



Quality management for building performance

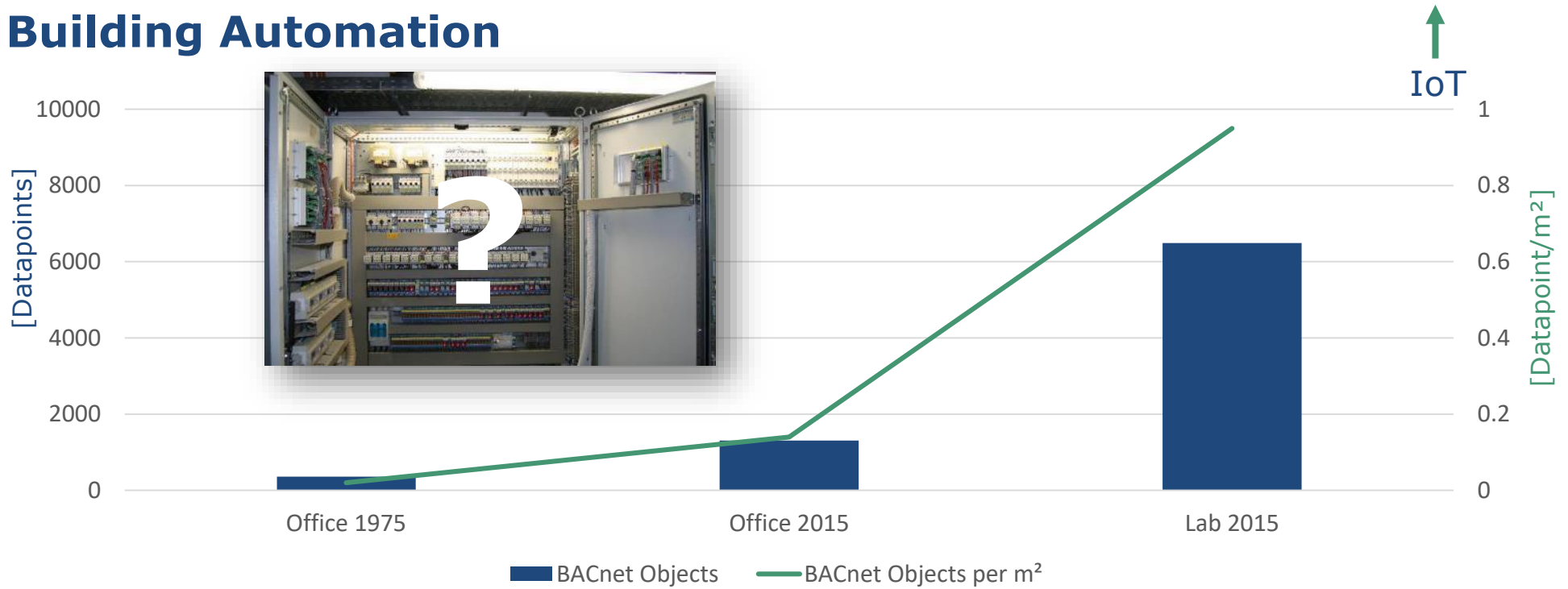
Quality Management for Building Performance – Closing the Gap between design and operation

Jan Mehnert

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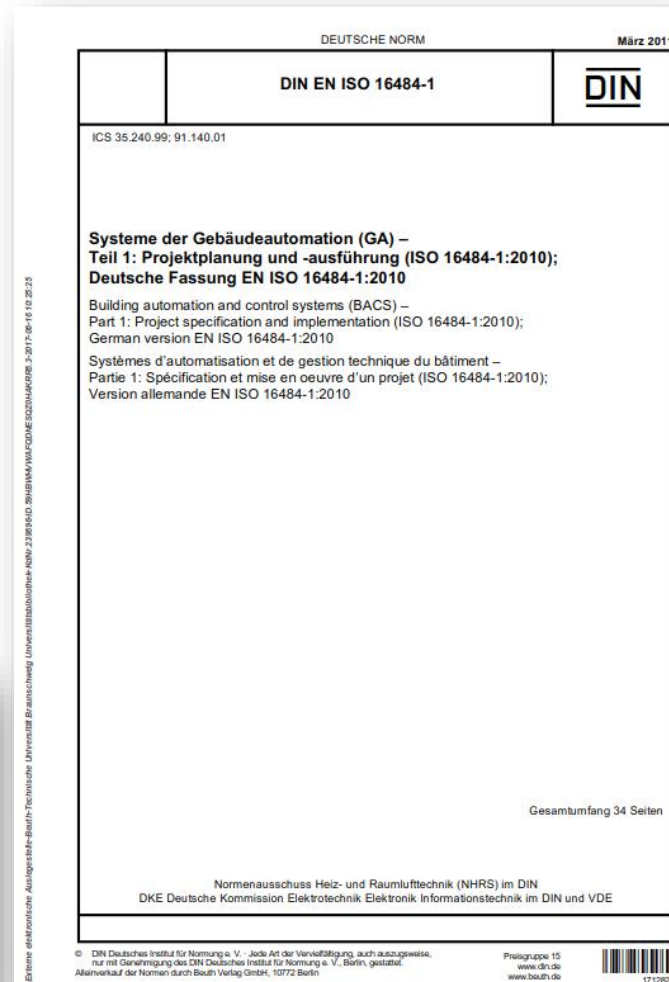
Building Automation



