Appendix

Appendix A – List of experts

Table A1 List of experts per stakeholder group, city, and date

No.	Expertise	Stakeholder group	City	Date
1	Manager	IC company	Cape Town	February/2019
2	CEO	IC company	Cape Town	February/2019
3	CEO	IC company	Cape Town	February/2019
4	CEO	IC company	Cape Town	February/2019
5	Technical manager	IC company	Cape Town	February/2019
6	Construction engineering and management	Academic	Cape Town	February/2019
7	Sustainability in construction	Consultant	Cape Town	February/2019
8	Director	Real estate developer	Cape Town	February/2019
9	Project management	Government housing agency	Cape Town	February/2019
10	Affordable housing	Architect	Cape Town	February/2019
11	Engineering and design	Consultant	Cape Town	February/2019
12	Project manager	Real estate developer	Nairobi	January/2019
13	Architecture and construction	Academic	Nairobi	January/2019
14	Sales administrator	IC company	Nairobi	January/2019
15	Technical representative	IC company	Nairobi	January/2019
16	Engineer	IC company	Nairobi	January/2019
17	Technical representative	IC company	Nairobi	January/2019
18	Sales administrator	IC company	Nairobi	January/2019
19	Affordable housing	Architect	Nairobi	January/2019
20	Engineering and design	Consultant	Nairobi	January/2019
21	Construction economics and management	Academic	Nairobi	January/2019
22	Land and construction policy and economics	Academic	Nairobi	January/2019
23	Quantity survey	Academic	Nairobi	January/2019
24	Architect and project lead	Real estate developer	Addis Ababa	December/2018
25	Engineer	Real estate developer	Addis Ababa	December/2018
26	Engineer	Real estate developer	Addis Ababa	December/2018
27	Block manufacturer	Supplier	Addis Ababa	December/2018
28	CEO	IC company	Addis Ababa	December/2018
29	Product developer	IC company	Addis Ababa	December/2018
30	CEO	IC company	Addis Ababa	December/2018
31	CEO	Architect	Addis Ababa	December/2018
32	Engineering and design	Consultant	Addis Ababa	January/2019
33	Alternative building technology	Consultant	Addis Ababa	January/2019
34	Policies and building codes expert	Consultant	Addis Ababa	January/2019

Appendix B –Global Warming Potential of wall systems in product and construction stages.

Table B1. Global warming potential of wall systems in product and construction stages.

Wall systems	Product stage	Construction stage	Total
	kg CO2-eq/m^2	kg CO2-eq/m^2	kg CO2-eq/m^2
Hollow concrete masonry (CW1-HCM)	53.85	1.35	55.2
Stonemasonry (CW2-SM)	9.04	9.04	18.08
Brick masonry (CW3-BM)	52.65	3.7	56.35
Expanded polystyrene with rebar (PW1-EPSR)	54.22	9.98	64.2
Expanded polystyrene with magnesium board (PW2-EPSMB)	59.12	8.66	67.78
Light gauge steel (FW1-LGS)	40.32	0.91	41.23
Precast reinforced concrete (FW2-PRC)	54.35	9.83	64.18
Cross laminated timber (FW3-CLT)	32.95	2.97	35.92

Appendix C – Lifecycle inventories of the eight external wall systems

Table C1. Composition of the exterior concrete masonry wall for the case study of Addis Ababa

Wall type	Inventory	Stage	Amount	Unit	Remarks
CW1-HCM	Hollow concrete blocks	A1	0,14	m3	Locally produced, 20 kms
	Mortar	A1	21,00	kg	Locally produced, 90 kms
	Base plaster	A1	21,00	kg	Locally produced, 90 kms
	TR-32EURO3	A4	7,52	tkm	
	Diesel building machine	A5	0,95	MJ	Diesel mixer, 2.5kW, 100 liters of mortar for 1h

Table C2. Composition of the light gauge steel wall for the case study of Addis Ababa

Wall type	Inventory	Stage	Amount	Unit	Remarks
	Steel, low-alloyed	A1	9,94	kg	30% locally produced, 100 kms

FW1-LGS					70% international supplier. 5000 kms
	Gypsum plasterboard	A1	5,40	kg	Locally produced, 100 kms
	Stone wool	A1	2,00	kg	Locally produced, 100 kms
	TR-16EURO3	A2	0,99	tkm	
	Electricity medium voltage, Ethiopia	A3	0,72	MJ	Roll-forming, 7.5 kW, 300m/h
	Sheet-rolling steel for light gauge steel production	A3	9,94	kg	Sheet-rolling steel
	TR-3.5EURO3	A4	1,73	tkm	Local construction site

Table C3. Composition of the stone masonry wall for the case study of Nairobi

Wall type	Inventory	Stage	Amount	Unit	Remarks
CW2-SM	limestone	A1	512,00	kg	Locally extracted, 100 kms
	Mortar	A1	21,00	kg	Locally produced, 100 kms
	TR-16EURO3	A4	53,30	tkm	Local construction site
	Diesel building machine	A5	0,95	MJ	Diesel mixer, 2.5 kW, 1h 100 liters of cement

