Cost optimal refurbishment:
A reality check from the Austrian Experience

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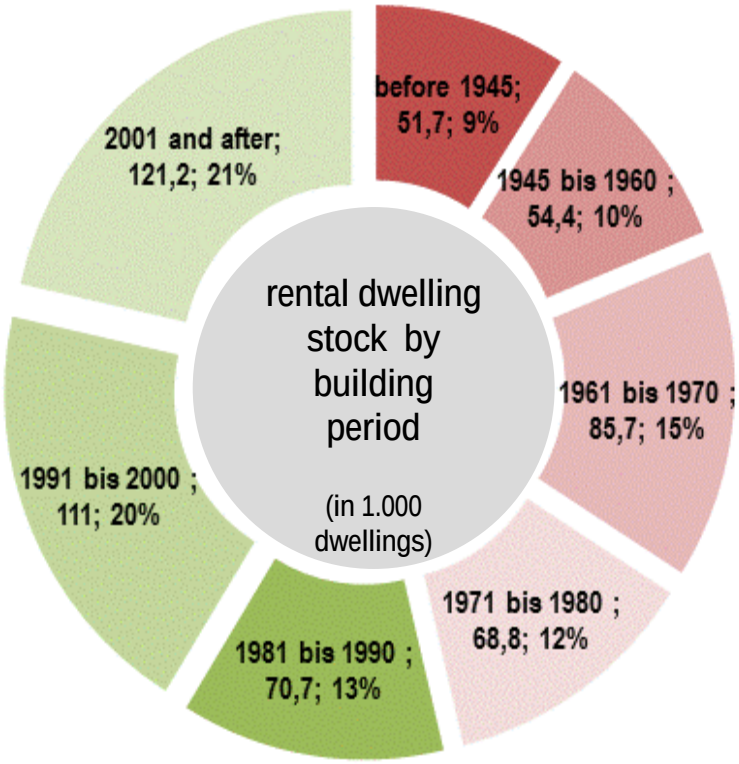
Austrian Federation of Limited-Profit Housing Associations

191 members:
99 co-operatives / 92 capital societies

Managing 810.000 dwellings
(of which are 561.000 rental dwellings)
= 22 % of total housing stock in Austria

New Construction: 15.000 dwellings per year, which is 20 - 30% of total new construction

Refurbishment:
10.000 – 12.000 dwellings per year



Lodenareal (2009), Neue Heimat, Innsbruck
189 dwellings

Hintere Achmühle (2010), VOGEWOSI, Dornbirn, 17 dwellings

Refurbishment Zirkusgasse,
Vienna 2010 – 2012
191 dwellings, built 1951/52

Background for intensified investigation of costs and participation in the EU Nearly-0 project:

- Limited profit providers in Austria produce each year about 15.000 new dwellings and renovate 10.000 – 12.000 per year.
  Their mission in general is the provision of affordable housing. There are subsidies avaiable both for new construction and refurbishment
- Since the year 2006 quality requirements have been tightened, requirements for subsidised housing are higher than in general building code.
- The last years brought a remarkable increase in construction costs
- While national plan towards Nearly-0 energy buildings and housing subsidy schemes will continue to increase requirements

=> This led to a investigation of the GBV housing stock to enable an analysis of energy consumption, energy costs, costs of construction and cost optimality

Cost Optimality – Concept and Results

- Cost optimality is a requirement of the building directive:
  Nearly-0 level in new constructions and refurbishment from 2020 have to be „cost optimal“; cost optimality is calculated on base of assumptions; model is designed be EU (Regulation (EU) 244/2012); member states have to submit cost optimality reports
- Definition/Calculation of Cost Optimality: Addition of costs of investment + energy + service/maintenace for the lifetime cycle of building components (30 years)
- Main disadvantage of cost-optimaltiy concept: The model is designed as investor model: costs of energy are costs of investor/owner; life time cycle is 30 years – also for refurbishment
- Results for Austria National Plan new buidings:

- there are little cost margins within the spectrum of low energy buildings (within a range between 27 and 56 kWh/m2(net)a for the heating demand for space heating):
  30 Euro/m2 for 30 years

- AND
  below this level (incl Passive houses) costs are higher
- AND
  there are different cost optimal levels for buildings depending on their size/compactness, nevertheless there is the same „average“ level for all types of buildings in the National Plan

Cost Optimality – Concept and Results 2

- Results for Austria National Plan Refurbishment:
  there are little cost margins within the spectrum of low energy buildings (within a range between 45 and 67 kWh/m2(net)a for the heating demand for space heating):
  appr. 20 Euro/m2 for 30 years
  AND
  passive house standard is not calculated
  AND
  there are different cost optimal levels for buildings depending on their size/compactness

Cost Optimality – Concept and Results 3
Background information

Dealing with costs of construction / energetic components we have to consider non-linearity of costs and energetic effects, e.g.:

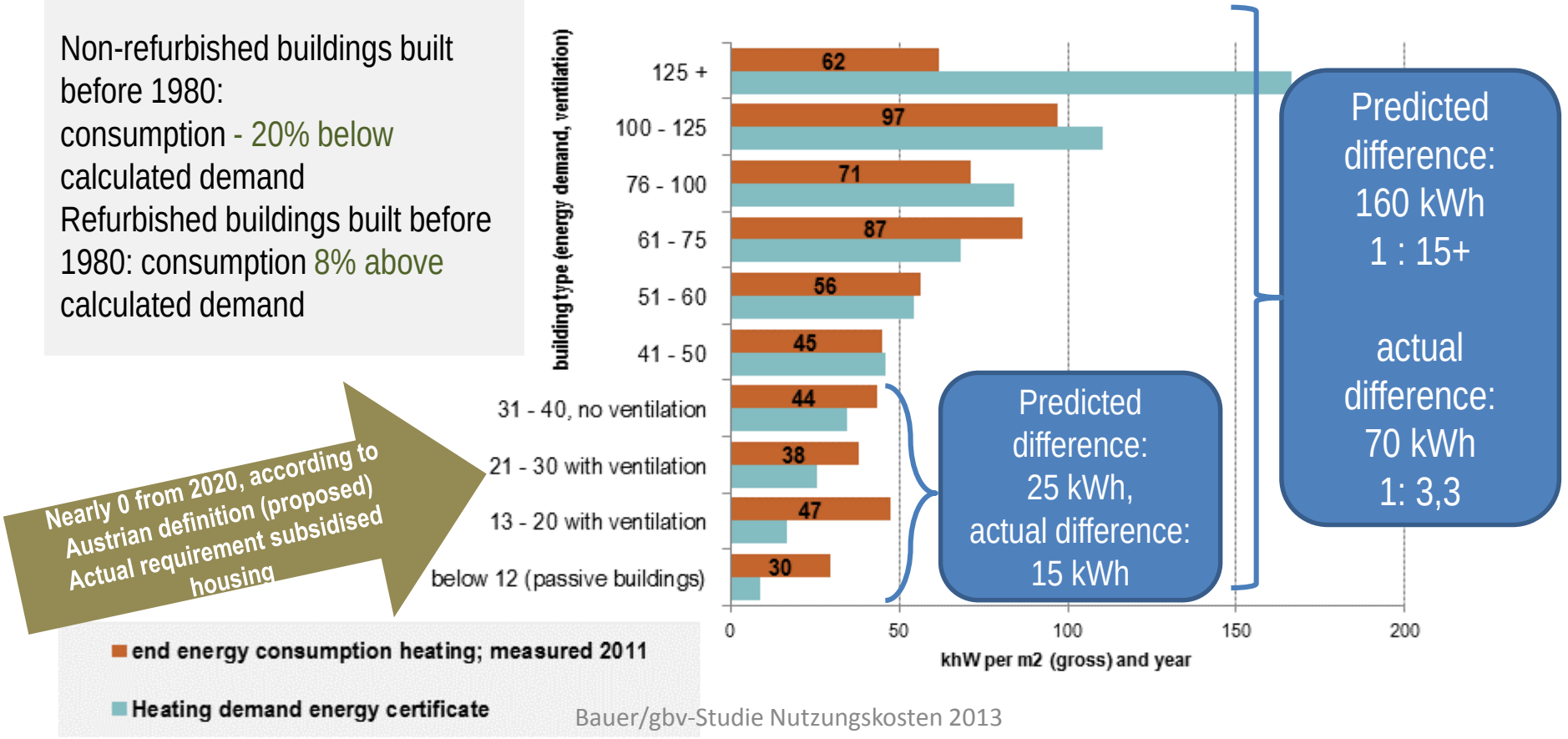
- decreasing effects of additional insulation: the „second layer“ of insulation results in a smaller reduction of heating demand than the „first layer“ (to reduce the heating demand in a low energy building from 32 to 20 kWh/m2(gross)a = factor 1,6 one needs to increase insulation thickness from 12 to 26cm = factor 2,2)
- At a certain level of insulation and air thightness automatic ventilation instead of mechanical (opening windows) is required to obtain sufficient ventilation (ventilation requires electric energy + service costs)
- to obtain additional effects of energy reduction heat recovery is required (in combination with automatic ventilation)
- Extra costs for passive houses: investment € 110; service + € 35 (35 years); energy savings 35 years: € -17 (35 years, calculated with measured consumption)

