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by

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SUSTAINABLE BUILDING TRANSITIONS IN
LUXEMBOURG AND FREIBURG: LOCAL MEANINGS,
CIRCUMSTANCES AND RATIONALES

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SUMMARY

Sustainable building has become a subject of high policy emulation to address sustainability challenges. Publications and interventions from international organisations concord in outlining the high share of greenhouse gas emissions produced by the building sector, while at the same time pointing towards the important leverage for sustainability interventions on the built environment. In particular given the availability of established technologies, design strategies and know-how at a minimal cost. At the same time though, the realisation of sustainable building crosses several functional domains: regulatory, economic, cultural, social, natural etc. It requires also to consider buildings in a comprehensive manner from their inception, construction, up to their use and eventual retrofit or demolition but also in relationship with their wider (urban) settings. And last but not least, it requires close interactions with a wide range of stakeholders from the private, public, and civil society realms with different interests and disciplinary perspectives. Following which of these aspects are prioritised, sustainable building is a widely diversified agenda that encompasses, for instance, high-tech single buildings, mainstream looking but highly efficient dwellings, experimental and organic looking community projects or whole neighbourhoods.

Hence the primary interest, as well as objective of this work, has been to try to better grasp the causes and mechanisms that explain such large differentiation of sustainable building. Drawing on critical sustainable urban literature, I posit sustainable building as diversified because it is a situated and socially mediated object. I take this stance against a widespread policy conception of sustainable building as an objective, pre-given and uncontested reality that engages mainly with the practicalities and technicalities of its implementation.

Conceptually, my work engages with two approaches. First the literature on sustainable socio-technical transitions, in particular the Multi-Level Perspective. Its grounding in co-evolutionary and institutional thinking helps to comprehend the socio-material complexity of sustainable building across a broad range of dimensions and connections. Applied to the sustainability project, the heuristic indeed looks at dynamics between actors, (technological) materialities and differently structured socio-economic and cultural institutions to conceive how sustainability change is mediated or impeded. In complementing, and following the adopted socially constructed stance, I further look at the discursive constructs used to argue in favour of the transformation towards sustainable building, as the performativity of discourse helps to explain why that change occurs.

The operationalisation of the research engages with sustainable building transformations in two European urban areas, Luxembourg (LU) and Freiburg (D), that both focus on sustainable building transformations in their urban policy agenda. Both places differ though in the time of their

engagement as well as on the international academic and policy recognition their interventions have acquired. Using a mix of qualitative research methods (interviews, cooperative research workshops, and the discourse analysis of a text corpus), I look into detail at how sustainable building policies are played out and how their content varies in relation to the geographical context in which they are situated. Of particular interest to my research is to understand why the transitions towards sustainable building in Luxembourg and Freiburg is a certain way, following the ideologies and interpretations that underlay it. This focus allows to uncover similarities in both Luxembourg and Freiburg where sustainable building is dominantly addressed via technicalities, energy efficiency and green growth, thus tying onto the mainstreamed socio-economic paradigm, despite locally differentiated circumstances.

The contribution of my work is threefold. First, it offers an empirical engagement with sustainable building as diverse and socially mediated, at odds with the policy emulation of the subject that largely ignores the issue. Second, through the detailed engagement with the situated circumstances but also discursive justifications that explain the diversity of sustainable building in each case study, this work has been able to uncover similarities across the case studies in the form of an ecological modernisation and green economy agenda. Lastly, it offers an empirical example of the application of the geographical agenda of the Multi-Level Perspective on sustainability transitions, which has stayed rather at a theoretical level of discussion.

ZUSAMMENFASSUNG

Nachhaltiges Bauen ist ein Thema von hoher politischer Aktualität, wenn es darum geht eine nachhaltige Entwicklung zu verwirklichen. Veröffentlichungen von internationalen Organisationen stimmen darin überein, dass der Bausektor einen hohen Anteil an Treibhausgasemissionen produziert. Sie unterstreichen jedoch gleichzeitig den relativ geringen Aufwand für nachhaltigkeitsbedingte Änderungen in Gebäuden, basierend auf der Verfügbarkeit etablierter Technologien, Designstrategien und Know-how zu minimalen wirtschaftlichen Kosten. Die konkrete Umsetzung nachhaltigen Bauens betrifft jedoch verschiedene funktionale Bereiche: u.a. regulative, ökonomische, kulturelle, soziale, umweltbedingte Bereiche. Zudem erfordert es auch die umfassende Betrachtung von Gebäuden von ihrer Entstehung, Konstruktion bis hin zu ihrer Nutzung und eventuellen Renovierung oder dem Abriss, sowie auch die Berücksichtigung der Einbettung von Gebäuden in einem weiteren (städtischen) Umfeld. Nicht zuletzt erfordert nachhaltiges Bauen auch eine enge Interaktion zwischen einer Vielzahl von Akteuren aus dem privaten, öffentlichen und zivilgesellschaftlichen Bereich mit unterschiedlichen Interessen und disziplinären Perspektiven. Abhängig von der Priorisierung dieser Aspekte, ist nachhaltiges Bauen eine breit gefächerte Agenda, die beispielsweise High-Tech-Einzelgebäude, Mainstream-orientierte aber energetisch hocheffiziente Wohnungen, experimentelle und ökologisch orientierte Gemeinschaftsprojekte oder ganze Stadtteile umfasst.

Daher besteht das primäre Interesse und Ziel dieser Arbeit darin, die Ursachen und Mechanismen, die solch eine umfangreiche Differenzierung nachhaltigen Bauens erklären, besser zu verstehen. Aufbauend auf kritischen Perspektiven aus der nachhaltigen Stadtliteratur erfasse ich die Vielfältigkeit nachhaltigen Bauens als situiert und sozial-konstruiert, im Gegensatz zu der weitverbreiteten politischen Ansicht von nachhaltigem Bauen als ein unbestrittenes Thema, bei dem es hauptsächlich um technische Einzelheiten seiner Umsetzung geht.

Konzeptionell befasst sich meine Arbeit mit zwei Ansätzen. Zunächst mit der Literatur zu nachhaltigen soziotechnischen Transformationen, insbesondere der Multi-Level-Perspektive. Die Anlehnung dieser Heuristik an co-evolutionäre und institutionelle Theorien ermöglicht es, die sozio-materielle Komplexität von nachhaltigem Bauen in eine Vielzahl interaktiver Dimensionen zu erfassen. Die Multi-Level-Perspektive betrachtet Interaktionen zwischen Akteuren, (technologischen) Materialitäten und weiteren strukturierenden, sozioökonomischen und kulturellen Institutionen, um zu verstehen, wie Nachhaltigkeitstransformationen vermittelt oder verlangsamt werden. In Ergänzung dazu und im Anschluss an das angenommene sozial-konstruierte Verständnis von nachhaltigem Bauen betrachte ich außerdem die diskursiven Konstrukte, die verwendet werden, um für die Transformation zu

nachhaltigem Bauen zu werben. Die Performativität von Diskursen hilft zu erklären, warum diese Veränderungen eine bestimmte Richtung einnehmen.

Der empirische Teil meiner Forschung befasst sich mit nachhaltigen Bautransformationen in zwei europäischen urbanen Kontexten, Luxemburg (LU) und Freiburg (D), die beide stark auf diese Thematik in der Verwirklichung ihrer Nachhaltigkeitsagenda setzen. Beide Orte unterscheiden sich jedoch in der zeitlichen Annahmen dieser Thematik, sowie auch in Bezug auf die internationale akademische und politische Anerkennung, die sie somit erzielt haben. Mit Hilfe einer Kombination aus qualitativen Forschungsmethoden (Interviews, kooperative Forschungsworkshops und Diskursanalyse eines Textkorpus) untersuche ich detailliert, wie nachhaltiges Bauen in beiden Fällen politisch umgesetzt wird und sich in Abhängigkeit vom geographischen Kontext verändert. Von besonderem Interesse für meine Forschung ist es, zu verstehen, warum die jeweilige Transformation zu nachhaltigem Bauen in Luxemburg und Freiburg sich aufgrund der zugrundeliegenden Ideologien und Interpretationen in eine bestimmte Richtung entwickelt. Dieser Schwerpunkt ermöglicht es Ähnlichkeiten in Luxemburg und Freiburg aufzudecken: Nachhaltiges Bauen wird in beiden Fällen in erster Linie durch technische Aspekte, Energieeffizienz und grünes Wachstum vorangetrieben und dient somit trotz der lokal unterschiedlichen Umstände der Weiterführung der vorherrschenden sozioökonomischen Paradigmen.

Der Beitrag meiner Arbeit umfasst demzufolge drei Aspekte. Erstens bietet es eine empirische Auseinandersetzung mit nachhaltigem Bauen als vielfältiges und sozial-konstruiertes Objekt, im Widerspruch zur politischen Ansicht, die diese Problematik weitestgehend außer Acht lässt. Zweitens konnte durch die detaillierte Auseinandersetzung mit den örtlichen Gegebenheiten sowie diskursiven Begründungen, die nachhaltiges Bauen in den einzelnen Fallstudien erklären, Gemeinsamkeiten zwischen den beiden Fallstudien in Form einer ökologischen Modernisierung und Green Economy-Agenda aufgedeckt werden. Schließlich bietet die Arbeit ein empirisches Beispiel für die Anwendung der geographischen Agenda der Multi-Level-Perspektive, die in der Literatur bisher eher theoretisch diskutiert wird.

1. INTRODUCTION: SUSTAINABLE BUILDING - A 'FLUID' REPERTOIRE?

“As parts of the built environment, buildings and built annexes are complex systems fulfilling defined tasks and functions. They are, amongst others, living space and work environment, they influence comfort, health and, happiness of users as well as the quality of living together. They carry an economic value, as much on the micro than on the macroeconomic side, contribute to create and secure jobs as well as value, and produce energy and material flows with matching impacts on the global and local environment. As such, they have a significant influence on sustainable development.” (BMBVS 2013)

“Sustainable building cannot follow fixed concepts. On the contrary, [sustainable building implies to develop a specific concept and to define areas of intervention and concrete measures for each construction project, by integrating all the relevant actors.” (CRTE et CRIT-B 2010 :14)

“The housing sector is a considerable source for reducing energy consumption, as much through the construction of new buildings as through retrofits of the existing building stock. The development of capabilities in that domain is a priority in order to transform the transition towards more energy efficient housing and commercial buildings in economic growth” (Programme gouvernemental 2013 :61)

These three statements all deal in some ways with the question of how buildings can or should contribute to objectives of sustainable development. And while all of them are taken from public policy documents, they yet focus on very different aspects of the relationship between sustainability and the built environment. The first excerpt stems from the introductory statement of the sustainable construction guide published by the German Ministry of Transport, Building and Urban Development. It relates sustainability to a building's societal functions, which in their fulfillment have economic, social and environmental consequences. Hence sustainable building, it is implied, consists of dealing with these economic, social and environmental consequences in a positive and pro-active way.

The second statement is also a quote from a sustainable construction guide for developers and architects, but this time in Luxembourg. The guide has a more practical flair, insisting on the impossibility to reach a 'one size fits all' in sustainable construction. Instead, it points towards the importance of tailored solutions that can only be reached by implicating all relevant actors. In that, the quote hints towards the fragmented and complex structure of the construction sector that encompasses a wide range of stakeholders and aspects. That complexity begins with the division of

labour in the construction process as such (planners, architects, developers, constructors, equipment manufacturers and installers, real-estate firms etc.). It further spans to the different types of users in buildings (owners, tenants and landlords, individuals or organisations etc.) but also encompasses further considerations regarding regulatory obligations and other public interventions (e.g. public funding, the provision of social housing, etc.) (Spinks 2015; Rohracher 2001).

The last quote, taken from a governmental coalition program is even more definite in its understanding: it explicitly focuses on the residential building sector, hence leaving aside commercial building uses. It also further distinguishes between new constructions and retrofits and submits sustainability in buildings to the fulfilment of two sets of objectives: energy efficiency and economic growth.

What are we talking about, when we talk about ‘sustainable building’?

In all their diversity, these statements yet share some commonalities. First and foremost, they are all taken from policy documents and as such are symptomatic of the exponential attention buildings, or actually the built environment in general has received in sustainable development policies at different government scales. Sustainable building, at least in the publicly prominent use of the term, is chiefly an object of public policies that aim at changing current building practices to fulfill sustainable development objectives (Brown and Southworth 2008; Souami 2011; Némoz 2010; UNEP 2011; IPCC 2014). Intrinsic to that policy focus on sustainable building is its conception as a progressive change process where interventions, whatever they may be, aim at correcting and improving the current built environment to help address sustainability challenges. This becomes particularly evident from the semantics of the aforementioned quotes: buildings “influence sustainable development”, they are not a “fixed concept” but need the “development of concepts” or of “capacities”, they are needed to “transform”.

However, despite the policy emulation of the subject of sustainable building, and as the quotes already hint towards, there still seems to be widely differing views as to what a sustainable built environment concretely entails. The range of possible interventions and considerations is indeed, to say the least, puzzling: from technical devices like insulation, on-site renewable energy production or water re-use systems, the conception and planning of a building in consideration of the different uses it is likely to fulfil in its lifetime, over collaborative construction approaches and uses, up to questions of affordability and accessibility, or even the respect of vernacular architectural traditions. Under what circumstances is a building then sustainable? When it has covered the largest possible extent of all these ideational, procedural and material considerations?

And even when turning towards finalised buildings labelled as sustainable, the choice is again wide: from technology but conventional looking houses to mediatised flagship high-tech buildings, from autonomous, experimental buildings with organic forms, to whole urban neighbourhoods planned to comprehensively address the social, economic and environmental impact of the built environment in cities. Consequently, O'Neill and Gibbs (2013) adequately qualify green buildings as a "relative" rather than absolute concept, a sector with a heterogeneous, wide range of practices rather than a cohesive agenda (Gibbs and O'Neill 2013 :1095).

While the recognition that sustainable building is a plural and multiple object in its conception and realisation is not new, "much of the contemporary debate [...] tends to sidestep the issue" (Guy and Frammer 2001 :140 in favour of engaging with the practicalities and technicalities of the implementation of sustainable building. Especially practitioner and policy debates have been keen to focus almost exclusively on the technical complexity and realisation of sustainable building. But as has been stated by Castree (2004 :360), while the "technicalities of implementing environmental policies remain important [...] equally vital is devising the ground rules or philosophy underpinning such policy". Hence critical contributions on sustainable building (see for instance Guy and Frammer 2001; Guy and Moore 2007; Moore and Bunce 2009; Berardi 2013; Bharathi 2013; Farla et al. 2012) pledge instead for an intellectual engagement with diversity, as a way to avoid closing down on a broader range of alternatives to sustainable futures. Authors build here notably on pledges to conceive sustainability as a socially constructed concept (Bunningham and Cooper 1999; Jones 2002; Mansfield 2009), in an effort to inquire the deeper reasons, mechanisms as well as wider consequences, in sum the politics, behind what are in fact policy choices and not objective pre-given and uncontested realities of sustainable building. I intend the present contribution to be positioned within that more critical approach to sustainable building.

The introductory chapter thus seeks to set the scene for sustainable building by navigating between these two dimensions. Accordingly, I will first sketch an overview of sustainable building as a policy object at different government scales, to help contextualise what we genuinely talk about, when we talk about sustainable building. I here avoid the term 'definition' on purpose, as my objective is not to set boundaries by offering an exclusionary outline of what sustainable building is, but rather to follow through on how the term is being employed and made sense of.

Thoroughly understanding what sustainable building is requires to take a multi-faceted approach, able to engage both with the technical and procedural, i.e. material aspects, of sustainable building but also crucially with its situated social and political components. Against this backdrop, the second part of the introduction will subsequently explicate the rationale and scope of the present work: to investigate

socio-material conditions, drivers, and situated understandings behind the policy ascendancy of sustainable building in two urban cases, Freiburg-im-Breisgau and Luxembourg.

Despite the above explicated analytical choice to avoid a foreclosed definitional exercise of what sustainable building is, some preliminary clarification on the terminology I use is still necessary. Throughout this work, I use 'sustainable building' rather than 'green', 'eco', 'low-energy' or 'low-carbon building' even though all terms seem to be sometimes used indifferently, similarly to debates on the use of different concepts and theories for sustainability in cities (see for example Guy and Marvin 2001; Rapoport and Vernay 2011; Bayulken and Huisingh 2015; de Jong et al. 2015). Using the more generic 'sustainable building' term allows me to keep an open approach towards how sustainable building is understood and implemented in the selected case studies. This does, however, not exclude that my empirical results are indeed showing a focus on particular aspects of the sustainability trio to the disregard of the others. Accordingly, I have also used other terms than 'sustainable building' when they have been employed so in the respective case studies, as for instance the term 'eco-construction' in Luxembourg.

In addition, the term 'sustainable building' is here used as an umbrella term for all activities related to sustainable construction. It is thus not limited to physical building realisations but applies a more comprehensive understanding of building activities, including the political and regulatory context, and relevant actors and stakeholders involved (Affolderbach et al. 2018).

1.1 Contextualising sustainable building policies

1.1.1 *Sustainable building as a technical object: policy interventions for energy efficiency and the green economy*

The international climate change context

International organisations engaging with sustainability and climate change strategically target sustainable building since the end of the first decade of the 2000s. The *Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (IPCC) and the United Nation Environment Programme's report *Towards the Green Economy* notably both encompass chapters dedicated to buildings (UNEP 2011; IPCC 2014). In 2013, the International Energy Agency has even published a whole report engaging with *The Transition to Sustainable Buildings* (International Energy Agency 2013). All three documents make similar arguments that provide a good first mapping on how sustainable building is generally understood amongst policy makers, experts, and technicians.

Following these publications, buildings indeed account for one-third of the worldwide final energy use, amounting even to 40% in Europe (2010), which makes them a considerable contributor to greenhouse

gas emissions. The bulk of that consumption can be attributed to space and water heating. Variations exist though between the residential and commercial sector, as well as across countries and world regions following climatic conditions but also differing characteristics in building unit size, density of occupancy, behavioural and cultural preferences, and technical availabilities (International Energy Agency 2013; IPCC 2014). In addition, the construction and operation of buildings are further estimated to account for one-third of the global resource consumption, including an important share of freshwater use, while at the same time generating 40% of the total estimated solid waste volume (UNEP 2011). Completing the picture with an overview of current demographic and urbanisation trends, all three reports concord these numbers can be expected to grow in the future if no transformative action is taken. Luckily, so the argument is pursued, established and commercially available technologies, design strategies, and know-how already exist and can allow significant reductions in energy consumption at a minimal cost, should they become widely implemented.

Relevant technological and design measures target both the supply (i.e. increased efficiency) and demand (i.e. reduction) aspects of energy consumptions in buildings, including, to name a few, a building's envelope and insulation, efficient inside appliances and thermal equipment, energy provision through renewables, but also passive design features in response to local contexts. A further key point is made towards the necessity to consider a building's energy use comprehensively across its lifetime, hence adopting a life-cycle perspective starting with the embodied energy of the used material, via the building's construction, to its operation and eventual recycling. Accordingly, interventions should also not only be restricted to the construction of new buildings but also to the retrofit of the existing building stock, even more so considering the long lifespan of buildings that creates emission path dependencies and lock-ins.

These solutions though are obviously not widely implemented yet, mainly due to what the reports point as structural constraints. These include the aforementioned institutional fragmentation of the building industry amongst a wide range of stakeholders, but also financial constraints (IPCC 2014; UNEP 2011). Policy interventions are accordingly presented as a central step to overcome these barriers and enable sustainable building transformations. All three publications mentioned previously highlight a similar set of policy actions that can be summarised around three main lines. The first one, rather classically, pertains to compulsory regulative provisions as for instance energy efficiency obligations and standards or energy performance requirements in building codes. It is complemented by financial incentives, mainly public funding schemes, but also favourable mortgages, tax schemes and alleviations, etc. The third domain of public intervention relates to information provision as well as learning and capacity building in the face of the technical complexity of the solutions outlined earlier. On the side of consumers, this includes for instance informative certificates. Similarly, building sector professional should acquire the necessary expertise through the provision of adequate training

programs. In addition, all publications concord on the important role of demonstration or exemplary projects. The development and increased popularity of different building assessment schemes have to be seen in that light as a reference and didactic tool to help practitioners navigate the different functional domains sustainable building touches upon, while also providing referential management tools (Hill and Bowen 1997; Berardi 2012).

Last but not least, the case for transforming the built environment along sustainability objectives is made even more compelling by highlighting significant “socio-economic co-benefits” (UNEP 2011; IPCC 2014). The three aforementioned publications investigate the economic benefits on investments in sustainable building, especially pointing towards positive effects on job creation as well as increased productivity of workers due to improved office indoor climate, increased daylighting, etc....These macro-economic dimensions add up to the monetary benefits of a reduced energy consumption and the higher market value of sustainable buildings. Social benefits on the other hand, are seen in increased health and environmental benefits following reduced pollution from and in buildings, as well as a potential contribution to alleviate fuel poverty. On that last aspect though, the case is less clear cut following the usually high investment costs for some of the mentioned technical solutions.

In this public policy approach, sustainable building is in essence conceived as an end-product with innovative technical characteristics. That end-product implicitly demarcates itself from ‘normal’ building by performing better against energy efficiency objectives or resource saving objectives in general. Sustainable buildings are here grasped as a technical transformation of the existing built environment while beside also providing socio-economic benefits. That transformation, while covering a multitude of aspects as described above, is though in essence mainly a management issue about implementing efficient technical solutions with the help of the right policy incentives.

The European energy policy context

The perception of sustainable building as a technically innovative end-product, addressing mainly resource efficiency questions, also contributes to inscribe sustainable building as a central aspect of the green growth or green economy project. That agenda sees environmental objectives and economic growth as compatible and is particularly clear in the European Union’s engagement with sustainable building. Sustainable buildings are here indeed first and foremost a full pillar of the Union’s energy and economic policy objectives. Both are hardly separable, energy efficiency and security being seen as a source of competitive advantage for Europe. The *Europe 2020 Strategy* (2010) for growth and jobs hence encourage member states:

“to use regulation, building performance standards and market-based instruments such as taxation, subsidies and procurement to reduce energy and resource use and use structural

funds to invest in energy efficiency in public buildings [...], [to achieve a] shift towards a resource efficient and low-carbon economy that is efficient in the way it uses all resources. The aim is to decouple our economic growth from resource and energy use, reduce CO₂ emissions, enhance competitiveness and promote greater energy security.” (European Commission 2010)

The latter *Energy Roadmap 2050* (2011) further elevates buildings to a key topic in achieving the Union’s objectives for a secure, competitive and decarbonised energy system by 2050. Accordingly, two sets of regulations, the 2010 *Energy Performance of Buildings Directive* (a recast of a piece of legislation from 2002) and the 2012 *Energy Efficiency Directive*, both set concrete obligations for member states to help reduce the energy consumption of buildings across the European Union. Main provisions of both documents are (European Parliament 2010, 2012):

- The obligation to provide energy performance certificates in advertisements for the sale or rental of buildings,
- The obligation for all new buildings to be nearly zero energy by December 2020,
- The national set-up of minimum energy performance requirements for new buildings and renovations,
- The set-up of long-term national building renovation strategies,
- An exemplary role for the public sector through an obligation to renovate yearly at least 3% of buildings owned and occupied by the central government, from 2014 onward.

Hence, the European Union’s tying of sustainable building to economic growth still transposes into a defined, technically sizeable agenda, similar to the one conveyed by the international climate change scene. With the right degree of preparation, for instance through binding energy targets, informative certifications, and financial incentives, that agenda seems attainable. While the cultural and behavioural role of users is acknowledged, the implementation of sustainable building has here however mainly a sectoral or industry focus. Most recent developments have even more reinforced the economic dimension of that agenda by complementing the energy focus with industrial concepts like the circular economy.

The building research context

Mirroring this policy agenda at the international and European level, a whole set of the academic literature at the building level engages with the nitty-gritty of the above mapped technical solutions, their diffusion (for example Butera 2013; Brown and Vergragt 2008 on Zero Energy Buildings) as well as the associated economic benefits and implementation barriers (Ahn et al. 2013; Ries et al. 2006; Häkkinen and Belloni 2011). The sheer size of this literature makes its investigation beyond the scope

of the present contribution and would only be redundant with the previous outline. Many findings from that literature are indeed integrated as the evidence base in reports like the IPCC's Fifth Assessment.

Nevertheless, some of the more critical contributions interrogate the concrete implementation and evaluation of a mainly technical approach (see for instance Rees 2009; Røstvik 2013; Zuo and Zhao 2014) and already hint towards the necessity for an enlarged perspective acknowledging sustainable building as a socially constructed concept. While usually applying a conceptual entry point that broadly pertains to theories of innovation and learning, authors are notably keen to investigate the concomitant role of institutional and social processes at work alongside the merely technological dimension of innovation. Bossink (2007) for example engages with cooperation processes between public and private organisations, while Sedlacek (2014) investigates the emergence and transformative role of third sector actors like Green Building Councils, instrumental in setting up building certification schemes. Berardi (2012) further discusses and compares the content of different sustainable building assessment systems, critically pointing towards an energy efficiency bias in their conception while in practice energy efficiency is far from being the best performing aspect of the evaluated buildings. Also contributing to the discussion on the relevance of energy assessment and accounting methods in the built environment, Anderson et al. (2015) highlight a crucial missing link between methodologies working at the building scale and those working at the urban level. They see this omission as highly problematic given "the actual pattern of construction: *new buildings within existing cities*" (Ibid: 156, emphasis added), that is to say, the impossibility to consider a building in abstraction to its surroundings.

Another key set of reflective contributions extensively engage with a fine-grained understanding of energy efficiency objectives and policies for the built environment in specific places, as for instance Rydin and Turcu (2014) for the United Kingdom, Hagelskjær Lauridsen and Stissing Jensen (2013) for Denmark or Faber and Hoppe (2013) and van Bueren and Priemus (2002) for the Netherlands. By doing so, these authors notably unravel the role of situated institutional conditions and path-dependencies in setting the drivers and barriers of sustainable (or rather energy efficient) interventions in the built environment.

This short literature review allows to already sketch the contours of two broader dimensions that need to be included into a conception of sustainable building doing justice to its socially constructed dimension. First, a scalar enlargement towards conceiving the built environment at the city or at least the neighbourhood scale, as a building does not exist in complete abstraction of what surrounds it. From this scalar engagement emerges a second, more theoretical and conceptual enlargement, that works along the lines of what Walker et al. (2015 :496) have called "socio-material interdependencies"

of carbon governance, engaging with “the politically formed and given meaning of [sustainable building] understanding in a particular setting and context”. I will elaborate on both aspects and their articulation hereafter.

1.1.2 *The sustainable city and neighbourhood*

As the previous review shows and as Moore and Rydin (2008) accurately summarise in a paper looking at policy and research networks on sustainable construction, the topic is split along two exclusive agendas, each with their own proponents and underlying organisations and philosophies. The first one basically equates to the technical agenda discussed above, while the second one is qualified as “a broader aspirational urban planning agenda” (ibid: 251).

In that last agenda, sustainable building is reintegrated as one particular lever of action for cities. The urban scale is here conceived as the most relevant site for the concrete implementation of sustainable development, exercised through multi-level politics (Bulkeley and Betsill 2013; Hodson and Marvin 2014). The corresponding literature is notably keen to highlight how this has led the sustainability agenda to be reshaped in accordance to particular situated contexts and knowledges, for instance in the application of governance frameworks like the Local Agenda 21 (Gibbs and Krueger 2005; Houghton 2005; Hodson and Marvin 2014).

Here again, the international sustainability and climate change policy context is instrumental in bringing cities at the forefront of the resolution of sustainability challenges, along relatively similar arguments than those presented for the focus on buildings. The previously mentioned *Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, for instance also includes a chapter dealing with urban planning and human settlements. But while the realisation of the proposed interventions on density, land use mix, connectivity, and accessibility obviously relates to different aspects of the built environment and its embedding within an urban infrastructure, links with the chapter on buildings stay surprisingly sporadic. This is symptomatic, following Moore and Rydin’s (2008) observation, of the missing integration of both agendas at the policy level, which they explain by diverging degrees of specificity.

On a more concrete level, the urban sustainability literature’s engagement with a conception of sustainable building that moves the focus away from the single buildings is probably best articulated in the sustainable neighbourhood concept. Academic but even to a larger extent practitioner-targeted publications here notably provide extensive descriptions on the realisation of a handful of famous sustainable neighbourhood developments, mainly from a European context (see for instance Souami 2011; Beatley 2012; Emelianoff 2013). The idea behind the investigation of what is presented as ‘best practice cases’ is to provide concrete returns on experience that can contribute to learning and

knowledge building, thus helping other cities to concretely implement urban sustainability. As pointed by Emelianoff (2007), this exchange mainly occurs in policy circles and via local authorities' networks like ICLEI (International Council for Local Environmental Initiatives), through good practice programs like the European URBACT or urban sustainability awards like the European Green City of the Year.

Critical academic contributions are though more interested in investigating the effects of such learning and exchange processes, illuminating how best practices transfers are far more than the simple transposition of an urbanistic technique. Highly mediatised projects, like for instance Vauban in Freiburg (D), BedZed in London (UK) or Eva-Lanxmeer in the Netherlands have a significant influence on policy-making, notably by creating codified –if not prescriptive– references around certain lines of intervention for sustainability in the built fabric: again the reduction of energy consumption at the building level, but also infrastructure interventions aiming at reducing car-dependency, other resource-saving measures like water retention and re-use systems, and not the least an increased involvement of citizens in project realisations (Souami 2011). Through this, sustainability becomes internalised in urbanist practices along what Emelianoff (2007) calls “professional rather than political terms”. That is to say, it encourages again a neutral, technical approach that obscures the political choices behind it (Bulkeley 2006), which are though inherent to sustainability, as sustainability is in essence political (Mansfield 2009; Connelly 2007).

Crucially indeed, the exchange of best practices is not a context-neutral process. Engaging with the literature on policy mobility, Faulconbridge (2013) characterises how different knowledges on sustainable building from different places are mobilised through a “bricolage” process. As a result, the collected knowledge is re-embedded and re-adapted to fit local institutional contexts and challenges, thus creating a situated interpretation and practice of sustainable building. In two seminal contributions on the practices of best practice Bulkeley (2006) and Moore (2013) both highlight even more the context-dependant political processes through which sustainable urban best practices are constituted as such, both in the originating as well as the receiving places. These processes are usually concealed by the almost universal character best practices have acquired, but as both Bulkeley and Moore point, best practices are actually co-constituted locally through an alignment between situated problems and local interests, that in the end tend to reproduce the already dominant and mainstreamed values and ways of doing things.

1.1.3 *Squaring the circle: the socio-material dimension of sustainable building and its embeddedness in contested urban sustainabilities*

Even though sustainable building is presented as one of the key arena to address sustainability and climate change issues, the description of its policy scenery has shown that it is nonetheless flawed by the same definitional blur as sustainability. But further than illustrating that complexity, the above review of the academic, practitioner and international climate change literature clarifies the necessity to acknowledge that interventions on the built fabric along the lines of sustainability are far more than a matter of choosing the right techniques and policy instruments (Castree 2004 :360). Sustainable building lays at the intersection of socio-cultural, demographic, economic and natural dimensions that determine as much the opening as the closing of opportunities (Ratcliffe 2008; Bharathi 2013). The wide range of involved stakeholders from the private, public, and civil society realms and especially their different interests and disciplinary perspectives (Rohracher 2001 :142-143) is here of primary significance.

Sustainable constructions are indeed the expression of situated transformational projects, with important political dimensions and consequences. Grasping sustainable building in all its diversity cannot be separated from a deep understanding of the particular social context in which it has been developed as a solution for sustainability challenges. In a range of several papers, Guy and colleagues (Guy and Farmer 2001; Guy and Moore 2007; Guy 2011) helpfully point towards the key explanatory role of the plurality of knowledge and escorting truth claims on the relationships between environment and society that are encapsulated in sustainable architectures. Farther than the “technological artefact” we need to be aware and inquire the “assembly of ideologies, calculations, dreams, political compromises and so on [wrapped up in buildings]” (Guy 2011 :410), as this explains the fluidity and diversity of the concept, but also crucially the assertion of particular definitions over others. Similarly, and as previously mentioned, the longitudinal study of low-carbon housing policy agenda in the UK by Walker et al. (2015) devises the useful concept of “socio-material interdependencies”, as the authors see the material ways of sustainable building as inseparable from the social conditions and relations in which they occur.

Intrinsically, this perception of sustainable building ties back to more general discussions of sustainability as socially constructed and hence a political and “contested concept” (Robinson 2004; Connelly ; Mansfield 2009). That is to say that “[r]ather than focus on searching for a definitive meaning of ‘sustainable development’ . . . it is necessary to recognise the multiplicity of sustainabilities and to analyse the ways in which these are shaped and mobilised in political discourse (Haughton and Counsell 2004 :72–73 quoted in Connelly 2007 :262).

Attempts to practically apply a social constructionism perspective to sustainable buildings point at the usefulness of complementary social science concepts, to help retrace the contingent understandings and interpretations of sustainable building (see for instance Rohrer 2001; Guy and Farmer 2001; Whyte and Sexton 2011; Berardi 2013; Bharathi 2013). The development of the urban sustainability agenda in human geography also further helps to flesh out the practicalities of such a research stance. Especially the already mentioned literature engaging with the determining role of localities in the sustainability and climate change agenda.

Following pledges to better account for places particularities in explaining differentiated sustainability responses, contributions indeed uncover the interplay of unique contextual institutions and materialities. These include historically specific developments, political systems, socio-economic or cultural conditions (Sharp 1999; Gibbs and Krueger 2005; Houghton 2005). Under critique of reifying the local, and in accordance with a relational stance on scale, that agenda has been complemented with enquiries of a place's relationship with other places in producing particular sustainability effects. Authors highlight notably the multi-tiered influence of national and international governance, but also the circulation of examples and best practices across urban networks (Bulkeley 2006; Betsill and Bulkeley 2007; Bulkeley and Betsill 2013; Temenos and McCann 2013; Harris and Moore 2015).

Particularly interesting for my endeavour though, is a range of admittedly theoretically differentially grounded works that have though all refined their understanding of sustainability endeavour at the urban level as a *change* process, or as put by Harris and Moore (2015 :108) a "pathway approach". Locating their work in urban metabolisms, transitions studies or actor-network theories, these authors all share a concern with the situated and specific interactions between materialities, socio-economic institutions and structures as well as actor coalitions in their analysis of sustainability at the urban level (Guy and Marvin 2001; Swyngedouw and Heynen 2003; Whitehead 2003: :1187; Bailey and Wilson 2009; Hodson and Marvin 2009; Bulkeley et al. 2011a; Hodson and Marvin 2012). That pathway approach is particularly appropriate, as it apprehends the sustainable city "not as ontologically pre-given object", but rather the outcome of complex and contextualised political and socio-economic factors and articulations (Whitehead 2003 :1187) that produce variability in understandings of what the sustainable city is.

1.2 Research themes and questions: inquiring sustainable building transitions in Luxembourg (LU) and Freiburg (D)

1.2.1 *Research questions*

Following the previous mapping, sustainable building should be approached as a diverse agenda. Not only due to its technical and material multiplicity but even more so as it is in essence a politically situated and thus relative project, which by breaking with the current built environment, aims at attaining a more sustainable development. Understanding how that change unfolds then raises the following questions:

1. What does sustainable building mean in specific places and why?
Under a socially constructed stance, this can be further refined to inquire why sustainable building is understood this way and not another in any one place? Where does that interpretation come from? What explains it?
2. What concrete impact does that situated interpretation have? That is to say, how does it practically get asserted into a particular material dimension of sustainable building practices, including physical building projects, but also policies and actor coalitions?
3. Are these new practices of sustainable building then truly transformational? Do they change something in comparison to what preceded them?

1.2.2 *Research outline*

To answer these questions, I seek to reconstitute and understand sustainable buildings conceptions and policy interventions in two particular urban cases: Luxembourg (LU) and Freiburg (D). Both places show historically different levels of maturity and experience with sustainable building, allowing to study a transition at different degrees of realisation. They also produce two situated political and economic contexts, while at the same time not being too much differentiated with regards to their broader socio-economic context, notably with regards to the regulative and strategic orientations on sustainability in the built environment, as stemming from the European Union.

Freiburg is relatively renowned for its long-standing achievements in the field of sustainable residential building. These include the realisation of two prominent neighbourhood developments in Vauban and Rieselfeld, both already planned in the early and mid-1990s and then developed in several phases up to the early 2010s. Freiburg further has the advantage to offer also examples of completed energetic retrofitting and refurbishment projects, thus already addressing what the literature on sustainable building considers as the 'next level' to urgently focus on (Dixon et al. 2014). These realisations are usually presented against a general backdrop of strong involvement of the civil society, as well as

informed by the scientific expertise of locally settled research centres. Here, the analysis will offer a wide range of different types of sustainable building realisations and be more about reconstituting past choices and consider their actual impact.

In contrast, Luxembourg has only relatively recently started to push the sustainable building agenda forward, mainly in connexion with its economic diversification strategy and the wish to promote the development of the eco-technology sector. As a consequence, finalised sustainable buildings and especially neighbourhoods are still few in numbers, most of the projects being in more or less advanced planning stages. At the same time though, there is currently a flourishing amount of initiatives and very diverse actors involved, which offers interesting insights into the building of relationships and the choice of specific trajectories by these actors. Importantly, the analysis focuses here on the national level, due to the small scale of the country and the important predominance of the national context in terms of involved actors as well as policies and regulations (this is further explicated in section 4.1).

