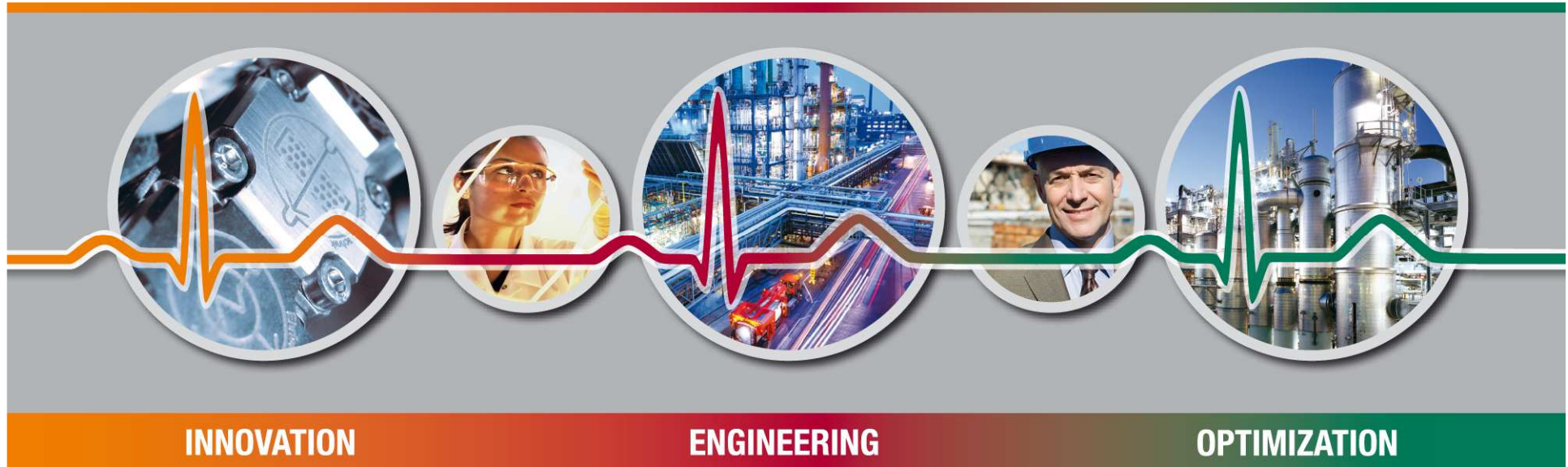


Powering Your Performance



How to save 20% through Energy Efficiency?

Dr. Jan Busch

Bayer Technology Services GmbH, Leverkusen



Bayer Technology Services

Increasing need to optimize energy efficiency and to reduce greenhouse gas emissions

Energy represents increasing share of operating costs at chemical plants

Percentage of total costs increased from ~3 to ~12 over last ten years due to rising energy prices

Reducing energy costs is key lever to increase profitability



Chemical companies contribute significantly to man-made greenhouse gas emissions

Reduction targets defined by several companies

Reducing greenhouse gas emissions is required for economic and social reasons



Increased interest of governments in energy efficiency

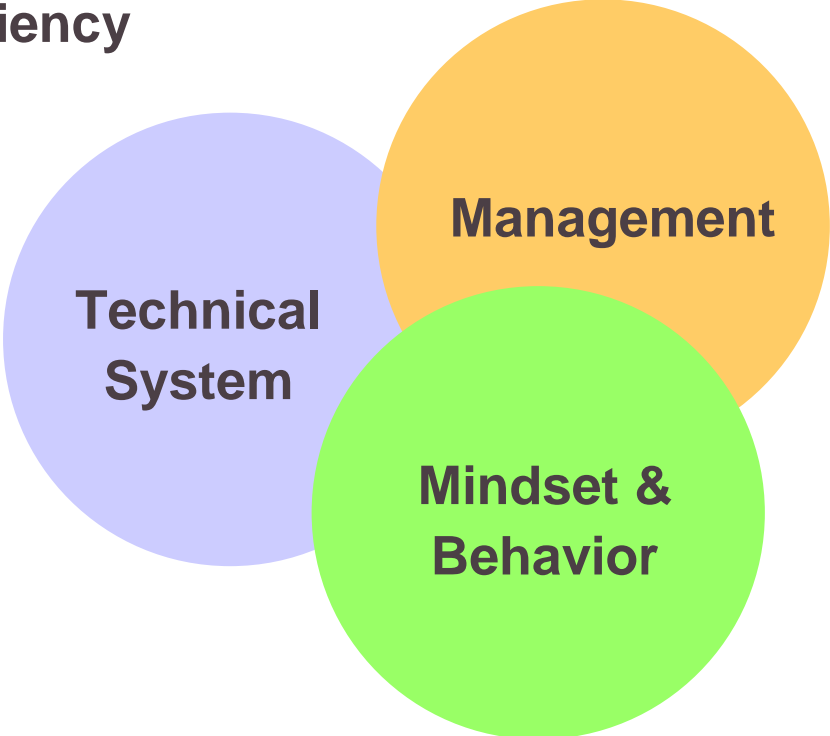
Regulation started (EEG hardship clause); implementation of energy efficiency law (EnEfG) possible

Satisfy increasing regulatory requirements by having a management system in place (EMS)



Existing processes: Sustainable energy efficiency optimization needs to consider three elements

Sustainable energy efficiency optimization of existing processes needs to consider three elements...



and requires an efficient workflow.



Sustainable energy efficiency is divided in two parts

Analysis

Idea
Generation

Evaluation

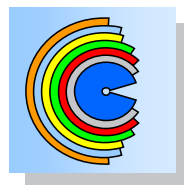
Implementation

Sustainability

Energy Efficiency Check


Energy Efficiency Check

- is a systematic screening
- identifies measures for energy & CO₂ emission reduction
- results in improvement suggestions



