Volume 1

Local Energy Autonomy

Spaces, Scales, Politics

Edited by Fanny Lopez, Margot Pellegrino and Olivier Coutard
Local Energy Autonomy
Urban Engineering Set
coordinated by
Bruno Barroca and Damien Serre

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## Contents

**Foreword** .......................................................... xiii

**Introduction** ......................................................... xv
Fanny LOPEZ, Margot PELLEGRINO and Olivier COUTARD

**Part 1. Governance and Actors** ........................................ 1

**Chapter 1. Urban Planning and Energy: New Relationships, New Local Governance** .......................... 3
Cyril ROGER-LACAN

1.1. Distributed energy: the constant adaptation of urban areas .......... 4
1.2. “Sustainable cities” and new energy systems:
from harmonization to a common origin ..................................... 9
1.3. Reshaping local governance ........................................... 12
1.4. References .................................................................. 17

Allan JONES MBE

2.1. Introduction.................................................................. 19
2.2. Background .............................................................. 20
2.3. Woking, UK ............................................................... 20
2.4. London, UK ............................................................... 22
2.5. Sydney, Australia ......................................................... 24
  2.5.1. Background .......................................................... 24
  2.5.2. Sustainable Sydney 2030 ......................................... 25
  2.5.3. Green Infrastructure Plan ....................................... 26
  2.5.4. Trigeneration Master Plan ....................................... 26
  2.5.5. Renewable Energy Master Plan ............................... 27
### Chapter 3. The Third Industrial Revolution in Hauts-de-France:
Moving Toward Energy Autonomy?

Eric VIDALENC

3.1. The industrial revolutions in the region .......................... 48
3.1.1. The cornerstones of the first industrial revolution .......... 48
3.1.2. The successors of the second industrial revolution:
   the automotive industry and electricity ..................... 50
3.2. The TIR’s resources in Hauts-de-France. ........................ 54
3.2.1. An expanded view of some of the local expertise ........... 55
3.2.2. The basis of local ecosystems. .............................. 55
3.2.3. Strong political backing .................................. 56
3.2.4. The expansion of the TRI/REV3 brand ....................... 57
3.2.5. Multiple financial tools ................................... 57
3.2.6. Subregional territorialization: energy subsidiarity ........ 58
3.2.7. Network managers are changing their views ............... 59
3.3. Initial assessments and analyses ................................. 60
3.3.1. Late, but still a strong objective .................................. 60
3.3.2. An update on the TRI/REV3 trajectories .......................... 61
3.3.3. A techno-centered vision .................................... 63
3.3.4. Tensions regarding the priorities and temporalities .......... 64
3.3.5. From solidarity to regional autonomy through energy subsidiarity ... 65
3.4. References .................................................................. 67
Chapter 4. Rethinking Reliability and Solidarity through the Prism of Interconnected Autonomies

Gilles DEBIZET

4.1. Introduction ............................................. 69
4.2. Four prospective scenarios for urbanized spaces ................. 71
  4.2.1. Large companies .................................... 72
  4.2.2. Local authorities ................................... 72
  4.2.3. Cooperative stakeholders ............................ 73
  4.2.4. Regulating state .................................... 74
4.3. Intermediaries with new energy autonomies ......................... 75
  4.3.1. Energy storage as an essential factor of autonomy ......... 75
  4.3.2. Energy autonomies as organizations .................... 76
  4.3.3. A combination of different energy scenarios according to the regions ........................................ 77
4.4. A variety of decision-making scales relating to energy infrastructure ........................................ 77
  4.4.1. The country and the continent ........................... 78
  4.4.2. Housing ............................................. 78
  4.4.3. The building ......................................... 78
  4.4.4. The district ......................................... 79
  4.4.5. The city or metropolis ................................ 79
4.5. Conclusion: solidarities must be reinvented in the era of connected energy autonomies ......................... 80
4.6. Acknowledgments ........................................... 82
4.7. References ................................................ 82

