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Development of New Sustainable Urban Areas: Horizontal or Vertical Planning Systems for Resource Efficient Cities

Ronald Wennersten

Additional information is available at the end of the chapter

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Abstract

China's remarkable economic growth has been partly driven by a high rate of urbanization and fast reduction of poverty. This has not been achieved without a price, that of environmental pollution. The Chinese government has made great efforts to reduce coal consumption; however, adjusting the fuel mix in a country like China is not easy. An important question is, if developing countries should follow the Chinese model and reduce poverty based on the Chinese vertical planning system with a strong one-party government? or should the developing countries use a horizontal model based more on local democratic principles? The transition to more sustainable energy systems will be gradual and may take longer time than expected. Sustainable development is a process involving conflicts between different aspects of sustainability and it is a value-based concept, which means that a participatory process involving key actors including the public is crucial for the development. The Chinese vertical model is compelling for many developing countries because it produces fast results on a massive scale. A horizontal planning system is slower but more resilient and adaptive concerning complexity of the urban fabric. In a new project, based more on horizontal principles, a Swedish planning support system, CITYLAB, is now being tested in a Chinese context.

Keywords: urban planning models, energy systems, China, Sweden, CITYLAB

1. Introduction

1.1. Global challenges for urban development

Our world is currently facing serious challenges. Human impacts affect basic ecosystem services as biodiversity and climate in a negative way with unknown long-term consequences. Large amounts of resources are needed for creating a decent life for a growing population in developing countries. It is important to reveal the built-in conflicts in future trajectories towards sustainable development on a global level. As stated by the Brundtland Commission, we have to take care of people today as well as of future generations [1]. This challenge cannot be met without more intelligent solutions for use of resources, solutions that will have less environmental impacts and save resources for future generations, and at the same time reduce poverty among people living today. When discussing resources in this chapter, we mainly refer to energy, materials, and water. Of these, energy is the central resource which makes it possible to utilize the other resources for human needs like building infrastructures, supplying food and water. Energy is the engine driving urban development. For this reason, the focus is on sustainable energy systems in this chapter.

Important global trends are now, especially pronounced in the developing countries, a growing population, migration to urban areas, and a growing middle-class population having increased demand for comfortable lives. This trend is particularly obvious in Asian countries like China and India, but in the near future, also Africa will go this way. Acute deprivation persists in the global energy sector, with 1.2 billion people without electricity and 2.7 billion reliant on the traditional use of solid biomass for cooking [2]. Achieving universal access to affordable, reliable and modern energy services by 2030 is now one of the UN Sustainable Development Goals, but projections show today's efforts falling short of reaching this goal. Embedded in the strategies to achieve the UN goals are high urbanization rates and high annual economic growth (7%) in developing countries which is an important criterium for reaching the goals. Urbanization and economic growth are in many ways seen as key factors for sustainable development and poverty reduction. This is because of an anticipated higher and more effective utilization of common services as building and transport infrastructure, hospitals, schools, etc. Other researchers however point to that urbanization will drive consumption and thus increasing use of resources. This is because consumption choices or lifestyles are not just a product of the values of individuals but actually tied to the form of the surrounding urbanization: that is, lifestyles are situated [3]. Urban areas can be on one side regarded as centers for innovation, but they are also part of modernization resulting in higher consumption patterns. However, the strong urbanization is probably more or less out of control globally, so the focus must be to see how resource consumption can be minimized under that boundary condition for urban development. If the goals of the UN SDGs are to be achieved this will inevitable be linked to increased use of resources globally [4]. To escape from this trap, there seems to be only one way out, to be more effective in the use of resources

in urban areas. Increasing supply cannot counteract the increasing demand in a sustainable way. New ways of urban planning play a central role in this development.

1.2. Central issues in this chapter

The fast global urbanization rate is a driver for increasing resource consumption which in turn is connected to an increasing energy consumption mainly from fossil fuels. This development will cause more of environmental impacts and international conflicts around resources. Many of these problems and conflicting goals are described in the UN 2030 Sustainable Development Goals which primary aim is to decrease poverty in the world. It is more and more obvious that renewable energy sources cannot till 2030 in a significant way change this situation to replace fossil fuels with clean energy. The increasing demand cannot be met by increasing supply. This leads to a central question, how we plan our cities? Are there ways which new strategies for urban planning can change the negative development? China has shown that its central model for planning, a vertical model, have had a huge effect on reducing poverty. This has been to a price of increasing resource consumption and environmental degradation. Sweden, a small developed country with very high environmental ambitions has chosen another way. Here participatory or horizontal planning models are used with early involvement of actors on local level. A central question is then, which model other developing countries should choose?

2. General trends affecting resource consumption

The general trends for resource consumption are important to keep in mind when discussing future pathways for sustainable urban development. Are we on a positive trajectory on the global level or are we going in the wrong way using more resources?

There are three important trends for the future development of global needs for resources:

- High urbanization rates
- Higher affluence stimulating consumption of goods
- Growing population on the global scale

These trends all points towards higher needs for resources on the global scale. To handle this there are international agreements formulated. One is the Paris agreement [5] with focus on reducing emissions of Green House Gases (GHG) till 2030, and the other one is the UN 2030 Sustainable Development Goals [6] with a set of more complex and partly conflicting goals. There are obvious conflicts between the goals as poverty reduction is linked to economic growth and availability of energy at reasonable prices. To be successful, these agreements should be implemented with more detailed goals on national and local levels. An important indicator of the progress is the energy consumption.

