



## IMPACT ON PRODUCTIVITY BY SMART ENGINEERING

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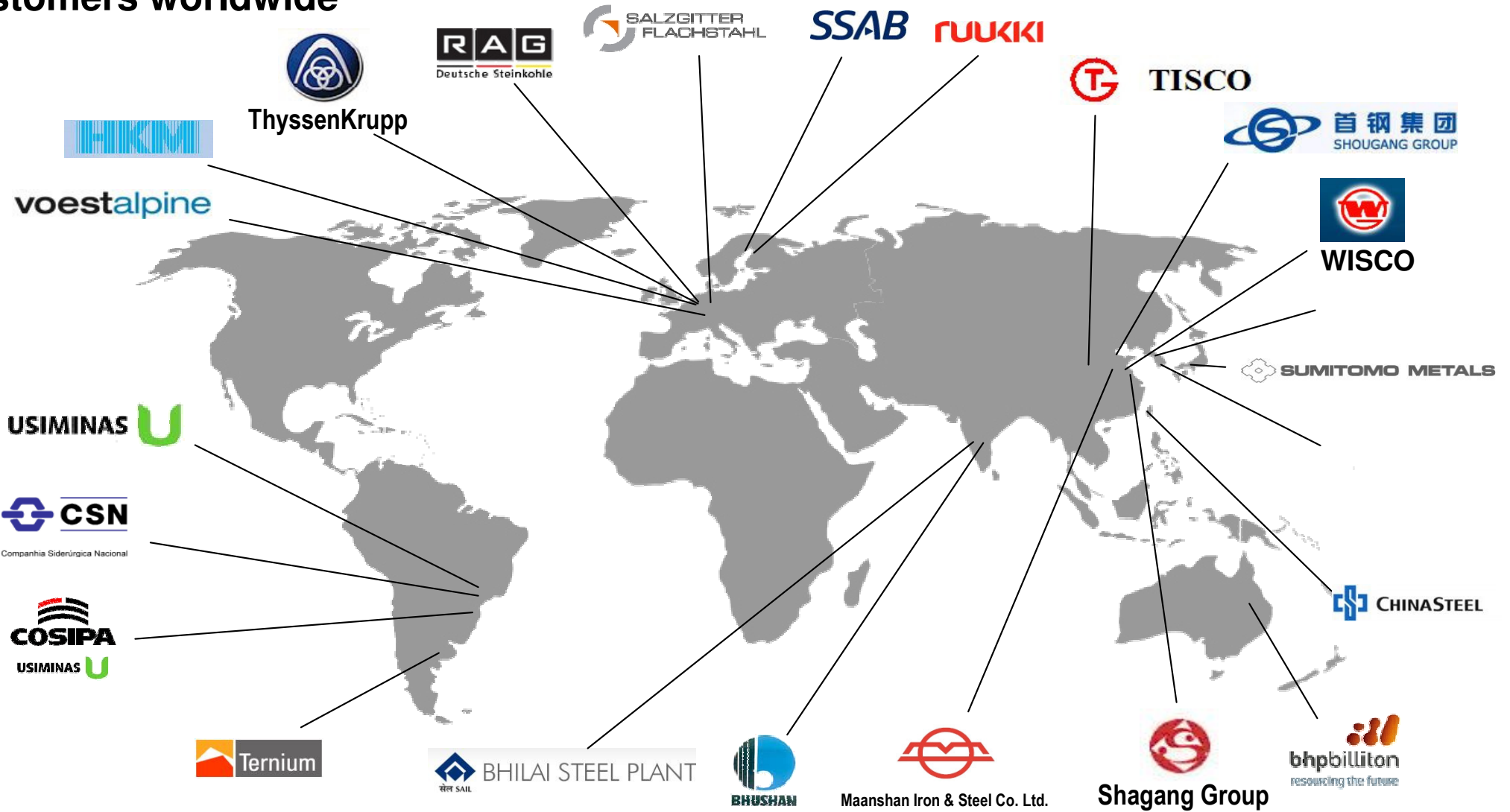
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# SMART ENGINEERING

