Energy performance certificate summary

Building:	1097 Budapest Mester street 76. B building Hrsz: 38257/14
Owner:	MESTER 76 Ingatlanfejlesztő Alap
Expert:	Mottl Tamás Okl. épületgépész tervező mérnök G-01-12714

Cumulated energetic parameter: 78.80 kWh/m^{2}a reference value: 127.83 kWh/m^{2}a

Overall energy performance requirement: 102.26 kWh/m^{2}a near zero energy demand buildings

The requirement for the overall energy performance MEETS.

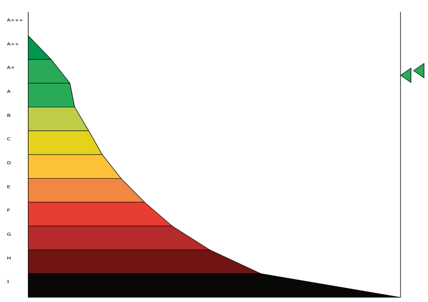
Specific carbon dioxide emissions: 16.92 kg/m^{2}a reference value:30.58 kg/m^{2}a

Specific carbon dioxide emissions requirement: 24.47 kg/m^{2}a

The requirement for specific emissions of carbon dioxide is FULFILLED.

Aggregated energy performance rating classification: A+ $_{2023}$ (77.1 %)

Specific carbon dioxide emissions classification:A+ $_{2023}$ (69.1 %)



Summer heat protection indicator:	0.267 <= 0,3 the requirement is met
Building surface-to-volume ratio:	0.275 m^2/m^3
Unit heat loss coefficient:	0.058 W/m^{3}K
Specific heat loss factor requirement:	0.140 W/m^{3}K

Date: 2024. 4. 30.

Construction types:

Ablak - fém
Type of: window (peripheral, metal)
Heat transmission coefficient: 1.300 W/m²K
Allowable value: 1.400 W/m²K
The heat transmission coefficient is suitable.
Glassing rate: 80 %
Glazing g value: 0.550
Night associate structure heat conduction resistant: 0.120 m²K/W
Shading method in summer: inside
Solar coefficient of shading in summer: 1.000

Ajtó - beltéri
Type of: door (towards inner, unheated space)
Heat transmission coefficient: 1.200 W/m²K
Allowable value: 1.400 W/m²K
The heat transmission coefficient is suitable.

Ajtó - fém
Type of: glass panel door (peripherial, metal)
Heat transmission coefficient: 1.300 W/m²K
Allowable value: 1.400 W/m²K
The heat transmission coefficient is suitable.
Glassing rate: 80 %
Glazing g value: 0.550
Night associate structure heat conduction resistant: 0.120 m²K/W
Shading method in summer: inside
Solar coefficient of shading in summer: 1.000

FR 2.1 - Homlokzati fal
Type of: Peripheral wall
Heat transmission coefficient of layered construction: 0.179 W/m²K
Allowable value: 0.240 W/m²K
The layered wall heat transmission coefficient is correct.
Resultant heat transmission coefficient: 0.206W/m²K
Heat transmission coefficient modifying factor: 15%
Attenuation coefficient: 237.55
Delay: 9.1 h
Unit mass: 565 kg/m²
Unit heat-storing mass: 480 kg/m²
Specific heat capacity: 403 kJ/m²K
Surface temperature at -15 °C: 19.2 °C 53 %
Condition of air outside: -2.0 °C 90 %
Condition of air inside: 20.0 °C 50 %
Outside heat-transfer resistance: 0.04 m²K/W
Inside heat-transfer resistance [m^2K/W]: 0.13 m²K/W
Diffusion period: 180 day
Technical impact of ventillation.
Data are missing for the calculation.
Layers from outside to inside

Layer	No	d	λ

title	. -	[cm]	[W/mK]
szálcement homlokzatburkolat	1	1	58,1
Kiszell. légr. Visszav. Függ.	2	5	0
Rockwool Fixrock FB1	3	20	0,039
vasbeton	4	20	1,55

FR 2.3 - Homlokzati fal

Type of: Peripheral wall
Heat transmission coefficient of layered construction: 0.179 W/m²K
Allowable value: 0.240 W/m²K
The layered wall heat transmission coefficient is correct.
Resultant heat transmission coefficient: 0.206 W/m²K
Heat transmission coefficient modifying factor: 15%
Attenuation coefficient: 238.13
Delay: 9.2 h
Unit mass: 581 kg/m²
Unit heat-storing mass: 480 kg/m²
Specific heat capacity: 403 kJ/m²K
Surface temperature at -15 °C: 19.2 °C 53 %
Condition of air outside: -2.0 °C 90 %
Condition of air inside: 20.0 °C 50 %
Outside heat-transfer resistance: 0.04 m²K/W
Inside heat-transfer resistance [m^2K/W]: 0.13 m²K/W
Diffusion period: 180 day
Technical impact of ventillation.
Data are missing for the calculation.
Layers from outside to inside