3. Energy is the core of the problem for increasing resource consumption

3.1. Energy is driving development

All living systems keep alive because they use energy of high quality and leave energy of low quality. It is the general principle of entropy increase. This applies also for human urban systems. The processes can be different when it comes to effectivity. We do not build cities in order to minimize carbon dioxide emissions.

Energy is thus the fuel that keeps urban areas as well as the whole society running. Much energy is spent on production of material goods which at the end creates waste and environmental impacts. A new trend which creates hope is to reuse and recycle materials expressed in ideas around circular economies. However, one should bear in mind that recycling of materials requires energy and it also involves degradation of quality of materials. The concept consumption is sometimes criticized because mass and energy are constant, but is merely used to describe the decreasing quality both for energy and materials. This means that the idea of circular economy does not in itself solve the problem of the increasing use of energy. Except from consumption of different goods, also sectors like urban transports and buildings are important parts in the energy demand in urban areas. In several ways, the different sectors are connected in a way which should be handled in more cross-sectoral ways to get optimal, not suboptimal, solutions [7].

3.2. Trends for global energy consumption

In World Energy Outlook 2016 [2], different scenarios for the future development of energy consumption are developed. The New Policies Scenario is based on a detailed review of policy announcements and plans, and reflects the way that governments, individually or collectively, see their energy sectors developing over the coming decades. Its starting point is the policies and measures that are already in place, but it also considers, in full or in part, the aims, targets and intentions that have been announced, even if these have yet to be enshrined in legislation or the means for their implementation are still taking shape. The result of this scenario is given in **Table 1**.

Predicting the future is inherently difficult and there are many unknowns and unknown unknowns on the way. However, according to the WEO16 New Policy scenario, fossil fuels will continue to dominate the world energy mix, at least till 2040. This is also important to have in mind when discussing specific countries like Sweden and China later on in this chapter. The global energy development is thus characterized by growing energy consumption especially in the developing countries. This has been shown also in other reports like BP Statistical Review of World Energy [8]. China is the world's largest emitter of carbon dioxide and a new study has forecast China's carbon emissions to accelerate further in 2018, despite Beijing's efforts to switch to greener energy sources and policies [9]. The conclusion from the figures in **Table 1** is, although renewable energy production is increasing, fossil fuels will remain as main primary resources for a predictable future. It is better to face facts early and

New policy scenario	2000	2014	2025	2040
Coal	2316	3926	3955	4140
Oil	3669	4266	4577	4775
Gas	2071	2893	3390	4313
Nuclear	676	662	888	1181
Hydro	225	335	420	536
Bioenergy*	1026	1421	1633	1883
Other renewables	60	181	478	1037
Total	10,042	13,684	15,340	17,866
Fossil-fuel share (%)	80	81	78	74
CO ₂ emissions (Gt)	23.0	32.2	33.6	36.3

*Includes the traditional use of solid biomass and modern use of bioenergy. Source: IEA [2].

Table 1. World primary energy demand by fuel and scenario (Mtoe).

plan for that than wishful thinking which later turns out to be just wishful thinking. If the Paris agreement and the UN 2030 SDGs fail, what hope and trust could there be in new goals then? What is then a sustainable energy system? Often the argument is that it is a system that only uses renewable energy. This is of course true in the very long run, when we have exhausted fossil fuels, but what about the transition period?

4. General principles for a sustainable urban resource use

The concepts of sustainable development suggest that development should be in some way towards higher states of sustainability. The problem related to sustainability is that it contains conflicting goals. Does it imply economic growth and if so, where should the balance lie between economic growth, poverty reduction and environmental protection for example, minimizing emissions of GHG which is just one effect among many? All these conflicting goals can easily be found in the UN 2030 SDGs. Maybe an even more important question is who should decide how to make priorities among the goals? For companies and most organizations, growth is desirable and when it comes to several frameworks for sustainability, the central idea is to decouple economic growth and environmental degradation often expressed as emissions of GHGs. This usually implies a target of continuing economic growth with less consumption of energy and materials. Some researchers argue that this kind of “sustainable development” cannot be achieved with existing economic growth models. The latter argument is in line with a doubt if ecological modernization is possible [10]. Can we handle the problems of rising population and consumption by technology development? We can only reflect over the fact that if the rich economies grow at 3% until 2070, and by that stage the emerging economies have attained similarly high living standards—which seems to be the aim of the global development agenda, the total world economic output and impact could

be 60 times larger than it is today. It is also important to consider that it is more difficult to change an urban development which is socially and economically declining. Cities and regions which are in a phase of growth always have more choices than those declining.

The discussion around growth models is an active and important on-going discourse beyond the scope of this chapter. Changing life styles and consumption patterns can only grow out from a bottom-up perspective in democratic countries and these changes will occur at different times in different cultures and developing states and cannot easily be controlled or predicted. The complexity around defining a long-term sustainable energy system depends mainly on the conflicts between different goals. These conflicts cannot be resolved with scientific methods although such methods should reveal transparent facts which could be used in decision processes involving different stakeholders. In many urban projects, the emissions of GHG have become a central criterion for the overall development. However, one must accept that it is one criterion among many others in a broad decision process in an urban context.

