



EnerKey

Working Field 2:

Energy demand and use in buildings

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Problem

- Energy management of a municipality is a very complex theme
- Impacts of changes can only be obtained with detailed studies
- Therefore often an initial impulse is missing
- Will to change to energy efficient structures cannot be based on reliable indicators in an early planning stage

Motivation

Why is an adviser needed?

- Easy access to different impacts on the energy demand in an early planning stage
- Rough estimation on energy demand or potential energy savings
- Nevertheless replaces a detailed calculation, but could push the decision to think about energy efficiency
- Estimation of potential energy savings and costs is often not possible without tools
- Reduction of financial risks in innovative innovations

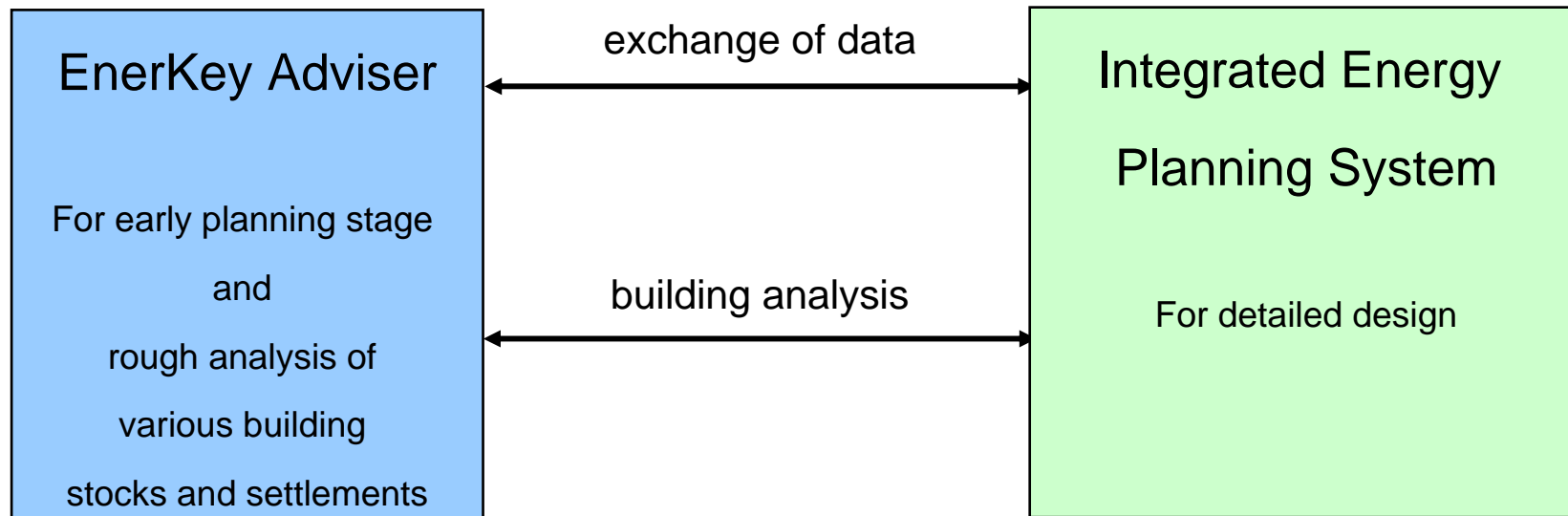
Possible Solution EnerKey Adviser?

- Prepare best practise concepts for different applications (housing, traffic, demand side,...)
- Easy-to-use tool for estimation of potential and risk
- Collection of case studies and best practise examples
- Realisation of demonstration project (Gauteng?)

How EnerKey Adviser and Integrated Energy Planning System – *EnerKey* work together

