THE FUTURE
WASTE-TO

E OF
O-ENERGY:
URBAN INDIA

By Aria Kovalovich

A DIRTY PROBLEM

With the height of a ten-story building, and the sprawl of nearly half of Central Park, this overflowing garbage pit in Ghazipur, New Delhi is the site of illegal dumping of nearly 2,500 tons of waste every day…by the city government.

To understand why waste disposal is such a heated issue in the world's second most populous city, one has only to see the trash mountain. With the height of a ten-story building, and the sprawl of nearly half of Central Park, this overflowing garbage pit in Ghazipur, New Delhi is the site of illegal dumping of nearly 2,500 tons of waste every day…by the city government. In fact, all three hazardous disposal sites in Delhi are being used past their capacity by their local municipalities. According to the 2000 Municipal Solid Waste Rules released by the Indian Ministry of Environment and Forests, all waste in a municipality must be collected so as not to pose a risk to human health, that waste must be segregated into organic and inorganic streams, and the storage of waste must be hygienic so as not to compromise public health or the environment. Currently, neither Delhi nor a majority of cities in India is in compliance with these rules. That is, in the course of a decade and a half following the release of the 2000 Municipal Solid Waste Rules little has been done to address the waste problem in India.

With a rapidly increasing population of over 25 million people (United Nations 2014), and a population density of over 12,000 people per square kilometer, waste disposal in Delhi is a huge logistical undertaking. Nine-thousand tons of trash, about 70-80% of total trash generated, are removed from the city each day by thousands of small tippers and rickshaw carts and then transferred to the larger garbage trucks, where they are taken to the growing landfill mountains. Trash left behind is not disposed of properly, and is often left on the street, burned in alleyways, or left to rot in haphazard landfills. This waste creates huge amounts of methane, a greenhouse gas that is 21 percent more potent than carbon dioxide. In addition, solid waste finds its way into surrounding landscapes and water bodies, wreaking havoc on local ecosystems and creating a serious public health problems. Rotting waste draws pests such as flies, mosquitoes, monkeys, and rats which carry infectious disease. In fact, the World Bank estimates that 21% of diseases in India are related to unsafe water. Diarrhea alone causes more than 1,600 deaths daily in India, and cholera, malaria, typhoid, and gastroenteritis are spread as a result of the poor water quality, especially during the summer and rainy seasons. Reducing the amounts of standing waste in both landfills and on the streets would reduce incidence of many of these illnesses and improve water quality. This fact has not escaped the notice of the citizens of the world's largest democracy. In 2012, India saw nationwide public protests against improper waste management, and feelings of unrest are expected to rise in coming years. As a result, governing bodies are looking to waste-to-energy plants as an innovative technological solution to these most urgent crises.

Mail Today Bureau. "Ghazipur plant fuels toxic alarm with its 5 million tonnes of garbage." Daily Mail India. 3 April, 2105.

Mark Magnier. "For many in India, landfill is a livelihood and a home." Los Angeles Times. April 22, 2012.

Government of India Ministry of Urban Development, & Central Public Health & Environmental Engineering Organisation (CPHEEO). Municipal solid waste management manual. May 2014. PDF. http://www.indiaenvironmentportal.org.in/files/file/municipal%20solid%20waste%20management.pdf

D.Chakraborty, & S. Mukherjee (Eds.). Environmental scenario in India: Successes and predicaments. New York, NY: Routledge, 2012. PDF e-book.

Demographia world urban areas. January 2015. Retrieved November 14, 2015, from: http://www.demographia.com/db-worldua.pdf

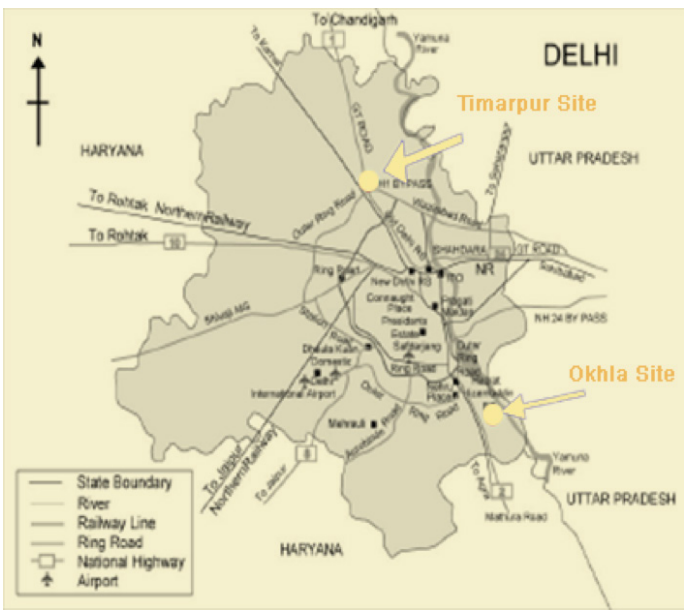
R. Chitlangia. "Waste-line workout." Times of India, Delhi. May 16, 2013.

