WP2 RESIDENTIAL BUILDINGS

asset and operational (draft) rating

ENERGY CERTIFICATE

BASIC BUILDING DATA	
Type of the building	Multi appartment building
Address	Bratovševa 22, Ljubljana
Heated area	12960 m^2
Building manager	Pate d.o.o.
Building owner	Mixed ownership
Number of stories	13
Year of construction	1976
Year of renovation	1995

Delivered energy and CO_2 emission

Class	Q [kWh/m^2a]	Asset rating CO_2 [kg/m^2a]	Operational rating Q [kWh/m^2a]
A	40	8	25
B	80	16	50
C	120	24	75
D	180	32	100
E	250	40	125
F	350	48	150
G		56	175
		64	200
		72	225
		80	250
		88	275
		96	300
		104	350
		112	375
		120	400
		128	425
	161	57	160

CERTIFICATE INFORMATION			
Issued by	EIE BUDI	Certificate number	2006 - 0001
Company	GI ZRMK	Date of validity	29.5.2006
Purpose of certificate	Renovation	Place of issue	Ljubjana

BRATOVŠEVA 1stran

ENERGY CERTIFICATE

ASSET RATING METHOD DETAILS		Building description
Shape factor A/V_e	0,23 1/m	Massive construction
Heated area A_u	538 m^2	Flat roof with 3 cm of insulation
Gross volume V_e	12960 m^3	Facade with 5 cm of insulation
Type of dimensions used	external	Unheated basement
Air exchange rate n	0,5 1/h	
Thermal capacity C	2705 MJ/K	
Internal temperature	20 °C	**Regulations**
Heat transmission H_T'	1,830 W/m^2K	0,675 W/m^2K
Heating demand Q_H	92 kWh/m^2	40 kWh/m^2
Domestic hot water demand Q_{DHW}	16 kWh/m^2	16 kWh/m^2

BUILDING ENVELOPE	Area	U
EXTERNAL WALL WITH INSULATION	1287 m^2	0,90 W/m^2K
WINDOWS FACING SOUTH	234 m^2	2,40 W/m^2K
NEW WINDOWS FACING SOUTH	351 m^2	1,60 W/m^2K
WINDOWS FACING NORTH	188 m^2	2,40 W/m^2K
NEW WINDOWS FACING NORTH	280 m^2	1,60 W/m^2K
FLOOR ON THE GROUND	312 m^2	2,34 W/m^2K
ROOF	312 m^2	0,62 W/m^2K
DOORS	2 m^2	3,10 W/m^2K

HEATING SYSTEM		Energy performance factor	
Fuel used for heating	District heating	Primary energy	1,58
Heat generation	Boiler for district heating	Generation	0,90
Heat distribution	Pipes	Distribution	0,92
Heat emissivity	Radiators	Emissivity	0,78
DHW SYSTEM		**Energy performance factor**	
Fuel used for DHW	Electricity	Primary energy	2,15
Generation	Local boilers	Generation	0,90
Distribution	No circulation	Distribution	0,92

BRATOVŠEVA 2stran

ENERGY CERTIFICATE

ENERGY SAVING SCENARIO 1

Installing thermostatic valves

Installing new windows, U_{min} = 1,2 W/m^{2}K

Insulating roof with 20 cm insulation

Initial energy demand	**161 kWh/m^2 a**	**Final energy demand**	**130 kWh/m^2 a**
Initial CO_2 emission	**57 kg/m^2 a**	**Final CO_2 emission**	**47 kg/m^2 a**
Initial benchmark	**D**	**Final benchmark**	**D**

ENERGY SAVING SCENARIO 2

Installing thermostatic valves

Installing new windows, U_{min} = 1,2 W/m^{2}K

Insulating roof with 20 cm insulation

Insulating pipes for heating distribution

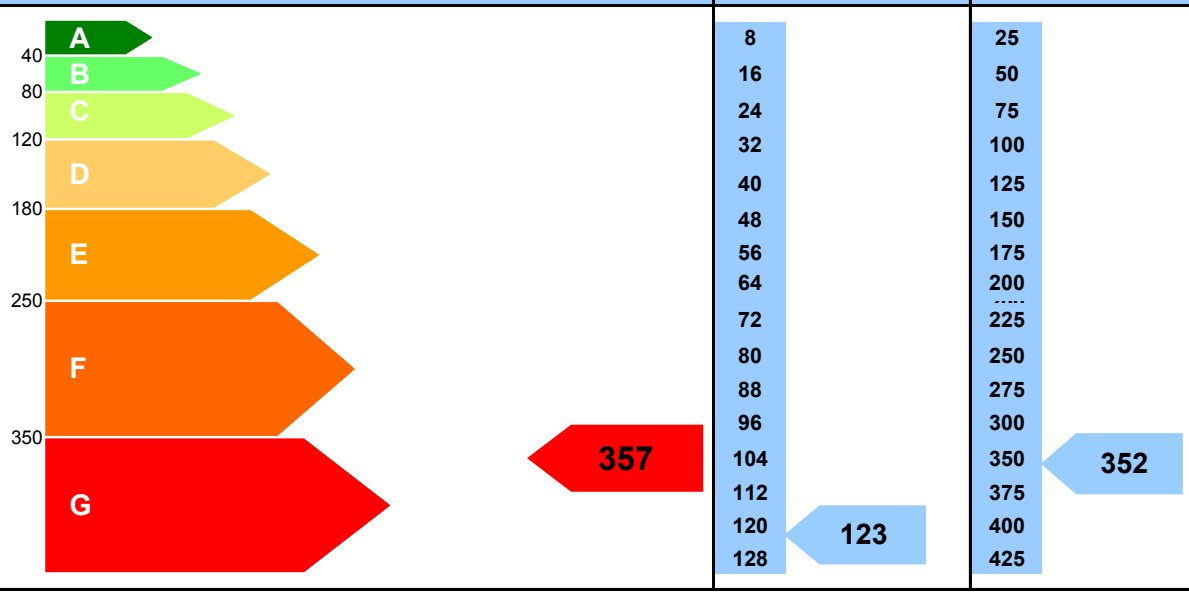
Insulating facade with 12 cm insulation

Initial energy demand	**161 kWh/m^2 a**	**Final energy demand**	**103 kWh/m^2 a**
Initial CO_2 emission	**57 kg/m^2 a**	**Final CO_2 emission**	**38 kg/m^2 a**
Initial benchmark	**D**	**Final benchmark**	**C**

ENERGY CERTIFICATE

BASIC BUILDING DATA	
Type of the building	Multi appartment building
Address	Fabijanijeva 41, Ljubljana
Heated area	882 m^2
Building manager	SZ RTV z.o.o.
Building owner	Mixed ownership
Number of stories	6
Year of construction	1957
Year of renovation	1992

Delivered energy and CO_2 emission



CERTIFICATE INFORMATION			
Issued by	EIE BUDI	Certificate number	2006 - 0002
Company	GI ZRMK	Date of validity	29.5.2006
Purpose of certificate	Renovation	Place of issue	Ljubjana

FABIJANIJEVA 1 STRAN

ENERGY CERTIFICATE

ASSET RATING METHOD DETAILS		Building description
Shape factor A/V_e	0,36 1/m	Massive construction
Heated area A_u	882 m^2	Flat roof without insulation
Gross volume V_e	2756 m^3	Facade without insulation
Type of dimensions used	external	Unheated basement
Air exchange rate n	0,5 1/h	
Thermal capacity C	348 MJ/K	
Internal temperature	20 °C	**Regulations**
Heat transmission H_T'	2,132 W/m^2K	0,675 W/m^2K
Heating demand Q_H	184 kWh/m^2	47 kWh/m^2
Domestic hot water demand Q_{DHW}	16 kWh/m^2	16 kWh/m^2

BUILDING ENVELOPE	Area	U
EXTERNAL WALL	532 m^2	1,68 W/m^2K
WINDOWS FACING SOUTH EAST	100 m^2	2,40 W/m^2K
NEW WINDOWS FACING SOUTH EAST	22 m^2	1,60 W/m^2K
WINDOWS FACING NORTH WEST	80 m^2	2,40 W/m^2K
NEW WINDOWS FACING NORTH WEST	27 m^2	1,60 W/m^2K
WINDOWS FACING NORTH EAST	4 m^2	2,40 W/m^2K
FLOOR ON THE GROUND	150 m^2	1,30 W/m^2K
ROOF	150 m^2	1,04 W/m^2K
DOORS	2 m^2	3,10 W/m^2K

HEATING SYSTEM		Energy performance factor	
Fuel used for heating	District heating	Primary energy	1,58
Heat generation	Boiler for district heating	Generation	0,90
Heat distribution	Pipes	Distribution	0,77
Heat emissivity	Radiators	Emissivity	0,79
DHW SYSTEM		**Energy performance factor**	
Fuel used for DHW	Electricity	Primary energy	2,15
Generation	Local boilers	Generation	0,90
Distribution	No circulation	Distribution	0,92

FABIANIJEVA 2 STRAN

ENERGY CERTIFICATE

ENERGY SAVING SCENARIO 1

Installing thermostatic valves

Installing new windows, U_{min} = 1,2 W/m^{2}K

Insulating roof with 20 cm insulation

Initial energy demand	**357 kWh/m^2 a**	**Final energy demand**	**290 kWh/m^2 a**
Initial CO_2 emission	**123 kg/m^2 a**	**Final CO_2 emission**	**100 kg/m^2 a**
Initial benchmark	**G**	**Final benchmark**	**F**

