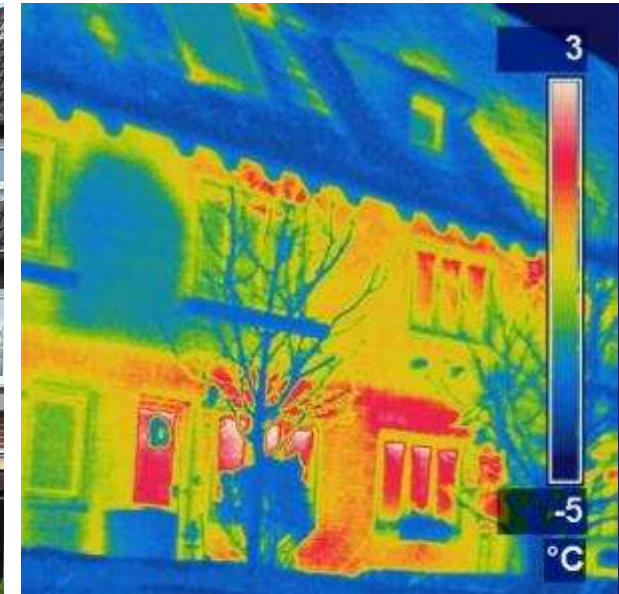




Co₂ol-Bricks - Model Project Garden-City Elmschenhagen

June, 3rd 2013

Matthias Fiedler
Jasper Harten
Jens-Peter Koopmann



Backstein im Kieler Stadtbild

Landes-
hauptstadt Kiel





Co₂olBricks



In the **model project garden-city Elmschenhagen**, a combined consulting and funding program for energy efficient refurbishment of historic and monumental buildings in a residential area in Kiel is developed and implemented.

The goal of the model project is to motivate and to support the house owners in this quarter to implement particularly high energy standards when refurbishing their houses.

At the same time advice is given how to meet the design designations contained within the binding land-use plan.





Location of Elmschenhagen



The quarter garden-city Elmschenhagen was constructed between 1939 and 1945.

The quarter includes 1.800 apartments mainly in two-storey terrace houses and nearly 4.000 inhabitants.

garden-city
Elmschenhagen



Impressions from garden-city Elmschenhagen





Impressions from garden-city Elmschenhagen

house
type 296



row houses





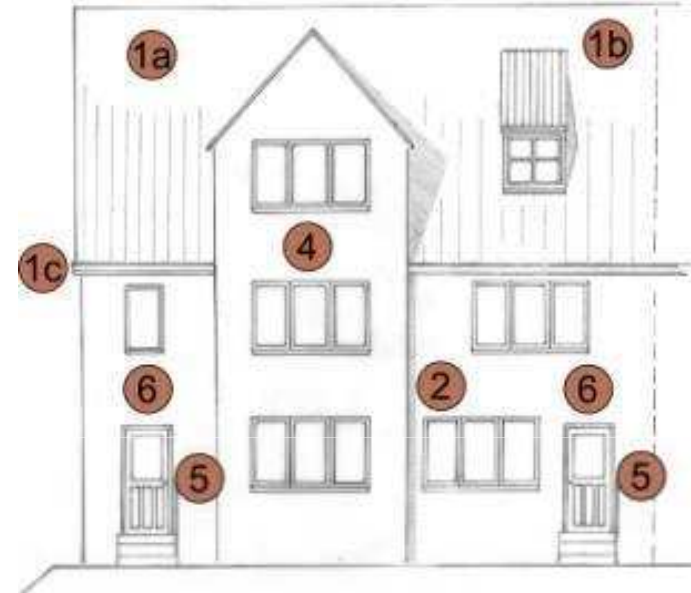
garden-paths



terraces from the garden-site



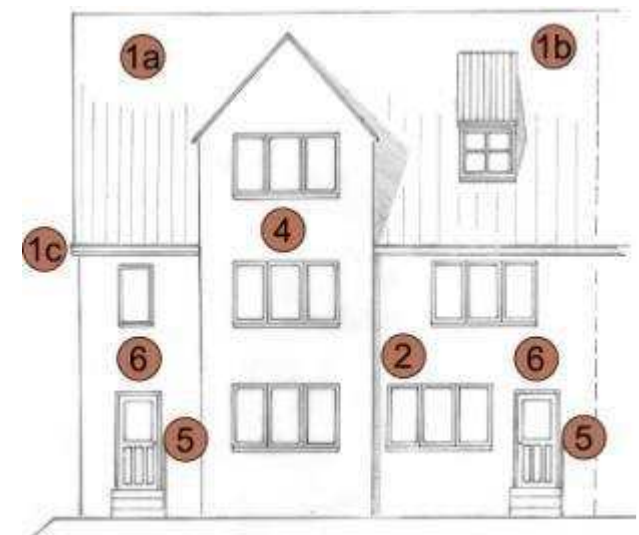
Development Plan No. 974





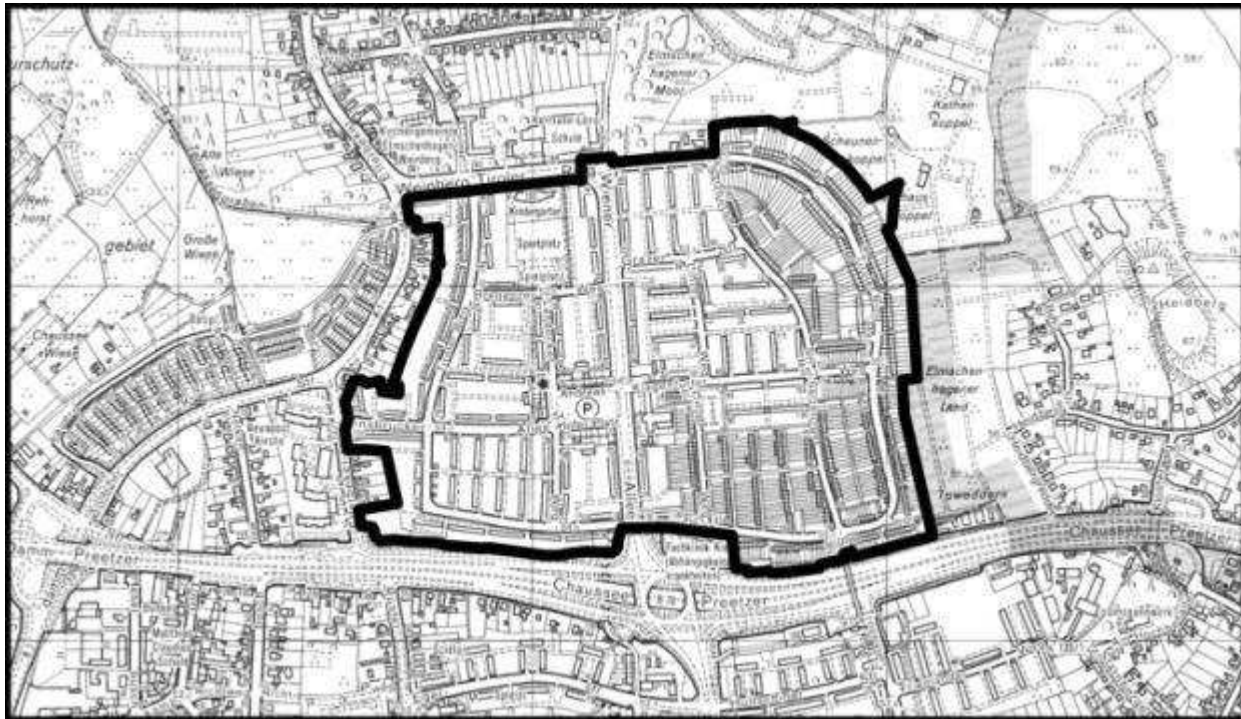
Planning Restrictions

- brick-red colored exposed brickwork
- matching color of bricks and joints, stonysize, bonds
- external wall insulation with brick slips
- roof pitch 53°
- color of roof covering red, red brown or anthracite; the same color for one structure
- eaves height 5.1 m
- continuous eaves line and ridge line
- front door canopy 1.4 x 1.0 m (width/high)
- no restrictions concerning solar collectors

