

WHY COOPERATING WITH RTOS AND WHAT ARE THE BENEFITS FOR ELKEM

22 March 2018

**Håvard Moe, Senior Vice President
Elkem Technology**

Elkem

Founded in 1904 by Sam Eyde

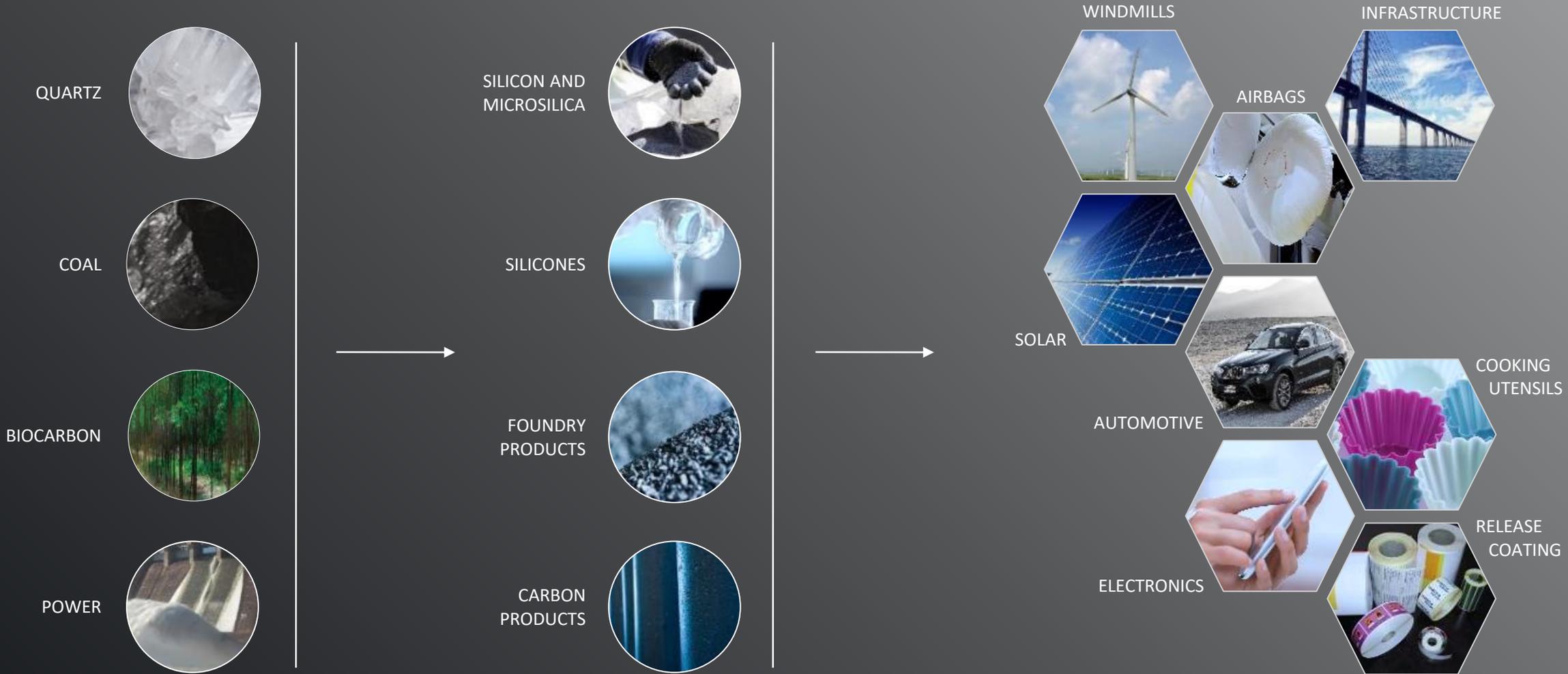
Owned by China National Bluestar since 2011

113 years of history as a technology provider

Main products: silicon, silicones, foundry products,
microsilica, carbon products