Table C4. Composition of the brick masonry wall for the case study of Cape Town

Wall type	Inventory	Stage	Amount	Unit	Remarks
CW3-BM	Sand lime brick	A1	0,14	m3	Locally produced, 20kms
	Mortar	A1	21,00	kg	Locally produced, 90 kms
	Base plaster	A1	21,00	kg	Locally produced, 90 kms
	TR-16EURO3	A4	7,52	tkm	
	Diesel building machine	A5	0,95	MJ	Diesel mixer, 2.5kW, 100 liters of mortar for 1h

Table C5. Composition of the expanded polystyrene wall with inner rebar for the case study of Nairobi

Wall type	Inventory	Stage	Amount	Unit	Remarks
	Concrete	A1	0,05	m3	Locally produced, 100 kms

PW1-EPSR	polystyrene expandable	A1	3,78	kg	Internationally sourced, 5000 kms
	Fiber mesh	A1	0,17	kg	International sourced, 5000 kms
	Reinforcement	A1	3,11	kg	Locally produced, 100 kms
	NI-Mortar	A1	42,00	kg	Locally produced, 90km
	TR-7.5EURO3	A2	17,51	tkm	
	Electricity, medium voltage, Kenya	A3	0,88	MJ	Used for expanding EPS
	TR-3.5EURO3	A4	17,51	tkm	Local construction site
	Diesel building machine	A5	8,75	MJ	Used for mobile crane, 105kW, 5min per element

Table C6. Composition of the prefabricated reinforced concrete wall for the case study of Nairobi

Wall type	Inventory	Stage	Amount	Unit	Remarks
FW2-PRC	Concrete	A1	0,20	m3	Locally produced, 100 kms
	Reinforcement	A1	1,97	kg	Locally produced, 100 kms
	TR-32EURO3	A2	52,08	tkm	
	Electricity, medium voltage, Kenya	A3	7,41	MJ	Assumption of 20MJ per element
	TR-16EURO3	A4	52,08	tkm	Local construction site,100kms
	Diesel building machine	A5	11,67	MJ	Mobile crane, 105kW, 5min per element

Table C7. Composition of the expanded polystyrene wall for the case study of Cape Town

Wall type	Inventory	Stage	Amount	Unit	Remarks
PW2-EPSMB	Polystyrene expandable	A1	5,04	kg	International supplier, 5000 kms
	Fiber mesh	A1	0,20	kg	International supplier, 500 kms
	Gypsum plasterboard	A1	2,97	kg	Locally produced, 100 kms
	Base plaster	A1	120,00	kg	Locally produced, 100 kms

	TR-7.5EURO3	A2	12,82	tkm	
	FP-ELCT	A3	1,17	MJ	Used for expanding EPS
	TR-3.5EURO3	A4	12,82	tkm	Local construction site
	Diesel building machine	A5	21,00	MJ	Used for mobile crane, 105kW, 5min per element

Table C8. Composition of the cross-laminated timber wall for the case study of Cape Town

Wall type	Inventory	Stage	Amount	Unit	Remarks
FW3-CLT	CLT	A1	0,10	m3	Locally produced, 100 kms
	Base plaster	A1	9,00	kg	Locally produced, 100 kms
	TR-7.5EURO3	A2	4,89	tkm	
	Electricity, medium voltage, South Africa	A3	43,87	MJ	Production of CLT
	TR-3.5EURO3	A4	4,89	tkm	Local construction site
	Diesel building machine	A5	4,38	MJ	Mobile crane, 105kW, 5min per element

Transport-related assumptions

For concrete and mineral resources like gravel or sand a lorry >32t, for bricks a lorry 16-32t, for EPS and wood a lorry 7.5-16t and for lightweight, prefabricated elements a lorry 3.5-7.5t was chosen.

Table C9. Net vehicle weight and average loads for the analyzed transport vehicles

Transport Mode	Lorry 3.5-7.5t	Lorry 7.5-16t	Lorry 16-32t	Lorry >32t
Net vehicle weight [t]	5	7.5	10	18
Average load [t]	0.98	3.27	5.76	11.68

Factory Processes

The energy demand of the factory processes is mostly derived from the data of the field trip. It is assumed that all factory processes are using electricity from the grid and do not work with diesel generators.

Table C10. Assumptions made for the factory processes

Process	Power demand	Explanation
Light gauge steel machine	7.5 kW	Roll-forming steel (Kedir, 2019)
Expanding polystyrene	0.2323 kWh/kg of EPS	Mould machine (Grube, 2017)

Construction Processes

As the construction on-site can require a lot of energy for the operation of the building machines, but the processes are not always done in the same way – sometimes by hand and sometimes with a machine – assumptions on the energy consumption had to be made. The energy consumption can be calculated by knowing the power demand and the time duration the machine is used. The energy source is mostly either diesel or electricity.

Table C11. Assumptions made for the construction processes

Process	Power demand	Explanation
Electric cement mixer	1.5 kW	Small mixing machine with a mixing volume of 110 litres, electric motor (Fraisse, n.d.)
Diesel cement mixer	2.5 kW	Small mixing machine with a mixing volume of 110 liters, diesel motor (Fraisse, n.d.)
Cement mixing truck	83 kW	Engine used for mixing of concrete with a capacity of 5m^3 (Rexroth and Spicer, n.d.)
Concrete vibrator	4 kW	Diesel-powered vibrator used to compact the concrete (Multiquip, 2014)
Tower Crane	244 kW	High capacity crane for high-rise building (Muhammed, n.d.)
Mobile Crane	105 kW	Mobile Crane of up to 30m (Liebherr, 2018)