# Power Supply and Control in an Electrified Calcination Process

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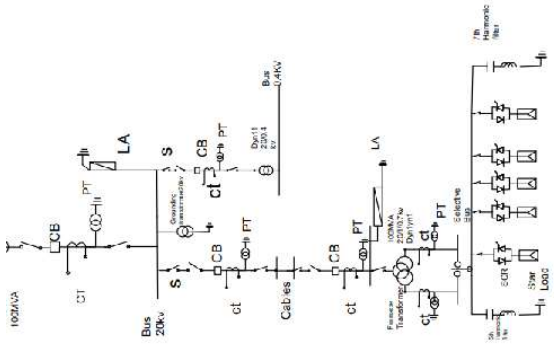
## Introduction and background

Concrete as a building material is crucial in today's construction process. However, cement production, which acts as a glue in the concrete, leads to 5 to 7 % of the world's $Co_2$-emissions yearly. Norcem, as a pioneer company in the cement industry, decided to capture the $Co_2$ emission up to 400000 tons per year which is almost close to 200000 light cars emissions annually. Calcination is one crucial step of the cement production process, leading to $Co_2$ production as a byproduct. In the existing production system, the exit heat from the kiln is used for pre-heating the raw material. This heated gas is mixed with $Co_2$ produced in the calcination process. to capture $Co_2$And there is a need for another downstream process to separate $Co_2$ from other mixed gas. Electrification of the calciner as an alternative solution will cause pure $Co_2$ production, and there is no need for additional downstream processes.

### Problem description and objective:

Delta and star connection of elements is applicable, and it must be decided on the design stage. The efficiency of both models is equal. The power supply's current and voltage are related to this arrangement, and it is decided as the first step in power supply design. Using a furnace transformer and SCR/thyristor together is a solution for the project. Three winding transformers are applied to provide reserve voltage and OLTC-Tap changer equipped transformer will make for variation in the resistivity of elements and cause for slight firing angle of the SCR system. A slight SCR firing angle will result in less harmonic. In full load operation firing angle is zero, and there is no harmonic in the system. To have an optimal operation, it is desirable to provide a zero or minimum firing angle condition. Therefore, heating elements are divided into five units around 15MW load. The maximum variation of the load is limited to 20%. In case of a more decrease in load, it is possible to switch one unit of the loads, and it helps to reduce firing angle and decrease harmonic. SCR power control system causes 5$^{th}$ and 7$^{th}$ harmonics. These current harmonics are intended to flow throughout the furnace transformer and cables to the grid. Installing a series filter on the LV side of the furnace transformer absorbs this current harmonic




**Candidate**:

Alireza Bazargan

**Telephone:**

46586184

**Email:**

238821@usn.no