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Typology of Public Buildings in Bosnia and Herzegovina and next steps

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Typology of public buildings in BiH

When **typology of public buildings was prepared?**

- In 2017 three typologies of public buildings (FBiH, RS, BiH) are conducted under the UNDP's „Green Economic Development“ Project

What is a **typology of public buildings?**

- The EPBD and EED define the typology as a **methodological framework for comparing energy efficiency measures using typical buildings.**
- A catalogue of information on the state of energy efficiency of public buildings.



Non-residential typology in European Countries

Typology Approaches for Non-Residential Buildings in Five European Countries

- Existing Information, Concepts and Outlook -

PDF-Download of the report: [TABULA_TR3.pdf](#)



Whereas in some European countries typologies for residential buildings have been used for several decades now, approaches to record non-residential buildings in a comparable structure have not been successfully implemented yet. Apart from introducing or further developing typologies for residential buildings, five European partners of the TABULA project (AEA / Austria, SOFENA / Bulgaria, IWU / Germany, NOA / Greece, NAPE / Poland) have also dealt with national approaches for non-residential building typologies.

Because of the broad variety of uses and associated characteristics, setting up a typology for the non-residential sector is rather complex. It is therefore important to consider both, practicability of and data availability for such a structure.

In the reporting countries, available data sources and the knowledge about the non-residential building stock differ. In general, data from official statistics are

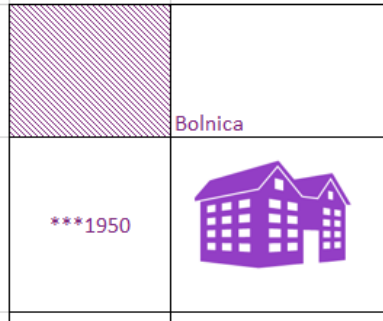
Source: <http://episcopo.eu/building-typology/tabula-structure/non-residential/>

- Complexity of the stock of non-residential buildings (purpose, types of users, construction and other characteristics)



Development of representative typical buildings

Representative facility of the sample/population



Statistical sample from the population

Statistical analysis based on:

- ✓ use,
- ✓ age,
- ✓ geometry,
- ✓ climate zones,
- ✓ geographic location, etc.

Characteristics of the sample from the population - AVERAGES

Features of the representative facility

- Surface
- U-value of the facade
- U-value of the windows
- Specific consumption kWh/m²a
- Specific emission of CO₂ (tCO₂e/m²a)
- Specific costs KM/m²a
- etc.

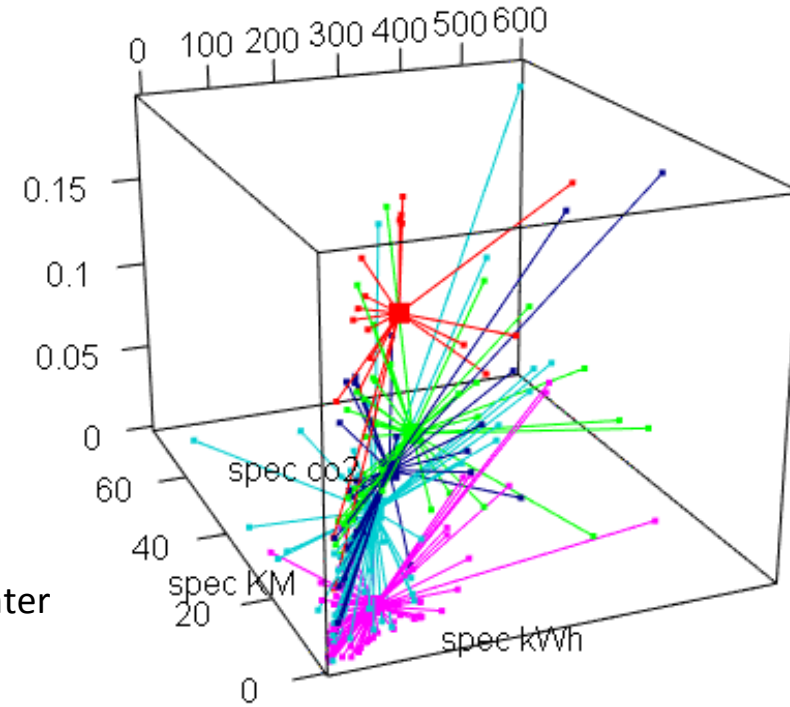
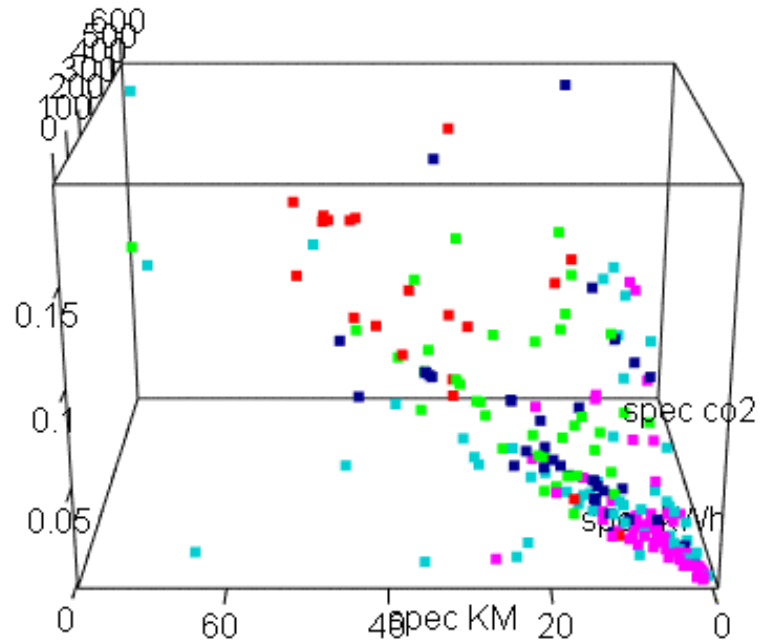
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Average sample surface