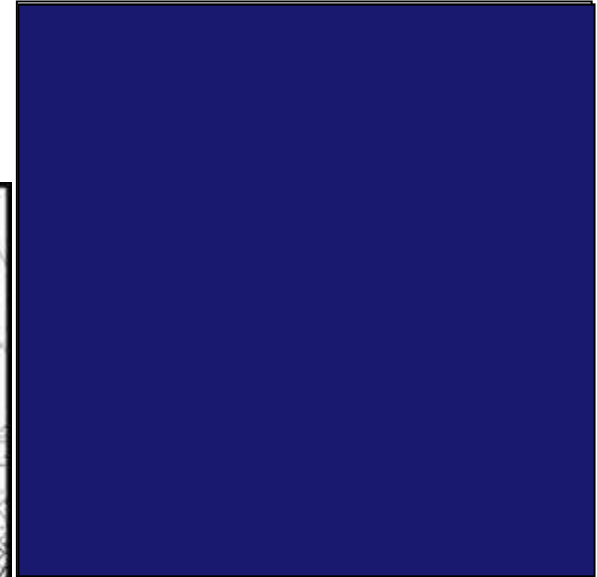




Preservation Statute

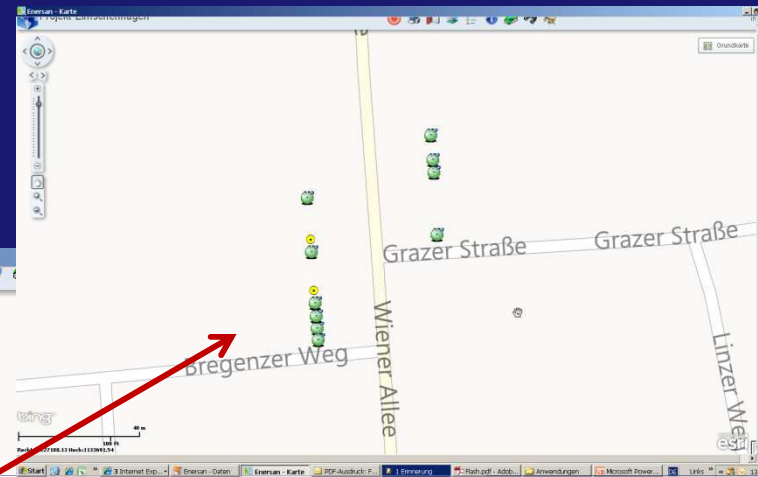
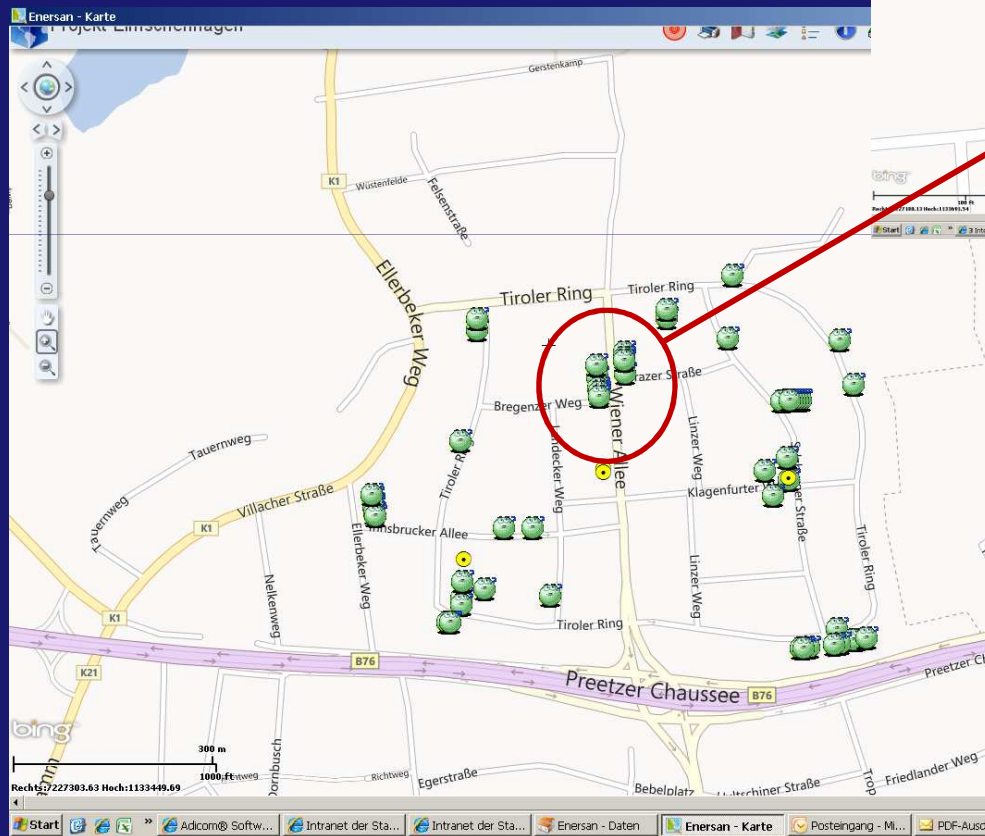


To obtain planning permission, the applicant must make a planning application.





Data Management



Enersan - Daten

Wiener Allee 87

Aktiv	AZ	Straße	Nr.	Zus.	Wgh	BeraterIn	Beratungs- datum	FA	Status erhob.	Status (%)
☐	1077-86	Tiroler Ring	86	1				☒	☐	-1
☐	1077-92	Tiroler Ring	92	1	Fiedler...			☒	☐	-1
☐	1077-92	Tiroler Ring	92	2				☒	☐	-1
☒	1077-95	Tiroler Ring	95	1	Harten...			☒	☐	-1
☐	1077-96	Tiroler Ring	96	1				☒	☐	-1
☒	1077-97	Tiroler Ring	97	1	Harten...			☒	☐	-1
☐	1159-10	Wiener Allee	101	1	Harten...		01.11.20...	☒	☐	-1
☒	1159-10	Wiener Allee	103	1	Fiedler...		22.11.20...	☒	☒	86
☐	1159-10	Wiener Allee	107	1	Harten...			☒	☐	-1
☐	1159-12	Wiener Allee	122	1			27.01.20...	☒	☐	-1
☐	1159-13	Wiener Allee	132	1				☒	☐	-1
☒	1159-13	Wiener Allee	134	1				☒	☐	-1
☐	1159-13	Wiener Allee	138	1				☒	☐	-1
☒	1159-47	Wiener Allee	47	1	Fiedler...		19.11.20...	☒	☒	57
☒	1159-49	Wiener Allee	49	1	Fiedler...		19.11.20...	☒	☒	46
☒	1159-87	Wiener Allee	87	1	Fiedler...			☒	☐	-1
☒	1159-87	Wiener Allee	87	2	Fiedler...			☒	☐	-1
☒	1159-89	Wiener Allee	89	1	Harten...		01.11.20...	☒	☐	-1

