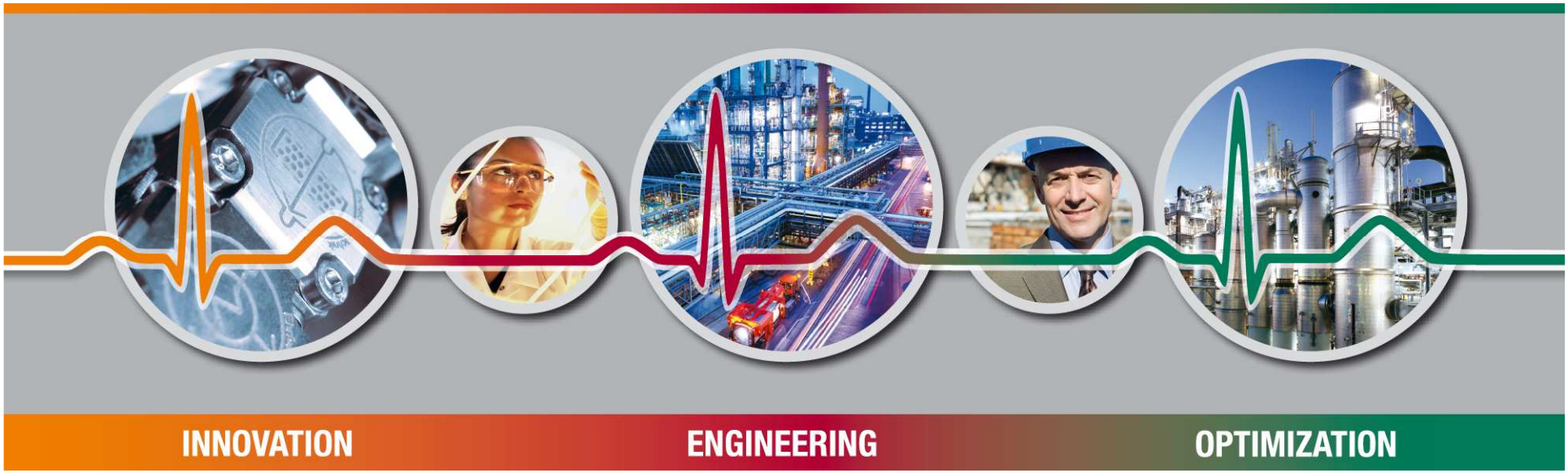
Powering Your Performance



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

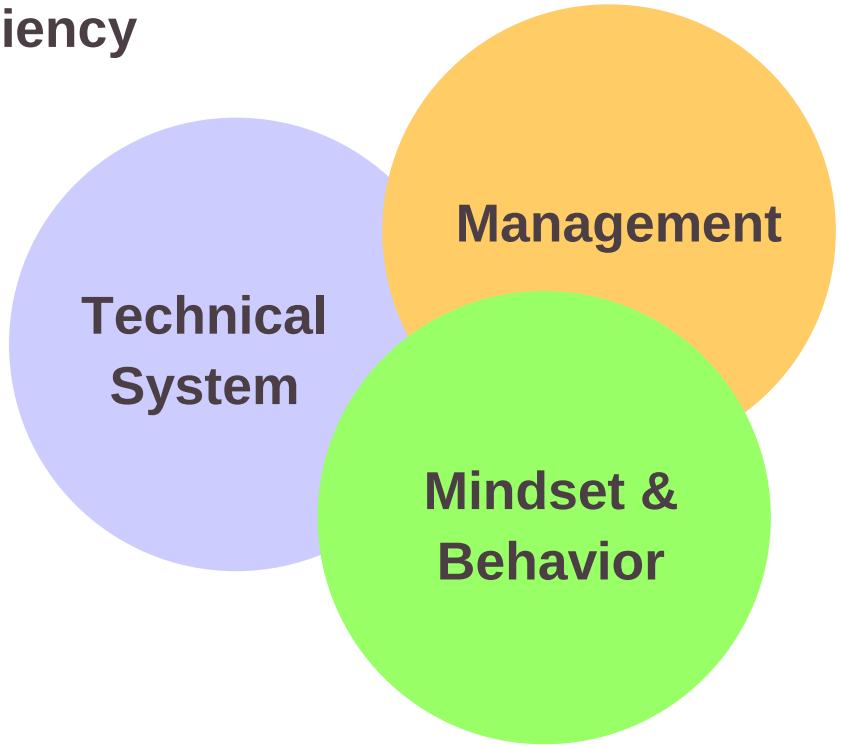
Increased interest of governments in energy efficiency

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 Management**

Energy Efficiency Check

- is a systematic screening
- identifies measures for energy & CO_2 emission reduction
- results in improvement suggestions