Part 2. Urban Projects and Energy Systems ............................. 85


Raphael MÉNARD

5.1. Introduction ............................................... 87
  5.1.1. What can environmental measures be related to? ......... 89
  5.1.2. Critical densities and catchment areas .................... 91
5.2. Energy consumption density ................................ 92
  5.2.1. Differences regarding the 2,000 watts .................... 92
  5.2.2. 0.1 watts per square meter as average for mainland France ........................................ 94
5.3. Renewable energy production density .......................... 97
  5.3.1. Renewable energy production is Eulerian .................. 97
5.3.2. Energy harvesting plans ........................................ 98
5.3.3. Quantification of the production flow of a region .......... 99
5.4. Self-sufficiency, convergence: 1-W regions .................. 100
  5.4.1. The 7 hectares, surface area per person in the world garden. 100
  5.4.2. The story of urban transition in cities ...................... 101
  5.4.3. The fundamental equality of self-sufficiency .............. 107
  5.4.4. Some self-sufficiency paths according to density ........ 108
5.5. Emission density and carbon neutrality ....................... 110
  5.5.1. Post-COP21 and carbon neutrality ......................... 110
  5.5.2. Equivalent emission densities ................................ 112
  5.5.3. Carbon sequestration density ................................ 112
  5.5.4. The fundamental equation of carbon neutrality .......... 113
5.6. Conclusion .................................................... 113
  5.6.1. Continent–sea balance ..................................... 113
  5.6.2. The city–countryside dichotomy ............................ 114
  5.6.3. The city, an energy-carbon monster ....................... 114
  5.6.4. The mathematics of density, relocating according to the right proportions ........................................ 115
  5.6.5. The scales in question ...................................... 116
5.7. References .................................................... 117

Guilhem BLANCHARD

6.1. Introduction .................................................... 119
6.2. Urban heating within development projects:
  an opportunity for local monitoring of the energy system .......... 121
  6.2.1. Windows of opportunity for local players .................. 121
  6.2.2. Urban development and district heating projects still remain subject to numerous external constraints .......... 124
6.3. The decision-based autonomy of urban heating projects from the perspective of urban development projects’ technical management .......... 127
  6.3.1. Design of the supply infrastructure:
    a weakly structured coordination between design arenas .......... 129
  6.3.2. Coordination of supply and demand:
    an even more significant division ................................... 132
6.4. Conclusions and final thoughts ................................ 135
6.5. References .................................................... 137
## Contents

**Chapter 7. Positive Energy and Networks: Local Energy Autonomy as a Vector for Controlling Flows**

Zélia Hampikian

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1. Positive energy, autonomy and flow dynamics</td>
<td>142</td>
</tr>
<tr>
<td>7.2. The case of Lyon confluence and the Hikari block: a rhetoric of</td>
<td></td>
</tr>
<tr>
<td>mutualization for achieving partial self-sufficiency</td>
<td>145</td>
</tr>
<tr>
<td>7.3. The “right” scale of autonomy and control over flows</td>
<td>150</td>
</tr>
<tr>
<td>7.4. From autonomy to flow management: who is in charge?</td>
<td>155</td>
</tr>
<tr>
<td>7.5. Conclusion</td>
<td>160</td>
</tr>
<tr>
<td>7.6. References</td>
<td>161</td>
</tr>
</tbody>
</table>

**Chapter 8. From Energy Self-sufficiency to Trans-scalar Energy**

Florian Dupont

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1. Self-sufficiency or sharing of the heat supply</td>
<td>164</td>
</tr>
<tr>
<td>8.1.1. Four examples of scale jumping that question self-sufficiency</td>
<td></td>
</tr>
<tr>
<td>8.1.2. Assess the strategic contribution of each operation</td>
<td>170</td>
</tr>
<tr>
<td>8.2. Redefining the goal of self-sufficiency</td>
<td>171</td>
</tr>
<tr>
<td>8.2.1. Using the cost–benefit analysis?</td>
<td></td>
</tr>
<tr>
<td>8.2.2. Using a new financial paradigm including the old one?</td>
<td>174</td>
</tr>
<tr>
<td>8.2.3. First achievement: 1,000 trees</td>
<td>174</td>
</tr>
<tr>
<td>8.2.4. From self-sufficiency to synergies</td>
<td>175</td>
</tr>
<tr>
<td>8.3. The importance of strategic planning using project levers</td>
<td>175</td>
</tr>
<tr>
<td>8.3.1. Electricity networks redefine their mesh</td>
<td>177</td>
</tr>
<tr>
<td>8.3.2. Liège: valorizing the electrical infrastructures</td>
<td></td>
</tr>
<tr>
<td>of the industrial valley</td>
<td>177</td>
</tr>
<tr>
<td>8.3.3. Mains gas seeks its revival</td>
<td>178</td>
</tr>
<tr>
<td>8.3.4. From data to planning: cities think about energy</td>
<td>179</td>
</tr>
<tr>
<td>8.4. Conclusion</td>
<td>181</td>
</tr>
</tbody>
</table>

**Part 3. Energy Communities**

**Chapter 9. Sociotechnical Morphologies of Rural Energy Autonomy in Germany, Austria and France**

Laure Dobigny

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.1. Introduction</td>
<td>185</td>
</tr>
<tr>
<td>9.2. Technical choices and autonomy processes</td>
<td>187</td>
</tr>
<tr>
<td>9.3. Actors of local energy autonomy</td>
<td>190</td>
</tr>
<tr>
<td>9.4. Spatial and autonomy temporalities</td>
<td>195</td>
</tr>
<tr>
<td>9.4.1. Bringing the relevant techniques into existence</td>
<td>195</td>
</tr>
<tr>
<td>9.4.2. Social and geographical morphologies</td>
<td>196</td>
</tr>
<tr>
<td>9.4.3. The influence of regulatory and legislative frameworks</td>
<td>200</td>
</tr>
<tr>
<td>9.4.4. The role of energy policies and political structures</td>
<td>201</td>
</tr>
</tbody>
</table>
9.4.5. Pioneer towns: “was it easier before?” .................. 203
9.5. From the construction to the transferability
of “models” of autonomy: what impedes and issue are there? ........ 206
9.6. References ............................................. 210

