Recommended Action Plan for the Chosen AFR's

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Most Promising Alternate Fuels

- RDF from municipal solid waste [MSW]
- Used tyres
- Hazardous waste
- Industrial plastic waste
- Biomass

RDF from MSW

Total Availability (million tpy)	Percentage of total Availability considered	Availability for co-processing (million tpy)
6.88	20	1.37

Average NCV (kcal/kg]	Moisture (%)	Chlorine (%)	Ash (%)	Sulphur (%)
2,500	20-25	< 1	< 25	<1

Potential TSR %	CO_2 mitigation [in million tonnes]
3.2	1.7

Barriers

Technical Barriers

- Poor quality MSW due to high recycling
- Presence of high moisture, chlorine and heavy metals in RDF, limiting TSR
- Customization of technology for MSW to cement grade RDF conversion units

Financial Barriers

- High investment cost for setting up pre-processing unit
- High collection and transportation cost of MSW

Policy & Regulatory Barriers

- Non availability of clean, transparent and detailed information on MSW availability in Public domain
- No clear policy that encourages conversion of MSW to RDF and its co-processing in Cement Plants as preferred alternative

Recommended Action Plan

Recommended Action Plan	Next Step for Implementation
Setting up a demonstration project in a public private partnership mode that addresses all the pillars of sustainability namely technical, institutional and financial.	Developing a proposal to bring together all the necessary stakeholders in a meaningful coalition.
RDF co-processing inclusion by MNRE under their waste to energy scheme	Preparing a white paper for MNRE, clearly articulating the merits of the case
RDF use for co-processing to be acknowledged as a CSR activity, which would unlock finances for this action that will have major societal benefits by partly solving the menace of MSW	Preparing a white paper for making a case for qualifying RDF use in cement kilns as a CSR activity

Used Tyres

Total Availability (million tpy)	Percentage of total Availability considered	Availability for co-processing (million tpy)
0.83	50	0.40

Average NCV (kcal/kg]	Moisture (%)	Chlorine (%)	Ash (%)	Sulphur (%)
7,500	< 1	0.1	< 3	< 1.6

Potential TSR %	CO_2 mitigation [in million tonnes]
2.22	1.2

Barriers

Technical Barriers

- Possibility of coating formation at kiln inlet due to high sulphur content
- Poor availability near cement plants

Financial Barriers

- High Price due to other uses, high transportation and collection cost
- High financial risk of setting up co-processing system due to uncertainty of availability at targeted price

Policy & Regulatory Barriers

- Lack of information on used tyre inventory, district & sector wise break-up of waste in public domain
- No clear policy that prefers co-processing of tyres to other modes of disposal

Barriers

Policy & Regulatory Barriers cont ..

- Cumbersome import permit process
- Requirement of emission trials by MoEF for ever new source of imported tyres

Recommended Action Plan

Recommended Action Plan	Next steps for implementation
Recommend ban on current practices of disposing used tyres that create huge environment pollution	Prepare a white paper for MoEF to present the merits of co-processing used tyres against its present ways of disposal
Recommend free import of tyre chips and rubber waste for co-processing.	CMA to take initiative and approach MoEF

Hazardous Waste

Total Availability (million tpy)	Percentage of total Availability considered	Availability for co-processing (million tpy)
0.54	75	0.40

Average NCV (kcal/kg]	Moisture (%)	Chlorine (%)	Ash (%)	Sulphur (%)
4,000	5-20	< 1.5	< 5 (liquid) < 20 (solid)	< 1.5

Potential TSR %	CO_2 mitigation [in million tonnes]
1.4	0.72

Barriers

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Technical Barriers

- Non uniform quality due to varying sources
- Presence of high moisture and Chlorine
- Lack of pre-processing facilities
- Limited technical knowledge and skilled manpower

Financial Barriers

- Time consuming and expensive trial runs needed for each new stream
- High capital cost for setting pre-processing platforms
- Huge competition for HW, impacting gate fee

Policy & Regulatory Barriers

- Unclear emission norms, cement industry required to demonstrate no change in emissions before and after HW use