Our products are **vital for modern societies**



LOW COST SUSTAINABLE INPUT FACTORS

HIGH TEMPERATURE / CHEMICAL PRODUCTION PROCESSES

EXAMPLES OF HIGH VALUE APPLICATIONS AND MARKETS

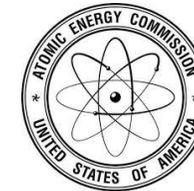
Examples of Elkem's R&D partners



Høgskolen i Telemark



UNIVERSITY OF OXFORD



UiO



University of Oslo



UPPSALA UNIVERSITET



SAPIENZA
UNIVERSITÀ DI ROMA
Logovaults

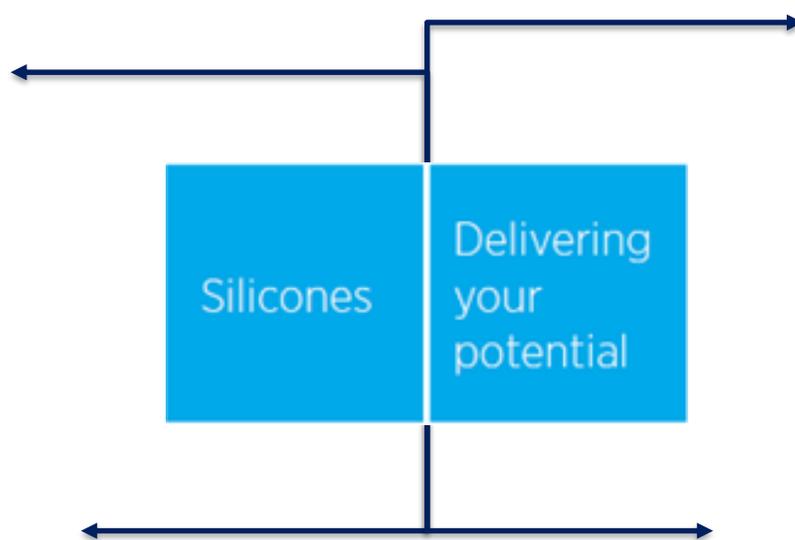


NCE EYDE Norwegian Center of Expertise
Sustainable Process Industry



Elkem Silicones Collaborative Network – Open Innovation

European & French
Research Fundings



Rhône-Alpes R&D Centers



Academics & Universities



Clusters



Collaborative Platform



Axel One & Cluster focus in Auvergne Rhône-Alpes region – A leading region in Chemistry & Environment

2 AREAS OF EXCELLENCE

INNOVATIVE
MATERIALS & PROCESSES



PARTNERSHIP WITH 3 NATIONAL CLUSTERS



Chemistry-
environment



Plastics

Textile & flexible
materials

NUMBER ONE PRODUCING AREA
of chemicals in France

SECOND LARGEST FRENCH NETWORK
of higher education and research institute

SECOND GREATEST INDUSTRIAL
metropolitan area in France

Axel One Mission

Sharing/Pooling of resources services & skills for
Collaborative projects (Industries/Institutes &
Academics)



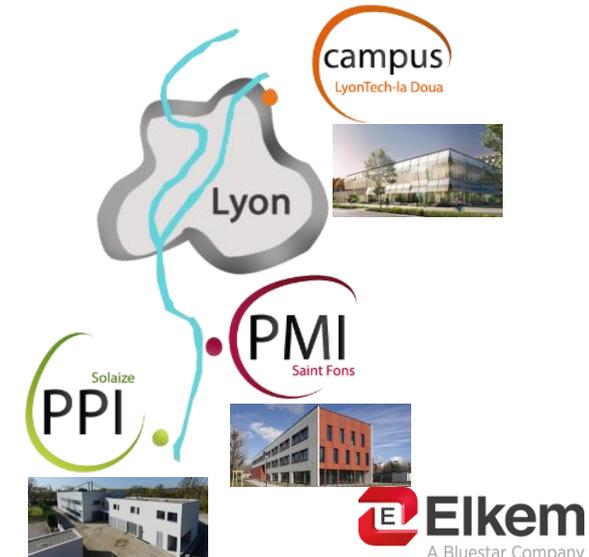
3 interacting facilities in the Lyon area