Layer	No.	d	λ
title	-	[cm]	[W/mK]
trapézlemez	1	1,2	58,1
Kiszell. légr. Visszav. Függ.	2	5	0
Rockwool Fixrock FB1	3	20	0,039
vasbeton	4	20	1,55

FR 2.4 - Homlokzati fal

Type of: Peripheral wall
Heat transmission coefficient of layered construction: 0.184 W/m²K
Allowable value: 0.240 W/m²K
The layered wall heat transmission coefficient is correct.
Resultant heat transmission coefficient: 0.212W/m²K
Heat transmission coefficient modifying factor: 15%
Attenuation coefficient: 228.40
Delay: 8.6 h
Unit mass: 486 kg/m²
Unit heat-storing mass: 480 kg/m²
Specific heat capacity: 403 kJ/m²K
Surface temperature at -15 °C: 19.2 °C 53 %
Condition of air outside: -2.0 °C 90 %
Condition of air inside: 20.0 °C 50 %
Outside heat-transfer resistance: 0.04 m²K/W
Inside heat-transfer resistance [m^2K/W]: 0.13 m²K/W
Diffusion period: 180 day
Layers from outside to inside

Layer title	No. -	d [cm]	λ [W/mK]
Rockwool Fixrock FB1	1	20	0,039
vasbeton	2	20	1,55

FR 2.5 - Parkoló fal

Type of:internal wall (towards unheated space)
Heat transmission coefficient of layered construction: 0.316 W/m²K
Allowable value: 0.400 W/m²K
The layered wall heat transmission coefficient is correct.
Resultant heat transmission coefficient: 0.332W/m²K
Heat transmission coefficient modifying factor: 5 %
Attenuation coefficient: 128.78
Delay: 8.4 h
Unit mass: 489 kg/m²
Unit heat-storing mass: 480 kg/m²
Specific heat capacity: 403 kJ/m²K
Condition of air outside: -2.0 °C 90 %
Condition of air inside: 20.0 °C 50 %
Outside heat-transfer resistance: 0.13 m²K/W
Inside heat-transfer resistance [m^2K/W]: 0.13 m²K/W
Diffusion period: 180 day
Layers from outside to inside

Layer title	No. -	d [cm]	λ [W/mK]
Rockwool Frontrock Super	1	10	0,036
vasbeton	2	20	1,55

FR 2.6 - Parkoló fal 2

Type of:inner wall (between heated spaces)

Heat transmission coefficient of layered construction: 2.570 W/m²K

Resultant heat transmission coefficient:2.699W/m²K

Heat transmission coefficient modifying factor: 5 %

Attenuation coefficient:	7.64		
Delay:	6.3	h	
Unit mass:	480	kg/m²	
Unit heat-storing mass:	240 / 240	kg/m²	
Specific heat capacity:	202 / 202	kJ/m²K	
Condition of air outside:	-2.0	°C	90 %
Condition of air inside:	20.0	°C	50 %
Outside heat-transfer resistance:	0.13	m²K/W	
Inside heat-transfer resistance [m^2K/W]:	0.13	m²K/W	
Diffusion period:	180	day	

Layers from outside to inside

Layer	No.	d	λ
title	-	[cm]	[W/mK]
vasbeton	1	20	1,55

PR - Kiugró födém

Type of:	floor on arcade		
y size:	1	m	

Heat transmission coefficient of layered construction: 0.152 W/m²K

Allowable value: 0.170 W/m²K

The layered wall heat transmission coefficient is correct.

Heat transmission coefficient:	0.152	W/m²K	
Attenuation coefficient:	3560.79		
Delay:	15.1	h	
Unit mass:	956	kg/m²	
Unit heat-storing mass:	45	kg/m²	
Specific heat capacity:	36	kJ/m²K	
Floor heat absorption coefficient:	4.168	kJ/m²Ks$^{1/2}$	
Floor classification:	cold		
Surface temperature at -15 °C:	19.1	°C	53 %
Condition of air outside:	-2.0	°C	90 %
Condition of air inside:	20.0	°C	50 %
Outside heat-transfer resistance:	0.04	m²K/W	
Inside heat-transfer resistance [m^2K/W]:	0.17	m²K/W	
Diffusion period:	180	day	