Barriers

Policy & Regulatory Barriers Cont…

- Incinerator standards to be followed for co-processing as there are no specific emission standards for cement kilns
- Interstate transfer of HW is restricted by some state PCB's
- Non availability of clear and transparent information on sources of HW, details on state wise / sector wise generation of wastes in public domain
- Outdated Classification of HW
- Preference to TSDF's

Recommended Action Plan

Recommended Action Plan	Next steps for implementation
Developing emission standards for Cement Industry using HW	Preparation of Draft emission standards
Recommend exemption of emission trials for selected categories of HW	Preparation of list of HW that can be co processed without emission trials
Suggest steps to increase availability of HW for co processing by including some part of land-fillable HW	Detailed technical paper listing wastes that should qualify under this criterion
Develop guidelines for HW pre-processing units for cement industry	Preparation of guidelines

Recommended Action Plan Cont …

Recommended Action Plan	Next steps for implementation
Facilitate availability of HW Inventory data base on software platform in all relevant states	Develop guidelines for preparation of HW data base. Sensitize and provide training to various state boards
Suggest amendments to existing HW rules to include co-processing of HW in Cement plants as a 4th option of HW disposal	Prepare a white paper recommending HW co processing to be included as fourth option of HW disposal
For HW Pre processing units for cement Industry, central/ state subsidy be encouraged based on viability gap funding	Gujarat subsidy model needs to be studied and recommended for implementation in other states as well

Industrial Plastic Waste

Total Availability (million tpy)	Percentage of total Availability considered	Availability for co-processing (million tpy)
0.20	50	0.10

Average NCV (kcal/kg]	Moisture (%)	Chlorine (%)	Ash (%)	Sulphur (%)
3,000	20-25	0.5-1	5-15	0.5-1.0

Potential TSR %	CO_2 mitigation [in million tonnes]
0.4	0.2

Barriers

Technical Barriers

- High moisture content and impurities
- Lack of pre-processing facilities for Industrial Plastic waste

Financial Barriers

- Lower charges motivating industry for land filling
- High transportation cost as cement plants are far off
- Availability inconsistent to justify installation of co-processing facility

Policy & Regulatory Barriers

- Unclear Policy at Central and state level about the need for environmental permits for co-processing
- Non uniform policy at state level regarding classification of plastic waste as hazardous or non-hazardous

Recommended Action Plan

Recommended Action Plan	Next steps for implementation
Replicate Gujarat model of encouraging plastic waste co processing in cement plants in other states of India	Sensitization and training of relevant stakeholders in other states
Normalization of policy with regard to categorization of plastic waste that facilitates its transportation across states	Preparing a white paper and persuading concerned agencies for having an uniform classification for plastic waste

Surplus Biomass

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Total Availability (million tpy)	Percentage of total Availability considered	Availability for co-processing (million tpy)
150	10	15

Average NCV (kcal/kg]	Moisture (%)	Chlorine (%)	Ash (%)	Sulphur (%)
3000	5-20	-	2-22	-

Potential TSR %	CO_2 mitigation [in million tonnes]
36	17.6

Barriers

Technical Barriers

- Low bulk density, bailing required for straws
- Used in boilers, furnaces, brick kilns making availability difficult for cement plants
- Requirement of shredders/ chippers for size reduction
- High Potassium and Sodium in some crop residues may cause kiln operational issues

Financial Barriers

- High costs of handling, bailing & transportation over long distances
- Uncertainty of regular availability of biomass makes investment decision on co-processing system difficult.
- Requirement of huge land area for cultivating energy crops