9 000 m2
dedicated buildings

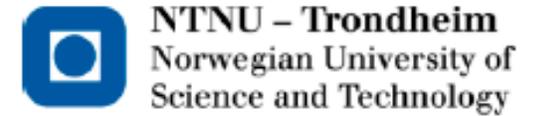
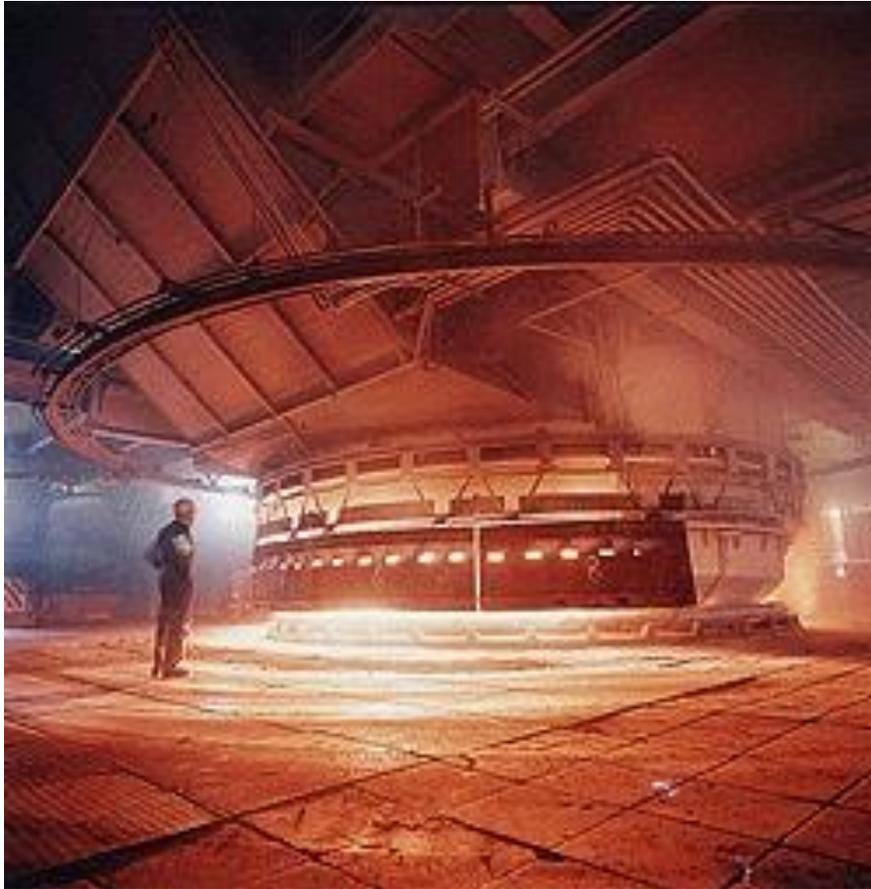
200 PEOPLE
hosted on our sites

