Goal 1: No poverty
Goal 2: Zero hunger
Goal 3: Good health and well-being for people
Goal 4: Quality education
Goal 5: Gender equality
Goal 6: Clean water and sanitation
Goal 7: Affordable and clean energy
Goal 8: Decent work and economic growth
Goal 9: Industry, Innovation, and Infrastructure
Goal 10: Reducing inequalities
Goal 11: Sustainable cities and communities
Goal 12: Responsible consumption and production
Goal 13: Climate action
Goal 14: Life below water
Goal 15: Life on land
Goal 16: Peace, justice and strong institutions
Goal 17: Partnerships for the goals
Goal 6: Clean water and sanitation
"Ensure availability and sustainable management of water and sanitation for all."

Goal 9: Industry, Innovation, and Infrastructure
"Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation".

Goal 11: Sustainable cities and communities
"Make cities and human settlements inclusive, safe, resilient, and sustainable."[1]

Goal 13: Climate action
"Take urgent action to combat climate change and its impacts by regulating emissions and promoting developments in renewable energy."

Goal 14: Life below water
"Conserve and sustainably use the oceans, seas and marine resources for sustainable development."
<table>
<thead>
<tr>
<th>Driver</th>
<th>Sustainable Development Goal (SDG)</th>
<th>Specific Target</th>
<th>Solid Waste Management (SWM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection of public health</td>
<td>SDG 11: Sustainable cities</td>
<td>11.1 Ensure access for all to adequate, safe, and affordable basic services; upgrading slums</td>
<td>Goal 1. Ensure access for all to adequate, safe, and affordable solid waste collection services. Uncollected waste is often dumped in waterways or burned in the open air, thus directly causing pollution and contamination. Waste also clogs the drains, which exacerbates floods, keeping stagnant water and contributing to water-borne diseases and malaria. Children are among the most vulnerable, so they are affected the most.</td>
</tr>
<tr>
<td></td>
<td>SDG 3: Good health and well-being</td>
<td>3.2 End preventable deaths of children under 5 years 3.3 End malaria and combat water-borne diseases 3.9 Reduce illnesses from hazardous chemicals and air, water and soil pollution, and contamination</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SDG 11: Sustainable cities</td>
<td>11.6 Reduce the adverse environmental impact of cities; special attention to waste management</td>
<td></td>
</tr>
<tr>
<td>LOCAL</td>
<td>SDG 12: Responsible consumption and production</td>
<td>12.4 Environmentally sound management of chemicals and all wastes in order to minimize their adverse impacts on human health and the environment</td>
<td>Goal 2. Eliminate uncontrolled dumping and open burning, as the first stepping-stone to achieving environmentally sound SWM practices.</td>
</tr>
<tr>
<td></td>
<td>SDG 6: Clean water and sanitation</td>
<td>6.3 Improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous materials</td>
<td>Goal 3. Achieve environmentally sound management of all wastes, particularly hazardous wastes (either chemical or biological hazardous wastes).</td>
</tr>
<tr>
<td></td>
<td>SDG 15: Life on land</td>
<td>15.1 Ensure the conservation of terrestrial and inland freshwater ecosystems and their services</td>
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</tr>
<tr>
<td>Protection of the environment</td>
<td>SDG 7: Affordable and clean energy</td>
<td>7.2 Increase the share of renewable energy in the global energy mix</td>
<td>Goal 3. SWM technologies can derive renewable energy from (organic) waste.</td>
</tr>
<tr>
<td>GLOBAL</td>
<td>SDG 13: Climate action</td>
<td>SDG 13: Take urgent action to combat climate change and its impacts</td>
<td>Goal 3. Adequate SWM practices can prevent emissions of large amounts of greenhouse gases.</td>
</tr>
<tr>
<td></td>
<td>SDG 14: Life below water</td>
<td>14.1 Prevent marine pollution of all kinds, in particular from land-based activities, including marine debris</td>
<td>Goal 1 and Goal 2. Extending waste collection to all and eliminating uncontrolled dumping will prevent waste (particularly plastics) ending up in the oceans.</td>
</tr>
</tbody>
</table>
Solid Waste Management

