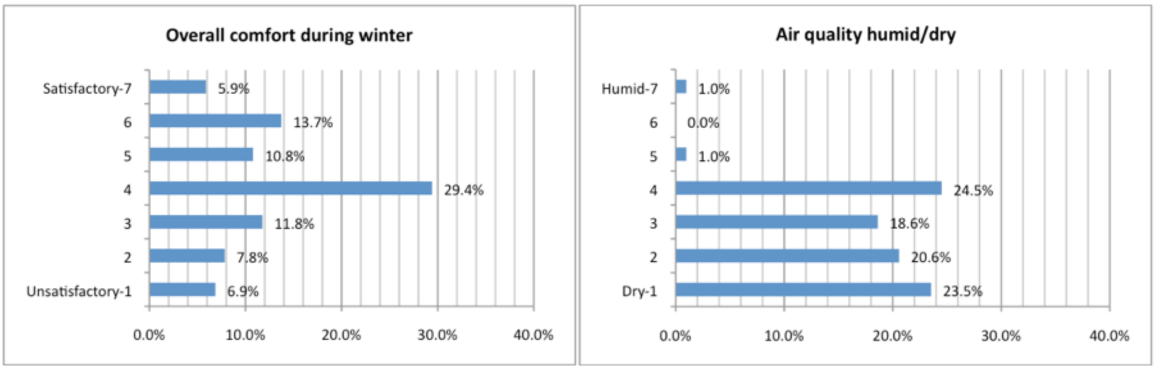

FIGURE 3. Overall comfort during winter / Air quality perception [Dantsiou, 2012]

In terms of control over heating, cooling, lighting and ventilation the majority stated to have very good or full control with the exception of cooling that a third of the users felt to have only some degree of control.

When it comes to energy saving activities, the majority of the building users (80%) stated they follow energy saving measures with the most popular ones being to turning off the lights and set the PC in sleep mode. There were some comments on limiting the use of air-conditioning mainly in summer and using energy efficient office equipment (‘*I turn off the lights, set moderate temperature in air conditioner, wear big clothes and use a disposable pocket warmer’*, *‘I try to do my best to refrain from using air conditioner, but I feel sick sometimes’).*

While the rate of responses related to energy saving measures was significantly high almost a third of the participants stated of personal reasons behind their behavioural change towards energy use reduction. The saliency of personal norms is highlighted while it poses the question of the ability of sustainability campaigns to cause long-term behavioural change.

2.2.3 Reason for Behavioural Change

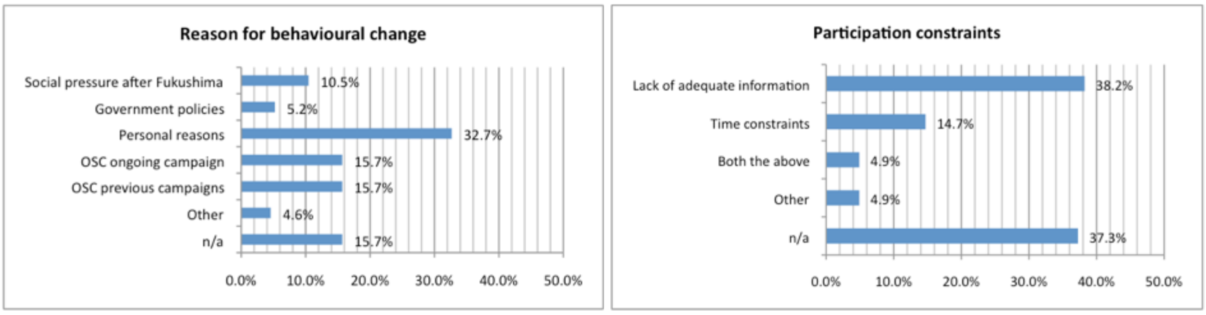

FIGURE 4. Reason for behavioural change and participation constraints. [Dantsiou, 2012]

