T20 SAUDI ARABIA 2020 THINK

POLICY BRIEF

WASTE MANAGEMENT AND ELECTRICITY GENERATION IN AFRICA: DEVELOPING WASTE-TO-ENERGY TO THE BENEFIT OF SUSTAINABLE CITIES?

Task Force 10

SUSTAINABLE ENERGY, WATER, AND FOOD SYSTEMS

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موجز السياسة

إدارة النفايات وتوليد الكهرباء في أفريقيا: هل يصبّ تحويل النفايات-إلى-طاقة في مصلحة المُدن المُستدامة؟

فريق العمل العاشر

نُظم الطاقة المستدامة والمياه والغذاء

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ABSTRACT

Waste-to-energy plants appear to be an effective means of dealing with the problems of electricity access and waste management together. In August 2018, the first waste-to-energy plant on the African continent was inaugurated in Addis Ababa. Today, other sub-Saharan countries like Kenya are interested in developing waste-to-energy solutions. Could this signal the beginning of large-scale deployment of this technology in sub-Saharan Africa? This policy brief describes the challenges posed by the increase of waste production and the low level of progress in electrifying the sub-continent. It also assesses the advantages and the limitations of waste-to-energy projects as a solution to these challenges.

تظهر محطات تحويل النفايات إلى طاقة بصفتها وسائل فعَّالة للتعامل مع مشكلات الحصول على كهرباء وإدارة النفايات في آنٍ واحد. ففي شهر أغسطس من عام ٢٠١٨، تم تدشين أول محطة لتحويل النفايات إلى طاقة في القارة الأفريقية في أديس أبابا بإثيوبيا. تولي العديد من الدول الأفريقية جنوب الصحراء الكبرى مثل كينيا، اهتمامًا في هذا الصدد وتقوم بتطوير حلول تحويل النفايات إلى طاقة. هل يمكن أن تكون هذه إشارة لبدء انتشار واسع لهذه التقنية في جنوب الصحراء الأفريقية؟ يعرض ملخَّص السياسة هذا التحديات التي تفرضها زيادة إنتاج النفايات وانخفاض مستوى التقدم في إمداد الكهرباء لدول جنوب الصحراء الكبرى في القارة الأفريقية. كما يقيّم مزايا وقيود مشاريع تحويل النفايات إلى طاقة بوصفها حلاً لهذه التحديات.

CHALLENGE

With the expansion of modern production and consumption patterns to large African cities, population growth and urbanization have increased, causing a sharp rise in the production of municipal waste. Unregulated dumps, which are increasing in number, cause strong negative health impacts by polluting the local environment. Mismanagement of waste fosters the proliferation of mosquitoes in the nearby urban areas. In recent years, the frequency of epidemics caused by arboviruses has increased. In addition, the degradation of waste in open dumps emits methane gas, which has high potential to contribute to global warming.

Despite being endowed with abundant energy resources, sub-Saharan populations have the lowest electricity access rates in the world. Electricity access has an important influence on the well-being of a population. It improves access to education, communication, and quality health care. In the long run, poor access to energy and electricity services hampers development prospects. The weakness of sub-Saharan power grids represents a significant cost for national economies. Waste-to-energy plants appear to be an effective means of simultaneously dealing with waste management and electricity access.

As urbanization, population growth, and globalization continue, waste generation in Africa will increase significantly in the upcoming decades. It is a major health problem for the continent and could have significant negative consequences for other continents and the environment. In parallel, access to electricity is a fundamental issue for economic development in sub-Saharan Africa. Despite the region's immense energy wealth, installed capacity remains far below levels required to meet demand. Given the climate urgency, and in line with the African Development Bank's recent pledge to stop coal financing, it is the responsibility of foreign governments and private stakeholders to propose solutions to local governments that promote sustainable alternatives.

PROPOSAL

Action 1: The G20 should create a working group with the mandate of identifying opportunities and challenges for the implementation of emergency measures to improve the downstream waste sector.

Introducing emergency measures to combat the harmful effects of waste generation in sub-Saharan Africa is highly important. Most municipal waste is burned on site or dumped in uncontrolled landfills on the outskirts of cities or in semi-controlled landfills without adequate treatment (Scarlat et al. 2015). Many landfill areas are chosen based on the immediate availability of land and not on objective criteria of pollution prevention. Three main actions would be required to introduce these measures.

Action 1.1: Encourage the installation of soil protection systems to prevent leachate from entering the soil.
The deposition of waste close to watercourses should be prohibited. Some landfills are located in sensitive areas, close to water reserves, without the protective measures that would prevent contamination of the surrounding environment. Thus, the leachate produced from water or liquid percolating through the waste can gradually infiltrate the soil and pollute the groundwater or nearby watercourses. Polluted water reservoirs then become a vector for the spread of disease with serious repercussions on the health of local residents. In addition, suffering from infectious diseases, particularly recurrent diarrhea, at an early age contributes to preventing normal cognitive and physical development of children. The effects from developmental issues can weaken a nation's work force by making adult populations less productive (Banerjee and Duflo 2012). In addition to the human costs, the economic costs of insufficient waste management are colossal. The pollution generates indirect costs which are higher than the cost of properly managing the waste in the first place (Hoornweg and Bhada-Tata 2012).

Action 1.2: Take action to ban the incineration of waste in open spaces.
Particularly in urban areas, the incineration of waste in open spaces has severe repercussions on local air quality. Incomplete and low-temperature combustion of waste releases various toxic substances, such as dioxins and furans, into the air. Respiratory infections in children are up to six times higher in urban areas—as compared to rural areas—where waste is not collected regularly (UN-HABITAT 2010).