Energy Efficiency Management

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

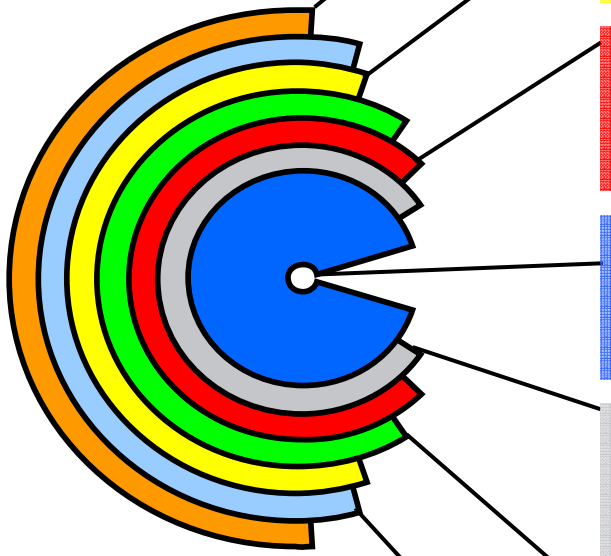
More than 100 EE-Checks completed until end of 2009

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

Analysis | **Idea Generation** | Evaluation | Implementation | Sustainability



Energy & Utility Supply
Assess generation and distribution

Raw Materials
Optimize raw material consumption

Heat Integration & Recovery
Perform Pinch Analysis and check waste heat recovery

Equipment Check
Evaluate energy consumers for best practice by checklists

Operational Improvements
Optimize operating parameters and process control

Process Improvements
Optimize design of processes

Buildings & Facility
Assess heating, lighting and HVAC

Idea generation phase determines suggestions for energy & CO_2 emission reduction

Analysis | **Idea Generation** | Evaluation | Implementation | Sustainability

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

Checklist Centrifugal Pump

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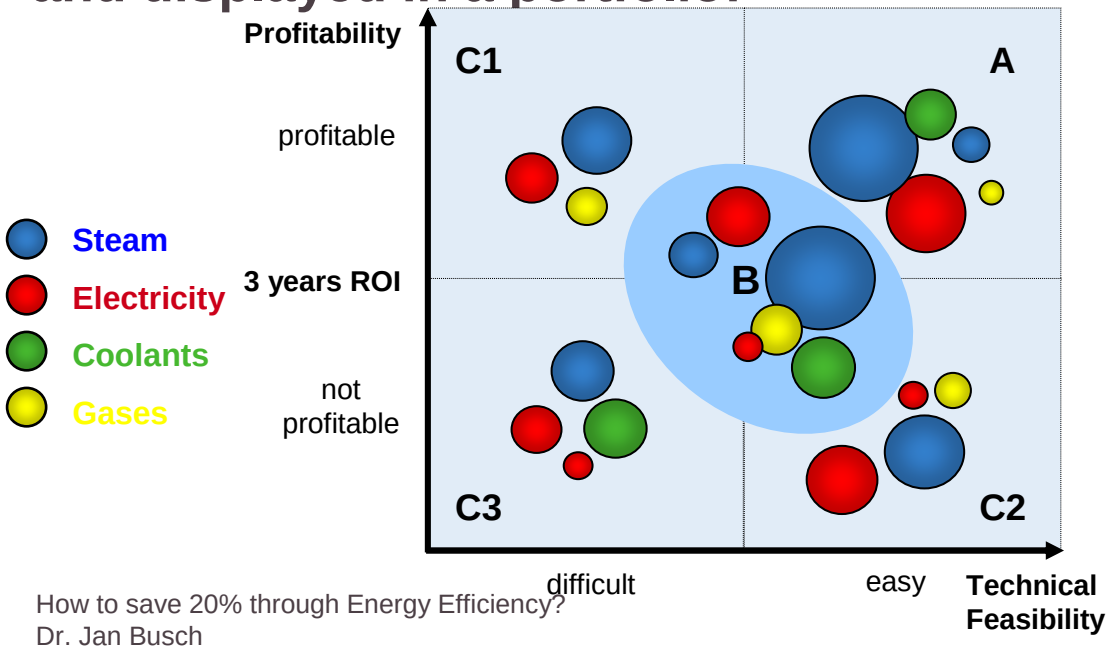
All improvement ideas are evaluated

Analysis | Idea Generation | **Evaluation** | Implementation | Sustainability

All improvement ideas are evaluated with regard to

- Technical feasibility
- Savings potential (CO_2e 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