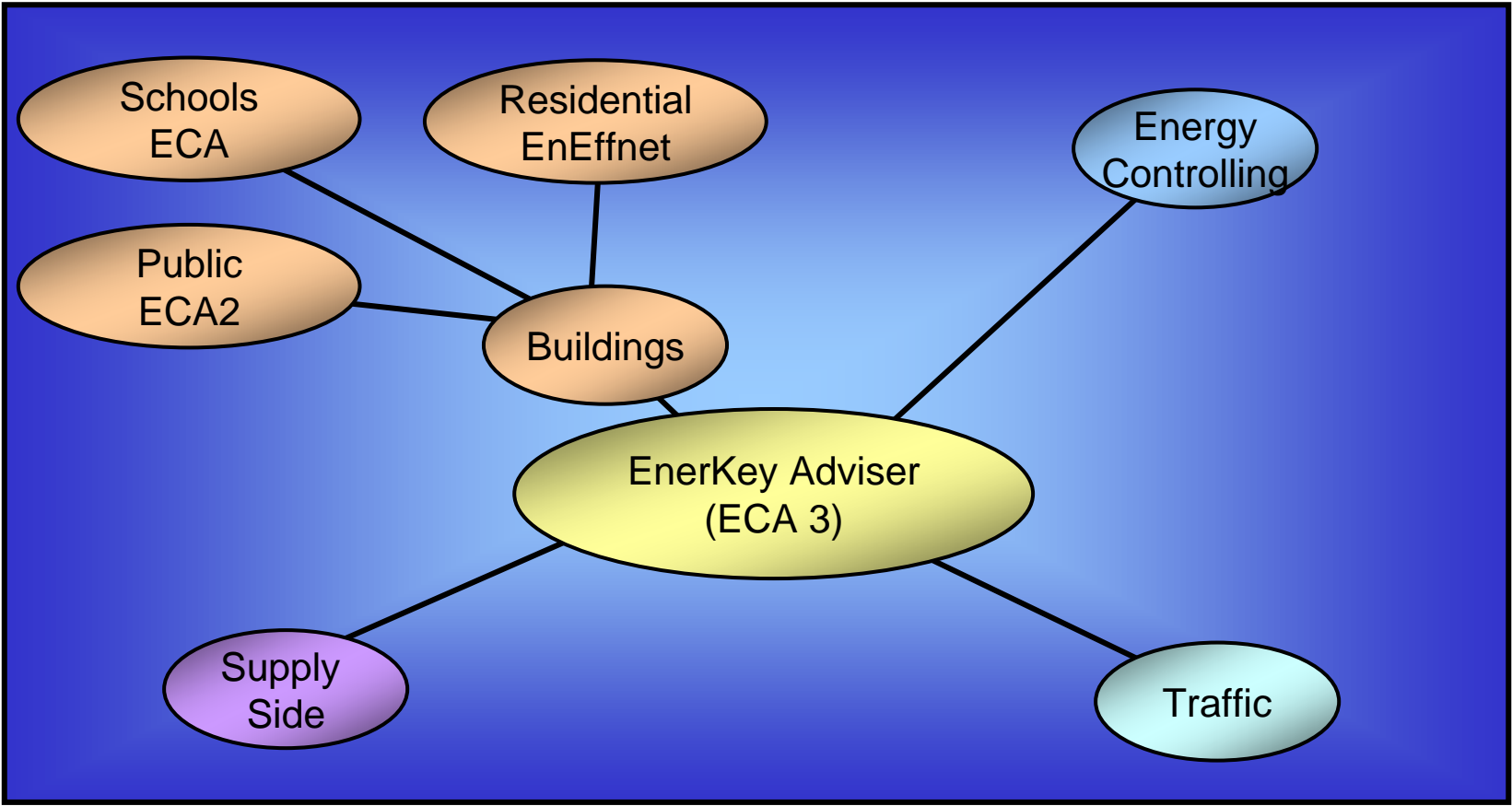
Early planning stage

Detailed analysis



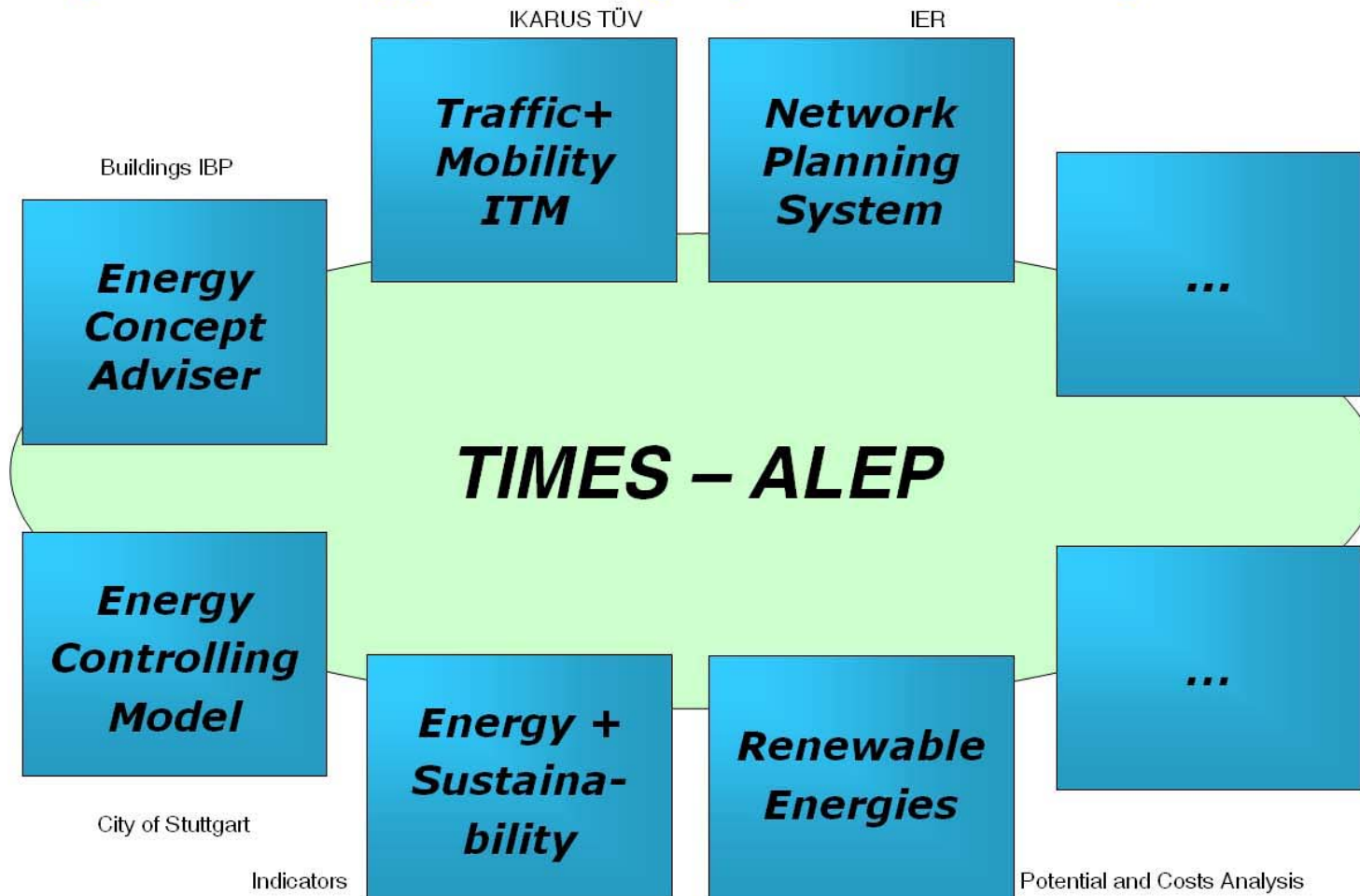
EnerKey Adviser

Parts of the Adviser





Integrated Energy Planning System - *EnerKey*



EnerKey Adviser– Information tool for energy demand of settlements

- Joint result of EnerKey
 - Information tool for early stage
 - Integrated Approach (Buildings, traffic, energy demand side,...)
 - High level research in working groups summarised and prepared for non Scientifics
- Target group
 - Decision makers
 - Technical committees of municipalities

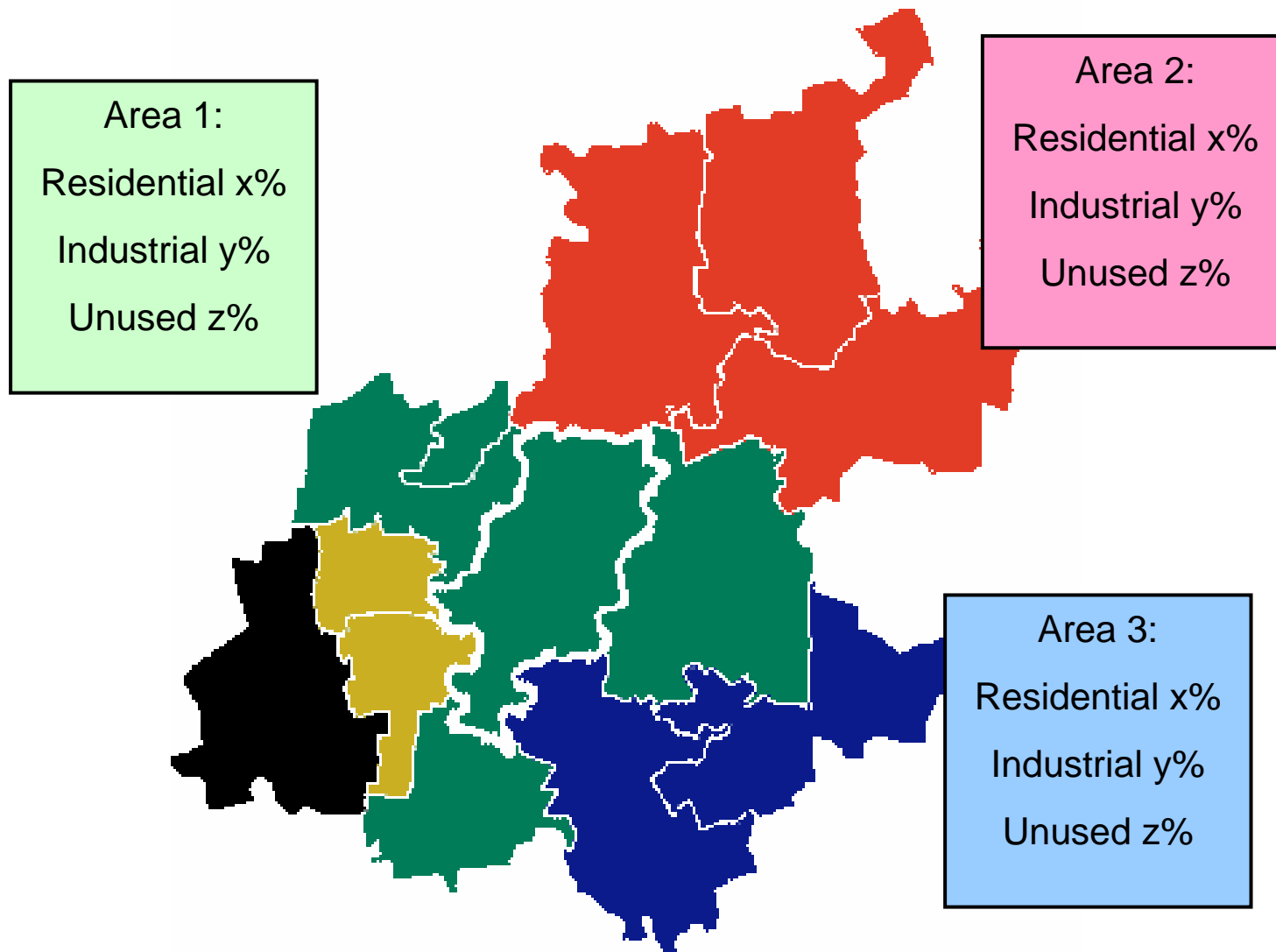
What are the results of the EnerKey Adviser?