## Customers worldwide



# SMART ENGINEERING

## Current orders

Uhde



1<sup>st</sup> Coke ceremony



Dangjin, Korea

**Phase 1/2**

- 7.63m Battery
- 3 Sets of Machines
- Completion 10/2011

**Phase 3:**

- 7.63m Battery
- 3 Sets of Machines
- Completion 10/2013

Uhde



POSCO

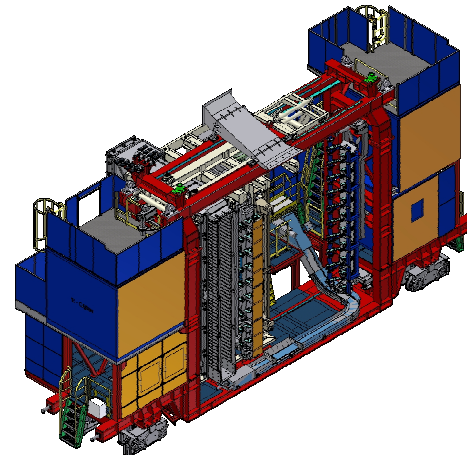
Gwangyang, Korea

- 7.63m Battery
- 3 Sets of Machines
- Completion 12/2011



Angul, India

- 7.6m Battery
- 2 Sets of Machines
- Completion 03/2013



Volta Redonda, Brazil

- 6m Battery
- 1 pc. OSDM – One-Spot-Door-M/C w/ Coke Guide
- Completion 10/2012

## Background:

### Historic Design

- Customers usually steel / coke producers own individual experience by internal R&D
- Equipment ordered by their own specification for required battery and machine characteristics

### Today's design challenge

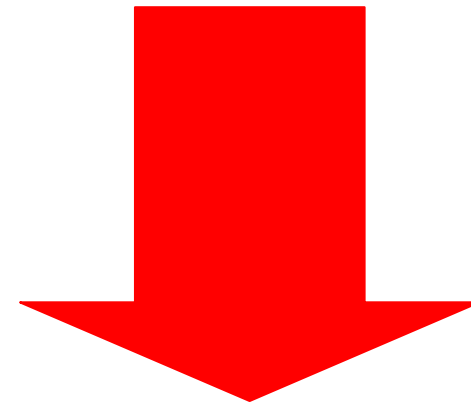
- Reduced customer efforts for internal R&D
- Customer depends on supplier's experience to get best-in-class battery and machinery equipment at specified performance

# SMART ENGINEERING

Changed requirements:

- Technology
- Design

**SPECIFIED EQUIPMENT**



- Quantity
- Productivity

**SPECIFIED PERFORMANCE**

# Smart Engineering

## Engineering Demands:

- Machine performance depends on battery and/or other plant process
- Process depends on interaction between machines and battery
- Prevention of process disturbances through measures at upstream plant units
- Suitable solutions require knowledge of related process cycle



## Example - Graphite Formation



### Cause:

- Inappropriate temperature profile
- Uneven coal charge
- Charging level too low

