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Innovationsplattform Ressourceneffizienz in der Produktion

Energy-benchmarking within Companies: Insights from Benchmarking Practice

Benjamin Sontag
Simon Hirzel
Clemens Rohde
et. al.

Bundesministerium für Bildung und Forschung

VDMA

Outline

1. The working group

2. Conceptual framework of energy benchmarking within companies

3. Case Studies

4. Conclusions and Outlook

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2 The starting point: „Effizienzfabrik“…

… provides **Information** about ressource efficient produciton

… supports **knowledge transfer**

… is a vital **network** aus of industry, science, politics and public

Webseite of Effizienzfabrik: www.effizienzfabrik.de

2 The Working Group

Workshon „**Energy management in production**“ in 2011

The discussions showed **need for clarification** …

? … how energy use can be **compared** and **assessed**

? … how a common **framework** for comparisions can be established

? … how can different **target groups** be addressed properly

2 Participants

Teilnehmer

aus Industrie & Forschung

2 What is benchmarking

Energy benchmarking…

… is a **systematic analysis** of energy use by comparision of indicators

… is an **instrument** to improve energy efficiency

… enables a comparative anaylsis of **efficiecncy gains** a development of guildelines.

- Unternehmensstandorte,
- Unternehmensbereiche,
- Anlagen, und
- einzelne Aktivitäten im Zeitablauf, …

- Wettbewerbssituation,
- Unternehmensübergreifende Effizienzfortschritte,
- Branchenanalysen,
- …

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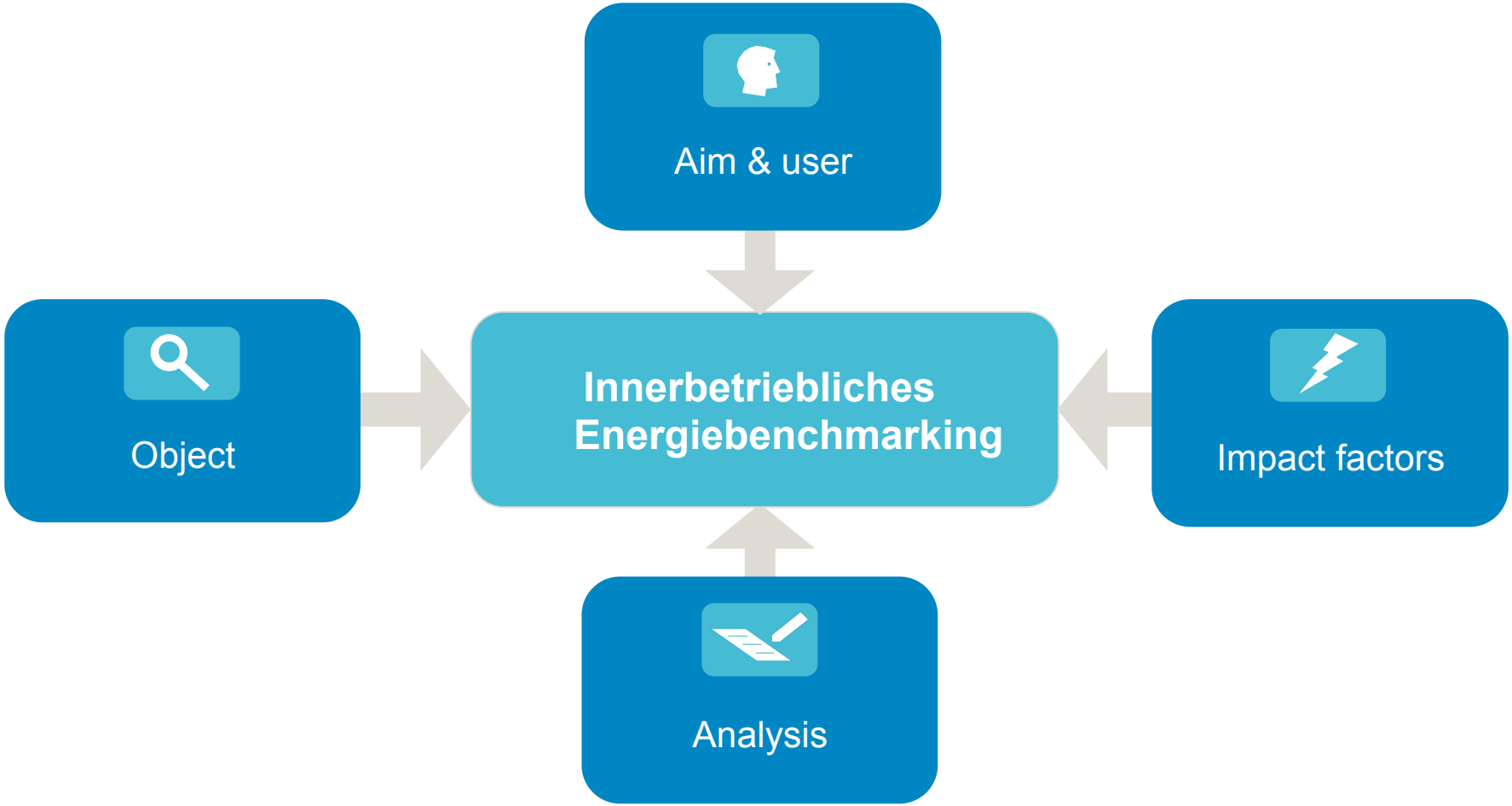
2 Conceptual Framework of Energy Benchmarking