Is key utility service that more than 2 billion people are currently lacking, solid waste management (SWM) is a crosscutting issue that can be directly linked to 12 out of the 17 UN Sustainable Development Goals (SDGs). Action needed covers physical components and governance aspects concerning basic solid waste collection services and controlled disposal. The United Nations Environment Programme (UNEP)'s 2015 Global Waste Management Outlook describes the governance issues in SWM and was subjected to commentary of large group of stakeholders from six continents. The study identifies a combination of complementary instruments required for extending collection to all and bringing disposal under control. While municipalities have a legal responsibility for providing services to their citizens, various service providers can contribute to an effective SWM system. Appropriate forms of funding are essential to secure financial sustainability of the services under the local conditions of affordability and willingness to pay. As new services require behavioral change on the part of citizens and municipal waste departments alike, Communication, exchange between stakeholders and capacity development of municipalities is crucial.
Goal 6: Clean water and sanitation
"Ensure availability and sustainable management of water and sanitation for all."

Goal 9: Industry, Innovation, and Infrastructure
"Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation".

Goal 11: Sustainable cities and communities
"Make cities and human settlements inclusive, safe, resilient, and sustainable."

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Goal 14: Life below water
"Conserve and sustainably use the oceans, seas and marine resources for sustainable development."
Contribution of AASTMT to support the Egyptian Government in implementing the National Waste Management Plan

Arab Academy for Science, Technology & Maritime Transport

Prof AbdelMonem Sanad

Assistant President for Environmental Studies and Sustainable Development
Ministry of Environment
Waste Management Regulatory Agency

Project
Korimate Recycling Complex

Consultant
AASTMT
Largest Egyptian SWTP

Separation, Treatment, Recycling, and Safe Disposal of Solid, Industrial and Hazardous Waste
Project
Project

62 km South of Cairo
500 Hectares
Treated Waste: 6000 ton/day
Consultant Team

Pr. Adel Belal, M. Ahmed A-Aziz, Dr Akram Soltan, Pr. Ayman Wanas, Dr Deif Soilman, Dr Ebtisam Yehia, Pr. Gamal Kotb, Pr. Hussein AboBakr, Pr. Khaled Shehata, Dr Mostafa Rostom, Dr Mostafa Youssef, Pr. Mostafa AbdelWarith, Dr Ola Monayeri, Dr Sameh AboSeoud, Dr Sameh Shabaan, Dr Sherif Sharkawy, Dr Tarek Eid, Pr. Yasser Galal
Duration of Consultancy Work: 8 months

I) Inception report
II) Site Surveying and Soil Characteristics
III) Urban Planning and Conceptual Design
IV) Detailed Design
V) Environmental Impact Assessment
VI) Feasibility Study
## Consultancy Works

### Field Works
- Land Survey & control points
- Bore holes & Soil tests

### Hydrogeology Studies
- Geophysics Tests & Study
- Flood Risk Study & protection

### Architecture & Urban Planning
- Current Status & Quantities
- General Layout
- Design of housing & service Facilities
- Design of Administration Facilities
- Design of Warehouses & Factories

### Civil Design
- Leveling & Roads Design
- Water Networks; Sewage, Irrigation
- Fire Fighting, Pump Station & Tank
- Design of Steel Structures
- Design of RC Buildings

