



# R&D – a vital strategic focus area

Kimmo Vesamäki, VP, Research & Development



# Kimmo Vesamäki



- **VP, Research & Development**

- Joined FLSmidth 14 April 2008

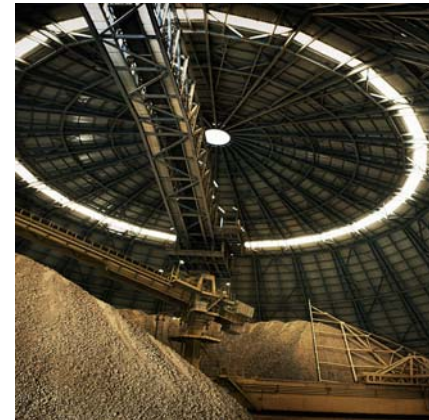
- Previous positions:

- VP, Research & Development (Cement), FLSmidth A/S (2008)
- VP, Product Management & Engineering, Construction – Contractor Solutions, Metso Minerals, Finland (2007)
- VP, Product Line Crushers, Metso Minerals, Finland (2003)
- Different positions within Metso Minerals (based both in Finland and USA): Engineering, sales support, product management and R&D with progressing responsibility (1994)
- Production Control Engineer, Valmet Avicomp Inc., Finland (1993)



## Overview

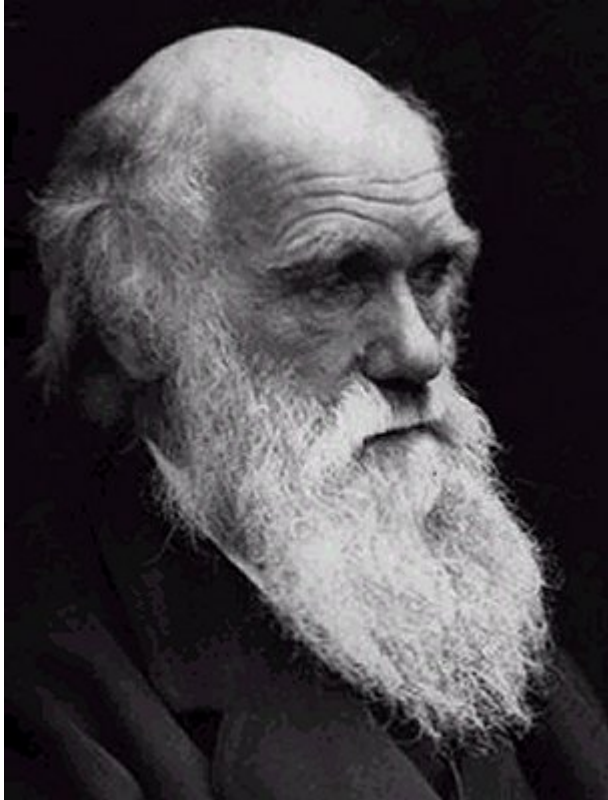
- Knowledge
- Development
- Innovation
- Summary





## Key questions addressed

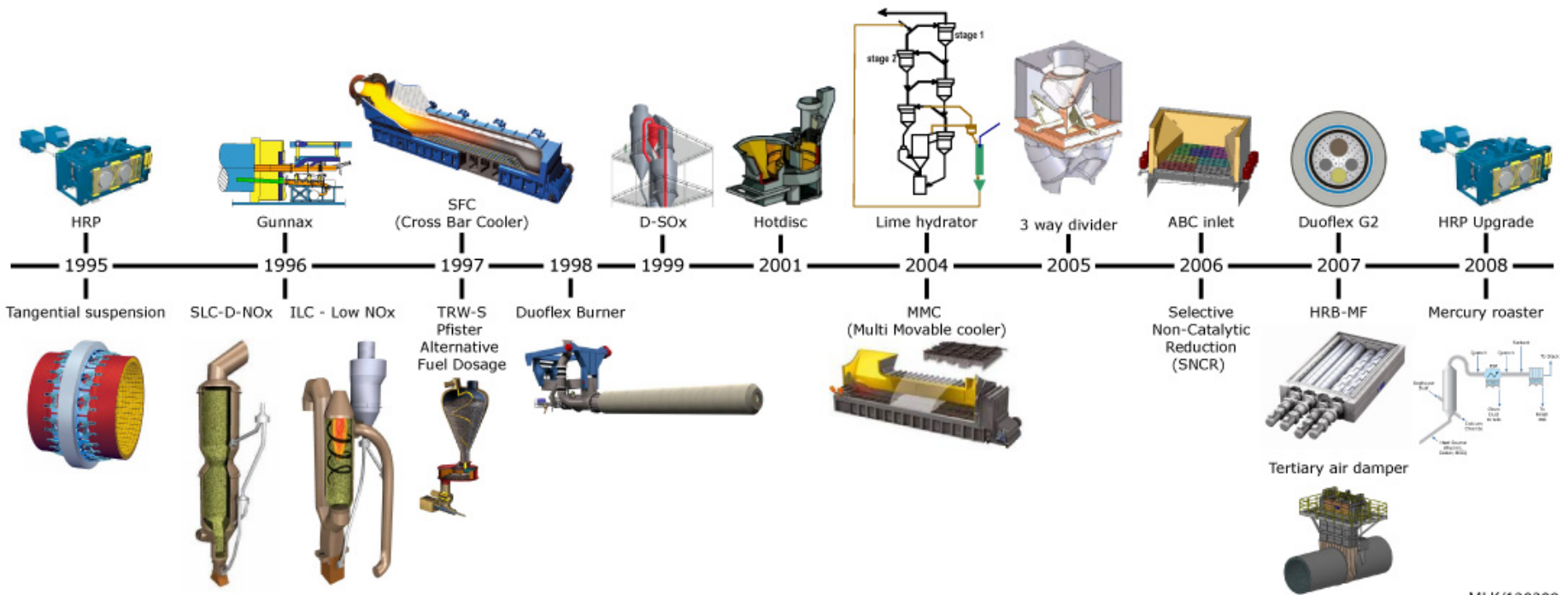
- **What is R&D focus on?**
  - Addressing main trends and industry needs
  - Developing world leading technology
  - Providing new attractive value propositions
  
