



Retrofit Advisor Entscheidungshilfe für die nachhaltige Bauerneuerung

Ökosan 09,
Internationales Symposium für hochwertige energetische Sanierung von
grossvolumigen Gebäuden
Kunsthaus Weiz, 8. Oktober 2009

Mark Zimmermann, Empa
mark.zimmermann@empa.ch



Materials Science & Technology



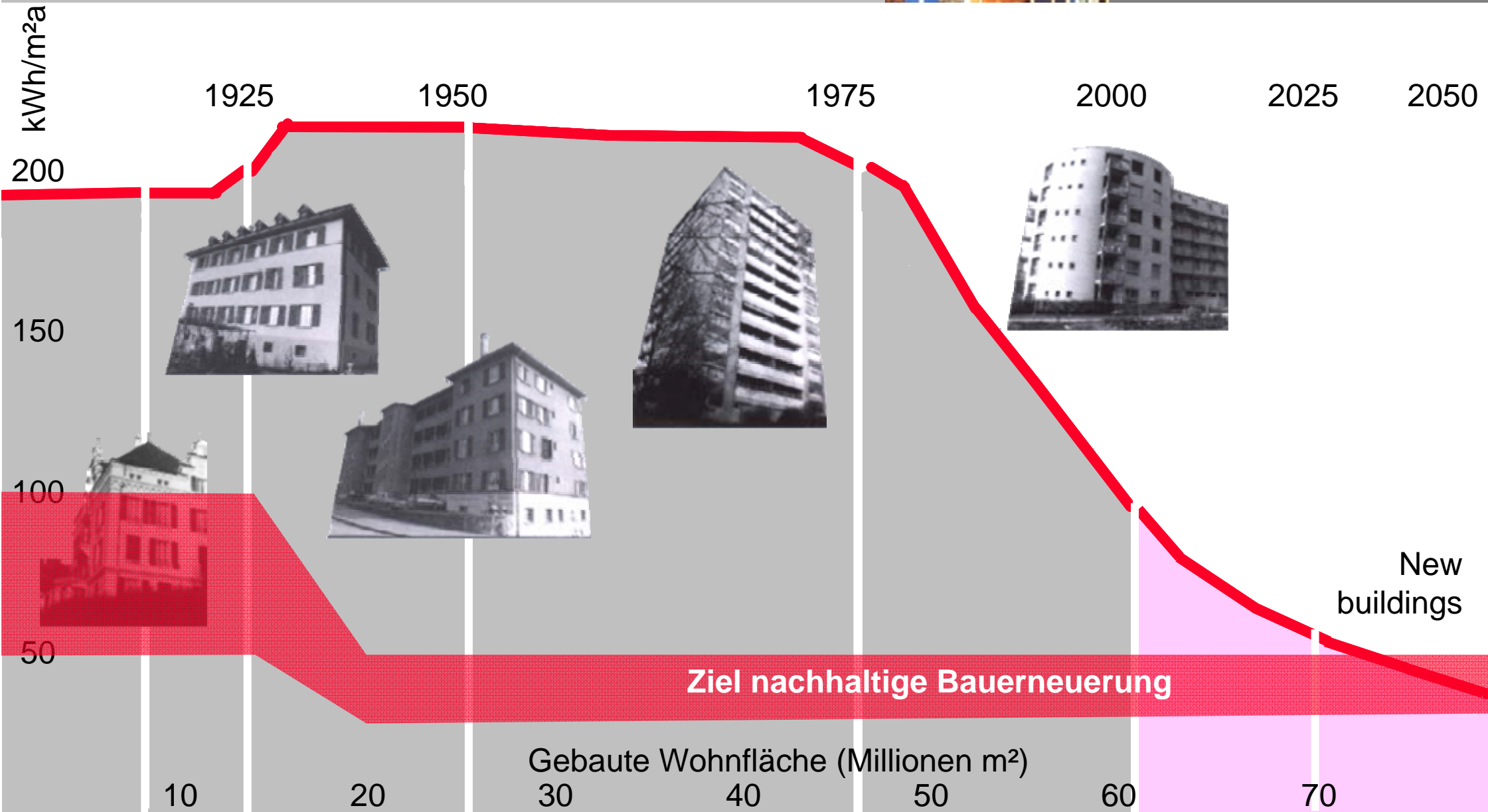
ccem.ch





Situation

- Entscheide für und vor allem gegen Bauerneuerungen werden vielfach willkürlich, ohne objektive Grundlagen gefällt.
- Insbesondere fehlen objektive Grundlagen zur Wahl der Sanierungsstrategie resp. für Abbruch und Ersatzneubau.
- Bauerneuerungen sind deshalb oft sub-optimal und behindern spätere Nachbesserungen.
- Viele europäische Wohnbauten sind jetzt 40 – 60 Jahre alt, sind nicht mehr zeitgemäss und brauchen dringend eine umfassende Erneuerung.





