ELKEM OG
DET GRØNNE OG DIGITALE SKIFTET

Alf Tore Haug / Trygve Hanssen
Mo i Rana
19 April 2017

Elkem
A Bluestar Company

KORT OM ELKEM

Trygve Hanssen
19 April 2017

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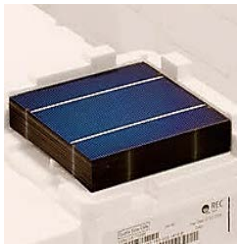
Elkemgruppen: To verdikjeder

SILISIUM

BLOKK

WAFER

CELLE



MODUL

Elkem Solar

REC Solar Singapore

Omsetning: 6,6 mrd NOK

Ansatte: 2215 (Norge: 270)

KVARTS

SILISIUM, STØPERILEGERINGER, KARBONMATERIALER

SILIKONER

Elkem AS

Omsetning: 14,6 mrd NOK

Ansatte: 3600 (Norge:1100)

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Elkem gruppen - et overblikk

- Grunnlagt av Sam Eyde i 1904
- Eid av China National Bluestar siden 2011
- 110 års historie som teknologileverandør

3800 ansatte
(1530 i Norge*)

28 verk på verdensbasis
hovedkontor i Oslo

21 mrd NOK
Omsetning i 2015

370 FoU-medarbeidere
Globale forskningssentere i Norge og Lyon

*tallet inkluderer 280 ansatte i Elkem Solar.

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BÆREKRAFT, KLIMA OG ENERGI

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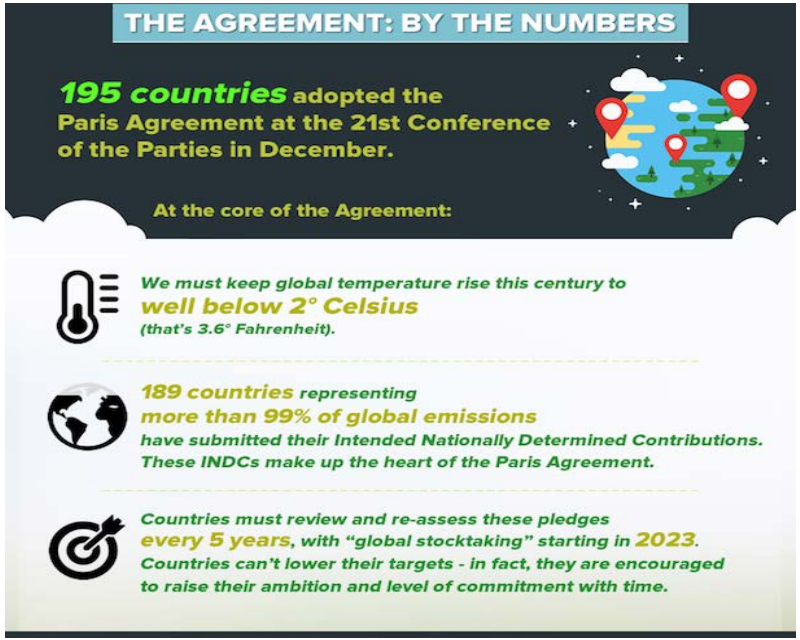
The Paris Climate Agreement

EUROPEAN CLIMATE ACTION

- The 2030 climate and energy framework sets three key targets for the year 2030:
  - > 40% cuts in greenhouse gas emissions (from 1990 levels)
  - > 27% share for renewable energy
  - > 27% improvement in energy efficiency
- EU Low-carbon economy roadmap proposes:
  - 80% emissions cuts by 2050 (below 1990 levels)
  - Milestones: 40% cuts by 2030 and 60% by 2040
- This would reduce emissions from fixed installations (allowances) to around 43% below 2005 levels by 2030 and 90% by 2050