Barriers

Policy & Regulatory Barriers

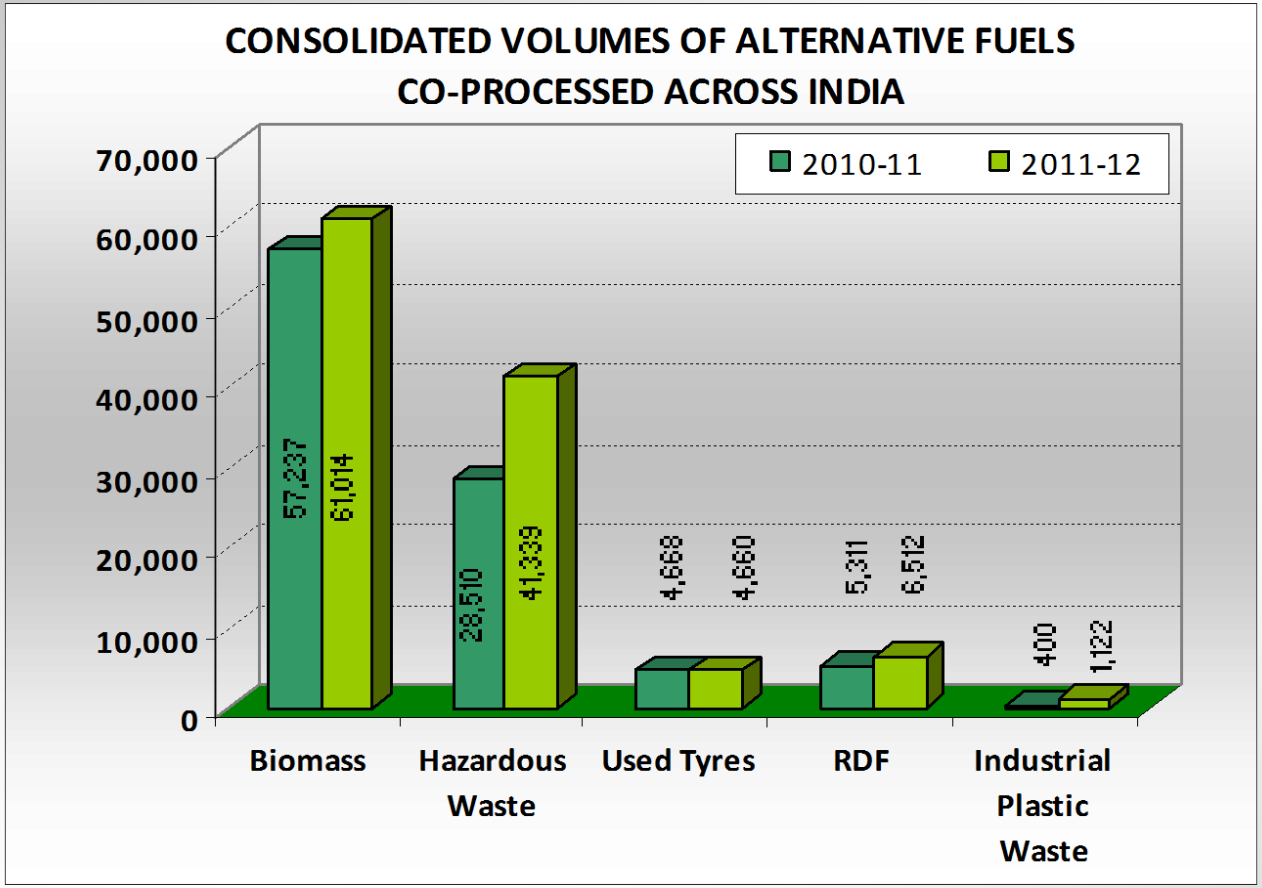
- Restricted usage of biomass only for power generation by some states, encouragement of biomass based power plants by state nodal agencies
- Practice of burning rice straw to clear fields, ban on such practices not enforced rigorously

