6.3.9.4 Substitution Benefit of AFR [RC]

Description

Extended substitution benefit of alternative fuels (SB of AF) corresponds to the theoretical cost of traditional fuels substituted by alternative fuels up to and including clinker production.

Substitution benefit of alternative raw materials (SB of AR) corresponds to the theoretical cost of traditional raw materials substituted by alternative raw materials up to and including clinker production.

Note that these indicators rely on certain assumptions and interpretations (especially in the case of AR and also in the case of missing a TF). Care should therefore be taken when analyzing the results of these indicators and comparisons against other companies is difficult.

Reference to Process

This indicator refers to:

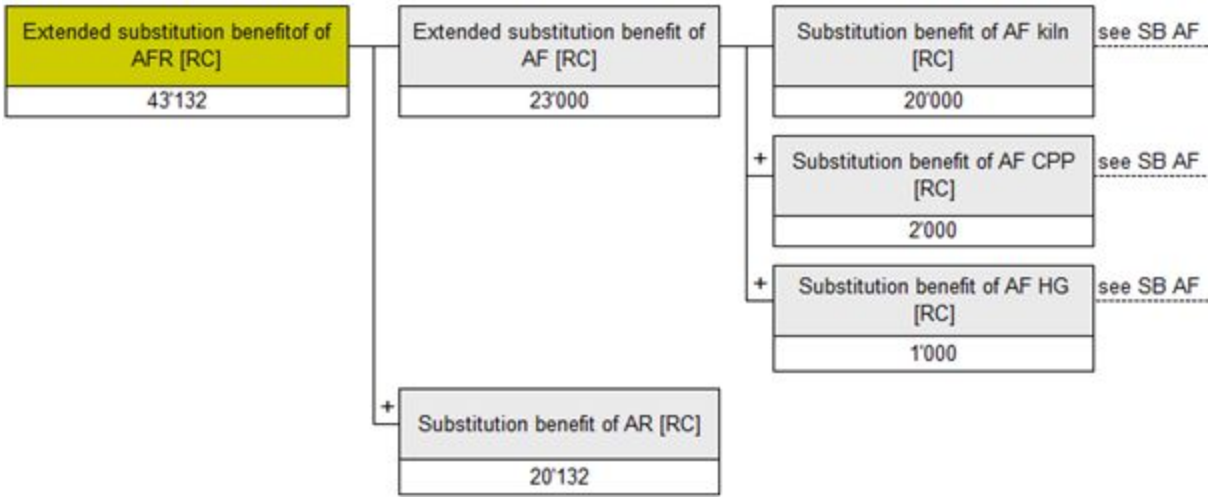
- Main cost centers: 'Raw material preparation', 'Raw meal preparation' and 'Clinker production'
- Pre-process cost centers 'Traditional fuels preparation and handling', 'Alternative fuels preparation and handling' and 'Alternative raw materials preparation and handling' and ‘Power generation’ at cement plant and 'Alternative fuels preparation and handling' and 'Alternative raw materials preparation and handling' at AFR Unit,
- Drying activities (Hot Gas Generators – HGG) of materials at cement plants
- ‘Corporate manufacturing - AFR’
- ‘Administration - AFR’
- Product sub-segment ‘Clinker and Cement’

Purpose

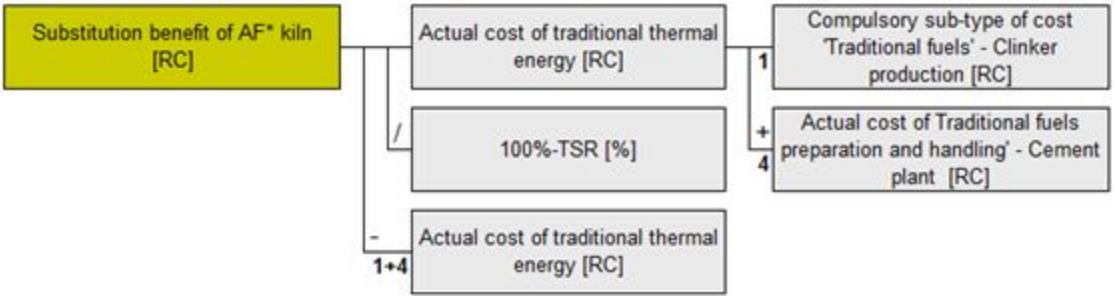
To measure the benefit from using alternative fuels and alternative raw materials to replace traditional materials. This is a component of EGAV.