A saliency of personal norms was identified counting as the most popular response to the cause of a behavioural change representing a third of the sample (32.7%) with the past and ongoing Office for Sustainable Campus (OSC) campaigns following with 15.7% each. Finally, the social pressure after the great east Japanese earthquake and strengthening of government policies were also considered, but figure drops at a lower level less than 10%. Similarly, the ratios attained were reflected in most of the comments were people mentioned having a pro-environmental behaviour already (*'I already started this kind of activities long time ago', 'My nature'*). The e-mails sent fro the OSC were another point mentioned as well as the Institutes sustainability policy and the social pressure *('I don't have personal reason, I follow the Institute's decision', Low Temperature Science Institute was selected as a showcase of energy saving', 'Because Office for a Sustainable Campus sends me a message saying "save power"', 'Social pressure is big'*). The participation rate in campus reduction activities was particularly low with 78.4% stating that they are not involved in any activity despite the fact that the survey sample was mainly students being in the building for more than a year. Lack of adequate information is the main reason for 38% of the respondents while an equal amount of them did not state any reason at all leaving space for further research (Fig. 4). Time constrains were also a refraining reason for 14.7% of the sample. It should be noticed that in the comments a difficulty to understand the exact meaning of the term 'energy reduction program/activity' was mentioned by some of the respondents while it was proposed to have some faculty representatives.

The interest in future participation was moderate counting 38.2% of the sample. However, there was a considerable amount of respondents that did not give a straight answer to the question indicating significant space for future action and shift of this opinion towards a positive response.

2.2.4 Energy Saving Trends and Community Commitment

Firstly, some limitations of the present research must be addressed, seen that the comparison with real data consumption gave surprisingly negative results. Before generalising the findings in a wider setting, we must consider that the sample population was limited in one institute and one building, and that it also took active part in the previous and ongoing campaign. Future research covering a wider sample may be required if a statistically valid result is aimed. However, salient characteristic of the Japanese society did have an echo in the Hokkaido University Campus and vice-versa, as well as the most sold object in the market of electric appliances seen in the offices, and the standard proportional factor of consumption per floor area and outside air temperature.

When the campus users where asked whether they prioritise energy saving over activity enhancement, a noticeable 42.2% was unclear answering *'maybe',* while a similar amount of respondents replied negatively, indicating firstly a lack of a strong opinion on the issue, and secondly a preference towards activity enhancement. Only a 15.7% stated a clear preference towards energy saving which could possibly be correlated with the 14.7% of people that were actively involved in such activities. The previous, in combination with the moderate comfort rating during winter, shows that the existing heating system may not be adequate for the users needs or that they do not have the knowledge to operate it efficiently. Fig.5 shows the substantially steady trend of the UNIHOK energy consumption, even with an increase of gas use between 2008 and 2011. The red column is the annual primary energy consumption, which reached about 1.7 million GJ/year in 2010. According to the proportion of each energy type, electricity and gas combined accounted for over 95 % of the total for both the entire year and the winter season. For the entire campus, the seasonal correlation was somewhat low for electricity and of course high for gas consumption (Fig. 6). To better discard co-factor and focus our attention on the role of community response, a multiple linear regression analysis with electricity consumption per floor area and capita was performed [Sonetti and Kikuta, 2013].

