Energy efficiency and profitability in the German building sector

Welcome to IWU!

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Darmstadt

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IWU Profile

- Non-profit research institute (since 1971)
- Institutional funding by the shareholders State of Hesse and the City of Darmstadt
- Third-party funding: municipalities, federal government, EU, private companies
- Interdisciplinary and integrated research
- Round about 40 employees

Photo: IWU

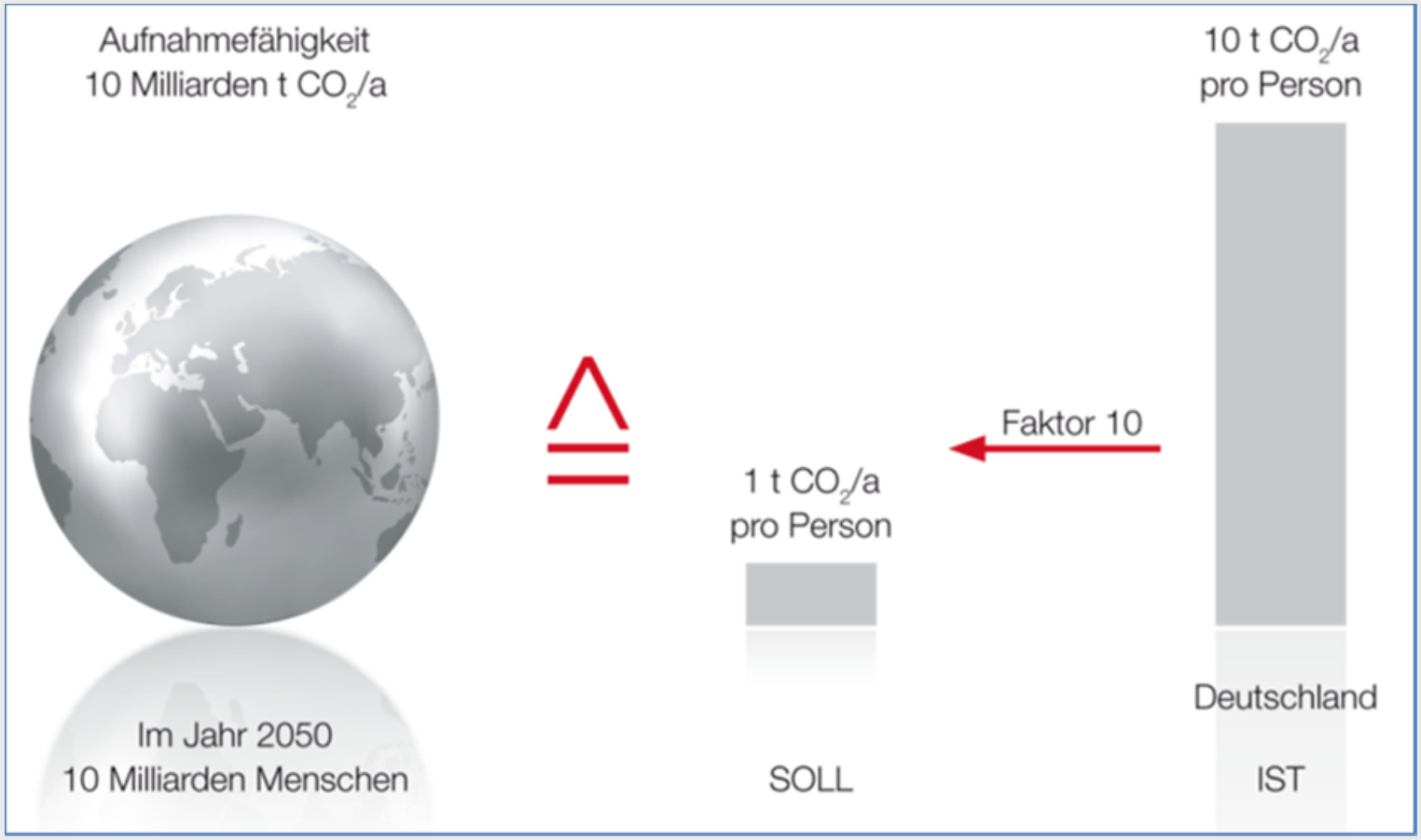
IWU Profile

- **Four fields of research:**
  - Housing markets & housing policy
  - Assessment and optimization of the energy performance of buildings
  - Strategic monitoring of building stock
  - Logics of action of actors in the building sector

