

## High-class continuous annealing and hot-dip galvanizing lines for a growing market

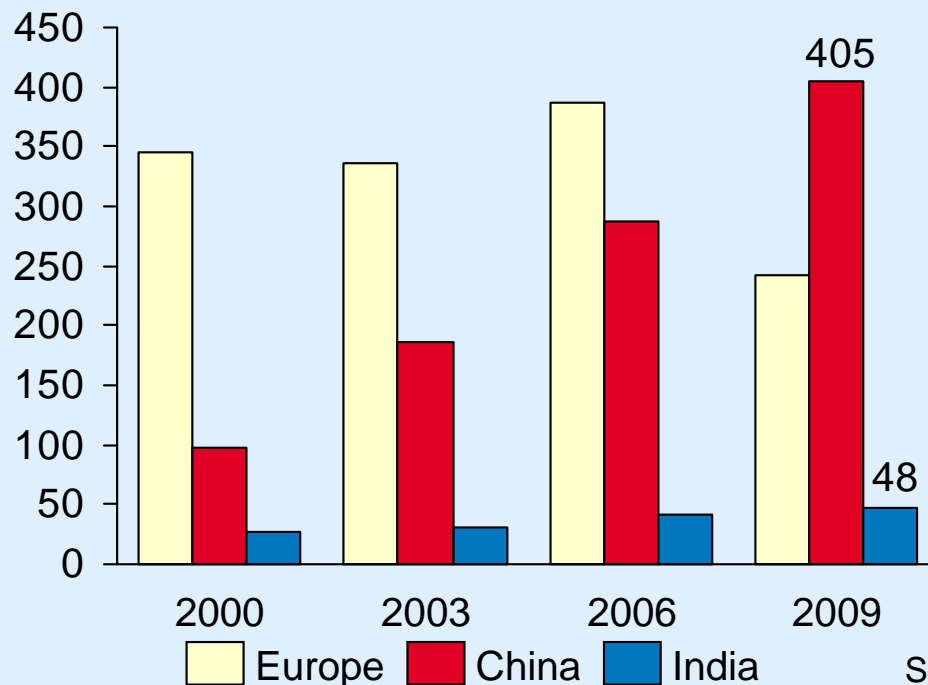
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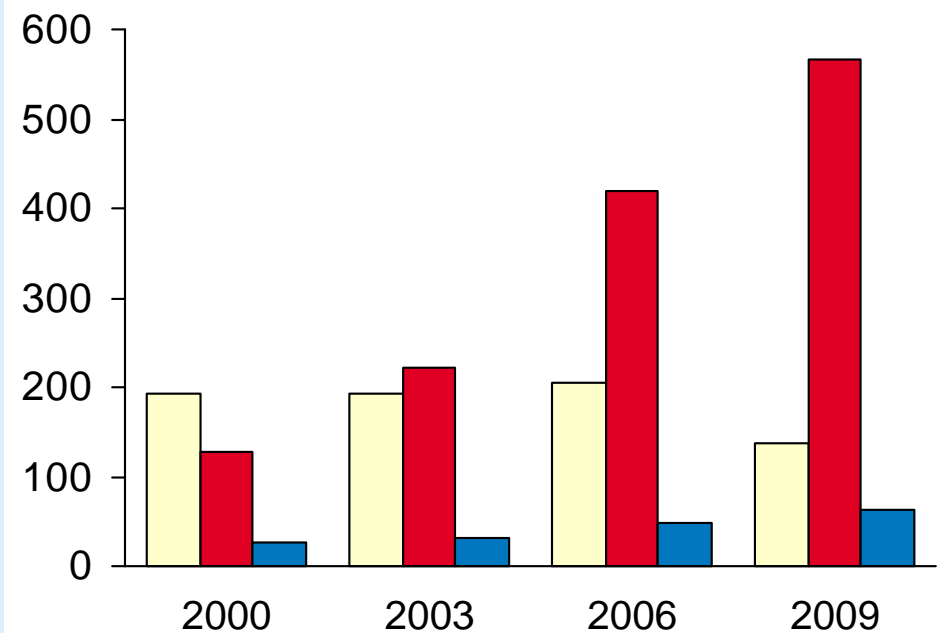
## Steel consumption in India will increase enormously

- Consumption per capita in India only 10% compared to China
- Estimations forecast an increase of Indias steel consumption by 14% compared to a global increase of 5% (Source: FAZ, 01.02.2011)

