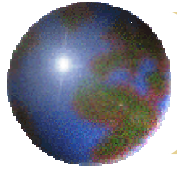


Profitability of energy-saving investments in German private rental housing

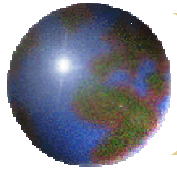


Presentation for the
European Network of Housing Research International Conference
Shrinking Cities, Sprawling Suburbs, Changing Countrysides, Dublin, Ireland
6.-9. July 2008
Presenter: Stefan Kofner, TRAWOS Institute



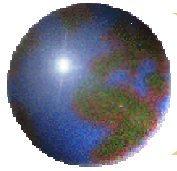
Contents

1. Introduction
2. Relevant regulation
3. Relevant subsidies
4. Investment analysis



The climatic background

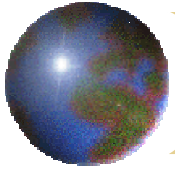
- ⊕ biggest lever for the reduction of green house gases is increased **energy-efficiency of buildings** (40 per cent of end energy consumption)
- ⊕ energy efficiency of the **private rental housing stock** matters
 - ▣ low homeownership rate
 - ▣ big share of private landlords in the rental housing stock (76 per cent)
- ⊕ **financial support** for the energetic modernisation of buildings (since 2000)



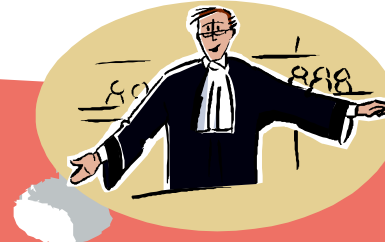
Economic efficiency

- ✚ Even money invested to save CO₂ emissions could be wasted.
- ✚ Such investment should not be expanded beyond the point where marginal cost equals marginal utility including social marginal utility.

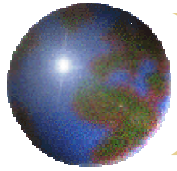




Relevant regulation

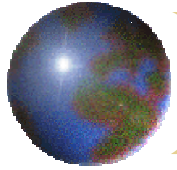


- In **case of letting** landlords can demand a rent up to 50 / 20 per cent above the (market-oriented) local reference rent.
- in an **ongoing rental contract** local reference rent as a strict upper limit
- additional **rent cap** of 20 per cent in three years
- Rent increase **in case of modernisation**:
 - modernisation costs per dwelling times 11 per cent per year (share in the costs)
 - payable until the landlord raises the rent referring to the local reference rent next time
 - in case of termination of the tenancy no share in the cost from subsequent tenant (→ local reference rent plus 50 / 20 per cent)



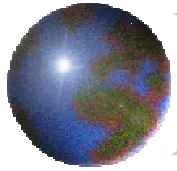
Relevant subsidies

- ⊕ Tax incentives
- ⊕ BAFA-subsidies for investment in renewable energies
- ⊕ KfW subsidised credit programmes
 - ▣ KfW residential property modernisation programme
 - ▣ KfW CO₂ programme



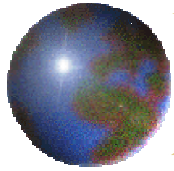
KfW CO₂ programme

- intensely subsidised programme with cheap rates **for 10 years**
- hard to fulfil the programme qualifications
- only **bundles of measures** with a remarkable effect on the carbon footprint
- **“Mortgage Principal Assistance”** (remission of 5 per cent of the initial debt) if energetic standard of a new building is reached
- **cost limit** of € 50.000 per dwelling



Investment analysis: three bundles of measures

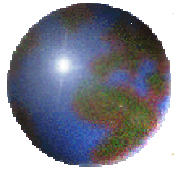
≥ 12 cm thermal insulation of outside walls		6 litre house: € 290 / m²
Combined heat and power district heating		
16 cm thermal insulation of topmost storey ceiling		8,5 litre house: € 185 / m²
8 cm thermal insulation of cellar ceiling		
Replacement of windows (U-value, $U_F \leq 1,3 \text{ W/m}^2\text{K}$) in dwellings and staircases		



6 litre house: total and apportionable costs

type of cost	amount €	€ per m ² living space
land value	11.200	140,00
value of the building substance	48.800	610,00
restoration costs	4.155	51,94
modernisation costs	19.045	238,06
total costs	83.200	1.040,00

