Functional Quality Assurance –
A Cx Approach For Innovative Systems

Bundesministerium
für Wirtschaft
und Technologie

OASE

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FQA - Functional Quality Assurance

Problem and Motivation

FQA - Functional Quality Assurance

Objectives

Tasks and Methods

Interactions with Project Team

Project Time Schedule

Tools

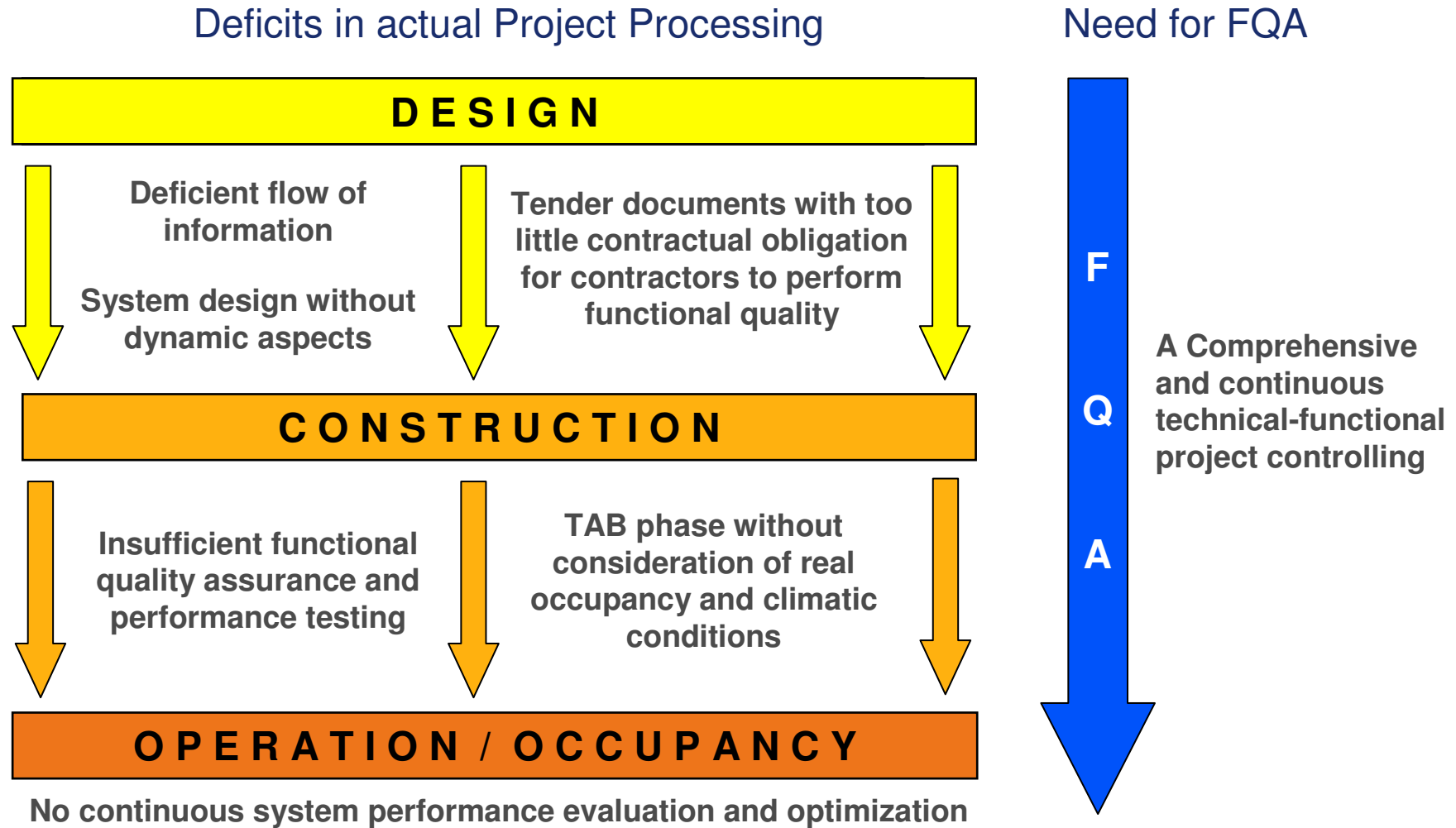Benefits

Conclusion and Status Quo

Outlook

F
Q
A

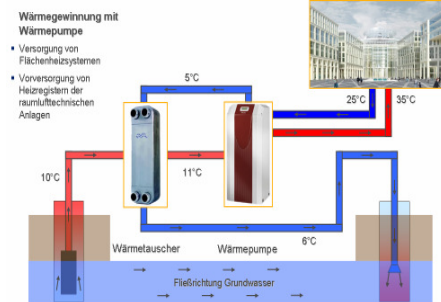Proceedings of the Eighth International Conference for Enhanced Building Operations, Berlin, Germany, October 20-22, 2008

