# UltraTech Cement Ltd.

## Alternative Fuel in Cement Industry

# Index

# Introduction

# Introduction.

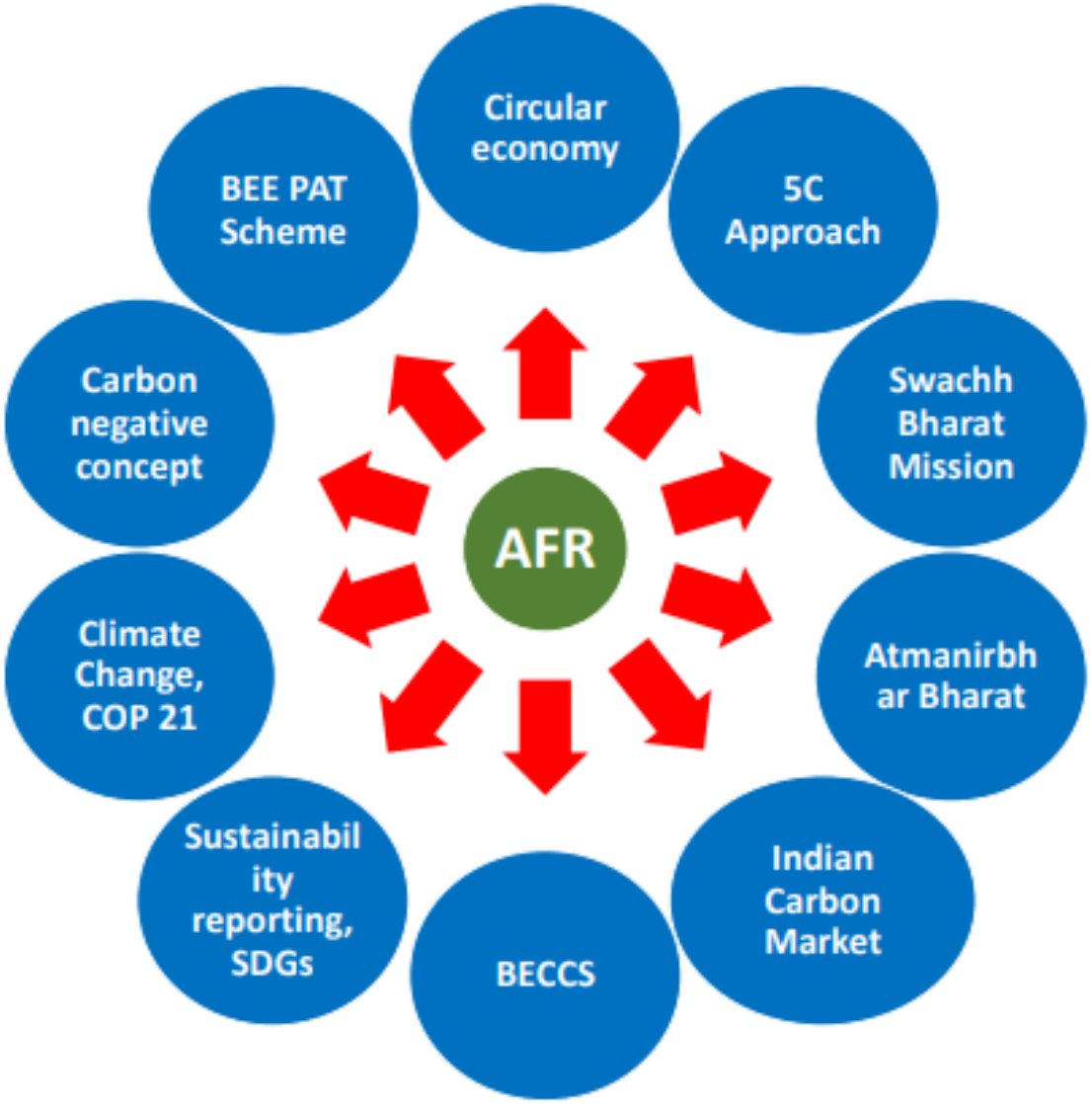
## What is AFR ??

- This term refers to the practice of substituting traditional fossil fuels and raw materials with alternative sources in the production of cement. The goal of using AFR is to enhance sustainability by reducing reliance on non-renewable resources, lowering greenhouse gas emissions, and managing waste more effectively.

- Alternative Fuels can include things like waste tyres, biomass, industrial wastes/by-products, and incinerable fraction of municipal solid waste.

## Types of AFR :

# Why AFR ?




## ➢ Environmental Benefits:

- Reduction in Greenhouse Gas Emissions.
- No landfills/no incineration.
- Reduced Waste.

## ➢ Resource Conservation:

- Less Dependence on Natural Resources.

## ➢ Energy Efficiency:

- Energy Recovery: Some AFRs have high energy content and can provide a significant portion of the energy needed for cement production, making the process more energy-efficient.

## ➢ Economic Benefits:

- Cost Savings.
- Lower Fuel Costs.
- Reduced Disposal Costs.

## ➢ Stable Supply of Raw Materials:

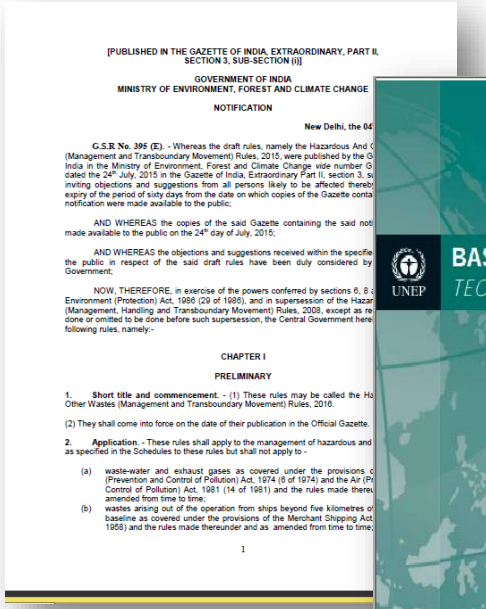
- Diversified Supply Chain: AFRs can provide a more stable and predictable supply of raw materials, as they are often available in large quantities and are not subject to the same market fluctuations as traditional raw materials.

