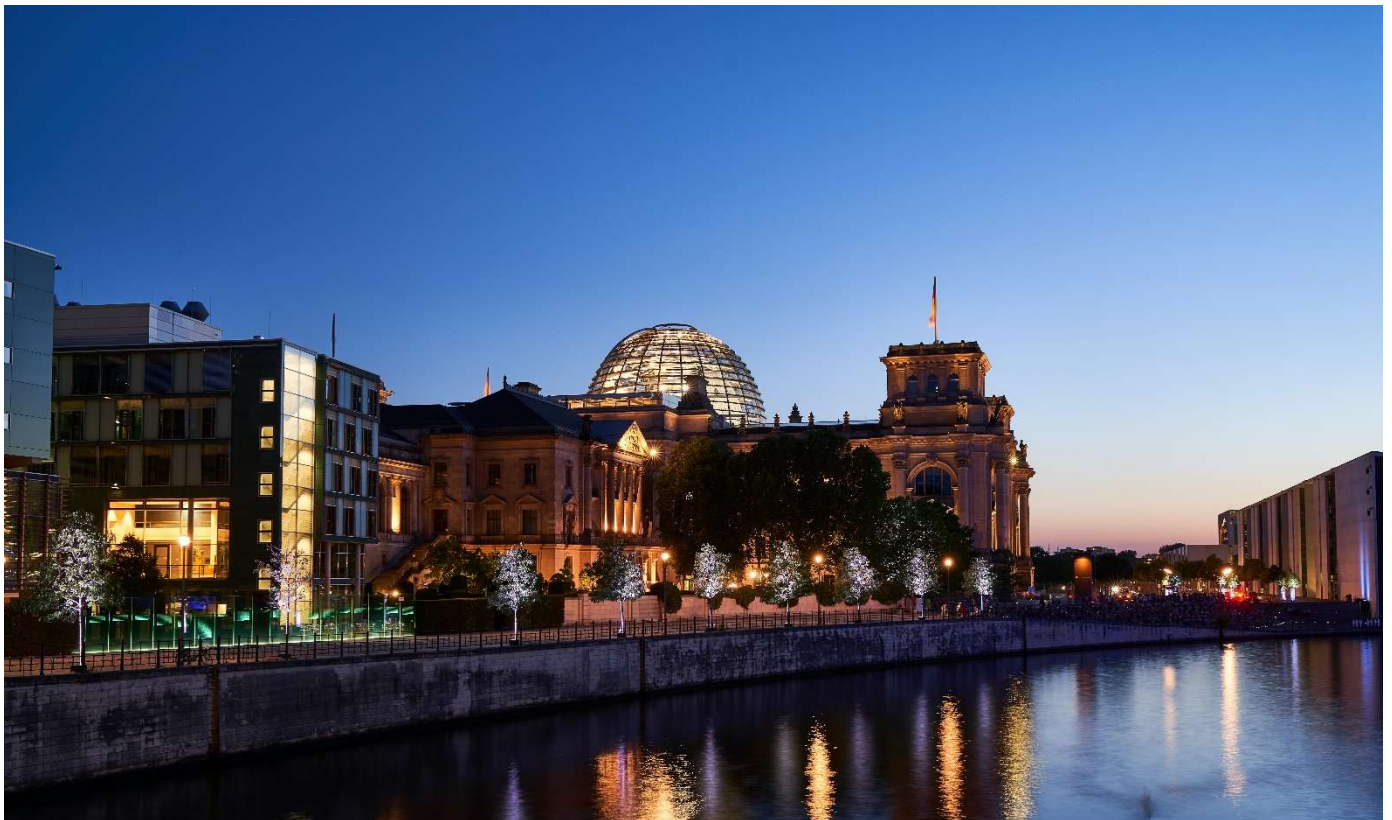


One Click LCA compliance with Qualitätssiegel Nachhaltiges Gebäude (QNG)

August 2024



Contents

1	INTRODUCTION	3
1.1	Background	3
1.2	Building reference data	4
1.2.1	Data sources used as a base for the calculation.....	4
1.2.2.	Further definitions to data sources	5
2	REFERENCE MODEL CALCULATION IN ONE CLICK LCA SOFTWARE	6
2.1	QNG tool description.....	6
2.2	Calculation example.....	7
2.2.1	Parameters and model settings.....	7
2.2.2	Material query	7
2.2.3	Energy query	8
3.	CALCULATION RESULTS FOR REFERENCE MODEL BUILDING	10
3.2.	Overall results for residential and non-residential buildings	10
3.3.	Residential building results (WG) by module.....	11
3.4.	Non-residential building results (NW) by module.....	12

