Urban Energy Transition

vol. 17 | n°2 | 2015

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network industries quarterly

contents

Urban Energy Transition

Welcome to the Summer 2015 issue of Network Industries Quarterly! This issue is dedicated to the governance of energy transition in urban energy infrastructures, by providing insights from different theoretical approaches as well as analyzing multiple case studies.

In the first article, Castan Broto takes a complexity approach on sustainable transitions and analyzes urban energy landscapes as the assemblage of socio-technical interactions in the case of urban energy transition in Hong Kong. Florentin, Gabillet, Gomez in the second article investigate the role of local utilities as the understudied actors in urban energy transitions, by focusing on three case studies in Grenoble, Magdeburg and Medellin. In the third article, Euston-Brown and Ndlovu consider the dynamics of urban energy transition in Sub Saharan African cities, and highlight the importance of other factors rather than the technology itself, such as learning capacity and knowledge development. Finally, Ichonose in the last article explains the climate change problems in Tokyo, and addresses different measures and requirements for climate change mitigation and adaptation programs.

We hope these contributions can draw your attention towards the importance of cities in the field of sustainable energy transitions, as the urban level is getting more interest in the transition research as an important level of analysis.

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dossier

Network Industries Quarterly | Published four times a year, contains information about postal, telecommunications, energy, water, transportation and network industries in general. It provides original analysis, information and opinions on current issues. The editor establishes caps, headings, sub-headings, introductory abstract and inserts in articles. He also edits the articles. Opinions are the sole responsibility of the author(s).

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ISSN 1662-6176 Published in Switzerland

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Urban Energy Landscapes and Transitions to Sustainability: Notes from Hong Kong

Castán Broto, V.*

Abstract - Understanding low carbon transitions in urban areas requires engaging with the complex socio-technical systems that shape service provision in specific urban energy landscapes. Urban energy landscapes are complex assemblages of material objects and socio-political relations. Using the case of Hong Kong I explain how to study urban energy landscapes through the engagement with socio-technical artefacts that characterizes socio-energetic transitions in a given city.

1. Introduction

In the last couple of decades the field of transitions to sustainability has matured from exciting theory to a practice-tested framework to bring about systemic change (Markard et al., 2012). Scholars in this field propose that achieving sustainability will not be possible without a radical reconfiguration of technologies and the social and institutional systems that shape their emergence and use (Elzen et al., 2004; Geels and Schot, 2007). A key concern in this literature has been finding spaces for innovation or intervention points.

Urban areas have emerged as key spaces for sustainability innovation for a multitude of reasons. Local governments are thought of as key implementing actors for international sustainable development agendas, such as the Millennium Development Goals and Local Agenda 21. More recently, local governments have played a key role in demonstrating feasible agendas for climate change action (Bulkeley, 2010; UN-Habitat, 2011; World-Bank, 2010). But the interest on urban areas is not just limited to local governments. There is now a growing body of evidence that demonstrates that a variety of actors play key roles in achieving sustainability at the local level, through sustainability and climate change experiments (Bulkeley et al., 2014b). These experiments are, in their majority, directed towards reconfiguring infrastructures. Urban areas are central to understanding the possibilities for a transition to sustainability, both in terms of the emergence of social and technological innovation and for the governance of transitions (Frantzeskaki et al., 2015).

Urban infrastructures are central to transitions because they play a key role in the transformation of resources that sustain urban economies. One general assumption is that transitions can be managed and directed towards certain future visions through the alignment of multiple interests and the promotion of protected spaces for innovation. However, critics have increasingly emphasized transition as an open-ended process which is contextually situated and whose outcomes are not certain (Bulkeley et al., 2014a). This is particularly the case for scholars who emphasize transitions as a means to achieve 'just sustainabilities', that is, as a means to bring together social justice objectives and ecological preservation concerns (Agyeman, 2013). This is particularly important in rapidly urbanizing cities in the global south, in which the distribution of resources is key to understand the possibilities to achieve fairer and thriving cities. Even when change is achieved, there are no guarantees that this change will be progressive (Bulkeley et al., 2014b).

Thus, it appears that the governance of urban transitions to sustainability will always be peppered with a series of contradictions, particularly in terms of the perceived needs for control VS the actual possibilities to manage a transition, and in terms of how far transitions will benefit those who need it the most. Rather than being a problem to solve, these contradictions are particularly important to think through existing processes of governance and find creative solutions to ongoing problems (Castán Broto, 2015). Contradictions may help in developing diagnosis and identifying progressive avenues for change towards thriving cities. As contradictions emerge from the interaction of social and technological systems, contradiction analysis requires holistic views that can engage both with technological change and innovation.

In this view, energy transitions emerge as embedded in a series of life interactions and experiences, with reference to the ecological transformations that depend on situated politics and embedded in particular cultures which have coevolved with the built environment. These relationships are mediated by certain socio-technological artefacts in which different energy histories are inscribed. These artefacts are assembled in energy landscapes. The focus on energy landscapes is a strategy to capture how energy is embedded in particular socio-technical assemblages and simultaneously reveal the contradictions on

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our dependence from energy. The study of energy landscapes reveals, first, the heterogeneity of socio-technical relations around energy infrastructure and, second, how these manifest in specific urban context. Research tools are needed to investigate energy landscapes on one hand, and context-based understanding of energy landscapes on the other. Thus, the next section extends the argument that energy landscapes can be studied by analyzing the cultural history of selected socio-technical artefacts. Then, the paper moves onto sketching the possibilities for analysis in a given city, in this case, Hong Kong, as a model of compact city. The paper concludes with a reflection on the possibilities of urban energy landscapes as a methodological approach and the extent to which we have the tools to research them.

2. Defining Urban Energy Landscapes

Energy landscapes refer first to a socio-technical assemblage, a compendium of objects, rules, beliefs and interactions, which somehow develop in relation to each other. Here, the concept of landscape, as defined in the European Landscape Convention[1], emphasizes the co-evolution of human activities and ecological systems. In so doing, it emphasizes the routine means whereby humans transform their environments. In the late 1980s and early 1990s, a few anthropologists proposed that landscapes emerged from humans' experiences of being in the world, through practices of dwelling which related to building a home, both in the sense of developing the built environment, but also in establishing material relationships between the build environment and the surrounding ecosystems. One such anthropologist was Tim Ingold who developed the idea of landscapes of dwelling as 'taskscapes', as places in which both human and ecological performances are imbricated (Ingold, 1993). To support his argument he analyzed a paradigmatic example of landscape in a painting, the Harversters of Pieter Bruegel[2], to emphasize that mountains, fields, corn, humans, trees, paths, they are all with each other, noticing each other not as something to look at, but as something to work with.

This analysis of landscapes is very relevant for understanding our relationship with infrastructures and how they are integrated in our everyday lives. Rather than being invisible infrastructures are something we notice and work with. Infrastructures are rarely singled out as individual technologies. Rather, infrastructures are understood within the spatial context in which they are situated, and in relation to objects which are connected to them, values about their purpose, and practices that are spatially located. A series of energy artefacts mediate socio-energetic relationships as people go around their tasks- creating a taskscape which depends on energy and reproduces our dependence from energy.

In an energy landscape, socio-technical artefacts are objects that, being 'ready to hand', help people to dwell in the landscape and build it through multitude of routine interactions (Graham and Thrift, 2007). Socio-technical artefacts are the bulbs we turn on and the transformer we walk by in our way to the market; the cook stove where urban dwellers burn charcoal and the solar lamp that lit up a remote village in India for the first time. These objects embody particular energy histories, and, in an urban energy landscape, they may represent the city and its relationship with energy more widely. These artefacts link the dual aspect of the energy landscape: on the one hand the energy landscape is characterized by a lattice of networks and flows that facilitate resource transformations; on the other hand, they are characterized by spatial practices in which energy use has coevolved together with needs determined by the built environment. A cultural analysis of artefacts points towards both the resource transformation and the everyday use of energy in a given urban context. In the following section, an example of the urban energy landscape in Hong Kong characterized by key socio-technical artefacts, such as the neon lights and the air conditioning units, provide an exploratory example of how the concept of energy landscapes can be articulated to understand socio-energetic relations and urban infrastructure.

3. The urban energy landscape of Hong Kong

Hong Kong, the 'Fragrant Harbour', is a unique city in many ways. One thing that characterizes Hong Kong is its history, shaped both by the Chinese culture and the influence of 155 years of British rule. In 1997, with the transference of Hong Kong to the People's Republic of China, it became China's first 'special administrative region', Hong Kong SAR. Hong Kong's coastal location, its political status and its dynamic local economy have made the city into a global node of trade and finance. Geographically, Hong Kong is shaped by Victoria Harbour which separates the original colonial settlement of Hong Kong Island- today's finance center- from the mainland Chinese district of Kowloon, other Hong Kong islands and the New Territories. Hong Kong's energy system is marked by is dependence from imported fossil fuels and by the structure of the housing system. Two socio-technical artefacts help describing the urban energy landscape in Hong Kong: neon signs and individual air conditioning units.

[1] Council of Europe, European Landscape Convention, Full text available at: http://www.coe.int/t/dg4/cultureheritage/heritage/Landscape/default_en.asp

[2] Available at the Metropolitan Museum of Art: http://metmuseum.org/toah/works-of-art/19.164

3.1. Fossil fuel flows and spatial patterns of energy use in Hong Kong

Hong Kong's energy system is characterized by its dependence from important fossil fuels. Two century-old companies, the Hong Kong Electric Company (HEK) Ltd and CPL Power Hong Kong (CPL) Ltd, supply electricity to Hong Kong, mainly from power plants that burn coal or gas. Both companies import fuels (coal from Indonesia and gas from Oman and Australia) and CPL imports nuclear energy from mainland China. At the moment, Hong Kong policy makers are interested in reducing the dependence from coal. However, experiments with renewables, such as the 800kW Wind Turbine in Lamma Island, have added to the general view that renewable power generation is not possible. The alternatives considered are fuel switching from coal to natural gas or increasing purchases from power grids in mainland China.