Layers from outside to inside

Layer	No.	d	λ
title	-	[cm]	[W/mK]
Csempe	1	0,6	1,05
cement esztrich	2	6	1,55
AUSTROTHERM technológiai szigete	3	0,009	0
AT-L4 expandált polisztirolhab	4	7	0,045
vasbeton	5	30	1,55
AT-L2 expandált polisztirolhab	6	20	0,045
Zárt légréteg Szokv. Hö felf.	7	5	0
szálcement homlokzatburkolat	8	1	58,1

PR 1.2 - Közbenső parkoló

Type of: cellar ceiling
y size: 1 m
Heat transmission coefficient of layered construction: 0.252 W/m²K
Allowable value: 0.260 W/m²K
The layered wall heat transmission coefficient is correct.
Heat transmission coefficient: 0.252 W/m²K
Attenuation coefficient: 306.16
Delay: 11.4 h
Unit mass: 739 kg/m²
Floor heat absorption coefficient: 0.045 $kJ/m^2Ks^{1/2}$
Floor classification: warm
Condition of air outside: -2.0 °C 90 %
Condition of air inside: 20.0 °C 50 %
Outside heat-transfer resistance: 0.17 m²K/W
Inside heat-transfer resistance [m^2K/W]: 0.17 m²K/W
Diffusion period: 180 day
Layers from outside to inside

Layer	No.	d	λ
title	-	[cm]	[W/mK]
Csempe	1	0,6	1,05
vasbeton	2	30	1,55
Rockwool Ceilingrock	3	12	0,035
Isoflex ALU alutükrös PE fólia	4	0,1	0,2

PR 2.2 - Földszinti födém

Type of: cellar ceiling
y size: 1 m
Heat transmission coefficient of layered construction: 0.180 W/m²K
Allowable value: 0.260 W/m²K
The layered wall heat transmission coefficient is correct.
Resultant heat transmission coefficient: 0.198 W/m²K
Heat transmission coefficient modifying factor: 10%
Attenuation coefficient: 4506.52
Delay: 16.1 h
Unit mass: 884 kg/m²
Floor heat absorption coefficient: 0.045 $kJ/m^2Ks^{1/2}$
Floor classification: warm
Condition of air outside: -2.0 °C 90 %
Condition of air inside: 20.0 °C 50 %
Outside heat-transfer resistance: 0.17 m²K/W
Inside heat-transfer resistance [m^2K/W]: 0.17 m²K/W
Diffusion period: 180 day
Layers from outside to inside

Layer	No.	d	λ
title	-	[cm]	[W/mK]
Csempe	1	0,6	1,05
cement esztrich	2	6	1,55
AUSTROTHERM technológiai szigete	3	0,009	0
AT-L4 expandált polisztirolhab	4	7	0,045
vasbeton	5	30	1,55

Rockwool Ceilingrock	6	12	0,035

TR 1.1 - Tető - általános

Type of: roof
y size: 1 m
Heat transmission coefficient of layered construction: 0.151 W/m²K
Allowable value: 0.170 W/m²K
The layered wall heat transmission coefficient is correct.
Resultant heat transmission coefficient:0.166W/m²K
Heat transmission coefficient modifying factor: 10%
Attenuation coefficient: 556.69
Delay: 11.5 h
Unit mass: 678 kg/m²
Unit heat-storing mass: 558 kg/m²
Specific heat capacity: 469 kJ/m²K
Surface temperature at -15 °C: 19.5 °C 52 %
Condition of air outside: -2.0 °C 90 %
Condition of air inside: 20.0 °C 50 %
Outside heat-transfer resistance: 0.04 m²K/W
Inside heat-transfer resistance [m^2K/W]: 0.10 m²K/W
Diffusion period: 180 day
Layers from outside to inside

Layer title	No. -	d [cm]	λ [W/mK]
AT-N150 expandált polisztirolhab	1	2	0,035
AT-N150 expandált polisztirolhab	2	20	0,035
Isoflex ALU alutükrös PE fólia	3	0,1	0,2
vasbeton	4	28	1,55

TR 1.2 - Tető - lépcsőház

Type of: roof
y size: 1 m
Heat transmission coefficient of layered construction: 0.152 W/m²K
Allowable value: 0.170 W/m²K
The layered wall heat transmission coefficient is correct.
Resultant heat transmission coefficient:0.168W/m²K
Heat transmission coefficient modifying factor: 10%
Attenuation coefficient: 319.72
Delay: 9.5 h
Unit mass: 486 kg/m²
Unit heat-storing mass: 480 kg/m²
Specific heat capacity: 403 kJ/m²K
Surface temperature at -15 °C: 19.5 °C 52 %
Condition of air outside: -2.0 °C 90 %
Condition of air inside: 20.0 °C 50 %
Outside heat-transfer resistance: 0.04 m²K/W
Inside heat-transfer resistance [m^2K/W]: 0.10 m²K/W
Diffusion period: 180 day
Layers from outside to inside
Layer No d λ

title	. -	[cm]	[W/mK]
AT-N150 expandált polisztirolhab	1	2	0,035
AT-N150 expandált polisztirolhab	2	20	0,035
Isoflex ALU alutükrös PE fólia	3	0,1	0,2
vasbeton	4	20	1,55

