Final Feasibility Report
on
Collecting, Recovering and Managing post-Consumer Non-Recyclable Multi-layer Plastics as an Alternative Fuel for Cement Factories in Nepal

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Contents

1. Background and Concept:

Non-recyclable plastic products such as multi-layer plastic packaging and wrappers are posing increasing environmental hazards in Nepal. Since, they cannot be recycled and do not have any market value, they are usually i. Not collected at all ii. Burnt at the source or iii. Sent to the landfills directly. However, recent developments in Nepal as well as around the world show that these so-called non-recyclables could be used for various applications such as

i. Alternative Fuel (AF) for clinker factories
ii. Plastic roads &
iii. Bricks and tile factories.

With the advancement in packaging technology across the FMCG companies, some of the multilayer packaging, which were earlier considered non-recyclable, can also be recycled into granules without separating the different layers. However, doing so requires appropriate technology for converting them into granules and awareness directed at waste pickers and transfer stations to segregate and extract the recyclable multilayer packaging from rest of the waste headed to the landfills.

2. Proposed Research Activities and Methodologies:

While the end goal of this study was to conduct the market feasibility and use of MLP as an alternative fuel in cement industries, it aimed to achieve the following:

i. Among the multilayer packaging from the existing recycling streams at the transfer stations, which currently are being sent directly to the landfills;

a) Identify plastics which can be recycled and which can have an alternative end use
b) Identify the appropriate end use and the technology and processing required to meet the requirements of those end uses.

ii. Quantify the amount of non-recyclable plastic packaging wastes generated at transfer stations so as to assess the scalability non-recyclable plastic packaging waste for commercial use(s).
iii. Develop and recommend a minimum viable quantity study of the use of MLP in consultations with concerned stakeholders for the commercial use of MLP as an alternative fuel in cement industries.

iii. Develop manual for awareness/training for segregators at transfer stations so that they can extract value from the identified type of plastic waste

iv. Identify potential uses and institutions that can use non-recyclable plastic packaging waste as an alternative fuel or some other value added end-use applications.

v. Develop a manual of multilayer packaging products that can be recycled and also carry out the needed works on identifying appropriate technology and parties for its end uses.

3. Proposed Pilot Project Sites

For the purpose of quantification of MLP in Kathmandu, three transfer stations sites were initially selected for the purpose of this study: Indra Rai-Chabahil, Padam Rai-Pepsi Cola and Tanka Adhikari-Charghumti. These transfer stations were already in the Avni network for the purpose of PET recycling works and altogether these three sites handled mixed waste from 40-50,000 households on a daily basis.

4. Methodologies

Combinations of desktop research, onsite observations, and interviews with key stakeholders were employed in order to complete this study. Desktop research was done to find out uses of MLP in other countries, and on site observations were conducted for the quantification, waste profiling as well as for training manual and key stakeholders interviews were done for the commercial viability of MLP as an alternative fuel in cement industries. Highlights of on-site observations and key stakeholders interviews are as follows:

- A total of four transfer stations (Chabahill, Radhe Radhe, Tikathali and Bhangal) and two collection companies (NEPSEMAC and Srijansil Batawaran Company) were selected for the onsite quantification observation work to find out daily generation of MLP in Kathmandu
- These sites handled mixed waste from more than 50,000 households on a daily basis
- Estimates on MLP generation was conducted using a mixed sample size ranging 27.5-371 kg
- Waste workers from the transfer stations as well as outside were employed for the purpose of segregating MLP from mixed waste
- Total 72 waste workers from 4 transfer stations were trained in MLP segregation as alternative fuel for
- Phone/virtual meetings were done with other packaging industry representatives like from Coca-Cola, Chaudhary Group, Unilever, P&G (Vishal Group), Surya Nepal, SA Polymet, Pharmaceutical Companies, PlastFoundation Nepal etc (Findings in Annex A1)
- A total of two factory visits were done (CGIP in Parasi and Wai Wai factory in Bhaisepati) to find out the industrial MLP waste generation (Findings in Annex A1)
- Cement Association leaders, factory owners/executives (Sarbottam, Ghorahi, Cosmos, Shivam and Udayapur) were interviewed for understanding the commercial viability of MLP as an alternative fuel to coal in kilnker factories
- A total of 17 onsite observation visits were conducted for the purpose of quantification and cost per unit of MLP generation in order to find out the commercial viability of MLP as an alternative fuel to coal in kilnker factories