The operation of both HEK and CPL is regulated by 10-year Scheme of Control Agreements (SCAs), due to expire in 2018. SCAs determine the rate of return for shareholders as a fixed percentage of average net fixed assets. This mechanism is thought to guarantee investments for a reliable and secure electricity supply at reasonable prices. However, Civic Exchange, Hong Kong's major think tank on urban sustainability, has warned that SCAs discourage investments in energy efficiency and has led to environmentally sub-optimal decisions (Leverett and Exchange, 2007).

In terms of the spatial use of energy, Hong Kong, is a superb example of a compact city. In the words of one local policy maker, the city became low carbon "by accident", especially because of the population pressure on land has pushed up land prices. Simultaneously, the government has long had a program for public housing which, due to popular pressures, focused as much on building public transport links as on building houses. Nevertheless energy consumption is quite high[3]. Electricity amounts for 54% of energy use, while oil and coal products amount for 29% and town gas and LPG 17%. Most of the oil and coal (89%) is used in transport. In contrast, most of the electricity (93%) and the town gas and LPG (67%) are used in the residential and commercial sectors- the built environment. The consumption of energy in these sectors is very high, despite the relatively good spatial configuration of the city with high rise towers and mixed land use. Electricity consumption per capita, for example, is 5.955 kWh/capita, more than double the average in mainland China, which is even more astonishing when considering the small size of the industrial sector in Hong Kong (responsible for only 5% of the total energy use). This indicates that increases in energy consumption are driven powerfully by consumption. Energy intensity has decreased as GDP has grown from 2002 to 2012, again showing the powerful link between energy use and the economy.

3.2. Socio-technical artefacts in Hong Kong's energy landscape

In Hong Kong, like in other cities, there are energy-dependent socio-technical artefacts that define the city, its politics and spatial relations, and hence, the urban energy landscape.

Neon signs and billboards are one key example of a socio-technical artefact that characterizes socio-energetic relations in Hong Kong, particularly within the commercial sector. For those of us who only know Hong Kong as tourists or occasional visitors, Hong Kong is a city of neon. In the period that followed the Second World War, neon signs substituted traditional oil lamps and banners that shopkeepers used to advertise their shops. During the 1950s, 60s and 70s the 'sea of neon lights' in Kowloon trading streets such as Nathan Road became a symbol of growth and prosperity. Neon lights were adopted as a symbol of prosperity and any kind of trade adopted it. In contrast, communist-sanctioned cultural products in mainland China used neon signs in cities such as Shanghai as symbols of consumerism and decadence (Braester, 2005). Neon signs in Hong Kong continue to shape today the urban landscape and its economy.

Light Emitting Diodes (LED) lighting was already developed in the 1960s but commercial applications only took off at the turn of the millennia. Shop keepers like LED because it consumes less electricity while providing more intensity of light. Compared with the traditional craft of neon signs, LED signs can be produced in a relatively inexpensive way, and shop keepers can choose from a range of designs available. Since the late 2000s LED signs have appeared in the streets of Hong Kong, often replacing neon signs. Simultaneously, health and safety preoccupations have led to the removal of emblematic old neon signs. The decline of neon is visible in streets and in the small artisanal economies that neon has sustained for decades. Embedded with a sense of nostalgia, neon signs have gained new significance: they have come to represent a disappearing past. For example, the Blue House in Wan Chain, Hong Kong Island, a few of the remaining buildings from the nineteenth century and a bastion against gentrification, organized in the Spring of 2015 an exhibition that celebrated local signs, in which neon lighting played a key role. The Kowloon Cultural Centre organized in 2014 an online neon exhibition that requested the submission of

[3] Hong Kong Energy End Use Data Available at: http://www.emsd.gov.hk/emsd/eng/pee/edata.shtml

pictures and its organizers were overwhelmed by the number of submissions[4]. Some have seen this as a symptom of a perceived loss of identity in the city since its transference to the People's Republic of China in 1997. A sense of nostalgia for a past city that seem to be vanishing with the neon lights resonates with the Umbrella Revolution protests that swept the city in 2014. Neon lights reveal a contradiction between this nostalgia and the aspirations to become a modern world city, with a display of the latest lighting technologies.

In contrast, air conditioning units are the key socio-technical artefact which defines socio-energetic relations in Hong Kong's domestic sector, although their use is also extended in commercial buildings. Air conditioning requires about one-third of the total electricity consumed in Hong Kong. In Hong Kong air conditioning infrastructure is an invariable presence. Window units and ductless systems are ubiquitous, so much that buildings are designed with structures to support them. High rise blocks are externally decorated with rows of air conditioning units. As a visitor, complaints about cold temperatures inside buildings are common. One interviewee explained how he had complained many times to the office managers in his work but did not managed to make them reduce the air conditioning. Another interviewee complained that when she went to a restaurant and complained that it was cold, she was offered a blanket. Another interviewee who had moved from the US explained that she had learnt to wear a multi-layered clothing style in Hong Kong so that she could confront all types of weather.

These observations are rare: Hong Kong indoor environments continue to be very cold. Since 2006 the Environmental Protection Department of Hong Kong's Government have taking efforts to promote a temperature of 25.5oC for indoor rooms, particularly in schools. However, few organizations seem to follow this guidance, and much lower temperatures are the norm. Like the US visitor, citizens in Hong Kong have changed their clothing habits according to the outdoor and indoor needs. In setting the air conditioning to a very cold level people in Hong Kong are also reasserting establish values about what is a healthy environment. They may be also be reasserting their status. Many shopkeepers believe that low temperatures attract customers to their shops. Air conditioning is an important part of the energy landscape in Hong Kong, and it has become naturalized to the point that people has adapted their clothing practices to adapt to air conditioned environments. Overall, air conditioning relates to the spatial configuration of the city, the perceptions of comfort and the availability of relatively cheap electricity. Here there is a strong contradiction between the spatial structure of Hong Kong as a model of compact city and the way the built environment drives forward electricity consumption for air conditioning.

4. Final thoughts

When we look into urban energy landscapes the central question is not how to change our behavior or improve the energy mix, but rather, how urban citizens live with energy and the kind of dependences that have emerged from the coevolution of urban and energy systems. Understanding urban energy landscapes requires looking simultaneously at the ecological resource flows that sustain the city and how the built environment shapes local energy practices. In Hong Kong, for example, the local energy system is shaped by its dependence from fossil fuels and by the highly dense spatial configurations of the city.

Looking at the cultural histories of specific artefacts facilitates a direct engagement with both energy flows and spatial patterns of energy use. In Hong Kong, neon signs shape its streets. Air conditioning units shape the built environment and how it is experienced. Both artefacts also influence cultural understandings of the city and they may even be used as political symbols. This connections help understand the significance of energy in this particular city and the obduracy of particular energy models in relation to cultural and social understandings of urban infrastructure.

In terms of governance, the exploratory analysis above suggest that looking at urban energy landscapes may enable the identification of contradictions within the energy system. Energy landscapes alone do not point towards ready-made solutions but areas of action, as they highlight key aspects in which current energy policy appears to be congealed. Here it points towards the significance of light signs and why they matter or towards the persistence of locally situated perceptions of air conditioning needs. Through extending our understanding of energy in society, urban energy landscapes are just a starting point in the quest to find pathways towards sustainable energy futures.

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[4] Exhibition available here: http://www.neonsigns.hk/?lang=en

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Larger, diversified and courted: the new triad of local firms of infrastructure in transition?

Florentin, D. ; Gabillet, P. and Gomez, C. D.*

Abstract - Following Jaglin and Verdeil's argument (2013), this article considers that a certain obsession for energy transition may overlook important transformations of energy systems. A focus on largely understudied local utilities in three very different contexts (Grenoble, Magdeburg, and Medellin) reveals important though silent changes that indicate new emerging infrastructure regimes and complete the literature on infrastructure firms.

1. Introduction

Over the last decade, the dominant discourse on energy systems has been that of energy transition. This has taken the features of a political injunction to transform their practices for both energy producers and energy users (Broto and Bulkeley, 2013). At the center of these new arrangements of socio-technical systems, local scales have been identified as the most accurate level to foster this transformation and cities have been encouraged to further develop innovative systems, be that through the production of renewable energy or the implementation of smart grids (Bulkeley et al., 2010; Broto and Bulkeley, 2013). This mainly reflects the fact that cities, as of 2008, do represent two thirds of the global energy consumption, 70% of CO2 emissions and consequently a highly relevant place to develop such a transformation (IEA, 2008).

However important this transformation may appear, its evolution is far from monolithic, even though some representatives of the transition management literature (Rip and Kemp, 1998; Rotmans, Kemp and Van Asselt, 2001) advocate for a quite generic change of urban energy systems. Following Jaglin and Verdeil (2013), we consider that there is neither a unique and worldwide model of energy transition nor a convergence towards such a model. Considering energy transition as systematic would tend to depoliticize the transformation of these systems and to underexploit historical, geographical and socio-political elements that are integral to the understanding of local arrangements (Shove and Walker 2007; Jaglin and Verdeil 2013; Rutherford and Coutard, 2014). What can be observed, are rather transformations of energy or infrastructure regimes (Monstadt, 2009) that differ according to the local contexts.

Placed at the core of these transformations, energy operators (and utilities in general) have been understudied in the analysis of these ongoing changes. Scant studies have thus tried to unpack their specific role in this transformation and the strategies they have adopted to transform their practices and local energy arrangements (Florentin, 2014; Furlong, 2014; Gabillet, 2014; Hannon and Bolton, 2014; Lorrain, 2005). This article tries to fill that gap by providing some insights on fundamental, though mainly overlooked, changes that affect local firms of infrastructure and constitute the background of many crucial aspects underpinning the various energy transitions and the evolution of urban services.