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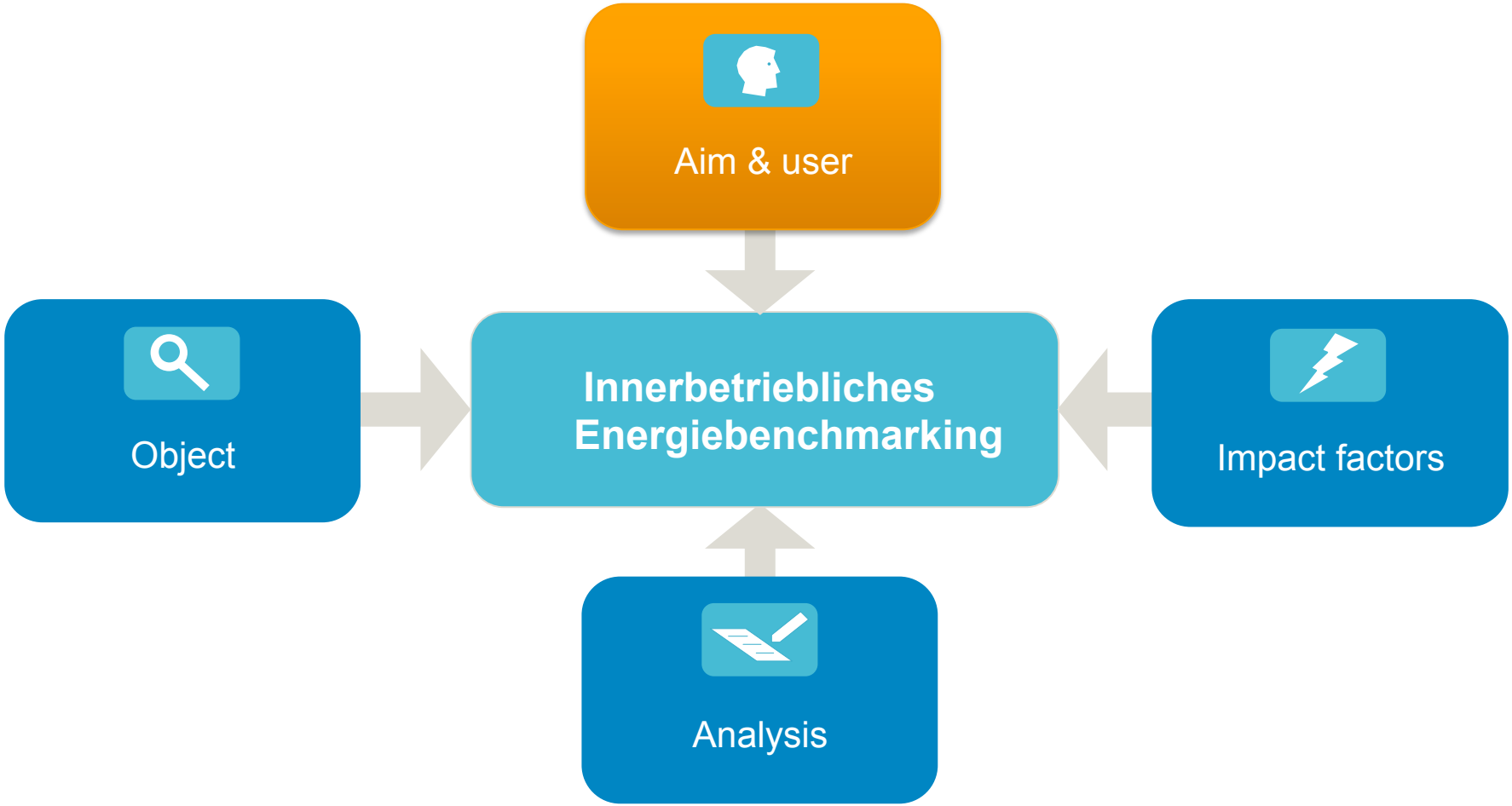
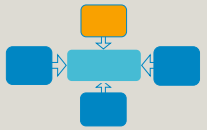
2 Purpose & user

