

Bio Energy

Alternative Fuels



**Agriculture waste
as an opportunity**

BioEnergy Early Start

Since its foundation, BioEnergy has been transforming tons of waste into a local and affordable source of energy for energy-intensive industries (EIIs).

In 2012, BioEnergy created a collection and pre-processing platform to transform agriculture waste into **Alternative Fuels and Raw Materials (AFR)** for cement industries.

BioEnergy was awarded by **Synergos** - a global organization, headquartered in New York, focused on sustainability – as one of “**Egypt pioneers**” in the field of providing sustainable energy.



The screenshot shows a profile page for Mahmoud Galal on the Synergos website. The page includes a header with the Synergos logo and navigation links. The profile section features a photo of Mahmoud Galal, his name, and the title 'Pioneer of Egypt'. Below this is a short bio and a quote about his work with Dayra, focusing on recycling waste to improve health and provide sustainable energy.

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 **Mahmoud Galal**
Pioneer of Egypt

Recycling waste to improve health, income and protect the environment while providing a sustainable energy source

Mahmoud is the founder of Dayra, offering comprehensive waste solutions for rural communities. After working for years in the field of environmental studies and waste management, Mahmoud noticed a variety of issues in Egypt. As landfills fill up and disposal costs rise, it is now estimated that 50% of Egypt's waste is not collected and is instead burned in fields and streets. This form of waste disposal is both environmentally unsustainable and physically dangerous.

Through Dayra, Mahmoud aims to tackle the root cause of this problem, and at the same time provide employment opportunities in the affected communities. Dayra works to collect, sort, recycle, and sell waste for commercial use as an alternative energy source. With increasing prices for fossil fuels, Dayra's waste recycling approach provides a cheap alternative fuel source for energy intensive industries.

Dayra's impact is felt across multiple sectors as farmers earn income by selling agricultural waste, local workers are employed to collect, sort, and deliver waste, consumers realize savings from the cheaper fuel, and environmental and health problems are reduced.

BioEnergy Today

Throughout the years, BioEnergy expanded its portfolio and product range.

Today BioEnergy produces and supplies different kind of AFR to world-renowned cement groups such as:

- ❑ **SuezCement Group SCGC (HeidelBergCement Group)**
- ❑ **ArabianCement (Cementos la Union)**
- ❑ **Lafarge Egypt**



THE PROBLEM

Egypt's Energy Crisis:

The political unrest led Egypt to unprecedented **energy crisis**.

The severe **shortages of natural gas** between 2013 and 2014 caused a **20% drop in the cement industry's average production**, in some cases up to 50%.

Even if the shortages eased in 2015, domestic energy prices continued to rise.

In 2015, the Egyptian government authorized the cement industry (which accounts 5% of GDP) to import **coal**.

Switching to coal will nearly **double the industry's CO₂ emission**: the coal has a CO₂ factor of 402 kg/GCal doubling the one of natural gas (216 kg/GCal).