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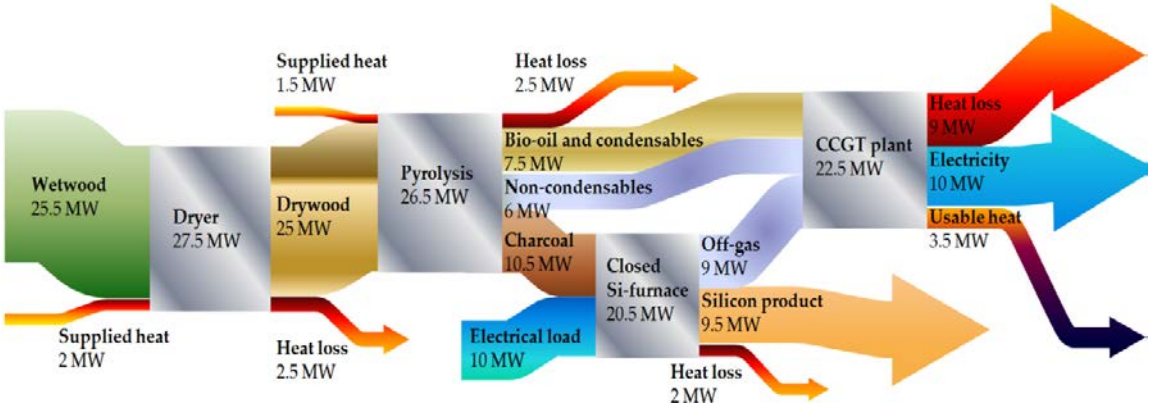
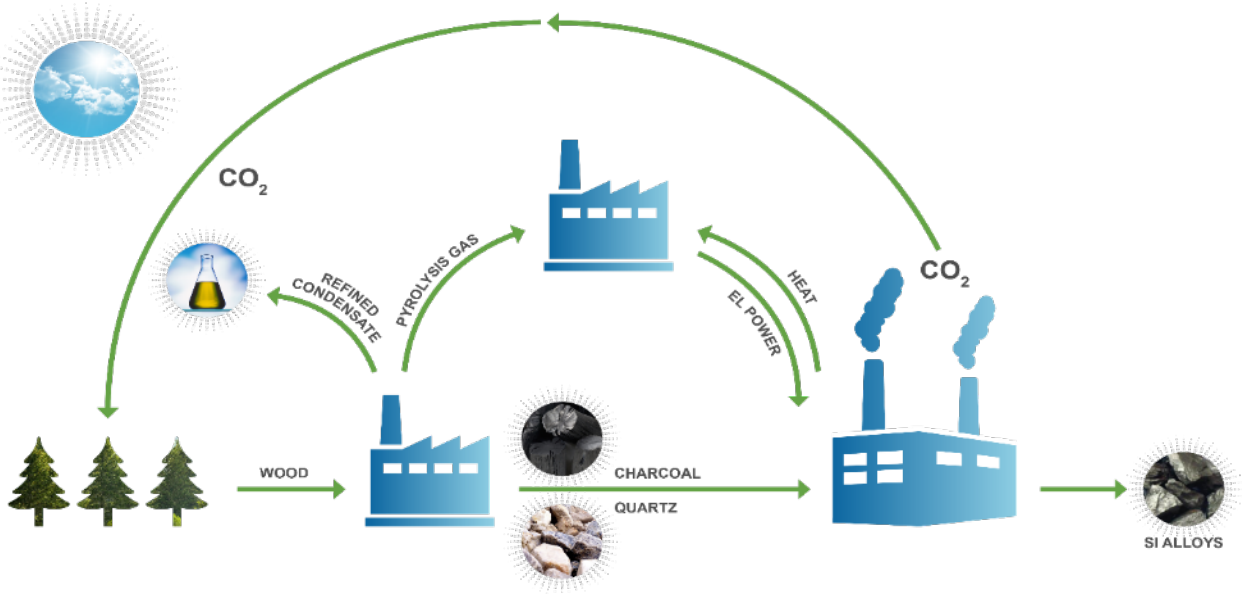
Carbon Neutral Metal Production