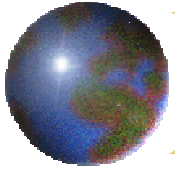
Type of measure	Costs € / m ²	Apportion- able costs € / m ²
Combined heat and power district heating	83,70	79,52
16 cm thermal insulation of storey ceiling	40,00	38,00
8 cm thermal insulation of cellar ceiling	16,50	15,68
≥ 12 cm thermal insulation of outside walls	105,00	73,50
Replacement of windows (U- value, $U_F \leq 1,3 \text{ W/m}^2\text{K}$) in dwellings and staircases	44,80	31,36
Total costs € / m²	290,00	238,06



6 litre house: financial structure

I. basic data	
living space in m ²	80
number of units	1
interest rates for KfW CO ₂ -mortgage in per cent year 1-10	3,35
Reference interest rate	5,5
administration costs per unit year 1 €	370
maintenance costs per m ² year 1 €	7,00
Loss of rent, percentage of target rent year 1	3,0
II. total costs	
land value per m ² living space €	140,00
value of the existing building substance per m ² €	610,00
restoration costs per m ² living space €	51,94
modernisation costs per m ² living space €	<u>238,06</u>
total costs per m ² living space €	1.040,00
III. financial structure	
equity capital €	60.000
debt capital €	<u>23.200</u>
total costs €	83.200

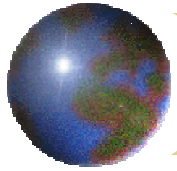
IV. cash outflows in year 1	
A. capital costs	
annuity for the KfW CO ₂ -mortgage €	777
B. operating costs	1.134
administration €	370
maintenance €	560
loss of rent €	204
V. rent revenue per year	6.799
previous rent per month and m ² €	4,90
share in the costs per month and m ² €	2,18
local reference rent per month and m ² €	5,65
rent after modernisation per month and m ²	7,08



Type of mortgage



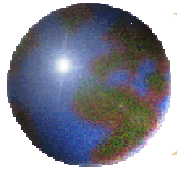
- modernisation measures financed exclusively with a KfW CO2-mortgage
- purchase price financed solely with equity capital
- € 23.200 per dwelling financed with a 10 year FRM (termtime: 20 years) at an interest rate of 3,35 per cent (afterwards 6,0 per cent)
- 6 litre house qualifies for the “Mortgage Principal Assistance” principal balance will be lowered by 5 per cent after the 6th quarter (€ 1.160)
- initial principal 0 per cent due to grace period
- Open principal balance (€ 8.326) is paid back when the property is sold after 15 years.



Mortgage payment plan

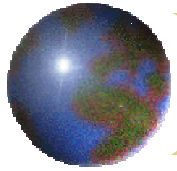
t	Principal balance €	interest €	principal €	annuity €
1	23.200	777,20	0	777,20
2	22.620	757,77	0	757,77
3	22.040	738,34	0	738,34
4	22.040	738,34	967	1.705,77
5	21.073	705,93	1.000	1.705,77
6	20.073	672,44	1.033	1.705,77
7	19.039	637,82	1.068	1.705,77
8	17.971	602,04	1.104	1.705,77
9	16.868	565,07	1.141	1.705,77
10	15.727	526,85	1.179	1.705,77
11	14.548	872,89	1.104	1.976,65
12	13.444	806,66	1.170	1.976,65
13	12.274	736,46	1.240	1.976,65
14	11.034	662,05	1.315	1.976,65
15	9.720	583,17	1.393	1.976,65

debt capital €	23.200
mortgage principal assistance €	1.160
i_{eff} in per cent	2,74
i_{t_0} in per cent	3,35
$i_{t_{10}}$ in per cent	6,00
initial principal per cent	0,00
principal t_4 per cent	4,39
principal t_{11} per cent	7,59
annuity t_0-t_3 €	777,20
annuity t_4-t_{10} €	1.705,77
annuity $t_{11}-t_{15}$ €	1.967,65
ref. interest per cent	5,5
reduction of interest per year €	640,32



