

Energy Efficiency in Berlin's Housing Stock



...and cooperation
projects with
Central/East- European
countries
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Senatsverwaltung für
Stadtentwicklung Berlin
Peter Wollschläger



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Berlin: Dwelling Data

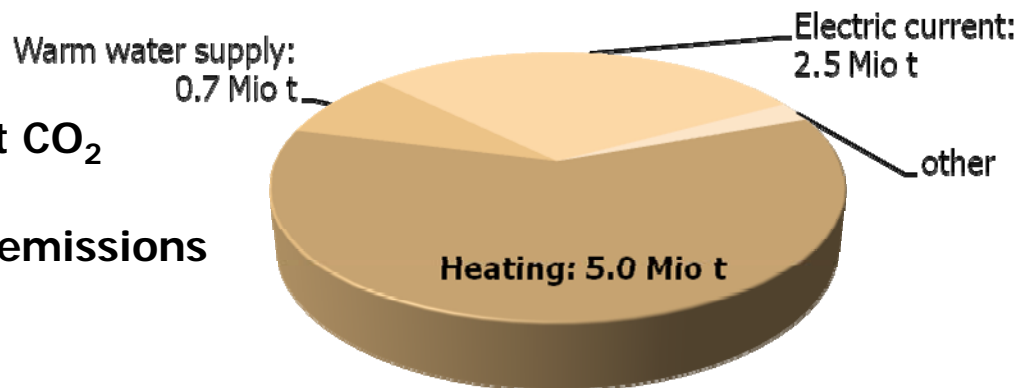
Urban population of 3.5 residents

- A total of 1.87 million dwellings,
- 1.9 residents per flat.
- Cost burden of rent below 25 % of a household's income
- Half of Berlin's housing stock was built before 1950
- 87 % of dwellings are rented flats,
- 90 % of them are flats in multi-storey buildings

Berlin's Climate Objectives up to 2020

- **Target: CO₂- Reduction (compared with 1990) 40 %**
 - 25% reduction achieved (2005) (1990: 29 Mio t; 2005: 22 Mio t)
 - To do: Further reduction of 4,3 Mio t CO₂ (15%) is needed
(aim 2020: 17,6 Mio t = 5,2 t per inhabitant)
- **The residential housing stock can and must deliver an above average contribution**
- **CO₂-Emissions of the housing stock 2005:**

- **Sum dwelling: 8,2 Mio t CO₂**
= 37 % of Berlin's CO₂ emissions



CO₂-Emissions of Different Energy Supply

Specific values of energy supply and CO₂-emissions		
Energy supply	Specific CO₂-emissions (kg CO₂ per kWh final energy)	Primary energy coefficient
Electric current	0,58 bis 0,70	2,70
Lignite	0,410	1,20
Hart coal	0,350	1,20
Oil	0,266	1,10
Natural gas	0,211	1,10
Timber (peletts)	-	0,20
Solar (thermal panels))	-	-
District heating		
Vattenfall	0,149	0,567
FHW MV	0,217	1,300
District heating Neukölln	0,220	0,940
BTB	0,046	0,387