# Regulatory Framework.

# Regulatory framework for co-processing

## Hazardous and Other Wastes

(Management, Handling and Transboundary Movement) Rules, 2016.


[PUBLISHED IN THE GAZETTE OF INDIA, EXTRAORDINARY, PART II, SECTION 3, SUB-SECTION (ii)]

GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

NOTIFICATION

New Delhi, the 04

G.S.R No. 395 (E). - Whereas the draft rules, namely the Hazardous And O (Management and Transboundary Movement) Rules, 2015, were published by the G India in the Ministry of Environment, Forest and Climate Change vide number G dated the 24th July, 2015 in the Gazette of India, Extraordinary Part II, section 3, su inviting objections and suggestions from all persons likely to be affected thereby expiry of the period of sixty days from the date on which copies of the Gazette conta notification were made available to the public;

AND WHEREAS the copies of the said Gazette containing the said noti made available to the public on the 24th day of July, 2015;

AND WHEREAS the objections and suggestions received within the specifie the public in respect of the said draft rules have been duly considered by Government;

NOW, THEREFORE, in exercise of the powers conferred by sections 6, 8 Environment (Protection) Act, 1986 (29 of 1986), and in supersession of the Hazar (Management, Handling and Transboundary Movement) Rules, 2008, except as re done or omitted to be done before such supersession, the Central Government here following rules, namely:-

CHAPTER I

PRELIMINARY

1. Short title and commencement. - (1) These rules may be called the Ha Other Wastes (Management and Transboundary Movement) Rules, 2016.

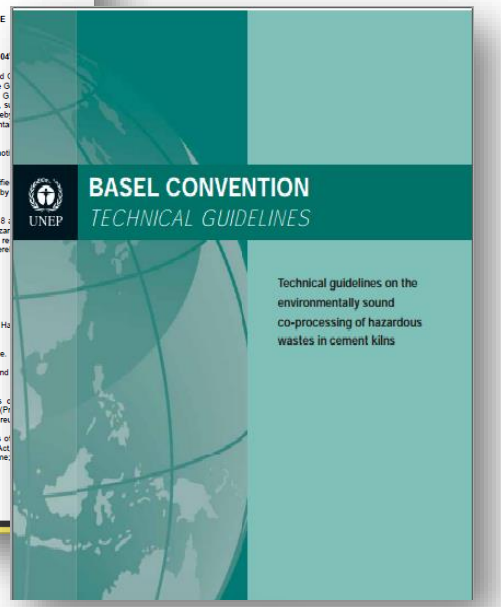
(2) They shall come into force on the date of their publication in the Official Gazette.

2. Application. - These rules shall apply to the management of hazardous and as specified in the Schedules to these rules but shall not apply to -

(a) waste-water and exhaust gases as covered under the provisions o (Prevention and Control of Pollution) Act, 1974 (6 of 1974) and the Air (P Control of Pollution) Act, 1981 (14 of 1981) and the rules made there amended from time to time;

(b) wastes arising out of the operation from ships beyond five kilometres of baseline as covered under the provisions of the Merchant Shipping Act, 1958) and the rules made thereunder and as amended from time to time;

1




CHAPTER-I & III

**4 & 9**

**Rule Nos.**

**Utilization of hazardous and other wastes.-**

- Co-processing is above land-fill/incineration in waste management steps.
- Authorisation is to be granted by SPCB based on SOP/guidelines released by CPCB.


Guidelines for Pre-Processing and Co-Processing of Hazardous and Other Wastes in Cement Plant as per H&OW(M & TBM) Rules, 2016

July, 2017

Central Pollution Control Board
(Ministry of Environment, Forest & Climate Change, Government of India)
Parivesh Bhawan, East Arjun Nagar,
Shahdara, Delhi – 110032

**Acceptance Criteria** | **Authorisation** | **Emission Standards** | **Potential Waste List**

## Guidelines on Co-Processing

Published by Central Pollution Control Board in July 2017

# Regulatory framework - co-processing

# Plastic Waste Management Rules, 2016.

Plastic Waste

5 & 6

**Rule Nos.**

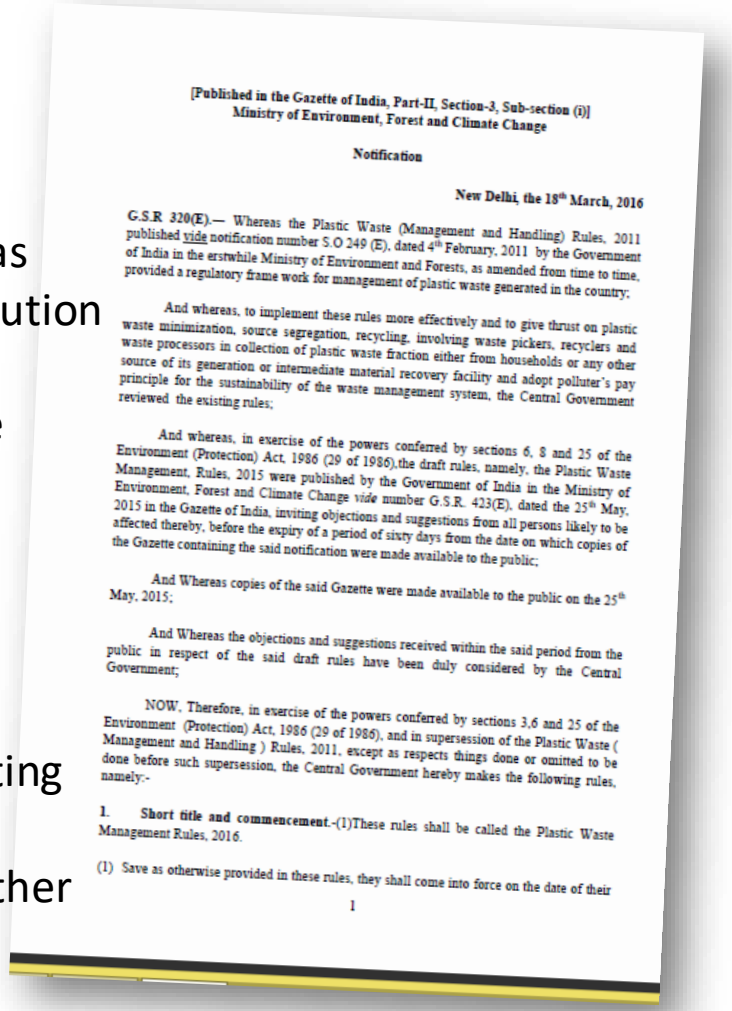
## Rule 5. Plastic Waste Management

1 [C] Thermo set plastic waste shall be processed and disposed off as per the guidelines issued from time to time by the Central Pollution Control Board.