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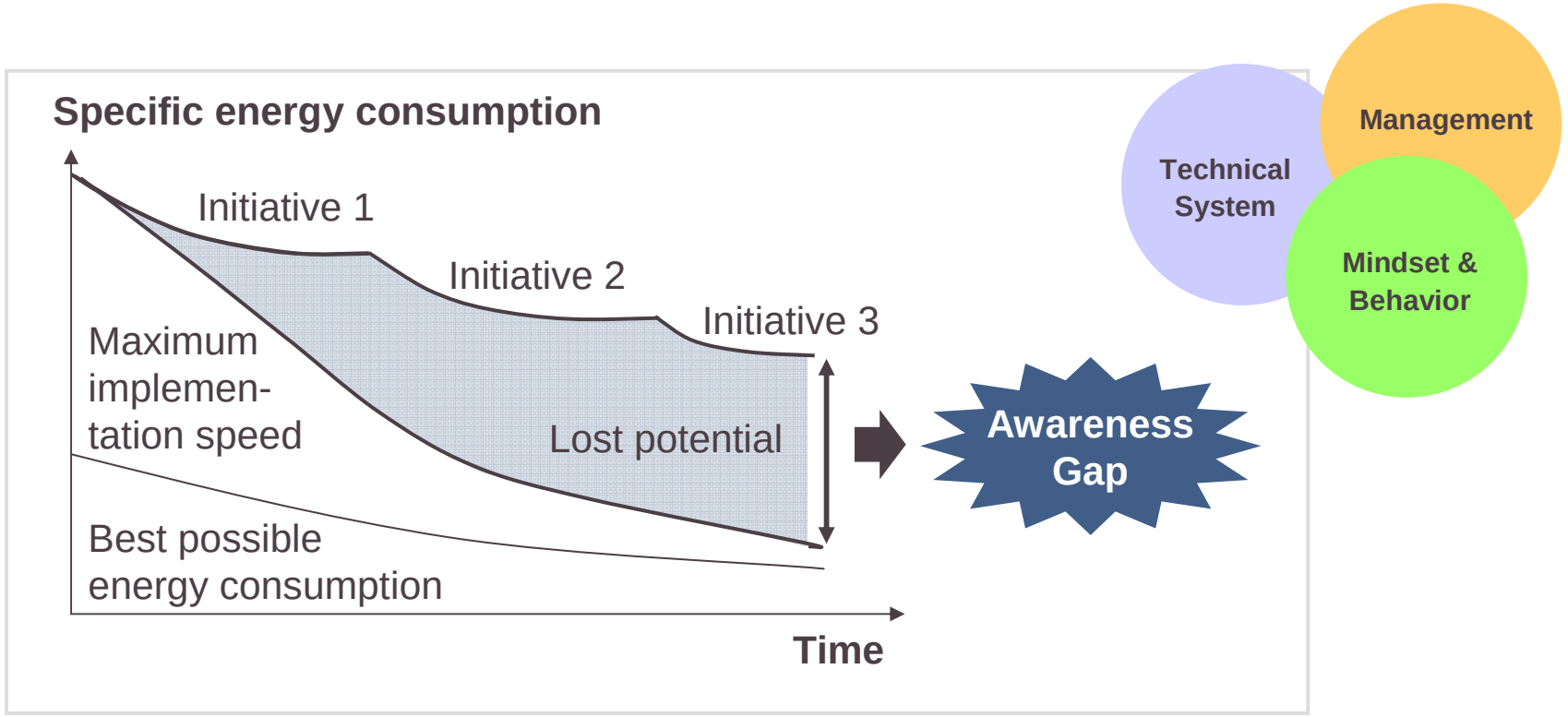
Closing the awareness gap is a challenge

Analysis | Idea Generation | Evaluation | Implementation | Sustainability



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

Source: *STRUCTese* Energy Solution Team

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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.

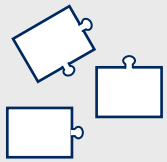
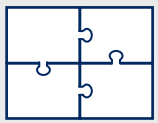
"Really cold"

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

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


vs.