Rent calculation

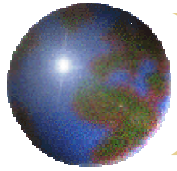
Type of rent	per year and dwelling €	per m ² and month €
previous rent	4.704	4,90
tenant's gross share in the costs: € 19.045 * 0,11	2.095	2,18
reduction of interest: (5,5 – 2,74) * € 23.200 / 100	640	0,67
payable rent	6.159	6,41
local reference rent after modernisation	5.424	5,65



Development of rent revenue

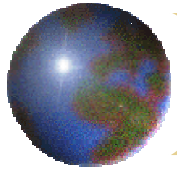
t	local ref. rent €	previous rent €	share in the costs €	reduction of interest €	target rent €
0					
1	5.424	4.704	2.095	-640	6.159
2	5.522	4.704	2.095	-640	6.159
3	5.621	4.704	2.095	-640	6.159
4	5.722	4.704	2.095	-640	6.159
5	5.825	4.704	2.095	-640	6.159
6	5.895				7.074
7	5.966				7.074
8	6.037				7.074
9	6.110				7.074
10	6.183				7.074
11	6.220				7.464
12	6.258				7.464
13	6.295				7.464
14	6.333				7.464
15	6.371				7.464

dynamisation: assumptions 6 litre house	per cent
growth rate local ref. rent year 1-5	1,8
growth rate local ref. rent year 6-10	1,2
growth rate local ref. rent year 11-15	0,6
local ref. rent markup year 6	20,0
local ref. rent markup year 11	20,0
growth rate operating costs	2,0
loss of rent / rent revenue	3,0
entry cap rate	6,06
exit cap rate	8,44
capital gains per year	-1,03



Exit assumptions

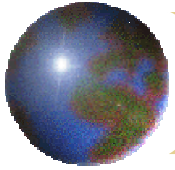
	6 litre house	8,5 litre house	11 litre house
entry cap rate after modernisation per cent	6,06	6,32	6,23
exit cap rate per cent	8,44	9,44	9,64
net sale revenue in year 15 €	71.248	57.903	51.264
yearly decrease in value per cent	1,03	1,69	2,17
accounting profit after year 15 €	11.344	4.047	0