1 (d) The inert from recycling or processing facilities of plastic waste shall be disposed of in compliance with the Solid Waste Management Rules, 2000 or **as amended** from time to time.

## Rule 6. Responsibility of local body

1 Every local body shall be responsible for development and setting up of infrastructure for segregation, collection, storage, transportation, processing and disposal of the plastic waste either on its own or by engaging agencies or producers.



[Published in the Gazette of India, Part-II, Section-3, Sub-section (i)]
Ministry of Environment, Forest and Climate Change

Notification

New Delhi, the 18th March, 2016

G.S.R 320(E).— Whereas the Plastic Waste (Management and Handling) Rules, 2011 published vide notification number S.O 249 (E), dated 4th February, 2011 by the Government of India in the erstwhile Ministry of Environment and Forests, as amended from time to time, provided a regulatory frame work for management of plastic waste generated in the country;

And whereas, to implement these rules more effectively and to give thrust on plastic waste minimization, source segregation, recycling, involving waste pickers, recyclers and waste processors in collection of plastic waste fraction either from households or any other source of its generation or intermediate material recovery facility and adopt polluter's pay principle for the sustainability of the waste management system, the Central Government reviewed the existing rules;

And whereas, in exercise of the powers conferred by sections 6, 8 and 25 of the Environment (Protection) Act, 1986 (29 of 1986),the draft rules, namely, the Plastic Waste Management, Rules, 2015 were published by the Government of India in the Ministry of Environment, Forest and Climate Change *vide* number G.S.R. 423(E), dated the 25th May, 2015 in the Gazette of India, inviting objections and suggestions from all persons likely to be affected thereby, before the expiry of a period of sixty days from the date on which copies of the Gazette containing the said notification were made available to the public;

And Whereas copies of the said Gazette were made available to the public on the 25th May, 2015;

And Whereas the objections and suggestions received within the said period from the public in respect of the said draft rules have been duly considered by the Central Government;

NOW, Therefore, in exercise of the powers conferred by sections 3,6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), and in supersession of the Plastic Waste ( Management and Handling ) Rules, 2011, except as respects things done or omitted to be done before such supersession, the Central Government hereby makes the following rules, namely:-

1. **Short title and commencement.**-(1)These rules shall be called the Plastic Waste Management Rules, 2016.

(1) Save as otherwise provided in these rules, they shall come into force on the date of their

1

# Emission Standards –
## Cement Plant with co-processing of wastes

| Parameters | Applicable Standards |
|---|---|
| Particulate Matter | 30 mg/$Nm^3$ |
| $SO_2$ | 100 mg/$Nm^3$, if pyritic S < 0.25%<br>700 mg/$Nm^3$, if 0.25 <= pyritic S <= 0.5%<br>1000 mg/$Nm^3$, if 0.5% < pyritic S |
| $NO_x$ | 600 mg/$Nm^3$* |
| | 800 mg/$Nm^3$ (ILC) **<br>1000 mg/$Nm^3$ (SLC) |
| HCl | 10mg/$Nm^3$ |
| HF | 1 mg/$Nm^3$ |
| TOC | 10 mg/$Nm^3$ |
| Hg and its Compounds | 0.05 mg/$Nm^3$ |
| Cd+Tl and their compounds | 0.05 mg/$Nm^3$ |
| Sb+As+Pb+Co+Cr+Cu+Mn+Ni+ V and their compounds | 0.5 mg/$Nm^3$ |
| Dioxins and Furans | 0.1 ngTEQ/$Nm^3$ |

Note: * - On/after 25.8.2014 **Commissioning of Plant**
** Before 25.8.2014 **Commissioning of Plant**