TR 1.4 - Tető - zöldtető

Type of: roof
y size: 1 m
Heat transmission coefficient of layered construction: 0.144 W/m²K
Allowable value: 0.170 W/m²K
The layered wall heat transmission coefficient is correct.
Resultant heat transmission coefficient:0.159W/m²K
Heat transmission coefficient modifying factor: 10%
Attenuation coefficient: 1493.51
Delay: 17.8 h
Unit mass: 954 kg/m²
Unit heat-storing mass: 558 kg/m²
Specific heat capacity: 469 kJ/m²K
Surface temperature at -15 °C: 19.5 °C 52 %
Condition of air outside: -2.0 °C 90 %
Condition of air inside: 20.0 °C 50 %
Outside heat-transfer resistance: 0.04 m²K/W
Inside heat-transfer resistance [m^2K/W]: 0.10 m²K/W
Diffusion period: 180 day
Layers from outside to inside

Layer	No	d	λ
title	. -	[cm]	[W/mK]
kavicsfeltöltés	1	10	0,35
AT-N150 expandált polisztirolhab	2	2	0,035
AT-N150 expandált polisztirolhab	3	20	0,035
Isoflex ALU alutükrös PE fólia	4	0,1	0,2
vasbeton	5	32	1,55

TR 1.5 - Tető - gres

Type of: roof
y size: 1 m
Heat transmission coefficient of layered construction: 0.150 W/m²K
Allowable value: 0.170 W/m²K

The layered wall heat transmission coefficient is correct.

Resultant heat transmission coefficient: 0.165 W/m²K
Heat transmission coefficient modifying factor: 10%
Attenuation coefficient: 737.98
Delay: 13.0 h
Unit mass: 810 kg/m²
Unit heat-storing mass: 558 kg/m²
Specific heat capacity: 469 kJ/m²K
Surface temperature at -15 °C: 19.5 °C 52 %
Condition of air outside: -2.0 °C 90 %
Condition of air inside: 20.0 °C 50 %
Outside heat-transfer resistance: 0.04 m²K/W
Inside heat-transfer resistance [m^2K/W]: 0.10 m²K/W
Diffusion period: 180 day
Layers from outside to inside

Layer	No.	d	λ
title	-	[cm]	[W/mK]
Csempe	1	2	1,05
AT-N150 expandált polisztirolhab	2	2	0,035
AT-N150 expandált polisztirolhab	3	20	0,035
Isoflex ALU alutükrös PE fólia	4	0,1	0,2
vasbeton	5	32	1,55

Üvegfal - hotel

Type of: glass wall in facing
Heat transmission coefficient: 1.190 W/m²K
Allowable value: 1.400 W/m²K

The heat transmission coefficient is suitable.

Glassing rate: 90 %
Glazing g value: 0.320
Night associate structure heat conduction resistant: 0.120 m²K/W
Shading method in summer: inside
Solar coefficient of shading in summer: 1.000

Üvegfal - hotel 0

Type of: glass wall in facing
Heat transmission coefficient: 1.190 W/m²K
Allowable value: 1.400 W/m²K

The heat transmission coefficient is suitable.

Glassing rate: 0 %
Glazing g value: 0.320

Üvegfal - iroda
Type of: glass wall in facing
Heat transmission coefficient: 0.760 W/m^2K
Allowable value: 1.400 W/m^2K
The heat transmission coefficient is suitable.
Glassing rate: 90 %
Glazing g value: 0.320
Night associate structure heat conduction resistant: 0.120 m^2K/W
Shading method in summer: inside
Solar coefficient of shading in summer: 1.000

Üvegfal - iroda 0
Type of: glass wall in facing
Heat transmission coefficient: 0.760 W/m^2K
Allowable value: 1.400 W/m^2K
The heat transmission coefficient is suitable.
Glassing rate: 0 %
Glazing g value: 0.320

Üvegfal - lakó
Type of: glass wall in facing
Heat transmission coefficient: 1.120 W/m^2K
Allowable value: 1.400 W/m^2K
The heat transmission coefficient is suitable.
Glassing rate: 90 %
Glazing g value: 0.320
Night associate structure heat conduction resistant: 0.120 m^2K/W
Shading method in summer: inside
Solar coefficient of shading in summer: 1.000