Distribution Systems: Examples from Berlin and Hamburg ........ 213
Arwen Dora COLLELL and Angela POHLMANN

10.1. Introduction ........................................... 213
10.1.1. Rethinking networked infrastructures
beyond “public versus private” ................................ 214
10.1.2. Citizens claiming networked infrastructures
in Germany’s largest cities ..................................... 214
10.2. Situational analyses of urban energy system transformation .... 216
10.3. People have the power? Citizens claiming energy infrastructure... 217
10.3.1. (Re)negotiating infrastructures of decision-making
on the power grid: the case of BEB ............................ 217
10.3.2. From protest to empowerment: civil society engagement
in Hamburg’s energy distribution systems ....................... 223
10.4. Discussion: reconfiguring the social in sociotechnical? .......... 228
10.5. Conclusion ............................................. 229
10.6. References ............................................. 231

Chapter 11. Autonomy and Energy Community:
Realities to Reconsider? ........................................ 239
Ariane DEBOURDEAU and Alain NADAÏ

11.1. Introduction ............................................. 239
11.2. Mapping and genealogy of energy community approaches ..... 242
11.2.1. Technological element: innovation
at the heart of energy communities ............................ 245
11.2.2. The collective element:
which community(s) favor energy issues? ....................... 246
11.2.3. Institutional element: framing and empowering communities 246
11.2.4. Discussion ........................................... 248
11.3. Scope and limits of existing works ........................ 249
11.3.1. A high presence of instrumental and normative approaches .... 249
11.3.2. The singularity of English language “critical localism” ....... 252
11.3.3. The locational nature of analytical frameworks ............... 253
11.3.4. The minimalist and shifting contents for the notion
of community ............................................. 253
11.3.5. Discussion ........................................... 260
11.4. Conclusion .................................................. 263
11.5. References ................................................. 265

Part 4. The Challenges of Energy Autonomy ..................... 271

Benoit BOUTAUD

12.1. Self-sufficiency analyzed through the prism of the territory .... 274
12.1.1. A reality far from clichés .............................. 274
12.1.2. Going beyond the productive aspect ...................... 278
12.2. Regional energy self-sufficiency: a legal issue ................. 281
12.2.1. Municipalities that become legally self-sufficient ......... 281
12.2.2. The energy self-sufficiency of municipalities:
an organizational challenge ........................................ 283
12.3. Conclusion .................................................... 287
12.4. References .................................................... 288

Chapter 13. Electricity Autonomy and Power Grids in Africa:
from Rural Experiments to Urban Hybridizations ............... 291
Sylvy JAGLIN

13.1. Introduction ................................................... 291
13.2. From the “crisis” to electrical experiments .................... 294
13.2.1. Electric disasters and riots ................................ 295
13.2.2. Huge investment needs ..................................... 296
13.2.3. Renewables and decentralized systems: a third way
for sub-Saharan Africa? ............................................. 298
13.3. Electrical hybridizations between pragmatic
autonomy and new dependencies ................................... 299
13.3.1. Rural experiments ........................................... 300
13.3.2. ... and urban hybridizations ............................... 303
13.3.3. Off-grid under constraints .................................. 305
13.4. Conclusion .................................................... 309
13.5. References .................................................... 310

Chapter 14. Energy Self-sufficiency:
an Ambition or a Condition for Urban Resilience? ............. 315
Bruno BARROCA

14.1. Introduction ................................................... 315
14.2. A matter of definitions ....................................... 316
14.3. Technical systems and resilience ................................ 319
14.4. Self-sufficiency and functional resilience ..................... 321
14.4.1. Functional resilience and system modeling ............... 321
In taking the local dimension into account in urban operations, calling into question the human, urban, technological and so-called “natural” risks of urban balances, and discussing the rise of digital technology in the design and management of socio-technical systems or the ever increasing scarcity of resources, a systemic interpretation of urban structures and a geographical interpretation of the social and spatial distributions of today and tomorrow are called for. It is to this dual approach that the Urban Engineering set, which puts forward thematic issues of knowledge resulting from the mobilization of theoretical foundations, analysis of practices and prospective approaches, responds.