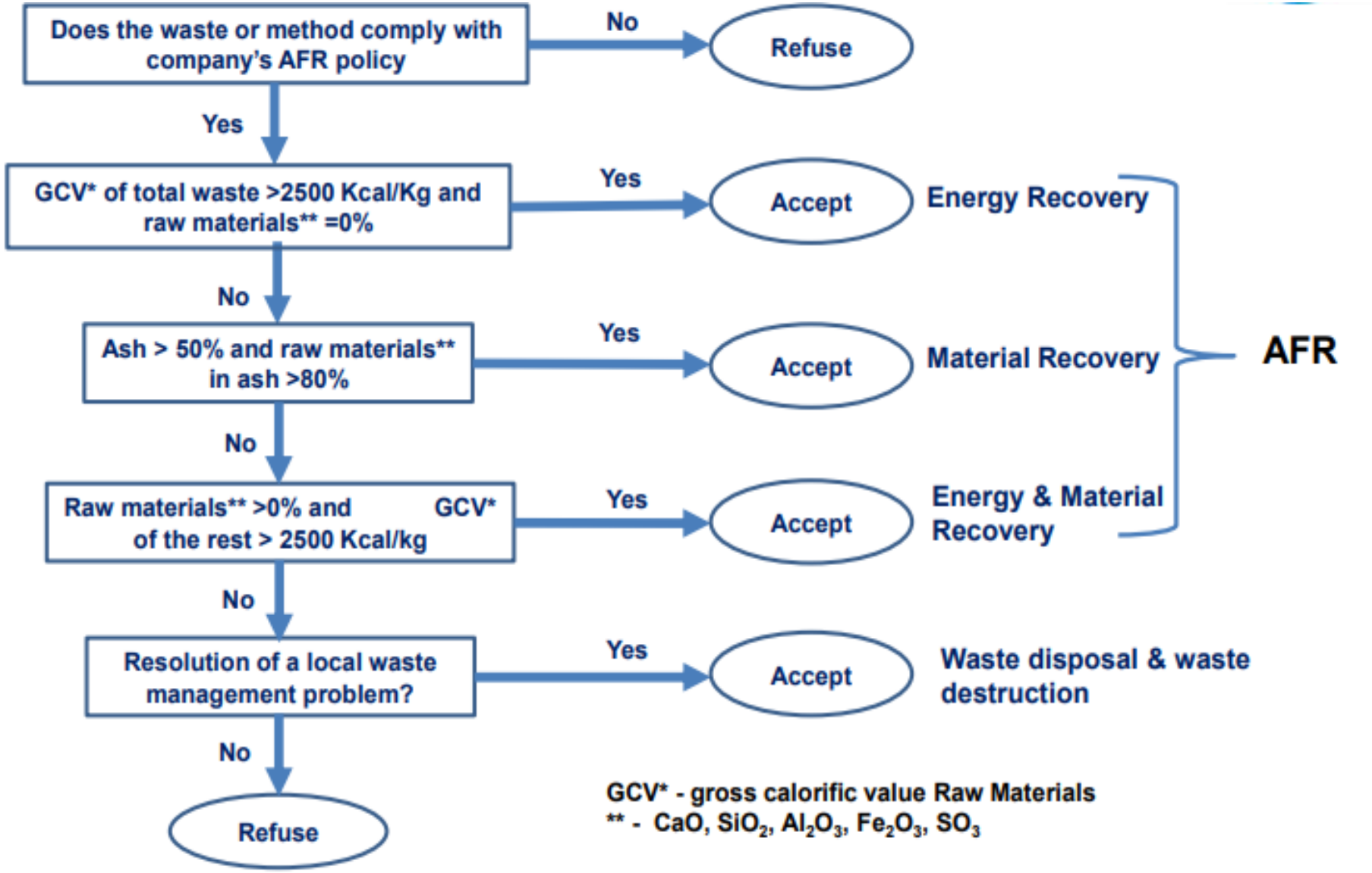
# Waste Utilization

# WASTE UTILIZATION HIERARCHY

# Five basic rules

- **Rule 1 -** Know the potentials and limits of the kiln for co-processing.
- **Rule 2 -** No waste enters the plant without rigorous quality control.
- **Rule 3 -** Use AFR standard equipment for storage, handling and dosing.
- **Rule 4 -** Know how to cope with negative impacts on
  - ❑ Kiln production rate
  - ❑ Kiln operation
  - ❑ Clinker Quality
  - ❑ Stack emissions
  - ❑ Steel corrosion & Refractory Failures.
- **Rule 5 –** Watch out for innovative solutions to improve co-processing.

# Acceptance / Refuse chart



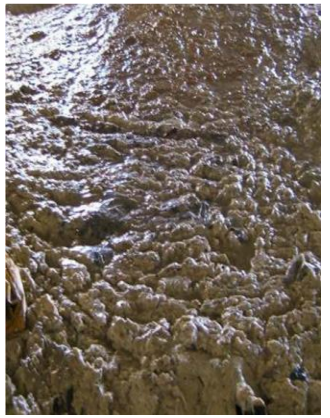

Source: Guidelines for Pre-Processing and Co-Processing of Hazardous and Other Wastes in Cement Plant as per H&OW(M & TBM) Rules, 2016

# Various wastes in use

- Industrial wastes (various incinerable wastes from automobile, textile, paper recycling, pharmaceutical/chemical industries)
- Footwear scrap
- Expired/Out-of-specs products (FMCG industry)
- Plastics / Sorted Municipal Waste / RDF
- Rubber/Tyre chips/ Carbon powder (from Pyrolysis of Tyres)
- Agricultural residues/husks








# What we can not co-process……

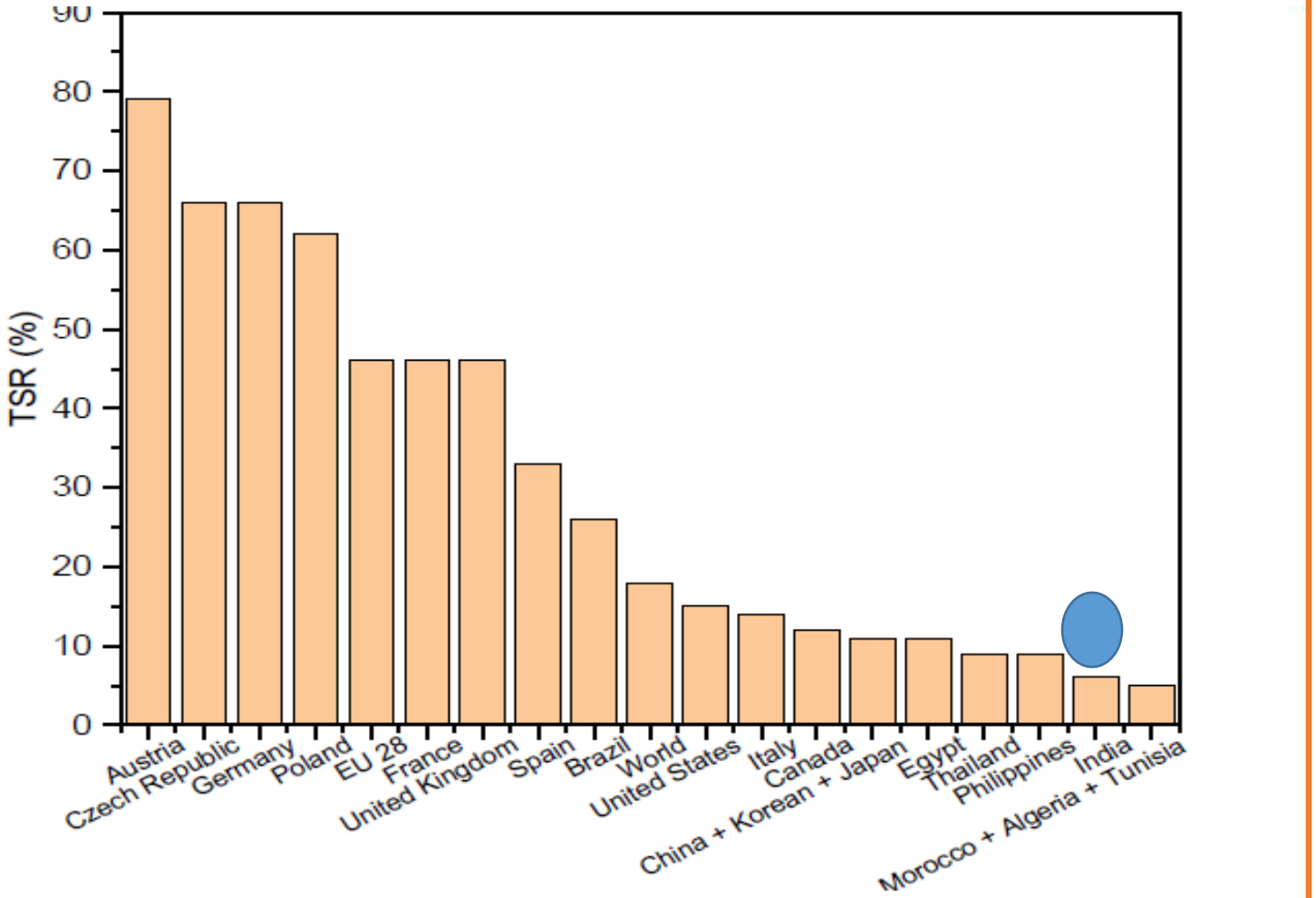
- Anatomical hospital waste
- Asbestos containing waste
- Bio-hazardous waste
- Electronic scrap
- Entire batteries
- Explosives
- High concentration cyanide waste
- Mineral acids
- Radioactive waste
- Unsorted municipal solid waste