5. Findings

5.1 MLP Generation and Estimates in Kathmandu

Studies from 15 out of the 17 onsite observations (two outliers of 68.5 % and 73% at Radhe Radhe were excluded- upon further analysis, it was concluded that these higher rates of MLP plastics were obtained as the waste pile from which these observations were made, was not the original mixed waste that arrives from the households, but an already segregated pile of single-use plastics) show that the average MLP generation at transfer stations was 4.21%. In other words, for every 100 kg of mixed waste, there was an average of 4.21 kg of MLP being generated in Kathmandu with the following highlights:

- Observations show that the MLP generation ranges as low as 1.8 kg to as high as 5.67kg on every 100 kg of mixed wast009e
- MLP was found to be very light (for eg. one 25-kg rice-sack full of MLP waste weighs around 1 kg) while compared to other plastics such as PET, HDPE and LDPE and hence was taking more time for waste workers to segregate MLP compared to other plastic products (in an 1 hour shift, from the current mixed waste, waste worker can collect a maximum of around 12 kgs)
- MLP generations differed based on the locations of transfer stations. Transfer stations like in Chabahil receive a lot of high generation industrial waste plastics (PET, Saline bottles, gloves, etc) from Hospitals like Teaching hospital and Bir Hospital whereas Transfer station in Har Har Mahadev also received a lot of industrial packaging waste from nearby industries like Lomus Pharmaceuticals. Generation was higher in Radhe Radhe site (average 5.67%) and the lowest was in Bhangal (3.07%). Though the type of mixed waste generated by the households in both places were comparable, the difference in segregation of MLP can be attributed to the fact that due to the available infrastructure in these stations, segregation was easier in Radhe Radhe facility whereas it was comparatively more cumbersome and time-consuming in Bhangal.
- Recovery rate of MLP was found to be relatively lower compared to other plastic products because of its light weight.
- Study (as per collection companies representatives like Nepsemac) shows that there are an estimated 220 trucks worth of mixed waste that get dumped at Shisodol landfill (Table 5)
- At an average rate of 4.21% (table 4), daily MLP generation is estimated at 74.1 tons in Kathmandu Valley (Table 5)

Table 1: MLP Segregation Quantification in Transfer Station #1, Tanka Adhikari, Bhaktapur

Facility-1 Tanka				
#obs	**Kg/vehicle**	**Mixed Waste-kg**	**MLP-kg**	**%MLP**
Vehicle-1	2000	371	15.278	4.12%
Vehicle-2	1500	71	2.75	3.87%
Vehicle-3	2000	78	3.2	4.10%
Vehicle-4	1600	95	3.92	4.13%
		Average		**4.06%**

Table 2: MLP Segregation Quantification in Transfer Station #2, Padam Rai, Radhe Radhe, Bhaktapur

Facility-2 Padam Radhe Radhe				
#obs	**Kg/vehicle**	**Mixed Waste-kg**	**MLP-kg**	**%MLP**
Vehicle-1	600-700	100	68.5	68.50%
Vehicle-2	650-720	100	73	73.00%
Vehicle-3	600-700	120	6.8	5.67%
		Average		**5.67%**

(Note: The two figures marked in red were excluded as outliers from the analysis).