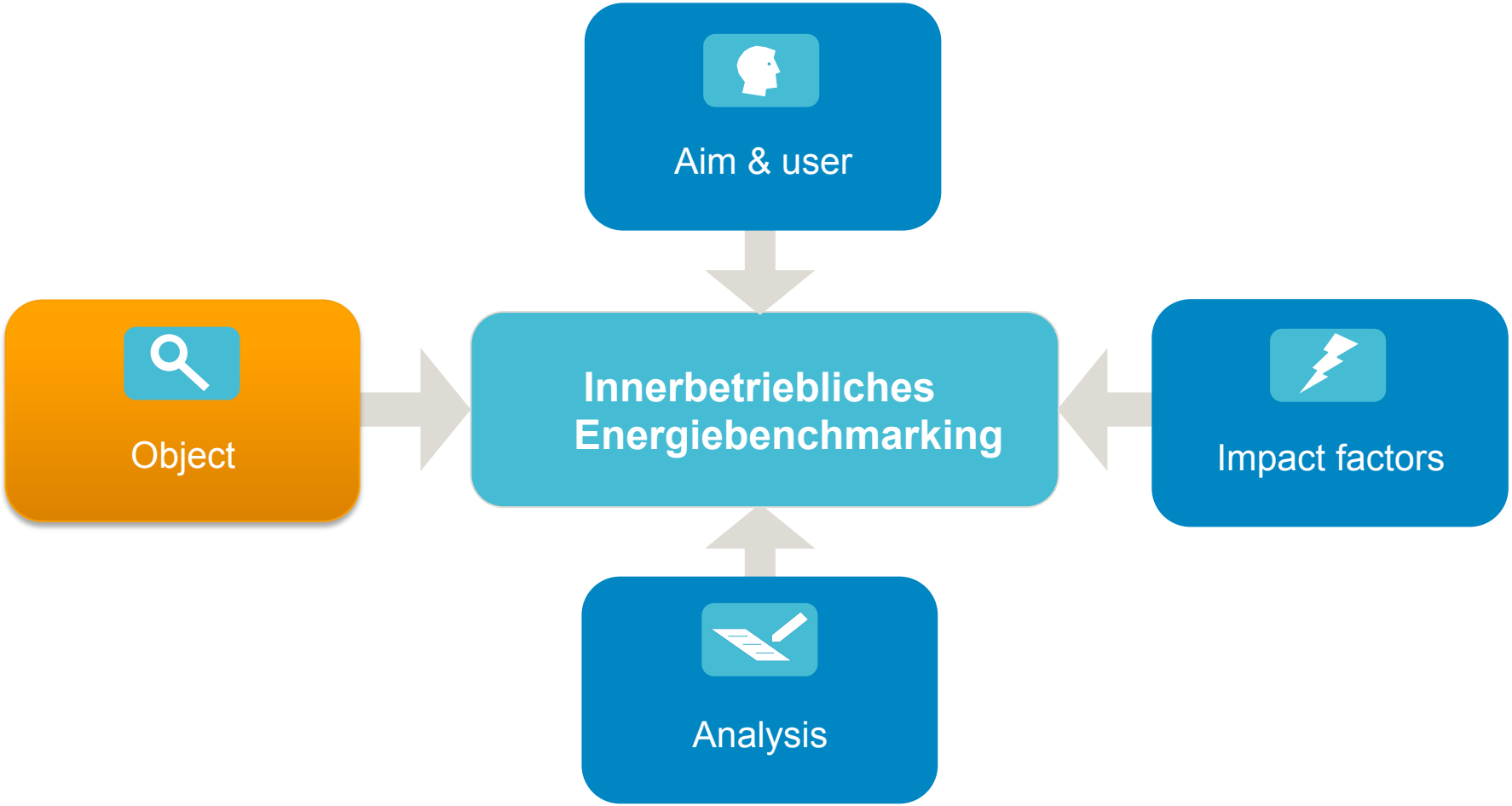


Aim & User

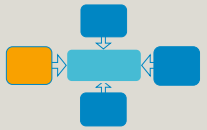


User group	Aims
Top management	development of the **energy strategy of the company**; analysis of past energy performance; information acquisition for the definition of **long-term energy targets** and for establishing **general programs** to improve energy performance in the company
Site management	analysis of **energy demand at the site**; breakdown of long-term energy targets into **short-term targets** and sub-targets for sites and areas; implementation of **local efficiency improvement** programs; review of site performance data
Shop floor worker	general monitoring of energy **efficiency of machines and processes**; condition monitoring; implementation of corrective action and adjustment of operating parameters
Efficiency team	monitoring of energy demand to identify **energy efficiency measures**; enforcing the implementation of specific measures as corrective action; **sensitizing** of other staff members
Energy management	specific and cross-cutting **monitoring** of short, medium and long-term energy performance on different levels; design and implementation of the specific **programs to improve energy performance**; development of metrics; **energy reporting** to management
Controlling	follow-up of **energy performance in the company**; aggregation of information on energy performance for energy/general management; prediction of energy demand for purchase