It is necessary to consider which basic criteria we should use to characterize more sustainable energy systems before we can start planning for these and compare different alternatives. We can use these criteria in decision processes to formulate targets for short, medium, and long-term planning. The specific choices should be taken in a broad democratic process on local level.

In many cases, the definitions of sustainability or sustainable development are too general and too vague to serve as guidelines for the practical implementation of more sustainable energy systems, and we will not review all these kinds of definitions here.

What is needed are more hands-on criteria which can be used by planners in formulating goals for a sustainable urban energy system. The criteria proposed here at two levels are by no means derived from scientific facts but more from practical experiences from urban development cases.

5. Planning for long-term sustainable urban energy systems

Energy is thus the fundamental resource for urbanism and social development. Today, the main primary energy sources are fossil fuels. To meet global challenges in the long run, there should be a transition to a 100% renewable energy, but it is more and more obvious that the transition will take longer time than anticipated today, and that we have to find alternative pathways for transitions based on local conditions. It might very well be that the developing countries first will have a phase of using more energy before they can enter as state of decreasing use of energy. In the UN SDGs, the “hope” is that the transition to renewable and clean energy can go faster than might be realistic. If so, there is a risk for a backlash for the goals which will be serious when realizing the failure with the earlier millennium goals. According to a new report, world hunger is on the rise: the estimated number of undernourished people increased from 777 million in 2015 to 815 million in 2016 [11]. The report also noted that slowdown in global growth has had a negative impact on people’s ability to get enough to eat. The cause for increasing number of starving people is related to conflicts and droughts

which could be partly connected to climate change. Increasing conflicts are often caused by increasing competition for resources for example, fossil fuels.

We should accept the fact that all primary energy sources are connected to social and ecological problems but are needed to improve social conditions for people. Today's one-sided focus on one environmental aspect, climate change and GHG emissions, draws attention from this fact. Most of the negative environmental effects of energy transformation are long-term and highly uncertain, making long-term planning and communication of risks. One problem here is that there is no red line for environmental effects as it also is for social development. We cannot foresee the long-term consequences of environmental impacts as well as social changes. There are thus no scientific solutions for sustainable development. Sustainable development involves many conflicting goals where different actors have different values concerning the priorities. To solve the conflicts local actors have to be involved. The urban transformation will be crucial for solving the problems related to resource use on a global scale. An important question is if the transition should start more as a bottom-up process than top-down processes on global and national levels and which role models could be used for the transition process? The top-down or *vertical process* can be more effective in the short-run but embedded risk is this fast development creates new problems because of too much focus on one side namely economic development. The local participatory, or *horizontal process*, might be slower but maybe safer in the long run. One major obstacle is the short-sighted vision where results on short-term are asked for.

6. Planning models

To solve the problems related to increased resource use, especially energy, on a global level it will be important to find principles for planning that can be adapted to local conditions in different countries and urban areas. This will be of central importance in relation to the UN 2030 SDGs. This chapter is comparing the development of more sustainable urban resource use looking at two very different countries, Sweden and China in order to evaluate which role model and principles for sustainable urban development could lead forward in relation to the UN 2030 SDGs. These examples are used to point out some critical factors underlying the development of more sustainable urban systems on short- and long-term. Sweden is a developed country with a small population depending very much on export of high-tech products. It is also renowned for high environmental standards and for several examples of urban development claimed to be sustainable. Swedish representatives have even argued that Sweden is the only country that has decoupled economic growth and emissions of GHG. This statement is under discussion and related to the problem if GHG emissions should be production or consumption based. In the Swedish calculations emission from our consumption of goods manufactured in China is not included. The Swedish Government is supporting an effort to export Swedish environmental technology and examples of sustainable urban development mainly to emerging economies [12, 13]. One of the most well-known cases is the "Hammarby-Sjöstad" area in Stockholm [14]. This case is clearly showing that the success of the Swedish planning system is based on the participation of all relevant actors in an early stage. We call this here horizontal planning.

On the other hand, China is an example of more vertical top-down planning system where strong actors play important roles. Chinese examples of urban development ranges from large-scale housing areas without any obvious focus on sustainability other than creating housing for the huge population migrating to cities in the effort to reduce social problems. The drivers for the developers of these areas are clearly short-term profits without more of longer term sustainability thinking. Also, China is now trying to export these kind of urban models, mainly to Africa and the question is how this fits into models of sustainable development [15]. Can any of these models be a role model for the transition of developing countries towards more long-term sustainability?

This chapter discuss how processes for gradual energy transitions can be developed mainly on the urban level, to find pathways towards more sustainable energy systems. The chapter analyses several key concepts in more detail: sustainability principles, sustainable energy systems, urban planning, and energy integration in urban planning. The overall goal is to give a more comprehensive view of problems and possibilities of implementing sustainable energy technologies, including policy implications on the urban level. These considerations are important also for researchers working in the field of applied energy as well as urban planning. It is necessary for the researchers to understand how technologies can be accepted and fit into emerging more sustainable energy systems. It is about widening ones' perspectives and looking at problems at different system levels.