**Steel consumption per capita (in kg/capita)**



**Total production of crude steel (in mio. t)**

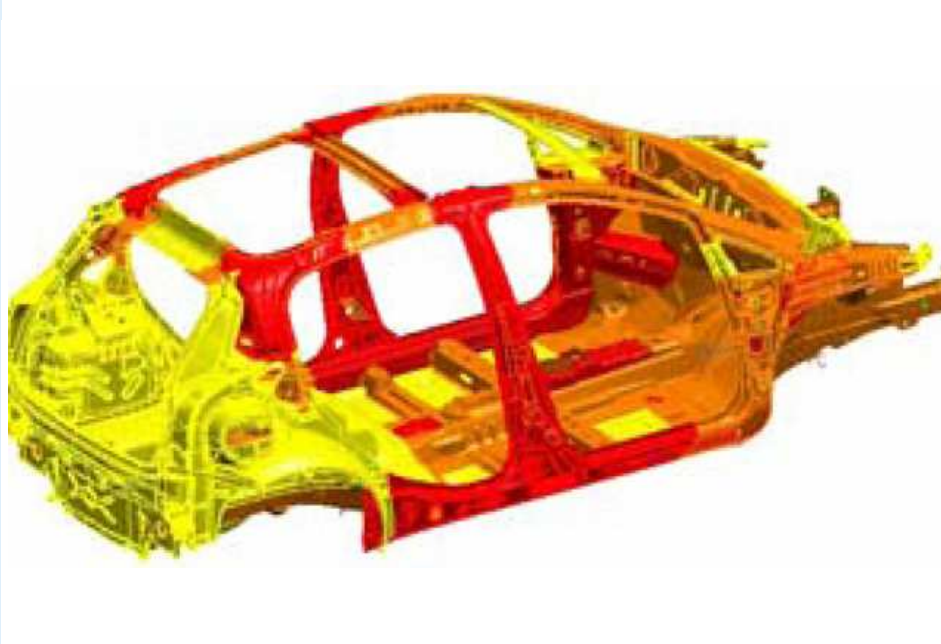


Source: Worldsteel Association, Steel Statistical Yearbook 2010

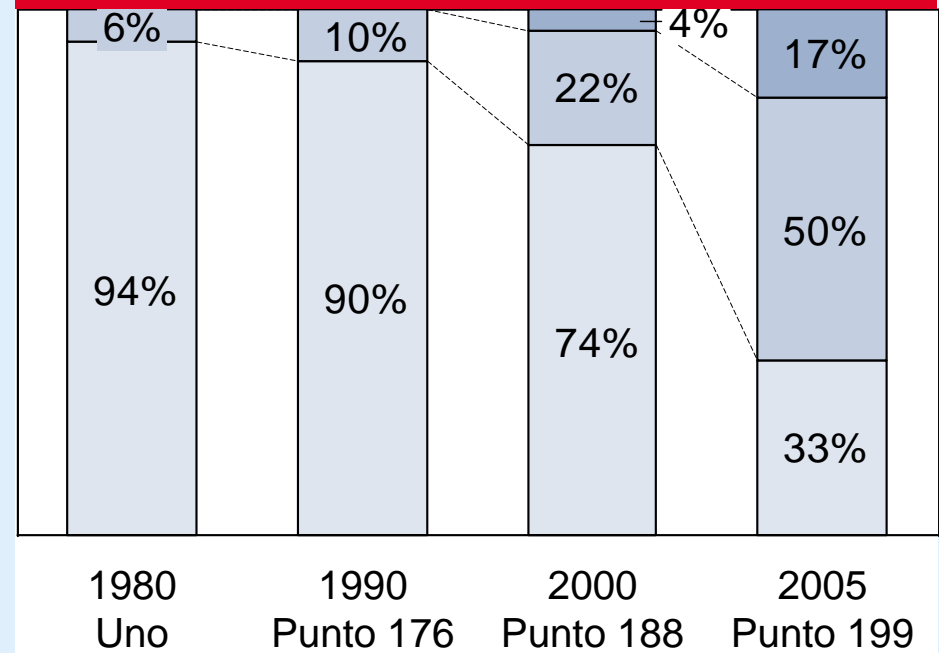
## Rising demand of high strength steel

High-strength steels are required for modern small and light vehicles

### Use of high-strength steel grades in compact cars



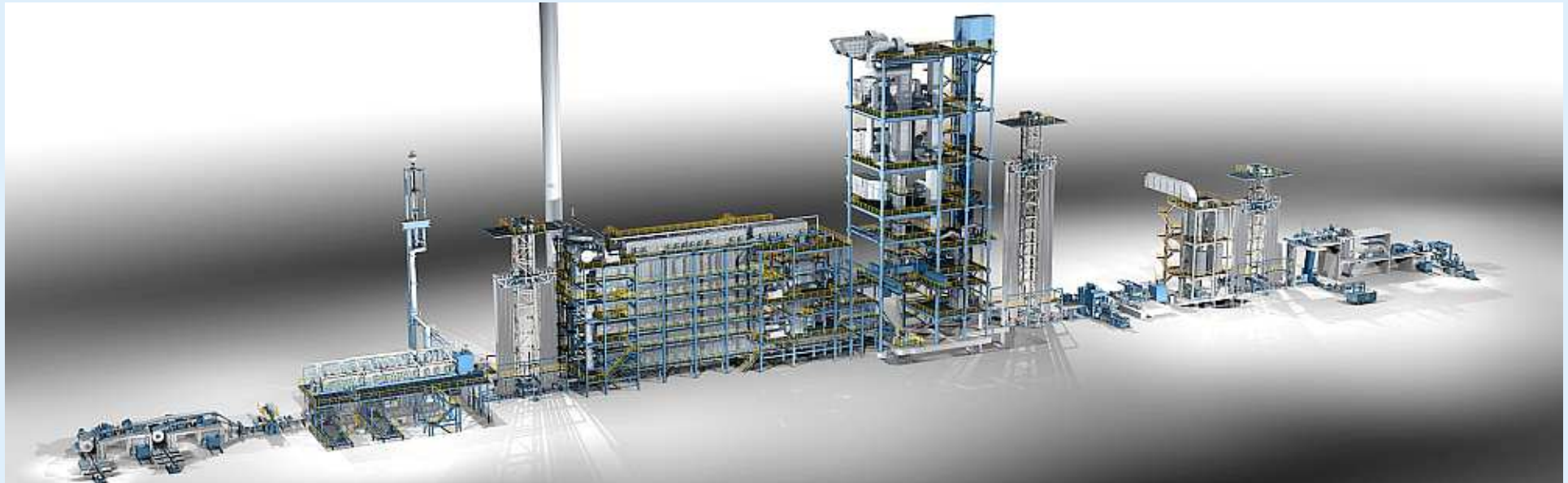
### Percentage of steel grades in the overall weight of a vehicle



- Ultra-high strength steels
- High-strength steels
- Low-carbon steels

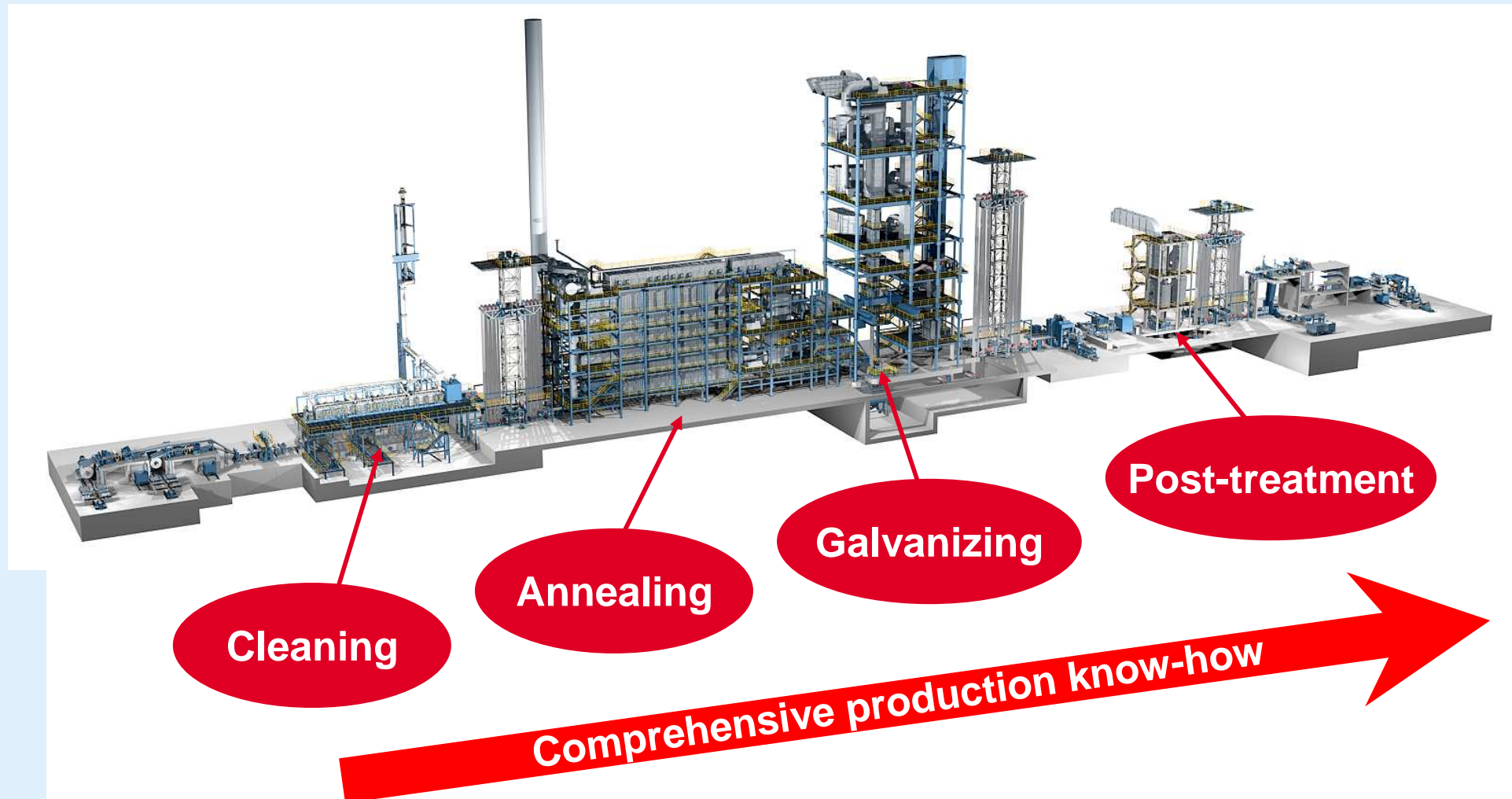
## Different line types for galvanizing and annealing

- Continuous Annealing Lines
- Combined Annealing or Galvanizing Lines
- Hot-dip Galvanizing Lines
- Hot-strip Continuous Galvanizing Lines (Heat-to-Coat)



# Galvanized and Annealed steel strip

Important process steps for manufacturing high-quality steel strip





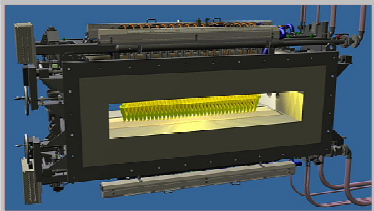
## New developments & optimized concepts

### Cleaning

Cleaning section



DFI Oxyfuel

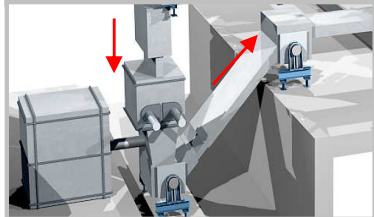


### Annealing

Ultra Fast Cooling

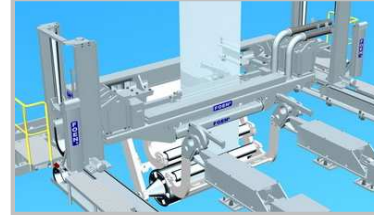


Water-Quench



### Galvanizing

Air-knife



Strip Stabilization

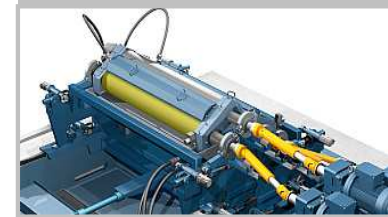


### Post Treatment

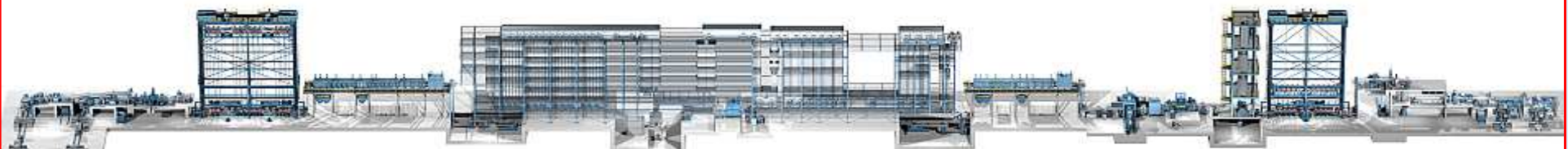
Nickel-Flash



Roll-Coater



## Comprehensive production know-how

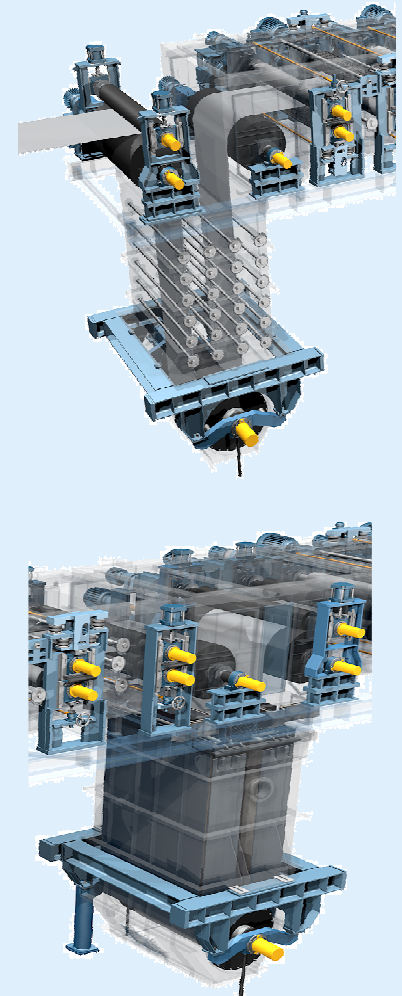
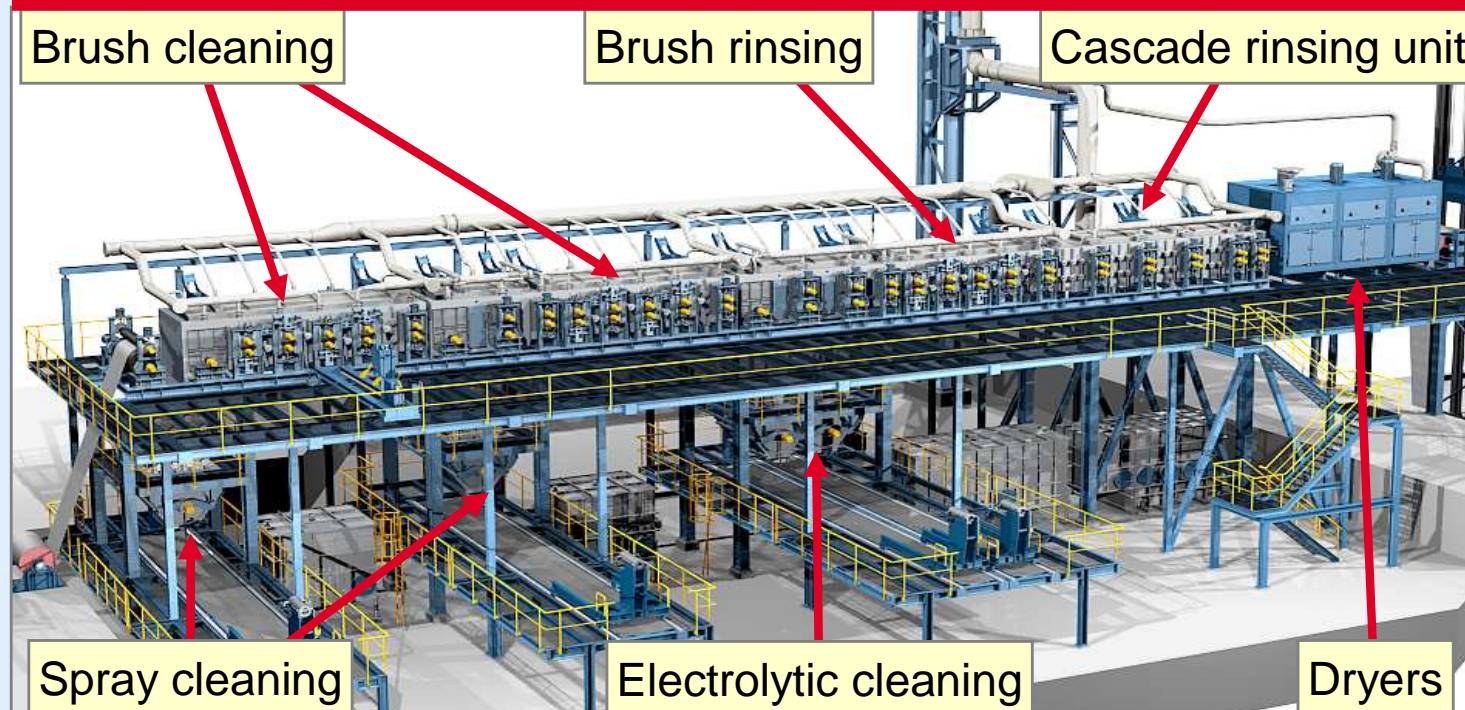


## Cleaning section

Efficient cleaning section vertical spray and electrolytic cleaning cells, horizontal brush cleaning and cascade rinsing

- Simple roll change possible during production
- Energy saved through low evaporation losses
- Heated by exhaust gas of furnace section

### Cleaning section in a Continuous Annealing Line



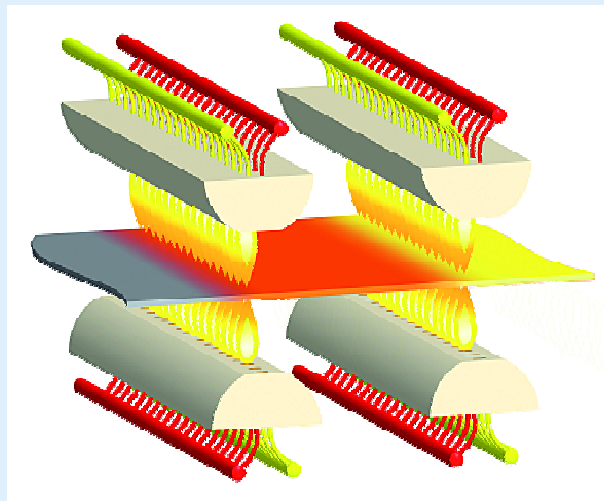
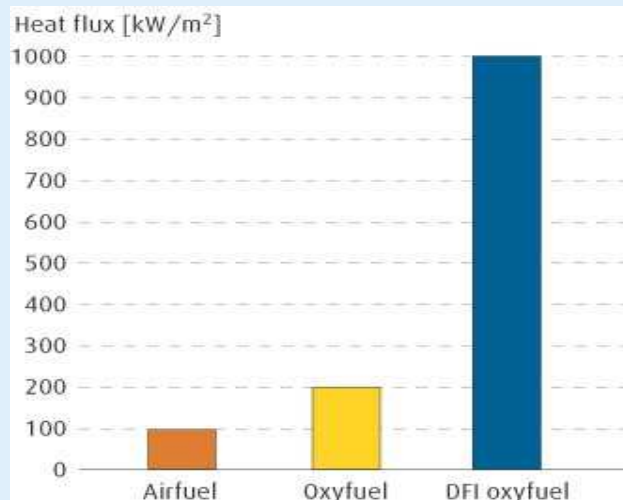
## Installation of a REBOX® DFI oxyfuel system in a continuous annealing line

### Process

- Gaseous fuel is burnt with pure oxygen
- To preheat the strip, the flame is directed specifically at the steel strip.
- DFI = Direct Flame Impingement

### Advantages when used in processing lines

- Extremely efficient heat transfer
  - Reduction in furnace length
  - Increase in furnace output for modernization projects
- Residual oils and solid particles are removed from the strip
  - Simplification of the pre-cleaning



Linde Gas

*Linde*

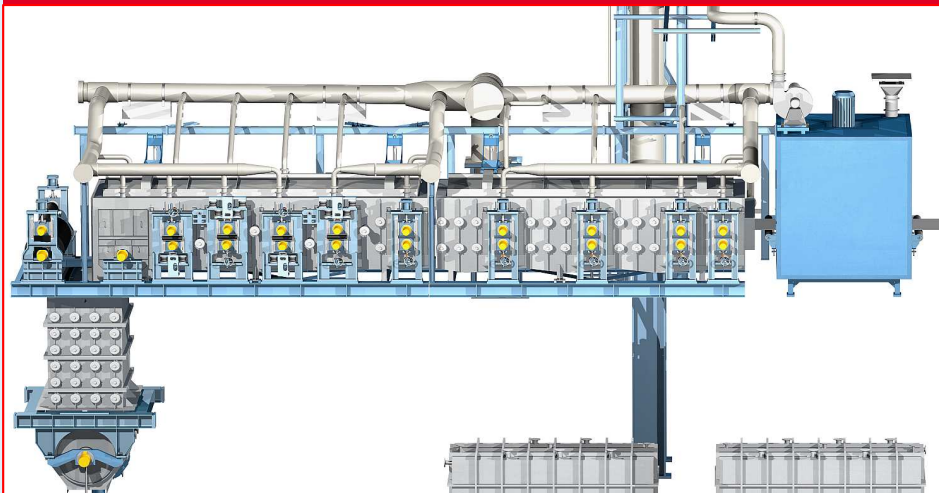
SMS Siemag and the Linde Group have signed a cooperation agreement on the exclusive marketing of the process developed by Linde.



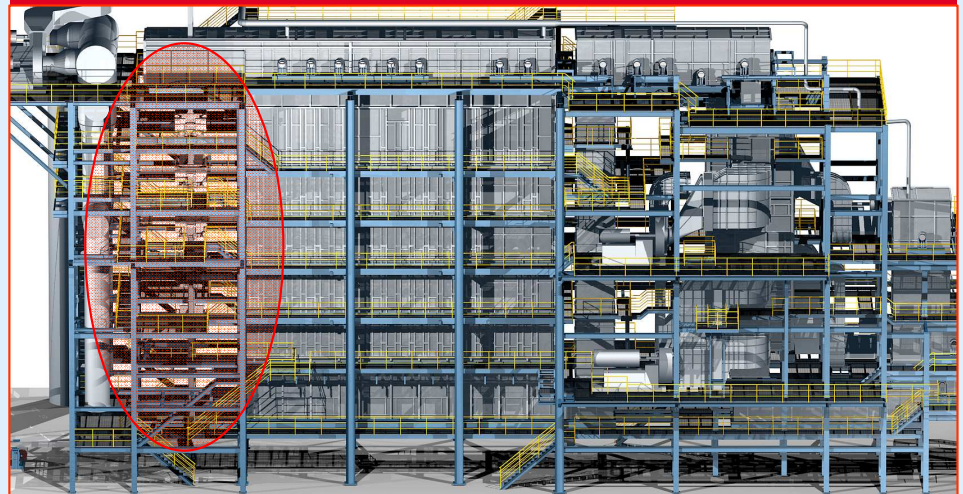
## Effects on the design of a continuous annealing line

- Thanks to REBOX® DFI, a strip processing line can be set up much more economically
- Lower investment and operating costs
  - In the furnace, the preheating zone and a part of the heating zone can be replaced
  - In the cleaning zone, certain sections can be removed (electrolytic cleaning, brushes)
- Nitrogen oxide emissions are reduced through combustion with pure oxygen
- The production capacity can be increased by 30% if the plant is modernized

Simplified cleaning section of a CAL

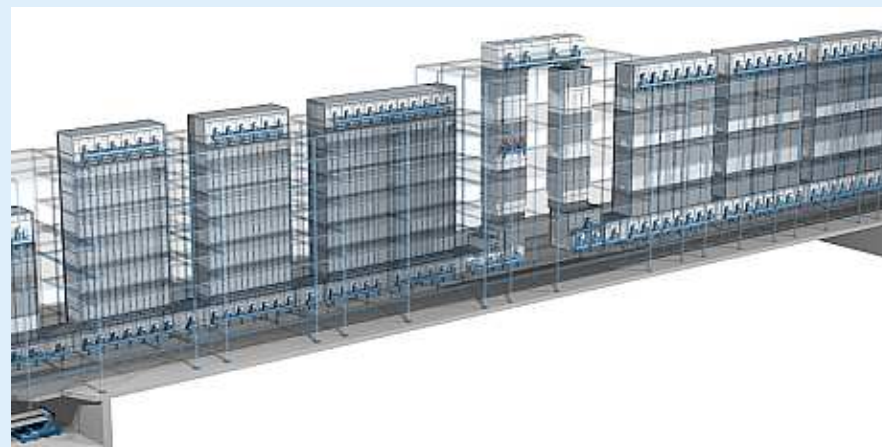
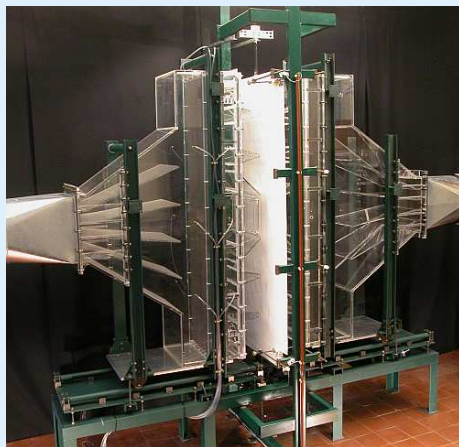


CAL furnace with REBOX® DFI system,



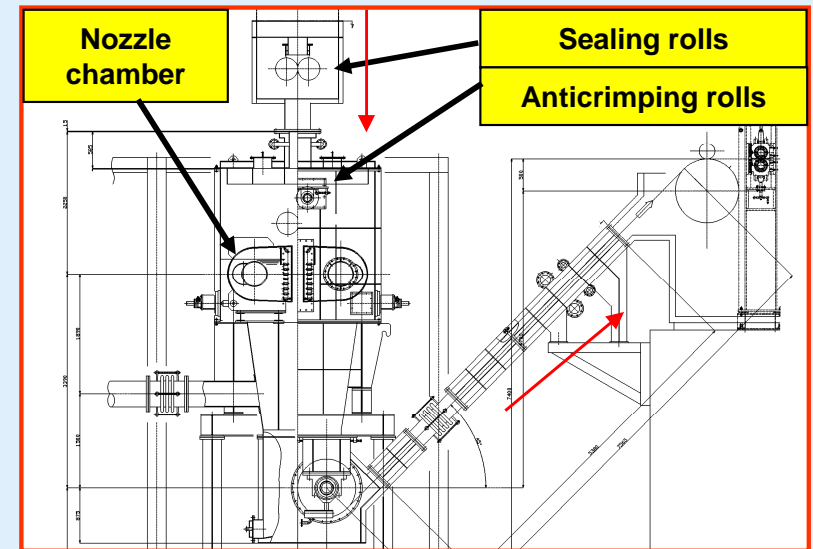
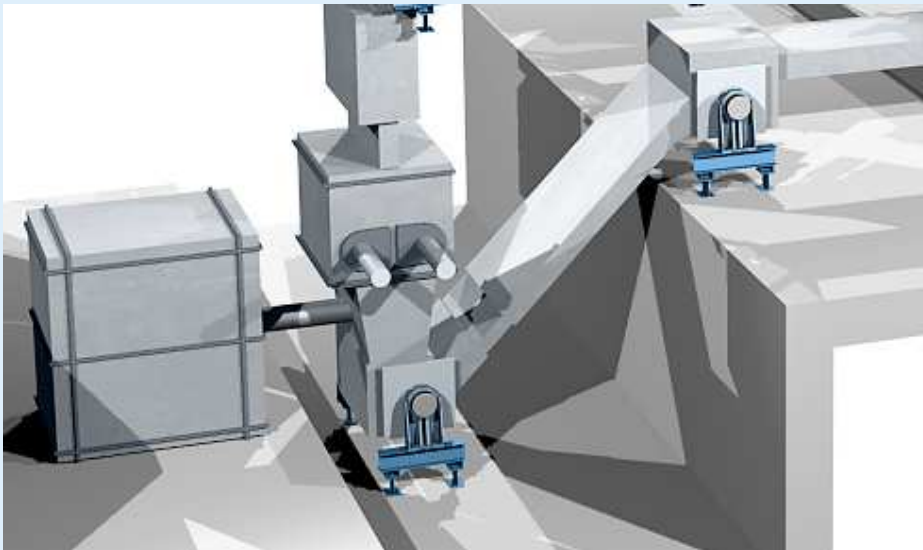
## Producing high-strength steel grades with high cooling rates

- Production of high-strength steel grades up to 980 MPa (TRIP & DP)
- Cooling rates of up to 130 K/s/mm are attained
- Direct supply of hydrogen into the cooling chamber enables a hydrogen content of 20 to 30% in the cooling area without increased hydrogen consumption
- Natural diffusion of hydrogen in the adjoining furnace sections
  - No complicated separation between cooling zone and neighboring zones
  - No additional hydrogen consumption compared to the traditional operation with 5% hydrogen in the shielding gas (forming gas)



## The only possibility of producing ultra-high strength steel grades in an annealing line

- Cooling rates of up to 1,000 K/s/mm possible
- Required for martensitic steel grades with yield strengths of more than 1000 MPa
- Manufacturing of ultra-high strength steel grades with yield strengths of up to 1550 MPa

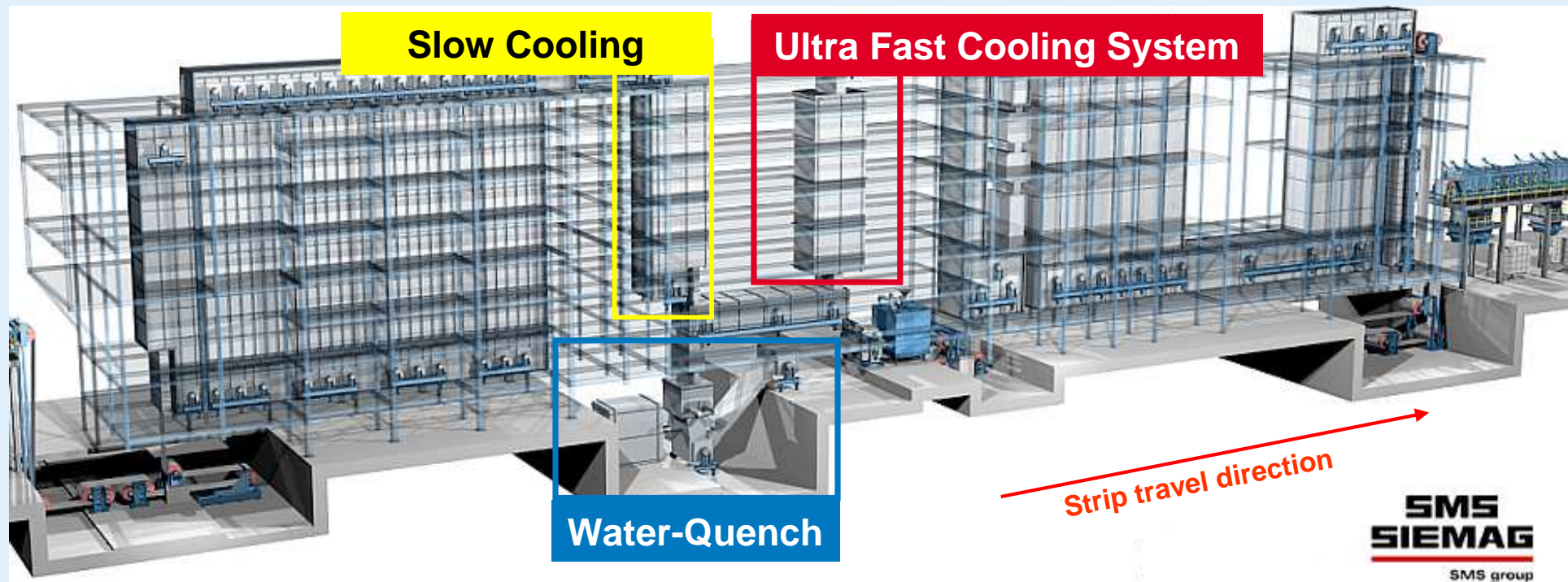


### Modern nozzle design

- Slot-nozzle configuration with uniform cooling capacity over the strip width  
→ No strip distortions  
→ Prevention of flatness deviations
- Anticrimping rolls upstream of the nozzle chamber for strip shape monitoring



## Modular design - Two options for fast cooling



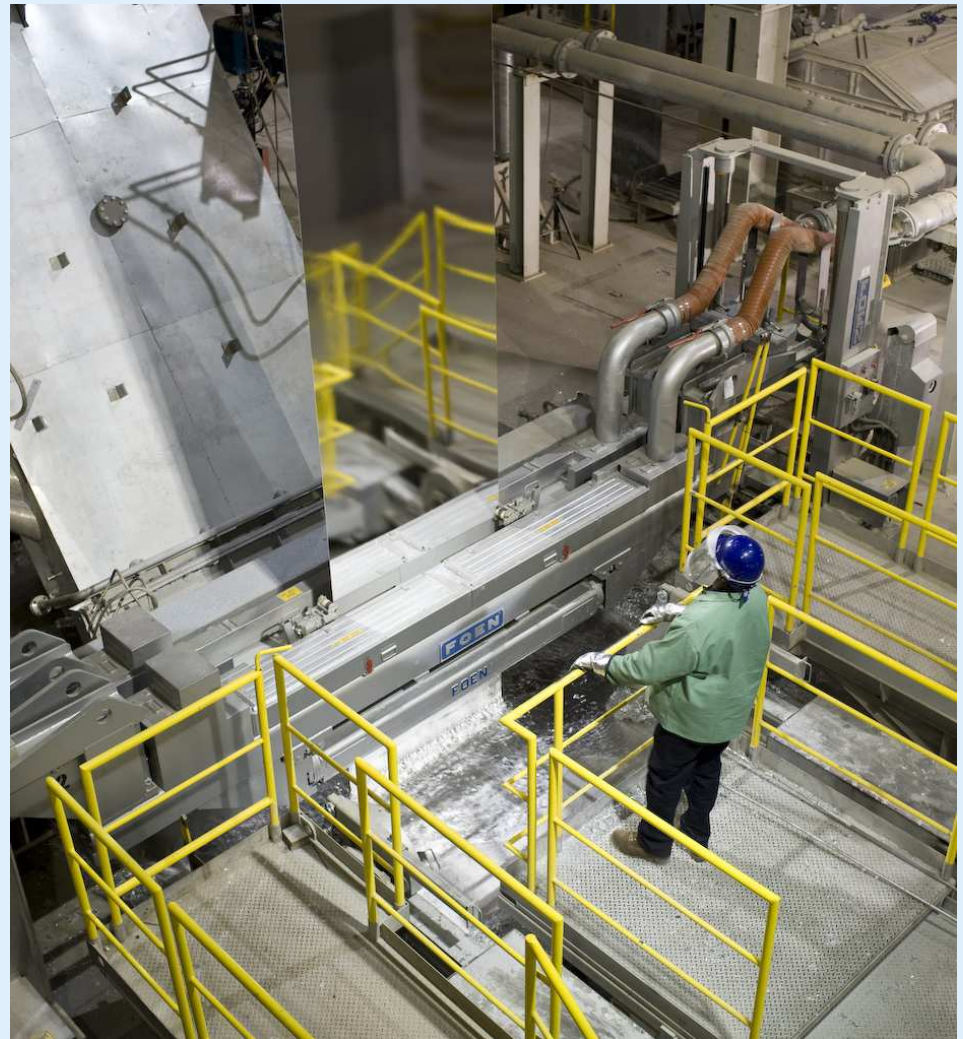
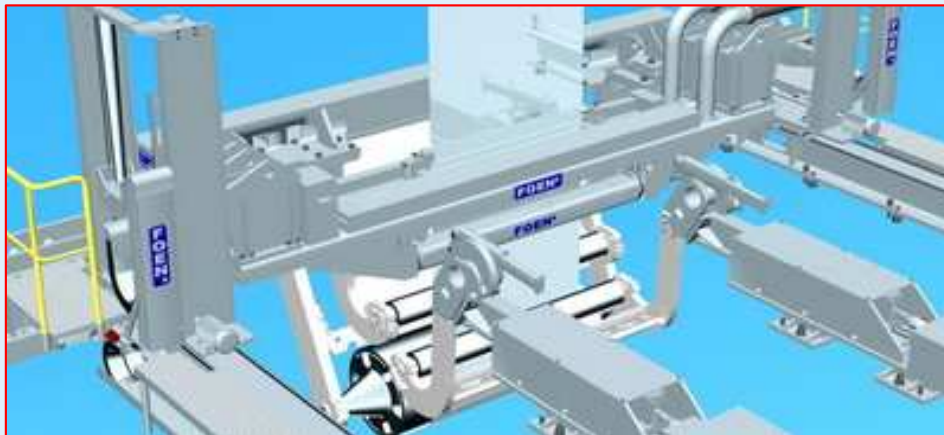
After slow cooling there are two options available:

- Ultra Fast Cooling system with cooling rates of up to 130 K/mm/s
- Water-quench system for cooling rates of up to 1,000 K/mm/s with following flash pickling



## Optimizations of the FOEN Air-knife system

- Laser controlled air knife parallelism to strip
- Variable nozzle gap width adjustment
- Touch less edge coating control device
- Model based coating weight controller
- Each air-knife can be upgraded with latest features



