

CLEAN WASTE MANAGEMENT, EGYPT'S WAY TO SUSTAINABILITY

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ABSTRACT

Today Egypt is in an enormous energy conflict; it faces choices about what energy sources it will use in the future. Conventional fuels are becoming increasingly expensive and there is recognition that these fuel resources are finite. Some estimates indicate that native natural gas and oil reserves, on which Egypt's electricity generation currently relies, will run out in about 30 or 40 years, making the transition to alternative energy sources a pressing need to avoid stagnant economic development.

Renewable energy technologies are slowly being introduced in rural communities to promote alternative sources of energy from biomass, which are abundantly produced. The calculated potential for biomass resources in Egypt is expected to reach 40 million tones per year. According to the New and renewable Energy Authority (NREA) the contribution of biomass to primary energy may reach more than 3.6 million tones of equivalent energy. Furthermore, biodiesel and biofuel production technologies for domestic use are currently in the research and development phase.

Bio-fuels are major source including the municipal solid waste reforming process. Municipal solid wastes have been inadequately managed for many years in the country. Waste collection systems have left large areas (up to 70 percent in some cases) of towns and cities unserved or under-served. Large amounts of wastes piled up in streets and vacant areas between buildings, in addition to the spread of informal dumpsites in a number of central areas. Open burning as a means of waste disposal has become one of the main sources of air pollution in Egypt. The government had, therefore, to take action to find a suitable solution for this aggravating problem and to implement the integrated waste management.

This paper discusses the waste management in Egypt and has initially started in the city of Alexandria, the second city in Egypt that has some positive contributions sustainable development, in co-operation with the French company "ONYX" since 2000. This innovative initiative is the first of its kind in Egypt. It covers the full spectrum of waste management activities from street cleaning to collection and treatment of all the household and commercial waste generated in the city.

Further step is the transformation of waste into energy through a Refused drive Fuel (RDF) process, using some complicated machinery. This is being introduced to the government for implementation in the near future.

1. Introduction

With the increase in Egypt's population by more than a double and a half over the last forty years, the increase in population density in urban areas, and the change in the consumption patterns in urban and rural areas alike, many pressures on the environment and public health have intensified, including the solid waste problem, whose harmful symptoms became clearly evident throughout the country [1]. Existing conventional waste management methods have become incapable of meeting society needs with its different groups, in terms of maintaining a reasonable level of cleanliness, controlling environmental impact and providing a generally civilized appearance for the country. Total waste quantities collected never exceeded in the best scenarios 77% of the wastes generated [1].



Figure 1: Large amount of wastes piled up in streets and vacant areas between buildings [1]

Open burning as a means of waste disposal has become one of the main sources of air pollution in Egypt. Therefore the MSW management project has been introduced to the Egyptian government through Dr.Momtaz N. Mansour (CEO of ThermoChem, Inc., Baltimore, USA) [2] for converting Egypt's MSW, organic and agricultural wastes to Energy. The government had therefore, to take action to find a suitable solution for this aggravating problem and to implement the integrated waste management initiated in 2001.

Municipal Solid Waste Estimated Quantities (%) Based on Actually Collected Wastes in 1999	
Governorate	Service efficiency
Cairo	62%
Giza	64%
Qaliubeya	50%
Gharbeya	50%
Alexandria	77%
Aswan	41%
Luxor	45%
Red Sea	52.5%
North Sinai	33.3%
Estimates of municipal solid waste collection services efficiency in some Governorates	

Figure 2: MSW Quantity Percentage for some Egyptian Governorates

2. Role of ONYX in MSW Management

Municipal solid waste (MSW) project for converting the organic wastes and agricultural waste to energy; Ethanol, Methanol, Electricity and heat in cooperation with ONYX. Total waste generation is 3000 tons/day MSW being handled by **ONYX** ;1000 tons/day is processed in recycling operations to recover recyclable material and the other 2000 tons/day buried at landfill in Borg Al-Arab -- an area of the north coast that is a popular summer playground for well-to-do Egyptians [3]. Complaints were filed by residents of the resort villages on the north coast near the landfill. Residents say that the landfill produces an intolerable stench in addition to a burgeoning population of flies and mosquitoes. Results in hydrocarbon greenhouse gas emissions from landfill and other water pollution potential.



Figure 3: North Coast Land fill; Onyx trucks in operation; Waste piled next to the onyx bins

2.1 Economic development and Environmental Objectives

The project has some economic benefits from the waste. It ameliorates many of the pollution effects in Alexandria. Recyclable materials from the remaining 2,000tons/day of MSW is produced. The collection is followed by steam reforming the remainder RDF, to make hydrogen. The hydrogen is beneficial in many different aspects [4]; it can be used by Fertilizer plant in Abu-Qir and can be also exported of to the EU. Most importantly it secures a clean source of renewable energy, thus lessens the threat of global climate change that has been made worse by inefficient and unclean use of non-renewable energy like oil [5,6]. This could bring about drought, famine, disease, and mass migration. And finally, dependence on oil increases instability and undermines development in much of the developing world. Rising energy costs can undermine our foreign assistance and hurt stability, development and disease eradication.