- Average U-value of the sample's facade
- Average U-value of the sample's windows
- Average specific consumption kWh/m²a of the sample
- Average specific emission of CO₂ (tCO₂e/m²a) of the sample
- Average specific costs KM/m²a of the sample
- etc.



































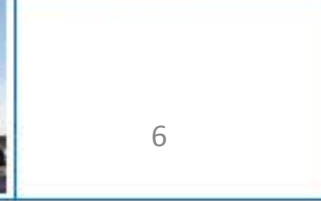


Development of representative typical buildings



- School
- Health center
- Hospital
- Administration
- Regional school

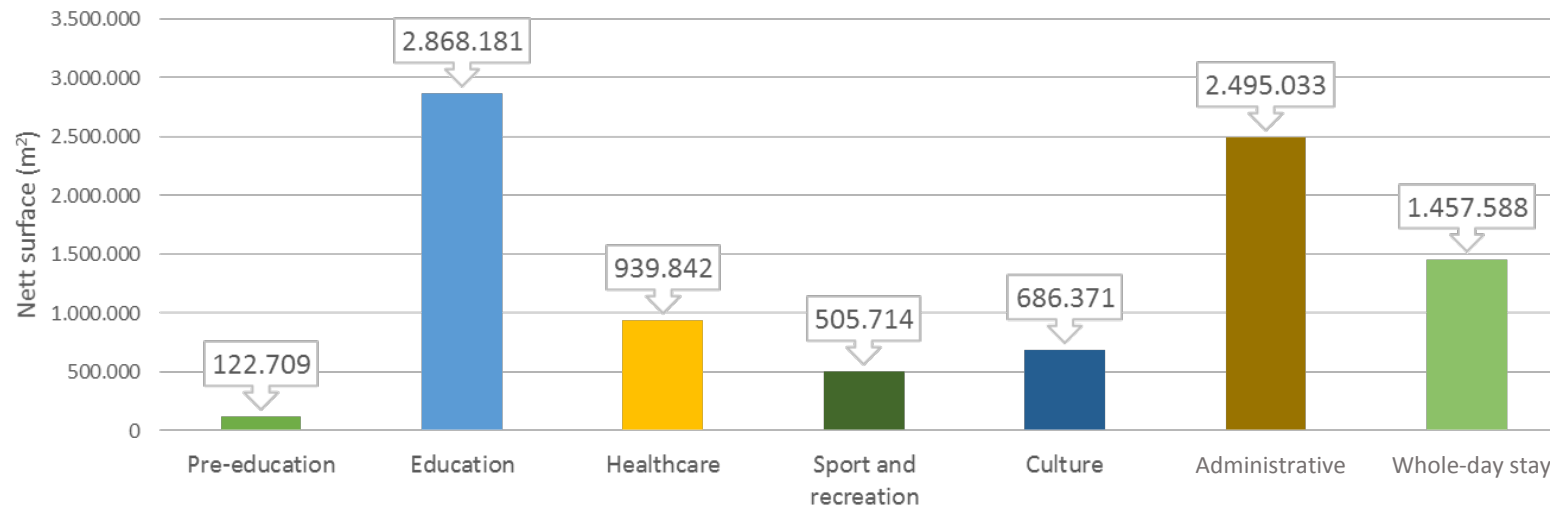


	<i>I</i>	<i>II</i>	<i>III</i>	<i>IV</i>	<i>V</i>	<i>VI</i>	<i>VII</i>
	<i>Pre-education</i>	<i>Education</i>	<i>Health</i>	<i>Sport</i>	<i>Culture</i>	<i>Administrative</i>	<i>Whole-day stay</i>
A <i>Until 1945</i>							
B <i>1946 - 1965</i>							
C <i>1966 - 1973</i>							
D <i>1974 - 1987</i>							
E <i>1988 - 2009</i>							
F <i>After 2010</i>							

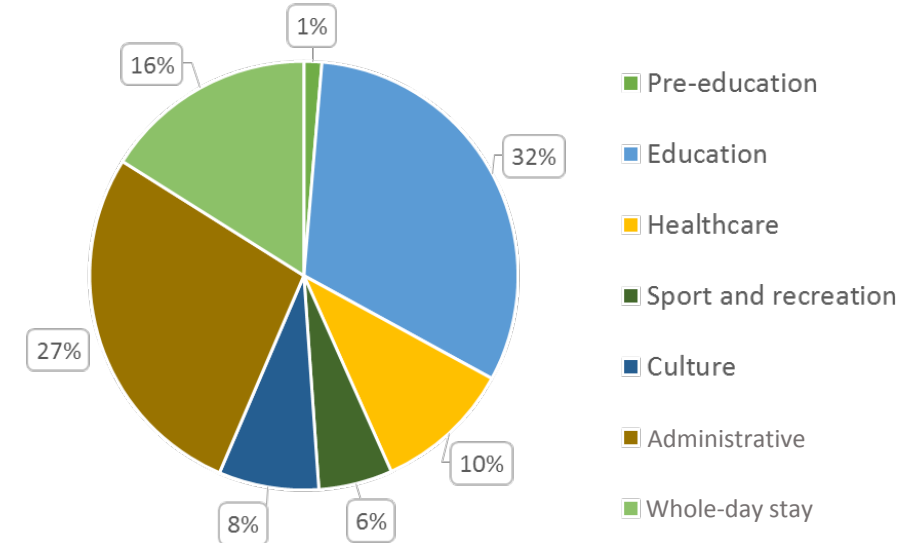
Typology results – surface of public buildings per type