— Building Standards

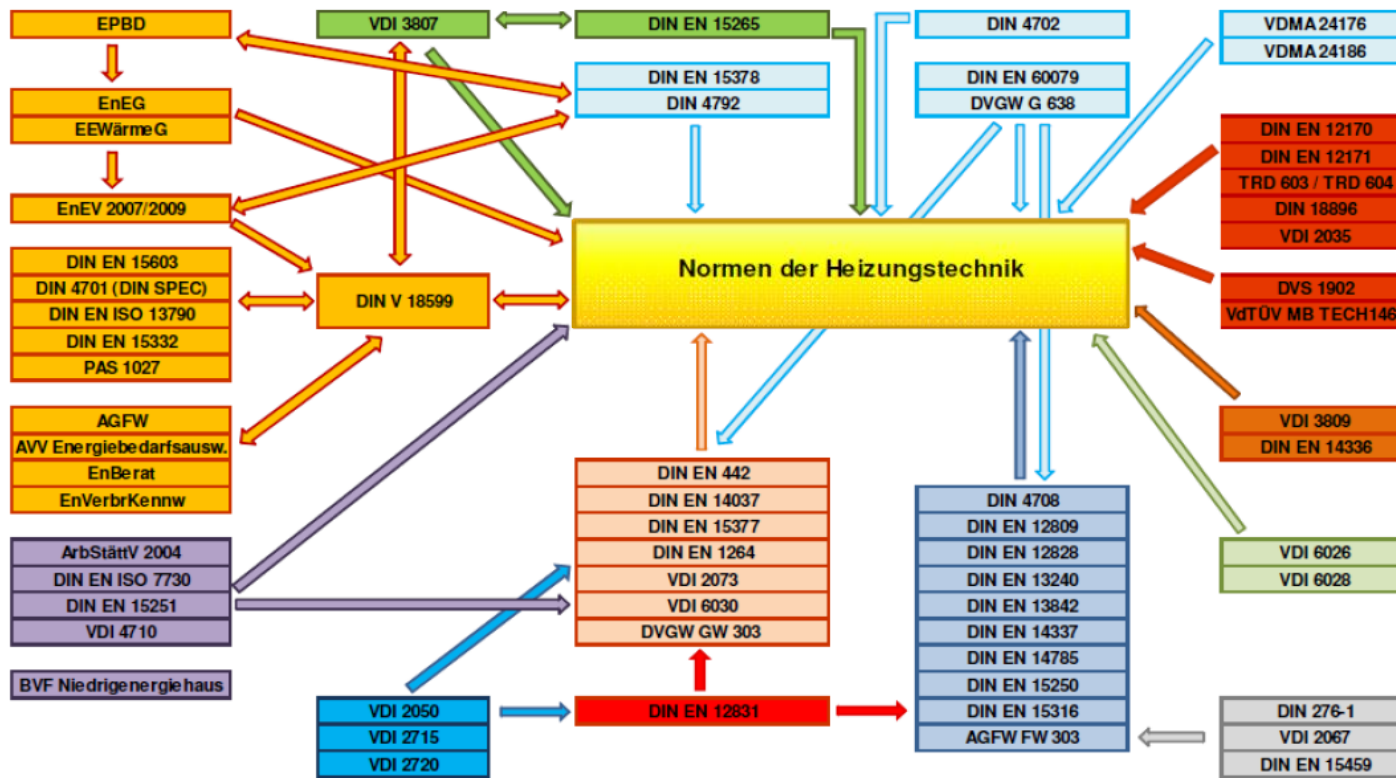


1973: 15 pages



2018: > 1.000 pages

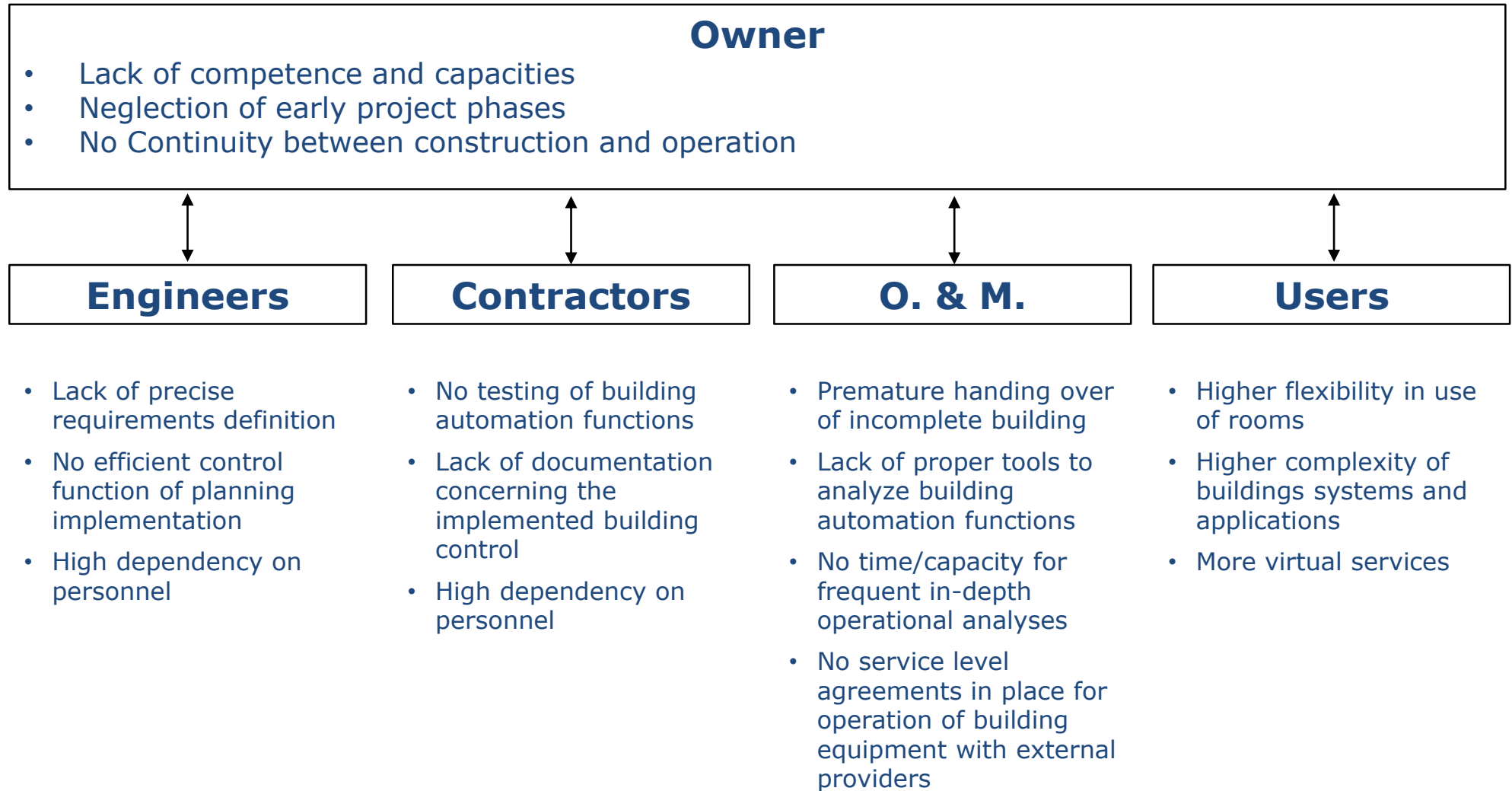
Building Engineering



Energiekennwerte	Systemauswahl	Betrieb & Nutzung
Energieeffizienz	Kosten/Wirtschaftlichkeit	Instandsetzung/Wartung/Inspektion
Innenraumklima	Technische Auslegung	
Bauliche Anforderungen	Dokumentation im Planungsprozess	
Ermittlung Heizlast	Abnahmeregelungen	

M. Bärthel, MA 03/10

Challenges for Building Performance: Excessive Demand



The Challenge

& Innovation > Participant Portal > Opportunities

OPPORTUNITIES HOW TO PARTICIPATE PROJECTS & RESULTS EXPERTS SUPPORT ▾ LOGIN REGISTER

TOPIC : New tools and methodologies to reduce the gap between predicted and actual energy performances at the level of buildings and blocks of buildings

Topic identifier: EeB-07-2015
Publication date: 11 December 2013

Types of action: IA Innovation action

DeadlineModel
Opening date:

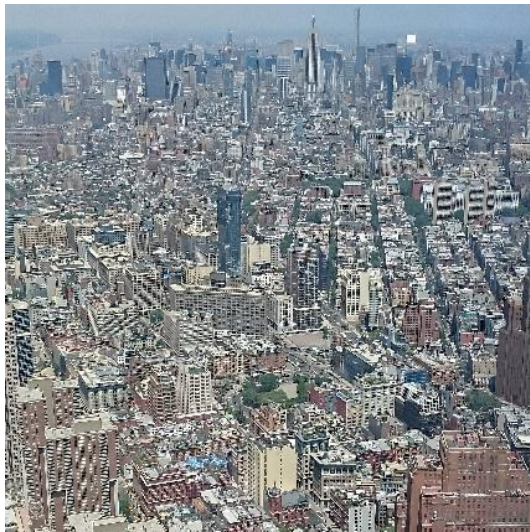
Horizon 20

Topic Descripti

Scope: At building level, the research focus is on developing methodologies and tools to monitor and assess actual building energy performance, considering relevant factors such as user behaviour, complex energy systems performance and weather forecast, and to be able to predict accurately building energy loads and consumption along the whole lifecycle. The new methods and tools could include energy performance diagnostics for predictive maintenance (related to different construction typologies and their thermal behaviour), to provide the accuracy required to properly value retrofit technologies and support decision making during the different stages in the life of the buildings. The effective monitoring and management of energy flows to reduce energy consumption and to ensure that the building is operated in a way that meets design intent should also be addressed. Common indicators, measuring technologies and data analysis methods should be developed to monitor building performance during operation.