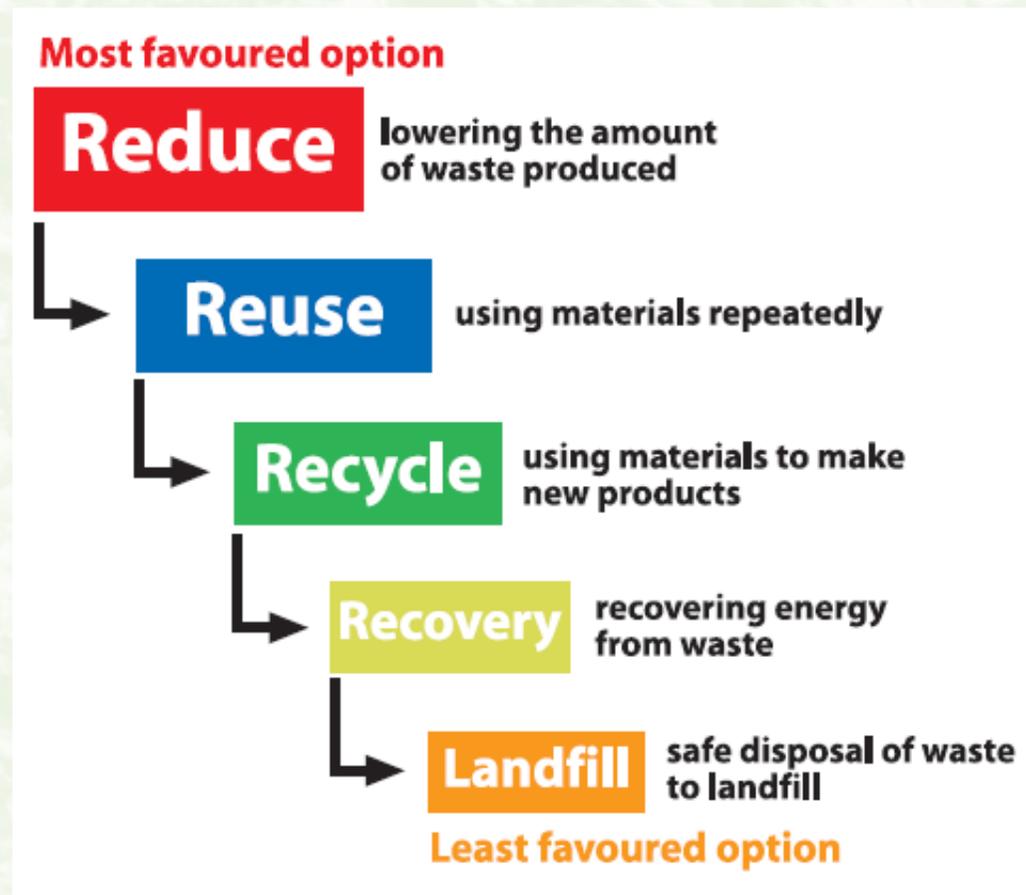
In 2015, Egypt generated approximately **24 millions tons of MSW (just 59% are collected)**, with an annual increase estimated at 3.4%.





WASTE MANAGEMENT HIERARCHY

The waste management hierarchy indicates an order of preference for actions to manage waste based on **sustainability**.



THE SOLUTION

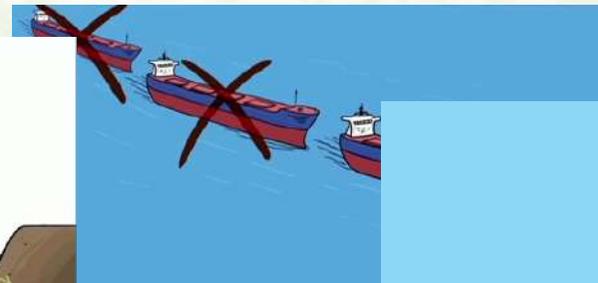
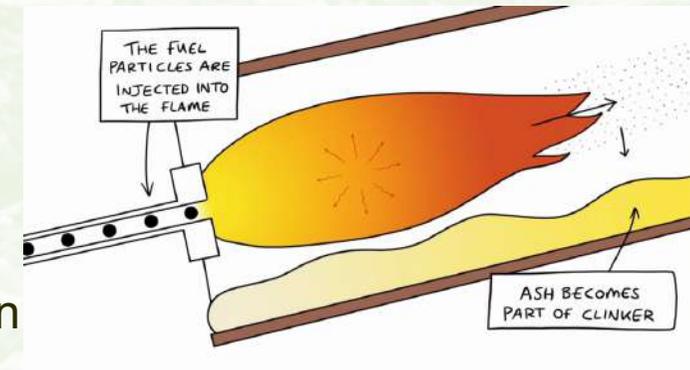
Waste can be used as replacement of fossil fuels or raw materials in cement industry.

This process is called:

Co-processing : Material Recycling + Energy recovery

The use of AFR in cement industry implies economic and environmental advantages:

- Reduction of landfill disposal and green house gas
- Reduction of fossil fuels dependence and importation
- AFR is a local and cheaper source of energy
- Reduction of CO₂ emission: ΔCO_2 (ton/ton coal replaced) = -1.55 (IFC, 2016).