25 MILLIONS EUROS
of R&D tools

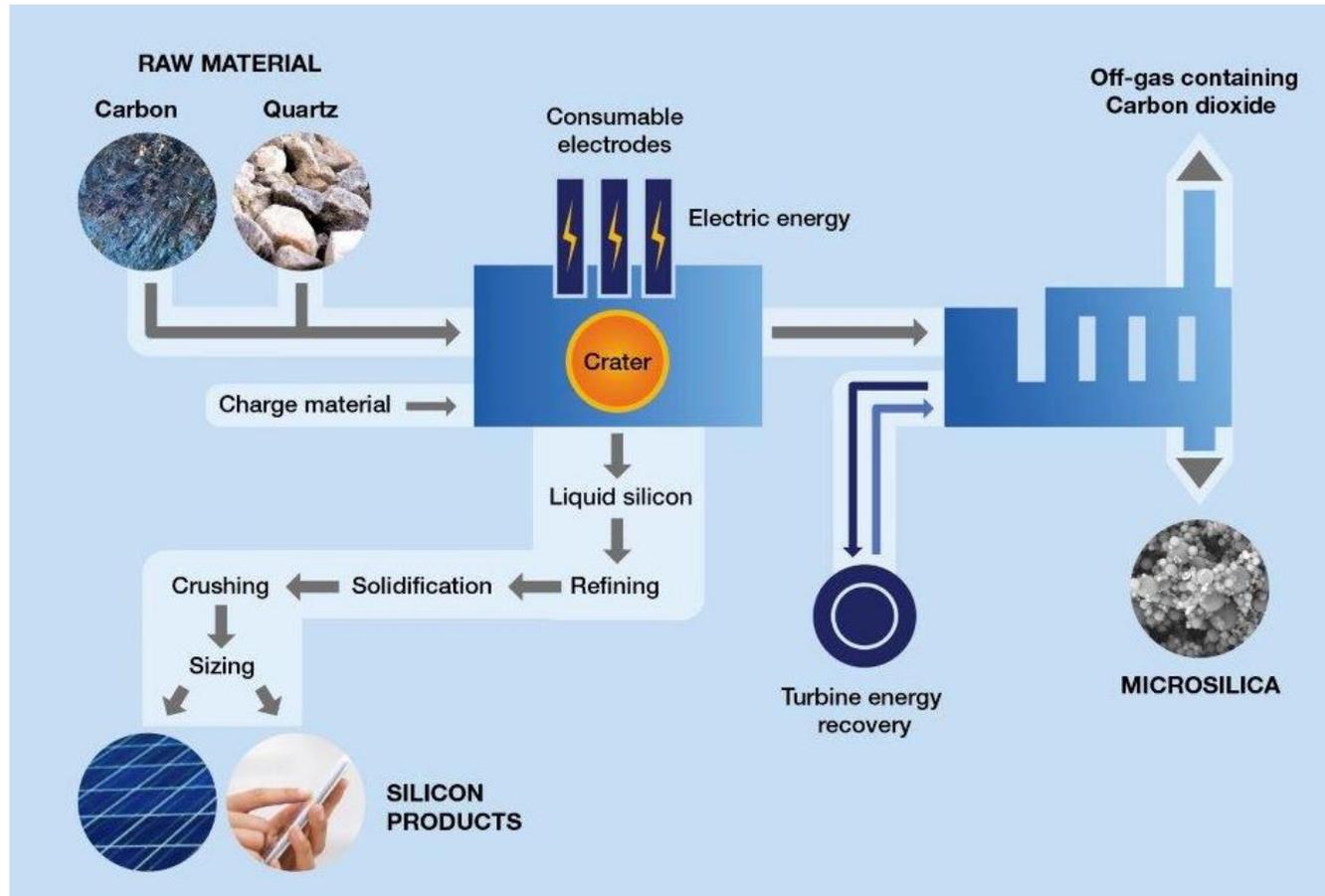
10 SMEs
45 PROJECTS



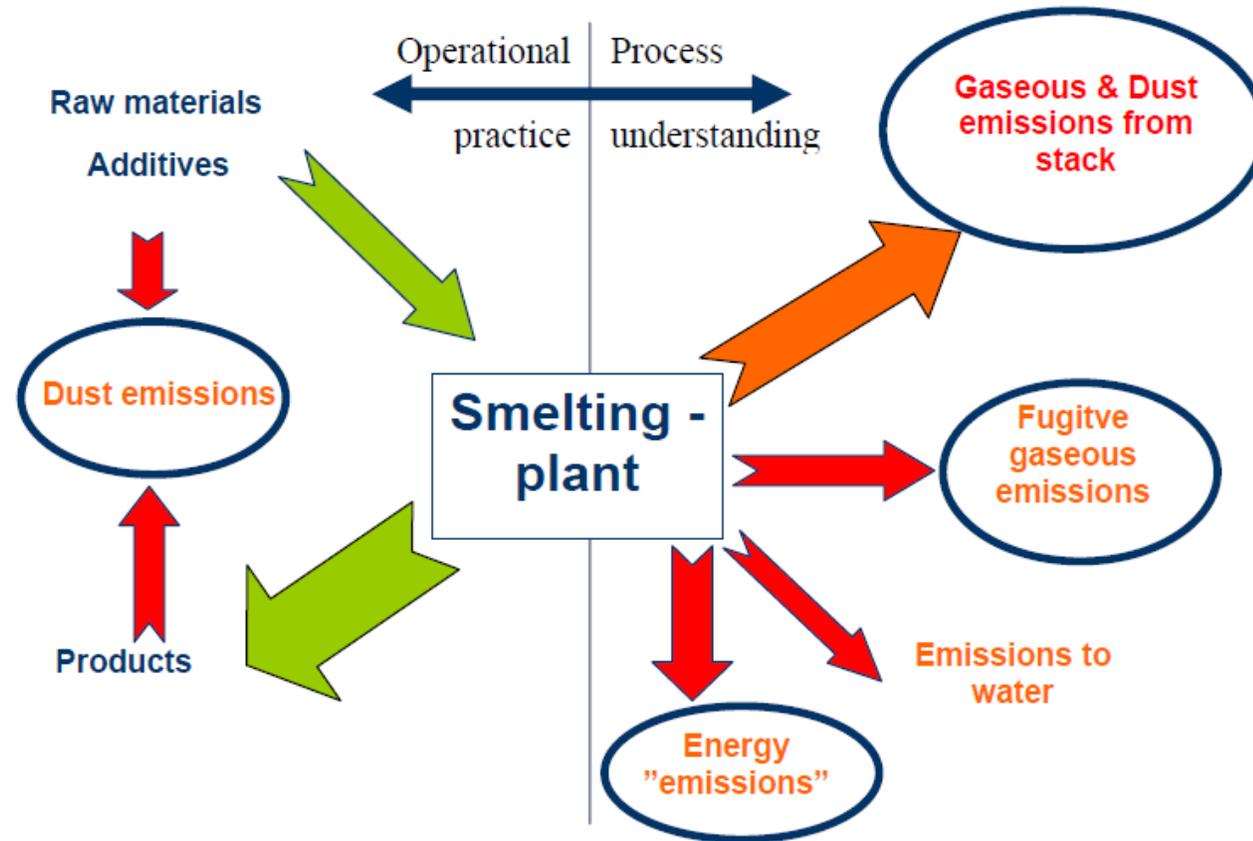
FFF – The Norwegian Ferroalloy Producers Research Association



