2017 Energy Management Award of Excellence

ARABIAN CEMENT العربية للأسمنت

ACC GHG Emissions Inventory Calculation & Reporting Climate Policy

Executive Summary

- Climate change is one of the major societal challenges of society in 21st century and the cement and concrete sector has a crucial role to play in meeting this challenge. Concrete is the most used material in the world (after water), with significant volumes demanded globally to build homes , schools , hospitals , workplaces and infrastructure for transport , energy and clean water. Concrete is integral to any climate change strategy not only for building the infrastructure needed to mitigate and adapt to climate change but also because its key component cement has a high carbon intensity.
- Arabian cement company is hopping to reduce the emissions of greenhouse gases and improve our carbon footprint. Considering that the carbon footprint of concrete is dominated by the production of cement , and the major GHG associated with the cement is CO_2 .
- Arabian cement company has released this policy / methodology for monitoring and reporting CO_2 emissions of its clinker & cement production which also covers energy consumption as one of the key drivers for CO_2 emissions.
- This policy / methodology give an introduction to the monitoring and reporting process with reference to GCCA Guidelines delivering the Key Performance Indicators (KPIs) that are considered most relevant for the cement industry

Glossary & Important Definitions

- Direct GHG Emissions (Scope - 1)
  - Emissions that occurs from sources owned or controlled by the reporting company (ACC) such as combustion and chemical processes related emissions. Examples include the emission occurred from process calcination and fuel combustion
- Indirect GHG Emissions (Scope – 2)
  - Emissions that are a consequence of the operation of the operations of reporting company (ACC) but occur at a source owned or controlled by another company. Example emissions related to purchased electricity
- Indirect GHG Emissions (Scope – 3)
  - All other indirect emissions which are a consequence of all other activities of the company but occur from sources not owned or controlled by the reporting company (ACC). Examples production of purchased materials, logistic & transportation of purchased fuels and use of sold products and services..etc.
- Biogenic carbon
  - Carbon derived from plant or animal sources excluding fossil carbon. Examples Biomass & Sewage Sludge
- Gross CO2 Emissions
  - Total direct CO2 emissions from a cement plant including CO2 from fossil carbon but excluding CO2 from biogenic carbon such as biomass & sewage sludge which are considered climate-neutral
- Net CO2 Emissions
  - Total direct CO2 emission from a cement plant Excluding CO2 from Alternative fossil Fuels (Gross minus CO2 emissions from alternative fossil fuels)
- Cement Equivalent
  - The cement production value which is determined from clinker produced on-site applying the plant clinker-cement factor Hence it is a virtual cement production under the assumption that all clinker produced in the plant is consumed for cement production
- Cementitious products
  - All clinker produced (excluding purchased clinker) by the reporting company (ACC) for cement production including direct clinker sale plus all additives (gypsum, , limestone , pozzolana , slag and all clinker substitutes) consumed for grinding
- IPCC : Intergovernmental panel on climate change
- EBRD : European Bank for Reconstruction & Development

Principles & objectives for the CO_2 reporting

1. **Relevance:**
   - Emissions may come from different points in the cement manufacturing process , depending on raw materials and fuels , kiln type and the mechanism used to control the emissions. While cement kilns typically operate at steady conditions (excluding startup and shutdown), naturally occurring variations in raw materials and fuel composition can lead to day-to-day variations in emissions.
2. **Completeness:**
   - Account for and report on all GHG emission sources and activities within the chosen inventory boundary.
3. **Consistency:**
   - Use consistent methodologies to allow for meaningful comparison of emissions over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.
4. **Transparency:**
   - Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.
5. **Accuracy:**
   - Ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.