Content

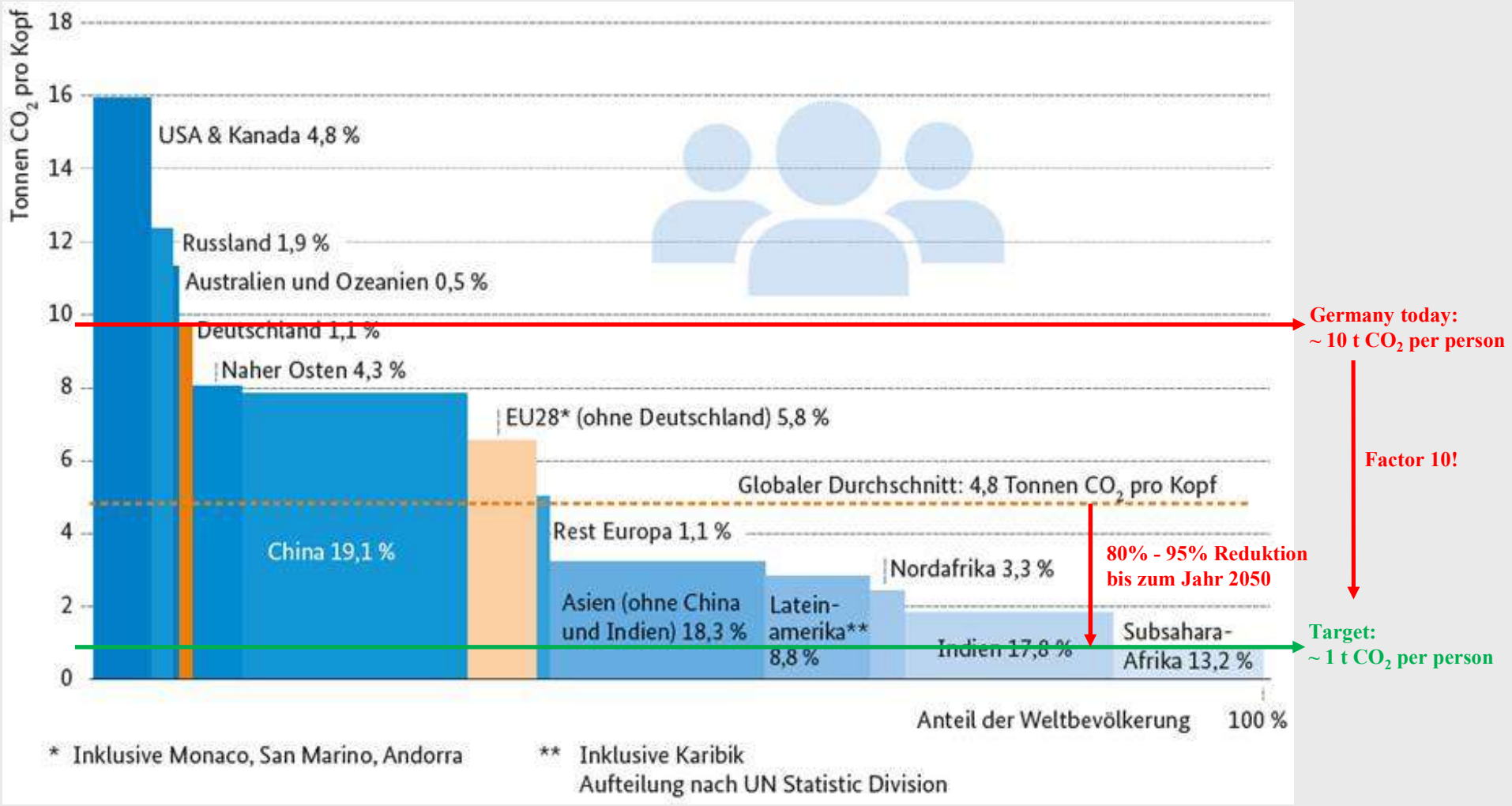
1. Challenges of climate change
2. Profitability of energy efficiency measures
3. Distribution of investment costs between investor, user and public organizations

Social challenge: Factor 10!