Business case / Background:

- Elkem's resource efficiency and environmental emissions:
  - Waste heat: ~5,9 TWh
  - CO_2: ~1,3 millon tonnes
- Elkem needs to reduce energy consumption and CO_2 emissions and increase energy recovery to be prepared for future requirements



Long term R&D:
Carbon neutral metal production



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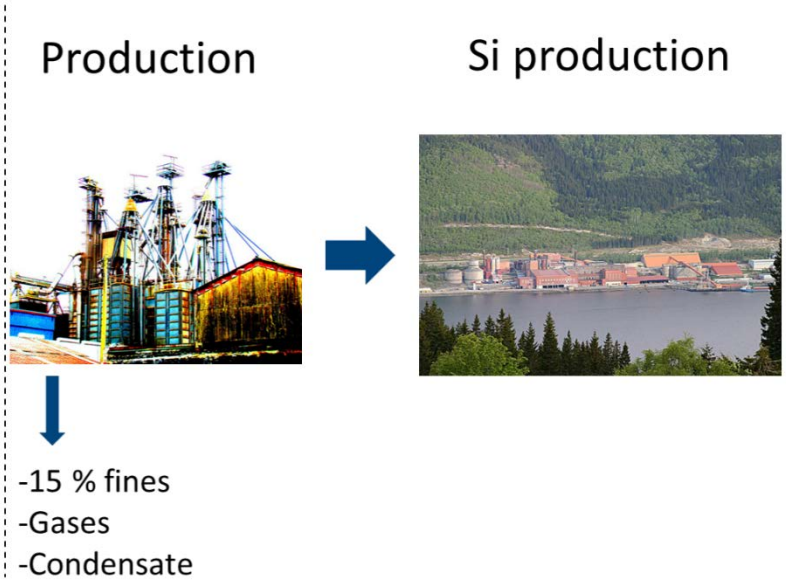
Elkem decentralized production



Decentralized production		
	Mass	**Energy**
Gate		
Biomass in	100 %	100 %
Gas	25 %	10 %
Fines	4 %	9 %
Charcoal	21 %	51 %
Condensate	50 %	30 %

Final distribution		
Charcoal	21 %	51 %
Gas	25 %	10 %
Condensate	50 %	30 %
Fines	4 %	9 %

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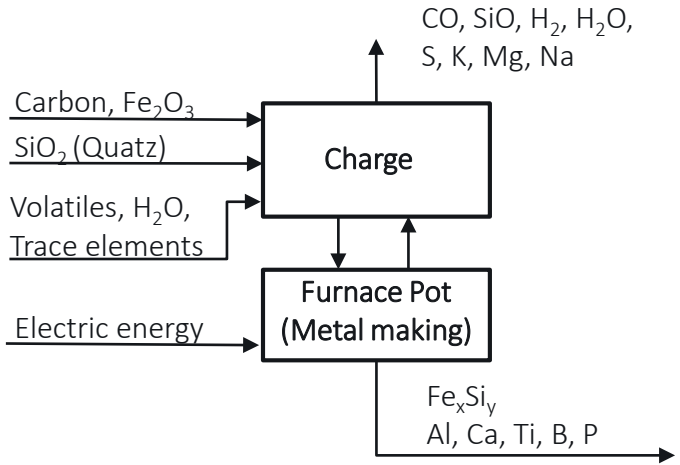
Utilization of the furnace off-gas components

COMPOSITION

- Typical off-gas composition: 60% CO, 25% H_2, 7,5% H_2O plus CO_2, N_2 and CxHy (charge mix dependent).
- The SiO content is a function of the Si yield.



