NZE Challenge

WP2 Task Force Meeting
Wiesbaden 4th/5th Dec. 2013

Presentation Eva Bauer/GBV

AGENDA Taskforce meeting WP 2, VIENNA

A. **Topic I: Methodology for Calculation Cost Optimality**
   (New Construction and Refurbishment)
   + „Cost Effectiveness“ of Project Deliverables
   aa. Cost Optimality according to Building Directive („Model Calculation“)
   ab. Energy Consumption + Energy Costs (Sample Calculation)
   ac. Related Costs (Service, Maintenance) (Sample Calculation)
   ad. Costs of Construction (+ Financing) (Sample Calculation)
   ae. Cost Optimality/Effectiveness: Sample Calculation for Projects

B. **Topic II: Policy Packages to deliver nZEB**

   aa. Presentation
   a. Reports by Participants

Energy Consumption and Energy Costs (Sample)

1. **Why Consumption + Costs:**
   - Consumption is the direct parameter to measure energy effectiveness
   - Costs depend not only on consumption but also on prices/tariff systems
   - Trade Offs between energy/heating systems and energy costs (solar panels, heating pump, heating system)
2. **Components of Heating Costs:**
   fixed costs (for system: investments, network, …), variable costs (energy consumed), metering - service (?!)
   components vary with heating system (e.g. investments and service for district heating is included in energy costs-bill, while investments , service for central heating system is not)
3. **Heating – Hot water**
   even if we only want to explore consumption/costs of heating we need to deal with consumption/costs of hot water: in some systems one cannot split the costs but has to make estimations!
4. **Solar Gains – Heating Pump:** No Costs for energy (only investments etc) but energy consumption

Energy Consumption and Energy Costs (Sample)

Example of Calculation and Comparison of Energy Consumption and Costs

	Project 1 District Heating	Project 2 Central Gas Heating + Solar
Energy Consumption Heating + Hot Water:	kWh/m2UFa	
Consumption kWh/m2a	84	72
Solar gains	0	12
Total Consumption	84	84
Energy costs:	Euro/m2UFa	
Energy bill Euro/m2a	8,40	5,76
Service Heating system		0,12
Total Heating Costs	8,40	5,88
Solar effects	Euro/m2UFa	
Cost saving (energy consumption*price)		0,96
additional rent (investment)		1,15
Total Heating Costs + Investment Solar	**8,40**	**7,03**

→ Energy efficiency is the same

Still not perfect since investment costs for heating systems are not calculated

For Comparison **for our purpose**: Take energy consumption including solar gains and multiply with average price:

84kWh * 0,09 € = 7,56

Energy Consumption - Energy Costs + Service (Sample)

	Project 1 District Heating + Ventilation with Heat Exchange	Project 2 Central Gas Heating + Solar
	Class I	Class IV
Energy Consumption Heating + Hot Water:	kWh/m2UFa	
Consumption kWh/m2a	73	72
Solar gains		12
Total Consumption	73	84
Energy costs:	Euro/m2UFa	
Energy bill Euro/m2a	7,30	5,76
Service Heating system		0,12
Total Heating Costs	7,30	5,88
Solar effects	Euro/m2UFa	
Cost saving (energy consumption*price)		0,96
additional rent (investment)		1,15
Total Heating Costs + Investment Solar	**7,30**	**7,03**
Energy consumption for Ventilation kWh	4	1
Costs (electricity - double price) €	0,72	0,18
Service €/m2UFa	0,12	0,03
Total Heating + Ventilation + Service	**8,14**	**7,24**
TOTAL WITH AVERAGE ENERGY PRICE	**7,41**	**7,77**

Class I: Passive + lowest energy, annual heating demand/m2GF less than 12kWh;
Class IV: low energy, annual heating demand/m2 GF 30 – 40 kWh