7. Planning for a global shift in energy

Much hope is put into that there is an on-going global shift to renewable energy sources, which is also a precondition in the UN 2030 SDGs. Poverty reduction will be dependent on huge amount of energy, and this energy should come from clean energy sources, in order not to conflict with other SDGs. If this problem cannot be solved environmental goals will be difficult to achieve. Also, the peace aspect will be endangered because with the fast-growing need for energy and other resources international conflicts will certainly increase.

To evaluate sustainable pathways and planning principles concerning energy systems, there should be some general and also more specific criteria for the planning process. Basically, these can be derived from scientific analysis but at the end, choices should be made, choices which are value based. Which future do we want? As will be discussed these choices can be made from central governments or from participatory processes on the local level.

Sweden and China are used as cases for discussion of role models for development of sustainable energy systems. The reason for this is that they are extremes when it comes to vertical and horizontal planning systems. Sweden is a highly developed country which is regarded as being very advanced when it comes to sustainable development and environmental protection. The Swedish government have decided that Sweden will have sustainable and resource-efficient resource supply in 2050 and there should be no net greenhouse gas emissions to the atmosphere. Sweden has a very flat planning system at the local level to a high degree independent on influence from the national government.

China, on the other hand, is the world's biggest emitter of GHG gases and the development does not seem to go in the right direction. China has also a very hierarchical planning system leaving local planners with fewer options. On the other hand, China has had a remarkable development when it comes to poverty reduction, a central goal in the UN SDGs. Using two case studies and analyzing the energy situation concerning sustainability leads to a discussion on how urban planning principles can be developed to be in harmony with all the UN SDGs.

8. Urban planning in China

Since initiating market reforms in 1978, China has shifted from a centrally-planned to more of a market-based economy and has experienced rapid economic and social development. GDP growth has averaged nearly 10% a year—the fastest sustained expansion by a major economy in history—and has lifted more than 700 million people out of poverty. It thus seems that China is a successful story when it comes to social development and reducing poverty but is less successful when it comes to decoupling economic growth from increasing resource use and environmental degradation. Much of the environmental problems are related to China's energy system. The success of the Chinese development has also been an attractive way for development for other developing countries, and China want to benefit from this. Examples are bilateral development with countries in Africa and the One Belt One Road (OBOR) project. In 2010, China overtook the US as the world's largest CO₂ emitter, mainly because its massive use of coal in the energy sector. Over the last three decades, China's energy transition has marginally moved towards a somewhat lower carbon structure: less coal and oil, more gas and more renewables. However, at the same time, the total amount of fossil fuels has increased. Many foreign scenarios are however predicting a fast increase in renewables. In one scenario, "The Energy [R]evolution scenario," it is argued that renewable energy can provide more than 80% of the world's energy needs by 2050 [16]. In a report published by Greenpeace [17], it is written "China leads the world in investment in solar and wind power, prompting many to say the country has reached a green tipping point [17]. The growth of renewable energy in China has thus been much commented on in positive terms, but what is the real situation? If we look at Chinese statistics, the change in the mix of primary energy sources is not revolutionary in any sense. During the period 2010–2014, the share of coal in percentage went from 69.87 to 66.03. Hydropower is dominant among renewable energy sources. The share of other renewables is still less than 2% in 2014. These figures show the relationship between primary energy sources which sometimes hide reality. The absolute amount of fossils fuels increased from 946.9 million tonnes of oil equivalent (Mtoe) in 2000 to 2649.6 Mtoe in 2014, and it will most likely continue to increase in the future [2, 18].

China is struggling with the transition of its economy from an old Soviet style to a modern market economy, but the central 5-year plans still dominate the planning system. According to the 18th Chinese Communist Party Congress, China will be a moderately prosperous society by 2021 and a fully developed country by 2049, 100 years after the country's foundation [19]. In practice, the planning system in China is still operating in a traditional way by predicting rising demand and establishing a supply for the growing demands for resources. If not new

ways for more radical shift of the societal metabolism can be found, fossil fuels will continue to be the main energy source in Chinese urban development.

The Chinese Government is trying to balance economic growth, social development, and environmental protection but up till now the focus has been on economic and social development. This top-down, vertical planning system has played an important role in the very fast infrastructure development and the reduction of poverty. This makes this model attractive for many developing countries and the question is if this one party, centrally controlled model can be a role model for sustainable development in other developing countries concerning the fulfillment of the SDGs. As mentioned before, Chinese attempts to export its urban development model and is investing in huge infrastructure projects in developing countries.

9. Urban planning in Sweden

The Planning and Building Act of 1987 established the basis for decentralized, autonomous municipal planning and limited possibilities for state intervention. The new Planning and Building Act of 2011 simplifies planning and building processes, while strengthening control of building construction. The new Act puts greater emphasis on the Comprehensive Plans as strategic and developmental documents. Independent municipal planning is a key aspect of local self-governance in Sweden, with each municipality deciding how land is used and developed. Before the 1987 Planning and Building Act, a central government agency approved local plans. Now, municipal plans approved by local assemblies have legal status, and central government can only interfere to protect national interests, natural resources or state security, or to ensure proper stakeholder participation.

The Law on Energy Planning (1977) requires that each municipality has a plan for the supply, distribution and use of energy. An amendment in 1999 requires that the plan include an analysis of how municipal energy operations affect the environment, public health, land management, water and other resources. Swedish municipalities mostly supply energy through municipal-owned or private contracted energy companies that in several cases operate district heating systems, often powered by waste incineration plants.