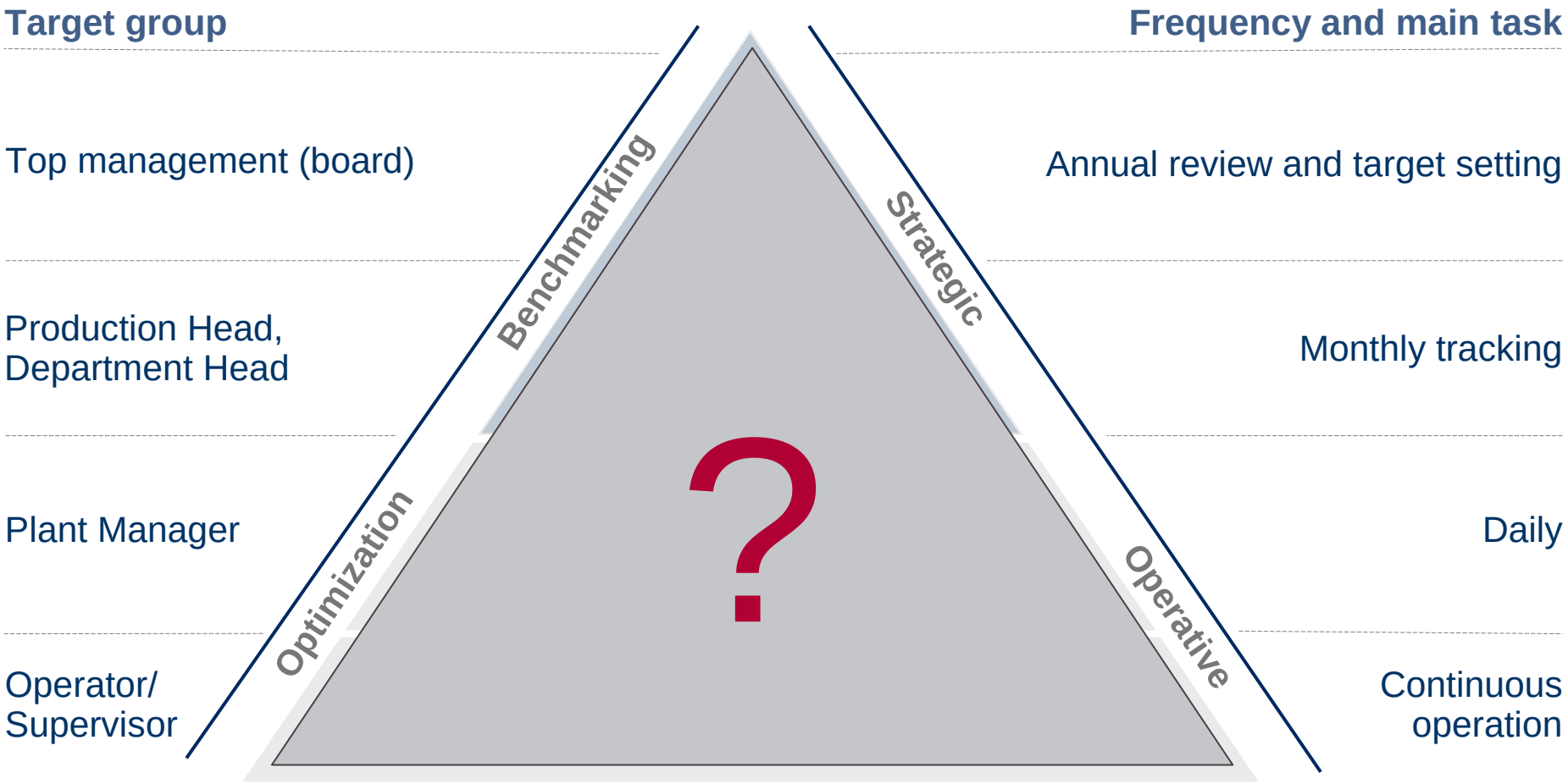

- How to ensure continuous **focus** on energy efficiency?


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

Analysis | Idea Generation | Evaluation | **Implementation** | **Sustainability**



Source: *STRUCTese* Energy Solution Team

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More efficient operation requires transparency

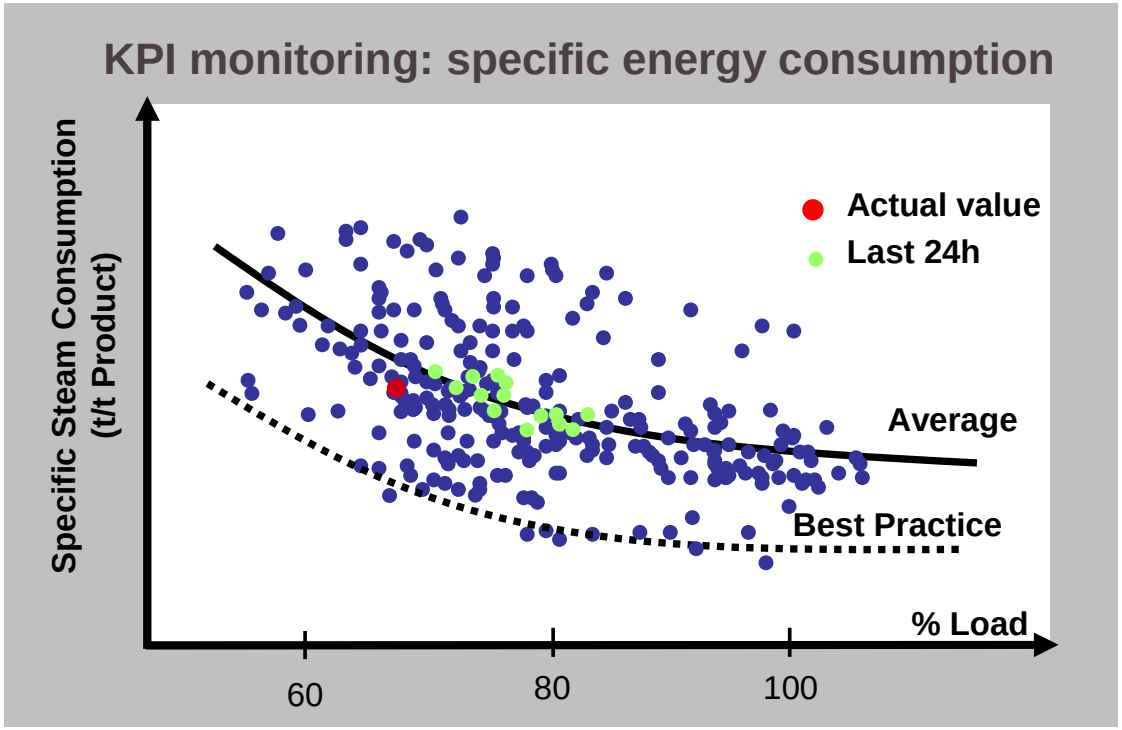
Analysis | Idea Generation | Evaluation | Implementation | Sustainability