Zielsetzung Retrofit Advisor

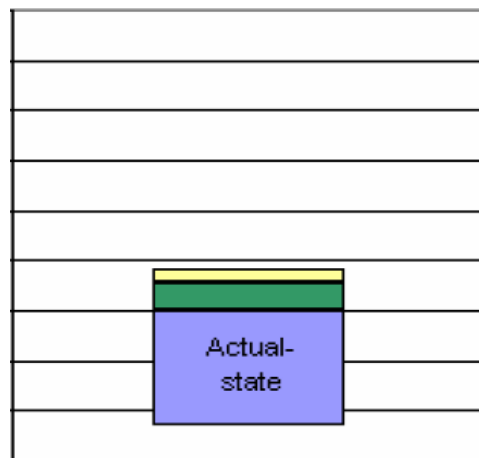
- Rasche Analyse der **Renovationsfähigkeit von Mehrfamilienhäusern**
- Beurteilung der **Wirtschaftlichkeit**, der **Energie- und Umweltaspekte**, sowie der **gesellschaftlichen Veränderung**
- Unterstützung eines objektiven Entscheidungsprozesses in Bezug auf die Optionen **Instandstellung, Gesamterneuerung** oder **Ersatzneubau**
- Fokus auf Gesamterneuerungen mit einem Standard **30-50 kWh/(m²-a) (Minergie bis Passivhaus)**



ECBCS Retrofit Advisor



Actual state



 Society

 Environment

 Economy



Entwicklung „Retrofit Advisor“

- **Checkliste nachhaltige Gebäudeerneuerung, gefördert durch BFE, BFW, Stadt Zürich, novatlantis**
 - Hans Bertschinger, QC-Expert AG, Dübendorf
 - Kurt Christen, Christen Architektur, Hinwil
 - Walter Ott und Yvonne Kaufmann, econcept, Zürich
 - Mark Zimmermann, Empa, Dübendorf
- **CCEM Advanced Energy Efficient Renovation of Buildings gefördert durch ETH-Bereich, BFE**
- **IEA ECBCS Annex 50 „Prefabricated Systems for Low Energy Renovation of Residential Buildings“**