One important aspect for this discussion is the policy of municipal monopoly in Sweden. Plan monopoly means that the municipality decides how land in the municipality should be used without influence from the national government. Another important aspect is that the principal revenue source for Swedish local government is income tax, and tax rates are decided by municipal and county/regional councils. The average is about 30% of income, with 20% collected by municipalities and 10% by county/regions. Tax revenues finance approximately 68% of municipal of public services and development operating costs and 72% of county council costs, with the balances funded by service fees and other sources. Compared to China, the city is not so much depending on exploiting land values, but can use money from land allocation to invest in infrastructure, social services, etc. The municipality in this case also has a possibility to put up restriction for developers concerning sustainability aspects.

Many municipalities and county/regional councils have over time developed more inclusive and integrated planning processes, and wider coordination and cooperation in the planning and

implementation phases, involving different departments, regional authorities, the private sector and other stakeholders. As a result, many visions, comprehensive plans, strategies and policies have the long-term and holistic perspective required for sustainable development. Several other cases for sustainable development in residential have been described elsewhere [20].

To sum up, there are at least three characteristics of the Swedish planning system which are important for the case study and in the comparison with the Chinese system. These are:

1. The Plan Monopoly for Municipalities: the municipalities can develop their plans without interference from the national level.
2. The municipality tax: most of the tax people pay in Sweden goes to the Municipalities not to the state. This means that municipalities have a possibility to develop strict conditions for developers which can receive land allocations at lower costs if they follow the conditions.
3. The practice to involve many stakeholders early in the planning process.

Recently, the collected experiences of horizontal planning in Sweden have been put into action by Sweden Green Building Council through the development of CITYLAB [21].

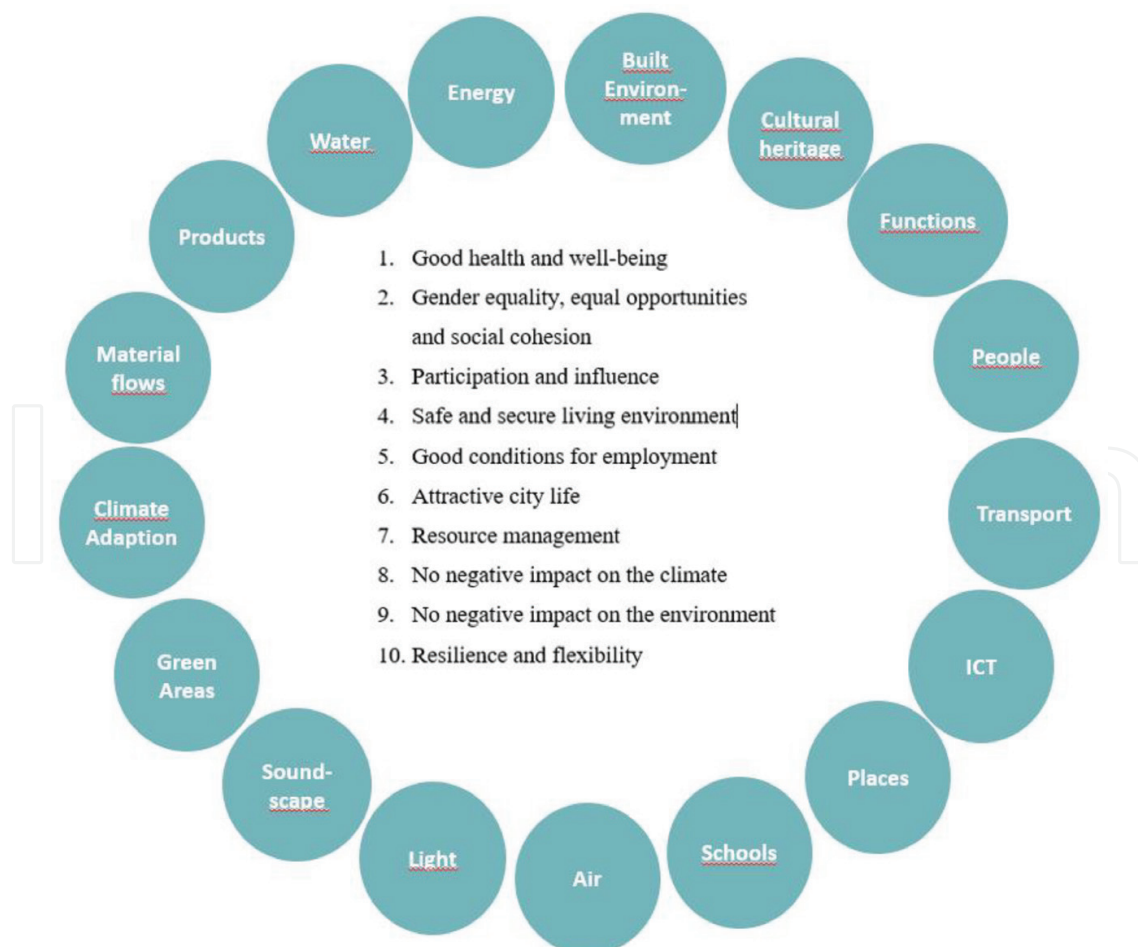


Figure 1. The 10 sustainability goals and 17 focus areas in CITYLAB GUIDE.