- **How is FLSmidth's multi faceted R&D approach?**
  - Research
  - Product development
  - External partner collaboration
  
- **What results have been and will be reached?**
  - New process knowhow & products
  - New & growing business
  - Patents



"It is not the strongest of the species that survives, nor the most intelligent, but the one most responsive to change"

— Charles Darwin

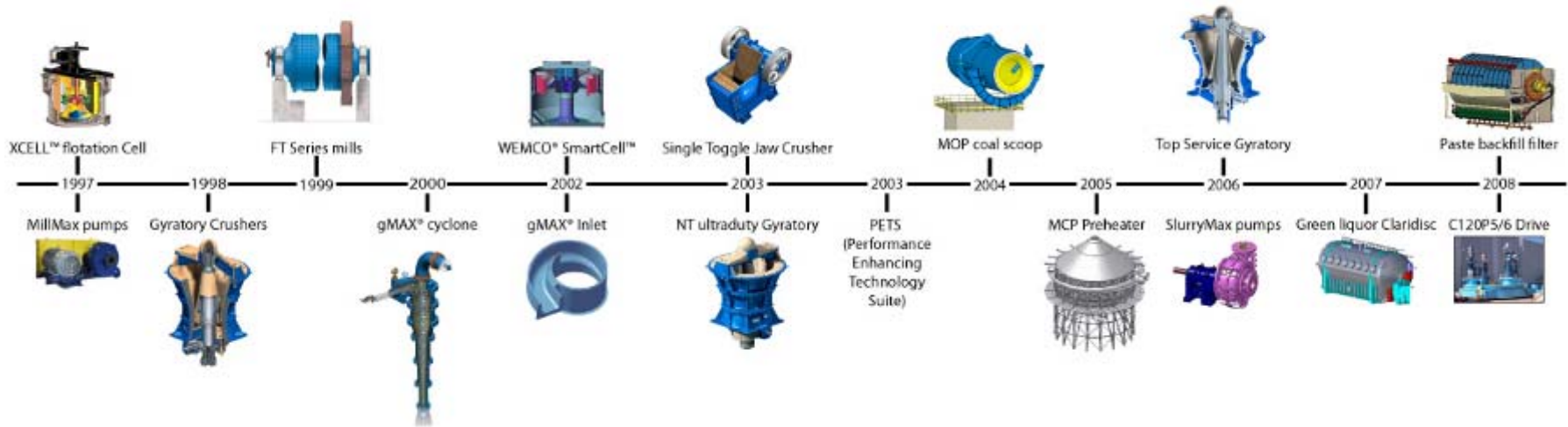
# Cement product introductions in last 15 years



MLK/120309



# Minerals product introductions in last 15 years



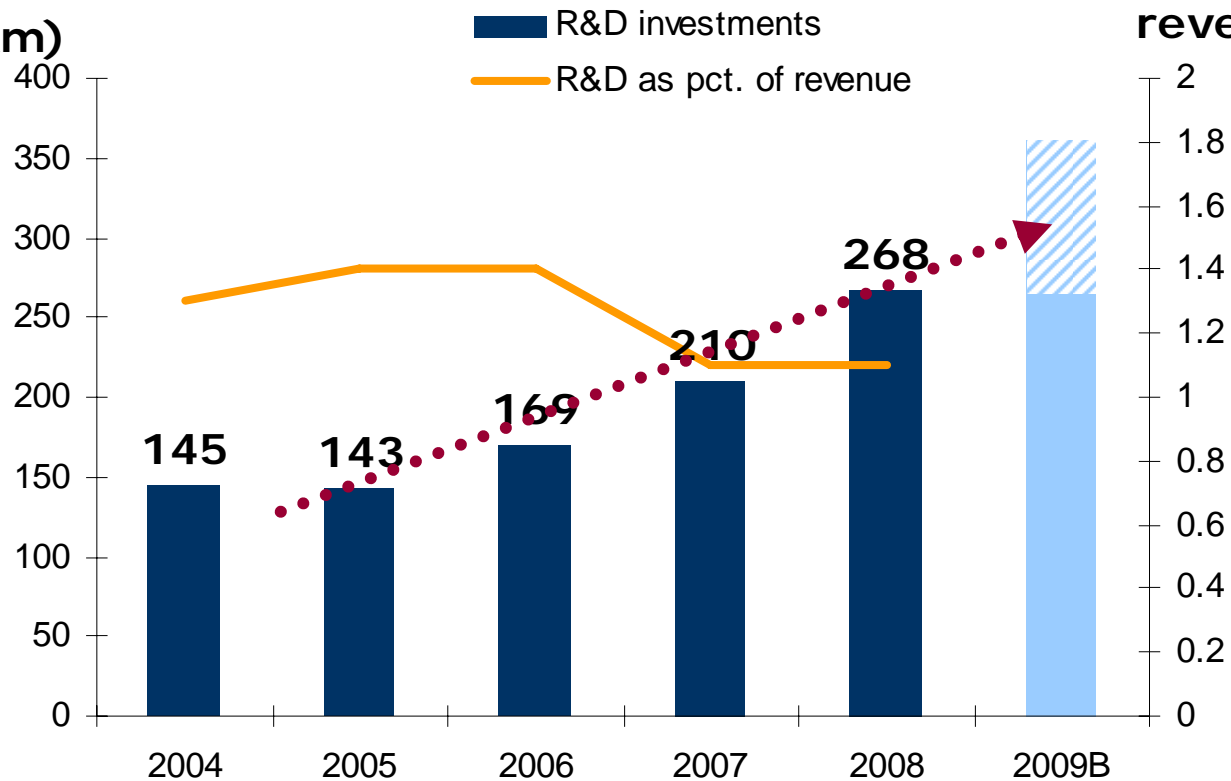
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# R&D investments continue strong