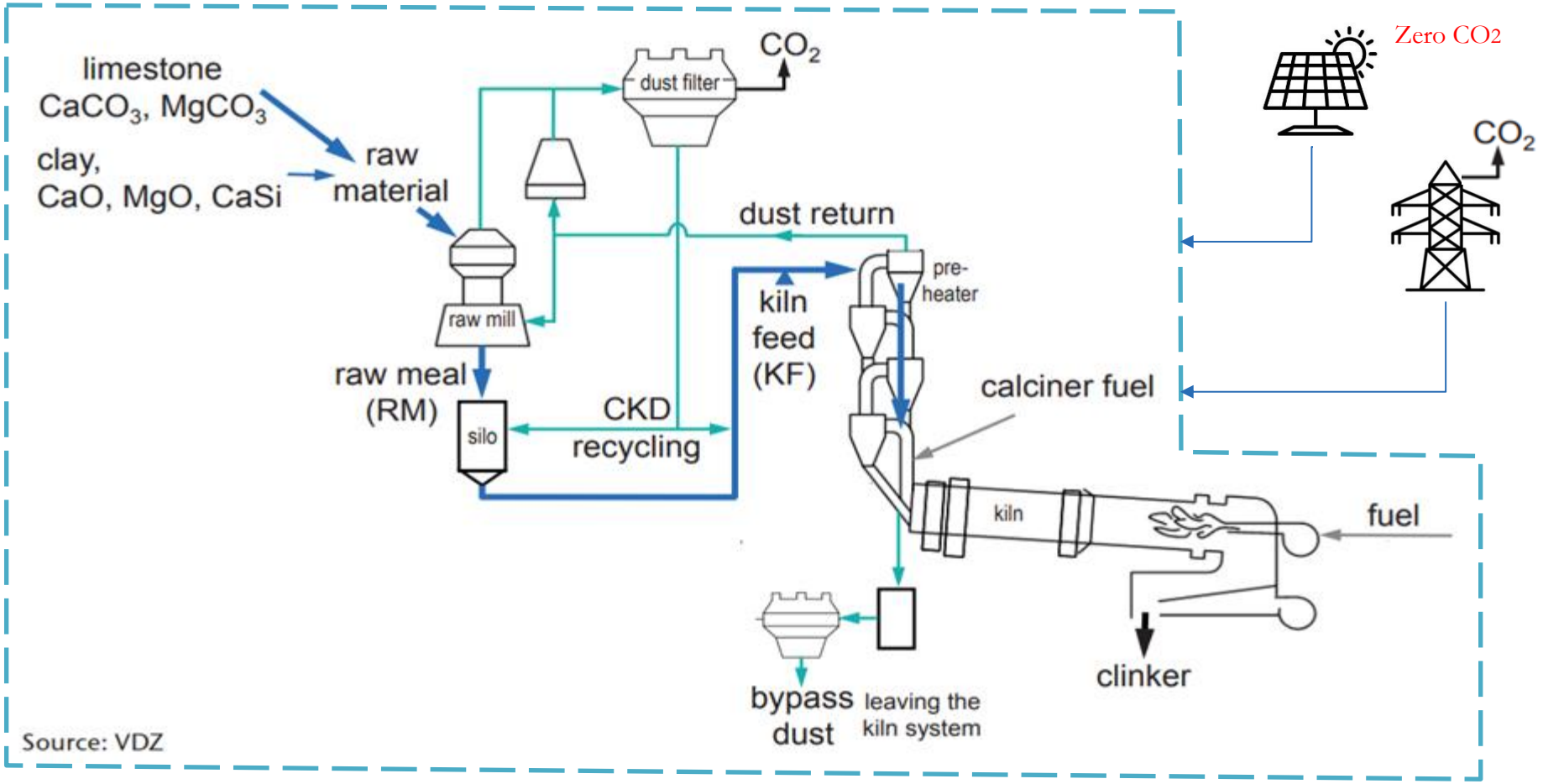
This Principal was designed to meet the following objectives:

- Avoid double-counting at plant, company, group, national, and international levels
- Allow to distinguish between different drivers of emissions (technological improvement, internal and external growth)
- Allow to report emissions in absolute values as well as specific (unit-based) terms
- Reflect the full range of direct and indirect CO2 abatements achieved
- Provide a flexible tool suiting the needs of different monitoring and reporting purposes

