

THE CASE FOR A “MOBILE COMBUSTOR” FOR REFUGEE CAMPS

A WASTE PROCESSING, RECYCLING AND DISPOSAL SOLUTION FOR MANAGING SOLID WASTE

The Numbers Don't Lie: Refugee Camps Don't Fade Away. Waste is a Big Problem

Per Wikipedia's data from UNHCR: When comparing the # of refugee camps (>20,000 people in 2006 and 2014):

- In 2014, there are 48 refugee camps with over 20,000 people. 6 of them >80K; 18 between 40K-80K.
- For camps, operating since 2014, their 2016 overall population increased from 800K in 2014 in 25 camps to 1.2M.
- 23 new refugee camps since 2006 around the world. 1M+ refugees in these camps.
- Syrian refugees since 2014: An additional 490K refugees currently in camps (2016 UNHCR stats)

THE ADDITIONAL BURDEN ON WASTE MANAGEMENT IN SURROUNDING COMMUNITIES (TWO EXAMPLES)

In Jordan:

In many saturated Jordanian municipalities, solid waste management was cited by a UNDP study as the most affected service in 33 of 36 surveyed towns. The influx of Syrian refugees increased solid waste volume by 340 tons daily. USAID estimated the total fiscal cost for municipal governments originating from the Syrian refugee crisis amounted to around \$25.4 million in 2013 and \$33.0 million in 2014...The additional waste generation has exacerbated preexisting pressures on waste management, in which service capacities in northern municipalities were already exceeded, funding already fell short of need, and collection supplies were already inefficient. **1**

In Palestinian Areas:

Most cities and villages surveyed currently burn their waste in open dumps or use random open dumping, lacking proper health and safety requirements... As a result, there is no doubt that there is a considerable potential for hazardous exposure to occur through poor waste management in the Palestinian districts, including high levels of contamination of air, soil and water, particularly within communities living in proximity to waste dumping sites...Additionally, there were no comprehensive waste recycling and reuse programs in any of the areas surveyed. **2**

SOME RISKS IN REFUGEE CAMPS ASSOCIATED WITH POOR SOLID WASTE MANAGEMENT: **3**

- Flies, which breed within waste, are disease transporting vectors
- Mosquitoes, which breed in blocked drains, cans and tires are disease carrying vectors
- Rodents which find shelter, food and breeding grounds in waste are disease carrying vendors
- Open burning of waste causes air pollution & gas emissions → hazardous to health & environment
- Uncontrolled dumping of waste can cause respiratory health problems
- Waste lixiviat runoff could contaminate water bodies, especially underground water
- Waste ends up in drains, causing blockages and flooding
- Psychological and aesthetic nuisance from waste in terms of smell and appearance

CURRENT VIEWS ON INCINERATION IN REFUGEE CAMPS PRIOR TO OUR MOBILE COMBUSTOR

PRIME REFUGEE CAMPS FOR OUR COMBUSTOR PILOT PROGRAMS

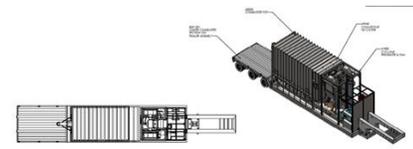
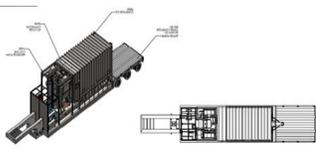
Greece

Jordan

Kenya

Incineration should be used as a last option

- Should only take place off-site or at a considerable distance downwind of dwellings
- All plastic products are removed before incineration
- Incineration takes place downwind of dwellings
- Incineration can be undertaken at a basic level using barrel incinerators or garden type incinerators, which increase burning temperatures and efficiency compared with open burning. However, these often do not reach sufficiently high temperature to obtain full combustion and air pollution is often a hazard. **4**



HOW OUR UNIT CHANGES THE USE OF INCINERATION IN REFUGEE CAMPS & IMPROVES WASTE MANAGEMENT & REFUGEE HEALTH

Until our small-scale mobile combustor, the waste disposal options available to refugee camp administrators were largely ineffective, damaging to air quality, and only a slight improvement over controlled burning in open pits. Our Unit is a game-changer as it can also dispose of plastics (clearly not an option before), diapers, and anything that can combust, and uses its “clean” hot exhaust air to produce up to a net 75 w/h of energy.

Frontline Waste Systems’ Small-Scale & Mobile Waste Heat To Energy Solution

<p>What We Offer</p>	<p>A production ready mobile combustor that utilizes technology which can dispose of a wide array of Refugee Camp solid waste streams, including plastics, diapers, dried animal and human waste, and all leftover waste post-recycling efforts. Installation of appropriate pollution abatement equipment will insure that emissions will produce safe hot exhaust air. We can then generate grid or off-grid power (for instance to recharge batteries and cell phones) from the waste heat using an off-the-shelf Organic Rankine Cycle generator. One Unit can destroy up to 7000 tons per year of waste and produce up to 600,000 kW of energy.</p>
<p>How We Differ From Normal Incineration</p>	<p>Small-Scale Combustion – Incineration/Combustion 2.0 [1] Our unit creates minimal ash and an easy disposal process [2] Our mobility is key as our unit goes where a refugee camp is located. Can be transported by boat, rail or semi-trailer truck. Can easily move to next refugee camp if a camp closes [3] Due to mobility and small-scale, “exhaust heat” is not concentrated in one location or in huge-quantities that occur within large-scale incinerators– less chance to negatively impact refugee camp air quality and health [4] Self-fueling. Our unit does not require additional diesel beyond 5 gallons/19 liters for start-up [5] Can be used to destroy plastics, heretofore, not possible with other incinerators [6] Small footprint of combustor and power generator – less than 2000 square feet/185 M². Locate as far as 0.6 miles/1 kilometer from connected “off-grid” use of power</p>
<p>Easy To Operate</p>	<p>[1] Requires 2-3 people to operate per 10 hour shifts, 20 hrs/day; waste must be sorted, and shredded by workers who then feed waste into combustor, then monitor waste in-take based on computer controls [2] Requires less than 1 month to involve NGOs/refugees to develop waste sorting processes & activities [3] Requires minor monthly maintenance and daily monitoring of potential of metals clogging system [4] FWS to provide 1 year of spare parts and will have 3rd Party maintenance contract to fix if broken</p>

<p>Impact of Combustor On Crisis Refugee Camps</p> <ul style="list-style-type: none"> • For new camps, can provide immediate waste disposal option within hours of arrival • Can provide power for operational center, for itself, and initial power requirements of refugee facilities • Enables waste disposal team to create a more comprehensive camp-wide waste management system to collect recyclables for reuse, and all inorganic waste that can be combusted cleanly 	<p>Impact of Combustor on Long-Term Refugee Camps</p> <ul style="list-style-type: none"> • Reduce waste in nearby public landfills, if available, • Ease overburdened local waste management efforts and local public concerns • Reduce transport costs from camp to where public landfills are being used • Reduce use/need of nearby and on-site waste pits • Provide power to offset expensive diesel fuel or electricity bills for more established camps • Better quality of health - less groundwater pollution
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Sources:

1. [Jordan Refugee Crisis by Carnegie Endowment For International Peace, 9/2015](#)
2. [Barriers Impact in Waste Management - United Nations Relief and Works Agency for Palestine refugees in the near east](#)
3. [OxFam Domestic and Refugee Camp Waste, 5/2008](#)
4. [OxFam Domestic and Refugee Camp Waste, 5/2008](#)