Energy Efficiency Management

Energy Efficiency Management

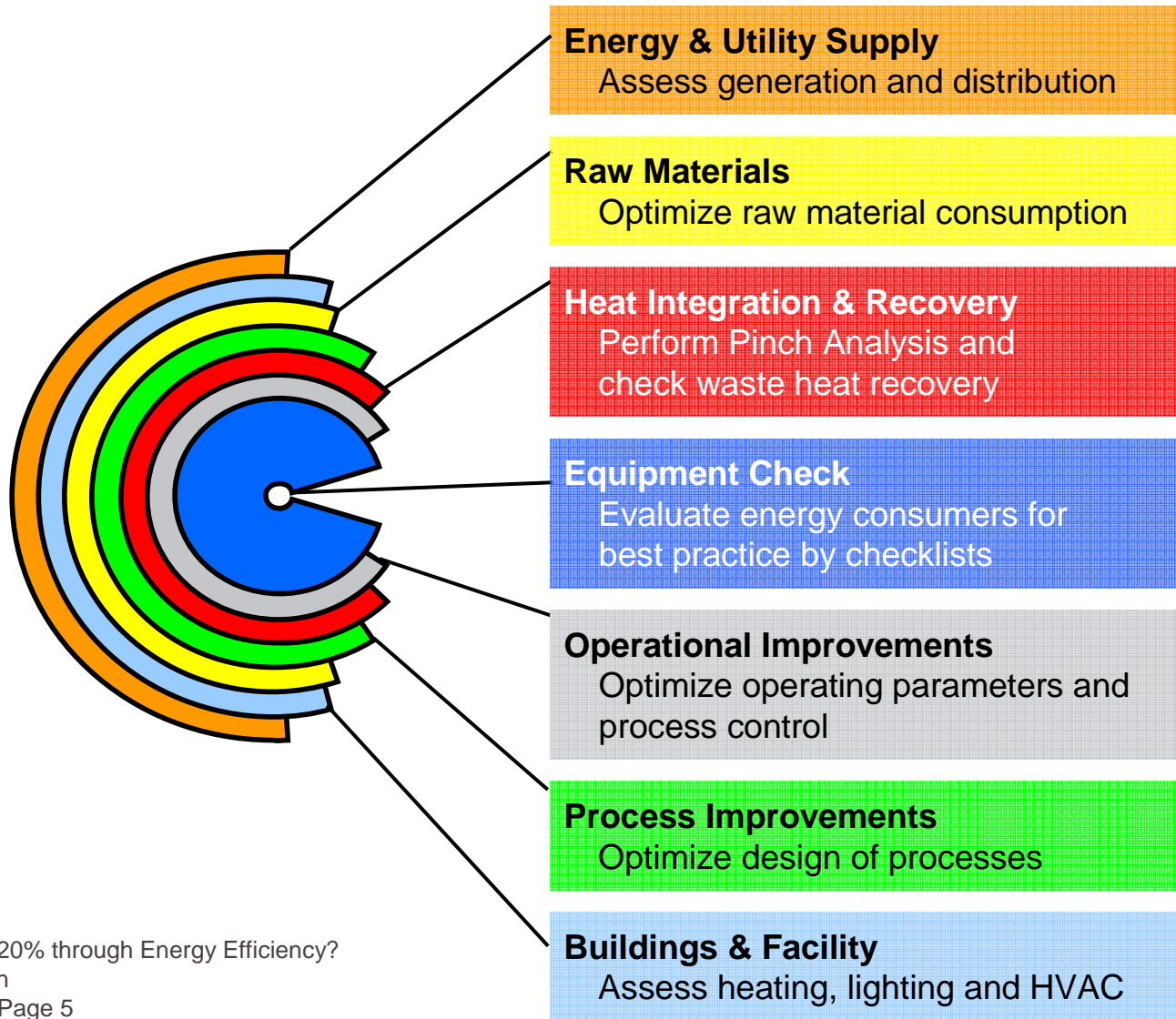
- ensures sustainable implementation of  improvement measures
- sustains a high awareness level

More than 100 EE-Checks completed until end of 2009

More than 2500 measures evaluated

How to save 20% through Energy Efficiency? Like this!

The Energy Efficiency Check considers a wide range of optimization levels



Idea generation phase determines suggestions for energy & CO₂ emission reduction



Sources for improvement suggestions:

- Checklists & best practices (BAT)
- Process experts
- Discipline experts of required competences
- Brainstorming sessions & Interviews to incorporate improvement ideas from plant management and operating employees



How to save 20% through Energy Efficiency?
 Dr. Jan Busch
 21-April-10 • Page 6

Checklist Centrifugal Pump

	A	B	C	D	E	F
1	Bayer Technology Services Energy-Efficiency-Analysis					
4	Centrifugal / Radial Pumps					
7	Author	Herr Stob (BTS-PT-PC-PA)	Tel (+49) 0214 30 3551			
8	Expert	Herr Janssen (BTS-ENGS-PLM-FE)	Tel (+49) 02133 91 2927			
11	Where:	Centrifugal / Radial pumps				
12	Background:	A significant amount of electricity costs is caused by operating a large number of pumps in a plant with power inputs varying from a few kW up to several 100 kW. Most of them are over-dimensioned. Assuming that energy savings of 15% over 8400h save costs of roughly 70 Euro/LEI (2006, only conversion price) and have a good rate. About 50% of the total energy consumption of a pump can be saved (requiring investments of a few 10'000), then a detailed consideration of a pump only makes sense for power inputs starting from 30-48 kW.				
15		Optimization possibilities depend on the system. In static systems (constant flow rate needed), the desired flow rate can be adjusted by valves (reducing the flow rate to the desired level - mostly at the expense of the pump's efficiency) but reducing the overall power input, or by changing the motor. In dynamic systems, the control mode has a large impact on energy consumption.				
16	Source:	Abwärt und Regeltag von Pumpen und Pumpensystemen.pdf				
17		Energieeffizienz in Pumpensystemen.pdf				
18	Detectmark:	Pumps with smaller input than 30-48 kW are not worth detailed investigation.				
21	Questions:					
22		Name				
23		Pump Type (e.g. GPK 60-250)				
24		Flowing speed (l/min, m³/min or RPM/min)				
25		Motor diameter (mm)				
26		Pump Power available				
27		Design Flow rate (full load mode) (m³/h)				
28		Design System Head (m)				
29		Design Flow rate (load mode) (m³/h)				
30		Pressure inlet (bar)				
31		Pressure outlet (bar)				
32		Operating hours (hour/year)				
33						
34						
35						
36						
37						
38		Is the system closed? (e.g.				
39		Flow, or				
40		Control mode				
41		Control mode				
42		Is the pump controlled				
43		How often and for what				
44		Is the pump				
45						
46						
47		What is the actual / optimal to				
48		by				
49		optimal discharge				
50		by checking				
51						
52						
53						
54						
55						
56		Do you have ideas for energy				
57		saving				
58						
59						
60						
61						



