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# Securing sustainability and access to energy in low- and middle-income countries: opportunities for the 'Hayah Karima' programme in Egypt

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## Summary

"Hayah Karima" or "Decent Life" is a national initiative that aims to improve the quality of life and provide better services in rural and unplanned settlements in Egypt within the framework of the Sustainable Development Strategy: Egypt Vision 2030. This paper is based on a study that employed a transdisciplinary approach to identify barriers and pathways for low-carbon development in three of the most densely populated governorates in Egypt. The findings revealed the significant sustainability benefits of waste-to-energy and sludge-to-energy projects compared to other renewable energy resources. We evaluate the prospect of developing integrated decentralized plants to achieve SDGs and explore the potential of these plants in enabling a just sustainability and energy transition in the targeted settlements of "Hayah Karima".

## Key Policy Recommendations

- Governmental authorities at national, regional, and local levels need to form collaborative partnerships with researchers and local communities to develop and adopt Integrated Decentralized Plants (IDPs), a novel approach to integrating waste-to-energy technologies in one decentralized plant.
- IDPs must address the gaps in accurate, high-quality data for sustainable resource management, which needs to be part of a stronger regulatory framework governing waste management to promote circular flows.
- International funding agencies need to provide financial support to aid the development and deployment of IDPs, particularly for informal settlements and rural areas in Global South states, places often infrastructurally disadvantaged.

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# Introduction

More than one billion people currently live in informal settlements[1], with the proportion in Global South cities being between 30% to 50%, and as high as 65% in Cairo and 70% in Dar es Salaam [2, 3]. Such settlements typically provide only limited access to basic services, such as electricity, water, and sanitation, have shortages of adequate housing, poor waste collection and management, and have illegal connections to national grids [2, 4–6]. Given projected population and urbanization growth rates in the Global South, it is crucial to address sustainability challenges arising from informal settlements and build climate-resilient places [7].

One key policy response to these challenges is to engage in sustainable resource management (SRM) to maximize the use of renewable resources and minimize waste generation and waste disposal to enable policymakers to achieve the Sustainable Development Goals (SDGs), whether they are directly or indirectly linked to resource management [5, 8]. SRM requires quantifying, assessing, and controlling inputs (such as energy, water, and food) and outputs (such as solid waste, wastewater, and emissions) [9] of human settlements to assist in creating integrated SRM strategies [5]. However, the characteristics of informal settlements complicate the development of robust SRM strategies due to the lack of high-quality data and the lack of infrastructure that are necessary for SRM and developing circular resource flows [5–6, 10].

Nonetheless, sensitivity to local circumstances is necessary to, for example, ensure that plans to reduce waste do not adversely affect groups who sustain themselves from informal activities. Hence, there is a need to recognize the dynamics of complex systems and develop context-sensitive interventions. One policy that has been developed and is being implemented to this end is “Hayah Karima”. This brief will propose Integrated Decentralized Plants (IDPs) to address the multiple complex issues regarding resource management in this context in Egypt.

# Hayah Karima and Integrated Decentralized Plants

**“Hayah Karima” (HK) or “Decent Life”** is a national initiative that aims to improve the quality of life and provide better services in rural and unplanned settlements in Egypt within the framework of the Sustainable Development Strategy: Egypt Vision 2030[2] [12–13]. Initially targeted at countryside areas, the programme now also covers informal areas. HK is focused on developing an integrated package of services for these areas, covering health, social development, and living conditions. There is potential for HK to align more closely with the SDGs and the principles of the Waste Wise Cities (WWC) programme [11]. To this end, we propose the development of IDPs as an intervention for enabling sustainability transition and community transformation in the targeted areas of HK, but also with the potential to be deployed elsewhere.

**An Integrated Decentralized Plant (IDP)** is a small-scale (or compact) plant that includes the following: 1) a wastewater secondary treatment

[1] The definition used by the Organization for Economic Co-operation and Development includes “areas where groups of housing units have been constructed on land that the occupants have no legal claim to or occupy illegally” and “unplanned settlements and areas where housing is not in compliance with current planning and building regulations (unauthorized housing)” [1].

[2] See https://www.hayakarima.com/phases_en.html

plant; 2) a municipal solid waste treatment plant (including sorting and recycling facilities); 3) a waste-to-energy facility for the treatment of sludge and food waste and production of biogas or green hydrogen; 4) a monitoring and controlling unit; and 5) a skills, training, and public engagement centre for all stakeholders such as civil society, private, public, and informal sectors. All these aspects of SRM currently exist; what is distinctive about the concept of an IDP is that these elements are all brought together and are mutually reinforcing and centred around a single decentralized plant. Such an approach needs to be embedded in wider governance reform of waste management systems at local levels, particularly in informal settlements and rural areas, which are invariably poorly served in terms of waste and energy infrastructure. Based on the empirical observations of the fieldwork underpinning this brief, the following objectives of IDPs have been identified:

1. providing better access to clean, affordable, and reliable energy and minimizing the use of non-renewable energy resources;
2. reducing the pressure on the national grid and illegal connections (including energy, electricity, and water networks);
3. improving municipal solid waste and sanitation services to reduce their environmental and social impacts to avoid the contamination or (pollution) of the limited water resources [5–6];
4. reducing energy and transportation costs of wastewater and municipal solid waste to centralized treatment plants;
5. providing job opportunities, adequate training, and skills development to reduce unemployment rates; and
6. improving the quality of data on solid waste generation and composition and wastewater generation [5–6] to better track the resource flows and manage secondary resources (quantify, measure, and control).