WASTE TO FUELS

Alternative Fuels (AFR) derived from different kind of waste:

1) **Biomass**: fuel produced by shredding agriculture waste such as rice straw and tree trimmings.

2) **Refuse Derive Fuel (RDF)**: RDF is a fuel produced by shredding and dehydrating rejects from MSWs.

3) **Industrial, oil and sewage sludge**: fuel produced through dehydrating of different kind of sludge.

4) **Tires Derive Fuels (TDF)**: fuel produced by shredding end-of-life tires.



Mixing different kind of waste increase the calorific value of Alternative Fuels!

WASTE BENCHMARKING

Waste Stream	Quantities available (tons/year)	Calorific Value (Gcal/ton)	ΔCO_2 (ton/ton coal replaced)	Advantages	Disadvantage
RDF 	2 to 5 million	3.1 – 3.8	- 0.4	<ul style="list-style-type: none"> • Plentiful supply • Good CV 	<ul style="list-style-type: none"> • Low collection • Illegal dumping
Biomass 	15 million	3.6 – 3.8	-2.5	<ul style="list-style-type: none"> • Highest availability • Higher CV than RDF and DSS • Biomass is carbon neutral 	<ul style="list-style-type: none"> • Geographic dispersion • Seasonal supply
DSS 	982.992	2.5 – 6.9	-2.5	<ul style="list-style-type: none"> • Good CV • Consistent chemical characteristics • Lower CO_2 emission 	<ul style="list-style-type: none"> • Handling hazardous waste • Investing for drying required
TDF 	Limited amounts	6.0 – 8.4	0.8	<ul style="list-style-type: none"> • Highest CV 	<ul style="list-style-type: none"> • Co processing of TDF is illegal • Other industries use tires

BIOMASS AVAILABILITY IN EGYPT

Agriculture waste constitute the first component of all waste generated in Egypt:

30-35 millions =36% of the total generated

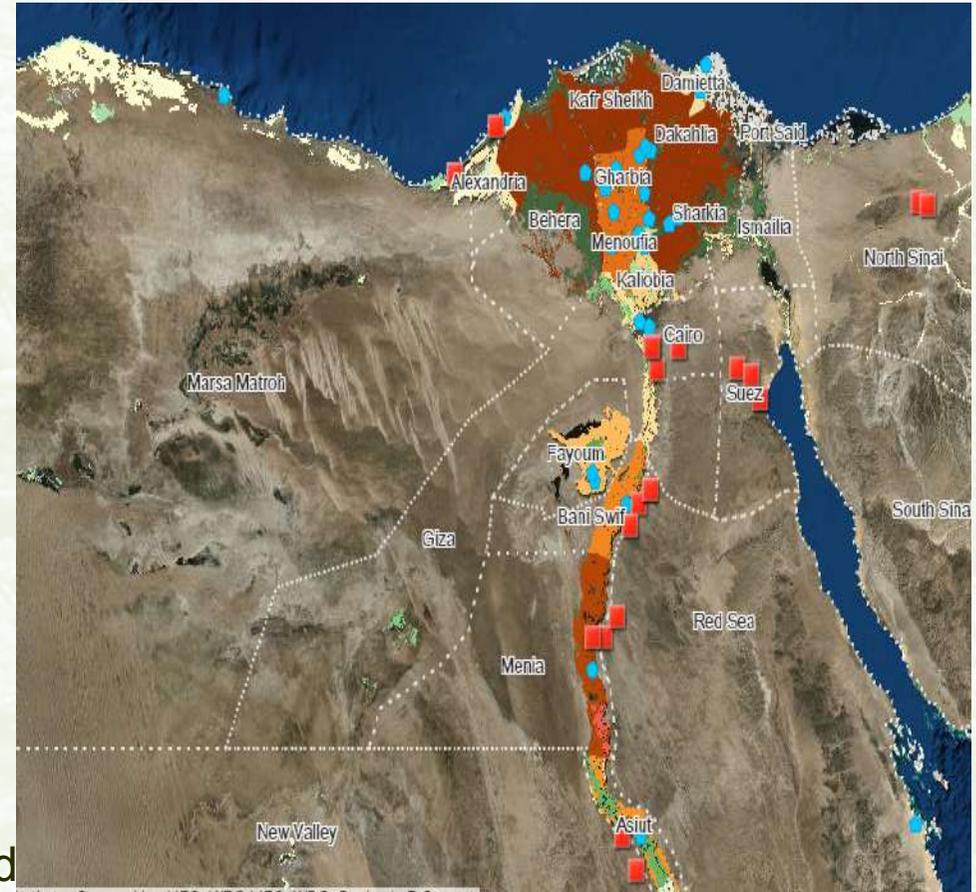
(Source: NSWP, 2013; HCWW, 2014; HCWW, 2016)