FQA - Functional Quality Assurance

Problem and Motivation

Deficits in actual Project Processing

Need for FQA

D E S I G N

Deficient flow of information

System design without dynamic aspects

Tender documents with too little contractual obligation for contractors to perform functional quality

F

Q

A

A Comprehensive and continuous technical-functional project controlling

C O N S T R U C T I O N

Insufficient functional quality assurance and performance testing

TAB phase without consideration of real occupancy and climatic conditions

O P E R A T I O N / O C C U P A N C Y

No continuous system performance evaluation and optimization

FQA – Functional Quality Assurance
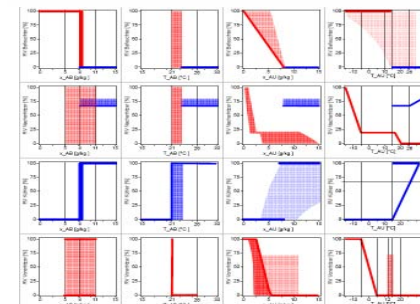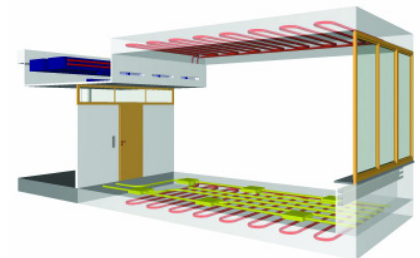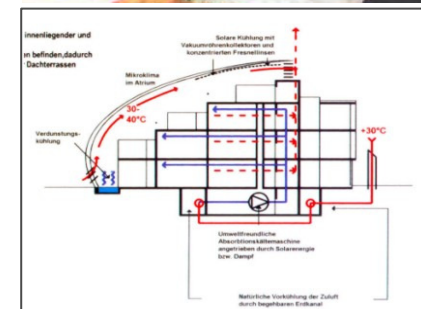
FQA Objectives

- Ensure that initial project goals get realized

- Improve the information flow between
  project team members and between project phases

- Enhance system operation and functional quality
  through early consideration during design

- Optimize indoor environmental and air quality, minimize
  energy consumption and operation costs

- Improve system condition at turnover

- Persistent optimization of system performance for the
  whole project life cycle

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FQA – Functional Quality Assurance

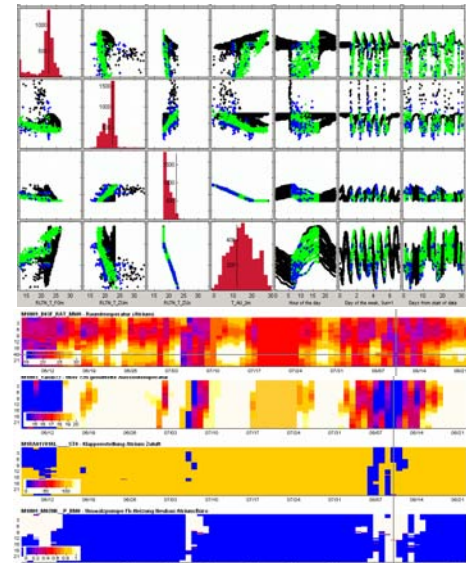## FQA Tasks and Methods – design phase

- **Definition of project goals and basic criteria**
  for design and function and control their correct implementation

- **Technical and functional project management and coordination**
  throughout the project run time

- **Design assistance due to innovative and integral concepts**
  for energy use, indoor environmental quality and operation costs

- **Verify the compliance with energy use regulations**
  and calculate the energy demand

- **Develop, document and optimize functional operation patterns**
  to specify operation sequence and use them as operation prognostics

- **Integrate contractual obligations and technical requirements**
  in tender documents for a construction according to FQA