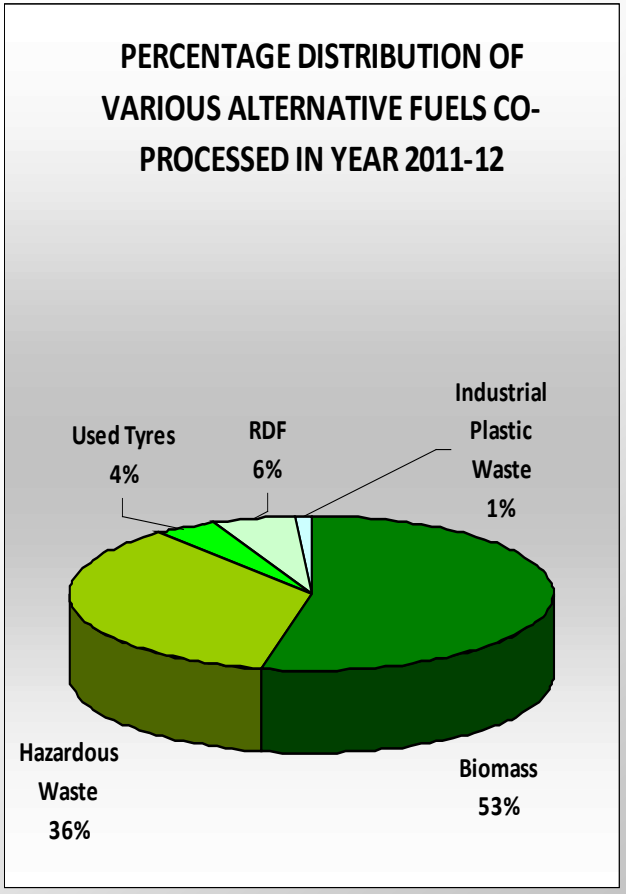
Recommended Action Plan

Recommended Action Plan	Next steps for implementation
Represent to MNRE for including biomass co-processing in cement industry in their action agenda for utilizing surplus biomass as green fuel	Preparing a white paper on biomass co-processing in cement plants, bringing out the merits of the case
Captive/ neighborhood energy crop plantation should be carried out by the cement industry as CSR activity	Preparing a white paper on energy crop plantation benefits as CSR initiative by cement industry

Alternative Fuels Co-Processed

(2010-11 & 2011-12)