3 Object


Aim & user
Object
Innerbetriebliches Energiebenchmarking
Impact factors
Analysis

2 Object

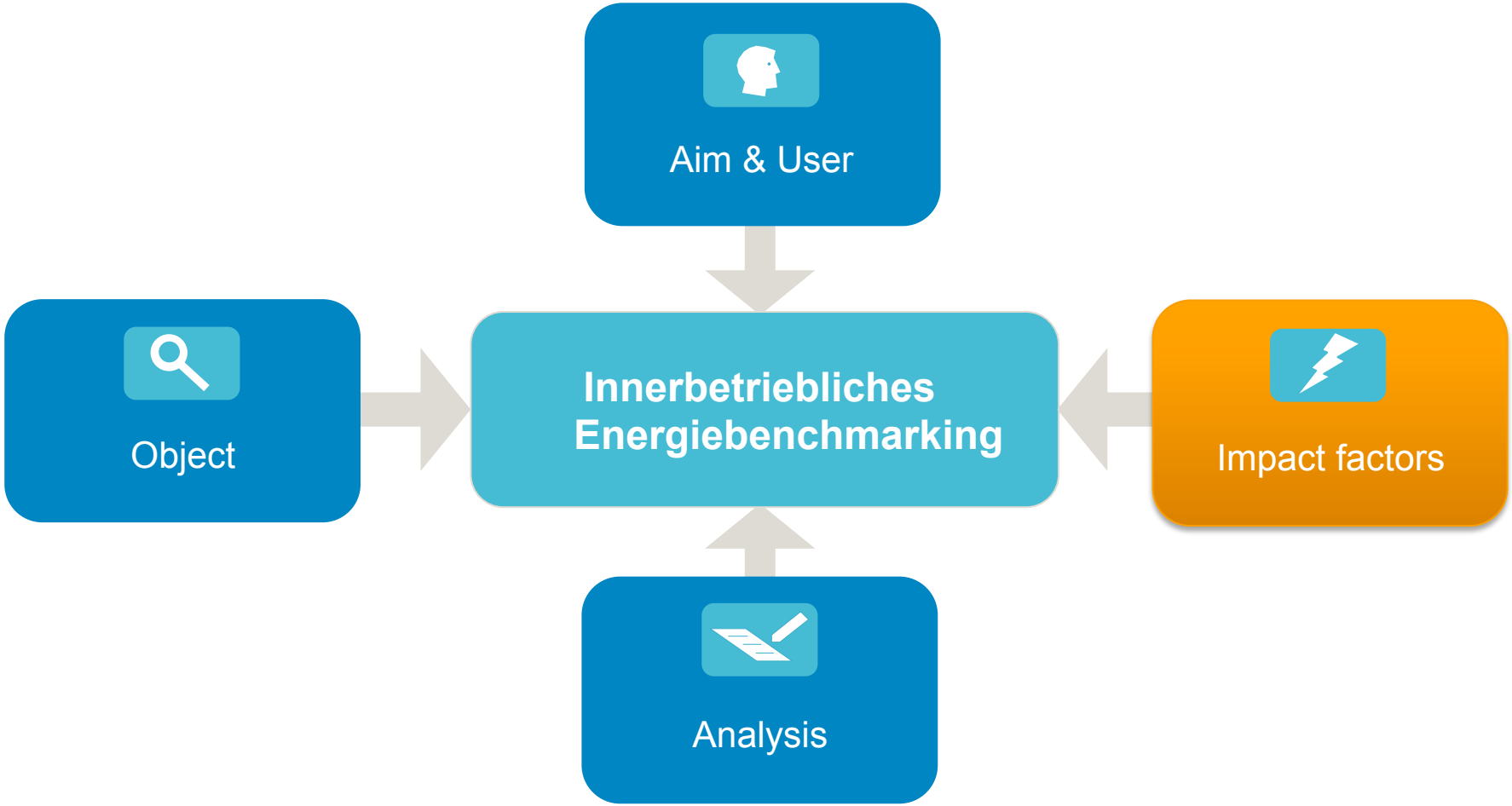


1. Comparable Activities
   (e.g. products, machines, production,lines, buildings, sites)

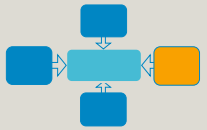
2. Further indicators

   - Development of **energy use over time** (e.g. for a product)
   - **Theoretical minimum** (e.g. thermodynamic limit for a process)
   - **Dedicated target** (ze.e. a 10% reduction of the specific energy demand compared to today‘s level)
   - **Model based values**
   - **Best-practice-values**