**R&D investments (DKKm)**

**R&D as pct. of revenue**







## R&D – Two main functions

- **Research (25%)**
  - To generate new knowledge (incl. new technologies, improved processes) based on a sound platform of science and engineering and to prepare ideas for using the new knowledge
  - Results in know-how and concepts, not products
  
- **Product Development (75%)**
  - To apply the new knowledge in technically progressive and value creating practical solutions
  - Builds on know-how and concepts and results in release to market of new products and processes



# Product development

## – Simulation tools (global support)

Innovative edge;

CAE (computed aided engineering) tools used in R&D to **speed-up** development processes and secure state-of-the-art results

- FEA – Finite Element Analysis
- CFD – Computational Fluid Dynamics
- DEM – Discrete Element Modeling

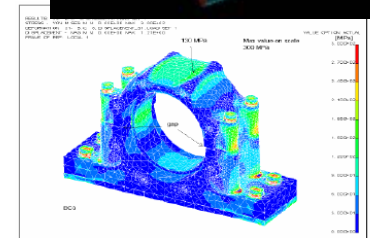
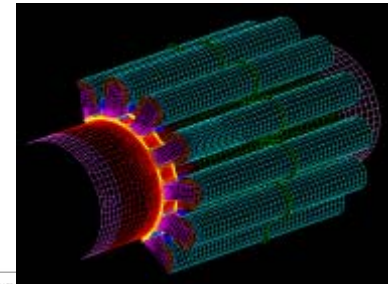
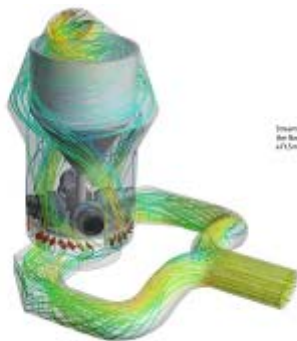
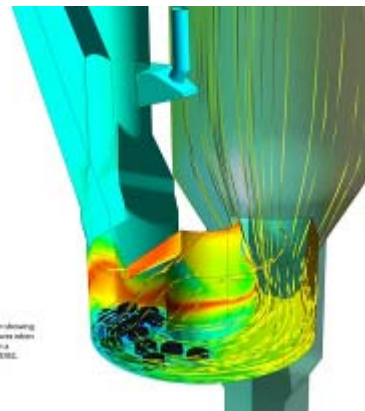


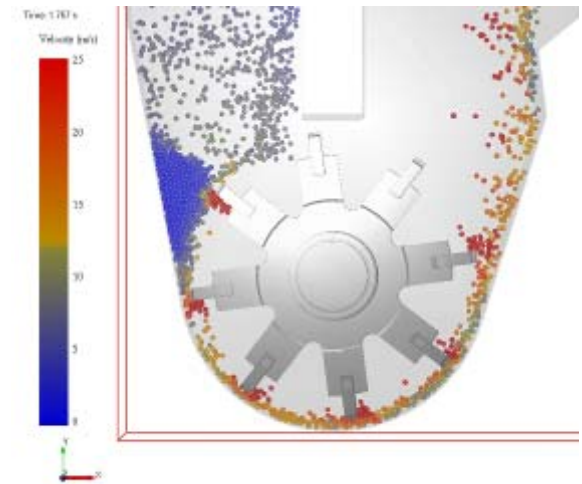
Figure 19: Von Mises stress distribution (taken from appendix 7)



CFD simulation showing flow patterns and velocity vectors in a bottle.