Pumps



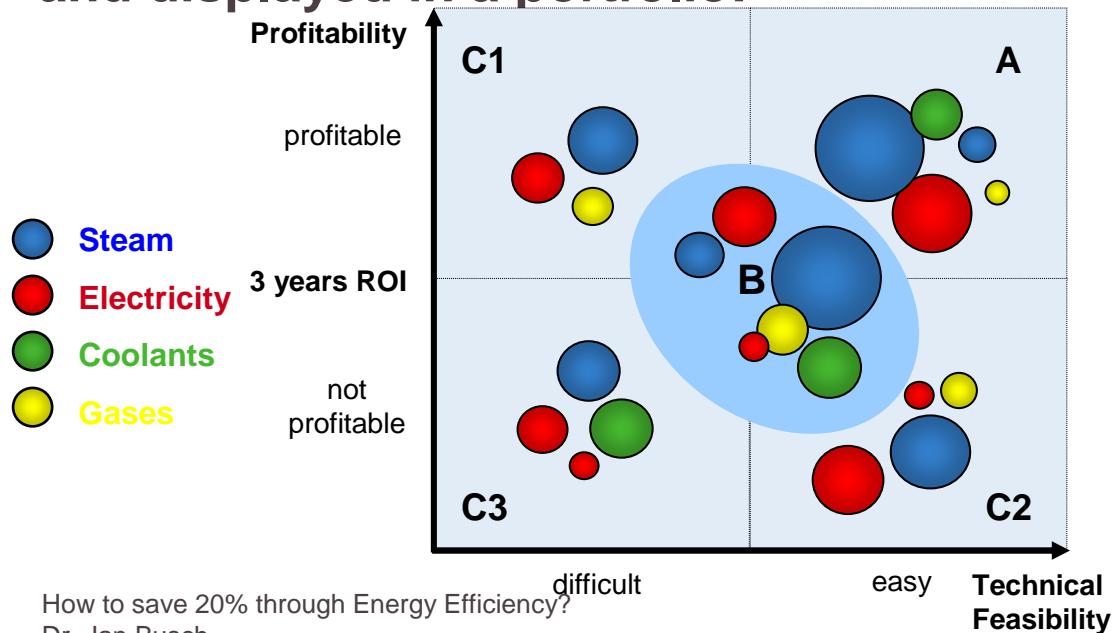
All improvement ideas are evaluated



All improvement ideas are evaluated with regard to

- Technical feasibility
- Savings potential (CO₂e and costs)
- Costs for implementation (rough estimate)
- Profitability (rough estimate)

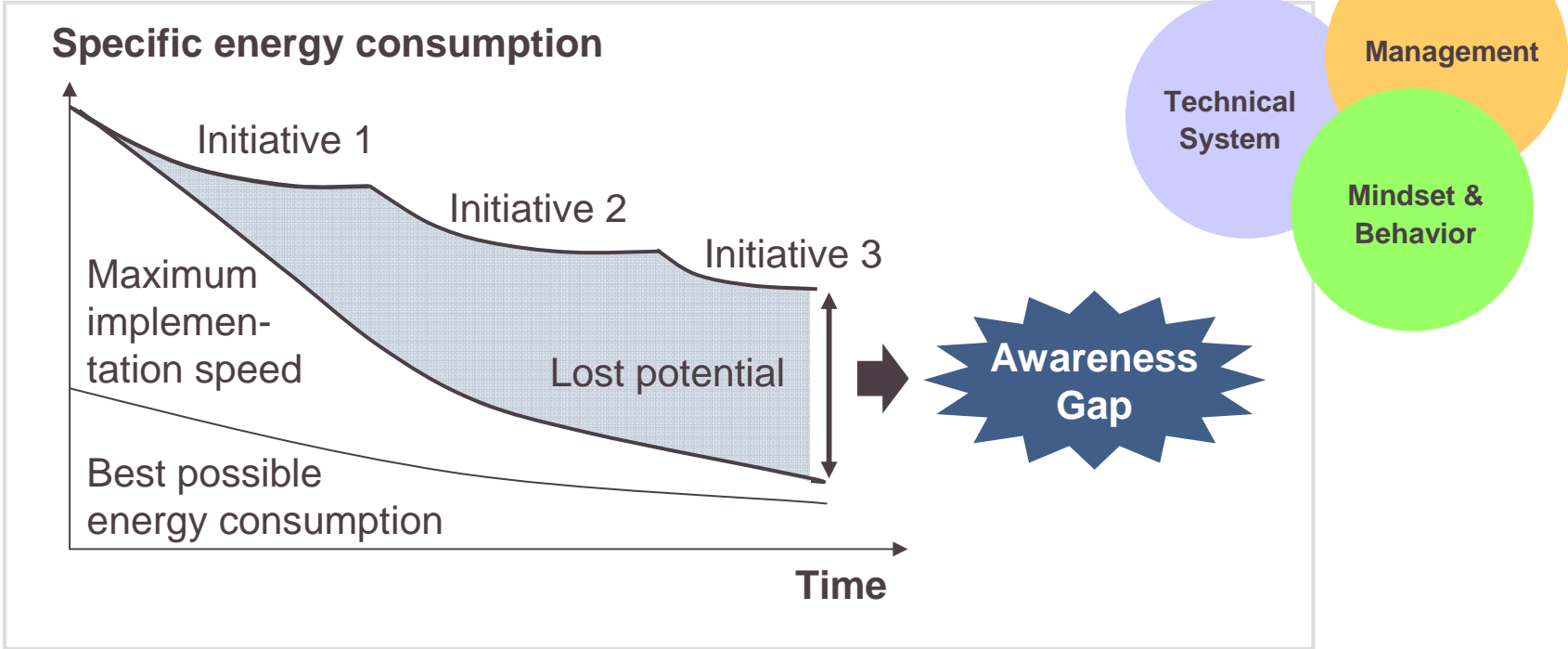
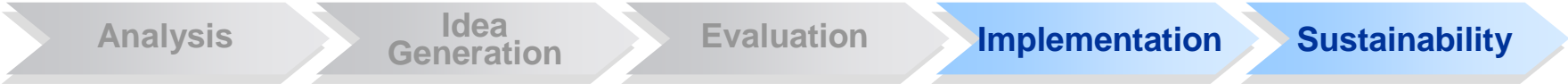
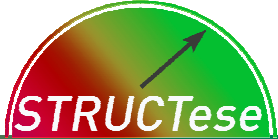
and displayed in a portfolio:



Categories
 A = feasible and profitable
 B = likely feasible and profitable, needs further evaluation
 C1 = technically not feasible but profitable
 C2 = technically feasible but not profitable
 C3 = technically not feasible & not profitable

Bubble Size = Savings Potential

Closing the awareness gap is a challenge



Individual energy savings initiatives cannot sustain a high awareness level over time.