Table 3: MLP Segregation Quantification in Transfer Station #3, Man Kumar Rai, Bhangal, Budhanilkantha

Facility-3 Man Kumar				
#obs	**Kg/vehicle**	**Mixed Waste-kg**	**MLP-kg**	**%MLP**
Vehicle-1	4000	47	1	2.13%
Vehicle-2	4000	27.5	0.85	3.09%
Vehicle-3	2000	29.5	0.95	3.22%
Vehicle-4	2000	85	3.5	4.12%
Vehicle-5	2000	63.5	1.88	2.96%
Vehicle-6	4000	75.3	2.1	2.79%
Vehicle-7	2000	44	1.95	4.43%
Vehicle-8	4000	50	0.9	1.80%
		Average		**3.07%**

Table 4: MLP Segregation Quantification in Transfer Station #4 Indra Rai, Chabahil & Kathmandu and average % of MLP in waste generated at these centres:

Facility-4 Indra				
#obs	**Kg/vehicle**	**Mixed Waste-kg**	**MLP-kg**	**%MLP**
Vehicle-1	2000	550	24.6	4.47%
Vehicle-2	1800	105	3.78	3.60%
		Average		**4.04%**
		Average of All		**4.21%**

Table 5: Quantification of Total MLP Generation every day in Kathmandu Valley

Estimated No of Trucks that go to the Landfill from Kathmandu Valley Daily	220
Average weight carried by each truck in tons	8 Tons
Total weight of waste that goes to the landfill from Kathmandu Valley Daily	1760 Tons
Estimated weight of MLP in that landfill waste (@4.21%)	74.096 Tons
Daily MLP Generation in Kathmandu Valley	74.1 Tons

5.2 Market and Industry Scenario

Consultations with 25 representatives of 18 different key stakeholders were done (viz., FMCG companies who use MLP packaging in their products, plastic granule/packaging suppliers, Cement Factories, Cement Association, waste workers, waste entrepreneurs, waste collection companies, etc) to find out the commercial viability of MLP as an alternative fuel to coal in clinker factories in Nepal. Nepal is in the verge of becoming self-reliant in household section of cement market (As per the per capita cement demand and supply mapping and internal competitor market analysis done by Sarbottam Cement – Annex A2 and A3). Since cement production, especially the kilnker production, being an energy intensive industry and coal being the primary source of fuel, Nepal is 100% importing coal from India and third countries. Studies and practices in Germany (supported by GIZ), in India (by Geocycle), and by Avni Ventures in Nepal (with Ghorahi Cement) has shown that plastics including MLP can be used as an alternative fuel to coal in kilnker factories for cement production. For the purpose of this study, owners/executives of several cement companies were interviewed and following are the highlights:

- There are 21 currently operating cement factories with their own kilnker productions at 25,800TPD all over Nepal, mostly in the Terai belt; with Hongshi being the highest at 6,000 TPD (Tons per day-Annex A2)
- There are 8 upcoming cement factories with their own kilnker productions at 23,200 TPD capacity (Annex A3)
- Interviews with Ghorahi and Sarbottam confirm that they could replace 8-12% of their coal use with MLP (50 tons per month to start with) given that MLP generates comparable calorific value to coal (5,500Kcal to 8,000Kcal).
- Sarbottam itself could consume 50+ tons a day of MLP given the calorific value and price remains viable
- Interviews with other industry leaders like Head of Cement Association of Nepal also confirm that there was a demand for 500+ tons of MLP in a month in cement industry
- Cement company owners were willing to give comparable price of coal to MLP which came around Rs 15/kg or Rs 2 per kilo calories (Annex –Interview)

5.3 Pilot MLP Use at Ghorahi Cement Factory

As part of the commercial viability aspect of this study, a truck load (5 tons) of MLP was collected from the waste centers and sent to Ghorahi Cement. This pilot testing was done to find out if the MLPs collected from waste centers are good to use at kilnker factories, find out its calorific value and also to determine the commercial aspect in the long run. Following are the highlights;

- MLP sent to Ghorahi Cement was a combination of regular multilayer plastics and MLP from Pharma Companies
- Test results were found to be highly successful both in terms of material quality as well as calorific value (Higher Calorific Value means higher amount of heat generated during combustion, hence a better quality fuel and more desirable for the Clinker Factories)
- Calorific value of the post-consumer MLP waste sent by Avni Ventures was found to be 7,500 KCalories which was above average of what these companies use for coal (Starting from 5,000 KCalories - 5500 KCalories and a maximum of 8,000 Kcalories)
- Logistics came out to be a bit challenging from pricing perspective; it cost around Rs. 35,000 per trip (one-way) to transport 5 tons worth of MLP from Kathmandu to Ghorahi. MLP transported for this study was not baled.