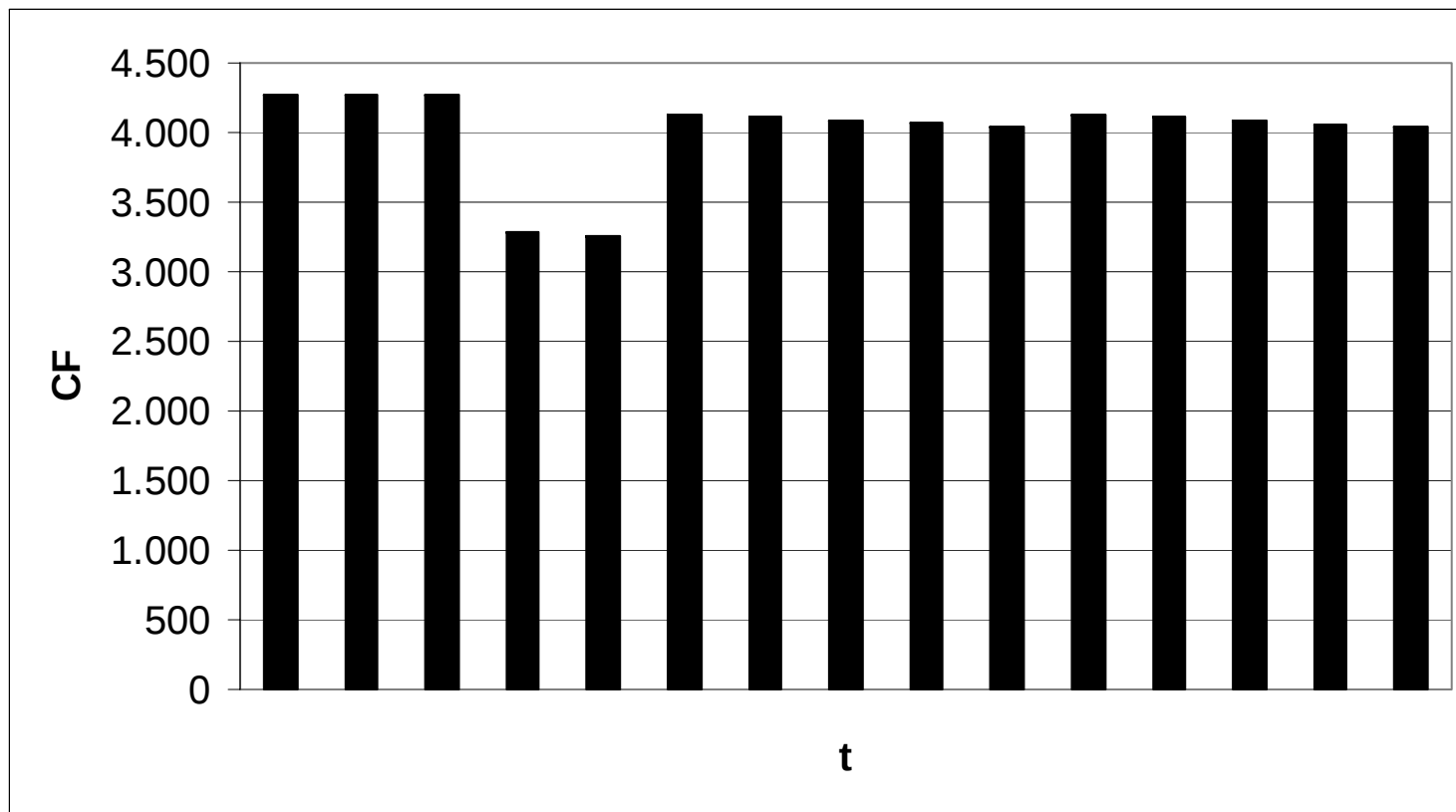
Cash flow components and property value

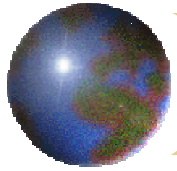
t	A_0/R_{15} €	rent €	capital gain €	value €	capital costs €	op. costs €	CF €
0	-60.000			83.200		0	0
1		6.159	-856	82.344	777	1.115	4.267
2		6.159	-847	81.497	758	1.133	4.267
3		6.159	-838	80.659	738	1.152	4.268
4		6.159	-830	79.830	1.706	1.172	3.281
5		6.159	-821	79.009	1.706	1.191	3.261
6		7.074	-813	78.196	1.706	1.239	4.129
7		7.074	-804	77.392	1.706	1.260	4.109
8		7.074	-796	76.596	1.706	1.281	4.088
9		7.074	-788	75.808	1.706	1.302	4.066
10		7.074	-780	75.028	1.706	1.324	4.045
11		7.464	-772	74.257	1.977	1.358	4.130
12		7.464	-764	73.493	1.977	1.380	4.107
13		7.464	-756	72.737	1.977	1.403	4.084
14		7.464	-748	71.989	1.977	1.427	4.061
15	71.248	7.464	-740	71.248	1.977	1.451	4.037

IRR before taxes: **6,88**
per cent (6,40 and 5,70
per cent, resp.)