A holistic “open” approach to building control and monitoring systems is required, integrating any possible existing control and monitoring infrastructure. The commissioning, sign-off and maintenance phase should be addressed. High quality, reliable and non-intrusive (including wireless) data acquisition methodologies are also needed. A positive impact on health and safety (e.g. hygienic aspects of ventilation or DHW systems) as well as comfort is an aspect to consider.

— The Challenge



Many buildings



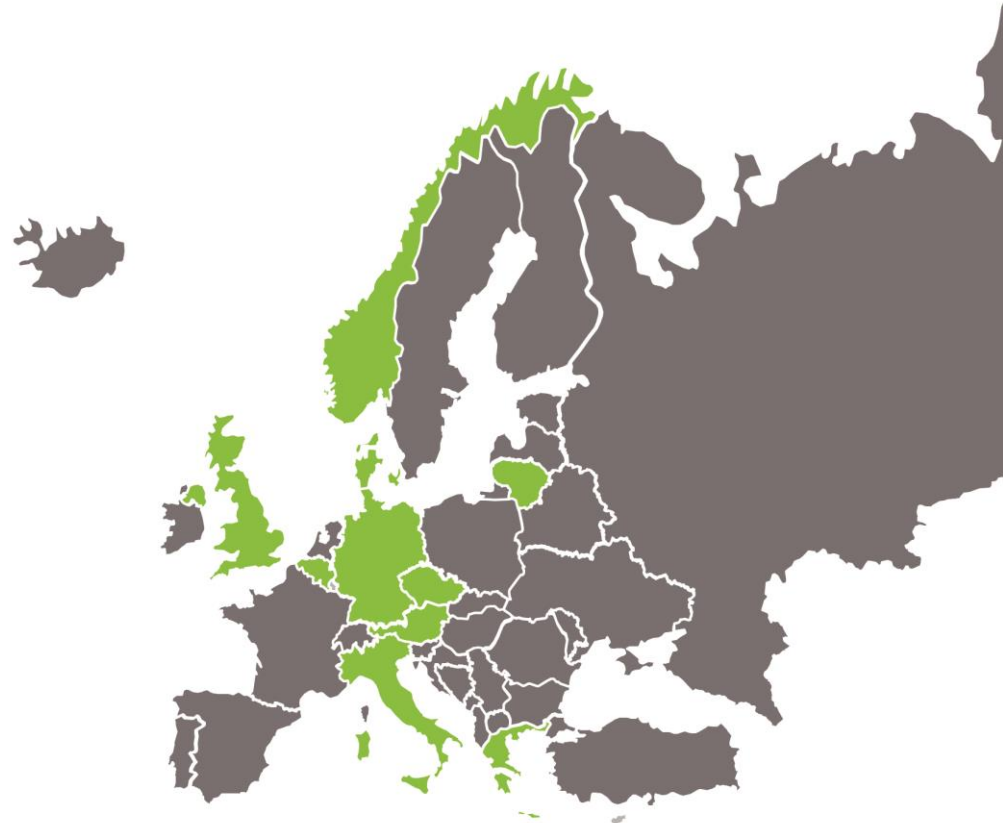
Few experts

The Solution:
ICT / Digitalization

Project Partners

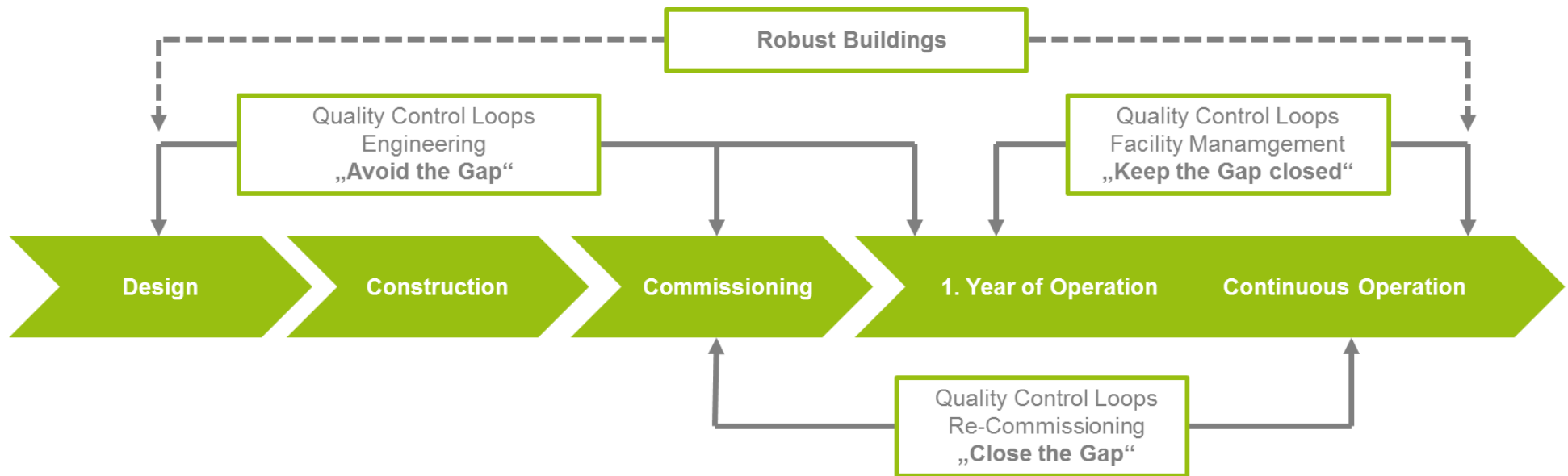


1. Technische Universität Braunschweig, Germany (Coordinator)
2. Factor 4 BVBA, Belgium
3. ENESA a.s., Czech Republic
4. E7 Energie Markt Analyse, Austria
5. COWI A/S, Denmark
6. SYNAVISION GMBH, Germany
7. Norges Teknisknaturvitenskapelige Universitet, Norway
