



Senatsverwaltung
für Stadtentwicklung

Complex Renovation of precast multi-storey
residential buildings

– Experiences from Germany

The renovation need for the precast building stock in East- Berlin (1993)

- Ascertainment of the typical renovation need for the main building types via expertises from scientific institutes
- Results: Renovation need up to 35.000 € per flat
- Results in details: A measure-costs-matrix (table)
- Energy efficiency measures included: ca. 8.000 € per flat
- Total renovation need: **6,6 Mrd. €** (table)

Measure-costs-Matrix of the renovation need in East- Berlin (precast building stock) (1994)

Serie	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	Loggia Dach	Sanit.	Lüftg.	Heizg.	Elektro	San.Obj.	Flies.	Eing.	Dämmg	K-tür	K-fenst.	Fenster	Trepp.	Roll.EG	WE-Tür	Gestaltg.	Behind.	Abfall	IS-Fass.	Br.sch.	Gesamt	
Q3A (66.500)	2.505 €	4.346 €	3.835 €	767 €	5.369 €	3.886 €	767 €	614 €	358 €	5.011 €	128 €	128 €	2.352 €	971 €	358 €		2.556 €	26 €	26 €			34.001 €
QX (64.000)	2.608 €	2.045 €	3.835 €	767 €	3.375 €	3.835 €	767 €	614 €	767 €	6.340 €	179 €	128 €	2.812 €	1.483 €	460 €	51 €	2.556 €	51 €	51 €			32.723 €
P2/5,10 (65.000)	4.090 €	1.125 €	4.602 €	767 €	3.323 €	3.963 €	767 €	614 €	511 €	4.883 €	128 €	77 €	2.812 €	2.505 €	409 €	51 €	2.556 €	26 €	26 €			33.234 €
P2/11 (47.500)	4.090 €	1.023 €	4.857 €	767 €	1.278 €	3.963 €	767 €	614 €	511 €	1.278 €	77 €			2.454 €			2.556 €	26 €	26 €			24.286 €
QP59-64 (69.00)	2.301 €	1.125 €	4.857 €	767 €	3.528 €	3.835 €	767 €	614 €	767 €	6.723 €	102 €	128 €	3.835 €	2.914 €	409 €		2.556 €	26 €	26 €			35.279 €
QP71 A (58.500)	1.278 €	767 €	3.477 €	767 €	3.375 €	3.835 €	767 €	614 €	409 €	5.624 €	102 €	102 €	3.323 €	2.403 €	409 €	51 €	2.556 €	26 €	26 €			29.911 €
QP71 B	1.278 €	767 €	3.477 €	767 €		3.835 €	767 €	614 €	409 €		102 €			1.023 €			2.556 €	26 €	26 €	1.227 €		16.873 €
WBS 70/11 ä. <small>1975-1979 (68.000)</small>	3.835 €	920 €	3.835 €	767 €	3.323 €	3.835 €	767 €	614 €	511 €	7.363 €		102 €	2.863 €	3.170 €	256 €		2.556 €	26 €	26 €			34.768 €
WBS 70/11 m. <small>1980-1986 (38.000)</small>	2.812 €	920 €	3.835 €	767 €		3.835 €	767 €	614 €	511 €			51 €		1.432 €			2.556 €	26 €	26 €	1.278 €		19.429 €
WBS 70/11 j. <small>1987-1991</small>	2.301 €	920 €	1.278 €						511 €		511 €			1.278 €			2.556 €	26 €	26 €	767 €		10.226 €
WBS 70/ 5;6 ä. <small>1973-1977 (64.500)</small>	3.835 €	1.432 €	3.835 €	767 €	3.323 €	3.835 €	767 €	614 €	409 €	7.005 €		153 €	2.812 €	1.125 €	409 €	51 €	2.556 €	26 €	26 €			32.978 €
WBS 70/ 5;6 m <small>1978-1986 (40.500)</small>	3.835 €	1.432 €	3.835 €	767 €		3.835 €	767 €	614 €	409 €		102 €	102 €		1.125 €			2.556 €	26 €	26 €	1.278 €		20.707 €
WBS 70/ 5;6 j. <small>1987-1991</small>	2.301 €	767 €	1.278 €						511 €		409 €	102 €	102 €	1.125 €			2.556 €	26 €	26 €	767 €		9.970 €
WHH-GT (47.50)	1.023 €	767 €	7.158 €	767 €		2.199 €	767 €	614 €	153 €				3.426 €	614 €		51 €	2.556 €	26 €	26 €	2.301 €	1.841 €	24.286 €
WHH-GT85	767 €	256 €					665 €		153 €								2.556 €	26 €	26 €	2.301 €	409 €	7.158 €
WHH-SK (44.00)	1.023 €	2.301 €	7.158 €	767 €		2.812 €	767 €	614 €	51 €		51 €			1.790 €		51 €	2.556 €	26 €	26 €	1.790 €	716 €	22.497 €
SK-Scheib. (44)	1.023 €	1.278 €	7.158 €	767 €		3.323 €	767 €	614 €	614 €		102 €			1.790 €		51 €	2.556 €	26 €	26 €	2.045 €	614 €	22.752 €