### Countermeasure:

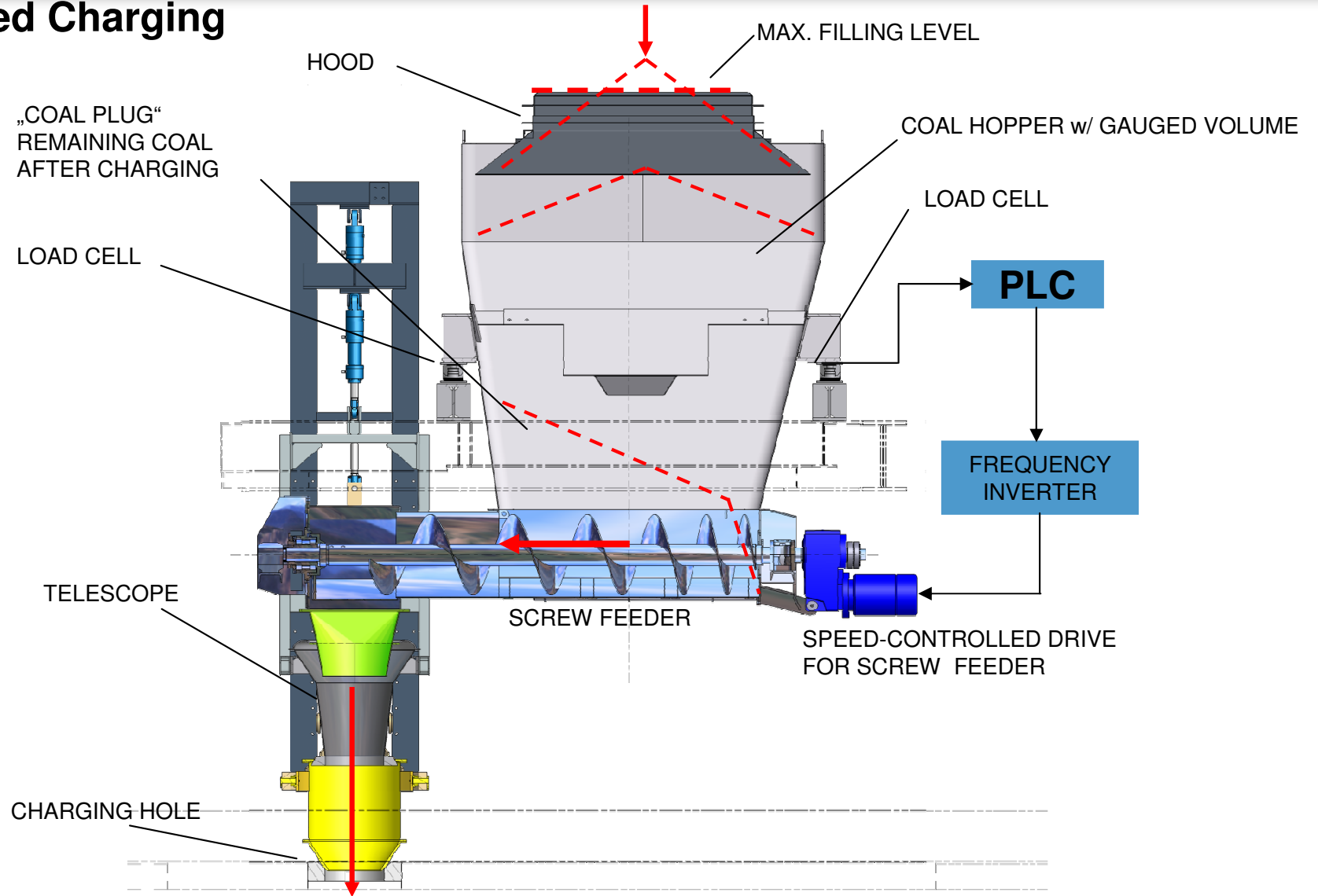
- Cleaning devices → 😞
- Clear cause instead of symptom → 😊

