

Bilfinger Bauperformance GmbH

# Identifying Energy Saving Potentials in Buildings by Energy and System Monitoring

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September, 25<sup>th</sup> 2013

- Introduction
- Energy and System Monitoring
- Sample Projects
- Summary

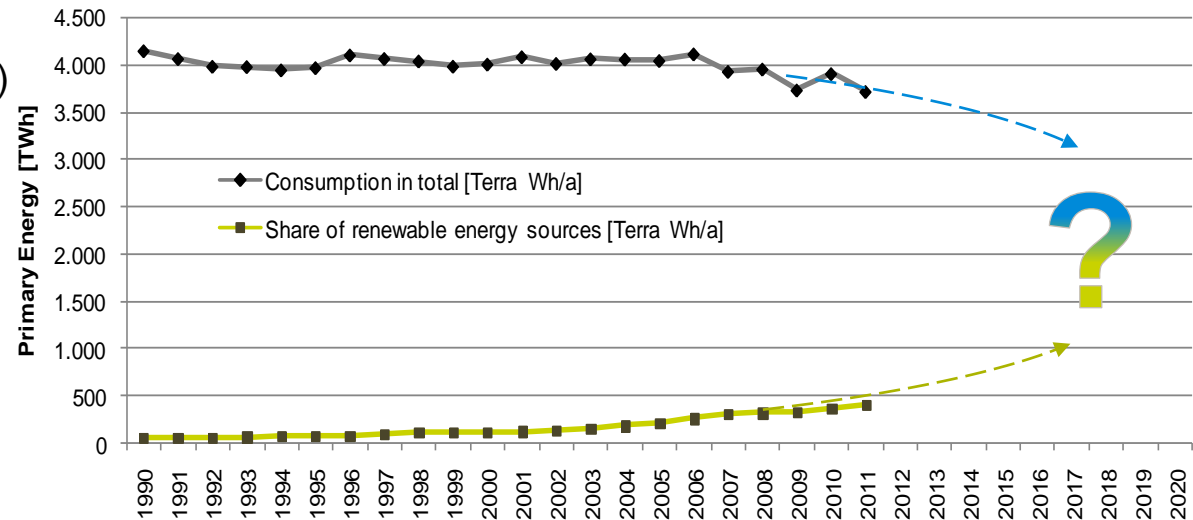
### Climate Protection Goals of EU till 2020

- 20-20-20:  
20% Reduction of CO<sub>2</sub>-emission (adv. 2008)  
20% Descent of energy consumption  
20% Increase of renewable energy sources

### Measures

- EnEV 2014 and 2016 each with 12.5% tightening compared to present EnEV
- Renewable Energies Act
- Renewable Thermal Energies Act
- Financial promotion programme ...

### Trend of annual primary energy consumption in Germany



Source: AGEB BMWi 2012

# Introduction

## Situation Existing Buildings

### POTENTIALS

- **40 million** housing units, thereof **75%** erected before 1979
- Buildings of the 50ies to 70ies (approx. **35% of building stock**) pass through their first renovation cycle in the **next 10 years**
- About **1/3** of all boilers in Germany are older than **20 years**
- More than **80%** of all heating systems in Germany are oversized and / or are not correctly adjusted
- Energetic inspections are insufficiently carried out

### OBSTACLES

- Economic inefficiency of measures
- Existing systems „are still working“
- Different scopes of interest of owner and tenant
- Effect of utilisation / interruption of business
- Confusing variability and complexity of system variants and legal requirements
- Uncertainty referring to financial support, tax depreciation and feed-in tariffs (e.g. photovoltaic)

**Problem : Renovation rate only 1% p. a.**

**Solution : Awakening willingness to invest instead of pressure towards renovation!**

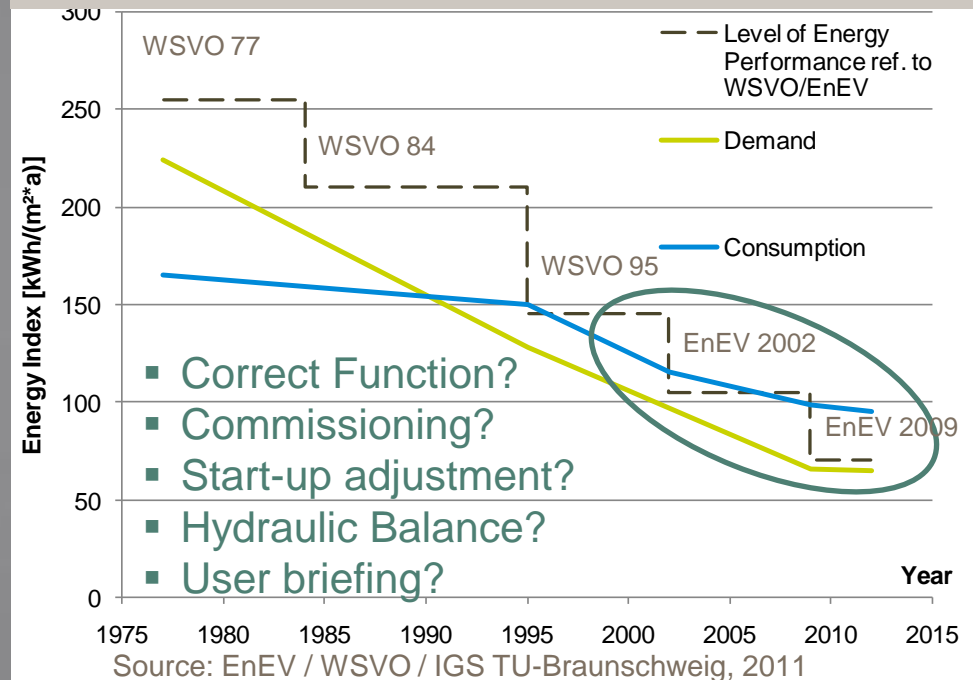
# Introduction

## Situation New Buildings

### CLAIM

- From low-energy house standard to net plus energy house
- Extensive energy design and simulation during planning phase
- Complex energy supply systems with high percentage of renewable energy sources
- Smart grid and networked building automation for metering, control and switching
- Demands change due to variable business and operation processes