ENERGY SAVING SCENARIO 2

Installing thermostatic valves

Installing new windows, U_{min} = 1,2 W/m^{2}K

Insulating roof with 20 cm insulation

Insulating pipes for heating distribution

Insulating facade with 12 cm insulation

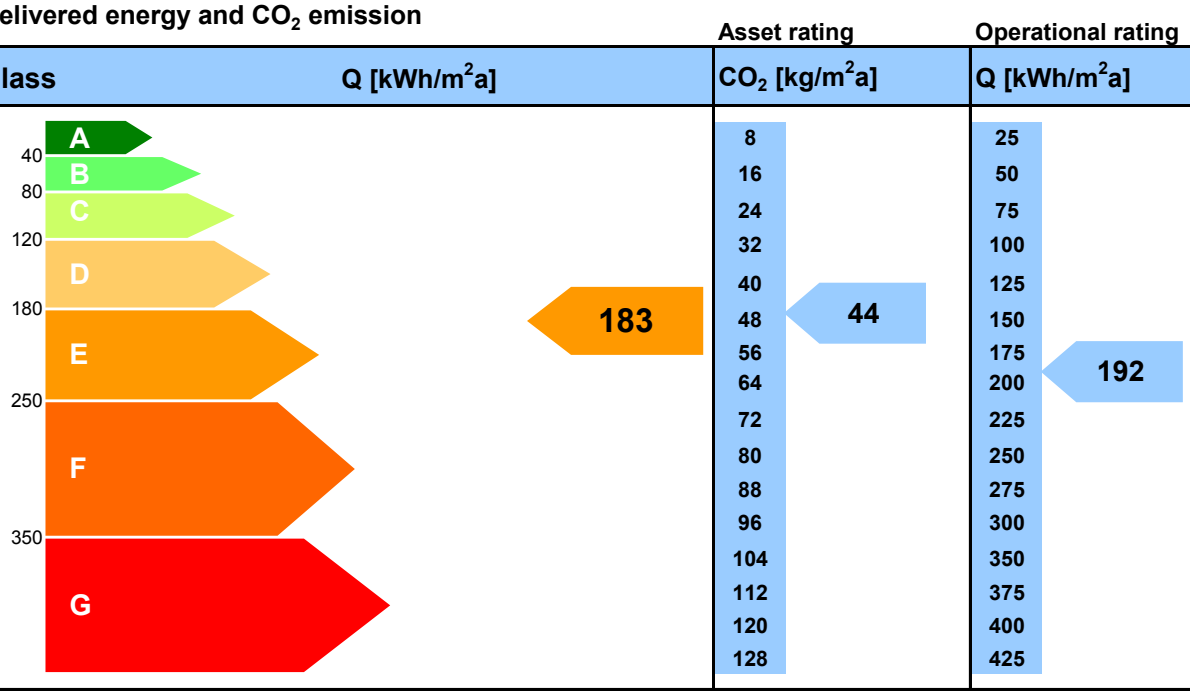
Initial energy demand	**357 kWh/m^2 a**	**Final energy demand**	**142 kWh/m^2 a**
Initial CO_2 emission	**123 kg/m^2 a**	**Final CO_2 emission**	**51 kg/m^2 a**
Initial benchmark	**G**	**Final benchmark**	**D**

FABIANIJEVA 3STRAN

ENERGY CERTIFICATE

BASIC BUILDING DATA	
Type of the building	Multi appartment building
Address	Glavarjeva 47, Ljubljana
Heated area	6774 m^2
Building manager	SPL d.d.
Building owner	Mixed ownership
Number of stories	15
Year of construction	1977
Year of renovation	1990

Delivered energy and CO_2 emission



CERTIFICATE INFORMATION			
Issued by	EIE BUDI	Certificate number	2006 - 0003
Company	GI ZRMK	Date of validity	29.5.2006
Purpose of certificate	Renovation	Place of issue	Ljubjana

GLAVARJEVA 1 STRAN

ENERGY CERTIFICATE

ASSET RATING METHOD DETAILS		Building description
Shape factor A/V_e	0,24 1/m	Massive construction
Heated area A_u	6774 m^2	Flat roof with 3 cm insulation
Gross volume V_e	21168 m^3	Facade with 5 cm insulation
Type of dimensions used	external	Unheated basement
Air exchange rate n	0,5 1/h	
Thermal capacity C	4733 MJ/K	
Internal temperature	20 °C	**Regulations**
Heat transmission H_T'	1,564 W/m^2K	0,675 W/m^2K
Heating demand Q_H	83 kWh/m^2	40 kWh/m^2
Domestic hot water demand Q_{DHW}	16 kWh/m^2	16 kWh/m^2

BUILDING ENVELOPE	Area	U
EXTERNAL WALL	2212 m^2	0,61 W/m^2K
WINDOWS FACING SOUTH	76 m^2	2,40 W/m^2K
WINDOWS FACING EAST	844 m^2	2,40 W/m^2K
WINDOWS FACING WEST	844 m^2	2,40 W/m^2K
WINDOWS FACING NORTH	76 m^2	2,40 W/m^2K
FLOOR ON THE GROUND	504 m^2	0,27 W/m^2K
ROOF	504 m^2	0,83 W/m^2K
DOORS	2 m^2	3,10 W/m^2K

HEATING SYSTEM		Energy performance factor	
Fuel used for heating	District heating	Primary energy	1,58
Heat generation	Boiler for district heating	Generation	0,90
Heat distribution	Pipes	Distribution	0,95
Heat emissivity	Radiators	Emissivity	0,81
DHW SYSTEM		**Energy performance factor**	
Fuel used for DHW	Gas oil	Primary energy	1,00
Generation	Central boiler	Generation	0,90
Distribution	Circulation	Distribution	0,80

GLAVARJEVA 2 STRAN

ENERGY CERTIFICATE

ENERGY SAVING SCENARIO 1

Installing thermostatic valves

Installing new windows, U_{min} = 1,2 W/m^{2}K

Insulating roof with 20 cm insulation

Initial energy demand	**183 kWh/m^2 a**	**Final energy demand**	**92 kWh/m^2 a**
Initial CO_2 emission	**44 kg/m^2 a**	**Final CO_2 emission**	**29 kg/m^2 a**
Initial benchmark	**E**	**Final benchmark**	**C**

ENERGY SAVING SCENARIO 2

Installing thermostatic valves

Installing new windows, U_{min} = 1,2 W/m^{2}K

Insulating roof with 20 cm insulation

Insulating pipes for heating distribution

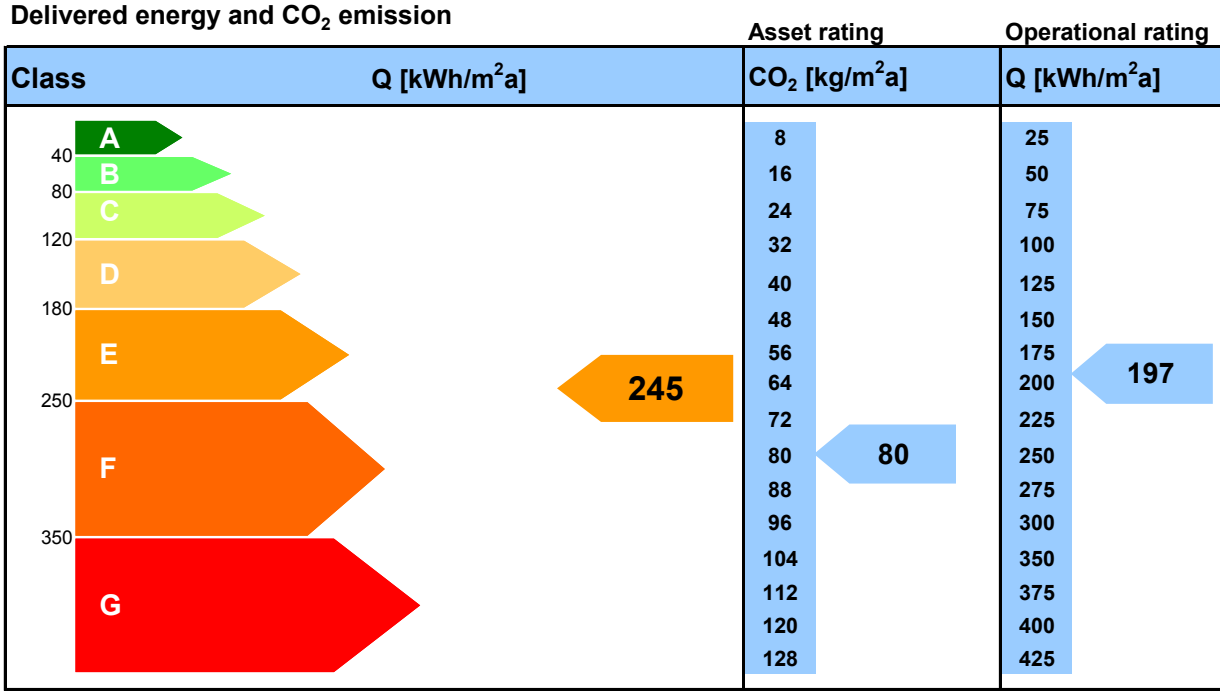
Insulating facade with 12 cm insulation

Initial energy demand	**183 kWh/m^2 a**	**Final energy demand**	**76 kWh/m^2 a**
Initial CO_2 emission	**44 kg/m^2 a**	**Final CO_2 emission**	**24 kg/m^2 a**
Initial benchmark	**E**	**Final benchmark**	**B**