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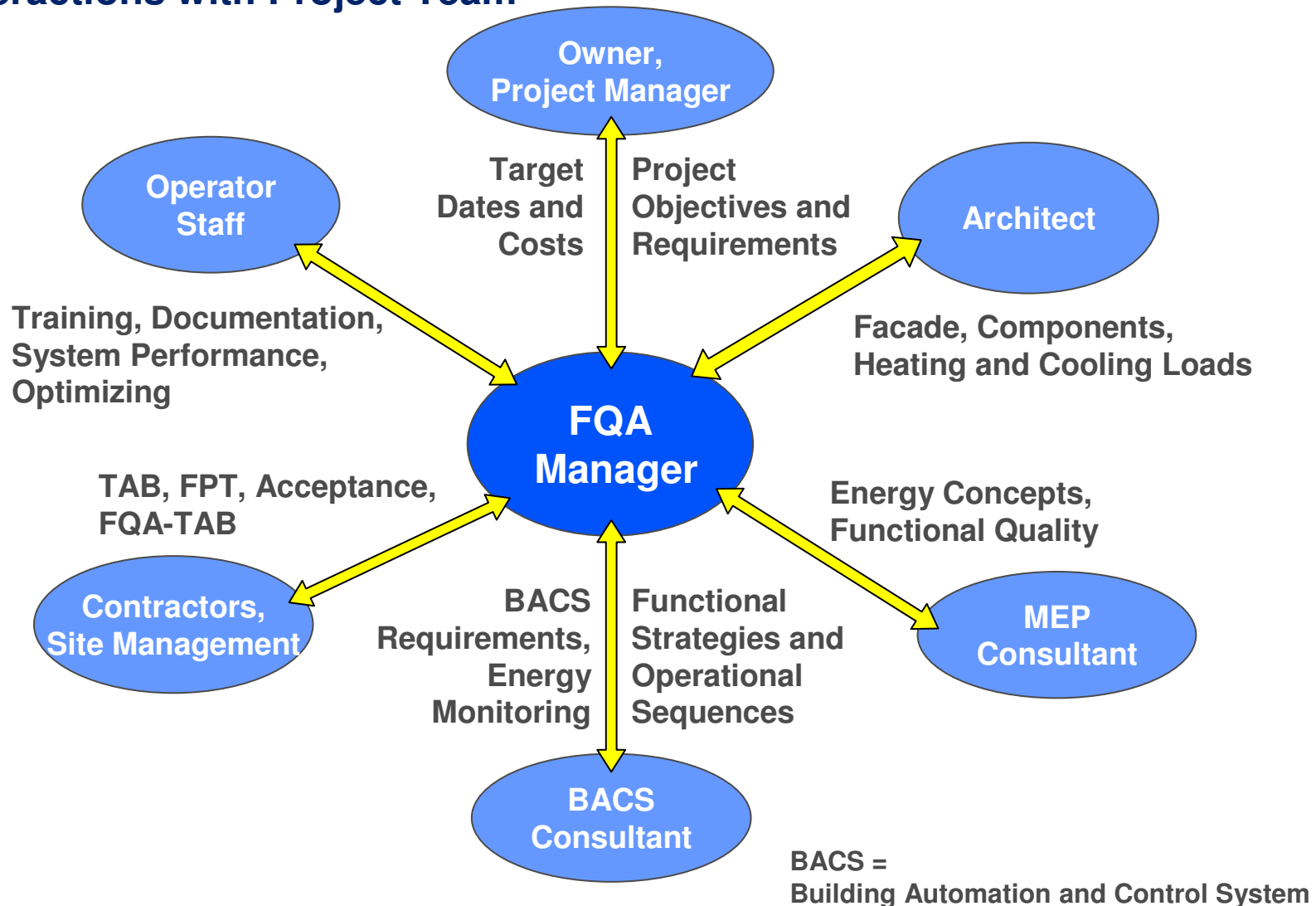
FQA – Functional Quality Assurance

FQA Tasks and Methods – construction and occupancy

- **Attendant guidance for contractors and site management**
  to achieve FQA requirements

- **Operation diagnostics part 1 (until acceptance):**
  Specification and execution of enhanced function checks and
  performance tests for a better operation start

- **Improved training of operator staff**
  concerning FQA specific knowledge and techniques

- **Manuals and documentation with FQA reference**
  to regular O & M and additional customizing for conversions

- **Operation diagnostics part 2 (during first occupancy, 1 year):**
  Definition of an additional FQA testing, adjusting and
  balancing phase with the collaboration of involved contractors