5.4 Waste worker training and feedback from the trainings:

Waste worker training manual was prepared to help the waste workers at the transfer stations understand the need to segregate and manage MLP waste, the proposed end use of MLP and their role as waste workers to make this solution possible. A training manual was finalized and slides were printed on paper to be used during the trainings at the stations. From 23rd to 25th September 2021, training was conducted to 72 workers from 4 different centres (2 in Kathmandu and 2 in Bhaktapur).

S.No.	Name/Location of the station	No. of workers trained
1	Mankumar station, Bhangal, Budhanilkantha Municipality	13
2	Padam Rai (Har Har Mahadev) station	21
3	Tanka Adhikari Station	25
4	Padam Rai (Radhe Radhe) Station	13
	Total Waste Workers trained	72

We floated 4-5 Rs/kg as the potential labour price that Avni could offer to the waste workers for the MLP segregation work. The training was very appreciated by the waste workers and entrepreneurs and they expressed optimism and eagerness towards the solution with few of their genuine concerns, expressed in section 5.5 below.

5.5 Waste worker testimonials after the training:

1. Radhe Radhe Station, Bhaktapur

Urmila Bishwokarma (Female, waste worker): 'We fully understood the training, there is no confusion. Now we can properly segregate the Multilayer plastics. We want to start from today only, just like we do for polythene.

2. Har Har Mahadev Station, Kathmandu

Milan Tamang (Male, waste worker): 'Once we segregate the Multilayer plastics, what if later it is not sold, and we don't get our labour cost for segregation?'

3. Tanka Adhikari Station, Bhaktapur

Sita Magar (Female, waste worker): 'All we want is to start segregating the Multilayer plastics and earning per kg from it as soon as possible.'

4. Man Kumar Rai Station, Bhangal, Budhanilkantha, Kathmandu

Mangal Singh Rai (Male, waste worker) : 'As of now, from the waste we have, in 1 full day shift (8 hours) one worker can segregate maximum of 100 kg of MLP. So, at the rate of NPR 4/kg, we can earn NPR 400 per day. But if we go for any daily wage work, we can easily earn between NPR 800-1,000 per day. So, a kg rage of NPR 8/kg only would be feasible for waste segregators like us to do the MLP work.'

5. Mankumar Rai (Male, Entrepreneur) - 'Since the waste itself comes in mixed form right now, it is very difficult to segregate. Either we have to ask the same waste workers to segregate other recyclables and MLPs both at the same time, which makes the MLP generation quite slow. Or, after a set of waste workers extract all the recyclable waste, the same waste must be segregated by another set of workers to extract MLP. For the second option, space constraints would be a challenge as it requires double the space. The best solution for proper and better recovery would be if we received biodegradable waste and non-biodegradable waste separately from the households.'

The queries raised by the waste workers during the training were addressed to the extent possible with the level of information available during the time of the training.

Response to the query of Milan Tamang: The solution of MLP as a alternative fuel for Clinker Factories has been tested and the demand is also established. So, Avni will guarantee that all the labour costs incurred for segregating the MLPs as per Avni's demand, will be paid for to all the waste workers involved in Segregation.

Response to the query of Mangal Singh:
Yes, if indeed it is possible to only segregated 100 kgs of waste (as happened during experimental phase) in an actual 8-hour shift on a daily basis in the future, the cost per kg will have to be significantly increased than proposed now. However, if the waste entrepreneur and the waste workers together can figure out a way of doing it faster (segregating close to 200 kgs per day in an 8-hour shift) by making some adjustments like: all the other recyclables get segregated by Set A of workers first and only the remaining file gets segregated into MLPs by Set B of workers, then even 4 Rs. Per kg might also be feasible.