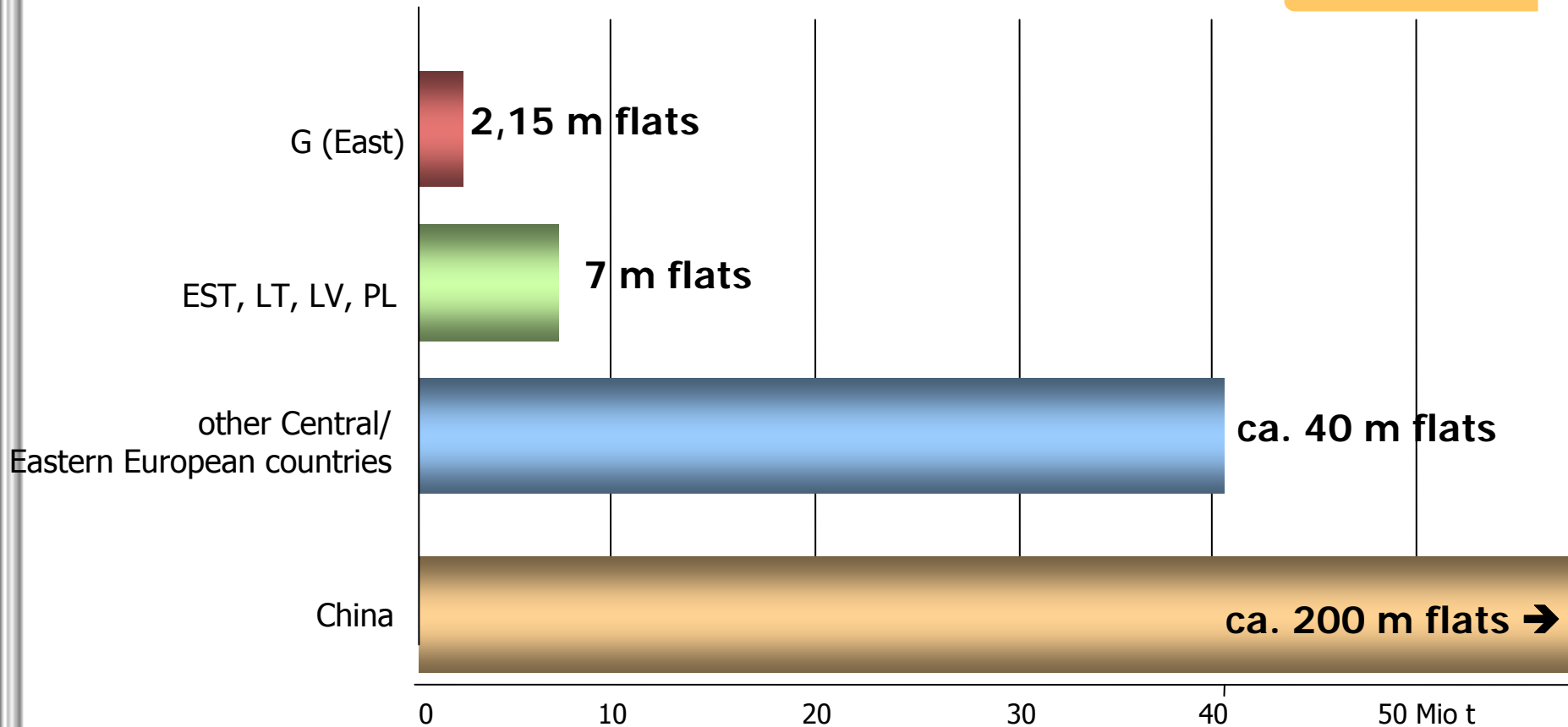
Berlin's Own Housing Stock sets a Good Example

Heat energy consumption of Berlin's communal flats			Berlin's Average
	Sum	thereof HOWOGE	
number of flats	267.824	48.433	1.840.000
living space	16.746.648	2.970.212	128.248.000
m ² per flat	62,53	61,33	69,70
Final energy consumption	in MWh	1.912.809	229.732
	kWh per flat	7.142	4.743
	kWh/m ² a	114,22	77,35
		100 %	68 %
Primary energy consumption	in MWh	1.715.185	160.518
	kWh per flat	6.404	3.314
	kWh/m ² a	102,42	54,04
		100 %	53 %
CO2-emissions	in t/a	377.896	37.750
	tons per flat annually	1.411	0,78
	kg/m ² a	22,57	12,71
	kg CO2 per kWh final energy consumption	0,198	0,164
		100 %	56 %

Renovation in Berlin



Prefabricated Housing



Achieved State of Renovation in Berlin

Total renovation investments (for the 273.000 precast flats): **5,5 Mrd. €**

- 65 % total renovated
- 35 % prevailing partly renovated
- Average renovation investments: 20.000 € per flat
- Included: 1.000 € per flat for surroundings

The „Berlin“ Pilot Project in Riga



Focus of Urb.Energy

Focus of BEEN:

- What is the optimal package of energy-saving measures for prefabricated housing?
- How can be achieved, that the condominium ownerships (installed after privatisation) become able to implement these measures?