Source: *STRUCTese* Energy Solution Team

How to save 20% through Energy Efficiency?
Dr. Jan Busch
21-April-10 • Page 8

The issue: how to achieve sustainable improvement of energy efficiency in the chemical industry?



VS.



- How to **compare** energy efficiency across processes and products?



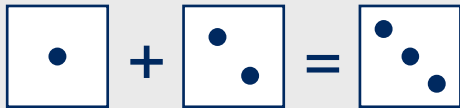
"Feels cold"

VS.



"Really cold"

- What is **really** the limit? How **far** down can you go?



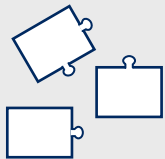
- How to **aggregate** energy losses meaningful on a company level?



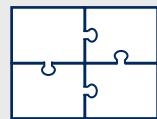
VS.



- How to ensure continuous **focus** on energy efficiency?



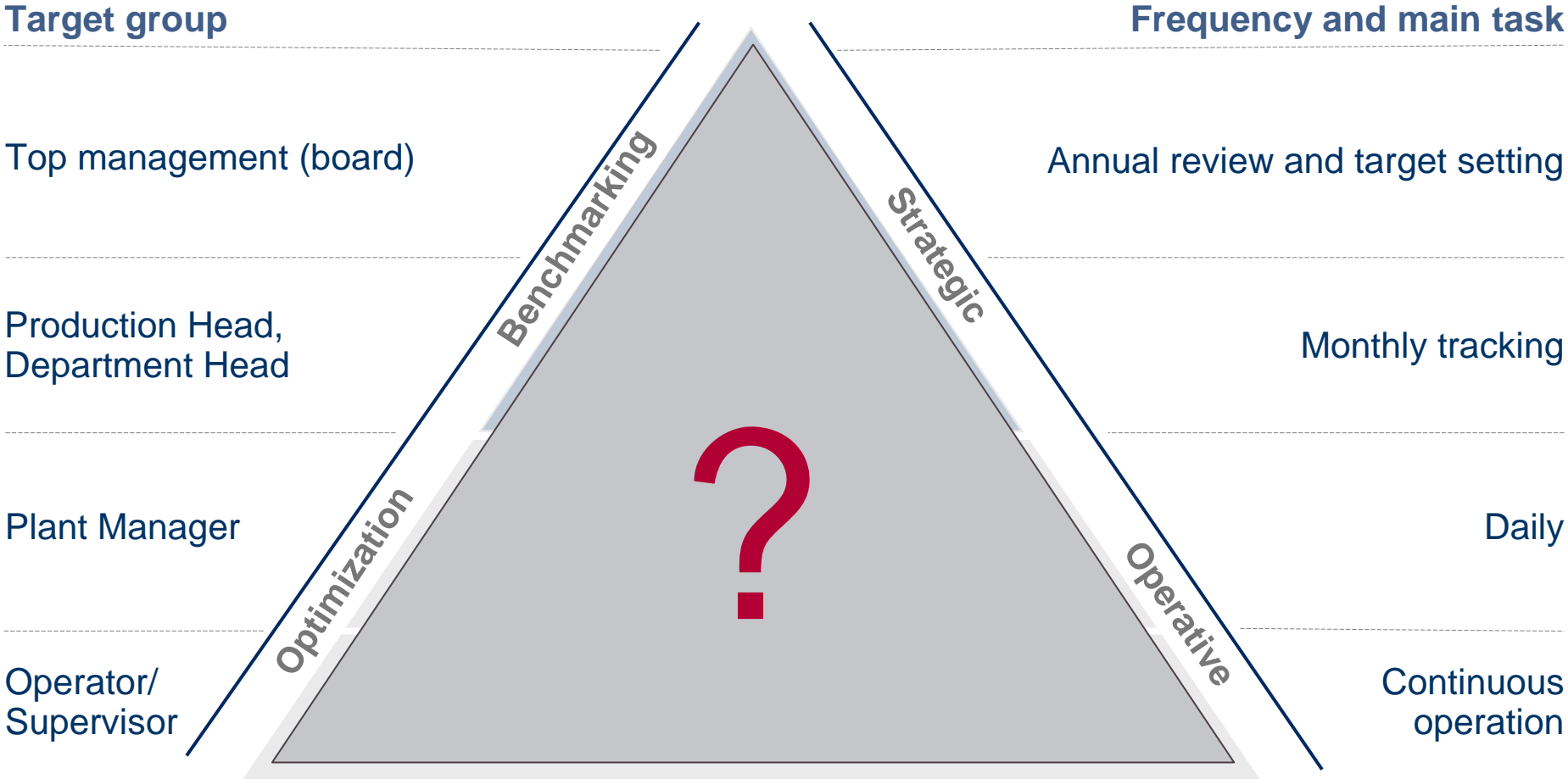
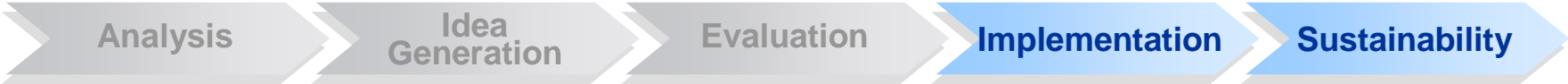
VS.



- How to **integrate** all existing energy tools?
- Are **all aspects** of energy management covered?