1 Introduction

1.1 Background

The federal funding programme *Bundesförderung für effiziente Gebäude* (BEG) was created to promote energy efficiency and renewable energies in the building sector in Germany. Since 2021, projects fulfilling the requirements of the state quality label *Qualitätssiegel Nachhaltiges Gebäude* (QNG) are eligible for funding through the BEG. There are two quality label variants, the QNG-WG23 (new construction of residential buildings) and the QNG-NW23 (new construction and complete modernisation of non-residential buildings). Residential buildings are defined as buildings primarily used for living, as defined by the GEG (*Gebäudeenergiegesetz*) regulation. This includes residential, retirement and nursing homes and similar facilities. Non-residential buildings are, by definition, those not considered as residential buildings (§3 paragraph 1, number 33 GEG).

To be eligible, requirement values (benchmarks) have to be achieved, and proof of compliance or fulfillment of requirements is carried out on the basis of a defined building and life cycle model as well as boundary conditions and calculation rules. The requirement values are defined for two types of model buildings, namely residential (*Wohngebäude*, WG), and non-residential (*Nichtwohngebäude*, NW). The calculation follows the EN 15978 standard, and modules A1-A3, B4, B6, C3, C4 and D must be declared as a minimum. For an LCA software to be recognised as a valid calculation tool, calculation of the reference model buildings is required. The software is considered valid if the obtained results are within the allowed variance of those defined for the reference model buildings.

1.2 Building reference data

1.2.1 Data sources used as a base for the calculation

This assessment is based on and follows the QNG guidance for residential building (*Wohngebäude*) and non-residential buildings (*Nichtwohngebäude*). See the table below for references.

Table 1. The data sources used for calculation of reference model building LCA.

Input	Definition	Data source
Scope of assessment	Wohngebäude (WG)	Handbuch QNG Wohngebäude – Anhangdokument 3.1.1 LCA-Bilanzregeln Wohngebäude
	Nichtwohngebäude (NW)	Handbuch QNG Nichtwohngebäude – Anhangdokument 3.2.1.1 LCA-Bilanzregeln Nichtwohngebäude
Details for building parts	WG/ NW	Handlungsplan Nachhaltiges Bauen – Teilprojekt Qualitätssicherung von LCA-Software – Anhang Definition Modellgebäude
Materials	Material names, material UUID codes, naming convention	Handlungsplan Nachhaltiges Bauen – RV 19.13_TP EEI_007 Teilprojekt Qualitätssicherung von LCA-Software – Anhang Definition Modellgebäude Ökobilanzierung – Rechenwerte 2023
	Material quantities	Handlungsplan Nachhaltiges Bauen – RV 19.13_TP EEI_007 Teilprojekt Qualitätssicherung von LCA-Software – Anhang Definition Modellgebäude
	Assumptions, omissions, further information	Handlungsplan Nachhaltiges Bauen – Bericht Teilprojekt Qualitätssicherung von LCA-Software – Teil 2. Anforderungsprofil und Validierung (Endbericht)
Material service lives	Cost groups (KG), Material service life	Nutzungsdauern von Bauteilen für Lebenszyklusanalysen nach Bewertungssystem Nachhaltiges Bauen (BNB) Anhang Beispielbericht (WG) Anhang Beispielbericht (NWG)
Energy	Electricity, overall (WG/NW) District heat (NWG)	Handlungsplan Nachhaltiges Bauen – Bericht Teilprojekt Qualitätssicherung von LCA-Software – Teil 2. Anforderungsprofil und Validierung (Endbericht)
	B6 submodules (WG)	Anhang Beispielbericht (WG)
	B6 submodules (NW)	Anhang Beispielbericht (NWG)

1.2.2. Further definitions to data sources

For suitable database, the following is stated in the QNG *Bilanzregeln* (WG,NW):

“Only ÖKOBAUDAT-2020_I114... should be used as the database for all calculations”.

Whereas the QNG *Handbuch* states:

“the only data to be used for all calculations is the table Ökobilanzierung - Rechenwerte 2023 published on the QNG portal”,

and

“the Rechenwerte table serves as a transitional version until the data is adequately represented in ÖKOBAUDAT in accordance with DIN EN 15804 A2”.