8. Ceske Vysoke Ucení Technické v Praze, Czech Republic
9. Ethniko Kai Kapodistriako Panepistimio Athinon, Greece
10. REHVA, Netherlands
11. EKODOMA, Latvia
12. Building Research Establishment LTD, United Kingdom
13. Energy Team spa, Italy
14. eERG Group - Politecnico di Milano, Italy

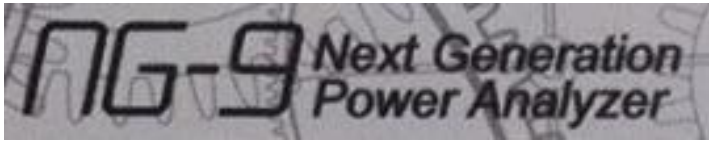


— The QUANTUM Tools: Objectives

- Development of tools, services and business models supporting QM in the design, construction, commissioning and operation phase
- Implementation of tools to a set of European buildings
- Proof cost effective multiplication



— What? – 3 Tools: Development & Testing



- **HPS/NG9 (by Energy Team, Italy):**
Cost effective and easy to install in-situ energy metering devices with online data analysis



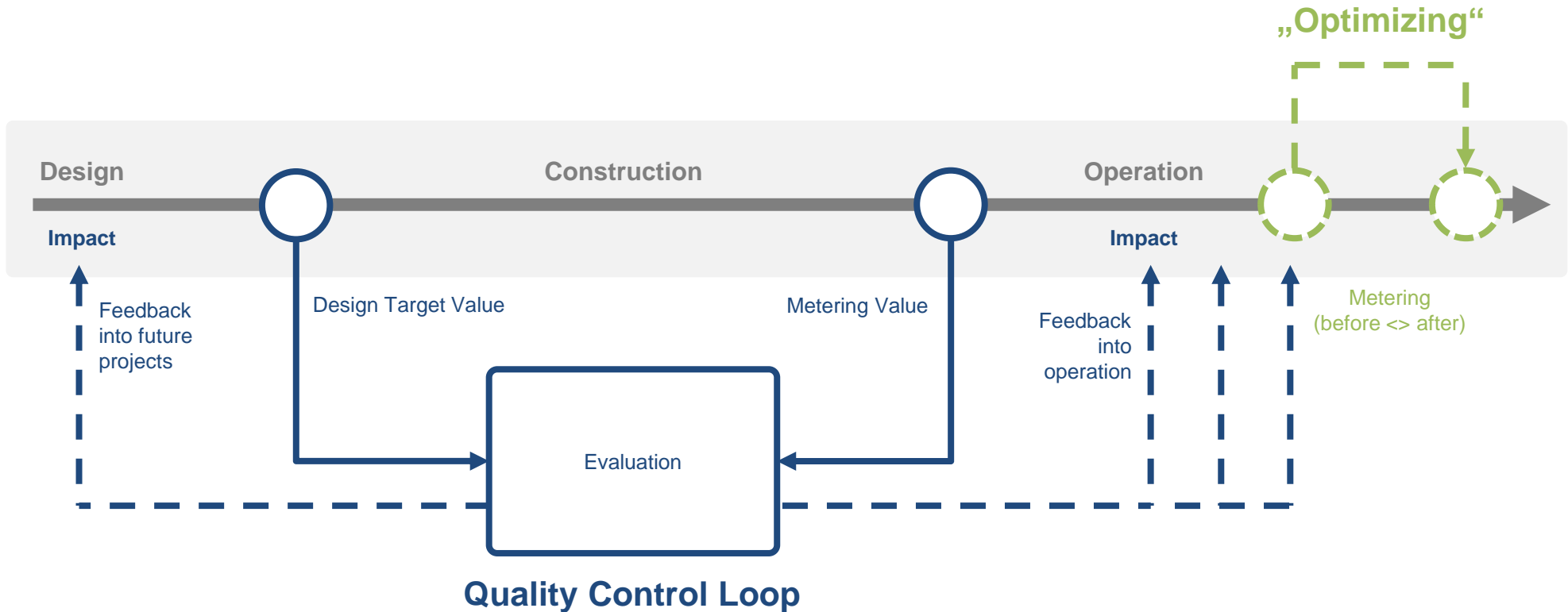
- **Comfortmeter (by F4, Belgium):**
Completely web-based questionnaire for perceived user comfort