- Rough estimation of energy demand under certain defaults and simplifications
- Different parts (building sector, supply side, traffic,...) can be considered with default values or more detailed (e.g. use of Energy Concept Adviser for educational buildings)
- Parameterisation can be imported in the detailed calculation tool

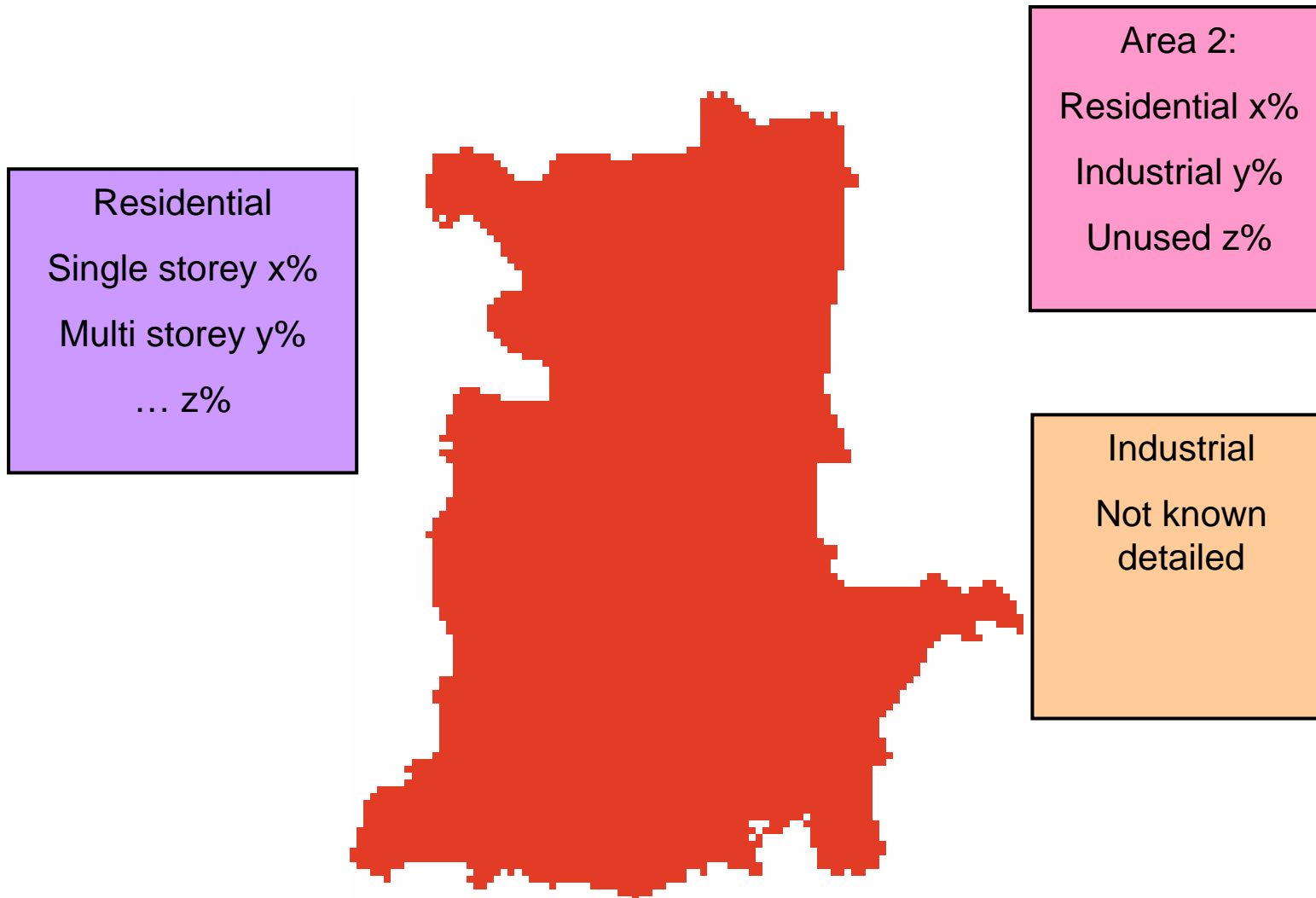
How does the EnerKey Adviser work?

- Starting with default values
- Depending on the focus of interest everything or only single parts can be examined in a more detailed way
- Either default values can be used or detailed values (known or calculated by toolset) can be applied

How does the EnerKey Adviser work?



How does the EnerKey Adviser work?



How does the EnerKey Adviser work?

Example *Residential Area*

Residential Area			
Single storey house (Percentage)		Multi storey house (Percentage)	...
Good standard (Percentage)	Poor standard (Percentage)	Estimation by default value	
Demand (Default Value or calculated with EnEffnet)	Demand (Default Value or calculated with EnEffnet)	Demand (Default Value)	
Average demand of single storey buildings		Average demand of multi storey buildings	
Average demand of Residential Area			

How does the EnerKey Adviser work?

Example *Building Sector*

Building Sector				
Residential Area (area)			Industrial area (area)	...
Single storey (Percentage)	Multi storey (Percentage)	...	Estimation by default value	
Demand (Default Value or calculated with EnEVnet)	Demand (Default Value or calculated with EnEVnet)		Demand (Default Value)	
Average demand of residential area			Average demand of industrial area	
Average demand of building sector				

How does the EnerKey Adviser work?

Example *Settlement*

Settlement				
Building Sector (total)			Supply side (total)	...
Residential (area)	Industrial (area)	...	Estimation by default value	
Demand (Default Value or calculated with toolset)	Demand (Default Value or calculated with toolset)		Demand (Default Value)	
Average demand of building sector			Average demand of supply side	
Average demand of settlement				

EnerKey Adviser Buildings sector

- EnerKey Adviser – set of tools for the buildings sector
 - EnEffnet – Residential Buildings
 - Energy Concept Adviser Version1 – Educational Buildings
 - Implementation for South Africa has already started
 - Energy Concept Adviser Version2 – Public Buildings
 - Ready till 2010

EnerKey Adviser EnEffnet residential buildings

Residential buildings – Information tool

easy approach to energy demand of residential buildings

Gebäudetypen	?	!	+
Aufbauten	?	!	+
Gebäude	?	!	+
Anlage	?	!	+
Berechnungsergebnis	?	!	+
Varianten	?	!	+
Energetischer Vergleich	?	!	+
Ausgabe	?	!	+
Dateiverwaltung	?	!	+
Information und Haftung			+

EnerKey Adviser EnEffnet residential buildings

Gebäudetypen ? ! -

Gebäudetyp:
eine Wohneinheit freistehend



Ansicht (Bild 1 von 6)

Flächen in m²:

Außenwand	121,00
Dach	135,00
Kellerdecke	125,00
Nordfenster	5,00
Ost/West-Fenster	11,00
Südfenster	11,00

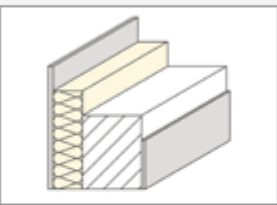
Gebäudekennwerte:

Wärmeübertragende Hüllfläche [m ²]:	408,0
Verhältnis A/V [1/m]:	0,92
beheiztes Volumen [m ³]:	443,5
Gebäudenutzfläche [m ²]:	141,9
Anzahl Wohneinheiten:	1
Anlage nach DIN 4701-10 Beiblatt 1:	49

EnerKey Adviser EnEffnet residential buildings

Aufbauten ? ! -

opake Bauteile anzeigen transparente Bauteile anzeigen neues opakes Bauteil

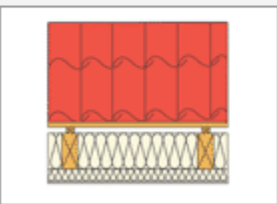


Das Bauteil **Außenwand** hat eine Fläche von **A = 121,00 m²** und einen U-Wert von **U = 0,18 W/m²K**.