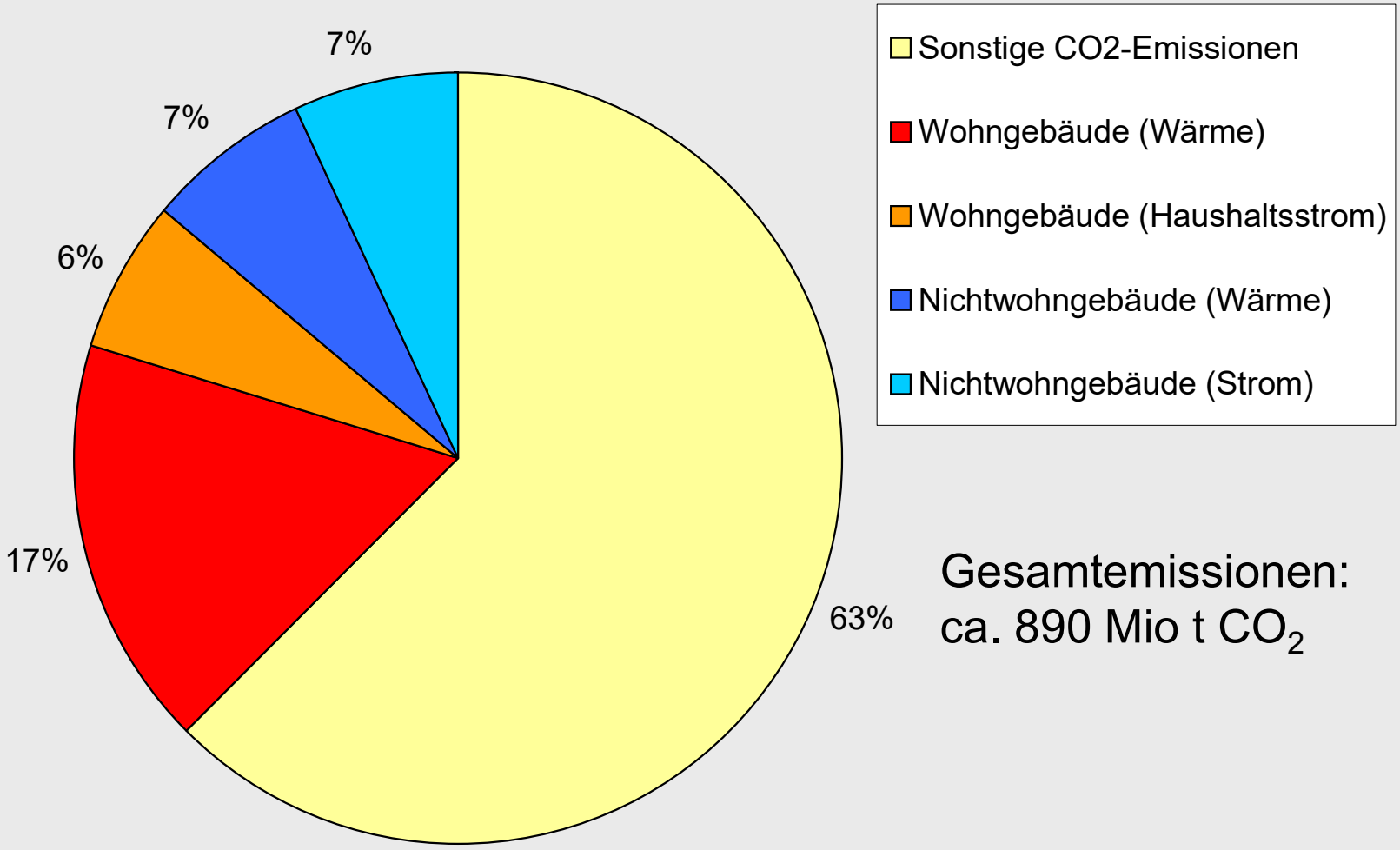
Source: IWU

Social challenge: Factor 10!



Grafik: Klimaschutz in Zahlen (BMU 2019)

CO2-Emissions in Germany: share of building sector

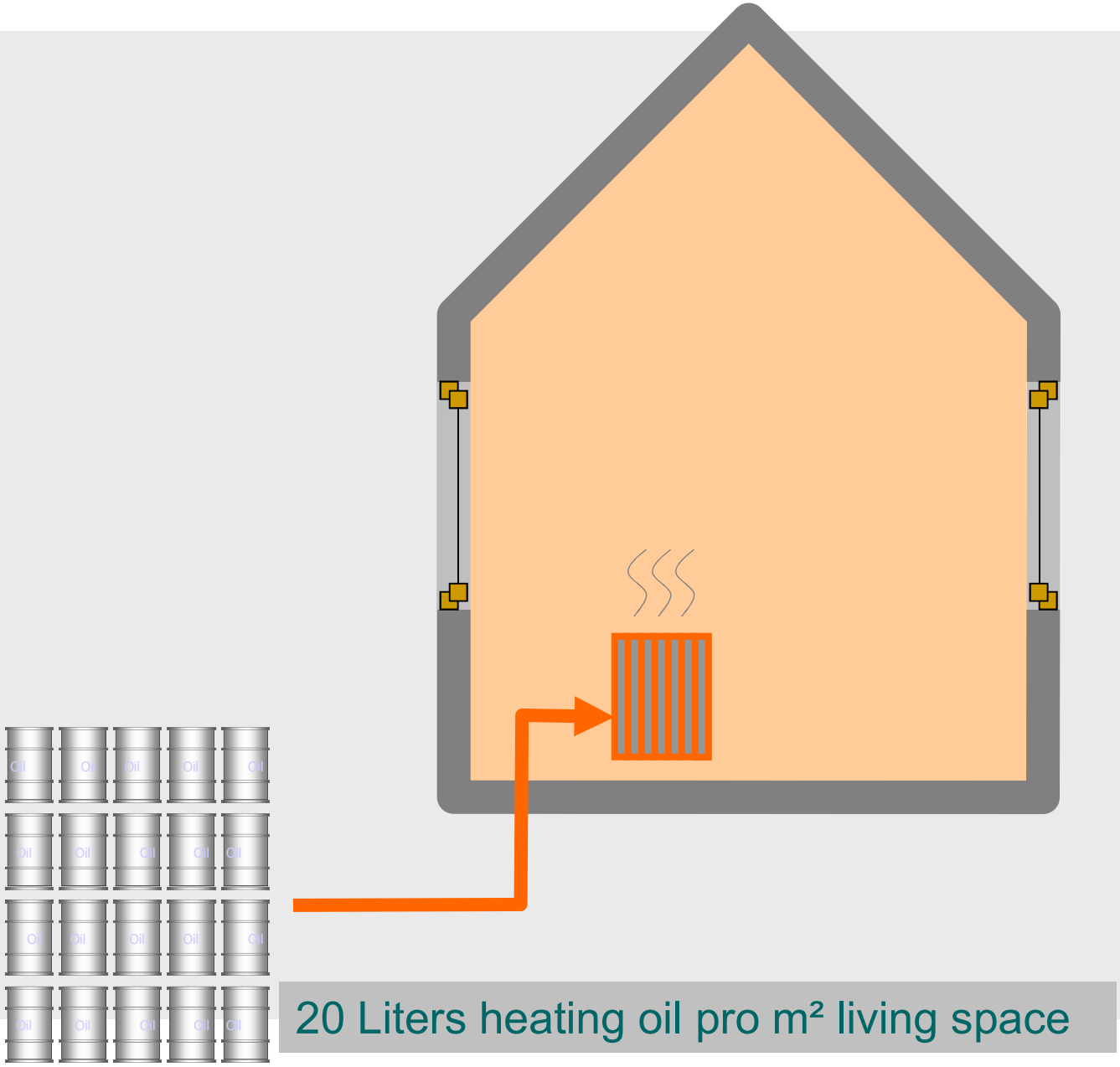


Gesamtemissionen:
ca. 890 Mio t CO_2

About one third of climate-relevant emissions are caused by buildings!