Different sizes/compactness of buildings have different cost curves

Reality Check 4

predicted and real consumption 2011; rental housing stock GBV - sample (134 buildings, 5.500 dwellings)

Non-refurbished buildings built before 1980:
consumption - 20% below calculated demand
Refurbished buildings built before 1980: consumption 8% above calculated demand



Bauer/gbv-Studie Nutzungskosten 2013

Reality Check –

Causes for descrepancy between predicted energy demand and actual consumption

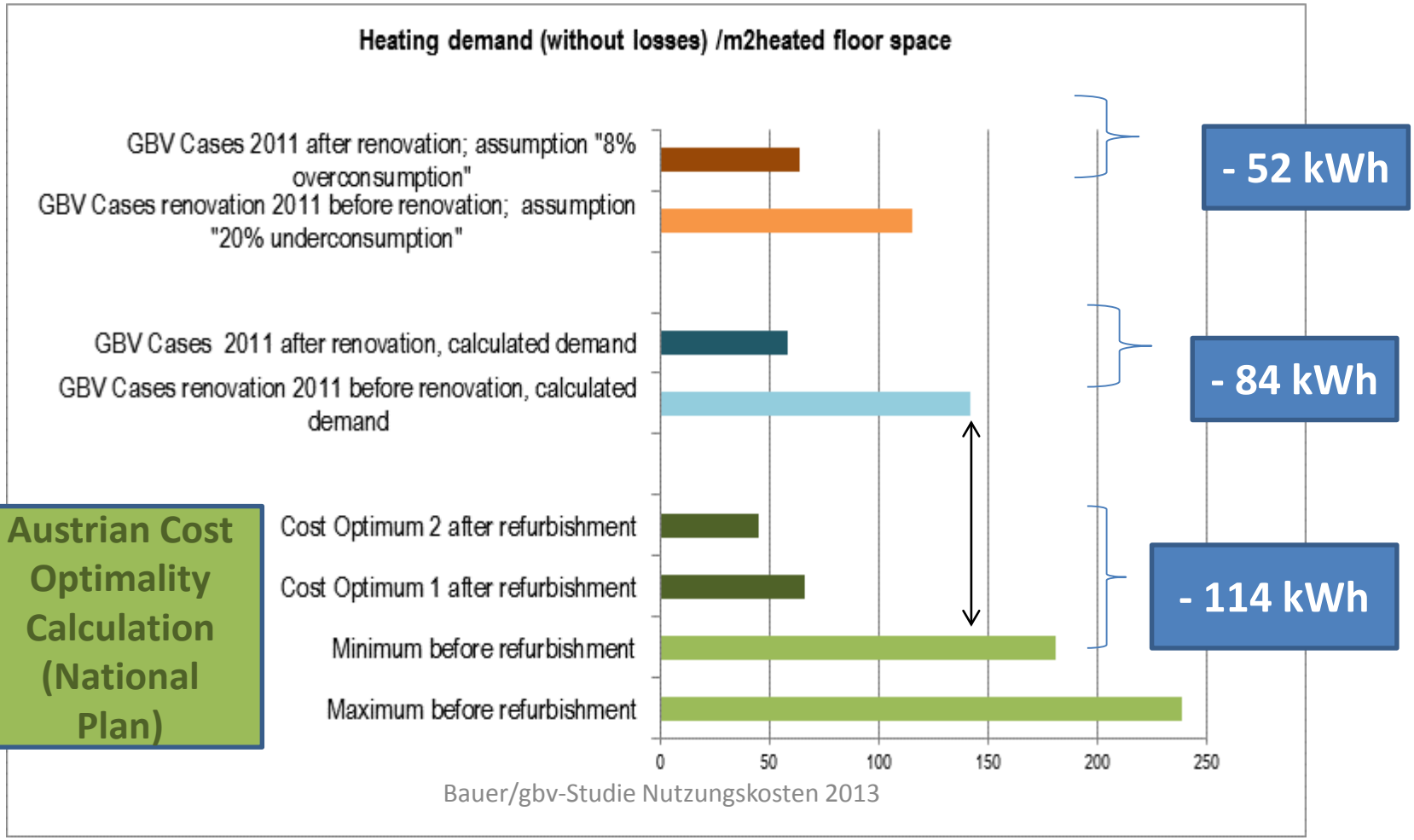
- Prebound effects : energy savings in low quality buildings
- Technical rebound effects: non-adapted heating systems
- Behavioural rebound effects: lower energy demand is transformed into higher comfort
- Complex system in very low energy/passive buildings: Combination of heating system and ventilation requires special handling
- and do not function always 100%
- AND: energy certificates seem to be not always 100% accurate

Reality Check –

Cost optimality calculated with real consumption and real costs of investment – new buildings

While theoretical calculations classify the 27kWh-building as cost optimal, the findings of the GBV sample see the 43-kWh in front (for a surface/volume ratio of 0,34; heating demand only, m2net):
12 instead of 21cm insulation, no automatic ventilation ….

Reality Check – Cost optimality refurbishment 1



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Reality Check – Cost optimality refurbishment 2

- Due to the fact that non-refurbished GBV-buildings are better than the the standard assumed for theoretical calculation a reality check is not possible directly
- Due to the fact that actual consumption in non-refurbished buildings is below predicted demand
- And actual consumption in refurbished buildings is (slightly) above predicted demand

$\Rightarrow$ We draw the conclusion, that reality is not in line with cost optimality calculation of Austrian National Plan

$\Rightarrow$ GBV cases have higher costs per reduced kWh since starting point is better

Reality Check – Costs of refurbishment and energy savings

- Costs for insulation of roof/basement/facade + new windows:
  170 – 190 Euro/m2 (in small buildings 200+).
  VAT has been deducted according to Austria VAT-regime.
- These costs cannot be compensated with energy savings within a period of 30 years, given the savings according to actual consumption (50kWh/m2a) – unless a cost reduction is calculated for „anyway components“ and/or subsidies are granted (as it is the case in Austria).

=> This fact should not prevent landlords from refurbishment since there are substantial reductions in energy consumption. But the standard of refurbishment should be on a reasonable level, as additional costs to the above mentioned never can be recovered.