3. MSW Process

1. Waste Pickup; Waste is picked up at residences and businesses throughout the community and taken to the waste processing facility for processing.
2. Receiving waste; Weighing each vehicle arriving at the facility will be weighed and its weight recorded upon arrival and departure.

3. Tipping Floor; Incoming waste is deposited and un-wanted items such as batteries, paint and other liquid and oversized bulky waster are removed.



Figure 4: Onyx Waste pickup; Removing bulky wastes

4. Pre-shredding; MSW is shredded to a desired size for screening and further processing

5. Screening; The screen separates the pre-shredded MSW into two distinct sizes: Plus (25.4cm) and Minus (25.4cm)



Figure 5: Waste shredded to smaller size; Waste shredded to smaller size

6. Magnetic Separation; Ferrous metals are automatically removed and conveyed to a storage area for further processing.

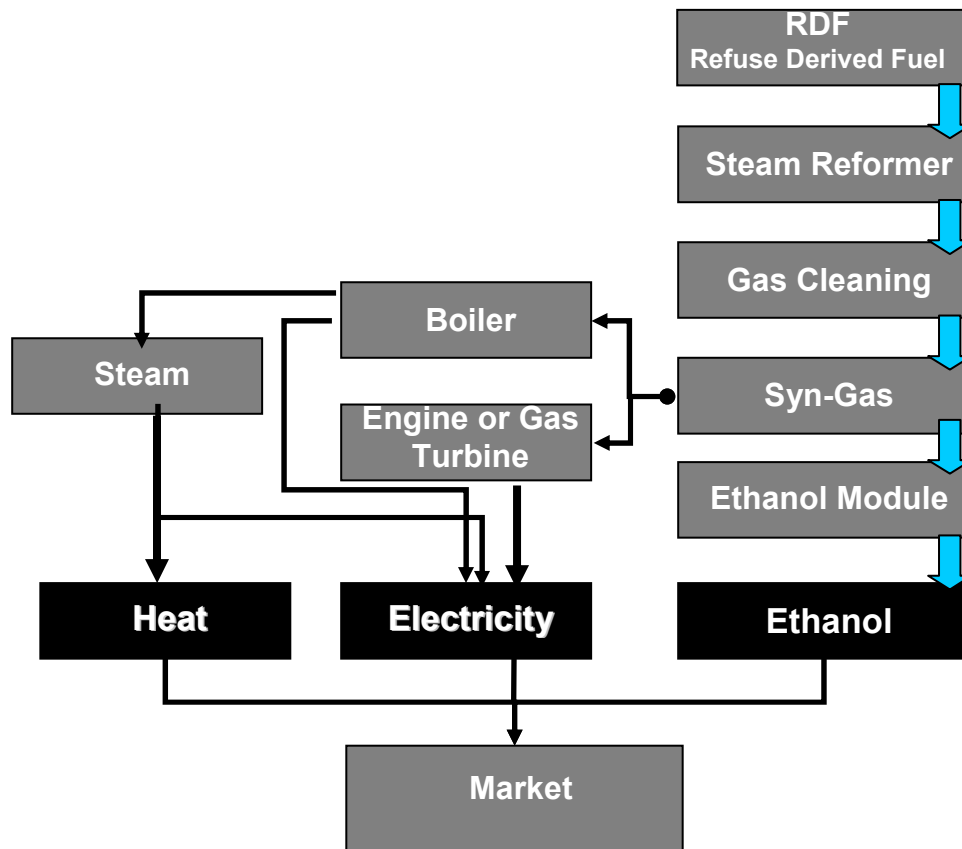


Figure 6: Removing metals for further use; Machine for non-ferrous metals removal; Removal of heavy materials; Shredding to smaller size

7. Non-ferrous Separator; Non-Ferrous metals are automatically removed from the MSW stream leaving high caloric materials and inert “heavies”
8. Density Separator; MSW is now conveyed to a density separator where product is automatically separated from the inert heavies such as metals, stones, broken glass and etc. high caloric materials and inert “heavies”
9. Secondary Shredding; The product from the density separator and the Plus (25.4cm) from the screen is now conveyed to a secondary shredder and reduced to a Minus (2.5cm) size (the desired size for RDF).
10. RDF Storage; The processed and shredded MSW is now an RDF product that is Minus 2.5 cm in size and free of metals, glass, stones and other inert materials, and ready for Steam Reformer.

Process Flow Diagram

Therefore the process comes out with different forms of energy which can be used in various applications: Ethanol operated; Electricity Generation and Heat source. Following is the process flow diagram.



4. RET's Commercialization

Barriers facing Renewable Energy Technologies, about 30 % concerning social awareness and deficiency in promoting the products [7]. Different parties are involved including (Government, NGO's, Media and Educators).