ACC Operational Boundaries

Scope 1 Emissions

Scope 2 Emissions



ACC Operational Control Boundaries

- **Scope -1** including all direct emissions occurred through process emissions from calcination of calcium carbonate, in addition to emissions occurred from stationary sources such as burning fuels in our cement kilns (Mandatory and calculated by ACC)
- **Scope – 2** including all indirect emissions occurred from purchasing electricity from national grid and emissions occurred from any purchased clinker (Mandatory and calculated by ACC)
- **Scope – 3** all other indirect emissions from vehicles or fleets for the production not owned by reporting company (ACC) , processing and transportation of all fuels and purchased materials to the plant (ACC) (Optional and not calculated by ACC till now)

Emission Factors

Fossil Fuel	Emission Factor (tCO2/TJ)
Natural Gas	56.1
Mazot	77.4
Diesel	74.1
Coal	96
Pet Coke	92.8

Electricity /Source	Emission Factor (tCO2/MWh)
IPCC	0.551
EBRD	0.406

Alternative Fuel	Emission Factor (tCO2/TJ)
Non-Biomass fraction of municipal waste **	91.7
RDF	(35.27/100)*(91.7) = 32.3
AG.WASTE	0
DSS	0
TDF	87

** Non-biomass fraction of RDF = 35.27 %

Reference :

- For Fuels : IPCC 1996,Revised 1996 IPCC Guidelines for national greenhouse Gas Inventories and IPCC 2006
- For Electricity : IPCC Guidelines till end of 2022 then Emission factor in 2023 updated source EBRD

Direct Emissions Calculations (Scope-1)

Overview :

Direct emissions are emissions from sources that are owned or controlled by the reporting entity (ACC). In cement plants, direct CO2 emissions result from the following sources:

1. Calcination of carbonates , combustion of organic carbon contained In raw materials
2. Combustion of Kiln fuels (fossil fuels & AF) related to clinker production
3. Combustion of non kiln fuels (plant vehicles)

1. Calcium Carbonate Calcination (Process Calcination) – Process Emission "GHG Protocol " --------

   Scope 1 / Direct Emission

   $$CaCO3 \xrightarrow[\text{Decomposition}]{\text{Endo Thermic}} Cao + CO2 \uparrow$$

2. Fuel Combustion (Burning Fuel) – Stationary Source "GHG Protocol" -Scope 1 / Direct Emission

   $$C + O2 \xrightarrow[\text{Combustion}]{\text{Exo Thermic}} CO2 \uparrow$$

In Direct Emissions Calculations (Scope-2)

Overview :

Indirect GHG emissions are emissions that are a consequence of the operations of the reporting entity but occur at sources owned or controlled by another entity. Cement production is associated with indirect greenhouse gas emissions from various sources. Key examples include the CO2 emissions from:

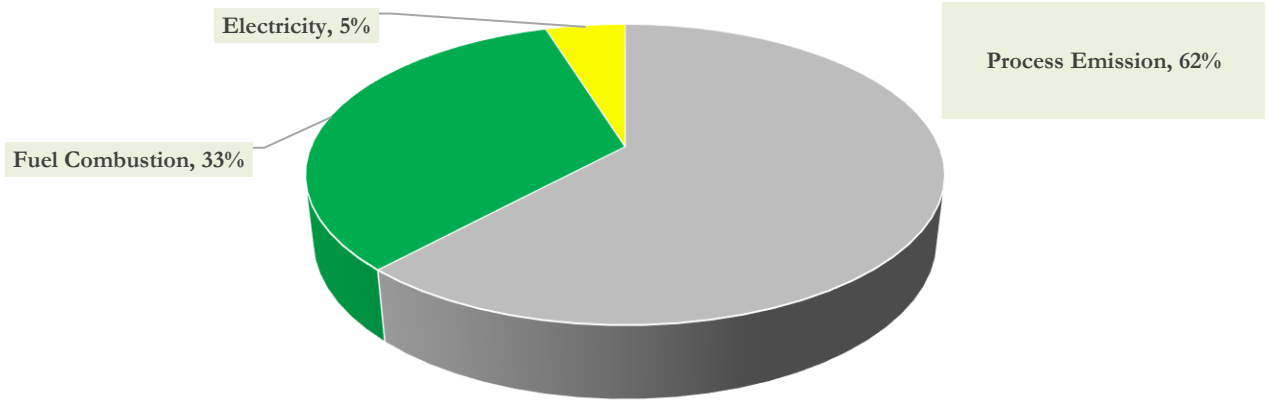
1. External production of electricity consumed by cement producers (purchasing Electricity from grid)
2. Production of clinker bought from other producers and mixed with own production