Üvegfal - lakó 0
Type of: glass wall in facing
Heat transmission coefficient: 1.120 W/m^2K
Allowable value: 1.400 W/m^2K
The heat transmission coefficient is suitable.
Glassing rate: 0 %
Glazing g value: 0.320

Bounding Constructions:

Title of construction	type	orientation	Angle of tilt	U	U*	Ψ	g
			[°]	[W/m^2K]	[W/m^2K]	[W/mK]	-
FR 2.4 - Homlokzati fal	Peripheral wall	NE	vertical	0,212	0,212	-	
Üvegfal - iroda	glass wall in facing	NE	vertical	0,76	0,74094	-	0,32
Üvegfal - iroda 0	glass wall in facing	NE	vertical	0,76	0,76	-	0,32
FR 2.1 - Homlokzati fal	Peripheral wall	SE	vertical	0,206	0,206	-	
FR 2.3 - Homlokzati fal	Peripheral wall	SE	vertical	0,206	0,206	-	
FR 2.4 - Homlokzati fal	Peripheral wall	SE	vertical	0,212	0,212	-	
Üvegfal - iroda	glass wall in facing	SE	vertical	0,76	0,74094	-	0,32
FR 2.3 - Homlokzati fal	Peripheral wall	SW	vertical	0,206	0,206	-	
FR 2.4 - Homlokzati fal	Peripheral wall	SW	vertical	0,212	0,212	-	
Ajtó - fém	glass panel	SW	vertical	1,3	1,2474	-	0,5498

	door (peripherial, metal)						4
Üvegfal - iroda	glass wall in facing	SW	vertical	0,76	0,74094	-	0,32
FR 2.3 - Homlokzati fal	Peripheral wall	NW	vertical	0,206	0,206	-	
FR 2.4 - Homlokzati fal	Peripheral wall	NW	vertical	0,212	0,212	-	
Üvegfal - iroda	glass wall in facing	NW	vertical	0,76	0,74094	-	0,32
Üvegfal - iroda 0	glass wall in facing	NW	vertical	0,76	0,76	-	0,32
TR 1.1 - Tető - általános	roof		horizontal	0,166	0,166	-	
TR 1.2 - Tető - lépcsőház	roof		horizontal	0,168	0,168	-	
TR 1.4 - Tető - zöldtető	roof		horizontal	0,159	0,159	-	
TR 1.5 - Tető - gres	roof		horizontal	0,165	0,165	-	
PR 1.2 - Közbenső parkoló	cellar ceiling			0,252	0,2016	-	
PR 2.2 - Földszinti födém	cellar ceiling			0,198	0,1584	-	
PR - Kiugró födém	floor on arcade			0,152	0,152	-	
FR 2.5 - Parkoló fal	internal wall (towards unheated space)			0,332	0,2656	-	

Heat storage masses:

Name	A [m²]	m_t [kg/m²]	M_t [t]	c [kJ/m²K]	C [MJ/K]
FR 2.1 - Homlokzati fal	9,0	480	4,30	403	3,61
FR 2.3 - Homlokzati fal	35,9	480	17,22	403	14,46
FR 2.4 - Homlokzati fal	46,8	480	22,48	403	18,88
TR 1.1 - Tető - általános	1062,5	558	592,90	469	498,33
TR 1.2 - Tető - lépcsőház	28,5	480	13,69	403	11,49
TR 1.4 - Tető - zöldtető	260,6	558	145,39	469	122,20
TR 1.5 - Tető - gres	53,2	558	29,67	469	24,94
PR - Kiugró födém	54,6	45	2,46	36	1,97
FR 2.5 - Parkoló fal	62,5	480	29,98	403	25,17
Total	-	-	858,09	-	721,05

Zones according to conditions of use:

Zone type	A [m²]	θ_F [°C]	θ_H [°C]	$n_{szüksüks}$ [1/h]	V_{LT}/A [m³/m²h]	t_{nap} [h/day]	$N_{év}$ [days/year]
Big office (>5 person)	8637,9	22	26	-	6,0	11,0	250
Corridor	468,1	22	26	-	-	24,0	365
WC és lavatory room	329,8	22	26	-	15,0	24,0	365
Dolgozói	45,0	22	26	-	15,0	24,0	365
Subordinate room	78,2	20	26	-	-	24,0	365

Heat-balance zones:

Zone name	A [m²]	$C_{m,eff}/A_N$ [kJ/m²K]	n_{filt} [1/h]	$n_{éjjel}$ [1/h]
	9559,0	75	0,06	-

Calculation zones:

Zone sign	Type	Heat balance same zone	t_e [°C]	A [m^2]	V [m^3]	$C_{m,eff}$ [kJ/m^{2}K]	$Q_{F,net}$ [MWh/a]	$q_{F,net}$ [kWh/m^{2}a]	Q_H [MW
F1	heating	9559,00 m2	22,0	45,0	125,9	640	23,92	532,2	
F2	heating	9559,00 m2	22,0	8637,9	24310,0	72	288,4	33,4	
H1	cooling	9559,00 m2	26,0	8637,9	24310,0	72			

Fűtési rendszer - fan-coil

Fan-coil, talajszondás hőszivattyú

A_N: 8637.94 m^2 (floor space of system)

$Q_{F,net,FR}$: 251228 kWh/a (net thermal energy demand of the operation)

$q_{F,net,FR}$: 29.08 kWh/m^{2}a (unit net caloric energy demand of heating)

Talajszondás hőszivattyú

Electric current (type of energy carrier)

ε_F: 0.20 (power factor of heater)

$w_{F,seg}$: 0.00 kWh/m^{2}a (specific auxiliary energy demand)

$Q_{F,vég}$: 53220 kWh/a (final heating energy demand)

Direct room air heating

Air heating (induction, fan coil) with continuous PI or PID control of internal temperature

$\varepsilon_{F,szab,0}$: 1.042 (Heater regulation)

$\varepsilon_{F,szab}$: 1.042 (correction to reflect the effect of the adjustment)

45/35°C elosztó hálózat

$q_{F,száll}$: 0.50 kWh/m^{2}a (unit loss of distribution pipe)

Pump with speed regulation; dt 10 K

$w_{F,sziv}$: 0.28 kWh/m^{2}a (unit power demand of circulation)

45/35°C tárolás

$q_{F,tár}$: 0.00 kWh/m^{2}a (unit loss of heat buffering and auxiliary power demand)

$w_{F,tár}$: 0.05 kWh/m^{2}a

Energy use

$W_{F,vég}$: 2920 kWh/a (auxiliary power demand)

$E_{F,vég}$: 53220 kWh/a (final energy demand) electricity

$E_{F,vég}$: 212878 kWh/a (final energy demand) environmental heat

Indicators

$E_{F,nren,fajl}$: **14.95 kWh/m^{2}a** (non-renewable primary energy demand)

$E_{F,ren,fajl}$: **26.59 kWh/m^{2}a** (renewable primary energy demand)

$E_{F,tot,fajl}$: **41.54 kWh/m^{2}a** (total primary energy demand)

$E_{F,CO2,fajl}$: **3.62 kgCO_2/m^{2}a** (CO2 emissions)

Fűtési rendszer - radiátor

Radiátor, talajszondás hőszivattyú

A_N:	44.95	m^2	(floor space of system)
$Q_{F,net,FR}$:	23124	kWh/a	(net thermal energy demand of the operation)
$q_{F,net,FR}$:	514.45	kWh/m^2a	(unit net caloric energy demand of heating)

Talajszondás hőszivattyú

Electric current			(type of energy carrier)
ε_F:	0.20		(power factor of heater)
$w_{F,seg}$:	0.00	kWh/m^2a	(specific auxiliary energy demand)
$Q_{F,vég}$:	4646	kWh/a	(final heating energy demand)

With free surface (radiator)

Regulation for reference room, PI controller, centralised room temperature control with room-by-room temperature control

$\varepsilon_{F,szab,0}$: 1.042 (Heater regulation)

double pipe heating and modernised single pipe heating 45 °C/35 °C

$\varepsilon_{F,szab,1}$: 0.012 (Temperature effect)

external wall mounted radiator

$\varepsilon_{F,szab,2}$: 0.009 (Barrier effect)

separate, able to switch on/off independently (e.g. thermostatic valve)

$\varepsilon_{F,szab,3}$: -0.060 (Room control)

Two-pipe system with dynamic control per radiators (e.g. with automatic flow limiters/pressure differential regulators)

$\varepsilon_{F,szab,4}$: 0.000 (Hydraulic control)

$\varepsilon_{F,szab}$: 1.003 (correction to reflect the effect of the adjustment)

45/35°C elosztó hálózat

$q_{F,száll}$: 0.70 kWh/m^2a (unit loss of distribution pipe)

Pump with speed regulation; dt 10 K

$w_{F,sziv}$: 1.98 kWh/m^2a (unit power demand of circulation)

45/35°C tárolás

$q_{F,tár}$: 0.10 kWh/m^2a (unit loss of heat buffering and auxiliary power demand)

$w_{F,tár}$: 0.63 kWh/m^2a

Energy use

$W_{F,vég}$:	117	kWh/a	(auxiliary power demand)
$E_{F,vég}$:	4646	kWh/a	(final energy demand) electricity
$E_{F,vég}$:	18584	kWh/a	(final energy demand) environmental heat