- **Guidance or assistance to FQA activities during operation**
  for sustainable compliance with functional quality

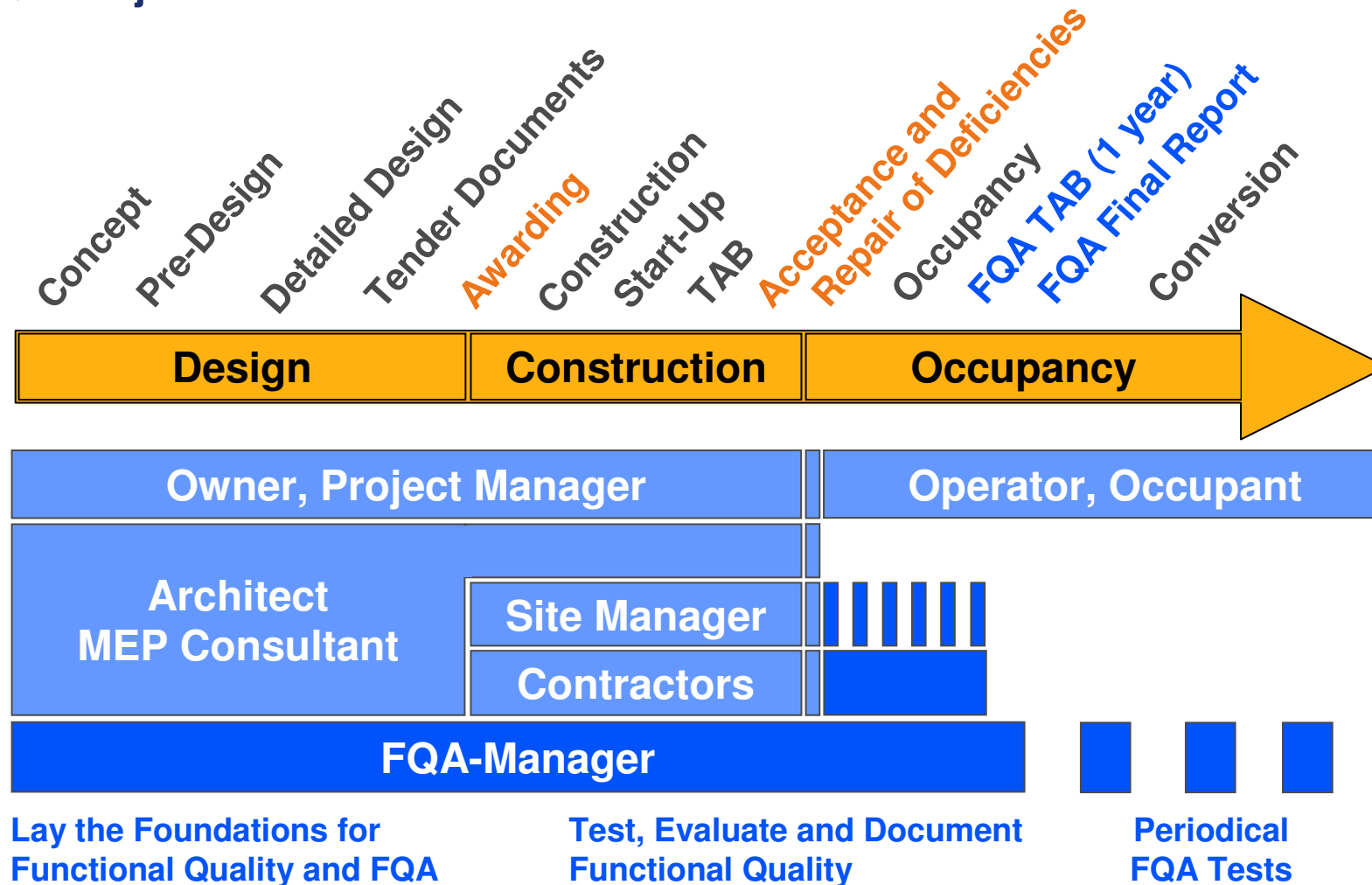Proceedings of the Eighth International Conference for Enhanced Building Operations, Berlin, Germany, October 20-22, 2008

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FQA Interactions with Project Team