ENERGY CERTIFICATE

BASIC BUILDING DATA	
Type of the building	Multi appartment building
Address	Hermana Potočnika 34, Ljubljana
Heated area	778 m^2
Building manager	SPL d.d.
Building owner	Mixed ownership
Number of stories	4
Year of construction	1996
Year of renovation	-

Delivered energy and CO_2 emission



CERTIFICATE INFORMATION			
Issued by	EIE BUDI	Certificate number	2006 - 0004
Company	GI ZRMK	Date of validity	29.5.2006
Purpose of certificate	Renovation	Place of issue	Ljubjana

ENERGY CERTIFICATE

ASSET RATING METHOD DETAILS		Building description
Shape factor A/V_e	0,54 1/m	Massive construction
Heated area A_u	778 m^2	Pitched roof with 5 cm insulation
Gross volume V_e	2430 m^3	Facade with 5 cm insulation
Type of dimensions used	external	Unheated basement
Air exchange rate n	0,5 1/h	
Thermal capacity C	819 MJ/K	
Internal temperature	20 °C	**Regulations**
Heat transmission H_T'	1,116 W/m^2K	0,578 W/m^2K
Heating demand Q_H	131 kWh/m^2	55 kWh/m^2
Domestic hot water demand Q_{DHW}	16 kWh/m^2	16 kWh/m^2

BUILDING ENVELOPE	Area	U
EXTERNAL WALL	432 m^2	0,56 W/m^2K
WINDOWS FACING SOUTH EAST	27 m^2	1,40 W/m^2K
WINDOWS FACING NORTH EAST	108 m^2	1,40 W/m^2K
WINDOWS FACING SOUTH WEST	108 m^2	1,40 W/m^2K
WINDOWS FACING NORTH WEST	45 m^2	1,40 W/m^2K
FLOOR ON THE GROUND	280 m^2	1,00 W/m^2K
ROOF	308 m^2	0,43 W/m^2K
DOORS	2 m^2	3,10 W/m^2K

HEATING SYSTEM		Energy performance factor	
Fuel used for heating	District heating	Primary energy	1,58
Heat generation	Boiler for district heating	Generation	0,90
Heat distribution	Pipes	Distribution	0,74
Heat emissivity	Radiators	Emissivity	0,87
DHW SYSTEM		**Energy performance factor**	
Fuel used for DHW	Gas oil	Primary energy	1,00
Generation	Central boiler	Generation	0,90
Distribution	Circulation	Distribution	0,80

HERMANA POTOČNIKA 2 STRAN

ENERGY CERTIFICATE

ENERGY SAVING SCENARIO 1

Insulating floor with 8 cm insulation

Insulating facade with 12 cm insulation

Insulating roof with 20 cm insulation

Initial energy demand	**245 kWh/m^2 a**	**Final energy demand**	**159 kWh/m^2 a**
Initial CO_2 emission	**80 kg/m^2 a**	**Final CO_2 emission**	**51 kg/m^2 a**
Initial benchmark	**E**	**Final benchmark**	**D**

ENERGY SAVING SCENARIO 2

Insulating floor with 8 cm insulation

Insulating facade with 12 cm insulation

Insulating roof with 20 cm insulation

Insulating pipes for heating distribution

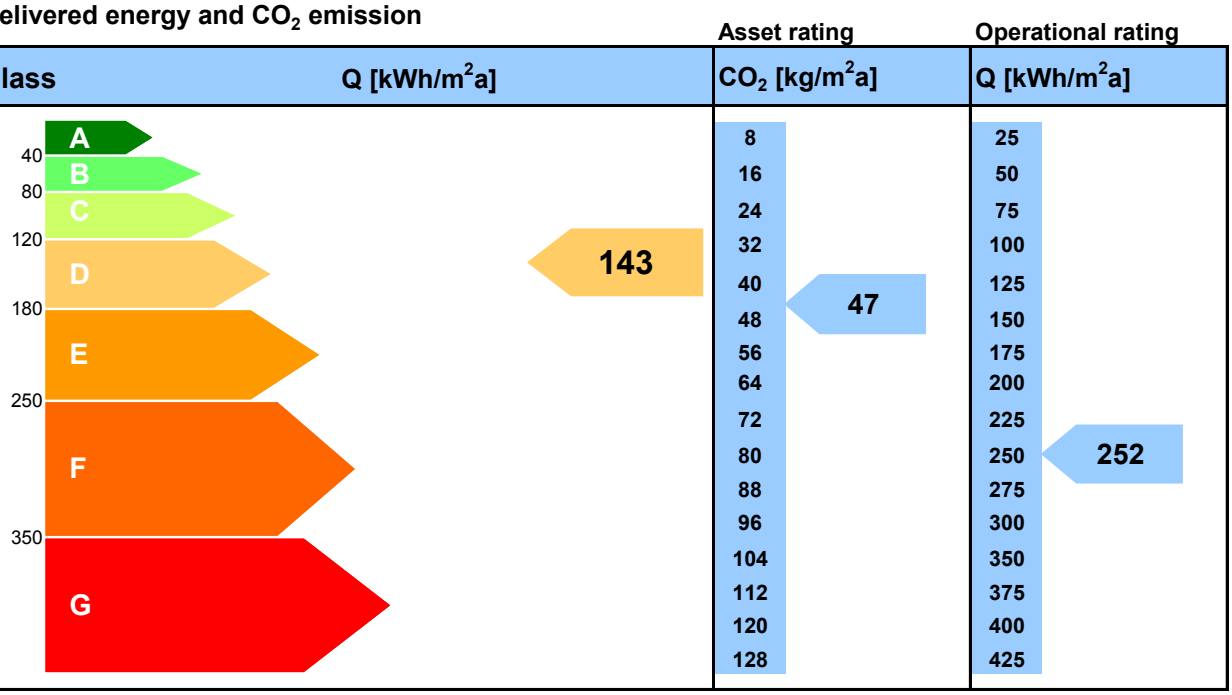
Initial energy demand	**245 kWh/m^2 a**	**Final energy demand**	**120 kWh/m^2 a**
Initial CO_2 emission	**80 kg/m^2 a**	**Final CO_2 emission**	**38 kg/m^2 a**
Initial benchmark	**E**	**Final benchmark**	**C**

ENERGY CERTIFICATE

BASIC BUILDING DATA

Type of the building	Multi appartment building
Address	Jakopičeva 19, Ljubljana
Heated area	1169 m^2
Building manager	SPL d.d.
Building owner	Mixed ownership
Number of stories	6
Year of construction	1995
Year of renovation	-

Delivered energy and CO_2 emission



CERTIFICATE INFORMATION

Issued by	EIE BUDI	Certificate number	2006 - 0005
Company	GI ZRMK	Date of validity	29.5.2006
Purpose of certificate	Renovation	Place of issue	Ljubjana

ENERGY CERTIFICATE

ASSET RATING METHOD DETAILS		Building description
Shape factor A/V_e	0,46 1/m	Massive construction
Heated area A_u	1169 m^2	Roof with 8 cm insulation
Gross volume V_e	3654 m^3	Facade with 8 cm insulation
Type of dimensions used	external	Unheated basement
Air exchange rate n	0,5 1/h	
Thermal capacity C	2238 MJ/K	
Internal temperature	20 °C	**Regulations**
Heat transmission H_T'	0,647 W/m^2K	0,629 W/m^2K
Heating demand Q_H	73 kWh/m^2	51 kWh/m^2
Domestic hot water demand Q_{DHW}	16 kWh/m^2	16 kWh/m^2

BUILDING ENVELOPE	Area	U
EXTERNAL WALL	1056 m^2	0,51 W/m^2K
WINDOWS FACING SOUTH EAST	78 m^2	1,42 W/m^2K
WINDOWS FACING SOUTH WEST	10 m^2	1,42 W/m^2K
WINDOWS FACING NORTH WEST	111 m^2	1,42 W/m^2K
FLOOR ON THE GROUND	200 m^2	0,41 W/m^2K
ROOF	207 m^2	0,26 W/m^2K
DOORS	2 m^2	3,10 W/m^2K

HEATING SYSTEM		Energy performance factor	
Fuel used for heating	District heating	Primary energy	1,58
Heat generation	Boiler for district heating	Generation	0,90
Heat distribution	Pipes	Distribution	0,74
Heat emissivity	Radiators	Emissivity	0,87
DHW SYSTEM		**Energy performance factor**	
Fuel used for DHW	District heating	Primary energy	1,58
Generation	Boiler for district heating	Generation	0,90
Distribution	Circulation	Distribution	0,80

ENERGY CERTIFICATE

ENERGY SAVING SCENARIO 1

Insulating facade with 12 cm insulation

Initial energy demand	**143 kWh/m^2 a**	**Final energy demand**	**109 kWh/m^2 a**
Initial CO_2 emission	**47 kg/m^2 a**	**Final CO_2 emission**	**36 kg/m^2 a**
Initial benchmark	**D**	**Final benchmark**	**C**