Indicators

$E_{F,nren,fajl}$:	**243.73**	**kWh/m^2a**	(non-renewable primary energy demand)
$E_{F,ren,fajl}$:	**445.22**	**kWh/m^2a**	(renewable primary energy demand)
$E_{F,tot,fajl}$:	**688.95**	**kWh/m^2a**	(total primary energy demand)
$E_{F,CO2,fajl}$:	**59.38**	**$kgCO_2/m^2a$**	(CO2 emissions)

Hot water system

A_N:	8682.89	m^2	(floor space of system)
q_{HMV}:	25.22	kWh/m^2a	(net power requirement of warm water producing)

1500 * 0.40 per person = 600.00 kWh/day Irodaház

Talajszondás hőszivattyú

Electric current			(type of energy carrier)
ε_{HMV}:	0.20		(power factor of heater)
$w_{HMV,seg}$:	0.00	kWh/m^2a	(specific auxiliary energy demand)
$Q_{HMV,vég}$:	51246	kWh/a	(final heating energy demand)

Distribution pipes in heated room; with circulation

$q_{HMV,v}$: 12.00 % (unit loss of warm water distribution)

with circulation EEI not known

$w_{HMV,száll}$: 0.10 kWh/m^2a (unit energy demand of circulation pump)

Placed in heated room, indirect heating boiler

$q_{HMV,t}$: 5.00 % (unit loss of warm water buffering)

Energy use

$W_{HMV,vég}$:	894	kWh/a	(auxiliary power demand)
$E_{HMV,vég}$:	51246	kWh/a	(final energy demand) electricity
$E_{HMV,vég}$:	204984	kWh/a	(final energy demand) environmental heat

Indicators

$E_{HMV,nren,fajl}$:	**13.81**	**kWh/m^2a**	(non-renewable primary energy demand)
$E_{HMV,ren,fajl}$:	**25.41**	**kWh/m^2a**	(renewable primary energy demand)
$E_{HMV,tot,fajl}$:	**39.22**	**kWh/m^2a**	(total primary energy demand)
$E_{HMV,CO2,fajl}$:	**3.37**	**$kgCO_2/m^2a$**	(CO2 emissions)

Ventilation system

A_{LT}:	8682.9	m^2	(floor space of system)
n_{LT}:	0.50	1/h	(Number of air changes per hour in using time)
V_{LT}:	13444.3	m^3/h	(Air volume flow rate in using time)
η_r:	80.0	%	(Efficiency of recuperator of ventilation system)
$\theta_{bef, F}$:	24.0	°C	(Supply air temperature on built in air heater)
$\theta_{bef, H}$:	26.0	°C	(Built-in air intake temperature)
$Q_{F,LT}$:	41805	kWh/a	(energy demand for heating)

Talajszondás hőszivattyú

Electric current			(type of energy carrier)
ε_{LT}:	0.20		(power factor of heater)
$w_{LT,seg}$:	0.00	kWh/m^2a	(specific auxiliary energy demand)
$Q_{LT,vég}$:	8361	kWh/a	(final heating energy demand)

Talajszondás hőszivattyú

Electric current (type of energy carrier)

ε_H: 0.17 (power factor of heater)

$w_{H,seg}$: 0.00 kWh/m^2a (specific auxiliary energy demand)

$Q_{H,vég}$:air supply temperature over 20°C, central pre-control

f_{LT}: 10.00 % (loss caused inaccurate suiting of heat power to heat requirement)

V_{LT}: 13444.3 m^3/h (air volume flow)

Δp_{LT}: 400 Pa (flow resistance of system)

η_{vent}: 50.0 % (total efficiency of ventilator)

$\Delta t_{LT,a}$: 8760 h (annual working time of ventilation system)

$W_{vent} = V_{LT} * \Delta p_{LT} / 3600 / \eta_{vent} * \Delta t_{LT,a} / 1000$

W_{vent} = 13444,3 * 400 / 3600 / 0,5 * 8760 / 1000 = 26171 kWh/a

Energy use

$W_{LT,vég}$: 26171 kWh/a (auxiliary power demand)

$E_{LT,vég}$: 94464 kWh/a (final energy demand) energy recovered by ground collectors, heat recovery

$E_{LT,vég}$: 8361 kWh/a (final energy demand) electricity

$E_{LT,vég}$: 33444 kWh/a (final energy demand) environmental heat

Indicators

$E_{LT,nren,fajl}$: **9.15 kWh/m^2a** (non-renewable primary energy demand)

$E_{LT,ren,fajl}$: **5.04 kWh/m^2a** (renewable primary energy demand)