2 Impact factors

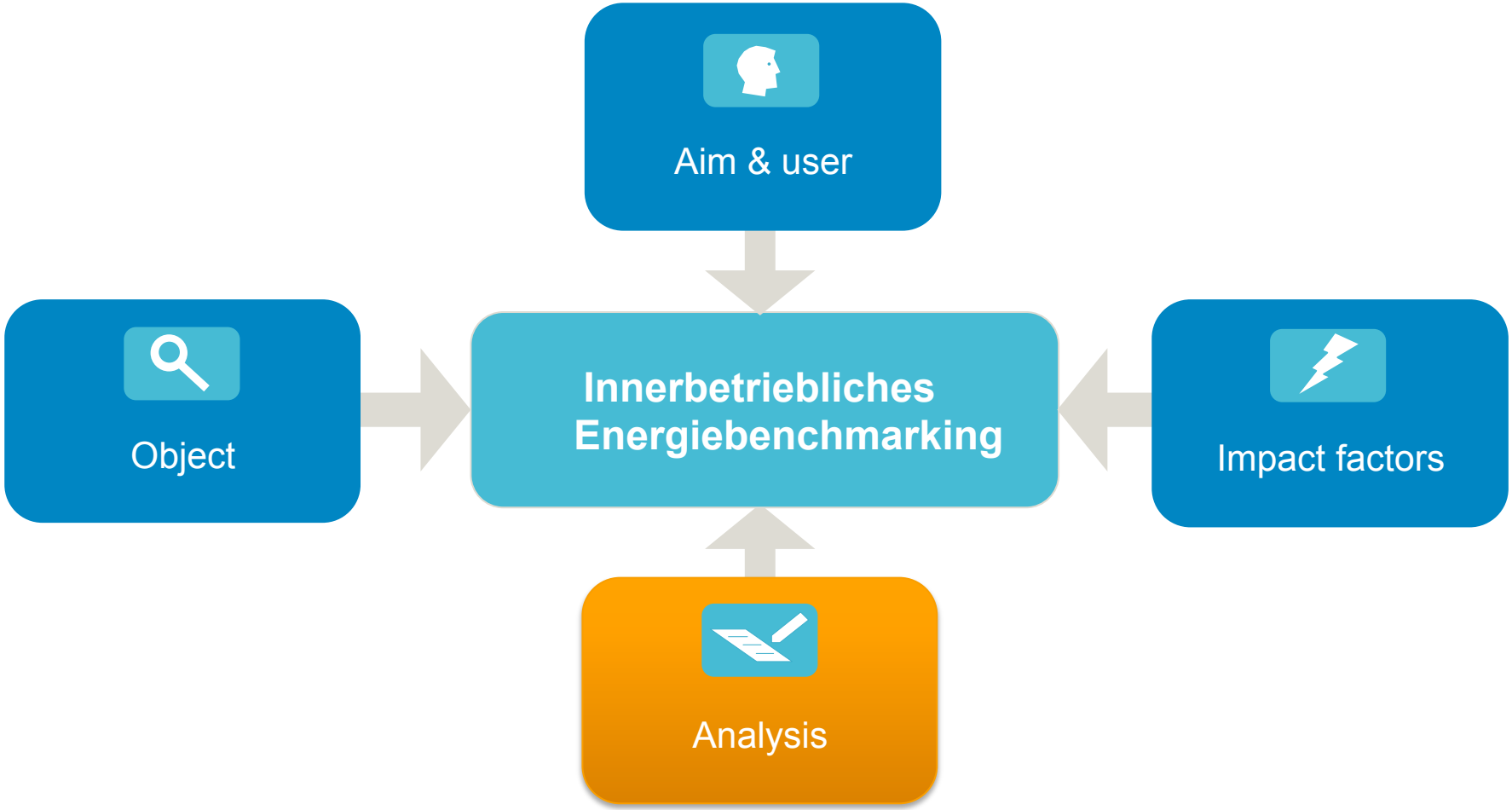


2 Influential factors affecting energy benchmarks

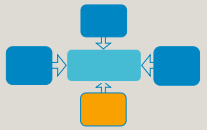


Product-related factors (e. g. number of pieces, weight, length, volume, material)	**Organizational factors** (e.g. shift model, staff at site, frequency of energy analysis)
Process-related factors (e.g. operating time, cycle time, speed, number of different setups, quality rate)	**Personnel** (e.g. user behaviour, intensity of instruction and education, presence of specialized staff members)
Ambient conditions (e. g. external and internal temperature, humidity, pressure, light)	**Location-specific factors** (e.g. area, space, refurbishment, age of equipment, status of supply infrastructure)
Production structure (e.g. degree of vertical integration, product segments, number of different products)	**Economic factors** (e.g. turnover, production costs, energy costs)

2 Data acquisition and analysis



Data acquisition and analysis



	Manual data acquisition	**Automated data acquisition**
Advantages	• High degree of flexibility • Little or no investments	• High resolution (time, disaggregation) • High quality of documentation
Disadvantages	• Intensive in terms of personnel • Rough resolution as limited number of data points • Competence requirements for proper acquisition	• Limited to predefined assessments • Costs for infrastructure, integration and operation • Competence requirements for proper operation

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3 Freudenberg Sealing Technologies GmbH

Site: 22 production sites in Europe and 23 in the USA

Sector: Plastics

Products: Sealing technologies

Turnover: 1.667,6 Mio € in 2011

Employees: 12.534 (2011)

Energiemanagement:

Certification acc. to DIN EN ISO 50001 in 2013/2014.

Case Study: Freudenberg Sealing Technologies GmbH

User	Top management	Controlling	Energy purchase	Maintenance	General staff	Energy efficiency team
Aim	Target definition	Accounting control	Estimation of future energy demand	Condition monitoring	Sensitizing	Identification of saving potentials
Object	Electricity	All forms of energy	Electricity / heating / cooling	Machine / process / equipment; electricity / heating / cooling	All forms of energy	All forms of energy
Metric	Energy analysis	Invoices / energy analysis	Energy analysis	Specific for machine / process / equipment	Energy analysis	Energy analysis
Data acquisition	Central	Central	Central	Local	Central and local	Central and local
Data analysis	Quarterly	Annual	Annual	Continuous	Quarterly / annual	Monthly

3 WESO-Aurorahütte GmbH

Site: Gladenbach

Sector: Ferrous-Metals

Products: iron casting products

Turnover: 60 Mio € p.a.