Source: IWU (Non- residential buildings- estimates)

Residential building

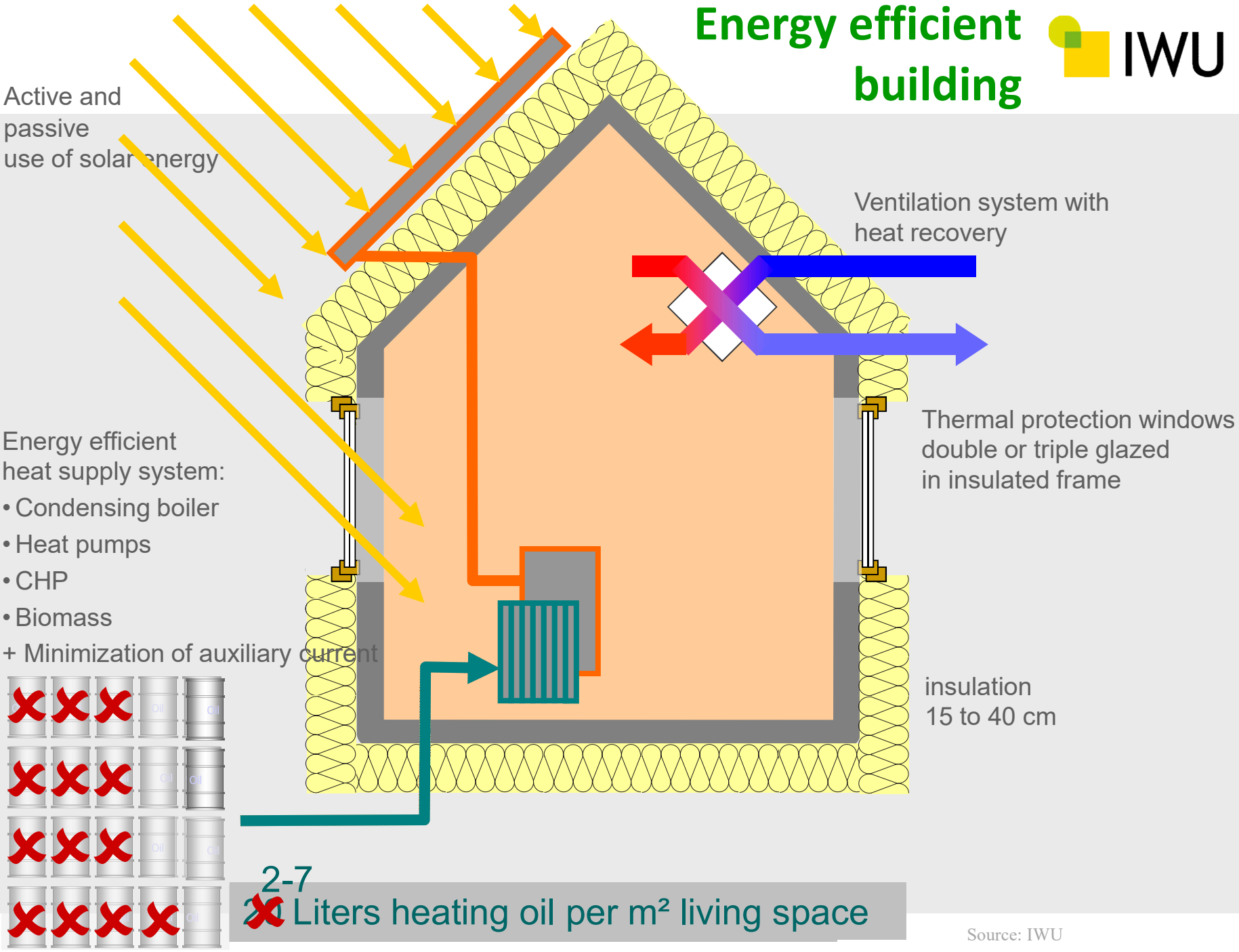


20 Liters heating oil pro m² living space

Source: IWU

Energy efficient building

IWU



Source: IWU

Target for residential buildings in Germany (2050)

Target: 80 % (Primary energy, CO2 emissions) reduction

Criteria for the achievement of objectives (reference values):

- **Climate-neutral new construction** (KfW efficiency houses 55, 40 or passive houses)
- **Existing building stock: “doubling" of the energetic modernization rate** and improved quality of thermal insulation
- **Modified structure of heat generation (main heat generator)**
  - high share of "alternative systems" (heat pumps, district heating, CHP, biomass)
  - low share of boilers (gas/oil)
  - electricity for heating sector predominantly regenerative

Instruments

- **Regulatory law and funding programs**
  - EnEG, EnEV, EEWärmeG -> GEG
  - KfW efficiency house standards
- **Economic instruments in existing building stock**
  - positive incentives (e.g. subsidies) as well as e.g. CO2 taxes necessary
- **Consumption transparency and quality assurance**
  - Equipment with measuring equipment and inspection after 3 years for new buildings
  - Regular inspection also for heat supply systems
- **“Soft“ measures**
  - Information for consumers and building owners
  - Qualification for architects, engineers, energy consultants and craftsmen
  - Market transparency through a more practical energy certificate

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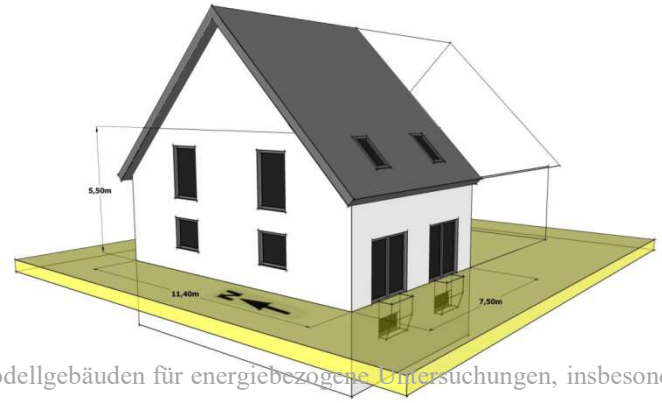
...does it pay off?