Public buildings
Total: 9.1 milion m²

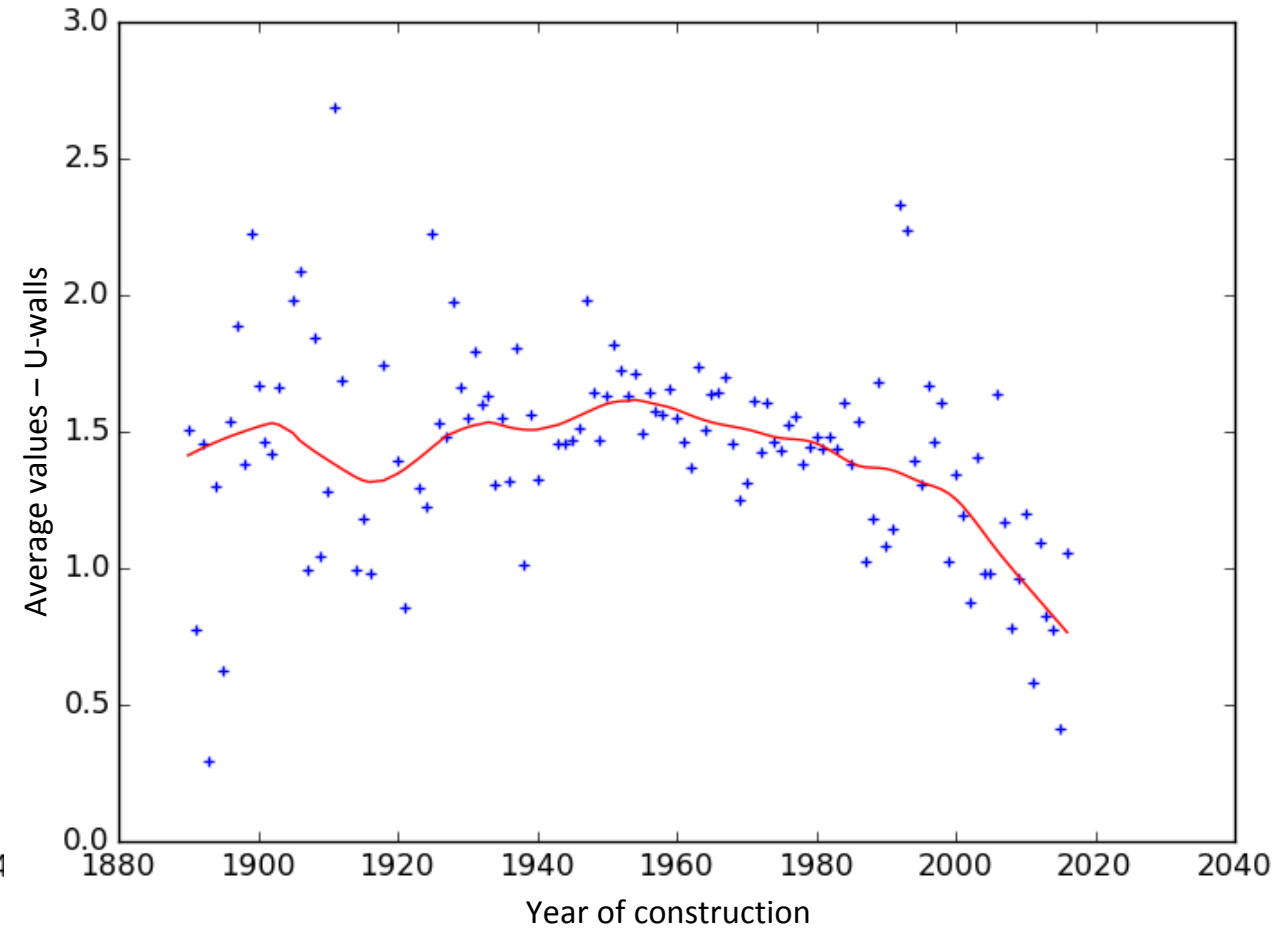