Owner, Project Manager

Operator Staff

Architect

Target Dates and Costs

Project Objectives and Requirements

FQA Manager

Training, Documentation, System Performance, Optimizing

Facade, Components, Heating and Cooling Loads

TAB, FPT, Acceptance, FQA-TAB

Energy Concepts, Functional Quality

Contractors, Site Management

BACS Requirements, Energy Monitoring

Functional Strategies and Operational Sequences

MEP Consultant

BACS Consultant

BACS = Building Automation and Control System

FQA - Functional Quality Assurance

FQA Project Time Schedule

Concept · Pre-Design · Detailed Design · Tender Documents · Awarding · Construction · Start-Up · TAB · Acceptance and Repair of Deficiencies · Occupancy · FQA TAB (1 year) · FQA Final Report · Conversion

Design	Construction	Occupancy

Owner, Project Manager	Operator, Occupant

Architect MEP Consultant		
	Site Manager	
	Contractors	

FQA-Manager

Lay the Foundations for Functional Quality and FQA

Test, Evaluate and Document Functional Quality

Periodical FQA Tests

FQA - Functional Quality Assurance

FQA Tools – in the Design Phase

Operation Prognostics with
Operation Patterns and Sequences

Simulation

Energy Demand Calculation
e.g. according to DIN V 18599

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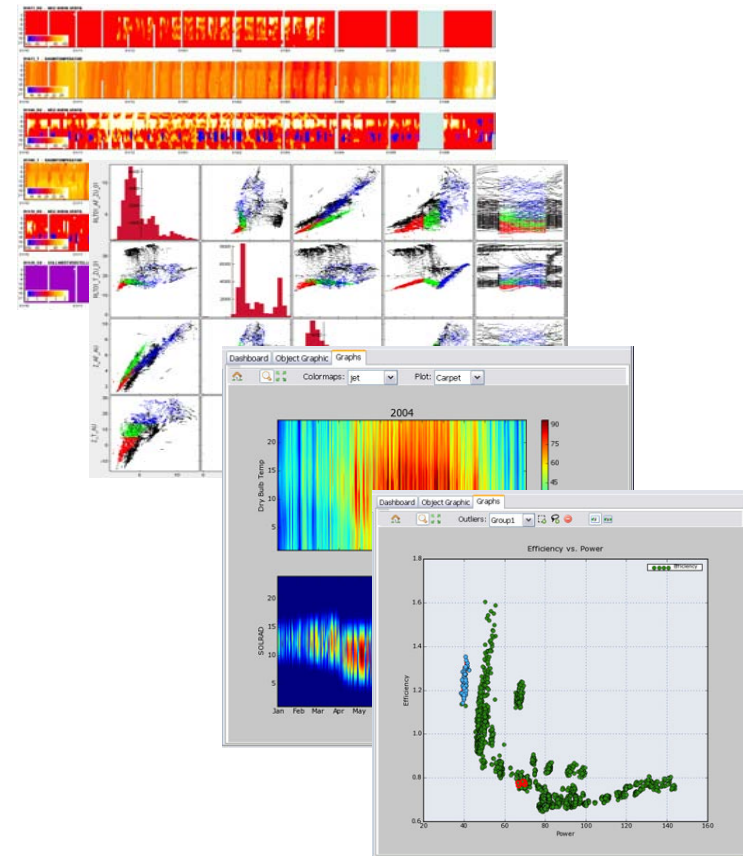
FQA Tools – in the Construction and Occupancy Phase