Following the previously outlined focus on the interdependence between material and social aspects of sustainable building, my analysis will proceed along the lines of two conceptual entry points. The first, known as the Multi-Level Perspective (MLP) on sustainability transitions offers a systemic (i.e. multi-dimensional) and co-evolutionary (i.e. interrelated) lens of enquiry in line with the 'pathway approach' discussed above. It indeed engages with mutual relationships between different analytical 'levels' to inquire how sustainability induced novelties diffuse and become mainstreamed. These levels represent different degrees of structuration and integrate a wide range of factors, from large socio-cultural trends, sectoral routinized rules and ways of doing, to material artefacts that structure the agency and interactions of involved actors.

Despite its attention and openness to multiple and interconnected social and material factors in explaining sustainability changes, the MLP is though not careful enough in accounting for the essentially political nature of these transformations (Shove and Walker 2007; Meadowcroft 2011; Avelino et al. 2016). As I assert sustainable building as a socially constructed object, encompassing multiple and contested meanings that are contextually contingent, it is essential that my methodology exposes and reconstructs the underlying justifications and arguments of the involved actors. These narratives and their constant articulation and re-articulation with social, economic and political circumstances of particular places are what brings about a concrete course of action on sustainable building, including physical constructions. I have thus supported my inquiry with a complementary discourse analytical stance. Discourses indeed help to better comprehend why the transitions towards sustainable building in a particular case is a certain way and not another by revealing how actors justify and argue for sustainable building.

Chapter outline

To present the result of my inquiry and answer the raised research questions, I have divided the following analysis into 7 chapters. The above introduction (Chapter 1) has served to assert the relevance of sustainable building as a research object, as well as set the scene for what sustainable building means in policy and research. As such, it provides the reader with a common, though preliminary, understanding of what I will engage with when inquiring sustainable building policies. Based on that review, the chapter has further outlined the objective and perspective my research has taken, which revolve around uncovering explanatory factors for diversified and situated interpretations of sustainable building in particular places.

Chapter 2 deals in detail with the two chosen analytical perspectives. Based on literature reviews, it exposes first the relevance of the Multi-Level Perspective on sustainability transitions. Secondly, it engages with the relevance of discourses to interpretively study the transformations processes at work in sustainable building transitions. I here particularly discuss what both theories allow to address and uncover and how they complement each other. With regards to discourse, this chapter provides a necessary narrowing down on the perspective and understanding of discourse. I use especially argumentative approaches and notably their application in existing work on environmental discourses. This step is of paramount importance in light of the variety of discourse approaches and theories that exist and already anticipates some methodological considerations, as discourse is both a theory and method.

Chapter 3 explicates the adequacy and relevance of the chosen research design and methodologies in light of the research object and the theoretical entry points I have chosen. I further explicate my methodical choices as motivated by my need to study in depth the multiple and situated interpretations of sustainable building in two urban case studies: Luxembourg and Freiburg. The chapter also gives further clarity on how the empirical data has been collected and interpreted.

Chapters 4 and 5 both present the results of the empirical work in Luxembourg and Freiburg. Following the dual theoretical entry points, chapter 4 presents a detailed and longitudinal narrative on the contextual framework conditions and agential processes at work in sustainable building transitions in Luxembourg and Freiburg, while also recalling the detail of their material outcomes through a range of illustrative building projects. The objective is to uncover the structural particularities and processes that explain how sustainable building is approached and realised in both places.

Chapter 5 then, engages more with the results of the discourse analysis by mapping the underlying interests and worldviews that explain why sustainable building is understood and realised a certain way in Luxembourg and Freiburg. As such, this chapter builds upon the features of sustainable building uncovered in chapter 4 but engages more with their whys, whereas the previous chapter engages

rather with the hows. I here also further look at discursive evolutions and variations and show how these are reconciled to produce a dominant and shared understanding of sustainable building.

Chapter 6 synthesises and reflects on the results in drawing back on the outlined research questions. Even if under consideration of the research's theoretical and epistemological positioning, it is especially the particularity of each case study that is of interest to me, this chapter attempts to generalise individual findings by relating them to each other. It further critically discusses the research's contribution and proposes

Chapter 7 concludes by summarising and highlight the research's main findings.

2. THEORETICAL AND CONCEPTUAL FRAMEWORK: ENLIGHTENING THE DYNAMICS OF SUSTAINABLE BUILDING TRANSFORMATIONS

In recent years, 'sustainability transitions' has risen high on the agenda in human geography and social sciences at large (Lawhon and Murphy 2012) and even been transferred to policy-making (Loorbach 2010). The appeal of the concept of transition lies in its implicit acknowledgement that the current socio-ecological challenges can be addressed, as the focus is moved away from mere diagnosis towards understanding the "socio-political feasibility" (van den Bergh et al. 2011) of change towards sustainability and its mechanisms. In that, it fits with the general trend within the global sustainability and climate change institutions (see also Section 1.1.1) that "is bringing to bear [...] an instrumental rationality to processes of managing change and practical action, with the monitoring techniques of managing sustainability that go along [...]" (Hodson and Marvin 2014 :5).

Even more though, the idea of a sustainability transition occurring at multiple social and technical levels further resonates with the 'pathway', or change process, approach to sustainability encouraged by constructivist contributions from the urban literature. As already discussed (section 1.1.3), this critical body of urban sustainability literature seeks explanations for the diversity of sustainable policies by engaging with the complexity of situated and multi-scalar political and socio-economic factors. This chapter will accordingly provide an overview of the literature on socio-technical sustainability transitions, and more specifically the Multi-Level Perspective, to determine what it can contribute to my research endeavour (section 2.1).

At the same time though, I will discuss growing critiques towards the Multi-Level Approach for being not sensitive enough to the political processes impacting sustainability transformations, despite the framework's attention to multiple and interconnected social and material factors in explaining sustainability changes (Shove and Walker 2007 ; Meadowcroft 2011; Avelino et al. 2016). I therefore complement the MLP theoretical framework with a discursive approach. As I assert sustainable building as a socially constructed object, encompassing multiple and contested meanings that are contextually contingent, it is essential that my approach and methodology exposes the underlying justifications of the involved actors. These subjectivities and their constant articulation and re-articulation with social, economic and political circumstances of particular places are what brings about a concrete course of action on sustainable building, including physical constructions. Accordingly, the second part of this chapter (section 2.2) will elaborate on what that discursive complement brings to the research and especially how I engage with discourse, following the vast choice of existing discourse theories, concepts and methods.

2.1 Transition approaches to conceptualise long-term and systemic pathways towards sustainability

Similarly to sustainability, sustainability transitions is riven with a range of different understandings and theoretical approaches (see also Affolderbach and Schulz 2018). Originally coined in innovation studies, transition theory has developed along three main research strands, although there are further nuances and associated research fields in each of these strands.

(1) A first blooming field of research is still closely related to the initial home discipline of transitions and seeks to better retrace and understand the large-scale and co-evolving, in sum systemic, changes necessary in technology and society to effectively address sustainability challenges (Elzen et al. 2004; Grin et al. 2010; Markard et al. 2012). Relevant contributions broaden traditional green innovation research, which focuses mainly on clean technologies and their implementation and support frameworks (van den Bergh et al. 2011), by enlarging the analysis of *what* is subject to innovation to encompass social, cultural and regulatory practices, that is to say entire *systems* of production and consumption (Smith et al. 2010 :436; Elzen et al. 2004 :7-8). Nevertheless, it is still markedly technological driven, as it mainly investigates sectoral and/or utility systems heavily dependent on technological infrastructure. Research foci include for instance transportation (e.g. Geels 2002, 2012), water and sanitation (e.g. Geels 2011b), energy provision (e.g. Raven and Verbong 2007; Rotmans and Loorbach 2010; Monstadt and Wolff 2015) or agriculture (Grin 2010).

(2) A second understanding of transition thinking is found in small-scale grassroots movements like the Transition Towns Movement. Here transition is a “radical eco-centrist vision” (Audet 2014 :47) that builds mainly on the ideas of community and permaculture (Aiken 2012). Individuals are encouraged to collectively take action at their local level to reach alternative and more sustainable lifestyles. The underlying rationales are significantly more normative than in the previous techno-economic understanding of transitions. In academia, work on “grassroots and/or radical innovation” engage with this second understanding of transition and focuses on solutions emerging from activists and citizen-led initiatives that position themselves ideologically in opposition to the mainstream (Seyfang and Smith 2007; Pickerill and Maxey 2009; Seyfang 2010).

(3) The third strand of literature on sustainability transitions is to be found in human geography, where the idea of urban sustainability transitions has taken ground in urban and climate change research. Scholars such as Bulkeley, Hodson, and Marvin claim theoretical inheritance to the systemic perspective advocated in the innovation studies body of literature, notably by assimilating the Multi-Level Perspective, one of its key heuristic (Bulkeley et al. 2011; Hodson and Marvin 2010). But their work is, in general, more societal and less technological in scope. Indeed their interest lies rather in

understanding the politics and governance processes of low carbon transitions as they take place in cities (Bulkeley et al. 2011) with a focus on material artefacts like the energy or water infrastructure.

Following the overall framework provided by a larger research project in which this work is positioned and the focus on sustainable buildings (see chapters 1 and 3), the present analysis engages mainly with an urban understanding of sustainability transitions. Understanding what the Multi-Level Perspective (MLP) can offer, as well as why and in how far it is a helpful framework to conceptualise the process of transitioning towards sustainable building, is thus an essential preliminary. Accordingly, the following sub-chapters will first provide a theoretical overview of that heuristic. I will then proceed with a literature review of the wider engagement and operationalisation of the MLP in a spatial, including urban, context. Lastly, I will elaborate on conceptual and analytical implications, as a spatial lens to sustainability transitions further requires to acknowledge the politics and subjectivities mobilised in transitioning.

2.1.1 The Multi-Level Perspective on socio-technical transitions: an alluring explanatory heuristic?

Given the ambiguous and contested nature of sustainability (see chapter 1), the complexity of sustainability issues in terms of their wide-ranging and hardly predictable implications, as well as the fact that unsustainable development paths are reproduced and maintained (Unruh 2000), socio-technical transition scholars have argued that the transformation to address sustainability challenges will have to be far-reaching, long-term and system-wide, meaning across mutually-dependent technical, economic and socio-cultural dimensions (Elzen et al. 2004; Markard et al. 2012; van den Bergh et al. 2011).

Theoretical lines of inspiration for sustainable socio-technical transitions hence resonate particularly with major tenets in economic geography. The projects of evolutionary and institutional economic geography notably advocate looking beyond market mechanisms and technological change in understanding the dynamics of development and growth and to integrate wider societal, context-specific, and mutually dependent factors (Amin 1999; Boschma and Martin 2010). Despite disciplinary debates (Boschma and Frenken 2006; Essletzbichler 2009; MacKinnon et al. 2009) regarding how far these are two separate projects, both approaches share a systemic view on change while departing from orthodox economic theory. They mainly build on social science concepts including evolution theory, complexity theory and the social study of technology to better understand the causalities and co-evolving mechanisms of change (MacKinnon et al. 2009; Truffer 2008). Research interests are particularly articulated around: (1) a focus on socio-economic actors and their interactions, as well as

on (2) their entrenchment in context-specific social and cultural systems that create opportunities for dynamism but also constraints through lock-ins and path dependencies.

While the relevance of these concepts to help grasp wicked and multi-dimensional sustainability challenges makes intuitively sense, much of the socio-technical transition work in economic geography has not specifically engaged with climate change and the environment, with the exception of few contributions around the concept of environmental economic geography (Braun et al. 2003; Gibbs 2006; Bridge 2008; Hayter 2008; Soyez and Schulz 2008; Patchell and Hayter 2013).

Over the last 10 to 15 years, most of the contributions arguing for a systemic and wider institutional understanding of sustainable transformations can be found within the socio-technical transition literature (see Markard et al. 2012 for a literature review). Two heuristics are here mainly in use: the Technological Innovation System (TIS) and the Multi-Level Perspective (MLP). Not excessively different, they both build on evolutionary economics and use explanatory concepts like institutions, path dependency, non-linearity, as well as historical and spatial contingency to explain the rise and diffusion mechanisms of innovation (Markard and Truffer 2008 :597; van den Bergh et al. 2011). Yet, the TIS approach has had less resonance than the MLP. The TIS focuses on the development of specific (sustainable) technologies or industries, by looking at the processes and structures that condition innovation at the national, regional or sectoral level (Truffer and Coenen 2012). While interested in the organisations and institutions within a geographically bounded system, as well as the relationships between them (Markard and Truffer 2008 :598) in fostering innovation, TIS researchers are especially interested in the system's components (i.e. products, networks of actors and institutions) and its "functions", or activities, for generating and diffusing technological innovation: e.g. formation of markets, entrepreneurial experimentation, mobilisation of resources, etc.... (Edquist 2001; Markard and Truffer 2008: : 601-602). The work of Philip Cooke on clean technologies and bio-tech sectors in regional innovation systems (e.g. Cooke 2011) is amongst the most prominent contributions applying the TIS approach to green technologies.

The Multi-Level Approach is claimed to have a less "narrow" focus (Lawhon and Murphy 2012; Truffer and Coenen 2012), as it looks at transitions at a more "aggregated level [...] involving a variety of innovations" (Markard and Truffer 2008 :596). Geels further advocates that the MLP addresses questions of change from one entire system towards another, whereas the TIS perspective settles on how the system functions to create innovation, leaving aside the broader question of what explains its function or dysfunction (Geels 2004; Geels et al. 2004; Smith et al. 2010). As such, the MLP seems a better fit to investigate sustainable building transitions. Driving forces for (sustainability) reforms in

the built environment are indeed not only technology based, but lay at the intersection of socio-cultural, demographic, economic and natural dimensions (Ratcliffe 2008; Bharathi 2013).

Additionally, as has been highlighted by Rohracher (2001 :142-143) and discussed in Chapter 1, reaching a more sustainable built environment is a complex because multi-dimensional and multi-player project. Grasping and retracing this complexity fully justify the use of an analytical heuristics that takes a holistic, mutually-causal and relational view on change mechanisms, rather than a merely technical entry point.

2.1.1.1 What is the Multi-Level Perspective and what does it offer to sustainability questions?

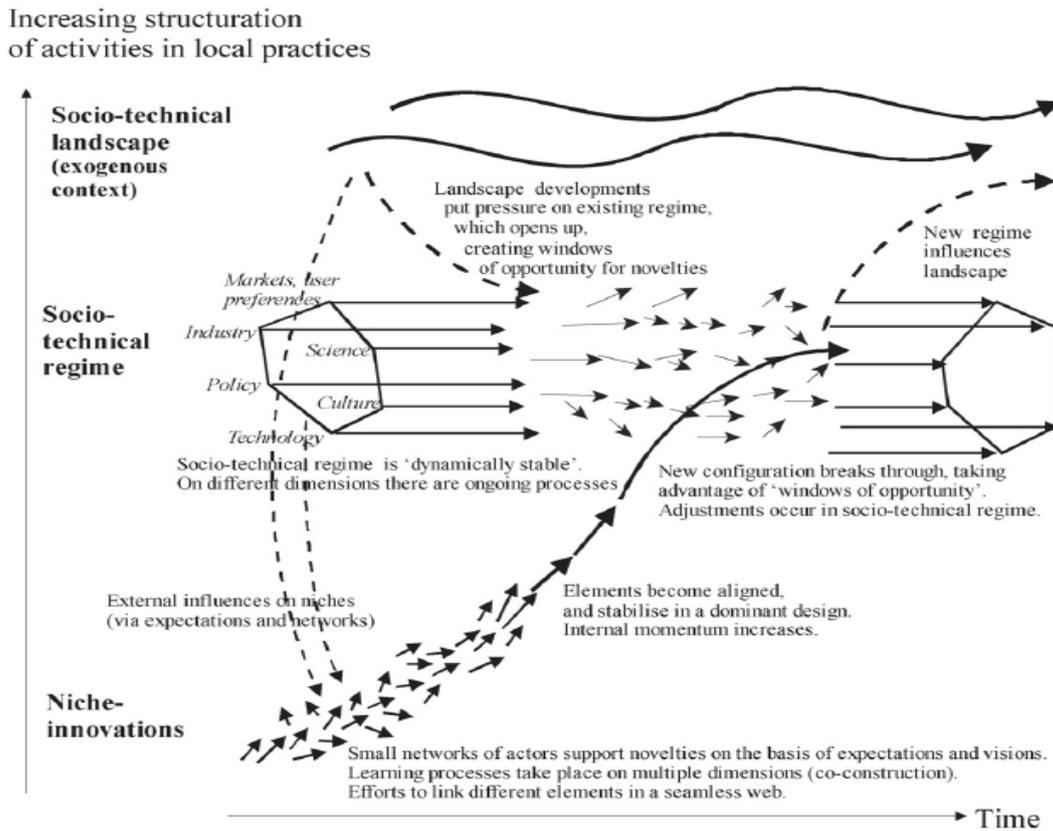
The MLP has been prominently elaborated by the Dutch researcher Frank Geels. It has been initially preoccupied with the historical understanding and description of the development and up taking of technological novelties through alignments with social structures, like for instance in the transition from sailing ships to steamships (Geels 2002).

Claiming intellectual inheritance from sciences and technology studies, evolutionary economics, sociology and institutional theory (Geels 2002, 2004, 2010; Geels and Schot 2010) the multi-level approach is presented as “a middle range theory that conceptualises overall dynamic patterns” (Geels 2011a :26) within a socio-technical system. To do so it looks at interacting developments between three nested analytical levels (see Figure 2.1.):

- (1) An overarching macro level called “socio-technical landscape”, which is mainly composed of exogenous factors, or what Geels (2002 :1260) calls “deep structural trends”. These trends are beyond the short-term influence of actors from the two lower levels and provide the general (social) context for their interactions. As such they encompass a heterogeneity of factors like: demographics, societal and cultural values, political ideologies, macro-economic patterns etc. (Geels 2010).
- (2) The second and meso level constitute the “socio-technical regime”:
“the rule-set or grammar embedded in a complex set of engineering practices, production process technologies, product characteristics, skills and procedures, ways of handling relevant artefacts and persons, ways of defining problems; all of them embedded in institutions and infrastructures” (Ripp and Kemp 1998 :340, quoted in Geels 2002 :1260).
In short, a regime encompasses the currently mainstreamed ways along which the system functions, i.e. the intertwined practices and structures within which the activities of actors and organisations are embedded. Drawing from structuration theory, Geels insists particularly on stability of the regime, its rules being produced by but also orienting the actions of actors

(Geels 2002, 2011a). An outcome of this stability though are also path-dependencies and lock-ins that might limit innovation to incremental novelties or worst lead to change resistance (Geels and Schot 2010).

Figure 2-1 The Multi-Level Perspective on socio-technical transitions



Source: (Geels 2011a :28)

(3) The third and micro level consists of “niches”. Drawing mainly from evolutionary economics, the concept of niches refers to spaces protected from the regime’s influence or more commonly the free market. For instance through public policy interventions, in order to allow for experimentations and the development of radical innovations (Geels 2002, 2011a). In his initial work, Geels conceived radical novelties as they emerge in niches as technological innovations, but has later widened the concept towards a more general understanding of “deviance from the mainstream” (Geels 2007 :1428-1429). He uses again a heterogeneity of factors to explain the processes at work in niches development, including networks of actors, learning as well as the articulation of expectations and visions (Geels and Schot 2010).

Key to that multi-level heuristic, although this is more clearly elaborated in later studies (Geels and Schot 2010; Raven et al. 2012; Fuenfschilling and Truffer 2014; Murphy 2015), is the increased

structuration or stability across the three levels (see the arrow on the left of figure 2.1) due to differences in generalisation, temporality and agency leverage. The long-term, general and rather heterogeneous social trends of the landscape bear few leverage to actors' direct influence. The system relevant activities at the regime level offer more room to agency, but are at the same time constrained by (1) routines and rules like consuming habits, technical standards, public funding mechanisms, etc., (2) material artefacts like infrastructure and (3) the existing arrangements between actors and organisations. All these elements have aligned in "configurations that work" (Rip and Kemp 1998 quoted in Geels 2010 :495) that make it difficult to depart from. The micro-level, the niches, is of course also subject to the same structural constraints, but to a lesser extent, thanks to its protected status from the regime. Dependencies between actors and rules at this level are less settled and stable offering more room to reconfigurations and mutations (Geels 2004; Geels and Schot 2010).

Transition, or systemic change, emerges then through a complex combination of developments and agency between and within all three levels. Radical novelties from the niches need for instance to assert themselves against, or at least to compose with, the regime level steadiness. Similarly changes or destabilisations at the landscape level, or regime dynamism may create opportunities for new, alternative niches to break-through and eventually become integrated into the regime as the new mainstream (For a detailed typology of possible transition paths, see Geels and Schot 2007).

Hence, as is argued elsewhere, by bringing into focus multiple explanations including actor-interactions, wider socio-cultural contexts and the complex dynamics and interdependencies between them, the MLP is an enticing analytical framework for addressing socio-environmental transformations (Elzen et al. 2004; Smith et al. 2010; Lawhon and Murphy 2012). But besides its openness towards institutions, the MLP's is also particularly interesting to help grasp barriers to changes, i.e. stability and persistence of deeply embedded unsustainable behaviours (Unruh 2000; Beddoe et al. 2009; Shove 2012). Accordingly, recent contributions using the MLP in relation to sustainability target dynamics at the regime level as well as interactions between niches and regimes as the relevant analytical levels for understanding how the system works and changes (Smith 2007; Lawhon and Murphy 2012; Fuenfschilling and Truffer 2014; Geels 2014). Obviously, this goes along a more or less clearly stated objective to use the gained insights for the purposive transformation of the current (unsustainable) socio-economic system. The related research fields of prescriptive Transition Management (see for instance Loorbach 2010) and Strategic Niche Management (Schot and Geels 2008) in particular, seek to propose concrete governance strategies and policy recommendations.

2.1.1.2 *Applying the MLP to sustainable building*

After having assessed the relevance of the MLP in conceptualising sustainability transformations at large, how does that framework concretely apply to sustainable building? As already outlined in Chapter 1, sustainable building is here neither to be understood as a specific technical artefact, like for instance the passive housing model, nor limited to one dimension of the sustainability triptych, like for instance green buildings with increased energy efficiency and reduced CO₂ emissions. Sustainable building is here understood in a very open and generic approach, to encompass all reforms within the built environment that are motivated by the realisation of a sustainability agenda in the analysed case studies (see also chapter 3 on case studies). I approach sustainable building with an attention towards its multiple but also contested understandings in specific places. I hence look of course at building novelties, but similarly to claims made by Rutherford and Coutard (2014) with regards to energy transitions in an urban context, I am even more interested in the related configurations. By this, I mean the actors, processes, politics, and their consequences that constitute the explanatory context for the changing materiality of sustainable building in specific places.

Henceforth, despite the MLP's openness to multiple connexions, this open definition of sustainable building obviously creates practical difficulties to map the relevant artefacts, actors and institutional change factors at the three levels. How to describe the complex processes at work without getting lost into details on the one hand, but also not present an overly general narrative without any in-depth and carefully nuanced analysis on the other hand?

The landscape level accounts for long-term trends in energy and climate change policy choices at international levels (Schulz and Preller 2016), for instance following the impact of nuclear events like Chernobyl and Fukushima, or engagements like the Kyoto Protocol. Global demographic trends like the increase in households or population ageing, or economic events like the 2008 financial crisis and their repercussions on public funding are just as relevant. Defining the regime with regards to sustainable building proves even more complex. Moore et al. (2014 :28) rightly argue the topic is located at "the cross-section of a multitude of other regimes, including the national economic regime and local and regional urban system regimes". The built environment in cities, as is further argued by Næss and Vogel (2012) can be characterised as a multi-segmented regime, combining a diversity of building solutions for different market segments. The niches lastly, can then also encompass a multiplicity of novelties: technological, organisational practices like building certifications, or particular planning approaches like transit oriented development, each of these holding the potential to be further broken down into niches within niches as pointed out by O'Neill and Gibbs (2014 :582).

The challenge in defining which factors are relevant to understand the dynamics of sustainability transition in the built environment shows in most contributions engaging with that subject under the MLP lens, as authors usually circumvent to provide clear explanations how they practically engage with the framework. As a thematic review of the relevant papers quickly shows, they instead narrow down their investigations in some ways: for instance to a sub-type of buildings, most notably housing (Smith 2007; Horne and Dalton 2014; Moore et al. 2014) or to one aspect of sustainable building like urban planning (Boyer 2014) or sustainable procurement (Brooks and Rich 2016), or even to the role of specific agents like green entrepreneurs (Gibbs and O'Neill 2013; O'Neill and Gibbs 2014). At the same time, this also goes along with a geographical case study focus that pays attention to locally contingent conditions and contexts.

The work of Adrian Smith (2007) on “eco-housing niche” translations into the regime though offers a compelling and well-structured analysis that helps to move beyond such boundary-drawing by putting the emphasis away from particular innovations and techniques. While analytically also engaging with one type of building, his application of the MLP to the built environment contrasts socio-technical practices as they occur within the eco-housing niche with the socio-technical practices of the mainstream housing regime. To do so, he proceeds along seven dimensions: guiding principles, technologies, industrial structure, user relations and markets, policy and regulation, knowledge, and lastly culture. Mainstream housing is hence for instance driven by a profit-loss principle, leading to volume building aided by standard designs and well-tested technologies that allow the use of cheap sub-contracted labour. Eco-housing, however, emerges from a normative commitment to the principles of ecology and requires specialist knowledge due to the use of complex solutions highly dependent on a building’s specific context. These complex requirements result in a trial-and-error and experimentation logic that is far removed from the standardisation at work in the mainstream housing regime.

By bringing to the fore the underlying world-views from which the practices and materialisation of both housing approaches stem, Smith’s provides an analytical starting point that avoids setting pre-defined boundaries on what sustainable building is. Rather it allows moving along the particular circumstances of the case studies by interpretively uncovering how sustainable building is concretised following how it is framed.

The difficulty to operationalise the MLP is already an important point of critique in the literature in general. Authors are especially criticised for insufficiently disclosing their methodological framework and subjective analytical choices (Genus and Coles 2008; Smith et al. 2010). Hence, as Smith et al. accurately sum up:

“Its [the MLP’s] terminology of niche, regime and landscape provides a language for organising a diverse array of considerations into narrative accounts of transitions. However, such abstract parsimony carries potential pitfalls which have to be approached with care. There is a tension between appreciating the bigger picture whilst maintaining a tractable parsimony in analysis. The MLP may help people simplify and intervene reflexively, but must not become counterproductively simplistic in its abstraction” (Smith et al. 2010 :442)

Solutions to this dilemma have been articulated around two main calls, already well taken on into the sustainability transition literature: the necessity to make the MLP more sensitive to (1) the role of geography and places which further leads towards (2) an increased sensitivity for the situated politics and subjectivities of the actor groups involved.

2.1.2 Going beyond process narration: accounting for geography and subjectivity

Following the previous sketch of the MLP and its tentative application to sustainable building, it becomes obvious that the MLP is a merely descriptive framework, with a clear added-value for complex and multi-faceted narratives on how a transition process unfolds. But at the same time the framework has some practical limitations when it comes to the nitty-gritty of why a transition occurs, hence requiring to be combined with and enriched by other more critical theories, as has been acknowledged by one of its main proponents:

“The MLP is an abstract analytical framework that identifies relations between general theoretical principles and mechanisms. But it does not specify precise, substantive mechanisms of interactions between technology, culture, politics, economics, sciences etc. To give explanations of such substantive relationships, the MLP needs to be complemented with more specific theories” (Geels and Schot 2010 :19).

2.1.2.1 The whereabouts of sustainability transitions

Until recently, applied contributions of socio-technical transitions have usually been concerned with processes unfolding in particular places (with a bias towards the national level) but otherwise rather oblivious in their analysis to the role of space as such (Smith et al. 2010; Raven et al. 2012; Hansen and Coenen 2015). Following geographers’ increased interest in the concept though, there is a number of theoretical calls to acknowledge the role of space and places as causal components (Coenen et al. 2012; Coenen and Truffer 2012; Truffer and Coenen 2012; Bridge et al. 2013).

In their extensive literature review on sustainability transitions from a geographical standpoint, Hansen and Coenen (2015) highlight that authors do so along two main lines of thoughts: (1) the

particularity of places where the transition occurs (i.e. the 'context' of the transition) and (2) the role of social interactions across different spatial levels, following a relational approach to space. Both dimensions build heavily on insights from economic geography and regional development studies, notably their elaboration on the effect of proximity on knowledge.

The first is seen as crucial to help explain the unevenness and diversity of sustainability transitions. Places are here conceived "as containers of spatial variables that explain transitions" (Raven et al. 2012 :70). Relevant contributions highlight the role of political objectives, visions and policies (Coenen et al. 2012; Truffer and Coenen 2012), institutional structures including also more subjective aspects like identities and beliefs (Coenen et al. 2012; Raven et al. 2012; Bridge et al. 2013; Murphy 2015 especially on the last aspect), available natural resources (Bridge et al. 2013), existing investments, specialisations and capabilities, as well as consumption patterns and market structures (ibid).

Besides the contextual role ascribed to space, the geographical agenda in sustainability transitions also further includes pledges for a relational approach to space, particularly via the multi-scalar relationships impacting the choices and behaviours of actors and organisations involved in sustainability transitions (Raven et al. 2012; Murphy 2015; Coenen et al. 2012). Hence by putting the focus on actors, questions on governance and politics and how these are exercised become key to scrutinising and explaining the dynamics of sustainability transitions (see also hereafter 2.1.2.2).

The translation of this geographical agenda is particularly well taken in work inquiring urban sustainability transitions (see for instance Bulkeley et al. 2011a; Rutherford and Coutard 2014). Picking up on the large literature deeming the urban level as particularly adequate to address climate change (Rees and Wackernagel 1996; Betsill and Bulkeley 2007; see also Chapter 1), authors look at case studies of urban infrastructure systems like energy, water, etc..., as sites of transitions.

Following critical discussions on how to operationalise the MLP at the urban level and as to where, if at all, locate cities within the niche-regime-landscape framework (Hodson and Marvin 2010; Geels 2011b; Næss and Vogel 2012), this research strand engages extensively with complex negotiations and contestations processes between diverse actor-coalitions across spatial levels. Using concepts like experimentation (Bulkeley and Castán Broto 2013), best-practice and demonstration (Späth and Rohrer 2012; Emelianoff 2013), or policy mobility (Affolderbach and Schulz 2016) authors seek to retrace how cities concretely engage with sustainability transformations in diverse ways, but also ultimately how much latitude cities have in doing so (Hodson and Marvin 2010).

Instrumental to the heightened attention given to policy and multi-level governance is here again the implicit idea that sustainability transitions in cities are purposively driven. As sustainable development is a value-laden societal project, characterised as aspirational and on-going, it indeed requires interventions (see Chapter 1; Meadowcroft 2011, 2007; Avelino et al. 2016). Crucially then, these

authors address regimes slightly differently than in the historical smooth accounts of socio-technical transitions. Instead of focusing on technologically driven innovations and their embeddedness in social contexts, they foremost inquire messy processes of regime continuity and reconfiguration through their embeddedness in political-economy contexts. A good example is While's (2011) work on the logics of carbon calculus governance and regulation. With the complement of critical perspectives from political economy and ecology, contributions further rely on interpretive and actor-centred analytical tools like power-relations, visions, agendas, discourses and framings to explain the complex, diverse and contested processes leading to the formulation and implementation of sustainable development in cities (Bulkeley et al. 2014; Hodson and Marvin 2012; Späth and Rohrer 2010, 2012). In this, they re-join another major tenet in the critique of sustainability transitions and the MLP: its insufficient attention to politics and agency.

2.1.2.2 And their wherefores

As the previous discussion illustrates, attending to the geographical context of sustainability transitions leads to a more critical engagement with the explanatory role played in change dynamics by specific actors' constellations and their goals. Hence, some critiques have called for a stronger theorisation of effects of agency and power, in short the "politics" of sustainability transitions to contextualise them into "the real-world" (Grin 2010 : 315; see also Shove and Walker 2007; Meadowcroft; Lawhon and Murphy 2012). Who are the actors behind such measures? Who acts in favour or is against it? Following which logic and interests? And how does this concretely impact the targets and direction of the transition? These questions are especially relevant to the acceptability and implementation of sustainability transitions, considering the normative tenets and contested interpretations behind the understanding of sustainability as already discussed in Chapter 1 (see also Smith and Stirling 2010; Meadowcroft 2011; Lawhon and Murphy 2012). Change dynamics in sustainability transitions are thus also substantiated by actors' different interests as well as ways of thinking about sustainability challenges.

Further, as transitions modify the dominant regime, they necessarily transform existing arrangements, potentially creating strains between winners and losers in the new system (Meadowcroft 2011). Paradoxically some authors critically assess that in practice, sustainable innovations that tend to become mainstreamed are still usually rather incremental. While providing a different way of doing things, it happens without fundamentally disrupting the existing dominant political-economy paradigm and institutional arrangements (Smith 2007; Monstadt and Wolff 2015; Hodson et al. 2016; Kenis et al. 2016). Even when leaving aside the strategic protection of the status quo by regime incumbents and their privileged access to influence a transition, it is inevitable that approaches on how a more

sustainable future should look like “are shaped by the [political] system and social environment [stakeholders] inhabit today” as put forward by Shove and Walker (2007 :765).

Hence apprehending the sources of change in sustainability transitions requires to understand the motives and interests of the agents involved in the transition and how they strategically interact with others to legitimate and enact their view on the subject matter. As much care should also be given to acknowledge their contextualisation in the institutions¹ of existing regimes, as these condition the possibilities at hand.

While a large part of the above critiques derives explicitly from the premises of Transition Management, they still hold validity for transition studies at large. Sustainability transition researchers accordingly seek to engage more explicitly with power and politics through a rich range of empirical case study focusing on actors’ steering role in innovation and the overcoming of path dependencies. One research strand proceeds through mapping and categorising relevant actors according to their institutional belonging (public, private, community, research-experts) or following their position at the niche or regime level (frontrunners and innovators, adopters, regulators, etc...). The objective is here to investigate the role played by particular individuals and their motives (e.g. green entrepreneurs Gibbs and O’Neill 2013; O’Neill and Gibbs 2014; North and Nurse 2014) but also by collectives like bridging or intermediary organisations (Farla et al. 2012; Brown et al. 2013; Hodson et al. 2013; Avelino and Wittmayer 2016). This work has especially proven useful to better understand how the structural and ideological positionality of actors impacts their attitude and behaviours in sustainable transformations.

At the same time, it also reaffirms the key role of institutional logics, notably by pointing towards the uneven degree of influence actors have on transitions due to differential access to resources, embeddedness in institutional contexts and –significantly for a societal project like sustainability– the degree of credibility and support they enjoy following perceived legitimacy and trust (Geels and Verhees 2011; Murphy 2015). As a result, some authors are inclined to relativise the credit given to actors’ capacity in shaping a transition, by pointing even more towards their embodiment in and relation with socio-material constellations (see Avelino et al. 2016 for an extensive review), for instance through the help of actor-network theory (Anders 2013) or practice theory and everyday life patterns (Shove and Walker 2010; Hargreaves et al. 2013).

With a lesser focus on the deterministic dimension of institutions, Longhurst’s (2013) concept of an “alternative milieu” also highlights the embeddedness of actors’ in geographical contexts that favour

¹ I understand institutions as formal structures like legal rules, policies, standards, but also informal rules like behavioural conventions, habits, etc. (Amin 2001)

sustainability innovations. He has developed that theoretical heuristic to better understand the formation of very specific places with an exceptional density of alternative institutions, including “localised cultural norms, values, worldviews and networks [that create] socio-cognitive spaces for [sustainability] experimentation” (Ibid 2015: 185).

Recent contributions attempt to square the circle by combining interpretive concepts together with concepts of institutional change mainly from political science and organisational theory (see for instance Brown et al. 2013; Fuenfschilling and Truffer 2014; Murphy 2015). Framings, discourses, strategies and visions are here used to uncover how actors make subjectively sense of an issue that then explains the enactment of a particular direction for sustainability transformations. Especially relational (discursive) processes like communication and social interactions at large play a dual role in the enactment of change. First they are one of the main dynamic and “signpost” (Hajer 1995) through which the structuration of novelties happens. Structuration is here understood as a novelty’s institutionalisation as the mainstream (and the de-institutionalisation of what preceded) (Fuenfschilling and Truffer 2014). At the same time discourses are also shaped in reference to the prevailing institutional context (see also Chilla and Schulz 2006 on this dual aspect of discourse) that provides a contextual structure. Especially Murphy (2015) makes an elaborate but enlightening distinction between on the one hand subjective/cognitive factors and on the other hand regulative and normative structural factors. The first group includes actor’s symbolic representations and individualised capacities thus driving the agency of transformation, while the second refers to formalised conventions of everyday interactions that provide the enabling and/or constraining template for a transformation.

Following the above review of the socio-technical sustainability transitions research field, it is clear that the framework provides a compelling narrative to retrace processes of sustainable transformations. It pays attention to the multiple and co-evolving social and material logics at work in change processes, also pointing towards propensities for continuity from existing institutions. While such a framework seems at first well fitted to the multi-dimensional and multi-player nature of sustainability buildings, this broad approach is at the same time one of the framework’s main pitfalls. By describing the wide range of relevant processes, actors, and artefacts involved in transitioning it still lacks analytical depth when it comes down to explaining why a transition is a certain way and not another.

As such and as the above general critiques of the MLP already discuss, this analytical framework alone does not suffice to do justice to the contextual contingency and political circumstances of sustainable buildings as a socially constructed object (see also Chapter 1). Following the propositions of critical

MLP authors, the following sub-chapter turns to a complementary discursive frame, to expose the argumentations of the involved actors, what is at stake for them in sustainable building transformations, and how the resulting narratives are then mobilised to bring about a concrete course of action, specific to the circumstances of a particular place.