ENERGY SAVING SCENARIO 2

Insulating facade with 12 cm insulation

Insulating pipes for heating distribution

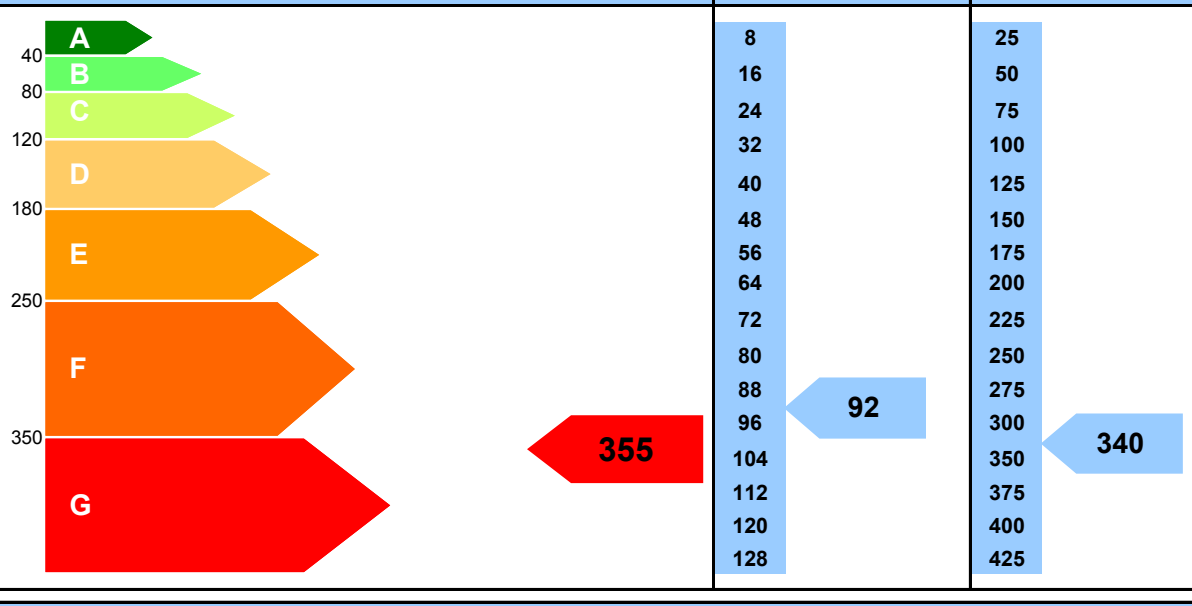
Initial energy demand	**143 kWh/m^2 a**	**Final energy demand**	**90 kWh/m^2 a**
Initial CO_2 emission	**47 kg/m^2 a**	**Final CO_2 emission**	**30 kg/m^2 a**
Initial benchmark	**D**	**Final benchmark**	**C**

JAKOPIČEVA 3 STRAN

ENERGY CERTIFICATE

BASIC BUILDING DATA	
Type of the building	Multi appartment building
Address	Jamova 70, Ljubljana
Heated area	914 m^2
Building manager	SPL d.d.
Building owner	Mixed ownership
Number of stories	6
Year of construction	1965
Year of renovation	-

Delivered energy and CO_2 emission



CERTIFICATE INFORMATION			
Issued by	EIE BUDI	Certificate number	2006 - 0006
Company	GI ZRMK	Date of validity	29.5.2006
Purpose of certificate	Renovation	Place of issue	Ljubjana

ENERGY CERTIFICATE

ASSET RATING METHOD DETAILS		Building description
Shape factor A/V_e	0,42 1/m	Massive construction
Heated area A_u	914 m^2	Pitched roof without insulation
Gross volume V_e	2856 m^3	Facade without insulation
Type of dimensions used	external	Unheated basement
Air exchange rate n	0,5 1/h	
Thermal capacity C	313 MJ/K	
Internal temperature	20 °C	**Regulations**
Heat transmission H_T'	1,832 W/m^2K	0,654 W/m^2K
Heating demand Q_H	178 kWh/m^2	49 kWh/m^2
Domestic hot water demand Q_{DHW}	16 kWh/m^2	16 kWh/m^2

BUILDING ENVELOPE	Area	U
EXTERNAL WALL	522 m^2	1,68 W/m^2K
WINDOWS FACING SOUTH EAST	101 m^2	2,11 W/m^2K
WINDOWS FACING NORTH EAST	94 m^2	2,11 W/m^2K
WINDOWS FACING SOUTH WEST	59 m^2	2,11 W/m^2K
WINDOWS FACING NORTH WEST	101 m^2	2,11 W/m^2K
FLOOR ON THE GROUND	150 m^2	0,66 W/m^2K
ROOF	180 m^2	1,26 W/m^2K
DOORS	2 m^2	3,10 W/m^2K

HEATING SYSTEM		Energy performance factor	
Fuel used for heating	Gas oil	Primary energy	1,00
Heat generation	Local boiler	Generation	0,90
Heat distribution	Pipes	Distribution	0,76
Heat emissivity	Radiators	Emissivity	0,78
DHW SYSTEM		**Energy performance factor**	
Fuel used for DHW	Gas oil	Primary energy	1,00
Generation	Central boiler	Generation	0,90
Distribution	Circulation	Distribution	0,80

JAMOVA 2 STRAN

ENERGY CERTIFICATE

ENERGY SAVING SCENARIO 1

Installing thermostatic valves

Installing new windows, U_{min} = 1,2 W/m^{2}K

Insulating roof with 20 cm insulation

Initial energy demand	**355 kWh/m^2 a**	**Final energy demand**	**262 kWh/m^2 a**
Initial CO_2 emission	**92 kg/m^2 a**	**Final CO_2 emission**	**68 kg/m^2 a**
Initial benchmark	**G**	**Final benchmark**	**F**

ENERGY SAVING SCENARIO 2

Installing thermostatic valves

Installing new windows, U_{min} = 1,2 W/m^{2}K

Insulating roof with 20 cm insulation

Insulating pipes for heating distribution

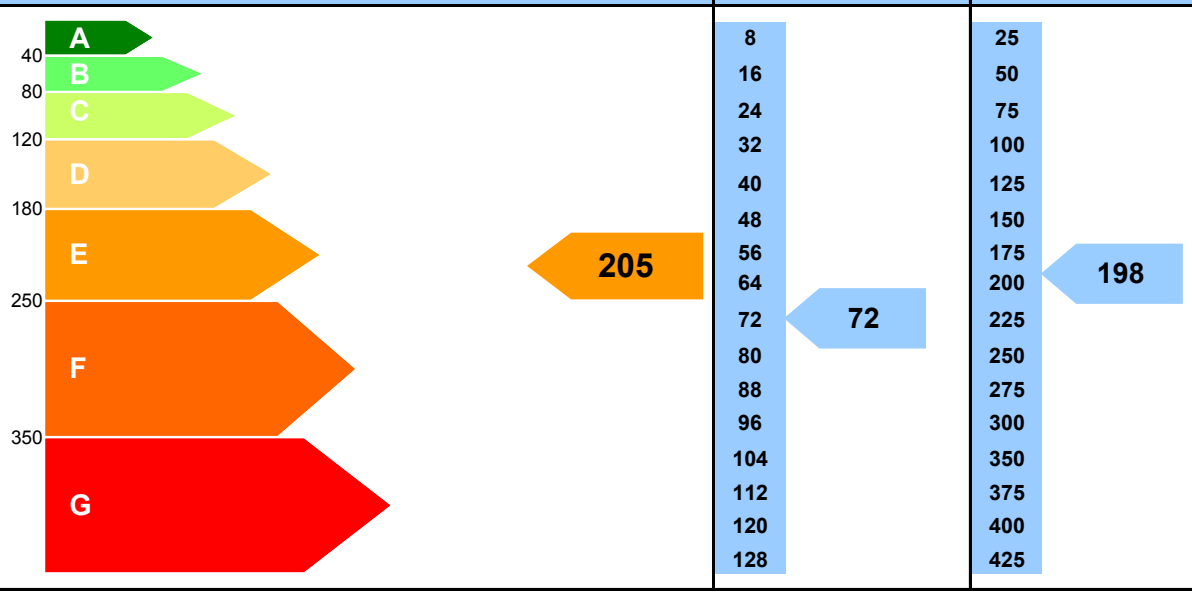
Insulating facade with 12 cm insulation

Initial energy demand	**355 kWh/m^2 a**	**Final energy demand**	**108 kWh/m^2 a**
Initial CO_2 emission	**92 kg/m^2 a**	**Final CO_2 emission**	**28 kg/m^2 a**
Initial benchmark	**G**	**Final benchmark**	**C**

ENERGY CERTIFICATE

BASIC BUILDING DATA	
Type of the building	Multi appartment building
Address	Linhartova 90, Ljubljana
Heated area	1436 m^2
Building manager	SPL d.d.
Building owner	Mixed ownership
Number of stories	7
Year of construction	1958
Year of renovation	1992

Delivered energy and CO_2 emission



CERTIFICATE INFORMATION			
Issued by	EIE BUDI	Certificate number	2006 - 0007
Company	GI ZRMK	Date of validity	29.5.2006
Purpose of certificate	Renovation	Place of issue	Ljubjana

ENERGY CERTIFICATE

ASSET RATING METHOD DETAILS		Building description
Shape factor A/V_e	0,31 1/m	Massive construction
Heated area A_u	1436 m^2	Flat roof with 2 cm insulation
Gross volume V_e	4488 m^3	Facade without insulation
Type of dimensions used	external	Unheated basement
Air exchange rate n	0,5 1/h	
Thermal capacity C	816 MJ/K	
Internal temperature	20 °C	**Regulations**
Heat transmission H_T'	1,541 W/m^2K	0,675 W/m^2K
Heating demand Q_H	102 kWh/m^2	44 kWh/m^2
Domestic hot water demand Q_{DHW}	16 kWh/m^2	16 kWh/m^2