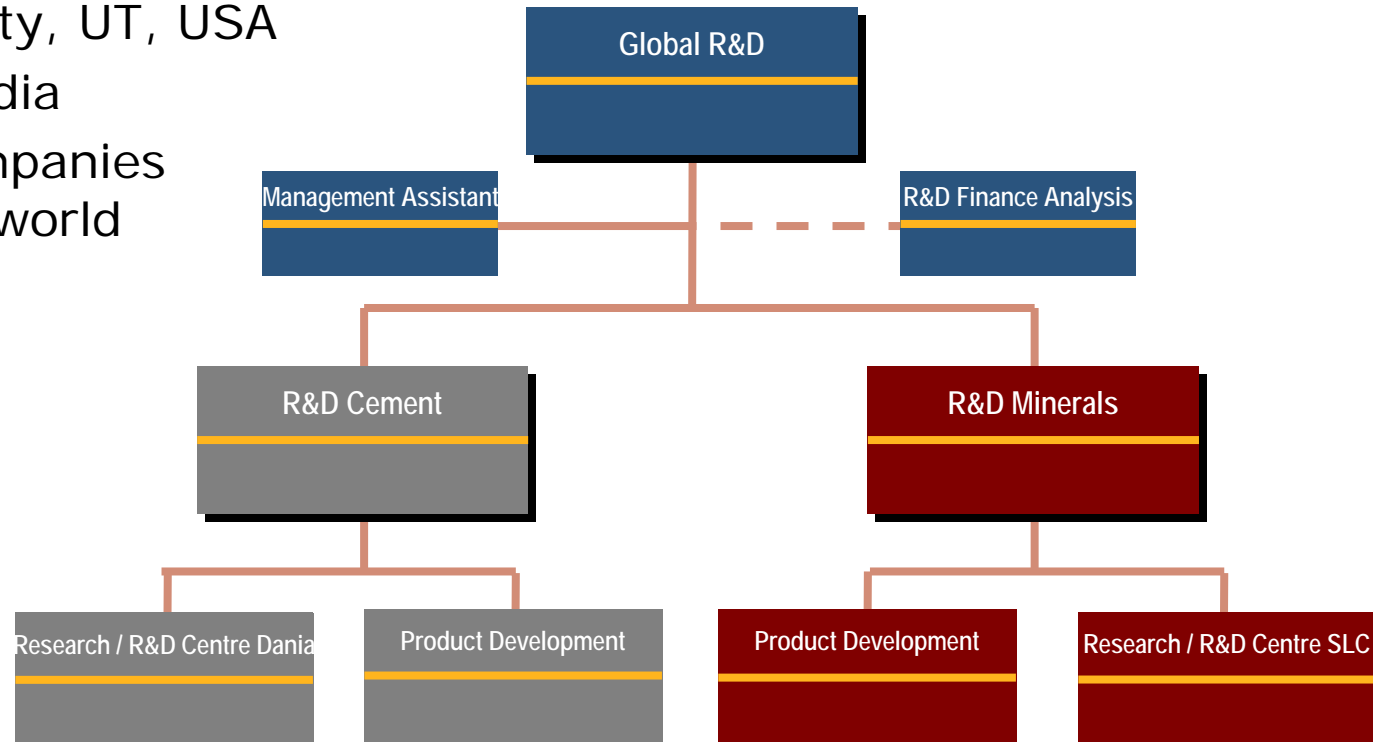
CFD simulation showing flow patterns and temperature distribution in a complex assembly.





# Global R&D activities

- Valby, Denmark
- Mariager, Denmark
- Bethlehem, PA, USA
- Salt Lake City, UT, USA
- Chennai, India
- Product companies around the world





## R&D Centre Dania in Denmark

- The world's largest experimental facility for cement production technology, incl.
  - Physical laboratory
  - Chemical laboratory
  - Pilot testing facility
  - Large pilot plants
  - Small test stands
- Used also by **Automation**, **Airtech** and **Minerals** activities
- In Chennai, India established supporting R&D Centre





## Development and Testing Centers in USA

- **Dawson Metallurgical Laboratories** (Salt Lake City, UT, USA)
  - Metallurgical analysis
  - Minerals beneficiation
  - Hydrometallurgy
  - Consultation services
  - Flotation, leaching, separation
  - Ore variability, flowsheet development
  
- **Whitehall Test Center** (Whitehall, PA, USA)
  - Pyro processing
  - Crushing / Milling
  - Emissions
  
- **DOE Laboratory** (Salt Lake City, UT, USA)
  - Flotation
  - Sedimentation
  - Filtration