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



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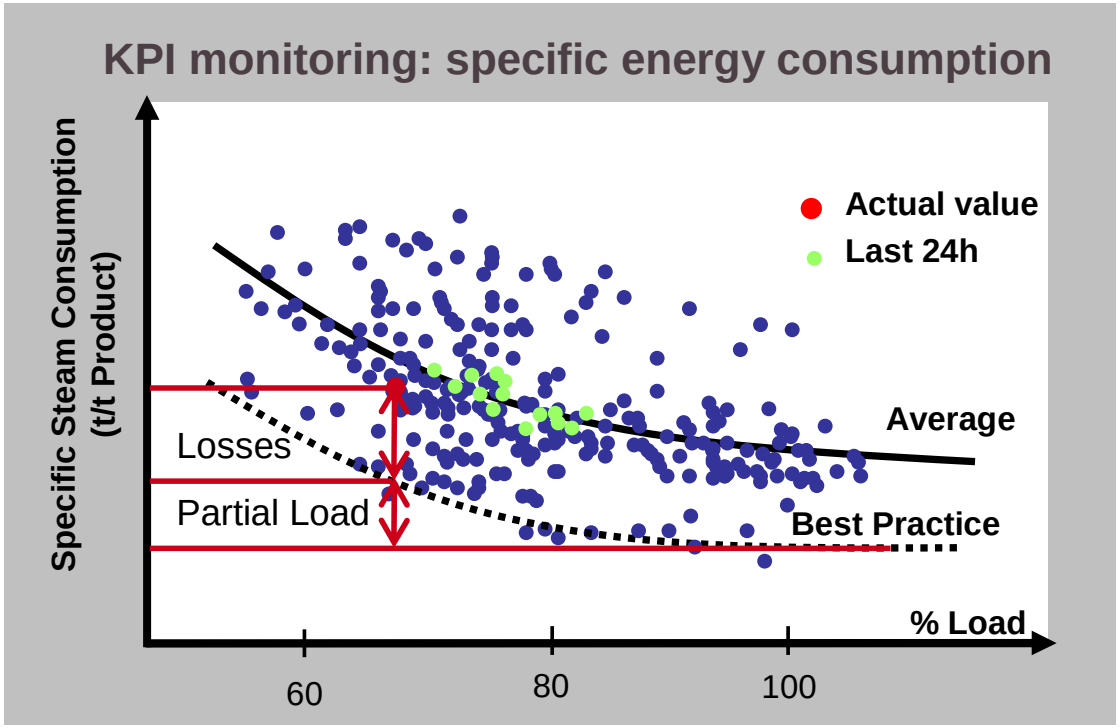
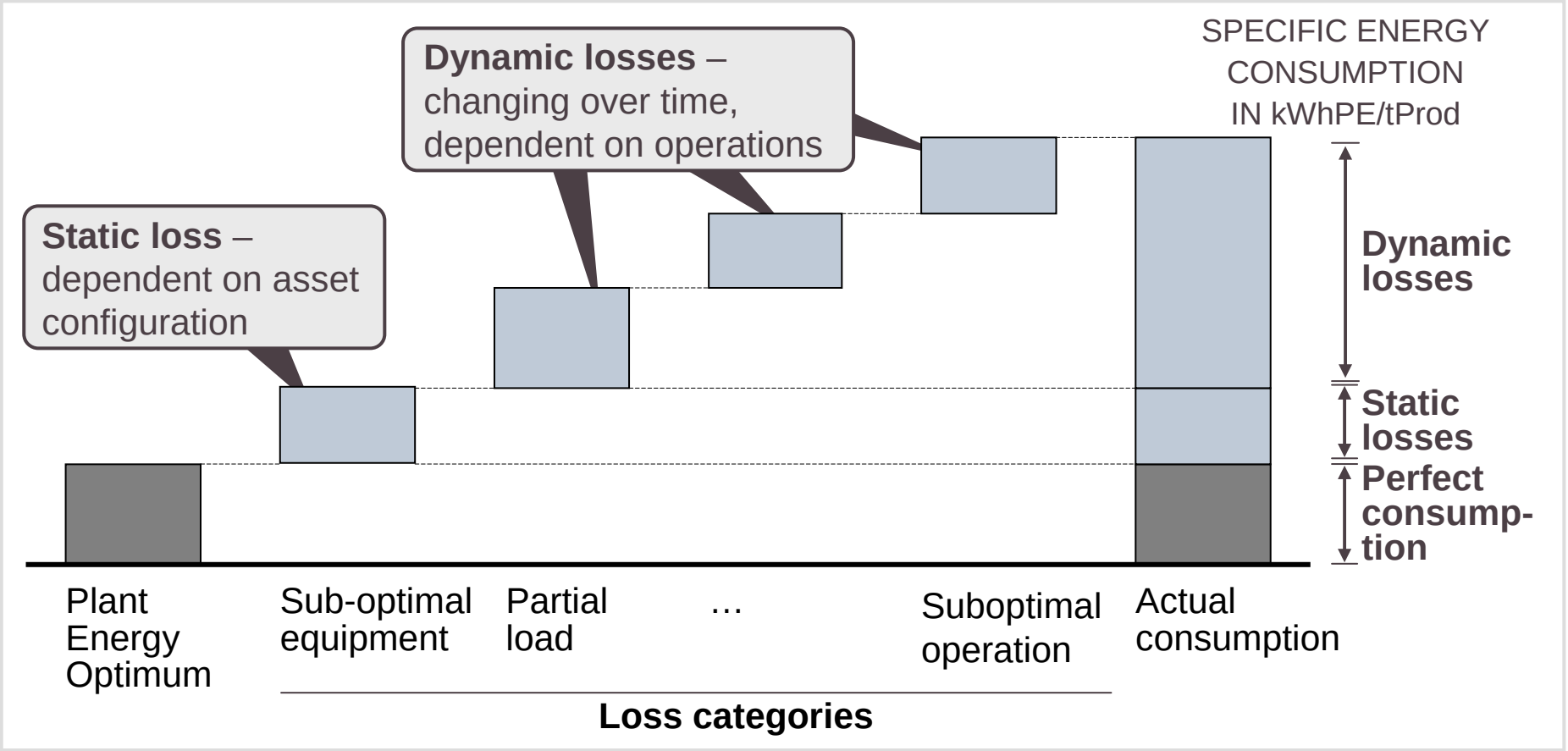