### REALITY

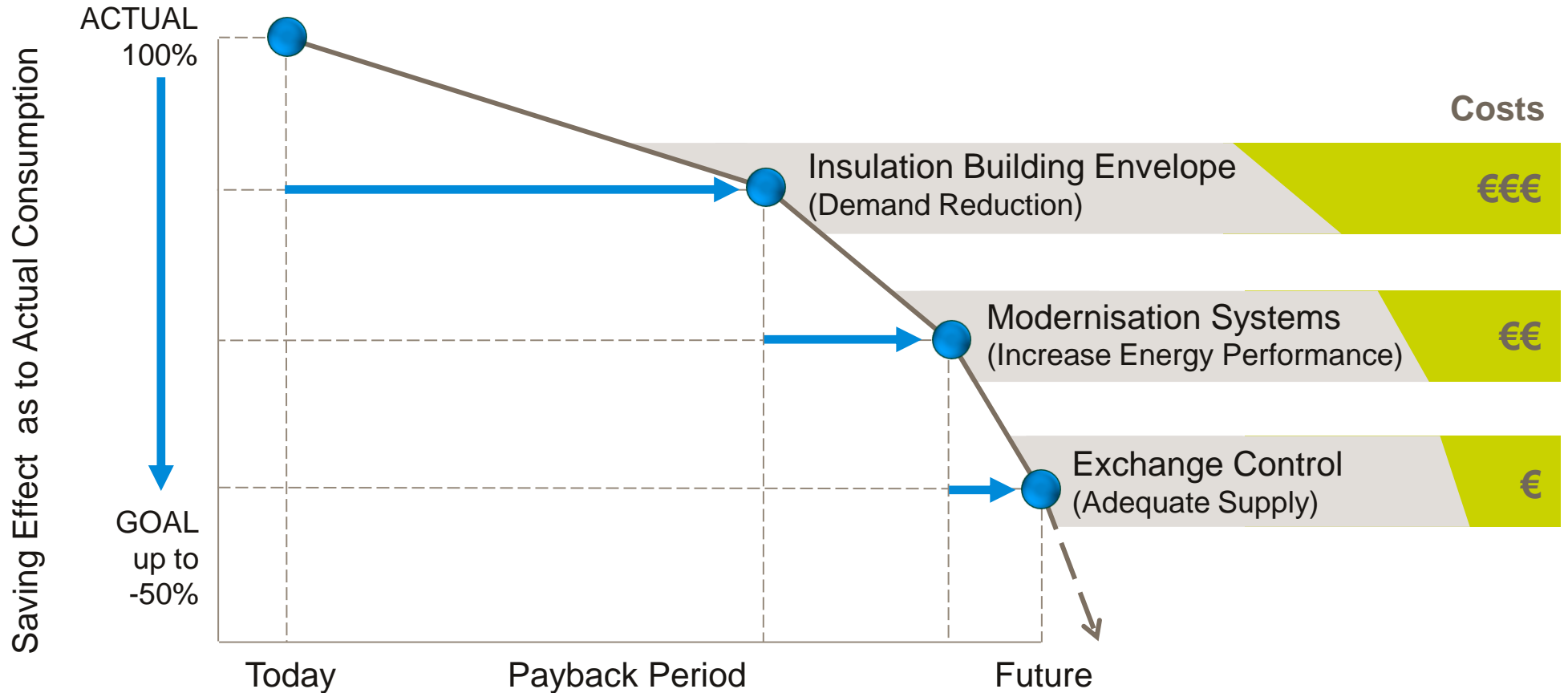


**Problem : Design requirements are not realised, nonconformance of buildings**  
**Solution : Energetical optimisation by precise adjusting of system parameter settings!**

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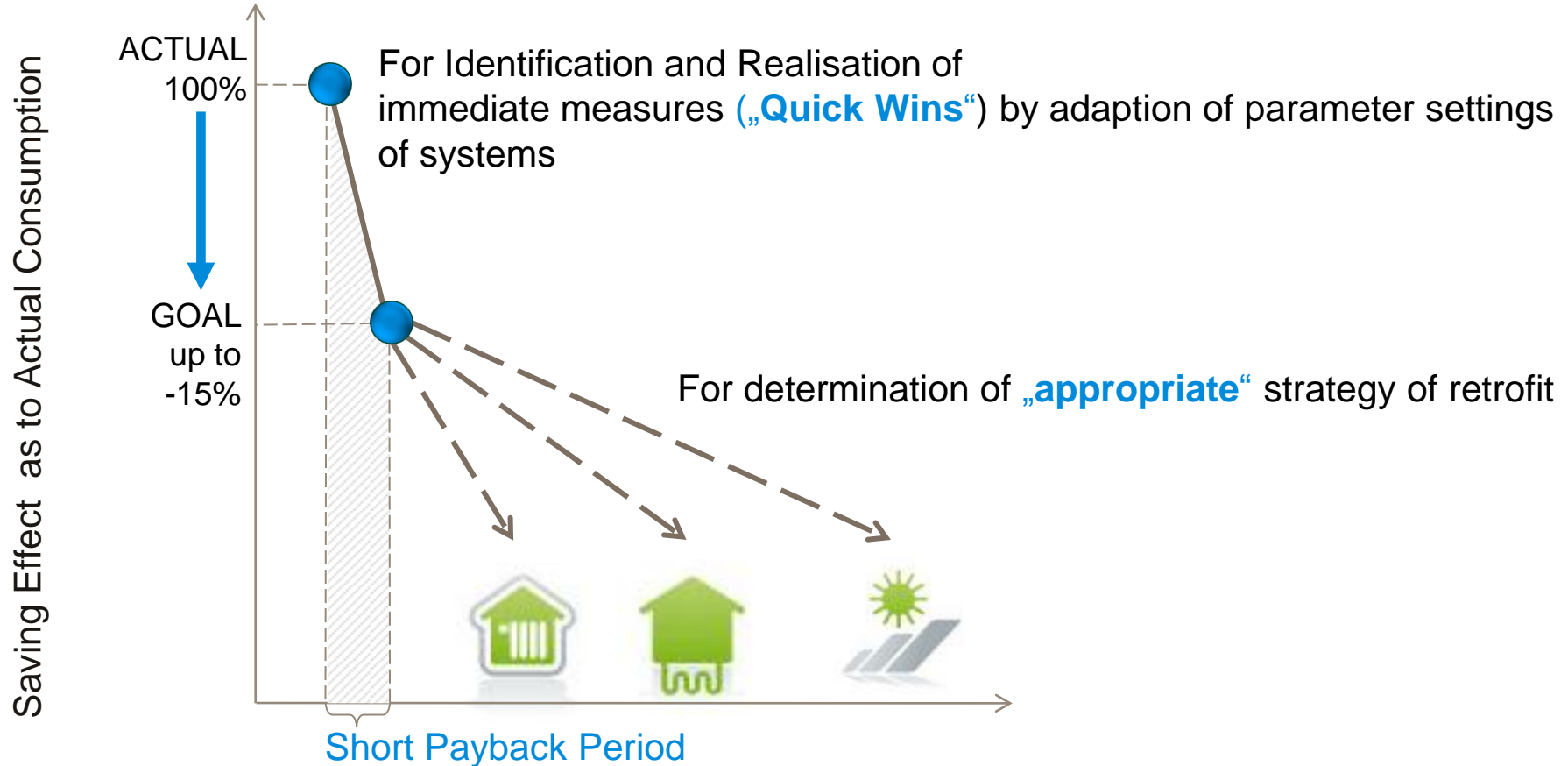
# Energy and System Monitoring

