



EIE Project ROSH

Development and marketing of integrated concepts for energy efficient and sustainable retrofitting of social housing

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Cost data base on retrofitting investments / equipment

WP 3 Advanced Tailored Financial Schemes
Task 3.1 Analysis of existing financial mechanisms and economic conditions
Deliverable D 14

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Organisation BAPE
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Investment costs

3,3542 PLN/EUR

Average exchange rate of NBP on June 30th, 2008

1,088

Windows & doors

Total investment costs, including material, manwork and transport

Reference building: stand alone building, 1,000 m² floor area, 140,000 kWh/m².a, 100 kW, 12 flats, 4 floors, gross built-up area: 320 m², building height 13 m, 1.5 x 1.5 m windows, 1.0 x 2.0 m entrance door

Reference installations: central heating system, fuel: oil (extra light), boiler: constant temperature, domestic hot water: decentral (electric), regulation: depending on outside temperature, 2 heater circuits, 2 pipes-system, pipes insulated (2/3 of the pipe diameter), 2 pumps: single level - not insulated, 5 radiators per flat (total 60 radiators), manually operated radiator valves, conventional chimney: 16 cm diameter

Nr.	activity	material	thermal quality	net amount	reference	VAT	gross amount	share of salary on total costs	average life
				[€]		[%]	[€]	[%]	[a]
1.1.1	repair of windows: painting of window frame	-	-	4,96	/m ² window	7,0	5	77	5 - 8
	repair of windows: painting of window frame & improving air tightness	-	-	7,12	/m ² window	7,0	8	88	2 - 8
1.1.2	replacement of panes	-	thermal insulation glazing and thermal edge bonding	40,05	/m ² window	7,0	43	15	40 - 90
		-	3-pane glazing	50,74	/m ² window	7,0	54	18	40 - 90
1.1.3	replacement of windows	wood frame	thermal insulation glazing and thermal edge bonding	198,25	/m ² window	7,0	212	7	90
		wood frame	for passive-house ¹⁾	301,06	/m ² window	7,0	322	5	90
		aluminium clad wood frame	thermal insulation glazing and thermal edge bonding	283,72	/m ² window	7,0	304	5	40 - 90
		aluminium clad wood frame	3-pane glazing		/m ² window	7,0	0		
		vinyl frame	thermal insulation glazing and thermal edge bonding	166,29	/m ² window	7,0	178	12	40
		vinyl frame	for passive-house ¹⁾	231,18	/m ² window	7,0	247	6	40
1.2	installation of shutters	jalousie	-		/m ² window	7,0	0		
		rolling shutter	-		/m ² window	7,0	0		
		marquee	-		/m ² window	7,0	0		
1.3	replacement of main entrance door	wooden	-	161,94	/m ² door	7,0	173	18	no data
		aluminium	-	236,48	/m ² door	7,0	253	5	no data

¹⁾ because of lack of data costs of labour works may be underestimated (installing costs are taken as for typical window, not for passive house one)



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Insulation

Total investment costs, including material, manwork and transport

Reference building: stand alone building, 1,000 m² floor area, 140,000 kWh/m².a, 100 kW, 12 flats, 4 floors, gross built-up area: 320 m², building height 13 m

Reference installations: central heating system, fuel: oil (extra light), boiler: constant temperature, domestic hot water: decentral (electric), regulation: depending on outside temperature, 2 heater circuits, 2 pipes-system, pipes insulated (2/3 of the pipe diameter), 2 pumps: single level - not insulated, 5 radiators per flat (total 60 radiators), manually operated radiator valves, conventional chimney: 16 cm diameter