CITYLAB does not replace existing planning systems in municipalities but rather supports the cooperation and experience exchange between different actors and projects. For this purpose, a guideline has been developed. CITYLAB primarily supports urban development projects in formulating sustainability targets and ensuring that those targets are achieved within the urban planning process.

Thousands of people have been involved in this work, including representatives of state agencies, municipalities, and building companies; as well as property owners, consultants, architects, and researchers.

CITYLAB has specified 10 overall sustainability goals for sustainable urban development. These goals have been developed based on the UN's Global Goals for Sustainable Development, the Delegation for Sustainable Cities' document "Fifteen obstacles to sustainable urban development," Sweden's national environmental quality objectives, public health policy objectives, and Vision for Sweden 2025.

The 10 overall sustainability goals for sustainable urban development are given in **Figure 1**. To achieve these goals, 17 focus areas (in blue) have to be handled in an integrated way described in CITYLAB GUIDE.

10. Role model for emerging economies

The UN 2030 Sustainable Development Goals have in its 17 goals an agenda for how developing countries can develop towards sustainability. It also seeks to strengthen universal and recognize that eradicating poverty in all its forms is the greatest global challenge and an indispensable requirement for sustainable development. However, there are obvious conflicting goals. To reach the development outlined in the SDGs requires huge amounts of resources, economic and concerning material and energy. As have been the case for China, the transformation will heavily depend on affordable energy sources [22]. The Chinese development has shown that eradicating poverty has been coupled with serious environmental impacts. There is a hope in the SDGs of that the development of the developing countries can find other ways thus minimizing the use of fossil fuels and using clean energy sources. Is this wishful thinking which can lead to disappointments when it comes to fulfillment of the SDGs as was the case with the millennium goals?

The development of developing countries is linked to high urbanization rates and resilient energy supplies. Thus, a key problem is to find solutions for planning sustainable energy systems for urban areas. This brings us to the question which planning models could support these solutions? Should it be a more centralized planning vertical model as in China or a more decentralized horizontal model as in Sweden for example, CITYLAB?

The question is highly relevant since both China and Sweden are trying to export their planning models to emerging economies.

China's influence in Africa is growing quickly on many levels. All across the continent, Chinese companies are creating new highways, light rail systems, Special Economic Zones, and mass housing developments. Cities have received brand new skylines made in

China, designed by Chinese architecture firms, financed by Chinese banks, and built by Chinese contractors. From foundational elements such as concrete, window frames, and fire extinguishers, to decorative ones such as carpets and curtains, many of the basic items used to construct these skylines have been sourced directly from China.

China's initiative One Belt One Road (OBOR) is a network of roads, railways, oil pipelines, power grids, ports and other infrastructural projects meant to connect China to the world. OBOR is an ambitious project and it encompasses almost 65 countries. China has planned around \$1 trillion of investment in various infrastructure projects by providing loans to the countries involved at a low cost.

Many developing countries find the Chinese offers attractive. It is a fast way to fulfill social development for the large number of people. However, the model for development is the same as in China, with huge need for energy and other resources. It also leads to a dependency of China in the future development because the economic debts to China.

Sweden has been widely praised for their efforts to develop and promote models of sustainability for the rest of the world. In this sense, "the sustainable city" has become a Swedish service to export. In order to strengthen a coherent image of Swedish sustainable urban development, the Swedish Trade Council initiated a marketing platform for eco-profiled companies under the name of "Symbio-City" [23, 24]. This concept has been applied in several urban development projects in China. An example of this knowledge transfer is the Caofeidian eco-city, which was marketed become a world-renowned, modern, people-focused, prosperous, climate-neutral and environmentally sustainable society [25]. The project was supported by both the Swedish and the Chinese government. However, it is obvious that the projects have run into several problems during the implementation phase which is common for many eco-city projects in China involving international cooperation. Several authors also have pointed out the Caofeidian eco-city exhibits several features of twentieth-century techno-cities and that on eco-city projects needs to consider not only the high-tech, new urban environments materialized as eco-cities, but also complex social factors. This is especially true in China with its situation with huge migration of people into urban areas. De Jong et al. developed this further and argued that problems to implement European cases for urban sustainable development in China is very much due to differences in the traditions and attitudes to what "good governance" is [26]. In another study, the problems with transferring urban development experiences from West to China was analyzed using the concept of "experimentation under hierarchy" to show important success criteria [27]. The study only investigated two cases but here the key factors for success were strong international inputs of expertise and funds. However, it is clear that importing whole city concepts to developing countries like China is difficult because these concepts are planned in another context.

In contrast, the Chinese administrative context is one of "power concentration among a limited number of people in the executive branch and obedient attitudes at the receiving end of all other branches of power." In China, it is often not easy to find out who these "limited number of people" really are. Urban policy has become more important yet also more challenging. Urban systems are becoming more and more complex with growing bureaucracies. It is inherently difficult to control this system in a vertical way.

The role of local governments in catalyzing effective transitions to more sustainable urban development is of central importance. Despite strong local political will and commitment to promote environmental integration, obstacles still exist to a considerable degree in China, including political instability, lack of understanding, knowledge and experience, and insufficient cross-sector coordination [28]. This is probably a situation which is similar in many developing countries. Current administrative organization of sector specific responsibility appears to impede cross-sector coordination for integrating environmental concerns in urban development.