AN INNOVATIVE & TESTED SOLUTION

Waste-to-energy (WtE) combustion has been used extensively throughout the developed world to decrease standing and buried waste. It kills two birds with one stone, so to speak, allowing municipalities to reclaim valuable urban space for development while creating cheap, renewable energy in the process. Governments also like WtE because it generates carbon credits under the international cap-and-trade system set up by the Kyoto Protocol to regulate carbon emissions. These developments are classified as Carbon Development Mechanisms (CDM) under Kyoto because they overall reduce greenhouse gas emissions by avoiding the methane emissions that are inevitable when storing solid waste in a landfill. Thus, under the trading program, WtE projects allow India to increase its carbon emissions or sell these additional carbon credits to other countries that may need allowances to release more carbon into the atmosphere. Additionally, these projects avoid the displacement of carbon dioxide emissions from carbon intensive sources to a renewable, otherwise wasted source. These credits, combined with revenue from the sale of electricity and the free source of raw material, give the plant a reliable revenue stream, making it simple to operate profitability at any point in time. Gasification of waste is considered by some to be among the most efficient of technologies for energy recovery and safe disposal of municipal solid waste in synchrony with environmental needs.

These credits, combined with revenue from the sale of electricity and the free source of raw material, give the plant a reliable revenue stream, making it simple to operate profitability at any point in time.

Many feel that waste-to-energy technology's success in the developed world, particularly in Europe, can be applied to combat the disastrous side effects of the exponential growth and modernization of many of the developing world's most prominent cities. Thirty-one such projects are expected to be funded in India in the coming years, and one has already begun operations near the Ghazipur trash mountain. Built in 2012 through a partnership between the Delhi government and the infrastructure development firm Jindal Co, the Okhla Waste Management Plant converts 1,800 tons of trash a day to produce about sixteen Megawatts of electricity. This is enough to power about 600,000 homes out of the city's 2.9 million, helping to mitigate the energy crisis in North India.



EPA. Methane and Nitrous Oxide Emissions from Natural Sources. U.S. Environmental Protection Agency, Washington, DC, USA. DC, USA. 2010.

"Clean water by riverbank filtration." (2007). Retrieved November 14, 2015, from: https://wbi.worldbank.org/development-marketplace/idea/clean-water-riverbank-filtration

"India." (n.d.). Retrieved from http://www.water.org/country/india

Intergovernmental Panel on Climate Change (IPCC) (2001) Climate change 2001-the scientific basis, Cambridge Press, 244-245.

R. Annepu. Outcomes from WTERT- India's 1st International Brainstorming Workshop: Observations from India's waste crisis (Research Report No. 89-B). Mumbai, MH: Waste-to-Energy Research and Technology Council - NEERI Mumbai Zonal Lab. February 2014.

K. Sruthijith. Jindal Group's upcoming waste-to-energy plant has Delhi fuming. The Economic Times. October 6, 2011.

Rosen-

THE PROBLEMS WITH THE SOLUTION

A hurdle for developing countries in these projects, however, is their high startup cost. A proper waste-to-energy plant can cost in the range of hundreds of millions of dollars (examples from Europe). The vast majority of this investment goes into procuring the appropriate pollution control equipment. Uncontrolled burning of mixed waste releases hundreds of potent toxins, prominently dioxins and furans, carbon monoxide, sulphur dioxide, and particulate matter, into the atmosphere, at levels devastating to human health. Proper boilers are designed to ensure that all the waste is completely combusted. High-tech filters thoroughly remove pollutants from emissions before they leave the plant and disperse throughout the atmosphere.