BUILDING ENVELOPE	Area	U
EXTERNAL WALL	538 m^2	1,81 W/m^2K
WINDOWS FACING SOUTH EAST	15 m^2	2,40 W/m^2K
NEW WINDOWS FACING SOUTH EAST	134 m^2	1,40 W/m^2K
WINDOWS FACING SOUTH WEST	13 m^2	2,40 W/m^2K
NEW WINDOWS FACING SOUTH WEST	119 m^2	1,40 W/m^2K
WINDOWS FACING NORTH EAST	4 m^2	2,40 W/m^2K
FLOOR ON THE GROUND	204 m^2	0,56 W/m^2K
ROOF	205 m^2	1,17 W/m^2K
DOORS	2 m^2	3,10 W/m^2K

HEATING SYSTEM		Energy performance factor	
Fuel used for heating	District heating	Primary energy	1,58
Heat generation	Boiler for district heating	Generation	0,90
Heat distribution	Pipes	Distribution	0,75
Heat emissivity	Radiators	Emissivity	0,81
DHW SYSTEM		**Energy performance factor**	
Fuel used for DHW	Electricity	Primary energy	2,15
Generation	Local boilers	Generation	0,90
Distribution	No circulation	Distribution	0,92

LINHARTOVA 2 STRAN

ENERGY CERTIFICATE

ENERGY SAVING SCENARIO 1

Installing thermostatic valves

Installing new windows, U_{min} = 1,2 W/m^{2}K

Insulating roof with 20 cm insulation

Initial energy demand	**205 kWh/m^2 a**	**Final energy demand**	**175 kWh/m^2 a**
Initial CO_2 emission	**72 kg/m^2 a**	**Final CO_2 emission**	**62 kg/m^2 a**
Initial benchmark	**E**	**Final benchmark**	**D**

ENERGY SAVING SCENARIO 2

Installing thermostatic valves

Installing new windows, U_{min} = 1,2 W/m^{2}K

Insulating roof with 20 cm insulation

Insulating pipes for heating distribution

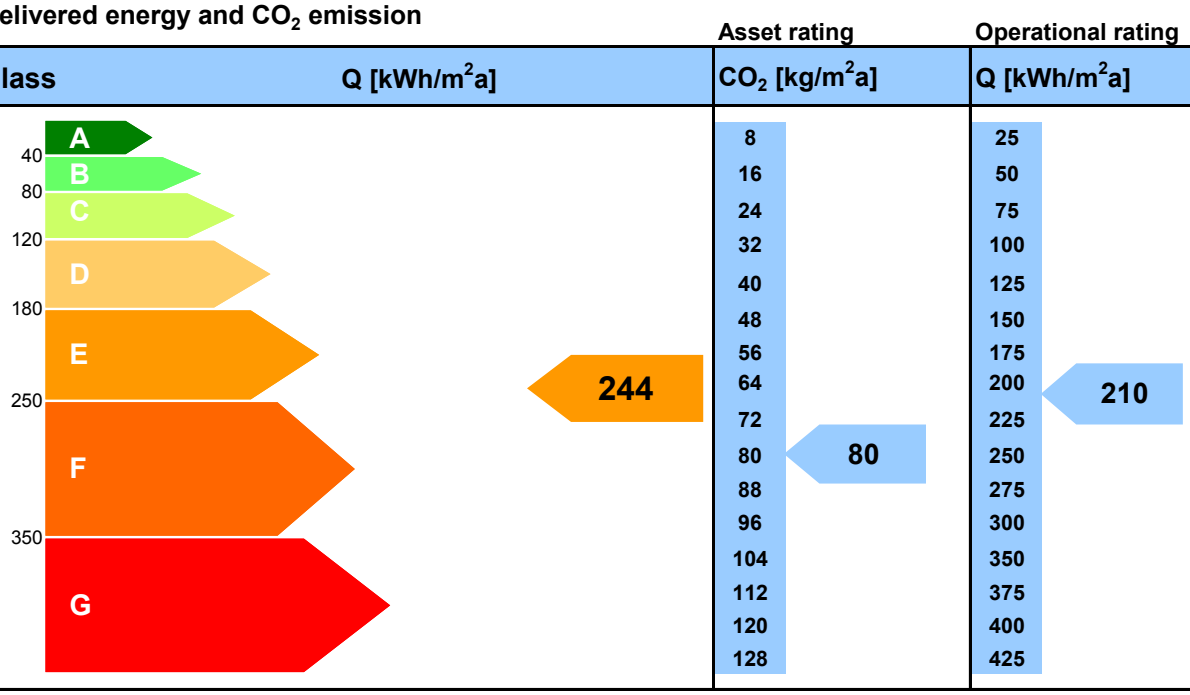
Insulating facade with 12 cm insulation

Initial energy demand	**205 kWh/m^2 a**	**Final energy demand**	**77 kWh/m^2 a**
Initial CO_2 emission	**72 kg/m^2 a**	**Final CO_2 emission**	**30 kg/m^2 a**
Initial benchmark	**E**	**Final benchmark**	**B**

ENERGY CERTIFICATE

BASIC BUILDING DATA	
Type of the building	Multi appartment building
Address	Neubergerjeva ulica 16, Ljubljana
Heated area	538 m^2
Building manager	SPL d.d.
Building owner	Mixed ownership
Number of stories	5
Year of construction	1968
Year of renovation	1990

Delivered energy and CO_2 emission



CERTIFICATE INFORMATION			
Issued by	EIE BUDI	Certificate number	2006 - 0008
Company	GI ZRMK	Date of validity	29.5.2006
Purpose of certificate	Renovation	Place of issue	Ljubjana

ENERGY CERTIFICATE

ASSET RATING METHOD DETAILS		Building description
Shape factor A/V_e	0,46 1/m	Massive construction
Heated area A_u	538 m^2	Flat roof with 3 cm of insulation
Gross volume V_e	1680 m^3	Facade with 3 cm of insulation
Type of dimensions used	external	Unheated basement
Air exchange rate n	0,5 1/h	
Thermal capacity C	261 MJ/K	
Internal temperature	20 °C	**Regulations**
Heat transmission H_T'	1,309 W/m^2K	0,626 W/m^2K
Heating demand Q_H	128 kWh/m^2	51 kWh/m^2
Domestic hot water demand Q_{DHW}	16 kWh/m^2	16 kWh/m^2

BUILDING ENVELOPE	Area	U
EXTERNAL WALL WITH INSULATION	317 m^2	0,95 W/m^2K
WINDOWS FACING SOUTH EAST	95 m^2	2,32 W/m^2K
NEW WINDOWS FACING SOUTH EAST	10 m^2	1,60 W/m^2K
WINDOWS FACING NORTH EAST	95 m^2	2,32 W/m^2K
NEW WINDOWS FACING NORTH EAST	10 m^2	1,60 W/m^2K
FLOOR ON THE GROUND	120 m^2	0,38 W/m^2K
ROOF	120 m^2	0,51 W/m^2K
DOORS	2 m^2	3,10 W/m^2K

HEATING SYSTEM		Energy performance factor	
Fuel used for heating	District heating	Primary energy	1,58
Heat generation	Boiler for district heating	Generation	0,90
Heat distribution	Pipes	Distribution	0,82
Heat emissivity	Radiators	Emissivity	0,78
DHW SYSTEM		**Energy performance factor**	
Fuel used for DHW	Gas oil	Primary energy	1,00
Generation	Central boiler	Generation	0,90
Distribution	Circulation	Distribution	0,85

NEUBERGERJEVA 2 STRAN

ENERGY CERTIFICATE

ENERGY SAVING SCENARIO 1

Installing thermostatic valves

Installing new windows, U_{min} = 1,2 W/m^{2}K

Insulating roof with 20 cm insulation

Initial energy demand	**244 kWh/m^2 a**	**Final energy demand**	**174 kWh/m^2 a**
Initial CO_2 emission	**80 kg/m^2 a**	**Final CO_2 emission**	**54 kg/m^2 a**
Initial benchmark	**E**	**Final benchmark**	**D**

ENERGY SAVING SCENARIO 2

Installing thermostatic valves

Installing new windows, U_{min} = 1,2 W/m^{2}K

Insulating roof with 20 cm insulation

Insulating pipes for heating distribution

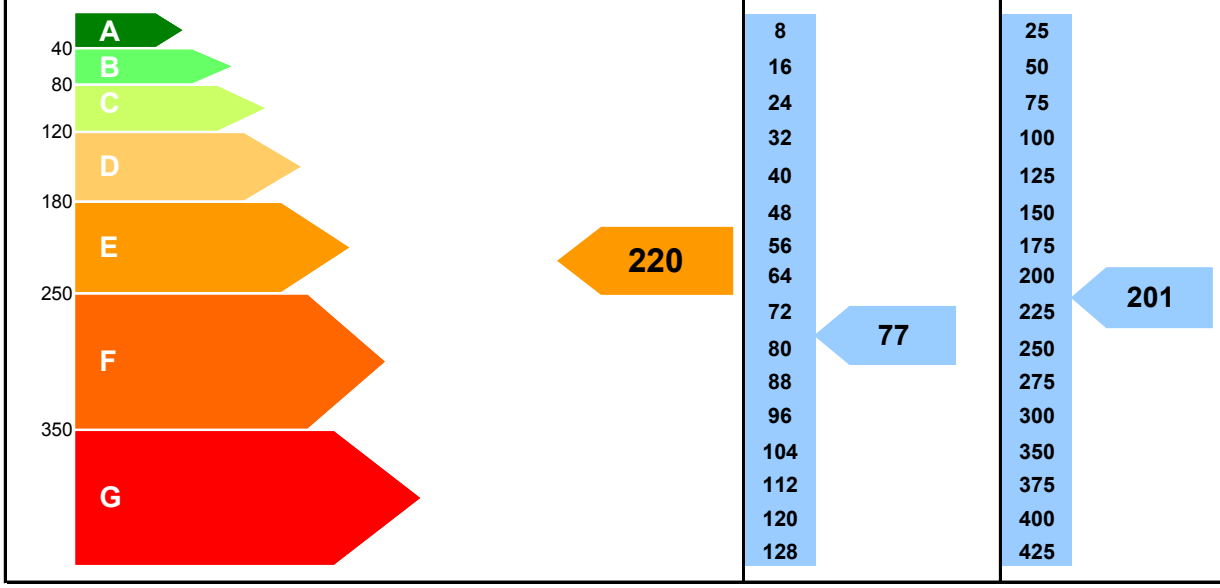
Insulating facade with 12 cm insulation

Initial energy demand	**244 kWh/m^2 a**	**Final energy demand**	**114 kWh/m^2 a**
Initial CO_2 emission	**80 kg/m^2 a**	**Final CO_2 emission**	**37 kg/m^2 a**
Initial benchmark	**E**	**Final benchmark**	**C**

