Differences by constructing sustainably

Based on a low-energy residential house example

- **Topics**

  - Example house
  - Decisions that affect costs the most
  - How do keep costs in reasonable budget
  - Decisions that help to remain sustainable
  - Benefits in use and maintainance

- **Example house**

Residential house in Rapla, built in 2012.

- **Example house**

Main characteristics of a low-energy house

- 115m^2 of heated floor area
- Energy calculations with PHPP 2007
- Calculated Primary Energy Demand 120 kWh/m^2 per year
- Calculated Heat Demand 25 kWh/m^2 per year
- Construction cost 925 EUR/m^2 + VAT
- Realistic Primary Energy Demand 85 kWh/m^2 per year
- Realistic Heat Demand 25,9 kWh/m^2 per year * *(not measured exactly)*
- Estimated time of paying back start costs is 15 years **
- Identical regular house would have had 8% smaller budget

**(based on general calculations of 2012 – 2014 monthly energy consumption, when estimating that there is no heating during summer months)*

***(if energy prices will remain the same)*

- **Example house**
  - Located exactly on east west direction with most glazing on south facade
  - 1 story rectangular floor plan
  - Main entrance with a hall
  - Technical and domestic rooms on north side
  - Horizontal sunshade on south facade
  - Wooden construction with PIR insulation, U value < 0,6 W/m^2K
  - Wooden windows with triple glass, U value < 0,9 W/m^2K
  - Special passive house front door
  - Ventilation system with heat recovery of 93%
  - Floor heating supplied by heat pump (for comfort reasons)
  - Rain water system for toilet and gardening
  - Electric sauna and LED lamps

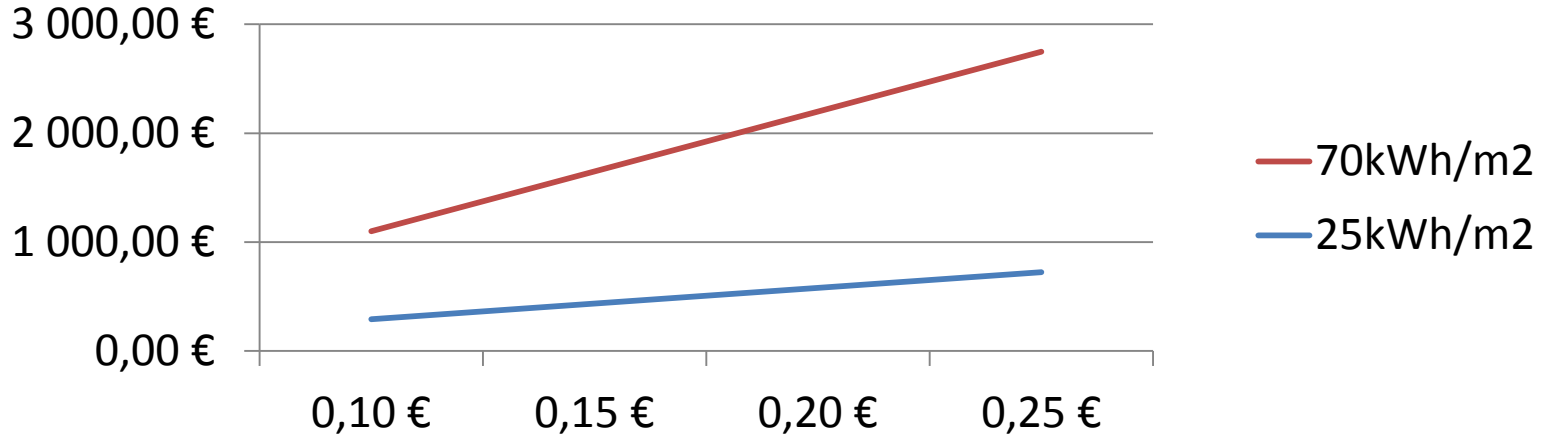
- **Example house**
  - Lessons
    - Keep it simple and stick with main rules
    - Do not underestimate summer cooling *(shading)*
    - Use quality materials and devices *(energy consumption, long life expectancy)*
    - Plan everything and then start to build
    - Each decision of design and comfort has a value on construction and maintainance costs *(floor heating, window sizes etc)*
    - About 8% higher construction cost compared to standard building from 7-8 years ago

- **Decisions that affect construction costs the most**
  - Positioning and landscape
    - East west orientation, south opening -> receiving passive energy
  - Architectural character and design, room plan
    - Shape, number of floors, balance of exterior surfaces, room plan -> insulation and shading amounts, HVAC systems
  - Facades and glazing
    - Windows per floor area, window positioning -> need for insulation (better view vs heat transmission)
  - Shadings
    - Morning and evening sun -> amount of cooling systems
  - Interior climate requirements and comfort
    - Indoor comfort -> heating type and systems

- **How to keep costs under control**
  - Follow the main rules of sustainable design and construction
  - Avoid large heating and cooling loads by design and construction envelope
  - Use simulations and exact calculation programs to prevent planning over or under your needs
  - Use efficient materials and devices to achieve simple construction types for outerior walls or roofs and HVAC systems
  - Try to keep HVAC systems simple and separate

- **Decisions that help to remain sustainable**
  - Remind that your house has a long life period and systems do need service
  - More complex system could lead to higher maintainance costs for service and back up, also higher possibility for regular errors and lower efficiency
  - Quality and life expectancy of materials, details, devices
  - Choose materials and devices that are not threatend by surrounding environment or construction faults. This way You can quarantee that calculated energy consumption is eqaul with real energy consumption
  - Ensure quality in construction works, plan as detailed as possible

- **Benefits in use and maintainance**
  - Lower energy demand makes You more independent of energy market prices in the future
  - Yearly costs for heating in low-energy vs ordinary home, based on Example house



**1 kWh – 0,1 eur*

***275 eur per year is heating cost for low energy house with 120m² of heated area (ca 23 eur/month, around 50 eur during winter)*

- **Benefits in use and maintainance**
  - Low Energy building quarantees good indoor climate and comfort *(constant air temprature throughout all room areas, warmer surfaces, always fresh air, less dust)*
  - Low Energy house usually brings quality and simplicity that results in less problems during maintainace period
  - If You keep systems simple, there are no additional regular services that You need to take into account

THANK YOU!

And keep it sustainable!