Function and Performance Testing
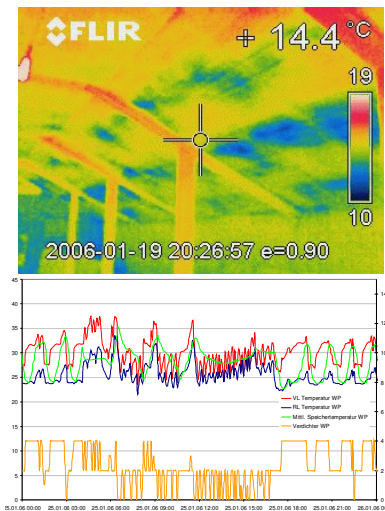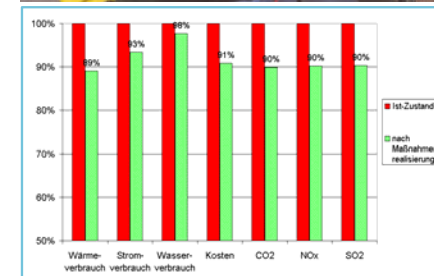
Operation Diagnostics Using Building Management Systems
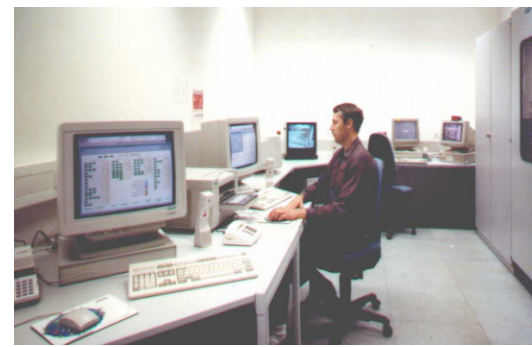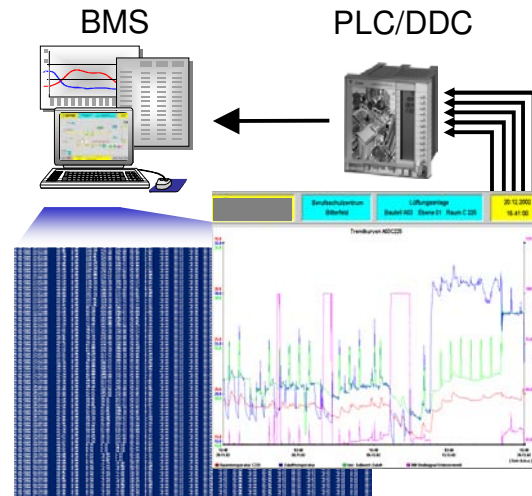
Operation Diagnostics Using Graphic Tools to Compare with Prognostics

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FQA - Functional Quality Assurance

FQA Benefits

- **Improved coordination between project team and all phases**
  means better flow of information

- **Construction cost savings due to prognostic system specification**
  and early problem identification and resolving

- **Fewer system deficiencies at building turnover**
  due to well timed quality assuring activities

- **Improvement of indoor environmental quality**
  because of optimized design and fitted system parameters

- **Reduced energy consumption and operation costs**
  due to optimized operation modes and sequences

- **Sustainable functional quality and optimization of system condition**
  during operation due to improved documentation, enhanced staff
  skills and the regular application of FQA methods

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FQA - Functional Quality Assurance

FQA Conclusion and Status Quo

- **FQA can contribute a lot to persistently improve building** environmental quality, energy and economic efficiency

- **Nevertheless FQA is currently in Germany not offered** and is therefore not practised

- **FQA exceeds the consultant services required by the rigid HOAI** (German Fee Structure for Architects and Engineers)
  ➔ FQA must be separately bargained with the owner

- **The FQA methods will soon be extended and enhanced** in the forthcoming research project inProG (funded within the scope of EnBop)

- **Ebert Engineers wants to apply FQA in proper future projects** and gain experience from it

EnBop
Forschung für
Energieoptimiertes Bauen

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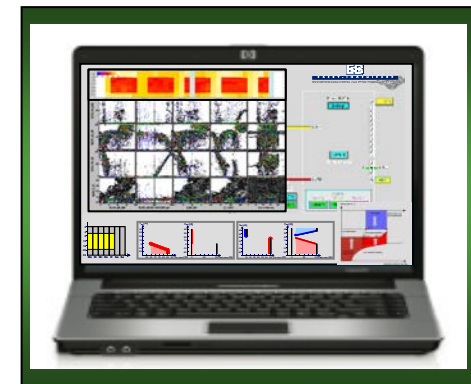
FQA – Functional Quality Assurance

FQA Outlook

- **FQA must become an acknowledged service in Germany** and establish in project processing within the next years in order to improve the quality of complex building services engineering

- **Need for FQA will definitely increase due to Green Building** certificates, like LEED™, DGNB German Sustainable Building Council

Desirable development of applied tools in the future:

- **Integrate visualization tools for operational diagnostics in BMS** software for common use by staff

- **Develop customizable digital operation pattern cataloges** that can be fit to different use cases with setpoints and tolerances

- **Implement these cataloges in software routines and enhance BMS** to an automated system diagnostic and FPT tool

- **Extend BMS function to perform auto-adaptive optimization** routines if system diagnostics detect possible improvement

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Thank you for
your attention!

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