Municipal Solid Waste Management System-----
A case study in ShangHai

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ABSTRACT

With the rapid development of economy and population, Municipal Solid Waste in Shanghai was augmenting daily. The reported generation of MSW was 7million tons in 2007. Treatment and Dispose of MSW had became an imperative problem for Shanghai. Currently, there were many problems of MSW Treatment system, 53% were treated in sanitary landfill, 16% in incineration, 10% in composting, 21% in unsanitary landfill, with no RDF, and less recycling. The waste were only collected with brief classify and even transported mixed and the major problem was that carbon dioxide were released with a gigantic volume in current system. This paper proposed 5 types scenarios through Waste Management Assessment Model to analyze the combustibles cost, recyclables cost, collection cost, transport cost, and also analyzed environmental impacts, calculated the impact weighting, compared which scenario were most appropriated in ShangHai.

1.Introduction

1.1 The current classification model

The classification of MSW in ShangHai were started at 1995, and adjusted several times, like ”Organic, Inorganic, Hazardous, Nonhazardous”;”Solid, Moist, Hazardous”;”glass, combustible, hazardous” etc.

Since 2007, Shanghai began to implement four classification modes. That Residential area classified "hazardous waste, glass, recyclable materials, and other waste"; In enterprises, established to implement "hazardous waste, recyclable materials, and other waste"; In public they classified with "recyclable Materials, other waste"; addition of food waste, bulky waste, construction Building waste, disposable plastic food containers for divided disposal.

1.2 Coverage

At present, the amount of settlement in Shanghai implemented garbage four categories have reached 3738; 2471 enterprises implemented garbage three categories; implemented garbage two categories of public places are including: Nearly 200 roads, parks and 380 bus stops.

1.3 Current Transportation

Sanitation units according to the actual situation to configure transportation vehicles and set transit point to operate wastes’ collection and transportation. There are 79 vehicles and 54 transit points in motion now.

1.4 Current Disposal

As Fig.1 showed, in 2007(waste amount was about 7,020,000t) there were 53% amount of waste in ShangHai treated in sanitary landfill, 16% in incineration, 10% in composting, 21% in unsanitary landfill, with no RDF, and less recycling.

Because of the great generation of waste was exceeded the landfill capacity, they did Unsanitary landfill in 2007.

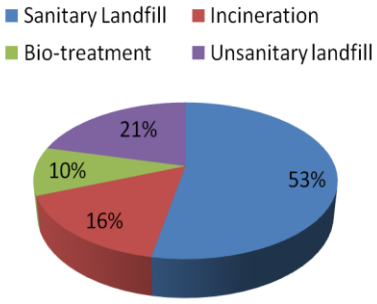

Fig.1 Disposal Percentage of MSW in 2007.

2. Problems

2.1 Capacity of treatment facility

Table.1 showed the amount of current treatment facility, with 3 landfill centre, 2 incineration facilities and only 1 bio-treatment facility. So the capacity of landfill is 2,427,250tons/year, 730,000tons/year for incineration and 365,000tons/year for

bio-treatment. Connect to Fig.1, we know many facilities are runned over their capacity.

	Amount	Treatment(tons/day)
landfill	3	10000
incineration	2	3000
Bio-treatment	1	1500

Table.1 Treatment Facility(2007)

2.2 Lacking operability

"Environment protection" is one of China's national policy. So as a part of Environment protection measure, MSW treatment are expressly embodied in many laws such as《Environmental Protection Law of the People's Republic of China》;《Solid waste pollution prevention law of People's Republic of China》;《City appearance and environmental sanitation regulations》.etc.

But whether it is state law or local ordinances, the point is that lacking of detailed regulations about how to classify, how to collect and dispose, the main responsibility for classification is not clear, and local laws and regulations does not rise to the legal level, all of these caused poor operability to protect environment.

3. Method

3.1 Sample

The population in Shanghai at 2007 was 18.58millon, and from Table.2, the waste generation in 2007 was 7.02million tons, including 58.76% of Organic, 12.82% of paper. 13.98% of plastic, 5.36% of glass, 4.41% of textiles, 0.98% of metal,1.49% of other waste.

Year	2003	2004	2005	2006	2007
Waste Generation(million ton/year)	5.85	6.10	6.22	6.58	7.02
Growth rate(%)	−	4.27	1.96	5.78	6.68

Table.2 waste generation from 2003~2007

We surveyed the proportion of waste in 2007 of ShangHai, the most part was combustible waste occupied 45.43% at all, it means 3,189,186 tons combustible waste were generated in 2007. Table.1 showed the incineration capacity was 1,095,000tons/year only, the rest combustible waste was went to Landfill.

1,482,624 tons Organic waste occupied 21.12% of the proportion, but the BIO-treatment capacity was only 547,500 tons/year (Table.1), and in 2007 there was 10% (702,000 tons from Fig.1) waste were treated with BIO way, because beside one Bio-treatment center there were many communities built their own composting point. And in Bio-treatment center, they dealt the Organic waste in two ways: composting and gasification, 3.11% of garden waste were treated with composting way.

Although we knew there were 11.82% of paper, 9.98% of plastic 5.36% of glass, 0.98% of metal, but only little part were recycled by social communities and the rest part were delivered to landfill center or incineration center, because ShangHai government had no Material Recovery Facility in 2007.