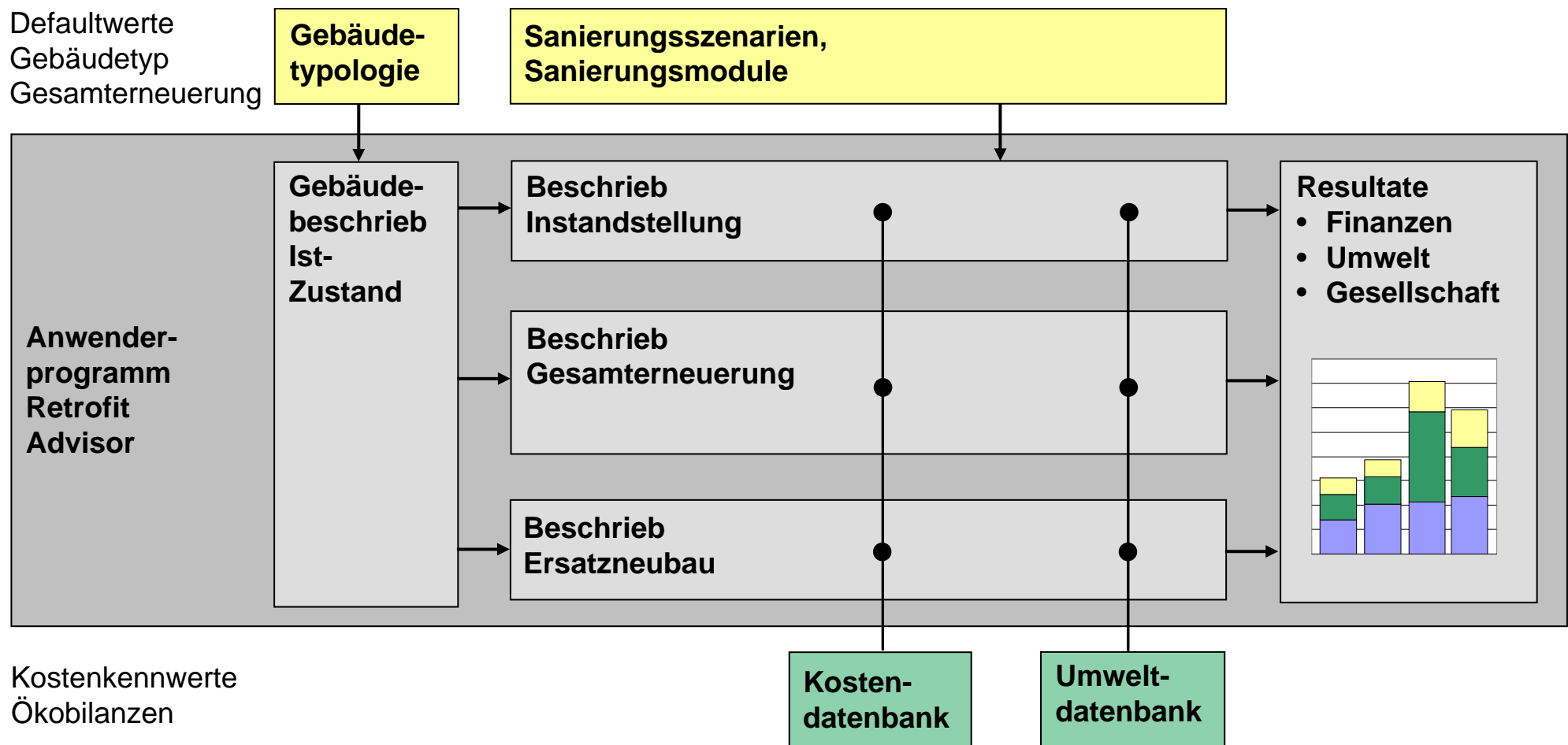


Anforderung an Retrofit Advisor

- Rascher Einstieg ($< \frac{1}{2}$ h) für **interessierte Bauherren** auf der Basis von Gebäudetypen und typisierten Gebäudesanierungen
- Verfeinerung der Analyse ($< \frac{1}{2}$ Tag) durch **Architekten und Planer** durch Eingabe von gebäudespezifischen Kenndaten
- Präzisierung der finanziellen Bedingungen über Lebenszyklus (Barwertmethode) durch **Immobilienbewirtschafter**



Konzept Retrofit Advisor





Realisierung Retrofit Advisor

- **Ende 2007**
Alpha-Version (Testversion Berechnung auf Excel-Basis)
- **Ende 2009**
Beta-Version (Test-Vollversion inkl. Standard-Datensätze für Gebäudetypen und Sanierungsvarianten auf Excel-Basis)
- **Ende 2010**
Internet-Version auf HTML-Basis, evtl. firmen- resp. sponsorenspezifisch (Verbände, Banken, öffentliche Hand)



Danke für Ihre
Aufmerksamkeit!



Retrofit Advisor

Apartment buildings renovation and reconstruction guide

Sprache Language Langue

English

Country

Switzerland

The Retrofit Advisor allows a simple evaluation of retrofit options for apartment buildings. Based on few input-data, the actual value of the property, its value after renovation and the estimated cost for refurbishment may be evaluated. It is an ideal tool to evaluate financially retrofit scenarios.

Please, choose the building type that fits best to your own building



**Anderer
Gebäudetyp
Other
Building Type**

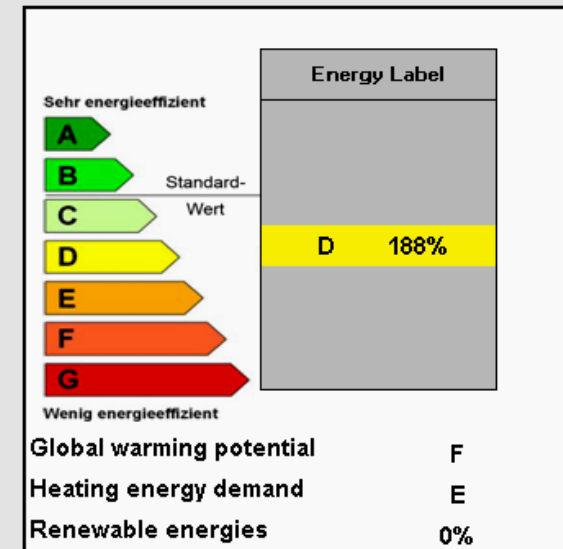


Retrofit Advisor

Description of reference building



Building type 2:
 Attached suburban apartment building, constructed before 1930
 Average standard, 3 to 4 room apartments, normally 3 to 4 stories, raised ground floor, massive wall construction, mixed wooden beam and concrete/brick floors, artificial stone reveals, overhanging balconies, roof space partially used as living space, small roof terrasses, simple staircase (partially wood), without elevator.