For the service life inputs, the *Endbericht* (page 32/44) states:

“according to the QNG rule, the user is required to check the useful life of each individual material against the background of the classification in the BNB Nutzungsdauern von Bauteilen table”,

and

“if there are contradictions between the QNG accounting documents and other data sources (ÖKOBAUDAT, BNB service life, application help, etc.), the rule from QNG documents always applies (e.g. photovoltaic replacement cycles)”.

For information on the energy inputs, the electricity and district heating is given in the *Anhang* document separately for WG and NG. For additional information on the B6 submodules, the following is stated in the dedicated guidance documents for the two building types:

“QNG Handbuch (WG): the operational energy B6 includes the energy expenditure for the operation and use (Modules B6.1 and B6.3)”,

and

“QNG Handbuch (NW): the module B6 is broken down into sub-modules B6.1 on regulated energy, B6.2 on unregulated energy, and B6.3 on user and usage-related energy. All these sub-modules are to be taken into account when specifying module B6”.

2 Reference model calculation in One Click LCA software

2.1 QNG tool description

One Click LCA software has developed a [QNG compliant calculation tool](#). The included modules are aligned with the QNG requirements for residential and non-residential buildings. The available queries are shown in Fig. 1 below.

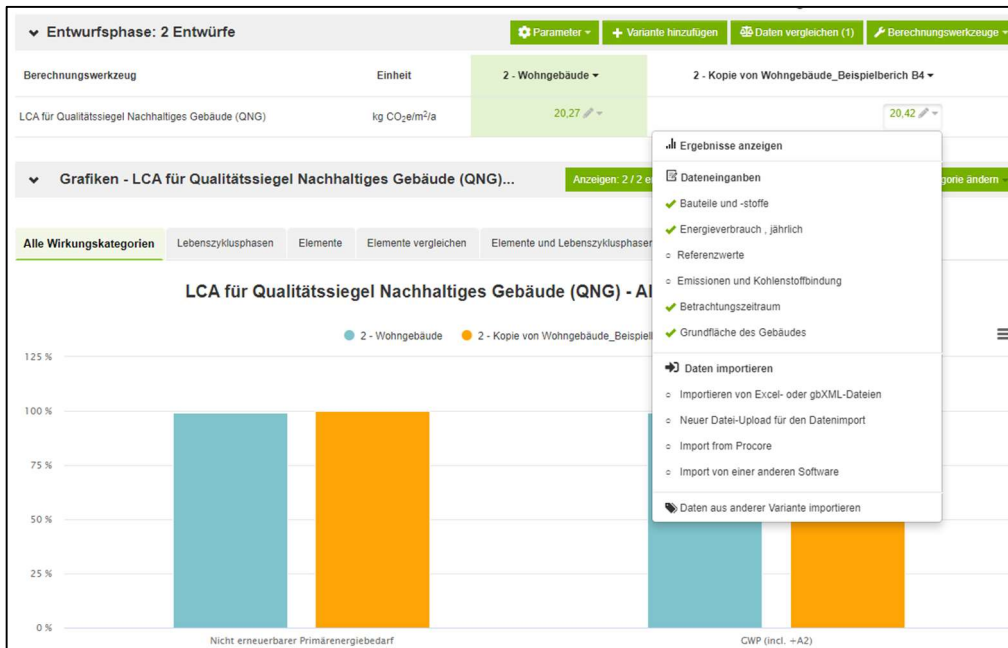


Figure 1. The main page of a project in One Click LCA using the QNG tool, with available queries.

Results are presented for two impact categories, as required: primary energy use, non-renewable (indicator PE_{ne}) and climate change (indicator GWP₁₀₀). The results are presented per Nettonraumfläche (NRF; according to DIN 277) for 50 years. The scope includes building parts from Kostgruppen (KG) 300 according to DIN 276 (2018), and defined building systems of KG 400. The QNG tool on One Click LCA uses the *Ökobilanzierung - Rechenwerte 2023* as source data.