2.2 Introducing discourses as a theoretical and methodological complement

The way a problem is articulated and delimited necessarily influences the possibilities to act upon it (Hajer 1995; Hajer and Versteeg 2005; Feindt and Oels 2005; Scrase and Ockwell 2010). But as already discussed in Chapter 1, sustainable building, presented as one of the key arenas to address climate change and environmental issues at large (UNEP 2011; International Energy Agency 2013; IPCC 2014) it is flawed by the same definitional multiplicity and contestations as sustainability.

The concept of discourse, understood as a shared and often implicit “specific ensemble of ideas, concepts, and categorisations that are produced, reproduced and transformed in a particular set of practices and through which meaning is given to physical and social realities” (Hajer 1995 :44; see also Sharp and Richardson 2001; Berg 2009) is here particularly relevant. It indeed helps to apprehend the different conceptions and realisations of sustainable building that can be witnessed empirically as underpinned by particular ideologies and rules on how things should be done. But significantly, it also helps to understand how these conceptions are mediated by agents through communicative interactions, and thus impact the social and material realities of sustainable building.

The following sub-chapters will hence first introduce discourse studies and their relevance for examining sustainable building transitions, including a short overview on how discourse² has already been employed in the field of sociotechnical transition studies. In a second part, I will elaborate on how to concretely operationalise the use of discourses in my research, based on existing contributions on environmental discourses.

2.2.1 *The explanatory role of language in change processes*

A focus on the assumptions and interpretations that lead to different ideas and practices of green building being developed and enacted in specific places strongly builds on work from the interpretive policy analysis field (Hajer 1995; Fischer 2003, 2007; Yanow 2007; Feindt and Netherwood 2011; Schmidt 2011). Considering that knowledge and meaning are subjectively constructed, proponents of that approach are interested in the situated interpretation of a policy issue and how this then channels the alternatives at hand, thus having a concrete impact. In that regard, they pay particular attention to the argumentative dimensions of discourse, language being the medium through which we interact to make sense of the world, but also the way we function about it (Durnova and Philippe 2013). That is to say, how a particular course of action is justified through interaction with other agents, leads to its implementation (or not) following agreement (or disagreement).

² In the following, I use the term discourse in a generic sense, to cover all approaches that seek to investigating an issue by focusing on the ways that issue is talked about.

Arts and Buizer sum up accurately how action and discourse mutually constitute each other when they explain that:

“The great many versions of discourse theory and analysis being advocated and applied nowadays have in common the aim to understand the social world by means of ideational and symbolic systems and orders. [...] it is neither rational calculations nor social norms that drive human behaviour and choice, but (collective) ideas, interpretations and meanings attached to (parts of) the world. [...] By giving meaning to the world, human agencies construct discourses. But ‘existing’ discourses mediate this meaning process at the same time.” (Arts and Buizer 2009)

Unfortunately, analysis of language and discourses in social sciences are beset by a bewildering diversity of theories, concepts, and methods (see for instance Keller 2011 for an overview) which makes it challenging to decide on how to practically proceed. Central though, is that using discourse is as much a method as a theoretical statement about the socially constructed nature of reality. Building on the four key premises characterising social constructionist approaches according to Burr (1995 as quoted in Jørgensen and Phillips 2005 :5 and Sharp and Richardson 2001 :194) this epistemology seems particularly adapted to understand the sources, circumstances, and dynamics for a transition towards sustainable building as it allows to account for:

- (1) the diversity of understandings on green building as produced by different way of seeing the world,
- (2) the local contingency of that understanding based on contextual specificities,
- (3) how that understanding is mediated and shaped through social interaction and lastly,
- (4) how this has then a physical impact, that is to say translates into concrete actions of doing sustainable building.

Two contributions are particularly helpful to further flesh out how these premises concretely apply in relation to the transition to sustainable building. Yanow’s (2000) work on how to conduct an interpretive policy analysis offers a useful elaboration of the two first premises. She underlines how an interpretive approach allows to treat different perspectives of an issue neither as right nor wrong, but as “different ways of seeing, understanding and doing, based on different prior experiences” (Ibid :8). Hence different sustainable building solutions are not necessarily better or worse in one place or another, but rather the result of how sense is made of it in that particular place. Yanow calls this “local knowledge”, not in a geographical but in an issue focused way (Ibid :17), hence bringing again to fore the importance of context. She also further signals that there might be different parties, with different interpretations in any one place, and hence alternative or even concurring conceptions on the same

topic. One of the first tasks of the researcher is then to identify these communities and to familiarise herself with their viewpoints.

The field of discursive institutionalism is particularly helpful to concretise how discourse and change work hand in hand. It both sets discourses within an institutional context and conceives them as interactive processes between agents that influence institutional change (Schmidt 2011, 2008; Arts and Buizer 2009; Hajer 1995 even if not under the label of discursive institutionalism). To better grasp the causal effects between discourse and change Schmidt (2008, 2011) works her way along four building blocks that help conceive discourse as contextual representations of ideas, but also the process through which these ideas are conveyed between actors thus leading to change.

Ideas, i.e. the (1) content of change, have different levels of generality. They can be very specific, usually in response to solving a punctual policy issue. This type of ideas are generally cognitive, that is to say interest and necessity motivated. But ideas can also be programmatic, as in a policy programme like Thatcherism or even more general when they are about broad philosophical concepts, i.e. ideologies and world-views. More general ideas tend to be normative, that is to say value-based in their legitimation and justification.

The (2) timing and pace of ideational change can be either radical because crisis-driven (through an event or a new idea), or incremental. The pace of change at least partly relates to the levels of ideas, as specific policies are faster to change than policy programmes or philosophical ideas.

(3) Agents, who convey ideas through interactive discursive processes, are in Schmidt's view central in driving change dynamics. Their "foreground ideational ability" (Schmidt 2008) consists of two dimensions: one coordinative amongst policy involved actors and one communicative between political actors and the public at large. Generally speaking, the coordinative dimension applies rather to the cognitive type of ideas, whereas the communicative dimension more frequently applies to normative ones.

Lastly, (4) the context of change, presented as agents' "background ideational ability" ties back to institutions. Schmidt sees it as "[agents] ability to make sense of and in a given meaning context [...] what goes on in individuals' mind as they come up with new ideas" (Ibid :314 - 315). She further insists that through their "foreground ideational abilities", agents are able to critically engage with, thus also ultimately change, their institutional context. As a result, discursive institutionalism conceives the agents-institutions relationship as dynamic, rather than deterministic following institutional rules and path dependencies.

Following the previously outlined limitations of the socio-technical transition fields and more particularly the MLP in unravelling the causes and particularisms of sustainable transitions, a discursive perspective provides hence helpful complementary insights. Especially work in political sciences that

explicitly engages with institutional changes links well with the institutional components present in the MLP framework, notably the structuration and stability at regime level. By taking a discursive perspective, I thus assume that the impulse for change is co-determined by contextual conditions and agential intentions that are both interpreted and conveyed in interactive processes of argumentation. Accordingly, in seeking to understand what sustainable building transitions in Luxembourg and Freiburg are, I will reconstitute the actors and processes of these transitions, but also the ways different actors talk about and justify sustainable building in both places, as this conditions actions for sustainable building. Based on this review, I will be able to discuss how far sustainable building approaches and projects in Luxembourg and Freiburg are truly transformational.

2.2.2 Discourses and sustainability transitions: state of the art

Following the strong relevance of discursive approaches to complement some of the 'black boxes' of the MLP, it should be no surprise that several contributions already combine that heuristic with a discursive perspective. Besides the previously mentioned theoretical work by Brown et al. (2013), Fuenfschilling and Truffer (2014), and Murphy (2015) that explicitly engages with interpretive elements (even if not explicitly discursive) in interaction with institutions, Smith and Kern (2009) uncover for instance the actors and content of the ecological modernisation story-line in Dutch environmental policy-making and in how far it has institutionalised a radical transformation. In a 2011 paper, Geels focuses on the role of cultural legitimacy in uncovering how innovations get accepted by society at large (Geels and Verhees 2011). Using the case study of the Dutch nuclear movement and the concepts of discursive frames and struggles he addresses as much the question on what creates legitimacy than its performativity through interactive processes of influence and struggle between agents. Through the concept of actor coalitions, Späth and Rohrer (2010) consider actors' use of guiding visions in shaping the transformation of energy provision in Austrian regions. Bosman et al. (2014) use storylines to investigate how discursive dominances and shifts between incumbent actors at the regime level impact change dynamics. The previously mentioned theoretical contribution from Fuenfschilling and Truffer (2014) further includes discursive analysis of a public inquiry to probe the (de-) institutionalisation logics that ensure the stability and coherence of the urban water regime in Australia and hence its potential for change. Genus (2014) similarly explicitly uses insights from institutional theory to address the role of discourse in institutionalising change in the governance of microgeneration in the UK. Hermwille (2016), situates its work at the landscape level and looks at narratives to help conceptualise how landscape disruptions affect nuclear energy regimes in Germany, Japan, and the UK. Markard et al. (2016) use the advocacy collation framework, and notably change in beliefs systems as visible in interest group publications, to analyse energy policy change in Switzerland.

In a purely theoretical paper, Pesch (2015) develops a framework to better integrate agency in sustainability transitions via fixations and changes in discursive fields.

Here again, the diversity of discursive concepts and approaches is striking. But all these contributions aim to gain a more fine-grained understanding of the dynamics of, and rationales for change (or persistence) in sustainable socio-technical transformations. To do so, most of them investigate the interaction between on the one hand the capacity of agents via their positionality on innovations (through beliefs, aims, objectives etc.) and on the other hand structural constraints and opportunities stemming from existing institutions, mainly at the regime level.

I intend to use discursive insights into the transition towards sustainable building along the same vein. I do not seek to evaluate the truth or rightness of one approach to sustainable building, but to reconstitute the local understanding of and argumentation for it, as this will provide insight into the question on why change occurs (or not) and ultimately allow to evaluate in how far that change composes with existing structures. Following Ockwell and Rydin's (2010 :168) call for "an appropriate middle range theory of discourse [that can be] applied to a specific context", I seek to use discourse in a pragmatic way, that is to say according to my research interests and not in an attempt to make a contribution to discourse theory.

2.2.3 *Operationalising discourses in sustainable building transitions: environmental discourses*

Considering that the subject of the research, sustainable building, is presented as one of the main solutions to address climate change (see Chapter 1), but also further considering that I focus on understanding the rationales for, and dynamics of change towards sustainable buildings, it makes sense to inform and operationalise my work through the experience and analytics developed in two of the main applied contributions engaging with discourse and sustainability: Maarten Hajer's (1995) work *The Politics of Environmental Discourse - Ecological modernization and the policy process* and John Dryzek's work *The Politics of the Earth: Environmental Discourses* (first edition 1997, latest revised edition 2012). Both publications engage with environmental policies from a discursive perspective, emphasising the multiplicity of meanings and understandings behind environmental issues, as well as the material outcomes of discourses. But even more crucially, both explicitly engage with discourses and change dynamics in ways that relate to the previously outlined interpretive conceptions of sustainability in policy analysis.

Despite these commonalities, Ockwell and Rydin's (2010) review of both approaches highlights that they rely on different theoretical groundings with different understandings on how discourses impact change. Dryzek's contribution builds on Habermas and his normative theory of communicative action and deliberative democracy, whereas Hajer's work applies amongst other Foucault's conception of discourses as the operation of power struggles for dominance (see also Sharp and Richardson 2001 on the Foucault/Habermas distinction).

Dryzek indeed produces a typology of different environmental discourses from which, so he presumes in a deliberative democratic system, agents are able to step back and critically compare. This capacity of actors leads to collective, legitimate and creative solutions in the interest of the community (Dryzek 2012 :12-13 and 236 ff.). Dryzek's typology amounts to four different broad perspectives on environmental issues. Each one is dividable in further variations or competing discourses following their departure from the dominant political and economic status-quo, which he calls industrialism. Industrialism is here to be understood as the existing backdrop against which these different discourses emerge. He distinguishes two dimensions in that departure, one along the scale of change (i.e. reformist or radical) and another one along how much that change copes with the existing structures (i.e. prosaic or imaginative). As an example, the discourse Dryzek calls "environmental problem solving" is characterised by limited questioning of the existing political-economic status-quo, hence prosaic, as it sees environmental issues merely as a matter of organised problem solving through the right instruments. These instruments, as for instance regulation or market mechanisms, are

conceived within existing tools that simply need adaptation to the problem at hand, therefore the discourse is also reformist.

Dryzek's categorisation is further refined by Bina (2013) who in her review of green economy proposals at the international scale distinguishes between three approaches –business as usual, greening and all change – following their transformative potential in respect to the current dominant socio-economic paradigm. In her conception, the more transformative approaches question the end of the dominant socio-economic paradigm rather than simply its means.

Another major advantage of Dryzek's work is its methodological clarity, which helps to overcome one of the main critiques of the use of discourse approaches in urban geography (Lees 2004; Jacobs 2006). Dryzek provides four analytical categories to concretely map the content of a discourse. The two first categories, "basic entities recognised" and "assumptions about nature relationships" retrace the ontologies at the base of the analysed discourse, i.e. the worldview it holds and its implicit understanding of human-nature relationships. The two last categories, "agents and motives" and "rhetorical devices" allow to dive into more details on who defends a particular perspective on environmental challenges, for what reason and with which arguments and tropes. These four categories provide for a concise depiction of the "story-line", i.e. the common thread of the analysed discourse.

Hajer, on the other hand, provides an in-depth historical analysis of the development and dominance in environmental policy-making of ecological modernisation, one particular environmental discourse. He defines it as "the discourse that recognises the structural character of the environmental problematique but none the less assumes that existing political, economic, and social institutions can internalise the care for the environment" (Hajer 1995 :25). Dominance for Hajer does not mean that other perspectives are non-existent even within a particular discourse, but rather that the way ecological modernisation makes sense of the world has reached authority in policy-making. He explains that dominance through ecological modernisation's coordinative power because it does not break with existing institutional arrangements. By this, he means that actors understand that particular discourse despite different disciplinary backgrounds, draw on it for their credibility, and concretely translate it into policy solutions.

This understanding builds on Foucault's conception of a discursive order and its co-constitutive effect on agency and structure (Ibid :47 and ff.). Hajer further complements Foucault's work with more interactive concepts to better clarify the role of individual agency in discursive dynamics and social change at large (Ibid: 47 ff.). He thus notably proposes the concept of problem specific "story-lines" as narratives reconciling different knowledge claims and cognitive commitments (i.e. actors' institutional context) around symbolic references. This reconciliation works through what Hajer calls "discursive

affinities” (Ibid :68). Story lines are then essential for the perpetuation and/or creation of a (new) discursive order (Ibid: 63-64). Actors indeed coalesce around story-lines, creating “discourse coalitions” with a common understanding of an issue they then use in their struggle to influence the policy-making process mainly through persuading other agents. Importantly, these discourse coalitions do not necessarily share the same ideology. In that respect, Hajer’s approach recalls the distinction Schmidt (2008; 2011) makes between the agent’s coordinative (i.e. discourse-coalition internal) and communicative (i.e. external) discourse abilities, while similarly acknowledging their institutional embeddedness. As Hajer summarises it, his:

“argumentative approach [...] allocates a central role to the discoursing subjects, although in the context of the idea of duality of structure: social action originates in human agency of clever, creative human beings but in the context of social structures of various sorts that both enable and constrain their agency” (Ibid :58)

Obviously, this perspective appeals to the debates and dilemmas encountered by sustainability transition researchers in accounting both for the agency of actors in bringing forward a sustainability transition and the implicit institutional constraints provided by the regime concept in the multi-level perspective.

Accordingly, both perspectives offer an added-value to help to grasp the discursive dimension of sustainable building. Dryzek offers a useful methodological toolbox to help map different conceptions and argumentations for sustainable building, as well as their detailed content including their ideological underpinnings and who advocates them. As such, applying Dryzek’s framework can be regarded as the first step of the discourse analysis of sustainable building transitions in Luxembourg and Freiburg. It allows me to identify existing viewpoints on the subject and to familiarise myself with their internal logic.

Hajer, in turn, offers help in interpreting the concrete impact as well as the transformative stance of these discourses by conceiving them in terms of dominant story-lines. Unravelling the contextually relevant articulations and connection of worldviews and institutional commitments that cements actor-coalitions on sustainable building in Luxembourg and Freiburg helps to understand the strength of one particular perspective of sustainable building in policy-making, but also ultimately to evaluate in how far that perspective is truly transformational.

2.3 Implications for an interpretive transition study of sustainable building in two urban cases

Using the Multi-Level Perspective on sustainability transition in complement with a discursive approach to understand sustainable building processes in two case studies leads me to make several research assumptions that have further theoretical but also methodological implications.

- By taking a transition perspective, I agree with the framework's statement that sustainable development, of which sustainable building is but one dimension, is a project that needs a systemic and wide-ranging transformation across multiple social, economic, political and technical dimensions. This then in my analysis of sustainable building processes in Luxembourg and Freiburg leads me to ask the ancillary research question if what I find truly fulfils these characteristics.
- Similarly, a transition perspective implies that my analysis will take the form of a narrative of the processes at work across multiple levels in the transformation towards sustainable building, while offering a nuanced acknowledgment of the role of both actors but also their entrenchment in local contexts and structures. The objective is not to apply the MLP frame as a strict mapping and delineation of factors across levels, but rather as an analytical lens that helps to broaden the focus towards accounting for multiple factors and interactions.

As I already pointed, considering the vastness of such a task, its proper operationalisation will inevitably require a selection of what to look at in more details. In my case, and given the position of my work within a larger research project with given methodological choices, I focus on a selection of specific policy measures, concrete building projects and actors in two geographically bounded case studies (for more details on how and why this selection has been done, see chapter 3).

- Using discourses allows me to methodologically and theoretically overcome some of the shortcomings of the multi-level perspective. It notably helps to focus on and flesh out the explanatory role of actors and local conditions on the particular perceptions and realisations of sustainable building in Luxembourg and Freiburg.

But at the same time, using discourse goes along with further theoretical implications. The most powerful one is about the socially constructed nature of reality. While, as already elaborated earlier (see Sections 1.1.3 and 2.2.1 above), the interpretive assumption fits well with my research interests, it implies that "the objective of [my] investigation becomes not the discovery of some ultimate 'truth', but rather a means of 'providing coherent and consistent explanations for event' (Jacobs 1999 :208 quoted in Sharp and Richardson 2001 :194). Hence my work will ultimately not provide policy relevant recommendations on how to 'rightly' do

sustainable building. Rather, by raising awareness on the implicit and unquestioned logics at work in particular choices on sustainable buildings, I hope to ultimately open up the discussions towards considering a larger range of possibly more radical alternatives.

- Further, when seeking to use discourses, the researcher is confronted with a broad diversity of approaches and understandings. Here again, I have made a choice: to use existing applied contributions of discourse analysis according to my research interests instead of engaging with grand discourse theories.

I have thus focused on contributions dealing with sustainability issues, providing a clear methodology, and elucidating change processes as deriving from the dynamic interaction between agents' argumentative capacity and their background ideational constructs which include the given institutional context at large.

3. RESEARCH DESIGN AND METHODS: ENGAGING WITH MULTIPLICITY, COMPLEXITY, AND SITUATEDNESS

Before going into the detail of the research design and methods, it is essential to clarify that the present work is located against the backdrop of a larger, collaborative research project. Consequently, the research objectives and methods of the project as a whole have significantly shaped my own work, as much from a theoretical as a methodological perspective. GreenRegio, an acronym for ‘Green building in regional strategies for sustainability: multi-actor governance and innovative building technologies in Europe, Australia and Canada’ has been jointly funded by the National Research Fund Luxembourg (FNR) and the German Research Foundation (DFG) between 2013 and 2016. Its main research objectives were to identify the condition and drivers for innovations and particular trajectories of sustainability transitions in green building in four case study regions: Freiburg (D), Vancouver (CA), Luxembourg (LU), and Brisbane (AUS) (GreenRegio - Project 2014).

As already extensively elaborated in the previous chapters, sustainability reforms in the built environment are not only a matter of material (or technological) conditions but lay at the intersection of socio-cultural, demographic, economic, natural but above all also political dimensions. Under such conditions, what sustainable buildings are and how they are realised varies significantly across different social and geographical contexts, which makes paying attention to their situatedness a key aspect to understand the topic (Faulconbridge 2013). The GreenRegio research project has sought to conceptually account for the diversity of elements determining sustainable building transformations via the analytical lens of the Multi-Level Perspective on sustainability transitions. As discussed in Chapter 2, recent contributions focusing on urban sustainability transitions indeed bring to fore the diverse strategies and approaches taken by different groups of actors within and between cities. They thus pinpoint to the role of places as well as steering multi-level governance processes in explaining the emergence and diffusion of sustainability transformations (Raven et al. 2012; Murphy 2015; Coenen et al. 2012).

Following the project’s objectives then, the research design is careful to provide the possibilities to adequately engage with contextual particularities, while at the same time allowing to explore the issue in-depth to investigate the diverse and complex interactions involved. This is provided by:

(1) Settling for the in-depth analysis of particular cases, their complexities, contingencies, and contexts through focusing on four case study regions: Freiburg (D), Vancouver (CA), Luxembourg (LU), and Brisbane (AUS). I have specifically engaged with the two European case studies, Freiburg (D), Luxembourg (LU).

(2) Using collaborative and interactive research methods to include a large range of actors in each case study region and more specifically take into account their plurality of perspectives.

(3) Based on my engagement with the transition literature and critique on the Multi-Level Perspective for not considering adequately the explanatory power of agent's background motives and structural commitments, I have even further engaged with an interpretive research approach. Investigating discourses both as causal processes and circumstances of change indeed helps me to retrace the details and mechanisms as to why sustainable building changes unfold.

3.1 The thick and particular description of sustainable building in Luxembourg and Freiburg

Stake (2005 :443-444) defines case study as a form of research that “optimises understanding”, as he conceives the case as a “bounded system [...] where coherence and sequence are there to be found”. Yin (2014) similarly highlight that the use of case studies stems from the need to study in depth a complex, contemporary social phenomenon for explanatory reasons. The appropriateness of case studies, both authors underline, is linked to the research questions but also to the pertinence of context for understanding the phenomenon under study. Case study based research hence seeks to get a deep understanding of a complex and situated phenomenon, usually with some prior theoretical sensitivity as to existing issues. Thus considering the previously elaborated situatedness and complexity of sustainable building transitions, looking at geographically bounded case studies seems well apt to offer the kind of rich insights needed to deepen understanding of the whys of the sustainable building phenomenon in particular places.

Against common criticism, Stake (2005) stresses the relevance of intrinsic interest in a single case, to uncover what is pertinent for the case in its own sake (see also Flyvbjerg 2006). He distinguishes it from instrumental case studies, where the researcher is rather concerned to provide insights into a more general issue and uses the case study with a purpose of generalising the research findings. In practice though, this distinction is actually conflated as “generalisation and proof linger in the mind of the researcher” (Ibid :448). The reliance on four case studies in the GreenRegio project has to be understood in that light: a theory led interest in illuminating the complex interactions of local agencies and circumstances that explain trajectories of sustainable building transitions in particular places. But at the same time, without being initially comparative in purpose, reflecting on commonalities across the case studies' individual results definitively bears potential for learning on the explanatory factors of sustainable building transitions in general (see also Affolderbach and Schulz 2018).

The theory informed rationale for applying a case-study research approach is then further decisive for the selection of the case(s) as well as its relevant unit of analysis, i.e. the boundaries of the case. The aim of the GreenRegio project in analysing four case studies in depth can be broadly categorised under what Flyvbjerg (2006 :230) sees as maximising the utility of the information gained, hence leading to an information-oriented selection that is based on expectations about the case(s). Or as Stake (2005) puts it even more bluntly, the researcher should turn towards the case(s) that give her opportunity to learn. Accordingly, the four case studies in the GreenRegio project have been selected following two main criteria: one based on ensuring relative commonalities of the cases in terms of their broader socio-economic characteristics (see table 3.1), so that variety amongst them can be expected to pertain mainly to locally contingent conditions and agencies. The main contrast, clear from the outset of the study, is that two of the cases are internationally acclaimed for their sustainable building initiatives whereas the two other ones have much more recently engaged with the topic. In sum, cases studies have here been selected according to the varying degree of historical 'intensity' they show regarding their engagement with sustainable building policies.

The second, much more pragmatic selection criterion, is based on ease of access to local documentary information and the actors involved, considering the breadth of information required by the multifaceted transition perspective. To put it simply, the selection has been affected by the location and existing links of the research team members with the case study regions, which Flick (2009) qualifies as "convenient sampling".

Luxembourg (LU) and Freiburg (D), the two case studies I have engaged with, are both embedded in western European contexts. As such, they have first of all similar climatic conditions, one non negligible determinant for differential focuses in sustainable buildings (see also Chapter 1). It further subsumes them to similar political and governance process, most notably the influence of European legislations and policies which decisively address sustainability, or rather energy efficiency, in buildings since the mid-2000s. Both places are further comparable in terms of their size and demographics (see Table 3.1), while I should clarify that for Luxembourg it is the national level that is the relevant (urban) scale of analysis. Luxembourg's sheer size, the dominance of its capital city in the country's urbanisation patterns, as well as its small-state political institutions strongly determined by the national level indeed all point towards a city-state context (see also Section 4.1. for more details on this). Luxembourg and Freiburg can be categorised as middle-sized urban contexts. More interesting though is that both are confronted to a steady population increase, mainly through inward migration, that has led to strong shortages and affordability issues within their real estate market (STATEC 2016b; Hesse 2016; Höhl 2017). As a consequence, important building activities and interventions can be expected in both places, which might impede or facilitate sustainable building transitions.

Table 3-1 Main characteristics of the selected case studies

	Freiburg (municipal area)	Luxembourg (state)
Territory (km ²)	153.06 km ²	2,586 km ²
Population (2016)	226,393	576,000
Pop. increase	1995-2015 20%	1991-2016 33%
GDP /capita (in €)	35,361 (2013)	92,900 (2016)

Source: design based on Affolderbach and Schulz (2018)

Data source: Amt für Bürgerservice und Informationsverarbeitung der Stadt Freiburg im Breisgau (2016); STATEC (2016b)

Since the early 1980s, Freiburg is internationally renowned as a best practice case in urban sustainability across a wide range of policy domains, including sustainable building. The City Council has, for instance, received a number of national and international awards recognising its involvement in environmental protection and sustainable urban development. Freiburg is also presented as best practice in an impressive number of textbooks on green urbanism (for e.g. Beatley 2012; Hall 2014). This has led to Freiburg being an object of intense study by policymakers, practitioners and researchers alike. In comparison, Luxembourg has engaged rather recently with the topic of sustainable building, the key triggers being the transposition of European legislation on energy efficiency in buildings around the mid-2000s. Since then though, the topic has moved high on the political agenda, as visible in the coalition programme of the 2013 newly elected government (Programme gouvernemental 2013).

The geographical focus should here not be understood as a strict limitation of the inquiry to a bounded place. As elaborated previously (see notably Sections 1.1.3 and 2.1.2), the focus on a particular place is rather conceived here under a relational understanding of the importance of situatedness.

As for the boundaries of each case study, the theory led focus on geographical units has been cascaded into smaller embedded units of analysis. This reductive step is fundamental, considering the practical difficulty for researchers in understanding everything about the case study (Stake 2005), especially as the relevant analytical levels, i.e. urban areas, are still extremely large in scope. The argument also re-joins the previously outlined necessity to make strategically justified reductions to be able to operationalise the multi-layered analysis of the MLP.

The embedded case studies have been primarily selected through an interactive feedback-system with local experts at an early research stage (see 3.2.1 for more details) and jointly refined by the project team under consideration of feasibility and accessibility to information. This means that early stage or too broad initiatives have been generally left aside. The selected initiatives allow to cover ground on different dimensions relevant to sustainability reforms within the built environment, as backed by the MLP framework on sustainability transitions (see Table 3.2). They address concrete building realisations, and through them technological change, but also the involved agencies as well as policy processes that participate to the changing materiality of sustainable building in Luxembourg and Freiburg. The selection is also careful to ensure variety by covering initiatives from the public, private and third sector, commercial and residential building projects, at the level of individual buildings and neighbourhoods.

The micro-case studies have further been instrumental in the empirical operationalisation of the research as they have determined the selection of interview partners, the topics discussed during interviews, as well as the review of secondary data, and the compilation of the text corpus for the discourse analysis.

Table 3-2 Selected micro case studies in Luxembourg and Freiburg

	Luxembourg	Freiburg
Policy	<ul style="list-style-type: none"> - Private and public (housing) building certifications - Public policies on energy efficiency and eco-innovation - Training and capacity building 	<ul style="list-style-type: none"> - Freiburg Standard - Retrofitting initiatives - Green City Freiburg
Actors and organisation	<ul style="list-style-type: none"> - Oekozynter Lëtzebuerg - My Energy (energy agency) - Ministry of Economy 	<ul style="list-style-type: none"> - Freiburger Stadtbau - Energie Agentur - Building groups - City Administration
Built environment	<ul style="list-style-type: none"> - Solarwind, Windhof (office) - Hollerich Village, Luxembourg (neighbourhood project) - Neobuild Innovation Centre, Bettembourg (commercial) 	<ul style="list-style-type: none"> - Buggingerstr. 50 (residential) - Vauban (neighbourhood) - Rieselfeld (neighbourhood)

Source: based on Affolderbach and Schulz (2018)

3.2 Accounting for the plurality of voices in sustainable building: interactive sustainability research³

Reaching a pluralistic understanding of the sustainable building context in each of the cases is central to the empirical operationalisation of the previously outlined interpretive transition research framework (Chapter 2). Accordingly, this step was essential to identify and map the relevant factors and processes of the past and on-going transition processes. To a certain extent case study research, at least when qualitative, already relies on interactive and interpretive engagements with stakeholders (Stake 2005). The need to grasp the often tacit realities, interests, and strategies but also concrete achievements and involvements of a large range of actors from the public, private, and non-governmental sector has though driven us⁴ towards a more advanced conception of our engagement with local stakeholders as collaborative and interactive.

Inspired by work in related disciplines, participatory approaches have significantly taken up in human geography around the mid-2000s (Kindon et al. 2007; Kesby 2007; Kinpaisby 2008). Calling upon critical geographies, political engagement of researchers and researchers turned activists (Chatterton et al. 2007; Chatterton 2008) contributors argue in favour of a reflexive engagement with the political place embeddedness of participation, in order to “ ‘conscienticize’ ” the participants (and the researcher) on “the forces affecting their lives” (Kindon et al. 2009: :90). In parallel, participatory approaches conceived as an interdisciplinary collaboration between researchers and non-academic constituencies are seen as central elements to generating impact in respect to wicked problems and big challenges such as global climate change. This conception draws on sustainability sciences’ call for a different “scientific practice which can cope with uncertainty, with value plurality, and with the decision-stakes of the various stakeholders of the problem at hand” (Hessels and van Lente 2008: :744; Brundiers et al. 2013) and thus fits well with the sustainability transition framework. Research participants are indeed here not just considered as holding situated knowledge but also as political actors representing specific and at times conflicting stakes in the issue at hand (Funtowicz and Ravetz 1993; Lang et al. 2012; Seijger et al. 2015).

Our approach is especially inspired³ by participatory notions of “cooperation” and “co-learning” to actively involve the research participants in both the conception and scoping of our empirical work as well as in the generation and validation of new knowledge (Kindon 2010). This has happened mainly

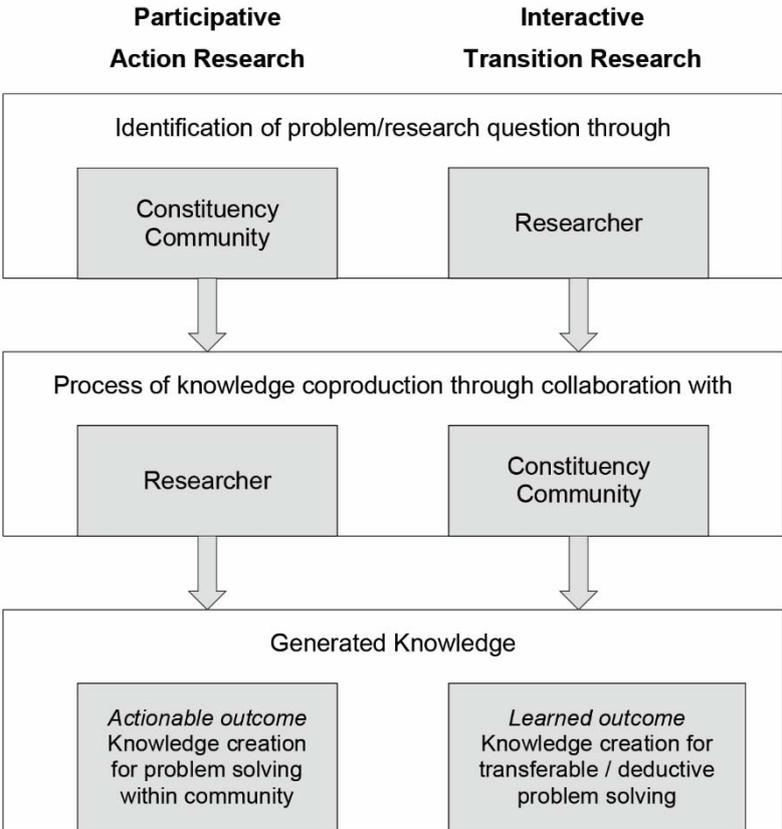
³ The section dealing with interactive and co-operative research approaches extensively draws on the peer-reviewed article Preller, B., Affolderbach J, Schulz C, Fastenrath, S and Braun, B. 2017. Interactive Knowledge Generation in Urban Green Building Transitions. *The Professional Geographer*, 69 (2), 214-24.

⁴ I am using here the “we” form, as this research approach has been a common thread for the whole GreenRegio research team.

through the organisation of two workshops in each case study, one at an early research stage and another following the end of the empirical work. Our objectives were to present our outcomes and results to the solicited stakeholders and invite them to critically assess, review, and validate findings, but also to disseminate and ensure transmission of the results to eventually allow for further utilisation within the community (for details on the concrete organisation and setting of these workshops refer to Section 3.2.1 hereafter).

Participatory approaches in their more normative and emancipatory sense prescribe that researchers join particular communities with which they co-produce knowledge to serve practical needs. In contrast, we have initially started from an inversed logic (see Figure 3.1) aimed at achieving a learned outcome, but also reflexive and pluralised insights through “interactive transition research” (ITR). This research-driven, learning, and knowledge generating perspective has allowed us to broaden and pluralise the views and interpretations obtained in the data while avoiding the trap of linear pre-determined representations of sustainable building transitions

Figure 3-1 Imperatives and objectives in participative research and interactive transition research



Source: Preller et al. (2017)

Crucially, this approach thus also differs from the primarily normative and social change orientation of transition management research, in which the researcher and the participants use collective foresight and participative vision building to initiate a desired change (Loorbach 2007; Wittmayer et al. 2013; Kivisaari et al. 2004; Eames and Egmoose 2011).

To summarise, co-productive methods offer here an effective way to access a large amount of relevant information as well as to access more tacit and interpretive representations within the time-constraints of funded research projects. But more crucially, by blurring “classical epistemological realms and corresponding roles of academic and non-academic actors” (Pohl et al. 2010 :269), knowledge production within the project has evolved from a one-directional provision of information to the research team towards more interactive exchanges. It has encouraged the generation of diverse knowledges that undergo critical and reflexive review from the participating experts and the researchers alike, while being collected. Research participants thus have turned from an object of study, or key source of information, to collaborators who co-create and benefit from new knowledge through interaction with the researchers but also with their involved peers. Traditional inquiry methods could neither have provided similar insights within a single research step nor ensured a similarly mutually beneficial process between participants and researchers, as for instance platforms for encountering and reporting back to and within the participating community or new connections of knowledge exchange between practitioners of the four case study regions.

3.3 Discourse analysis as a “difficult- to-define method”⁵

In addition to the two previously outlined research approaches that have been applied to the whole GreenRegio project, I have made the theory-informed choice to focus on the interplay of agential motives and meaning-systems with their institutional circumstances to help explain why sustainable building is understood and pursued a certain way in particular places. The social constructionist perspective of discourse analysis, in particular approaches that see discourse and reality as co-constitutive (see Chapter 2), provides a helpful conceptualisation of (policy) change processes as triggered by agents’ argumentative capacity in relation to their institutional/structural commitments. Following the strong interrelation between theory and methods in discourse analysis (Jorgensen and Philipps 2005), some relevant methodological ground has already been covered in Chapter 2 (see Section 2.2). For the sake of avoiding redundancies, I will here only briefly outline some more practical aspects of the operationalisation of discourse analysis. Its exponential success in geography has indeed been often accompanied by criticism for not disclosing enough how the analysis has been concretely done (Lees 2004; Jacobs 2006; Berg 2009; Waitt 2010).

⁵ (Berg 2009 :218)

The difficulty runs partly back to discourse theories, at least the ones that are relevant to my analysis, in the sense that they “offer a more abstract mapping of the discourses that circulate in society” (Jorgensen and Philipps 2005 :21) rather than a detailed engagement with everyday texts and spoken language as in linguistics. Especially the writings of Foucault, which are the backbone of the storyline and discourse coalition approach developed by Hajer (1995), explicate how discourses function but rather leave aside the details on how to proceed with the uncovering of discourses (Sharp and Richardson 2001; Waitt 2010). Accordingly, as pointed by Berg (2009) and Waitt (2010) discourse analysis is rather conceived as an intuitive process of learning by doing.