The total renovation need on the precast residential building stock in East-Berlin

building types	year of construction	number of flats	renovation need	financing with own means and KfW-loans		building stock with need of additional interest subsidies	
				Gesamt- Bedarf		Gesamt- Bedarf	
		<i>WE</i>	<i>in € / WE</i>	<i>WE</i>	<i>in Mio €</i>	<i>WE</i>	<i>in Mio €</i>
Q3A (b)	1959-1969	18.600	31.444 €	-	-	18.600	584.866.783 €
Q3A (a)	1959-1969	10.000	34.001 €	-	-	10.000	340.009.101 €
QX	1962-1969	3.300	32.723 €	-	-	3.300	107.984.845 €
P2/5 P2/10	1966-1970	6.900	33.234 €	-	-	6.900	229.314.409 €
P2/11	1970-1975	9.500	24.286 €	9.500	230.720.461 €	-	-
QP59-64	1959-1973	17.000	35.279 €	-	-	17.000	599.745.377 €
QP71 (a)	1973-1983	10.200	29.911 €	-	-	10.200	305.087.866 €
QP71 (b)	1973-1983	10.000	16.873 €	10.000	168.726.321 €	-	-
WBS 70/11a	1975-1979	16.100	34.768 €	-	-	16.100	559.762.352 €
WBS 70/11m	1980-1986	35.250	19.429 €	35.250	684.875.475 €	-	-
WBS 70/11j	1987-1990	14.350	10.226 €	14.350	146.740.770 €	-	-
WBS 70/m a	1973-1977	6.000	32.978 €	-	-	6.000	197.869.958 €
WBS 70/m m	1978-1986	22.400	20.707 €	22.400	463.843.995 €	-	-
WBS 70/m j	1987-1990	14.300	9.970 €	14.300	142.573.741 €	-	-
WHH GT	1968-1987	17.500	24.286 €	17.500	425.011.376 €	-	-
WHH GT 85	1985-1988	1.600	7.158 €	1.600	11.452.938 €	-	-
WHH SK	1970-1986	2.900	22.497 €	2.900	65.240.844 €	-	-
Sk-Scheibe	1975-1982	4.700	22.752 €	4.700	106.936.697 €	-	-
Bezirksserien (b)	1977-1989	23.255	16.529 €	23.255	384.382.917 €	-	-
Bezirksserien (a)	1977-1989	29.145	30.583 €	-	-	29.145	891.339.316 €
Summe		273.000		155.755	2.830.505.535 €	117.245	3.815.980.006 €

(a)= große Schäden

(b)= weniger Schäden

	2.830.505.535 €	3.815.980.006 €
Sum total need	6.646.485.541 €	
realised until 2005	20.147 €	5.500.000.000 €

Ascertainment and evaluation of the renovation need

Concerning the total need with an extent of **6,5 Mrd. €** was differenced:

- Building types with lower support need and
- Building types with higher support need.

Higher financial support need was reckoned, if the ascertained renovation need (pursuant the measure-costs-matrix) exceeded **20.000 €** per flat.

Background is the financial scope for reasonable cost-apportionments at the residents:

	LV	PL	LT	EE	East-Germany
monthly household income on average	300,00 bis 500,00 €				1.700,00 €
monthly dwelling costs (without renovation) on average	50,00 bis 80,00 €				280,00 €
Reasonable renovation apportionments	35,00 €				145,00 €
loan annuity (sum interest and redemption in %)	16,0%				8,5% (1990er)
affordable renovation loan	2.625 €				20.471 €

Financial support:

- Either „only“ basic support: with interest-reduced KfW- loans (up to 250 € per m²) or
- Additional interest subsidies: for additional needed bank loans (over 250 € per m²)

Achieved state of renovation (2005)

- Total renovation investments (for the 273.000 precast flats): **5,5 Mrd. €**
- ● 60 % total renovated
- ● 15 % partly renovated
- Renovation investments per flat (on average): ca. 20.000 €
- Included: ca. 1.000 € per flat for improvements of the surroundings

The groups of renovation measures

The renovation measures implemented in Berlin (pursuant measure-costs-matrix) were involving seven renovation arrays :

- 1. Energy efficiency measures (EEM)**
- 2. concrete basic structure (constructional stability)**
- 3. facades, windows and roofs**
- 4. warm water supply, cooking and electric current**
- 5. general renovation need**
- 6. improvements of the surroundings**
- 7. constructional upgrading**

Renovation measures with an average extent of 20.000 € per apartment could be realised.