Table 2. Scope of calculation with the DIN EN 15643: 2021 (*Bilanzierungsregeln des QNG für Wohngebäude*)

Life cycle stages included in the assessment			
Product stage	Use phase	End-of-life	Benefits and loads beyond the system boundaries
A1-A3	B4, B6	C3, C4	D1, D2
Raw material extraction, Transport to processing, Material production	Replacements, Operational energy	Processing, Final disposal	Recycling potential, exported energy effects

2.2 Calculation example

2.2.1 Parameters and model settings

Product specific service life was chosen from the parameter setup. The floor areas (NRF) for calculation are given for the two building types in the *Anhang Definition Modellgebäude* documents from Energie Effizienz Institut. These are 1 067 m² for WG, and 1 047,2 m² for NW.

2.2.2 Material query

The material specifications were extracted from *Anhang Definition Modellgebäude* as follows:

- Material quantities were calculated from given areas and material thicknesses;
 - o Materials were cross-checked from ÖKOBAUDAT using the documented UUID and *Ökobilanzierungen-Rechenwerte 2023*;
 - o Quantities were converted to kg or m³ as material thickness between QNG specifications may differ from datapoint thickness.
- Service lives were cross-checked with “*Gebäudelebenszyklusanalysen nach Bewertungssystem Nachhaltiges Bauen (BNB), Nutzungsdauern von Bauteilen*” as suggested in the background documents (*Endbericht* page 24/44)
 - o The service lives were also cross-checked with *Beispielbericht*. When the service life data differed between the *Beispielbericht* and *BNB Nutzungsdauern von Bauteilen*, the values from *Beispielbericht* were used.

Ressource	Menge	CO ₂ e	Kommentar	Company Classification	Nutzungsdauer	Kostgruppen	Wiederverwendetes Material
Innenfarbe Dispersionsfarbe scheuer	182.78 kg	1,9t - 0,2%	Aussenwand	No classification	15	330 Aussenwänden	<input type="checkbox"/>
Gipsputz (Gips-Kalk-Putz), 7.13	5272.47 kg	0,87t - 0,1%	Aussenwand	No classification	50	330 Aussenwänden	<input type="checkbox"/>
Kalksandstein Mix m3, 1.19	140.60 m3	45t - 4%	Aussenwand; ÖKOBAUDAT	No classification	Wie Gebäude	330 Aussenwänden	<input type="checkbox"/>
Mineralfolle (Fassaden-Dämmung), 5	93.73 m3	14t - 1%	Aussenwand	No classification	40	330 Aussenwänden	<input type="checkbox"/>
Kalkzement Putzmörtel, 7.7	15817.41 kg	6,7t - 0,6%	Aussenwand	No classification	45	330 Aussenwänden	<input type="checkbox"/>
Fassadenfarbe Silikat-Dispersionsfa	179.26 kg	1,1t - 0,1%	Aussenwand	No classification	15	330 Aussenwänden	<input type="checkbox"/>

Figure 2. Example of material inputs (exterior walls).

2.2.3 Energy query

In the QNG guidance, the operational energy in module B6 is divided into B6.1 (operational and regulated energy), B6.2 (energy consumption for elevators and central services), and B6.3 (user and usage-related energy).

In the *Endbericht* documentation, only B6.1 is specified for calculation of the reference model building:

- For WG the electricity is 25 450 kWh/a of national net electricity mix (*nationaler Netstrommix*)
- For NW the electricity is 23 015 kWh/a of national net electricity mix
 - o For NW building, district heating using only fossil fuels is also given: 54 280 kWh (*Fernwärme/Nahwärme KWK-fossil*)

For the other B6 submodules the documentation does not specify values. On page 24/44 of *Endbericht* it is stated that:

“Ausdrücklich wurde hier nur der Ökobilanzteil geprüft, die korrekte Ermittlung der Endenergiewerte für das Modul B6 ist der Ersteller verantwortlich” (...the creator is responsible for correctly determining the final energy values for the B6 module);

“Sie muss den Eigennutzungsanteil einer ggf. vorhandenen PV-Anlage nach DIN V 18599-9 unter Einbezug der Parameter der QNG-Regeln berechnen können“ (...must be able to calculate the share of personal use of any existing PV system taking into account the parameters of the QNG rules);

“Sie muss den Anwenderstrom („nutzer- und nutzungsbezogenen Energieaufwand“, Modul B6.3) nach QNG-Regeln berechnen können”. (...must be able to calculate the user electricity (“user and usage-related energy expenditure”, module B6.3) according to QNG rules).