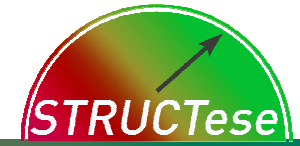
Integrated management tool addressing needs of all levels of the organization



Source: *STRUCTese* Energy Solution Team

How to save 20% through Energy Efficiency?
 Dr. Jan Busch
 21-April-10 • Page 10

More efficient operation requires transparency

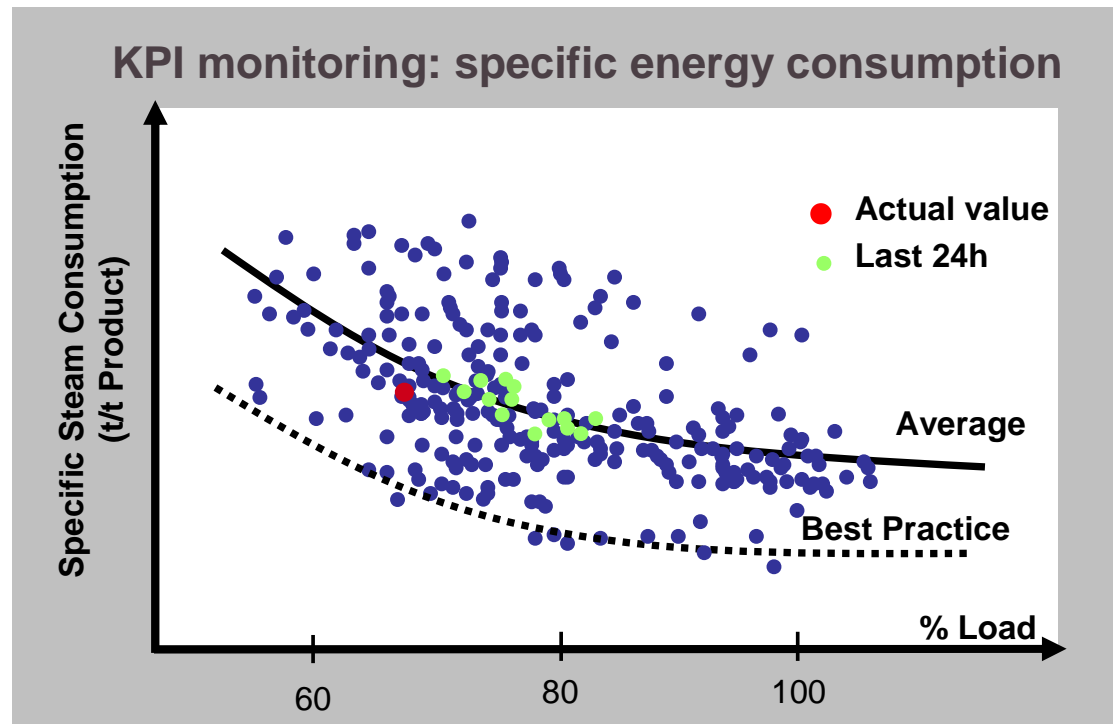


First requirement for more efficient operation is:

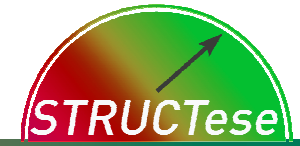
Ability to change

Goal: Create Transparency

- Let the operator know in which status the plant is
- Visualize energy influencing operating parameters (target vs. actual)
- Define and visualize KPIs



More efficient operation requires transparency



Analysis

Idea
Generation

Evaluation

Implementation

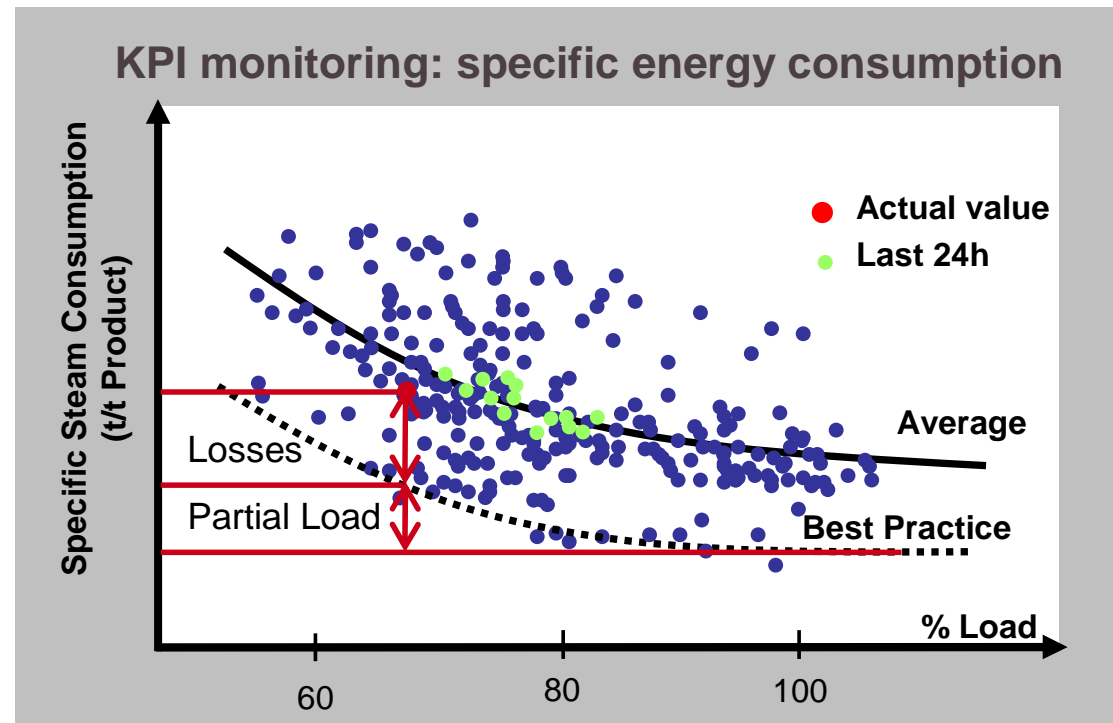
Sustainability

First requirement for more efficient operation is:

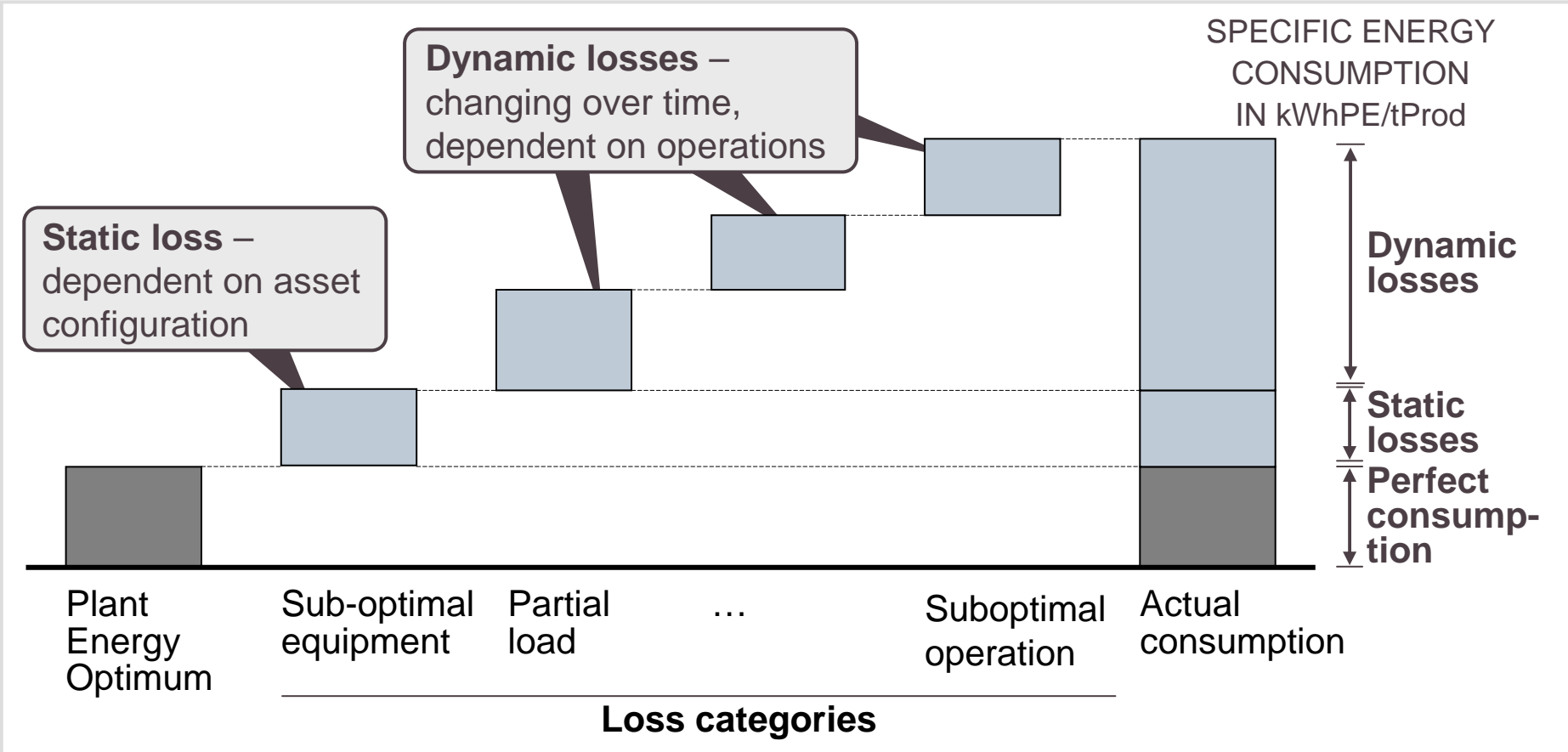
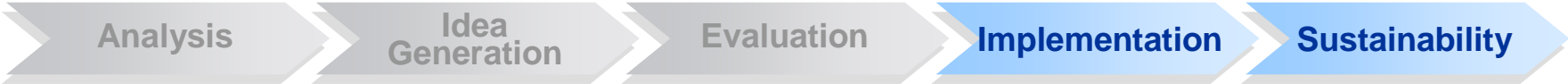
Ability to change

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Energy loss tracking cascade enables objective measurement and target setting



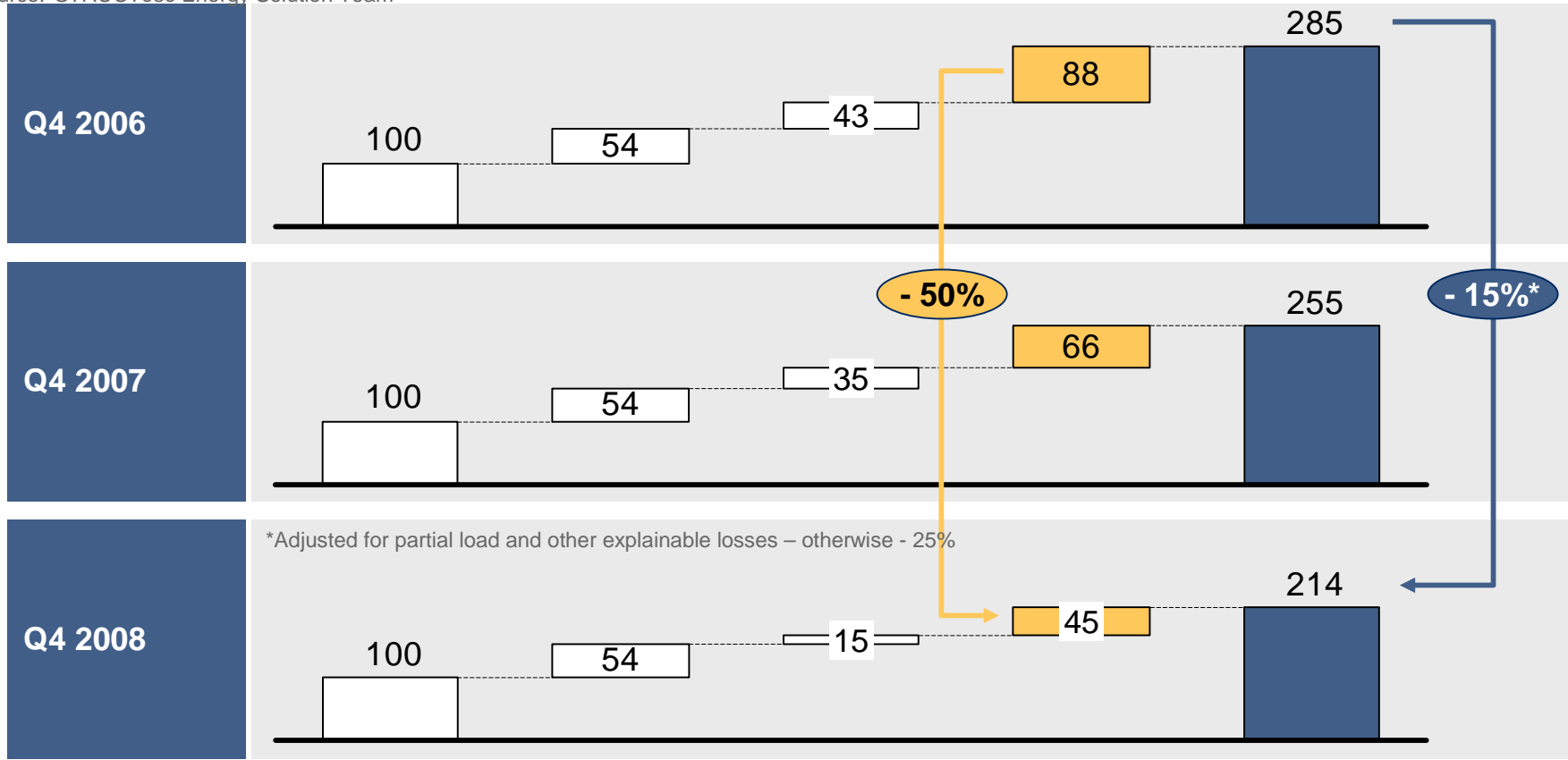
Source: *STRUCTese* Energy Solution Team