- **Performance Test Bench (by synavision, Germany):**
First tool for the digital specification and automated validation of Building Performance
→ Technical Monitoring

Guidebook

Quality Control Loop to check for fulfillment of requirements.



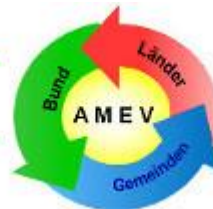
AMEV Recommendation Technical Monitoring

- Official call for quality management in construction projects and for existing buildings in order to ensure that technical and economic potentials are reached in normal operation
- Clear definition of the work packages, services, and results in order to request Technical Monitoring in public tenders
- First to define the role of quality management as a third party service in construction projects



Federal Ministry
of the Interior, Building
and Community

Arbeitskreis Maschinen-
und Elektrotechnik



staatlicher und kom-
munaler Verwaltungen



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Digital Performance Test Bench

Digital Quality Management & Technical Monitoring
for Smart Buildings

— Key steps for the implementation of Technical Monitoring

Step 1: Design

- Definition of technical objectives
- Definition of testing procedures

Step 2: Trial operation

- Run trial operation under specified conditions (1-4 weeks)
- Hand over operation data
- Evaluate operation data and report

Step 3: Continuous or repeated testing

- Monitoring
- Quarterly or annual testing

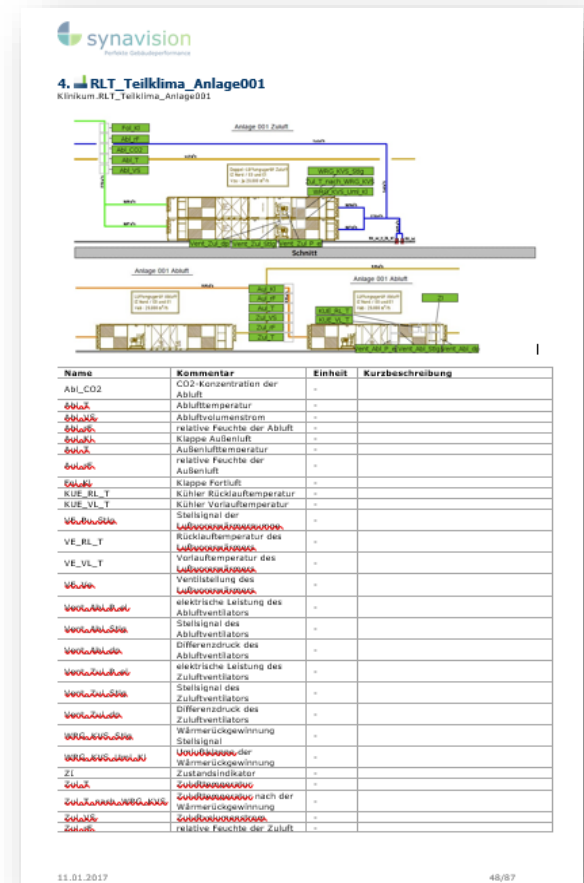


— Step 1 (Design): Setpoints & Testing Procedures

- Design review
- Specification of relevant test parameters for the building and the systems
- Specifications for data collection and transfer.
- Specification of testing procedures.

Documents provided by TMon provider :

- List of Data points for each system to be tested
- Testing Specification for each system to be tested
→ Creating a Digital Twin of Functional Requirements
- Tender document for trial operation
- Tender document for data export