## Research & patents

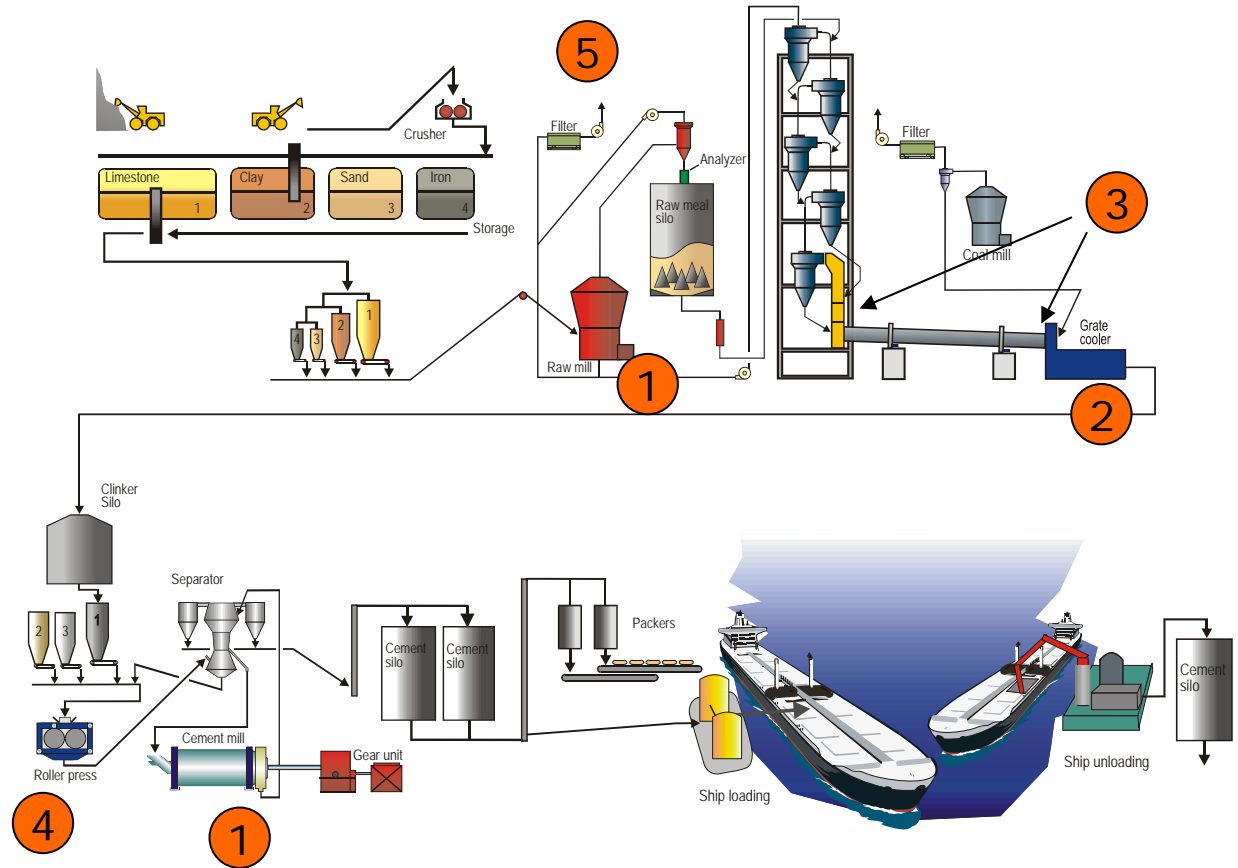
- **Research focused on our customers future needs**
  - CO<sub>2</sub>, Fuels and Energy Efficiency
  - Environment and Emissions
  - Comminution
  - Mineral liberation technologies
  - Separation technologies
  - Materials and wear processes
- **2008 was record year in FLSmidth's patent history**
  - Patent protection filed for 39 new inventions
  - Strong focus and determination on remaining an industry leading technology company
  - Protect technologies



**Innovation is the process of  
creating and delivering  
new customer value  
in the marketplace**

# Development areas within Cement process

1. Vertical Roller Mills (VRM)
  - raw mills
  - cement mills
2. Cooler
3. Alternative fuels initiatives
4. Roller press
5. Emissions