Unfortunately, to reduce costs, the New Delhi government has cut corners, failing to invest in the same state-of-the art pollution filtering technology for the Ghaziur plant as that of the waste-to-energy projects in Europe and the United States. As a result, measures of dioxins and furans were measured by the National Green Tribunal to be thirty times the thresholds set by the National Ambient Air Quality Standards (NAAQS). This has led to a serious intrusion upon the environmental rights of those living around the plant. Residents of Okhla have reported a layer of "black dust" settling on outdoor surfaces, and a rising number of people have been treated for respiratory illness in area hospitals since 2012.

Neighborhood organizations have filed a lawsuit against the plant for using unapproved mass-burning technology and releasing illegal levels of pollutants, resulting in two court injunctions. The National Green Tribunal (NGT) has ordered the plant to submit within a week an affidavit detailing steps that will be taken to improve segregation of wastes and to ensure that burning of recyclables and non-organic waste are minimized. According to NGT chairperson Swantanter Kumar, "We will shut the plant down if it does not install improved segregators to the satisfaction of Member Secretaries of CPCB and DPCC." This most recent conclusion makes it clear that there is a decision to be made with regards to this plant in particular, as well as the future of waste to energy in Delhi.

The Okhla Waste Management Plant converts 1,800 tons of trash a day to produce about sixteen Megawatts of electricity. This is enough to power about 600,000 homes out of the city's 2.9 million, helping to mitigate the energy crisis in North India.

WHAT SHOULD BE DONE?

India should reduce its sitting trash and generate sustainable electricity from it through the use of technological solutions that invigorate rather than devastate the communities around them.

Does this apparent failure of waste-to-energy technology in urban India necessitate that the trash mountains may climb to the heights of the majestic Western Ghats, or even the Himalayas? Not necessarily. Waste-to-energy is still an extremely viable solution to India's waste management problem but only if inorganic waste is segregated from better combustible organic waste, a process that can even be facilitated by hiring workers to do it by hand. This solution is ideal to combat some of the

R. Annepu. Outcomes from WTERT- India's 1st International Brainstorming Workshop: Observations from India's waste crisis (Research Report No. 89-B). Mumbai, MH: Waste-to-Energy Research and Technology Council - NEERI Mumbai Zonal Lab. February 2014.

R. K. Singh. "New Delhi locals cry foul against incinerator's exhaust." Bloomberg Business. May 30, 2014.

Rosencranz, A., & Bhati, H. V. (2015). Waste-to-energy projects - comparing approaches Environmental Policy and Law, 45(3), 130-132.

Sukhdev Vihar Residents Welfare Association & Ors. V. State of NCT of Delhi & Ors., Online National Green Tribunal Records (National Green Tribunal Principal Bench New Delhi 2013).

D. Ferris. "Out of India's trash heaps, A controversy on incineration." December 3, 2013. Retrieved March 19, 2016, from http://e360.yale.edu/feature/out_of_indias_trash_heaps_a_controversy_on_incineration/2716/

Sukhdev Vihar Residents Welfare Association & Ors. v. State of NCT of Delhi & Ors., Online National Green Tribunal Records (National Green Tribunal Principal Bench New Delhi 2013).

M. Manohar. "Haste makes waste: Lack of focus takes shine off drive." The Times of India. November 6, 2015.

mass unemployment of low-caste migrants to the cities. It also may bring about a greater social justice outcome for trash pickers displaced by the construction of the plant, that is, those families who earned a living sorting through the trash mountains' toxic piles for metal, plastic, and other valuables to sell but now are forced to seek lower paying jobs. In addition to an increase in human resources, municipalities and investors must spend the necessary capital to ensure that pollution filtering equipment successfully prohibits airborne toxins from being released into the surrounding neighborhoods. Biomethanation, the process by which organic material is converted to biogas under anaerobic conditions, is also an extremely viable technological solution to decreasing India's municipal solid waste, and should be experimented with in urban areas. Given the rapid population growth, the dire state of the landfills, and the years of unacceptable inaction by the Delhi government, this problem needs to be addressed in the short term by its political leaders. India should reduce its sitting trash and generate sustainable electricity from it through the use of technological solutions that invigorate rather than devastate the communities around them.

Press Trust of India. "NGT asks Okhla plant to use better tech to segregate waste." Business Standard. November 18, 2015.

Aria Kovalovich is a sophomore from the Philadelphia suburbs studying Cognitive Neuroscience and minoring in Sustainability and Environmental Management. She plays on the club field hockey team, writes for the DP, and is publicity chair for Alpha Phi Omega. In her spare time she likes to hike, explore the city, and dismantle systems of oppression with Epsilon Eta, Penn's newest environmental fraternity.