# TSR (Thermal Substitution Rate)

# TSR

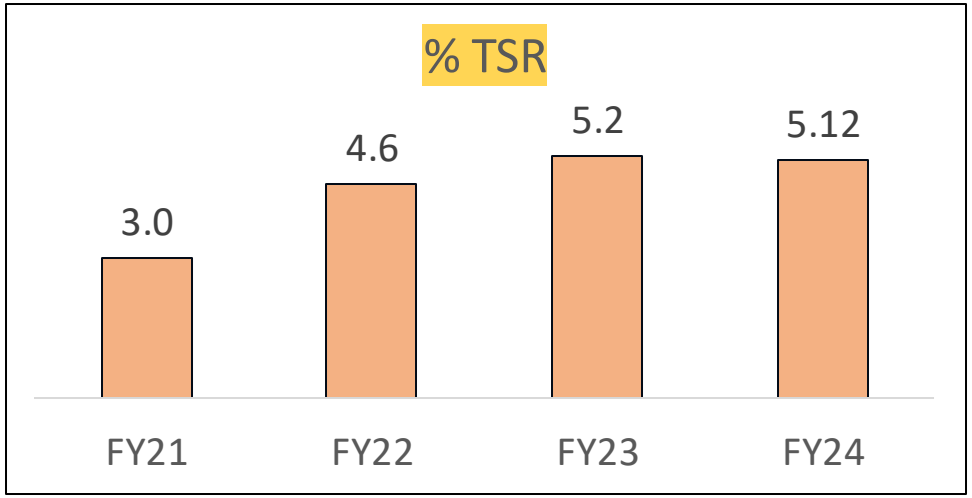
- The thermal substitution rate (TSR) is a measure of the rate at which an substituted fuel is being consumed in energy recovery. It is defined as the ratio of the rate of change of the fuel inventory to the actual fuel inventory (in terms of units of energy)
- TSR is the ratio of the thermal energy substituted by alternative fuels to the total thermal energy used in the process
- TSR = (Energy from Alternative Fuels / Total Energy Input) x 100

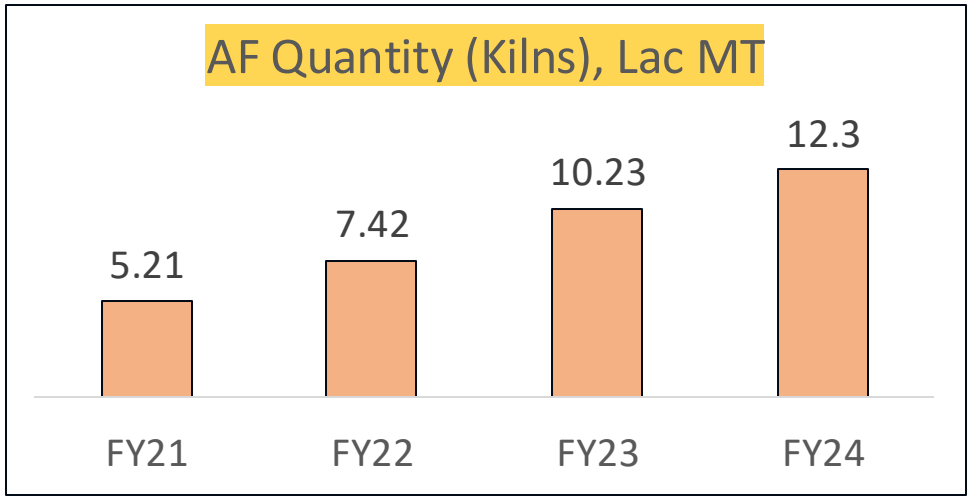
# AF Utilization Scenario (% TSR)