### Cause prevention:

- Improve charging process
- Adjustment of levelling sequence

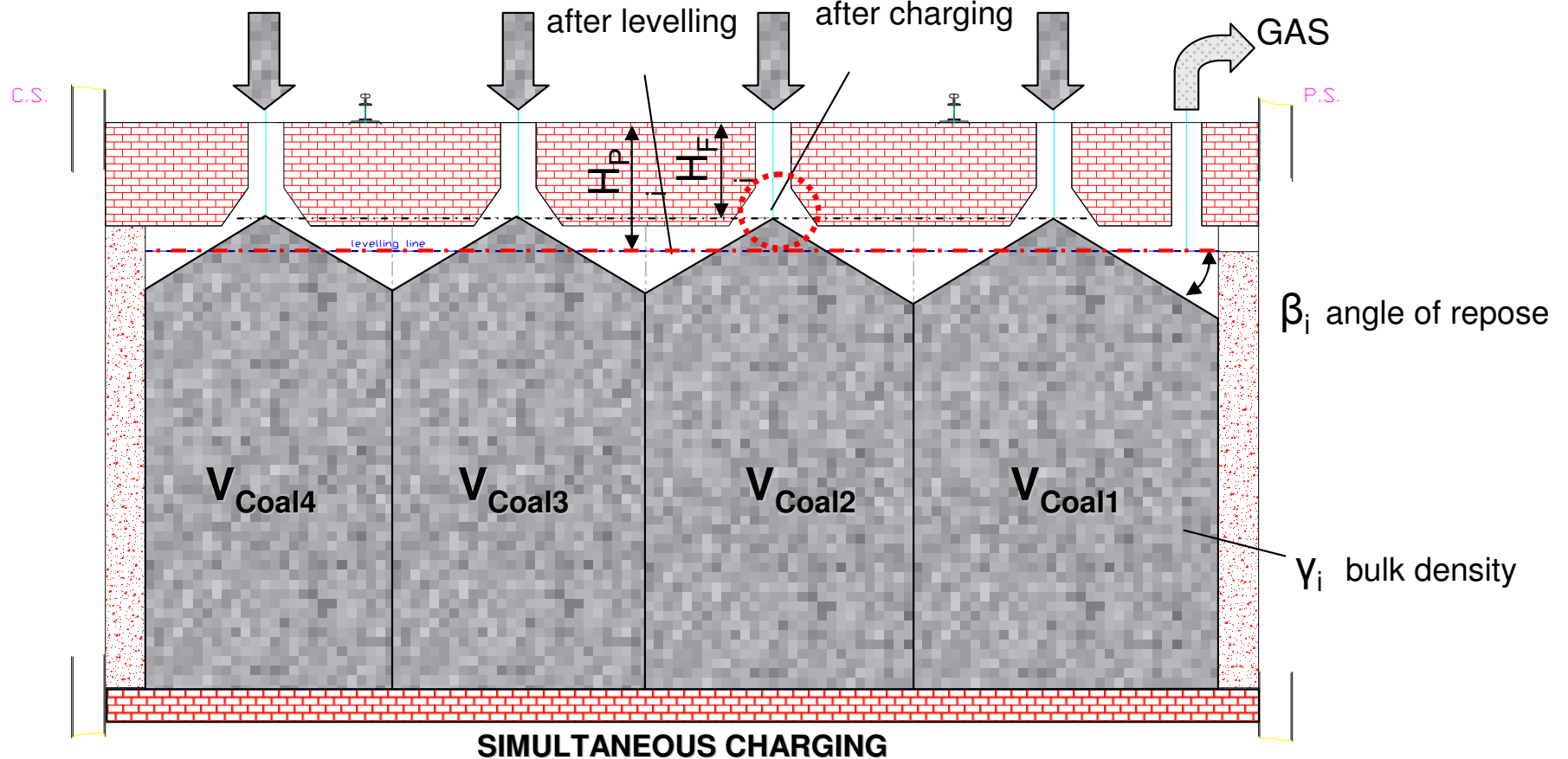
# SMART ENGINEERING

## Example - Controlled Charging





## Example - Charging Characteristics



- Coal charge before levelling to achieve optimal charging grade
- Coal tip  $H_{Fi}$  should be measured for adjustment of charging volume
- Compensation of increased density by compacting in oven chamber

# SMART ENGINEERING

## Optimizing of coal charge



yesterday

### Gauge bar

- Manual Measurement
- Bad reproducibility
- Hazardous

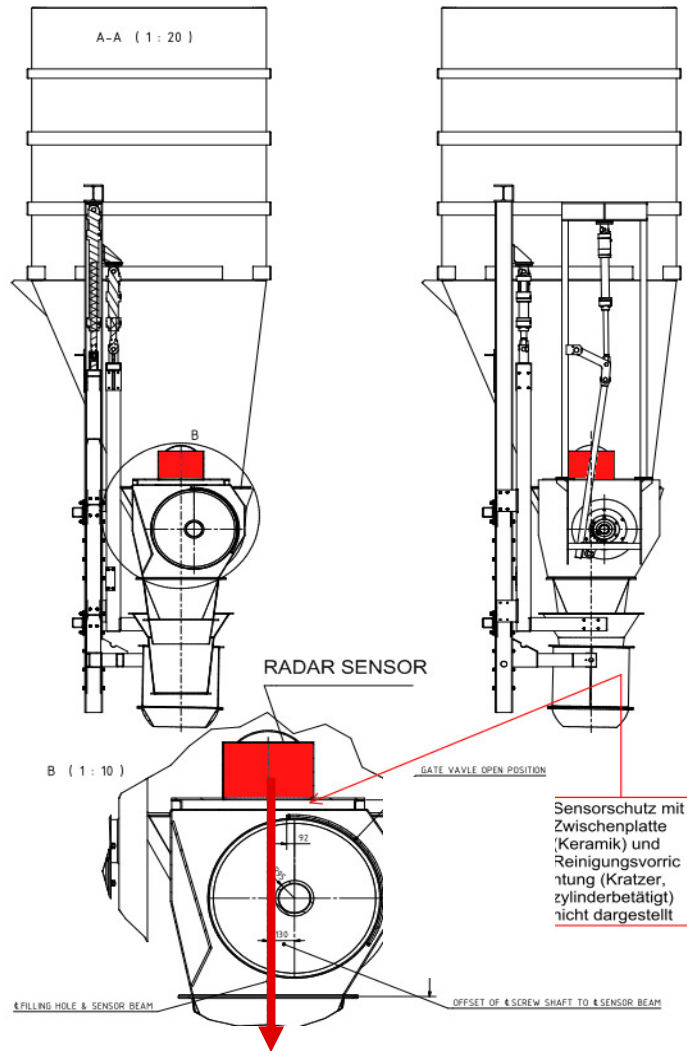
### Mobile measuring device

- Easy to handle
- Fast operation
- Contact-free
- Reproducible data
- Recordable data
- Fits below telescope
- Safe



