Annex 61: Deep Energy Retrofit of Public Buildings

Economic Feasibility of 'Deep Retrofit':
A Financial Approach to Project Assessment and Development.
Economic Model and Case Study

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Outline

1. Motivation
2. Goals and (research) questions to be answered
3. Economic feasibility model and tool (methodology)
4. Case study and sensitivity analyses, Germany
5. Discussion and outlook
Initial situation and motivation

1. **Technical studies** take time and resources, data availability is a pain ... (which are often unpaid) but often still **fail to reach decision makers**

2. **Decision makers** are typically non-engineers => they want to talk **cash flows** and **risks**. And they may not even be interested in your great technical solution.

3. **We** need to talk cash flows and KPIs and present results in an easy and quick to understand way

=> Develop a tool for **financial project assessment** based on easily available data => **feasibility check**
   For presentation to **financial decision makers**

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Economic feasibility model and tool:
**Goals and questions to be answered**

1. Build **cash flow scenarios and KPIs** with easily accessible input data to communicate with **building owners/decision makers**

2. **Awareness raising** and **visualization** for **building owners**:
   - How much do you currently pay for energy?
   - And how might energy cost develop (scenario)?
   - What if so much could be saved?
     And which investments could be re-financed from these savings?
   - How much does it cost to wait?

3. **Estimation of financial saving potentials**
   - How much money could be saved (min. - max.)?
   - And how do NPVs of saving cash flows compare to investment needs?

4. **Easy to communicate with decision makers:**
   => **Cash flows** and **KPIs**; no technicalities; figures, little text
Economic feasibility model and tool: 
**Input data, outputs and methodology**

1. **Input data** (either first estimates, benchmarks or from detailed analyses):
   - Current **OPEX:** energy, water, o&m, others (e.g. CO₂, productivity loss)
   - **Annual price development factors** for each cost category
   - **Saving potentials** per cost category: Minimum and maximum values (to model and account for insecurities about exact data)
   - **Project term** and **discount factor**
   - **Optional:** **Investment cost** of interventions („Delta cost“)

2. **Outputs:** Scenarios and KPIs
   - **OPEX development** scenario without interventions
     => individual and cumulative **baselines**
   - **Saving cash flow** scenarios
     => individual + cumulative **saving potentials** (Min. – max.)
   - **NPV of future savings cash flows** => comparison with investments
   - **Sensitivity analyses** (single + multiple parameters)
   - **Opportunity cost:** How much does it cost to wait?

3. **Iteration based on more detailed analyses and data** (if needed)
Economic feasibility assessment, case study
IWU building, Darmstadt

(based on data inputs from KEA, Germany)
Economic feasibility assessment, case 1
IWU building, Darmstadt:
Cost optimized PH refurbishment Sc 3
(based on data inputs from KEA, Germany)

IWU: Cost optimized PH refurbishment Sc 3
Cost development w/o measures = Baseline
**IWU: Cost optimized PH refurbishment Sc 3**

**Accumulated saving potentials**

![Graph showing accumulated savings over time with different potential savings categories.]

**IWU: Cost optimized PH refurbishment Sc 3**

**Baseline, savings scenario □ NPV of Savings-CF**

![Graph showing total OPEX and savings scenario with NPV calculation.]

Opportunity cost: 0.038 Mio EUR/a
**Economic feasibility assessment, case 2**

**IWU building, Darmstadt:**

“Cost optimized PH refurbishment Sc 3”

**vs.**

“Alexander Special - 59% Sc 7”

(based on data inputs from KEA, Germany)

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**IWU: Alexander (Sc7) vs. PH (Sc 3)**

Accumulated saving potentials

![Accumulated savings graph](image-url)
IWU: Alexander (Sc7) vs. PH (Sc 3)
Baseline, savings scenario □ NPV of Savings-CF

Economic feasibility assessment, case 2 – "manual" sensitivity analyses
IWU building, Darmstadt: "Cost optimized PH refurbishment Sc 3"

"Alexander Special - 59% Sc 7"
(based on data inputs from KEA, Germany)
IWU: Alexander (Sc7) vs. PH (Sc 3)
Sensitivity analyses: **30 years** (Ref.: 23 y)

IWU: Alexander (Sc7) vs. PH (Sc 3)
Sensi: **Price development: 0%/a** (Ref.: 2% /a)
IWU: Alexander (Sc7) vs. PH (Sc3)

Sensi: Price development: 4%/a (Ref.: 2%/a)

Economic feasibility assessment, case 1 – “automatic” sensitivity analyses
IWU building, Darmstadt:
Cost optimized PH refurbishment Sc 3
(based on data inputs from KEA, Germany)
IWU: Cost optimized PH refurbishment Sc 3

Single parameter sensitivity analyses

Multiple sensitivity analysis: Project NPV = f(Saving potential, Project term); f(Saving potential, Price development)
**IWU: Cost optimized PH refurbishment Sc 3**

**Single + Multiple parameter sensitivity**

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**Economic feasibility model and tool:**

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Discussion

1. Few data inputs needed for feasibility analyses. Can be estimates, benchmarks or from detailed assessments.
2. Which of your questions are answered by the feasibility model? What is still missing in your views?
3. Financial (vs. technical) approach: Suitable to inform and convince building owners?
4. Opportunity cost: It costs to wait.
5. New ESPC paradigm: ESCo models for co-financing (not necessarily 100%) + ??? …
6. … we need additional financing sources for deep retrofit, e.g. Non-Energy-Benefits: e.g. comfort or productivity increase (c.f. www.comfortmeter.eu, Johan Coolen) or mitigation of future price increases, client relationships, CSR … (c.f. IEA publication)

Outlook

1. Economic feasibility: => Your projects (up to 10)
   => contact me to receive template for data input
2. Deep retrofit business models
   => please check Task 16 publication (c.f. separate slide) and provide feedback
3. Non-energy-benefit (NEB) for co-financing
   => ideas, literature …
4. Investment grade calculation and financing:
   => Your projects (up to 3)
Task 16 paper on 'Comprehensive Refurbishment of Buildings with Energy Services'

Bleyl, Jan W.; Schinnerl, Daniel

Comprehensive Refurbishment of Buildings with Energy Services
in ECEEE Summer Studies, paper ID 5,039, France June 2009