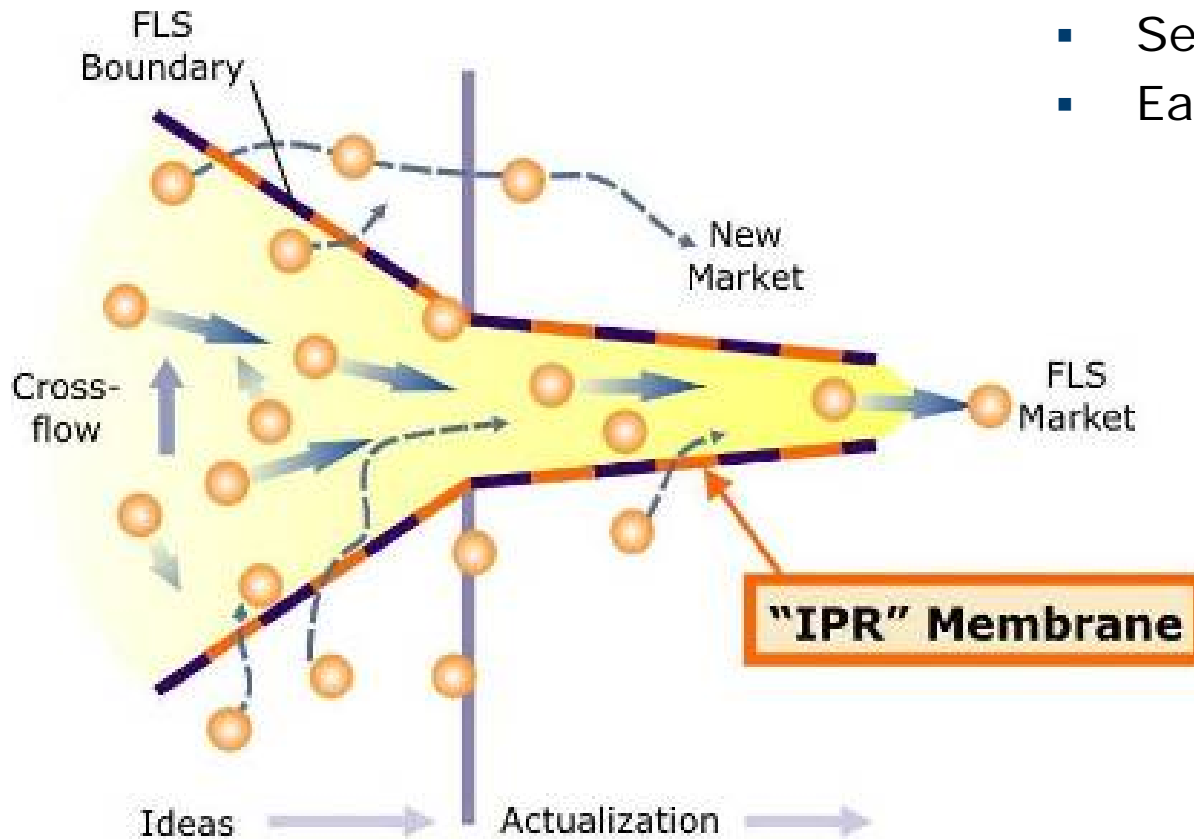




# Open Innovation

**“IPR” Membrane to allow proactive innovation**

- Secure IPR rights
- Early, often, and in detail



## New Cement Production Technology - 50m DKK program

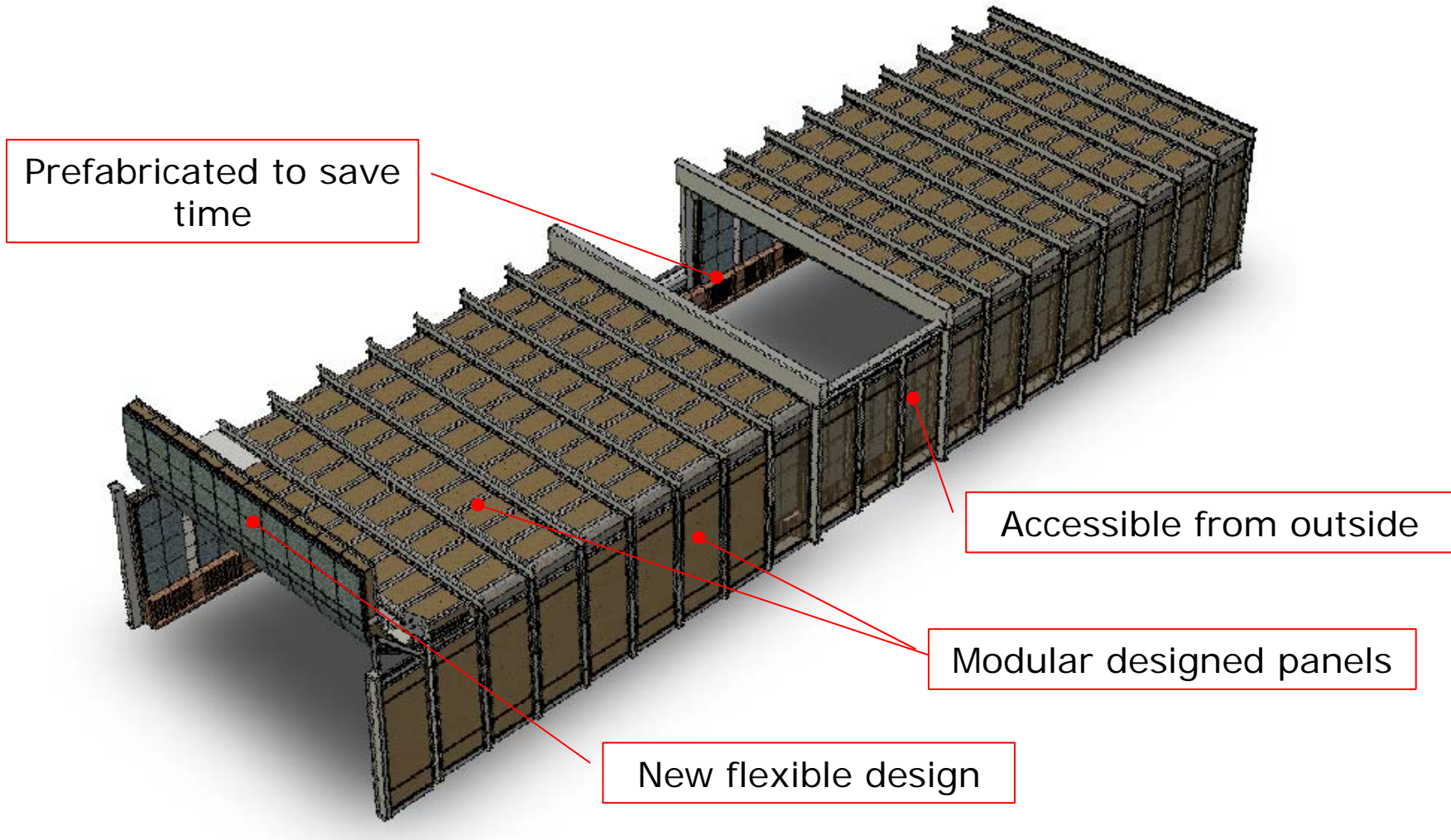
- 5 year research program started in spring 2008
- In co-operation with the Department of Chemical Engineering at the Technical University of Denmark (DTU) and financially supported by the Danish National Advanced Technology Foundation
- Planned total of 8 PhD projects
- Target of researching more environmentally friendly cement manufacturing processes, where the main focus areas are:
  - Reduction of energy consumption
  - Improved emission control