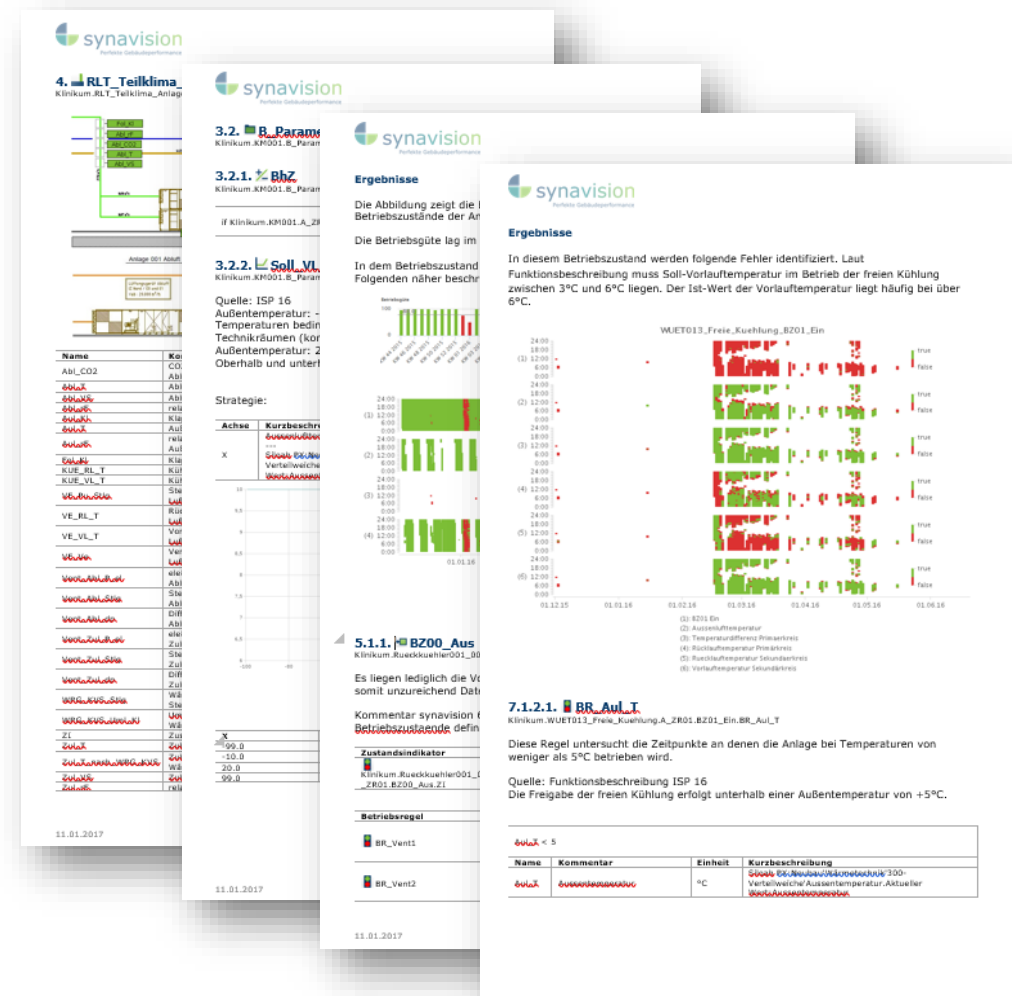


— Step 2: Monitoring in trial operation

- Contractor notifies test readiness
- Contractor hands over data export test data
- **TMon provider** tests data and notifies test readiness
- Contractor runs systems as specified (“hands-off operation”, but possibly with special load situations)
- Contractor hands over data as specified
- **TMon provider** analyses data as specified and reports

Documents provided by TMon provider :

- Testing Report on each system
- Dashboard (optional)



— Step 3: Monitoring in regular operation

Building systems are regular operation

- **O&M Personnel** hands over data regularly (or continuous automated hand over)
- **TMon provider** creates reports for the owner on building performance and facilities manager performance

Documents provided by TMon provider :

- Testing Report on each system
- Dashboard
- Ticket System
- ...



Example: Dashboard-Template for a chiller

synavision Digital Test Bench

Complete Quality Management from Design to Operation

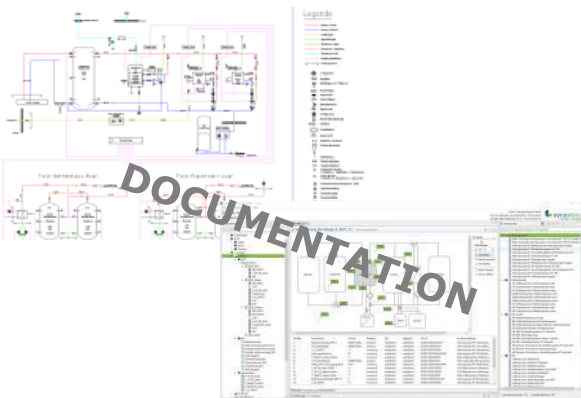


1



Digital Engineering

Fast functional specification on the level of actors and sensors through templates



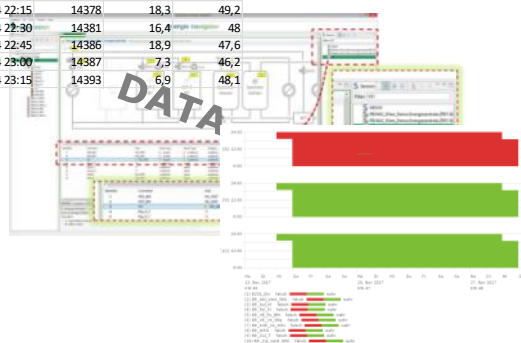
2



Digital Analyses

System-independent data import-plugins for maximum compatibility and automated mass data analysis