Response to the query of Mankumar Rai:
To solve that challenge, the generation and collection of waste from Household level will need to transform. For that, we (the waste collection/management ecosystem) would need support from either local governments, or Donor Agencies or private companies (or all of them) to transform the system to handle each type of waste separately.

5.5 Costing Analysis

Costing study was carried to find out how much it will cost to segregate per kg of MLP to waste workers in the transfer stations. However, the study could only suggest a desirable range per kg of segregating MLP from mixed waste, and not a specific per kg value because of the following reasons:

- MLP segregation turned out to be very slow compared to other plastic waste such as PET, HDPE and LDPE
- MLP was particularly challenging because of its low weight compared to other materials
- However, interviews with waste workers and waste entrepreneurs suggest that the support price could range from Rs 4-8 per kg for the waste workers for segregation alone depending upon the centers (Table 6)

Table 6 MLP Pricing and Quantification Findings based on Existing Market Scenario:

Average Daily Wage/Waste Worker	Rs. 800-Rs. 1,000
Average Segregation/Worker/Day	70-150 kg per day (average estimated at 100 kg per day)
Average segregation Price per kg	4-8 Rs/Kg
Average earning of waste worker per day from MLP segregation	400-800 Rs/Day

5.6 MLP Market Demand Prospects with the Cement Companies

Based on the business demand conversation we have had so far with the 3 different companies viz., Ghorahi Cement, Sarbottam Cement and Chaudhary Group with the highest potential end-users of the MLP as alternative fuel, here are the market prospects:

1. Sarbottam Cement has placed a purchase order of 10 tons which we are planning to dispatch before Dashain (Pricing @Rs 2 per KCal as per actual Calorific values of waste obtained). The MLP supplied by Avni Ventures will be in non-shredded form, which will need to be shredded in Sarbottam facility before using as a fuel. After this 10 tons is used and passes the trial, Sarbottam is interested in buying their own shredding machine and given the pricing comes under their coal cap price, start ordering 50 tons a month of MLP as fuel.
b. Ghorahi Cement has placed an order of 150 tons of non-shredded MLP (their feeding system doesn't need shredded material) which Avni will start delivering after Dashain (price not decided, price of coal to be as reference point)

c. An MoU to start a pilot phase of MLP management is underway with CG for management of MLP waste from their Bhaisepati (Kathmandu) as well as CGIP (Chitwan) plant to start with. As soon as the MoU is signed, Avni will start buying MLP waste from CG at Rs. 5 per kg. Once this phase is successful and the prices look feasible, price negotiation will be done and they are requesting Avni to manage their MLP from other factories spread over Nepal like the one in Bardiya.
Later, when their clinker plant in Palpa is operational, they have proposed that their clinker plant can be one of the buyers of MLP waste supplied by Avni.

Table 1.7 MLP Pricing Model for Companies

Reference prices of Coal considere as a the price cap the Cement Companies are willing to offer, given the quality of MLP is comparable to the coal quality and generated roughly 7,500 KiloCalories.
Rs. 2/Kcal or 12-15 Rs/Kg. However, as Ghorahi also receives MLP from different companies free of cost for disposal, Ghorahi is only willing to pay a maximum amount of Rs. 8/kg (Landed price in their Dang facility).

Cement Factory	Waste Workers Segregation cost/kg	Baling processing cost	Waste Entrepreneur Margin	Avni Ventures Margin	Logistics Cost (Loading/Unloading/ Transportation cost)	Local Government Kawadi Transportation Tax	Shredding Cost	Total Cost
Sarbottam Cement Industries Limited, Nawalparasi (minimum cost scenario)	4 Rs/kg	3 Rs/kg	2 Rs/kg	1 Rs/kg	3 Rs/kg	1 Rs/kg	1.5 Rs/kg	15.5 Rs/kg
Sarbottam Cement Industries Limited, Nawalparasi (maximum cost scenario)	8 Rs/Kg	3 Rs/kg	2 Rs/kg	1 Rs/kg	3 Rs/kg	1 Rs/kg	1.5 Rs/kg	19.5 Rs/kg
Ghorahi Cement Industries, Dang (minimum cost scenario)	4 Rs/kg	3 Rs/kg	2 Rs/kg	1 Rs/kg	5 Rs/kg	1 Rs/kg	0	16 Rs/Kg
Ghorahi Cement Industries, Dang (maximum cost scenario)	8 Rs/kg	3 Rs/kg	2 Rs/kg	1 Rs/kg	5 Rs/kg	1 Rs/kg	0	20 Rs/Kg