Energy loss tracking cascade enables objective measurement and target setting

Analysis | Idea Generation | Evaluation | **Implementation** | **Sustainability**



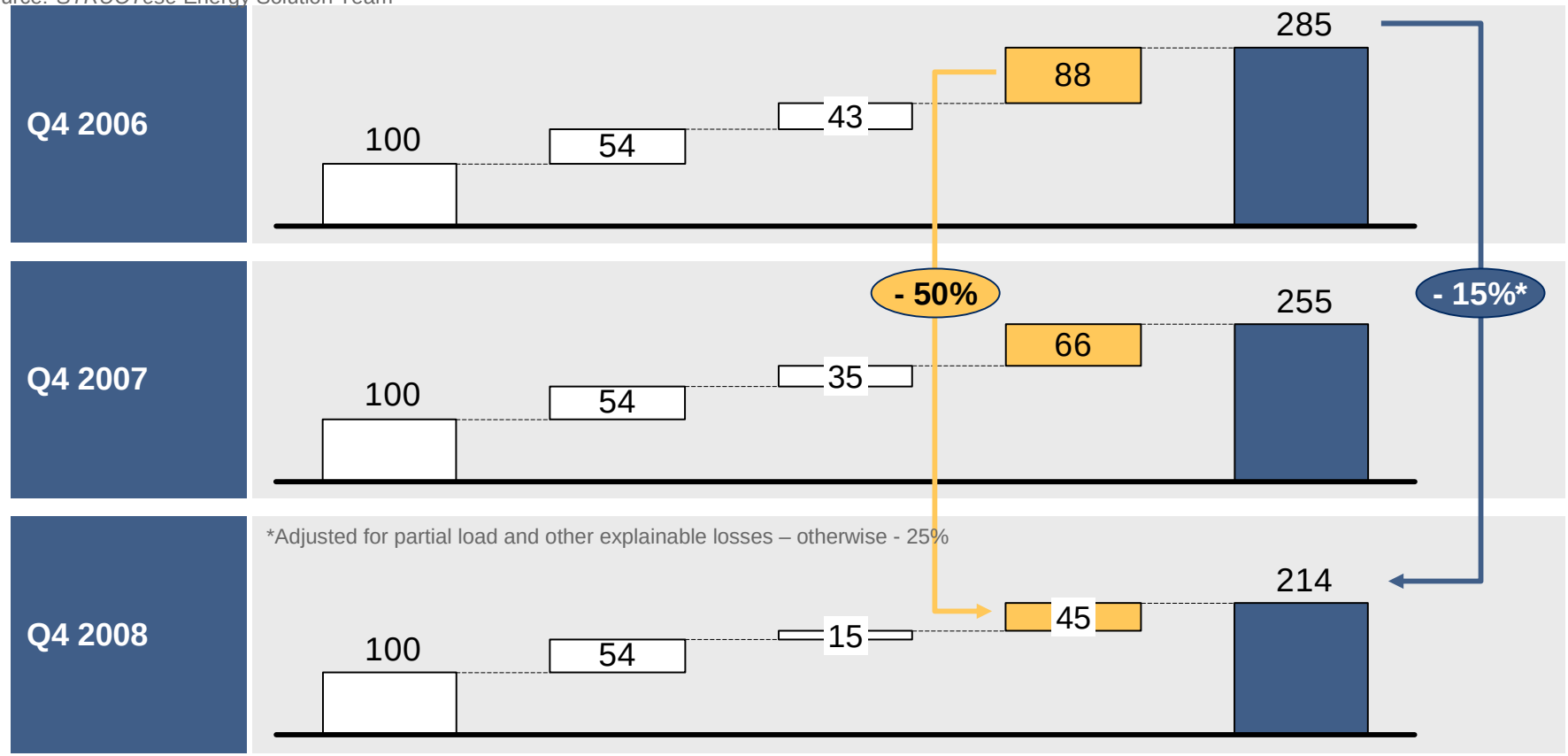
Source: *STRUCTese* Energy Solution Team

