


A Model for Bioenergy and Water Nexus in Egypt

By

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Preface;

Some Related Socioeconomic indicators:

- Egypt total land area is 1 Million Km^2 .
- 97 % of the total area is hyper arid desert, which totally exposed to Drought and desertification disasters.
- Only 4% of the total area is occupied by 90 million people, representing more than 1.16% of the world total population. In another word one person of every 86 people of the plant is a resident of Egypt.

Cont., Some Related Socioeconomic indicators :

- **Water Crisis:** Egypt has a very limited water resources never exceed than 58.3 million cubic meter annually.
- The water crises was magnified by the rapid population growth together with the pollution and it leaves no chance for the use of water as a source for generating electric power by any means possible.
- **The Energy Crisis:** At present these factors combined together along with the limited natural resources of the fossil fuels led to the intense pressure on the socio-economic levels.

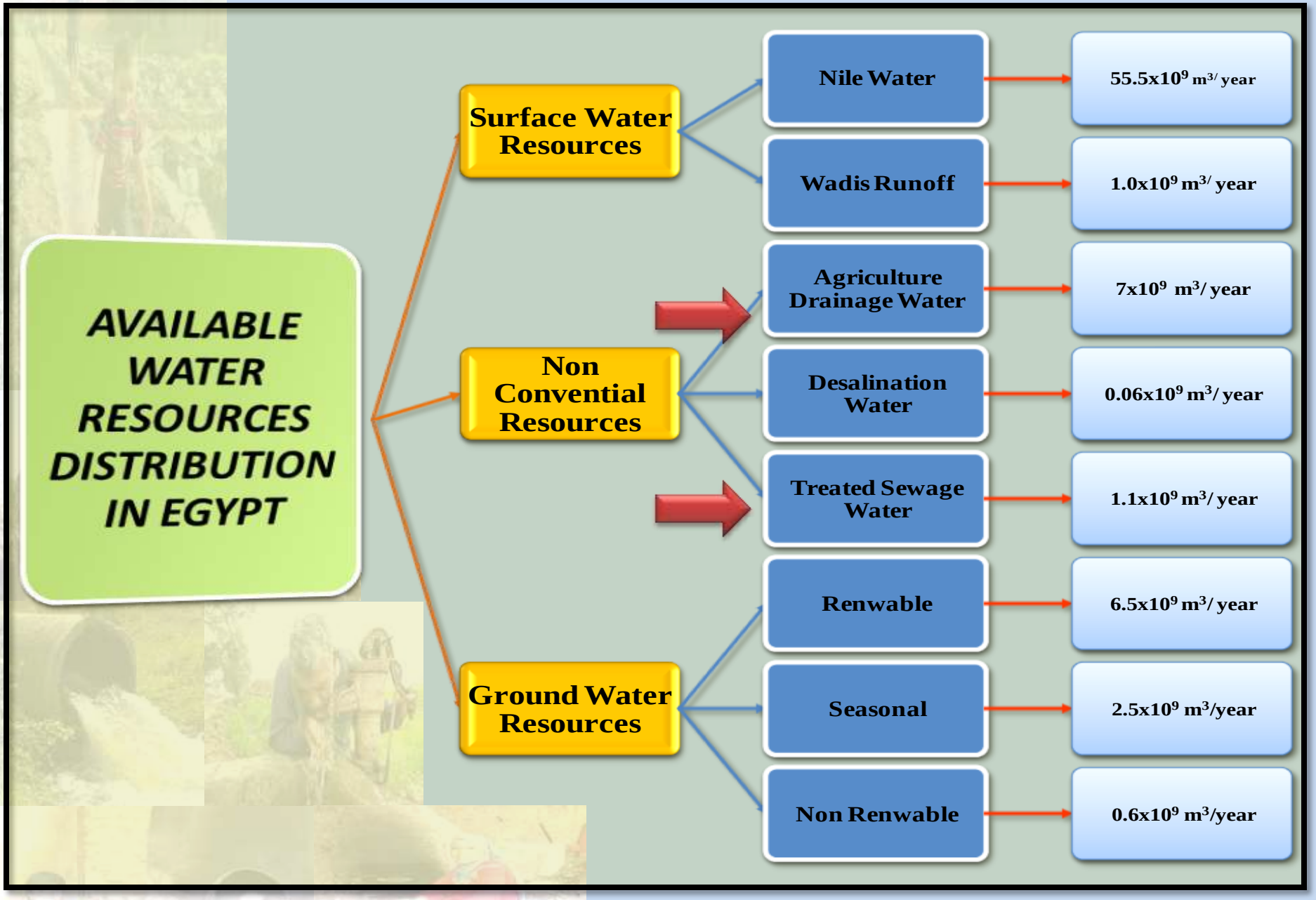
- Despite large energy production potential, Egypt has become dependent on hydrocarbon imports due to the structural increase in domestic consumption and the stagnation of investment.
- The negative consequences are substantial: a deteriorating trade balance, swelling budget deficit and disrupted economic activity. Recent support from the oil producing countries has helped reduce short-term pressures.
- Thereafter, reforms will be needed to make investment in Egypt's energy sector more attractive.