Gefunden:

☐ Aktiv
☐ AZ
☐ Adresse
☐ BeraterIn

Filter

☐ Förderantrag
☐ Maßnahme
☐ Bauteil
☒ Geographischer Filter

Energetischer Status

Bauteil	Baujahr	Wert
*		

Geplante Maßnahmen

Art	FA Eingang	Bew.	Betrag	Auszahlung
Vordämmung	20.10.2012	☐		
*				



Co₂olBricks



Baltic Sea Region
Programme 2007-2013



Results (Mai 2013):

103 owners of row houses have been consulted
66 owners have carried out some energy saving measures
3 appartmen buildings (30 appartments each)
where totally refurbished by Frank ECOzwei

360.000 kWh per year energy saving of natural gas
72 tons per year CO₂- reduction



Energy Consultancy

Aims of energy consultancy for buildings

- Provide an energy refurbishment concept as a decision making support for architects and house owners
- Identifying ecologically worthwhile measures
- Identifying economically worthwhile measures
- Identifying eligible measures

Steps of energy consultancy for buildings

- Analysing the energetic quality of the building
- Analysing the heating system and the warm water system
- Calculating the energy losses and energy demand of the building
- Making energetic refurbishment proposals
- Calculating the cost effectiveness of measures
- Helping to find financing alternatives and support programmes

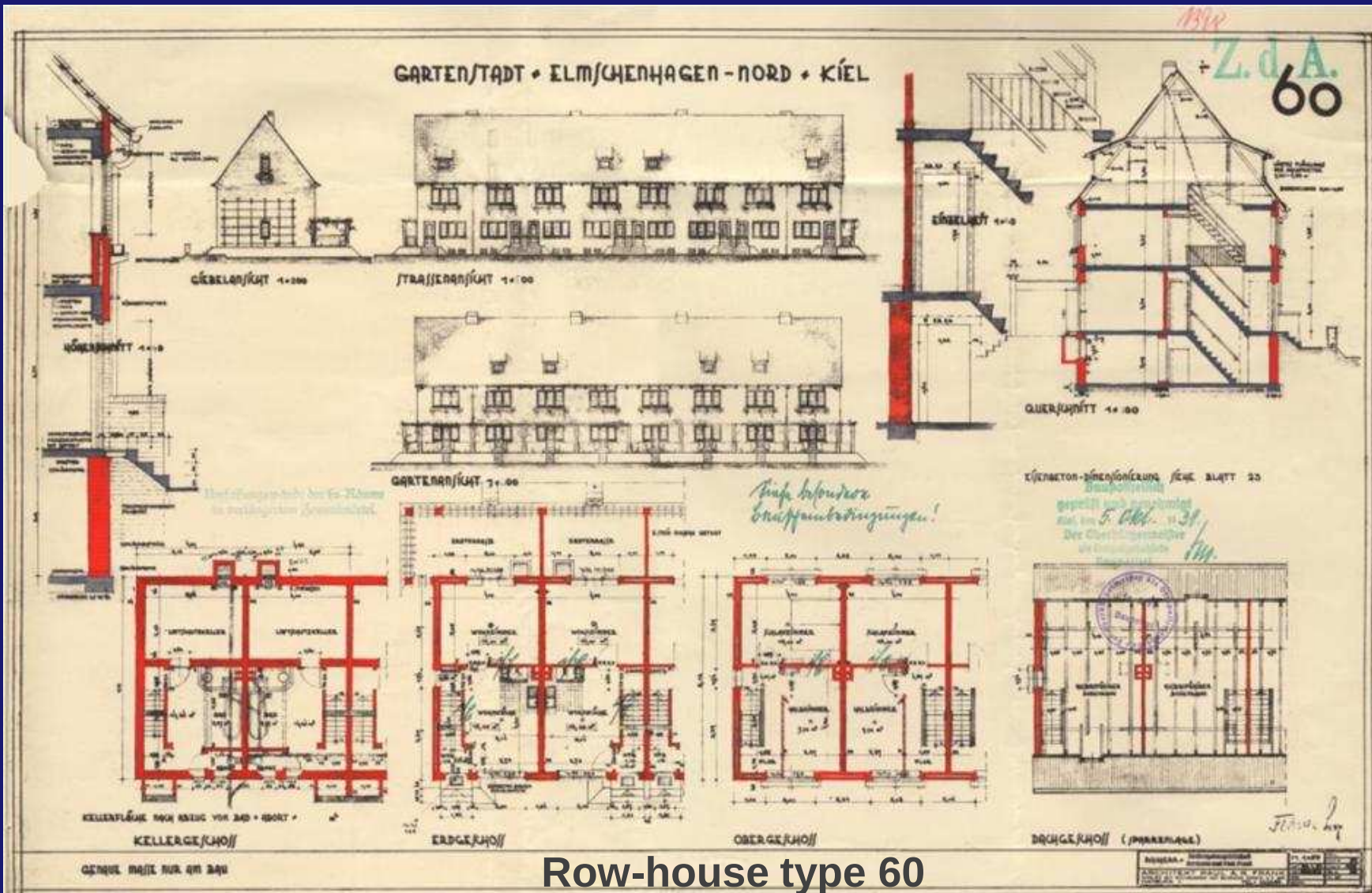


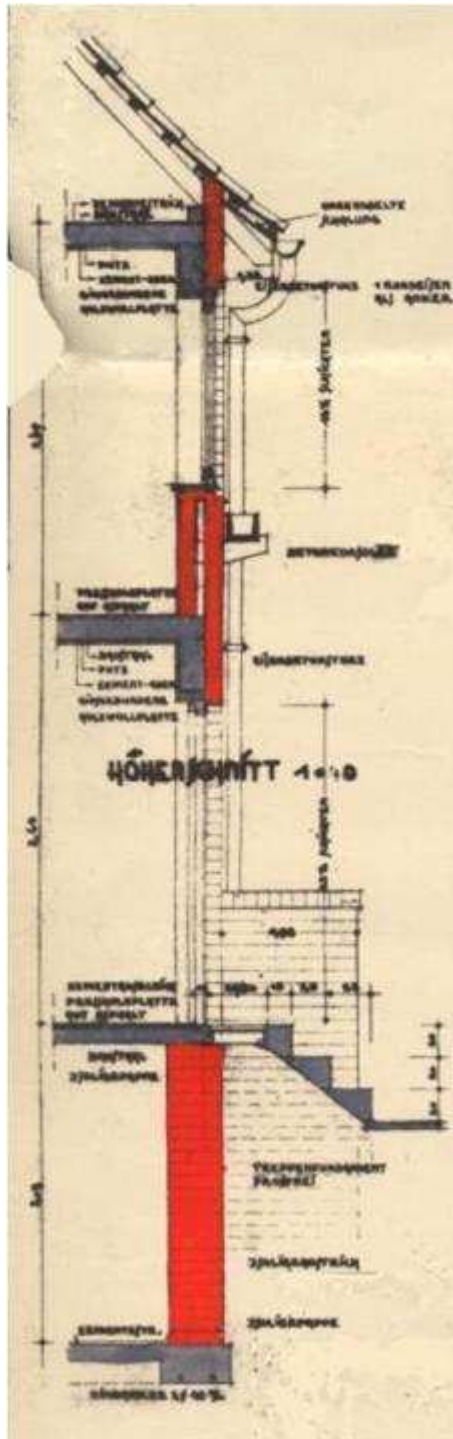
Model refurbishment concept



Dipl.-Ing. Thomas Hahn
Dipl.-Ing. Stefan Saleh
Dipl.-Ing. Jasper Harten







Basic structure of the buildings

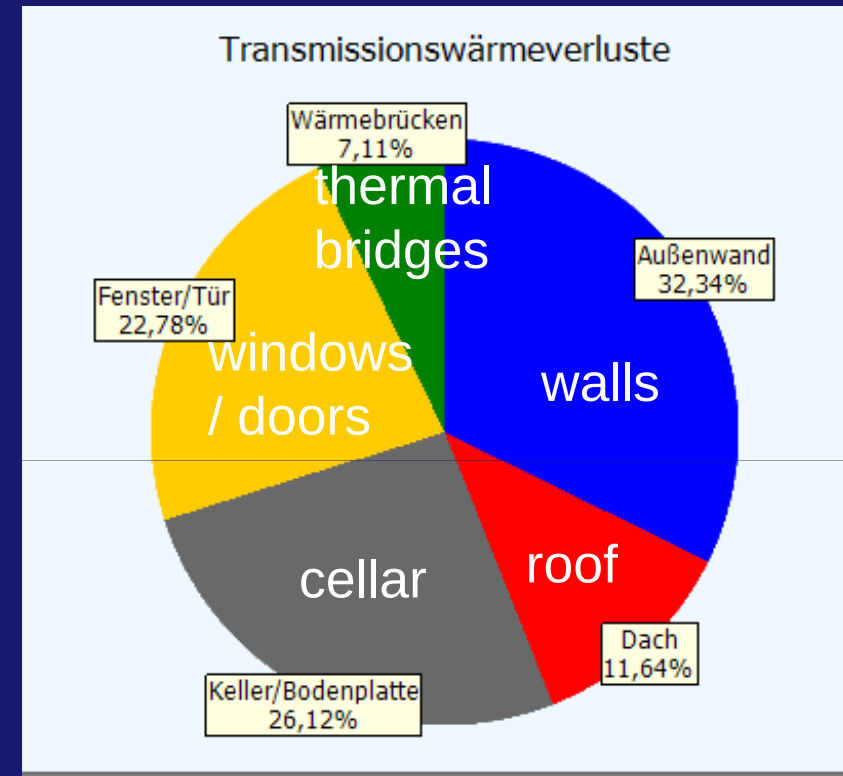
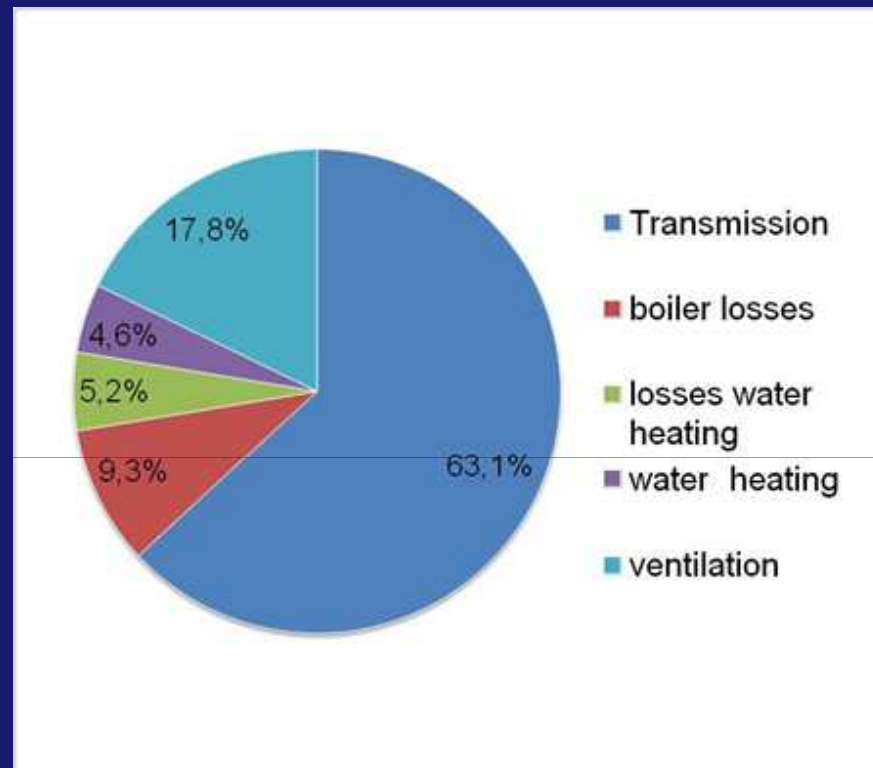
Purlin roof originally not with finished attic

Cavity wall
outside 11 cm brick,
inside 11 cm sand-lime brick
about 6 cm cavity

Basement wall approx. 34 cm

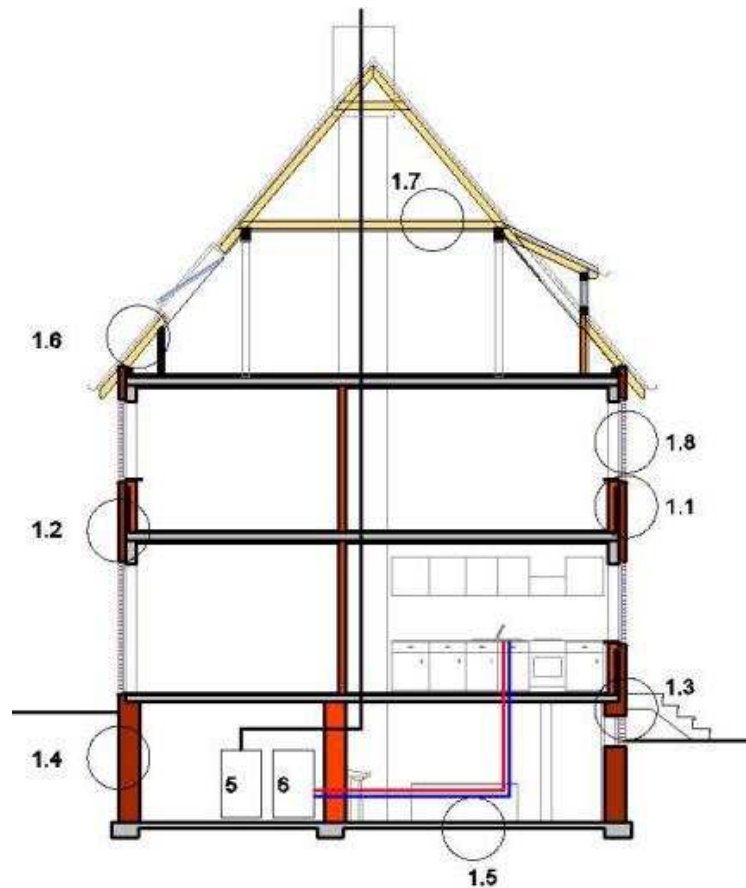
Basement height approx. 1.96 cm

Bottom plate approx. 10 cm concrete



Heat loss through the wall approx. 1/3

Heat loss through wall bottom-plate of the basement approx. 1/4



Measures for the energy efficient refurbishment

Nr.	Material / Bauteil	Sollwert EnEV 2009	Bestand IST	Sanierung NEU
1.1	Außenwand,	$U = 0,24 \text{ W/(m}^2 \cdot \text{K)}$	1,80	0,46
1.2	Außenwand Sturz / Geschoßdecke	$U = 0,24 \text{ W/(m}^2 \cdot \text{K)}$	1,90	0,65
1.3	Außenwand Sockelzone	$U = 0,24 \text{ W/(m}^2 \cdot \text{K)}$	1,55	0,25
1.4	Kelleraußenwand gegen Erdreich	$U = 0,30 \text{ W/(m}^2 \cdot \text{K)}$	1,55	0,25
1.5	Bodenplatte gegen Erdreich,	$U = 0,30 \text{ W/(m}^2 \cdot \text{K)}$	3,77	0,25
1.6	Dach	$U = 0,24 \text{ W/(m}^2 \cdot \text{K)}$	~ 0,70	0,22
1.7	Dach, oberste Geschossdecke,	$U = 0,24 \text{ W/(m}^2 \cdot \text{K)}$	~ 0,70	0,20
1.8	Fenster, Fenstertüren	$U_w = 1,30 \text{ W/(m}^2 \cdot \text{K)}$	~ 3,00	1,30 / 0,87
5	Heizungsanlage	Gesonderte Betrachtung		
6	Anlage zur Warmwasserbereitung	Gesonderte Betrachtung		



Refurbishment of 12 apartments

- Cavity wall insulation reduces the energy consumption by 12 %
- Insulation of the whole outer surface (wall, roof, windows) reduces the heating load by 54 %.
- Each apartment needs less than 5 kW.
- A central heating system would be more efficient.



Cavity wall insulation



With compressed air the insulating material is blown into the cavity through a hose from the outside of the house.





Cavity wall insulation

Concerning cavity wall insulation special attention must be paid to walls that are not in good condition and that are regularly exposed to wind-driven rain.

Standards and guidelines for repairing joints, replacing bricks and applying water repellents correctly have to be developed in order to securely prevent rainwater from penetrating the outside wall and make the insulation damp.

Cavity wall insulation

In this case it is necessary to repair the mortar joints.



If the walls of the building are not in good condition, rainwater can penetrate the outside wall and make the insulation (and the inside of the house) damp. The façade should be in good state of repair before cavity wall insulation is installed.

Cavity wall insulation

- Endoscope Inspection of the cavity
- Inspection of Facade, Bricks and Joints



Cavity wall insulation - Endoscope Inspection



**The wall anchor is
in good condition**

Drilling, blowing, pressure measurement



ohne Kerndämmung

mit Kerndämmung

Landes-
hauptstadt Kiel



Cavity wall insulation – thermal bridges

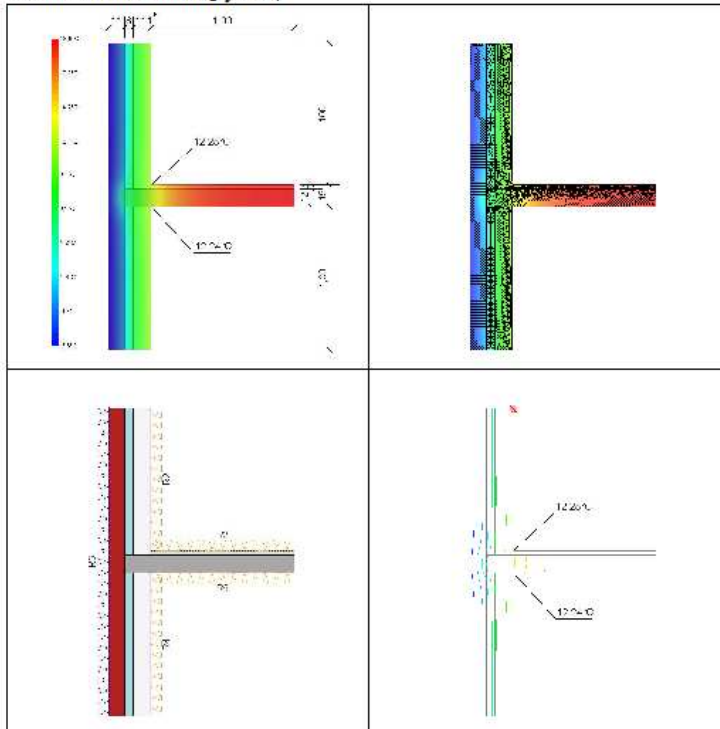
without cavity wall insulation

with cavity wall insulation

Bauvorhaben: Bestand

Datum: 24.3.2013

Wärmebrückenberechnung (f-Wert)



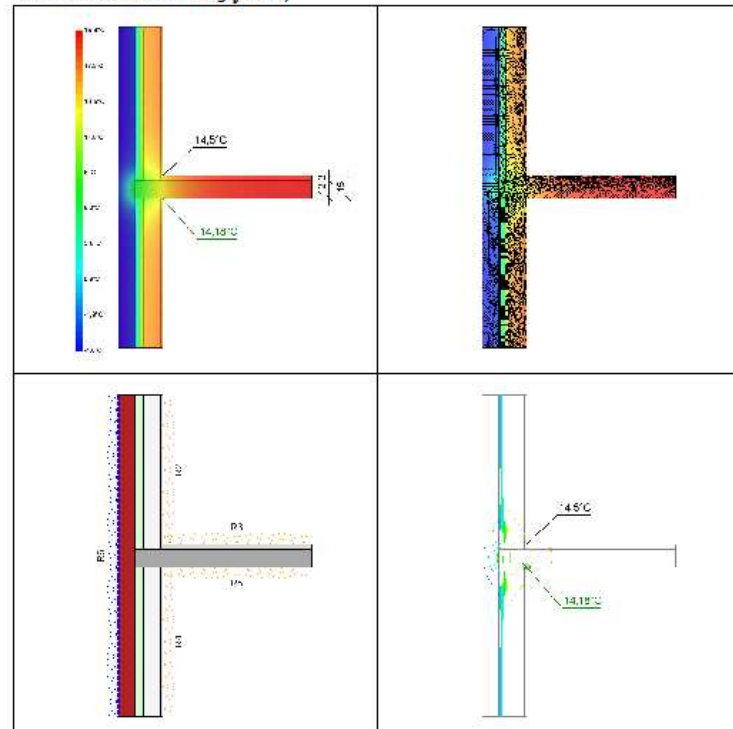
Mindestwärmeschutz nach DIN 4108-2 ist nicht erfüllt.

$f_{RSI} = 0,66 < 0,70$

Bauvorhaben: Sanierung

Datum: 24.3.2013

Wärmebrückenberechnung (f-Wert)



Mindestwärmeschutz nach DIN 4108-2 ist erfüllt.

$f_{RSI} = 0,77 > 0,70$

 FLIR

thermal image

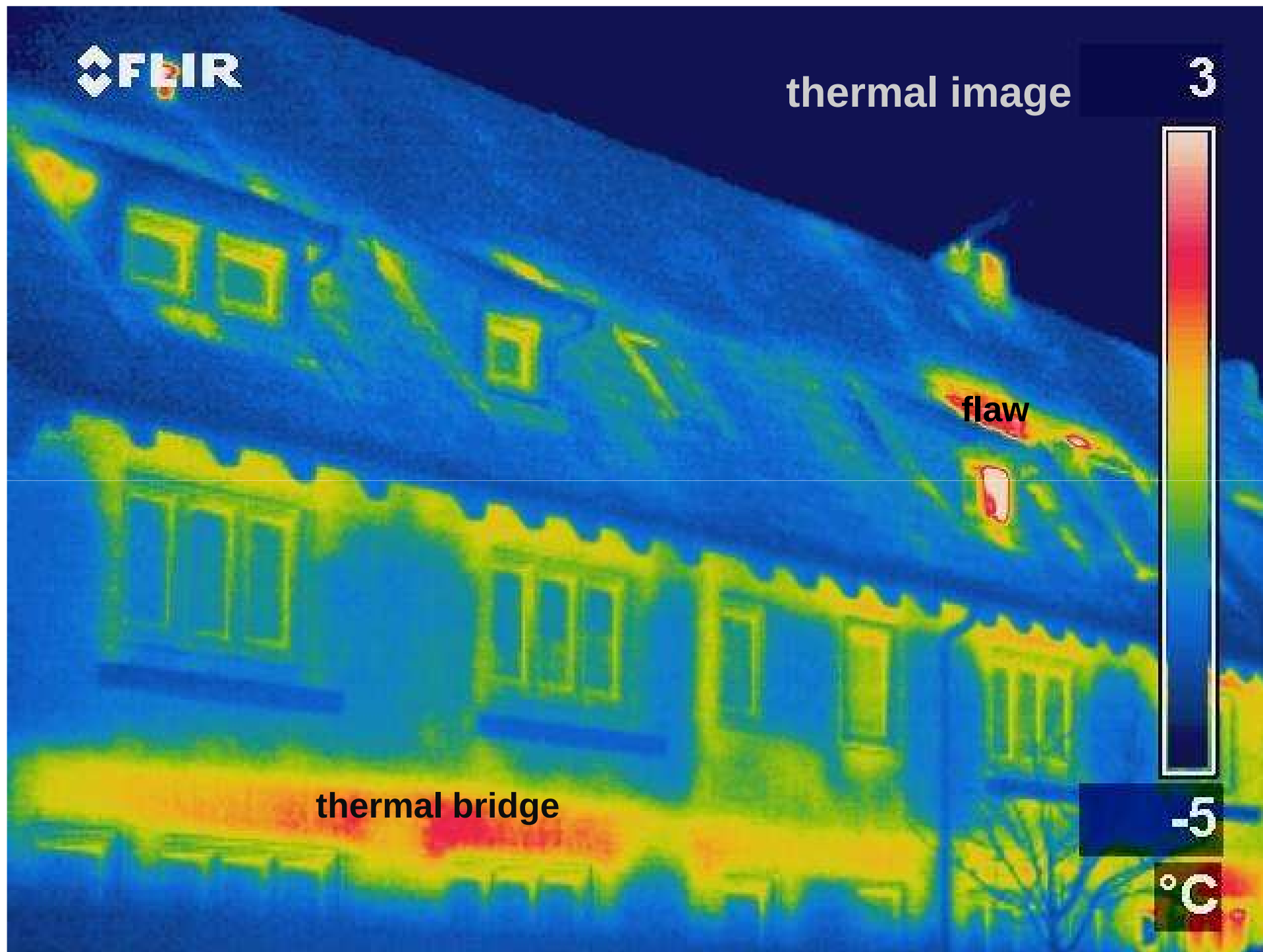
3

flaw

thermal bridge

-5

°C





thermal image

3

cavity wall
insulation

new window

design-dependent thermal
bridge, cover and lintel

non-insulated
wall

old window

°C

-5



thermal image

5

no insulation

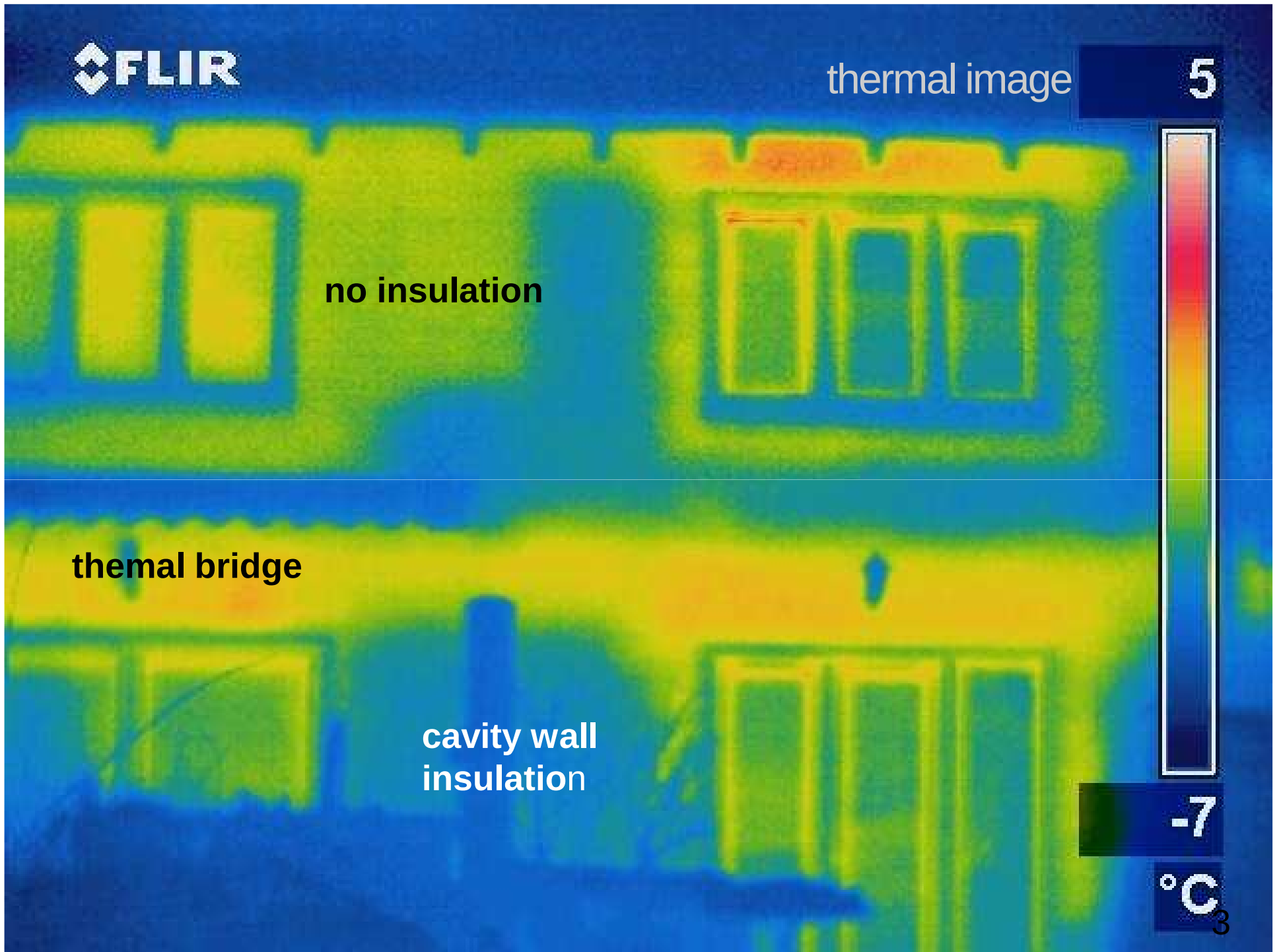
thermal bridge

cavity wall
insulation

-7

°C

3





Cavity wall insulation

Ellerbeker Weg 20 – 26

8 apartments

Measures:

New entrance doors, U-Factor: 0,90 W/m²K

Cavity wall insulation

Material polystyrene HK 35, hydrophob

Water vapor diffusion resistance $\mu = 5$

Thermal conductivity: $\lambda = 0.034$ W/mK

Thickness of insulation = cavity 6 - 7 cm

Energy savings approx. 14 %

Investment approx. 8.000 €

Repayment time approx. 5 years



Cavity wall insulation - results

- Preservation of the brick facade is possible
- Very cheap energy saving measure:
1.000 € / 2.000 € middle / end house
- Good energy saving potential (12% row house)
- Reduction of thermal bridges
- More living comfort: higher wall temperatures
+ 5,4 K
- No moisture transport through insulating material
- No change of vapor diffusion properties of the wall
- Quality control with thermal imaging possible

„Heizungs – EKG“ ECG for the Heating System



Measuring the Performance of the Heating System with a monitoring system.

- measuring the temperatures of the heating system and warm water system
- measuring the runtime of the heater

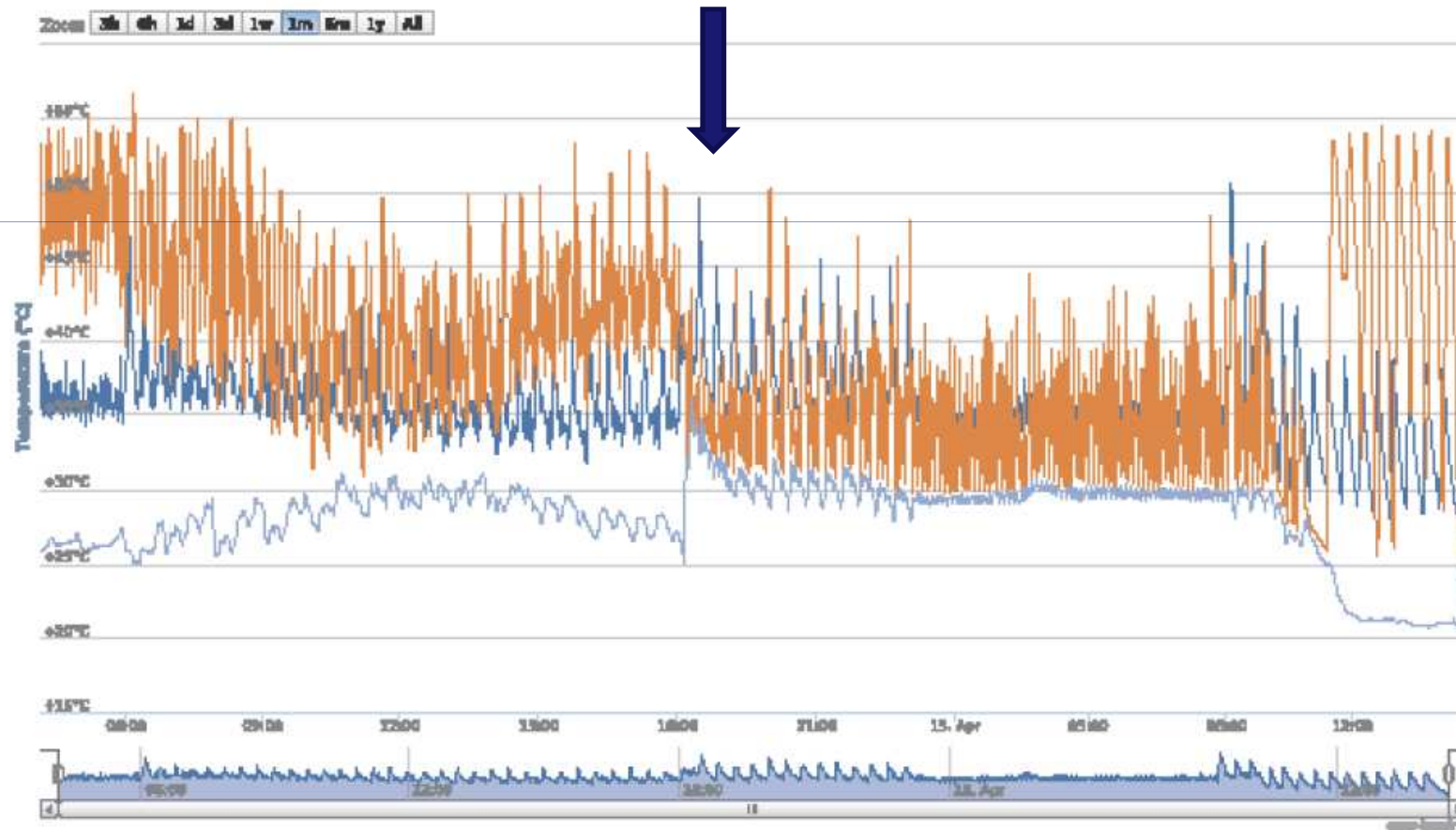




Elsterbauer Weg 22b

— **Algen** — VL = Speicherschwung — SL = Speicherleitung — VStrommeter = Stromzähl — Antriebsmotor — VL = Meldeleitung — RL = Meldeleitung

Hydraulic Balancing

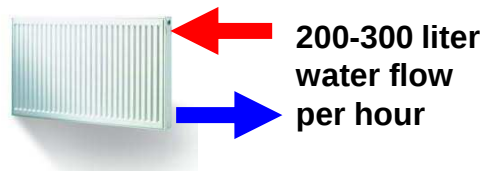


Hydraulic balancing of the Heating System

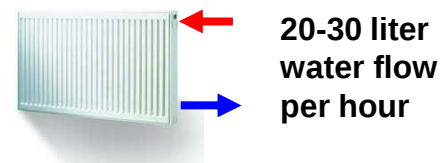
The KfW-funding demands hydraulic balancing of the heating system, when the heat-demand of the house has been reduced by more than 25 %.

Hydraulic balancing can be achieved by pre-setting the flow of water through the radiators.