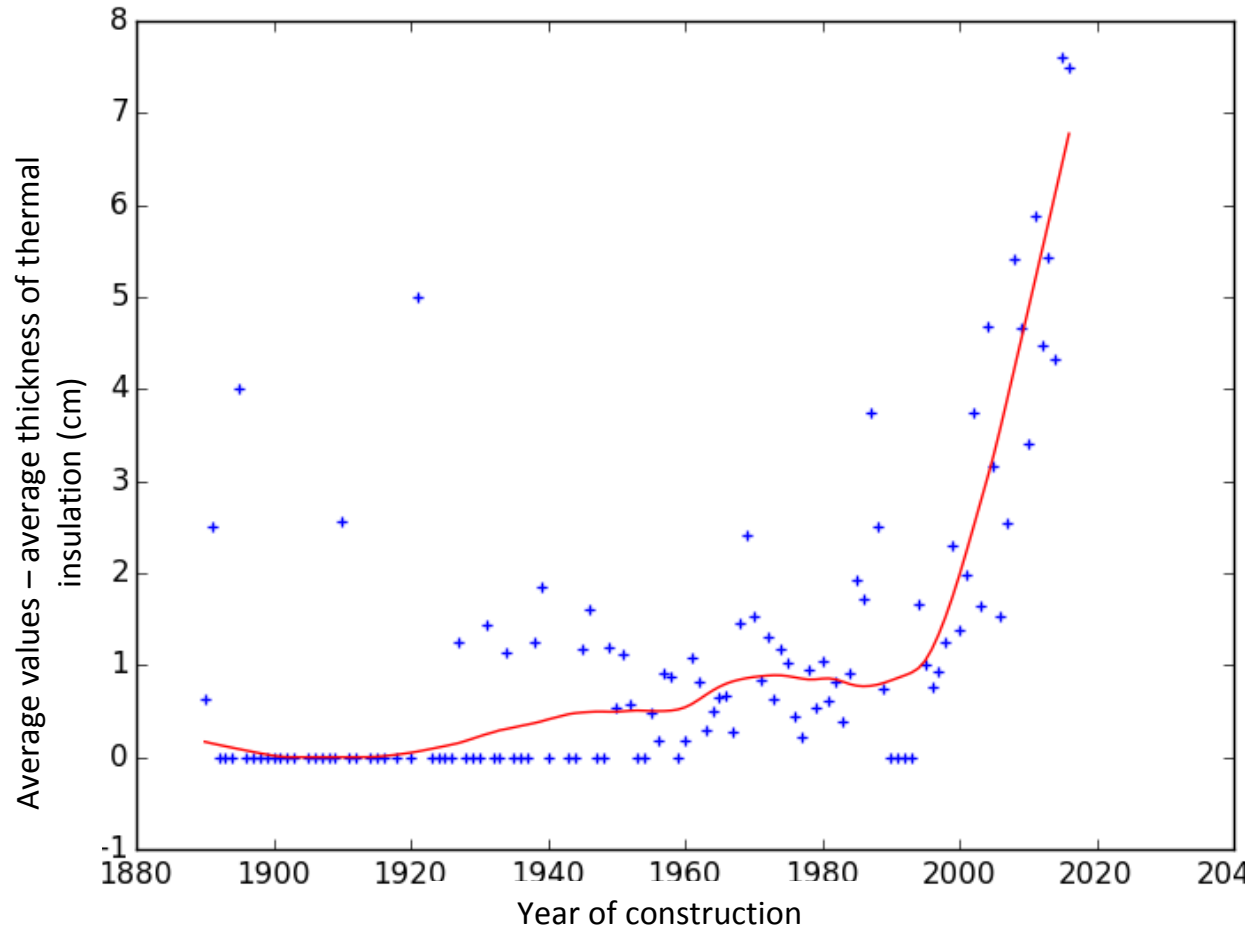
NETT SURFACE OF PUBLIC BUILDINGS IN BIH PER TYPE