Other In Direct Emissions Calculations (Scope-3)

Overview :

- Scope 3 is an optional reporting category that allows for the treatment of all other indirect emissions.
- Scope 3 emissions are a consequence of the activities of the company but occur from sources not owned or controlled by the company.
- Some examples of scope 3 activities are extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services (Up & Down Stream)

ACC CO2 Emission Breakdown



The Methodology for Reporting CO_2 Emission

Referring to the GCCA guidelines which focus on the practicalities of monitoring and reporting CO_2 emissions from the cement production

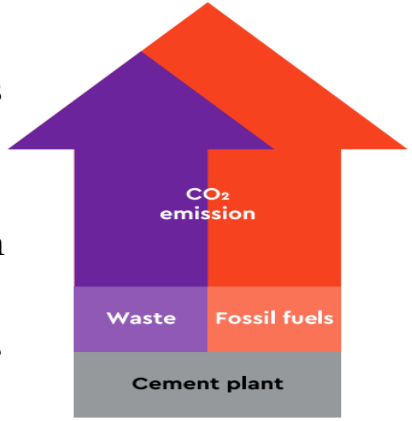
1. Mass balance on the output or input of cement plants show the highest level of accuracy of CO_2 emission. The mass balance method account for the total carbon content and thus all oxidized carbon . This sum covers more than 99.5 % of the direct GHG emissions.
2. The direct GHG emissions of cement plants almost entirely consist of CO_2. The contribution of other non-CO_2 GHG emissions has been shown to be negligible

Emission Measurements

The mass balance concept (the most accurate to measure the emissions) used in GCCA Guidelines covers all cement plant CO_2 emissions including those from the main stack and from other emission points aligning to the CBAM guidance and CSI Protocol

Gross & Net Emissions

- Gross Emissions : Some waste material (AF) may substitute traditional fossil fuels and minerals in cement production. The resulted direct CO2 emissions from fossil fuels are reduced by using AF, however direct CO2 emissions from AF occur which may be higher or lower than replaced fossil fuel source depending on the emission factor of fuel involved
- Net Emissions : Excluding all emitted CO2 from Alternative Fuel portion "Gross CO_2 emissions minus CO_2 emissions from alternative fossil fuels"



Key Performance Indicators

Referring to GCCA Guidelines to track the progress of improvement, and to communicate this progress clearly to stakeholders. There are 4 simple, reliable and representative KPI's as below:

1. Total Direct CO_2 emissions – gross basis " Absolute values , tones "
2. Total Direct CO_2 emissions – net basis " Absolute values , tones "
3. Specific CO_2 emissions – gross basis " Kg CO_2 / ton cementitious material "
4. Specific CO_2 emissions – net basis " Kg CO_2 / ton cementitious material "

ACC Climate Change Road Map

ACC is exerting a huge efforts to manage and reduce CO_2 emissions and supports transparent communication with stakeholder.

ACC settled a decarbonization road map for reducing our CO_2 emissions with around 31 % by 2031.

ACC decarbonization roadmap owns a bundle of new projects to fulfil the targeted mitigation plan with huge CAPEX