In this frame the total package of EEM (measure group 1) could be implemented .

Since the EEM cost ca. 8.000 € per apartment in Germany, there were available financial scopes for measures in the arrays 2 bis 7, although there couldn't be complied all wishes.

Renovation array 1: Energy efficiency measures (EEM)

The key measure is insulation of the walls (and EE windows)



Modernization of the heating cellar station : Advanced control and regulating equipment, to realise the reachable heating consumption savings



The economic ranking of the EEM

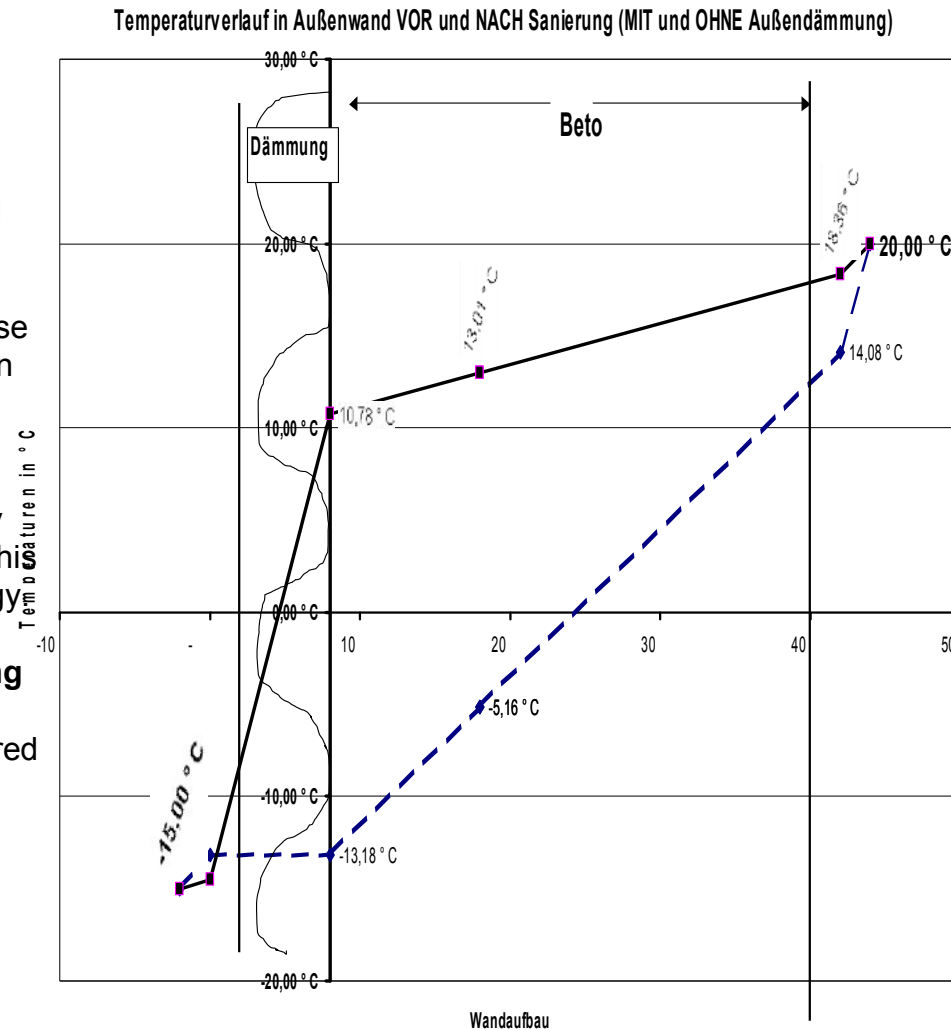
Germany	housing financing factor		Amortisation period		EEM ranking
<i>energy costs increasing in %</i>		5,0%		5,0%	
EEM	<i>constantly</i>	<i>dynamically</i>	<i>constantly</i>	<i>dynamically</i>	
A.1a gable wall insulation	1,05	0,82	14,97	11,36	3
A.1b insulation lengthwise walls	1,36	1,06	19,49	14,21	5
A.2 insulation of the last storey ceiling (accessible)	0,36	0,28	5,15	5,15	1
A.3 insulation cellar ceiling	2,85	2,26	40,67	28,11	6
A.4 insulation heating pipes outside flats	0,41	0,32	5,82	5,65	2
A.2 new windows	1,09	0,85	15,52	11,76	4
B. Accompanying measures					
sum	1,84	1,45	24,81	18,61	
Latvia	housing financing factor		Amortisation period		EEM ranking
<i>energy costs increasing in %</i>		10,0%		10,0%	
EEM	<i>constantly</i>	<i>dynamically</i>	<i>constantly</i>	<i>dynamically</i>	
A.1a gable wall insulation	3,75	1,98	24,97	12,16	3
A.1b insulation lengthwise walls	4,48	2,37	29,90	13,90	5
A.2 insulation of the last storey ceiling (accessible)	1,57	0,85	10,50	7,05	2
A.3 insulation cellar ceiling	8,34	5,23	55,60	26,82	6
A.4 insulation heating pipes outside flats	1,14	0,71	7,57	6,45	1
A.2 new windows	4,34	2,41	28,95	14,11	4
B. Accompanying measures					
sum	6,23	3,57	40,38	20,64	