ENERGY CERTIFICATE

BASIC BUILDING DATA	
Type of the building	Multi appartment building
Address	Rašiška 8, Ljubljana
Heated area	896 m^2
Building manager	Standom d.o.o.
Building owner	Mixed ownership
Number of stories	4
Year of construction	1970
Year of renovation	1992

Delivered energy and CO_2 emission



CERTIFICATE INFORMATION			
Issued by	EIE BUDI	Certificate number	2006 - 0009
Company	GI ZRMK	Date of validity	29.5.2006
Purpose of certificate	Renovation	Place of issue	Ljubjana

ENERGY CERTIFICATE

ASSET RATING METHOD DETAILS		Building description
Shape factor A/V_e	0,31 1/m	Massive construction
Heated area A_u	896 m^2	Flat roof with 3 cm insulation
Gross volume V_e	2800 m^3	Facade without insulation
Type of dimensions used	external	Unheated basement
Air exchange rate n	0,5 1/h	
Thermal capacity C	665 MJ/K	
Internal temperature	20 °C	**Regulations**
Heat transmission H_T'	1,045 W/m^2K	0,604 W/m^2K
Heating demand Q_H	118 kWh/m^2	53 kWh/m^2
Domestic hot water demand Q_{DHW}	16 kWh/m^2	16 kWh/m^2

BUILDING ENVELOPE	Area	U
EXTERNAL WALL	672 m^2	0,94 W/m^2K
WINDOWS FACING SOUTH EAST	50 m^2	2,40 W/m^2K
NEW WINDOWS FACING SOUTH EAST	76 m^2	1,40 W/m^2K
WINDOWS FACING NORTH WEST	50 m^2	2,40 W/m^2K
NEW WINDOWS FACING NORTH WEST	76 m^2	1,40 W/m^2K
FLOOR ON THE GROUND	204 m^2	0,39 W/m^2K
ROOF	250 m^2	0,96 W/m^2K
DOORS	2 m^2	3,10 W/m^2K

HEATING SYSTEM		Energy performance factor	
Fuel used for heating	District heating	Primary energy	1,58
Heat generation	Boiler for district heating	Generation	0,90
Heat distribution	Pipes	Distribution	0,84
Heat emissivity	Radiators	Emissivity	0,78
DHW SYSTEM		**Energy performance factor**	
Fuel used for DHW	Electricity	Primary energy	2,15
Generation	Local boilers	Generation	0,90
Distribution	No circulation	Distribution	0,92

RAŠIŠKA 2 STRAN

ENERGY CERTIFICATE

ENERGY SAVING SCENARIO 1

Installing thermostatic valves

Installing new windows, U_{min} = 1,2 W/m^{2}K

Insulating roof with 20 cm insulation

Initial energy demand	**220 kWh/m^2 a**	**Final energy demand**	**165 kWh/m^2 a**
Initial CO_2 emission	**77 kg/m^2 a**	**Final CO_2 emission**	**59 kg/m^2 a**
Initial benchmark	**E**	**Final benchmark**	**D**

ENERGY SAVING SCENARIO 2

Installing thermostatic valves

Installing new windows, U_{min} = 1,2 W/m^{2}K

Insulating roof with 20 cm insulation

Insulating pipes for heating distribution

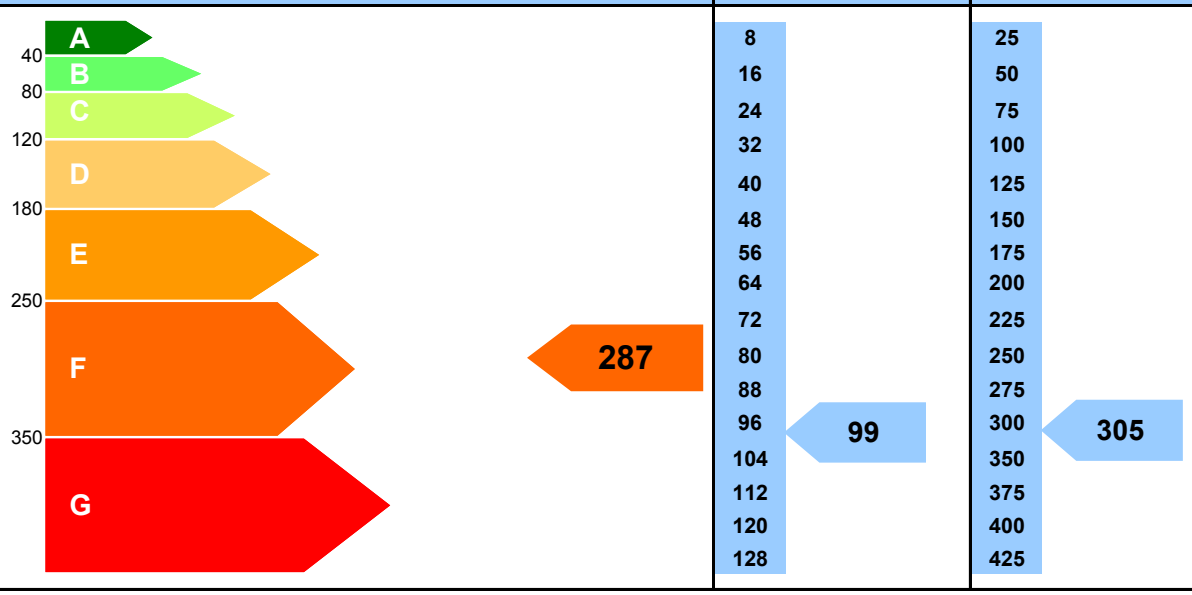
Insulating facade with 12 cm insulation

Initial energy demand	**220 kWh/m2 a**	**Final energy demand**	**86 kWh/m^2 a**
Initial CO_2 emission	**77 kg/m2 a**	**Final CO_2 emission**	**32 kg/m^2 a**
Initial benchmark	**E**	**Final benchmark**	**C**

ENERGY CERTIFICATE

BASIC BUILDING DATA	
Type of the building	Multi appartment building
Address	Šišenska 36, Ljubljana
Heated area	605 m^2
Building manager	Financa operativa d.o.o.
Building owner	Mixed ownership
Number of stories	6
Year of construction	-
Year of renovation	1993

Delivered energy and CO_2 emission



CERTIFICATE INFORMATION			
Issued by	EIE BUDI	Certificate number	2006 - 0010
Company	GI ZRMK	Date of validity	29.5.2006
Purpose of certificate	Renovation	Place of issue	Ljubjana

ENERGY CERTIFICATE

ASSET RATING METHOD DETAILS		Building description
Shape factor A/V_e	0,49 1/m	Massive construction
Heated area A_u	605 m^2	Flat roof with 2 cm insulation
Gross volume V_e	1890 m^3	Facade without insulation
Type of dimensions used	external	Unheated basement
Air exchange rate n	0,5 1/h	
Thermal capacity C	665 MJ/K	
Internal temperature	20 °C	**Regulations**
Heat transmission H_T'	1,374 W/m^2K	0,604 W/m^2K
Heating demand Q_H	150 kWh/m^2	53 kWh/m^2
Domestic hot water demand Q_{DHW}	16 kWh/m^2	16 kWh/m^2

BUILDING ENVELOPE	Area	U
EXTERNAL WALL	483 m^2	1,66 W/m^2K
WINDOWS FACING SOUTH	23 m^2	2,40 W/m^2K
NEW WINDOWS FACING SOUTH	40 m^2	1,40 W/m^2K
WINDOWS FACING WEST	23 m^2	2,40 W/m^2K
NEW WINDOWS FACING WEST	40 m^2	1,40 W/m^2K
WINDOWS FACING WEST	64 m^2	2,40 W/m^2K
FLOOR ON THE GROUND	130 m^2	0,39 W/m^2K
ROOF	130 m^2	0,45 W/m^2K
DOORS	2 m^2	3,10 W/m^2K

HEATING SYSTEM		Energy performance factor	
Fuel used for heating	District heating	Primary energy	1,58
Heat generation	Boiler for district heating	Generation	0,90
Heat distribution	Pipes	Distribution	0,72
Heat emissivity	Radiators	Emissivity	0,87
DHW SYSTEM		**Energy performance factor**	
Fuel used for DHW	Electricity	Primary energy	2,15
Generation	Local boilers	Generation	0,90
Distribution	No circulation	Distribution	0,92