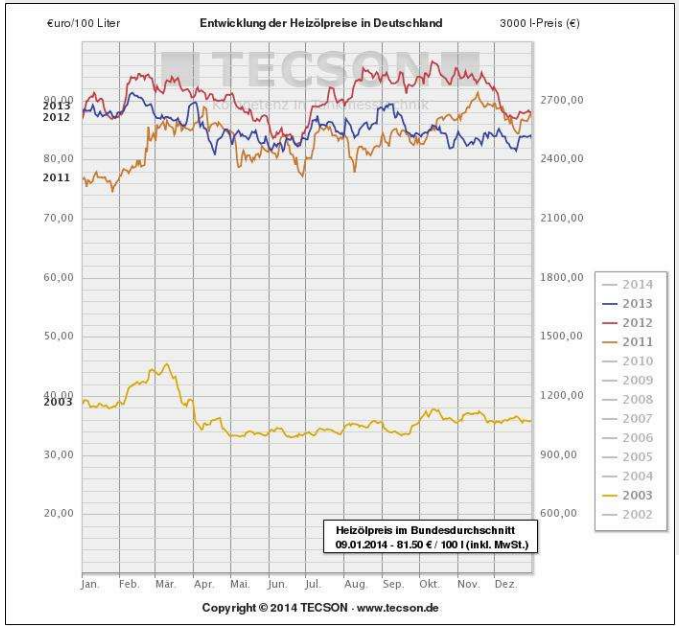
- Residential or non-residential building?
- New construction or existing building?
- Rented or owner-occupied building?
  - ➢ owner-occupied: future energy cost savings
  - ➢ rented: rent increases



Source: S. Klauß, „Entwicklung einer Datenbank mit Modellgebäuden für energiebezogene Untersuchungen, insbesondere der Wirtschaftlichkeit," Zentrum für Umweltbewusstes Bauen e.V., Kassel, 2010.

...does it pay off?

- Profitability – influencing factors
  - Cash outflows (e.g. investment costs)
  - Cash inflows (e.g. energy cost savings)
  - Methodology (method of calculation)
  - Parameters (e.g. calculation period, discount rate)
  - Risks and uncertainties (e.g. future energy prices)

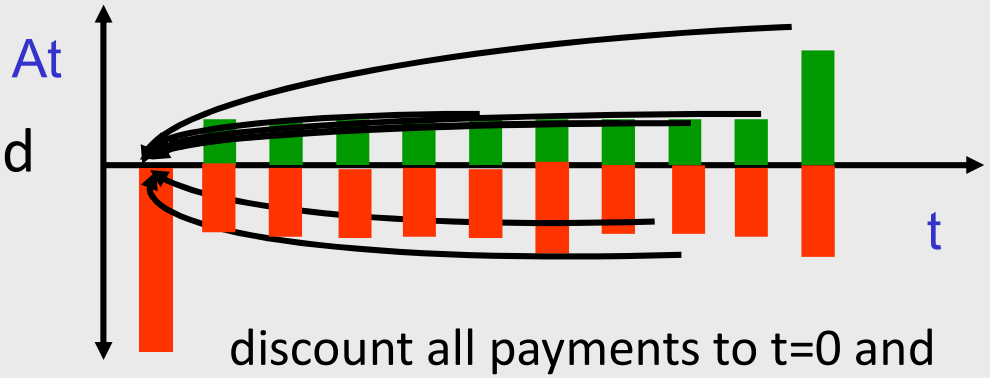


https://writerswhocare.files.wordpress.com/2014/02/uncertainty-ahead.jpg

Profitability - example

Calculation of global costs

- Net Present Value Method



discount all payments to t=0 and add them up (net present value)