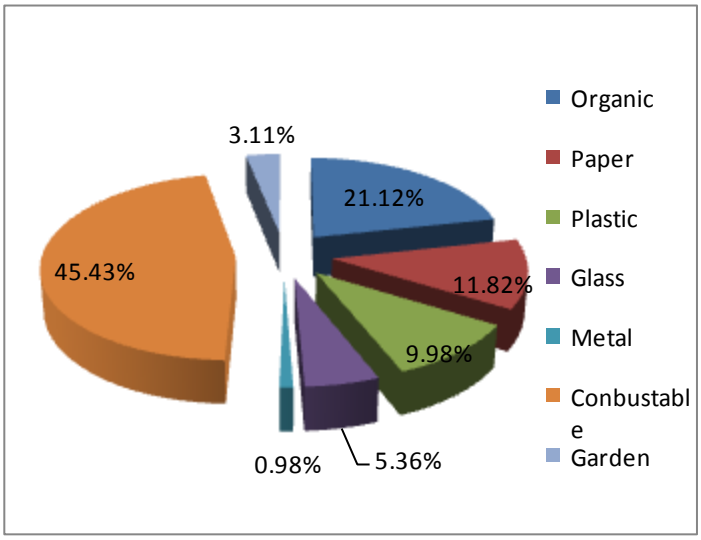

Fig.2 proportion of waste in 2007

3.2 Scenario

This paper proposed 5 types scenarios through Waste Management Assessment Model to analyze the combustibles cost, recyclables cost, collection cost, transport cost, and also analyzed environmental impacts, calculated the impact weighting, compared which scenario were most appropriated in ShangHai.

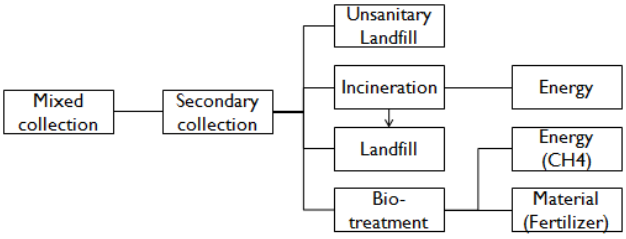

Fig.3 scenario 1

Scenary I is the current disposal and recovery flow, collected with mixed way and need secondary collection, and go to

Bio-treatment center Incineration center and landfill center, recovered Energy and fertilizer.

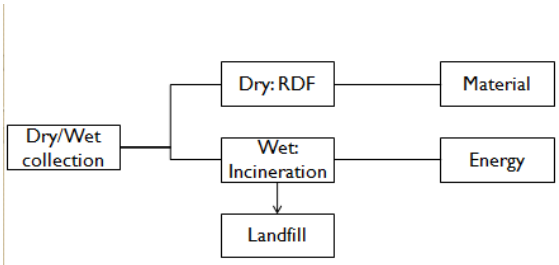

Fig.4 Scenario II

Scenario II suggested Dry/Wet collection to decrease the collection cost and make higher operability. Dry waste go with Refuse Derived Fuel to get RDF materials and wet waste all goes to Incineration to get energy and the ash goes to landfill.

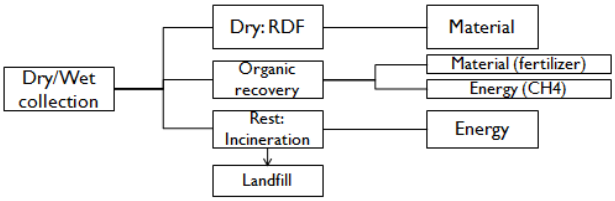

Fig.5 Scenario III

Scenario III also use Dry/Wet collection. Like scenario II Dry waste are dealt with RDF to get material, but in Wet waste, Organics are dealt with a better way, it goes to Bio-treatment center to get fertilizer and methane, the rest waste goes to Incineration and take the ash to landfill center.

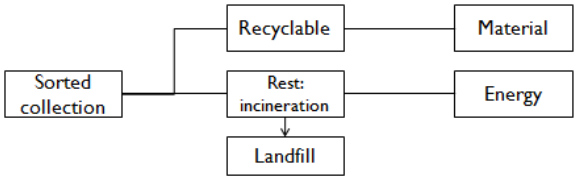

Fig.6 Scenario IV

Scenario IV supposed sorted collection. This kind of collection would cost more money and hard to operate, but scenario IV can recycle material and recycling means consummating sustainable social. The rest waste goes to incineration to get energy and take ash to landfill.

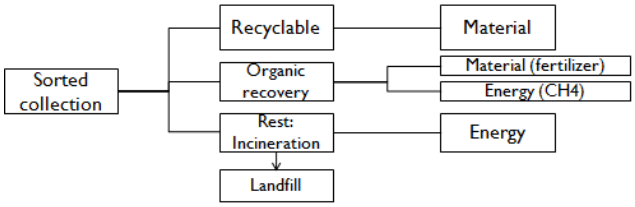

Fig.7 Scenario V

Scenario V would cost more, after sorted collection, recyclable waste goes to Material Recovery Facility to get material, Organic waste goes to Bio-treatment facility to get fertilizer and methane, than rest waste goes to Incineration.

4. Future work

After these 5 scenarios, we should use a soft named INTEGRATED WASTE MANAGEMENT MODEL (IWM-2) to calculate collection cost, transport cost, treatment cost, final disposal cost, and get scenario total cost.

In another hand, we also should get the human impact and environmental impact: climate change gas emission, acidification potential, human toxicity, landfill use.

And use all of these dates to calculate and compare the weighing of impact categories of 5 scenarios, and carry out which scenario is most appropriated in ShangHai.

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