POSSIBLE USES

Carbon monoxide (CO) and Hydrogen (H_2)utilization:

- Energy recovery
  - Electric energy (Thamshavn and Bjølvefossen)
  - Steam (Chicoutimi)
  - Combined Cycle Power Plant (Closed furnace)
- Chemical conversion:
- Gas fermentation – microbe growth

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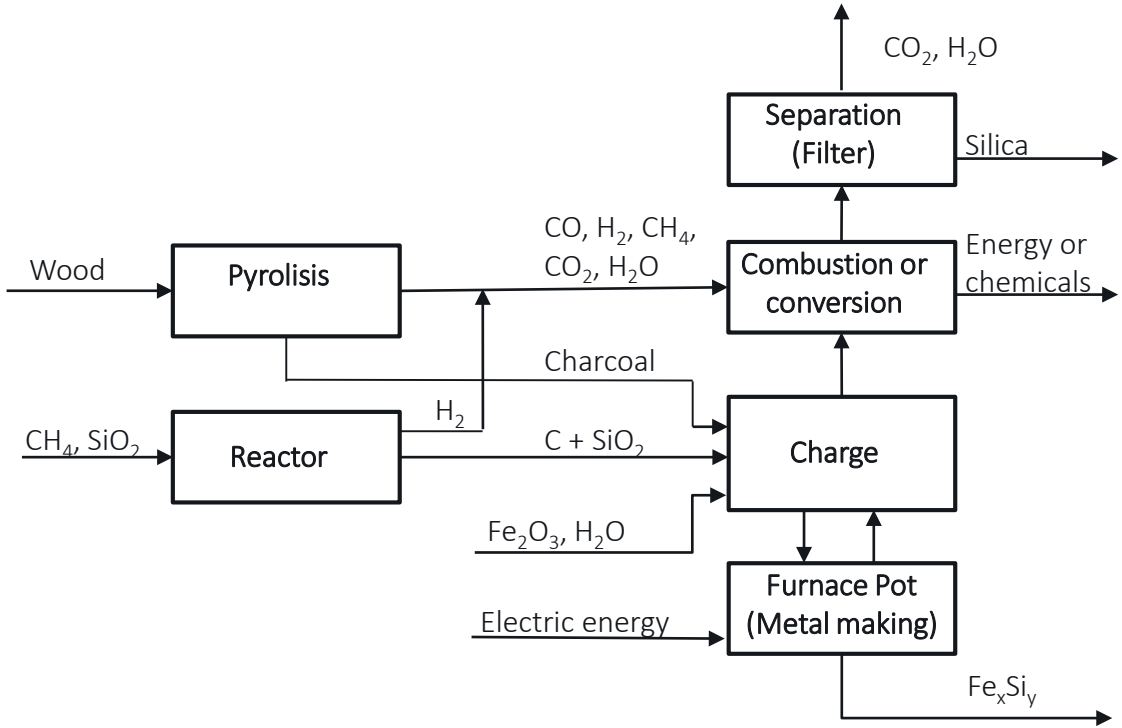
Future (ferro) silicon process?



Benefits of a closed process:

- No loss of carbon / improved carbon balance
- Si yield > 95%
- Reduced cost of coal
- Sustainable charcoal production
- Low cost high purity carbon source from natural gas
- Energy or chemicals production from gaseous by-products
- NOx emissions eliminated
- Enables low cost SO_2 removal
- Prepared for Carbon Capture

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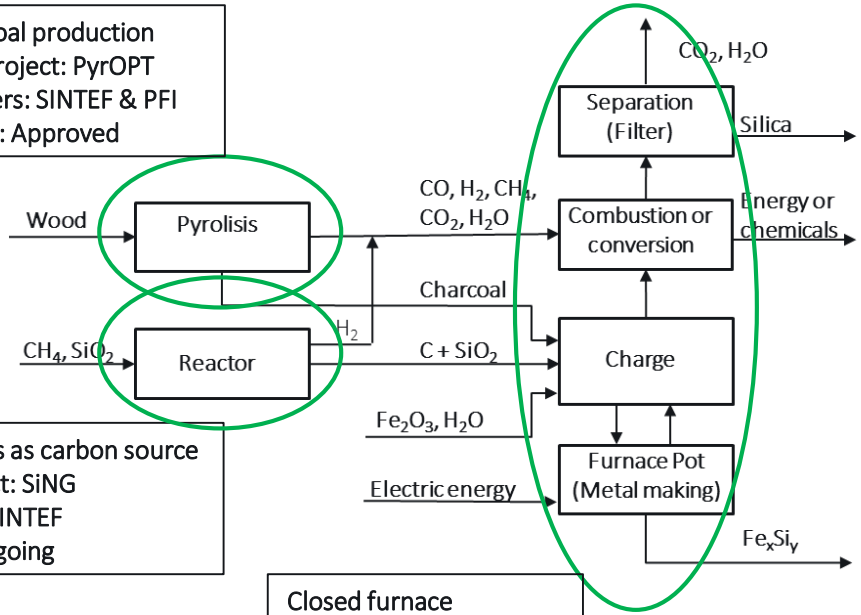
R&D projects and technology monitoring