Public buildings stock structure in BiH



Typology results – average U values



Typology results – cards of standard buildings

Annual required energy for heating Qhnd (kWh/m²) for region „north“

Construction period /Clasification of public building		I	II	III	IV	V	VI	VII
		PRE-EDUCATION	EDUCATION	HEALTH	SPORTS	KULTURE	OFFICE BUILDINGS	ALL DAY STAY
A	Up to 1945		173,19	191,12		249,60	176,65	
B	1946 - 1965	278,70	199,91	206,29	382,44	271,05	195,34	191,41
C	1966 - 1973	240,43	197,25	198,71	343,88	263,92	178,83	175,80
D	1974 - 1987	270,50	197,32	212,35	299,74	264,85	187,29	200,07
E	1988 - 2009	176,81	148,09	181,20	281,36	156,26	136,18	137,04
F	After 2010	155,61	101,86		291,73		124,86	

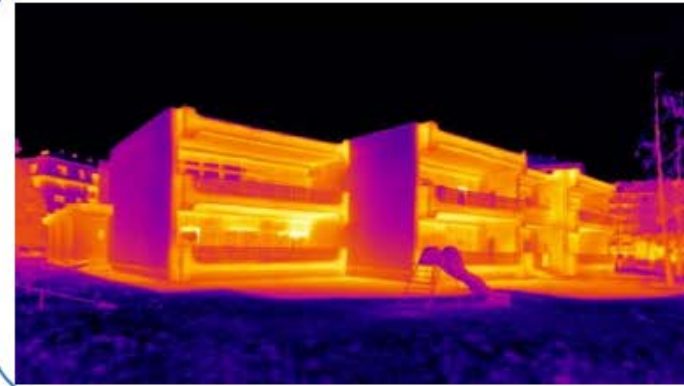


Typology results – cards of standard buildings

PUBLIC BUILDING TYPE

TYPE DI

Sector of application	Preschool education
Construction period	from 1974 to 1987
Average useful area of the heated section (m ²)	888
Average heated air volume (m ³)	2.858