Calculation

Substitution benefit of AFR



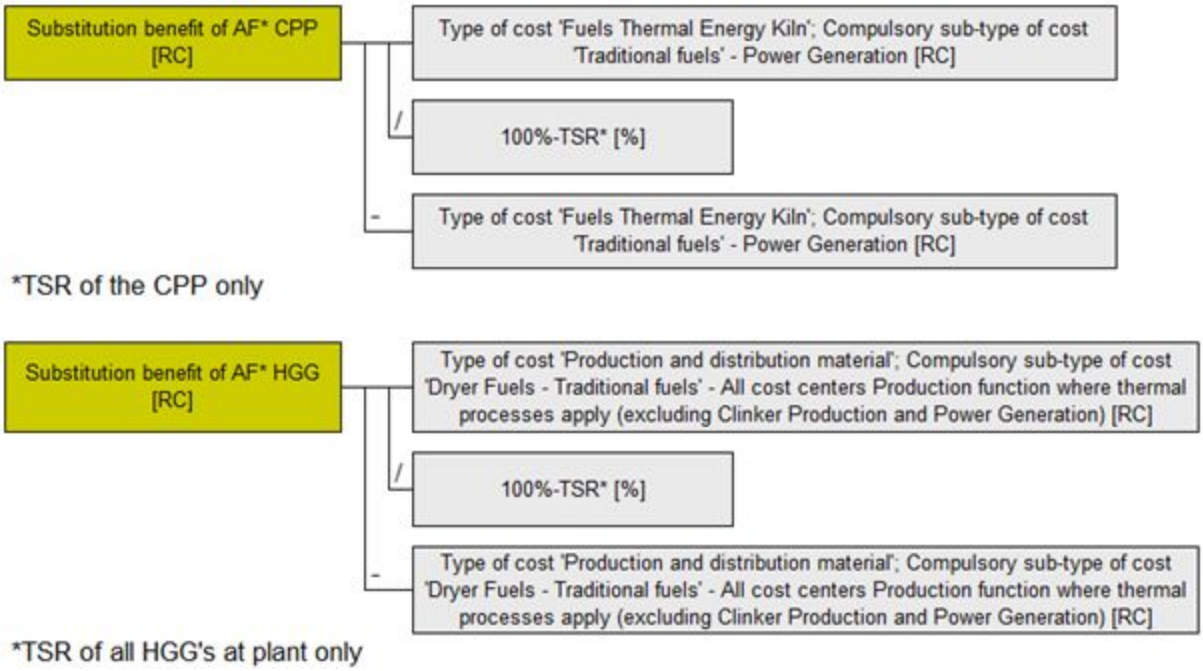
Substitution benefit of AF



The calculation of the indicator is performed on plant level (all kilns are included).

Substitution benefit AF CPP / HGG

The above described formula for kilns also applies for CPP and HGG with some simplification: the preparation and handling cost of TF is neglected, this is already captured in 'SB AF kiln'.



In case of complete replacement (100 % TSR) the SB AF CPP / HGG equals to the theoretical cost of traditional fuels replaced.

When calculating the theoretical cost of Traditional fuels substituted in Power generation (CPP) respectively in drying activities the following options for reference value can be considered:

- Current cost of traditional fuels in use
- Historical cost of the traditional fuels (e.g. prior year cost adjusted for inflation)
- Market price is also acceptable, if no current or historical data exists

Substitution benefit of AF is also known as Theoretical cost of TF substituted.

'Month-to-Date' (MTD) values are calculated with month data.

'Year-to-Date' (YTD) values are calculated as sum of month (MTD) values.