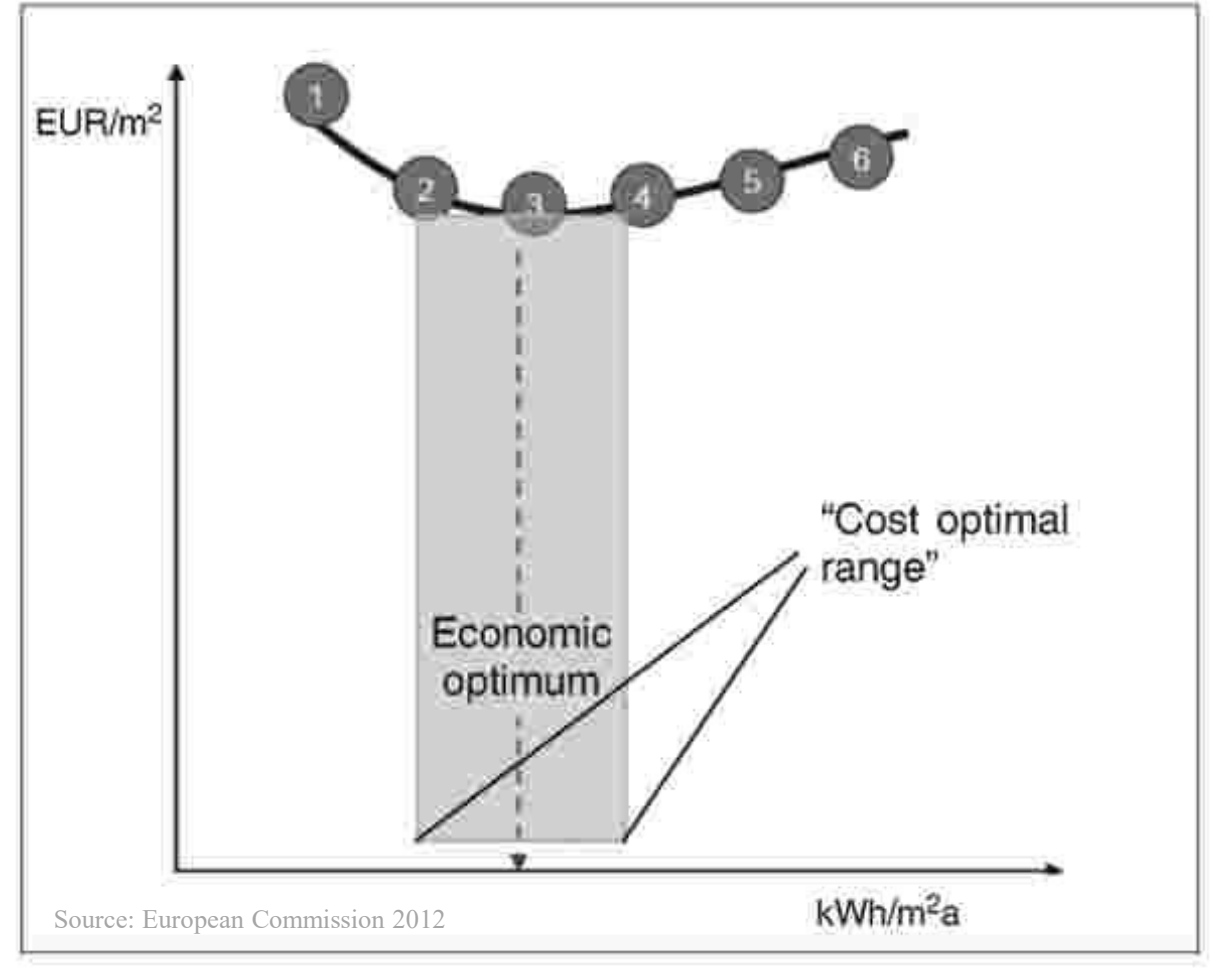
- $NPV_{Global} = NPV_{Investment} + NPV_{Replacement} + NPV_{Disposal} + NPV_{Maintenance} + NPV_{Energy} - NPV_{Residual\ value}$

Source: IWU

Profitability – global costs

Global costs

- Economic optimum = Minimum of global costs



- For flat curves: cost optimal range

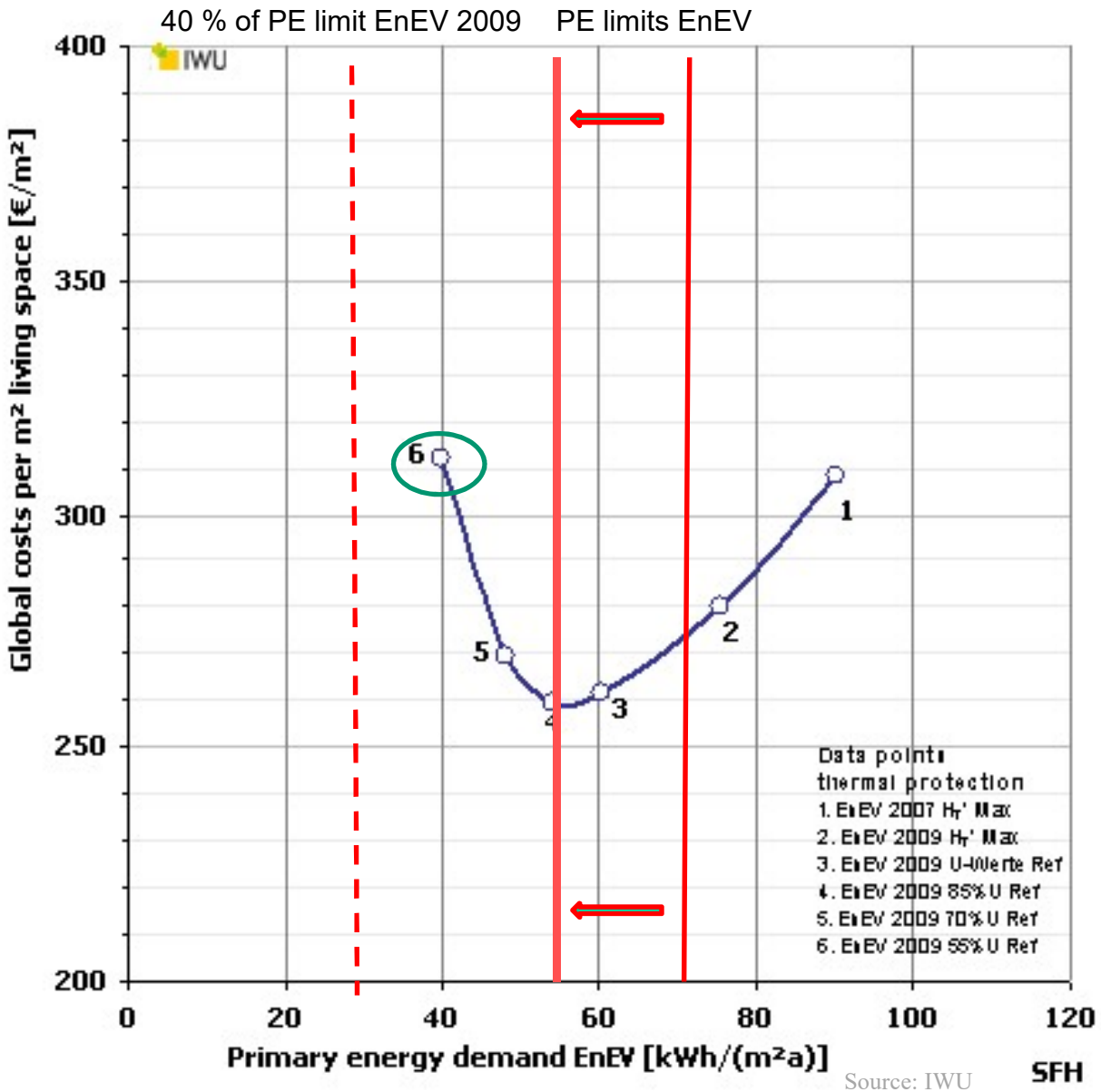
Global costs – assumptions for new buildings