Employees: 400

Certifications: DIN EN ISO 9001, IRIS, DIN EN ISO 14001 und DIN EN ISO 50001,

Audited acc. To EMAS III

3 Case Study: WESO-Aurorahütte GmbH

User	Top management	Areas in the company	Processes and equipment	Staff (shop floor)	Maintenance	Energy efficiency team
Aim	Compliance with energy policy; basis for valuation; target definition; cost reduction	Compliance with targets; identification of saving potentials	Identification of efficiency and energy optimum; general comparison	Awareness raising; corrective action	Optimization of operating conditions; maintaining grid quality	Local multiplier providing skills and knowledge; identification of potentials
Object	Primary and secondary energy carriers; areas in the company	Primary and secondary energy carriers in the area; energy intensive processes and equipment	Energy consumption of every energy carrier; process data	Generally relevant objects directly at the workplace	Consumption of equipment; quality of supply networks	All relevant energy consumption; load curves

3 Case Study: WESO-Aurorahütte GmbH

User	Top management	Areas in the company	Processes and equipment	Staff (shop floor)	Maintenance	Energy efficiency team
Metric	Ton of good & produced cast iron; energy costs	Ton of cast iron; number of pieces; process time; operating hours	Theoretical minimum; share of stand-by	Number of pieces; process time; operating hours; share of stand-by	Output of products; share of base load	All relevant reference values
Data acquisition	Main measuring point(s) of every energy carrier; ERP	Measuring points at the equipment and processes in this area	Measuring points in the process per energy carrier; process control systems	Workplace in general	Main measuring points(s) of every energy carrier; process control systems	All relevant measuring points; ERP; process control systems
Data analysis	Daily to annual; mainly automated, sometimes manual	15 minutes to monthly; mainly automated	Real-time; automated	Real-time / shift; mainly automated	Real-time to annual; mainly automated, sometimes manual	Real-time to annual; automated and manual

3 Adam Opel AG

Site: Rüsselsheim

Sector: Automotive

Product: Cars

Turnover: 9.994 Mio € (2010)

Employees: ca. 37.000 (2012)

Certifications: ISO 14001

End of 2012 4 of 11 European production sites are DIN EN ISO 50001 certified

Wir leben Autos.

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Case Study: Adam Opel AG

User	Top manage-ment	Central energy management	Central energy management	Site Utility Manager	Staff member for energy in area	Staff (shop floor)
Aim	Reduction of energy costs; compliance with energy targets	Calculation of annual energy demand targets (based on long-term targets) und follow-up of targets	Analysis of current energy efficiency and progress of sites	Reduction of consumption; follow-up of site and area targets	Reduction of consumption; achievement of area targets; enforcement of discipline for energy-savings	Sensitizing staff members; enforcement of organizational energy saving measures
Object	Monthly / annual energy consumption per vehicle and site and throughout Europe	Monthly / annual energy consumption per production output	Hourly consumption values; averages of consumption during and outside production	Monthly / energy consumption per vehicle / unit, site and area; energy saving projects	Monthly energy consumption per car/unit; energy saving projects	Information for staff members; best practice; behavioural rules; visualization

Case Study: Adam Opel AG

User	Top manage-ment	Central energy management	Central energy management	Site Utility Manager	Staff member for energy in area	Staff (shop floor)
Metric	Number of produced cars	Budgeted and current production schedule	EPI on consumption compared to average production	Number of produced vehicles resp. motors and gears	Number of units; process time; operating hours; share of stand-by	Number of information (internal brochures, group sessions)
Data acquisition	Monthly demand per energy carrier	Monthly demand per energy carrier	Interval data from suppliers or measuring points / energy management	Monthly demand and sub-metering per energy carrier	Sub-metering per energy carrier	Production areas; site
Data analysis	Monthly	Once a year; monthly follow-up	Weekly/when required	Monthly	Real-time to shift; mainly automated	Several times per year / when required

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4 Conclusions

Energy benchmarks within companies

- …should be user oriented
- …require specific information
- …are individual solutions
- …are dynamic systems

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6 Outlook

Challenges in the fields of:

Input and Output of energy benchmarks: Energy benchmarks can become quite detailed. With increasing complexity the efforts for data aquisition and analysis increase tremendously.

Link to other indicator systems: The question remains, whether energy benchmarking can be linked to other indicator systems inside a company.

Robust indicators: The aggregation of energetical questions to a single (or a few) indicators is always linked to the risk of simplification. You might miss the crucial point!