Focus of Urb.Energy:

- Upgrading of the residential environment and infrastructure
- Integrated concepts for holistic rehabilitation of residential areas

Subject of BEEN: The Traditional Package of Energy-Saving Measures

Measures		Function and purpose of measures
Insulation	gable	Reduction of heat loss
	longitudinal walls	
	top floor ceiling	
	cellar ceiling	
	heating pipes	Avoidance of unnecessary heat loss
New windows		Reduction of heat loss via window panes and frames
		Avoidance of unnecessary heat loss (due to unwanted draughts of rickety windows)
Heating system		To enable the realisation of energy savings



Bleak Concrete Slabs Facades



BEEN Best-Practice Projekt Paldiski Road 171, Tallinn (Estland)



Learnt from Pilot-Projects?

What have we learnt from

- pilot projects and
- pilot programmes

with the aim

- to activate self-running large-scale refurbishment measures?

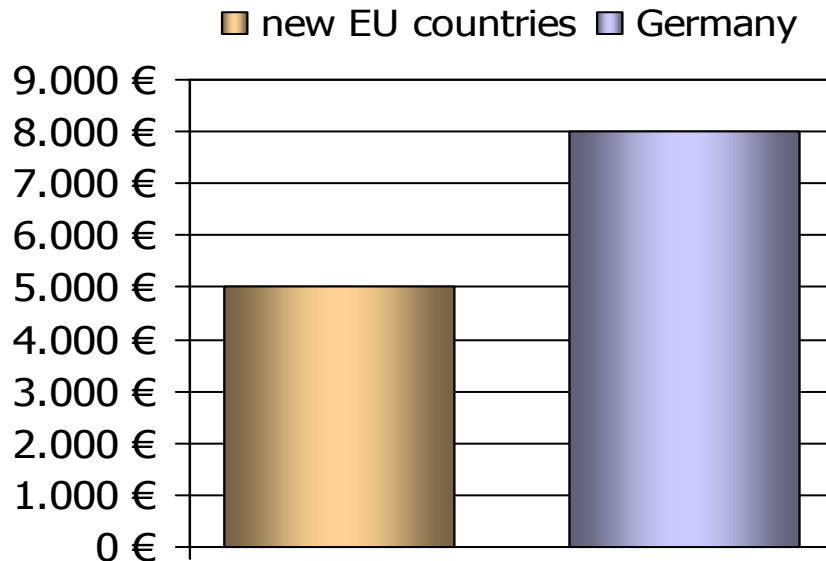


Pilot Project in Beijing (GTZ China)



Savings Potential in terms of the Final Energy Need of Dwelling

Costs of energy-saving measures per flat



Achievable Energy Savings: 50 %

i.e. per flat (54 m²) annually:

- reduction of heating need: **4.200 kWh**
- saving primary energy: **500 to 700 litres oil** (or equivalent gas, coal)
- reduction CO₂: **1 to 1,4 t**

Potential of Heating Cost Savings

per average flat building type 2		EST, LT, LV, PL (54 m ²)	D (East) (56 m ²)
Energy prices (per kWh)		0,03 €	0,06 €
Annual heating consumption	PRIOR renovation	8.370 kWh	8.990 kWh
Annual heating costs		251,10 €	539,40 €
Monthly heating costs		20,93 €	44,95 €
Potential of saving		50%	
Monthly heating costs savings		10,46 €	22,48 €

Scope for Renovation Apportionments

Monthly per average flat	EST	LT	LV	PL	D (East)
Disposable household incomes	450,00 €	366,00 €	350,00 €	530,00 €	1.700,00 €
Typical housing costs	87,50 €	66,50 €	62,50 €	107,50 €	300,00 €
	19,4 %	18,2 %	17,9 %	20,3 %	17,6 %
Reasonable burden of housing costs in % of income	25,0 %				
Scope for renovation apportionments	25,00 €				125,00 €