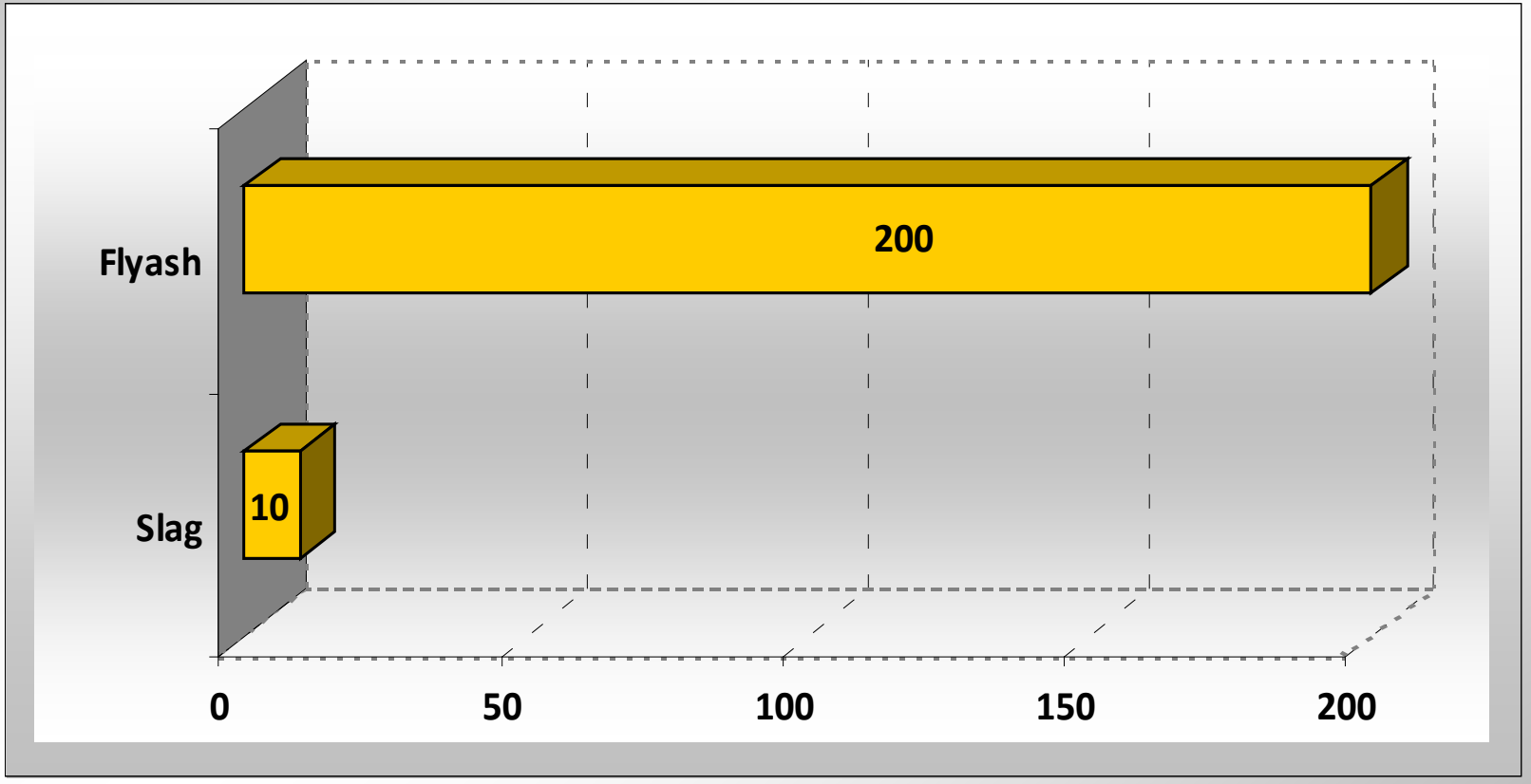




* (Based on Data Collected from 25 Cement Plants)

Comparison of Volumes of Alternatives fuels Co-processed in Year 2010-11 & 2011-12 & Percentage Distribution of Various Alternative fuels co-processed in Year 2011-12

Most Promising Alternate Raw Materials



Quantity in mio tonnes per annum

Fly ash - Typical Characteristics

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Physical Characteristics	
Fineness (Blaine)	3000-6000
Lime reactivity (N/mm^2)	3.5-6.5
Chemical Characteristics	
SiO_2	45-60%
Al_2O_3	15-30%
Fe_2O_3	5-10%
Unburnt carbon and small amounts of calcium, magnesium, alkalies and sulphates.	

Barriers to enhanced Usage of Fly ash

TECHNICAL

- Limited fly ash addition to clinker made from low and medium grade limestone
- Quality of available fly ash restricts percentage addition in PPC.

FINANCIAL

- Distant Location of fly ash sources from cement plant clusters

Policy & Regulatory Barriers

- Reluctance of Government department to use fly ash based cement
- Fly ash addition in PPC limited to 35% by BIS

Recommended Action Plan

Recommended Action Plan	Next steps for implementation
Policy amendments to increase fly ash usage in cement industry to 40%from the present level of 35%	Prepare a white paper for BIS and National fly ash mission for steps related to increasing the consumption of fly ash in cement industry

Slag - Typical Characteristics

Physical Characteristics	
Bond grindability index	15-18 kWh/t
Specific gravity	2.90
Bulk density	1200-1300 kg/m3
Chemical Characteristics	
Al2O3	10-15 %
MgO	2-10 %
SiO2	30-35 %
CaO	35-40 %

Barriers to enhanced usage of Slag

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TECHNICAL

- Lack of infrastructure in steel plants to convert all blast furnace slag to granulated slag
- Restricted usage of slag due to high moisture and low quality

FINANCIAL

- Slag available around Steel Industry, transportation of slag over long distances unviable

Policy & Regulatory Barriers

- No national policy in force to encourage enhanced use of slag in cement industry

Recommended Action Plan

Recommended Action Plan	Next steps for implementation
Pre sorted and sized LD slag from steel plants to be used as raw material	Approach steel industry to provide sized LD slag to cement industry.

Techno Economic Feasibility Study Findings

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Parameters	Case Study -I		Case Study -II	Case Study -III	Case Study -IV
Alternative Fuel	Solid HW	Liquid HW	RDF from MSW	Used Tyres	ETP Sludge*
Envisaged TSR %	6		7.5	5	1**
Investment Cost (INR in Million)	60	50	100	15	45
IRR (in %)	34	63	43	34	27
Payback Period (in years)	2.8	1.6	2.3	3.0	3.5

* ARM ** Percent Substitution of ARM

THANK YOU

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