Nr.	activity	material	thickness	net amount ¹⁾ [€]	reference	VAT [%]	gross amount ¹⁾ [€]	costs for additional insulation [€/cm]	share of salary on total costs [%]	average life [a]
1.5	changing balconies to wintergardens	wooden construction	low energy standard		/m ² floor	7,0	0			
		wooden construction	passive house standard		/m ² floor	7,0	0			
		aluminium construction	low energy standard		/m ² floor	7,0	0			
		aluminium construction	passive house standard		/m ² floor	7,0	0			
		vinyl construction	low energy standard		/m ² floor	7,0	0			
2.4.1	insulation of basement floor (only thermal insulation without covering)	PS	10 cm	8,57	/m ² floor	7,0	9	0,69	13	no data
		PU	10 cm		/m ² floor	7,0	0			
2.5.1	insulation of exterior wall ²⁾	mineral wool	10 cm	20,08	/m ² floor	7,0	21	1,73	6	no data
		PS	10 cm	31,81	/m ² wall	7,0	34	0,96	50	30
		PS	16 cm	36,34	/m ² wall	7,0	39	0,96	49	30
		PU	10 cm		/m ² wall	7,0	0			
		PU	16 cm		/m ² wall	7,0	0			
		mineral wool	10 cm	46,93	/m ² wall	7,0	50	2,11	38	30
		mineral wool	16 cm	58,76	/m ² wall	7,0	63	2,11	37	30
2.5.2	painting of outer wall	-	-	1,35	/m ² wall	7,0	1	-	56	
2.5.3	renewing of external plaster (without insulation)	-	-	9,02	/m ² wall	7,0	10	-	86	30-40



Nr.	activity	material	thickness	net amount ¹⁾ [€]	reference	VAT [%]	gross amount ¹⁾ [€]	costs for additional insulation [€/cm]	share of salary on total costs [%]	average life [a]
2.6	insulation of top floor slab ³⁾ (as well flat roof with "open" air space)	PS	24 cm	11,00	/m ² floor	7,0	12	0,47	4	
		PS	36 cm	16,26	/m ² floor	7,0	17	0,47	3	
		mineral wool boards	24 cm	11,09	/m ² floor	7,0	12	0,46	6	
		mineral wool boards	36 cm	16,24	/m ² floor	7,0	17	0,46	4	
		granulated mineral wool	24 cm	13,95	/m ² floor	7,0	15	0,51	no data	20
		granulated mineral wool	36 cm	19,63	/m ² floor	7,0	21	0,51	no data	20
2.7	insulation of high peaked roof	PS	24 cm	42,70	/m ² roof	7,0	46	0,32	64	
		mineral wool	24 cm	49,94	/m ² roof	7,0	53	0,35	64	
2.8	substitution of a flat roof with an attic roof	-	-		/m ² roof	7,0	0			
2.9	insulation of flat roof (without "open" air space) with roofing paper ⁴⁾	PS	24 cm	32,64	/m ² roof	7,0	35	0,71	9	
		PU	24 cm		/m ² roof	7,0	0			
		mineral wool	24 cm	59,52	/m ² roof	7,0	64	1,88	5	

Comment:
Insulation made of PU board is very expensive then it is almost not applied in Poland

- 1) not including costs of additional works, which have to be done together with basic activity
- 2) amount should be increased by 30 to 100 % for costs of additional works which should be performed together with basic activity
- 3) not including costs of a insulation covering
- 4) amount should be increased by 20 to 100 % for costs of additional works which should be performed together with basic activity



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Building services

Total investment costs, including material, manwork and transport

Reference building (insulated!): stand alone building, 1.000 m² floor area, **70.000 kWh/m².a, 50 kW**, 12 flats, 4 floors, gross built-up area: 320 m², building height 13 m

Reference installations: central heating system, fuel: oil (extra light), boiler: constant temperature, domestic hot water: decentral (electric), regulation: depending on outside temperature, 2 heater circuits, 2 pipes-system, pipes insulated (2/3 of the pipe diameter), 2 pumps: single level - not insulated, 5 radiators per flat (total 60 radiators), manually operated radiator valves, conventional chimney: 16 cm diameter