Photo from the Pilot hall at DTU



# Top Casing for Clinker Cooler





## Top Casing for Clinker Cooler

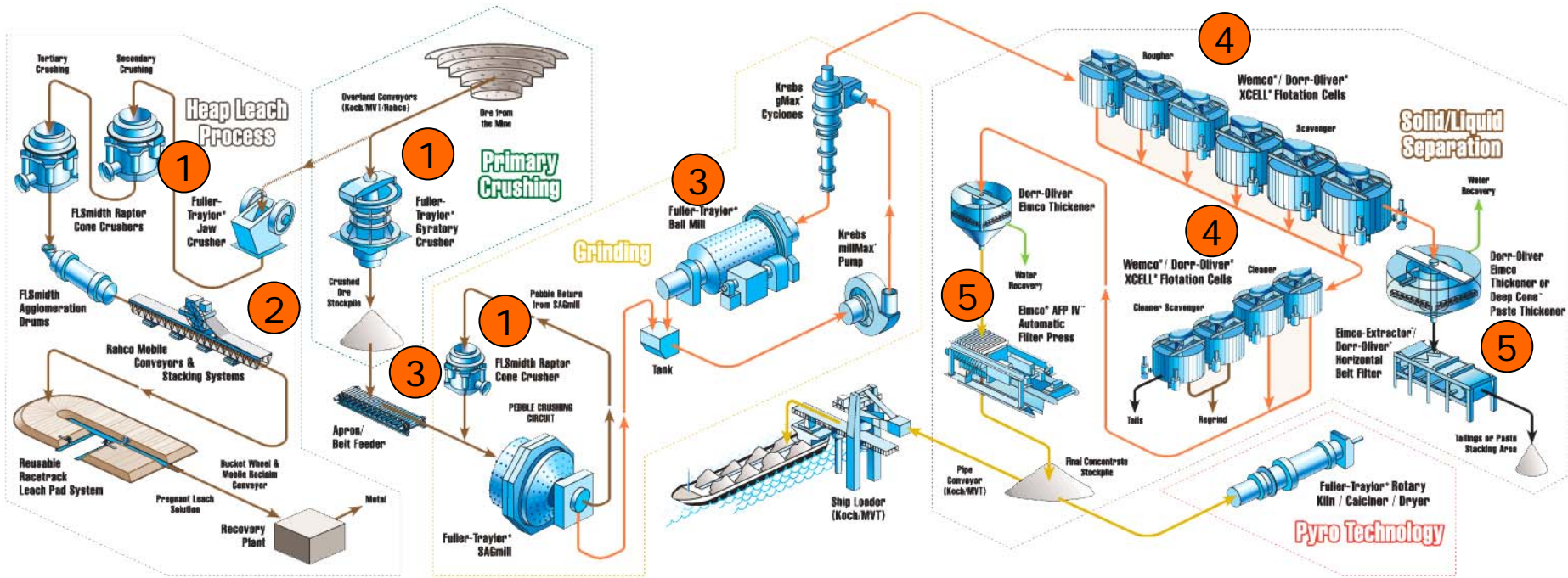
### Benefits for customer

- Estimated 40% reduction in time needed for erection
- Replace panels instead of repair inside
  - No curing time after erection
- Better quality
  - Manufacturing of modules at workshop conditions
- Higher safety during installation and maintenance

### Benefits for FLSmidth

- Specialized external partners used for development
- From idea to a saleable product just in 7 months
  - Time to market is critical success factor
- Secured IPR protection of new application
- New concept has attractive potential at other applications

# Development areas within Minerals process



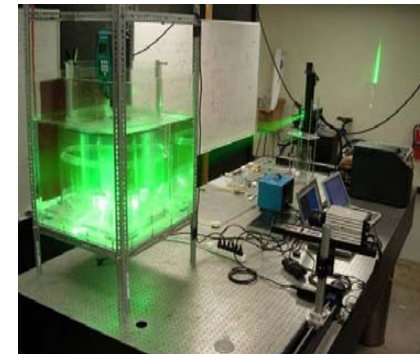
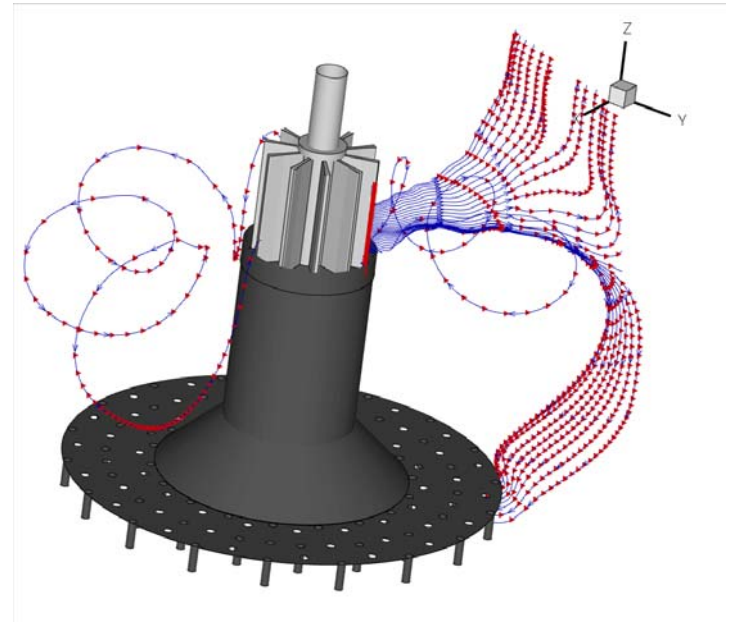
1. Crushing
2. Mobile conveying
3. Grinding – HPGR, Mills
4. Flotation
5. Filtration/Thickener
6. Environmental (Mine tailings, Water recovery)