Action 1.3: Given the low collection rate, prioritize the collection of plastic waste such as containers that allow the proliferation of mosquitoes.
In the wild, mosquitoes reproduce by colonizing natural water-filled reservoirs where

their numbers are regulated by the presence of insectivorous predators. In urban areas, these predators are present in small numbers. In slums and precarious neighborhoods, residents do not have access to water management services and are forced to store water in canisters to meet their needs. These water reservoirs are potential artificial habitats that can be colonized by mosquitoes. Likewise, any uncollected waste resembling a container can become a breeding ground once it is filled with water.

Action 2: The G20 should ask relevant organizations and stakeholders to identify best practices and develop capacity-building programs for establishing national waste data collection systems.

It is necessary to implement reliable and comprehensive data collection systems for waste composition at the local level. Before initiating an incineration project, it is necessary to have in-depth knowledge of the composition and volume of waste at the local level. Therefore, it is essential to have reliable data collection systems that provide long-term data of local waste composition to account for seasonal variation. Four actions can be taken to address this missing information.

Action 2.1: Assist African governments in developing data collection systems on waste composition at the regional, national, city, and local levels.
Waste collection levels are much lower than the levels of waste production, with a gap strongly correlated to country income level. In 2012, only 44% of the waste generated was collected on average for the region, with significant differences between countries: less than 24% of waste was collected in Benin, while up to 96% was collected in Mauritius (Scarlat et al. 2015). Within each country, collection rates also differ between regions, cities, and even neighborhoods.

Action 2.2: Assist in creating data collection systems that cover average annual waste composition.
Waste that is used as an energy source is heterogeneous. Paper does not burn like plastic, which does not burn like food waste. Each type of waste has its own calorific value corresponding to the thermal energy released during combustion of one kilogram of material. The average calorific value of a heterogeneous set of municipal waste determines its combustibility, and therefore, the energy potential that can be extracted to produce electricity. This variable is not fixed, and tends to increase with a country's economic development and standard of living (Hoornweg and Bhada-Tata 2012). As disposable incomes increase, consumption patterns change and evolve, resulting in changes in waste production.

Action 2.3: Gather information on waste composition flows.

Like consumption, waste composition fluctuates depending on the time of year. It may change according to the seasons, or be influenced by local customs such as traditional festivals or holidays (Miezah et al. 2015; Ofori-Boateng et al. 2013; Marshal et al. 2016). Annual precipitation is also an important factor. While it does not directly affect the calorific value of the waste, precipitation alters the moisture content, and therefore, combustibility. Humidity greatly reduces waste incineration potential.

Action 2.4: Data must also be collected on the influx of waste to landfills.

In sub-Saharan Africa, conditions that allow for continuous shipment of waste to the power plant are not always met. The variability and lack of data on waste composition may cause discontinuity in waste shipment. Plant operation can be interrupted if there is an interruption of waste influx.

Action 3: Articulate waste management policies toward a more effective system, considering the specific requirements of waste-to-energy technology.

The implementation of incineration projects would be facilitated by sharing good practices for the development of the projects, and more generally, for improvement of the waste management sector. Incineration can reduce more than 90% of the initial volume of waste (Hoornweg and Bhada-Tata 2012), and considerably reduce the final mass of waste that will be buried. Reducing the waste makes it easier to find optimal landfill sites located away from urban areas and water reservoirs. It also lowers the cost of investment necessary for environmental protection measures, such as the installation of mineral or plastic coatings to waterproof landfill soils. Energy produced from waste could potentially replace power plants that use fossil fuels, and could cope with the low capacity to generate electricity. Monni (2012) estimated that a power plant fueled by municipal waste emits between 35% and 60% less pollutants than a fossil fuel power plant, after considering the equivalent of methane emissions that would have been released in a landfill. In addition, implementing waste-to-energy technology could play a part in providing the 20 million jobs needed to absorb the flow of youth into the labor market each year. Three main recommendations are made to improve waste management policies.

Action 3.1: Take action to establish waste management plans more suited to incineration.

From the financial point of view, utilizing waste-to-energy technology to manage waste is not attractive, either in the waste management sector or the electrical sector. The costs of incineration to treat waste are much higher than the costs associated with landfills, especially when the sector is underdeveloped and its organization is partly informal, as in Africa. In the electricity sector, the capital and operating costs of incineration are very high compared to other available technologies (Menikpura, Sang-Arun, and Bengtsson 2016). In addition, the risks of plant shutdown and the additional costs linked to the discontinuous supply of waste are not insignificant. Therefore, these projects are hardly viable financially.

Action 3.2: Assist in sorting waste to ensure that only those items with the highest calorific value are incinerated.

To increase the calorific value of waste, and improve the profitability of the plant, it may be worthwhile to implement simple measures such as separating organic waste from other waste at the source. Organic waste can be used as compost, while the rest can be sent to the incineration plant. Once organic waste is separated, the average calorific value of incinerated waste will increase, improving the efficiency of waste-to-energy plants. In the short term, the interest of incineration projects in sub-Saharan Africa, therefore, does not necessarily lie in their financial profitability, but in their capacity to promote the development of a more efficient waste management sector.

Action 3.3: Assist in optimizing waste collection via collective containers.

Despite the presence of collective containers in city districts, their numbers are insufficient. Since they are rarely emptied, these containers are often saturated and the waste piles up around them. Due to the lack of containers, households must travel farther to deposit their waste in the skips, adding to the arduousness of the task. The result is the proliferation of waste deposits in ditches, abandoned land, or on the edge of the numerous streams below the city.

Disclaimer

This policy brief was developed and written by the authors and has undergone a peer review process. The views and opinions expressed in this policy brief are those of the authors and do not necessarily reflect the official policy or position of the authors' organizations or the T20 Secretariat.

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