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

Analysis | Idea Generation | Evaluation | Implementation | Sustainability

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

Source: *STRUCTese* Energy Solution Team



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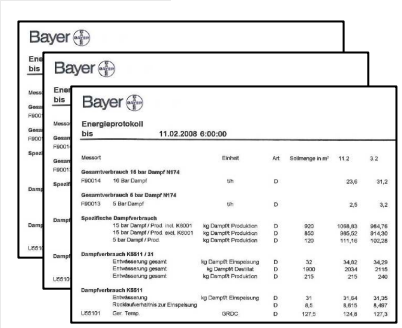
Loss Cascade is complemented by Daily Energy Protocol and Online Monitoring

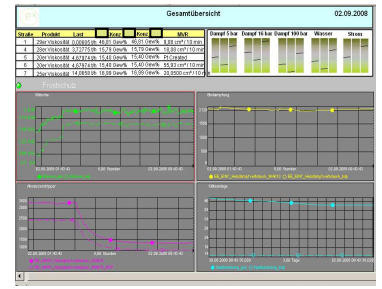
Daily Energy Protocol

- 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



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



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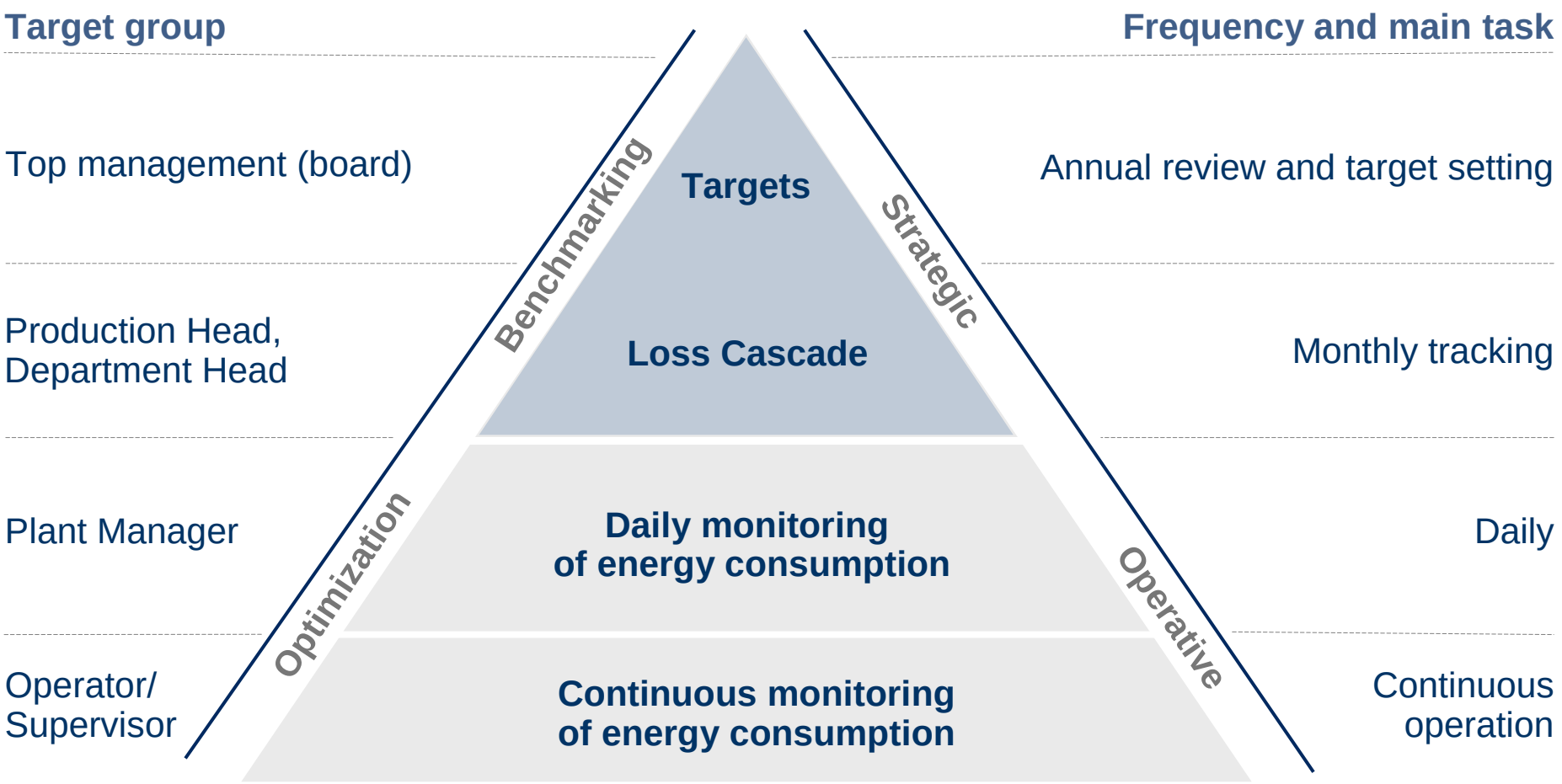
Integrated management tool addressing needs of all levels of the organization

Analysis | Idea Generation | Evaluation | **Implementation** | **Sustainability**