Nr.	activity	net amount [€]	reference	VAT [%]	gross amount [€]	costs for additional power [€/10kW]	share of salary on total costs [%]	average life [a]
3.1	installation of a condensing gas-boiler (including fee for connecting to the gas-net for 10 m of connecting pipe)	9,91	/m ² floor area	7,0	11	402	2	14
3.2	installation of a gas-boiler (including fee for connecting to the gas-net for 10 m of connecting pipe)	2,75	/m ² floor area	7,0	3	198	7	14
3.3	installation of a condensing oil-boiler	6,73	/m ² floor area	7,0	7	664	3	14
3.4	installation of an oil-boiler	2,83	/m ² floor area	7,0	3	194	6	14
3.5	installation of a district heating station, including fee for connection to district heating system for 10 m of connecting pipe)	7,75	/m ² floor area	7,0	8	255	12	5,5 - 7
3.9	installation of a solar system for hot water supply (35 m ² flat-plate collectors, 1.700 l storage)	16,90	/m ² floor area	7,0	18	6.891	4	15 - 30
3.10	installation of a solar combi system - for hot water & heating (90 m ² flat-plate collectors, 4.500 l storage)	43,47	/m ² floor area	7,0	47	6.891	4	15 - 30
3.12	installation of a decentral ventilation system - with heat recovery (3 ventilation appliances per flat)		/m ² floor area	7,0	0	-		
3.13	installation of a central ventilation system - with heat recovery (3 exhausts for inlet air and 3 discharge air outlets per flat)		/m ² floor area	7,0	0	-		
3.14	insulation of pipelines (thickness corresponds to diameter of pipes)	5,64	/m ² floor area	7,0	6	-	20	
3.15	installation of thermostatic valves	1,75	/m ² floor area	7,0	2	-	5	10
3.16	installation of energy efficient and speed controlled pumps	0,26	/m ² floor area	7,0	0	-		7
3.17	hydraulic adjustment	0,09	/m ² floor area	7,0	0	-	100	



Running costs

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Fuel costs only for heating

Reference building: insulated! (see 1.3_Building services)

Definitions:

old heating system: ~ 30 years old, without thermostatic radiator valves, without automatic central temperature control depending on outside temperature

new heating system: new installed heating system with thermostatic radiator valves, with automatic central temperature control depending on outside temperature

efficiency of heating system: includes heat losses of boiler (heat exchanger, heat pump, oven), storage, distribution and heat dissipation (e.g. radiator) for an average old heating system and for an average new heating system

Nr.	heating system	fuel	unit [...]	net amount [€/...]	energy content [kWh/...]	efficiency of old heating system [%]	efficiency of new heating system [%]
1.1.	central heating	biomass	pm	14,66	698,89	48	73
1.2		pellets	kg	0,15	4,86	48	73
1.3		district heating	kWh	0,04	1	60	86
1.4		oil	l	0,78	9,89	45	75
1.5		natural gas	m ³	0,38	10,0	45	75
1.6		heat pump	kWh	0,10	1	200	287
1.7		coal	kg	0,12	7,44	34	60
2.1	individual central heating	biomass	pm	14,66	698,89	39	62
2.2		pellets	kg	0,15	4,86	39	62
2.3		district heating	kWh	0,03	1	60	86
2.4		oil	l	0,78	9,89	39	74
2.5		natural gas	m ³	0,38	10,0	39	74
2.6		coal	kg	0,12	7,44	34	60
3.1	stove heating	biomass	pm	14,66	698,89	18	29
3.2		pellets	kg	0,15	4,86	18	29
3.3		oil	l	0,66	9,89	43	63
3.4		natural gas	m ³	0,38	10,0	43	63
3.5		electricity	kWh	0,10	1	90	90
3.6		coal	kg	0,12	7,44	18	29

Running costs

3,3542 Average exchange rate of NBP on June 30th, 2008

Energy cost for old heating systems

Reference building: insulated! (see 1.3_Building services)

Definitions:

Net amount in € per kWh: is estimated by the total energy costs and the efficiency of the heating system

Total energy costs include all fuel/energy costs i.e. costs to be paid to fuel/energy provider (with costs for delivery of fuels, for demand rate (district heating), for costs which occur irrespective of consumption (e.g. costs for network access), for meter charge and invoicing) as well as operating costs (for maintenance, for chimney sweeper, for mandatory checks, for electricity of pumps, regulation etc.)

no repair, depreciation and administration costs and environmental fees are included