All these factors together made the shift into renewable energy strategy is essential; the overall target was set to reach 20% of the total electricity generated by 2020 including 12% wind, 6% hydro and 2% solar.

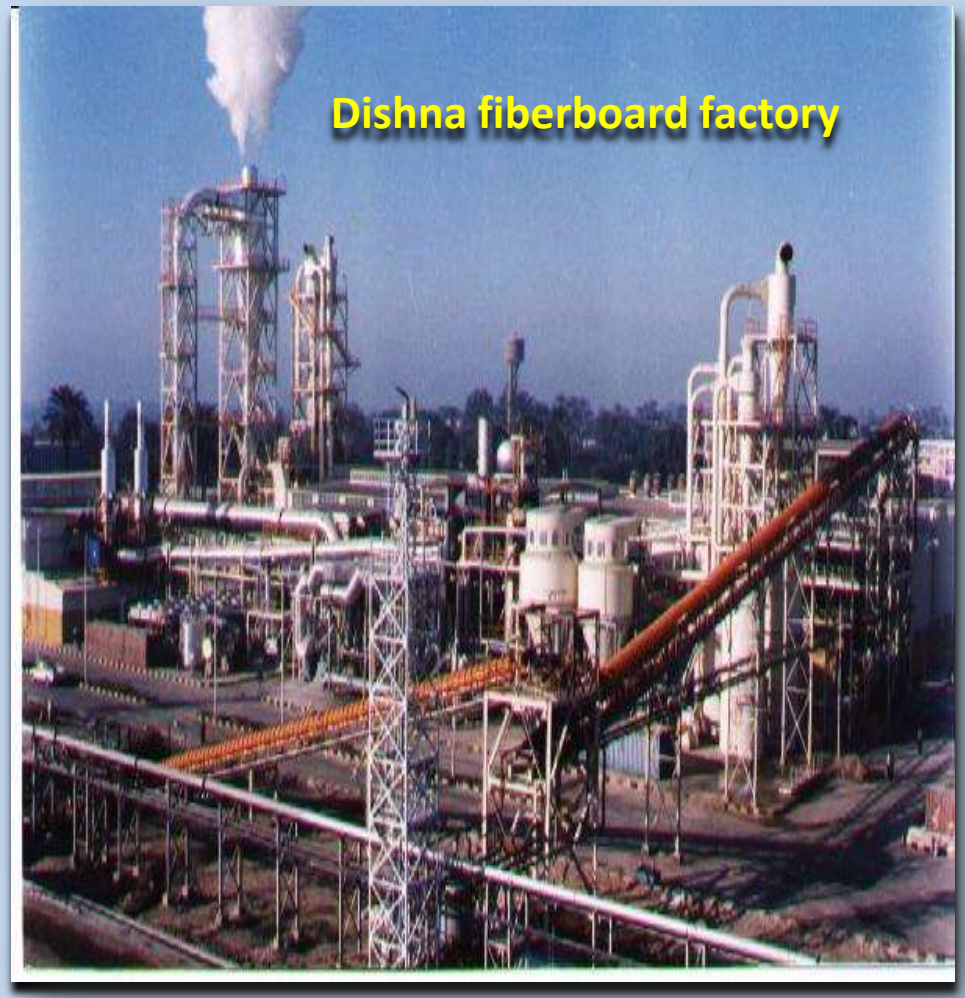
Introduction:

- Food, energy and water availability and sustainable management are essential for human wellbeing.
- Their interconnections indicates that the management of each of them can't be considered in isolation but in an integrated and holistic way.
- Their inter-linkage should be considered also among different scales; between local and global processes of resources use, and between social and economical aspects of society, in order to properly asses the impacts of new policies or interventions.

- As a matter of fact bioenergy and water are inextricably linked.
- The world already facing water stress, largely due to over 70% of fresh water being consumed by agricultural sector.
- Bioenergy is likely to increase this pressure through feedstock production and conversion process.
- This example is highlighting the risks and opportunities that already existed.


AVAILABLE WATER RESOURCES DISTRIBUTION IN EGYPT
Surface Water Resources
Non Convential Resources
Ground Water Resources
Nile Water
55.5x10^9 m^3/ year
Wadis Runoff
1.0x10^9 m^3/ year
Agriculture Drainage Water
7x10^9 m^3/ year
Desalination Water
0.06x10^9 m^3/ year
Treated Sewage Water
1.1x10^9 m^3/ year
Renwable
6.5x10^9 m^3/ year
Seasonal
2.5x10^9 m^3/year
Non Renwable
0.6x10^9 m^3/year

Dishna sugar and fiberboard factories



Location:

Dishna City – Qena Governorate - Upper Egypt

- **Naga Hammady MDF company was established with the ministerial decision No. 320 /1996.**
- **The Equity capital: 150 million EGP.**
- **Shareholders:**
  - **Holding Company for Food Industries : 30%**
  - **Sugar Industries for supplements: 20%**
  - **The National Investment Bank: 15%**
  - **The Egyptian National Bank: 15%**
  - **Alexandria Bank: 10%**
  - **Miser Bank: 10%**
  - **The Factory area: 24 Acre.**
- **Number of workers: 300 persons**
- **Production capacity: 60000 m3/ year**
- **Working days: 300 day/year.**

Status: The Example is currently implemented and start by 2010 and still going on for its perfect impacts on the Environmental Aspects.

The Main Problem (drivers)

Discharge the highly polluted water into The Nile Basin :

Bad consequences:

- **Deterioration of fresh water quality in the Nile basin.**
- **Degradation in the soil physical and chemical quality out of using low quality irrigation water.**
- **Deterioration of the agricultural productivity per hectare.**
- **Therefore, poverty rates were increased.**

Implementation of the plan of work:

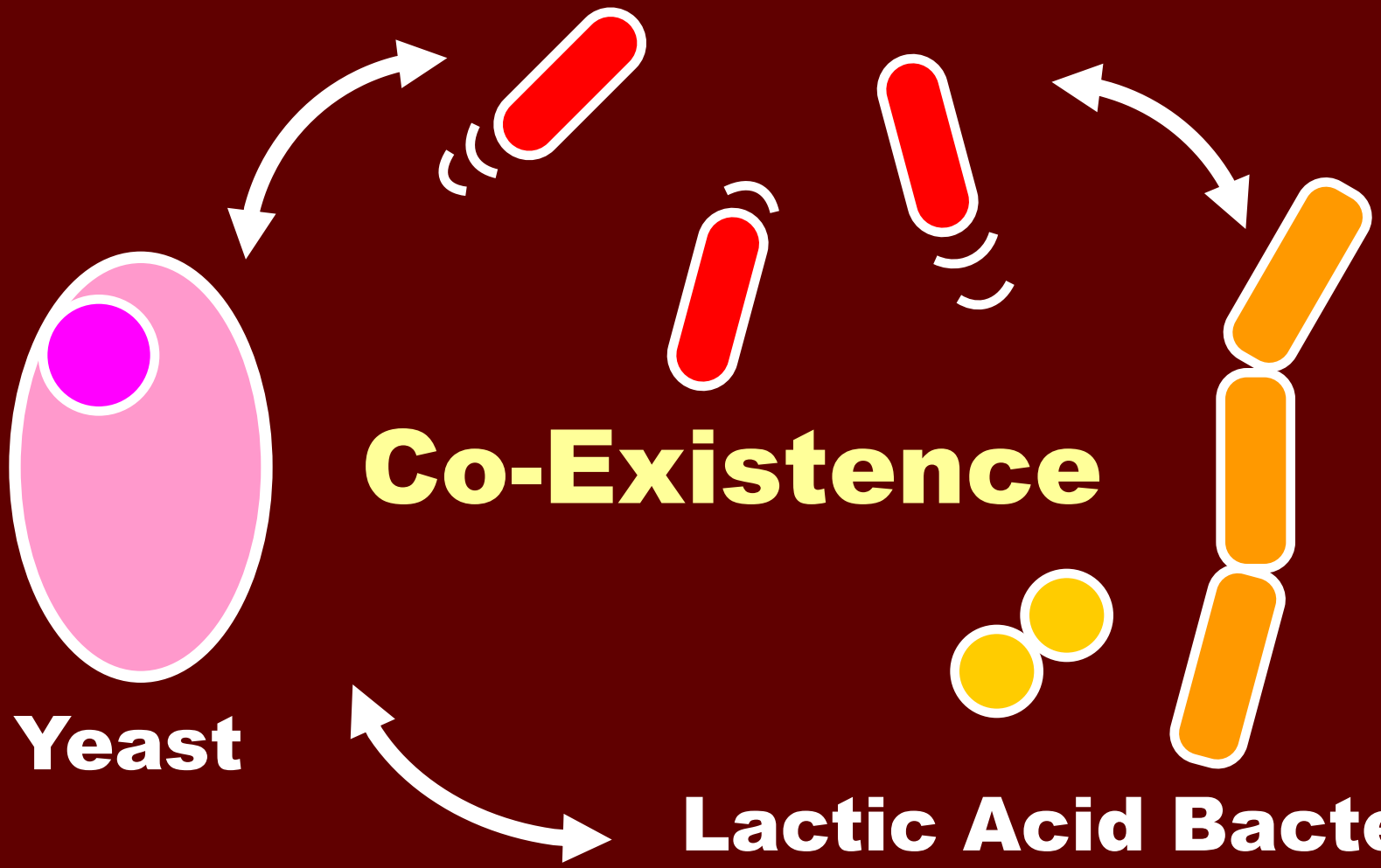
1. Selecting the **Effective Microorganisms (EM)** to bioremediation of industrial drainage water.
2. Growing Sesbania (*Sesbania Aegyptiaca* [Poir]) using the bioremediation industrial water.
3. Prevention and criminalization of discharging the untreated industrial drainage into the Nile Basin. (Environmental Law 4/2004)
4. Using the growing shrubs as a bio-drainage tool, main steam for MDF manufacturer and the secondary branches and leaves were sent to the sugar plant beside bagasse to generate electricity .

1. **Selecting the Effective Microorganisms (EM) to bioremediation of industrial drainage water.**

BUT WHY EM?

- It is Environmentally Accepted.
- Low Running Cost.
- Effective.
- Available.
- Has a wide range of applications.