Reality Check – Total costs of refurbishment – energy is not all

- Average costs of refurbishment for buildings/dwellings 35 – 40 years after construction:
  250 Euro/m2 (VAT has been deducted according to Austrian VAT-regime)
- „Complicated“ older buildings of very poor quality have higher costs – up to 1.000 € per m2 (building-in of elevators, upgrading of dwellings, barriere-free construction)

⇒ Energetic quality is not only aspect of refurbishment.

⇒ That gives also reason to keep energetic levels in refurbished buildings on a reasonable level

Reality Check - Conclusions:

- Low energy buildings can contribute to increase energy efficiency, reduce greenhouse gas emissions and also can contribute to energy security
- But within low energy buildings differences in consumption are very small so that we should regard costs effects very carefully to define the optimal level of nearly-0 energy buildings.

⇒ Austrian limited profit housing associations favour „simple“ low energy buildings without need for an automatic ventilation due to cost and handling of technical systems.

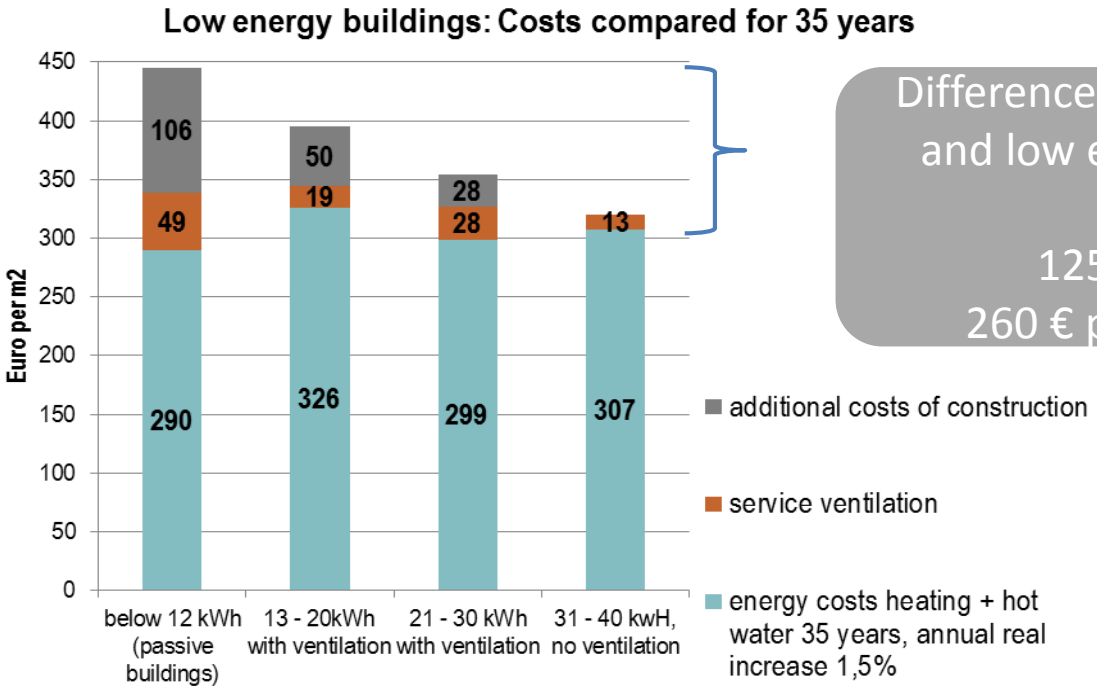
⇒ Housing/energy policies should be based on CONSUMPTION DATA rather than on calculated demand since there is a substantional divergence between these data

⇒ If requirements for refurbishment are too high – and thus too expensive – refurbishment will be prevented rather than promoted.

⇒ The fact that subsidies for measures to obtain required level by National Plans from 2020 are forbidden by EU-legislation will not help to improve energetic refurbishment.

Cost aspects of very low energy /passive buildings:

Calculation of lifetime cycle 35 years:



Difference between passiv building and low energy building without ventilation:
125 €/m2 35 years =
260 € per dwelling and year