This obviously opens the door to strong critics as developed in a fierce essay by Antaki et al. (2002) entitled “Discourse analysis means doing analysis: a critique of six analytical shortcomings”. Here, the authors point to insufficient engagement with the textual material that in their opinion leads amongst others to: under-analysis through summary, over quotation or context isolated quotations, or simply the spotting of features without a true analytical reflection and engagement with the material. In addition, as noted by Jacobs (2006) the absence of methodological details facilitates accusations of bias in discourse informed research endeavours. This pertains notably to the selective disclosure of evidence according to the favoured arguments, which then raises possibilities for a different interpretation of the same material.

I partly circumvent some of these issues through my engagement with existing applied discursive contributions on the environment. In particular Dryzek’s (2012) clear categorisation system already conditions what to look for in the text corpus (see Section 2.2.3 in Chapter 2 and Section 3.4.4 hereafter) but still leaves some aspect open as to how to concretely proceed with the analysis. While a too concrete methodological formalisation would probably be rather detrimental in the light of the strongly interpretive and reflective nature of discourse analysis as well as its many theoretical variations, Waitt (2010), followed by Berg (2009) offers seven helpful guiding principles for doing discourse analysis. These principles relate primarily to Foucauldian inspired discourse analysis, but I find these guidelines have a more general relevance as they provide useful hints on how to engage in depth with the text corpus to help illuminate patterns. At the same time, they give pragmatic tactics to cope with the sheer mass of documents, both issues I have found challenging when assembling my corpus (see also Section 3.4.1 hereafter on selection criteria for the text corpus):

- (1) Choose the corpus in light of the research objectives, being notably aware of the audience addressed but also possible writing conventions for different genres of texts. In addition, a meaningful selection strategy is essential, notably to keep a manageable size of the text corpus.

- (2) Seek to suspend as much as possible pre-existing categories. The researcher needs here to be particularly reflexive about her own positionality and aware of how that influences her interpretation.
- (3) Truly engage and familiarise with the text but also its social context. The last point requires to keep in mind who produced the text, for which audience and what its production and circulation circumstances are, as all these elements condition the textual outcome and tend to reproduce existing structures.
- (4) Use coding to analyse the text corpus, first to organise the data, and based on this a second time to interpret the data.
- (5) Investigate regimes of truth. This means being aware of and understand how legitimacy is built in the textual material through particular kinds of knowledge-making practices (e.g. the resort to statistics or spokespersons like experts) that have a persuasive effect towards the audience.
- (6) Identify inconsistencies within discourses, as these might contest or reinforce the dominant discourse.
- (7) Be aware of silences, notably the subjects and worldviews that are left out of the discourse, as this is a mechanism of power reproducing structures.

3.4 Empirical methods of data collection and analysis

Based on the theoretical framework and the research objectives that focus on the plurality of sustainable building understandings under a socially constructed premise, the research design is articulated around three combined pillars described in detail above:

- The in-depth analysis of the multiple evidences and specifics of sustainable building transition in two urban case studies: Luxembourg (LU) and Freiburg (D).
- A particular care to engage interactively with the local stakeholders solicited in the research process of each of the cases, to produce plural, reflective but also mutually beneficial knowledge.
- A focus on mapping and reconstituting policy discourses about sustainable building in each case study, as these are seen as explanatory for the social and material dimensions of sustainable building transformations.

The following sub-section then deals with how these three aspects are concretely operationalised through a mix of qualitative research methods that build upon but also complement each other, hence also ensuring methodological triangulation (see also Affolderbach and Schulz 2018).

A less formalised but nonetheless essential preliminary step has involved my general acquaintance with the context of the case studies. Desk reviews of the main policy documents and the analysis of existing secondary literature, if available, have allowed me to preliminary map relevant actors and initiatives, as well as provided background knowledge on the topic of sustainable building in each case study. I have further complemented this desk work by attending relevant local events, like conferences and fairs, which I also used as a way to make first connections with potentially relevant research participants.

3.4.1 *Interactive expert workshops*⁶

Following the preliminary, mainly desk based work to get acquainted with the case studies, interactive kick-off workshops were organised in each of the GreenRegio project case studies, following the participative research approach discussed earlier. I have selected participants based on their involvement in the field of sustainable building (see Box 3.1) and across the public, private and third-sector. The first contacts were initiated following the results of the preliminary desk-based actor mapping. They have been progressively complemented by the involvement of local researchers engaging with sustainability-related work, as well as cross-referencing amongst invited participants.

The workshop participants were invited to attend a locally held World Café in order to define the local meaning and understanding of various facets of sustainable building. The World Café method has developed out of spontaneous small table conversations and replaces traditional large-circle discussions (The World Café - History 2016). It indeed provides a group environment which encourages an open dialogue between participants by conveying an unconstrained and interactive atmosphere as in a normal café. For each workshop, local participants were split across three parallel running discussion tables. Each table focused on a specific dimension of the sustainable building sector following the project's co-evolutionary approach: actors and organisations, building projects, and framework conditions (encompassing institutional aspects like legislation, socio-economic aspects, etc.). Based on returns from the first Café experience in Vancouver, the project team eventually added a fourth discussion table addressing challenges and barriers to the development of sustainable building practices (Table 3.3).

Participants of the World Cafés in Luxembourg and Freiburg progressed through several conversation rounds as they were asked to circulate and mix across the tables. The content of each conversation round has been retained in written form and passed on to the next group by a fixed table host. A complementary final plenary discussion has ensured sharing and connecting of the information

⁶ This section is based on the peer-reviewed article: Preller, B., Affolderbach J, Schulz C, Fastenrath S and Braun B 2017. Interactive Knowledge Generation in Urban Green Building Transitions. *The Professional Geographer*, 69 (2), 214-24.

amongst the totality of participants. This “recombination” of knowledge (Brown 2001 :3) is central to the World Café method, as it stimulates reflexive processes amongst participants, progressively leading to the emergence of shared patterns. The group’s collective understanding of an issue can thus be mobilised, including tacit knowledge, but also further allows for ownership of the results by the participants (Brown 2001; Fouché and Light 2010; Prewitt 2011).

Table 3-3 Configuration and content of the kick-off workshops in Luxembourg and Freiburg

Workshop	Participants (+ researchers)	Actor types / affiliations	Responses to follow up questionnaire	Summary of the main outcomes
Luxembourg 29 Jan. 2014	27 (+7)	Architects, engineering and design firms, private and public developers, interest and professional associations, research institutes, NGOs, ministries (sustainability, economy, housing), national energy consultancy	9	<ul style="list-style-type: none"> • Key role of legislation on energy efficiency (esp. EU directives) • Strong technological / innovation focus • Need for increased streamlining and coordination amongst (public) actors and procedures • Numerous private/corporate initiatives • Call for better advertisement of achievements (building projects) • Overall top-down policy led approach
Freiburg 12 Feb. 2014	10 (+7)	Architects, engineering and design firms, public developers, research institutes, municipality, energy provider	6	<ul style="list-style-type: none"> • Key role of environmental sensitive and engaged population • Good connections and exchange platforms between a wide range of actors (public, NGOs, research centres) • Early (90s) energy efficiency legislation and consequent application in two public development (Vauban & Rieselfeld) as key motors • Call for thematic renewal and enlargement of green building understanding, and especially a more visionary approach from the policy side

Source: based on Preller et al. (2017)

A second interactive research step has involved the dissemination of a report summarising the main outcomes of the workshop, accompanied by a questionnaire asking participants to critically re-assess and validate the transition factors that had emerged during the discussions.

The input from the Café, later confirmed through the questionnaires, were used to identify a number of key aspects for in-depth qualitative case studies in each of the four city regions. These are the previously detailed micro case studies covering selected green building policies and programmes, influential organisations and actors, as well as specific built environment projects (see Table 3.2). In addition, the World Cafés further provided a list of relevant interview partners, necessary background knowledge, and general contact to central figures in the research field, which was helpful to get access to further interview participants.

Towards the end of the research project in 2016, outcomes and results were presented in a closing workshop in Luxembourg and Freiburg. All the research participant solicited during the course of the project were invited to participate, in order to critically assess, review, and validate findings, but also to ensuring dissemination and transmission of the results to allow for their further utilisation within the community. Here a more traditional group meeting setting was chosen, starting with a reporting presentation by the research team followed by a discussion round.

Box 3-1 What is expert knowledge?

Prior to detail the different research methods used and how they have been concretely implemented, I want to clarify what I mean with local experts and expert knowledge, as two of the applied research methods engage with local actors in their role of experts on sustainable building. The key question is here: Who is an expert, as the answer obviously influence the selection of relevant research participants but is also foremost dependant on the researched subject. As articulated by Meuser and Nagel (2009), the researcher assumes that a particular person possesses knowledge not everyone has access to in the field of interest to her research. This assumption pertains to a sociology of knowledge perspective that distinguishes between layperson and expert, and sees the expert as possessing a knowledge advantage over the other, including the researcher. That position of advantage is usually expressed in the expert's influential and acting capacity within the field of relevance, and thus ultimately relates to his or her involvement in the field, generally through a professional function. As such, it is the function of the person that is here of interest, much more than the individual (Meuser and Nagel 2009 :467-469).

3.4.2 *Semi-directive expert interviews*

Arguing in favour of qualitative interviews in the context of research on the built environment, Moore (2015 :409) points to the method's enabling of "a fine-grained investigation of the real and perceived relations which exist between context, process and the production of the built form". The interview, so she further argues "generate context dependant and case-specific knowledge that can support improved explorative generalisation (where valuable) about a weakly understood development industry" (ibid :410). Non directive interviews give access to the situated and multiple experience, knowledge, and perspectives of participants, providing the researcher with particular cues on how the participant articulates its understanding of the inquired issue (Mason 1996). As such, interviewing sits well with the ontological and epistemological premises of my research that seeks to engage with sustainable building as a socially constructed object, paying particular attention to the particularity and complexities of socio-political contexts.

Following the kick-off workshops, I have topically targeted interview partners to cover the selected micro-case studies (see Table 3.2). Here again, actors are considered in their role of local experts on the matter of relevance (see Box 3.1) and have been selected because they have either initiated or are involved in the implementation of the relevant initiatives.

In Luxembourg, 19 interviews were conducted with 16 interview partners (some were interviewed twice and one interview was done with two persons at a time) between August 2014 and December 2015. Interviewees covered the public, private and non-governmental sector, as visible in more details in Appendix 9.1. They were conducted both in French and German.

In Freiburg, 23 interviews were conducted in German between September 2014 and March 2015 with 24 interviewees, as one interview was done with two participants. The investigations proceeded jointly with another member of the GreenRegio research team. Similarly to the interview partners in Luxembourg, participants belonged to the public, private and non-governmental sector (see Appendix 9.2).

I have proceeded through semi-directive interview questions based on an interview guide jointly elaborated by the GreenRegio project team (see Appendix 9.3). The questions are mainly theory-led and organised around two blocks: one dealing with the interviewees' general understanding of the sustainable building context and another block more specifically targeting the relevant micro case studies. This last block aims at gaining a more procedural knowledge on how the specific case studies are organised and unfold (Meuser and Nagel 2009). The interview guide has been used as a guide that is to say as an open and flexible 'aide-mémoire' and not a rigid framework. I have rather conceived it as a backup checklist on the topics that needed to be covered, but individually prepared and adapted

it to the respective interview, notably with regards to the questions for the micro case studies. As pointed out by Meuser and Nagel (2009), this step is key in expert interviews. It allows to demonstrate familiarity with the topic and thus avoid unequal relationships between the interviewee and the interviewer that could negatively impact the interview dynamic.

Upon prior informed agreement of the participants and following an outline of the research project and its objectives, the interviews have been recorded. Not all participants have agreed to it: out of 19 interviews with 16 interviewees in Luxembourg, one refused to be recorded while another one first refused but changed his/her mind during the course of the interview. In Freiburg, two out of 23 interviews were not recorded. One because the interviewee refused, another one because the interview setting as a field visit did not allow it. For the non-recorded interviews, I have compiled written protocols.

3.4.3 *Qualitative content analysis*

To produce actual research data from the collected interview interactions (Mason 1996), I have first transcribed verbatim and anonymised the recorded interviews. I have then analysed the textual data from these written transcripts by assigning them to codes with the help of the qualitative content analysis software MAXQDA. Hennink et al. (2011 :205) define qualitative content analysis as a “discovery process that [...] remains close to the data and [thus provides] and evidence-based understanding of the research issue”. When it comes to the details of coding strategies though, as shown by Schreier (2014b), a variety of procedures exist. She though presents “the content-structuring approach” as the core approach. As the name hints, it aims at identifying a selection of content related aspects to then systematically analyse and conceptualise the whole material under these key themes. The process eventually brings out a thematically summarised description of the material (ibid).

In that sense, my use of the coded data derived from the interviews has to be understood as literal. That is to say, I was interested in its literal substance, rather than seeking to interpret what participants mean by saying things in a particular way, following a distinction made by Mason (1999 :54). I feel this is more truthful to the informed consent I have negotiated with my interview partners. I have therefore restricted the interpretive and more critical analysis of what is being said to my discourse analytical text corpus (see Section 3.4.4 hereafter) as it is composed of text extracts that have been purposely produced with a public use in mind.

Schreier (2014a :170-171) outlines three key objectives of the qualitative content analysis that help to flesh out how it is done in practice. A key feature of the analysis is first to reduce the amount of material as it is a process through which the researcher thematically focuses on the aspects relating to her research question. This makes the data manageable as much in terms of size than in terms of content.

The grouping of interview passages in shared categories allows indeed a higher level of abstraction than when engaging with each interview individually. Schreier pursues that a qualitative content analysis needs to be systemic in its examination of the material so as to avoid pre-imposing the researcher's subjective assumptions. Lastly, she underlines the method's flexibility that allows the devised coding categories to be as much data-driven as theory led, following a distinction other authors make around inductive and deductive coding (see for instance Hennink et al. 2011).

Accordingly, the coding frame for my analysis of Luxembourg and Freiburg relies on categories developed jointly by the GreenRegio research project team on the base of the interview guide, but also with a sensibility towards including inductive categories where the data on the individual cases requested it. The final coding tree for the Luxembourg and Freiburg case studies is thus similar (see coding tree in Appendix 9.4). This also had the advantage to facilitate a later generalisation of the research findings by allowing to set both case studies in relation to each other, even though my interest lies more on the particularity of each case, following the theoretical and epistemological orientation of the work.

3.4.4 *Discourse analysis*

Corpus selection and delimitation

The bulk of the discursive analysis has relied on government documents. It built upon the insights gained from the workshops, the interviews and their content analysis that have outlined the central role public authorities play for the sustainable building agenda in both my case studies. My corpus has included regulatory documents: Parliamentary records in Luxembourg and City council resolutions in Freiburg, policy studies, as well as promotional brochures or websites for the building projects. I have targeted these documents because of their openly communicative scope. As I sought to retrace how sustainable building is argued for and justified, it made sense to look at documents that deliberately either target an audience of other policy actors (e.g. elected representatives) to convince them to support a particular policy measure, or documents that target members of the general public to present the benefits of a policy or project.

I have collected documents on the websites of the relevant public authorities or owners of the projects/ initiatives through keywords researches covering the selected micro-case studies. In order to keep the size of the text corpus manageable, as advised by Waitt (2010) and Berg (2009), I have limited the number of policy documents per micro-case study to one, being careful to select a document outlining the rationales for the initiative. Where initiatives stretched over longer time frames, as for instance the development of the Vauban neighbourhood in Freiburg for which discussions started in 1992 while the project was officially closed by the city in 2009, I have included both an early text (the

council's 1993 resolution on the development regulation for the area) and a later text (the official closing resolution of the development project by city council in 2009) to account for potential evolutions and variations over time.

The review of policy documents has been complemented by local newspaper articles in order to capture a wider breadth of the discourse across different perspectives and time. Here again, the corpus has been assembled through keyword researches based on the micro-case studies. In Freiburg, articles originate from the main local newspaper the "Badische Zeitung" accessed via the wiso-net online database for higher education institutions. The newspaper's archive is unfortunately only digitalised back to 2003 and hence does not allow to go back to articles contemporaneous of the some of the initiatives and building projects selected, as these originated in the 1990s (notably the Vauban and Rieselfeld neighbourhoods as well as the Freiburg low energy building standards). Nevertheless, all of them have been pursued, amended or modified into the 2010s, allowing me to capture the newspaper articles contemporary to these evolutions. In Luxembourg, media documents originate from the main national newspapers as I have accessed them via the archives of the daily press reviews produced by the State's press service. This service daily compiles thematic files of national newspaper articles intended for the state's ministries. In that case, I did not encounter any time constraint to compile the corpus, which I set between 2006 and 2015, to include discussions in preparation of the first major piece of legislation dealing with sustainability in the built environment in Luxembourg that was passed in early 2007. An exception has been done for the articles addressing the LENOZ public certification scheme for housing, as this project has gained momentum at the end of 2016.

Analysis

The scope of the analysis has been here to reconstitute broad mappings of the central policy discourses on sustainable building in Luxembourg and Freiburg, to then interpret them in terms of dominant storylines impacting social and material changes in sustainable building.

In a first step, Dryzek's analytical framework (see Section 2.2.3) has been applied to Luxembourg and Freiburg based on the selected policy micro case studies (Table 3.2). While the interviews have not been formally included in the text corpus, their qualitative coding already provided for a solid preliminary understanding of the local context of sustainable building as well as clear indications about the key actors involved, their motives, and their understandings of the topic. I first scanned and coded the corpus following three of Dryzek's (2012) categories: "basic entities recognised", "assumptions about nature relationships", and "actors and motives". The resulting text segments have then been content analysed and thematically sub-coded, with a particular attention towards how legitimacy for sustainable building is built and which arguments are brought forward. Insights regarding the fourth

analytical category “rhetorical devices” were also gained during that step. Further care has been taken to uncover inconsistencies, absences, and argumentative shifts.

The results are presented in tabular forms following Dryzek’s framework (see tables 5.1, 5.2, 5.3 and 5.4 in chapter 5). To describe the “basic entities recognised” and the “assumptions about nature relationships” of sustainable building discourses in Luxembourg and Freiburg, I conveniently use some of the labels Dryzek has developed his own analysis (Dryzek 2012), as his discourse categorisations can be regarded as ideal types approaches of solving environmental challenges. Obviously, such succinct tabular representations only selectively reflect the richness of the arguments, interests, and assumptions at stake. But it has the advantage to concisely expose the ‘raison d’être’ for sustainable building policies in each case study region, and in how far their innovativeness actually reproduces the influences of particular local agency constellations, as well as more background contextual logics like for instance economic or social challenges and priorities.

Hajer’s framework (1995) is relevant for the interpretation of the mapped discourses and the evaluation of their transformative stance. The concept of “story-lines” is here particularly helpful. It highlights on which symbolic references and conciliating “discursive affinities” discourses are built to ensure their persistence as relevant frames of reference in the policy-making process. In this, I conceive discourses as argumentative tropes articulated around context-specific worldviews and institutional references that are used by actor-coalitions on sustainable building to coordinate and further influence the policy process. By unravelling these processes, I am in the position to make a statement on the transformative stance of sustainable building in Luxembourg and Freiburg.

For this more interpretive step, Waitt’s (2010) and Berg’s (2009) general guiding principles on what to pay attention to when doing discourse analysis (see Section 3.3) have been particularly helpful.

3.5 Limitations and further considerations

In the previous review and discussion, I have been careful to disclose the appropriation of the research approaches and methods with respect to the research’s aims and theoretical framings, as well as the procedural details on how I have concretely executed the research. Flick (2009) sees awareness and disclosure of both aspects as central to ensure quality in qualitative research.

Nevertheless, my methodological choices still necessitate some reflection on their potential limitations and shortages, in order to confirm the validity and reliability of the work. While theoretical debates on the relevant criteria and terms for assessing the quality of qualitative research abound (Flick 2009; Elo et al. 2014), I feel that potential limitations are best encapsulated in the following question: in how far are my results truly representative of what happens around sustainable building in both case studies?

The answer to that question pertains to the concept of trustworthiness for both the raw data and my interpretation of it (Elo et al. 2014). This then amounts to break down my initial question into two more refined ones: First regarding the representativeness of the information sources I used. And second, considering that the analysis relies on interpretive approach, in how far is the interpretation and reporting of the results not the reflection of a subjective bias?

Representativeness of data sources

As I progressed through the description of the different research methods used, I have disclosed in detail the selection criteria, accessibility constraints as well as coping strategies I have applied. Both for recruiting participants to the interactive workshops and interviews, and for compiling the text corpus for the discourse analysis. To avoid redundancy, I intend this section as a more high-level reflection on methodological blind spots that require me to engage with my research's epistemology and design, rather than a description of practical coping strategies.

As already explicated, my recruitment of participants to the workshops and interviews has been purposive, following their perceived expertise and knowledge of sustainable building and the selected micro case studies in Luxembourg and Freiburg. In general that expertise pertains to their professional engagement with the subject, although the commonly shared GreenRegio project frame has put emphasis on including actors with different expertise and constituencies, including academic and practitioners from economic, environmental and social backgrounds. A review of the categorisation of the interviewed actors (see Appendix 9.1 and 9.2), as well as of the selected micro case studies (see Table 3.2) both show a dominance towards public policy, and to a smaller extend private sector actors and initiatives, both in Freiburg and Luxembourg. Thus leaving de facto the non-governmental sector on the fringe of my research in both case studies. This definitively raises questions regarding the representativeness of generated outcomes, despite the participative and constructivist premises aspects of the research design (see notably Sections 3.2 and 3.4.3). To go even further, and following Castree (2004 :362), it raises the question of a research "working within the parameters of existing norms, power relations and value, [rather] than [critically] exposing deeper processes and wider consequences".

A combination of several factors helps to explain that situation. First, my initial focus on the policy dimension of sustainable building which has been reinforced as the research unfolded, as sustainable building proved to be de facto strongly steered by public actors in both cases (see details in Chapter 4). While Freiburg, according to secondary literature, is characterised by a strong activist engagement on urban sustainability questions (Wolfgang 2011; Bichard 2014), the non-governmental sector here simply proved difficult to recruit for the research. This might relate to an over-solicitation of these actors in that particular case, re-joining traditional issues regarding the practice of participation in

policy-making. In addition, the high commitment of participants and their availability over the project's lifespan and beyond as required in collaborative methods (North 2013) has certainly further exacerbated the issue.

Several aspects of the research design though help to bypass that representativeness issue. First, the collaborative dimension still provides for openness and diversity: even though the participants were mainly recruited according to their professional engagement with the subject of sustainable building, the results of the workshops illustrate that participants indiscriminately pointed towards initiatives they deemed relevant outside their respective organisations, including the non-governmental sector. Second, my inquiry in each case study is articulated around two methodological entry points and two data sources: texts and interviews. According to Flick (2009 :417), this provides for an improved quality and reliability due to data triangulation. Arguably part of my text corpus is again based on policy documents but it has been complemented by newspaper articles which provide for a larger breadth of perspectives.

A second issue I already touched upon in the description of how the data was collected relates to time-bounded limitations in terms of accessibility and actual availability of data. In Freiburg, the accounts of the research participants point towards the very long time span of the sustainable building phenomenon. Without going back to energy protest movements in the early 1970s, the first concrete policy initiative addressing sustainability aspects in buildings still dates back to the early 1990s. Further, than the legitimate question regarding the manageable size of data covering such long time frames, I have encountered practical difficulties to access contemporary documentary data, notably for the text corpus, as the online sources I use do not go as far back. Similarly, the question regarding the reliance of interview accounts from participants that were not contemporaneous with the events needs to be raised too. It bears the indeed the possibility to encounter accounts that have been harmonised and smoothed a posteriori, to fit into a certain narrative.

And while Luxembourg's engagement with sustainable building is more recent, it is currently such a major policy topic that several important breakthroughs were announced at the end of 2016 and in 2017, after I had completed my data collection phase at the end of 2015. Similarly, Freiburg has announced the development of a new neighbourhood in the tradition of the Vauban and Rieselfeld projects in early 2017. Accordingly, my insights have to be seen as what they are: a snapshot in time that can make claims with regards to past events but cannot predict on future developments of sustainable building in Luxembourg and Freiburg.

Subjective bias

As I have posited my inquiry of sustainable building as a socially constructed phenomenon, the epistemological convictions that go along that perspective regarding the subjective construction of knowledge need to be extended to my own construction of academic knowledge on the subject (Flick 2009 :94). This mainly crystallises around the relationship between my empirical data and the analysis of that data (Elo et al. 2014).

Bardin (1977), relativises the negativity of subjectivity by stating that “as an effort in interpreting, content analysis balances between two poles, the rigor of objectivity and the fruitfulness of subjectivity”. In addition, my overall research design provides for safeguards on the base of triangulation. Following the inscription of my work within a larger research project with shared methods and concepts of inquiry, I can draw back on common decisions regarding the design of the interview guide and content analytical frame. The GreenRegio framework has also further allowed me to refine and validate my interpretation in interaction with other researchers. Last but not least, the reflexive and collaborative involvement with research participants, especially the feedback workshop hold in each case study further provided a validation of the findings.

4. SUSTAINABLE BUILDING IN LUXEMBOURG AND FREIBURG: PROCESSES AND CIRCUMSTANCES OF A POLICY CHOICE⁷

Following the dual dimension of the research framework and of the corresponding data collection procedures, I have split the presentation and interpretation of the findings in two different chapters. The first one, Chapter 4, relies more on the insights gained under the application of the co-evolutionary and institution focused Multi-Level Perspective on sustainability transitions. The objective is here to frame how sustainable building is understood in Luxembourg and Freiburg as well as to map which institutional context and circumstances impact that understanding.

Following the role of subjective interpretations and meaning-making in conditioning choices on sustainable building, I have epistemologically posited (see Section 2.2), the subsequent chapter (Chapter 5) deals in turn with the interpretive analysis of the dominant discourses on sustainable building in Luxembourg and Freiburg. The objective in that second finding chapter is then to better answer the whys of what is uncovered in Chapter 4.

This chapter accordingly presents two longitudinal narratives of the processes and circumstances at work in the transition towards sustainable building in Luxembourg (Section 4.1) and Freiburg (Section 4.2). Throughout the narrative, I am careful to present the actors steering these processes as well as relevant contextual and other institutional factors. The insights presented here were mainly gained through the participative workshops, the qualitative expert interviews, and their subsequent content analysis. As such the time frame and event sequences are the literal substance provided by the interviewees, thematically summarised following the content analyse of the interviews (see Section 3.4.3).

Luxembourg is known internationally for its economic wealth linked to the finance industry. But the country has recently shown significant efforts to transform its building sector. Sustainable building is on the agenda in Luxembourg since the late 1990s and is strongly driven by progressive government regulations and policies that illustrate different understandings and approaches of the topic. Roughly, two policy approaches can be distinguished: (1) green growth and (2) social housing and urban

⁷ The following chapter has been published in a different form in: Preller B (2018) Luxembourg: A Policy-Led Approach Caught Between Green Growth and Affordable Housing. In Affolderbach J and Schulz C Green Building Transitions - Regional Trajectories of Innovation in Europe, Canada and Australia. Springer, Cham, 159-88, and in Fastenrath S and Preller B (2018) Freiburg: The Emblematic Green City. In Affolderbach J and Schulz C Green Building Transitions - Regional Trajectories of Innovation in Europe, Canada and Australia. Springer, Cham, 69-97.

sustainability.

Following a general review of Luxembourg's socio-economic context in relation to sustainable building, the following sub-chapter (4.1) then mainly progresses in explicating these two policy approaches, while also reflecting on them in connection to the (urban sustainability) literature. The first approach consists of a green growth perspective that assumes the compatibility of environmental and economic objectives. During the 2000s, sustainable building in Luxembourg was primarily understood through energy efficiency to be achieved at the scale of individual buildings. This focus has been broadened over time towards eco-technologies in a more general sense, in a strategic effort to further diversify and reinforce the position of Luxembourg's economy on the international scene. The second, less dominant approach moves beyond technological fixes and the scale of individual buildings towards more holistic dimensions of urban sustainability via affordable housing. Whilst government initiatives and (partly) the private sector's efforts have gained considerable momentum, public participation and civic engagement in sustainable building are rather marginal.

In comparison, Freiburg has long been acclaimed as a model city for the implementation of urban sustainability policies (e.g. Bichard 2014; Hall 2014). Amongst these policies, a range of interventions have specifically targeted the built, primarily residential, environment. Stringent and at the time innovative energy efficiency standards for new building were notably set up in the early 1990s. The standards have been subsequently applied in the two neighbourhood developments of Rieselfeld and Vauban. As a result, the conceptualisation of sustainable building has been enlarged to an urban planning perspective. More recent policy initiatives target the retrofitting of the building stock, hence providing again an energy efficiency focus. Freiburg thus offers a research context in which sustainable building transitions are already well initiated, potentially offering more possibilities to engage reflexively with what has already been achieved.

Symptomatic to the Freiburg case is the inscription of sustainability achievements in a logical historic progression, rooted in strong civic and activist concerns about energy provision and nature protection. This narrative exists as much amongst the research participants as in existing contributions from the academic and secondary literature. But in an effort that could somehow seem at odds with that framing, Freiburg's City council has since the 2000s seized the opportunity provided by the international attention it has received to develop a markedly entrepreneurial and outward facing marketing approach that is well summarised by its slogan: "Green City Freiburg". Freiburg's environmental policies, of which sustainable building is one dimension, are here put into a markedly economic perspective: generating jobs and contributing to the city's international competitive positioning.

The Freiburg sub-section (4.2) addresses these policy developments in detail, illuminating them with the help of concepts of the literature. Here too, the narrative will be mainly historical in its progression,

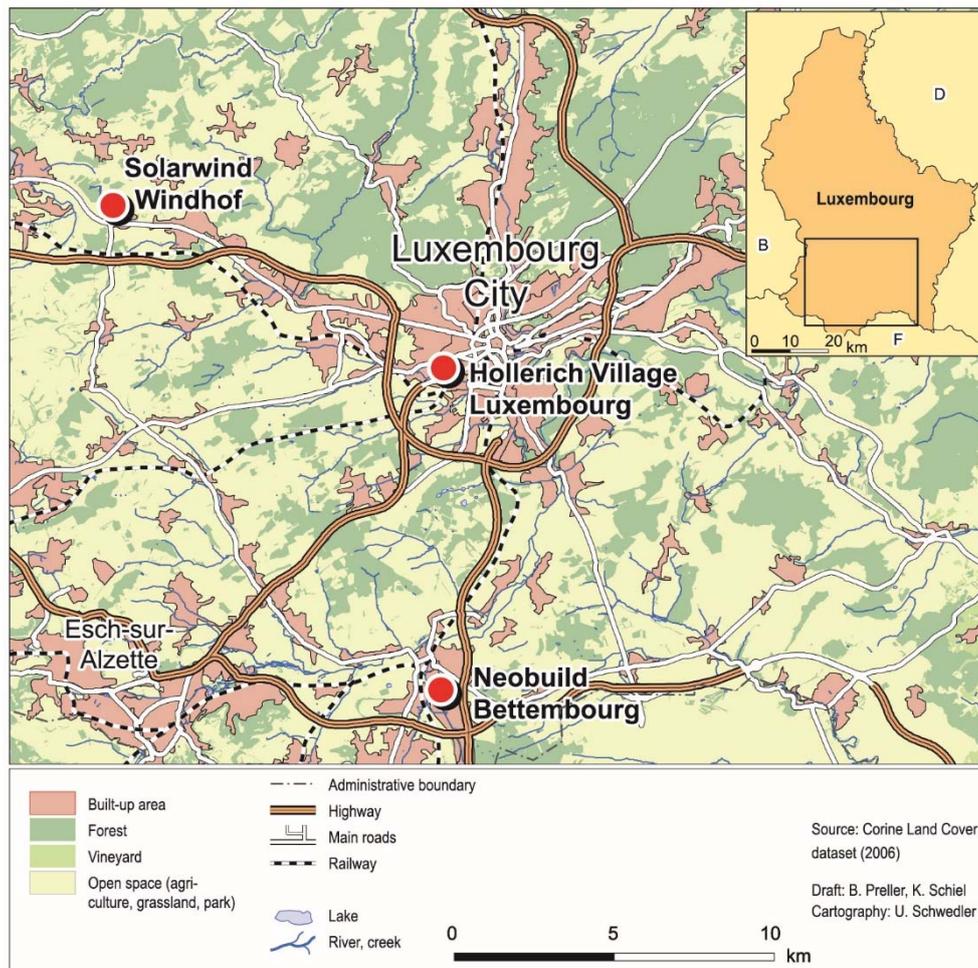
while being careful to outline interactions between actors and relevant contextual factors shaping sustainable building.

4.1 Luxembourg: A policy-led approach caught between green growth and affordable housing

4.1.1 *Sustainable buildings in an economically dynamic small state: opportunities and pressures*

The Grand Duchy of Luxembourg (in the following referred to as ‘Luxembourg’, Figure 4.1), a small state of 2,586 km², is primarily known for its exceptional prosperity and economic dynamism, mainly induced by the state-led rise of its capital city (Luxembourg City) as a specialised financial centre of European and international importance in the 1980s (Walther et al. 2011; Hesse 2016; OECD 2015). Since the early 2000s though, the government has articulated a growth strategy to address its monolithic economy. One key development target of that strategy are eco-technologies, with a particular focus on green building (EcoInnovation Cluster 2016). In the wake of the financial and related service sector boom, the country has faced unprecedented growth in population and economic functions, leading to almost a doubling of the built-up area between 1990 and 2010 (Chilla and Schulz 2015: 514-15; STATEC 2017). These intense construction activities of office and residential buildings have positioned the building sector just behind the financial sector in terms of employment, making it a key contributor to the country’s economy (STATEC 2016b). Luxembourg has further one of the highest GDP per capita amongst OECD countries (OECD 2015) and its small state political structures are characterised by short decision paths and a reduced number of government levels (Lorig and Hirsch 2008; Chilla and Schulz 2012). Together these particularities provide a positive financial and political context to realize the country’s ambitions in positioning green building and eco-technologies as a key economic sector both locally and internationally.

Figure 4-1 Luxembourg City and the studied building projects



Source: Preller (2018)

Luxembourg’s exceptional growth also poses challenges in terms of liveability most notably with regards to shortages and affordability in housing as the real-estate market has been unable to keep up with the steady demand by the economic and residential sectors. The country’s population has almost doubled since 1980 to reach 576,000 in 2016 of which 47% are foreigners (STATEC 2016b). Inhabitants are projected to reach 1 million in 2050 (Menelaos 2015). The situation is further exacerbated by a tendency to prioritise office space over housing and speculative tendencies partly attributed to a high share of private land ownership. The combination of these factors has led to an explosion of housing prices and rents (Hesse 2016; Hesse and Christmann 2016), reminiscent of issues more broadly documented in the critical literature on affordability in “eco” or green cities (e.g. Dale and Newman 2009; Caprotti and Bailey 2014). Luxembourg’s residential patterns further challenge sustainable urbanism and living practices: at country level the privately owned single-family home dominates amongst the dwelling types making up 83.5% of the housing in 2011, even though the construction of apartments has been steadily on the rise since 1990 (Heinz et al. 2013a) especially in the larger urban

area of the capital. Average housing surface approximates to 130m² with an average of 64.4 m² per person and is amongst the highest in the European Union (Heinz et al. 2013b). Similarly, car ownership rates of 661 for 1,000 inhabitants (2015) are amongst the highest within the European Union. Even though the rate can be partly attributed to large company car fleets for cross-border commuters (Eurostat 2017), residents strongly privilege the automobile, even for short trip distances under one kilometer within the agglomeration of Luxembourg City and despite good public transportation in place (Schulz and Chilla 2011 :19).

As already mentioned, and in contrast to the Freiburg case study the analysis in Luxembourg has focused on the national level as (urban) scale of analysis. Luxembourg's sheer size and its small-state political institutions both provide arguments in favour of an analysis at the national level. The nation-state is indeed the main decision-making level and as such a central player when it comes to sustainable building regulation and policies. This is obvious when sustainable building is part of a national economic diversification strategy, but also when the urban planning dimension of the topic comes to play. The aforementioned development pressures have indeed resulted in efforts towards more coherent and coordinated spatial and sectoral planning at the national level, despite a historical tradition of municipal autonomy (Chilla and Schulz 2011; Chilla and Schulz 2012; Affolderbach and Carr 2016; Hesse 2016; Chilla and Schulz 2012). The overarching goal-setting and regulatory powers with regard to spatial development are thus orchestrated by the central government and decisively set under the lead normative concept of sustainability (Carr 2011 :5; Carr 2014 :1827). Municipalities remain in charge of land use plans within their boundaries and are further involved through different consultation mechanisms (Eser and Scholtes 2008 :295-297). The particular case of Luxembourg City does not contradict this picture despite the city's economic dominance and its undisputed status as major urban centre of the country counting approximately one-fifth of the inhabitants (STATEC 2016b). As has been shown by Hesse (2014), it is admittedly a micro-metropolis providing specialised services to the international service industry. But this development is to be credited and still mainly orchestrated by the national level. As such, Luxembourg is essentially a city-state formation. Consequently, most of the economic and non-governmental actors involved in sustainable building in Luxembourg are also mainly organised and active at the national scale.

The following two sections explore how Luxembourg's specific conditions, including the combination of political voluntarism towards green growth and a particular socio-economic context, have shaped the country's approach to sustainable building. Within this context, sustainable building in Luxembourg can be described as shaped by two co-existing and not necessarily reconcilable agendas. These are consistent with Moore and Rydin's (2008) observation of policy networks promoting sustainable

construction in the UK and at the European level: (1) a “construction technology agenda”, supported by the industry and articulated around technical innovation and economics, and (2) “[an] urban sustainability planning agenda” which is “much more general, process-oriented and aspirational in tone” (: 240). To better understand the constitution of these two agendas the chapter takes a primarily historical perspective. Throughout the narrative, arguments put forward will be illustrated with three case studies of relevant building projects (see Figure 4.1 for their geographical location and table 4.1 for the projects’ main characteristics). While sustainable building projects are prevalent across the whole country, the most emblematic ones addressed in this chapter still belong to the larger catchment area of Luxembourg City, mostly due to the exceptional dynamism of the capital’s real estate market.