Research on infrastructure firms has been predominantly focusing on multinationals and their role in globalization as new actors of urban capitalism (notably in Lorrain's classic work, 2002). We would like to complete this approach by looking at the other side of the pipe, focusing on local infrastructure firms in cities that are not necessarily at the head of the metropolitan archipelago (Dolffus, 1996; Robinson, 2006). Over the last decade, one has easily noted a renewed interest on local infrastructure firms for mainly two reasons. First, they have been at the very center of debates of political economy on their juridical status, and much attention has been given to processes of remunicipalization of urban utilities with the flagship examples of Berlin, Grenoble or Bogota (Blanchet, 2015; Hall et al., 2013; Hüesker, Naumann and Moss, 2011). Second, they have been inserted in socio-technical debates, where local utilities are considered as levy of energy transformations at local level (Ambrosius, 2012; Nieswandt, 2012). Our contribution wants to go beyond these two arrays of debates to illustrate socio-technical transformations of a different kind. Our joint work started with the comparison of our respective case studies, all of them centered on local infrastructure firms but in much differentiated contexts.

To sketch it briefly, the first one is enshrined in the typical context of post-socialist transition (Golubchikov et al., 2014; Sykora and Bouzarovski, 2012) in the city of Magdeburg (Germany, capital city of the Saxony Anhalt region, 100 km away from Berlin). Urban services are predominantly delivered by the local multi-utility, the Stadtwerk of Magdeburg (SWM), which is a typical case

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of the German strong municipal model of urban services (Krämer, 1992; Barraqué, 1995). The Stadtwerk has had to face tremendous diminutions of consumptions of water, gas and district heating, which forced the utility to initiate a massive transformation of the urban water and energy system. The second case is situated in Grenoble, a French middle-sized city close to the Alps, whose energy system does not entirely reflect the traditionally state-led French model of energy governance. Due to political decisions of the early 20th century, the city is supplied by a local public utility (Gaz Electricité de Grenoble, GEG), while the regulation of gas and electricity markets remain national. This regulation and general organization is currently questioned by the twofold process of liberalization and the integration of climate-energy objectives in public policies and programs. The third and last case is incorporated within the framework of the intensely liberalized energy market of Colombia, in the city of Medellin, the second biggest city of the country. The local multi-utility of the city (Empresas Publicas de Medellin, EPM), which historically had played a key role in the development of electricity at the regional level all the 20th century long, has managed to span unchanged the multiple neoliberal reforms of the 1990s that deconstructed the traditional model of municipal multi-utilities.

Despite the variety of institutional and geographical contexts of these cases, something seems to emerge out of their comparison. Their respective evolution tells a somewhat common story, and important similarities arise in the strategies adopted to deal with highly competitive energy market: this goes beyond the simple coincidences. Although they obviously do not represent all the local firms of infrastructures, they do embody a trajectory followed by numerous similar utilities, which translates into a new infrastructure regime (Monstadt, 2009) that constitutes the essential background to decrypt the modifications of urban energy systems. This transformation rests on three pillars, which constitute the three following parts of this article: a rescaling of their supply area, a diversification of their business model and a reconfiguration of their relation with the city. These three transformations are crucial to understand the context in which energy transformations are happening.

2. The rescaling of local infrastructure firms

The first pillar of this fairly silent but decisive transformation is relating to a modification of the territoriality of these firms. The liberalization of energy markets and the increasing development of new forms of energy production and distribution have contributed to new spatial arrangements in energy systems: over the last fifteen years, new scales of governance have appeared, which accelerated the production of new geographies of local infrastructural firms.

This process translates into a form of rescaling, and echoes one of Brenner's hypothesis that state rescaling processes were accompanied by new forms of (spatial) redistribution occurring at regional level, which he coins as "neo-Fordist political projects" (Brenner, 2004:466). Through the various forms of rescaling they have carried out, local infrastructure firms are increasingly becoming multi-scale actors. Our three cases reveal a twofold expansion strategy, combining an expansion at a local level in continuity with existing infrastructures and an extension at a regional if not national level.

In the case of Magdeburg, this rescaling is quite striking, yet marked by the ambivalent alternation between processes of de-territorialization and re-territorialization. The first steps of liberalization of energy markets were used by the multi-utility to develop its activities in other cities to expand their markets, like in cities in the Northern part of Germany such as Hamburg or Schwerin. This went as far as provoking a form of de-territorialization, as SWM was selling more electricity outside Magdeburg than in its traditional core of intervention. Such a trend was considered as potentially risky by some of the directors of the company, and the general strategy developed by the company now favors a regional scale and a form of re-territorialization.

The utility's zone of influence has consequently been extended at a regional level, may that be in power, gas or water sectors. The utility has, for instance, taken over the technical management of Schönebeck's region water provider (South of Magdeburg, WZV Schönebeck) or the commercial management of Stendal's Stadtwerk. Similar evolutions have occurred in the power sector, as parts of other local multi-utilities specialized in the energy provision have been bought by SWM, in Zerbst or Stendal. This general expansion can be considered as a combined territorial consolidation and upscaling of the Stadtwerk. Its goal is clearly expressed by many representative of the company: becoming a regional utility and not only a local communal one.

As in other similar cases such as Halle, the utility of the regional metropolis progressively extends its zone of influence by buying local Stadtwerke. This allows the company to compensate a somewhat shrinking or not-growing original market quite typical of post-socialist contexts, which are characterized by emerging cold spots (Moss, 2008) where demand has tremendously decreased and where the level of service has worsened. Such a strategy highly nourishes the economic viability of the company, as 40% of its benefits now come from this network of subsidiaries. To a certain extent, this also mimics a similar path adopted by one of the shareholders of SWM, Gelsenwasser, which has also largely extended its zone of influence in the water sector in other regions to compensate a declining demand in the Ruhr area. Local multi-utilities such as SWM are progressively becoming regional political actors, and consequently unavoidable actors of possible energy transitions or adaptations.

The Medellin case tells a quite similar story, although the dialectic between de-territorialization and re-territorialization may be slightly different. The local multi-utility has largely exceeded its original territory and operated an impressive spatial metamorphosis. Its expansion has been both incremental and monumental. The utility first extended its network at a local level, in the Aburra valley (today's Medellin's metropolitan region) and in its surrounding region of Antioquia, anchoring its influence at a regional level. The primary goal of this change was to enhance the capacity of production of the utility to satisfy the growing demand of energy of the local market. Through these extensions, EPM managed to build a strongly intermeshed power network, which now comprises 24% of the national capacity of production for electricity and commercializes 23% of the consumed electricity at the national level. This helped the utility to become not only a local actor of the energy arena, but a regional and even a national one. During the energy crisis that affected the country in the early 1990s, EPM appeared as a key actor at the national level as they led the construction of an interconnected electricity network and drew a new plan enhancing the supply capacity at the national level (López Díez, 2003; Varela Barrios, 2010). Due to reforms liberalizing urban services, EPM had to reshape its administrative structure and created a holding named Grupo EPM. This holding has, through its various subsidiaries, further fostered its spatial development, so that the utility is now active in seven Colombian regions and in six Latin-American countries . EPM is thus no small provider anymore, but rather an impressive firm owned by the municipality of Medellin, but whose tentacles are drawing radically transformed geographies of local firms. EPM explicitly follows a strategy of de-territorialization of its activities: one of the objectives of Grupo EPM is that 40% of the total revenue should be generated through the subsidiary companies working at the international level. Yet, this form of de-territorialization does not altogether mean that EPM has deserted the local arena: its spatial model has been twisted but the utility remains locally owned and deeply anchored in its regional native territory.

In the Grenoble case, the possibilities of a similar rescaling of the utility are lower, as the energy distribution remains a national monopoly and consequently locks many possibilities of extension. However, the utility has also adopted new forms of territorialization (Jaglin, 2005) and tries to expand its initial frame of action. The utility has installed new sources of renewable energy outside of the city, and increasingly favour the regional scale to develop its various projects. The de-territorialization is not a relevant issue in this case, but the utility really tries to strengthen and develop its spatial core of intervention, deploying its capacities and activities in concentric circles whose vibrating heart remains the city of Grenoble. The utility has also developed new products to be commercialized in the region, which leads us to the second pillar of the transformation of local infrastructure firms.

3. The diversification of the business model of local infrastructure firms: a new role in the urban arena

The rescaling of local infrastructure firms produces new geographies of infrastructure management. Yet, this does not exhaust the understanding of the change towards a new infrastructure regime. This geographical mutation is accompanied by a transformation of their business model, and more precisely by the diversification of their production of value. Local infrastructure firms are no longer limited to the lonely transport and supply of a fluid going through a pipe: they have become provider of larger urban services that largely exceed their traditional mission.

This diversification of the activity is the corollary of the rescaling, as both tend to anchor further the utility in a larger territory. This gives to the utilities a new role in the urban arena. To phrase it in a different way: one can even wonder whether these utilities can be characterized as simply infrastructure firms.

In the three cases, this alteration of their traditional business model follows two main lines: the expansion of services related to the provision of energy and the development of other services largely unrelated with the core mission of a utility. This process is particularly prevalent in the EPM case in Medellin. Through its subsidiaries, Grupo EPM has developed a large range of activities and services that include investment companies (Panama, Caiman Island, Guatemala) or the commercialization of electric appliances (El Salvador). At the local level, EPM, like many other utilities, has started to enlarge its portfolio of services to downstream users, with offers ranging from advice to reduce consumption to the design of financial programs to obtain credits in order to buy domestic appliances .

Yet, the most decisive part of this strategy of diversification has been carried out outside of the traditional role of energy provider, notably through its programs of Corporate Social Responsibility (CSR). Most of them have been implemented through the Fundacion EPM. The utility is thereby involved in the management of public spaces and equipment, constructing and running some cultural or educative buildings such as the EPM Library, Parque de los pies descalzos or the new Unidades de Vida Articulada. Through this commitment, the utility participates to the fabric of the urban and to its physical transformation as well as its everyday management. Such a strategy reinforces the visibility of the utility within the city of Medellin, which could almost be named the EPM city. This image-based approach renders the utility both visible and closer to its inhabitants/users and strengthens the attachment of the inhabitants to the utility. In acting so, EPM accentuates its rootedness in the local context, compensating the rescaling of its management. Internationally, EPM also exports the image of Medellin, as if the utility had absorbed the city. This diversification is, in other words, a process of territorialization, which legitimizes the utility as a major player of the local governance.