**Figure 1** maps how these objectives align with the aims and objectives of HK and the principles of WWC and SDGs. IDPs provide integrated solutions to address multiple sustainability challenges by embedding circular flows and harvesting local resources to enhance communities' resilience to climate change [14].

# Methodology

This policy brief is based on research that employed a transdisciplinary approach to identify the barriers and pathways to low-carbon development in Egypt (national level) and three of the country's most densely populated governorates (local level) [5]. The study applied the urban metabolism framework [5, 10] – an approach focused on the flow of materials through urban systems – and used an indicator set to collect data on population, the economy, biophysical characteristics, consumption and production of energy, electricity, and water, generation of solid waste and wastewater, and access to basic services [5–6]. The temporal dimension was included to identify changes in consumption and production patterns over time[3] [5–6]. Site visits[4] and semi-structured interviews[5] were conducted to understand the challenges and opportunities in providing basic services and challenges of resource management in various types of settlements.

[3] Data were collected for the period 2000–2016.

[4] More than 11 site visits to various types of settlements (low-, medium-, and high-density, planned and unplanned urban settlements) [5–6]. Handwritten notes and photographs were taken during these visits. These were organized, coded, analysed, and merged with the results of the study.

[5] High-level key stakeholders from the Ministry of Environment, the Ministry of Electricity and Renewable Energy, the Holding Company for Water and Wastewater, and the Cairo Cleaning and Beautification Authority [5–6].


*Figure 1: Integrated Decentralized Plant (IDP) objectives mapped against Waste Wise Cities (WWC) principles, the Sustainable Development Goals (SDG), and Hayah Karima (HK) objectives*

The growth of informal settlements surrounding one of the tourist attractions of Cairo Governorate *(Source: author's site visits [5]).*

The growth of informal settlements surrounding one of the tourist attractions of Cairo Governorate *(Source: author's site visits [5]).*

Unplanned growth on agricultural land *(Source: author's site visits [5]).*

An unplanned settlement in Cairo Governorate showing urban forms, the poor quality infrastructure, and narrow streets preventing efficient flow of resources *(Source: author's site visits [5]).*

> *"There is potential for HK to align more closely with the SDGs and the principles of the Waste Wise Cities (WWC) programme"*

PHOTOS: YESMEEN KHALIFA [6]

A dumpsite near the ring road and an informal settlement in Cairo Governorate. This photo shows that residents use this area as a dumpsite, creating an environmental and public health hazard *(Source: author's site visits [5]).*

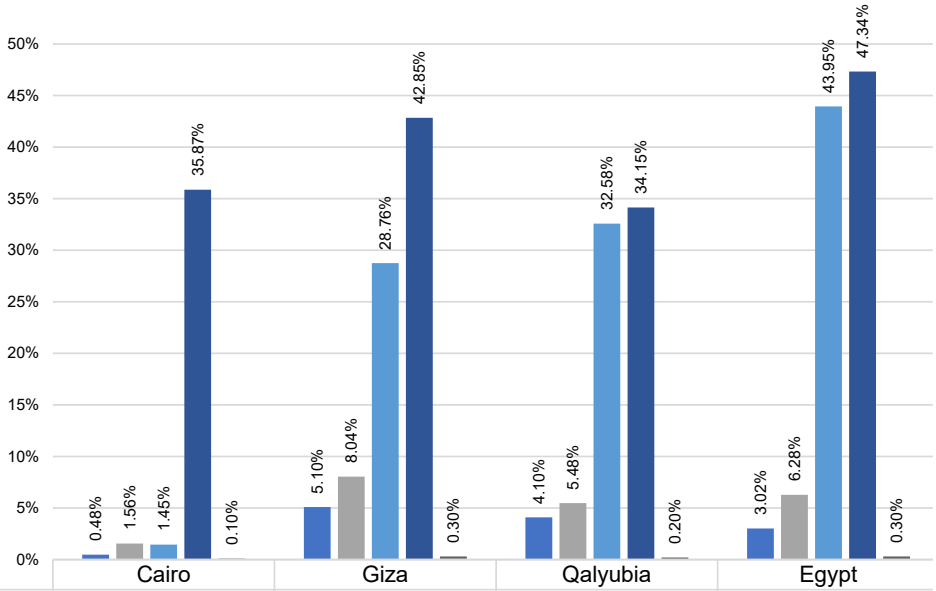
# Key Findings

The rational for IDPs as part of Hayah Karima and other Global South settings arises from our research which revealed a significant gap between urban areas and rural and unplanned settlements in terms of accessibility to basic services and the distribution of resources (see **Figure 2** and **Table 1**) [5]. Major challenges were identified in the energy, electricity, water, wastewater, and solid waste sectors. This includes the lack of an integrated sustainable waste management system, limited access to sanitation services in rural and unplanned settlements, limited water resources, high percentages of water and electricity losses due to illegal connections, and ageing infrastructure. All of which contribute to the challenges of quantifying resource flows in order to achieve an effective strategy for SRM [see 5–6].