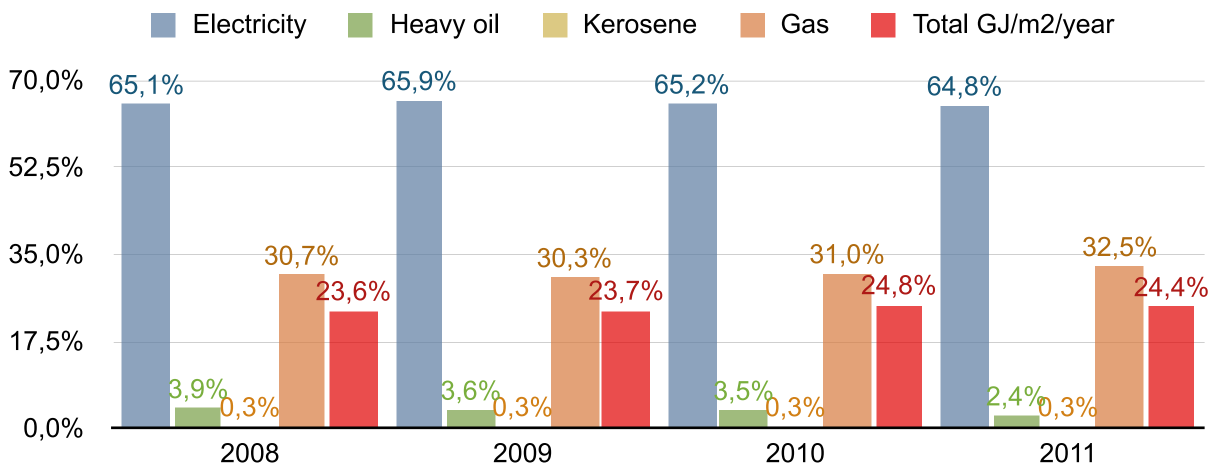

FIGURE 5. Energy consumption trends percentages weighted for energy source at the Hokkaido University Campus [Sonetti and Kikuta, 2013]

In order to understand the effects of the explanatory variables, the standardised partial regression coefficient taking multicollinearity into account was verified [see Sonetti and Kikuta, 2013]. Larger absolute values of the standardised partial regression coefficient are associated with a stronger relation of the explained variable and explanatory variables. The adjusted R^2 was all 0.5 or higher, and as a result, the outside air temperature was the strongest

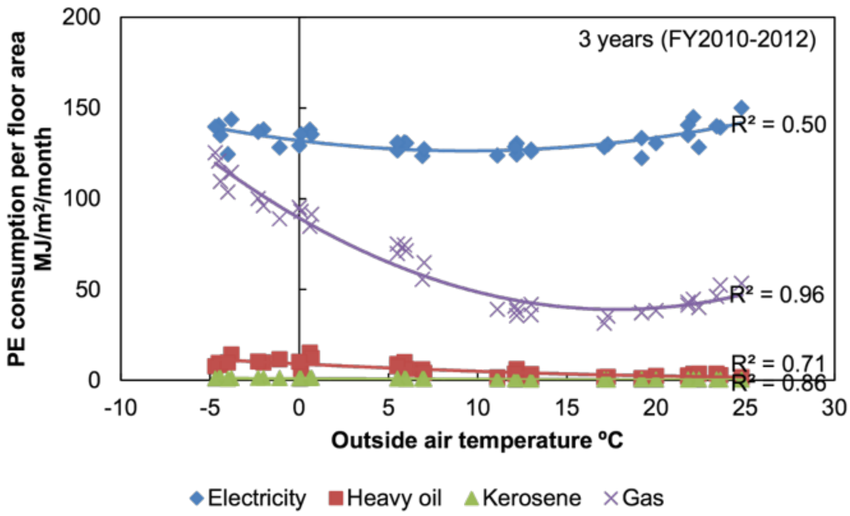

FIGURE 6. Relation between outside air temperature and PE consumption [Sonetti and Kikuta, 2013]

factor for the agriculture, while the proportion of students was the strongest factor for the other departments. In particular for the period from November to April, the influence degree of the outside air temperature was largely different for individual departments. We can infer that the thermal performance of buildings and how to operate the heating are both significant factors. In addition, the number of lecture days for Engineering was a more important factor than for the other departments, demonstrating the significant role of the human factor in the energy management. Eventually, individual lifestyle is still the key to change energy consumption habits, but something can be done also shifting the ICT contribution from where they control and inform the user to when and how it does it.

One of the reasons why the objective of reducing energy consumption is hardly met lays in the configuration itself of energy: it is not tangible, it is not (or no more) visible. Furthermore, actions are not generally aimed at consuming energy. Instead energy is what allows the deployment of common daily practices, defined by Shove and Warde (2002) as "inconspicuous consumption". This is also reflected in the outputs of research projects related to ICT: in fact, while on the production side ICT tools can useful allow to remotely control energy distribution thus increasing grid efficiency, on the consumption side these solutions are still not fostering substantial changes. Indeed, consumption is often related to an invisible energy, inherently present in routinised daily practices. In this sense, a continuous debate between social scientists, energy engineers and computer scientists is fundamental for the success of ICT products for energy saving. It is more and more evident that the cooperation among different scientific fields is a necessary prerequisite.