Photosynthetic Bacteria



FUNCTIONAL COMBINATION

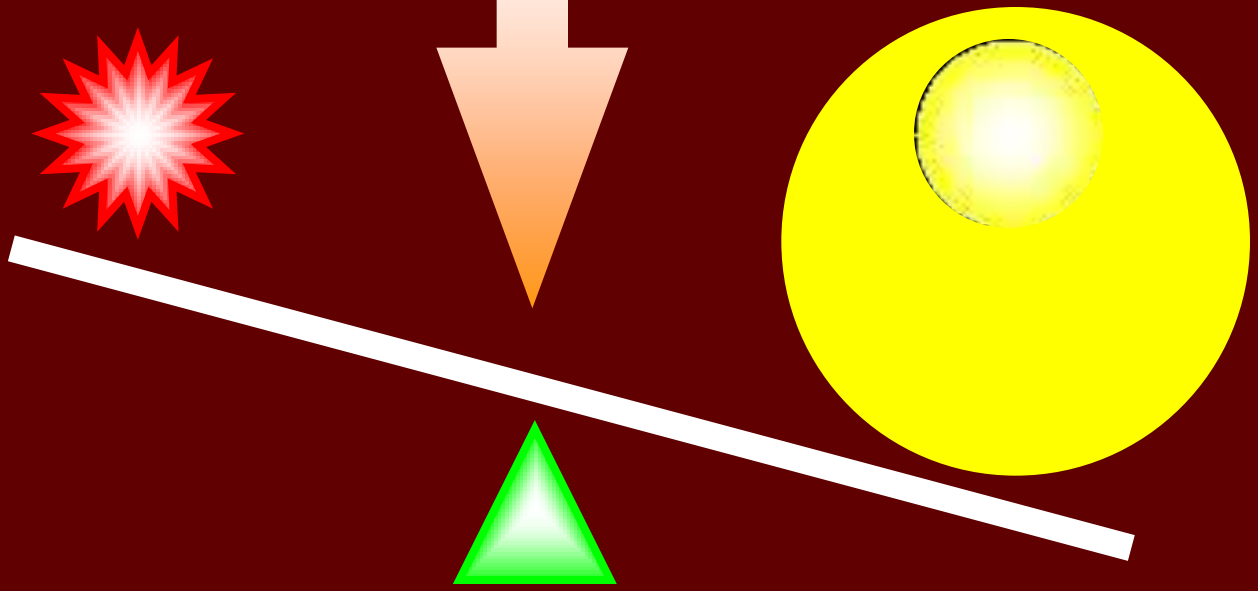
Invisible Trinity

EM

Pathogenic Microbes

=

Beneficial Microbes



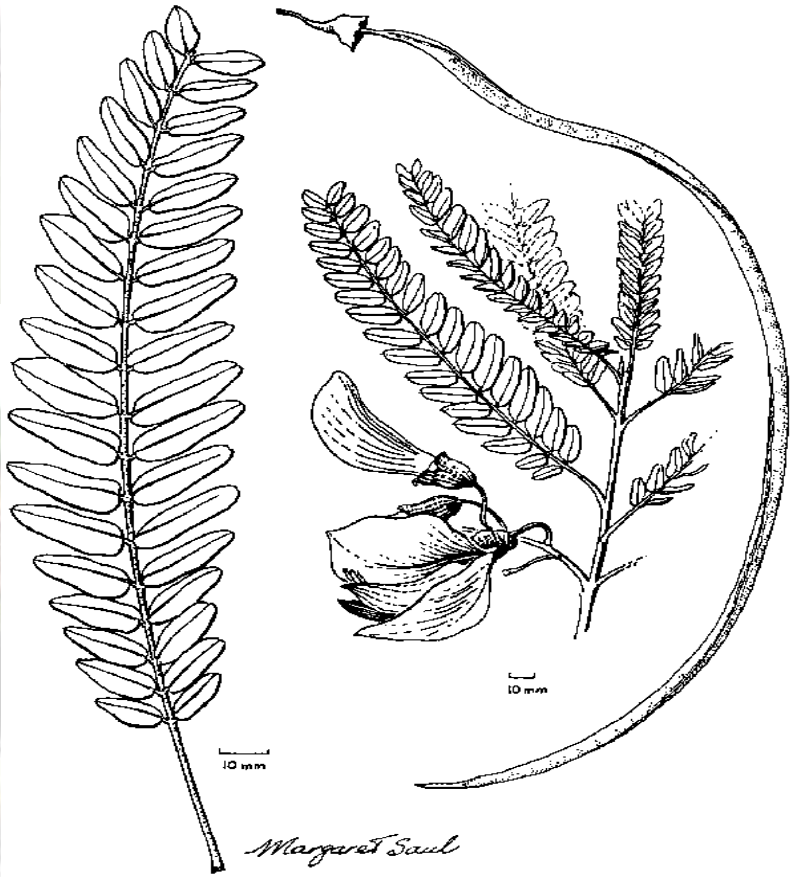
MICRO-FLORA IN ENVIRNMENT

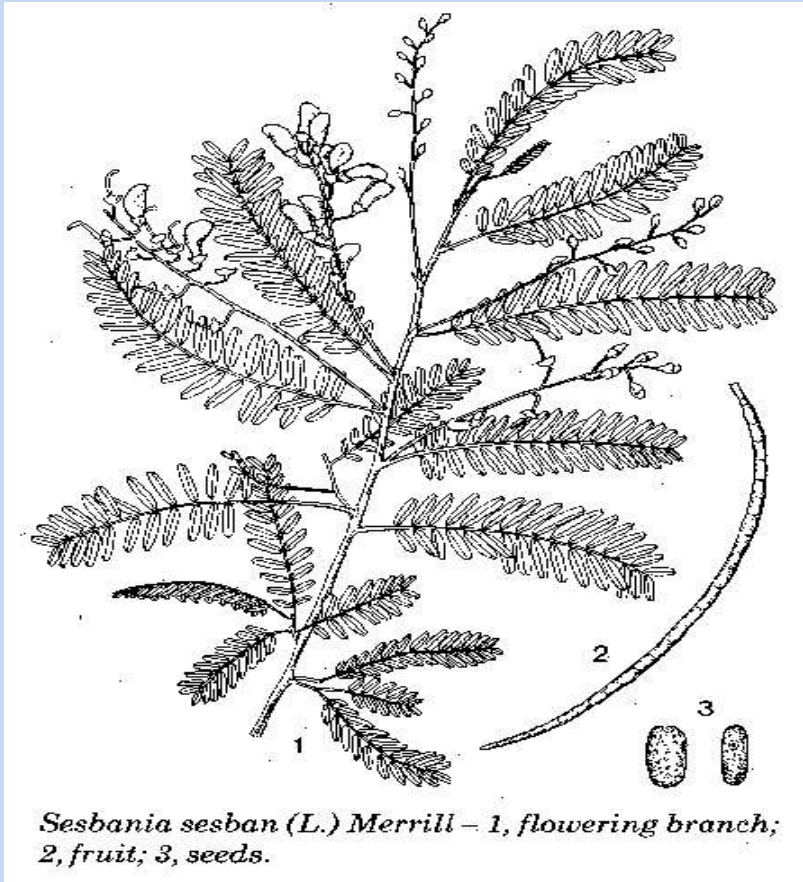
EM works well


EM


EM

2. Growing Sesbania (*Sesbania Aegyptiaca* [Poir]) using the bioremediation industrial water.





Sesbania sesban (L.) Merrill – 1, flowering branch; 2, fruit; 3, seeds.

Sesbania (*Sesbania aegyptiaca* [Poir])

Sesbania (*Sesbania aegyptiaca* [Poir])

Sesbania (*Sesbania aegyptiaca* [Poir])


The bagasse moistening water and bio-remediated industrial drainage were used to irrigate the Sesbania forest to conserve the fresh water in the Nile Basin.

3. Prevention and criminalization of discharging the untreated industrial drainage into the Nile Basin. (Environmental Law 4/2004)

4. **Using the growing shrubs as a bio-drainage tool, main steam for MDF manufacturer and the secondary branches and leaves were sent to the sugar plant beside bagasse to generate electricity .**





Positive impacts for water quality:

- The quality of the industrial drainage water were improved to be a valuable fertigation source.
- The fresh water in the Nile basin was conserved from pollutants.