ŠIŠENSKA 2 STRAN

ENERGY CERTIFICATE

ENERGY SAVING SCENARIO 1

Insulating facade with 12 cm insulation

Installing new windows, U_{min} = 1,2 W/m^{2}K

Insulating roof with 20 cm insulation

Initial energy demand	**287 kWh/m^2 a**	**Final energy demand**	**152 kWh/m^2 a**
Initial CO_2 emission	**99 kg/m^2 a**	**Final CO_2 emission**	**54 kg/m^2 a**
Initial benchmark	**F**	**Final benchmark**	**D**

ENERGY SAVING SCENARIO 2

Insulating facade with 12 cm insulation

Installing new windows, U_{min} = 1,2 W/m^{2}K

Insulating roof with 20 cm insulation

Insulating pipes for heating distribution

Initial energy demand	**287 kWh/m^2 a**	**Final energy demand**	**91 kWh/m^2 a**
Initial CO_2 emission	**99 kg/m^2 a**	**Final CO_2 emission**	**34 kg/m^2 a**
Initial benchmark	**F**	**Final benchmark**	**C**

Example of calculation by draft national calculation methodology (2006) for energy performance indicators

Aup [m2]	**4147**	uporabna površina
A [m2]	**2966**	zun ovoj
Ve [m3]	**12960**	volumen bruto
V [m3]	**10368**	volumen neto
fo	**0,23**	oblikovni koeficient

,

element	**A [m2]**	**U [W/m2K]**	**A*U [W/K]**
Streha 1	**312**	**0,62**	193
Streha 2			0
Zunanja stena 1	**1287**	**0,90**	1158
Zunanja stena 2			0
Zunanja stena 3			0
Okna 1	631	**1,60**	1010
Okna 2	422	**2,40**	1013
Vrata	**2**	**3,10**	6
Tla oz. neogrevano	**312**	**2,34**	730
Toplotni mostovi	-	-	**1317**
Ht **5427**	**W/K**	**PRAVILNIK**	
Ht' rač. **1,830**	**W/Km2**	**0,675**	**W/Km2**

Fs	**1,00**	**Ff**	**0,70**	**Fc**	**1,00**	**g**	**0,60**	*	**0,420**
OKNA [m2]	**S**	**SV**	**V**	**JV**	**J**	**JZ**	**Z**	**SZ**	
1	**280**	**0**	**0**	**0**	**351**	**0**	**0**	**0**	
2	**188**	**0**	**0**	**0**	**234**	**0**	**0**	**0**	
efektivna p.	196,56	0,00	0,00	0,00	245,70	0,00	0,00	0,00	

Ht	5.427,42	W/K
Hv	1.728,00	W/K
H	7.155,42	W/K
T not	20,00	°C
C	**2.705,00**	MJ/K

n [h-1]	**0,5**	
a0s	0,8	h
t0s	28	-
t	105,01	h
as	4,55	-

a0m	1	h
t0m	15	-
tm	105,01	h
am	8,00	-

KLIMATSKI PODATKI

Wh/m2	**°C**	**S**	**SV**	**V**	**JV**	**J**	**JZ**	**Z**	**SZ**
Januar	-1	257	264	466	943	1401	1220	673	281
Februar	1	410	436	803	1474	2134	1941	1206	540
Marec	6	634	805	1344	1912	2334	2196	1611	898
April	9	1027	1364	1948	2282	2329	2351	2041	1427
Maj	14	1200	1698	2301	2386	2129	2320	2250	1693
Junij	18	1417	1841	2322	2288	2026	2363	2451	1948
Julij	20	1270	1738	2359	2425	2154	2493	2541	1928
Avgust	19	1040	1471	2149	2448	2413	2570	2330	1606
September	15	787	974	1514	2058	2400	2276	1743	1080
Oktober	10	526	585	907	1420	1821	1595	1040	599
November	4	324	340	532	896	1126	913	542	336
December	0	226	232	394	748	997	804	433	230
povprečna	**9,58**								
LJUBLJANA		**3300**			**27.september - 15.maj**				**231**

dni	S*dni	SV*dni	V*dni	JV*dni	J*dni	JZ*dni	Z*dni	SZ*dni
31	7967	8184	14446	29233	43431	37820	20863	8711
28	11480	12208	22484	41272	59752	54348	33768	15120
31	19654	24955	41664	59272	72354	68076	49941	27838
30	30810	40920	58440	68460	69870	70530	61230	42810
15	18000	25470	34515	35790	31935	34800	33750	25395
0,0001	0	0	0	0	0	0	0	0
0,0001	0	0	0	0	0	0	0	0
0,0001	0	0	0	0	0	0	0	0
4	3148	3896	6056	8232	9600	9104	6972	4320
31	16306	18135	28117	44020	56451	49445	32240	18569
30	9720	10200	15960	26880	33780	27390	16260	10080
31	7006	7192	12214	23188	30907	24924	13423	7130
231								

kWh	S*dni*ef	SV*dni*ef	V*dni*ef	JV*dni*ef	J*dni*ef	JZ*dni*ef	Z*dni*ef	SZ*dni*ef	skupaj
Januar	1566	0	0	0	10671	0	0	0	12237
Februar	2257	0	0	0	14681	0	0	0	16938
Marec	3863	0	0	0	17777	0	0	0	21641
April	6056	0	0	0	17167	0	0	0	23223
Maj	3538	0	0	0	7846	0	0	0	11385
Junij	0	0	0	0	0	0	0	0	0
Julij	0	0	0	0	0	0	0	0	0
Avgust	0	0	0	0	0	0	0	0	0
September	619	0	0	0	2359	0	0	0	2977
Oktober	3205	0	0	0	13870	0	0	0	17075
November	1911	0	0	0	8300	0	0	0	10210
December	1377	0	0	0	7594	0	0	0	8971
								skupaj	**124657**

POTREBNA TOPLOTA ZA OGREVANJE	mesec	ŠT. dni	Temp [°C]	**Toplotne izgube [kWh]**	Notranji pritoki [kWh]	Sončni pritoki [kWh]	**Skupni pritoki [kWh]**	gama	izkoristek	**Raba energije [kWh]**	**Raba energije [GJ]**
	Januar	31	-1,0	111.796,3	12.342,1	12.237,0	24.579,1	0,22	1,00	87.217,3	314,0
	Februar	28	1,0	91.360,4	11.147,7	16.937,6	28.085,2	0,31	1,00	63.276,7	227,8
	Marec	31	6,0	74.530,9	12.342,1	21.640,6	33.982,6	0,46	1,00	40.582,8	146,1
	April	30	9,0	56.670,9	11.943,9	23.223,1	35.167,0	0,62	0,99	21.801,3	78,5
	Maj	15	14,0	15.455,7	5.972,0	11.384,5	17.356,5	1,12	0,83	1.032,8	3,7
	Junij	0	18,0	0,0	0,0	0,1	0,1	3,42	0,29	0,0	0,0
	Julij	0	20,0	0,0	0,0	0,1	0,1	685,38	0,00	0,0	0,0
	Avgust	0	19,0	0,0	0,0	0,1	0,1	6,96	0,14	0,0	0,0
	September	4	15,0	3.434,6	1.592,5	2.977,5	4.570,0	1,33	0,73	94,0	0,3
	Oktober	31	10,0	53.236,3	12.342,1	17.075,1	29.417,2	0,55	1,00	23.934,1	86,2
	November	30	4,0	82.430,4	11.943,9	10.210,3	22.154,2	0,27	1,00	60.276,6	217,0
	December	31	0,0	106.472,6	12.342,1	8.970,9	21.313,0	0,20	1,00	85.159,7	306,6
	sezona	**231**	**9,58**	**595.388,2**	**91.968,4**	**124.656,8**	**216.625,2**	**58,40**	**0,75**	**383.375,3**	1.380,2
									raba/Aup	**92,44**	**0,33**
									PRAVILNIK	**39,57**	

OD TU NAPREJ VSE ZA LETNO RABO

OGREVALNI SISTEM

SISTEM ZA PRIPRAVO TOPLE VODE

	0,33	1,58	0,56	2,15	
	co2 [kg/kwh]	**prim [-]**			
ENERGENT					
☐ zemeljski plin	0,20	1,00		☐ zemeljski plin	
☐ utek. naftni plin	0,23	1,00		☐ utek. naftni plin	
☐ ekst. lahko kur. olje	0,22	1,00		☐ ekst. lahko kur. olje	
☐ lahko kurilno olje	0,26	1,00		☐ lahko kurilno olje	
☒ daljinska toplota	0,33	1,58		☐ daljinska toplota	
☐ elektrika	0,56	2,15		☒ elektrika	
OGREVALA					
	etaR	**0,8**			
☐ samo centralna regulacija	0,80				
☐ termostatski ventili	0,93			☐ enostanovanjska hiša 12 kWh/(m2 a)	
odstotek vgra. termost. ventilov	100%			☒ vecstanovanjska hiša 16 kWh/(m2 a)	
	etaZ1	**0,88**			
☐ 90/70	0,88	**20**			
☐ 70/55	0,93				
	etaZ2	**0,95**			
☒ ogrevala ob zunanji steni, normalna okna	0,95				
Fogr 0,78	**fint**	**1,00**			
☐ prekinjeno ogrevanje	1,00				
☐ neprekinjeno ogrevanje	0,97				