### Electro-mechanical work
- Separation & Recycling Units
- Treatment Units & Incinerators
- Electrical works

### Environmental Social Impact Assessment

### Feasibility Study
Site Investigation
Site Topography
Geology & Soil Characteristics
Project Components

**Infrastructure**
- Flood Protection Works
- Roads
- Water & Drain Networks
- Electrical Network

**Industrial Zone**
- Reception Area
- Separation Area
- Recycling Factories
- Incinerators

**Construction Zone**
- Housing Zone
- Service Zone
- Administration Zone

**Land Fill Zone**
- Solid Waste Cells
- Hazardous Cells
Road & Earthworks

Final Surface
Example of Traffic Circulation
- Industriel Zone -
| الكميات | الوحدة | توضيح بتوضيح
<table>
<thead>
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<th></th>
<th></th>
<th></th>
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<tbody>
<tr>
<td>21052135 م³</td>
<td></td>
<td>بالمتفرع المكعب أعمال تسوية ترابية بالقطط لطبية الأرض الموجودة بالموقع لجميع أنواع التربة وأيضاً للوصول إلى مناسبة التسوية المطلوبة، رقم البند 1</td>
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<td>2827881 م³</td>
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<td>بالمتفرع المكعب أعمال تسوية ترابية بالقطط من الأرض الموجودة بالموقع لجميع أنواع التربة وأيضاً للوصول إلى مناسبة التسوية المطلوبة، رقم البند 2</td>
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<td>7627240 م³</td>
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<td>بالمتفرع المكعب أعمال تسوية ترابية بالقطط لطبية الأرض الموجودة بالموقع لجميع أنواع التربة وأيضاً للوصول إلى مناسبة التسوية المطلوبة، رقم البند 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>تشمل أعمال الرش والدمشك وتجهيز السطح لاستقبال طبقة الأساس والمقاس الطبيه للمسطح الأفقية بعرض الطريق عند نهاية منشأة المردم لطبقة الأساس وحسب تعليمات الاستشاري وكذلك تشمل الفئة على نقل نتائج الحفر إلى المقالب العمومية طبقاً لأصول الصناعة</td>
</tr>
</tbody>
</table>
Water Network

Fresh Water, Fire Fighting & Irrigation

Reservoir
Waste Water Collection Lines
Treatment Units & Pump Station

Compact Unit (PS1)

Force Main to PS1

Force Main to PS2

Compact Unit (PS4)

SewerCade network

(PS3)
Reception Area

Weighing Station

- Number of weigh stations: 8
- Weight station volume: 18 m
- Height: 3 m
- Capacity of the load cell: 120 tons
- Number of workers in total: 24
Received Waste

The waste management project is focused on reducing waste from residential and industrial sources in the greater Cairo area. The waste capacity in the first stage is 6,200 tons per day distributed as follows:

- Municipal waste: 4,500 tons/day
- Garbage: 2,250 tons/day
- Organic materials: 580 tons/day
- Paper and cardboard: 450 tons/day
- Glass: 50 tons/day
- Hazardous waste: 500 tons/day
- Other materials: 500 tons/day

The waste is categorized and treated according to the following table:

<table>
<thead>
<tr>
<th>طن/يوم</th>
<th>النوع</th>
<th>م</th>
</tr>
</thead>
<tbody>
<tr>
<td>4500</td>
<td>Municipal waste</td>
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</tr>
<tr>
<td>500</td>
<td>Garbage</td>
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<tr>
<td>50</td>
<td>Organic materials</td>
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</tr>
<tr>
<td>50</td>
<td>Garbage</td>
<td>4</td>
</tr>
<tr>
<td>50</td>
<td>Hazardous waste</td>
<td>5</td>
</tr>
<tr>
<td>50</td>
<td>Other materials</td>
<td>6</td>
</tr>
<tr>
<td>500</td>
<td>Chemical waste</td>
<td>7</td>
</tr>
<tr>
<td>500</td>
<td>Hazardous waste</td>
<td>8</td>
</tr>
</tbody>
</table>
Solid Waste Treatment Cycle
Separation Zone

عدد خطوط الفرز: 10 خط بسعة 40 طن/ساعة للخط

الخطوط تفرز الآتي:

1. مخلفات عضوية
2. بلاستيك
3. زجاج
4. ورق – كرتون
5. معادن (حديد – نحاس – ألومينيوم)
6. خامات أولية للوقود البديل (Refuse-derived fuel - RDF)
منطقة تصنيع السماد العضوي – Compost

• يوجد في المشروع 2 منطقة لتصنيع السماد العضوي بطاقة إجمالية 2570 طن/يوم

خطوات تصنيع السماد العضوي:
1. مصفوفة للتخمير

المعدات الميكانيكية المطلوبة لكل مصفوفة:
1. عدد 10 جرار زراعي قدرة 100 حصان - لنقل السماد
2. عدد 10 قلابات هيدروليك بجرار زراعي ومزود بوصلة فرامل وكهرباء
3. عدد 5 مكينات تقلب قدرة الماكينة 250 حصان

بمدخل ماء أو خزان ماء للرش
يوجد في المشروع 2 منطقة لتصنيع الوقود البديل بطاقة اجتمالية 1060 طن/يوم.