12 to 15 millions tons of agriculture waste is unused, disposed of, or burned

(El Essawy, 2014)

This presents enormous untapped potential.

Agricultural waste in Egypt are, as one would expect, highly concentrated around the Nile and Nile Delta areas, where are located most the cement plants too.



CO₂ MITIGATION BY AFR

In 2015, Egyptian government authorized the issuance of coal importation license in favor to cement companies with the executive regulation Decree 964/2015.

Coal has a CO₂ emission factor (216 kg CO₂/Gcal) double than the one of natural gas (402 kg CO₂).

So, the coal license will be granted only to those firms which would present a greenhouse gases (GHGs) plan to mitigate the difference between the consumption of coal and the consumption of HFO = required reduction of 5.3 millions ton of CO₂.

Incineration of biomass significantly reduce the CO₂ emissions, as agriculture waste are CO₂ neutral emissions.

Waste stream	Emission Factor (KgCO ₂ /Kcal)	ΔCO ₂ ^{a,b} (ton/ton coal replaced)	Required amount mitigate GHGs to difference (million tons/year)
RDF 	115	-0.4	4.4
Biomass 	0	-2.5	3.8
DSS 	0	-2.5	5.3
TDF 	355	-0.8	2.2

AFR STATUS IN EGYPT

The last statistics available for AFR use in Egypt refers to 2014 (IFC, 2016).

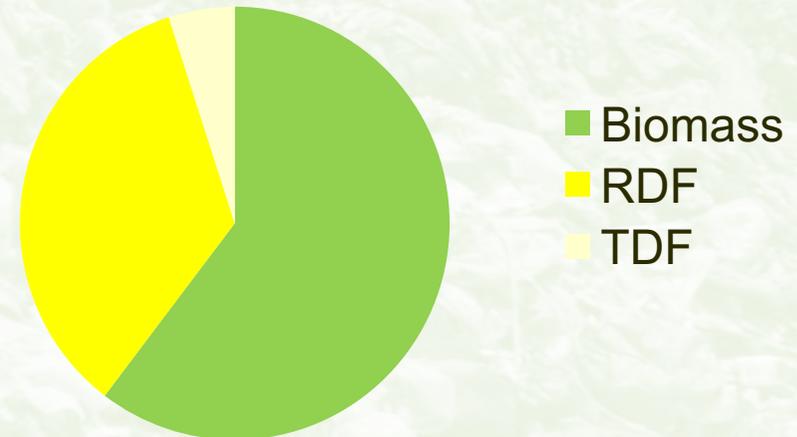
In 2014, in Egypt 8 plants were using AFR and 3 of them were using RDF.

In 2014, the average TSR across cement industry was 5.4% and 9.6% between plants which are using AFR.

In 2014, they were consumed (IFC, 2016):

AFR Consumption in 2014

- ❑ 388,000 tons of biomass (57%)
- ❑ 223,000 tons of RDF (38%)
- ❑ 32,000 tons of TDF (5%)



Four companies are in preparation stages to co-process AFR.

