

# Contents

## Part I Background

<b>1 The Construction Industry and Lifespan</b>	<b>3</b>
1.1 Ageing of a Building	3
1.1.1 Ageing	3
1.1.2 Obsolescence	4
1.2 Buildings, Construction Products and Lifespan	5
1.2.1 Technical Lifespan and Tools for Evaluating It	5
1.2.2 Functional Lifespans of Products and Buildings	9
1.3 Factors Influencing Lifespan	12
1.3.1 Impact of Maintenance on Lifespan	12
1.3.2 Maintenance and Maintenance Rules	12
1.3.3 Adaptability	13
1.3.4 Product Reuse and Recycling	13
1.4 Tools for Assessing Performance	16
1.4.1 Taking Account of Lifespan Using Standards	16
1.4.2 Lifespan Consideration in Tools of Impact Assessment	17
1.5 General Analysis	18
1.5.1 The Window Example	18
1.5.2 Recycling and Recovery	19
1.5.3 EUROCODE 0	19
1.5.4 Concerning Maintenance	20
1.5.5 Adaptability	20
1.5.6 Optimization	20
1.5.7 Need	21
1.6 Conclusion	21
References	22
<b>2 Building and Sustainable Development</b>	<b>25</b>
2.1 Background	25
2.1.1 Definitions	26
2.1.2 Principle: Analysis of Life Cycle	27
2.1.3 Eco-Design and Eco-Building Materials	28

2.2	Indicators and Sustainable Development Data. . . . .	30
2.2.1	Indicators and Indices. . . . .	30
2.2.2	Emissions from the Sector and Its Products. . . . .	33
2.2.3	The Characteristics of the Data and Data Sources. . . . .	36
2.3	Tools for Ecological Performance . . . . .	39
2.3.1	Standards and Guides. . . . .	39
2.3.2	The Analytical Tools for Evaluating the Performance . . . . .	41
2.3.3	The Models. . . . .	42
	References. . . . .	42
<b>3</b>	<b>Research Analysis . . . . .</b>	<b>45</b>
3.1	Conclusion . . . . .	47
	References. . . . .	47
 <b>Part II Method and Application</b>		
<b>4</b>	<b>Method . . . . .</b>	<b>51</b>
4.1	Wall Unit . . . . .	51
4.1.1	Delimitation of the System. . . . .	51
4.1.2	Scales of Evaluation. . . . .	54
4.1.3	Summary . . . . .	54
4.2	Choice of Indicators and Means Employed . . . . .	55
4.2.1	General Principles of Evaluation . . . . .	55
4.2.2	Choice of Indicators . . . . .	56
4.2.3	Availability and Choice of Data Sources . . . . .	56
4.2.4	Data Sources. . . . .	57
4.2.5	Contradictory Data in Environmental Databases . . . . .	59
4.3	Presentation of the Method. . . . .	63
4.3.1	Analysis of Performance of the Wall Unit and the House . . . . .	63
4.3.2	Taking Impact of Utilization into Account. . . . .	64
4.3.3	Development of the Method. . . . .	65
4.4	Conclusion . . . . .	69
	References. . . . .	70
<b>5</b>	<b>Application. . . . .</b>	<b>71</b>
5.1	Data Selected . . . . .	71
5.2	Indicator Values . . . . .	71
5.3	Definition of the Element Under Study . . . . .	78
5.3.1	Chosen Solutions (Phase 2) . . . . .	80
5.4	Environmental Data: Values of GHG Indicator . . . . .	82
<b>6</b>	<b>Results and Analyses. . . . .</b>	<b>83</b>
6.1	Cumulative GHG Emissions for the Walls (Phase 5). . . . .	83
6.2	Relative Proportions of Emissions from Insulation and Coatings for the Duration of the Function. . . . .	86

6.2.1	Solutions Having the Best Performance . . . . .	86
6.2.2	Second-Order Solutions . . . . .	87
6.3	Demonstration of the Uncertainties Inherent in the Official Indicators . . . . .	88
6.4	Impact of Service Life of Technical Solutions on GHG Emission . . . . .	89
6.4.1	Evolution of Emissions (Phase 6) . . . . .	89
6.5	Comparison of Technical Solutions . . . . .	91
6.6	Conclusion . . . . .	92

### **Part III Conditions for Generalization and Prospects**

<b>7</b>	<b>Conditions for Generalizing the Approach . . . . .</b>	<b>95</b>
7.1	Analysis . . . . .	95
7.2	Modelling Elements . . . . .	95
7.2.1	Evolution of the Impact of a Product <i>i</i> Over Time . . . . .	95
7.2.2	Evolution of the Impact of a Product <i>i</i> According to Its Service Life . . . . .	96
7.2.3	Analyses . . . . .	96
7.2.4	Impact of Service Life and Technological Improvements . . . . .	97
7.2.5	Comparison of Products . . . . .	97
<b>8</b>	<b>Limits . . . . .</b>	<b>99</b>
<b>9</b>	<b>Interest and Prospects . . . . .</b>	<b>101</b>
9.1	Contributions to a Sustainable Development Approach . . . . .	101
9.2	Research Prospects . . . . .	102
9.2.1	Impact of Lifetime for a Building . . . . .	102
9.2.2	Multidisciplinary Reflection for a Sustainable Development Approach . . . . .	103
9.2.3	Indicators and Evaluation Tools . . . . .	103
9.2.4	Deeper Understanding of the Relative Contributions of the Component Parts of a Building . . . . .	103
9.2.5	Recycling . . . . .	103
9.2.6	Adaptability . . . . .	104
9.2.7	Total Number of Buildings and Demand . . . . .	104
9.2.8	Impact at Different Scales . . . . .	105
	References . . . . .	105
	<b>Conclusion . . . . .</b>	<b>107</b>
	<b>Appendix 1: Référentiels . . . . .</b>	<b>109</b>
	<b>Appendix 2: Tools of Sustainable Development Assessment . . . . .</b>	<b>117</b>

**Appendix 3: Management Protocol Database on  
Environmental and Health Declaration of  
Construction Products (INIES) . . . . . 121**

Lifetime Environmental Impact of Buildings

Mequignon, M.; Ait Haddou, H.

2014, XIII, 121 p. 25 illus., Softcover

ISBN: 978-3-319-06640-0