Expected difference:
30 kWh;
Measured difference:
11 kWh

Class I more expensive due to price

Class I less expensive

COSTS OF CONSTRUCTION New Built

Reflections on Comparability for single projects/sample

GENERAL

- Average Cost of Construction GBV-Sample: 1.820 € /m2 UF (Price level 2011) (note: no VAT due to VAT system in Austria)
- 37% of variance according to compactness (surface/volume); difference between very compact and less compact buildings (A/V 0,35 – 0,55) about 250 €/m2 UF
- Cost of garages
- Relation dwellings/elevator
- Average floor space/dwelling
- Local price differences
- Quality (energy and other)
- Building period

FOR OUR PURPOSE: total costs of construction vs. „energy only“
real costs vs. standardized – methodology for standardization

COSTS OF CONSTRUCTION New Built
GBV-Sample

- Decision: comparison of total costs of construction (less complicated for data collection)
- Price adaption according to building period (official index)
- Deduction of costs of garages
- Deduction of costs for solar panels
- Standardization according to average floor space of dwellings
- Elevators: deduction of costs in smaller buildings
- Elimination of regional price differences

- **Result: Variation in costs was reduced, correlation between cost level and energy efficiency as well**
- **Building compactness: no standardization but controlle in analysis**
- **Difference between class I and class IV: 1.690 – 1.580 = 110 €/m2 = 7%**

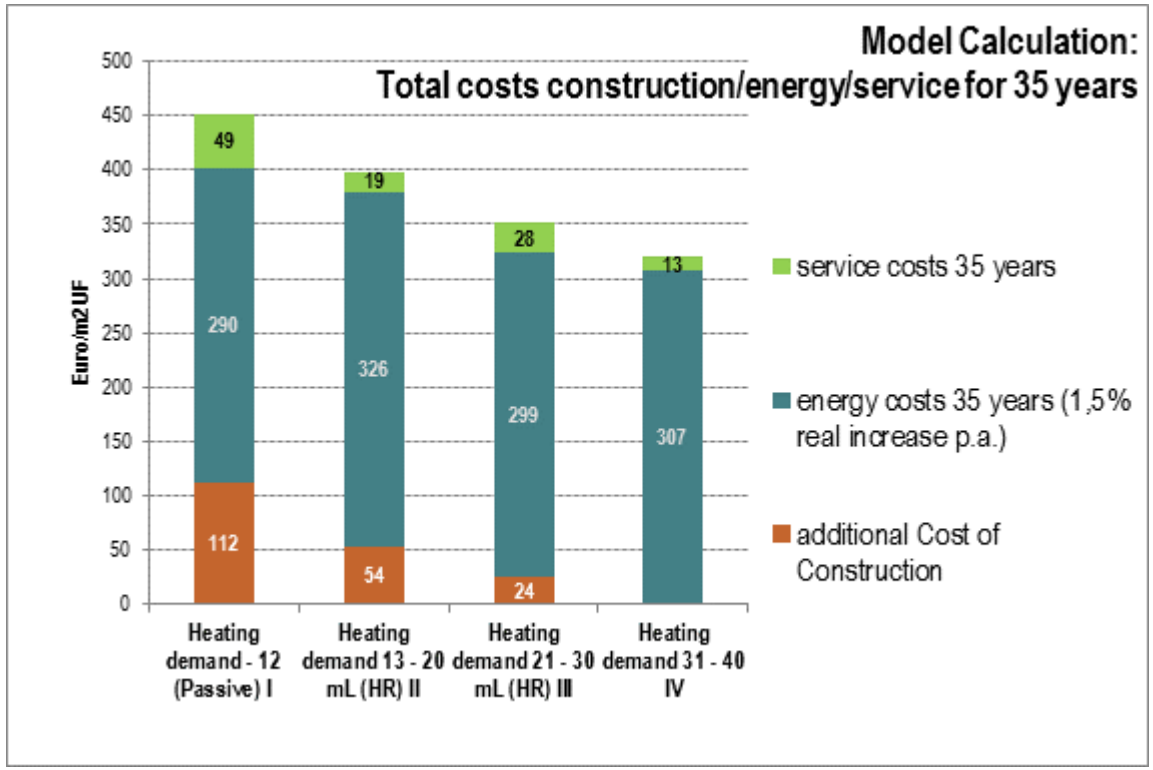
Total Lifecycle Costs New Built

- Calculation is different to that of the Building Directive which deals only with „building types“ and not with „real“ buildings