Based on the current pricing model (the cost of the MLP segregation and supply) vs the price the companies are willing to pay, there is a gap ranging from 0.5 Rupees (in case of minimum cost, maximum price offered by Sarbottma) to a gap of Rs. 12 Rs per kg (in case of maximum cost and

Rs. 8/kg offered by Ghorahi). So, the cost gap depends heavily on the company where MLP is being supplied, the price that company has offered and the cost offered to the waste workers.

Formula for calculation of Price Gap:

Current Costs (A) = Current cost of collection + processing + delivering the MLP in the Cement Factories (all calculated in per kg)

Current Landing Prices at their factories offered by the companies (B) = Also in per kg

Price Gap (B-A) = Landing Prices offered by the companies per kg at their factories - cost of transporting required processed MLP waste up to their factories

6.0 Feasibility of Using MLP as an Alternative Fuel for the Cement Clinker Plants

Our research has shown that the solution of using MLP as an alternative fuel for cement clinker plants is technically and volume-wise feasible. Because MLP fuel as a market commodity is very new, the main challenge all the actors in the supply chain are facing in fixing the prices across the value chain is that none have a prior experience/idea of the exact costs incurred when it will be done on a regular basis, in industrial volumes. Hence, the waste segregators, waste entrepreneurs, processors and suppliers like Avni Ventures and the cement factories are not being able to pin-point the final prices without piloting on a regular basis for minimum 2-3 months. Everyone in the value chain is looking to work on a pilot phase for 2-3 months on a tentative pricing model and based on the actual costs, calibrate the prices after the pilot period. As given in the pricing model above, the costs of each of the steps in the value chain can be standardized. However, the level of processing of MLP required varies based on the requirements of the clinker facility, and the transportation costs depends on the distance of the cement facility from the MLP supplier, as well as the local waste taxes incurred along the way. Hence, the landing price at each of the clinker facilities will vary and need to be customized for each clinker facility.

Challenges faced and mitigation measures:

This being a new type of work and research, not all of the selected transfer stations were co-operative enough to allow us to use their facility/workers to carry out the required observations for segregating MLPs. For eg., the entrepreneur Indra Rai backed out of the research at the last minute as he was not keen in allocating his workers at the station to help us with the segregation research and requested us to bring our own workers. So, at the last minute, one of the experiment sites was switched to the Facility of Man Kumar Rai in Bhangal, who was supportive.

Since fixing a price for MLP at each stage of the value chain is a completely new work that is being done for the first time in Nepal, it has been a challenge to fix or pin-point a per kg price of MLP at each stage (eg. during collection, during segregation, loading, transportation, shredding,

margins for entrepreneurs at each level of value chain, etc. All the players in the value chain are of the opinion that only after doing this work for at least 2-3 months everyone will be able to calculate their actual costs incurred, calibrate the prices and arrive at a more accurate per kg rate. However, since all of the partners working with Avni Ventures to establish as a feasible market based solution, everyone is willing to work together at a rough range of prices at each stage of the value chain (For eg. the cost of segregation still hovers likely between 4-8 Rs/kg for now) which can be calibrated with enough experience in 2-3 months of doing this work on a regular basis.

