

Cities in a post-carbon society. A French perspective

Cities are key players for a transition towards a post-carbon society; nevertheless, there is a wide variety of pathways they may follow to achieve it. As a consequence, the use of foresight methods is important to evaluate the triggers cities can use, and the obstacles they can face, in such a perspective. This article aims at presenting a four-year research program work, where six contrasting scenarios were designed to tackle climate and energy issues at the urban level, from today to 2050.

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What is the role of cities in climate and energy issues? How can urban areas achieve transitions to lead to a post-carbon society? These are the questions this brief article will discuss, using a French perspective.

Cities and climate-energy issues

Bearing a responsibility of two thirds of the world primary energy consumption and of over 70% of global CO₂ emissions [1], cities play a major role in current climate change and energy issues. Their demographic weight and their economic impact is surely at stake. For instance, in France, about 80% of the population live in urban areas, the latter representing about 20% of the whole French area [2]. Regarding French cities' economic activity, more

than half French GDP is achieved in the 15 biggest metropolitan areas (>500,000 inhabitants), while they also contribute to 75% of GDP growth [3]. Eventually, it appears that, in France, 95% of the whole population lives in a sphere of urban influence [4].

On the other hand, cities are also vulnerable to climate change consequences. Indeed, they can be struck by direct impacts of climate change: global warming, change in precipitation patterns, higher frequency and intensity of extreme events or sea rise. In the future, these expected risks are extremely likely to increase, and will be borne by local authorities, which will have to face their cost [5] and adapt to them [6]. The availability and price of energy are also two essential issues for French cities, which import almost all their primary energy needs. Again, beyond this direct impact, the most important issue is that urban areas will have to deal with uncertainties since they are hardly able to predict to what extent they will be affected by this sort of events [7]. Energy issues and sensitivity to its price (expected to rise and be more volatile) will also have clear negative socio-economic impacts on the inhabitants' well-being. Constrained

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mobility, energy poverty and vulnerability are the main troubles they will face. These consequences may increase inequities since they tend to have negative distributional impacts across revenues [8], and may be more severe for people leaving in semi-urban regions [9]. In other words, the whole urban metabolism may be threatened in the medium term. To sum up, cities are both perpetrators and victims of climate change. Beyond the strong inertia they are facing, unique opportunities still exist.

Rethinking cities in a post-carbon society

Based on these evidences, the Foresight Unit of the French Ministry in charge of Sustainable Development and the French environment and energy management agency (Ademe) led together a four-year research program entitled “Rethinking cities in a post-carbon society” [10]. Focusing on the French case, it analyzed the role cities can play in a transition towards a post-carbon society, from today to 2050, through a comprehensive research action on six local authorities, combining thematic seminars, building scenarios and applied territorial research. A post-carbon society would achieve three main objectives by 2050: dividing by four its GHG emissions, adapting to climate change, and almost no longer relying on the burning of fossil fuels (especially oil). In addition, solutions must be compatible with a sustainable development, so that suggested measures are effectively driving towards a better future.

Six scenarios for a transition

One part of the research program consisted in developing scenarios. The goal was to create, compare, and partly evaluate a number of possible strategies for achieving a post-carbon society. The aim was not only to produce and describe pictures of the post-carbon city in 2050, as this would only have limited significance, given the wide variety of existing cities. Actually, the main purpose was to go further by bringing these strategies up for

discussion, to develop new ones, and to assess the players’ degree of flexibility considering opportunities and obstacles. At the end of the exercise, some trajectories from today to 2050, which seemed consistent across all key players involved, were obtained.

The backcasting method allowed to devise transition pathways within a timeframe of 30 to 40 years.

Formally, the procedure consisted in starting with the ultimate objective (i.e., the three components of a post-carbon society in 2050), and to identify the pathways to reach this objective. At the same time, a forecasting method was used to make projections about megatrends, i.e. variables tightly linked to the context.

Considering the distant time horizon, uncertainty and the large variety of representations of the future naturally play a major role in the design of strategies. The main and basic assumption adopted to design scenarios was that the transition pathways mainly depend on how stakeholders (in particular local authorities) perceive the uncertainties associated with the situation, as well as on how they identify their own opportunities and their degree of flexibility. Having this in mind, six differentiated scenarios were constructed, which can be represented in a 3x2 matrix, according to the level of flexibility perceived – on economic tools, urban infrastructures and planning, or on lifestyles and urban forms – and the type of context – trend vs. pro- innovation (Table 1). Thus, economical, technical, cultural and social aspects of the city can be – at least partly – considered across the various scenarios.