While urban territories play a central role in current global issues, this set of books presents an interdisciplinary vision of the relationships between urban spaces and their environments. Just as closely related to urban planning and geography as to urban sociology or engineering sciences, urban engineering is not fixed in a particular discipline but establishes connections between them. It provides urban actors with knowledge and approaches that link together planning, engineering and territory. To work as an urban engineer is to master the techniques corresponding to urban systems while integrating them into their local contexts. In urban engineering, the notion of technical optimum and reflection at the spatial and temporal scales is only relevant when considering other urban, social, territorial and environmental legitimacies.

Despite the advantages expressed by the scientific methods used, by the recognition of practitioners, local authorities and operational and institutional actors, urban engineering does not guarantee immediate and disciplinary unity. This assumed fact raises questions about its position in the field of academic research. The set is part of this questioning: it defends both the interdisciplinary nature of urban engineering and also its operational nature, which makes it possible to link research and action. These advantages lead to the reinterpretation of dominant
models, the proposal of approaches to the evolution of practices and the exchange and confrontation of knowledge to stimulate reflection on the future.

This first book – *Local Energy Autonomy* – launches the *Urban Engineering* set based on a forward-looking theme and discusses particular social, economic, technical and environmental challenges.

Bruno BARROCA and Damien SERRE
Coordinators of the Urban Engineering set
Energy and territories: towards new configurations

Energy production, supply and consumption in territories are once again provoking public debate. While the peak oil horizon seems to be constantly shrinking, particularly due to the development of non-conventional hydrocarbon exploitation, the challenge of climate change has imposed the theme of energy transition at international level. This is reflected in the discourses and (to a lesser extent) the actions of many actors (political, economic, associative) according to different registers: evolution of the primary energy mix of electricity or heat production systems; promotion of low-carbon or non-carbon renewable energies and reduction of dependence on fossil fuels (to which nuclear energy can be added, or not, depending on the country); the quest for energy efficiency gains in transport, buildings, productive activities (goods, services, food, etc.) and the promotion of less energy-consuming practices.

These forms of action have one thing in common, although they are not limited to it: they all aim, by their very principle, at a reduction in greenhouse gas emissions linked to energy production and consumption. There is, however, a modality of action that is experiencing increasing success – some would say a revival of fortune – in energy transition discourses and strategies, and that does not mainly rest on the same principle: the search for increased local energy autonomy [DOU 19]. This quest for autonomy was forcefully articulated more than 10 years ago by the then Mayor of London, Ken Livingstone, as part of the “decentralized energy revolution” that he initiated in London and which his successors, Boris Johnson and the current Mayor of the British capital, Sadiq Khan, have essentially pursued. It is now expressed in a number of strategic documents issued by cities or other local authorities and confirmed, for example, by the growing interest among stakeholders in exploiting

Introduction written by Fanny LOPEZ, Margot PELLEGRINO and Olivier COUTARD.
Local energy autonomy (more systemically) local energy potential. It also largely underpins, for instance, recent legislative provisions in France promoting the development of “self-production” and “self-consumption”.

The authors of this book have therefore chosen to examine contemporary reconstructions of the links between energy and territory through the issue of local energy autonomy, and the related processes of empowerment, a term used here to designate the increasing power of local actors on issues related to energy. The term “local energy autonomy” refers to a wide variety of existing or planned configurations and is not systematically used in documents or by the actors concerned. Three factors of diversity stand out in particular: the variable content and scope of the targeted autonomy (electricity, heating of buildings, travel, power, etc. separately or in combination); the diversity of the spatial scales envisaged (from buildings to the greater metropolitan area); and the various meanings of the notion of autonomy applied to energy production, circulation and consumption. Let us clarify this latter point.

Figures of local energy autonomy

In its original political sense, the notion of autonomy refers to the dual ability (of an individual or group) to define one’s own rules and to comply with them. In this perspective, local energy autonomy refers to the ability of an actor or, more often than not, a local system of actors (a system in which some are generally supra-local actors) to define the conditions of production, circulation, supply and consumption of energy of the “place” under consideration. This concept applies in particular to organized collectives: a population group under the same local political authority (commune, department, region, etc.) or an association of individuals on a voluntary basis (as in the transition towns movement).

It seems to us that two main types of energy autonomy should be distinguished in this political sense. On the one hand, secessionist autonomy, which refers to a radical independence project or community isolationism [MAR 16] or to groups or individuals wishing to break away from, especially, electricity operators for possibly very different reasons [LOP 14, VAN 15]. This is the consequence of the deliberate action taken by a group of individuals, a community or a State to establish an economy, or even a society, a closed and an energy system without any interconnection with traditional networks. Thus, secessionist autonomy is close to autarky or autarchy. On the other hand, there is a cooperative or generative autonomy which, differently from the first case, is open to the potential for achieving mutualization and interconnection between autonomous local networks according to a political project shared by the actors, and which could be referred to
as “connectable places”. The scale can be as large as in the first case, and the actors and the levels of governance are more diverse [LOP 19].