$E_{LT,tot,fajl}$: **14.19 kWh/m^2a** (total primary energy demand)

$E_{LT,CO2,fajl}$: **1.91 $kgCO_2/m^2a$** (CO2 emissions)

Cooling system

$A_{hű}$: 8637.9 m^2 (floor space of system)

$Q_{H,net}$: 6,0554E5 kWh/a (yearly net energy demand of machine cooling)

Talajszondás hőszivattyú
Electric current (type of energy carrier)

ε_H: 0.16 (power factor of heater)

$w_{H,seg}$: 0.00 kWh/m^2a (specific auxiliary energy demand)

$Q_{H,vég}$: 133219 kWh/a (final heating energy demand)

10/15°C elosztó hálózat
$\varepsilon_{H,szab}$: 1.100 (regulatory loss factors)

10/15°C elosztó hálózat
c_H: 1.250 (the ratio between total and perceived power)

$\varepsilon_{H,száll}$: 1.000 (distribution loss factor)

Energy use

$E_{H,vég}$: 133219 kWh/a (final energy demand) electricity

Indicators

$E_{H,nren,fajl}$:	**35.47**	**kWh/m²a**	(non-renewable primary energy demand)
$E_{H,ren,fajl}$:	**4.63**	**kWh/m²a**	(renewable primary energy demand)
$E_{H,tot,fajl}$:	**40.10**	**kWh/m²a**	(total primary energy demand)
$E_{H,CO2,fajl}$:	**7.02**	**kgCO₂/m²a**	(CO2 emissions)

Lighting system

A_N:	8682.89	m²	(floor space of system)
MV:	498	lx	
FH:	120.0	lm/W	LED
η_{vil}:	0.50		All LED type
F_{fe}:	0.78		Dimmable LED
$F_{kihaszn}$:	0.20		Office
F_{szab}:	0.80		Manual on / automatic off
t_{nappal}:	2250	h/a	Office building
$t_{éjjel}$:	250	h/a	
F_{nappal}:	0.35		Facade glazing ratio over 80%

Energy use

$E_{V,vég}$:	46699	kWh/a	(final energy demand) electricity

Indicators

$E_{V,nren,fajl}$:	**12.37**	**kWh/m²a**	(non-renewable primary energy demand)
$E_{V,ren,fajl}$:	**1.61**	**kWh/m²a**	(renewable primary energy demand)
$E_{V,tot,fajl}$:	**13.98**	**kWh/m²a**	(total primary energy demand)
$E_{V,CO2,fajl}$:	**2.45**	**kgCO₂/m²a**	(CO2 emissions)

Assessment of building services systems:

Name	$E_{nrenren}$ [kWh/a]	$E_{nren,ref}$ [kWh/a]	$E_{nren}/E_{nren,ref}$ [%]	Classification

The aggregate energy characteristic of the building (part)

$E_{nren} = E_{F,nren} + E_{HMV,nren} + E_{LT,nren} + E_{H,nren} + E_{vil,nren} + E_{exp,nren}$ = 14,65 + 12,55 + 8,31 + 32,05 + 11,24 + 0

$E_{nren,fajl}$: **78.80 kWh/m²a** (Calculated value of cumulated energetic parameter of building)

$E_{nren,fajl,max}$: **102.26 kWh/m²a** (permissible value for new buildings)

Specific carbon dioxide emissions of the building

$E_{CO2} = E_{F,CO2} + E_{HMV,CO2} + E_{LT,CO2} + E_{H,CO2} + E_{vil,CO2} + E_{exp,CO2}$ = 3,55 + 3,06 + 1,74 + 6,34 + 2,22 + 0

$E_{CO2,fajl}$: **16.92 kg/m²a** (the calculated value of specific emissions of carbon dioxide)

$E_{CO2,fajl,max}$: **24.47 kg/m²a** (permissible value for new buildings)

Estimated annual consumption by energy sources

Energy carrier	E [MWh/a]	H	F [/a]

Electric current	327,49	-	327,49 MWh
environmental heat	469,89	-	1691,60 GJ
energy recovered by ground collectors, heat recovery	94,46	-	340,07 GJ
Total			

Data of reference building

Building

The nature of the external walls: few heat bridges

The nature of the roof: few heat bridges

Increase in air exchange due to congestion: 0,06 (windows on several facades or ventilation horns)

Heating system

Heater is in heated room

Distribution pipes placed in heated room

More than 10 heat emmiter

Hot water system

Distribution pipes placed in heated room

Cooling system

Cooler performance factors: air-to-water heat exchanger, nominal power < 400 kW, SEER: 3,8

The calculation was made according to 9/2023 ÉKM decree as of 1.XI.2023.

Near-zero energy demand buildings (Annex 2).

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signature