		Degree of flexibility for action		
		Through technology and price signal	Action on urban investment and urban planning	Action on urban forms and lifestyles
Context	Baseline	Scenario 1 Smart wait-and-see attitude (low carbon price)	Scenario 3 New climate and energy infrastructures (centralized)	Scenario 5 Self-contained city (urban forms)
	Disruption: fosters innovation	Scenario 2 Carbon creativity (high carbon price)	Scenario 4 Biopolis (decentralized)	Scenario 6 Urban frugality (lifestyles)

TABLE 1 Six contrasting scenarios towards a post-carbon city



From Table 1, it appears that: (1) picking up a line (i.e. context), the more we go to the right, the more the perceived degree of flexibility; (2) choosing a column (i.e. degree of flexibility for action), the second line offers more freedom for disruptive change while the first one sets up more constraints. In the following, we will present scenarios using columns as entries, that is by stabilizing the degree of flexibility for action. More detail is available upon request.

In an initial configuration (scenarios 1 and 2), little flexibility is given for transformational policies at the urban level. Instead, local authorities, businesses and residents adapt to incentives, constraints and opportunities in a smart – but reactive – way. Actually, these incentives are mainly imposed to local authorities, that is to say coming from national or international policies, and are especially related to energy and carbon prices, new technologies, technical standards, etc. In other words, price-signals are a decisive element in these two scenarios. Scenario 1, Smart wait-and-see attitude, is based on a low carbon price. The priority is thus given to no-regret strategies and to other measures that do not require massive investments. Scenario 2, Carbon creativity, faces a strong price-signal on carbon, and economic agents tend to change their habits to greener activities. Although economic instruments are used at a national and community level, local authorities play a role for driving local innovation as well as setting up pricing policies (e.g., urban tolls). A second configuration envisions a massive transformation of urban and energy infrastructures, in a more or less decentralized setting (scenarios 3 and 4, respectively). Massive investments are realized in the retrofitting of buildings to ensure their very low consumption of energy; in energy systems so that they can be based on a larger share of renewables; and finally in all types of general infrastructures, such as public and collective transportation, infrastructures to tackle climate change impacts, etc. In brief, the transformation of territories is here at the heart of these two scenarios. Still, this second configuration does not properly consider any change in lifestyles, nor in the ways of using space.

A third and final configuration (scenarios 5 and 6)

explores the conditions and the expected impacts of large-scale changes in lifestyles and the ways of using space. In scenario 5, Self-contained city (), local authorities and town planner are leaders in the transition towards post-carbon cities, while in scenario 6, Frugal urbanity, inhabitants themselves are at the heart of deep and disruptive changes. These two last scenarios allow the minimization of vulnerability to climate change and fossil fuel dependence. They also offer unique opportunities to design and rethink, with the participation of inhabitants, urban areas so that they can be more attractive, resilient and sustainable. However, they consider economical transitions that are hardly conceivable today.

The importance of territorial application

Above all, the research program “Rethinking cities in a post-carbon society” sought to build on the myriad of initiatives, on climate and energy issues, that already exist in exemplary cities across the world. What is really at stake is, indeed, the dissemination of such a movement at all scales and for all actors. As a result, designing scenarios consistent with post-carbon objectives is an attempt to gather ambitious local experiences in order to foster their diffusion at a wider scale.

In addition, practical insights were given in the research program thanks to the involvement of six French local authorities, namely Lille, Tours, Plaine Commune, Fontainebleau, Mulhouse, Grenoble. For instance, the city of Lille analyzed how to address the social challenge through redistribution, in a context of high carbon price (scenario 2). As for the city of Fontainebleau, the role of social innovation and the importance of the local fabric was explored in the perspective of scenario 4 (Biopolis).

Conclusions

Qualitative and quantitative assessments of the scenarios were conducted and led to the following conclusion: none of them reached the post-carbon

society by 2050 (i.e., they failed at least in one of the three criteria). In other words, a solution would lie in the combination of scenarios, when they are compatible with each other.

Beyond this analysis, three issues clearly appear to be crucial in the transition towards a post-carbon society. Firstly, the combination of technical and social innovation will be required to address the

challenge of sustainability. Secondly, the role of changing behaviors and lifestyles is also important. Thirdly, more consistency shall be given in transition processes between time horizons (short, medium, long terms) on the one hand, and spatial scales (from the individual to global level) on the other.

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