4.1 Governmental Sector

- Creating new cities which are just based on renewable energy resources Ex. "Solar City", "Green City", "Zero Pollution" [8,9] including environment-friendly activities and introducing new technologies of renewable energies in order for the citizens to be familiar with. which can raise funds by visitors to be used in developing other cities or new energy equipments
- Encourage more research work concerned by trainers in environmental issues



Figure 7: MUCSAT (Mubarak City for Scientific Research and Technology Applications) Borg Al Arab (Photo courtesy Essam Shoukri-Al-ahram weekly)

- Encourage investment in energy or science parks which can be beneficial for both businessmen and visitors
- Decrease or remove Taxes & fees to increase market competition
- Establishing new rules concerning usage of renewable energies at new companies, hotels, factories.....etc.
- Museums explaining the whole idea of energy generation since the starting of mankind and the pollution it caused and how to save again our planet which can visitors interact with.

4.2 Organizational Sector

Developing NGO's just responsible for renewable energy promotions and provides funds or grants to small and large scale projects. NGO's enhance awareness for citizens and sustain expo's, conferences and seminar sessions.

4.3 Media Sector

Organizing seminars and interesting TV shows. Different media sectors is to encourage commercials, newspapers, documentary movies and talk shows.

4.4 Educational Sector

Introducing renewable energy in school's syllabus, and the problems caused by pollution (global warming, ozone layer, etc). Encouraging competitions between schools in environmental topics and celebrating "*world's environmental day*" or we could say "*Green Day*". Setting workshops and activities involved with energy and "Saving Planet Earth." Study Exchange for graduate students concerned with environmental issues.

5. EDRG Green Day

Part of the activities done by the Environmental Design Research Group (EDRG) is to promote and aware students within all education levels about the use of renewable energy technologies to decrease carbon dioxide emissions all over the world and save our planet from global warming.

The Green Day campaign started with the Deutsche School in Alexandria, Egypt titled "**Save Our Planet Earth**", it lasted for 2 weeks with different forms of presentations for grade 1, 3, 4, 9 and 11 explaining how global warming will affect our planet and methods of saving it.



Figure 8: 11th Grade Open discussion after presentation and 3rd Grade workshop Products

In addition to open discussions between the students and the EDRG team for using renewable energy technologies and ways of decreasing pollution in our country and how future generations can change the catastrophic present we are in.

Moreover, for younger ages we've started with some simpler presentations and mainly focused on workshops to provide them with a quick introduction about what's happening all over the world in the former issues and some art work expressing the current situation and some solutions concerning renewable energies.

6. Future Enhancement

Decision makers must be aware of the problem facing us, and co-operate with NGO's and businessmen to encourage the start of the municipal solid waste project. Research centers and educational institutes in parallel with NGO's, and business parties should work towards increasing the environmental awareness of public industry, and governmental sectors through communication, and launching massive media and educational programs. The legislative and governmental agencies need also to work to develop rational and achievable standards and laws in order to constructively control such development plan

Interested agencies and organizations are to develop a national environmental management system that includes monitoring, surveillance, law enforcement and taking corrective measures. Insisting on proper environmental evaluation and planning for all major projects, development and new industries. Forbid harmful environmental practices and material (pesticide & herbicides, leaded gasoline, use of CFCs). Generate different alternative ideas and solutions towards more renewable, passive, and environmentally friendly technologies, substances, and practices. Reduce public health risks by developing programs to assess the health risks and to implement measures and technologies to reduce hazardous and toxic chemicals in air, water, and soil. Developing assistance programs to help the industry and service providers to reduce pollution and become more environmentally friendly. Establish effective environmental monitoring and surveillance, facilities and report the results to the public through the news media.

Make environment, global warming issues and climate change an obligatory subject at schools and under/postgraduate studies. Promote programs that would protect bio-diversity Help in the transfer of knowledge and experience in environmental protection from leading countries and industries. Encourage universities and institutes to have environmental and energy department for detailed researches in the field of energy saving and environmental treatments. Finally, sponsoring well-designed media and advertising programs, banners and posters in streets, and everywhere can increase the environmental awareness for the public.

7. Conclusion

The Global Warming is expected to destroy a big part of the Delta in the next decade with a noticeable percent which will affect the Delta population. Therefore, the Egyptian Government is requested to encourage the Renewable Energy Program to decrease the Global Warming due to the continuous carbon dioxide emissions. The Government has a renewable energy target of 3 per cent by 2010; however, yet the renewable energy program did not achieve its goals in reasonable usage of renewable energies, while Egypt has lots of RET's potentials; (solar, wind, biomass, and hydro resources).

Yet the resources available could provide a much larger contribution if the right direction, encouragement and framework were provided. Use of Biomass feedstock like wheat, corn and sugarcane and converting it into energy will lead to increase in prices of these agricultural products hence increase poverty in third nation countries. Thus governmental legislations and subsidy need to be placed on such products and removed from more conventional energy sources like oil and petrol. The government is highly requested to take a quick action in the Municipal Solid Waste conversion to energy as soon as possible cooperating with other interested private sectors. Commercializing Energy can be accomplished through co-operation between different sectors including the Government, Organizations, Media and Education.

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