Das Bauteil gehört zur Bauteilgruppe **Außenwand**.

Aufbau:

Bauteil ändern
Bauteil löschen



Das Bauteil **Dach** hat eine Fläche von **A = 135,00 m²** und einen U-Wert von **U = 0,18 W/m²K**.

Das Bauteil gehört zur Bauteilgruppe **Dach (Dachraum ausgebaut)**.

Aufbau:

Bauteil ändern
Bauteil löschen

EnerKey Adviser EnEffnet residential buildings

Gebäude ? ! -

Gesamte wärmeübertragende Fläche A [m ²]:	408,0	Nutzfläche [m ²]:	141,91	Anzahl der Wohneinheiten:	1
Verhältnis Fläche zu Volumen A / V [1/m]:	0,92	beheiztes Volumen V [m ³]:	443,48	Werte ändern	

Nachweis der Luftdichtheit:
wird durchgeführt

Ausführung der Bauteilanschlüsse
gemäß DIN 4108 Beiblatt 2, Aufschlag 0.05 kWh/m²a

Anlage

Die Heizanlage wird betrieben mit:

Strom: Wärmepumpe

Die Warmwassererzeugung erfolgt

zentral mit der Heizungsanlage

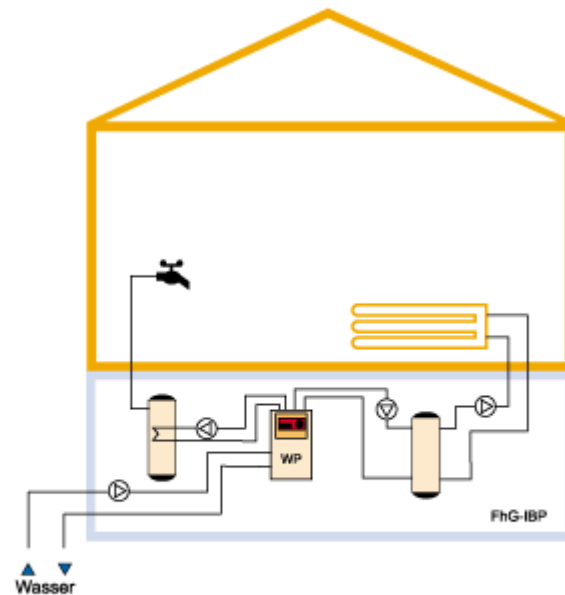
Es stehen folgende Heizanlagen gemäß DIN 4701 Teil 10 Beiblatt 1 zur Verfügung:

Anlage 49: Fußbodenheizung; Wärmepumpe Wasser/Wasser, ohne Zirkulation

Ausgewählt wurde Anlage 49 gemäß Beiblatt 1!
Jede Wohneinheit hat eine eigene Heizanlage,
die sich in einem unbeheizten Bereich befindet.

Anlagenaufwandszahl ep:

1,02



Beschreibung der Warmwasserbereitung:

gebäudezentrale Versorgung; ohne Zirkulation; Verteilung außerhalb der thermischen Hülle; indirekt beheizter Speicher; Aufstellung außerhalb der thermischen Hülle; Heizungs-Wärmepumpe Wasser/Wasser mit Strom betrieben;

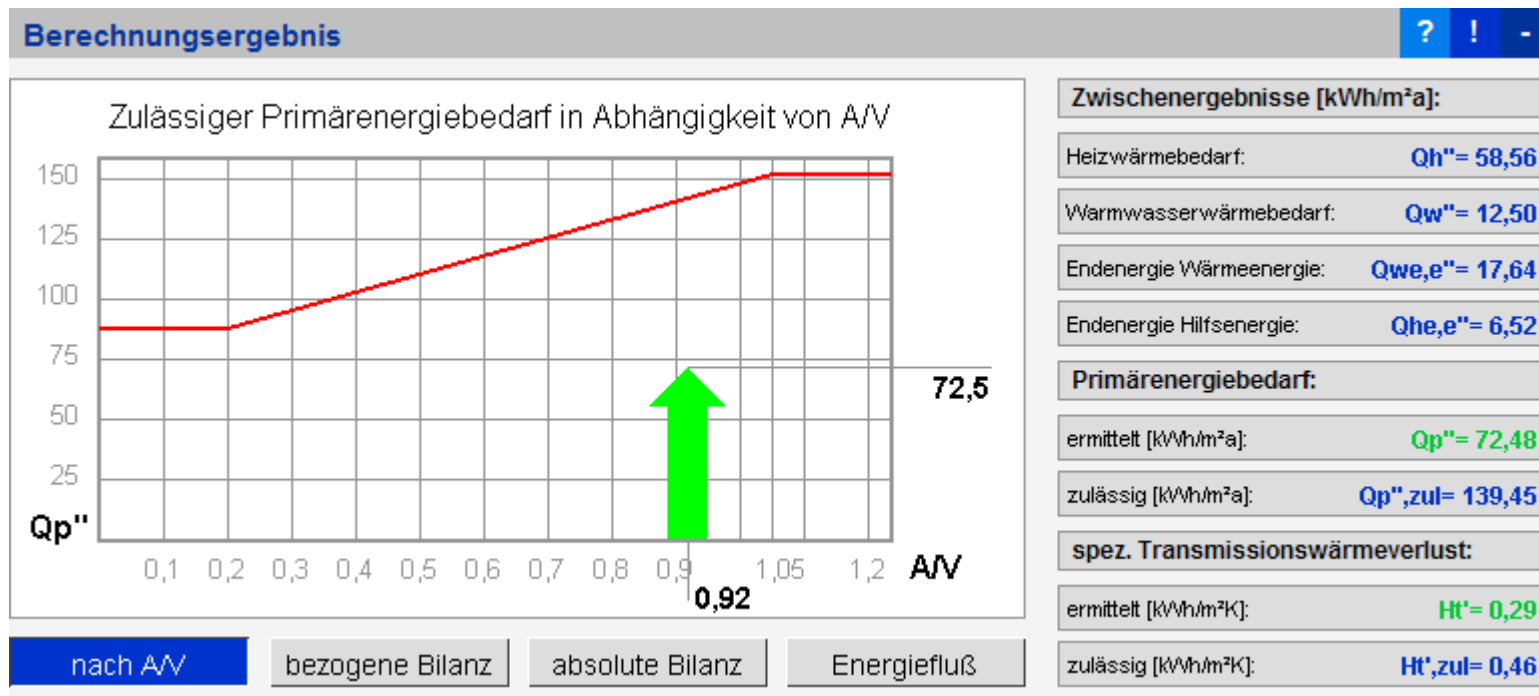
Beschreibung der Heizanlage:

integrierte Heizflächen (z.B. Fußbodenheizung); Einzelraumregelung mit Zweipunktregler Schaltdifferenz $X_p=2K$; 35/28°C-Auslegung; zentrales System; horizontale Verteilung außerhalb der thermischen Hülle; Strangleitungen innenliegend; geregelte Pumpe; Pufferspeicher vorhanden; Aufstellung außerhalb der thermischen Hülle; Elektrowärmepumpe Wasser/Wasser;