- تنقل خامات ال-RDF من الفرز باستخدام خطوط نقل مباشرة و من منطقة تصنيع الاسماد العضوي ب 12 سيارة نقل.

خطوات تصنيع الوقود البديل للأسمنت:

1. مصفوفة للتجفيف
2. فصل الخامات الثقيلة بالهواء RDF
3. تقطيع خامات ال-RDF

المعدات المطلوبة لكل مصفوفة:

- 3 ماكينات تقليل 250 hp
- 1 لودر لعمل المصفوفة - 160 hp
- 2 حفار للتخزين والمناولة - 450 hp
Plastic Recycling

The plastic recycling plant processes different types of plastics with a daily capacity of 400 tons per day. The types of plastic and their quantities are as follows:

- Polypropylene (pp) - 100 tons/day
- High Density Polyethylene (HDPE) - 100 tons/day
- Low Density Polyethylene (LDPE) - 100 tons/day
- PET (polyethylene terephthalate) - 100 tons/day

Alternative processes:

- Washing and preparing the raw materials without crushing
- Crushing the raw materials in a ready-to-sell form without crushed.
Glass Recycling

Recycling unit 18 ton/hr
200 KW electricity
• كمية الورق والكرتون المعاد تدويره يوميا 360 طن.

بدائل التدوير:
1- كبس الورق والكرتون لبالات
2- فرم بالات الورق والكرتون وتحويلها لروولات

الورق يمكن التحكم في طوله 180 طن/يوم

X 2 Units
كمية المعادن والكبلات المعاد تدويرها يوميًا 90 طن
وحدة تدوير الحديد
وحدة تدوير النحاس
وحدة تدوير الالومنيوم

عدد خطوط التدوير 1 بسعة 5 طن/س للخط:
المعدات الميكانيكية المطلوبة لكل خط:
1- 1 لودر لتغذية الخط - سعة 2 م³ Bobcat
2- مكبس رأس الحديد - 5 طن/س
3- 1 ونش شوكة - 1 طن
Wood Recycling

- The recycling process involves cutting wood into small pieces and selling them.
- The necessary mechanical equipment for each line:
  1. 1 Bobcat - feeding line - 3 m³
  2. Cutting machine - 3 tons per hour - product line - 3-5 tons per hour

The total electrical power of the entire line for repeated harvesting of wood is 200 kilowatts.

- Number of workers in total for all lines = 10 workers
Industrial & Hazardous Zone

• 4 x محطة الوزن
• المعمل
• منطقة التشوش والتخزين
• وحدة فرز المخلفات الصناعية
• وحدة المعالجة الكيميائية (المعادلة)
• وحدة المعالجة الفيزيائية (التصلد)
• وحدة فصل وتدوير الزيوت
• وحدة معالجة المرتشحات
• برك التبخير
• المحرق
الكمية المعاد تدويرها 50 طن يومياً سعة الخط 4 طن/ساعة
المعدات:
1. لودر Bobcat حعان سعة 2 م3
2. مكينة نزع سلك الإطارات
3. مطحنة تنتج 50 مم
4. ماكينة تقطع 6-12 مم
5. ماكينة تقطع 1-4 مم
6. غربال هزار
7. مغناطيس كهربائي
8. عائمة تعبئة
9. وحدة تعبئة
Slaughterhouse Waste Treatment

The unit operates with a variety of waste from slaughterhouses, producing an average of 50 tons/day. The process involves an anaerobic digester and daily recycling of sludge and water, with the remaining waste being incinerated.

- Anaerobic digester unit
- 2 units per hour, each with a capacity of 1 ton/hour
- 2 Bobcat units per hour, each with a capacity of 2 m³
- 3 units per hour, each with a capacity of 2 m³
- 1 unit per hour, each with a capacity of 2 m³
- 1 unit per hour, each with a capacity of 2 m³
- 1 unit per hour, each with a capacity of 2 m³

The total number of workers in the unit is 30 workers.