today

## Optimizing of coal charge:



## Integrated measuring device

- Compensation of coal densification
- Adjustment of coal charge on levelling
- Self-regulating charging process
- Feeder screw offset to charging hole
- New design required of screw feeder and discharge housing
- Ideal on overhauling of equipment

## Reference

### Charging Optimization (6 m battery in 2011/2012)

- Assessment study



- Re-definition of charging sequence
- Implementation of revised charging software
- Commissioning of charging process
- Performance test
- On-site training

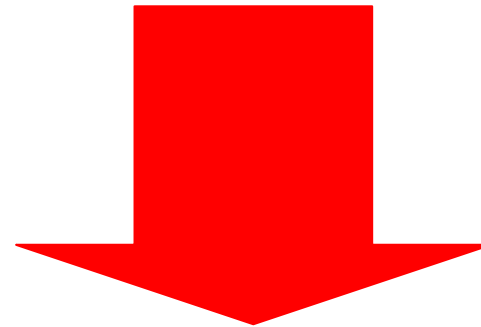
### Results:

- Re-adjustment of design capacity of coal charge
- Exceeding of design capacity by considering coal densification
- **Increase of coke production by 4%**

# SMART ENGINEERING

## Advantage of solution

- Integral process examination
- Easy detection of root cause
- Elimination of failure sources
- Retrofittable on equipment overhauling



- Target-oriented problem solving
- Applicable for individual tasks  
by SCHALKE Service



# SMART ENGINEERING

## Service conception:

PURPOSE:

INCREASE OF PRODUCTIVITY

SERVICE  
1. STEP:

QUICK-CHECK - PROCESS ANALYSIS

POTENTIAL:

CYCLE TIME  
REDUCTION

CHARGING  
OPTIMIZATION

MINIMIZING  
DOWNTIME

PERSONNEL  
DEVELOPMENT

INCREASED  
PERFORMANCE

EMISSION  
REDUCTION

SERVICE  
OPTION:

✓ MAXIMIZING  
SPEED OF  
ACTUATORS

✓ SOFTWARE  
REVIEW  
✓ ADJUSTING  
CHARGING  
VOLUMES

✓ M/C  
COORDINATION  
REVIEW  
✓ ADJUSTING  
SENSOR SYSTEM

✓ STRENGTHEN  
SKILLS BY  
REGULAR  
TRAINING  
✓ MAINTAINING OF  
EXPERTISE

✓ INCREASE  
AUTOMATION  
LEVEL

✓ COMMON  
ACTIVITIES WITH  
PLANT SUPPLIER

AGREEMENT  
FOR  
ACTIVITIES  
AND SCOPE  
OF SUPPLY:

✓ IMPROVED  
ACTUATORS  
✓ CONTROL UPDATE

✓ DETECTION SYSTEM  
FOR CHARGING  
LEVEL  
✓ PROCESS UPDATE

✓ COOR UPDATE  
✓ ADVANCED  
SENSOR TYPES

✓ OPERATOR  
TRAINING  
✓ REPAIR TRAINING

✓ UPGRADE TO  
SHIFT-MODE OR  
MANLESS  
OPERATION

✓ UPGRADES FOR  
PROCESS  
IMPROVEMENT

VALUE:

✓ HIGHER  
PRODUCTION BY  
INCREASED NO OF  
OVENS

✓ HIGHER  
PRODUCTION BY  
INCREASED  
THROUGHPUT  
✓ MINIMIZED  
GRAPHITE

✓ HIGHER  
AVAILABILITY  
✓ REDUCED LOSS  
OF PRODUCTION

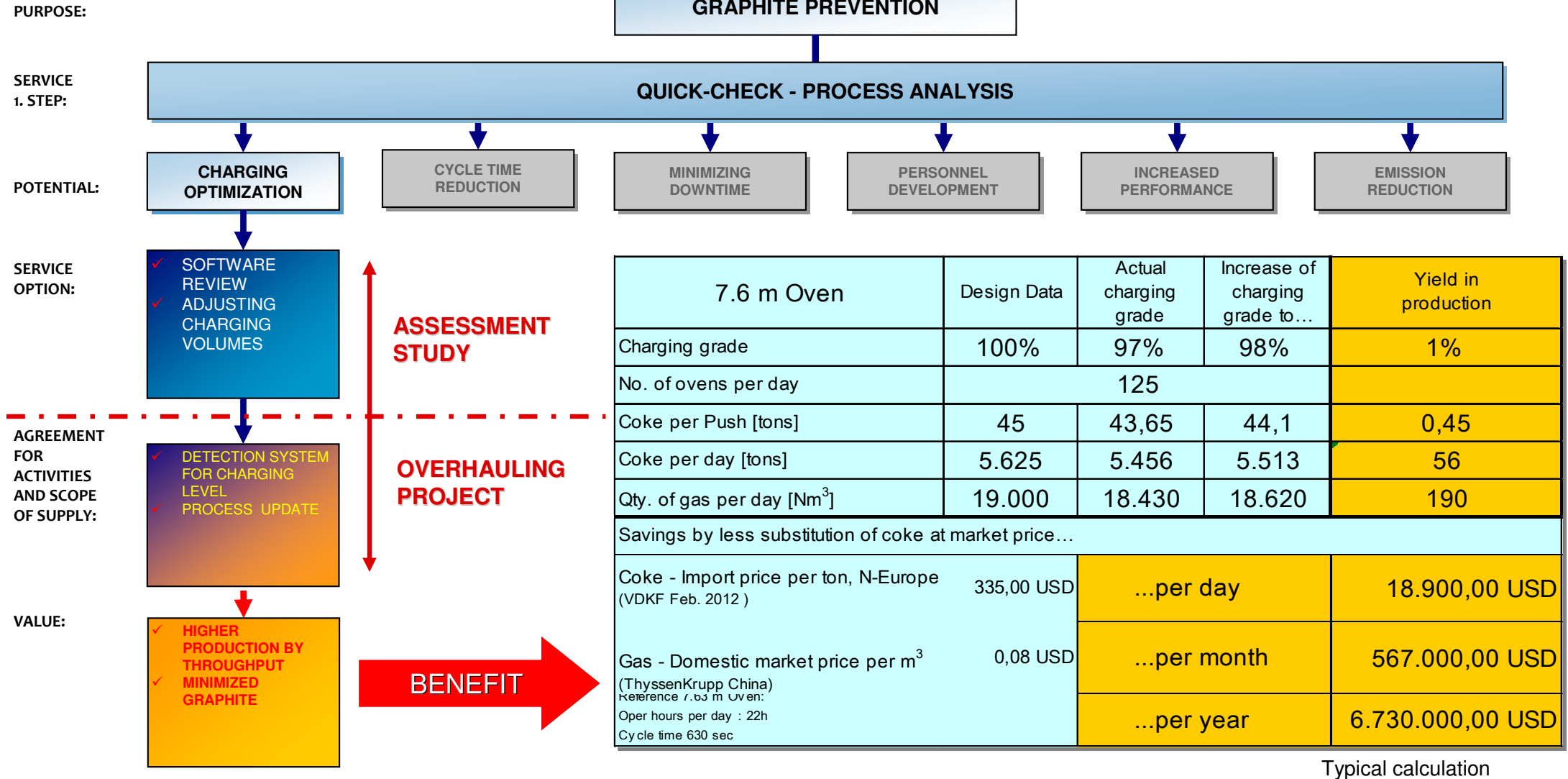
✓ HIGHER  
AVAILABILITY  
✓ REDUCED REPAIR  
TIME  
✓ MORE  
PRODUCTION

✓ HIGHER  
AVAILABILITY  
✓ LESS DOWNTIME  
✓ LESS REPAIR

✓ OPTIMIZED  
PROCESS  
✓ MORE  
PRODUCTION  
✓ HIGHER COKE  
QUALITY

# SMART ENGINEERING

## Service approach:





## Summary

- Many process disturbances are not caused where they occur
- Knowledge of the whole process chain allows to develop preventions where they are most suitable
- Solutions developed under these considerations might be simple and reliable
- Solutions are easily retrofitable on existing equipment
- Efforts for retrofitable solutions mostly make just a fraction of the actual benefits

**Prevent root cause instead of symptom treatment!**

Thank you very much for your kind attention!