## Usual Steps for Energetical Retrofit of Existing Buildings



# Energy and System Monitoring

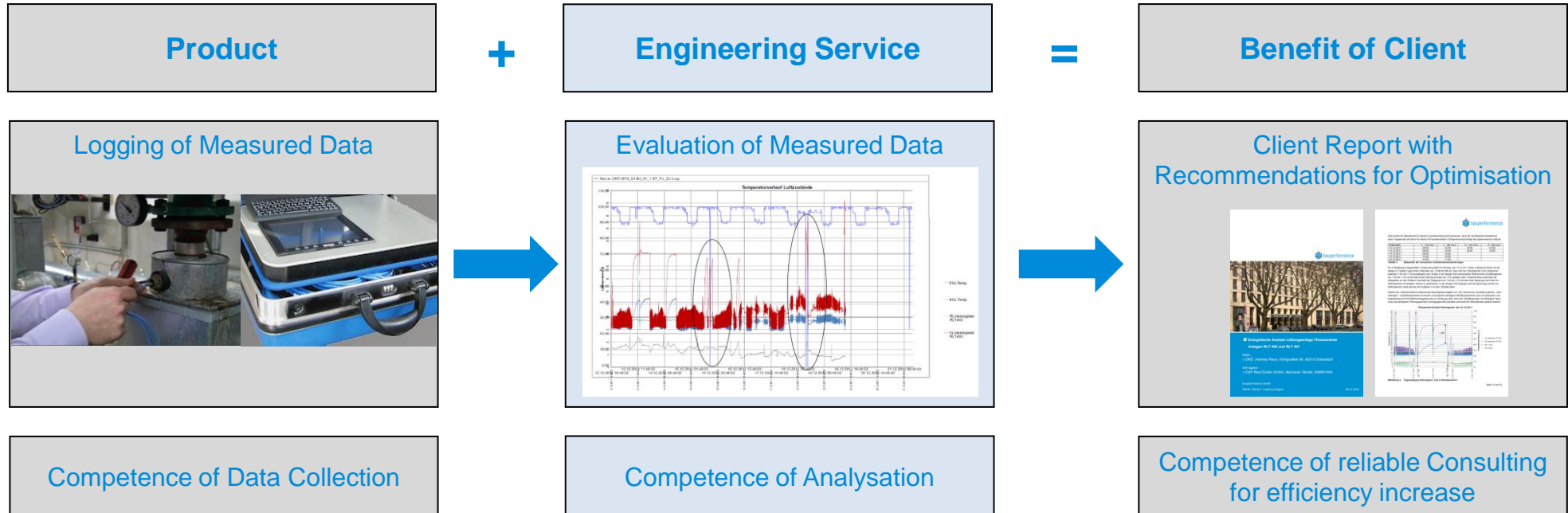
## Our Approach: Generation of Quick Wins in Existing Buildings





# Energy and System Monitoring

## Own Innovation and Development



# Energy and System Monitoring

## Procedure and Analysis Process

### Data Acquisition

- Metering instruments with cable and radio based sensors
- Logging of operation mode and system behavior during a period of 1-3 weeks by „monitoring suitcase“ on site
- Daily transfer of data for verification by remote access

### Analysis

- Evaluation of collected data for identification of effective savings and improvement potentials
- Transparency of daily profiles and percentages of specific energy consumer

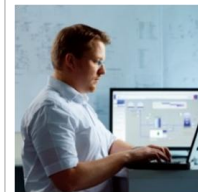
### Results

- Client report with presentation of saving strategy
- Realisation and result checking of measures

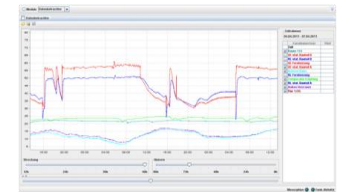
Clarification scopes and tasks with customer



Temporary measurement at systems during operation  
Instruments in suitcase



Supervision, verification and analysis of daily recorded monitoring data



Building performance



Realisation of recommended measures, and revision of savings

Evaluation of measured data of system operation within transparent customer reports



# Energy and System Monitoring

## Application: Existing Buildings

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- Situation:  
Old "analog controller" provide  
no data basis for optimisation