Charcoal production
NFR Project: PyrOPT
Partners: SINTEF & PFI
Status: Approved



Natural gas as carbon source
NFR Project: SiNG
Partners: SINTEF
Status: Ongoing

Closed furnace
NFR Project: SiNoCO2
Partners: SINTEF
Status: Approved

CO_2 capture
NFR Project: CO_2stCAP
Partners: TELTEK, Norcem, AGA
Status: Ongoing

CO_2 capture
EU Project: COOPERATE
Partners: Mefoss / Steel
Status: Application submitted

CO_2 to Urea
EU Project: CURE
Partners: Mefoss / Steel / Agri.
Status: Application submitted

CO_2 / CO / H_2 utilization, dialogue:
- Lanzatech (Eramet)
- Mo Industripark
- Salcape
- Etc.

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FOCUS ON THE DIGITAL CHANGE FROM AN AUTOMATION POINT OF VIEW

Trygve Hanssen

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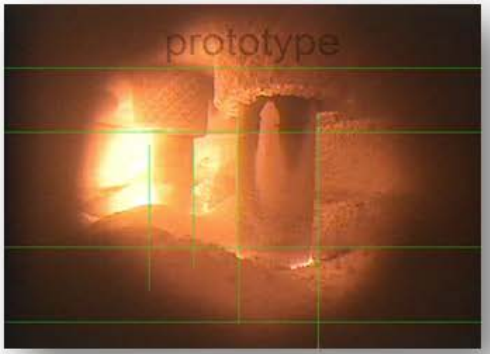
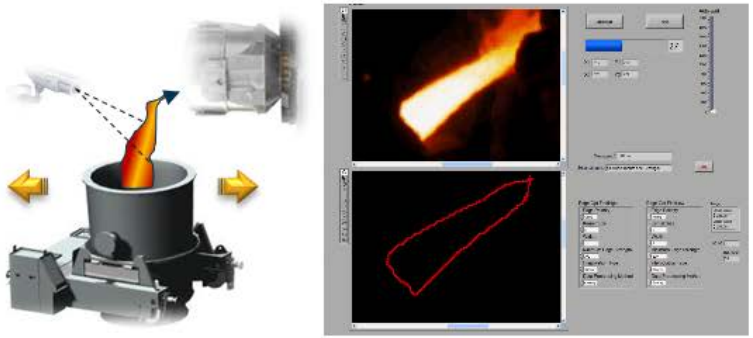
Potentials of new technology and digitalisation



Improved regularity with measurement of electrode positions through image processing



Reduced EHS risk and cost of maintenance with automatic ladle positioning using digital imaging surveillance

Improved precision in production using “Process Intelligence” applications with big data

Increased process control and quality with fiber optic temperature measurements in ladles