Aggregation of Substitution benefit of AF

Substitution benefit of AF is aggregated on company level by adding up the Substitution benefit of AF achieved on plant level. This is to avoid the dilution of the company level value by plants not using AF.

$$\sum_{i=1}^{n} SB_i = \sum_{i=1}^{n} \frac{TF\$_i}{1 - \frac{AE_i}{TE_i}} - \sum_{i=1}^{n} TF\$_i$$

Where:
i = number of plants (TSR>0)
SBi = Substitution benefit [RC]
TF$i = Actual cost of traditional thermal energy [RC]
AEi = Alternative thermal energy [MJ]
TEi = Traditional thermal energy [MJ]

Substitution benefit of AR

When calculating the Substitution benefit of AR the following options can be considered:

- Current cost of traditional raw material
- Historical cost of the traditional raw material (e.g. prior year cost adjusted for inflation)
- Market price is also acceptable if no current or historical data exists

The Substitution benefit relates always to substitution of traditional raw materials. This also applies when an AR is substituted with another AR.

The cost of traditional raw materials substituted must be corrected for the Replacement ratio.

The Replacement ratio is calculated on a dry material basis. It is the ratio of oxide content (in %) of alternative raw material in relation to the oxide content (in %) of the traditional raw material substituted. The largest economic contributor must be considered as a minimum; additional, minor components are allowed, if practical.

The comparison of the main oxides content is performed on a dry weight basis when determining the replacement ratio of 1 ton of traditional raw material with 1 ton of AR:

- CaO analysis
- Al2O3 analysis
- Fe2O3 analysis
- SiO2 analysis

The preferred solution is the current cost. The reporting entities must be able to support and document the calculation of the AR substitution benefit which must be made in a consistent basis from period to period.

Following the current AFR Classification fly ash and slag consumed up to and including clinker production are considered alternative raw materials.

Substitution benefit of AR is also known as Theoretical cost of RM substituted.

Aggregation of Substitution benefit of AR

Substitution benefit of AR is aggregated on company level by adding up SB of AR achieved on plant level. Plant level SB of AR is the sum of the SB of AR on materials substituted.

Comments and examples

Substitution benefits are always positive.

Accounting for one-to-one replacement of fuels

In certain operations and circumstances a specific (single) fuel is directly one-to-one (1-2-1) replaced by another specific (single) fuel where the second fuel typically more cost efficient on RC/GJ basis. Such typically results in a more accurate value replaced in economic terms. It can be termed as 'economic SB' or 'SB 1-2-1'.

This additional economic benefit is allowed to be computed and reported as an addition to the standard SB of AF; the reporting of 1-2-1 replacement must be acknowledged and approved by the Head of Corporate Geocycle on a case-by-case basis.

The 1-2-1 replacement economic benefit concept is applicable for various replacement scenarios:

a. Expensive traditional replaced by cheaper alternative

b. Expensive alternative replaced by cheaper alternative (for this the theoretical expensive traditional fuel can be considered baseline)

Possible calculation example for scenario a)

$SB_{1\text{-}2\text{-}1}$ [RC] = ([1]CSFR [RC/GJ] – [2]SACTTE [RC/GJ]) x [3]ATER [GJ]

Where:

[1] CSFR – Cost of Fuel Replaced (including actual or estimated cost of preparation) which is actually being replaced 1-2-1 by another fuel, on per GJ basis. An estimate is allowed when the original Fuel is no longer in use or no historical data are available;

[2] SACTTE - Specific Actual Cost of Traditional Thermal Energy [RC/GJ];

[3] ATER - Actual Thermal Energy of the replacing fuel, the one replacing the old (typically traditional) fuel, in GJ, (used in the 1-2-1 replacement).

This is also to be considered / included in SB for CPP and HGG, if approved.

Examples to help estimate the 'Substitution benefit of AR' to calculate EGAV AR:

Example 1:

Traditional iron ore costs at Plant A $30/ton (wet basis). The x-ray analysis of the iron ore shows a 92% Fe2O3 on a dry weight basis.

The alternative raw material (mill scale) contains 88% Fe2O3 on a dry weight basis.

The calculation as follows:

Substitution benefit of AR =

= ($30/ton + 2$/ton for corrective preparation & handling) x 0.96 (88/92 = 0.96; not a 1:1 replacement)

= $30.72/ton

Example 2:

Traditional sand costs at Plant A $4/ton. X-ray analysis for SiO2 shows a 92% SiO2 on a dry weight basis.

The alternate raw material is foundry sand with an x-ray analysis of 95% SiO2.

