Experiences from Energy Renovation of Multi-family Buildings in Sweden

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Professor - Exellence Profile

Buildings – Energy use and efficiency

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Boundary conditions - I

- Multi-family buildings
- Owned by municipalities
- Rented apartments
- Mainly concrete element buildings built in the 70's ..
- Buildings built in the 50's and 60's ..

Boundary conditions - II

- We do not have ”social housing”, but we have poor building areas ..

  (all pay the same rent, but some have a subsidized rent ..)
- Heat and DHW is included in the rent ..
- ~ 80% of the heat supplied by DH ..
- >70% of DH from biofuels ..
  <10% of DH from fossil fuels ..

Milparena

Miljonprogramsarena

- Co-operation between CHALMERS and SP Techn. Research Institute …
- .. and a number of municipal housing companies and other stakeholders ..
- Builds on a number of realised energy renovation projects ..

Energy use

- "**Energy use**" - (measured) annually delivered energy for heating, ventilation, DHW and common electricity (fans, etc., i.e. excl. household electricity) in kWh/m^2 "heated floor area" ..
- "**heated floor area**" - A_{temp}, i.e. the total (inside) floor area kept at a temperature above 10 ºC all year ..

Gårdsten .. 500 apartments ..

Before: 263 kWh/m² **After: 145 kWh/m²**

Techn. + social refurbishment 1998 – 2005 ..

Brogården .. 300 apartments ..!

Before: 177 kWh/m² **After: 65 kWh/m²**

Comprehensive energy renovation 2007 - ..!

Katjas gata 119 .. Pilot project ..!

Energiklass F

Energiklass B

Before: 178 kWh/m² **After: 60 kWh/m²**

Comprehensive renovation 2009 ..!

Maratongatan .. 260 apartments ..

Before: 145 kWh/m² **After: 92 kWh/m²**

”Traditional” + HX on vent .. 2011 - ..

Bergsjön .. Planned ..!

Before: ~200 kWh/m²

After: <100 kWh/m² ..??

Energy use

Project	Before	After
Gårdsten	263	145
Brogården*	177	65
Katjas gata*	178	60
Maratonvägen	145	92

*** .. incl. ”new” building envelope ..!**

Economics

Project	Approach
Gårdsten	Low hanging fruits - Yes
Brogården	Holistic Municipal – Yes ?
Katjas gata	Strict economic – No !
Maratonvägen	Flex economic – Maybe

Conclusions

- + Energy use reduced by 50% with existing knowledge and technologies .. i.e. we do not need to invent !
- - Lack of (economic) incentives ..
- - Restricted knowledge/skills ..
- - Counter productive debate ..

Reality ..

- Politicians have got cold feats ..!
- Authorities and building owners struggle with new requirements !
- Building owners with good economy and/or ambitions take initiatives !
- While others protest ..
- .. and both are right ..!

AREA OF ADVANCE ENERGY

Katjas gata extrapolated to 150 units ..

Apartment 80 m^2	Traditional		
Investment	800 000		SEK
Own funding	400 000		SEK
Required loan	400 000		SEK
Cost for loan	24 000		SEK/yr
Reduced maint.	- 4 000		SEK/yr
Energy supply	0		SEK/yr
Net cost for loan	**20 000**		**SEK/yr**
	1 Euro about	**10 SEK**	

Katjas gata extrapolated to 150 units ..

Apartment 80 m^2	Traditional		
Investment	800 000		SEK
Own funding	400 000		SEK
Required loan	400 000		SEK
Cost for loan	24 000		SEK/yr
Reduced maint.	- 4 000		SEK/yr
Energy supply	0		SEK/yr
Net cost for loan	**20 000**		**SEK/yr**
Area specific			
Rent before	**695**		**SEK/yr.m^2**
Net cost for loan	**+ 250**		**SEK/yr.m^2**
Rent after	**945**		**SEK/yr.m^2**
Deficit	**0**		**SEK/yr.m^2**

Katjas gata extrapolated to 150 units ..

Apartment 80 m^2	Traditional	+Energy	
Investment	800 000	1 040 000	SEK
Own funding	400 000	400 000	SEK
Required loan	400 000	640 000	SEK
Cost for loan	24 000	38 400	SEK/yr
Reduced maint.	- 4 000	- 4 000	SEK/yr
Energy supply	0	- 6 800	SEK/yr
Net cost for loan	**20 000**	**27 600**	**SEK/yr**
Area specific			
Rent before	**695**	**695**	**SEK/yr.m^2**
Net cost for loan	**+ 250**	**+ 345**	**SEK/yr.m^2**
Rent after	**945**	**945**	**SEK/yr.m^2**
Deficit	**0**	**- 95**	**SEK/yr.m^2**

Extra investment down 50% ..!

Apartment 80 m²	Traditional	+Energy	
Investment	800 000	**920 000**	SEK
Own funding	400 000	400 000	SEK
Required loan	400 000	520 000	SEK
Cost for loan	24 000	31 200	SEK/yr
Reduced maint.	- 4 000	- 4 000	SEK/yr
Energy supply	0	- 6 800	SEK/yr
Net cost for loan	**20 000**	**20 400**	**SEK/yr**
Area specific			
Rent before	**695**	**695**	**SEK/yr.m²**
Net cost for loan	**+ 250**	**+ 255**	**SEK/yr.m²**
Rent after	**945**	**945**	**SEK/yr.m²**
Deficit	**0**	**- 5**	**SEK/yr.m²**

AREA OF ADVANCE ENERGY

Energy costs up 100% ..!

Apartment 80 m^2	Traditional	+Energy	
Investment	800 000	1 040 000	SEK
Own funding	400 000	400 000	SEK
Required loan	400 000	640 000	SEK
Cost for loan	24 000	38 400	SEK/yr
Reduced maint.	- 4 000	- 4 000	SEK/yr
Energy supply	0	**- 13 600**	SEK/yr
Net cost for loan	**20 000**	**20 800**	**SEK/yr**
Area specific			
Rent before	**695**	**695**	**SEK/yr.m^2**
Net cost for loan	**+ 250**	**+ 345**	**SEK/yr.m^2**
Rent after	**945**	**945**	**SEK/yr.m^2**
Deficit	**0**	**- 10**	**SEK/yr.m^2**

Economics ..!?

- **Reduced ”extra cost” .. !?**
- **Larger part from own capital .. !?**
  (Poor economy ? .. Balance sheet ?)
- **Better loans .. or guarantees .. ?**
- **Increased energy prices .. !?**
- **Increased rent .. !?**
- **.. or a combination ..!!**

Summary

- **We know how to reduce the use of energy .. !?**
- **.. but all may not have the skills ..!?**
- **We do not know how to manage the economics .. !?**
- **.. i.e. focus on economic frameworks ..!!**

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