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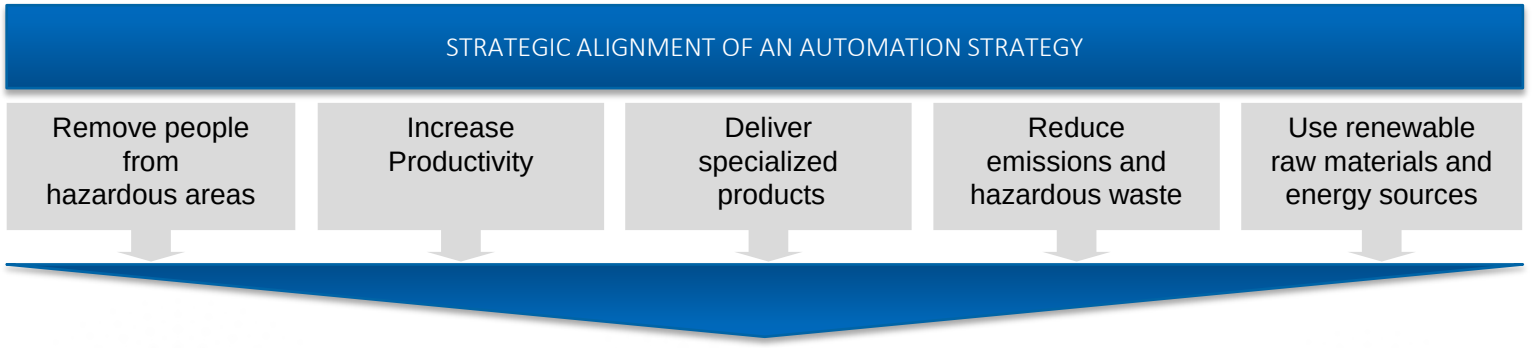
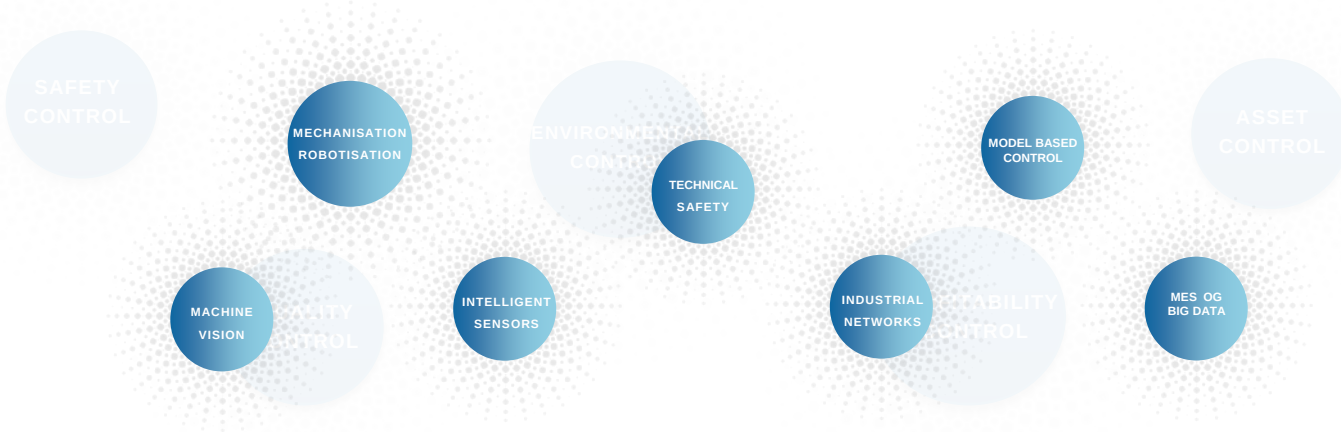
Implementation to create benefit





Technology enablers

Challenges

- Bridging the gap between technology lookout and real implementation
  - How do we make use of new technology to gain real benefit for the production
  - How do we choose the right approach – push or pull
- Measuring value from automation improvements
  - How do we achieve the right effect goals – automation has no value in itself
  - How do we measure value (payback) from implementing new technology
  - How do we use leading and lagging indicators (KPI's) to make priorities
- Knowledge to select prioritisations
  - What competence do we need to make the right choices

ADVANCED MATERIALS
SHAPING THE FUTURE