Scope for Financing in Total

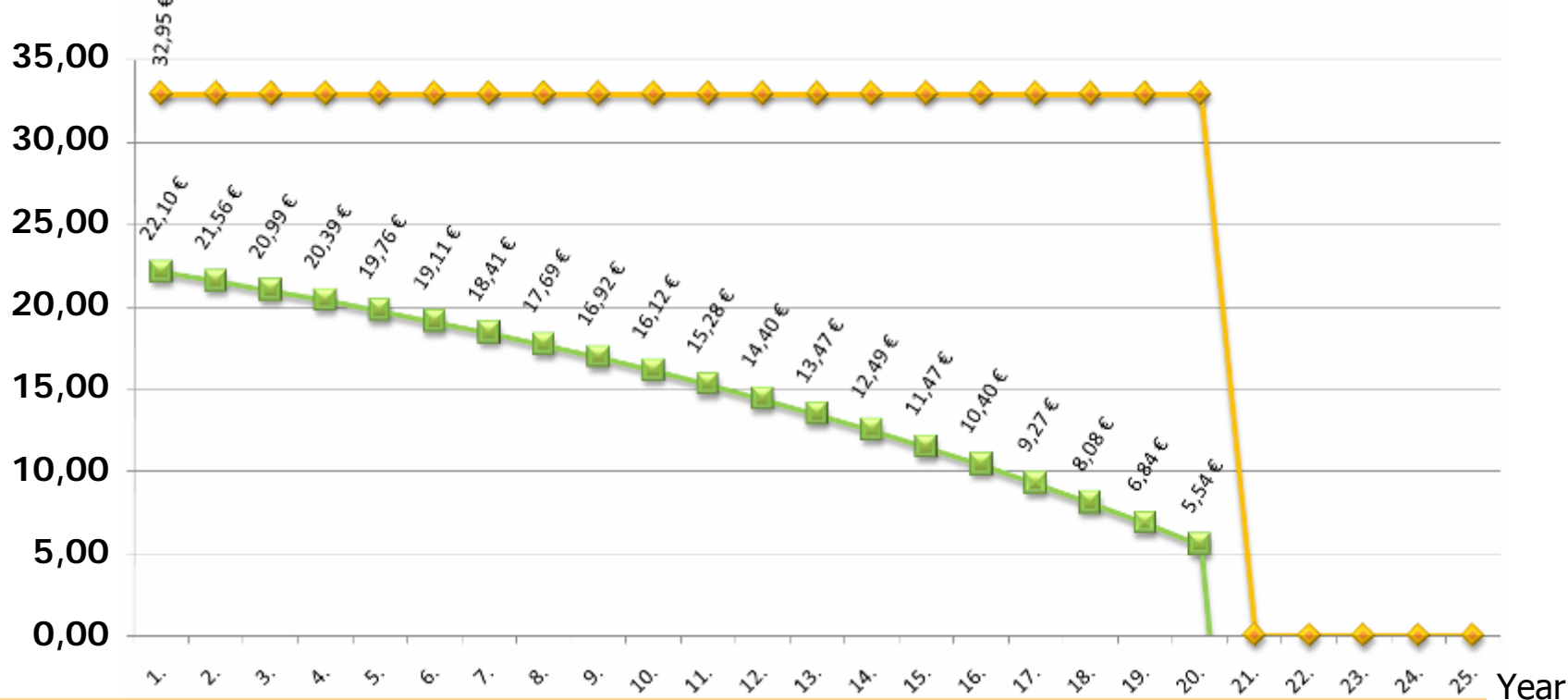
	EST LT LV PL	D (East)
Renovation apportionments	25,00 €	125,00 €
Scope of monthly heating cost savings	10,00 €	20,00 €
Sum of financing scope	35,00 €	145,00 €


What Renovation Investments can be financed?