The workers are as follows:
- 71% of the workers in the unit are male.
- 29% of the workers in the unit are female.
Service Stations

1- Gas Station

- The gas station has 4 fuel pumps with a tank capacity of 20,000 liters.
- 2 cars with a half trailer equipped with diesel 1000 liters.

2- Car Washing Station

- 4 fuel pump car wash - 2 car washers

3- 4- Maintenance Workshop and Spare Parts

- 2 Kam Double - 5 car lifter - 2 units of car rack assembly
- 10 units of tire - 2 units of general car maintenance workshop

4- General Workshop - General Maintenance Workshop - 2 units of motor

- 2 units of motor
- 2 engines
- 40 employees
Steel Structures
Landfill

C & D Cells / Construction Waste

Municipal Waste Cell

Hazardous Waste Cell
Cells Capacity

Municipal 1
Total Air Vol 6 863 261 m³

Hazardous 2
Total Air Vol 2 881 047 m³

C & D 3
Total Air Vol 9 090 000 m³

Total Air Space Vol. = 18 834 308 m³
Cell Construction & Lining

- Waste
- Granular Drainage layer between two Geotextile layers
- GCL Bentofix NSP 4000
- Compacted Subsoil

Final Soil Protection
Closure & Landscape
Residential Zone
Administration Building
Building Type 1
ESIA Study

Objective

 skulle أن يتم تنفيذ المشروعات التنموية طبقاً للقانون من قبل جهاز شئون البيئة المصري ومن ثم فقد تم إعداد هذه الدراسة لإجراء تقييم الأثر البيئي والاجتماعي (EISA) (EIS) باتباع الشروط المرجعية (ToR) التي قام بإعدادها جهاز تنظيم إدارة المخلفات.

Dr. Tarek Eid Elruby

05/03/2019
<table>
<thead>
<tr>
<th>Effect on Cultural and Social Impact</th>
<th>Effect on Movement</th>
<th>Safety</th>
<th>Health</th>
<th>Plant Health</th>
<th>Water Quality</th>
<th>Soil Quality</th>
<th>Air Quality</th>
<th>Lighting</th>
<th>Dust</th>
<th>Noise</th>
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</thead>
<tbody>
<tr>
<td>Non-recovery 12</td>
<td>12</td>
<td>2</td>
<td>8</td>
<td>9</td>
<td>12</td>
<td>12</td>
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<tr>
<td>Non-recovery 12</td>
<td>12</td>
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<tr>
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<td>1</td>
<td>12</td>
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<td>36</td>
<td>18</td>
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</tbody>
</table>

Note: The values in the table represent the importance rating of each effect on the specified aspects.
| Activity Impact on Human \n| Impact on Human | Visibility \n| Impact on Human | Social \n| Impact on Human | Environment \n| Impact on Human | Freshwater \n| Impact on Human | Air Quality \n| Impact on Human | Noise \n| Impact on Human | Waste \n| Impact on Human | Ecosystem Impact | Ecological Impact |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | 12 | 2 | 8 | 2 | 9 | 12 | 12 | 6 |
| 12 | 12 | 2 | 8 | 6 | 9 | 18 | 12 | 6 |
| 4 | 12 | 2 | 8 | 6 | 9 | 18 | 9 | 6 |
| 4 | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 2 |
| 3 | 3 | 2 | 3 | 2 | 4 | 27 | 4 | 2 |
| 4 | 8 | 2 | 8 | 2 | 2 | 4 | 4 | 2 |
| 2 | 2 | 2 | 2 | 2 | 2 | 4 | 2 | 4 |
| 4 | 6 | 2 | 6 | 6 | 6 | 12 | 12 | 12 |
| 4 | 6 | 2 | 6 | 6 | 6 | 12 | 12 | 12 |
| 1 | 2 | 1 | 4 | 1 | 12 | 9 | 18 | 1 |
| 1 | 6 | 1 | 12 | 3 | 36 | 36 | 12 | 1 |
| 1 | 6 | 1 | 18 | 3 | 36 | 18 | 12 | 1 |
Second : Qualitative Assessment
- RIAM -