Example: Reduction of operational losses by ~50% resulted in overall energy savings of ~15%



LOSS CASCADE – SPECIFIC ENERGY IN kWh/t (INDEXED)

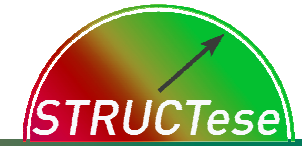
Source: STRUCTese Energy Solution Team



*Adjusted for partial load and other explainable losses – otherwise - 25%

Plant Energy Optimum Sub-optimal equipment Partial load and other explainable losses Sub-optimal operations Actual consumption

Loss Cascade is complemented by Daily Energy Protocol and Online Monitoring



Daily Energy Protocol

- Shows **24-hour average energy consumption** of selected equipment compared with target level as defined by unit supervision
- Unit supervision's tool** to push for improvements in every morning meeting
- Pilot experience (plant A): daily use over two years led to **15% energy reduction** without any investments

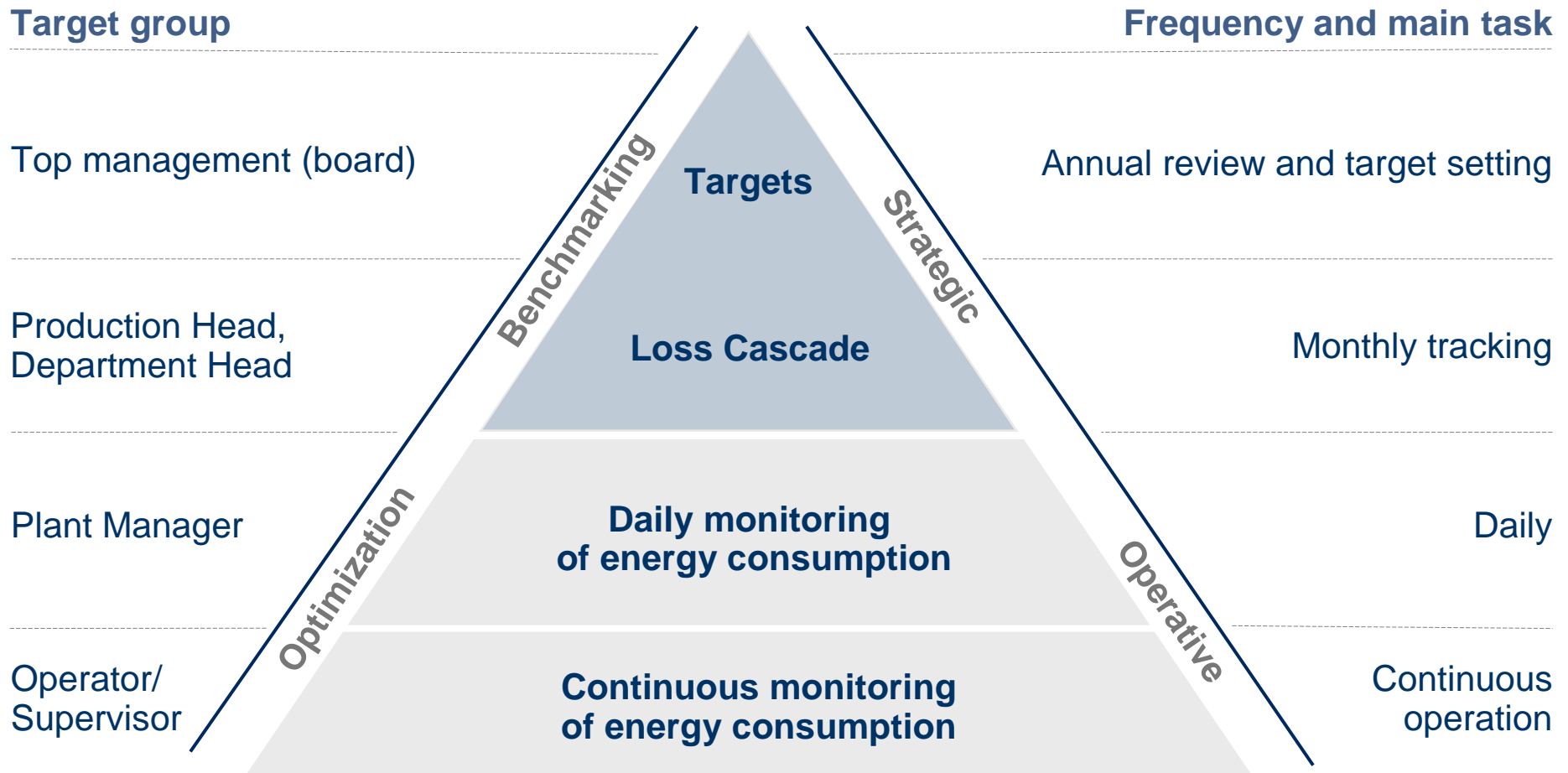
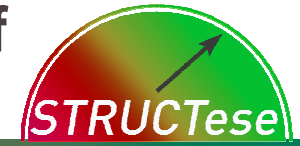
Einheit	Einheitstyp	Einheit	Einheit	Einheit	Einheit	Einheit	Einheit
Gesamter Verbrauch	14 für Dampf	14 für Dampf	14 für Dampf	14 für Dampf	14 für Dampf	14 für Dampf	14 für Dampf
Spezifische Dampfverbrauch	14 für Dampf	14 für Dampf	14 für Dampf	14 für Dampf	14 für Dampf	14 für Dampf	14 für Dampf
Gesamter Verbrauch	14 für Dampf	14 für Dampf	14 für Dampf	14 für Dampf	14 für Dampf	14 für Dampf	14 für Dampf