If Medellin is converting into an EPM city, Magdeburg is also increasingly turning into a SWM city, as a result of a similar policy of diversification led by the utility. Beyond the expanding offer of services relating to energy provision that characterizes the classic commercial turn in the energy sector, SWM has also diversified its mission by providing its customers a special card, the SWM card. This card is free of charge, yet offers no service at all as far as urban technical systems are concerned. However, this item provides its users with various commercial advantages such as discounts in some shops, or free access to several cultural events. The utility is also supporting numerous cultural events in the city. SWM is consequently slightly invading the everyday-life of Magdeburg's inhabitants, not only with the countless SWM cars of technicians that are crossing the city's streets, but also through various channels outside of the classic relationship between energy users and provider. This is primarily reinforcing the connection between the utility and its supplied area.

This diversification is slightly more limited in the Grenoble story, as the utility is diversifying its activities, but concentrates this diversification around energy issues. Amongst other projects, the company has invested in the production of renewable energy and on smart grids. The transformation of activities is, in this context, mainly driven by financial opportunities relating to national public policies encouraging an energy transition.

4. New regulations and reconfigured relations between the city and the utility

This twofold move of rescaling and diversification of local infrastructure firms reconfigure the political arrangements between the city and the utility. A growing tension emerges between the eminently political will expresses by utility heads to remain autonomous and the inclusion of the utility in the local political landscape. As public firms and representatives of public services, the local utilities are bound to the municipal authorities. Their transformation combined with a renewed interest in energy questions accounts for new forms of regulations (and conflicts) between local powers and the utilities,

In our three cases, the utility has long been conceived quite uniquely as a source of revenues for the local authority. In Grenoble, the utility certainly benefits from a certain autonomy to establish its own strategy, but it substantially nourishes at the same time the city's revenues. The city's role has long only consisted of validating strategic choices of territorial expansion and economic diversification to ensure the continuity of the city's incomes, with little interest showed to the energetic dimension of the utility.

However, the implementation of new public policies on energy and climate has changed the context. Local political actors have seized this opportunity to reconsider GEG as a potential tool for these new urban energy policies. Within the city's administration, this new discourse is advocated by departments in charge of sustainable development, environment and urban affairs, and translates into the elaboration of local climate plans. In this context, GEG is encouraged to participate to urban projects such as eco-districts or innovative experiments of smart grids. Even though these changes remain marginal, they attest the emerging search to integrate the utility in urban policies, which provides it with new opportunities and are a way to acknowledge the eminently urban and political role of the utility. This transformed relationship may lead to intern frictions within the local authority, but also between the city and its utility. Conflicts arise mainly because the utility try to preserve a form of industrial and strategic autonomy in this context of growing politicization of local energy issues.

Similar frictions can be observed in Magdeburg between the city and the utility, as a result of the transformation of the latter. A large part of the SWM benefits is now accumulated outside of Magdeburg, but 60% of these benefits are transferred to the city budget according to the number of shares owned by the city authorities. This epitomizes possible complex relations between Magdeburg and its region, and the complex dilemma between a traditional communal mission, supporting the local development, and new economic strategies.

The reconfiguration of the role and place of the utility in the local arena also triggers new conflicts with the city in the Medellin case. This is particularly salient with regard to the supply of certain areas of the city when the technicians of the municipal authority disagree with the technicians of EPM. In spite of attempts to exert a larger control over the firm, the city remains often inferior, as the economic, technical and symbolic power of the firm practically dispossess the city's technicians.

5. Conclusive thoughts

The purpose of this short paper was threefold. First, by considering the transformations of energy systems as not univocal, and by integrating it into more urban and politicized contexts to take into account its diversity, it tries to go beyond the obsession of the energy transition. Second, our sociotechnical approach was centered on one specific and understudied actor, the local utility, whose role is largely underestimated in the emergence of new infrastructure regimes. Confronting a similar type of actor in three very different contexts seemed fruitful to delineate crucial though silent ongoing metamorphosis of local firms of urban services. Deciphering the elements of such a transformation is essential to analyze the evolution of urban energy systems and to reflect the political and social issues at stake in the various local contexts.

Last, by showing a manifold transformation of some local utilities, we have illustrated the fact that they have to be placed in a larger field of research than an area restricted to technical worlds constituted of pipes and afferent services. They become a decisive actor of the urban development, a quasi-structure of the urban fabric and not only a firm of infrastructure, whose evolutions are part of the energy systems' transformations.

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'Theatres of technology innovation': supporting local government in sustainable energy transition in South Africa, Ghana and Uganda

Euston-Brown, M and Ndlovu, M*

Abstract - Local government provides an important arena for energy transition. The growing experience of Sub Saharan African urban energy transition reinforces that the emphasis should be on establishing a learning support process, building local knowledge and capacity, rather than technology-push.

1. The challenge and opportunity of urbanizing Africa from an energy perspective

Africa is in the midst of major transitions. The latest State of African Cities Report (UN-Habitat, 2014) indicates that it is the fastest urbanizing continent in the world, with urban populations set to triple in the next 40 years. African city economies have grown at rates of 4 – 8% per year over the past ten years and the African middle class is burgeoning (by 2020 128 million African households are projected to have transited to "middle class"), boosting consumption and spending potentials.

At the same time, 50% of Africans remain at incomes below USD 1.25 per day, while only 4% receive more than USD 10 per day. The majority of urban poor remain under serviced conditions. African city governments are under empowered and under resourced, with limited revenue powers, weak revenue collection and even less spending power[1].

The energy powering African cities is substantially fossil fuel and biomass derived. Transport is a major component of city energy consumption (in larger towns usually around 50% of total energy: SEA, 2015 and ERC, 2015) and it is entirely dependent on oil-based fuels. In South Africa, electricity is 90% fossil fuel dependent (SEA, 2015). Although woody biomass and charcoal, the major source of cooking fuel in Ghana and Uganda (and most African countries: African Energy Outlook, 2014), is carbon neutral, the rapid process of deforestation underway is devastating to local and global environments.

Energy futures modelling of municipalities in South Africa, Ghana and Uganda[2] indicates that under a 'business as usual' scenario population and economic growth will result in an on-average doubling of energy demand in over the next twenty years, graphically illustrating the service delivery and environmental challenge facing urban governance in this sector alone. The challenge is how to meet this demand in a manner that would avoid the potentially catastrophic environmental impacts and social and economic costs of growth along the current energy pathway.

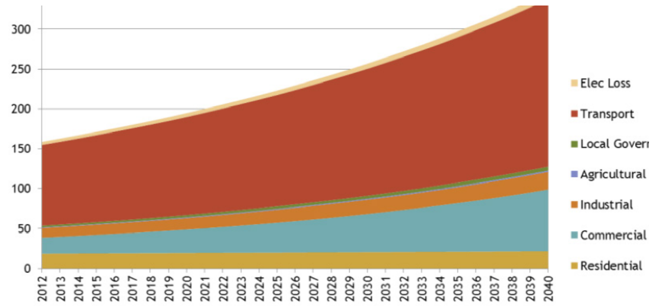

Figure 1: Cape Town energy consumption by sector under a Business as Usual scenario, 2012 – 2040 (City of Cape Town LEAP Technical report, SEA, 2015).

Energy is only one of the challenges of urbanization and growth, but as a resource flow fundamental to the economy, household livelihoods and social inclusion it also provides a vital opportunity. From an energy and sustainability perspective, city government has important powers and functions through which to affect a different energy pathway: roads, waste, water and sanitation, electricity and gas supply, traffic and street lighting, public facilities

[1] Many African cities spend only between 1% and 6% of their city GDPs; although South African metros do spend around 10% of GDP (Hunter, R, 2014).

[2] Detailed energy futures modelling, using the Stockholm Sustainability Institute Long-range Energy Alternatives Programme (LEAP) model, has been done for Cape Town and eThekwini municipalities in South Africa (SEA, 2010, 2014 and 2015) and are underway for the municipalities of Polokwane (South Africa), Jinja and Kasese (Uganda), Ga-East and Awutu-Senya (Ghana). The latter being undertaken as part of the SAMSET Programme.

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management, public transport, town planning and building control. Some social service powers also relate, such as the delivery of social housing, air quality and environmental regulation, school-feeding schemes.

These mandates are, however weak to moderate in most African cities and towns (Hunter, R, 2014). Further, cities have limited human or financial capacity to delivery on mandates, often decentralized in name, but not in practice, with senior staff appointments being a lengthy national process (Bawakyillenuo, S and Agebelie, I, 2014). In particular they have very limited infrastructure financing, and so often operate at a small-scale, with any larger projects being donor or grant financed (Hunter, R 2014; Mann, Namukisa and Ndibwami, 2014).

The temptation is to write off local government and focus on national agencies. However, the outcomes and experiences within South African and Sub-Saharan African municipal sustainable energy transition support programs[3] strongly support the rationale that cities are dense areas of energy consumption where the implementation of new approaches and technologies can and must take place. Building and supporting a "transition arena" here – developing a shared vision amongst stakeholders, growing capacity and enhancing shared knowledge and leadership – lays an effective foundation for real, on-ground, change, while also building and strengthening local governance.

2. The new paradigm for energy

The sustainable energy paradigm (emerging out of the oil shocks of the 1970s, which disrupted traditional energy planning and reinforced through the growing climate and development crisis) highlights the consumption of energy as the driver of the energy equation, rather than a passive demand point that should be met through growth-oriented, supply-side, consumption-directed energy systems planning approaches. Energy is seen as an instrument for sustainable development and the level of energy services for human beings should be the measure, rather than the magnitude of consumption. This, it was asserted, also enlarged the 'domain of opportunities' (Reddy, 2002) for technological innovation and leapfrogging in developing countries.