Before Hydraulic Balancing

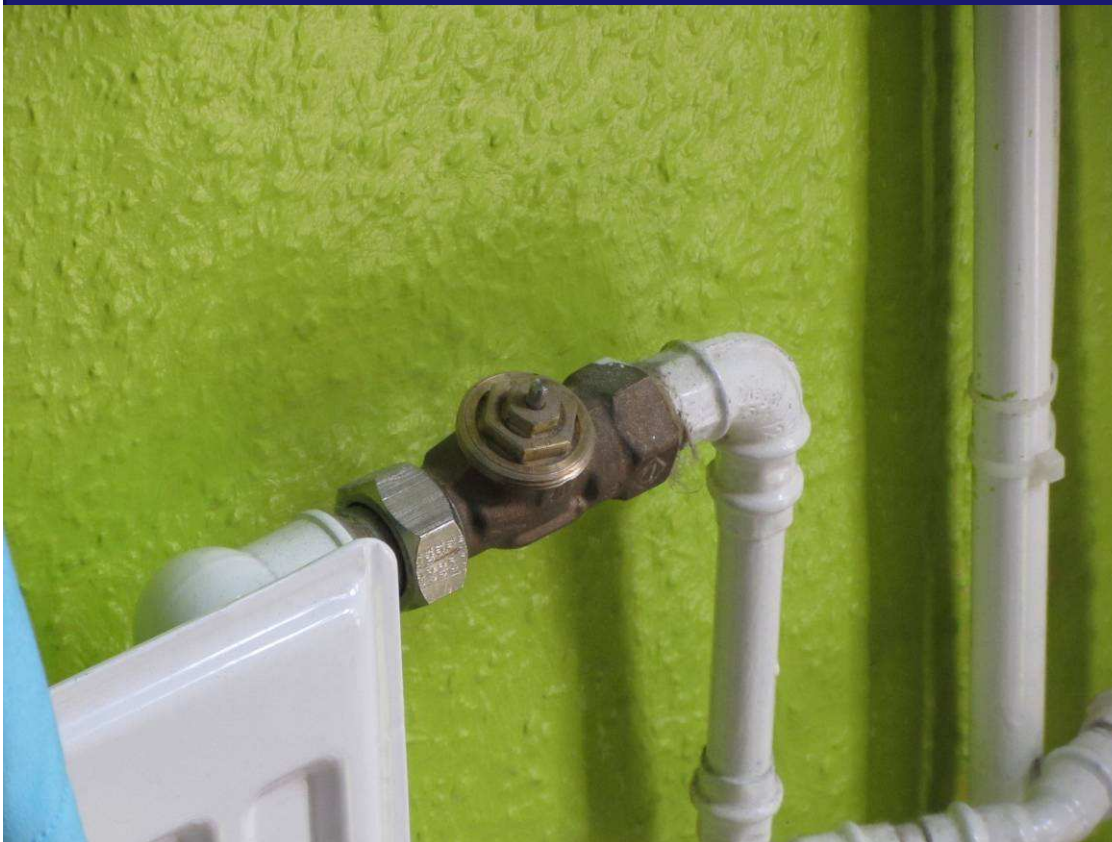


After Hydraulic Balancing



Installation of new thermostats

Installation of pre-adjustable flow limiting valves



Finding the
right settings
for the
thermostats.

Thermostatkopf auf 5 stellen
und 24 Stunden warten.



Der
Raum ist
zu warm!

Thermostatkopf auf 4 stellen
und 24 Stunden warten.



Der
Raum ist
zu warm!

Thermostatkopf auf 3 stellen
und 24 Stunden warten.



Einstellung gefunden

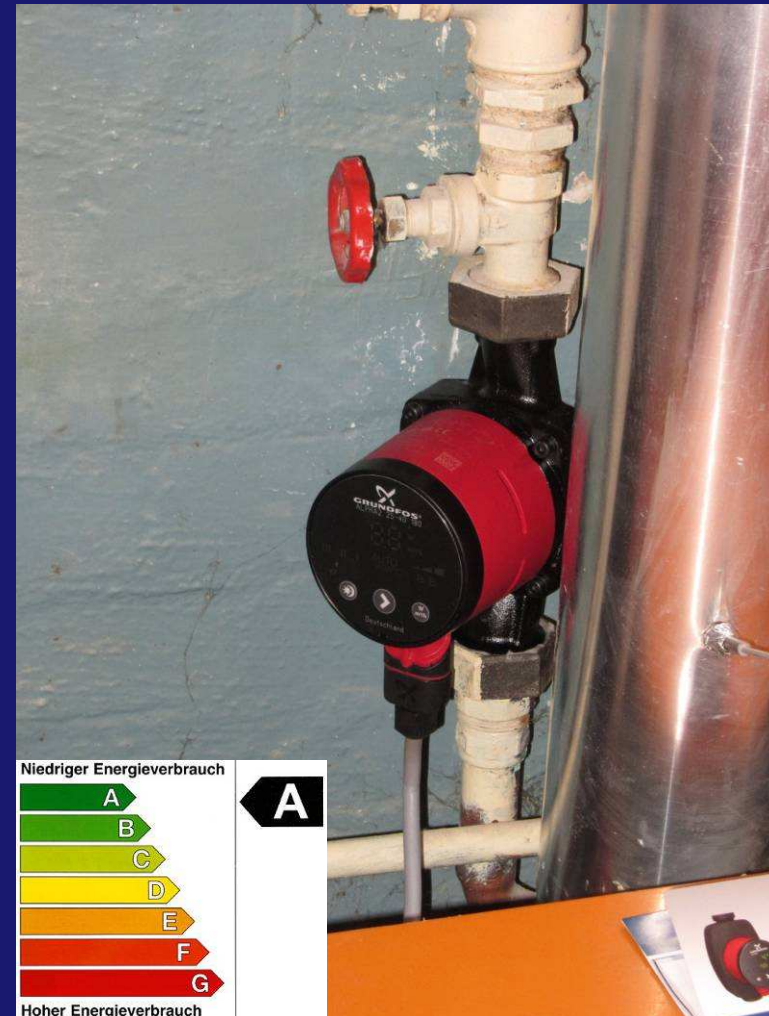


Installation of pressure-controlled efficiency pumps

The Grundfos ALPHA2 is an A-labelled circulator and the winner of 2 Energy+ Awards for being Europe's most efficient domestic circulator.

Thanks to its pressure-controlled operation, Grundfos ALPHA2 can run on as little as 5 watts.

The pump allows to match its performance to the system requirements and the actual heat-demand.





Results

Ein Mustersanierungskonzept fasst Aspekte der Gestaltung, der Modernisierung und der energetischen Optimierung zusammen und ist ein geeignetes Mittel, um Eigentümer, Architekten und Handwerker zu beraten.

Eine unabhängige Energieberatung ist für eine energieoptimierte Sanierung erforderlich. Sie wird in Deutschland vom Staat gefördert.

Die nachträgliche Kerndämmung von zweischaligem Mauerwerk ist ein kostengünstiges und wirtschaftliches Verfahren.

Vor einer Kerndämmung muss die Fassade auf Schäden untersucht werden. Eine Stein- und Fugensanierung kann – insbesondere bei Wetter exponierten Wänden – erforderlich sein.

Nach einer wärmetechnischen Sanierung und nach Einbau einer neuen Brennwert-Heizungsanlage muss ein hydraulischer Abgleich erfolgen.



Results

The model refurbishment concept combines aspects of design, refurbishment and energy optimization. It is an adequate means to consult owners, architects and craftsmen

An independent consultation is necessary to achieve energy optimized refurbishments. In Germany public funding is provided

The subsequent cavity wall insulation in double wall masonry construction is a cost-efficient/competitive and economic procedure.

Before insulation the cavity the façade needs to be examined for damage, brick and joint repairwork can be required, especially for weather exposed elevations.

After installing thermal insulation and condensing boiler system a hydraulic assumption for the heating-watersystem should be executed.



Landeshauptstadt Kiel
Umweltschutzamt