		EST LT LV PL	D (East) in the 1990th
Loan conditions	Term in years	8 to 12 years	20 to 25 years
	Interest	4,5 to 7 %	6 to 8 %
	Annuity (Σ redemption and interest)	15 %	8,5 %
Financing scope		35,00 €	145,00 €
Achievable loan		2.625,00 €	20.470,59 €
By comparison: costs of energy-saving measures		ca. 5.000 €	ca. 8.000 €

Monthly Loan Apportionments per Flat with a BEEN recommended Support Loan

Apportionment in €
per month and flat



 Loan burden (sum interest and redemption) for a loan amount of 5.000 € per flat, 5 % interest; annuity 7,91 %

 Burden after heating cost savings (for increasing energy prices by annually 5%)

Advantages of Wall Insulation beyond Energy-saving Effects



Saves maintenance costs

Eliminates mould and mildew

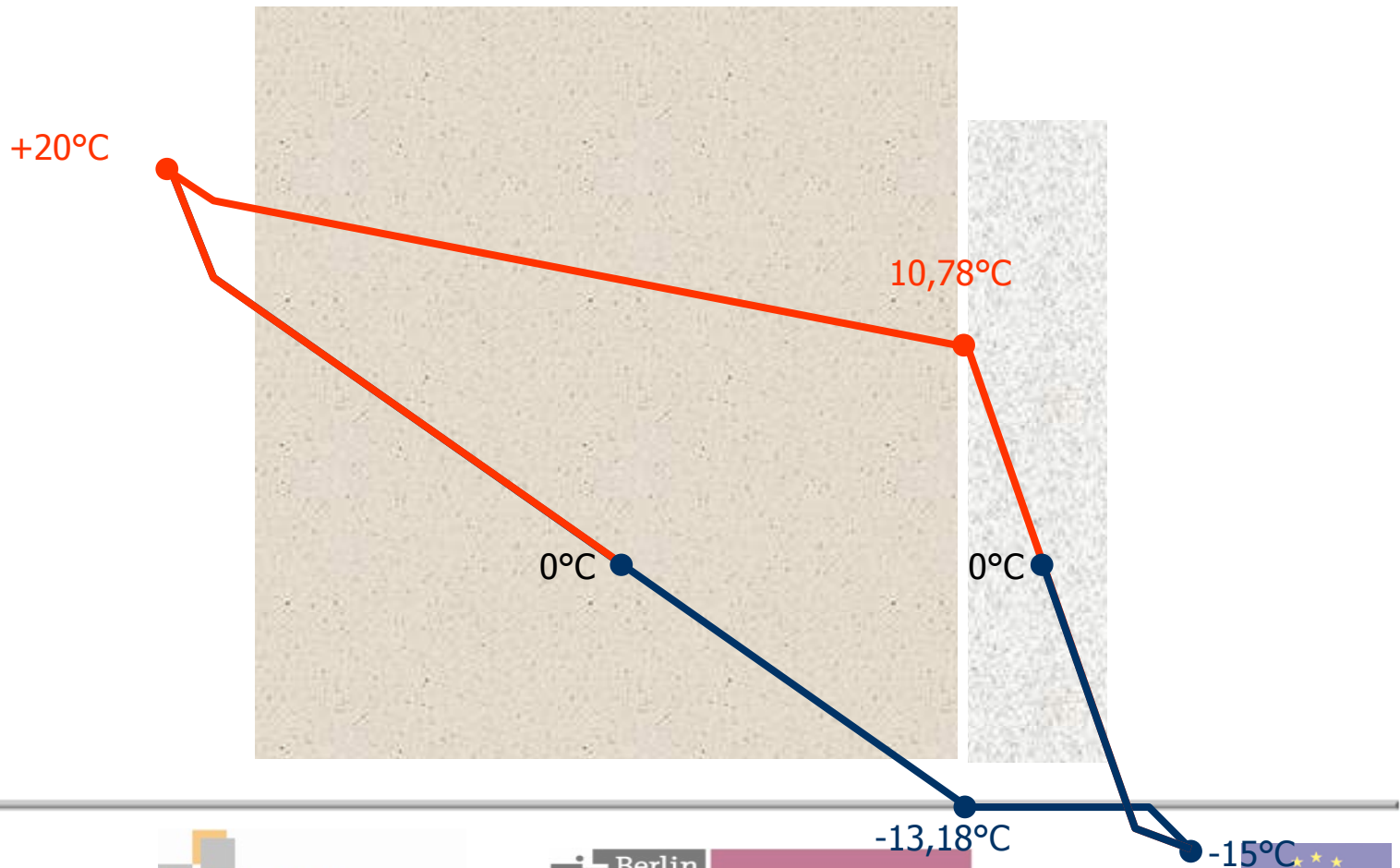
Eliminates “cold radiation”