In South Africa, these ideas were taken up by those looking at new approaches to energy governance in a democratic South Africa. The South African White Paper on Energy Policy (1998) espoused many of these concepts, and in 2004 the government produced an Energy Efficiency strategy and a White Paper on the Promotion of Renewable Energy (DME, 2004), both with measurable targets to be achieved. A Free Basic Energy grant was put in place to ensure that basic energy services would be accessible to all. Similar policy directions have been underway within Ghana and Uganda. The Government of Ghana has made significant efforts to improve energy efficiency through formulating policy instruments and undertaking programs, while access to electricity has increased significantly through the National Electrification Programme since 1989 (Bawakyillenuo, S and Agbelie 2014). Uganda has had a national Renewable Energy Policy since 2002 (Mann, Namukisa and Ndibwami, 2014).

Table 1: Local Government powers and functions relevant to achieving energy-related global, national and local development and climate mitigation objectives

Energy Objectives	Related municipal mandates, roles or functions
Energy security, diversification of supply sources and primary sources of energy	Energy demand management through urban form and built environment regulation. Promotion of local renewable energy development, both relating to municipal waste streams and generation opportunities, and to facilitating local commercial renewable energy and cleaner energy development, through engaging national players, assisting with licensing and permitting processes, and purchase of power.
Increase access to energy and ensure affordability of energy	Reduce energy needs of poor households through thermally efficient housing (building codes or housing delivery programmer management) and promote efficient cook stoves (information or rollout programs), plan and invest in affordable transport and non-motorized transport infrastructure. Improve access through electrification; Free Basic Services subsidy rollout, develop and provide access to a 'basket' of energy services, e.g. solar water heating, thermal efficiency interventions, alternative cooking stoves. Undertake long-term planning to manage energy costs over time and to enable basic services subsidy rollout; cross-subsidy management.
Promote energy efficiency in the economy and minimize emissions	Building codes and planning approval; provision of a platform for information and running efficiency programs amongst industry, commerce and residents; "Green" and retrofit public procurement and facilities; Regulate for dense urban form; plan for and invest in viable public transport development; develop pricing mechanisms for single occupancy vehicle reduction.
Promote localization and technology transfer and the creation of jobs	Promote local economic development through municipalities availing themselves of locally sourced, unlimited, non-polluting and income generating means of renewable energy generation and energy service production.

[3] Sustainable Energy Africa (SEA) has run urban energy development and capacity building programmes in South Africa, since 1998: the Danida-funded Sustainable Energy for Environment and Development Project (1998 – 2010), the British High Commission-funded City Energy Support Unit (2010-13) and the Bread for the World-funded Sustainable Cities Programme (2013-2015); the Dfid-EPSRC-funded SAMSET (Supporting Sub Saharan African Municipal Sustainable Energy Transition) Programme is an extensive partnership programme involving SEA, Energy Research Centre, University of Cape Town, the Institute for Social Science and Economic Research (ISSER), University of Ghana, Uganda Matyrs University, Uganda, UK-based Gamos, Durham University of University College London. SAMSET runs 2014 – 2017

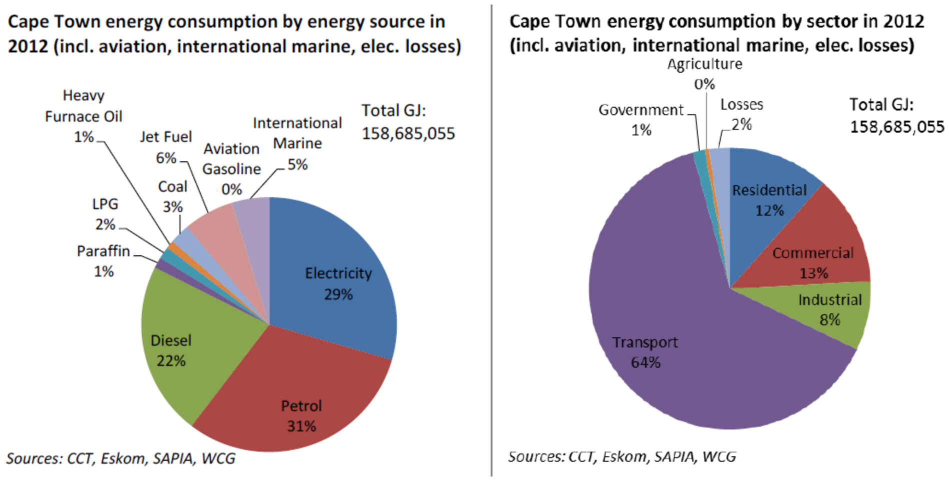

Figure 2: Energy consumption in Cape Town by energy source and sector, 2012

While these national policy directions do not specify a role for local government, the shift in policy emphasis brings local government into the energy picture 'willy nilly'. Even in countries where the mandates accorded local government are far weaker than those in South Africa in relation to driving development, the areas of building and development control, waste and water management, public facilities and lighting and local public transport licensing pertain in most places (Hunter, R 2014)[4].

This then is the potential 'theatre' where a diverse mix of energy services can be developed. Energy efficiency and renewable energy thrive on local and even community-based arrangements, owned and managed in distributed ways. Located between the people themselves and national government, in a situation where energy development is shifting from top down, supply-oriented, centrally planned systems to an increasingly diverse mix of energy services, with local-level renewable generation, local government has a vital role to play.

3. Developing and exploring the local energy picture

The new energy approach requires a detailed understanding of where and how energy is used, by whom and for what purpose. This has been a key starting point in the African urban sustainable energy transition programs. The energy future modelling has taken this picture and projected it into the future, under different scenarios, which the local stakeholders themselves wish to explore. This powerfully represents risks and opportunities.

Interestingly, although local level energy data is, in many instances, scarce, the experience is that the exercise of looking for the data starts to improve the data and builds interest and capacity around the issues. So, the data collection is not an abstract accounting exercise, rather the exercise prods data producers, raises awareness of the issue, and where there are gaps, funding has been deployed to undertaken surveys and produce original data.

There is something very powerful in making visible a picture that belongs to a particular location. The picture reveals the relative contribution of different sectors, and different fuel sources, to total energy demand and local and global emissions. The drivers of this picture and the unfolding story within the possible energy futures are explored. All stakeholders are engaged in this exercise – municipal officials, other spheres of government, community groups, organized stakeholder groups relating to labor, commerce, property owners, etc. – and it is an exercise of engaging with their own realities and concerns, their own actions and relative responsibilities.

The pictures of course differ between cities and between countries, and are too complex for a short article. However, there are a range of issues and themes that arise that are common to all: the need for greater energy security to enable development, the huge dependence on fossil-fuel energy pathways, the need to protect poor households from rising energy costs (particularly where they must move away from "free" environmental resources such as fire wood and charcoal), the need to protect the environment from deforestation and climate change, the rapid increase in car ownership as household wealth increases and the urgent and challenging task of managing development and urban form towards vibrant, dense, inclusive cities, rather than sprawling and congested places.

These challenges are particularly difficult in the context of cash-strapped municipalities with pressing issues of service delivery today, developer-driven development, traditional and private land ownership regimes and situations of urban-rural coexistence within municipalities. There are

[4] This has also been apparent in dialogues with SAMSET municipal partners Ghana and Uganda.

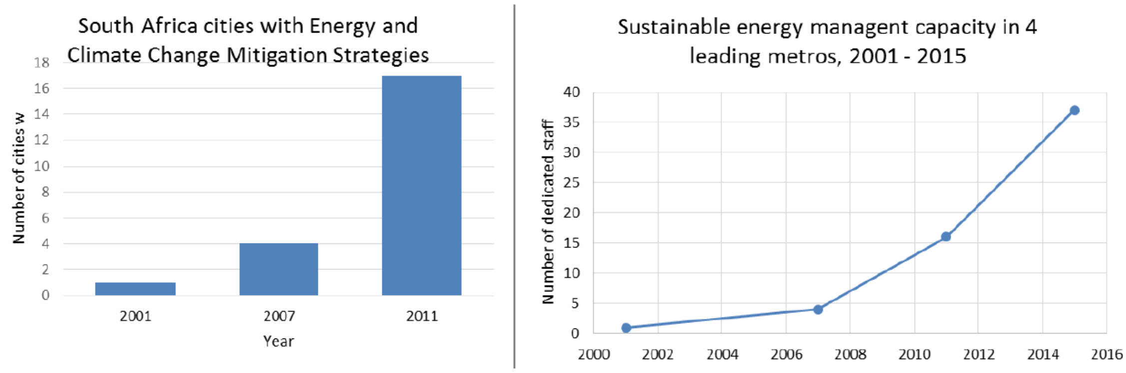

Figure 3: Growth of South African city energy and climate mitigation strategies and dedicated energy development staffing, 2000 – 2015 (SEA, 2015).

also substantial, and complex challenges that relate to the increasing liberalization, privatization and globalization of energy markets. This is partly due to push of global finance institutions, but also to do with the nature of renewable energy and the rapid development of new technologies that is outstripping regulatory reform process. This is most pressing in situations where the public sector is relatively weak and dependent on the private sector to delivery energy services – raising questions of how public benefits can be advanced and protected in these situations.

4. Towards implementation: overcoming barriers and supporting achievements in urban energy transition

Despite national policy intent, there was little initial formal support of local government energy initiatives outside of electrification in South Africa. However, from its early roots amongst a small group of pioneering cities and support programs, South African cities have grown exponentially with regard to data, policy, institutional capacity and implementation of sustainable energy projects over the past fifteen years. These are increasingly finding support from national government, but are often ahead of national policy in terms of intent and target commitments[5].

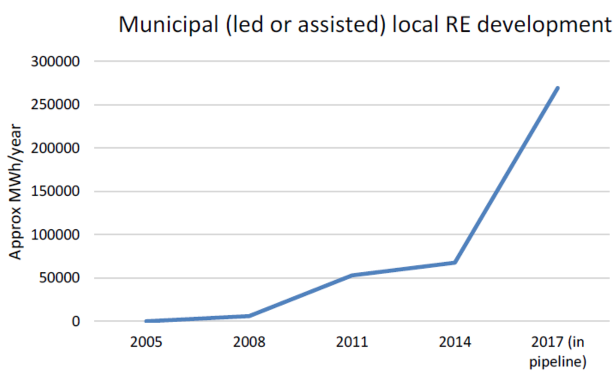

Figure 4: The expansion of local, municipal-led, renewable energy projects amongst South African cities, 2005 - 2017 (SEA, 2015).