Calculation period	**30 years**
Discount rate	**3,0 % (real)**
Life time of building components	**50 years (thermal protection) / 30 years (windows) / 15 years (energy supply system)**
Annual maintenance costs (only energy supply system)	**2 % of investment costs**
Price development maintenance costs and replacement costs	**0 %/a (real)**
Current energy prices	**7,0 (7,5) Cent/kWh (Gas/Oil), 5 Cent/kWh (Biomass), 25,0 Cent/kWh (Electricity), 19,0 Cent/kWh (Electricity heat pumps)**
Energy price development	**2,8 %/a (real)**

Source: IWU

Global costs – results SFH (private financial perspective)

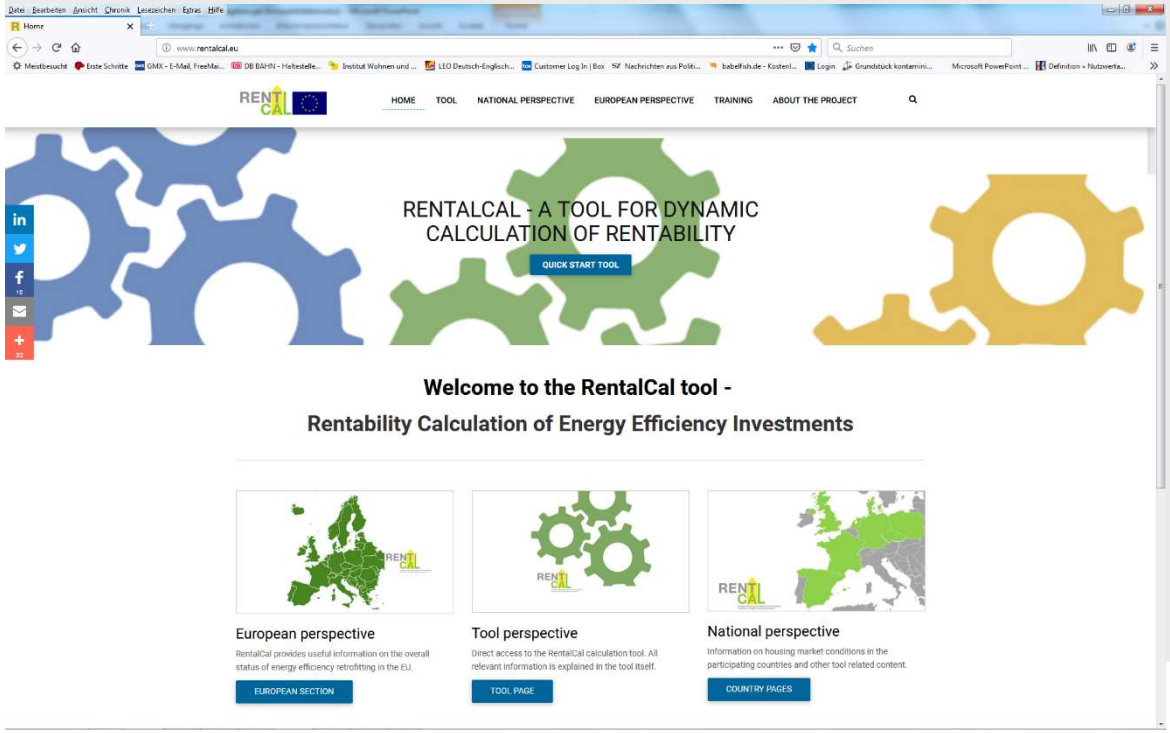
- Lowest global costs (Condensing gas boiler+solar)
- Actual Energy saving ordinance (EnEV): Cost optimum for new constructions
- Public funding is needed if efficiency standards are increased to reach profitability



Source: IWU

EU-Project RentalCal (2015-2018)

- Web tool for calculating the profitability of energy-saving investments in the rental housing market
- Consideration of green exit value
- Additional: Presentation of non-monetary benefits
- www.rentalcal.eu



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Model calculations for Lviv/Ukraine

- Client: GIZ - Deutsche Gesellschaft für Internationale Zusammenarbeit (12/2018 - 9/2019)
- On behalf of the BMU, GIZ is implementing a project to promote the comprehensive energetic refurbishment of MFHs in the Syhiv district of Lviv (Ukraine)
- Target groups are home owner associations (OSBBs) with a high share of HUS recipients (HUS)
- IWU gives advice on the following issues:
  - Baseline study (selection of typical buildings, energy balances, cost estimates)
  - Development of a municipal funding instrument
  - Technical and strategic consulting

Model calculations for Lviv/Ukraine

- Comprehensive energy efficiency refurbishment without any funding is **not economically feasible** for Homeowner Associations (usually very long pay back periods).

- Even the **funding** from the Energy Efficiency Fund (EEF) is not high enough to make such a refurbishment project profitable: The savings in heating costs cannot fully cover the additional investment costs.