Information about your own building

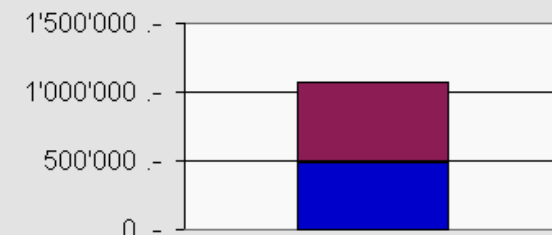
Default values of the selected building type will be used for missing information. The more information you can give, the more precise the evaluation will be.

Building data

| | | default input |
|---------------------------------|----------------|---------------|
| Heated floor area | m ² | 610 |
| Unheated floor area | m ² | 210 |
| Room height (in apartments) | m | 2.50 |
| Floors (ground floor and above) | Number | 4.0 |
| Elevator | yes/no | no |
| Plot size (GSF) | m ² | 730 |

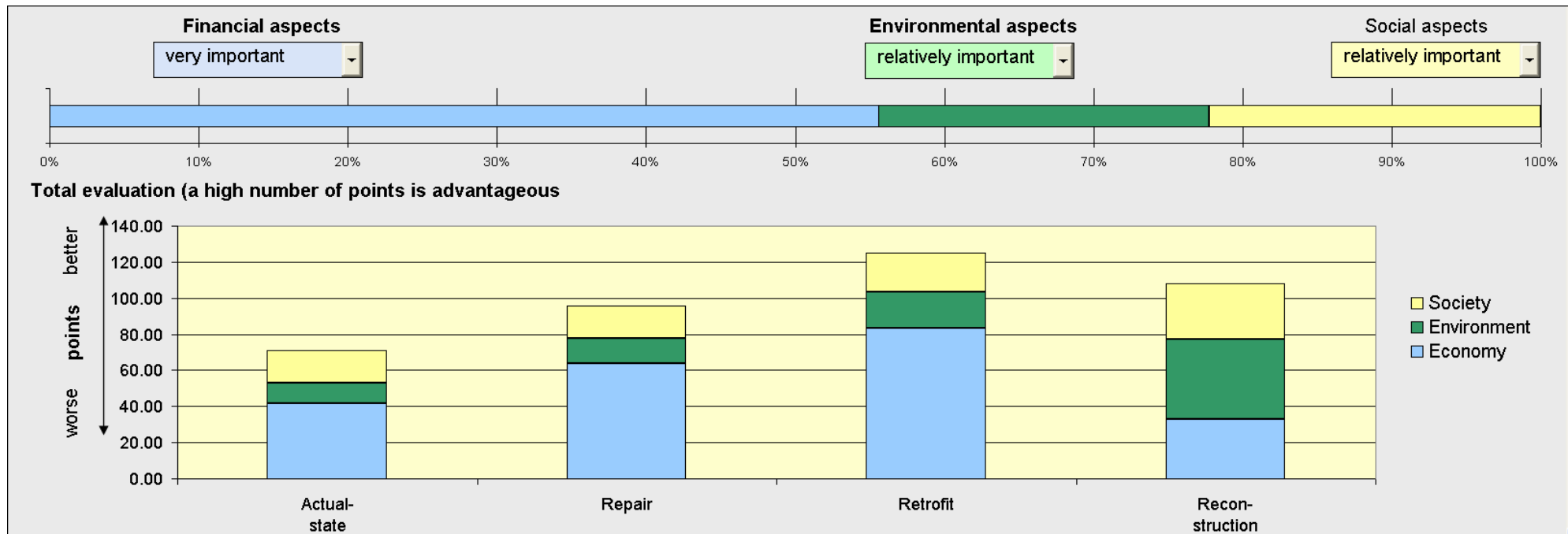
First evaluation

Market value



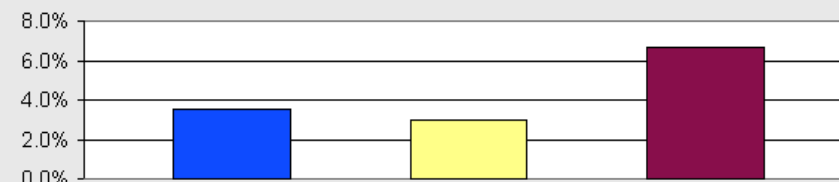
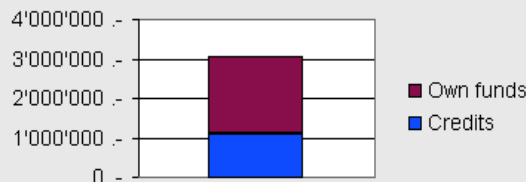