- **Definition of Lifecycle costs Model A**:
  * **Investments** for Energy Components CALCULATED as difference between costs of buildings of different energy classes (price level 2011)
  * energy costs for heating/hot water/ventilation for 35 years with average prices and a real increase of 1,5% p.a.
  * costs of service ventilation system for 35 years (no price increase)

- **Definition of Lifecycle costs Model B:**
  * Investment costs calculated as a component of a cost rent for 35 years (puts more weight on investment since there are financing costs)
  * energy and service as above

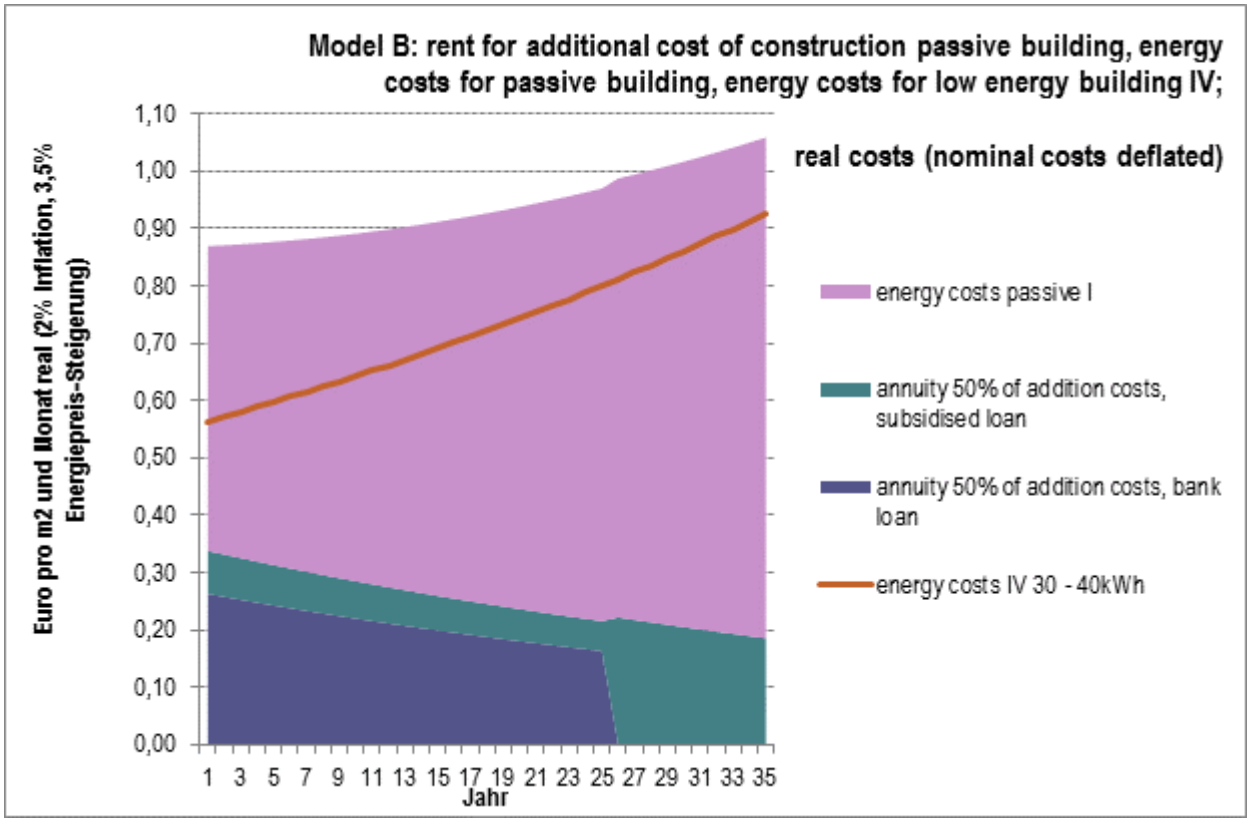
Result GBV-Sample Lifecycle Costs for 4 types of low energy buildings MODEL A