7.0 Further Studies and Recommendations

While study on MLP for its potential use was the first of its kind in Nepal, scope of work can be further expanded into the following in the future:

- A thorough waste generation profiling in Kathmandu so that better policy as well as market interventions can be devised for green-waste economy
- Awareness and Waste-Segregation-at-source support to collection companies who collect waste from households to better enforce the source-segregation policy as mandated by Solid waste management Act which will be crucial in better recovery and management of waste
- Study on the potential use of technology such as conveyor belt and other for the purpose of increasing the recovery rate
- Revisiting and rethinking the taxes imposed by the local governments during the transport of waste en route from one place to another inside their jurisdiction
- Study on the ways to increase the recovery rate of waste that has market value so that more revenue and green jobs can be generated while also reducing the amount of waste being sent to the landfill
- Formulation and implementation of EPR (Extended Producer's Responsibility) Policies that make the companies who manufacture and distribute the products with MLP packaging responsible for the collection and management of all their post-consumer packaging
- Formulating and stablising the market price of MLPs at all levels of the supply chain from collection, segregation, handling, transportation to sale to the Clinker Factories

Annex:

A1: Summary of Stakeholders Consultations- Industries

Name	Company	Remarks
Mr. Tenzin Tamang-Director	Sarbottam Cement	i.Daily coal consumption is 500 TPD (tons per day) ii. Current feeding system can handle 5-15 mm MLP flakes only iii.Plan is for 8-10% substitute for coal by MLP iv.Current coal price is Rs. 15/kg on an average
Mr. Dibash Neupane-Procurement	Sarbottam Cement	i.Prepared to make necessary changes in feeding system and installing shredding unit. ii. Calorific value of currently used coal averages at 5,500 kcalories iii.Price of coal averages Rs 2 per kcalorie iv.Use of MLP has to be cost effective for the company v.Baled MLP to be supplied by Avni Ventures vi.Shredding to be done at their facility, Sarbottam to arrange/buy a shredding machine themselves
Mr. Aditya Shanghai-Director	Ghorahi Cement	i.Ghorahi has been using alternative fuels for a while. Used cement shacks, tyres and plastics are being used. ii. Ghorahi has set up a required shredding unit worth INR 1.3 crores iii.It can handle 15-55mm of flakes iv.Company is very interested to use baled MLP as a substitute of coal v.However, prices offered are low (up to 8 Rs/kg as they also receive a lot of free material for disposal)
Mr. Sandeep Sharma -Procurement Head	Ghorahi Cement	i.Daily coal requirement is 300+TPD ii. Use of MLP will be breakthrough from environmental perspective in Nepal iii.Average landing price of coal at the facility is Rs.15/kg, hence the MLP price should not exceed this iv. Ghorahi will be able to consume

		50 tons of MLP on a monthly basis at the beginning. v. Sample MLP sent by Avni has the required calorific value (7,500 k calories per/kg)
Mr.Gaurav Goyal- MD	Hongshi Cement	i.It has among the largest clinker factory in Nepal (6,000TPD) ii. It doesn't have any shredding facility and no immediate plans to do so. iii. Not very positive view about the use of MLP as an alternative fuel because of higher standards of incoming raw materials needed for the clinker production.
Mr. Dhurba Thapa-Director	Cement Association of Nepal	i.Use of MLP can be very helpful for the cement production in Nepal. ii. The daily demand can be 150-300 TPD of MLP if it is used as an alternative fuel iii. Generation of MLP on a daily basis can be challenging at this scale
Mr. Krishna Pandey-Sales	Arghakanchi Cement	i.It has clinker facility but doesn't have any facility for shredding inbuilt ii. Company didn't have any immediate plan for using MLP in near future iii. They didn't seem to know much about the idea.
Mr.- Bishnu Chapagain- Business Head	Chaudhary Group	i.Need for the management of noodles/confectionary wrappers from their factories in Parasi, Bardia and Bhaisepati. ii. CG Cement is under production with 4,000 TPD of clinker facility inbuilt. iii. Plan is for setting up the needed shredding plant for MLP uses.
SM Agarwal - Supply Chain Head	Chaudhary Group	CG wants to start a pilot with Avni from two of its facility in Kathmandu and Chitwan to manage industrial MLP waste, wherein Avni Buys at a minimum cost to begin with. When the pilot is successful, prices will be negotiated for the long run. Later, other factory waste as well as Post-consumer MLP can be looked at