Silicon is produced by reducing quartz (SiO_2) with use of carbon materials (coal, coke, char coal and wood chips) in electric furnaces



Schematic of the emissions from a ferroalloys plant



Source: KMB Fugitive Emissions of Materials and Energy (FUME)



Example: Nitrogen oxide - NO_x

- NO_x gases are produced from the reaction among nitrogen and oxygen during combustion
- NO_x is an important air pollutant:
 - Significant impacts on human health (may cause or worsen respiratory diseases, such as emphysema or bronchitis)
 - Contributes to the formation of acid rain
- The Gothenburg Protocol establishes mandatory emission reductions for four major air pollutants (including NO_x)
- Starting in 2009, the FUME project has developed in-depth competence in the area of “fugitive” emissions of materials (gas, dust/particles etc.) to internal and external environment
- Based on new knowledge from the FUME project, Elkem implemented the first low NO_x silicon furnace in 2012
- Elkem’s total global NO_x emissions:
 - 2014: 8869 tonnes
 - 2016: 7427 tonnes
 - Target reduction from 2016 to 2022: >1000 tonnes

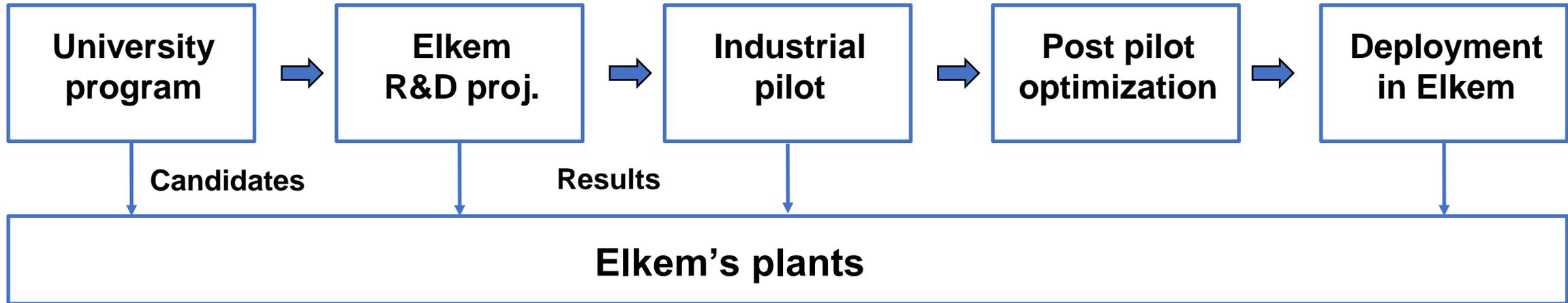


Knowledge development from universities to Elkem's plants

FFF – Fume (6 years from 2009)

NOx Thamshavn (2012)

NOx Salten (2013&15)



THREE CATEGORIES OF PROGRAMS IN THE UNIVERSITY / INSTITUTE SECTOR:

- Large cross industry public initiatives (SFI Metal production, FME HighEFF, BioCarb+)
- Industrial consortium (FFF-Eramet, Elkem, Wacker, Finnfjord, ..)
- Elkem controlled R&D projects (PyrOPT, SiNoCO2)

TYPICAL PUBLIC SUPPORT LEVEL: (ELKEM INPUT VS. TOTAL BUDGET)

- Large cross ind. public initiatives: ~5% (FME Sol: Elkem 1,2 / Total 26 MNOK)
- Industrial consortium: ~35% (FFF: Elkem 2,5 / Total 9 MNOK)
- Elkem controlled R&D projects: ~65-50% (Elkem part cash and InKind)

Challenge – SPEED!

- Elkem has a long track record of successful R&D and Innovation projects
- Most projects have been in cooperation with strategic RTOs cofounded by the French and Norwegian governments
- The biggest challenge in joint projects with RTOs is innovation speed!
- Major time thieves:
 - Project application development and approval (6 – 15 months)
 - Project mobilization and start-up (3 – 6 months)
 - Ability to deliver results on time during project execution (usually < 80% of the milestones are passed according to plan)
 - Mobilization and funding after successful project completion

Recommendation to the Norwegian government and the Research Council of Norway:
Establish mechanisms to extend successfully completed projects to refine successful R&D results, share the results in the scientific community and support initial piloting at near industrial scale!

DELIVERING YOUR POTENTIAL