Characteristic look of the building type



Typology results – cards of standard buildings

Building description

A freestanding public building for pre-school education. The building has a rectangular base with a complex roof. It is characterized by a massive constructive system. External walls are predominantly made of 27cm thick block brick, and to a lesser extent of solid brick, aerated concrete and reinforced concrete, which affects the average heat transfer coefficient of the walls. The walls are plastered on both sides and 32% of the total external wall surface is covered with a layer of thermal insulation with an average thickness of 9cm. The final floor towards the attic is made primarily of reinforced concrete and the ceiling is made of plaster, as well as of wood beams and fert beams, which affects the average heat transfer coefficient of the ceiling. Double wooden frames joined at the wings and single-pane windows have been mainly used for the external openings on the building, as well as PVC and AL frames to a lesser extent, which impacts the average heat transfer coefficient of the openings. The thermal image in several shades of purple gives a reading of reduced losses of thermal energy in parts of the building envelope covered in thermal insulation, whereas the parts of the building colored in yellow give a reading of increased losses due to an absence of thermal insulation. These losses are especially pronounced in the front parts of the terraces and represent a typical example of thermal bridges. In addition to these losses, an increased loss of thermal energy has also been registered at the open windows showing up in white on the thermal images of the façade openings in the ground-floor terrace at the left wing of the building.



Typology results – cards of standard buildings



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<i>Average technical parameters</i>	<i>Unit</i>	<i>Value</i>
Shape factor	m ⁻¹	0.82
Surface of external walls	m ²	485
Surface of external openings	m ²	165
Surface of final ceiling and/or roof	m ²	847
Ground floor	m ²	847
Total surface of the building envelope	m ²	2345

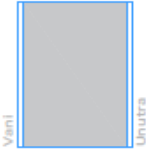
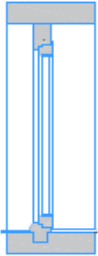
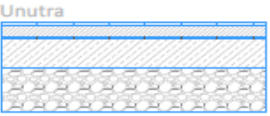

<i>Average heat transfer coefficient</i>	<i>Unit</i>	<i>Value</i>
U-walls	W/m ² K	1.35
U-openings	W/m ² K	2.49
U-ceiling	W/m ² K	1.66
U-floors	W/m ² K	1.56
U-external envelope	W/m ² K	1.62

Specific annual energy need for heating – region north, $Q_{H,nd,ref.n.}$ (kWh/m²/yr.)	270.5
Specific annual energy need for heating – region south, $Q_{H,nd,ref.s.}$ (kWh/m ² /yr.)	149.1

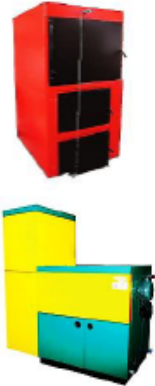


Typology results – cards of standard buildings

ELEMENTS OF THE EXTERNAL ENVELOPE

<p>EXTERNAL WALL</p>	 <p><i>plaster 2.0cm, block brick 27cm, plaster 2.0cm, U=1.35 (W/m²K)</i></p>
<p>WINDOWS</p>	 <p><i>wooden frame window U=2.49 (W/m²K)</i></p>
<p>GROUND FLOOR</p>	 <p><i>parquet 1.2cm, cement screed 5cm, waterproofing 1cm, concrete slab 10cm, gravel 10cm</i></p> <p><i>U=1.56 (W/m²K)</i></p>
<p>FINAL CEILING AND/OR ROOF</p>	 <p><i>plaster 2.0cm, reinforced concrete slab 16cm, U=1.66 (W/m²K)</i></p>