The general perspective adopted in this book is to question local energy autonomy in its political meaning and scope, as we have just described it. However, the current uses of the notion of autonomy (in terms of energy in any case) also fall under two other meanings:

i) a metabolic meaning, referring to the notions of self-production, self-consumption and self-sufficiency, i.e. the idea that autonomy can be measured by the capacity of an individual, a household, a group, the population of a territory, to produce their own means of energy subsistence, to paraphrase François Ascher¹ (one could even speak of energy autotrophy);

ii) a socio-technical or organizational meaning, referring to the structure and management of energy systems, energy autonomy being assessed according to the capacity of a local energy supply system to operate more or less independently of neighboring or higher-level systems [RUT 14]. From this point of view, a solar panel installed on the roof of a detached house has a very different meaning depending on whether it is owned, managed and used by the house’s inhabitants (autonomous configuration) or by the regional or national electricity company (heteronomous configuration).

Taken together, the chapters in this book provide insights into these three registers of local energy autonomy and their inter-relationships. As detailed at the end of this introduction, the chapters have been grouped into four parts according to their main focus, i.e., respectively: actors involved in the governance of local energy systems; the consideration of energy issues in urban projects; energy communities; and the “challenges” of energy autonomy. This structure provides a first reading grid for the book. In the rest of this introduction, we would like to propose a second one, even if this double grid obviously does not exhaust the richness of the analyses, reflections and theories developed in each contribution.

Four major cross-cutting questions seem to emerge from the different chapters and objects of study presented by the authors:

– the form and dynamics of the links between the metabolic, socio-technical and political dimensions of local energy autonomy;

– the scales of structuring contemporary network spaces;

– energy autonomy as a context or a breeding ground for experimentation (innovations, appropriations, diversions, etc.);

¹ Ascher (ASC 2001: 11) suggests to define cities as “groupings of populations that do not produce themselves their means of food subsistence”.
– infrastructural diversification (in terms of socio-technical systems, decision-making structures and power relations).

**Metabolic, socio-technical and political empowerment: congruences and tensions**

The three dimensions of autonomy do not necessarily go hand in hand. There are examples of highly centralized policies to promote local energy self-sufficiency (for example, at the scale of large regions, or at the much finer scale of the housing block). Nor is there any strict infrastructural determinism. For instance, interconnection to major networks does not prevent the existence of forms of local decision-making autonomy, and the same infrastructure systems can be put to very different uses. In France, for example, decentralized production is currently perceived as an economic means of adjustment between supply and demand to the benefit of major suppliers. In the near future, hierarchies could be reversed: the large electricity grid could become a last-resort supplier for local “energy territories” in case of insufficient local generation or system overload, or to prevent a blackout. The deliberate design of energy islands is also justified in terms of energy security, in view of the possible increase in climatic disasters (hurricanes, tidal waves) or other major disruptions, as discussed by Bruno Barocca (Chapter 14).

However, the change in socio-technical configuration and organizational scale can also be accompanied by the advent of more localized energy governance, as shown by Laure Dobigny (Chapter 9) in her chapter on autonomous rural communities in Germany, Austria and France or by Arwen Colell and Angela Pohlmann (Chapter 10) in their study of electricity supply compensation projects in Hamburg and Berlin. The collective organization of “energy commons” or energy projects led by civic forces (inhabitants, local economic actors) will seek institutional and/or municipal support. To achieve progressive empowerment, it is the very notion of an energy community that must be redefined, as Ariane Debourdeau and Alain Nadai explain (Chapter 11).

Thus, the search for local forms of energy autonomy can act, at the same territorial levels, as a factor of empowerment, in the energy field or more broadly. In other words, for a system of local actors, the issue of energy (supply) can be a factor of political empowerment. In particular, the “takeover” of the energy issue can give rise to a broader process of infrastructure transition aimed at defining (or reinventing) a unit of place (housing, housing block, neighborhood, city, territory) designed to be efficient in terms of energy, ecological and economic balance, based on a “relocation” of the entire chain (resource, production, management) of one or more service loops.
The structuring of network spaces: new logics and new scales

During the second half of the 20th Century, energy (as well as many flows) was largely “invisible” at a local level and particularly in cities, both literally by burying or removing part of the infrastructure and figuratively by “relocating” energy choices. Today, debates, reflections and projects concerning the relocation of energy and the search for forms of energy autonomy contribute to providing a new visibility to the question of energy, its production, circulation, uses, the income generated, associated pollution, etc. This visibility takes various forms: from “abstract” awareness through institutional or activist messages to the spatial materialization of energy systems (such as wind power installations), which are often a source of conflict. Bringing the question of local scale, short distances, decentralized or distributed energy production, local pollution, strategies and processes of energy transition back to the center of public debates contributes to or announces major transformations in the urban and territorial project, and in the organization and management of space. The energy issue also offers the actors of the territory the opportunity to build a new story. This was particularly the case in the Hauts-de-France where Eric Vidalenc analyzes the strategy of the Third Industrial Revolution (Chapter 3).