Source: Cemtech Webinar 2020, NCCBM Databank

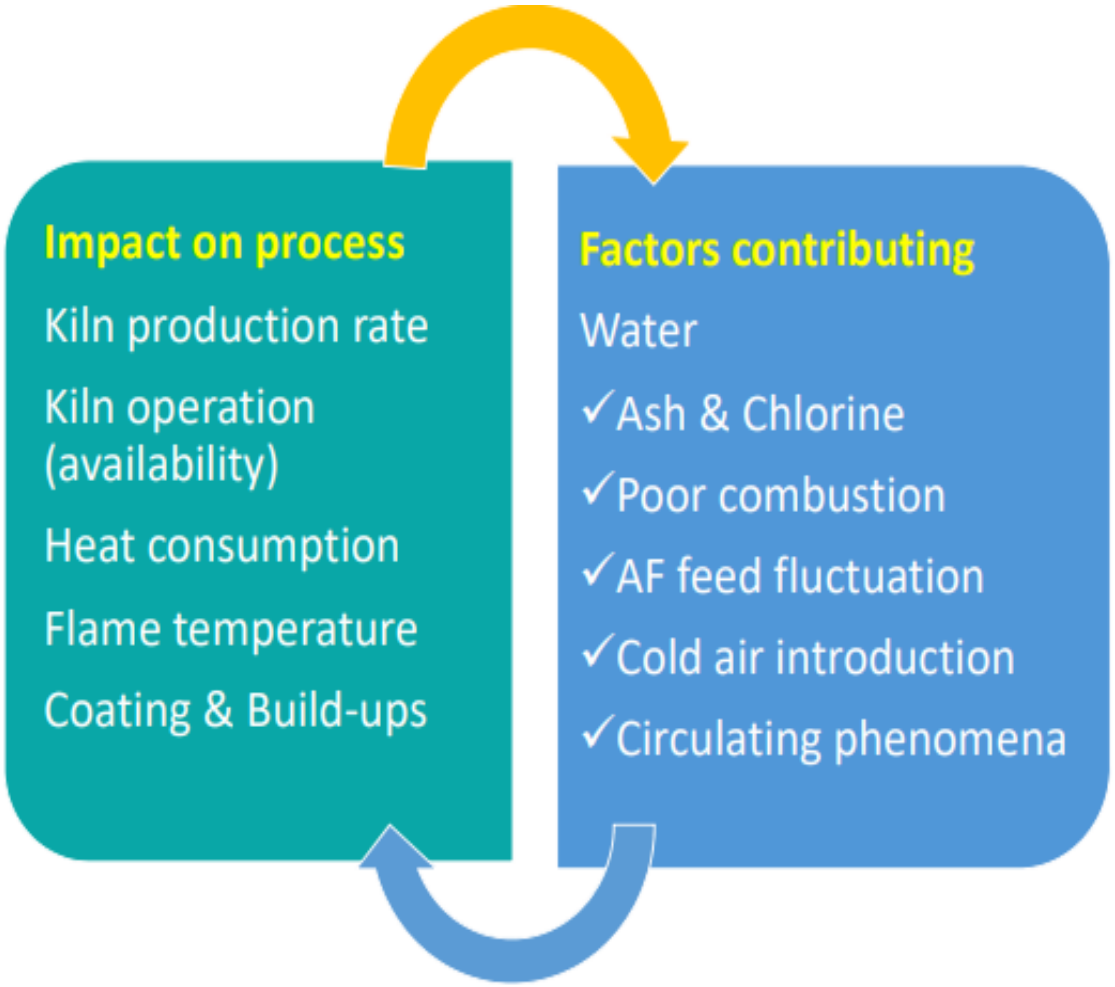
**Worldwide AF Utilization Scenario (% TSR)**