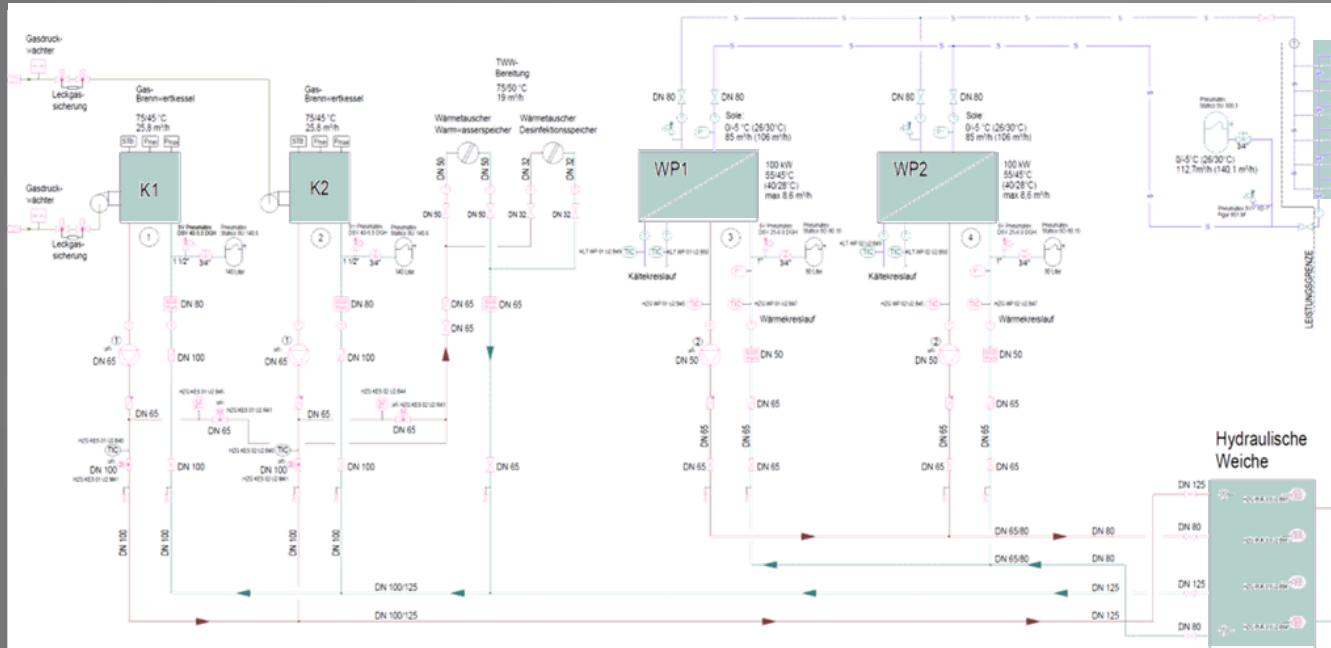


- Our metering and analysis  
make energy flows visible

**Only measured data is subject of  
directed optimisation**

# Energy and System Monitoring

## Application: New Buildings



- Example:  
Heating system with multiple heat generators in combination

- Situation:  
Complex system composition with parameter settings only according to design specifications



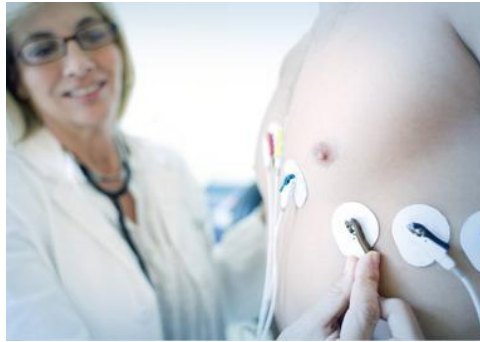
- Our metering and analysis check and optimise existing system parameters