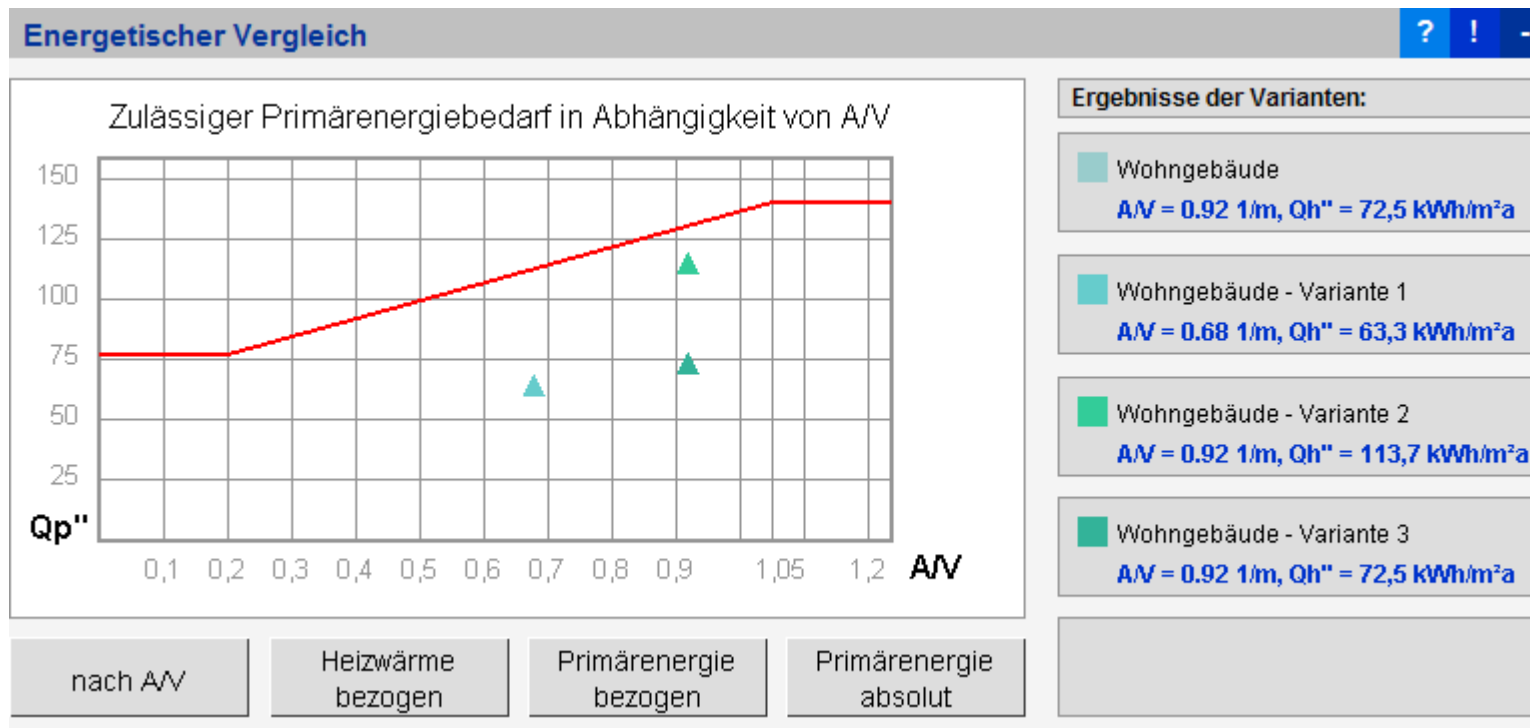
Beschreibung der Lüftungsanlage:

keine mechanische Lüftungsanlage;

EnerKey Adviser EnEffnet residential buildings



EnerKey Adviser EnEffnet residential buildings



What were the reasons why the Energy Concept Adviser was developed?

- high energy consumption in educational buildings (nursery schools, schools, universities,...)
- decision makers are often not qualified enough informed
- many different factors for a high energy consumption building itself, heating system, ventilation, lighting, controls, (cooling)
- an estimation of investment costs and the potential of energy savings not possible without tools

EnerKey Adviser

Energy Concept Adviser

ECA - Structure

Recommendations

Solutions for existing problems
e.g. IAQ, glare, high energy consumption

Case Study Viewer

Collection of exemplary retrofitting of educational buildings sorted by country and building type

Retrofit Measure Viewer

Collection and description of retrofit measures

Benchmarking

Comparison of the consumption of the own building with the typical average consumption of the country

Retrofit Concept Development

Starting with a building type you are able to analyze different retrofit measures on your own building. You can create different concepts and look on the energy relevant results as well as on the economic calculations

Auditing & Monitoring

Kulu and Auditing report



REDUCE Retrofitting in Educational Buildings

INTERNATIONAL ENERGY AGENCY

Energy Conservation in
Buildings & Community
Systems Programme



ENERGY CONCEPT ADVISER

for Technical Retrofit Measures

Participating
countries in
IEA-Annex36:



additional
countries:





REDUCE

Retrofitting in Educational Buildings

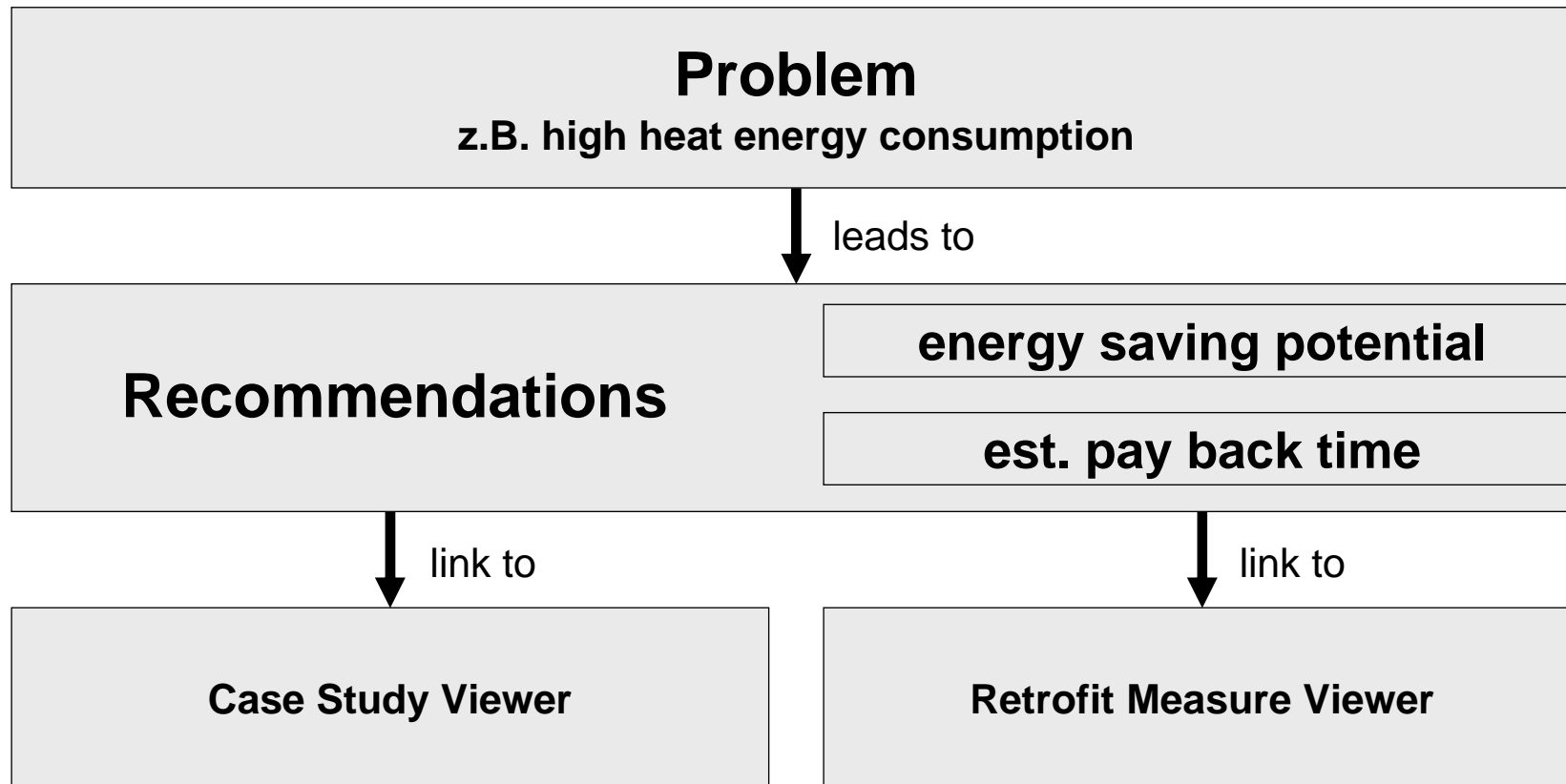


ENERGY CONCEPT ADVISER

for Technical Retrofit Measures

obtain recommendations for specific problems in your building	Recommendations
study more than 30 retrofitted buildings and retrofit measures	Case Studies & Retrofit Measures
compare your building's consumption to national data	Performance Rating
develop an energy efficient retrofit concept for your building	Retrofit Concept
programs and methods to analyse your building performance	Utilities
any questions	Info & Contact

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Energy Concept Adviser
Recommendations





Problem Related Recommendation



General Information

**This knowledgebased list of recommended measures may fit only partly to your building.
Select your problem in the left column and in the right column it is possible to group the measures in main g
Select the useful measures manually and read detailed description in the lower part.**

Select the existing problem

General Problems

Electrical energy consumption is high

Heating energy consumption is high

Water consumption is high

Indoor air quality problems

Specific Problems

Building envelope not airtight

Humidity or moisture problems

Windows need replacement

Roof covering needs replacing

Heating controls need upgrading

Pipework needs replacing

Boiler or burner needs replacement

Building fabric insulation is poor

Pipework needs insulating

Ventilation uncomfortable due to draughts

Heating inadequate in winter; rooms too co...

Group measures by

No grouping

Possible measures

Close off open chimneys to prevent ventilation losses ...

Payback time

Very short Term (less than two years)

Close off unused air grilles behind radiators.

Payback time

Very short Term (less than two years)

Weather strip windows and doors and seal gaps in buil...

Payback time

Very short Term (less than two years)

Fit closures to external doors.

Payback time

Short Term (2 to 5 years)

Fit wind covers/back draught dampers to through the w...

Selected Measure

Install cooking sensor controls on the kitchen hood fans

Payback-time:

Very short Term (less than two years)

Kitchen extract fans extract large volumes of heated air and should only be on when required

Can be carried out with routine maintenance

Related Information

Retrofit Measure Viewer



Lighting and electrical appliances - Control systems

Case Study Viewer



Exemplary Retrofitting of a School (EROS) in Stuttgart, Germany



University of Stuttgart



University of Ulm

EnerKey Adviser
Energy Concept Adviser
Case study viewer

- Case studies are shown in a standardised format
- Information can be easily accessed and be compared to each other
- 33 case studies are included
- Complete report to every case study is available
- also available as book



Case Studies & Retrofit Measures

Sorting of:

Case Studies by

Retrofit Measures by

Country	Retrofit Measures Case Studies						
---------	-----------------------------------	--	--	--	--	--	--

South Africa

Central corridor school

--	--	--	--	--	--	--	--



Case Study Viewer

Laerskool Garsfontein, Tshwane

Download of
REPORT as
PDF

General Data

Site, Typology

Before Retrofit

Retrofit Concept

Energy Savings

User Evaluation

Renovation Costs

Lessons Learned

Additional Information

Building Construction

These were the original school buildings. Although they should be replaced by the permanent buildings, they are still in use. The buildings are build out of pre fabricated elements, which have to outer layers of thin panels. Between there is an insulation. The windows are single pane glazing with a metal frame.

Every building is for a separate class room. The climatic conditions are rather bad in theses buildings.



◀ Northern facade at a pre - fab building. ▶

Heating / Ventilation / Cooling and Lighting System

Heating

Due to the bad insulation, there are heaters needed in wintertime. There are two heaters in every corner of the room. According to teachers, it takes some hours to heat up the room.

Ventilation/Cooling

The buildings are ventilated in by opening the windows supported by two fans (70 W). Some buildings have mobile heating/cooling devices in the beuildings, but they are usually not switched on as they are not effective. Additional there are some buildings with windows that open vertical. These windows aren't opened, as the pathways are along the buildings and if they would have been opened, pupils would hit the opened windows.

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Performance Rating

- allows a comparison of the actual consumption of a building
- e.g. in Germany:
 - 303 university buildings
 - 59 technical colleges
 - 199 schools
 - 35 kindergartens
 - over all 596 examined buildings



Performance Rating



Building Information

The building is a: school

The reference climate zone: mean climate South Africa

It has a heated floor area of: 2000,00

[Click here to get further Information about the climate zones](#)

Consumption of electrical energy:

Includes already heat energy consumption

Consumption of heat energy:

Energy source: oil

Unit of the consumption: kWh/m²a

Unit of the consumption: kWh/m²a

Consumption: 35,00

Consumption: 158,00

Consumption of water:

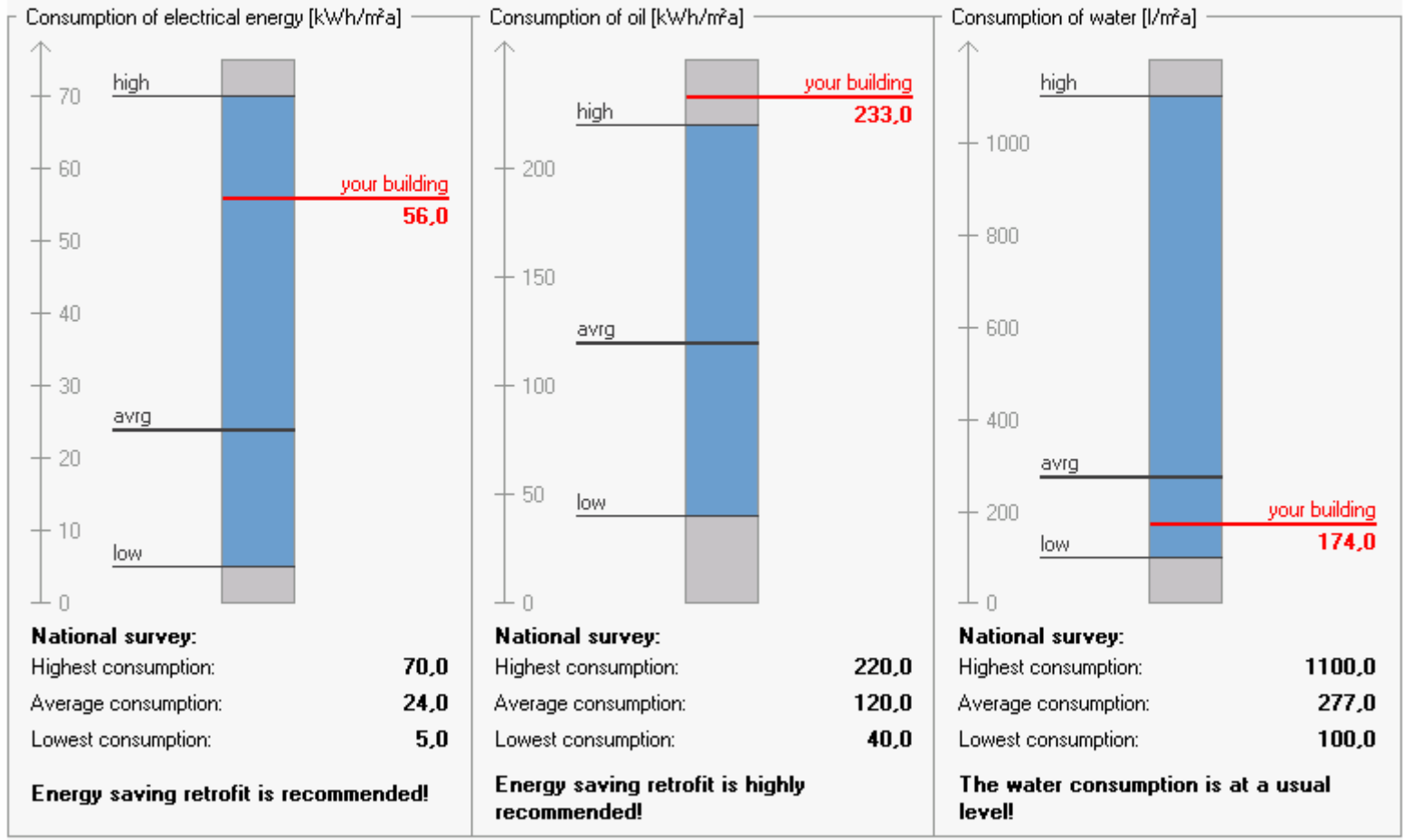
Unit of the consumption: l/m²a

Consumption: 20,00

Consumption of water:

Unit of the consumption: Consumption

Attention! All energy consumptions are shown in kWh/m²a resp. water consumption in l/m²a.



Your consumption is compared to the results of a survey of Annex 36 about the energy consumption of educational buildings!

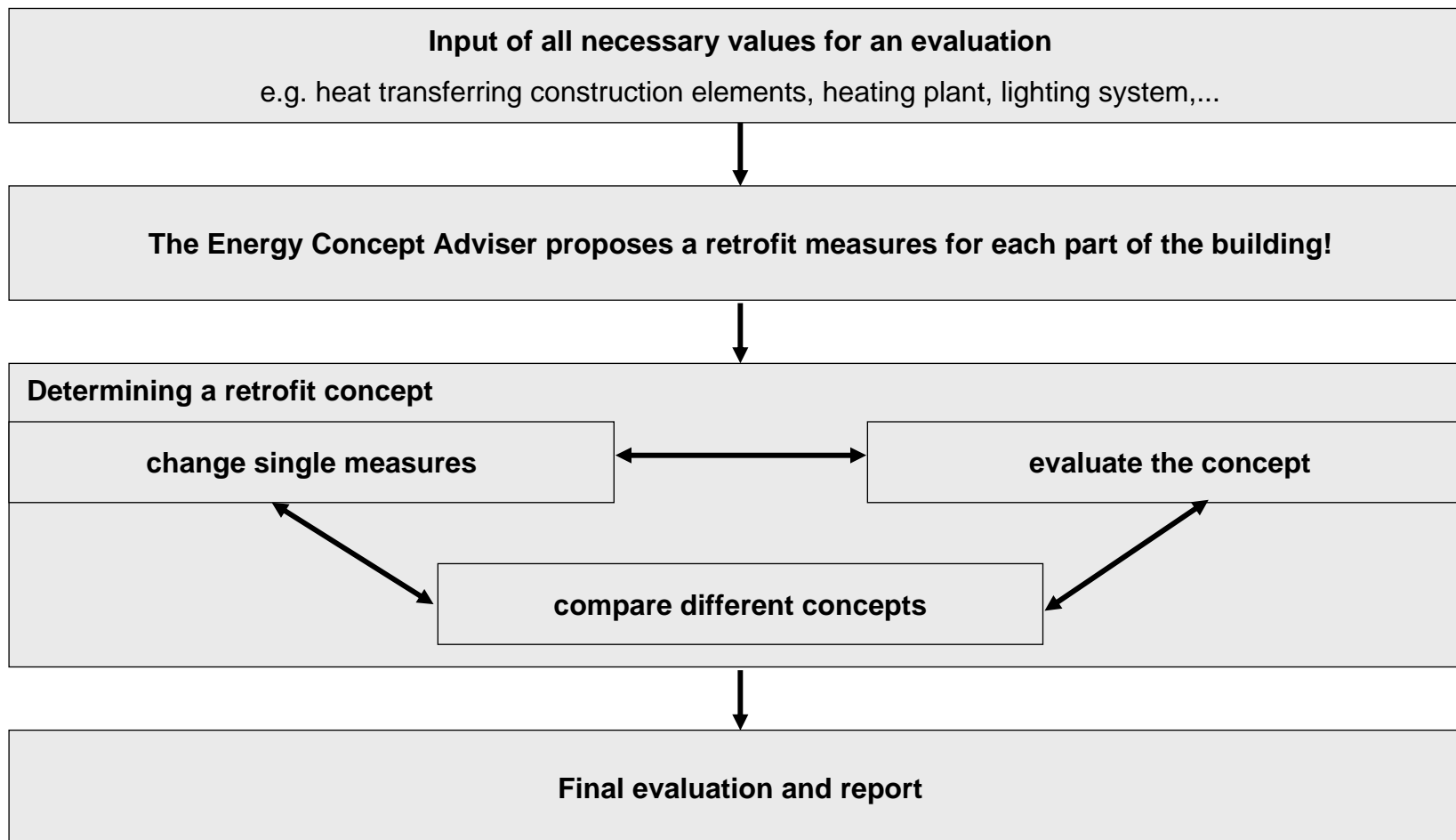
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Concept Development

- chance to examine the possibilities shown in the other parts in detail
- possible retrofit measures can be evaluated (economically and energetical)
- a strategy for retrofitting is proposed

How to do find a concept






Retrofit Concept Development



General Information

The development part is structured in the sectors listed below. A sector can be opened or closed by clicking on its bar. For all needed informations (values, costs etc) default values from national studies are included, but can be changed individually by the user. So please check the default values for your confidence. If you need help while operating click on 

Additionally there is a manual for the whole Energy Concept Adviser available.

[Download manual for ECA](#)

Describe the existing building



Select one retrofit measure for each building element



Create and compare energy saving concept



Summary and Report



Describe the existing building

? -

How to use this part

The building, for which the possibilities for a energy efficient should be analysed, is defined in this section.

By choosing the basic values, a default building is created.