		as well as supplying MLP as fuel to CG's own Clinker Facilities.
Naresh Boora	Unilever Nepal	Need to manage flexi/multilayer packaging to meet Unilever's target to reduce or recycle 100% of their packaging waste and be packaging neutral On their own, they are changing the composition of some of the MLP packaging in Nepal to make them recyclable to reduce waste and meet their packaging neutral targets in the similar model they have done in India.
Arpit Agarwal	Vishal Group	Need to manage flexi/multilayer packaging but they need to co-ordinate and get go-head as well as funds from P&G India as they are only a distributor. Also, regarding the details of the existing MLP packaging or to change the packaging composition, they need to reach out to P&G.
Irina Karki Gurung	Bottlers Nepal	Need to manage coke bottle wrappers to make the coke bottle 100% recyclable as per their world without waste commitments
Kusum Shrestha	Time Pharmaceuticals	Need to manage the factory waste of Medicine wrappers as well as post-consumer packaging
Ajay Pradhananga	Nepal Pharmaceuticals	Need to manage the factory waste of Medicine wrappers as well as post-consumer packaging
Govind Sapkota	Vega Pharmaceuticals	Need to manage the factory waste of Medicine wrappers as well as post-consumer packaging
Shuvash Lamichhane	Polymet SA Pte. Ltd. (Singapore based)	Biggest single importer and supplier of Plastic granules in Nepal, importing between 1,50,000-2,00,000 Tons of plastic granules per annum.
Rahul Agarwal	Plastfoundation Nepal	Association of plastic producers of Nepal. They are interested in carrying out a detailed quantification of different types of plastic waste and to play a more active role in helping recollection, recycling, etc efforts of

		Plastic waste.
Vikas Bhutra	Surya Nepal	Surya Confectionary - Need to manage the factory waste of chocolate wrappers as well as post-consumer packaging
Mr. Mitra Ghimire	NEPSEMAC/NEPSEMAC SEWA PRA LI	Very enthusiastic to partner with Avni in MLP segregation and alternative use efforts as it will reduce the landfill disposal costs for companies like them and also fetch higher price from their collected waste which is contracted for segregation to different waste entrepreneurs.
Padam Rai, Tanka Adhikari, Man Kumar Rai, Indra Rai, Jalandhar Jaiswal	Transfer Stations	Need to streamline collection and segregation from households so that waste workers can collect more volumes and more efficiently and the MLP business will be profitable and lucrative for the collectors and entrepreneurs as well.

A2: Cement Factories With Clinker Facilities

Clinkerisation units under operation:	**Capacity TPD**
Sarbottam cement Pvt Ltd	1,200
Arghakhanchi cement Pvt Ltd	1,200
Gorahi cement	2,200
Cosmos cements	600
Shivam cement	1,900
Hetauda cement	750
Udayapur cement	800
Maruthi cement	1,600
Agni cement	800
United cement	900
Sonapur Cement	900
Butwal cementmills (VSK kiln)	200
Dynasty cement	200
Supreme cement	200
Reliance	200
Unitech Cement (VSK Kiln)	200
Rolpa Cement (VSK Kiln)	200
Arghakhanchi cement- Line 2	2,200
Sarbottam cement- Line 2	1,800
Haunshi Shivam cement	6,000
Palpa cement	1,800
Total Tons Per Day	**25,850**

A3: List of Cement Factories With Clinker Factories Under Production

Clinkerisation units under Constrution:	**Capacity TPD**
Riddhi Siddhi Cement	2,200
CG cement	4,000
Shaurya cement	3,000
Gorahi line-2	4,000
Samrat cement	4,000
Maruti Cement line-2	2,000
Waxsin Cement	4,000
Sonapur line-2	TBD
Total expected Production	**23200**

Annex A4: Pictures of MLP Segregation Training Provided to Waste Workers:

Annex A5: Pictures of MLP Segregation Training Provided to Waste Workers: