From Evolution to Revolution

Workshop: Technology to the Rescue I

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Member of the Managing Board
SMS Siemag AG, Germany
Main drivers of technological evolution

- Lowest production costs
- Green technologies
- Advanced products
Technological evolution, example: CSP®

1989: First CSP® plant at Nucor (USA)

1993: First CSP® plant for automotive grades (SDI, USA)

1995: Ultra thin strip (≥ 0.9 mm)

2003: Semi-endless technology for ultra-thin strip

2005: First CSP® plant with complete E/A

2010: New possibilities with CSP® flex

2012: CSP® eco

Steadily rising complexity requires innovative solutions from plant manufacturer
CSP® technology

Width range
Today: 31 – 78”
Future: up to 83”

Larger width, more profit

Unlimited
CSP® – The unlimited technology

COMPLETE PRODUCT PORTFOLIO

Thin strip
Pipe grades
Si-grades
Automotive
CSP® – The unlimited technology

PRODUCTION CAPACITY
From 900,000 to 4,000,000 tons per year

Economical caster concepts for complete product range
CSP® – The unlimited technology

- First 3-strand CSP® plant: Essar Steel, India, annual production ~ 3.5 m. tons per year
- Production potential: up to 4.5 m. tons per year (depending on product mix)
CSP® eco – The economic technology

LOWEST TOTAL COST OF OWNERSHIP

High profitability

Lowest conversion costs
CSP® eco – The economic technology

Lowest energy consumption costs – possible with CSP® eco

Energy consumption [KWh/t]

- Conventional process
- CSP® process
- Endless process
- CSP® eco

Strip thickness 0.079" (2 mm)
CSP® eco – The economic technology

Furnace Rollers
- 50% energy savings
- New roller concept with improved insulation
- Under development: uncooled rollers for even higher savings

Heating System
- Induction heating
- Lower furnace temperature
- Reduction of overall energy consumption

Rolling Mill
- Work rolls with smaller diameter
- Smaller distance between mill stands
- Optimized roll gap lubrication and cooling
- Optimized descaling technology

Reduction of energy losses with individual technology packages
ECOPLANTS® – Economic and environmental balance

ECOPLANTS®
Environmental solutions

Energy
Air Pollution Control
Water Treatment
Residual Substances & Recycling
Environmental Technology Service
# Energy & Environmental Technologies

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June 18, 2012
ARCCESS® steady EAF (S/EAF®)

Revolutionary
Completely new designed
Patents pending
ARCCESS® steady EAF (S/EAF®)

Continuous operation
Electrode slipping system
Operation under power-on
**ARCCESS® steady EAF (S/EAF®)**

Efficient Flat bath operation  
Steady DRI charging
**ARCCESS® steady EAF (S/EAF®) – Process sequence**

Electric power

![Diagram of EAF operation with time and tapping events]

**EAF operation**

<table>
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<tr>
<th>Melt</th>
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<td>Tapping</td>
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**steady EAF operation**

Electric power

![Diagram of steady EAF operation with time and tapping events]

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Time
**ARCCCESS® steady EAF (S/EAF®) – Optimum adjustment to DRI plant**

**Ultra-high productivity**

- 3.3 m. tpy DRI
- 100 % hot charging

**Conservative boundary conditions**

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<thead>
<tr>
<th></th>
<th>EAF</th>
<th>S/EAF®</th>
<th>Δ</th>
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<tbody>
<tr>
<td>Tapping weight</td>
<td>250 t</td>
<td>250 t</td>
<td></td>
</tr>
<tr>
<td>Production capacity</td>
<td>2.4 m. tpy</td>
<td>2.9 m. tpy</td>
<td>+ 20%</td>
</tr>
<tr>
<td>Productivity</td>
<td>310 t/h</td>
<td>375 t/h</td>
<td>+ 20%</td>
</tr>
<tr>
<td>Tap-to-tap time</td>
<td>48 min</td>
<td>40 min</td>
<td>- 8 min</td>
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New technology for advanced products (BCT®)

Advantages of Belt Casting Technology (BCT®)
- Special light weight automotive grades
- Car body weight: 4% lighter
- Saving of million tons of CO₂ emissions

Unique casting technology for the production of ultra-high alloyed steel grades
Use of HSD®-steel in car bodies helps to **reduce weight, save fuel** and **minimize CO2-emissions**.

**Technological possibilities**

- **Potential analysis:** HSD®-Steel car body
- Example: *Volkswagen Golf V body*

**Impact**

- **~19% weight reduction** (for 8 units)
- **~4% body shell reduction**
- **~0.5% fuel savings**
- **~0.5% CO₂-emission-reduction**

HSD®
15%Mn; 2.5%Al; 2.5%Si
high strength and ductility
### Advanced products: High-strength steel – ultra high strength steel grades

<table>
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<th>Material Mix in Modern Cars</th>
<th>Press Hardened Steel</th>
<th>Advanced High-Strength Steel</th>
<th>Mild Steel</th>
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<tr>
<td><strong>Ford New Grand C-Max</strong>*</td>
<td>10%</td>
<td>20%</td>
<td>43%</td>
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<tr>
<td><strong>Saab 9-5</strong></td>
<td>5%</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td><strong>Opel Meriva B</strong>*</td>
<td>5%</td>
<td>13%</td>
<td>43%</td>
</tr>
<tr>
<td><strong>Aluminum</strong></td>
<td></td>
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<td>36%</td>
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*Source: Ford, **Source: Saab, ***Source: GME Engineering*
Heating & cooling as a key process for modern steel grades

**Heat Treatment Cycle**

- **Ultra high strength steel**
  - e.g. CP1000 (HCT980C) or manganese-boron-steel (22MnB5)
- **Extra high strength steel**
  - e.g. TRIP800 (HCT780T) or DP800 (HCT780X)
- **Very high strength steel**
  - e.g. BH340 (HX340BD) or HSLA420 (HX420LAD)
- **High strength steel**
  - e.g. IF220 (HX220YD) or HSLA260 (HX260LAD)
Continuous annealing line for ultra high-strength steel grades

- Ultra Fast Cooling system with **cooling rates of up to 120 K/s/mm** and for **high-strength steel grades** up to 980 MPa (TRIP & DP)
- Water-Quench system for **cooling rates of more than 1,000 K/s/mm** for **ultra-high-strength steel grades** with up to 1,550 MPa
Innovative solutions over the process chain

Technological Drivers
- Lowest production cost
- Green technology
- Advanced products

ARCCESS®
CSP®
BCT®
Annealing