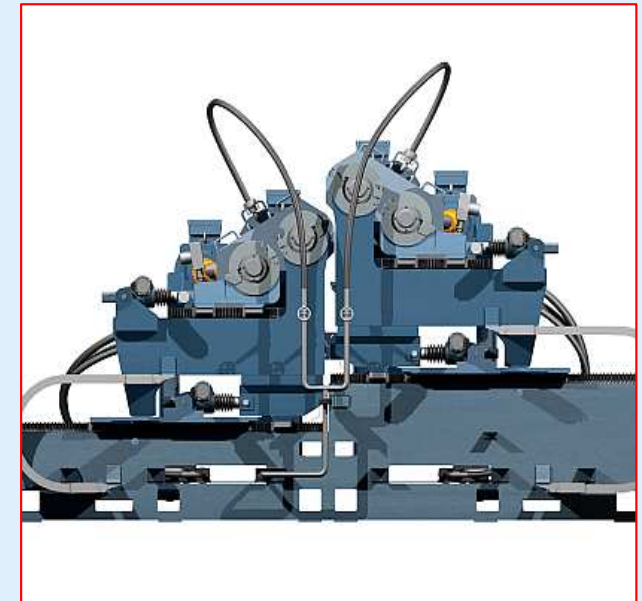
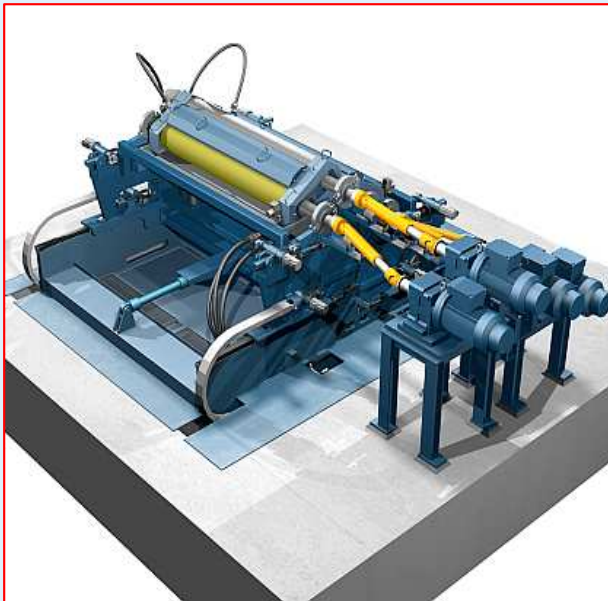
- Electromagnetic strip stabilizer “DEMCO” for reduction of over coating
- Zinc savings due to reduction of strip vibration and strip shape control
- More uniform coatings due to improving of strip shape at air-knife  
→ result in more uniform coatings
- The outer pairs of magnets are positioned at the strip edge, the inner pairs are adjusted to the problematic zones, while the center pair is fixed to the strip centre





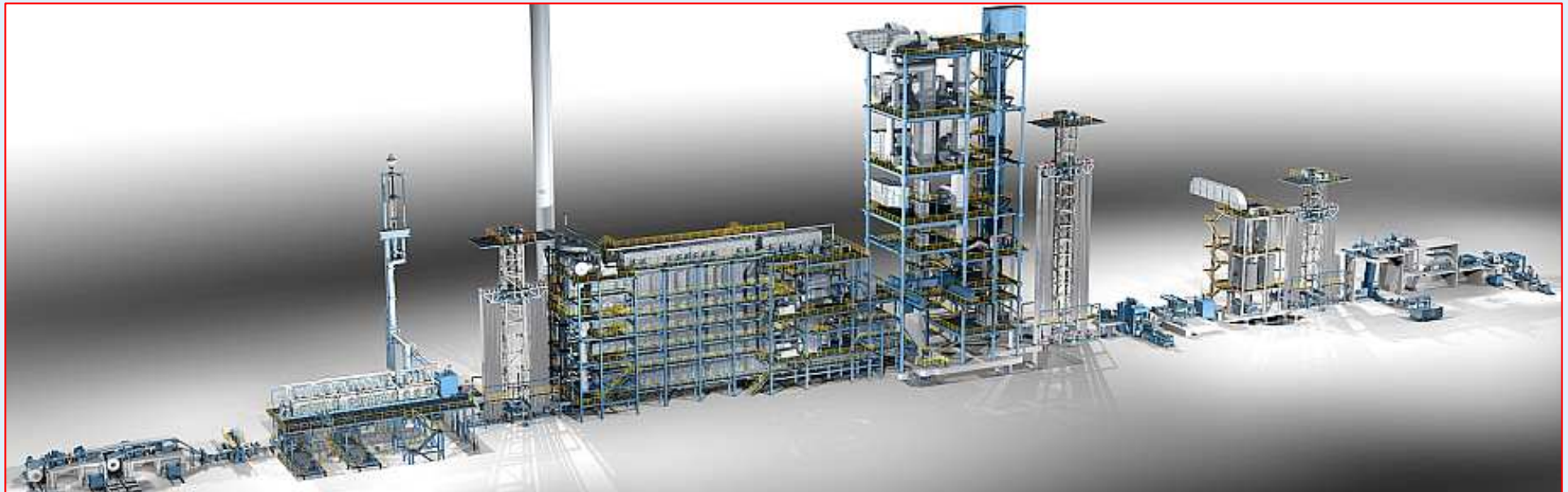
## Extreme precisely and reliable coating thickness

- Separate circulation systems for different coating types
- Shuttle coater system for quick product change
- Motor system holds both rolls in an optimal position for even coating – a controlled electric drive unit ensures the rolls turn in unison
- High efficiency and eco-friendliness, no waste water, no vapor



### Customer benefit of comprehensive operation and process know-how

- Correct layout of the line according to requirements of European, Japanese, Korean or Chinese steel composition philosophy
- Entering the market for highly profitable steel grades
- Fast start up leads to earlier cash flow → saves time and money for own developments
- Advanced steel grades ease saleability of commodity grades by selling packages





## Steel treatment process

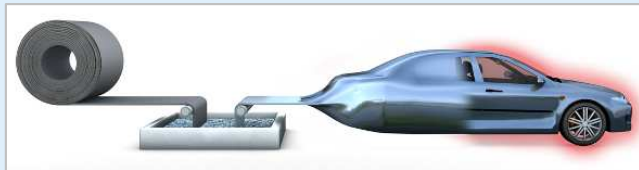
- Basic production parameters
- Process description
- Technical consulting
- Energy management
- Environmental protection

## Operation of equipment

- Start-up and process optimization
- Operational assistance and technical support
- Classroom training of customer personnel
- Management training
- Practical training at SMS cooperation partners site
- On-the-job training of customer personnel

## Quality control

- Plant descriptions
- Process parameters
- Failure management
- Process requirements
- Quality control/ assurance
- Maintenance requirements
- Job description
- Sample selection and management





**MEETING** your **EXPECTATIONS**