| | Primary energy Actual State | Primary energy Repair | Primary energy Retrofit | Primary energy Reconstruction |
|-------------------------------|--------------------------------|--------------------------|----------------------------|----------------------------------|
| Sehr energieeffizient | | | | A 45% |
| A | | | | |
| B | | | | |
| C Standard-Wert | | | C 105% | |
| D | D 188% | D 153% | | |
| E | | | | |
| F | | | | |
| G | | | | |
| Wenig energieeffizient | | | | |
| Global warming potential | F | E | C | A |
| Heating energy demand | E | D | C | A |
| Renewable energies | 0% | 0% | 0% | 28% |





Building: XY
 Address: 9999 Nowhereland
 User: Hans Meier
 Date: 16.11.2007



Market value

Gross return

Net return

Return on own funds

DCF Evaluation
Retrofit

Figures in CHF

| | after renovation | Budget | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---------------------------------------|------------------|---------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | 2010 | | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% | 2% |
| Inflation | 1.5% | | | | | | | | | | | |
| Normal rent income without investment | 74'400 | 67.2% | 74'400 | 112'397 | 114'083 | 115'794 | 117'531 | 119'294 | 121'084 | 122'900 | 124'743 | 126'614 |
| Rent increase due to investment | 0 | 32.8% | 36'336 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Expected rent income | 74'400 | 100.0% | 110'736 | 112'397 | 114'083 | 115'794 | 117'531 | 119'294 | 121'084 | 122'900 | 124'743 | 126'614 |
| Vacancy / lost rents | 0 | 2.0% | 2'215 | 2'248 | 2'282 | 2'316 | 2'351 | 2'386 | 2'422 | 2'458 | 2'495 | 2'532 |
| Actual rent income | 74'400 | 98.0% | 108'521 | 110'149 | 111'801 | 113'478 | 115'181 | 116'908 | 118'662 | 120'442 | 122'248 | 124'082 |
| Maintenance and repair | 5'208 | 7.0% | 7'752 | 7'868 | 7'986 | 8'106 | 8'227 | 8'351 | 8'476 | 8'603 | 8'732 | 8'863 |
| Operating costs without extra costs | 298 | 0.4% | 443 | 450 | 456 | 463 | 470 | 477 | 484 | 492 | 499 | 506 |
| Administration costs | 3'720 | 5.0% | 5'537 | 5'620 | 5'704 | 5'790 | 5'877 | 5'965 | 6'054 | 6'145 | 6'237 | 6'331 |
| Renting costs | 1'488 | 2.0% | 2'215 | 2'248 | 2'282 | 2'316 | 2'351 | 2'386 | 2'422 | 2'458 | 2'495 | 2'532 |
| Insurance costs | 744 | 1.0% | 1'107 | 1'124 | 1'141 | 1'158 | 1'175 | 1'193 | 1'211 | 1'229 | 1'247 | 1'266 |
| Capital tax | 0 | 0.2% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Caretaker costs | 0 | 0.0% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Building lease costs | 0 | 0.0% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Operational owner costs | 11'458 | 15.6% | 17'053 | 17'309 | 17'569 | 17'832 | 18'100 | 18'371 | 18'647 | 18'927 | 19'210 | 19'499 |
| Extraordinary repair (not shiftable) | 302'800 | | | | | 0 | | | 0 | | 0 | 4'542 |
| Extraordinary repair (shiftable) | 454'200 | 8% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Investment | 757'000 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4'542 |
| Free Cash Flow (FCF) | -694'058 | | 91'468 | 92'840 | 94'233 | 95'646 | 97'081 | 98'537 | 100'015 | 101'515 | 103'038 | 100'042 |

Assumptions for residual value

Annuity rate: 5.00%
 Remaining service life (years): 50

Return on invested own funds

| | | |
|----------------------------|----------------------|----------|
| Market value | 3'044'000 | - |
| Credits | 1'100'000 | - |
| Own funds | 1'944'000 | - |
| Credit costs | Interest rate: 4.50% | 49'500 |
| Tax deductions | | 6'642 |
| Income in own funds | 48'610 | - |

| | | |
|-----------------------------------|------------------|----------|
| Market value (DCF-value) | 3'044'000 | - |
| Gross return of investment | 3.57% | |
| Net return of investment | 3.00% | |
| Return of own funds | 6.66% | |