**Exclusively, the understanding of system operation enables to optimise it!**

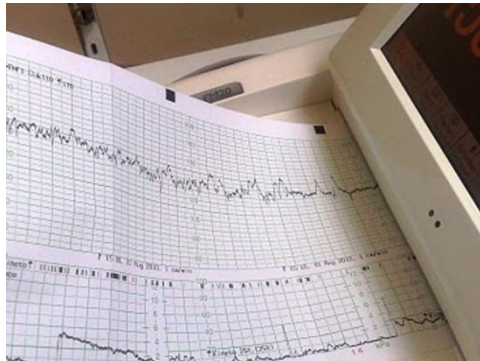
# Energy and System Monitoring

## Real Estate "Health-Check"

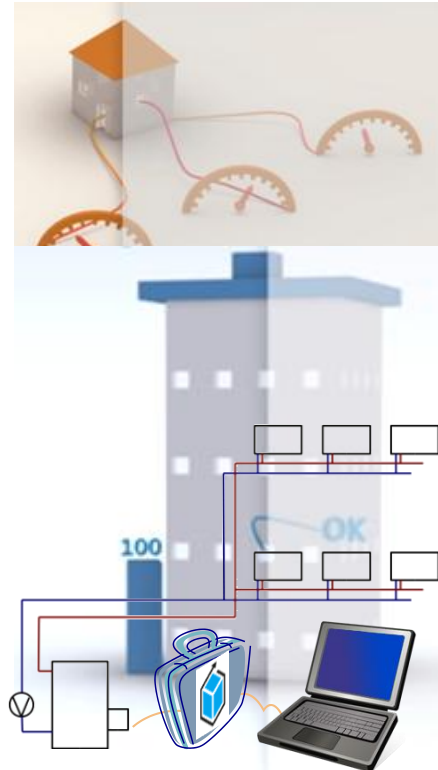
### HUMAN



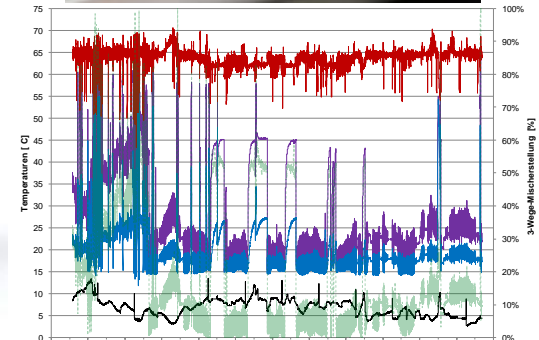
**Examination  
before Healing**



### REAL ESTATES



**Measurement  
before Saving**



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# Sample Projects

Generally: Decisions and Savings by Temporary Monitoring



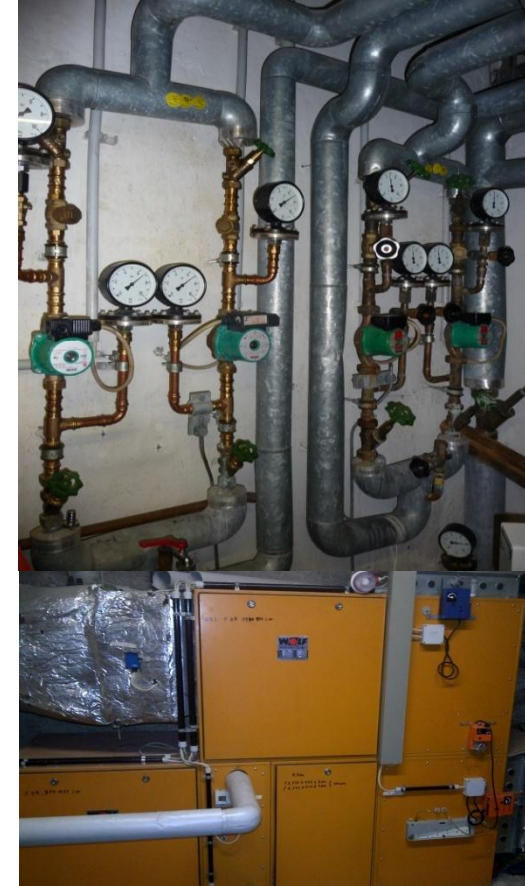
Sustain



Retrofit

Exchange

Adjustment



# Sample Projects

## 1. Temporary Monitoring Kindergarden Neckar Promenade (1)



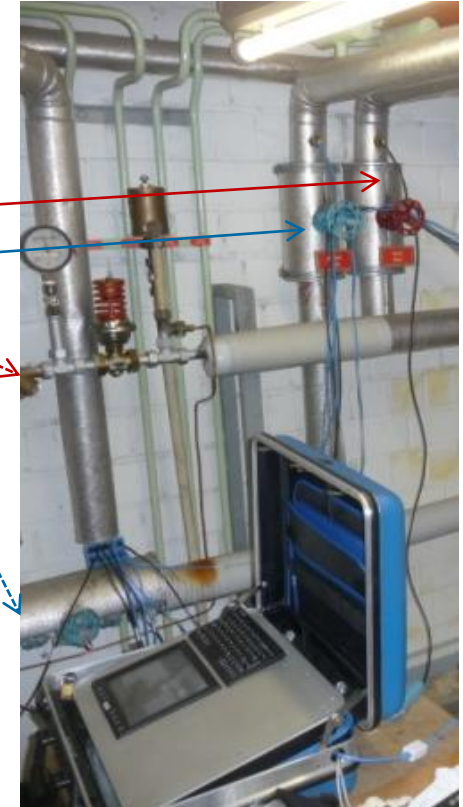
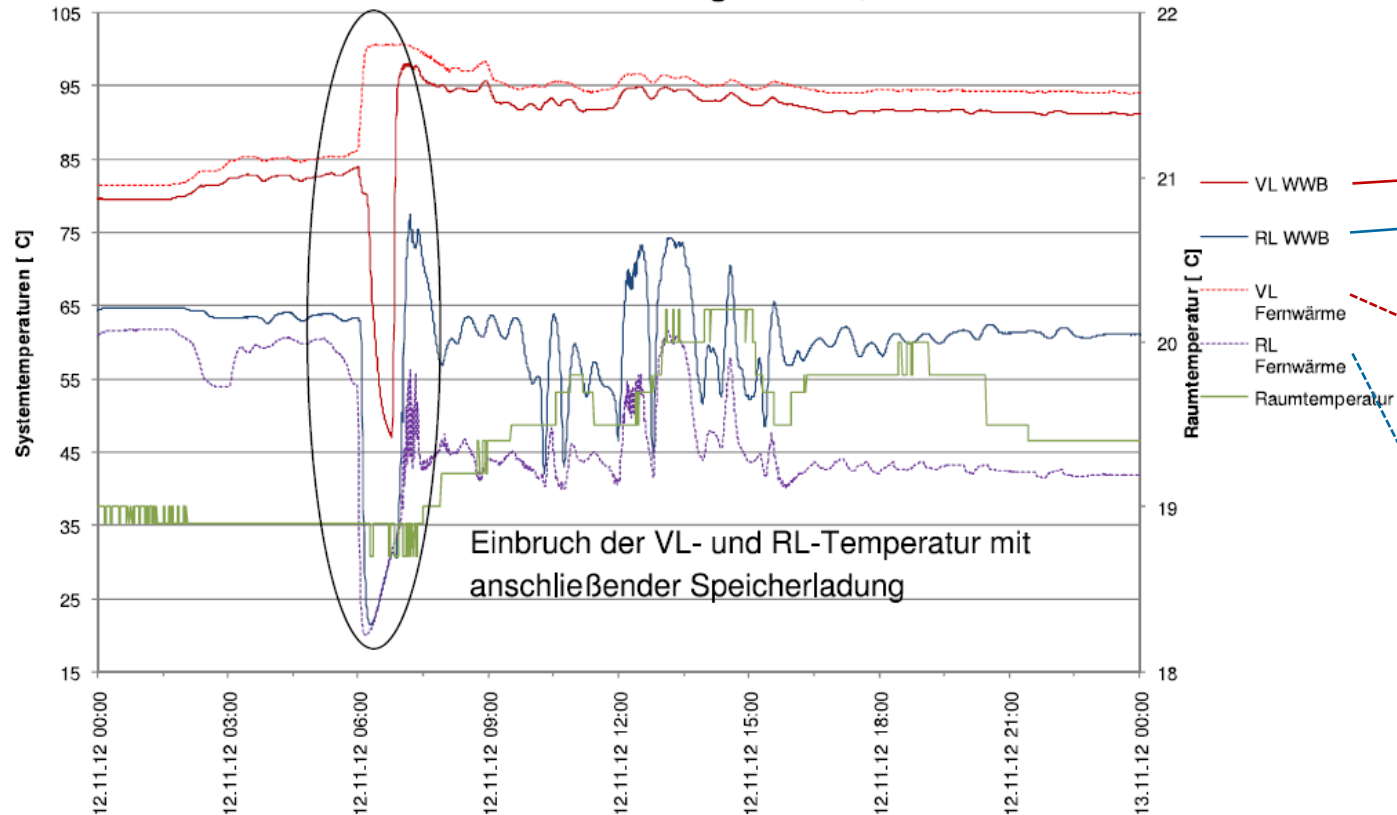
- Pro-active replacement of circulation pumps by high-efficiency pumps
- Nonreturn valve in piping for hot water system due to fail-circulation
- Adoption of heating control function (safety temperature limit – kids protection)
- Check of further reduction of connected load of district heat
- Savings. approx. 13%



# Sample Projects

## 1. Temporary Monitoring Kindergarten Neckar Promenade (2)

### Warmwasserbereitung am Mo., 12.11.2012



# Sample Projects

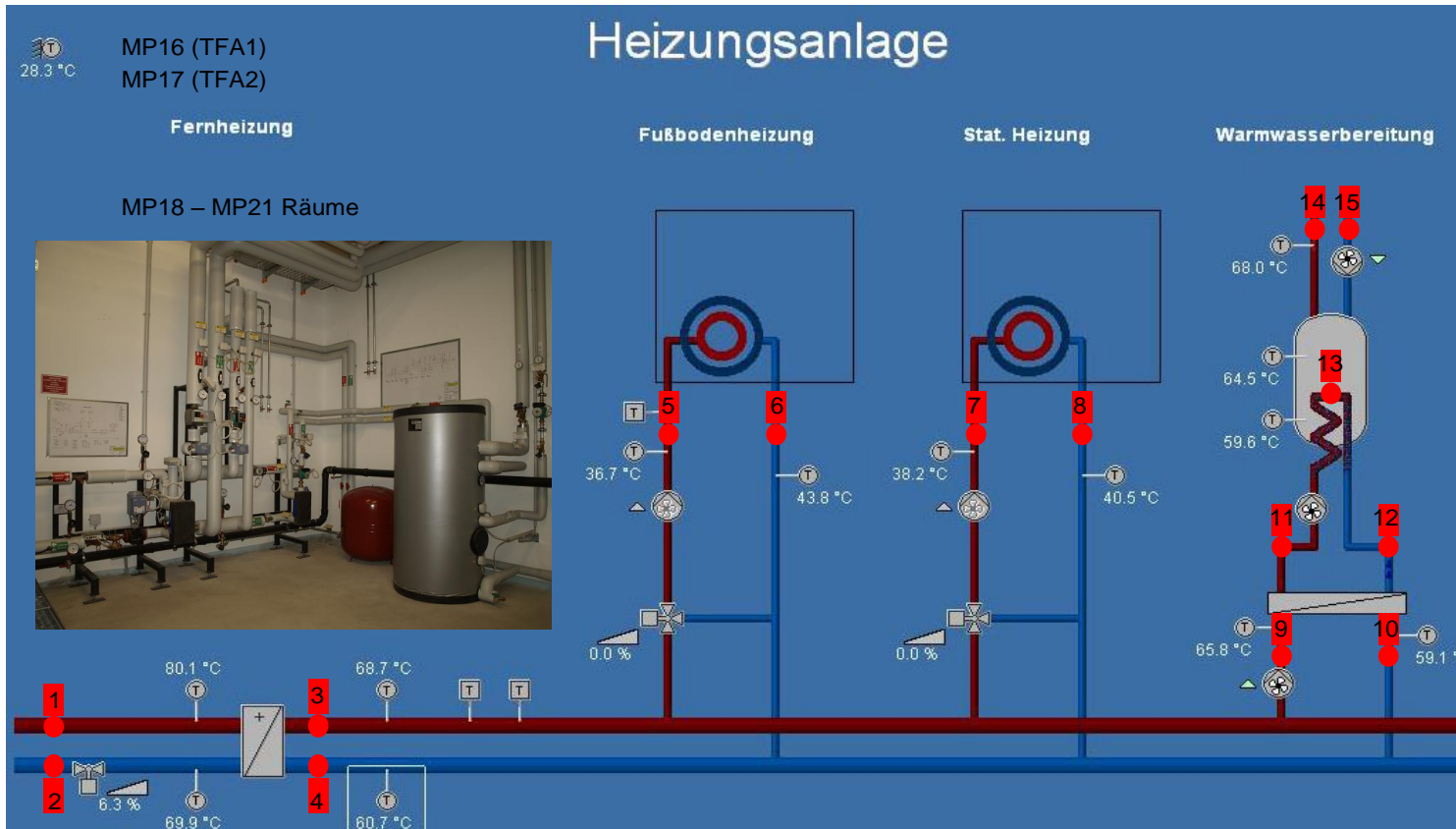
## 2. Temporary Monitoring Kindergarden August-Kuhn Street (1)



- Confirmation of EnEV -30% level
- Commissioning Check
- Parametric adjustment of control (pre-defined operation modes for hot water storage and circulation)
- Demand oriented set-values and time profiles of room temperatures (system specific due to floor heating)

# Sample Projects

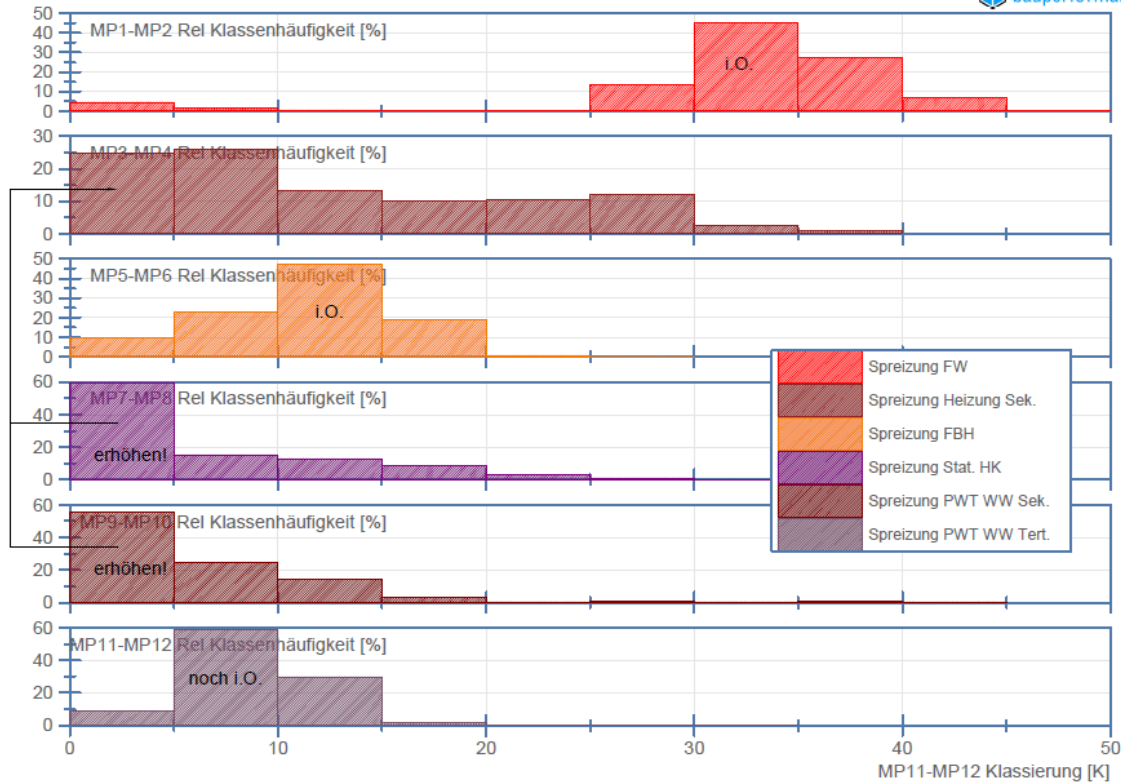
## 2. Temporary Monitoring Kindergarden August-Kuhn Street (2)



- Metering points

# Sample Projects

## 2. Temporary Monitoring Kindergarden August-Kuhn Street (3)



- Statistic classification of occurrence of system supply temperatures

# Sample Projects

## 3. Measurement wattage and electric load profiles Arsenal of REM



- Plausibility of electric power demand and annual consumption

Abgelesene Leistungswerte der Verbraucher mit anschließender Berechnung der elektr. Wirkarbeit							elektr. Wirkarbeit gesamt in [kWh/a]		837,497.5			
RaumNr.	Raumbezeichnung	Unterverteilung gemäß Schema	Verbraucher	Anzahl in [Stück]	Einzelleistung je Verbraucher in [W]	Faktor Nutanteil elektr. Leistung (1,0 = 100%)	Leistung gesamt in [kW/a] (= Spalte 5* Spalte 6* Spalte 7/1000)	Nutzzeit in [Stunden/Tag]	Nutzzeit in [Tage/Woche]	Nutzzeit in [Wochen/Jahr]	Faktor Nutanteil Zeit (1,0 = 100%)	elektr. Arbeit in [kWh/a] (abgelesen und dann berechnet) (= Spalte 8* Spalte 9* Spalte 10* Spalte 11* Spalte 12)
1	2	3	4	5	6	7	8	9	10	11	12	13
<b>UV 6.1 - 5.0G</b>												<b>17,989.67</b>
5.02	Sicherheitszentrale	6.1	LCD-Bildschirme	18.00	40.00	1.00	0.72	24.00	7.00	52.00	1.00	6,289.92
5.02	Sicherheitszentrale	6.1	PC	3.00	50.00	1.00	0.15	24.00	7.00	52.00	1.00	1,310.40
5.02	Sicherheitszentrale	6.1	Splitgerät Sanyo SAP-KR124EA	1.00	1090.00	1.00	1.09	24.00	7.00	52.00	0.70	6,665.57
5.02	Sicherheitszentrale	6.1	Leuchten	2.00	28.00	1.00	0.06	12.00	7.00	52.00	0.60	146.76
5.0G	Flur	6.1	Leuchten	13.00	7.00	1.00	0.09	12.00	7.00	52.00	0.60	238.49
5.01	Personalraum	6.1	Leuchten	2.00	28.00	1.00	0.06	3.00	7.00	52.00	0.90	55.04
5.01	Personalraum	6.1	Boiler	1.00	2000.00	1.00	2.00	2.00	7.00	52.00	0.50	728.00
5.03	Behinderten WC	6.1	Boiler	1.00	2000.00	1.00	2.00	2.00	7.00	52.00	0.50	728.00
5.03	Behinderten WC	6.1	Downlights	1.00	10.00	1.00	0.01	7.00	6.00	52.00	0.30	6.55
5.04	Damen WC	6.1	Boiler	1.00	2000.00	1.00	2.00	2.00	7.00	52.00	0.50	728.00
5.04	Damen WC	6.1	Downlights	2.00	10.00	1.00	0.02	7.00	6.00	52.00	1.00	43.68



# Sample Projects

## 4. Start-up Monitoring Indoor Swimming Pool Neckarau

- Monitoring of district heat transfer station
- Analysis of Building Automation Trend logs:
  - Control of heating circuits, hot water generation and pool heating
  - Control of supply air temperatures of ventilation systems

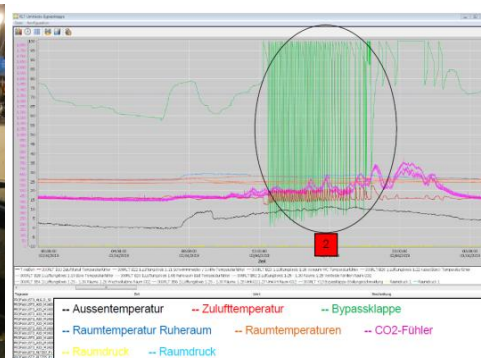


Abbildung 32: Bypass-Klappe RLT-Umkleide, Tredlogs



# Sample Projects

## 5. Monitoring Ice Rink Herzogenried



- Monitoring icing phase
  - Optimisation of waste-heat recovery and use
  - Analysis summer case:  
maximum cooling, minimum heating
  - Analysis winter case:  
maximum heating, minimum cooling
- Operation transfer pump of desuperheater for extracting heat from cooling system
- Operation ground heating antifreeze protection

# Sample Projects

## Room Measurements: Thermal Comfort, Humidity, ppm CO<sub>2</sub>, Lux

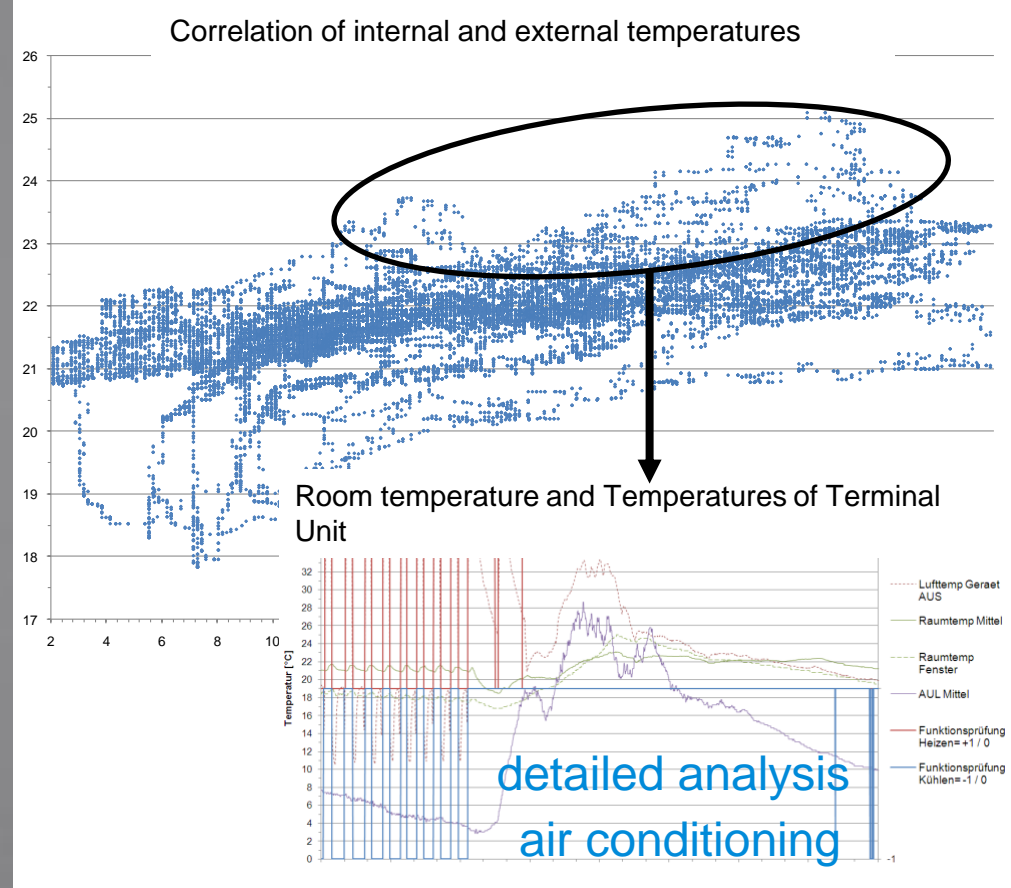
- Measurement of
  - room temperature
  - humidity
  - supply temperatures



- precision adjustment of room control loop



- increase of comfort for user





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# Summary

## Building Quality made by Bilfinger Bauperformance

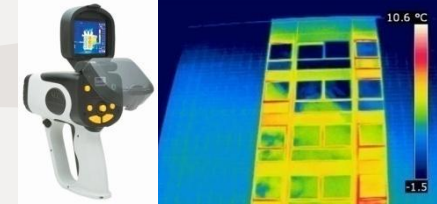
### Praxis Proven Methods for Measuring and Improvement Functional and Energetic Performance of Real Estates



Energy Monitoring  
Building Systems



Thermography

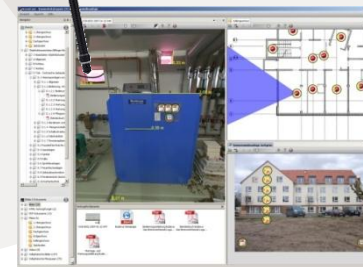


Sound Level  
Metering

Quality measurement  
air handling systems,  
thermal comfort and  
Lighting

Ultra Sonic  
Flow-Meter









Spherical  
Camera



Blower-Door-  
Test

# Summary

## Surplus Factors

-  Energy savings and cost cutting measures within short payback period
-  Security for clients in decisions about the adequate renovation strategy
-  Interruption of business and disturbance of systems for monitoring not required
-  Very flexible to use:   ...from residential buildings to laboratories,  
                                          ...from simple heating systems to more complex HVAC-systems,  
                                          ...for electric power, heating, chilling and water consumption
-  Increase of system reliability and energy efficiency by correction of inaccurate settings
-  Calculable period between monitoring and analysis results for client
-  Small measures with high outcome
-  Raise of attractiveness of real estates by reduction of running costs

# Summary

## Award as innovative Solution for Energy efficiency



**Thank You for Your Kind Attention !**

Dr.-Ing. Benjamin Freiherr von Wolf-Zdekauer