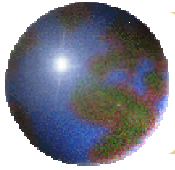
CF before taxes, 6 litre house





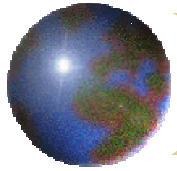
6 litre house: after tax rate of return

t	A ₀ /R ₁₅ €	rent €	interest cost €	interest- income €	total capital costs €	op. costs €	CF before taxes €	IRR1	Det. base €	Depr. rate per cent	Depr. €	Taxable income €	Income tax €	CF after taxes €	IRR2
0	-60.000					0	0	-60.000						-60.000	
1		6.159	777	0	777	1.115	4.267	4.267	83.200	2,00	1.664	2.603	-911	3.356	
2		6.159	758	293	758	1.133	4.267	4.267	81.536	2,00	1.664	2.897	-1.014	3.254	
3		6.159	738	607	738	1.152	4.268	4.268	79.872	2,00	1.664	3.211	-1.124	3.144	
4		6.159	738	942	1.706	1.172	3.281	3.281	78.208	2,00	1.664	3.527	-1.234	2.047	
5		6.159	706	1.232	1.706	1.191	3.261	3.261	76.544	2,00	1.664	3.830	-1.340	1.921	
6		7.074	672	1.541	1.706	1.239	4.129	4.129	74.880	2,00	1.664	5.040	-1.764	2.365	
7		7.074	638	1.931	1.706	1.260	4.109	4.109	73.216	2,00	1.664	5.444	-1.905	2.203	
8		7.074	602	2.347	1.706	1.281	4.088	4.088	71.552	2,00	1.664	5.874	-2.056	2.032	
9		7.074	565	2.789	1.706	1.302	4.066	4.066	69.888	2,00	1.664	6.332	-2.216	1.850	
10		7.074	527	3.260	1.706	1.324	4.045	4.045	68.224	2,00	1.664	6.820	-2.387	1.658	
11		7.464	873	3.763	1.977	1.358	4.130	4.130	66.560	2,00	1.664	7.333	-2.566	1.564	
12		7.464	807	4.305	1.977	1.380	4.107	4.107	64.896	2,00	1.664	7.919	-2.772	1.336	
13		7.464	736	4.884	1.977	1.403	4.084	4.084	63.232	2,00	1.664	8.544	-2.990	1.094	
14		7.464	662	5.500	1.977	1.427	4.061	4.061	61.568	2,00	1.664	9.212	-3.224	837	
15	71.248	7.464	583	6.158	1.977	1.451	4.037	66.958	59.904	2,00	1.664	9.924	-3.473	63.485	0,03608556



Bundle	11 litre	8,5 litre	6 litre
costs per m ² €	140,00	185,00	290,00
tenant's gross share in the costs per year and dwelling € / per month and m ² €	1.071,93 / 1,12	1.448,13 / 1,51	2.094,93 / 2,19
reduction of interest per year € / per month and m ² €	240,80 / 0,25	318,20 / 0,33	640,32 / 0,67
tenant's net share in the costs per year and dwelling € / per month and m ² €	831,13 / 0,87	1.129,93 / 1,18	1.454,61 / 1,52
rent markup upon local reference rent after years 5 / 10 per cent	15 / 10	20 / 15	20 / 20
entry / exit cap rate per cent	6,23 / 9,64	6,32 / 9,44	6,06 / 8,44
decrease in value , per cent per year	2,17	1,69	1,03
sale price after year 15 €	51.264	57.903	71.248
IRR before / after tax per cent	5,70 / 2,60	6,40 / 3,05	6,88 / 3,70

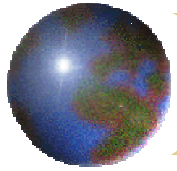
Overview of results



IRR without interest rate reduction

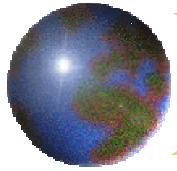
Bundle	11 litre	8,5 litre	6 litre
IRR before / after tax per cent	5,70 / 2,60	6,40 / 3,05	6,88 / 3,70
hypothetical IRR without interest rate reduction before / after tax per cent	5,88 / 2,61	6,64 / 3,05	7,34 / 3,69

IRR after tax unaltered!



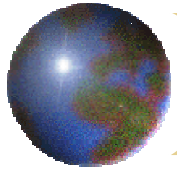
Effect of interest rate subsidy on IRR

Bundle	11 litre	8,5 litre	6 litre
IRR before / after tax per cent	5,70 / 2,60	6,40 / 3,05	6,88 / 3,70
IRR without subsidised credit before / after tax per cent	5,58 / 2,59	6,24 / 3,05	6,59 / 3,60



sensitivity of IRR relating to changes in the subsidised interest rate, 8,5 litre house

subsidised interest rate per cent	5,5	5,0	4,0	3,35	3,0	2,0	1,0	0,0
IRR before tax per cent	6,26	6,29	6,36	6,40	6,42	6,47	6,52	6,56
IRR after tax per cent	2,96	2,98	3,03	3,05	3,06	3,10	3,13	3,16
yearly rent after modernisation €	6.152	6.078	5.930	5.834	5.782	5.634	5.486	5.338
monthly rent per m² after mod. €	6,41	6,33	6,18	6,08	6,02	5,87	5,71	5,56



Conclusion

- ✚ The sensitivity of the IRR on interest rate changes is very low.
- ✚ *The final recipients of the interest rate subsidies are the tenants.*
- ✚ But lower interest rates, a higher cost multiplier or the cancellation of the interest rate reduction would only raise the tenant's energetic burden without doing much good for the landlords.
- ✚ Recommendation: **tax subsidies** → higher depreciation rates for energy-efficient buildings