## Research and Development – 300m<sup>3</sup> SuperCell™

- Design worlds largest Flotation cell, with **improved recovery**, power consumption, efficiency, reduced wear part consumption
  - Modeled using most modern CFD tools
  - Models verified through lab scale pilot units (water and slurry)
  - Further validation via large pilot scale units
  - Improvements identified, and incorporated into new design



## Research and Development – 300m<sup>3</sup> SuperCell™

- **Full Scale Testing of New Design at Rio Tinto's Kennecott Concentrator in Salt Lake City, Utah (USA)**
  - Expertise from FLSmidth companies
    - Dorr-Oliver Eimco
    - CEntry
    - Krebs
    - Dawson Metallurgical Labs
    - FLSmidth Automation
  - 110 days from agreement to start-up!
  
- **Proven Value for Customers**
  - Larger sizes for reduced CAPEX
  - **Better recovery for improved OPEX**
  - More energy efficient
  - 26 sold to date

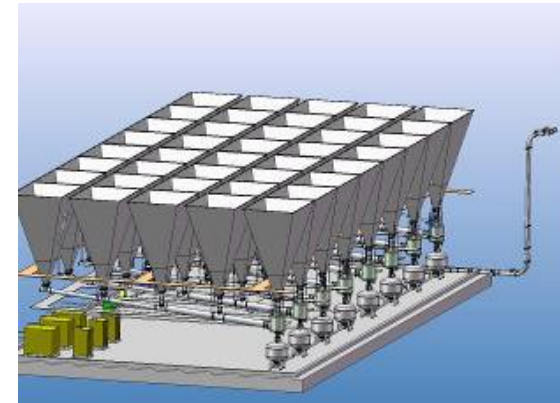


# Möller - Example of a Product Company R&D

- Market in ash handling has expanded
  - Innovative solutions required
  
- Development of new ESP Ash Removal systems

## Target

- Reduced investment costs
- Extend Möller's lead against competition
- Highest possible performance and reliability

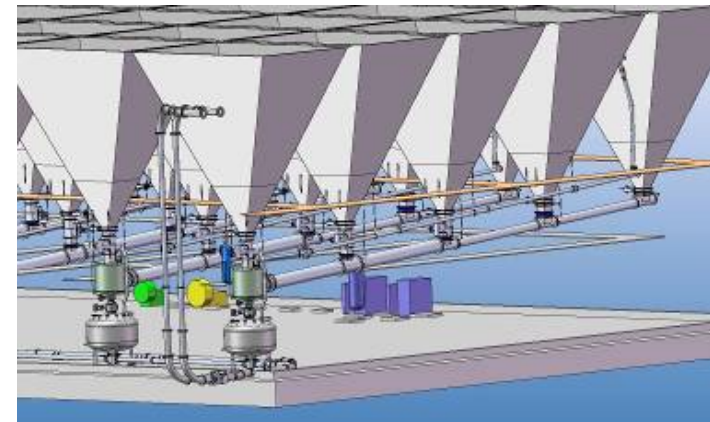


## Technical Highlights

- Reduced number of pressure vessels
- Low cost solution for the rear fields

## Results

Over 60 mDKK in sales since Oct 2008







## Synergies between Cement & Minerals RD activities

- Sharing of knowledge from similar technologies
  - For instance: Emissions, Comminution, Separation
- Open access to all existing R&D Centers/Laboratories
- Cross functional R&D efforts in selected projects
- Alternative fuels
- Sharing of specialist functions



## Summary

- **FLSmidth R&D focuses on**
  - Addressing main trends and industry needs
  - Developing world leading technology
  - Providing new attractive value propositions
  
- **A multi faceted approach is used**
  - Research
  - Product development
  - External partner collaboration
  
- **Results**
  - New process knowhow & products
  - New & growing business
  - Patents



# Questions

**Design**  
**Build** The preferred partner  
of the cement and  
minerals industries  
**Operate**  
**Maintain**

Capital Market Day London 16.03.09 **FLSMIDTH**

The graphic features the words 'Design', 'Operate', and 'Maintain' in blue, and 'Build' in orange. To the left, two construction workers in blue overalls and white hard hats are looking at a set of plans. To the right, two men in business suits are standing, one holding a rolled-up document. The text 'The preferred partner of the cement and minerals industries' is positioned between 'Build' and 'Operate'. At the bottom, it says 'Capital Market Day London 16.03.09' followed by the FLSMIDTH logo.