HEATING SYSTEMS

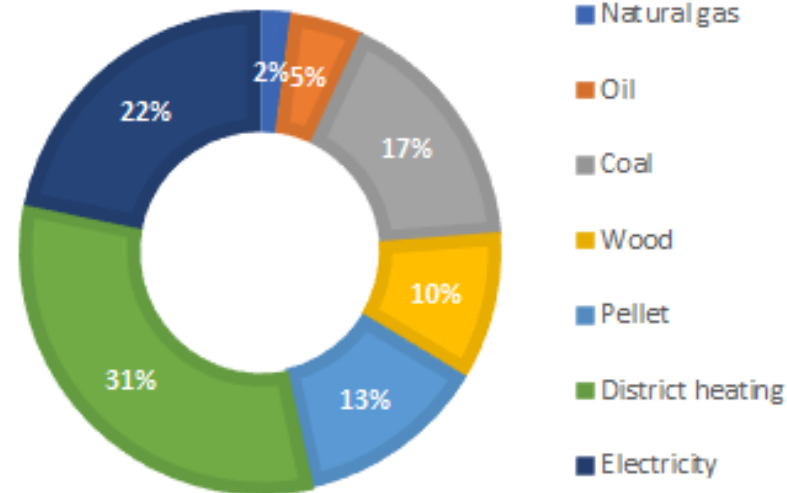
<p>SPACE HEATING SYSTEM</p>	 <p><i>Central heating systems using solid fuel (coal and wood) with an efficiency ranging from 60% to 75% and central heating systems using pellet with an efficiency ranging from 87% to 96% are mostly used. The average specific installed capacity of the boilers per m² of the useful area of the heated part of the facility for the region north is 309W/m², and 170W/m² for the region south.</i></p>
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Typology results – cards of standard buildings

Use of energy in public buildings

Energy source	Buildings %
Natural gas	2
Oil	5
Coal	17
Wood	10
Pellet	13
District heating	31
Electricity	22



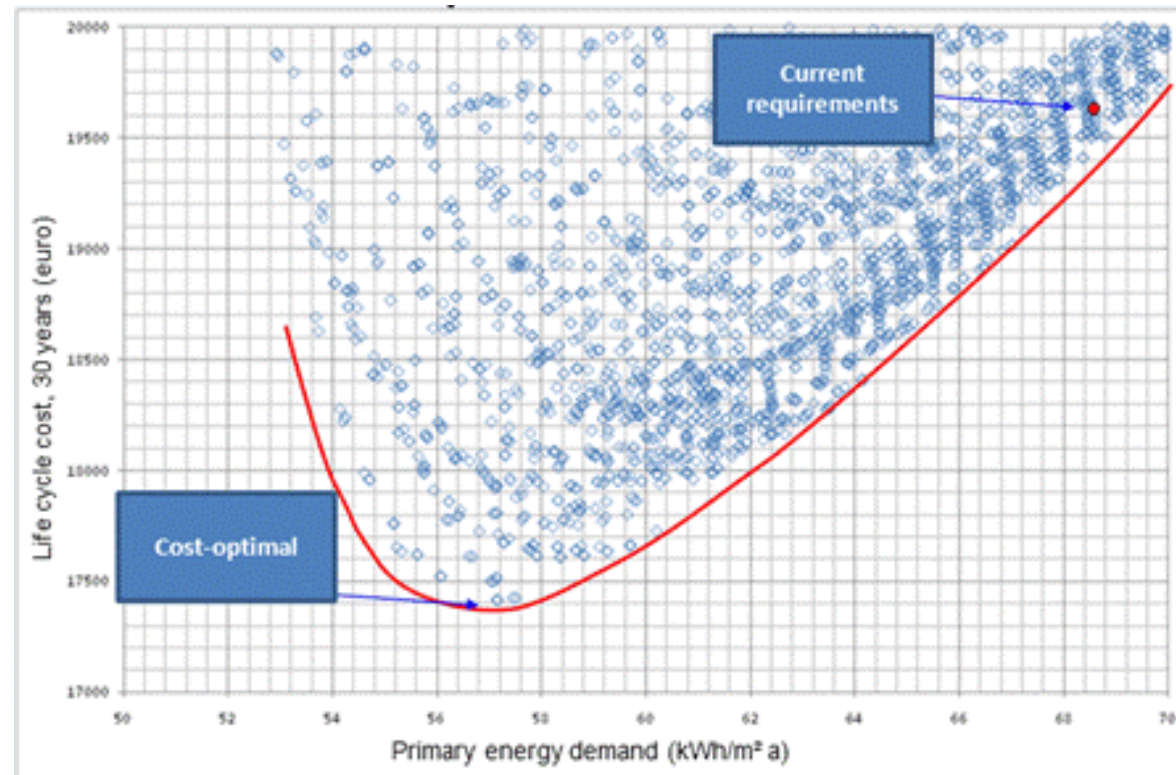
Typology of Public Buildings available at:

http://www.ba.undp.org/content/bosnia_and_herzegovina/bs/home/library/environment_energy/tipologija-javnih-zgrada-u-bosni-i-hercegovni--.html