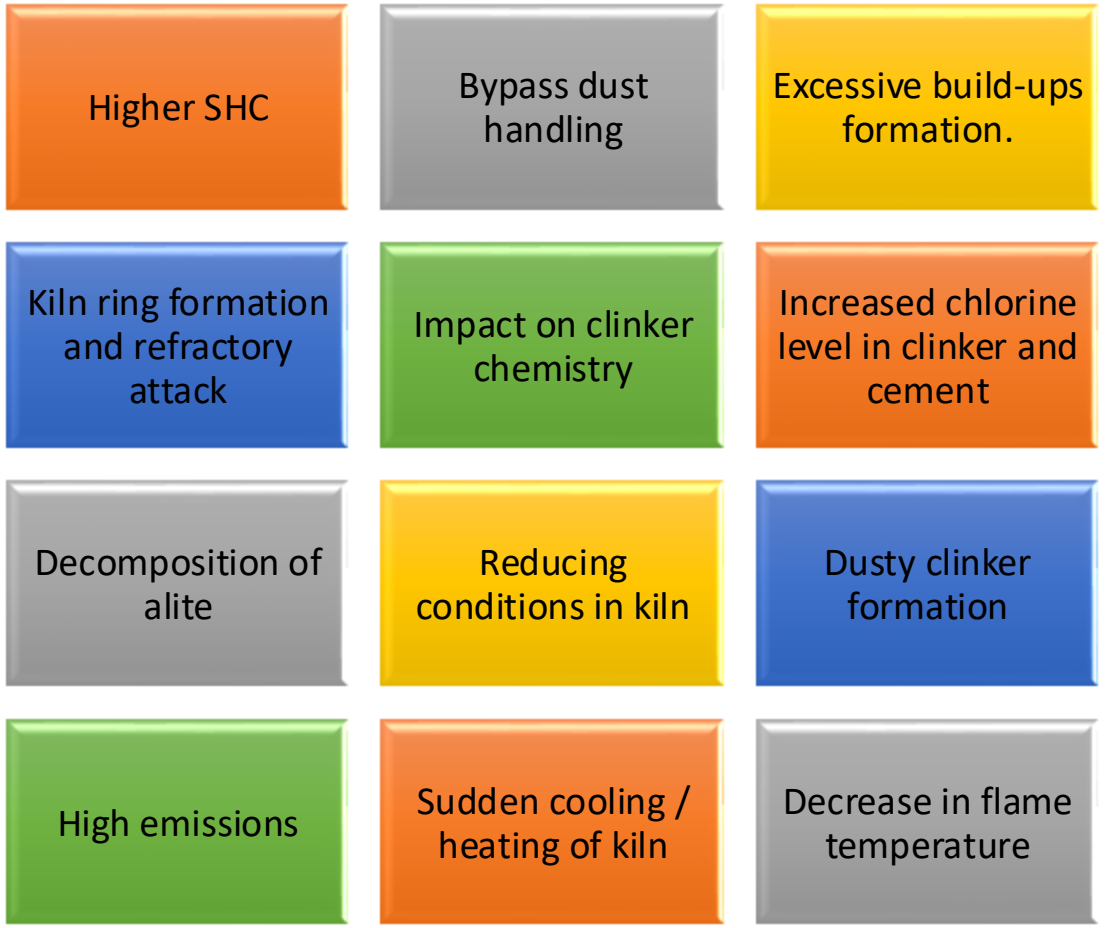




**UTCL AF Utilization Scenario**

# Key Challenges

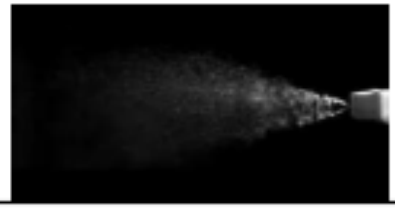



AF Impact on Kiln behaviour & Operation

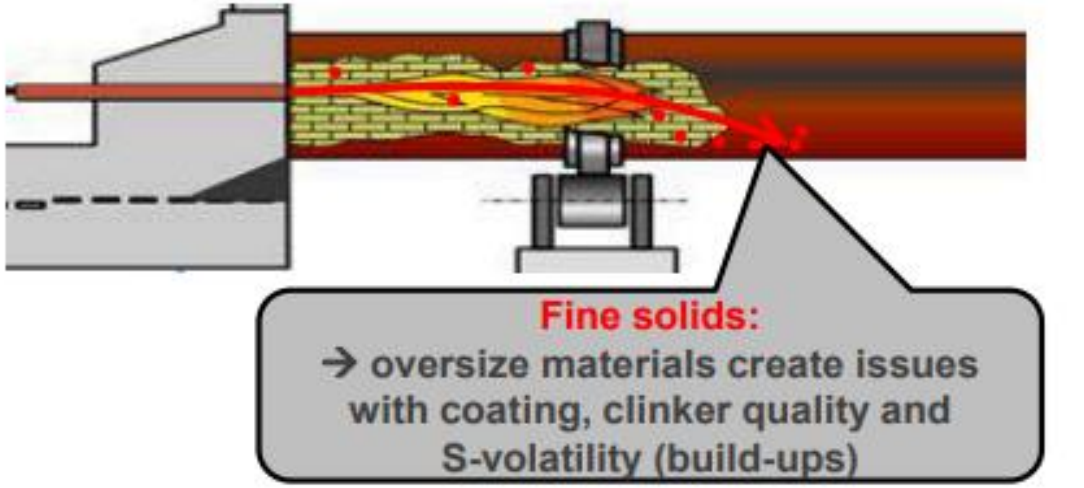



AF Impact on process and Quality

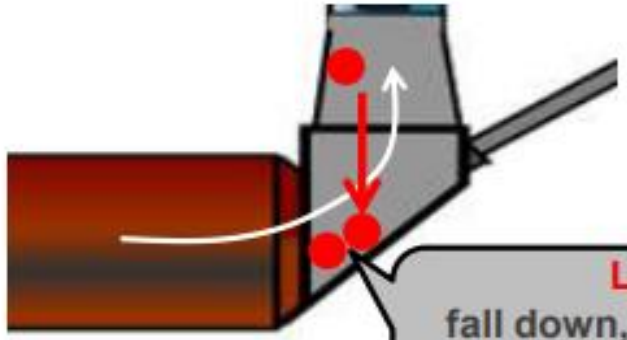
# Fuel Preparation & Feeding arrangement

| AF Category | Characteristic | Examples | Picture |
|---|---|---|---|
| **Lump fuels**<br>3D solids >50mm<br>2D foils >200mm | Cannot be carried by kiln gases (burns at kiln inlet). | Whole tires, filter cakes, bagged material |  |
| **Coarse solids**<br>3D solids <50mm<br>2D foils <200mm | Can be carried by kiln gases (suitable for in-line calciner).<br>Pneumatic feeding not possible. | Tire chips, shredded plastics and textextiles, $RDF_c$ |  |
| **Fine solids**<br>3D solids <5mm<br>2D foils <50mm | Can be carried easily by kiln gases (suitable for kiln firing, separate-line calciner).<br>Pneumatic feeding possible. | Fluff ($RDF_f$), impregnated saw dust, animal meal, rice husk |  |
| **Sludges** | Pumpable with piston pump → lump fuel.<br>If atomized by compressed air or sludge rotor → coarse solid. | Petroleum / paint sludges |  |
| **Liquids** | Can be atomized with compressed air<br>(solid particles in liquid <2-4mm) | Waste oil, solvents, emulsions |  |

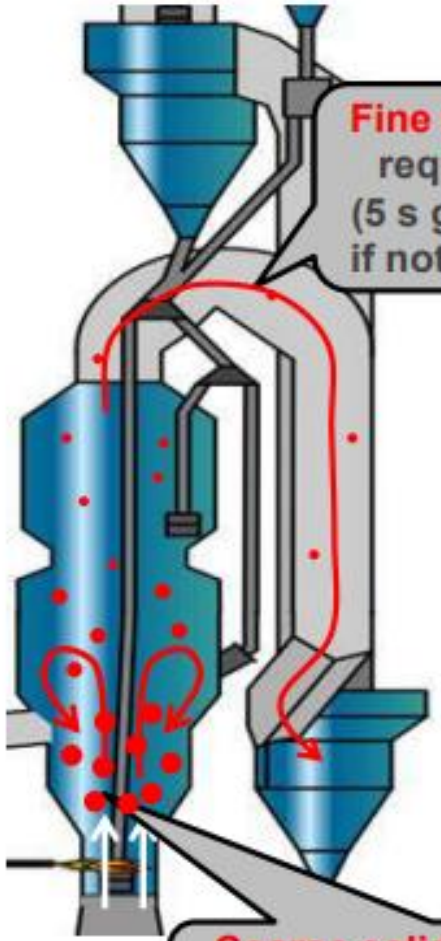
# Feed Point specific combustion behaviour and issues with solid AFR