To fill in the needed information, values from the *Beispielbericht* were used as below:

- WG:
 - o B6.1 25 450 kWh/a (as also given in *Endbericht*)
 - o Own generation: -15 622 kWh
 - o User electricity 12 400 kWh
 - o Exported electricity 620 kWh

1. Stromverbrauch ☁ 591 Tonnen CO₂e - 54 %

Strombedarf (Pflichtangabe) [↔ Andere Angaben anzeigen](#) ▾

Bitte den Stromtyp, den Stromverbrauch und die Nutzung angeben. Der gekaufte Strom wird hier eingegeben. Der Stromverbrauch kann nach Nutzungsart aufgeschlüsselt oder als Gesamtstromverbrauch angegeben werden. In der Entwurfsphase eines Gebäudes werden Durchschnittswerte des Stromverbrauchs verwendet.

Per Tastatur eingeben oder auf den Pfeil ▾

Ressource ⇅	Menge ⇅	Kommentar ⇅	Profil ⓘ	Kostgruppen	Nutzung ⓘ
Nutzung - 1 kWh nationaler Netzstro ?	22228 kWh ▾	Endbericht: Bedarf mit	QNG2023	B6.1 Betriebsbedingter und	Gesamt Ändern ▾

Figure 3. Input for B6.1 for WG.

- NW

- B6.1 23 015 kWh/a (net electricity, as also given in *Endbericht*)
- B6.1 54 287 kWh/a (district heat, as also given in *Endbericht*)
- B6.2 1 523 kWh/a
- B6.3 13 452 kWh/a

1. Stromverbrauch ☁️ 1011 Tonnen CO₂e - 47 %

Strombedarf (Pflichtangabe) ➡ [Andere Angaben anzeigen](#) ▼

Bitte den Stromtyp, den Stromverbrauch und die Nutzung angeben. Der gekaufte Strom wird hier eingegeben. Der Stromverbrauch kann nach Nutzungsart aufgeschlüsselt oder als Gesamtstromverbrauch angegeben. In der Entwurfsphase eines Gebäudes werden Durchschnittswerte des Stromverbrauchs verwendet.

Per Tastatur eingeben oder auf den Pfeil ▼

Ressource	Menge	Kommentar	Profil	Kostgruppen	Nutzung
Nutzung - 1 kWh nationaler Netzstro ?	23015 kWh	EndBericht;page 11/44; Für	QNG2023	B6.1 Betriebsbedingter und	Gesamt Ändern ▼
Nutzung - 1 kWh nationaler Netzstro ?	1523 kWh	Beispielbericht NWG	QNG2023	B6.2 Energieaufwand für Aufzüge	Gesamt Ändern ▼
Nutzung - 1 kWh nationaler Netzstro ?	13452 kWh	Beispielbericht NWG	QNG2023	B6.3 Nutzer- und nutzungsbedingter	Gesamt Ändern ▼

3. Fernwärmeverbrauch ☁️ 671 Tonnen CO₂e - 31 %

Fernwärmeverbrauch ➡ [Andere Angaben anzeigen](#) ▼

Bitte gegebenenfalls das Fernwärmenetzwerk auswählen und den Verbrauch eingeben

Per Tastatur eingeben oder auf den Pfeil ▼

Ressource	Menge	Kommentar	Profil	Kostgruppen	Nutzung
Nutzung - 1 kWh Fernwärme/Nahwärme ?	54280 kWh	Endbericht page 11/44;	QNG2023	B6.1 Betriebsbedingter und	Heizung Ändern ▼

Brennstoffe, die in nahe gelegenen oder vor Ort befindlichen Wärmeversorgern eingesetzt werden ➡ [Andere Angaben anzeigen](#) ▼

Figure 4. Inputs for B6 for NW (electricity, district heat).

3. Calculation results for reference model building

3.2. Overall results for residential and non-residential buildings

According to the instructions in *Endbericht* the allowed deviation from the required value is $\pm 1\%$ for residential building and $\pm 2\%$ for non-residential building. The overall results for both building types show that the life cycle impacts for the two impact categories are in line with the requirements stated in the *Endbericht*.

Table 3. WG. Model building values vs. values obtained from calculation with One Click LCA QNG tool.

Valid value	QNG	OCL result	Difference	Pass/fail
GWP₁₀₀	20,4	20,4	<1%	PASS
PE_{ne}	67,1	66,8	<1%	PASS

Table 4. NW. Model building values vs. values obtained from calculation with One Click LCA QNG tool.