Next steps / EPBD Cost-optimal levels

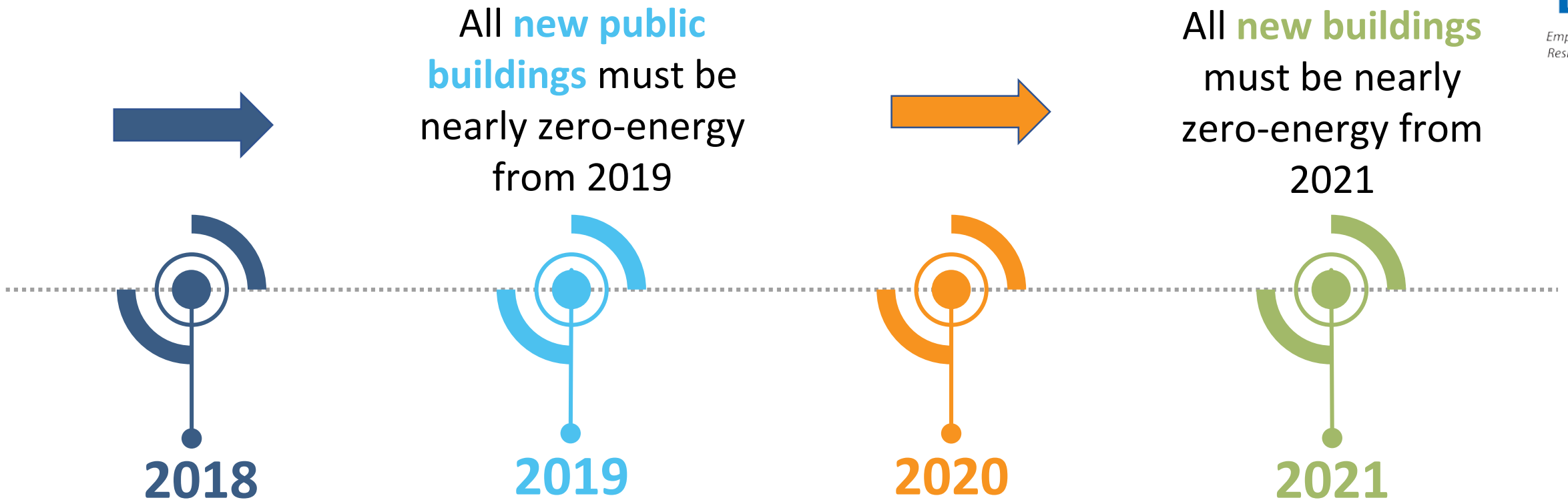
Development of the cost-optimal calculations for public buildings in BiH according to the requirements of the EPBD directive (2010) and based on data from Typology of Public Buildings.



Next steps / EPBD - Article 9 - Nearly zero-energy buildings (nZEB)



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Definition of nZEB for BiH (public buildings), reflecting national, regional or local conditions, and including a numerical indicator of primary energy use expressed in kWh/m² per year.



Cooperation with other relevant projects/agencies in BiH



In fourth quarter of 2017, **GIZ, USAID and UNDP** established **Joint Energy Efficiency cooperation and coordination** of their activities with regards:

- to transpose the EE Directive in BiH within their scopes of work,
- to develop a joint approach to EE public outreach and
- to cooperate and coordinate other activities related to EE in BiH.

From March 2018, the **Joint EE Programme between GiZ and UNDP** with aim:

- to clearly identifies both Agencies' goals and objectives of donor assistance in BiH
- to ensure an common agreed approach to EE stakeholders and EE processes in BiH



Activities with the German Agency for International Cooperation (GiZ)



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In the first stage of the **Joint EE Programme** objectives are prioritized and defined:

- 1. Energy management model** - created as a common agreed approach to EE stakeholders, by defined:
 - **Scheme that contains organizational structure** for EM obligators
 - **Field of action / sectors and subsectors**
- 2. Regulations**
 - (MVP and EMIS as a mandatory tools for savings and energy consumption monitoring, reporting and verification)
- 3. Activity plan** for common training program 2018 – 2019.





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THANK YOU

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