The industrial minerals blueprint represents a typical production layout in the industrial minerals sector covering the major process steps and the related energy and material requirements. Due to the extensive scope of materials covered by the industrial minerals sector, this EPOS Sector Blueprint was built from the production of calcium carbonate (CaCO₃), using the industrial expertise of the EPOS industrial partner Omya. Like many other industrial minerals, calcium carbonate is a versatile material used in numerous market segments such as the construction industry, the food and pharmacy industries, and as filler in paper, plastics and paint production. Each of these applications requires different properties, the most obvious being the appropriate particle fineness: where products for construction and environmental purposes are relatively coarse, food additives and especially fillers require very fine particles, often below 10µm.

**MINERALS INTRODUCTION**

The industrial minerals blueprint provides a flexible, customisable thermo-economic model, representative of a typical industrial minerals site. It allows for elaboration of the (raw) material, electrical and heat profile as a function of the following main inputs (or sizing streams):

1. Production mass flow-rate and particle fineness
2. Plant type and raw material

The blueprint guides the user to investigate industrial symbiosis potentials when applied throughout European clusters. In addition, users can quickly adapt the model’s key performance indicators or operational parameters so that it can be applied to their own specific site/location. The following figure shows a diagram of the information flow for the blueprint.

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1 Industrial minerals are all geological materials that are neither fuels nor metals.
Three distinct production processes are covered by the industrial minerals blueprint:

- **Dry process**
- **Wet process**
- **Chemical process**

**DRY PROCESS**

The **dry process** is by far the most commonly installed process type due to its relative simplicity and it does not differ fundamentally from that of other minerals or ores. The quarried raw material is mechanically crushed and ground to the desired particle sizes. Depending on the moisture content of the raw material, a drying stage may be required.

**WET PROCESS**

The **wet process** uses similar equipment to the dry process; however, the material is suspended in water, forming a slurry. This allows for a more efficient production of ultrafine particles in wet stirred mills. Additionally, wet processes usually involve more processing stages and large volumes of water are cycled to reduce the required feed of fresh water from external sources.
CHEMICAL PROCESS

The chemical process is particular to the production of precipitated calcium carbonate (PCC), which can be precipitated from a calcium hydroxide solution by the admixture of CO₂. PCC is predominantly used in the paper industry and many PCC plants are on-site facilities feeding their product directly into the paper production, thereby representing an already existing industrial symbiosis.

ENERGY AND MATERIAL PROFILES

The production of industrial minerals usually starts with raw material extraction from a quarry. Crushers then reduce the quarried rocks to sizes suitable for transport and for feeding into the subsequent process stages. Material of lower quality is sorted out in the early process stages, however, reject rates can vary significantly from one deposit/mineral to another. The exact product mix can vary strongly from site to site depending on market demand.
Thermal energy use in industrial minerals plants is driven by the moisture content of the raw material (up to 20%), which has to be reduced to a level suitable for grinding mills (ca. 0.1%). Dryers are mainly used in dry processing, whereas wet and chemical processes are endothermic, generating low temperature waste heat.

Almost the entire **electricity consumption** of a typical site is crushing, grinding and classification, which are key processes in the industrial minerals, mining and cement industries. The particle fineness has a huge impact on the specific energy consumption, hence most of the electricity is used in the (fine) grinding stages. This also means that the electricity consumption is strongly dependent on the product mix of a specific site.
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