Efficiency of heating system: see 2.1_Fuel costs

Nr.	heating system	fuel	net amount			VAT [%]	gross amount [€/kWh]
			fuel costs including system efficiency [€/kWh]	operating costs [€/kWh]	total energy cost [€/kWh]		
1.1.	central heating	biomass	0,04	0,09	0,13	22,0	0,16
1.2		pellets	0,06	0,04	0,10	22,0	0,12
1.3		district heating	0,08	0,00	0,08	22,0	0,10
1.4		oil	0,18	0,03	0,20	22,0	0,25
1.5		natural gas	0,10	0,03	0,12	22,0	0,15
1.6		heat pump	0,05	0,01	0,06	22,0	0,07
1.7		coal	0,05	0,09	0,13	22,0	0,16
2.1	individual central heating	biomass	0,05	0,01	0,07	22,0	0,08
2.2		pellets	0,08	0,01	0,09	22,0	0,11
2.3		district heating	0,06	0,00	0,06	22,0	0,07
2.4		oil	0,20	0,01	0,22	22,0	0,26
2.5		natural gas	0,12	0,01	0,14	22,0	0,17
2.6		coal	0,05	0,01	0,06	22,0	0,08
3.1	stove heating	biomass	0,12	0,01	0,12	22,0	0,15
3.2		pellets	0,17	0,01	0,18	22,0	0,22
3.3		oil	0,16	0,01	0,17	22,0	0,21
3.4		natural gas	0,11	0,01	0,13	22,0	0,16
3.5		electricity	0,11	0,00	0,11	22,0	0,14
3.6		coal	0,09	0,01	0,10	22,0	0,12

Running costs

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Energy cost for new heating systems

Reference building: insulated! (see 1.3_Building services)

Definitions:

Net amount in € per kWh: is estimated by the total energy costs and the efficiency of the heating system

Total energy costs include all fuel/energy costs i.e. costs to be paid to fuel/energy provider (with costs for delivery of fuels, for demand rate (district heating), for costs which occur irrespective of consumption (e.g. costs for network access), for meter charge and invoicing)

as well as operating costs (for maintenance, for chimney sweeper, for mandatory checks, for electricity of pumps, regulation etc.)

no repair, depreciation and administration costs and environmental fees are included

Efficiency of heating system: see 2.1_Fuel costs

Nr.	heating system	fuel	net amount			VAT [%]	gross amount [€/kWh]
			fuel costs including system efficiency [€/kWh]	operating costs [€/kWh]	total energy cost [€/kWh]		
1.1.	central heating	biomass	0,03	0,09	0,12	22,0	0,14
1.2		pellets	0,04	0,04	0,08	22,0	0,10
1.3		district heating	0,06	0,00	0,06	22,0	0,07
1.4		oil	0,11	0,03	0,13	22,0	0,16
1.5		natural gas	0,06	0,03	0,09	22,0	0,11
1.6		heat pump	0,03	0,01	0,04	22,0	0,05
1.7		coal	0,03	0,09	0,11	22,0	0,14
2.1	individual central heating	biomass	0,03	0,01	0,05	22,0	0,06
2.2		pellets	0,05	0,01	0,06	22,0	0,08
2.3		district heating	0,04	0,00	0,04	22,0	0,05
2.4		oil	0,11	0,01	0,12	22,0	0,15
2.5		natural gas	0,08	0,01	0,09	22,0	0,11
2.6		coal	0,03	0,01	0,04	22,0	0,05
3.1	stove heating	biomass	0,07	0,01	0,08	22,0	0,10
3.2		pellets	0,11	0,01	0,11	22,0	0,14
3.3		oil	0,11	0,01	0,12	22,0	0,15
3.4		natural gas	0,08	0,01	0,10	22,0	0,12
3.5		electricity	0,11	0,00	0,11	22,0	0,14
3.6		coal	0,06	0,01	0,06	22,0	0,08



Running costs

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Total operating costs: without fuel costs

	net amount [€/per total floor area]	VAT [%]	gross amount [€/per total floor area]
minimum	0,00	22,0	0,00
maximum	6097,00	22,0	7438,34
on average	1456,00	22,0	1776,32