Table 4-1 Analysed sustainable building projects in Luxembourg

	Building	Main Characteristics	Owners/investors	Sustainability characteristics
Luxembourg	<p>Solarwind, Windhof</p> <p>Finalised and in use since November 2012</p>	<ul style="list-style-type: none"> - Commercial office building (10 000 m²) - Greenfield development - Demonstration and commercial objectives: investors' skills in green building (headquarter location) - Learn to handle green building requirements and technologies, notably international certification schemes 	<p>Consortium of three firms from the building sector:</p> <ul style="list-style-type: none"> - Pro Group (engineering and consulting) - Groupe Schuler (land and real estate developer) - In Der Laey S.A. (land and real estate developer) 	<ul style="list-style-type: none"> - CO₂ neutral: on site energy production (wind, photovoltaic, geothermal, biomass, etc.) complemented by green electricity sourcing - High insulation standards (wood façade) - Green roof and wall - Circular economy approach: e.g. up-cycled fittings and furniture - Monitoring and visualisation of energy consumption - Triple certification: HQE, BREEAM, and DGNB
	<p>Hollerich Village, Luxembourg City</p> <p>Advanced planning stage, On hold since early 2016</p>	<ul style="list-style-type: none"> - Mixed-use neighbourhood (4 ha) - Brownfield development - Strong involvement of local ENGOs and international sustainability networks - Strong communication and demonstration objectives 	<ul style="list-style-type: none"> - Groupe Schuler (land and real estate developer) - Conceptual input from Polaris Architects 	<ul style="list-style-type: none"> - Increased density - 'One Planet Living Community' sustainability principles based on carbon footprint reduction through for e.g.: - Reduced energy, resources, and material consumption, - local material sourcing, - sustainable mobility concepts, - biodiversity and on-site/local food production, - Health and community aspects.
	<p>Neobuild Innovation Centre, Bettembourg</p> <p>Finalised and in use since October 2014</p>	<ul style="list-style-type: none"> - Commercial living laboratory (2 200 m²) - Greenfield development - Public innovation funding - R&D and local skill demonstration: Focus on new technologies and construction material sustaining the sector's competitiveness 	<ul style="list-style-type: none"> - CDEC (business association of the building sector) and its subsidiaries: - Neobuild LTD (private innovation hub for sustainable construction) - IFSB (training centre for the building sector) 	<ul style="list-style-type: none"> - Passive standards reached through on-site energy production (geothermal, photovoltaics, high insulation standards, etc.) - Rainwater retention - Green façade and roof garden - Modularity of rooms: allowing for deconstruction/change, also for training purpose - Involvement of local SMEs

Source: Schulz and Preller (2016)

4.1.2 *Energy performance requirements: a trigger for sustainable building approaches.*

“At some point, it became clear for the Luxemburgish government that the only thing they could politically do in order to reach the specifications from Brussels is energy efficiency. [...] In Luxembourg [energy efficiency] seems to be a “low hanging fruit” [in English in original] [...]. Can you believe that?! That this aspect is the easiest for Luxembourg?” (Consultant, Lux05).

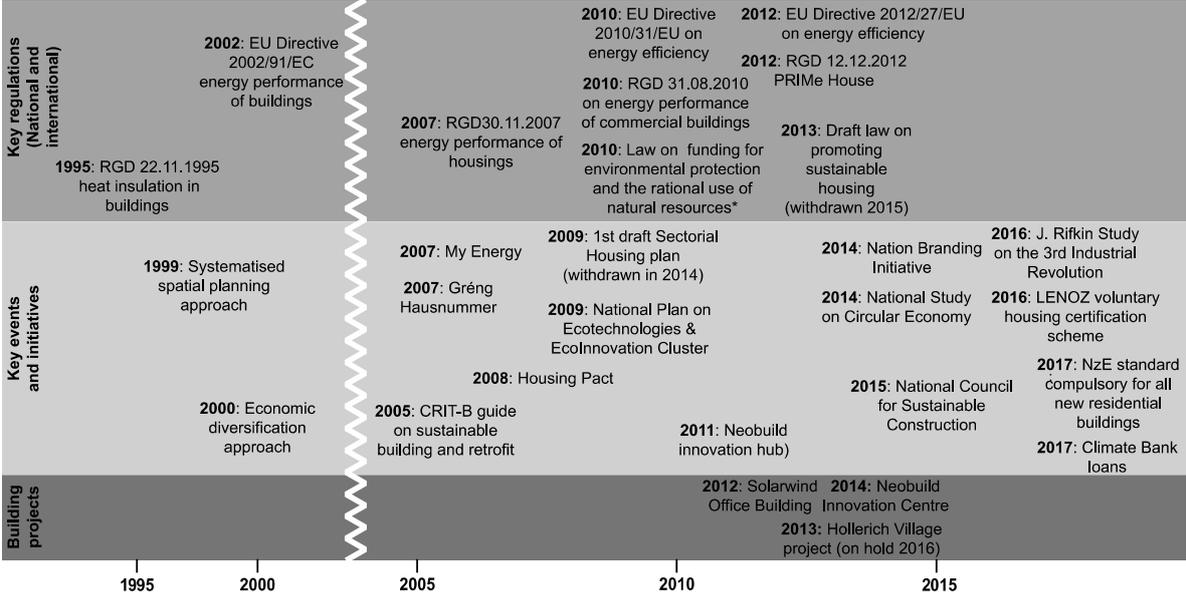
Luxembourg has been involved in and ratified most of the international treaties and events on climate change. As such the country is committed to keep the corresponding commitments towards reductions of greenhouse gas emissions (Carr 2011 :9). Similarly, European strategies like the Lisbon Agenda and its successor Europe 2020 have also contributed to shape Luxembourg’s approach to sustainability through notions of sustainable growth and resource efficiency and security. Sustainable building needs to be understood in this context. Figure 4.2 provides a timeline of the major relevant European and national regulations as well as national events and initiatives. The building together with the transport sector has been identified as one of the areas with the highest potential to reach the country’s energy efficiency objectives and thus climate change engagements⁸. The third National Energy Efficiency Action Plan foresees half of the projected energy savings until 2020 to be gained in buildings (Ministère de l'Economie 2014a :8), an objective that takes into account Luxembourg’s strong construction activity. Metric targets for CO₂ reductions, energy efficiency and related policy actions for new and retrofitted buildings are further articulated in several key policy programs (Figure 4.2), ranging from the first National Climate Action Plan (Ministère de l'Environnement 2006) and its follower (Ministère du Développement Durable et des Infrastructures 2013), the Action Plan for Renewables (Ministère de l'Economie et du Commerce extérieur 2010) to the National Plan for Intelligent, Sustainable and Inclusive Growth - Luxembourg 2020 (Luxembourg 2017). Even the coalition agreement of the 2013 newly elected government addresses the topic in several sub-chapters, underlying its political prominence (2013a).

Sustainability in the built environment is accordingly mainly articulated through energy questions, a focus frequently seen as too narrow by interview respondents. The focus is unsurprising, as the topic has been brought to salience in the wake of the transposition of the European Energy Performance of Buildings directives in the mid-2000s. This reference to European legislation consistently emerged as part of a chronological narrative from most interviews. Luxembourg has passed a first heat insulation

⁸ When considering final energy consumption shares across sectors, the bulk goes to the transport sector, followed by industry, households and the service sector (STATEC 2016a). Buildings are thus considered as a key area for action due to their cross sectoral relevance.

regulation in 1995 (Gouvernement du Grand-Duché de Luxembourg 1995) in order to limit energy losses through building envelopes. Further legislative steps to address the energy performance of housing and commercial buildings more comprehensively were only achieved in 2007 (Gouvernement du Grand-Duché de Luxembourg 2007) and 2010 (Gouvernement du Grand-Duché de Luxembourg 2010b) respectively. Both pieces of regulation derive from the European directive 2002/91/EC (Parliament and Council of the European Union 2002) and have later been revised in response to the follow-up directives 2010/31/EU (European Parliament 2010) as well as 2012/27/EU (European Parliament 2012) on energy efficiency and retrofit. Through the relatively late implementation of the 2002 European directive, the Luxembourgish Ministry of Economy, which is in charge of energy questions, has had the time and opportunity to learn from other European countries. This has spurred the country’s ambition to do well (Government representative, Lux06). While the European directive 2010/31/EU requires a nearly zero-energy (nZE) standard for all new residential buildings from 2020 onward, Luxembourg has made that target bounding since 2017. In line with the European directives, the Luxembourgish regulation mainly addresses technical dimensions of energy consumption in new and retrofitted buildings, including quantified energy requirement targets, the set-up of compulsory energy performance certificates and the corresponding detailed calculation methods.

Figure 4-2 Key milestones and event for sustainable building in Luxembourg



RGD = Règlement Grand Ducal
* financing sustainable innovation (eco-technologies)

Source: Preller (2018)

The explanatory statements in the parliamentary records for both bylaws provide a clear example of this energy-related understanding of sustainable building. Stated rationales range from addressing

energy dependency and security which have a negative impact for the economy, international climate change commitments of the Kyoto protocol and positive impacts of energy efficient building technologies for employment (Chambre des députés 2006; Chambre des députés 2009). The focus on employment is particularly salient, illustrating both the key economic role attributed to the construction industry and a trust in interventions on the production side for a smooth and effective implementation of the regulative obligations. This has been clearly stated by one interviewee when discussing rationales for training initiatives:

“Of course we know that if we inform and target only the final consumer, we won’t have reached much. Because [...] in the ideal case, we would have managed to raise awareness amongst a large number of final consumers [but] if the market can’t answer the demand that we would like to create or that we would like to help support, this is strongly counter-productive. That’s why we have discovered for ourselves other important target groups: [...] of course all those involved in planning and building processes, that is to say architects, craftsmen, engineers, energy advisers and then for the implementation all the craftsmen’s firms.” (Public employee, Lux13)

The coalition program of the 2013 newly elected government composed of social democrats, greens and liberals set the tone even more clearly:

“The housing sector represents a considerable source for the reduction of energy consumption, as much through the construction of new buildings as through retrofits of the existing stock. The development of capabilities in that domain is a priority in order to transform the transition towards more energy efficient housing and commercial buildings for economic growth” (Programme Gouvernemental 2013: 61)

Indeed, a study jointly conducted by the national energy agency (Myenergy), the professional chambers and the building sector’s main business association anticipates that by 2020 more than 8,000 new jobs will be created as a result of the new energy standards (Myenergy Luxembourg et al. 2013 :6). A high level of turnover within the sector and the fact that most workers are immigrants or cross-border workers with very diverse training backgrounds (ibid) makes the provision of adequate training and capacity building even more essential for success. The large-scale LuxBuild 2020 initiative, a European co-funded consortium of the same three actors, seeks to prepare blue-collar workers for the 2017 deadline. It has structured existing training offers around a yearly evaluation of needs, including a monitoring of technological advances. Complementary technical but also transferable skills courses addressing the building professions at large are offered to ensure the passive standards are effectively delivered on construction sites (Myenergy 2017).

To increase the effect of compulsory regulations, user-oriented policy instruments have also been streamlined. Sustainable commercial building developments and retrofits can receive financial support under the 2010 law encouraging innovation through the use of eco-technologies and sustainable resource management (Gouvernement du Grand-Duché de Luxembourg 2010a). Similarly, previously existing public funding for new housing construction and retrofits (Prime House) has been revised significantly in 2012 and is now based on energy performance certificates. Accordingly, funding is only available in combination with energy efficiency measures and renewable energy measures (since 2012) and has become progressively more stringent and eventually ceased and replaced by other sustainability criteria for new constructions by the end of 2017. Further policy measures include the transformation of the national energy agency in 2007 that was split into two organisations. The new entity, Myenergy, has the main tasks of raising public awareness and providing advice on renewables and energy efficiency. Sustainable building and housing have been explicitly added to its responsibilities since 2013 and one of the organisation's biggest successes is a yearly fair providing households with hands-on access to resource-efficient building technologies and expertise.

Respondents generally agreed that this set of public interventions has proven quite successful in anticipating and preparing the construction sector and consumers for the 2017 deadline in achieving energy efficiency. One private sector representative (Lux07) argued that the energy efficiency box has been ticked as energy efficiency has become "the norm [...], of course there are still some exceptions but in general everyone can live with it [i.e. the energy performance certificate]". But this large-scale adoption was also linked to resistance, as several respondents recalled an initial reluctance amongst the industry, which consists mainly of small and medium-sized enterprises (SMEs). Compliance with the regulatory changes was indeed first perceived as burdensome, time constraining and costly that averted human resources from the daily business. Acceptance only grew once the technical feasibility and especially the economic advantages became tangible and visible, hence encouraging more actors to want their share of the cake:

"You have the pioneer who starts and builds a residence on the left side of Haut-Cents [neighbourhood in Luxembourg-City] with an A-class, while the one on the right side does it with a B-class. And the one doing it in the B-class suddenly realises that the one doing it in A cannot only sell at a higher price but that in addition, there are customers ready to pay that price. [...] So you have a realisation [...] amongst building companies that energy performance is something tangible [...] that can be grasped in monetary terms." (Private sector representative, Lux01)

“[...] I think people said: “it’s technically feasible!” That was, by the way, the goal of the exercise, doing a demo building. “It’s possible.” And in the aftermath, it led to a certain form of...de-dramatisation, if you wish.” (Sectoral representative, Lux07)

Even though compulsory changes seem to have been accepted and incorporated into the daily construction business, several interviewees have pointed towards a persisting reluctance to change across the business community. This became particularly clear in the shared feeling amongst sector representatives that the sector was already facing enough challenges responding to energy efficiency targets. Having to address sustainable construction and green building in a broader sense that considered, for example, alternative design, building materials, and new actor constellations was described as a further burden:

“I remember a meeting of the Sustainable Building Council where the representative of the professional chamber said very clearly: ‘Well that’s not on top of the list amongst craftsmen, the sustainable building topic. For them, it’s first to manage properly the topic of energy efficiency that is at the top.’” (Public employee, Lux13)

“And that’s what stroke me within the last years. That is to say how much the concept of sustainable building has become a limiting concept. [...] In sum, it’s the additional requirements that will apply to buildings from the moment passive buildings will be compulsory.” (Architect, Lux15)

In sum, sustainable buildings, here understood as energy efficient buildings, are not the objective per se but means to an end within a structured causal chain beginning with quantified carbon reduction targets. These objectives are presented as achievable following calculation of energy efficiency improvements, which in turn are to be attained through technological enhancements in buildings brought forward by compulsory bylaws and adequate training and expertise of blue collar workers. Following that line of argumentation, sustainable building appears to be realistically achievable as it is a predominantly technical challenge. This culminates in a “fabric-first” approach (Walker et al. 2015 :500) where the focus lies heavily on addressing single buildings and leads to very similar realisations (see Figure 4.3). This is particularly manifest in housing, through an almost standardised repetition of proven technological solutions and interventions on the built form, as clearly expressed in the following quote:

“There has really been a cross-sectional and vertical mobilisation within the whole production chain, but on an energetic objective, with a quantified energy performance objective that has been prepared by the energy performance certificate [...], that pushes for increasing

requirements in terms of energy performance, and hence a building system that repeats itself in each and every building. You know it by now: triple glazing, strong insulation, controlled mechanical ventilation, all the concepts related to passive building.” (Architect, Lux15).

Walker et al. (2015) present similar findings in their review of the mainstreaming of zero carbon homes in the UK using the concept of reproducing “normality” through technical solutions on the building fabric that avert from eventually more extensive changes in lifestyle. Likewise, Souami (2009) in an analysis of perceptions of relevant energy territories in sustainable neighbourhoods notes how representations of energy spaces in such projects put forward precise and simplified boundaries – in the case of Luxembourg, the individual building – rendering invisible the interdependencies of energy consumption questions. He attributes this to an “analytical bookkeeping logic per territorial units” which is necessary “to build legitimacy for the technical realisations aiming at energetic quality within each perimeter” (Souami 2009 :81), hence highlighting again the link between technical solutions and metrics at stake in energy efficiency approaches.

Figure 4-3 A typical A-class energy efficient building, Belvaux, Luxembourg



Photo: Bérénice Preller

4.1.3 *Green building as economic diversification strategy*

The legitimation for green building around carbon commitments and energy performance objectives fits with the general policy trends towards “carbon control” (While et al. 2010). In Luxembourg, that logic is pursued even further through the voluntary positioning of green building as a strategic area for economic activity. As illustrated in a programmatic statement from the 2013 governmental coalition agreement, carbon reduction logics in Luxembourg are further articulated with development opportunities for an eco-building sector, thus tying energy and climate change objectives to economic growth:

“The government aims towards a convergence between policies on energy and the environment on the one hand and economic diversification on the other hand. Eco-technologies encompass technologies aiming towards a reduction of the energy and resource consumption as well as the protection of the environment.

The government will put particular stress on the topic of eco-building, sustainable mobility, and circular economy. In order to support the development of the eco-building sector, competence centres [...] will reinforce research and innovation as well as bring the actors together. A concerted approach of actors from the sustainable construction sector will be ensured through the setting up of a National Council for Sustainable Construction [CNCD]. SMEs will be better supported through a facilitated access to innovation and research, the « branding » of the sector, the realisation of lighthouse projects and a facilitated entry of national actors on the Greater Region⁹ market.” (Programme Gouvernemental 2013)

This strategy provides a prime example of a techno-centric, ecological modernisation approach that is increasingly addressed within the green economy literature. Even though this agenda is still very diverse in its implementation, common elements are the belief of a compatibility between environment and economy, the key role ascribed to technological innovation and progress in general, as well as an active involvement of the private sector (Kenis and Lievens 2015 :4-5; Bina 2013). Critical contributions in the literature raise questions as to whether such expressions of the green economy or green growth agenda can actually be transformational or whether they simply reconstitute the dominant socio-economic paradigm under a new label (While et al. 2004; Bina 2013; Whitehead 2013, Caprotti and Bailey 2014; Kenis and Lievens 2015; Jones et al. 2016).

The question is particularly relevant to Luxembourg where sustainable building is subordinate to and

⁹ The Greater Region is a geographic region including the Saarland and Rhineland-Palatinate in Germany, the French Lorraine region (now part of the Grand-Est region), Luxembourg and Wallonia (together with the French Community and German-speaking communities of Belgium).

legitimised by a perpetuation of the overarching goal of continued socio-economic affluence. While there is a general consensus that the development of the country's financial industry has brought a high standard of living, the dependence of the economy on the sector is seen as critical in a context of global economic competition (Ministère de l'Economie et du Commerce extérieur 2012). To address this challenge, the government and more specifically the Ministry of Economy has since 2000 driven a strategy of economic diversification and sought to attract alternative investment. Amongst other measures, a national cluster strategy was set up in 2004 under the lead of the national innovation agency Luxinnovation with the objective to support development and innovation in strategic high value-added sectors. Since the publication of an action plan in 2009, ecotechnologies are one of the favoured priorities, in line with developments at the European level. The EcoInnovation Cluster, created the same year, mainly aims at connecting its public and private sector members as well as increasing their (international) visibility. While the cluster has recently shifted towards mobility, circular economy, and sustainable cities and smart technologies (EcoInnovation Cluster 2016), research into sustainable building has been identified as a transversal axis for the implementation of the cluster's priorities since 2012 (Ministère de l'Economie et du Commerce extérieur 2012) under the label of "eco-construction and materials". In line with this, Luxembourg's promotional website¹⁰ advertises Luxembourg's research and innovation competencies in environmental technologies, particularly emphasising the country's relevant research facilities. To provide a further reflexive exchange platform, the state together with the industry's main representatives launched in 2015 a National Council for Sustainable Construction (Conseil National de la Construction Durable, CNCD). The new structure is conceived as a think tank addressing challenges and development in the building sector. Current members are the main representative associations of the construction sector (including construction firms, architects, planners, developers, building material suppliers and specialised engineers) and government officials from the four concerned ministries (housing, environment, economy and energy, and public works). The press announcement following its creation explicitly mentions the objective to increase Luxembourg's international visibility and competitiveness in the field as part of an initiative of "Nation branding" (Ministère de l'Economie 2014b).

Initiatives that seek to increase the profile or externally "brand" a country internationally to attract visitors, workers and investment are well studied in the urban literature under the concepts of city marketing and urban entrepreneurialism and managerialism (While et al. 2004; Jonas et al. 2011; Béal and Pinson 2015; Andersson 2016). But similarly to Cidell's (2015) observations with regards to the performativity of green leadership in Vancouver and US local authorities, this "branding" of Luxembourg follows not only an extrovert but also an introvert, citizen-oriented, logic (see also

¹⁰ <http://www.luxembourg.public.lu/fr/investir/secteurs-cles/technologies-environnementales/index.html>;

McCann 2013 and Affolderbach and Schulz 2017 on Vancouver). In this second aspect, objectives are to support employment and development in the second most important economic sector of the country but also to increase or at least secure “quality of life” for residents in the context of growth pressures, and most notably the frenetic construction activity and increasing strains on infrastructure. This coalescing of local economic preoccupations with sustainability elements provides for a locally contingent “sustainability policy fix” (While et al. 2004) in green building, which despite its sectoral and technological component is still strongly characterised by state-led interventions. The Ministry of Economy in close collaboration with the sector’s lobby associations and professional chambers has deployed strong efforts to increase competencies as well as to streamline the multiplicity of players in the field around coherent objectives and actions. This „clean up commando“ (Public sector employee, Lux05) is strongly articulated around a technological fix approach and mainly materialises along three lines of action: (1) realisation of lighthouse projects, (2) implementation of building metrics and certificates and (3) capacity building and structured exchange with and within the industry through platforms like the EcoInnovation Cluster and the CNCD. This last aspect is reminiscent of the strategy deployed with regards to energy efficient building.

Leading developers have adopted this agenda and further infused it with their own visions and projects. The current president of the EcoInnovation Cluster, for instance, has markedly contributed to positioning the cluster on the topic of the circular economy, helped through his work experience and engagement with the real estate market. Another example can be found with the director of the Council for the Economic Development of Construction (Conseil pour le Développement Economique de la Construction – CDEC), who strongly supports the sustainable building agenda but has complemented it with a smart building/smart city approach. Since 2013, an annual conference with international speakers from service providers and model smart cities but also Luxemburgish actors promotes this vision. It is organised by Neobuild, a substructure of the CDEC that is co-financed through public innovation funding from the Ministry of Economy. Neobuild further functions as an innovation-hub for sustainable construction (see also Figure 4.5).

These different visions and priority setting are not only specific to the private sector, government initiatives similarly tap into different ‘Leitbilder’ which appears at odds with the streamlined objective outlined above. For example, the cluster was renamed from EcoDev (2009) to EcoInnovation (2013), while Luxembourg’s promotional website for inward advertises a thriving “CleanTech” sector. Strategic studies have led from an Action Plan on Eco-technologies (Polfer 2009) and a Study on Circular Economy in 2014 (Hansen et al. 2014) to most recently a strategic study for a Third Industrial Revolution (The TIR Consulting Group LLC 2016) emphasising digital components. This last study provides a general blueprint to transform the country’s economy to reach a “smart society” by 2050 and has been produced jointly by local representatives and team members of Jeremy Rifkin’s Third

Industrial Revolution consultancy. It includes a detailed scenario for buildings, which, given the involvement of local actors in its conception, makes an effort to consolidate several of the different promoted visions or 'Leitbilder'. The initial statement around the imperative for (energy) retrofit is further presented as the key opportunity to upgrade towards intelligent and smart buildings that achieve energy efficiency due to self-regulating and networked digital technologies that respond to feedback mechanisms within the system. A total circularity of the material used in buildings as well as quality of life reached through human centred urban design are the other dimension of the study's future vision on buildings (The TIR Consulting Group LLC 2016). While the diversity in approaches might in part be owed to efforts to conform to the fashion of the day, there is still a coherence in the overall narrative or 'fix': the (sustainable) construction sector as a key contributor to the national economy with international export potential is seen as a way to demonstrate innovativeness and ensure quality of life through a decisively ecological modernisation approach.

A further illustration on how that 'fix' is concretely articulated can be found in a certain fondness for building certificates. The certificates are perceived by building owners as an objective set of metrics designed to judge, compare but also better showcase a building's sustainable quality through a list of clear indicators. The energy performance certificate (see 4.1.2) already provides one such framework, but owners and/or occupants of large office buildings in the "office islands" of the financial service industry (Hesse 2016 :618) have proven especially keen on having their building certified according to international green building schemes. 14% of the office building stock is certified according to a range of different standards including BREEAM, DGNB, HQE, and LEED (PwC Luxembourg 2015). Stated motives are here linked to economic advantages in terms of improved commercialisation or occupancy rates following lower operating costs as well as to prestige. This trend has been mainly initiated by international investment funds that sought certified buildings for their investment portfolio creating a de facto demand and a market for sustainable certified office buildings. Certified office buildings are now almost seen as the norm, even though one respondent noted that the initial enthusiasm seemed to have died down. Green rationales are rather ancillary, or even an obstacle as clearly stated by one interviewee:

"The main argument for me is that once you have explained to people that it [green building] makes economically sense, you convince them. I have at a point of my life [...] tried to communicate around [...] environmental protection in the construction sector. It doesn't work at all. It convinces maybe...some percentage, I don't know if I could even say 10%, but it's a message that is extremely counter-productive. Of course, we are interested in protecting nature, there is no doubt! [...] But in the end, protecting nature is good but it is mainly protecting it to keep a nice living environment for us... and the ones who will follow. And thus, as a selling argument if you wish, it is a bad entry point in a milieu like construction. [...] You

will always believe in something once you've seen the positive economic returns. These returns can vary a lot. I don't say it doesn't make sense to do it, I simply say that the way you present it... having less...if you talk about CSR, if you talk about sustainable building, construction of healthy buildings, less unsatisfied tenants etc. These are all purely financial arguments." (Consultant, Lux12)

Counting on the competitive advantage of Luxembourg's multilingual and multicultural environment, the construction industry even advocates to keep a diversity of certification schemes to communicate openness and flexibility towards international investors:

"We are a small country and we need foreign investors here, we need to differentiate ourselves from the neighbouring countries. In France they almost only know HQE, even if there are other schemes, in Germany it's DGNB and in English speaking countries BREEAM, or LEED if it's an American pension fund that wishes to invest. I believe we have an interest to stay open to all these certifications, so we can offer a know-how stating: "You're coming here to Luxembourg and you want to invest in an office building, you can have it certified in BREEAM, DGNB...we have the know-how, French, German, English... We are at the crossroad of German-speaking and French-speaking countries, so we can fulfil your expectations." (Private employee, Lux01)

The private sector has positioned itself differently from the government who seeks to streamline and adapt certifications systems to the Luxemburgish context as a way forward to improve knowledge and skills. The use of one unified system is seen as a way to reduce complexity while offering planning security for the national construction industry. Despite a shared feeling that the practice of international certification tools has brought the sustainable building agenda forward by increasing awareness but also technical proficiency on the topic, some respondents regretted that it sometimes amounts to a retroactive box-ticking practice without leading to more thoughtful and comprehensive sustainable planning from a building's conception onwards.

Similarly, the provision of lighthouse green building projects is seen as crucial to demonstrate leadership and innovativeness at the international scale, but also to create emulation and capacity building at the national level. Interviewees frequently pointed towards the low number of such projects as a hindrance in two ways. First, their absence is perceived as harmful to the visibility of Luxembourg's existing green building expertise even though expertise was seen as already comparable to other 'emblematic' or 'model cities' like Freiburg or Masdar, but just not advertised well enough. Second, the lack of lighthouse projects is seen as a deterrent for experimental spaces through which different building methods and technologies could be tested and hence contribute to local know-how.

Potential lighthouse sustainable building projects are thus perceived as indispensable displays for the sector to coalesce around and identify with. Still, a number of recently finalised building or planned projects have been identified by respondents as having the potential for becoming such lighthouse projects (Figure 4.4 and 4.5 and Hollerich Village in 4.1.4).

Solarwind Office Building, Windhof

Figure 4-4 The Solarwind office building: green façade, solar panels and roof wind turbines, Windhof, Luxembourg



Photo: Bérénice Preller

The Solarwind Building in Windhof is one such project, initiated and developed jointly by three Luxembourg based companies (two real estate developers and one engineering consultancy). In use

since 2012, the office building hosts amongst others two of its initiators. It is located 15 km away from Luxembourg City, close to the Belgium border (see Figure 4.1). CO₂ neutrality is reached through a combination of high insulation standards, notably via a wood façade, the partial provision of on-site energy production with different forms of renewable energy (solar, wind, geothermal and biomass) and a green sourcing contract covering the remaining electricity demand. Rainwater is also captured and the external design features a green roof and façade. The interior furniture partly applies circular economy principles, for instance by using up-cycled fittings and office furniture as well as recycled carpets. As acknowledged by one of the project owners, some of these features are key to a building's visibility and much more about communication than contributing to its sustainable character:

“For a project to work [...], you need ‘gimmicks’, you need things that are visible, that are visual, that people look at. Because [in order to] do a high performing building...you need extraordinary things, even if they are small things, that people remember, that they see so that it sells. Think about BedZed and its famous chimney!” (Solarwind owner¹¹)

Several further aspects have helped to position and present the building internationally. Solarwind has notably been awarded three certifications from three different international green building schemes: the French HQE, the British BREEAM, and the German DGNB schemes. The triple certification strategy is justified by the initiators as a ‘pedagogical’ test to verify compatibility between the certification schemes. But they also use it to showcase their green building competencies as they are themselves active in the real-estate market. Constant monitoring and visualisation of energy and resource consumption allow fine-tuning and adaptations to the building use but also dissemination of project performance as the information is shared with researchers at a University in Belgium. In addition, Solarwind acts as a national pilot site for a European funded research consortium which collaboratively seeks to enhance the implementation of cradle-to-cradle principles in new and existing business estates. Eventually, the building's model character has been internationally acknowledged in 2015, through its nomination for the green building solution award competition of Construction 21, a social media platform targeting professionals from the sustainable building sector (Bosquet 2015). Furthermore, the project has contributed to group the surrounding firms within an economic interest group, the Ecoparc Windhof, which aims at facilitating inter-firm pooling in terms of rational resource use, material efficiency and management (material loops), and employees' mobility within the business park.

¹¹ For the sake of keeping the anonymity of further quotes by that person, the interview's numerical reference has been omitted here.

The Neobuild Innovation Centre, Bettembourg

As has already transpired from the role attributed to certification and lighthouse buildings, increasing capacities and expertise at the local level is considered a crucial element of the sector's international competitiveness and its ability to put sustainable buildings into practice. Accordingly, lifelong learning plays a pivotal role in Luxembourg's green building agenda as apparent in the initial excerpt from the governmental coalition program. In addition to targeted training with regard to energetic building (Section 4.1.2), sustainable construction is also a central axis in the lifelong training offer of the Engineers and Architects Professional Association (OAI). The course is provided together with a Luxembourgish based applied research centre specialised on environmental technologies and materials. Likewise, the LuxBuild initiative discussed in Section 4.1 seeks to advance blue-collar workers skills in the face of environmentally induced technical and organisational evolutions but the initiative also aims at encouraging firms to innovate. A recently completed building, the Neobuild Innovation Centre (Figure 4.5) in Bettembourg close to the French border (Figure 4.1) has a particular role to play in that respect. The 2,200 m² office building compliant with passive house standard has been completed at the end of 2014. Conceived as a modular living-lab, the building has been planned as an experimental and learning tool but also an international display of the sector. It is also headquarter to Neobuild, an innovation hub for sustainable construction co-financed by innovation funding from the Ministry of Economy.

Figure 4-5 Neobuild Innovation Center, Bettembourg, Luxembourg



Photo: Neobuild S.A.

New and in some cases even experimental construction materials and technologies are showcased and tested in the Neobuild building through a combined use and mix of products. The living lab approach provides space for experiments, learning, and demonstration of new materials and building designs but in the case of the Neobuild Innovation Centre, the focus is more market-oriented. A large number of service providers involved in the building's construction were local SMEs which were involved due to their innovativeness but also on sustainability criteria including social aspects, for instance, working conditions. Neobuild's objective is to allow these local firms to demonstrate their skills in green building, again under an extroverted advertising logic for the green construction sector in Luxembourg. Different types of insulation have for instance been used in adjacent wall segments, diverse heating and cooling systems have been implemented for different sections of the building, as well as several usages of collected rainwater including water supply to a roof greenhouse and a green wall, to name but a few. Technological solutions are also at the heart of the building, for example, through constant monitoring of the components through a range of sensors. The installation aims at allowing 'in-vivo'-tests as well as a comparison of technological and other components' performance and user-friendliness, which participating firms are encouraged to profit from before implementing them in future building projects. The trial and error logic is pushed even further in an experimental area, where

the used materials can be flexibly re-adapted and transformed to allow for technical evolution. Similarly to the Solarwind building (Figure 4.3), the Neobuild Innovation Centre has been a laureate of the green building solution award competition of Construction 21 in the category of smart building.

Based on the previous account, awareness of sustainability dimensions and sustainable change in buildings has been triggered by compliance to external pressures like European or international agreements, and then selectively framed through a political vision with dominant economic motives. Strengthening the local building industry by making it fitter for implementing innovative technical building solutions (eco-technologies) is expected to promote visibility at an international level that will eventually attract external capital but also offer export opportunities. This approach presents a “sustainability fix” or “coherent collation around new (urban) growth strategy” that While et al. (2004) observed in Manchester and Leeds. But as these authors further discuss in their conclusion, governmental steering towards greening can still create a momentum for more transformative alternatives. An analysis of actors involved in the practice and realisation of sustainable buildings in Luxembourg reveals, for instance, unconventional assemblages, including environmental non-profit organisations (Schulz and Preller 2016). In addition, alternatives, understood here as more paradigm-shifting and socially sensitive approaches, are gaining ground in Luxembourg due to their link with a central everyday concern for citizens: the extreme tightness and unaffordability within the housing market.

4.1.4 *Sustainable housing: addressing quality and affordability*

Housing in Luxembourg is worth an in-depth look at as it offers potential for a different perspective on sustainable building. Quality of life is once more a central element in the narrative but supported by different motives and arguments. The housing market is indeed considered to display expectations for highly qualitative building fabric and finishes (Stadtland Dipl.-Ing. Alfred Eichberger GmbH 2009 :8-9), as it is driven by high disposable income levels. At the same time though, scarce supplies on the real estate market undermine this quality-demand following the customers’ willingness to pay for housing –even housing at relatively low standards– which has led to an overheating of the real estate market. Nevertheless, respondents felt that the energy efficiency agenda and the performance certificate have been well received amongst homeowners and tenants. They are generally perceived as a way to reduce expenses, increase in-house comfort and also a metric that shows “that they have the best house” (Public employee, Lux13). As a result, consumers are presented as better informed and more sensitive to healthy living themes like ecological building materials and indoor pollution as well as comfort and

accessibility (PwC Luxembourg 2015) which contributes to a widened understanding of sustainable building beyond the purely energy and resource saving aspects.

Here again, certification schemes and notably the associated databases for building materials are highly regarded, as they are perceived to provide sound information on the materials' environmental performance, thus allowing an informed choice. The certification approach is, however, simpler and more straight-forward than the international frameworks favoured in the commercial building sector. PwC Luxembourg (2015) further argues on the basis of an inquiry amongst developers, architects, and real estate agents, that given the current quality standards most of the certifications requirements could be achieved anyway with a minimum of efforts.

Unlike the energy efficient and green economy approaches to building outlined above, the non-governmental sector is more present and involved in sustainable housing questions. Especially the non-profit Oekozer Luxembourg, belonging to the local Friends of the Earth structure, is particularly active in disseminating best practice on environmentally sound and healthy building materials. The Oekozer has set up a whole range of initiatives targeting individuals: building advisory services, the organisation of the Oekofoire¹², an annual trade fair exhibiting ecological products including housing solutions, or the Gréng Hausnummer" (green house number) an annual voluntary and checklist-based assessment and award for sustainable housing. The Gréng Hausnummer mainly aims at demonstration and dissemination. In addition, the Oekozer has also contributed to formalise these topics at a policy level due to its policy advisor activities for its main funder, the Ministry of Housing. This includes preliminary work for a sustainable building guide comprising extensive descriptions and evaluations of building materials, for instance, in respect to their embodied energy, their toxicity, or their lifetime (CRTE et CRIT-B 2010). The final version of the guide has been continued by the Centre de Recherche pour les Technologies de l'Environnement¹³ (CRTE), a local applied research centre focusing on environmental technologies and materials, and is now a well-established resource for the sector. Similarly, the Gréng Hausnummer provides the preliminary basis for the set-up of a voluntary sustainable housing certification system: the LENOZ scheme. In preparation since 2009, the detailed composition of this sustainability certificate adapted to the Luxembourg context has been outsourced to an engineering consultancy and is part of a legislative proposal currently under review to promote sustainable housing. The criteria catalogue of the certification is particularly interesting: it covers, of course, economic aspects, measured through energy savings, ecological elements like building materials and resource consumption but also further evaluates social aspects, including urban sustainability considerations related to a building's surroundings and accessibility (Gouvernement du

¹² Following the 2016 Edition and almost 30 years of existence the Oekofoire has been discontinued.

¹³ Since the fusion of the two main research centres in Luxembourg in 2015, the CRTE is integrated within the LIST (Luxembourg Institute of Science and Technology).