Keeps temperatures balanced

New exterior appearance



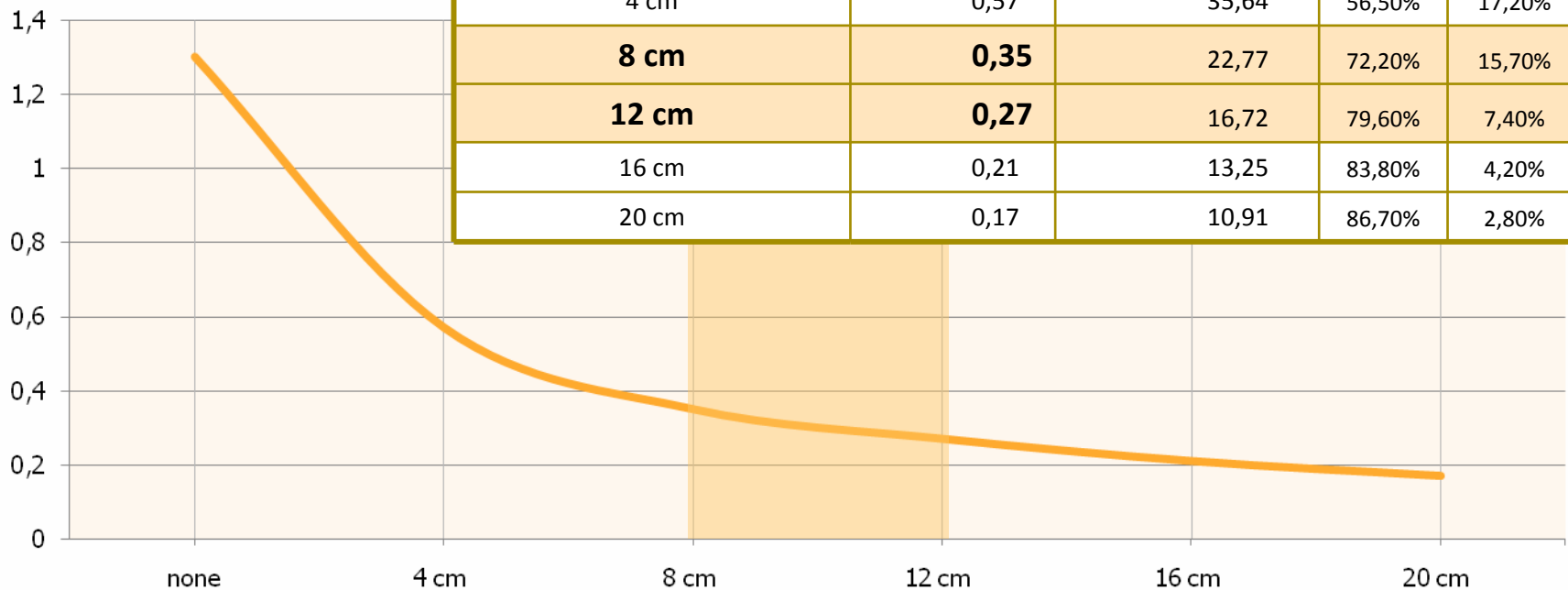
Wandering of the Dew Point due to Thermal Insulation



Insulation Layer Thickness

Influence of the insulation thickness in respect of the heat energy losses of prefabricated housing (Type 2)

Thickness of insulation layer	U-value in W/m ² K	Heat energy loss in kWh/m ² per annum	Savings	Increase
Uninsulated exterior wall	1,30	82,00	–	–
1 cm	0,98	61,88	24,50%	24,50%
2 cm	0,79	49,70	39,40%	14,80%
4 cm	0,57	35,64	56,50%	17,20%
8 cm	0,35	22,77	72,20%	15,70%
12 cm	0,27	16,72	79,60%	7,40%
16 cm	0,21	13,25	83,80%	4,20%
20 cm	0,17	10,91	86,70%	2,80%





Senatsverwaltung
für Stadtentwicklung

