# SisAl Pilot

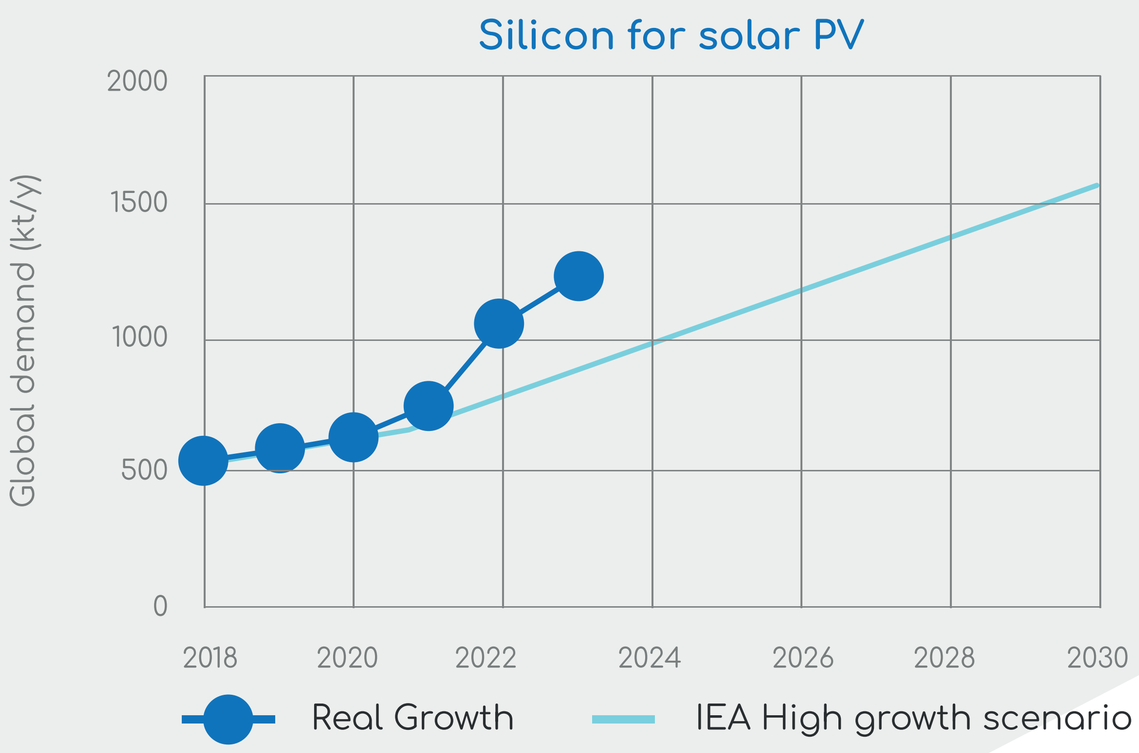
Innovative pilot for Silicon production with low environmental impact using secondary Aluminium and silicon raw materials

The timing of SisAl Pilot is impeccable with respect to key European challenges; the transformation to a circular economy, the strongly enhanced focus on climate and future expected EU-ETS CO2 allowances with associated risk for carbon leakage from Europe, the rapidly increased difficulty of exporting aluminium scrap from Europe to China, and modern society's ever-increasing need for silicon metal. With SisAl, all these challenges are turned into new European opportunities.

## ADVANCEMENTS IN THE PROJECT

### SISAL PILOT REDEFINES SILICON PRODUCTION FOR SOLAR PV AND BEYOND

The main product from the SisAl process, silicon metal, has three main end uses: aluminium-silicon alloys mainly for automotive, silicones for the chemical industry and silicon for solar PhotoVoltaics (PV). While all these markets are expected to grow in the coming years, the need for silicon in solar cells is already by far outstripping the International Energy Agency's (IEA) most ambitious growth scenarios from 2020.




During the first part of the project, Elkem performed 22 SisAl pilot tests with production of silicon metal and calcium-aluminate slag. Different aluminium sources were tested: pure aluminium, aluminium scrap and white dross. Results showed yields and compositions in accordance with lab scale tests performed at NTNU. Furthermore, refining of SisAl produced silicon was performed at Elkem, using silicon slag and sculls from Wacker. Refined silicon reached a purity of 98,5 % Si. The refined metal was further purified to a purity of 99,999% by Reykjavik University in collaboration with Silicor. All tests at Elkem were completed without any major problems. Furnace operation, raw material charging and tapping performed as expected. The robot for handling hot & heavy operations installed for the SisAl Project worked perfectly, and saved operators from manual handling. During the last 12 months Elkem together with IME RWTH University have demonstrated the SisAl process in 100 kg scale using an inhouse made reactor for the off-furnace reaction.

To completely demonstrate the Pilot assigned to FREY, an interesting trial concerning the manufacturing of a Aluminum/Silicon tube using a gas furnace was carried out. It was also used to check the feasibility of using this furnace in the SisAl project, comparing the results with those obtained with the induction furnace. The target was to obtain a tube with a minimum 20% of Si through a centrifugal casting process. For that, aluminum ingots with a 3.8% of silicon and around 8kg of Silicon fines with a 99% purity were used. Once obtained, the chemical analysis of the tube material shows that it has a 25% of Si, which is an excellent result. The microstructure of the material consists mainly of primary aluminum dendrites and Si crystals. With these trials, one of the main objectives of the SisAl project for FREY, which is the manufacturing of an Al/Si high performance tube has been reached. During the last period of the project, new tubes will be manufactured by FREY, using the same furnace, but increasing the amount of Si, and test with 2 different cooling rates to compare the microstructure and the mechanical properties. Both 20mm and 50mm thickness tubes will be manufactured.

During the last project year Mintek will demonstrate the SisAl process in ton scale. Elkem and SIMTEC is working closely with Mintek to finalise the design of the process.

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PROJECT COORDINATOR
Gabriella Tranell
gabriella.tranell@ntnu.no

EXPLOITATION MANAGER
Torstein Haarberg
th@bnw-energy.com



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