Alongside the development of energy data reports and strategies in some 16 cities and towns, three State of Energy in SA Cities reports (2006, 2011 and 2015) have been compiled by Sustainable Energy Africa (SEA) measuring sustainable energy transition against indicators developed through a participatory programmer with city staff and stakeholders. In 2014, the South African Local Government Association (SALGA) produced a Local Government Energy Efficiency and Renewable Energy strategy to provide guidance to all municipalities and coordinate support. Capacity to undertake this work in South African cities has also grown sizably. This has included the creation of specialized units and dedicated staff[6]. Although growth has been exponential, skills and capacity remain a challenge and many officials still suffer the burden of additional tasks being added to existing, full jobs.

In terms of implementation of sustainable energy, achievements have included the ongoing electrification of households, including: within informal settlements and rollout of the national energy grant for poor households; energy management and efficiency retrofit of public buildings, facilities and lighting; the implementation of the new national energy efficiency building regulations; ongoing exploration of 'sustainable human settlement' development and solar water heating technology rollout; efficiency behavior campaigns and forums amongst residents and businesses; the development of procedures for grid feed-in from small-scale embedded generation; substantial BRT and transit-oriented development planning; and the development of local, municipally-led or facilitated, renewable energy generation projects.

Although much more recently underway, partner organizations within the SAMSET program have produced

[5] For example, eThekwini has a target to achieve 40% renewable energy-sourced electricity by 2030.

[6] Amongst the leading five metros there has been a range of creative approaches. The City of Tshwane has established a Sustainability Department in the Office of the Mayor, eThekwini has an Energy Office which has led in the area of local solar mapping and the city's climate change strategy has a target of 40% of electricity supply to be renewable sourced by 2030; Cape Town has pioneered much of the energy work in the country and has a hugely comprehensive Energy and Climate Action Plan; Johannesburg has radical planning and urban form transition underway, a substantial waste to energy project and pioneering solar water energy service rollout within City Power; Nelson Mandela Bay are pioneering mechanisms to support local renewable energy development in the region and Ekurhuleni has a municipal commitment to a 10% renewable energy supply, with a plan of developing 1MW from waste sites per annum.

pioneering local level energy pictures for the partner municipalities within Ghana and Uganda. This has involved extensive data collection and survey processes. Municipal partners have engaged stakeholders and citizens around the emerging energy picture and in some instances have already integrated key strategic areas into the municipality's overarching strategic (integrated or medium term) development plan.

5. Supporting transition: insights gained from practice

Reddy et al note that of course "radical ideas do not become new orthodoxy overnight and certainly not without continuous struggle and persistent effort." Whole system change certainly requires the multi-level change that energy transition theory talks to: from global imperatives, to national policies and funding, to local regulation and local innovations. This study looks at a particular locus within this – that of local government.

Early sustainable energy transition work amongst South African cities was often strongly resisted by officials and many of the systems themselves proved highly resistant to change. Contrary to initial expectations, given that the technologies were proven and made economic sense, uptake was slow and challenging. The social component of energy systems - competing agendas, municipal procurement systems, vested interests, embedded or locked in infrastructure or systems and knowledge bases – became increasingly apparent.

Many South African municipalities are also distributors of electricity. Efforts to reduce consumption through solar water heating, for example, were competing with strong interests in the increasing sale of electricity. Seemingly simple street lighting retrofit programs required that staff understand new technologies, such as the impact of different light dispersion on existing infrastructure (e.g. spacing of light poles) and ensuring accordance with national lighting regulations. Lighting is also a substantial procurement area of local government, with established interests, and one South African municipality ended up in lengthy court proceedings relating to challenges around lighting procurement specifications adjustments.

Municipal building retrofit has been a particularly complex area. At least in South Africa few municipal buildings have had electricity consumption metered and consumption is simply a book entry (i.e. no actual payment from a department to a central office). This means that the energy services company model of drawing on savings to pay for the retrofit service does not easily apply and funding for this work is difficult to secure from limited internal budgets; in addition, this business model is considered to carry risk and therefore is in contravention of the Municipal Finance Management Act.

Renewable energy projects within municipal waste streams have recently got underway in South African cities, but have taken many years and an inordinate amount of legal and financial expertise to develop. Central is the question of risk where a private entity is establishing a business reliant on a public entity's waste stream. The public entity cannot guarantee the fuel stream – for example, a downstream pump breaks down it may take the public entity a couple of days to fix it given staff capacity and maintenance priorities. This poses enormous business risk to the upstream private enterprise.

Given these complexities, and the bureaucratic nature of municipalities, it is very helpful for transition processes to be led by agencies outside of the state, such as non-government organizations, or research institutions (Kern). In South Africa, Ghana and Uganda the urban energy support programs are led by an intermediary organization (Non-profit organization or university). These organizations establish and lead the reflexive and deliberate learning process and support local government with technical and facilitative inputs as it engages with the diverse social actors[7].

Transition management indicates that the more inclusive the process, drawing on an 'inclusion and contribution psychology', the better (Borraine, 2013). To do this requires developing a shared positive vision and a new network (old policy networks are usually 'captured' by the current regime). The energy picture, within the urban energy support programs under discussion, has been used a starting points from which to establish a common, positive vision. Next is the more challenging exercise of identifying the specific actions within the transition agenda to be undertaken. This needs to focus on areas that align with existing priorities and which all can agree to work on. Getting these actions into the municipal systems – budgets, performance indicators – is critical and complex.

Given that 'outsiders' cannot easily grasp the detailed inner dynamics of municipalities, which are often bureaucratically complicated and subject to political idiosyncrasies, it is essential that the transition agenda – in the form

[7] In South Africa, this has been led by NPO Sustainable Energy Africa, but has grown and developed to the point where there are now a range of support actors (SEA in partnership with the local government association and cities network, also ICLEI and increasingly government research partners) who together manage an urban energy platform. In Ghana, the Institute of Social Science and Economic Research, of the University of Ghana is developing capacity in this regard and in Uganda, the support work is housed in the Department of the Built Environment of the Uganda Matyrs University.

of the energy strategy – is led by the municipality itself, with the intermediary organization fulfilling facilitation and support roles (Bawaykyillenuo, et al 2015).

The role of the intermediary is thus one of creating the environment, seeing what works and being responsive to support needs as they arise. The growing of a learning network has been enormously useful within the South African environment. This is an informal space that brings together self-identified municipal 'champions' from some sixteen or so cities and towns, from a cross-section of line departments (environment, electricity, planning, housing), as well as regional and national government, to learn and discuss. Meetings are held bi-annually and the focus of each meeting will be on immediate issues and challenges being faced. The sessions include both technical expertise, shared experience and, importantly, a vertical linkage with national government, in an informal context, for policy input and discussion. Capacity is also developed through more formal skills training[8].

Another key aspect of support is technical assistance, specifically addressing the particular circumstances of the municipality/ies in question and as they arise. This is thus not just typical guide documents, but can range from assistance in putting together technical aspects of tender specifications relating to new technologies, to clarifying legal aspects of municipal procurement, generating application procedures for small-scale electricity generation grid-connection or modelling the relative impacts on energy and cost of different urban form approaches. It often requires a 'jack of all trades' ability, learning as the process demands. These roles, although operating within a clear transition intention, may be fairly open ended and are often challenging to funders as they operate in the area of responding, listening, enabling the beneficiary organization to lead, rather than having a pre-existing and set agenda (with associated measurable outputs).

In an independent evaluation of the support program, participants specifically noted that it is the relationships developed in these spaces, the space of mutual respect and open reflection that is of value (CDRA, 2014). Process support further brings experienced and knowledgeable facilitation expertise into cities to assist them in building the transition agenda within their institution.

6. Conclusion

Local governments are particularly well placed to drive a sustainable energy transition: they can engage multiple players and are also motivated by public interests. The data and energy futures models indicate what needs to be done if African cities are to indeed leapfrog to avoid environmental catastrophe and achieve a democratic and services-oriented energy regime. Evidence of implementation and growing capacity (human and financial) from work over the past fifteen years in South African cities indicates that these efforts can yield impressive results.

However, major challenges to locally driven energy transition have still to be faced, notably around enlarging mandates and functions of local government and expanding the financial flows to enable investment in sustainable energy services and infrastructure. Experience of transition support at this level strongly endorses the emphasis on learning process rather than technical-push policies as the challenge of implementation increasingly indicated the socio-technical nature of systems.

The process will take time and require the ongoing support of intermediary agencies. It is vital that through these processes, local government is developed and local capacity built to undertake transition, rather than simply technology, or expertise-dumping. Ultimately, the sustainable energy transition should contribute to urban development and urban governance broadly, boosting planning abilities and service delivery.

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Governing climate change in Tokyo

Ichinose, T.*

Abstract - This article investigates the climate change problems in Tokyo and the governance challenges for addressing these problems. Based on the discussed facts and figures, the article addresses measures necessary to combat climate change problems in Tokyo, as well as the requirements for the effective implementation of climate change programs.

1. Summer heat problems in the urban settings of Tokyo

Increasing urbanization is generally associated with heat islands - a phenomenon of rising temperatures in urban settings. As a result, more people are affected by higher temperatures for longer periods. Heat islands not only make life uncomfortable for urban residents, the increased temperatures adversely affect people's health (e.g. accelerating air pollution by less ventilation) and the natural ecosystems (e.g. changing flora and fauna) in cities.

With increasing urbanization, ground surfaces have been converted from natural soil or green tracts of land, which function to lower the surrounding air temperature through the cooling effect of evapotranspiration, to materials such as asphalt or concrete, which lack any water content and tend to heat the atmosphere (Fig. 1). Moreover, in major urban regions, although work is ongoing to develop parks and similar amenities, there has been a substantial decrease in greenery and 'productive green land' in residential areas. Land for roads, public facilities, offices, and high-rise residential blocks is increasingly surfaced with water-impermeable substances such as asphalt paving. Asphalt or concrete ground surfaces reach relatively high temperatures - in the region of 50–60 °C - during the daytime on clear summer days, and this daytime heat builds up and is still present during the night.