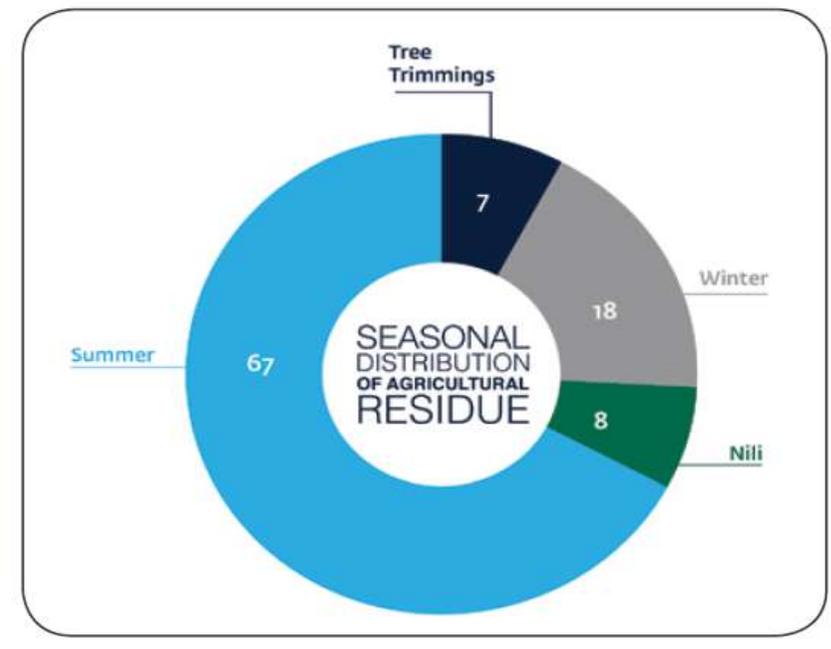
Interviewed by IFC in 2015, 2 of the 4 plants declared that they will be equipped with a dosing system for coarse solid waste by the end of 2015, 1 will be equipped in 2016 and the remaining in 2017.

CHALLENGES IN REUSE BIOMASS

Open-air burning is the most common practice between farmers to dispose agriculture waste, contributing to the seasonal “Black Cloud” phenomenon.

Indeed the reuse of biomass implies several challenges:

- Agriculture land ownership is fragmented and therefore high cost of collection and transportation. And sometimes transportation it's impossible for lack of infrastructure.
- Low bulk density of biomass implies difficulties in transportation, handling, processing and firing.
- Fertilizers products from biomass are not economically viable (1 ton of fertilizer cost 300 EGP and it can be sold for 150 EGP)
- Seasonality



BIOMASS IS THE BEST SOLUTION FOR CEMENT INDUSTRY?

IFC study – “Unlocking the value: Alternative Fuels for Egypt’s Cement Industry” (2016) – concluded that agriculture waste are the best AFR for cement industry:

- Plenty of supply
- Easy and less costly processing
- Higher CO₂ emission reduction

Is that simple???????

Unfortunately, BioEnergy experienced that is not!

And even IFC study states that:

“All the plants interviewed have not yet started to use AFR but that have made decisive steps in this direction.....they intend to use only RDF and/or DSS. None is considering industrial waste for these reasons:

- **collection issues** (large volumes but disseminated over too many locations)
- **seasonality issues** (the plants can neither absorb all the volume in a short period of time nor store it during off-seasons, for safety reasons).



WHAT IS THE BEST SOLUTION?

Several studies show that for the cement industry, the best AFR procurement strategy is to mix different waste stream for two reasons:

- Mix different waste increase the calorific value of AFR.
- Rely on different kind of waste guarantee a constant supply of AFR, a fundamental requirement for the cement industry.

Therefore, there is not a best AFR for the cement industry, but the best solution is to mix different kind of waste!

However, we think that RDF should be prioritized rather than biomass, for environmental and economic/operational reasons.

We believe also that biomass should remain a relevant AFR for the cement industry.

Indeed, the quantity of agriculture waste available is huge to imagine that they might be totally recycled or converted in biogas/biodiesel.

And there is no doubt that the practice of burning waste is more environmentally harmful than co-processing:

With the Black Cloud we loose energy and we emit toxic elements in the atmosphere!!

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***THANKS FOR YOUR KIND
CONSIDERATION!!!***