Online Monitoring

- Shows **real-time energy consumption** of selected equipment against best demonstrated practice consumption
- Unit operation's (board operator's) tool** to influence energy use
- Pilot experience (plant B): operation of energy efficient processes led to **12% energy reduction** within two months without any investments



Integrated management tool addressing needs of all levels of the organization



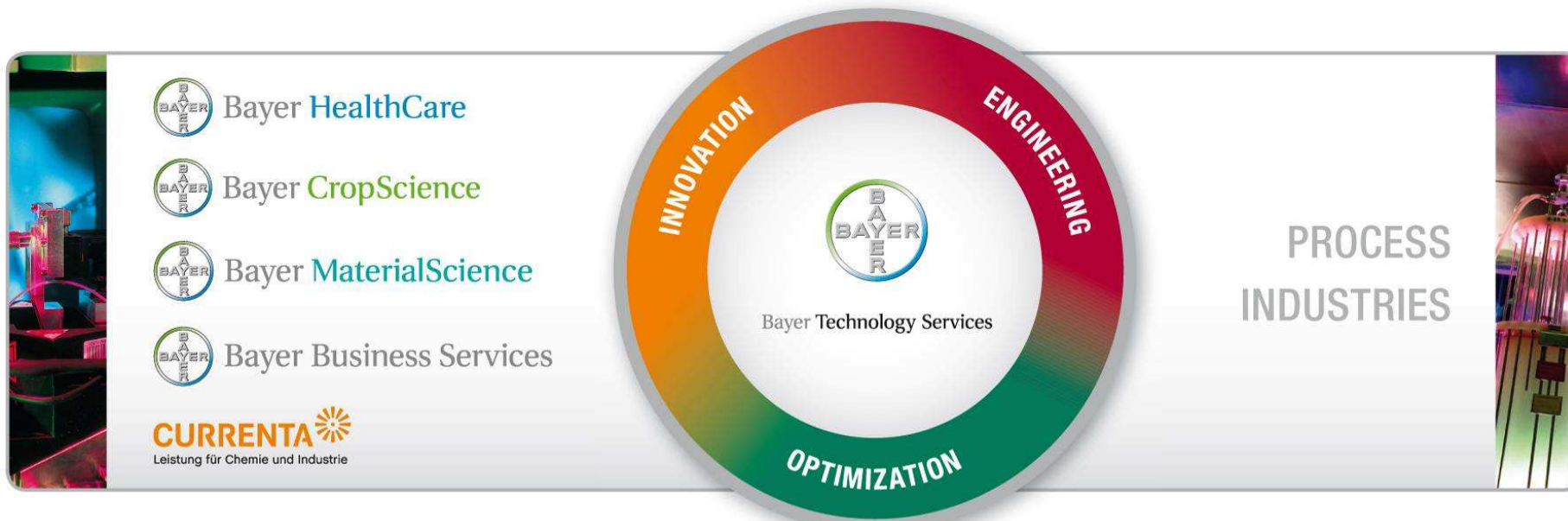
Source: *STRUCTese* Energy Solution Team

How to save 20% through Energy Efficiency?
 Dr. Jan Busch
 21-April-10 • Page 16



Bayer Technology Services

BTS auf einen Blick



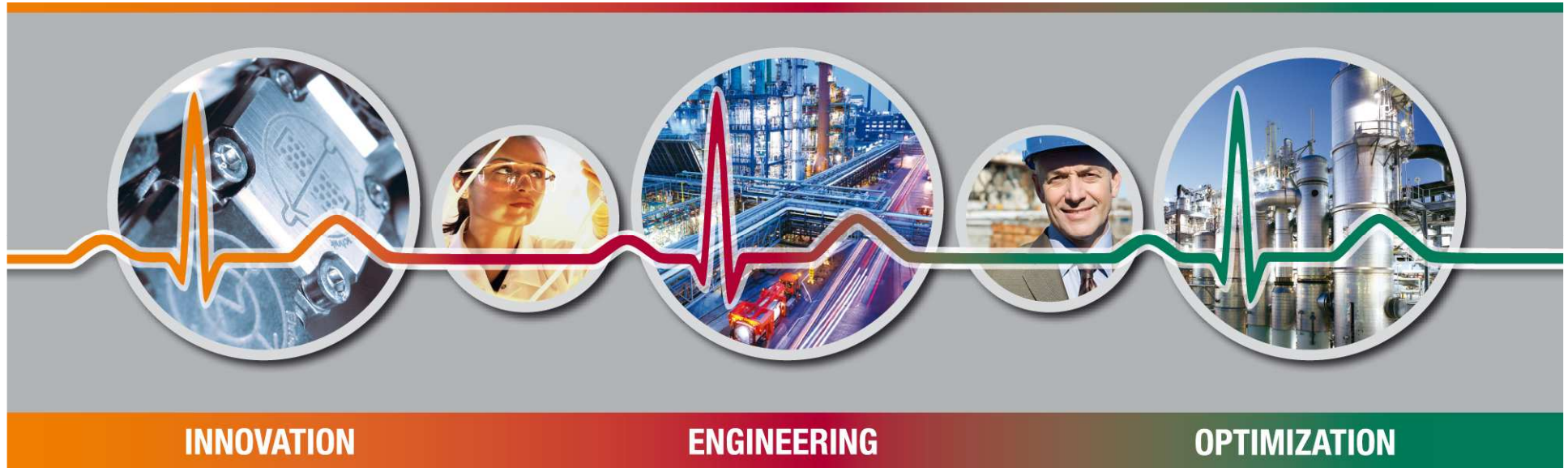
Turnover worldwide (*) 420 Mio. EUR

Employees worldwide (**) 2,600

(*)2008 (**)Dec 31, 2008

Auf der Hannover Messe: Halle 7 Stand C35

Powering Your Performance



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