*Table 1: Percentages of households according to the type of fuel used for cooking in 2017 [5].*

| | CAIRO | GIZA | | QALYUBIA | | EGYPT | |
|---|---|---|---|---|---|---|---|
| | | Urban | Rural | Urban | Rural | Urban | Rural |
| Gas Cylinder | 29.51% | 33.77% | 92.82% | 34.81% | 91.48% | 45.61% | 96.48% |
| Natural Gas | 70.19% | 65.78% | 6.83% | 64.98% | 8.30% | 54.10% | 3.35% |
| Electricity | 0.24% | 0.41% | 0.32% | 0.16% | 0.18% | 0.24% | 0.10% |
| Solar Energy | 0.03% | 0.03% | 0.01% | 0.03% | 0.02% | 0.02% | 0.01% |
| Kerosene | 0.02% | 0.01% | 0.02% | 0.01% | 0.02% | 0.03% | 0.04% |
| Other | 0.01% | 0.01% | 0.00% | 0.01% | 0.01% | 0.01% | 0.02% |

*Figure 2: Percentages of households without access to basic services in 2017 [5].*




| | Cairo | Giza | Qalyubia | Egypt |
|---|---|---|---|---|
| % of households without direct access to water | 0.48% | 5.10% | 4.10% | 3.02% |
| % of households without direct access to drinkable water | 1.56% | 8.04% | 5.48% | 6.28% |
| % of households without sanitation | 1.45% | 28.76% | 32.58% | 43.95% |
| % of households living in areas without public waste collection | 35.87% | 42.85% | 34.15% | 47.34% |
| % of households without grid electricity connection | 0.10% | 0.30% | 0.20% | 0.30% |

The research showed that waste-to-energy and sludge-to-energy address multiple sustainability challenges and fit with the characteristics of the selected case studies compared to other renewable energy resources [5–6]. For example, the existing grid infrastructure in high-density, unplanned areas faced challenges in developing solar power due to extensive illegal connections [6]. The potential to implement innovative technologies, such as waste-to-energy schemes, or to learn from other cities has been recognized by the United Nations [11]. We hence evaluated the prospect of developing Integrated Decentralized Plants (IDPs) to achieve SDGs and explore the potential of these plants in enabling a just sustainability and energy transition in the targeted settlements of Hayah Karima.

# Challenges

The concept of an IDP has challenges. First, the local percentages of municipal waste collection and sanitation services in informal settlements and rural areas are low [5–6, 15]. This means that achieving the scale of waste needed to sustain an IDP could be challenging [see 5–6 for further information]. Second, the current regulatory system needs to be strengthened and orientated to work with civil society, private, and informal actors to ensure that the reform is equitable. Third, partnerships with these actors need to be forged to support IDPs due to the limited institutional, financial, and technical capacities of local actors in the Global South. A key element of such partnerships needs to be the support of international funding agencies. Given the weak fiscal capacity of states in the Global South, the provision of financial support is essential to aid the development and deployment of IDPs in informal settlements and rural areas.

These actors could be developed and deployed to help generate social acceptance of such a programme. Given the scale of rapid population growth and urbanization described earlier, if IDPs could be made to work in Egypt, they are likely to be feasible in diverse places.

# Recommendations

## For Hayah Karima:

- For Integrated Decentralized Plants (IDPs) to be successful, it is important that they align with Waste Wise Cities' 12 principles [11], including the '5 Rs': Rethink, Reduce, Reuse, Recycle, and Refuse the use of single-use items.
- IDPs and Hayah Karima (HK) need to be developed to enhance the working conditions of waste workers in both formal and informal sectors.
- IDPs need to be woven into the plans for HK and other Global South cities.

## For the Global South:

The lessons from Hayah Karima and the concept of an IDP offers potential to develop integrated designs to address the management of waste in informal settlements in other contexts. IDPs are particularly likely to be viable for development in the Global South due to their scalability and ability to fit in various contexts. For example:

- In places with limited access to sanitation services, public toilets could be added to the IDPs;
- In high-density urban settlements where electric vehicles (EV) are being introduced, public EV charging points could be added to the IDP; and
- In low-and medium-density settlements, where land is available, solar panels could be added to the IDP.

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