RAZVOD OGREVALNEGA SISTEMA

	lc	**fsch**	**Lv**	**Ls**	**La**
☐ enocevni sistem	**10**	**1**	**85**	**70**	**619**
	35	0,7	127,5	1154	390
☐ dvocevni sistem	10	1	127,5	244	2145
		fabgl			
☐ hidravli. uravnotežen	1,0	**1,1**			
☐ hidravli. Neuravnotežen	1,1				

Dolžina stavbe L	m	15
Širina stavbe B	m	20
Število etaž nG	-	13
Višina etaž hG	m	2,5
Prekinjeno ogrevanje	h	0
Qn s piko	kW	129
deltaThetaHK	K	20
V s piko	m3/h	7,4
tlačni padec deltaP	kPa	21
lmax	m	135
Phydr	W	42
betai	-	0,69
Wh,d,hydr	kWh	178
eh,d,e	-	9,2
Wh,d,e	**kWh**	**1630**
vrnjena v zrak	kWh	408
vrnjena v medij	kWh	408
Delež cevi v neogrevanem prostoru		
horizontalni vodi Lv	%	100%
dvižni vodi Ls	%	10%
vodi do radiatorjev	%	0%
Izolacija cevi v neogrevanem prostoru		
U'	W/mK	1,00
povp. temp. medija	°C	80
temp. neog. Prostora	°C	10
izgube	kWh	40.882
Izolacija cevi v ogrevanem prostoru		
U'	W/mK	1,00
povp. temp. medija	°C	80
temp. neog. Prostora	°C	22
oddaja	kWh	115.640
ogrevala	kWh	492.637
izgube cevi	kWh	40.882
vrnjeno od elektrike	kWh	815
potrebno za sistem	kWh	532.705
Frazvod	**-**	**0,92**

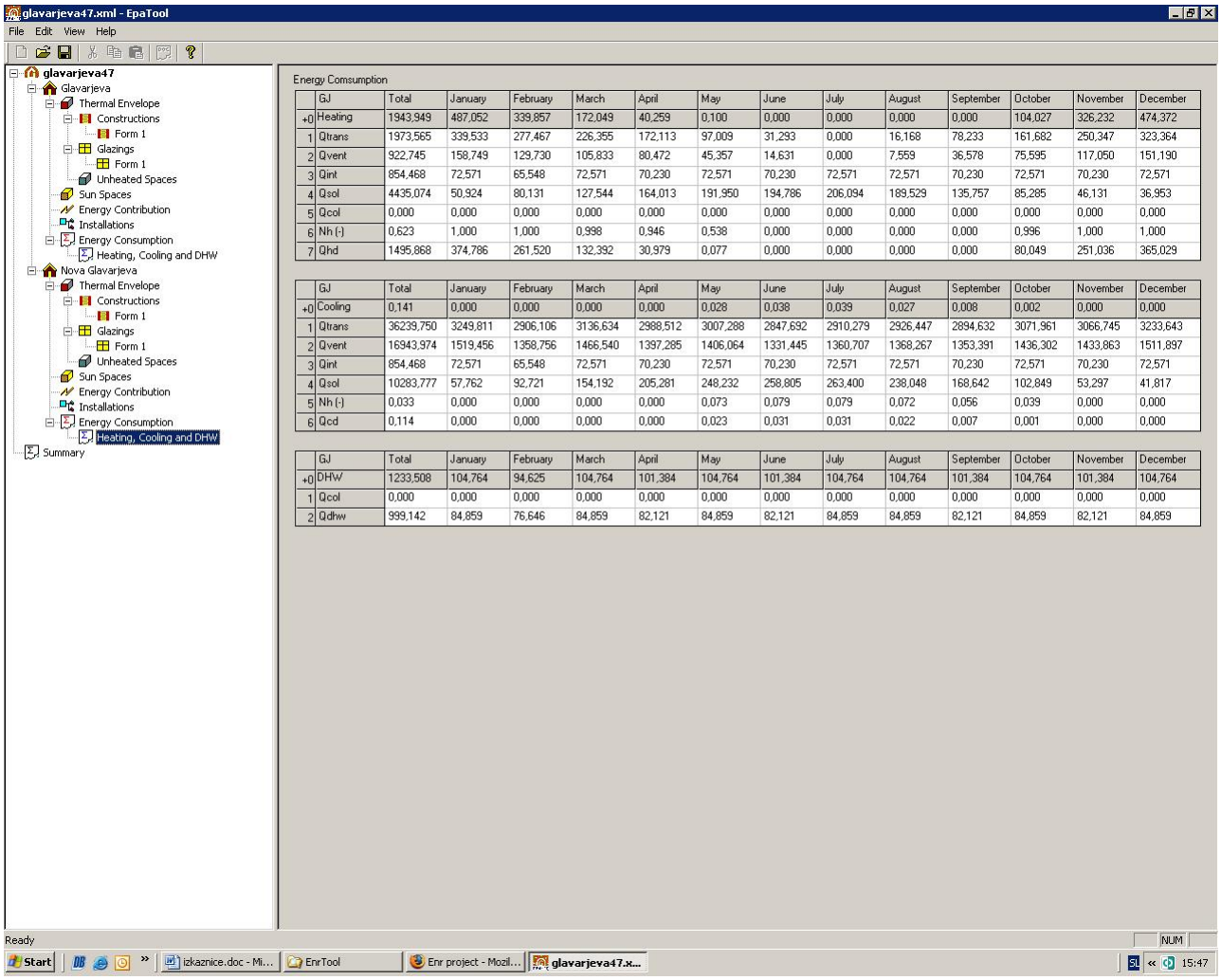
KURILNA NAPRAVA

	faktor	**elektrika**
☐ daljinsko ogrevanje F=0.95	0,95	0%
☒ dober kotel F = 0.90	0,9	1%
☐ slab kotel F = 0.85	0,8	2%
Fkotel	**0,90**	**0,01**
potrebno za kotel	kWh	591.894
za elektriko	kWh	5.919

POTREBNA TOPLOTA ZA OGRE.	kWh	**591.894**
	GJ	**2131**
	kWh/m2	**142,72**
	GJ/m2	**0,514**
emisija CO2	kg	**195325**
	kg/m2	**47,1**
dodatna električna energija	kWh	**7.549**
	kWh/m2	**2**
	GJ/m2	**0,007**
emisija CO2	kg	**4228**
	kg/m2	**1,0**
energija potrebna za pripravo tople vode		
	kWh/m2	**16**
	GJ/m2	**0,058**
emisija CO2	kg	**37159**
	kg/m2	**9,0**
SKUPAJ		
	kWh	**665798**
	kWh/m2	**160,54**
	GJ/m2	**0,578**
emisija CO2	kg	**236711**
	kg/m2	**57,1**

EPA – ED

Example of calculation for residential building Glavarjeva 47, Ljubljana



	GJ	Total	January	February	March	April	May	June	July	August	September	October	November	December
+0	Heating	1943,949	487,052	339,857	172,049	40,259	0,100	0,000	0,000	0,000	0,000	104,027	326,232	474,372
1	Qtrans	1973,565	339,533	277,467	226,355	172,113	97,009	31,293	0,000	16,168	78,233	161,682	250,347	323,364
2	Qvent	922,745	158,749	129,730	105,833	80,472	45,357	14,631	0,000	7,559	36,578	75,595	117,050	151,190
3	Qint	854,468	72,571	65,548	72,571	70,230	72,571	70,230	72,571	72,571	70,230	72,571	70,230	72,571
4	Qsol	4435,074	50,924	80,131	127,544	164,013	191,950	194,786	206,094	189,529	135,757	85,285	46,131	36,953
5	Qcol	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
6	Nh (-)	0,623	1,000	1,000	0,998	0,946	0,538	0,000	0,000	0,000	0,000	0,996	1,000	1,000
7	Qhd	1495,868	374,786	261,520	132,392	30,979	0,077	0,000	0,000	0,000	0,000	80,049	251,036	365,029

	GJ	Total	January	February	March	April	May	June	July	August	September	October	November	December
+0	Cooling	0,141	0,000	0,000	0,000	0,000	0,028	0,038	0,039	0,027	0,008	0,002	0,000	0,000
1	Qtrans	36239,750	3249,811	2906,106	3136,634	2988,512	3007,288	2847,692	2910,279	2926,447	2894,632	3071,961	3066,745	3233,643
2	Qvent	16943,974	1519,456	1358,756	1466,540	1397,285	1406,064	1331,445	1360,707	1368,267	1353,391	1436,302	1433,863	1511,897
3	Qint	854,468	72,571	65,548	72,571	70,230	72,571	70,230	72,571	72,571	70,230	72,571	70,230	72,571
4	Qsol	10283,777	57,762	92,721	154,192	205,281	248,232	258,805	263,400	238,048	168,642	102,849	53,297	41,817
5	Nh (-)	0,033	0,000	0,000	0,000	0,000	0,073	0,079	0,079	0,072	0,056	0,039	0,000	0,000
6	Qcd	0,114	0,000	0,000	0,000	0,000	0,023	0,031	0,031	0,022	0,007	0,001	0,000	0,000

	GJ	Total	January	February	March	April	May	June	July	August	September	October	November	December
+0	DHW	1233,508	104,764	94,625	104,764	101,384	104,764	101,384	104,764	104,764	101,384	104,764	101,384	104,764
1	Qcol	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
2	Qdhw	999,142	84,859	76,646	84,859	82,121	84,859	82,121	84,859	84,859	82,121	84,859	82,121	84,859