**Fine solids:**
→ oversize materials create issues with coating, clinker quality and S-volatility (build-ups)



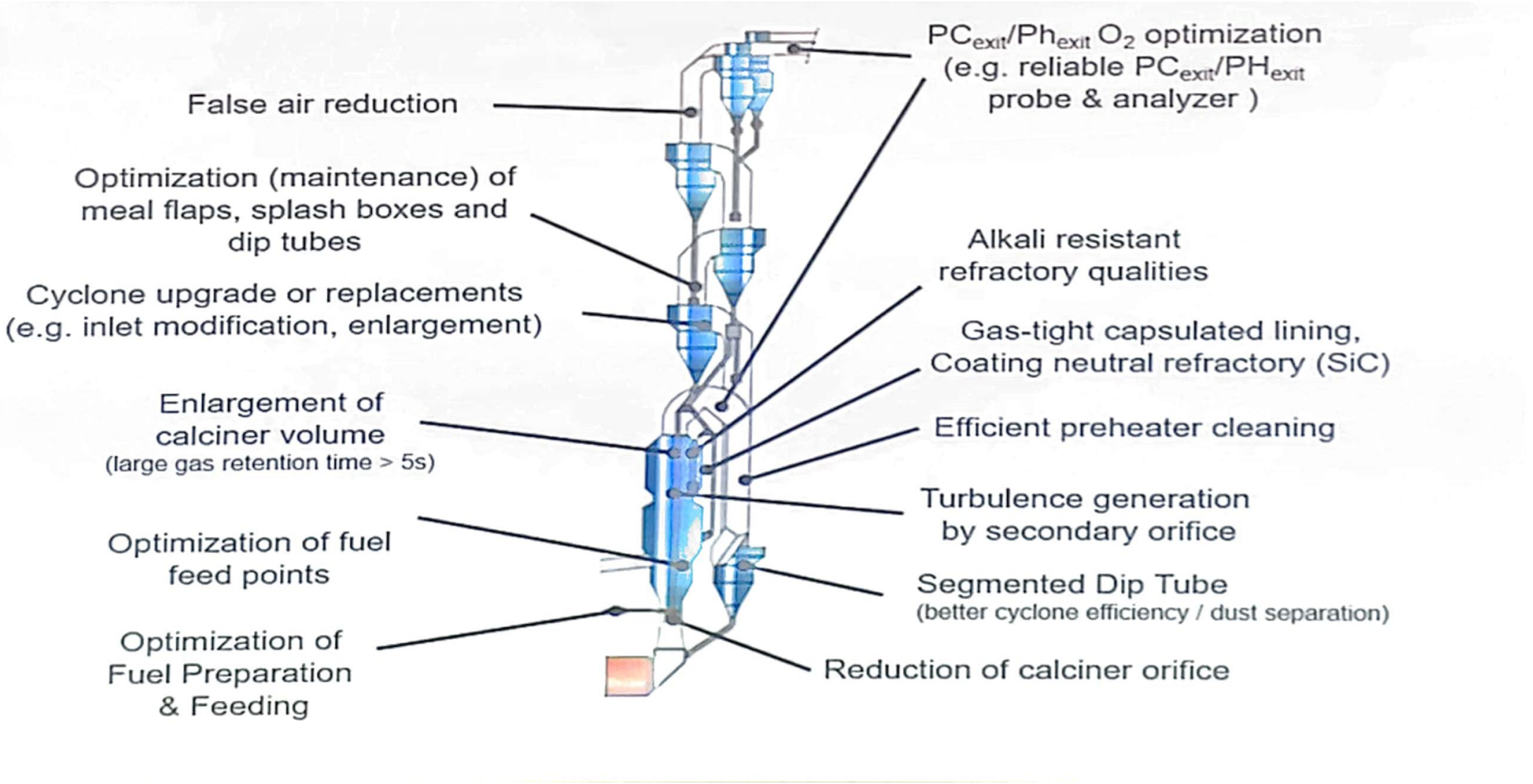
**Lump solids:**
fall down, poor mixing with O2
→ slow combustion, build-ups
→ low TSR potential



**Fine solids:** big calciner required for burn-out (5 s gas residence time) if not: CO, heat losses,..

**Coarse solids:** suspended in gas stream (35-45 m/s)
→ good mixing

# Preheater : Optimizations / modifications to reduce SHC, exhaust gas flow and increase availability



# Modifications required for increasing TSR

| 10% TSR | 15% TSR | 25% TSR |
|---|---|---|
| ✓ **Pre-processing facilities including shredding, screening & proper storage** | ✓ Separate dedicated system for AF feeding end storage | ✓ **Improvement of turbulence in calciner by optimization of its design and flow deflections** |
| ✓ **Improvements of AF dosing systems** | ✓ Modification of orifice in calciner | ✓ **Addition of controlled hot spot in calciner** |
| ✓ Optimum elevation and position of feed point in calciner | ✓ **Upgradation of burners/new high momentum burner** | ✓ Automated multi-fuel controller |
| ✓ **Enlargement of calciner volume to increase gas residence time** | ✓ **Bypass installation to remove Cl in case of chlorinated waste** | ✓ Expert operational control systems |
| ✓ Repair/replacement of kiln inlet seal for reduction of false air | ✓ Selection of suitable refractories in kiln and calciner | ✓ Addition of meal curtain to reduce build-up formation |
| ✓ State of the art laboratory | ✓ Technologies to meet emission norms | ✓ Additional safety measures for handling multiple waste |

# Approach

1

Expert Assessment

Analysis

MOU & Regulatory Clearance

2

Receipt and Sampling

Laboratory Control

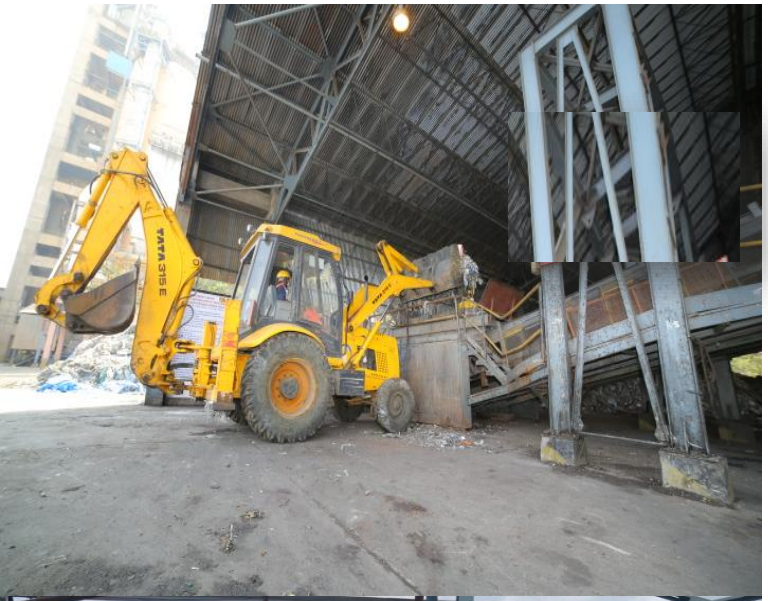
Pre-Processing

3

Co-Processing

Certification

# Infrastructure (Storage, Pre-processing and Co-processing).




# Infrastructure.

## Laboratory





Plastic, MSW,
Hazardous & Other
Wastes

# AFR

# Thank you