- Consequently, there is still **a gap to profitability** and **additional municipal financing** is needed to increase the incentives to invest in energy efficiency.

Model calculations for Lviv/Ukraine

- The model calculations determine the **size of the gap** (in % of the investment costs and in UAH) for 2 typical residential buildings.

- **Key assumption**: the "minimum" amount of additional municipal financing should **close** exactly **the gap** to reach profitability (**“gap financing”**).

- The calculation method applied compares the cash inflows and the cash outflows related to a refurbishment project over a period of 10 years by the help of a discount rate (**Net Present Value Method)**.

Model calculations for Lviv/Ukraine

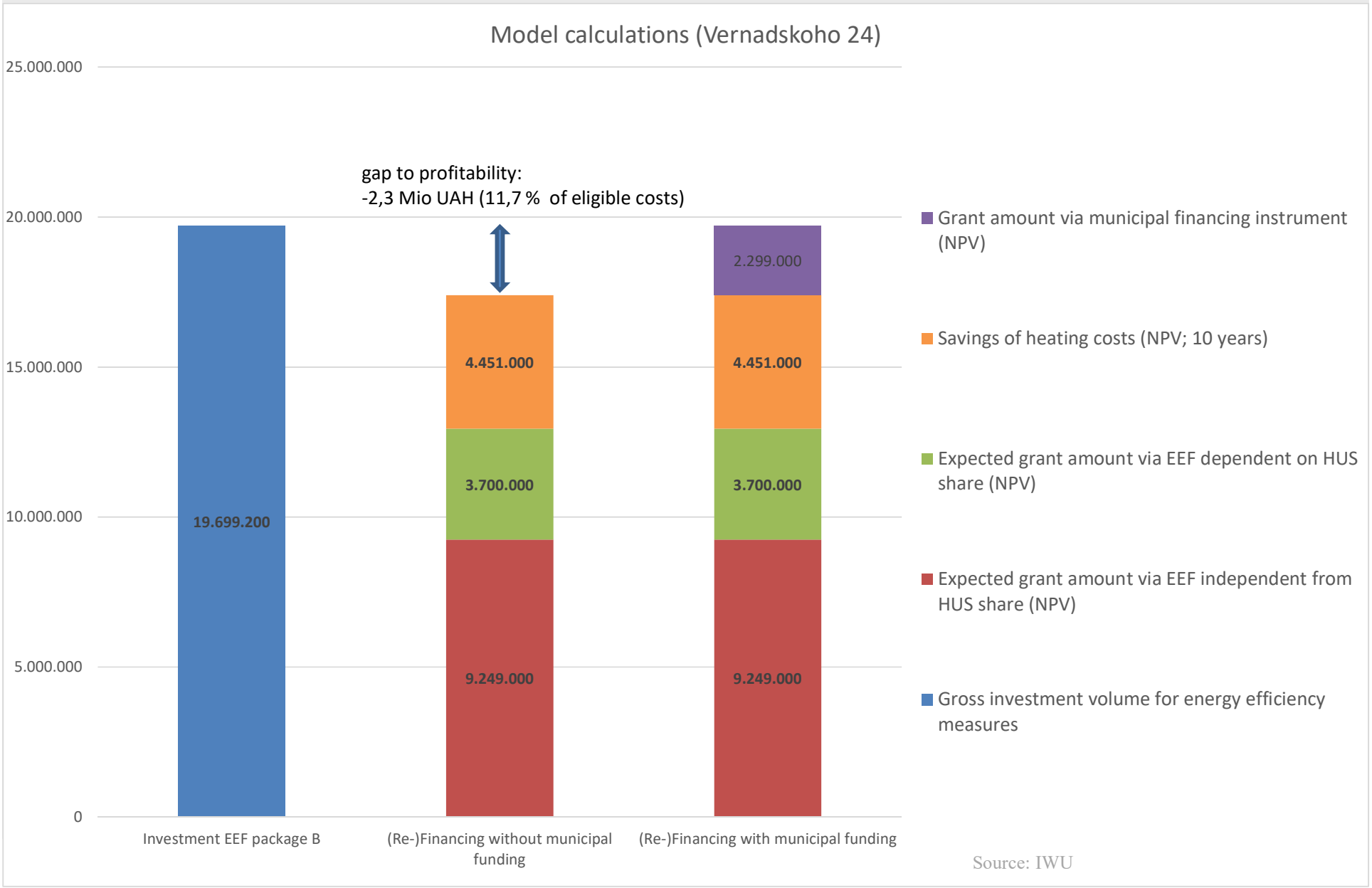
Basic information	**Method of calculation applied**	Net Present Value Method	
Basic information	**Calculation period**	10	years
Basic information	**Discount rate (nominal)**	21,2 %	
Basic information	**Energy price delevopment (nominal)**	12,5 %/a	
Basic information	**Inflation rate**	10,0 %/a	
Basic information	**Variable energy price (district heating)**	1,262	UAH/kWh
Subsidiy information	**max-. Grant amount EEF package B**	70 %	

Model calculations for Lviv/Ukraine


Photo: Olexandr Dudka

- Multi-apartment building (108 flats) in Lviv, Vernadskoho 24
- Building age: 1995
- 6.785 m² living area (without public area)
- Connected with the district heating system
- Refurbishment package (EEF package B)
- Typical investment costs (without funding): around 19,7 Mio. UAH (182.000 UAH per flat)
- Energy savings around 46 %
- Energy cost savings (year of the measures): around 8,05 UAH/m²Month (6.068 UAH per flat)

Model calculations for Lviv/Ukraine – (Vernadskoho 24)



Buildings for Future!

Photo: Unknown/climatevisuals.org

Thank you very much for your attention!

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