The calculation as follows:

Substitution benefit of AR =

= ($4/ton + $2/ton for corrective preparation & handling) x 1.03 (95/92 = 1.03; not a 1:1 replacement)

= $6.18/ton

Example 3:

Traditional sand costs at Plant A $7/ton, traditional limestone costs at Plant A $2/ton, and traditional iron costs plant A $36/ton. X-ray analysis for sand shows a 92% SiO2 on a dry weight basis. X-ray analysis for limestone shows a 98% CaO on a dry weight basis. And X-ray analysis for iron ore shows a 95% Fe2O3 on a dry weight basis.

The alternative raw material is a lime sludge with an x-ray analysis of 25% SiO2, 60% CaO, and 8% Fe2O3.

The calculation as follows:

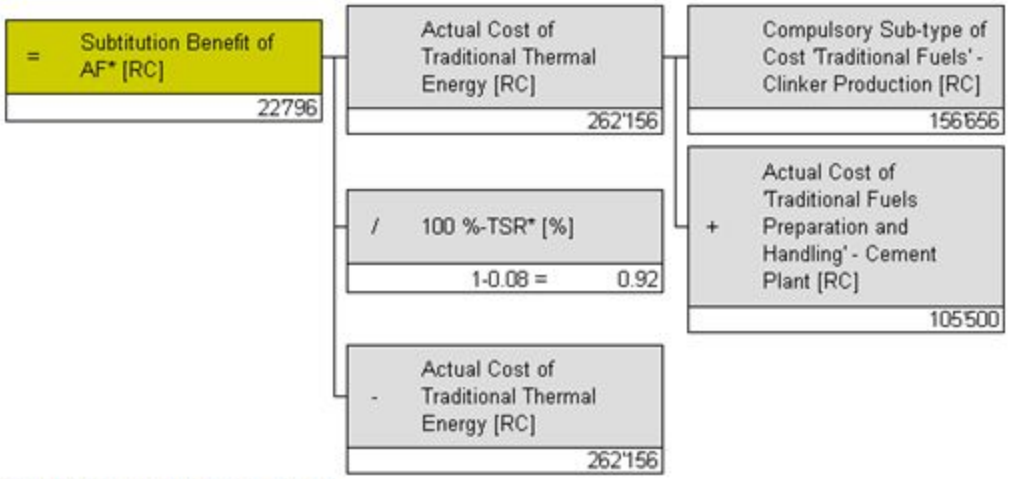
Substitution benefit of AR = ($7/ton + $2/ton for corrective preparation & handling) x 0.27 (25/92 = 0.27; not a 1:1 replacement) + ($2/ton + $2/ton for corrective preparation & handling) x 0.61 (60/98 = 0.61; not a 1:1 replacement) + ($36/ton + $2/ton for corrective preparation & handling) x 0.08 (8/95 = 0.08; not a 1:1 replacement)