Valid value	QNG	OCL result	Difference	Pass/fail
GWP₁₀₀	41,4	41,2	<2%	PASS
PE_{ne}	135,3	134,7	<2%	PASS

3.3. Residential building results (WG) by module

The *Endbericht* gives clear details on target values, also on how the values are divided between life cycle stages and modules. The overall results are within the allowed deviance from required values. The results obtained with the One Click LCA software QNG tool are shown below.

Ergebnisse der Lebenszyklusanalyse gemäß für Qualitätssiegel Nachhaltiges Gebäude (QNG)			
Ergebniskategorie	Erderwärmungspotenzial (incl. +A2) kg CO ₂ e/m ² /a ⓘ	Nicht erneuerbarer Primärenergiebedarf kWh/m ² /a	
Produktion ⓘ	5,51	15,58	Details
Berechneter Wert für das Modul B1 (Kältemittel) ⓘ			Leere Zeilen ausblenden
+ Austausch und Modernisierung ⓘ	1,72	6,79	Details
+ Summe der Module B6 - Energieverbrauch ⓘ	11,08	38,78	Details
Abfallbehandlung	0,78	0,84	Details
Deponierung	0,13	0,32	Details
KG 400 - Sockel	1,2	4,5	Details
Gutschrift aus Wiederverwendung und Recycling (Modul D)	-1,02	-3,24	Details
Exportierte Energie (nicht in den Gesamtwerten enthalten) ⓘ	-0,31	-1,08	Details
Total	20,42	66,82	

Alle Ergebnisse werden pro Jahr pro Fläche (NRF oder BRI) des Gebäudes angezeigt.

Figure 5. The results table from One Click LCA software for WG.

Minor variance is identified within the WG module B4, replacements. The base for calculation is the service life value, which is extracted from the *BNB* documentation. The B4 values for certain plastics and plaster were not directly available in the *BNB* document, and some values also differed between the document and the *Beispielbericht*. Values from the *Beispielbericht* were used in these cases.

- PP-Folie (Unterspannbahn PP): 30 years. Could not identify in BNB.
- Polyesterharz Anstrich (PVC Plastisol): 5 years. Could not identify in BNB.
- Kalkgipsputz (Gipsputz (Gips-Kalk-Putz)): 50 years. Could not identify for roof construction in BNB.
- PA-folie als Unterspannbahn (Dampfbremse PA): 40 years. Could not identify in BNB

3.4. Non-residential building results (NW) by module

The non-residential building shows some variation between values specified in the *Endbericht* and those obtained from the software. The deviation is significant only in the impact category PE_{ne} and does not change the overall sum values that are well within required limits. Below are shown the results as they are presented in the software.

Ergebnisse der Lebenszyklusanalyse gemäß für Qualitätssiegel Nachhaltiges Gebäude (QNG)			
Ergebniskategorie	Erderwärmungspotenzial (incl. +A2) kg CO ₂ e/m ² /a ⓘ	Nicht erneuerbarer Primärenergiebedarf kWh/m ² /a	
Produktion ⓘ	5,4	15,21	Details
Berechneter Wert für das Modul B1 (Kältemittel) ⓘ			Leere Zellen ausblenden
+ Austausch und Modernisierung ⓘ	1,41	6,22	Details
+ Summe der Module B6 - Energieverbrauch ⓘ	32,11	108,06	Details
Abfallbehandlung	0,97	0,83	Details
Deponierung	0,11	0,28	Details
KG 400 - Sockel	1,23	4,11	Details
Gutschrift aus Wiederverwendung und Recycling (Modul D)	-1,27	-4,56	Details
Total	41,23	134,71	

Alle Ergebnisse werden pro Jahr pro Fläche (NRF oder BRI) des Gebäudes angezeigt.

Figure 6. The results table from One Click LCA software for NW.

Regarding service lives, in addition to the materials mentioned under WG the following material service lives were extracted from the *Beispielbericht* due to inconsistencies to values stated in the *BNB* document:

- Zellulose: 40 years (50 years in BNB)
- Kalkzement Putzmörtel: 40 years (45 years in BNB)
- Kies: 50 years (30 in BNB)
- Edelstahlblech: 25 years (could not identify in BNB (Radbox))
- Sonnenschutz: 15 years (the document does not specify whether these are retractable or static, however, datapoint suggests static lamellas in which case the service life would be 50 years).