Exhaust heat from urban energy consumption, such as air conditioners or vehicle traffic, is also a major factor in atmospheric heating (e.g. Ichinose et al., 1999). Namely, anthropogenic heat generated by energy consumed in the course of urban activities - especially by buildings, traffic, and industry - plays an important role in urban climates. It is one of the main causes of the urban heat island effect, which is responsible for numerous severe problems in urban areas.

In the 23 wards that comprise the inner-city area of Tokyo (Fig. 2), the daily average value of anthropogenic heat during summer is 32 W/m2 (Ashie et al., 2004). That is 18% of the average daily solar radiation. In winter in central Tokyo, the anthropogenic heat flux exceeds 400 W/m2 during the daytime. The maximum value was found to be 1590 W/m2 on winter mornings 250 x 250m grid cell (Ichinose et al., 1999). The sea breeze in the Tokyo area is especially weak in wintertime. This together with anthropogenic heating causes the formation of a strong urban heat island.

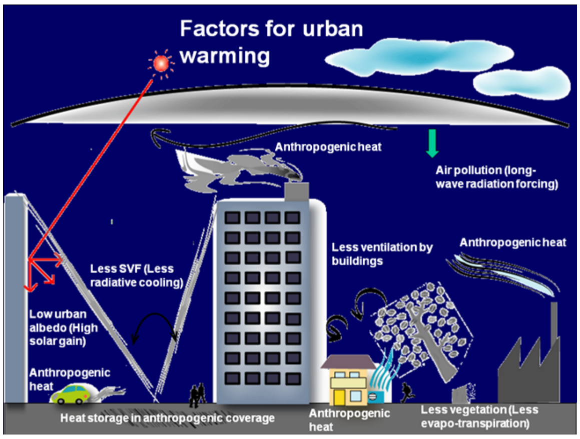

Figure 1. Factors for urban warming (by Ashie, Building Research Institute of Japan)

Although there are differences according to the season, the amount of anthropogenic heating at night is lower than during the daytime. Cooling in summertime and heating in wintertime are some of the main sources of anthropogenic heat in office and residential buildings. Anthropogenic exhaust heat from buildings is concentrated in the center of Tokyo.

The warmed atmosphere moves according to meteorological or geographic conditions such that the heat not only affects the region where it originated but also produces downwind effects.

Urban environments create a complex set of factors, such as:

1. the blocking of heat dispersal through natural wind

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flows, because of the formation of conurbations;
2. the location of factories and other major heat sources at coastal sites (windward) in seaside cities;
3. the formation of low-wind areas where the atmosphere tends to stagnate because of the shape of the ground surface, including urban topography and the presence of large buildings.

Japan's Ministry of the Environment (MoE) has recently investigated these issues through various committees (e.g. MoE, 2001a; MoE, 2001b), concluding that heat islands are domains of thermal atmospheric pollution, caused by human activities. The Ministry of Land, Infrastructure and Transport (MLIT) and local municipal authorities have also started to debate various measures, while the general public is also increasingly interested in this topic as an environmental problem (Ichinose, 2005). We discuss on the impact of heat islands using actual examples of their assessment.

2. Impact of urban heat islands in Tokyo

It has recently been suggested that urban warming, as symbolized by heat islands (e.g. Landsberg, 1981), is affecting ecosystems, including our environment. The impact on ecosystems was pointed out some time ago (Numata, 1987), but unusually almost no research has been undertaken to evaluate this effect. Impact assessments are important in terms of providing warnings concerning the issues involved and educating urban residents and as basic information or evaluation tools for use in social policies and to estimate the costs involved (Matsumoto et al., 2006). As such, impact assessments can be thought of as barometers or indices for changing climatic environments.

2.1. *Impact on human activities*

Heatstroke and other health issues are the main risks from higher urban temperatures. Figure 3 shows Tokyo Fire Department figures for the number of individuals transported to hospital with heatstroke during the summer. Heatstroke often occurs when individuals are working or exercising outdoors, but this figure also includes some examples of individuals requiring emergency transport after being indoors. The results shown illustrate the harsh environment during the summer heat in cities.

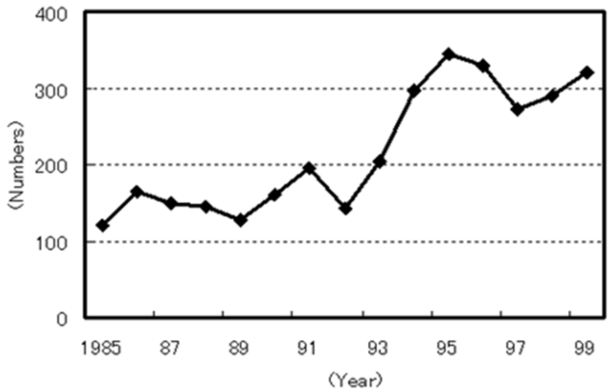

Figure 3. Transported to hospital with heatstroke in Tokyo (Running average in 3 years) (Tokyo Metropolitan Government, 2006) <http://www2.kankyo.metro.tokyo.jp/heat/heat1.htm>

Another problem that is becoming prevalent is the increase in the number of summer 'tropical nights' in urban settings when daily minimum temperatures exceed 25 deg C (Fig. 4). This is attributed to heat storage by artificial ground surfaces and its release during the night, which prevents temperatures from falling. Such temperatures produce discomfort, including sleep difficulties, physical fatigue due to inadequate sleep, additional burdens on cardiac function, and psychological stress. There also appears to be an increasing number of heatstroke cases occurring at night. Fatigue due to inadequate sleep affects the individuals concerned the following day and this should not be overlooked as a risk factor associated with the onset of heatstroke during the day.

Other factors behind such hot summer environments

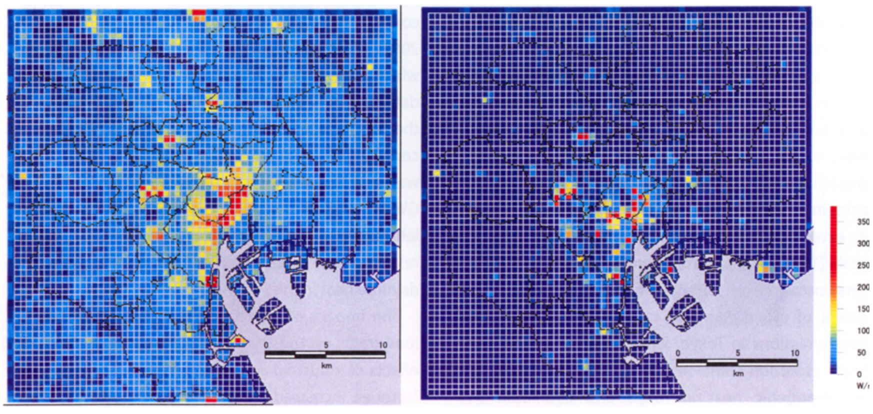

Figure 2. Sensible (left) and latent (right) anthropogenic heat in Tokyo (MoE, 2003)

involve urban living infrastructure, including the widespread use of air conditioners. The lifestyle of urban residents has become dependent on air conditioning, and this promotes health problems resulting from summer heat. Air conditioning use superficially appears to be a way of preventing or coping with summer heat, but it actually creates a vicious circle whereby the air conditioner is switched on because it is hot, and this then consumes energy and the exhaust heat makes the outside temperatures even hotter. Another recently recognized problem is summer colds caused by air conditioning use.

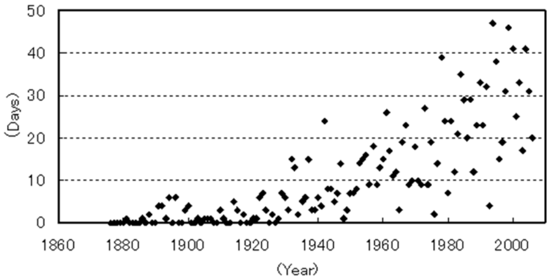

Figure 4. Numbers of “Tropical Nights (minimum temperature is exceeding 25 deg C)” in Tokyo

Of course, such high temperatures are caused not only by urbanization, but can also occur as a result of extreme weather phenomena, such as heat waves, not directly related to urbanization. References such as the report by the Intergovernmental Panel on Climate Change (IPCC) highlight the possibility of increasingly fierce summers due to global warming. However, urbanization itself definitely plays a role in exposure to high temperatures. When conducting impact assessments of rising temperatures in urban settings, we may need to consider comparisons with the impact from global warming as well as synergistic effects with global warming.

2.2. Impact on urban ecosystems

We have recently started to see changes in the vegetation season, with flowers blooming earlier in the spring and leaves changing color later in the fall (Yoshino and Park, 1996; Momose, 1998).

Figure 5 shows inter-annual changes in average March temperatures and the date of Somei Yoshino cherry tree blossoming in the Tokyo District Meteorological Observatory. The figure demonstrates that the cherry blossoms have recently bloomed earlier each year in line with rising temperatures.

Figure 6 shows an assessment of the impact of heat islands in the Tokyo wards on the date of Somei Yoshino cherry tree blossoming. In heat islands in the heart of

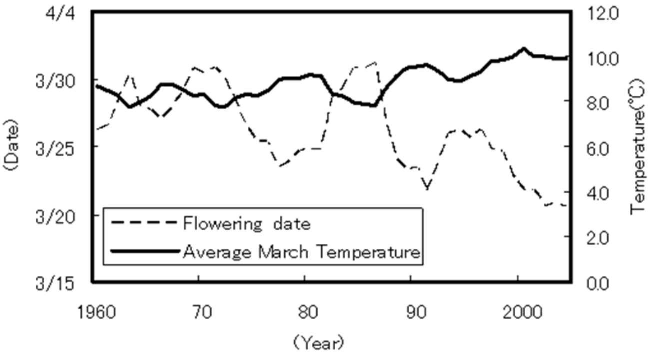

Figure 5. Inter-annual changes in average March temperatures and the date of Somei Yoshino□cherry tree□ blossoming in the Tokyo District Meteorological Observatory (Running average in 5 years, during 1960 - 2004)

Tokyo, the cherry trees are blossoming some five-six days earlier than in the suburbs (Matsumoto et al., 2006). Moreover, there have been reports that in Kumagaya City, a small-to-medium sized city in Saitama Prefecture (population: approximately 160,000), cherry trees located in heat islands in the city center are blossoming around two days earlier than those in the suburbs (Matsumoto and Fukuoka, 2003). This suggests that the earlier blossoming is not simply a result of global warming, but may be associated with rising urban temperatures as symbolized by the heat islands. There have also been reports of the leaves on gingko and Japanese maple trees changing color later in the fall in city centers (Matsumoto and Fukuoka, 2002; Matsumoto, 2004).