The links between the design of built-up areas and the design of energy systems question both the perimeters and scales of each other. Territories are subject to a certain density of “energy harvesting” and new consumption ratios, which produce scalar tensions. By extending the analysis to a set of flows (energy, but also water, waste, human and animal food, etc.) – in other words: metabolism – Sabine Barles (Chapter 15) shows that, in the current situation, any claim to autonomy for dense cities is impossible to achieve. However, if we look at it from a more forward-looking point of view, the perspective may change. Raphael Ménard (Chapter 5) thus places the massive reduction in energy consumption at the heart of the changes needed to achieve a carbon neutrality objective. Under these assumptions, a significant reduction in the gap between the supply perimeters and the emission and discharge areas of flows, particularly energy flows, seems conceivable.

It is also the divergent interests of actors that lead them to favor different scales or “scalar arrangements”. For example, some developers prefer the scale of the building or the micro-district, while energy companies project on a larger scale: large districts, even large territories. The spatial-technical approach to energy transition calls for an adaptation of governance in the light of the new links between energy and urban planning. Cyril Roger-Lacan (Chapter 1) thus defends the idea that urban planning and energy planning should be systematically associated, and details the issues and implications of this vision.
Energy autonomy projects reveal two divergent approaches. On the one hand, the attempt to identify “good” perimeters, giving priority to a certain scale: BEPOS, TEPOS, energy catchment area, etc. On the other hand, the gradual abandonment of this quest for dimensional optimum for rethinking energy empowerment in light of three distinct registers of action that are likely to refer to different scales or spaces. These include the mobilization of existing resources, the management of emergencies and climate and energy crises, and social (re)configurations that are conducive to empowerment.

Taking into account the existing situation as a lever makes it possible to promote mutualization and energy solidarity with what already exists in terms of the territory, i.e. not only to “land” a new technology or the new decentralized massive production of energy and to think upstream of the synergies between networks and buildings, both new and old (the latter in connection with thermal renovation). This requires moving towards weakened solutions where the relevance of the scale is determined on a case-by-case basis based on the reality of each project. This operational vision is confronted with divisions in decision-making and the contributions of Zélia Hampikian (Chapter 7), Guilhem Blanchard (Chapter 6) and Florian Dupont (Chapter 8), who describe and analyze the various clashes and tensions that result.

The perspective of climate and energy emergencies leads us to consider autonomy as a temporary and non-permanent condition (the notion of autonomy thus acquiring a temporal dimension), as well as a relative condition (partial autonomy). On the basis of different topics, Bruno Barroca (Chapter 14) and Allan Jones MBE (Chapter 2) both conclude that there is an interest in guaranteeing a minimum local energy supply, making it possible to respond to sudden crisis situations, limited in time and limited in space (i.e., to a specific portion of a territory, a specific facility, a subnetwork, etc.). The (micro) local solidarity scales (at least regarding functional solidarity) would be more robust (resilient) in the face of extreme events: see for example the doctrine developed by the State of New York, which supports an ambitious micro-grid development program.

Thinking about autonomy based on social (re)configurations thus means questioning the conditions of aggregation, mobilization, participation, the construction of a collective meaning, an ideology, even a conflicting vision, etc. One topic appears throughout these different visions: that of abandoning a universal system of local autonomy in favor of a plural vision of territories that do not have the same status or the same relationship with energy, and where infrastructural diversity prevails.
Infrastructure diversification, redistribution of skills and reconstruction of stakeholder systems

The social ideal of major infrastructure as a public service construction, which combines economy of scale, technical reliability and quality service for the greatest number of people, has been destabilized since the 1990s by the logic of liberalization and commodification [GRA 01]. The centralized technical object is confronted with new assemblages and changes in value. Attempts to rebuild public service from the commons [ALI 18] and “return to the public” or “de-privatization” changes at municipal or regional level are increasing and should not be perceived as a downturn [JEA 17]. Micro-installations for energy production and other citizen initiatives for energy relocation are most often a sign of the desire to re-energize the public at local level. As John Dewey [DEW 27] argued, the public concerned by infrastructure is not an immobile and predefined mass of citizens, but an active community of interest, part of which is increasingly engaged in the search for more collective and efficient governance of natural resources and new arrangements for the diptych of autonomy/solidarity, as Gilles Debizet (Chapter 4) points out.