This building can be further defined in the lower part of this section

If there was already a further definement, changes in the basic parts sets all the values back to default!

Define key values for a default building

Basic Data

Building Type:

Construction year:

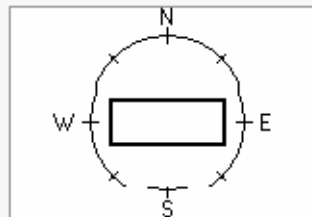
Type of Roof:

Type of basement:

Total floor area [m²]:

Number of storeys:

Orientation:



Click on diagram to select orientation

Example buildings

Typology:

Click on picture to have a look at the case study!



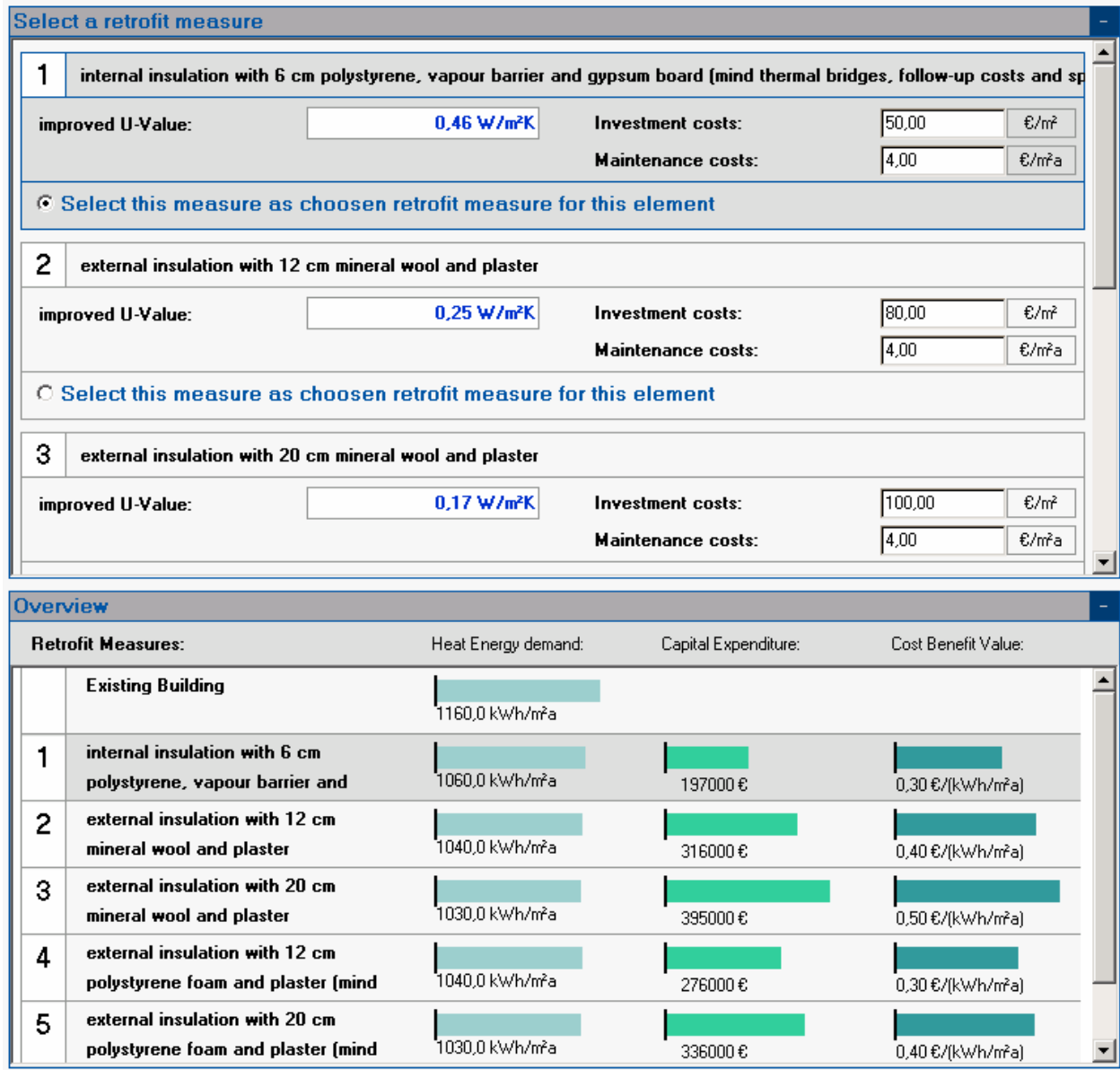
Wausau West High School Wisconsin
USA

Consumption of heat energy:

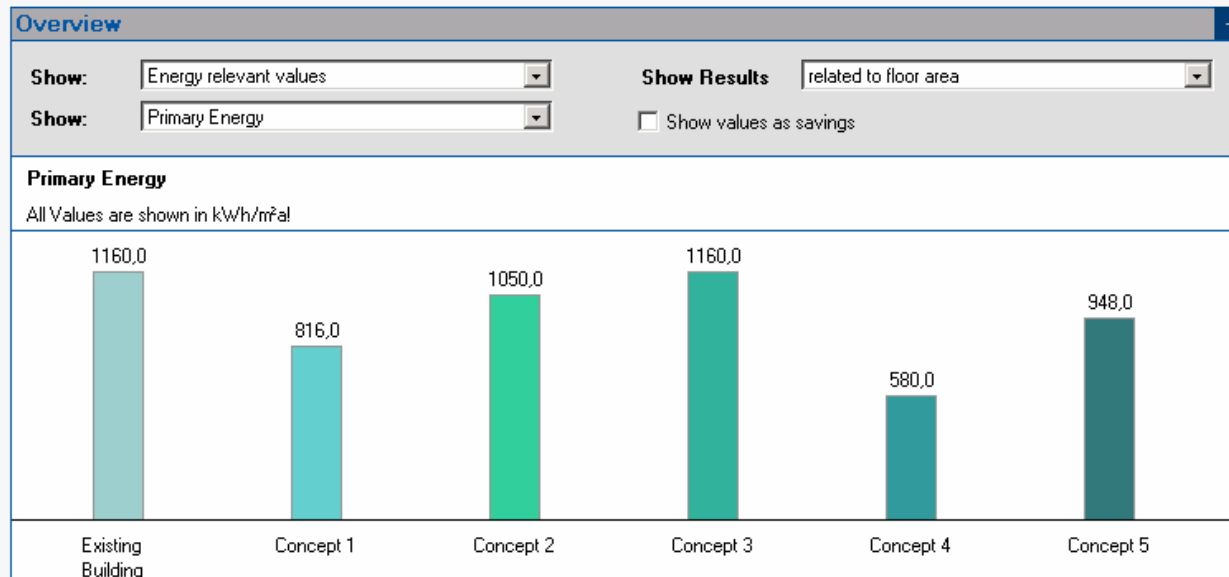
Energy source:

Consumption: kWh/m²a

Further Refinement of the building



Select elements for the different concepts					
Element: Chosen retrofit measure:	Concept				
	1	2	3	4	5
pitched roof 14 cm mineral wool insulation between the rafters, vapour barrier, water barrier, lattice	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ground plate 4 cm mineral wool, screedfloor (extra costs for shortening of the doors)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
steam heating Low Temperature Boiler 70/55	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
external wall internal insulation with 6 cm polystyrene, vapour barrier and gypsum board (mind their	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
lighting source Compact Fluorescent	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
window north The measures are sorted by benefit-cost-value					



EnerKey Adviser **Energy Concept Adviser 2** public buildings

Public buildings – Information tool

Still to come

EnerKey Adviser

