

ANNEX IV – JOB DESCRIPTION OF GROUP 2

1. GENERAL INFORMATION

Calucem d.o.o. is implementing "Development of a new innovative ECO₂Flex product" project, in accordance with the project application submitted to the Call for Proposals *"Increasing the development of new products and services that derives from R&D activities – Phase II"* (ref No: KK.01.2.1.02), implemented by the Croatian Agency for Small Business, Innovation and Investment; HAMAG BICRO and the Ministry of Economy and Sustainable Development.

The project is co-financed by the European Regional Development Fund under the Operational Program Competitiveness and Cohesion 2014 - 2020.

The Company plans to develop an innovative technological solution in the construction industry, for reduction of CO₂ and usage of energy in production, called ECO₂Flex, which is based on a combination of patented calcium aluminate cement (CAC) with selected CO₂ neutral cementitious materials (SCM). Partners on a project that will contribute to the successful implementation of the project and the development of an innovative technological solution in the construction industry called ECO₂Flex are the University of Zagreb Faculty of Civil Engineering and Calucem GmbH, Germany.

The total value of the project is HRK 34.926.624,69; eligible costs amount is HRK 27.764.236,85, and the expected aid is HRK 14.900.633,24. The estimated duration of the project is 36 months.

2. TECHNICAL DESCRIPTION / JOB DESCRIPTION

The subject-matter of procurement: Procurement of external services for process mathematical and CFD modeling

Group 2 – External services for process CFD modeling

Procurement number: 04/2021

2.1. INTRODUCTION

Calucem is a producer of calcium aluminate cements. Clinker is produced by a continuous process of melting raw materials (limestone and bauxite) in an L-shaped shaft kiln at temperatures > 1400°C. Energy source is combustion of coal dust in a mixture with air. Combustion gases exit the kiln through the shaft, this way preheating the raw materials that are loaded at the top of the shaft. Temperature critical parts of the kiln are protected by installed steel boxes cooled by high flow of sea water. All critical process data are measured continuously as part of production control system and will be made available to the selected tenderer. Missing data needed for model set up will be measured additionally.

Calucem has launched an EU funded ECO2FLEX project to develop a novel high performance calcium aluminate cement with reduced energy and CO₂ footprint. The goal is to reduce CO₂ emission of the production process by 25%. Possible routes to this goal include heat recovery (reuse of the recovered heat at adequate location(s)

of the kiln production process) and/or use of the recovered heat outside the process. CFD modeling is expected to help better understand the production process and identify optimization possibilities.

2.2. JOB DESCRIPTION

Phase 1 – Industrial

1. Build and validate a CFD model of the kiln production process. The level of complexity of the model (dimensionality, mesh distribution, physico-chemical phenomena included etc.) should be optimized for project goal as stated in the Introduction and for minimum development and computational burden. Deadline: 3 months from signing of the contract. Minimum one visit to Calucem during the first month after the signing of the contract is required.
2. Using the developed model find optimum process working point (minimum energy consumption, maximum productivity, minimum kiln refractory wear):
 - a. for the existing kiln: parameters to optimize: fuel/air quantity and ratio, combustion air speed and temperature, burner position, inclination and shape, outlet position, raw material size depending on melting properties and pressure drop through the shaft.
 - b. for the new kiln: to the parameters listed in 2.a. include: change of kiln size (length, width, height of burner chamber and shaft), additional burner(s), change of fuel type and fuel type mix/air ratio.

Deadline for part 2.a+b is April 30, 2022.

- c. for the existing kiln with changes introduced by heat recuperator (e.g. for higher temperature of preheated combustion air). Expected start: May 1, 2022. Deadline July 31, 2022.

Calucem will provide:

- I. kiln design, process and raw materials and product data
- II. steady-state heat and mass balance data for various input data (process operating points)
- III. design data on any heat recovery equipment to be installed as part of the production process

CFD partner should deliver:

- I. for each point listed above (1, 2.a,b,c and d) a full report that includes at least: description of the developed CFD model, validation data, performed simulation work (in MS Word and PDF format)
- II. reports on performed simulation studies must include visual descriptions (graphics) of mass concentration, velocity, pressure and temperature distribution (at least) in the kiln burning chamber
- III. suggestions for kiln design and process operating point changes that can lead to:
 - a. more energy efficient process
 - b. and/or less kiln wear (improved kiln life time)

Phase 2 – Experimental

1. after testing of improved kiln with heat recuperator in production, repeat process working point optimization as described in 2.a. Expected start: April 1, 2023. Deadline July 01, 2023. Minimum one visit to Calucem during the experimental phase is required.

3. TENDER

Tenderer confirms that he offers the required services described in item 2. TECHNICAL DESCRIPTION OF THE Annex IV – Technical description for Group 1, by submitting signed and certified Annex IV – Technical description for Group 2.

FOR TENDERER:

At _____, on _____

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*(first name, last name, title and
signature of authorized person)*