Calculated with COEE

The (besides heating cost savings) huge advantages of wall insulation

Wall insulation as the key EE measure involves (besides energy savings) huge general dwelling advantages:

- 1.** **Spring repairs on facades and slab joints;** the increasing of facade damages and rusted steels becomes stopped.
- 2.** **Eliminating the danger of mould,** because the walls are warm (the frost remains in the insulation slab)
- 3.****Eliminating the „cold- radiation“ of the walls in the winter season.** This gains, that already room temperatures of 19 ° C are sensed as warm. This gains an additional possibility to save heating energy
- 4.**insulation works for room **climate balancing** in spring and autumn; in the summer the insulation prevents the heating-up of the walls. If it is clever aired in summer time (opening the windows in the cooler night; during the day shutting down the blinds) the insulated walls effect balanced room temperatures.
- 5.** **New optical appearance;** a building with a new insulation facade looks like a new building.



Renovation array 2: Damages at the concrete basic structure

No damages with danger for the structural stability of the buildings

But damages at loggia concrete plates

Grave damages at balcony concrete plates

Grave stability damages at concrete balustrades of loggias

Only few damages on concrete roofs over entrance doorways



Renovation array 3: Facades, windows and roofs

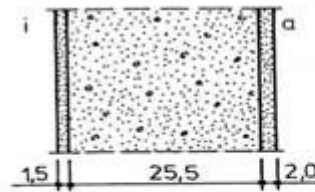
Only few damages on roofs

Heating energy wasting through old windows

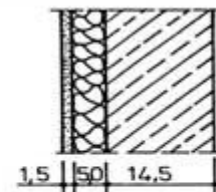


Repair need on the concrete plate facades

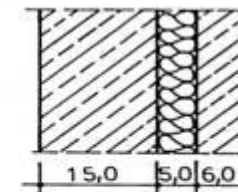
•At "1-layer- concrete-slabs"



a
einschichtige
Außenwand



b
zweischichtige
Außenwand



c
dreischichtige
Außenwand

•At "2-layer-concrete slabs"

•at "3-layer-concrete slabs" („Sandwich-plates“)

•Repair need at the plate joints



Renovation array 4: warm water supply, cooking, electric current

Warm water supply

A **warm water supply via peripheral gas heater** (in connection with gas for cooking) were the optimal economic solution and provides the best water quality.

But a modification afterwards at peripheral warm water supply is mostly not possible due to not available chimneys.

Energy supply for cooking

Only gas for cooking isn't economically, because maintaining the gas pipes only for cooking is too expensive.

Wherever heating supply with district heating was existing (and this was prevailingly the fact) the only gas pipes for cooking were removed, and electric cooker were installed.

Electric current supply

Central equipment for bell and door opening

TV and media equipment



Renovation array 5: general renovation need

Pipes for supply with fresh water and waste water

Air ventilation for inboard WC/ bathrooms

elevators

Modernisation bathrooms

Constructional improvements for seniors and disabled persons

Noise insulation

Shutters for flats in the ground floor

Burglar-proof doors

Constructional fire protection

Rubbish chutes

Constructional lightning protection



Renovation array 6: surroundings



Renovation array 7: constructional upgrading

Beautification of the facades



Renovation of the staircases and entrance areas

Elevators for buildings with 5- and 6 floors



Relocatable glass plates on loggias

New large loggias for apartments (if there weren't loggias or balconies until now)



Modification of room planning inside the apartments

Partly pulling down of high buildings with constructional steppings and terraces



Summary

The complex measures, if implemented in total, cost up to 50.000 € per apartment.

On average implemented in Berlin: ca. 20.000 € per flat

Part of EEM in Berlin: ca. 8.000 € per flat

This EEM cost in Lithuania ca. 4.000 € to 6.000 € per flat.

And now the connection to the BEEN- Projekt:

BEEN deals with the question:

How can be achieved that the whole EEM package can be implemented for each precast residential building in the BEEN- countries?

BEEN ends in Dec. 2007.

The result of BEEN will be:

- This aim is reachable.
- BEEN is going to indicate the optimal approaches, how every condominium ownership can afford the implementation of the whole EE measure package with investment cost of ca. 5.000 € per flat.
- (By a monthly apportionment up to 25,00 € per flat. And by a yearly decreasing burden depending from increasing of the energy costs.)