Datenpunktadresse	DP_ID_001	DP_ID_002	DP_ID_003
Klartext	Zählerstand	Wirkleistung	Vorlauftemp
Einheit	m3	kW	°C
01.01.2014 22:00	14375	17,4	47,5
01.01.2014 22:15	14378	18,3	49,2
01.01.2014 22:30	14381	16,4	48
01.01.2014 22:45	14386	18,9	47,6
01.01.2014 23:00	14387	7,3	46,2
01.01.2014 23:15	14393	6,9	48,1

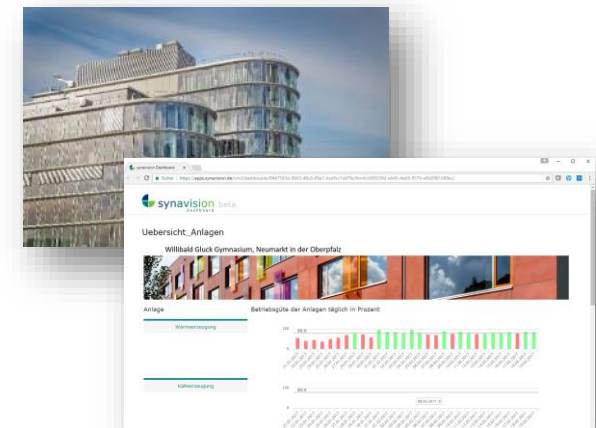


3



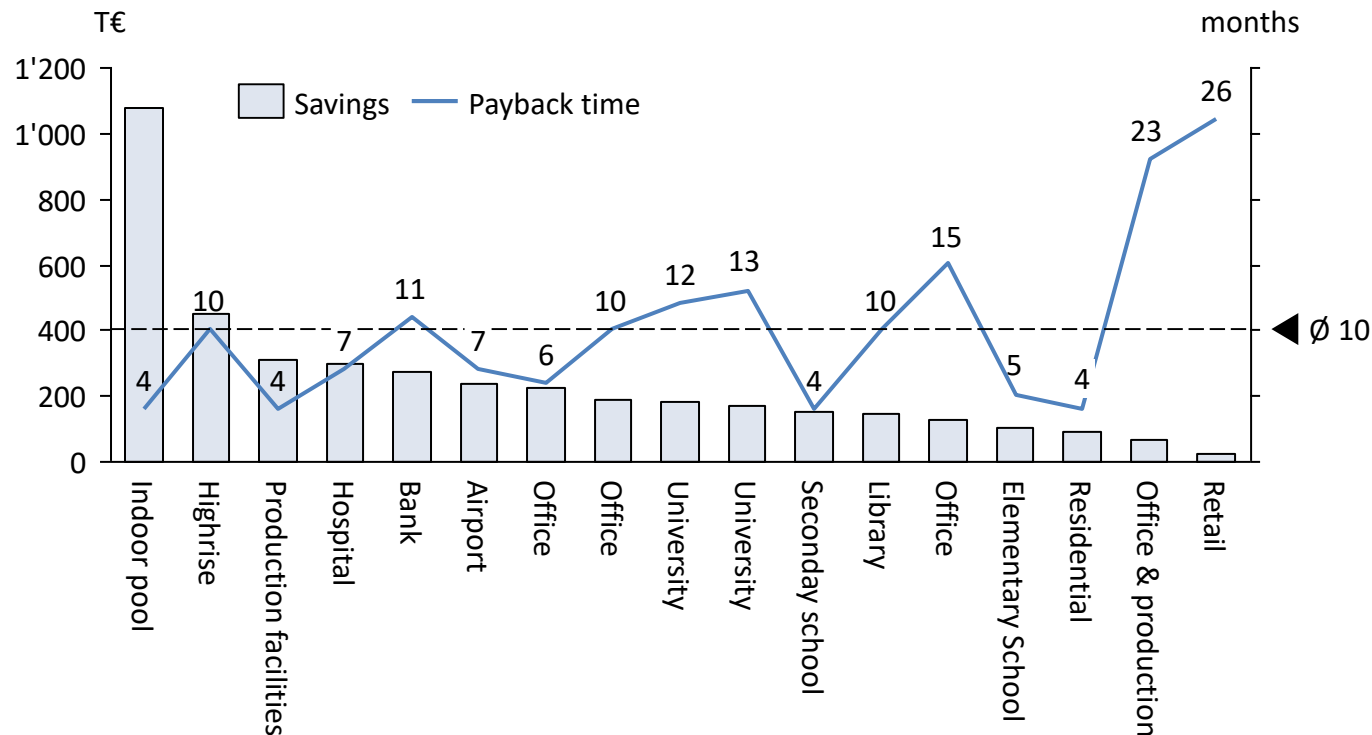
Digital Monitoring

Reporting of optimization potential and continuous monitoring of building performance



■ With average payback times of less than one year, synavision offers a highly attractive investment opportunity

Identified savings potential¹ and customer payback times



- **Business model:** Fix price /data point tested (1-3% of total available data points)
- Sustainable improvement of building performance
- Customer's benefit of entire savings potential
- Optimization measures include also comfort improvement and reduction of depreciation

Detected measures are easy to implement and require no investments

Professional private and public technical building operators work with synavision