The competition between the two role models is thus unbalanced. On one side, the Chinese massive investments requiring huge amounts of resources but rather fast result for raising welfare among poor people.

On the other side, the Swedish slow step-by-step processes built on participation of many actors including inhabitants.

In another case study, there has been a trial to implement the planning strategy used in the Swedish case. Important conclusions from this case are that it is difficult to break the traditional planning routines at the city level and that there should be an initial phase where the ideas behind the new planning strategy should be carefully explained. It is important to state that it is a project-based demonstration case and that external funding can be used to compensate for extra resources needed. A new project is now initiated in China as a cooperation between Sweden Green Building Standard, School of Architecture, Southeast University in Nanjing, Planning research institutes in Jiangsu province, and local governments. The purpose of the cooperation is to find mechanisms to develop a strong partnership that can lead to benefits for all partners in the work for more sustainable urban development. The project will use a pilot urban development case in Nanjing, based on the CITYLAB concept, and is running in 2018–2019.

11. Concluding discussions

Despite international agreement to reduce the use of fossil fuels and to reduce GHG emissions, the existing trends show something else. EIA (the U.S. Energy Information Administration) has projected that the worldwide energy consumption will grow by 53% between 2008 and 2035. The Chinese government is struggling to promote sustainable development with focus on economic development and poverty reduction. Millions of people have been lifted out of poverty because of economic growth and urbanization. At the same time, resource consumption, for example, fossil fuels and materials, is steadily increasing and this has raised huge environmental problems affecting eco-systems and people's health. China is trying to tackle the problems by developing strategies for example, low carbon eco-cities. However, it is doubtful if such strategies could eventually improve energy and resource efficiency. There is no sign that the consumption of fossil fuels will decrease soon or that the reliance on fossil fuels will be replaced by renewable energy. In practice, the planning system in China is still operating in a traditional way by predicting demand and establishing a supply for the growing demands for resources for example, energy. If not new ways for more radical shift of the societal metabolism can be found, fossil fuels will continue to be the main energy

source in Chinese urban development for a long time. The UN released in 2015 its Sustainable Development 2030 Goals aiming primarily to reduce poverty on a global level. Embedded in the strategies to achieve the goals are high urbanization rates and high annual economic growth (7%) in emerging economies. Urbanization is in many ways seen as a key factor for sustainable development. China has been regarded by many emerging economies as a role model for their development. However, following China's example will increase the use of energy drastically on a global scale creating international conflicts and threatening other SDGs like peace and a healthy environment. Sustainability of energy systems should also be built on some principles taking many criteria into account, not only emissions of GHG.

This chapter demonstrates the difference between two planning systems, the Swedish and the Chinese. The Swedish system is more horizontal than the Chinese and more based on actor participation and local urban conditions. The central question around role models for sustainable energy systems for developing countries is of course complicated. One would be to follow the energy intensive Chinese model to create fast development and decreasing poverty. An argument for this is what the Western world did. However, the situation is different now when several billion people are going this way in a short time. It will surely create international conflicts around resources and increased environmental degradation. The other model would be to follow the Swedish system and use criteria developed on local level with participation from many actors including ordinary urban inhabitants. This is a slower process but involving all affected actors in democratic processes might be the only stable model for development in the long run. Urban development on the local level based on democratic processes is the only guarantee that many aspects are taken into account.

It seems more and more obvious that the transition to more energy- and resource-efficient cities will be gradual and take longer time than expected. We will have the correct answer when the UN 2030 SDGs are presenting the results, but then it might be too late. It is also clear that transitions have to be anchored in a local context at the urban level where all key actors take part in the planning process. Urban systems are examples of very complex systems and the study of complex systems is about understanding indirect, sometimes unwanted effects. Problems that are difficult to solve are often hard to understand because causes and effects are not always obviously related. Pushing on a complex system "here" often has effects "over there." This has become more and more apparent in our efforts to solve societal problems or avoid ecological disasters caused by our own actions. We tend to solve complex problems by breaking them down into understandable units in a reductionist way. This is true for planning departments as well as in many academic disciplines.

Urban planning is also a process where many aspects and interests have to be taken into account. There are conflicts of interests between key actors in the planning for future cities. The central planning system in China does not really accommodate the situation at the local level especially when it comes to the complex concepts like sustainability.

It is clear that there is a lack of integrated multidisciplinary planning for sustainable energy systems in China. This is partly due to the lack of knowledge about energy systems among planners and the difficulty in adopting the participatory planning approach to involve key actors from various areas. To solve this, the transparency between the planning levels has to

be enhanced and key actors from various urban sectors should be involved in the participatory planning at an early stage creating more of evolutionary processes than fully planned. The only way to overcome the complexity of urban planning is probably to use more horizontal planning at a local level with a high degree of transparency between the planning levels. The transparency can help resolve conflicts and avoid corruption. In China, this is difficult but in the long run, it is inevitable. Sustainable urban development, which is a buzzword in today's urban development, is not just about building energy-efficient homes. It is also about planning and building in a way that gives people a sense of participation, which in the long run can increase the confidence of both politicians and society at large. It is certainly no easy task. But it is good if people feel that there is a serious ambition to strive for this.