Grand-Duché de Luxembourg 2016). Together with the LENOZ certification, the government has further introduced a climate bank system, providing attractive loans to households for energy retrofitting according to socio-economic criteria.

While these aspects certainly broaden the previously described focus on resource efficiency and single buildings, the framing of sustainability in housing as a warrant of quality again provides for relatively conventional building solutions (see Figure 4.3). Furthermore and as already mentioned in the previous section, quality of life is conveniently articulated with the eco-technologies and green growth agenda at the policy level. As such, sustainable housing can be considered to be consensually framed as “a middle-class policy of the living place rather than a politics of sustainable urban development” (While et al. 2004 :565).

Yet, the elements discussed up to now are not providing the whole picture on sustainable building and liveability in Luxembourg. While interview questions about the local understanding of sustainable building usually received answers along the previously outlined aspects (including energy efficiency, capacity building, and eco-technologies), almost all interviewees point to the challenges arising from the very peculiar real estate situation. As already outlined, the Luxemburgish real estate market is indeed characterised by scarcity. The development of the country as an international financial centre has led to an increased demand for office buildings but also for housing, as high-skilled employment generated by the financial sector as well as European Union institutions is being covered through immigration (Hesse 2016; Becker and Hesse 2010). Considering also increasing housing demands due to demographic trends of household reductions, Luxembourg is confronted with very pressing housing shortages. According to previsions, over 6,000 new units would be required every year to meet the growing demand (Urbé 2012; Bousch and Licheron 2012). This has led to steady price increases in the rental market, which rose by 22% between 2002 and 2015 (Bingen 2016) and in the property market, which rose by almost 190% between 1995 and 2010 (Hoffmann 2012). As already mentioned, the pressure is reinforced by a tendency to prioritise office development (Hesse 2016; Hesse and Christmann 2016). The fact that property is mainly in private hands has favoured speculation (Urbé 2012) but also skewed the market towards offering more property than rental units and houses (Becker and Hesse 2010). In addition, affordability challenges have been rather weakly addressed by public housing providers: social housing only made up for 3.6% of the stock in 2009 (Stadtland Dipl.-Ing. Alfred Eichberger GmbH 2009 :16). As a result, low-income and middle-class households are pushed out of the market, forcing some of them to seek accommodation within the neighbouring countries (Becker and Hesse 2012). This, in turn, increases the already consequent flow of daily work commuters (171 000 in 2016) and strains the transport system. There was hence a diffuse feeling that any economic or moral arguments for sustainable housing choices become negligible or even

redundant due to the heated real estate market. In practice, this seriously limits more comprehensive approaches to sustainable building including urban design and spatial planning aspects:

„Well, there is a challenging deterrent here in Luxembourg...that always sets the best argument in the shadow: it's the situation in the real estate market. It's no secret. The prices are what they are, the distress of people to get an apartment is what it is [...]. And it makes it certainly difficult if sustainable building... or when trying to explain that it's more sustainable not to live in the North [of the country] and then to commute by car x-km into the city. You can argue on this, it's true everybody can grasp it. But when someone looking for accommodation gets into the real estate market and realises, that in the North it is simply so much cheaper, then you can explain a thousand times, they can even grasp it, but they can't afford it differently. And I see this as a huge problem, a huge barrier.” (Public employee, Lux13)

These everyday concerns of at least parts of the population carry a strong social dimension into the discussions, opening the way to alternative approaches to green building. Sustainable urban planning has been the main tool to address these issues, thus moving away from the focus on individual dwellings or buildings as addressed in the green growth/technology agenda towards the neighbourhood and urban scale. Similarly to Moore and Rydin's (2008) observation, the sustainable urban planning agenda puts more emphasis on the role of public actors: in Luxembourg, the Ministry for Sustainable Development and Infrastructures as well as the Ministry of Housing are the respective institutions which play only a marginal role in the development of the eco-technological and growth agenda described above. Key policy instruments include:

- (1) the Housing Pact (Pacte logement) set up in 2008 which encompasses conventions between the state and communes, as well financial and legislative tools (Gouvernement du Grand-Duché de Luxembourg undated),
- (2) and the more general planning approach of the Sectoral Housing Plan (Plan Sectoriel Logement - PSL), introduced as a draft document in 2009. The finalised version of the PSL had to be withdrawn shortly after its publication in 2014 following criticism based on legal aspects and insufficient consultation of local authorities. Both documents have to be understood in the wake of a more systematised approach to spatial planning in Luxembourg that seeks to transition towards “integrated development” of the different socio-economic functions and geographic regions of the country (Hesse 2016; Chilla and Schulz 2011) with sustainability as the assumed normative goal (Carr 2011). The main objectives are poly-centric growth concentrated on several urban centres, as well as infill development, increased density, and mixed developments at the urban scale. For housing, this concretely translates into concepts of public transport accessibility, the

reduction of land consumption and increased density, a mix of functions, the creation of qualitative public space, but also efforts to increase the availability of public housing. The focus lies here on the neighbourhood or even larger urban scale, with key projects and growth areas identified throughout the whole country (Stadtland Dipl.-Ing. Alfred Eichberger GmbH 2009). While more social in scope than the green economy perspective, these plans are still categorised as too theoretical and planner-led to be truly integrated into a public understanding of sustainable building:

“Every type of actor has its vision on the topic. Talking about sustainable construction, it’s really putting...a big name on things that are sometimes really different [...] you are not exactly addressing the questions that arose to most people, who renovate a house, buy a house or renovate an apartment, change window frames...you have to see at which level you situate yourself. That’s what I think...when I was talking about professions, building firms, they are really into this: changing window frames, insulate a house, change the boiler, make energy saving, how much does it cost? Is it more expensive? How much? Do I get funding? All this is one approach to sustainable building, it’s a very concrete and very technical way to handle all this.” (Architect, Lux15)

At the same time, the densification is met with scepticism amongst citizens and local media as it is perceived as a threat to the current architectural aesthetic and quality of urban living, even though the housing prices significantly contribute to a pragmatic acceptance. Hesse (2016) has further pointed to the constraints of political economy practices favouring private and real estate economic interests due to different rationales between the local and the national level. While being high (state) level policy approaches, these instruments have the merit to articulate a key question for a socially inclusive understandings of sustainable construction: Which “forms of living together” (Consultant, Lux05) or which “spirit of social cohesion” (Developer, Lux11) does the country envision for its future?

In this context, several mainly non-governmental initiatives are calling for alternative approaches to address the housing issue. In 2012 Caritas Luxembourg has, for instance, focused its annual publication on the social situation in Luxembourg around the topic of sustainable housing and living. The report provides a very thorough analysis of the aforementioned socio-economic challenges but also sketches concrete solutions like cooperative housing throughout a wide range of articles by academics, non-profit and institutional actors (Schronen and Urbé 2012). Since 2014, the citizen initiative Adhoc is also placing cooperative housing onto the agenda via conferences, participative workshops but also the realisation of a housing project in Luxembourg City. An increased public and political recognition of alternative approaches is visible in Luxembourg’s 2016 contribution to the International Architecture Exhibition “La Biennale” in Venice. The exhibition indeed also brings alternative housing solutions at

the forefront and inscribes them within the concept of “Tracing Transitions”, seeking traces of and calling for a structural shift away from the current housing situation and policy configurations (LUCA 2016; Christmann et al. 2017).

Hollerich Village, Luxembourg-Hollerich

Hollerich Village is another example of raised awareness and interest for alternative projects. The privately planned neighbourhood development on four hectares of a former industrial site at the edge of Luxembourg City’s centre (see Figure 4.1) is frequently quoted as a particularly ambitious model project with regard to sustainable building and living. The area belongs to a private developer already involved in other sustainable building projects including the Solarwind office building. The planned new urban quarter will offer residential and office space in line with the “One Planet Community” principles developed by BioRegional. The UK based foundation provides advice for reference projects worldwide and has notably been involved in the internationally renowned BedZED project. For Hollerich Village, this would translate into reduced energy consumption with 100% of heat and 20% of electricity generated on-site (100% renewable energy), a pedestrian-friendly urban design, good integration with public transportation, the re-naturalisation of a creek crossing the site and a cradle-to-cradle concept aiming at getting all building materials from within 150 km of reach. A community garden is also planned, not the least since local food production is given key importance. Despite its flagship potential, discussions with the City administration regarding acceptance of the master plan for the development stalled and the developer has reassessed its investment priorities putting the project on hold for the time being. The fact that the project site belongs to a larger wasteland area with different owners including the city, the state and a major tobacco company explains – at least partially – the lengthy negotiations. It has indeed proven difficult to devise a common vision for the development of the area amongst all landowners which seems to be an important criterion for the city as the site is strategically located at a main entry point into the city.

Despite being currently on hold, the project initiated several interesting partnerships with local environmental non-profit organisations during its planning phase. These include a Transition Town group, the Centre for Ecological Learning (CELL), as well as local primary schools invited to use the project as a sustainability teaching case. These partnerships have also led to a number of events, including an annual trade fair for organic plants on the intended development site. The recruitment of a consultancy entrusted with the communication of the project between 2013 and 2016 has resulted in public awareness of the project and also positive framing of its sustainable image, thus reinforcing its model character (Schulz and Preller 2016). As a result and despite its unknown future, the project has connected actors with alternative perspectives on sustainable building and provided them with a public platform that increased their visibility.

While the housing and affordability agenda is putting sustainable building into a much more holistic and interactive relationship with its surroundings, some elements are still reminiscent of the previous growth and eco-technology agenda. Quantitative data, specifically on land and housing availability as well as population figures, are again very central to the argument. Similarly, a key motivation is again to maintain quality of life even though this is here understood as a socially inclusive project rather than the mere perpetuation of an affluent way of life. Last but not least, key actors are again public authorities and other institutionalised actors, wisely acting for the common good, even though the Housing and Sustainability Ministries may be expected to follow different objectives than the Ministry of Economy. By default, the key role taken by these actors shows that citizens are notably absent from the debate, with some rare exceptions (e.g. the Adhoc initiative). If at all, they are mainly apprehended as consumers in the first “green growth and eco-technologies” approach and as subjects at the mercy of the housing market in the “affordable housing and urban planning approach”.

4.2 Freiburg: The emblematic Green City

4.2.1 *A distinctive and alternative place?*

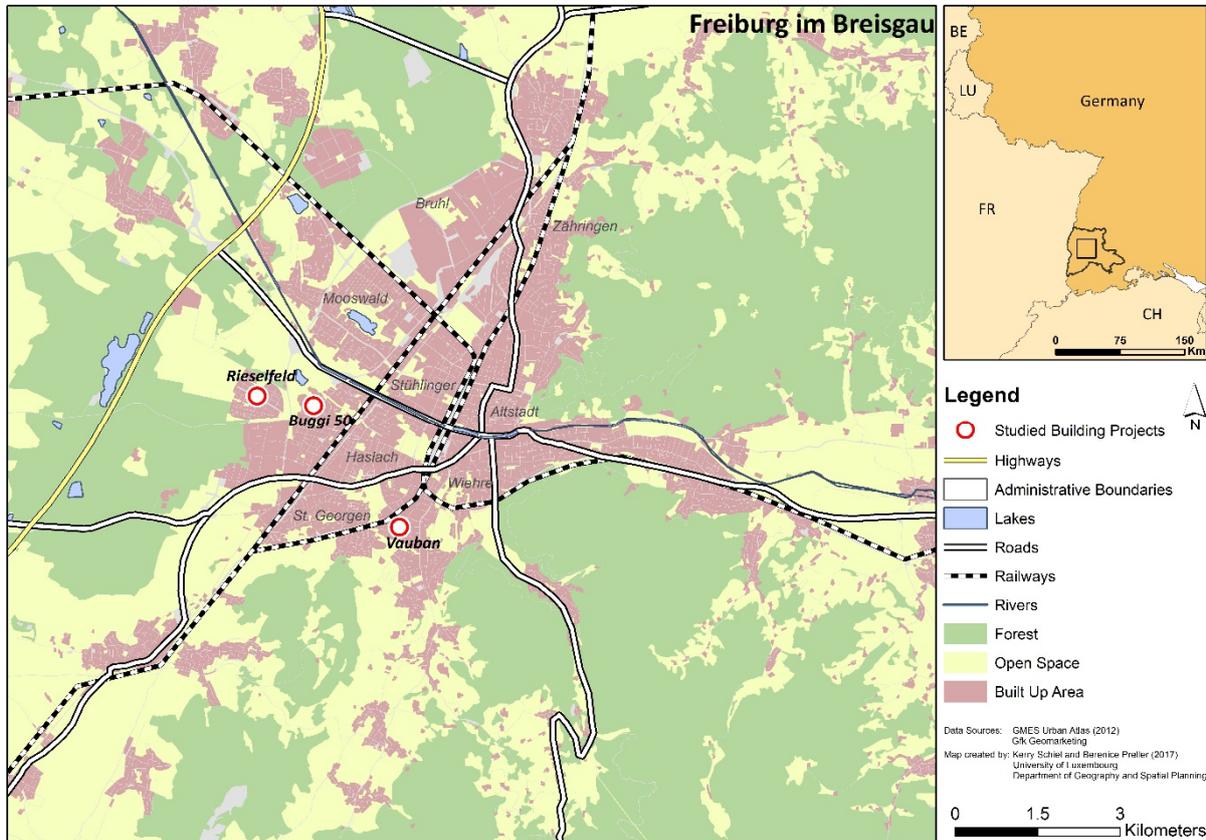
Freiburg-im-Breisgau is a university city located on the outskirts of the Black Forest in the south-west of Germany and close to the Swiss and French borders (see Figure 4.6). With a population of 226.393 in 2016 (Amt für Bürgerservice und Informationsverarbeitung der Stadt Freiburg im Breisgau 2016), it can be considered a mid-sized city. But what particularly characterises its demographic structure is a steady population increase throughout the last two decades, mainly due to inward migration: between 1995 and 2015, Freiburg's population grew by 20%, with a yearly average migration surplus of 1 440 persons (Ibid :4). Similarly to the Luxembourg case, though at a smaller scale, this strong migration places significant strains on the real estate market that is unable to cope due to limited availability of building ground. The issue is not necessarily new: Freiburg has already seen a strong alternative housing movement that occupied buildings in the mid-1970s and early 1980s in order to raise public awareness on accessibility and shortages issues, especially for students and low-income households (Klus 2013). Similarly, the two districts Rieselfeld and Vauban were planned in the 1990s under the lead objective to provide affordable housing (City of Freiburg 1993). Early 2017, and after several years of debate, the City council has settled on the development of a new neighbourhood project on 164 hectares greenfield behind Rieselfeld in order to accommodate the current and projected steady population growth (Lutz 2017).

Freiburg's economic structure is characterised by a dominance of the service sector, two of the main employers being the public sector and the research/academic sector (Höhl 2017). Besides from the University, the city does indeed host several research centres like the Institute for Applied Ecology (Ökoinstitut e.V.) and the Fraunhofer Institute for Solar Energy Systems (ISE) or think-tanks like ICLEI (International Council for Local Environmental Initiatives). Most of them, as the names already reveal, focus on environmental questions and are thus relevant actors with regards to sustainable building processes. Due to the vicinity to France and Switzerland, but also especially to the Black Forest (see Figure 4.6), tourism is another pillar of Freiburg's economy. A particularity though is that 'traditional' touristic activity has been complemented since the mid-2000s by a boom in trade tourism focusing on sustainable or green urbanism (Röderer 2007). As proudly stated by the city's green marketing brochure:

"Today there is a never-ending stream of over 25,000 'trade' visitors to the city from around 45 nations every year, but not because the city has spectacular large-scale projects or huge solar factories. It is something else that makes Freiburg such an attractive city and one sought

after as a partner: nowhere else are there more pilot projects, more extensive ‘green’ expertise, sensitivity and political experience to be found” (FWTM 2014 :18)

Figure 4-6 Freiburg-im-Breisgau and the studied building projects



Freiburg has indeed raised international interest for its distinctive sustainable urbanism policies as well as engagement with energy and transportation systems. This is particularly visible in the large number of prizes awarded to the city over the course of the last 20 years, Freiburg has successively been “Germany’s 1992 Green Capital”, “The 2010 European City of the Year” or had the opportunity to present the Vauban neighbourhood as a best practice case at the UN-Habitat II Conference in 1996 (Bichard 2014), a conference that played a key role in putting the urban dimension of sustainability on the agenda (Ghorra-Gobin 2008). Freiburg and notably the realisations of two sustainable neighbourhoods in Vauban and Rieselfeld feature prominently in a number of a best practice publications (see for example Buehler and Pucher 2011; Frey 2011; Bichard 2014; Hall 2014). As a result, the city is flooded by international information requests and visiting delegations composed of policymakers, students, or practitioners, that have led to set up a dedicated department to manage these demands in 2008 (City of Freiburg 2010b).

Academics too are keen to engage with Freiburg's best practices. Relevant contributions inquire for instance the city's urban planning processes, notably as they have been applied in the development of Vauban and Rieselfeld (Medearis and Daseking 2012; Hamiduddin 2015), sustainable urban policy-making practices (Mössner 2015a, 2015b; Kronsell 2013), urban energy transitions concepts (Rohracher and Späth 2014; Späth and Rohracher 2011) or the city's public transportation policy (Buehler and Pucher 2011). In contrast to the emulation of the more practitioner-oriented contributions though, several of these authors take a critical stance towards the neoliberal tendencies in Freiburg's 'green policies'. Their concern focuses especially on the social implications of Freiburg's glossy sustainable urban development (Mössner 2015a; Freytag et al. 2014), social aspects being rather the 'poor cousin' of the sustainability trio (Hamiduddin 2015; Kronsell 2013) thus leaving aside crucial questions like affordability and accessibility of housing (Klus 2013).

Sustainable building policies and practices in Freiburg have to be understood against this backdrop. Stakeholders and the city administration have had the time and opportunity over the past decades to develop the compelling story of a locally distinctive, pioneering and successful place that strongly identifies with its environmental policy. This is already clearly evident in the above-quoted excerpt from the "Green City" brochure but is also a recurring theme throughout the interviews. Actors usually start their narratives with specific building policy interventions, placing them in a continuity of foundational and distinctive historical events, as exemplified in the three following interview extracts:

"In my opinion, an important political trigger in Freiburg that cannot be ignored is the protest against the nuclear plan Wyhl, that's where everything started. And this is earlier in Freiburg than in many other cities, that's why there are also a lot of experts in the energy field here. [...] the Ökoinstitut, the Fraunhofer Institute, the Solarfabrik [...] there is a huge energy scene" (city employee, Fr02)

"Well [...] the whole topic that gets today considered under the keyword energy transition is a topic in Freiburg since 30 years that is how it is. Therefore there has been an early realisation, especially through actors from the research domain...well, these are interactions that's why there is such a strong research area on that aspect because there were many actors and in the past, this has of course mirrored into communal actions [...]. Not only with regards to energy provisions and the question of renewables, but also on the building side. The potential of the communal leeway has been broadly used at an early point" (city employee, Fr08)

"I believe the specificity of Freiburg in comparison to other German cities and also internationally, is that the German environmental movement is born in the Freiburg region at

the time of the protest against the Wyhl nuclear power plant. And that was a trigger that has had long-term effects. First, an energy scene has established itself in the region [...]. A second effect was the development of a strong environmental conscience in the population at large. In principle from right to left, also politically, there has been a very broad consensus, that sustainability and environmental topics at large play an important role in Freiburg [...]. This means we had an extremely favourable situation for sustainable building [...] very early and until today. (City employee, Fr10)

These exemplary quotes illustrate quite well the structuration of the narrative around three key elements that then articulate into a consistent historical progression of Freiburg's distinctiveness with regards to urban sustainability. (1) The large-scale protest against a planned nuclear power plant in Wyhl, a small community located 20 km away from Freiburg in the 1970s provides here the emotional background trigger. The protest has brought together students, farmers, conservatives and social-democrats along motivations that pertained initially to nature conservationist ideals (Zhu 2008). Nevertheless, the event counts as the birth moment of the green party in Germany, which, as particularly visible in the interview Fr08, further contributes to single out Freiburg as a unique and important place for sustainability.

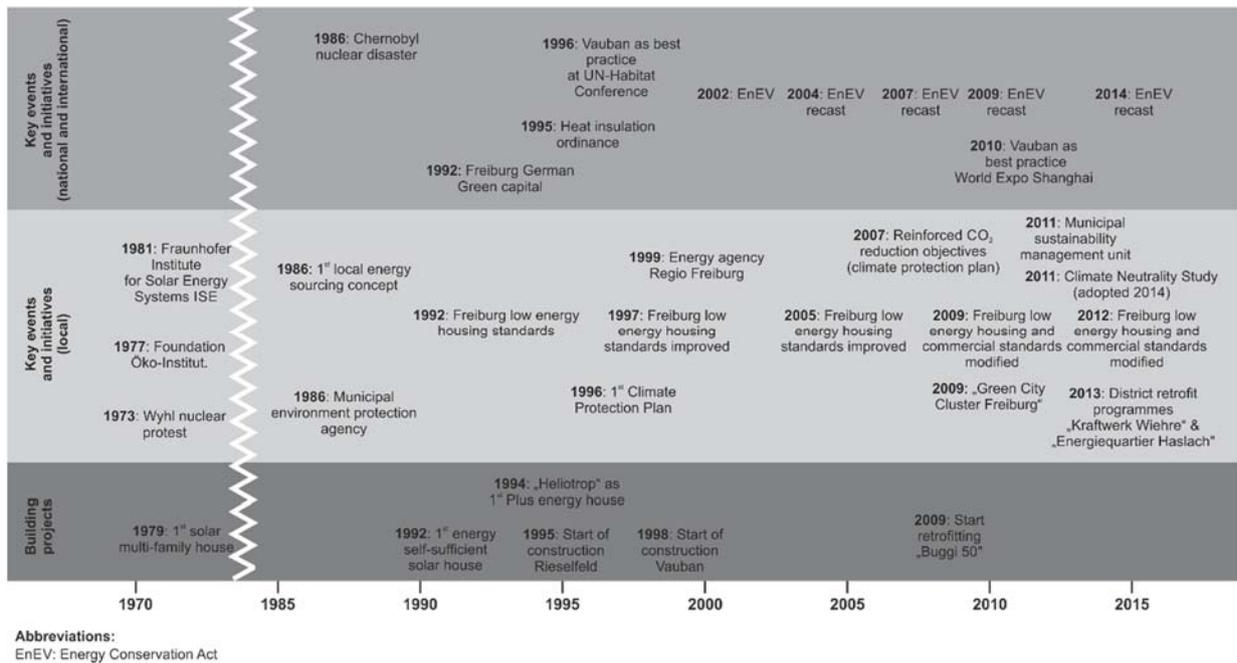
(2) By raising awareness on energy provision challenges, the protests are then seen as having favoured the emergence of a distinctive and engaged "energy scene" in Freiburg, a rather diffusely defined network of environmental activists, technical pioneers, researchers as well as citizens interested in alternative energy provisions. The fesa e.V (Förderverein Energie- und Solaragentur Regio Freiburg) for instance, a local not for profit association acting in favour of renewables and solar energy, is one of the three shareholders of the local energy agency. It is worth underlining though that this early environmentalism and energy focus is distinct from Freiburg's present approach to energy in relation to climate change. It builds indeed on the refusal of an energy source perceived as dangerous and encroaching on the natural surroundings. Interviewees and publications alike highlight the key contributions within that "energy scene" of newly created environmental research centres like the Ökoinstitut e.V. and the Fraunhofer Institute for Solar Energy Systems (ISE), but also of individual architects (see Figure 4.7) throughout the 1980s and early 1990s. More specifically, it is their technical inventiveness in building experiments that is put forward (see also Frey 2011; FWTM 2014; Fastenrath and Braun 2016): from prototype roof solar panels to whole buildings like the 1994 built "Heliotrope" by architect Rolf Disch, that turns towards the sun. Freiburg then harnesses a strong and distinctive density of inventive and active "energy experts" which is reminiscent of the popular belief in Baden-Württemberg to be a tinkerer (in German 'Tüftler') Land (Paul 2015).

(3) Last but not least, the protests and subsequent organisation and institutionalisation of the Freiburg energy scene are considered to have raised a strong environmental awareness amongst citizens which combines with conservationist ideals of the natural setting of the neighbouring Black Forest. A usual examples given to illustrate that statement is Freiburg's strong tendency to vote for the Green party: in the 2013 parliamentary election, 44% of the voters in Vauban did so (Amt für Bürgerservice und Informationsverarbeitung der Stadt Freiburg-im-Breisgau 2016), while since 2002 Freiburg is at the hands of a Green mayor.

Through this account, Freiburg's sustainability concerns and policies are both presented as bottom-up and citizen-driven but also particularly alternative and innovative as they emerge from an early protest spirit that combined with pioneering, local, technical resourcefulness. The Wyhl protest and the subsequent energy and environmentally sensitive 'scene' have become the legitimating cornerstone of all the following discussions and experiments on energy savings and alternative energy production, up to the point that this 'foundational' story is somewhat a topos every stakeholder seems compelled to mention. One interview partner even related his personal biography to it, by explaining how his parents actively participated to protest sittings in Wyhl (architect, Fr22).

Altogether, this narrative around a strong political and civic engagement as well as local resourcefulness and expertise in respect to energy resonate with Noel Longhurst's (2013) concept of an "alternative milieu". While I am careful to consider the above account for what it is, that is to say a retroactively smoothed out presentation harnessed to support Freiburg's reputation of green distinctiveness, the occurrence of these events taken individually still concords to indicate a very particular local milieu. Similarly, as will be elaborated hereafter, some of the distinctive experimentations around alternative ways of living in the Vauban and Rieselfeld neighbourhoods, even though they were not necessarily the doing of the city administration, are further indicative of the alternative lifestyle dimension also characteristic to Longhurst's heuristic.

Figure 4-7 Key milestones and events for sustainable building in Freiburg



Source: Partly based on Fastenrath and Brown (2016) and Fastenrath and Preller (2018).

4.2.2 Technical interventions: from energy efficient housing to sustainable neighbourhood planning and back again

Following the previously discussed background ideational context on environmental protection and alternative energy provision, interviewees concord to present the city’s search for alternative energy provision solutions as the backbone of Freiburg’s concrete engagements with sustainable building. A frequently referenced key document is the local energy sourcing concept from 1986 that encompasses a strategy resting on three pillars: energy conservation, production of renewable energy, and the development of environmentally friendly technologies. In later policy and strategy documents, that pillar of energy conservation is strongly linked to energy-efficient building design and effective insulation of buildings (City of Freiburg 1997b). Buildings have further kept that central role in the subsequent climate action plan and its updates (see Figure 4.7) that all prominently link buildings with the attainment of the city’s climate change and CO₂ objectives (City of Freiburg 2011, 2007, 1994, 1996, 1999).

4.2.2.1 *Freiburg's Low Energy Housing Standard: energy efficient housing*

The first concrete milestone engaging directly with building provisions is a council bill from 1992 that had been proposed jointly by the Green party and the Social democrats. The bill sets energy standards for new housing constructions at a 65 kWh/m²/year, which at the time was slightly less than half of the provisions in the existing German building regulation. The practical realisation of this energy objectives rested on stronger thermal insulation requirements, as well as the architectural use of passive solar energy, both linked to the delivery of building permits. While the City council could only make these requirements compulsory for projects built on public land, several interviewees refer to this bylaw as a milestone for Freiburg's subsequent strong engagement with buildings and sustainability. The requirements of the Low Energy Standard (LEH) have indeed been successively made more stringent over the years. In 2009, energy prescriptions were eventually extended to commercial buildings and the bylaw's last reform in 2012 has set up a quasi-passive housing standard. As an assumed goal of the city administration's reforms is to move ahead of improvements in the national Energy conservation legislation (EneV – Ennergieeinsparverordnung see Figure 4.7) in order to preserve the city's knowledge advantage, notably with regards to the economic benefits this brings for local artisan firms (Fr06, Fr10, Fr17). This has though also led to missteps, as the 2009-reform has resulted in differentiations between the calculation bases for the local and national regulations that extensively complicated the funding system for house builders.

The bylaw, also referred to as the Freiburg Low Energy Housing Standard (LEH) is presented as the outcome of a combination of two contextual elements that allowed the Freiburg energy and environmental scene to pressure the city administration. First, in the wake of the nuclear disaster of Chernobyl in 1986, Freiburg's City council has committed itself to dismiss nuclear power from its energy provision system. This in turn required to reassess the communal energy provision strategy and eventually led to the prominence of energy efficiency and saving measures, including in buildings. In its subsequent new energy sourcing concept, the city even presents this strategy an active response to citizen concerns in light of the Chernobyl disaster (City of Freiburg 1999).

In parallel, an acute need for affordable housing by the end of the 1980s has indirectly provided for a reinforced momentum for sustainable building (Klus 2013: 131; Müller 2015; Zhu 2008). A long and fierce public debate had indeed occurred around the city's project for greenfield neighbourhood development in Rieselfeld, a former sewage farm outside the urban fabric that had acquired a protected status (City of Freiburg 2010) (see figure 4.6). City councillors from the Green and Social Democrat parties indeed partly opposed the project following concerns about urban sprawl and its environmental outcomes and were further supported by a part of Freiburg's citizens. In sum, gaining support for the project has been a delicate act of conciliating ecological and social responsibility, as

explained by one interview partner: “It was a question of social responsibility versus environmental responsibility [...] ‘If the project is a flop, we will have to sell the forest!’ [meaning letting sprawl encroach on the Black Forest]...that was the message!” (city employee, Fr18). Accordingly, the City council’s decision to develop approximately 80 hectares of the Rieselfeld area eventually went through in 1991 (Zhu 2008), but part of the political deal has been to make the delivery of building authorisation within the new neighbourhood conditional to stringent efficiency requirements.

In line with this historical policy developments, the main actors involved in the realisation of sustainable building in Freiburg are the city’s planning office as well as its environmental office, in cooperation with two semi-public structures: the local energy agency for technical inputs and the public housing provider Freiburger Stadtbau (FSB) to which the city can make prescriptions regarding the energy efficiency of its building stock. With the move on the agenda of retrofitting initiatives, these two agencies have gained even more importance, as will become visible in the following sub-chapters.

4.2.2.2 Rieselfeld and Vauban: energy efficiency in the context of sustainable neighbourhoods

Rieselfeld

In accordance with the previously mentioned political deal, the Rieselfeld development is the first large-scale application, and hence also somewhat the testbed, of the Freiburger LEH standards. Implementing the standards has though not necessarily been as easy as today’s best practice narrative might suggest, as conceded by one stakeholder:

“When we worked out the building plans and marketing principles [for the lots], it was already clear: This will become the first low energy district. But that was only political idle talking. Nobody knew how to do it, no architect, no planer, no heating engineer, no developer. Nobody knew how to do it“(city employee, Fr12)

The difficulties relate as much too technical aspects as to organisational ones. The energy requirements have indeed been made bounding through private sale contracts between the city administration and the land purchasers. Accordingly, it was the city’s building authority that carried the responsibility to review the projected energy consumption as part of the building permit deliverance process and later on, also to control their actual realisation (city employee, Fr17). Due to the extent of the task, as well as the lack of experience with the implementation of the standards, the city eventually hired a dedicated architect in charge of explaining, controlling and assisting with energetic building requirements. The move is presented as the outcome of a communicative approach instead of using sanctions (Siegl 2014). It has had the significant advantage to encourage learning and transfer processes that are recognisable in the following Vauban project.

Figure 4-8 Aerial View of the Rieselfeld neighbourhood (at the front) Freiburg, 2012



Luftaufnahme vom 25.05.2012: Erich Meyer, 79686 Hasel

Source: City of Freiburg, <http://www.freiburg.de/pb/,Lde/208560.html>

On the organisational side, the city administration set up a cross-sectoral project group composed of city employees delegated from different departments who have been in charge throughout the development until 2010. It has been mirrored by a dedicated and cross-party working group at the level of the City council, to facilitated political decision making.

Figure 4-9 Impression of the Rieselfeld neighbourhood: housing and tramway



Photo: Bérénice Preller

Rieselfeld has been planned for more than 10,000 inhabitants in approximately 4,500 housing units. The first construction work started in 1995 (figure 4.7), but the basic planning principles had already been set in a development plan that emerged from a public tender held in 1991 (Siegl 2014). As Rieselfeld's 'raison d'être' was initially to address the housing shortage issue, the city planners have envisioned a dense and socially-mixed district, that has been accordingly arranged in a predominantly block structure. Buildings with heights of four to five storeys cluster around inner green space yards (Figures 4.8 and 4.10). The project group has deliberately kept the lots small and care was further taken to not sell adjacent lots to the same type of investors, in order to secure a social and ownership mix (Fr13 see also Back 2005).

The land was sold progressively through four building phases, to allow the progressive financing of the infrastructure, notably the tramway line, without burdening the city's budget (Müller 2015). The tramway is a central pillar of the development, as it provides an essential and swift connection towards the city centre, (Figure 4.9). These features of the development, are easily recognised as some of the key features of sustainable urbanism, showing hence a conceptual enlargement away from the initial

approach through energy-efficient buildings. Energy efficiency and sustainable urbanism have though not always well co-existed, as applying the energetic requirements to the block structure proved partly challenging: “For example, in the north-east corner of a block, it is of course always extremely difficult to reach high energy standards. Large areas of the buildings do not have energy input from the sun” (architect, Fr14). A city employee (Fr17) even mentions that sampling conducted after the first building phase confirmed that on housing blocks, not each individual house actually reaches the set requirements.

Figure 4-10 Impression of the Rieselfeld neighbourhood: block structure and inner green yards



Photo: Bérénice Preller

Public participation was also a strong component throughout the development, as a citizen council has been involved from the planning stages onward (Zhu 2008). The City administration has set up and financed the K.I.O.S.K project (Kontakt, Information, Organisation Selbsthilfe und Kultur / Contact, Information, Organisation, Support and Culture) as early as 1996. This contact point was intended to build up social ties within the neighbourhood from its early days onwards (Back 2005; Müller 2015)

and has been later taken over by a citizen initiative. It still is today a key rallying point for information, discussions but also cultural offers within the neighbourhood.

Under the pressure to sell enough land plots to secure funding for the infrastructure, and following an initial disinterest from developers, the city administration was further keen to provide lots for building groups (“Baugruppen”), especially during the third and fourth building phases (Müller 2015). After successful pioneering projects in Rieselfeld, the project group in charge of the development has even been keen to place options on lots for building groups, as well as proactively contacted architects to encourage them to undertake building group projects (Müller 2015). As a result, the neighbourhood counts 90 building groups as for 2010 (City of Freiburg 2010). The Rieselfeld project team considers that building group owners have been able to significantly save costs during the construction process. As such, the building group practice has brought positive social effects that balance out the fact that the city could not build as much social housing in Rieselfeld as initially planned, due to policy changes at the state (Baden Württemberg) level (Müller 2015).

Vauban

Figure 4-11 Aerial views of the Vauban neighbourhood, Freiburg, in 1992 and 2012



Source: City of Freiburg, <http://www.freiburg.de/pb/,Lde/208764.html>

Almost three years after the launch of the Rieselfeld development, inner-city land became available as military land and barracks were vacated by the French army (see Figure 4.11). With its 38 hectares, Vauban covers a smaller area than Rieselfeld and has been planned to accommodate up to 5,000 inhabitants. As has been accurately summarised by an involved planner „Rieselfeld was kind of an icebreaker and we conveniently followed the tracks” (Fr18, city employee), as the city administration has simply sought to reapply its Rieselfeld experience almost as a ‘whole package’: from the settling of energy building obligations within the private land sale contracts, the progressive selling of lots to pre-finance the infrastructure, to the organisational structure within the City council and the city administration and the backing of building groups.

Still, the project’s realisation proved more contested and encompassed more interventions from the side of the inhabitants, which has been in part attributed to their strong environmental orientation (Fr 06; Fr18; Fr20; Fr21). A good example is how the participative structure “Forum Vauban” was instrumental in reaching constructions with almost passive building standards, hence stricter than those requested by the city. Following the Forum’s lobbying, the possibility was hotly debated with the City council, who ultimately decided against a compulsory new passive house standard but supported more ambitious homeowners and developers in Vauban by giving them preference in the land purchasing procedures (City of Freiburg 1997a). As a result, some areas in Vauban have been developed according to an unofficial stricter standard than others: at least 200 units are built with de-facto passive house standard, even including a somewhat ex-centred area built along plus energy standards, the “Solarsiedlung” by the architect R. Disch (Figure 4.12). Yet, as is narrated by Späth and Rohrer (2015), the high share of passive housing which is nowadays one of the central features in Vauban’s reputation and advertisement was not the straightforward outcome one could expect given the city administration’s showcased environmental objectives. Indeed, as the city pursued in parallel the development of its district heating policy, house builders who had chosen to invest in passive housing had at the same time to pay the high fix price for connecting to a district heating system they would barely use (Ibid: 275 – 276). Eventually, the city agreed upon setting exemptions despite its initial reluctance articulated around the need for a critical mass to ensure efficiently functioning district heating infrastructures. As the exemption conditions prescribed to the passive house builders have though been particularly burdensome, most of the affected houses still possess a district heating connection (Ibid: 277). As concluded by the authors, this example illustrates how despite shared visions, multiple interests, (infrastructure) path dependencies, contestations and power issues are shaping sustainable (building) transformations.

Interestingly, these sometimes conflictual sustainable building experiences have still produced learning effects, as reflected in the city’s successive reinforcement of its building standards (see details in Fastenrath and Braun 2016) that now also include commercial buildings and have become even

more formalised through an anchoring in the city's land use and construction plan (Baulandpolitische Grundsätze).