Explanations:

- Each „type“ represents average data of a sample of 5 – 10 buildings;
- Calculation of energy costs as demonstrated before (measured consumption incl. solar gains, average energy price) for 35 years with 1,5% increase p.a.
- Service costs according to sample; 35 years, no increase
- Difference per year and dwelling between I and IV: 280 Euro, between III and IV: 80 Euro

Result GBV-Sample Lifecycle Costs for 4 types of low energy buildings MODEL B



Result: energy costs of low energy building IV are lower than energy costs + rent for additional investment in passive building;

Difference per dwelling and year: 300 Euro

COSTS OF CONSTRUCTION – COST EFFICIENCY REFURBISHMENT

Reflections on Comparability for single projects/sample

More complicated than new construction:

- costs of energetc components difficult to define (separation between „costs anyway“ and energetic component)
- Period of calculation hard to define: different periods of lifecycle of components and financial aspects (mortgages)
- Refurbishment not only requires energetic measures but also other repairs and upgrading (e.g. elevators)
- Energy Savings: Divergence between calculated and actual (measured) savings due to prebound and rebound effects (difference up to 50%)

- Findings Austria: Cost of a „simple“ energetic refurbishment to obtain a **MEASURED** 35 kWh/m2GF reduction (= 45kWh/m2UF) by changing windows and insulating fassade amounts to 170 – 190 €/m2UF (in smaller buildings more than 200; no VAT!). Energy savings cannot compensate for these costs within 15 years (usual maturity of a loan for refurbishment). **Compensation is only possible within 35 years AND costs of about 50% of the above mentioned (see following sheet)**

COSTS OF CONSTRUCTION – COST EFFICIENCY REFURBISHMENT CALCULATIONS

A. Energy savings by refurbishment						
	energy saving	Energy price			savings €/m2UFS	
	kWh/m2 UFS	2011	real 1,5% 15y	real 1,5% 30y	year	month
calculated	90	0,08	0,09	0,10	9,3	**0,78**
measured	45	0,08	0,09	0,10	4,7	**0,39**
B. Payback Period and Loan Financing						
cost of refur	payback		loan financing			
€/m2 UFS	assumption	years	interest rate	maturity	installment/y	installment/m
180	measured	39	0,03	15	15,1	**1,26**
112	calculated	12	0,03	15	9,4	**0,78**
56	measured	12	0,03	15	4,7	**0,39**
180	measured	39	0,03	30	9,2	**0,77**
92	measured	20	0,03	30	4,7	**0,39**
105	measured	22	0,02	30	4,7	**0,39**

Needs and Workplan

A. Sharing Knowledge on Framework
on nZEB-Strategies in member states (legislation, financing, subsidies)
DELIVERABLE: 2.2 Basic Report (WP-Leader) 9-2012

B. Sharing Knowledge on Costs, Practice and methodological approach
- common data base by demonstration sites (5 – 10 per partner; DELIVERABLE 2.3 4-2013)

- exchange of methodologies, existing documentation/analysis
WORKSHOP 2-2013 in Vienna
Sharing Knowledge on (operating) Costs, usability and cost-effectivness
- 2-years- monitoring of 10 sites of WP-leader (plus voluntary others …)
DELIVERABLES 2.4 2.5 2.6 4-2014 (with interim reports 6 months previousely)
questionnaire to be tested with other partners‘ „test sites“ (2 out of 5)

C. Development on Guidelines/Recommendations /Lessons learned“
"Core elements for national NZE 2020 road maps“
DELIVERABLE 2.7 4-2014
WORKSHOP 2. Semester 2014: Agreement on „Recommandations + Guidelines“