There is a new form of cooperation growing in Europe where many urban projects cooperate to exchange experiences and creating innovative environments. Cooperation on international level cannot be in a sustainable way through copying of city areas or of national planning models. This is because development is a step-by-step evolution anchored in a framework of experiences, culture, etc. Copying means that one loses the context and the copy has lost its content compared to the original.

The Chinese vertical model is compelling for many developing countries because it produces fast results on a massive scale. A horizontal planning system is slower but more resilient and adaptive concerning complexity.

Vertical planning is effective for moving fast in one direction. The question is what happens if we move in the wrong direction? The discussion around planning models must be central for the further discussions around how to reach the UN 2030 Sustainable Development Goals.

Author details

Ronald Wennersten

Address all correspondence to: rw@kth.se

School of Architecture, Southeast University, Nanjing, China

References

- [1] Brundtland GE. Report of the world commission on environment and development: our common future. In: Our common future: The World Commission on Environment and Development. U. Nations, editor. Oslo; 20 March 1987
- [2] IEA. World Energy Outlook 2016. Paris, France: International Energy Agency; 2016
- [3] Heinonen J et al. Situated lifestyles: II. The impacts of urban density, housing type and motorization on the greenhouse gas emissions of the middle-income consumers in Finland. *Environmental Research Letters*. 2013;8(3):1-10

- [4] Wennersten R, Sun Q. United Nations sustainable development goals for 2030 and resource use. In: World Symposium on Sustainability Science: Implementing the UN Sustainable Development Goals; Manchester, United Kingdom; 2017
- [5] United Nation, Paris Agreement, Draft decision-/CP.21, December 15 2015
- [6] UNDP. Sustainable Development Goals 2030. 2015. <https://www.un.org/sustainable-development/sustainable-development-goals/>
- [7] BP Energy Outlook 2018. <https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/energy-outlook/bp-energy-outlook-2018.pdf>
- [8] BP Statistical Review of World Energy 2018. <https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/statistical-review/bp-stats-review-2018-full-report.pdf>
- [9] China's carbon emissions on track for fastest growth in 7 years. China Economic Review, May 30, 2018. <https://chinaeconomicreview.com/73045-2/>
- [10] Weskamp AS. Ecological modernization in China's settlement development, Master Thesis, Student No. 1236970, College of Architecture and Urban Planning, Tongji University; June 2013
- [11] Food and Agriculture Organization of the United Nations, The state of food security and nutrition in the World. 2017. ISBN 9789251098882
- [12] Government Office of Sweden. SymbioCity—Sustainability by Sweden. 2017 [cited 2017 September 30]. Available from: <http://www.symbiocity.se/>
- [13] Government Office of Sweden. Environmental Technology—13 Swedish Solutions. 2013 [cited 2017 September 30]. Available from: <http://www.regeringen.se/contentassets/724f78d9290f4ea7974341bbac04a1f8/environmental-technology---13-swedish-solutions>
- [14] Wennersten R, Liu H. HAMMARBY SJÖSTAD—A unique sustainability project in Stockholm, ISOCARP· Review 10—Water and Cities—Managing A Vital Relationship. 2014. ISBN 978-94-90354-29-9
- [15] Zhuang J. How Chinese urbanism is transforming African cities, Metropolis, 2014. <https://www.metropolismag.com/cities/how-chinese-urbanism-is-transforming-african-cities/>
- [16] Teske S et al. Energy [R]evolution 2010—A sustainable world energy outlook. Energy Efficiency. 2010;4(3):409-433
- [17] Greenpeace. Coal's terminal decline. 2015. <http://www.greenpeace.org/international/Global/international/publications/climate/2015/Coals-Terminal-Degradation.pdf>
- [18] BP. BP Statistical Review 2015 China's energy market in 2014. 2014
- [19] Xi J. The Chinese Dream of the Great Rejuvenation of the Chinese Nation. Beijing, China: Foreign Languages Press; 2014

- [20] Developing Sustainable Cities in Sweden. <http://www.symbiocity.se/>
- [21] Sweden Green Building Council, CITYLAB Guide Version 2.0. 2018. <https://www.sgbc.se/in-english>
- [22] Wennersten R, Qie S. United Nations Sustainable Development Goals for 2030 and Resource Use. Springer Nature; 2017
- [23] SIDA. The Sustainable City Approach. 2015
- [24] Cleantech S. Exporting Sustainable Cities. 2017. Available from: <http://www.swedish-cleantech.se/english/cleantechsectors/sustainableconstruction/exportingsustainablecities.4.5fc5e021144967050481899.html>
- [25] Liu H et al. Analysis of sustainable urban development approaches in China. *Habitat International*. 2014;**41**:24-32
- [26] de Jong M, Stout H, Sun L. Seeing the People's Republic of China through the eyes of Montesquieu: Why Sino-European collaboration on Eco City development suffers from European misinterpretations of "good governance". *Sustainability*. 2017;**9**(2):151
- [27] Miao B, Lang G. A tale of two eco-cities: Experimentation under hierarchy in Shanghai and Tianjin. *Urban Policy and Research*. 2014;**33**(2):247-263
- [28] Yin Y. Environmental Integration in Sustainable Urban Planning from an Institutional Perspective - A Study of Swedish and Chinese Eco-City Development, PhD thesis, Royal Institute of Technology, 2014. ISBN 978-9-7595-251-2