Figure 4-12 The Solarsiedlung, part of the Vauban neighbourhood, Freiburg



Photo: Bérénice Preller

Housing groups

The intense engagement of the city with technical aspects of sustainable building and urban planning in Rieselfeld and Vauban though conveniently leaves aside more problematic social questions. Critics point here notably to the continuous issues of housing affordability and high priced rents in Freiburg (Klus 2013), including in Vauban and Rieselfeld which somehow paradoxically were built to resolve this situation. Vauban, for example, has turned into one of the most sought-after and accordingly expensive neighbourhoods in Freiburg (Mössner 2015b) with real-estate prices up to EUR 3.958/m² for existing dwellings in 2016 compared to the Freiburg average of EUR 3.300/m² (Höhl 2017). Several authors further highlight the processes of “social selectivity” (Hamiduddin 2015) leading to a relatively homogenous tenant structure especially in Vauban (Freytag et al. 2014), which mainly consist of middle class, educated families with young children. While this is in part a result of the physical characteristics of the neighbourhood, notably the car-reduced and sustainability aspects, Hamiduddin

and Gallent (2016) further put forward the important share of building groups as one contributing factor:

“The opportunity for self-selection (and deselection) was an important part of the social motive for building groups. [...] tenant participants believed that greater community cohesion would come from the collaborative nature of building groups from the outset. In reality, such enduring cohesion was found to form between households with similar educational backgrounds, similar values, and those occupying broadly the same socio-economic class” (Hamiduddin and Gallent 2016 :375).

The tendency to homogeneity is a general issue of building groups which Müller (2015: 263 and 341-342) attributes to the fact that such groupings occur on a voluntary basis, according to a range of attraction criteria like sympathy and similarity amongst members. In its inquiry of the building group phenomenon in Rieselfeld with regards to the contribution of this type of projects to sustainable neighbourhoods, Müller (ibid) finds that building group members tend to be more engaged and represented within the neighbourhood’s participative structures than other residents, hence providing them with more steering opportunities.

Nevertheless, Vauban and to a smaller extent Rieselfeld have also provided opportunities to alternative building practices in the form of aforementioned building groups but also through cooperative housing. Especially in Vauban, the beginning of the development saw the squatting of some of the former military barracks in opposition to their demolition. After long negotiations with the city administration, the SUSI – Selbstorganisierte Unabhängige Siedlungsinitiative (Self organised independent housing initiative) was able to realise its alternative and cooperative co-housing project which, similarly to a neighbouring student housing project, is still today located in several of the former barracks. Together with the persistence of some mobile squatters, this contributes to the image of “the neighbourhood’s aspects as tolerant and colourful” (Mössner 2015b: 977) and provided for the enthusiastic feeling of “Christiania” amongst early employees of the citizens’ association Forum Vauban (Sperling 2013).

Further than only retracing the approach and understanding Freiburg has on sustainable building, the engagement with the details of the development of the energy buildings standards and the Rieselfeld and Vauban neighbourhoods clearly illustrate that sustainable building transitions are not linear processes. They are rather contingent on a combination of local particularities, opportunities and agencies. The conceptualisation and realisation of sustainable building under the lead of the city administration have been punctuated by a range of tests, conflicts, negotiations and omissions. This is

well illustrated by the fact that the two neighbourhood projects have played out differently despite initial institutional and organisational settings that were not significantly different, as the city has reproduced the same approach in both.

4.2.2.3 Back to energy: retrofitting the building stock

Funding initiatives

While retrofitting the built environment is on the agenda since the city's update of its climate action plan in 1996, more concrete policies and programmes have only gained momentum since the early 2000s (see Fastenrath and Preller 2018). This is mainly a result of the city administrations' impression that with regards to new buildings the standards have been pushed as far as possible with the now quasi-passive level (Fr02). As for the LEH standards, the rationales for retrofitting are stated in the city's climate change strategy and its successive updates as a mean to reduce CO₂ levels (City of Freiburg 2011; 2007; 1996)

First encompassed under initiatives for heat preservation in existing buildings and since 2002 under the lead of a more global approach to energy savings, interventions prominently include the city's own building stock to demonstrate leadership in realising climate goals. This is complemented by a range of differentiated retrofit funding initiatives targeting home-owners on the base of different technological approaches, in order to do justice to the variation of building forms amongst the city's neighbourhoods (Fr04 and Fr05). The Kraftwerk Wiehre initiative, for instance, has aimed at encouraging the uptake of combined heat and power plants in an area with a high share of listed buildings and for which façade insulation was accordingly not an option (Freiburg-im-Breisgau - Energieeffizienz-Offensive für Blockheizkraftwerke in Freiburg 2017). The parallel initiative "Energiequartier Haslach" has targeted another neighbourhood characterised by a great variability in its building structure. The project has here focused on setting up and documenting model projects for different types of buildings to help animate house owners to realise retrofitting projects. Both projects have been realised under the lead of the local energy agency, following public tenders.

The city has though encountered only mitigated success on these initiatives, due to the restricted leverage she has on home-owners and has accordingly mainly worked with promotional material, and the set-up of expert networks (Fr04 and Fr05).

The Buggingerstrasse 50 project

The renovation project of a high-rise residential building from the 1960s located Buggingerstrasse 50 within the Weingarten-West neighbourhood (see Figures 4.6 and 4.13) is worth a closer look. The city has here had the necessary leverage, as it is the majority shareholder of the building's owner: the Freiburger Stadtbau GmbH (FSB), the largest housing company in the city. The FSB is the heir of a long

tradition of municipal interventions on housing policy as well as the building of social housing since the middle of the 19th century. These initiatives and the resulting building stock became the Freiburger Stadtbau GmbH around 2000 (Klus 2013). In 2006 the City Council unveiled its intent to privatise the Freiburger Stadtbau GmbH and accordingly the municipal social housing stock to help solve its financial distress. Vivid discussions and debates followed amongst political parties and the population and eventually led to a local referendum on the subject. After a very emotional and polarised campaign, the citizens refused the sale (Ibid for a detailed account). This event reveals the existence of strongly contrasting views regarding the provision of affordable housing in Freiburg. The front lines have persisted until today and are an important background to any discussion occurring in the city with regards to affordable housing (Ibid :182-184).

Between 2008 and 2010 the Buggingerstraße 50 was the first of four concrete blocks located next to each other to undergo a complete refurbishment. The project is Freiburg's latest flagship building project, as it is, so the city claims, the world's first retrofitted residential high-rise building that meets the passive house standard (Freiburg 2010a). To reach that standard, the building has been completely stripped down to its façade while the retrofit has involved a large number of technological interventions and experimentation, notably under the lead of the Fraunhofer ISE (BINE 2012). In the end, the process has proven extremely costly, raising questions on the commensurability between the realisation costs and the energy savings that can be reached. Accordingly, the retrofit has not been repeated to the same extent for the subsequent renovations of the neighbouring blocks. In sum, the project can be regarded foremost as a political statement, as criticised by one interviewee:

“I don't think it [Buggingerstrasse 50] is a good project. From the energy side maybe, but it is an example of a project that has been focused on the external effects and technically questionable and economically also questionable [...]. With huge efforts to increase the living space, to create more apartments that have a worse layout than previously, and well the worldwide first retrofitted passive high rise building. That was the objective, the label. [...] well it is a demonstration project, you need it as a vitrine, as you say in French”. (Architect, Fr20)

Figure 4-13 The Buggingerstrasse 50 project, Freiburg



Photo: Bérénice Preller

The project funding has been covered by a partnership of the Freiburger Stadtbau, the City of Freiburg, but also federal and state government funds earmarked from the urban development program Soziale Stadt (social city) which provided the bulk of the sum. Rents within the renovated building have been progressively increased from 4.82 €/m² to 6.67 €/m² (2014) which is though compensated by the smaller layouts and reduced energy costs according to the landlord. While the new rents remain under the Freiburg average of 7.35€/m² (City of Freiburg 2014), this is still an important increase, considering that tenants include recipients of social benefits. In addition, the new agreement on rent controls has been put up for 10 years only and is hence soon bound to expire. In that light, it is also worth mentioning that most of the former tenants have not moved back into the renovated Buggingerstrasse 50 building. They have instead chosen to stay in other renovated apartments administrated by the FSB.

Interview partners explain this mainly through the demographic structure of former tenants, as elderly people have wished to avoid to move twice within a short time period (Fr01 and Fr07).

In line with the social city programmes' funding conditions, a focus on social aspects and the realisation of consultation process were essential steps throughout the building's renewal. The neighbourhood's association Forum Weingarten organised several consultation events, including a resident survey conducted prior to the retrofitting. During the renovation, construction talks (Baustellengespräche) have allowed the residents to give further input, for example, regarding the building's colour, single components in the newly designed apartments and the community garden. After the finalisation of the building project, the social workers of the Forum Weingarten have trained residents to explain the correct usage of the building's new technological features to other residents. Prior to the move in, the Forum Weingarten has also brought potential residents together in a floor swap action (Stockwerksbörse) to meet their potential neighbours ahead and swap apartments if necessary. While these initiatives are now part of the lighthouse character of the building, they have not been repeated in an equal extent in the following retrofits in Weingarten. Part of it is grounded in the usual shortcomings of participative processes (including representativeness, time and financial costs, etc.). Despite these efforts, interviews with the landlord and the city administration seem to share the feeling that the community work with the tenants in Buggingerstrasse 50 was not monitored and mediated enough, which has led to conflictual situations in terms of raised expectations and implementation possibilities.

4.2.3 *An “extrospective” U-turn? Green City - Green economy*

As shown by the previous review, Freiburg can look back upon a rich experience of targeted building projects and policies that progressively mainstreamed sustainability aspects in the built environment, along with a broader set of policies addressing sustainability in the city. As already considered, several of these elements strongly resonate with dimensions of Noel Longhurst's (2013) concept of an alternative milieu. In particular the framing of Freiburg's green distinctiveness as a result of activism and protest against a nearby nuclear power plant, the burgeoning and very dense network of civil society, the strong presence of research centers, NGOs and business engaging specifically with questions of energy provision and last but not least the resulting pioneering solar building experiments in the 70s and 80s (see Figure 4.7) all concord to indicate a very particular local milieu. Similarly, distinctive experimentations around alternative ways of living in the Vauban neighbourhood, like the important share of building groups (Baugruppen) or cooperative projects like the SUSI (see Section 4.2.2.2), are indicative of the alternative lifestyle dimension characteristic to Longhurst's analytical heuristic. Strong interactions between these different actors within the policy-making process in the

1980s and 1990s have led to the development of, at the time, innovative and alternative environmental policies.

Slightly at odds with these alternative dimensions though, seems the city administration's current marketing slogan and corresponding documentation of urban sustainable best practice cases, following a breadth of international requests on Freiburg's sustainability initiatives (Röderer 2007; Zimmermann 2008) particularly around the two neighbourhoods of Vauban and Rieselfeld. The Freiburg Green City brochure claims that "Freiburg is regarded today as a model for the reconciliation of 'soft' ecology and 'hard' economics" (FWTM 2014 :2). The slogan has been used since the end of 2007 by the city administration and the local economic agency, the Freiburg Wirtschaft, Touristik und Messe GmbH (FWTM), as part of an effort for interurban competitive positioning. In the brochure, that claim is notably substantiated by highlighting the strong local expertise of local research centres and businesses on renewable energy technologies, especially solar energy. Through this, the brochure clearly brings to the fore the economic dimension of sustainability. The argumentation for sustainable urban initiatives then becomes one of "job creation" and "value creation" (Ibid :4) in a rhetoric strongly suggestive of neoliberal green growth seeing sustainability as an economic opportunity as well as a way to improve quality of life (Dale et al. 2016). Together with the central role given in the city's climate protection strategy to energy saving objectives and the aim to reach carbon neutrality (Freiburg 2011; FWTM 2014), the city administration enacts here a rather consensual socio-political fix around ecological modernisation (While et al. 2004; Lombardi et al. 2011; Long 2016). Other cities apply similar strategies which authors often criticise as limiting because they perpetuate a socio-economic status-quo rather than offering truly transformational sustainability options (see for instance Andersson 2016; McCann 2013; While et al. 2004).

At the same time though, it is interesting to note that it is the emphasis placed on local expertise that allows reconciling the green economy focus with the alternative and pioneering narrative discussed earlier (see Section 4.2.1). The above review of Freiburg's sustainable building policies development has indeed shown a strong technical focus as much from the side of the city as the 'energy scene'. This technical focus is accompanied by a strong feeling of pride and identification with Freiburg's achievements and technological pioneering spirit that is both salient to the narrative about the city's early and distinctive engagement with sustainability and to the touristic and economic development discourse.

4.3 Conclusion

The review of Luxembourg's relatively recent engagement with sustainable building, shows how the topic is understood and materialised along the lines of two co-existing agendas. While the first agenda combining energy efficiency and green growth is overly present, the second one on affordable housing appears rather latently, even though it has been just as much referenced by interview partners but less explicated.

These two agenda present a local meaning-making of sustainable building that materialises into three concrete building types: (1) highly energy efficient but normal looking houses, (2) visibly different flagship office buildings with the corresponding technological "show off" as a statement of innovativeness and (3) neighbourhoods with a range of urbanistic sustainability characteristics, that up to now have rather stayed at a programmatic level.

The globally recognised case study Freiburg gives the opportunity to trace back long-term socio-technical transitions in the building sector. Freiburg, often presented as best practice in urban sustainable development, has a long tradition of addressing sustainability in the built environment. What can be regarded as a successful policy development has though been increasingly accompanied by a raising marketisation at an international level of Freiburg as "Green City", which in the end is not very different to the approach that prevails in Luxembourg.

In what can be regarded as an urban entrepreneurial project (While et al. 2010), Freiburg's past achievements have been harnessed in a compelling story, seeking to ensure a convergence with economic development objectives (international branding, development of a green economy sector), as well as ensuring buy-in and the political support of citizens. But further than calling for a critical reflection of the selective assumptions behind this shift, it is worth raising the question of its impact on green urban policies that, at least at some point, were path-breaking and innovative. In her work on green city branding practices in Växjö, Andersson (2016) pointedly raises the issue of resulting policy path dependencies, notably in terms of less flexible green policy definition, earmarking of public funding and a skew towards flagship projects. This in turn and quite ironically, might be detrimental in precluding new and/or alternative sustainability policies, or to say it in the words of stakeholders in Freiburg lead to simply "rely on the laurels of the past".

5. UNCOVERING LEGITIMISING STORY-LINES OF SUSTAINABLE BUILDING IN LUXEMBOURG AND FREIBURG¹⁴

This second empirical chapter deals with the presentation and interpretation of the results gained through the discourse analysis. The focus is here much more on the way sustainable building is talked about in both cases. That analysis is, of course, informed and partly overlapping with the insights from the previous chapter, as in both case studies, the interviews and review of publicly available policy documentation already allowed me to uncover the broad lines of the sustainable building agenda. In Luxembourg green growth and affordable housing both co-exist and keep their policy-making relevance, even though the second dimension needs to liberate itself from the dominance of the first one. In Freiburg, there seems to be an apparent contradiction between the narrated pioneering and activist beginnings of Freiburg's green building path in the 1980s and 1990s on the one hand and the more recent green city marketing agenda on the other hand.

To better grasp how, in both places, these differential agendas can co-exist, it is worth taking a closer look at their rationales and justifications to better understand how differences are erased under the broader goals perpetuated by cohesive storylines around which actor coalitions regroup.

To that aim, this second empirical chapter uses first Dryzek's (2012) analytical tools and tabular representation of the content of environmental discourses to summarise the arguments and underlying values at stake in the sustainable building agendas of both cases. The two categories "entities" and "assumptions about nature relationships" retrace the ontologies at the base of the analysed discourse or, in other words, the worldview and the understanding of human-nature relationships that determine the "raison d'être" of sustainable building. The two further columns "agents and motives" and "rhetorical devices", provide more details on who holds a particular perspective on sustainable building, for what reason and with which arguments. Altogether, these elements add into a consistent "story-line" that is the common thread of a discourse. Hajer's definition of storylines is here useful to push the analysis even further. He indeed defines storylines as

"condensed statements summarising complex narratives, used by people as 'short hand in decision'. Identifying [them] brings out that people not merely refer to a problem with a fixed

¹⁴ The following chapter has been published in a different form in: Preller B (2018) Luxembourg: A Policy-Led Approach Caught Between Green Growth and Affordable Housing. In Affolderbach J and Schulz C Green Building Transitions - Regional Trajectories of Innovation in Europe, Canada and Australia. Springer, Cham, 159-88, and in Fastenrath S and Preller B (2018) Freiburg: The Emblematic Green City. In Affolderbach J and Schulz C Green Building Transitions - Regional Trajectories of Innovation in Europe, Canada and Australia. Springer, Cham, 69-97.

identity but are continually *changing the problem definition*” (Hajer 2006: 69, emphasis original; see also Lovell 2004).

Story-lines thus help to cement together different discourses by ensuring a common understanding (Hajer 1995).

In Luxembourg, the integrative “storyline” of both agendas coherently presents sustainable building as ensuring quality of life and reinforcing nation building. In Freiburg, the common threads demarcate the city as a distinctive, green, and clever place and thus also emotionally appeal to the citizen’s pride to be part of that place.

5.1 Luxembourg - Green building for quality of life and nation building

5.1.1 Energy efficiency and eco-technologies

Table 5-1 Green Growth and Eco-technologies: Contextual sense-making of sustainable building in Luxembourg

Green Growth & Eco-technologies			
Entities	Assumptions about nature relationships	Agents & Motives	Rhetorical devices
Finite fossil resources, climate change & security crisis Private sector = growth motor, state (Ministry of Economy) = enabler Economic diversification through eco-technologies and construction as high impact sector	Ecology & economy compatible 'Promethean' approach: technical fix and manageability	State (Economy), sectoral representatives (business and employees associations), key individuals (private developers) International obligations & commitments (Kyoto, EU 2020, etc.) Pursue (sustainable) growth through synergies between energy policy and economic development Reduce energy dependency & costs (negative for the economy) Position Luxembourg on the map: “branding” as innovative & dynamic	Quantitative analysis and standards/norms (CO ₂ objectives, energy efficiency, employment...) Rationalisation & efficiency via- administrative pragmatism Training and capacity building, positive for the whole sector Buzzwords: Green growth, Eco-innovation, Clean-tech, Circular economy, Smart cities...

Categorisation after Dryzek (2012).

The energy-efficiency and eco-technology approaches (Table 5.1) can be regarded as one perspective on green building in Luxembourg that historically started with the first to over time evolve into the second, more elaborated, one. The tabular analysis presented above relies mainly on the parliamentary records of the national regulations for energy efficiency in buildings as well as press documents from the main national newspapers (see Section 3.4.4). Due to the limited availability of natural resources (including fossil fuels and building materials), green building is seen as a way forward by rationalising resource consumption and securing the current (highly qualitative) way of living. Technological elements on the buildings' fabric, like insulation or heating and cooling systems, are largely seen as standardised and proved solutions to reach this rationalisation and hence central to the understanding of green building. As a result, the firms installing these technologies play a key role but with the state and business associations setting the tone through their role as facilitators. This encompasses on the one hand building standards for energy consumption and on the other hand adequate, mainly technical, training of the building sector. Economy (in the sense of efficiency and resource saving) and ecology are here understood as compatible. By extension, if Luxembourg is able to position itself at the forefront of ecological building technologies this will even more conveniently serve its economy, and by extension its model of affluence through sectoral diversification and reputation building. In addition to institutionalised actors, this agenda has been eagerly endorsed by a handful of proactive private developers, who have brought forward lighthouse projects as well as 'Leitbilder' as for instance the circular economy, hence also positioning themselves and their business as key interlocutors for the government.

Quantitative measurements of resource efficiency, economic impacts, standards, etc. are overly present in the narrative while the focus lies mainly on single building realisations, combined to currently in fashion concepts like "green growth", "circular economy" or "smart cities". In sum, sustainable building appears here as a technical but also manageable topic which primarily ensures continued economic growth. As such, green growth and eco-technologies approaches in Luxembourg fall into Bina's (2013) "business as usual" categorisation rather than constituting a deep systemic transition.

5.1.2 *Affordable housing and sustainability*

The second perspective on sustainable building (Table 5.2) in Luxembourg holds potential for deeper and more substantial changes. If implemented well this agenda may challenge the current development model more generally, by shifting priorities from economic gains to social and environmental objectives.

Table 5-2 Affordable housing and urban sustainability: Contextual sense-making of sustainable building in Luxembourg

Affordable housing and urban sustainability			
Entities	Assumptions about nature relationships	Agents & Motives	Rhetorical devices
Limited land resources and demographic pressures → accessibility to housing, density, mobility issues	«Tragedy of the commons»: Pressures, limits and (land-use) competition Holistic vision including society and quality of life	State (Housing and Sustainability) and institutionalised non-profit (Caritas, Okeocentre...) Absent citizens	Quantitative analysis (population growth, consumed hectares, commuter numbers...) Impediments to life quality: Mobility, accessibility, quality of life
Integrative and long-term planning (Public plans and large urban projects)		Key role of expert and wise public manager Persistence of a high-quality way of living (notably via health and accessibility aspects)	Barriers: time, cultural changes and motivation

Categorisation after Dryzek (2012)

The affordable housing and urban sustainability perspective is more concerned with societal aspects of green building, but in the narrative’s structuration still shows some key overlaps with the eco-technology perspective. The first and most obvious overlap exists in the primary justification of sustainable building as a response to limited natural resources, though here it is land and housing that are at stake rather than energy. As a result, quantitative measures are again rhetorically very present, this time mainly through demographics: population growth, numbers of commuters, the evolution of housing prices, etc. Similarly, the topic of qualitative living is the central line of argumentation but apprehended through health and accessibility to housing rather than economic wealth.

While the first perspective on green growth is publicly well articulated, the key trigger of the second one, housing affordability, is also very present in the public debate, which is also confirmed by the interviews I did in Luxembourg. Nevertheless, adequate measures have rather stayed at a programmatic and diffuse planning policy level, and have even been further restrained by implementation difficulties. As a result, concrete realisations and policy outputs are up to now significantly less visible and articulated than building projects emerging from the green growth agenda. Key actors in this more holistic approach to green building are again public agents taking the role of wise managers of the public interest together with some NGOs. Citizens, even though primarily affected, are however marginally active with the exception of consultations around planning documents and some rare single initiatives. Altogether, this second perspective still needs to become

more decisively enunciated and concretised to be truly transformational. As it is currently articulated around quality of life impediments that are presented as mainly behavioural and lifestyle dependent, and thus more diffuse to influence, the narrative takes the focus away from a re-assessment and re-evaluation of the role of past political decisions on infrastructure and settlements. This strongly resonates with Shove's (2010) contention that behavioural approaches might keep more imaginative, and potentially more transformational policy solutions at distance.

Crucially, despite their different aspirational tones, these different discourses are united through common language tropes that reveal a shared "storyline" around sustainable building as a solution for resource problematics, may they be economic, land or social, that are threats to the currently affluent and qualitative way of living in Luxembourg. Quantitative analyses are here a central element, common to both discourses, as well as the presentation of public authorities as rational agents, able to get to grips with these threads through regulative instruments.

This is further complemented by references to quality of life as an essential element for nation-building, which under the first agenda is outward looking to promote the country's international image, whereas in the second agenda it relates to a sense of belonging and identification, that needs to be put in perspective with the important inward commuting from the neighbouring countries Luxembourg faces daily, as well as the strong inward migration.

5.2 Freiburg – Pride and identification with the urban legend

As shown by the previous account (Chapter 4.2), Freiburg can look back on a rich experience of targeted building projects and policies that mainstreamed sustainability aspects in the built environment, along with a broader set of policies addressing sustainability in the city. This has though been complemented since the mid-2000s by a tendency of the city administration to marketise these achievements along the lines of a green economy approach that sees sustainability and growth as compatible.

In order to better apprehend the apparent contradiction between the narrated pioneering and activist beginnings of Freiburg's green building path in the 1980s and 1990s on the one hand, and the more recent green city marketing agenda, on the other hand, it is worth taking a closer look at the rationales and justifications presented by the city administration in relation with its sustainable building policies. This way, it will be possible to illuminate in how far this shift can be attributed to the gradual mainstreaming of green building initiatives through its uptake in the city's environmental policies from 1992 onward (Fastenrath and Braun 2016). And eventually, as argued elsewhere (see for instance Ray 2009), if this illustrates the subsuming of sustainability aspects to rather consensual political goals like

rising the attractiveness and profile of the city on an international scene or secure an economic strategy by supporting one of the city's key industries: the renewable (solar) energy sector.

The following analysis relies on city council resolutions from 1994 to 2015 dealing with the city's climate protection concept (Klimaschutzkonzept) formally adopted in 1996 as well as the "Green City Freiburg" brochure (FWTM 2014), and is complemented by Council resolutions addressing the project selected as micro case studies: Vauban, Rieselfeld and Buggingerstrasse 50. It further calls upon the review of newspaper articles from the main local printed media, the *Badische Zeitung* (see also 3.4.4). As buildings are identified as a key aspect to reach the city's climate change objectives, I have favoured the resolutions dealing with climate protection over the set of council resolutions dealing directly with energy efficiency policies in buildings (Freiburg LEH, retrofitting initiatives). This last set of resolution is indeed significantly more technical in scope and thus offer less relevant material regarding underlying rationales.

Based on the discursive analytical framework provided by Dryzek (2012; see also chapter 2) two phases can be distinguished in the city administration's justification lines for green building. The first one starts in the early 1990s with the passing of the bill for low energy standards in buildings (the Freiburg LEH, see Section 4.2.2.1) as well as the genesis of the two eco-neighbourhoods Rieselfeld and Vauban. The second phase started around the mid/end 2000s, following the increasing international attention towards Freiburg successful environmental urban policies.

5.2.1 Pioneering energy efficiency in housing (1990 – mid-2000s)

When Freiburg's energy bylaws were passed in 1992, they were ambitious and path-breaking, as they were significantly more stringent than the German federal regulations. Nonetheless, despite being significantly older in Freiburg, the approach to sustainable building through energy efficiency still shows many similarities to the present carbon calculus approach outlined in Luxembourg. The key rationale for acting on buildings revolves around global warming with a strong focus on the resulting looming crisis and dangerous consequences this will have at a global scale, such as flooding or droughts, the melting of the Arctic icecap, etc. (City of Freiburg 1994). Humanity's role in bringing forward this crisis through the consumption of fossil fuels leading to increases in CO₂ emissions is also particularly highlighted (Ibid; City of Freiburg 1996).

As a result, climate change is here mainly apprehended through CO₂ and energy aspects and leads to the corresponding calculative, managing and controlling procedures aiming to reduce energy consumption and hence emissions (see Table 5.3).

Table 5-3 Pioneering energy efficiency in housing: Contextual sense-making of sustainable building in Freiburg

Pioneering energy efficiency in housing			
Entities	Assumption about nature relationships	Agents & Motives	Rhetorical devices
Global warming & climate change crisis → Climate change = CO ₂ and energy issues Responsible & decisive city administration	Management & rationalisation	Local level = key player to reach sustainability; Political responsibility in reducing CO ₂ levels through energy efficiency Heat insulation and renewables in buildings as priorities following technical and economic feasibility Experts: Exchange networks & research organisations (Ökoinstitut, Fraunhofer ISE) Learning, through testing, models and expertise Cooperation with other actors impacting energy use (households, business, trade, industry, etc.)	Crisis vocabulary Quantitative analysis & targets (CO ₂ levels, energy savings...) Technical implementation issues and reporting (financial, practicality, controlling...) → precision Administrative steering & rationalisation

Categorisations after Dryzek (2012)

Quantitative analysis and rhetoric are thus central to the argument. They are also further constitutive of a display of the city as acting rationally on the basis of scientific knowledge provided by its strong collaboration with scientific institutes and experts (like the Institute of Applied Ecology – Ökoinstitut) as well as its involvement in international networks like the Climate Action Network or ICLEI - Local Governments for Sustainability. In that sense, the key general responsibility of a city administration in addressing CO₂ is particularly highlighted. Freiburg is taking an early, decisive but also political stand by leading on the crucial issue of climate change. Similarly, the international political climate change context and higher governmental level actions in climate change are only marginally evoked in favour of a more local/regional embeddedness.

Financial arguments are key from the beginning, following a prioritisation of potential actions according to their CO₂ reduction potential, implementation effort but also financial sustainability for the communal budget. Through this ranking criteria, heat insulation and energy saving measures in existing and new buildings, as well as the promotion of renewables have been propelled to the top of

the list (City of Freiburg 2007) and are to be implemented in cooperation the energy consumers: i.e. households, firms, etc.

In sum, while legitimation is here articulated around the urgency of the climate crisis, the challenges are presented as manageable due to the pragmatic and steering approach of the city administration, or as coined by (Caprotti and Bailey 2014: 1290) in a critical paper on eco-cities “a justification through recourse to techno-socially rationalised crisis discourses”. Learning is also central to that discourse. Hence for instance in Rieselfeld and Vauban, the city is keen to bring forward its concept of “learning planning”, which encompasses the idea of flexibility via re-adaptations throughout the progress of both developments.

5.2.2 Freiburg, *THE model green city (since the mid-2000s)*

As explained above, the city administration under the lead of its green mayor presented the “Freiburg Green City” slogan it developed jointly with the FWTM, the city’s economic development agency, by the end of 2007. The concept was initially met by scepticism due to a rejection of Anglicism (BZ 2008), the feeling it was reductive and not original (Röderer 2008; Ruskamp 2008) and further grieves that the decision was a unilateral and un-transparent move (BZ 2008; Ruskamp 2008). Nevertheless, the introduction of the slogan is symptomatic of an argumentative shift that can be further observed in the subsequent city council resolutions addressing the follow up of the City’s Climate Action Plan (Klimaschutzkonzept).

Instead of merely enacting the political responsibility of the city administration to act against climate change (see Table 5.1 above), the “environmental excellence” (City of Freiburg 2008) of Freiburg’s actions are brought to the forefront and have become a rationale per se. This shift can clearly be related to the perceived success of green building and environmental urban planning policies in the city’s two “flagship” neighbourhood projects Rieselfeld and Vauban and most certainly the international recognition and interest both projects have acquired (Röderer 2007). The city council resolution setting the presentation of Vauban as best practice case at the 2010 World Expo in Shanghai exemplifies this drive in showing how benchmarking and comparison to other cities have become central to the rhetoric (see Table 5.2). The documents indeed emphasise that Freiburg will be represented along a list of 55 other cities from around the world, even including the detailed list as an annexe (City of Freiburg 2008). In the same vein, the “Green City” brochure lists all the awards and prizes Freiburg has received over the years.

The city feels compelled to stay ahead of the highly competitive city branding game by perpetuating its reputation and even pioneering character on sustainable urbanism (see Andersson 2016 for similar examples on green branding in Växjö, Sweden or McCann 2013 on Vancouver). A consequence has

been to raise the Climate Protection concept ‘to the next level’ by aiming to reach urban climate neutrality by 2050 with a bulk of the planned measures addressing again energy efficiency and renewables in buildings. As in the previous phase (see Table 5.1), the city relies again heavily on expert reports, as well as quantitative and financial analysis conveying anew a sense of sound and responsible management.

The corresponding resolution (City of Freiburg 2011) but also the related inserts on climate neutrality in the “Green City” brochure are both sprinkled with a value-loaded vocabulary seeking to state the innovativeness and even boldness of the approach, successively qualified as “a vision”, “a climate (or energy) revolution”, “ambitious targets”, “exceptional measures, way over current climate change efforts”, etc.. The substantial technological retrofit of the Buggi 50 high-rise building follows the same logic of displaying progressive and innovative green expertise not the least following the involvement of experimental technologies and research centres like the Fraunhofer ISE in its completion.

Table 5-4 Freiburg THE Green City: Contextual sense-making of green building in Freiburg after 2000

"Freiburg THE Green City"			
Entities	Assumption about nature relationships	Agents & Motives	Rhetorical devices
Green reputation and scientific expertise as economic advantages	Ecology and economy compatible: "green" growth and jobs axed around environmental (solar) technologies Social sustainability = quality of life/green lifestyle	The city has a responsibility as model & pioneer: always outperform itself, be the first mover	The Wyhl-legend & proximity to nature (Black Forest)
Freiburg as a distinctive place: Seedbed for the Green Party & civic traditions of environmental fight (Wyhl nuclear protest in the 70s)		High implication of the FWTM (local economic development agency)	Moral rhetoric of political inclusiveness and participation (Mössner 2015a) and identification of inhabitants as strongly supportive and in favour
Post Carbon /Carbon neutrality (study 2011) as the next level		Other governmental scales (national/international) as enablers but not ambitious enough	Value loaded vocabulary: Innovative, future-oriented, progressive city
		Business, research centres & university: Green City Cluster Freiburg	Comparison to other cities

Categorisations after Dryzek (2012)

This green branding is clearly indicative of an urban entrepreneurialism agenda (Andersson 2016; Long 2016; McCann 2013; While et al. 2004) believing in the compatibility of the environmental and the

economy agenda arising from growth potentials in environmental technologies and green reputation and expertise. In a top-down move similar to the set-up of the Eco-Innovation cluster in Luxemburg, the Green City Cluster initiative has been launched in 2009 by the FWTM in order to better coordinate and bundle the expertise of the large number of Freiburg located companies and research centres in the field of renewables, notably solar energy, as well as the touristic side effects to Freiburg's international reputation. The economic dimensions of Freiburg's green branding and marketisation strategies are already clearly stated in the 2008 Council resolution dealing with the display of Vauban as best practice case at the Shanghai World Expo:

“Through the nomination at the exhibition of Vauban contribution, the FWTM [...], in accordance with its business purpose, gets the unique chance to present the City of Freiburg in one of the world's strongest economic region over a period of six months. Due to the direct thematic closeness to the World Expo slogan “BetterCity – Better Life”, it will be possible to point out the excellence of environment-related topics in Freiburg. This will lead to a sustainable promotion of Freiburg's firms and service providers, the University and the research centres, especially in the environmental economic sector. In addition, opportunity to present [Vauban] offers an outstanding chance for place promotion, for a positive development of the economy, science and research. Also tourism, especially technical, congress and fair-related tourism for Freiburg will be significantly improved due to the presentation”. (City of Freiburg 2008)

As already clear through the analysis of the interviews, the city's self-representation of its model green character relies heavily on narrative references to the specific history and context of the strong environmental consciousness of the civil society and the opposition to the Wyhl nuclear plant. Freiburg is “the birthplace of the environmental movement” while “milestones” of Freiburg's “green profile” are displayed in a timeline starting with the resistance to Wyhl in 1973 (FWTM 2014) which gains the status of a foundational myth central to Freiburg's identity as green city. This is complemented by conveying the sense that Freiburg's environmental sensitivity spurs from the strong connection to the seemingly pristine natural surroundings of the Black Forest, in a utopian and aesthetic spatial imaginary in line to what (Longhurst 2015) observed in Totnes.

This is where the observed alternative experimentations in line with Longhurst's (2013) milieu heuristic meet with the apparently contradictory green growth rhetoric and justifications of the city administration to provide for a coherent “storytelling” (Andersson 2016) around a “sustainability policy

fix” (While et al. 2004). This ‘fix’ ultimately serves to secure support for the perpetuation of the socio-economic status quo, despite claims of green innovativeness.

Mössner (2015a, 2015b) and Kronsell (2013) have already thematised this politically instrumentalised process at work in Freiburg, which consists in the re-appropriation of the moral elements of political inclusiveness and tolerance conveyed by the activist dimensions. The ultimate aim is to reach internal consensus, legitimate and secure the green growth ambitions at stake in the Green City project that thus becomes a morally compelling and hence undebated or “apolitical” project (Mössner 2015a). Hajer (1995 :272) calls this discursive process “black boxing”, as it makes appear some things as natural, hence suppressing latent contradictions and contestations. The re-appropriation further participates to an identity buoying by the citizens, which similarly to Andersson’s (2016) findings for Växjö, relies on a sense of pride for their city’s green distinctiveness “and can also ensure the continuity of green policies by [the citizens’] support” (Ibid: 1210, See also McCann 2013).

The fact that most of the citizen-initiated alternatives today presented as exemplary, like the large share of cooperatives and house building groups in Vauban or the large amount of passive housing, have been rather incidental, not to say initially opposed by the city’s administration (e.g. Späth and Rohrer 2015) is here conveniently by-passed. Similarly, socially problematic aspects, like the continuous challenges in housing accessibility and affordability (Klus 2013) or the social self-selectivity (Hamiduddin 2015) and social homogeneity of Vauban (Freytag et al. 2014) are mainly left aside in the narrative. Nevertheless, there is raising awareness amongst stakeholders that to keep its pioneering status rather than only relying on the “laurels of the past”, Freiburg will also have to take a stronger hold on the social dimension of sustainability (BZ 2008; Bochtler 2012).

While the storyline in Luxembourg cements two discourses with different aspirations and rationales, in Freiburg it rather serves to validate the evolution of the discourse as a “re-organisation of the past” (Hajer 1995: 40). Here the strong activist dimensions are progressively incorporated as a consensual point of reference into the narrative. Mössner (2015) points towards a politically instrumentalised process aiming at reaching consensus and structured around moral elements of political inclusiveness and tolerance. The legitimation further appeals particularly to emotional elements, by bringing to bear the pride and identification of stakeholders with the distinctiveness of their city.

6. DISCUSSION: SUSTAINABLE BUILDING IN LUXEMBOURG AND FREIBURG DIVERGENCES AND COMMONALITIES

6.1 The Multi-level Perspective a useful heuristic...but then not?

Sustainable building as a study object brings about several preliminary implications that, as outlined in the introductory chapter, necessitates theoretical and methodological approaches able to account for complexity, diversity, and interrelations, or as put by Law (2003) to engage with “messiness”. As extensively discussed in Chapter 1 and Chapter 2, sustainable building encompasses a plurality of understanding and material objects, which ultimately relate to differential conceptions of sustainability and its objectives. In addition, the achievement of the sustainability agenda in the built environment, whatever is understood by it, is a multi-process and multi-stakeholder endeavour that covers several functional domains (Rohracher 2001; Bharathi 2013).