الاقتصادية / التشغيلية
EO

الفيزيائية والكيميائية
PC

الاجتماعية الثقافية
SC

البيولوجية
BE

السيناريو الأول: الدفن العشوي
السيناريو الثاني: المدفع
السيناريو الثالث: التخزين
السيناريو الرابع: الحرق
السيناريو الخامس: إعادة التدوير
# Risk Management

<table>
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<th>Risk matrix</th>
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<td>Less likely</td>
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</table>
Environmental Management Plan

Components

- Program for Environmental Monitoring
- Environmental Action
- Environmental Impact
- Organizational Requirements

05/03/2019 Dr. Tarek Eid Elruby
Public Hearing Session
Feasibility Study

Project Economic & Social Impact

The project economic & social impact study is designed to assess the feasibility of a project that is aimed at increasing income and providing social impact, along with waste removal. The study is focused on evaluating the project's financial feasibility and its potential social and economic benefits.

The project aims to provide a sustainable solution for waste removal, with a focus on social and environmental impacts. It seeks to address the complex issues related to waste management and its effects on the community, with a particular emphasis on creating a sustainable income stream for the community.

The project's feasibility study is structured to analyze the project's potential for success, taking into account various factors such as financial viability, social impact, and environmental sustainability.

- **Waste Removal**: The project focuses on waste removal as a key element in achieving its objectives.
- **Financial Income**: The project is designed to generate income, thereby increasing the community's economic well-being.
- **Social Impact**: The project aims to have a positive social impact by improving the community's quality of life and promoting sustainability.

The project's feasibility study is crucial in determining the project's potential for success and its ability to address the needs of the community effectively.
### Project Estimate Cost

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost (Egyptian Million)</th>
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<tbody>
<tr>
<td>Land</td>
<td>0</td>
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<tr>
<td>Engineering Works</td>
<td>3,705</td>
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<tr>
<td>Equipment and Tools</td>
<td>242</td>
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<tr>
<td>Total Direct and Indirect</td>
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<tr>
<td>Capital Expenditure</td>
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<td>Operations and Maintenance</td>
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<td>Reserve Fund</td>
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<td>Total General</td>
<td>6,603</td>
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</table>
Conclusion

- The Project treats all type of waste; solid, industrial & hazardous and solves a critical national problem.
- The Financial Study shows that the project is feasible if:
  - A new Logistic System insure the delivery of Waste with typical corporant.
  - Separation of Operation from Ownership & Management by Specialized company.
  - Initial Investment is required & PPP is advantage.
  - Collaboration/Integration of actual private sector working in the field is advised.
Industrial Waste in Egypt

The industrial waste generated by Egyptian industries is estimated to be between 3 and 6 million tons per year. This amount is calculated based on data from various sources and is considered a significant environmental burden. The graph illustrates the breakdown of waste types, with the largest share being industrial waste, followed by domestic waste. The composition of waste is diverse, with each category playing a role in the overall environmental impact of industrial activities in Egypt.
Main Source of Industrial Waste
Dispose of Cement Kiln Dust (CKD) in landfill
Production of Brick
Cement Production

In Egypt, production of the different types of cement reached nearly 30 million tons, with 3 million tons CKD/year in dry lines. Up to twenty-five years ago, cement was produced by the wet process in Egypt. Nevertheless, the on-going shift in the cement industry to the dry method is expected to increase the accumulated dust. The dry process of cement production produces three times more dust than the wet process.\(^1\)
Experimental Works

Produced bricks & determination of characteristics

1- Compressive Strength
2- Flexural Strength
3- Water Absorption
4- Abrasion
5- Unit Weight
6- Resistance to Seawater & Magnesium sulfate Attack
Results

Compressive strength of solid cement bricks.
(a) with 150 kg/m³ PC  (b) with 200 kg/m³ PC

(a) 200 kg/m³ PC

<table>
<thead>
<tr>
<th>Age (days)</th>
<th>0% CKD</th>
<th>30% CKD</th>
<th>50% CKD</th>
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<tr>
<td>28</td>
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</tbody>
</table>
Results

Compressive strength of solid cement bricks.

(b) 250 kg/m3 PC
Thank you
Ref.1: El-aleem & Didamony, 2005
Ref.2: Corish & Coleman, 1995