Substitution benefit of AR = ($2.43 + $2.44 + $3.04)/ton = $7.91/ton

Examples to help estimate the 'Substitution benefit of AF' to calculate EGAV AF

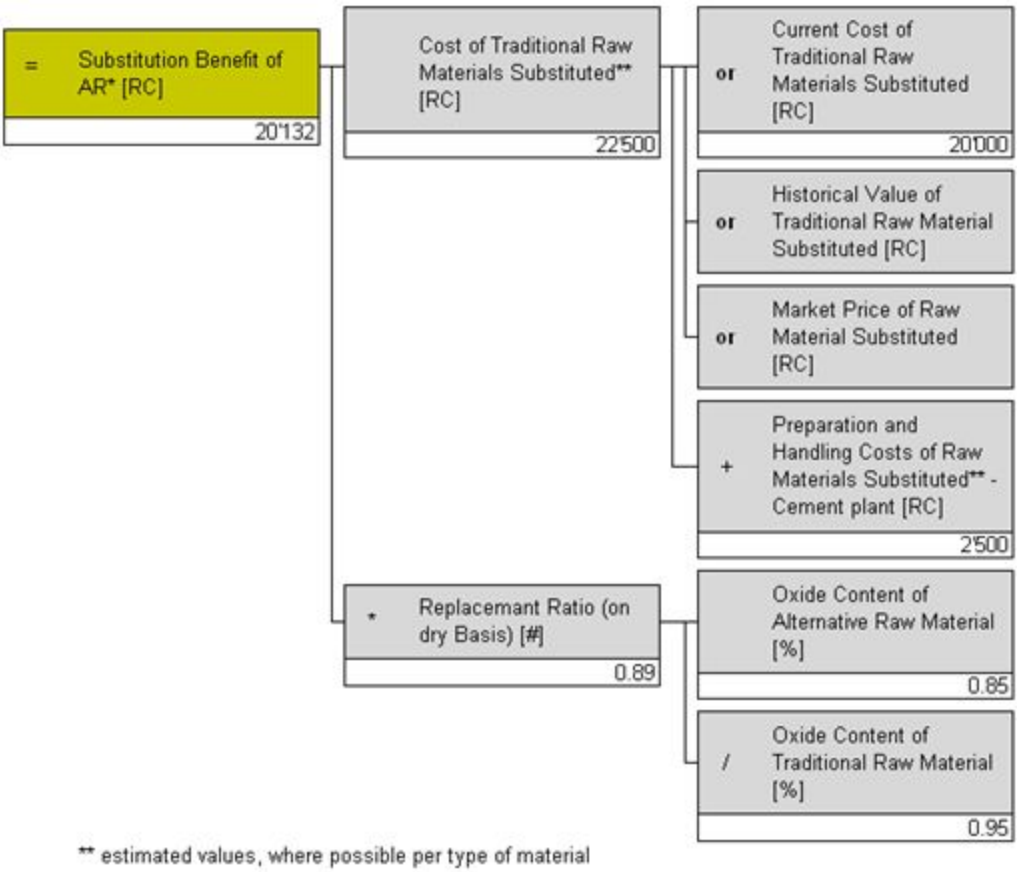
Example 4:

Calculation example for Substitution Benefit of AF



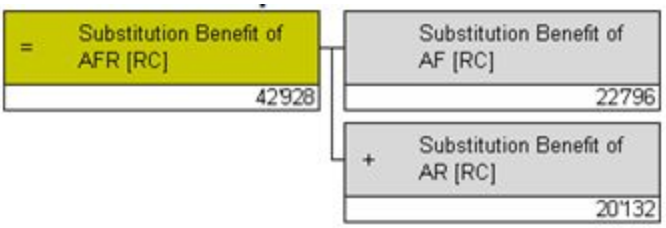
* In this example TSR = 8 %.

Calculation example for Substitution Benefit of AR:



** estimated values, where possible per type of material

Calculation example for Substitution Benefit of AFR:



Example 5:

Calculation example for Substitution Benefit of AF with 1-2-1 replacement.

A plant has a fuel mix of 80000 GJ of coal which costs $3.25/GJ, 4000 GJ of HFO which costs $6/GJ and 5000 GJ of AF (biomass) which costs $2.20/GJ. The 4000 GJ of HFO are replaced by 4000 GJ of waste oil at a cost of $5/GJ.

The calculation is as follows:

Standard SB of AF = 9000 GJ of AF replaced at an average TF cost of $3.25/GJ = $29,250

Additional SB from 1-2-1 replacement = ($6-$3.25) = 2.75/GJ x 4000 GJ of traditional thermal energy actually replaced = $11,000

Economic SB of AF = Standard SB of AF + Additional SB from 1-2-1 replacement = $29,250+$11,000 = $40,250

GAV with economic SB of AF = [NCB AF (5000 x – $2.2)+ (4000 x -$5) = - $31,000] + [Economic SB of AF =$40,250] = Net saving of $9,250

This corresponds to actual fuel savings of : Biomass replacing coal [(3.25 – 2.20)= $1.05/GJ x 5000 GJ = $5,250] plus Waste oil replacing HFO [(6-5)=$1/GJ x 4000GJ= $4000] = $9,250 in total.

Without 1-2-1 replacement, the GAV based on the standard SB of AF shows a net loss of -$1,750 [NCB AF -$31,000 + Standard SB of AF $29,250] which would not encourage the right business decision.

Reporting Requirements

The indicators are reported in SAP FC.