In addition to these effects on vegetation seasons, heat islands are also thought to impact other organisms in various ways. For example, there have been reports of the successful open-field cultivation of tropical aloe plants in the Tokyo city center (Nemoto et al., 2001), as well as reports of the disappearance of dragonflies (Shinada et al., 1987) and a fall in black-spotted pond frog numbers (Momose, 1998).

Of course, we do not know enough about the mechanisms behind the relationship between heat islands and early cherry blossom blooming or tropical plant cultivation, so these examples do not necessarily prove a direct causal relationship. Moreover, we have the impression that these phenomena do not appear to be particularly relevant to urban living. However, ecosystems consist of complex relationships between organisms, one example being the food chain, so a breakdown in the balance of the ecosystem could eventually result in the extinction or, indeed, a plague of a particular organism. We also run the risk that the natural environment in which we live, including the atmosphere, water, or soil that have long been cleaned by other organisms, will no longer function normally. This could also bring about changes in sanitary conditions, such as the emergence of pests or changes to agricultural production in city suburbs. From this perspective, it is becoming increasingly important to evaluate changes not only in summer, but also in winter, spring, and fall.

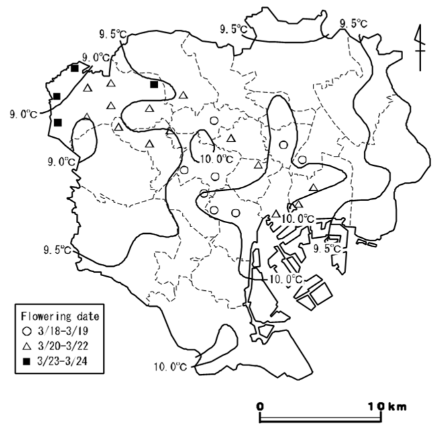

Figure 6. Distribution of flowering dates of Somei Yoshino (cherry tree) and mean temperature in March in the Wards Area in Tokyo in 2004 (Based on Matsumoto et al., 2006)

In conclusion, it is necessary to conduct careful monitoring and study-based assessments of the impact on natural ecosystems in urban climates. Such assessments need to take a multidisciplinary approach to comprehensive analyses, drawing on expertise from various fields, including meteorology, medicine, ecology, geography, agriculture, and anthropology.

Observations of bio-ecosystems within cities are inexpensive and easily understood methods of understanding local environmental change and can also be used in observation networks or for monitoring environmental impacts on the citizen level. Moreover, they can act as learning tools for real-life environmental education when schools and other educational establishments are involved.

An understanding of the actual impact of urban warming, as symbolized by heat islands, can play an important role in helping to work out necessary measures (e.g. improving the social environment and preventive measures).

3. Concluding remarks: measures to combat urban heat islands (UHI) in Tokyo

Rising temperatures caused by urbanization can be thought of as anthropogenic climate change and measures to combat such change involve actions to mitigate the effects. However, the concept of mitigation is not applicable to rising temperatures caused by fierce summer heat unrelated to urbanization. In recent years, we have seen a focus on the concept of adaptation to global warming. Basic measures to combat, or mitigate, heat islands can be understood as adaptation in order to live a cooler, more comfortable, and safer life in hot climates.

In Japan, the three main measures currently under consideration to address increasingly high temperatures in urban areas are to

1. Reduce anthropogenic heat exhaust associated with energy consumption
2. Change to urban structures and materials on the ground surface that heat the atmosphere less
3. Ensure airflow through cities.

Of these concepts, the measures thought to be the most effective include reducing air-conditioning cooling loads, for example by: planting vegetation on buildings (on roofs and walls); using water-retentive paving; painting walls light colors; improving the reflective capabilities of roof materials; preserving and developing green tracts of land; developing water channels in parks or flowing small streams through open channels; and relocating large-scale green tracts of land or business facilities (taking into account sea breezes and other prevailing winds) (Fig. 7).

In 2001, the Japanese Government established the Ministries' League (ML) on UHI to promote discussion for mitigation of urban thermal environment widely. In 2004, the Fundamental Policy of the Japanese Government on UHI was published. Such action was the first attempt in the world. These movements of the Japanese Government have given much awareness of the local government for UHI issues. In summer of 2002, the Tokyo Metropolitan Government has settled a new monitoring network of UHI with high spatial resolution (120 stations in the 23 wards of Tokyo with the size of 30 km by 30 km).

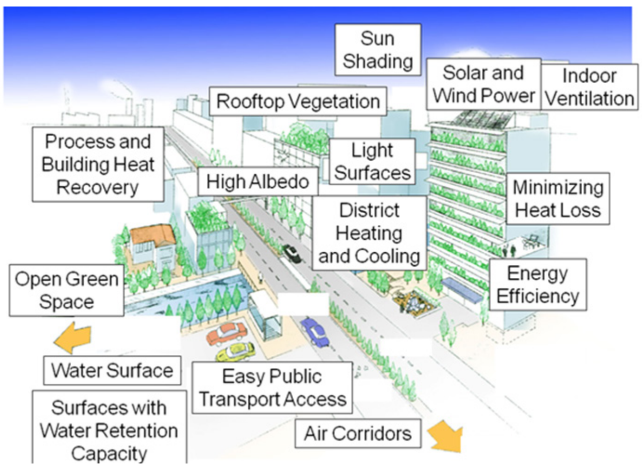

Figure 7. Measures for UHI (Revised JEA, 2000)

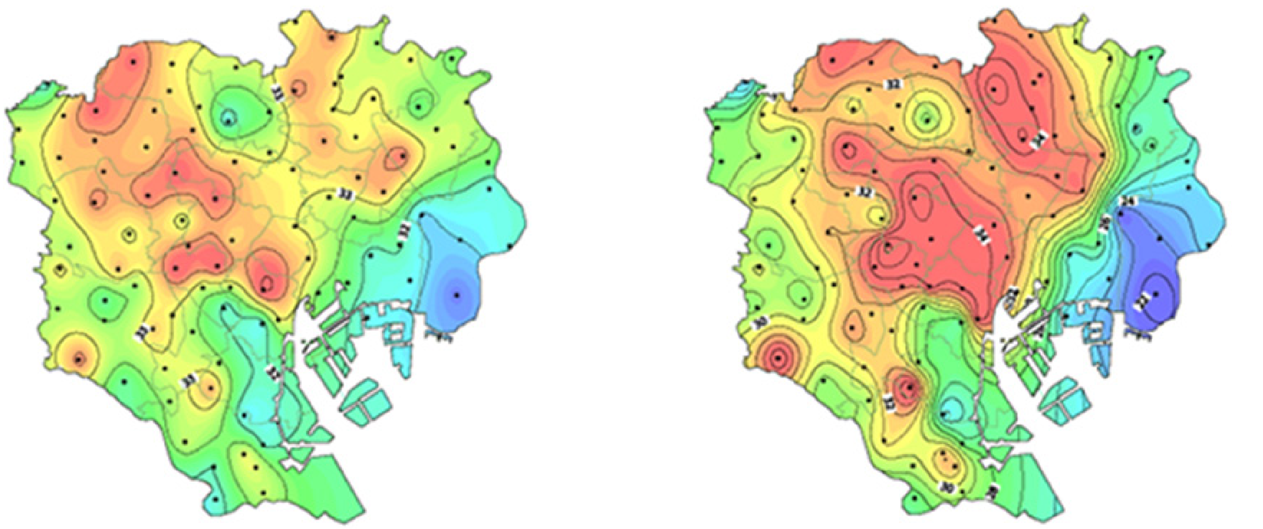

Figure 8. Average of maximum temperature and ratio (%) exceeding 30 deg C by METROS (July 20 - August 31, 2002) (Tokyo Metropolitan Government)

This monitoring network enabled to express demographically the precise distribution of air temperature and thermal environment (Fig. 8). It gives information where we need measures for UHI in Tokyo with higher priority.

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The Transport Area of the Florence School of Regulation

The Florence School of Regulation (FSR) has been created in 2004 as a partnership between the European University Institute (EUI) and the Council of the European Energy Regulators (CEER). Since then, the Florence School of Regulation has expanded from Energy regulation to Telecommunications and Media (2009), Transport (2010) and Water (2014).

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- to actively contribute to the evolution of European regulatory policy by way of research.

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Antitrust Compliance Programs in Europe: Status Quo and Challenges Ahead

A kick-off workshop dedicated to **Antitrust compliance programs around Europe** took place at the EUI premises on **26-27 June**. The event was the opportunity to launch a new project that will be run at the Robert Schuman Centre for Advanced Studies of the European University Institute. The project, focused on competition law and economics, is called ENTraNCE – European Networking and Training for National Competition Enforcers – and aims to provide training to officers of National Competition Authorities (NCAs) and private enforcers, to carry out research and to promote informed discussions on key policy issues on competition law and economics. The new project builds upon and complements the experience gained by the RSCAS during the past five years in organizing ENTraNCE for Judges.

This first workshop, articulated in 4 panels during two half days, focused on Antitrust compliance programs in Europe: Status quo and challenges ahead, with the aim of giving a complete overview on the issue through the participation of different stakeholders coming from the European Institutions, the NCAs, the Academia as well as law and consulting firms.

For more information on the programme, contact the director Prof Pier Luigi Parcu entrance@eui.eu