3. CONCLUSIONS

3.1 The importance of resilience thinking for urban governance

For the past half century, prevailing systems of resource use and environmental management have been largely supported by non renewable and allochthonous materials inputs and, more importantly, by dislocating environmental impacts. Measured in terms of output, these systems have been successful in providing societal quality of life. However, these short term gains in outputs have produced long term and unequal distribution of well being, in the notion our mind recall this concept in this century. Another co-product of this curricular operational paradigm towards energy efficiency, often neglected, is that resilience won't grow when community is not exposed to its socio-ecological output; in other words, the shift in time and space of the "negative" effect of our actions, e.g. the long waste disposal scenarios, technological ways for mitigating the climate, or smart solutions for "fast and furious" lifestyles perceived as desirable, will decrease our ability to react to external changes, in one word, our resilience.

Yet, for the first time in history, is argued that humans are causing global scale changes in the biophysical processes of the Earth; this paper encourage the resilience thinking to reframe problems, putting attention the the persistence, adaptability and transformation capacity of (urban) systems. It would mean to assume change and uncertainties in our evaluation, nurturing conditions for recovery and renewal after disturbances, combining different type of knowledge for self-learning, creating opportunities for self-organisation of future, truly smart cities. Far from romanticising "the past", or "the slow", the conclusion of this contribution is useful to outline that the "immunity" from environmental disturbances offered by the most common idea about smart city can blind us from our critical dependences on nature, reduce our resilience capacity and shape unsustainable futures. Further research is needed to evaluate these long term effect, and which kind of indicators may be suitable to track our progress toward a city that include resilience and humanism in its governance, rights and values [Lombardi, 2011]. Even if there is still no agreement about a common definition for urban resilience, what we want to explore is the process of translating the theoretical concept of community resilience into practice by using recent experiences from our ongoing evaluation on university campuses. A further step for this research could be to conceptualise community resilience to emission reduction needs moving from flooding-resilience studies [Forrest et al, 2014] and borrowing their approach through their five components: social resilience, institutional resilience, infrastructure resilience, economic resilience, and community capital. The use of those community resilience indicators coupled university energy consumption data could help to understand differences between university communities and to shape future community energy resilience interventions and, when scalable, further urban governance directions.

3.2 The university campuses as energy resilience living lab

The campus scale offered a suitable test for understanding new models of citizens environmental awareness and the role of information technology communicating the quest for energy reduction. The solution we turn the attention to is not purely technological. It is something that uses external controls but is also supported by administrative innovations and policy tariffs, that can be implemented only within a City-Region-Country scheme. Tariff systems based on dynamic pricing and direct bills allocation can be the point of convergence for all those efforts. Depending on the application context, resilience thinking may force policy makers to consider issues such as the users' socio-demographic features, the level of available awareness (professional, technological, energy, environmental), the degree and the kind of motivation, an information tailoring ad-hoc for different targets, and so forth. The most interesting approach to put in top-down needs and bottom-up demand is believed to be the participatory design, which is much more useful if the participants involved are carriers not only of interest, but also of skills and differentiated experiences and active contribution for scoring the common goal.

Indeed, a collective response was lacking when modern buildings and high-tech equipment in the University Campus unloaded the self-consciousness of the sustainability duty to third parties (e.g. external contractor of services, monitoring devices, database, administrative bodies paying the bills, global evaluative boards, national disaggregated policies, and so forth). In HOKUDAI, like in other Universities analysed after the Uni-metrics project, the findings of the presented surveys can stand for a good indicator of the current situation, and a resilience-enhancer tool for feedback as learning mechanism and self-organisation tool. The campus users presented self-motivation drivers along with the effect from the existing energy reduction campaigns as causes of behavioural change. The limited participation in sustainable activities is outweighed by a great interest in future participation, indicating the potential of sustainability initiatives as long as the right communication tools and strategies are implemented, profiting of the university-made prototypes to monitor and collect data, allowing comparisons and self-evaluations by students and staff, and above all nurturing a strong sense of community and self-responsibility to be spread, hopefully, also outdoor.

However, a larger sample and the use of more sophisticated analysis tools (neural network analysis, multiple linear regressions, urban metabolism methods [Carpaneto et al, 2011]) can help in put together different variables (energy use behaviour, demographic characteristics, traditional values, type of available appliances and energy sources) and their interaction with socio-ecological systems, resilience capacity, community building and cultural identity preservation [Cannarella & Piccioni, 2011].

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