Source: *STRUCTese* Energy Solution Team

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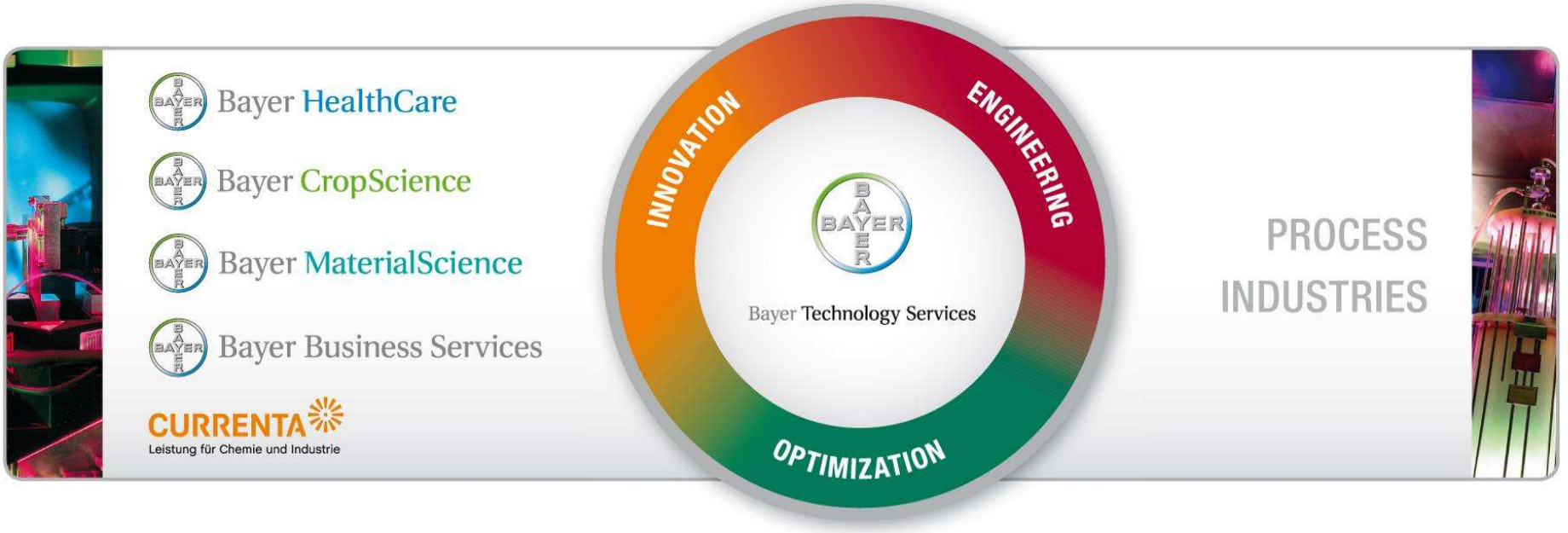
BTS auf einen Blick



Turnover worldwide (*) 420 Mio. EUR

Employees worldwide (**) 2,600

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

Auf der Hannover Messe: Halle 7 Stand C35

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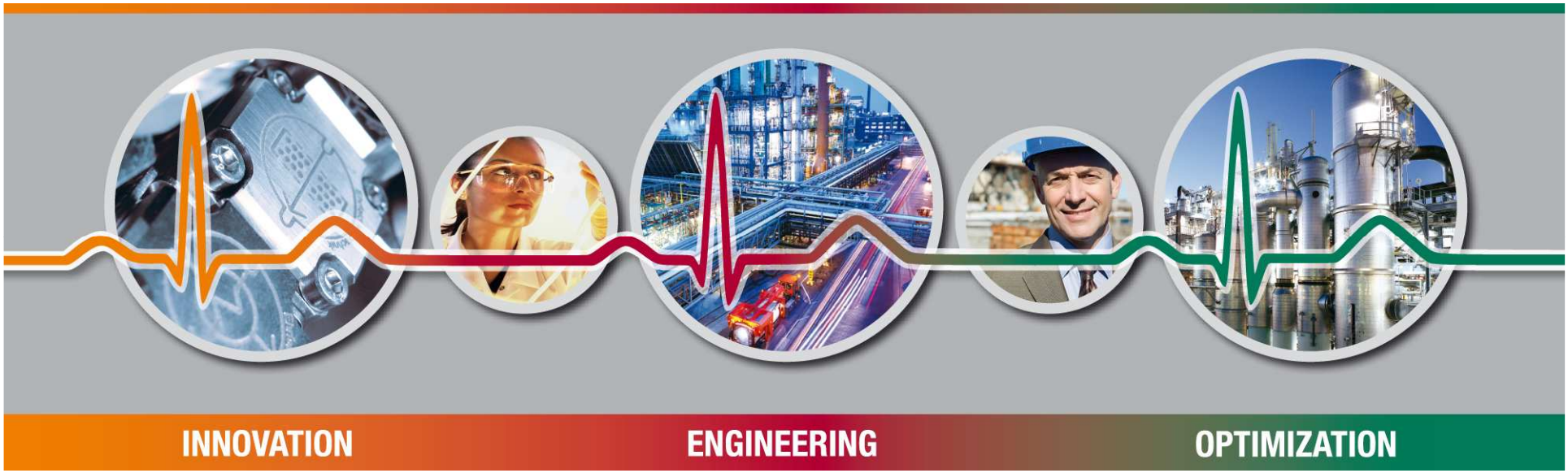
Powering Your Performance



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