Ultimately, it is appropriate to speak of forms of autonomy or processes of empowerment in the plural. Indeed, processes of infrastructure transition(s) are marked by a wide diversity of technical and political choices at local levels, often resulting in a socio-technical hybridization of existing systems rather than the deployment of new supply configurations independent of these systems. In her study on the supply of energy in urban and rural areas in Africa, Sylvy Jaglin (Chapter 13) highlights the ambivalence of the changes at work, between pragmatic autonomy and new dependencies, and the unexpected circulations between rural and urban areas. The organization of space and hierarchies within stakeholder systems are thus disrupted by energy changes and the quest for greater autonomy. The materialization of the transition is subject to a need to develop concurrent engineering and energy project management. This issue is addressed in many chapters, including those written by Guilhem Blanchard (Chapter 6) and Gilles Debizet (Chapter 4), who stress the need for “intermediate actors”. Historical actors in the energy or urban sectors are looking for new skills to imagine a redistribution of roles for the control of relocated energy flows, but also in the design-maintenance of systems. As Guilhem Blanchard (Chapter 6) and Zélia Hampikian (Chapter 7) show, new roles are also emerging for private actors in urban production (developers, donors, etc.): what place is there for new business models? Or for new forms of contractualization (performance guarantee, etc.)?

Transformation dynamics can be top-down or bottom-up. For Allan Jones MBE (Chapter 2), a top-down approach (strategy broken down into projects and actions) can work, particularly for large cities (London, Sydney and Seoul). The approach is based on a range of principles, tools and objectives that are flexible and adaptable to
local contexts, rather than on the transfer of a “ready-made” model. Benoit Boutaud (Chapter 12) shows that French-style localism tends to rule out any idea of an autonomous “energy community” that would emerge more or less spontaneously from civil society or even local authorities, in favor of “territories” engaged in an autonomy approach circumscribed by state frameworks. This is why empowerment processes must also be understood in their legal dimension in order to highlight these frameworks. Conversely, the contributions of Laure Dobigny (Chapter 9) and Arwen Colell and Angela Pohlmann (Chapter 10) attest to the importance, in the German context, of bottom-up approaches among associations. The analytical opposition between “ascending” dynamics (conquered autonomy) and “descending” dynamics (granted autonomy) must however be relativized. Indeed, an empowerment that is initially top-down, granted or conceded by the State, can be appropriated by a community to be further developed, in the energy field or in other areas of common interest, even if the achievement of the empowerment processes requires a favorable legislative and regulatory framework and, more broadly, a congruence between citizen mobilization and action by local and national (and, where applicable, European) public authorities.

At the crossroads of innovation, experimentation and diversion

What are the possible forms of support for these changes by the public authorities? One way consists in establishing, by way of derogation, spaces allowing experimentation and the local appropriation of energy issues, at least temporarily. The notion of experimentation is important because it makes it possible to capture both projects framed by explicit procedures and more unexpected forms of action, diversions and overflows, “more subversive, informal and undisciplined dynamics of experimentation, shaping in their own way electrical autonomies that escape projects”. The notion of diversion opens up another important issue concerning the standardization of experiments and autonomy solutions and their relation to model-based solutions. Sylvy Jaglin (Chapter 13) points out that, in some African countries, “the territorialization of electrical autonomy resists the standardization of electrical experiments”. From a dynamic perspective, “ready to use” models and experiments “without a safety net” thus appear as two particular modalities of a continuum of approaches combining the two action logics to varying degrees; indeed, local experiments often mobilize elements of models in circulation at international level. On a more theoretical level, the analyses in terms of the circulation of models and those in terms of experiments refer to two distinct conceptualizations of local public action, the first limiting the competence of local actors (or, more rigorously: local systems of actors or action) to the choice of “solutions” more or less adapted to the problems they wish to solve, the second granting these local actors an ability to assemble resources (cognitive, technical, financial, etc.) of diverse origin in real processes of local innovation.
Perspectives

To conclude, let us mention three perspectives opened up by this book.

Firstly, it seems to us that all the contributions confirm an assumed bias in the book, namely that it is the processes of empowerment rather than the degree of autonomy achieved within a given local territory that must be the focus of researchers’ attention. It is the study of these processes – understood as the provisional, incomplete, controversial, conflictual, even reversible, but also potentially transformative... outcome of the strategies and (interdependent) actions of a set of actors – that most accurately and completely illuminates the possible room for maneuver available to local action systems and the constraints they face.

Secondly, we would like to note that while the book highlights the spatiality (and “scalarity”) of energy empowerment processes and forms of local energy autonomy, it does not deal head-on with their temporality. However, this temporal dimension is of major importance in at least two inter-related respects. On the one hand, the quest for autonomy is based on a vision of a more desirable future whose imaginary, ideological, but also material modalities of construction must be questioned. Indeed, these visions of the future provide information for research on empowerment, and on transition dynamics more generally, both from an analytical point of view (what is important to study and how can it be studied?) and from a normative point of view (for what purpose should local energy autonomy be sought? Are the processes at work consistent with the visions of the future underlying them?). On the other hand, empowerment processes are long-term and must be understood as such. Over what time scale is autonomy sought? What trade-offs are there between the search for autonomy in the short term and in the long term? What are the links between the urgency of contemporary challenges and the powerful but slow dynamics of infrastructural reconfigurations?