Following its inspiration from co-evolutionary and institutional thinking (Geels 2004), the Multi-Level Perspective on sustainability transition offers an enticing research approach to help conceive the socio-material complexity of sustainable building across a broad range of dimensions and connections (see Chapter 2). When applied to the sustainability project, the heuristic looks at dynamics between actors, (technological) materialities and differently structured socio-economic and cultural institutions to conceive how sustainability change is mediated or impeded (Elzen et al. 2004; Markard et al. 2012). As such it also provides for the pathway understanding of sustainability as a fluid and constantly evolving concept that is advocated in critical contributions from the urban sustainability literature.

The Multi-Level Perspective has thus informed my overall research approach but also, in particular, the design of the empirical inquiries in each case study. This is particularly visible in the design of the discussion tables during the interactive actor workshops and the interview guide (See Appendix 9.3), following the overall framework provided by the GreenRegio research project. Throughout the empirical interview phase as well as the subsequent content analysis and interpretation of the data, the MLP has widened my attention towards the role of institutional factors that provide the influential societal context in which sustainable building unfolds (landscapes) but also towards dominant practices and ways of doing that might contrive sustainable buildings (regimes). At the same time it has narrowed down my inquiry to specifically seek key turning points, or what Temenos et al. (2017) call “particular moments”, broadly understood as configurations between actors or single (building) events or policy initiatives, that have determined the direction of the sustainable building agenda in both case studies (niches). In sum, the MLP with its three analytical levels of structuration provides a

conceptual map and language to conceive the complexity of sustainable building transformations, thus also helping to orient the empirical inquiry.

Besides though, I still have to acknowledge a certain discomfort with the significance and practicability of the Multi-Level heuristic for the reporting and analysis of my findings. In a recent review of the engagements between transitions studies and human geography Schwanen (2017 :8) sharply pin-points the reason for a similar discomfort to the “disciplinisation” of transition studies into geography, as geographers’ uptake of the transition agenda goes along a “disciplinary obligation” to inquire “spatial phenomenon and scalar politics”. While these lines of inquiry are useful additions to the classic application of transition along technological and market-based perspectives (for e.g. Geels 2002), they have also lead to reworking, qualifying, selecting, simplifying and differentiating the analytical tools provided by the transition perspective to allow them to fulfil geography’s disciplinary focus (Ibid). Bringing into play the whereabouts of transitions and notably the causal role of not only place specifics but also relationalities inevitably creates the necessity to bend the nested hierarchy of the MLP analytic, as Affolderbach and Schulz (2016 :1952) also point out:

“A relational perspective questions the hierarchies and logics of the multi-level perspective where innovations are clearly situated within contained niches instead pointing to how they develop and spread in different ways connecting formerly unconnected places, actors and practices [...]. Such a perspective dissolves the clear boundaries of niches and regimes, changes the relationship between different levels and disconnects the alignment and hierarchy between distinct levels and spatial scales. Even further, if transition processes are understood as assembled or simultaneously co-produced by agents at multiple scales, we need to question the origin of innovations and inherently the role of ‘niches’ as test beds.”

Accordingly, Schwanen pursues, transitions are for geographers “matters-of-concern rather than matters-of-facts” (2017 :8). Eventually, the geographical perspective reintroduces a complexity that blurs the apparent conceptual neatness and abstractive clarity of the Multi-Level heuristic which provided for its attractiveness in the first place.

As a result, my report of the case study findings under the lead of the Multi-Level Analysis does not explicitly engage with the three nested levels either, hence running similar to many contributions applying the conceptual lens of the Multi-Level Perspective (Smith et al. 2010; Genus and Coles 2008). The geographical lens indeed only exacerbates a recurrent critique regarding the operationalisation of the analytical levels across the transitions literature, as already discussed in Chapter 2 (see for instance the general contributions of Smith et al. 2010; Genus and Coles 2008 and of Næss and Vogel 2012; Moore et al. 2014; O'Neill and Gibbs 2014 with a focus on the built environment).

Still, as conceded by Smith et al. (2010) on the base of a review of empirical works dealing with the Multi-Level Perspective, the “qualitative narrative accounts” produced certainly are useful to provide rich descriptions of the “emergent and reflexive phenomena” characteristic of sustainability. The longitudinal and circumstanced description of key policy and building initiatives provided in Chapter 4 allow indeed to follow through on a contextual mix of actors, contingencies and structural factors that help grasp the characteristics, practices but also individuality of sustainable building in Luxembourg and Freiburg.

Reaching that understanding is an essential starting point, but eventually raises the question of what to do with it? The Multi-level’s conceptual allure in allowing holistic inquiries of multiple and complex socio-material interdependencies runs the risk to turn in practice to rather anodyne descriptions that do no justice to the variegated nature of sustainable building as an object of socially mediated and contested processes. As such, the Multi-Level analysis comes short to provide explanatory and critical engagement on what drives the sustainable building agenda and with what consequences. Similarly to that argument, Bailey and Caprotti (2014 :1802) qualify socio-technical transition perspectives as “descriptive theorisations” they deem helpful to understand the nature of change processes brought about by, in their case, the green economy. But they strongly advocate complementing that insight with explanatory and critical theorisations, as in their view these are indispensable to grasp the phenomenon in its entirety, i.e. the mechanisms through which particular understandings are defined and what their implications are. Even worse, as some critics point out (Lawhon and Murphy 2012; Affolderbach and Schulz 2016), the initially technological and technocratic focused understanding of sustainability in transitions work using the MLP runs the risk to bias the inquiry of transformation along the lines of existing parameters, reproducing mainstreamed and dominant ways of doing. In that wake it also produces smooth, longitudinal historical accounts with strong structural focuses, conveniently editing out alternatives, contingencies and contestations.

Returning to the argument of Schwanen (2017) these issues have put geographers into the position to need to extend and combine the MLP with other more critical (urban) concepts (e.g. Murphy 2015; Bulkeley et al. 2011a and 2011b; Hodson and Marvin 2009). It is precisely through an engagement with that literature that I have posited a discursive examination in complement to the MLP from the onset of my work. Several authors further point towards the need for more empirical work under the geographical agenda of the MLP to help overcome the above operationalisation problematics (Smith et al. 2010; Gibbs and O’Neill 2014).

Nevertheless, and to avoid running in circles, despite my empirical engagement with the MLP I see no alternative to its conceptual augmentation in order to produce mindful research results that critically reflect and explicate the rationales behind transformations the framework has merely helped to

describe and contextualise. Castree's (2004) strongly encourages researchers to reflect on what they intend to contribute to in shaping environmental debates, farther than to engage solely with implementation technicalities. Accordingly, given the multi-faceted and socially mediated dimension of sustainable building in situated contexts, could this not have more effectively studied by applying other, more critical, urban theories that do not need theoretical additions but can stand alone?

In a contribution from 2003, Whitehead uses for instance insights from political economy, notably the regulation theory, to inquire the political and socially constructed manifestation of sustainable cities at particular times in particular places. Through his single conceptual approach, he is both able to critically untangle structural regularities of (regulatory) process that perpetuate the current regime of accumulation in capitalism, while at the same time acknowledging the situatedness of the sustainable city in particular milieux (Whitehead 2013).

6.2 Energy and economy, a preferred and shared understanding of sustainable building?

Following, the previous point of discussion that reflects on theoretical aspects of my work, this second sub-chapter engages more with the empirical evidence gained.

I have studied two urban areas that both address sustainable building as a central field of action in their sustainability policy strategies. I have in particular focused on their situated individuality to explain their diverse engagements with the topic. Still though, despite historically different contexts and time frames in their approach to sustainable building, both case studies show a political engagement with the subject that enrols into the green economy and ecological modernisation conception of sustainability. That agenda mainly assumes a compatibility between sustainability and economic objectives thanks to the role of (innovative) energy efficient technologies (Bina 2013; Bailey and Caprotti 2014).

In Luxembourg, that conception is politically and publicly clearly assumed with eco-construction as a technological and sectoral based policy that should contribute to the country's economic diversification and nation branding. In Freiburg, that agenda is maybe less bluntly stated, following the narrative's enrolment of green activism and political openness within the "Green City" approach. At the same time though, the corresponding brochure (FWTM 2014) does not shy away to present the economic aspects of sustainability by highlighting the local sectoral and technical expertise, as well as the international attention the city receives as a best practice model. This strong economic and outward facing dimension of sustainable building is an application of "policy boosterism" as discussed in the literature of urban entrepreneurialism (McCann 2004; Andersson 2016). Both places seek indeed to competitively position and brand themselves as innovative and model urban areas thanks to their

pioneering environmental constructions and initiatives. In Luxembourg, this is rather a future-oriented goal whereas in Freiburg this means securing a position coming from past achievements.

At the same time though, the evolution of the narratives seems somewhat reversed: In Luxembourg, the more comprehensive and transformative understanding of green building is still second to the current green growth agenda but the pressing housing affordability issue is pushing its way forward. In Freiburg beginnings of the sustainable building agenda were certainly pioneering, the local building bylaw being much more stringent than the national ones, while the active involvement of environmental activists provided for innovative approaches going much further than what the city initially intended. The current rationales though, which mainly rely on the not always intended achievements of the past, are very mainstream in their use of green growth rhetoric and environmental technologies to economically position the city.

In some ways, the analysis of sustainable building policy rationales in both places illustrates very conventional policy approaches to urban sustainability. Many cities have taken that road, as documented in critical contributions on the neoliberal practices at stake in (urban) environmental policies (Brand 2007; Gibbs and Krueger 2007; Jonas et al. 2011; Bina 2013; Whitehead 2013; Bailey and Caprotti 2014). This body of literature is therefore particularly useful to answer the question raised at the beginning of my work regarding the transformational dimension of sustainable building in both cases. Following Lombardi et al. (2011), I understand transformational here in the sense that sustainable building endeavours imply a fundamental reassessment of values and lifestyle.

The analytical concepts of a “sustainability policy fix” and “eco-state restructuring” developed by While et al. (2004; 2010; see also Lombardi et al. 2011 and Long 2014) are also particularly relevant to answer that question. Both concepts seek indeed to inquire how sustainable development agendas selectively incorporate ecological or sustainable goals within existing local policy and governance dilemmas, most notably as “part of the search for a spatio-institutional fix to safeguard growth trajectories in the wake of industrial capitalism’s long downturn, the ‘global ecological’ crisis and the rise of popular environmentalism” (While et al. 2004 :551). The use of discourse analysis has been here especially able to reveal the similar characteristics of that fix across both case studies: reliance on similar worldviews that see the economy and the environment as compatible, a focus on carbon accounting and control strategies including a strong justification for intervention on the base of quantitative analysis, the central mobilisation of energy efficiency and its technical dimension, and accordingly a strong reliance on the authority of experts, learning, and testing that all contribute to construct an image of public authorities as rationally and orderly steering the process.

6.3 Further considerations and research needs

The two theoretical entry points I use for my work both highlight the importance of agential interactions in bringing about change. The MLP especially engages both with (1) the role of socio-economic actors and their interactions as agents of change at the niches and regime level but also (2) their entrenchment in context-specific social and cultural systems that create opportunities for dynamism but also constraints through lock-ins and path dependencies.

The argumentative discourse perspective, notably as advocated in discursive institutionalism (Schmidt 2008, 2011) also engages with agents' ability to bring about change following the performative dimension of discourse. Here too, discourses are set within a constricting institutional context but at the same time, the interactive processes between agents can influence institutional change, as agents are able to critically engage with their institutional context. Both approaches thus conceive the agents-institutions relationship as a dynamic, rather than deterministic process that would only follow institutional rules and path dependencies.

In addition, the GreenRegio project's research design is also built around strong engagement with individuals in their role of experts on sustainable building. First, via reliance on their testimony as a source of data, but even more so following the participative design of the study. This aspect of the research has been central to grasp the often tacit realities, interests, and strategies but also concrete achievements and involvements of a large range of actors from the public, private, and non-governmental sector. While my findings engage with sectoral actors and organisations involved in sustainable building as well as with their discursive activities, they do not engage at a more individual level with the role of actors' perspectives on sustainable building transformation.

A few contributions in the literature on socio-technical transitions point towards the necessity to engage not only with sectoral categories of actors but also with the role of individual actors in negotiating and influencing sustainability transformations (Avelino and Wittmayer 2016). North and Nurse (2014) for instance inquire business' motivations to engage with sustainability and provide a typology along competitiveness and 'good for business' opportunities, compliance requirements, but also ethical pressure and self-commitment. Similarly, Gibbs and O'Neill (2013) also engage with green entrepreneurs under the framework of the MLP to better understand their role in facilitating a shift towards green building. While they also encountered a combination of different entrepreneurial motives other than economic ones, they further highlight that single actors fluidly move between categorisation as conventional or green business and need to be conceived in relation to their wider networks. That realisation is further taken on by Spinks (2015), who uses social network analysis to capture and explain the connections amongst professionals involved in a BREEAM building project. He

shows how these connections enable or impede action, as professionals with different understandings of sustainable building influence each-others within the network.

A related side project to this work (Schulz and Preller 2016) also inquires more precisely the complex geographical and relational actor constellations providing sustainable building services in Luxembourg and distinguishes between three categories:

(a) businesses created with an explicit if not exclusive focus on 'green' aspects identifying themselves with the 'niceness' of their approach,

(b) established service firms having reoriented their core business towards sustainability services (e.g. heating fitters specialising in eco-efficient technologies and renewable sources) notably to proactively engage with new market opportunities, and

(c) firms occasionally and rather coercively adapting their service portfolios due to regulatory pressure, strong client demand or other external factors.

Further than a typology, this work also shows that innovative projects are most often initiated by single pioneering actors, receive inspiration from abroad and remain embedded in international networks and lastly include more than the usual corporate and public actors notably from the non-profit sector (Ibid :287-288).

Altogether, these contributions only start to sketch a field of inquiry around the emergence of new actors, new actor constellations and especially their individual motivations for joining, influencing or impeding sustainable building transformation that offers promising ground for further research.

7. CONCLUSION

This work starts with the realisation that sustainable building has become a subject of high policy emulation to address sustainability challenges and more specifically climate change and economic development objectives. This is ostensibly visible in publications and regulations produced by international organisations and at the European level (International Energy Agency 2013; IPCC 2014; European Commission 2010; European Parliament 2002 and 2010). A review of these policy publications in Chapter 1 has helped to sketch the outlines of two broad conceptions of what sustainable building can entail. On the one hand, a technical approach revolving mainly around questions of energy efficiency and resource savings in buildings. On the other hand, an urban planning oriented agenda that is concerned with buildings through their embeddedness in a larger urban infrastructure, seen as the more relevant level of action to implement sustainable development. While the first agenda revolves mainly around individual building as end of pipe solutions to address climate change, the second one finds its main expression in sustainable neighbourhood projects, planned around different types of interventions of which resource saving in buildings is but one aspect.

Further than the wide conceptual discrepancies and realisation specifics between both agendas (see Moore and Rydin 2008), Chapter 1 has exposed in details how the practicability of each of these agendas entails a wide range of interventions across several functional domains (see for instance Bailey and Caprotti 2014 with regards to the green economy): regulatory, economic, cultural, social, natural etc. This extends along the whole lifespan of buildings and neighbourhoods from their inception up to their use and eventual retrofit and in close interactions with a wide range of stakeholders from the private, public, and civil society realms. Similarly, existing building objects labelled as sustainable widely differ and following only a simple visual check seem to have nothing to do with each other: conventional looking but highly energy efficient housing, against high-tech buildings with fancy additions like green walls or automatically shading roof panels, radical low impact developments (Pickerill and Maxey 2009) with organic forms or straw ball insulation, or again whole urban neighbourhoods with features like district heating systems, building orientation that facilitate air cooling, passive solar use and shading or water retention.

Hence the primary interest, as well as the objective of this work, has been to try to better grasp the causes and mechanisms that explain such large differentiation of sustainable building. I have accordingly posited sustainable building as a socially constructed object, in opposition to a conception of it as an objective pre-given and uncontested reality. In this I follow calls made in the literature to critically unpack the assumptions and interpretations behind that diversity, as a way to avoid partial

engagements that run the risk of closing down on a broader range of alternatives to sustainable futures, in favour of engaging solely with the practicalities and technicalities of its implementation (e.g. Guy and Farmer 2001 :140; Castree 2004). Critical literature on the contested and intrinsically political nature of sustainability (Burningham and Cooper 1999; Jones 2002; Connelly 2007; Mansfield 2009), especially the urban sustainability literature that sees sustainable cities as the outcome of complex political, economic, social and cultural re-negotiation and adaptations occurring within specific settings (Sharp 1999; Gibbs and Krueger 2005; Houghton 2005; Whitehead 2003) has provide the necessary canvas to operationalise my research endeavour. Through the detailed investigation of the particularities of two urban cases, I have not sought to provide ready-made solutions on what is right or wrong in sustainable building, but rather to illuminate the rationales that lay behind local understandings of sustainable building, and thus encourage reflections on the practicalities and materialisations of the sustainable building agenda.

Under the light of my research interest, objectives and premises, this chapter restates and summarises the three main contributions of this work:

- (1) Following calls in the literature, this work offers an empirical engagement with sustainable building as diverse and socially mediated rather than an ontologically given, steady and uncontested policy object (Section 7.1.1).
- (2) Through the detailed engagement with the situated circumstances but also discursive justifications that explain the diversity of sustainable building in each case study, this work uncovers similarities across the case studies in the form of a hold onto ecological modernisation and green economy understandings of sustainability. While the articulation of that agenda is specific to each case, it still highlights common articulations of sustainable building within mainstream socio-economic conditions (Section 7.1.2).
- (3) At last, following again calls in the literature (e.g. Smith et al. 2010; O'Neill and Gibbs 2014), this work also offers an empirical example of the application of the geographical agenda of the MLP on sustainability transitions, which has stayed rather at a theoretical level of discussion (Section 7.2).

7.1 An empirical contribution engaging with sustainable building as a diverse and socially mediated object

The first contribution of my work is to actively engage with the diversity of sustainable building, following observations in the literature that policy engagement tends to conveniently ignore that diversity (Guy and Farmer 2001). My work thus presents two empirical accounts of how sustainable building policies are played out and how their content varies in relation to the geographical context in which they are situated.

I have here first reconstructed the spatially specific combination of socio-material entanglements of sustainable building transformations in two particular urban cases (see Chapter 4). This first, merely descriptive step, has helped me to map what the dimensions, actors and realisations of sustainable building are in a particular place, following their embeddedness into socio-economic structures and historical developments. Building upon this preliminary step, I have then used discourse analysis to further reconstruct how sustainable building is argued for and legitimised in each case study (see Chapter 5). This second step allows me to move beyond the practicalities of sustainable building's diversity to better comprehend the rationales of these choices, as the way a policy problem is constructed and negotiated between different parties conditions its solutions (Hajer 1995; Hajer and Versteeg 2005; Feindt and Oels 2005; Scrase and Ockwell 2010). Here the objective was to retrace why transitions towards sustainable building in a particular place are a certain way and not another, following the ideologies and interpretations that underlay it. This further participates to re-introduce dynamism in the analysis of sustainable building change, in contrast to linear accounts relying too heavily on historical paths.

7.1.1 The situated circumstances and processes of sustainable building policies in context

Luxembourg's recent momentum around sustainable building shows co-existing understandings of what sustainable building encompasses. The first one is prominently articulated into the economic policy field around a range of regulations, incentives, formalised encounters between public actors and the building sector, as well as strategic studies. It engages with buildings under the lead of energy efficiency and green growth. My inquiry has here notably pointed towards the central role played by the country's strategic objective to perpetuate economic dynamism and prosperity. Drawing upon the economic importance of the construction sector due to the steady activity growth brought about by the financial boom, sustainable building is mainly a diversification opportunity in the government's growth strategy. This approach further combines with already well-articulated policies and practices

to address energy efficiency in buildings encouraged by compliance to European regulative and climate engagement to reduce CO₂, as buildings and transport are amongst the most CO₂ intensive sectors of the country.

That first agenda is seconded by another one that focuses on affordable housing and housing shortages but appears rather latently, even though both agendas somehow relate to each other, as housing shortage stems from the need to accommodate the growing population brought in by the economic activity the first agenda seeks to perpetuate. At the policy level, this second agenda is mainly represented in the country's urban planning policies and notoriously crystallises around contested questions regarding the density of urban development in Luxembourg. Buildings are here conceived in a more holistic and interactive relationship with their surroundings while social equity aspects are a key rationale. Nevertheless, adequate measures have rather stayed at a programmatic, planning policy level and have even been further restrained by implementation difficulties. Still, that agenda is so far very present in public debates and in the media due to its tangible reality that can be experienced daily by every inhabitant of the country.

Crucially, despite their different aspirational tones, the discourse analysis has helped to illuminate how both discourses are nevertheless united through common language tropes that reveal a shared "storyline" around sustainable building as a solution for resources problematics. These resource problematic, may they be economic, land-related or social, are threats to the currently affluent and qualitative way of living in Luxembourg. This is further complemented by references to quality of life as an essential component for nation-building, which under the first agenda is outward looking to promote the country's international image, whereas in the second agenda it relates to an inward-oriented sense of belonging and identification. This last aspect particularly builds upon to the strong inward commuting from neighbouring countries, as well as inward migration, Luxembourg has faced following the attractiveness of its labour market.

Ultimately, both agendas present a local meaning-making of sustainable building that materialises into three concrete building types: (1) highly energy efficient but normal looking houses, (2) visibly different flagship office buildings with the corresponding technological 'show off' as a statement of innovativeness and (3) neighbourhoods with a range of urbanistic sustainability characteristics, that up to now have rather stayed at a programmatic level.

The case study of Freiburg-im-Breisgau (D) and its engagement with sustainable buildings stretches over a longer time frame than Luxembourg, as the first concrete policy step in form of a municipal energy efficiency regulation for new housing constructions dates back to 1992. The inquiry has here outlined a progressive institutionalisation of the sustainable building agenda over time, which needs though to be nuanced under consideration of a strong narrative on Freiburg's reputation as forerunner

and model city with respect to sustainable urbanism. As the interviews have shown, stakeholders share indeed a common frame of reference through a compelling and smoothly progressing narrative that harnesses the pioneering and bottom-up origins of Freiburg's engagement with sustainability. Sustainable building is here contextualised in a historical continuum of local distinctiveness. A recurring theme is the pulling role of the local "energy scene", a loosely defined mix of environmental activists, technical pioneers and architects, researchers from the local solar and sustainability-focused research centres, as well as interested citizens.

Accordingly, the local awareness and acceptance around questions of alternative energy sourcing is a central backbone to Freiburg's approach to sustainable building, which stems from a back and forth between expectations and experiments on the side of the local "energy scene" and policy initiatives from the city administration. The initial policy approach to sustainable building in Freiburg focuses on housing energy efficiency and is also a very technical and quantitative approach, with detailed regulative obligations that have been successively straightened. Expertise as well as testing and demonstration are the necessary counterparts to these regulative provisions and have conveniently combined with two planned large-scale neighbourhood projects intended to provide affordable housing for Freiburg's steady population increase. The two neighbourhood developments in Vauban and Rieselfeld were the city's key testing grounds for energy efficient housing. Both projects have though also provided for an enlarged understanding of sustainable buildings in relation to their urban context, while a more recent focus on building retrofits shows a return towards mainly technical and single building solutions. In parallel, these policy developments have though been increasingly accompanied by a raising marketisation at the local and international level of Freiburg as "Green City". The focus is here heavily placed on the economic revenues that can be harnessed through the local businesses' expertise on sustainable, notably solar, building techniques, as well as the locational positioning of Freiburg as a policy model for urban sustainability.

Again, the discursive analysis of these two agendas has allowed me to go beyond the analysis of a historical path and structural conditions to illuminate the rationales articulated in the sustainable policy choices made in Freiburg. Similarly to Luxembourg, it has especially permitted to uncover a storyline that cements the evolution of the discourse as a re-organisation of the past (Hajer 1995 :40) where the strong activist dimensions have been progressively harnessed as a point of reference into the narrative. Authors like Mössner (2015) already highlight this politically instrumentalised process aiming at reaching consensus by calling onto moral elements of political inclusiveness and tolerance. Accordingly, sustainable building legitimation strategies in Freiburg appeal strongly to emotional elements, by bringing to bear the pride and identification of stakeholder with the distinctiveness of their city.

7.1.2 *A convergence around mainstreamed technocentrist and green economy concepts*

Further than the empirical added value of a conscious engagement with sustainable building as a diverse and socially constructed endeavour, this work also practically illustrates that despite historically different contexts, rationales and time frames, sustainable building policies in both case studies converge in engaging with the subject under the lens of ecological modernisation and the green economy (Hajer 1995; Bina 2013). This is clearly visible in the analysis of the discursive argumentation for sustainable building in both places. In accordance with set targets and approaches at the international climate change level, the focus lies heavily on energy efficiency objectives and their realisation through highly technical or/and pioneering building initiatives that are advertised as front-runners: “the first passive high-rise retrofit”, “the first triple certified building”, etc.... The objectives for both Freiburg and Luxembourg are to demarcate themselves through innovativeness and attract international attention as model urban areas as well as inward investments. In Luxembourg, this is rather a future-oriented goal whereas in Freiburg this means securing a position coming from past achievements and that has been driven by local particularities. This points towards a differentiation between a later follower (Luxembourg) that has looked for concepts and inspiration towards existing best practice cases like Freiburg, who appears as an early mover. Under the pressure to keep its leader status, Freiburg has increasingly taken on a strong economic and outward facing dimension of sustainable building which is symptomatic of an international tendency towards “policy boosterism” as discussed in the literature of urban entrepreneurialism (McCann 2004; Andersson 2016).

At the same time though, the prominence of this agenda can, in Luxembourg and Freiburg, be related to local circumstances. In Luxembourg, it relates to the existing social consensus to keep the existing model of affluence and economic development. Sustainable building and eco-technologies are a mean to diversify the economy, while outwardly positioning the country as innovative and competitive. In Freiburg, the development and uptake of that agenda by the city administration is less clear-cut. The “Green City” policy approach is indeed rather justified by the city a reaction to manage and cope with its international reputation and the increasing demands for best practices exchanges on the existing track record. At the same time though, interviews, as well as policy documents like the Green City brochure (FWTM 2014), heavily focus on the economic aspects of sustainability by highlighting the sectoral technical expertise and knowledge advantage that local artisan firms have acquired. The analytical concepts of a “sustainability policy fix” and “carbon calculus” developed by While et al. (2004; 2010; see also Lombardi et al. 2011 and Long 2014) are here particularly helpful, as they highlight how urban sustainability agendas selectively integrate pre-existing local problematics around efficiency and economic growth imperatives under a neoliberal logic (Bailey and Wilson 2009).

Accordingly, the proposed solutions are rather consensual evolutions than revolutions, as they narrow down to what fits well with the existing socio-economic paradigm and leave aside more radical alternatives (Ibid; Bina 2013; Lombardi et al. 2011).

7.1.3 An empirical application of the Multi-Level Perspective

Lastly, this work has also provides insights with regards to the operationalisation of the MLP, as many existing publications in geography engage foremost theoretically with that framework. Following a breath of contributions that focus prominently on the need for conceptual improvements to the MLP to account for the spatial and political dimensions of sustainability transitions, authors have indeed posited the necessity to increase empirical contributions (Smith et al. 2010; O'Neill and Gibbs 2014). In line with existing contributions that emerged from the engagement of human geographers with the socio-material aspects of transitions to sustainability at large (see for instance Schwanen 2017 for a summary), I have from the conceptualisation of my study complemented the MLP with a more interpretive stance through discourse analysis. I have indeed asserted the studied object, sustainable building, as a socially constructed object, encompassing multiple and contested meanings that are contextually contingent following their articulation and re-articulation with social, economic and political circumstances of particular places. Discourses help to better comprehend why the transitions towards sustainable building in a particular case is a certain way and not another by revealing how actors justify and argue for sustainable building.

As discussed in Chapter 6 the MLP informed my overall research approach and in particular the design of the empirical inquiries in each case study. The framework has indeed focused my attention towards the role of steering institutional factors that provide the societal context in which sustainable building is embedded (landscapes), as well as dominant practices and ways of doing that might contrive sustainable buildings (regimes). In parallel, I have narrowed down my inquiry to specifically seek key turning points that have impacted the direction of the sustainable building agenda in both case studies (niches). Both focuses transpire in the design of the interview guide, as well as the selection of key micro-case studies (building projects, actors, and policies) that local stakeholders helped to preliminary map as some of the key turning points (see the section on collaborative workshops in Chapter 3).

But while the MLP's three analytical levels of structuration provide a helpful conceptual entry point and language to navigate the empirical inquiry, I still have to acknowledge a certain discomfort with the framework's significance for the reporting and analysis of the findings. Further than the difficulty to operationalise the three levels (see also discussions in Chapter 2 and 6), the necessity to go beyond a description of sustainable building transformations and their local circumstances in order to provide explanatory and critical depth led me to use yet another body of literature, critical of green economy

processes at the urban level in my empirical chapters (see notably Chapter 4). While Bailey and Caprotti (2014) openly argue in favour of multi-theoretical frameworks to study the complexity of green economy transition pathways, the imperative to complement the MLP as much in my theoretical than in my empirical engagement with the framework blurs, in my view, its initial conceptual clarity and accordingly makes it lose some of its theoretical allure versus other approaches to critically inquire sustainability induced transformations.

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LIST OF ACRONYMS

BREEAM	Building Research Establishment Environmental Assessment Method
CDEC	Conseil pour le Développement Economique de la Construction (Business association of the building sector – Luxembourg)
CNCD	Conseil National de la Construction Durable (National council for sustainable building – Luxembourg)
CRTE	Centre de Recherche pour les Technologies de l'Environnement (Research center on environmental technologies – Luxembourg)
DGNB	Deutsche Gesellschaft für Nachhaltiges Bauen (German green building certification)
IEA:	International Energy Agency
EneV	Energieeinsparverordnung (German energy efficiency ordinance)
(E)NGO	(Environmental) Non-Governmental Organisations
FWTM	Freiburg Wirtschaft, Touristik und Messe GmbH (Freiburg's city marketing agency)
HQE	Haute Qualité Environnementale (French green building certification)
ICLEI	International Council for Local Environmental Initiatives
IFSB	Institut de Formation Sectoriel du Bâtiment (Training institute for the building sector – Luxembourg)
IPCC	Intergovernmental Panel on Climate Change
ISE	Fraunhofer Institute for Solar Energy Systems
ITR	Interactive Transition Research
K.I.O.S.K	Kontakt, Information, Organisation Selbsthilfe und Kultur (Neighbourhood initiative in Rieselfeld, Freiburg)
LEED	Leadership in Energy and Environmental Design
LEH	Freiburg Low Energy Housing Standard
LENOZ	Lëtzebuenger Nohaltegkeets-Zertifizierung fir Wunnéngen (Luxembourgish sustainability certification for housing)
MLP	Multi Level Perspective on socio-technical transitions
nZE	Nearly Zero Energy building
OAI	Ordre des Architectes et des Ingénieurs-Conseils (Business association for architects and engineers – Luxembourg)
SUSI	Selbstorganisierte Unabhängige Siedlungsinitiative (Self organised independent housing initiative – Vauban, Freiburg)
TIS	Technological Innovation System
UNEP	United Nation Environment Programme

9. APPENDIX

9.1 Interview partners Luxembourg

Function	Interview Date	Sector	Code
Private employee	05.08.2014	Industry	Lux01
Researcher	18.08.2014	Research	Lux02
Sectoral representative	02.09.2014 24.09.2014	Industry	Lux03 Lux07
Sectoral representative	02.09.2014 08.10.2014	Industry	Lux04 Lux08
Consultant	03.09.2014	Industry	Lux05
Public employee	11.09.2014	Policy	Lux06
Architect	23.10.2014	Industry	Lux09
Developer	04.12.2014 20.02.2015	Industry	Lux10 Lux11
Developer	16.03.2015	Industry	Lux12
Public employee	22.06.2015	Policy	Lux13
Researcher	08.07.2015	Research	Lux14
Architect	17.07.2015	Industry	Lux15
NGO representative	28.07.2015	Non-governmental	Lux16
Public employee Public employee	13.10.2015	Policy	Lux17
Consultant	16.10.2015	Industry	Lux18
Member of the government	02.12.2015	Policy	Lux19

9.2 Interview partners Freiburg-im-Breisgau

Function	Interview Date	Sector	Code
Public employee	08.09.2014	Policy	Fr01
City employee	09.09.2014	Policy	Fr02
City employee	09.09.2014	Policy	Fr03
Public employee	10.09.2014	Policy	Fr04
City employee	10.09.2014	Policy	Fr05
Researcher	30.10.2014	Research	Fr06
NGO representative	30.10.2014	Social	Fr07
Public employee	31.10.2014	Policy	Fr08
City employee	17.11.2014	Policy	Fr09
City employee	18.11.2014	Policy	Fr10
City employee	19.11.2014	Policy	Fr11
City employee	19.11.2014	Policy	Fr12
Sectoral representative	20.11.2014	Industry	Fr13
Architect	20.11.2014	Industry	Fr14
Sectoral representative	17.12.2014	Industry	Fr15
City employee	18.12.2014	Industry	Fr16
City employee	24.02.2015	Policy	Fr17
City employee	24.02.2015	Policy	Fr18
Architect	25.02.2015	Industry	Fr19
Architect	25.02.2015	Industry	Fr20
Member of the city council	24.03.2015	Policy	Fr22
Architect	24.03.2015	Industry	Fr23
Sectoral representative	26.03.2015	Industry	Fr24

9.3 Interview guide

1. Introduction

- What is your professional background? (professional biography)
- How and when did you first get interested and/or involved in green building?
- What is your understanding of green/sustainable building (generally and case region specific)?

2. Case study region: either/and 2.1 or 2.2

2.1 Case study region (background interviews only)

The following questions are aimed at obtaining specific information complementary to the findings gathered during the expert workshops. They focus on the interviewee's personal viewpoints regarding the specificities of the case study region, its current evolution and the potential future of green building.

- Main triggers / motivations: When / Why did green building become a topic? (housing vs. commercial, city vs. region)
- How is it generally understood/promoted/debated? (e.g., policy driven, marketing/image building, climate change mitigation, urban planning, resilience, etc.)
- Were there any key events / turning points in respect to green building? (e.g., key steps/developments)
- Who were/are the key actors promoting green building? (internal/external) => only if not covered in workshop
- Institutional specificities: What are favourable factors and main barriers/challenges? (role of formal and informal networks and exchange platforms)
- What are the sources of information, inspiration and reference? (Import of practices, technological innovations, standards, policies)
- In your opinion, does the city hold a leadership role nationally/internationally in green building? In what way? What are the main reasons/factors?
- What is/are the greatest achievement(s)? (Export of ideas, models, best practices, etc.)
- Any missed opportunities? Failed projects?
- What are the current trends? Outlook & future developments?

2.2 Micro case studies

- What were the origins? What were the main objectives?
- Who were the key actors? What was/is your role?
- What are the general characteristics (description of case study)?
- Were there any role models and sources of inspiration? Any technological, organisational, legislative, organisational, economic, social, ecological innovations?
- Success / non-success factors (evaluation)?
- Existing transfer / learning initiatives from case study (i.e. export, exchange platforms, expert networks, etc.)?
- What development/future perspectives are there? Next steps?
- Would you do anything differently if you had to do it again?

3. Individual parcours

- Sources of inspiration: People, projects, ideas, concepts?
- Did you change your perspectives/focus over time?
- Knowledge export/dissemination/transfer: Are you involved in any expert networks, knowledge and learning

Wrap-up: Additions, comments, questions

This interview guide has been translated in French and German to conduct the interviews in Freiburg im Breisgau and Luxembourg.

9.4 Coding tree

Framing of sustainable building

- Economic/sectoral opportunity
- Innovation
 - Technical
 - Learning/training
- Social
 - Community building
 - Affordable housing
 - Quality of life
 - Other social aspects
- Address climate change
 - Environment/ecology
 - Resources
- Type of projects
 - Urban planning
 - Housing/commercial
 - Specific projects
 - New/greenfield
 - Retrofit
 - Mainstream
- Policies and incentives
- Locally relevant (vernacular)

Drivers for sustainable building

- Demonstration
 - Marketing/image building
 - Innovativeness
 - Feasibility/experimentation
- Compliance
 - Legislation
 - Funding
 - Follow the leader
- User demand
- Social considerations
 - Affordable housing
 - Community building
 - Quality of life
- Ecological/environmental considerations
 - Resource scarcity
 - Resilience
 - Climate change
- Economic
 - Economic vs green
 - Investment/rent premium
 - Growth/competitively
 - Savings

Realisation conditions

- Need for models
 - Pioneers

- Lighthouse projects
- Policy coherence
 - Communication/critical mass
 - Streamlining/organisation
- Legitimate actors
 - Users
 - Bottom up/to down
 - Public/private

Barriers

- Affordability
- Lengthy process
- Policy priorities
 - Lack of strategy
 - Lack of continuity
 - Lack of incentives
- Burdensome
 - Procedural
 - Costly
- Technical complexity
- Cultural/resistance to change
- Skills/knowledge

Actors involved

- Key individuals/organisations
- Non profit
- Public
- Political
- Economic/corporate
- Academic/scientific community

Evaluation

- Attitude change over time
- Next steps
- Lessons learned
- Missed opportunities
 - Failures
- Success
 - Transfer and learning effects