Finally, the issues studied in this book cannot be dissociated from more general political questions. A change in the socio-technical energy regime, including a change in the primary energy source (from nuclear to solar, from coal to wind power), in infrastructure scale (large to small), in governance (from large globalized companies to citizen cooperatives, for example), can significantly reduce the negative impacts of existing energy systems on ecosystems. On the one hand, however, it does not in itself guarantee the emergence of a generally more virtuous political dynamic, i.e. one that would aim at a transition to an ecological society based on a radical transformation of production and lifestyle patterns in order to adapt our consumption to the planet’s carrying capacity. On the other hand, energy autonomy can serve different purposes: lower energy use, carbon neutrality, social cohesion, etc. But it is not the prerogative of progressive groups. It can be promoted by members of a gated community of white supremacists or by developers exposed
to real estate speculation as well as by groups of *degrowth activists* in rural areas. Thus, the definition of an energy project that is ecologically compatible with the territories concerned is only one of the elements of a broader project. In the context of climate change and energy transition [LEP 18], it seems to us not only politically desirable, but also scientifically heuristic to place these questions on new territorial energy arrangements in the more general perspective of the advent of an ecological society, involving a decrease in consumption, the effective search for sobriety and the definition of a more global emancipation project [AUD 17].

**Book structure**

The 15 chapters of this book propose to jointly understand the spatial, infrastructural and political dimensions of projects and processes for energy empowerment. The authors – whether architects, historians, engineers, geographers, socio-anthropologists or urban planners – seek to shed light on the links between the forms of relocation of energy production, circulation and consumption at work, the underlying interplay of actors and the concomitant (re)articulation between small and large socio-technical regimes. The authors are particularly interested in the processes (partial and contested) of energy relocation that articulate forms of metabolic, socio-technical and political empowerment. The chapters are grouped into four parts according to their main purpose (questioning).

In Part 1 – *Governance and Actors* – four contributions question the notion of energy autonomy through the role of the actors involved, who support and promote it or who endure it. Based on case studies at different scales, the challenges of energy governance – actors’ skills, forms of solidarity and horizontal or vertical relations of coordination or coercion – are linked to those arising from broader political decentralization processes. The relevance and limitations of planning tools and various approaches promoting energy autonomy are examined.

The four chapters of Part 2 – *Urban Projects and Energy Systems* – are based on an analysis of recent urban projects in which the issues of local energy production and distribution have been a central element in the thinking of architects, urban planners, developers, builders and contracting authorities. They tend to demonstrate that the consideration of energy issues in these projects has had an impact not only on the choice of technical solutions adopted, but also on actors’ practices and the conduct of projects.

Part 3 – *Energy Communities* – sheds light on the notion of autonomy through the study of citizen initiatives. These are described throughout empirical studies of their development trajectories, highlighting local roots, contextual conditions and inter-relations (interdependencies?) with public action and private actors, at different
scales. Additional insight is provided by an analysis of the growing scientific literature on energy communities.

The fourth and final part of this book – *The Challenges of Energy Autonomy* – brings together four contributions that examine the spatial and functional limits of energy autonomy from a specific analytical perspective: urban metabolism and territorial ecology; urban resilience; experimentation; and (French) local authority law.

The contributions collected in this book are the result of a series of three seminars organized under the aegis of Labex Futurs Urbains.

The first seminar, entitled *Les territoires de l'autonomie énergétique* and coordinated by Olivier Coutard (CNRS, LATTS), Fanny Lopez (ÉAV&T, LIAT) and Margot Pellegrino (UPEM, Lab'URBA), was held at the École nationale supérieure d’architecture Paris-Malaquais and the École d'architecture de la ville & des territoires in Marne-la-Vallée (ÉAV&T) on 17th and 18th February 2016. The second, entitled *La fabrique de l'autonomie énergétique*, coordinated by Guéhén Abplan and Zélia Hampikian (ENPC, LATTS), François Balaye (Université Grenoble Alpes, PACTE), Milena Marquet (UGA, GAEL) and Charlotte Tardieu (EIVP, Lab'URBA) took place in Paris (EIVP & ENPC) on 13th and 14th June 2016. The third, entitled *Grassroot initiatives in energy transitions: Paris/London/Berlin* and coordinated by Olivier Coutard, Fanny Lopez and Margot Pellegrino, was held on 19th May, 2017 at the ÉAV&T.

In total, these seminars brought together about 30 speakers, half of whom were selected to compose the book after a revision process by the scientific editors.

**References**


PART 1

Governance and Actors