Water quality indicators	Irrigation water quality		
	Untreated Industrial Drainage water	EM-Bioremediation Industrial Drainage water	Nile water
BOD (mg/l)	105 a	3.7 b	2.17 c
COD (mg/l)	208 a	12 b	5.7 c
pH. (units)	9.4 a	7.3 b	7.0 c

*Means having similar letters in the same row are not statistically differed at P≥0.05.

Positive impacts for water availability:

- The water quantity that consumed during the industrial process were reduced almost by 50% , by the mean of conserving the fresh water for the agricultural and the domestic usage.

- The industrial drainage was reused for translocation & moisturization of bagasse.
- Thus the quantity of water which remained for the Municipal usage were increased.

Positive impacts for soil quality:

- The soil properties of the experimental forest were improved significantly and had positive impacts on plant and soil water relations, thus conserve the irrigation water.
  - Soil texture was improved.
  - Soil water holding capacity.
  - Organic matter content.

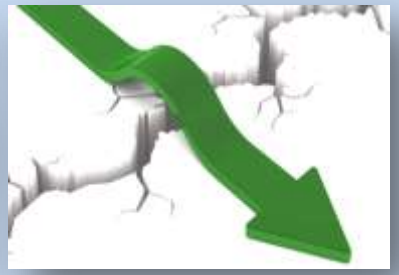
Key enabling factors;

1. *The presence of strategic will.*
2. *The strong and integrated presence of the national working bodies such as EEAA, MSEA, MALR and Qena Governorate.*
3. *The NGOs and local community interest.*
4. *The appreciated return values for using the bioremediation drainage water as a source of fertigation.*
5. *The economical returns of the produced wood.*
6. *The availability of market for the produced wood.*
7. *The need for mobilization and implementation the environmental law.*

Achieved Outcomes

1. The water quality indicators of the bioremediation industrial drainage water were improved like BOD, COD and pH.
2. This bioremediation water was used to fertigate the Sesbania forest as bio-drainage for the industrial drainage water instead of discharging it into the fresh water into the Nile Basin.
3. Thus the water quality in the Nile basin was conserved.
4. Also the bioremediation water was used in the industrial process in the sugar and MDF factories.
5. This led to conserve large amounts of fresh water for domestic use instead of using it for the agricultural and industrial activities.
6. Almost 95% of the electrical power that consumed in the industrial process in both factories were coming from biomass (Sugarcane bagasse and Sesbania second branches & leaves).

Main challenges encountered



<u>The main challenges e.g., Policy , technical, financial, other</u>

1.The need for rising public awareness through the local media who wasn't interested in this work.

2.The small national allocated fund for this activity.

3.The illiteracy rate that affected negatively the public enthusiasm.

4.The absence of the political support from the people assembly representatives in the region.

5.The real gap in trust between the governmental bodies and the local community.

6.The conflict happened with the fertilization business sector

Potential for scaling-up and replicability.

- This example is ready to be scaled up or replicated with any industrial sector in Egypt or any country in Africa or any part of the world particularly those are suffering from water scarcity and drought.
- With some modification in the growing crop we can choose between either a raw material crop, biomass crop or a biofuel crop.
- The most important key of success that should be taken into consideration is the clear political will that helps in promoting some policies to implement such kind of projects.
- It is also important to take into account that without the local media contribution and key persons involvement; local stakeholders will not have the needed level of enthusiasm that helps in the project implementation.

Historic Touch

FIRST SOLAR PLANT IN THE WORLD
AL MAADI. EGYPT. 1913

مصر تقدم الطاقة الشمسية إلى العالم

يوليو ١٩١٣

مصر تنشئ أول محطة للطاقة الشمسية المركزة فى العالم فى المعادى
بقوة ١٠٠ حصان و تضخ ٦٠٠٠ جالون مياه فى الدقيقة
ومخترع المحرك الشمسى يقول:
"ماحدث فى مصر انطلاقة لعصر جديد من الطاقة فى التاريخ"

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THE ELECTRICAL EXPERIMENTER

H. GERNSBACK EDITOR
H. W. SECOR ASSOCIATE EDITOR

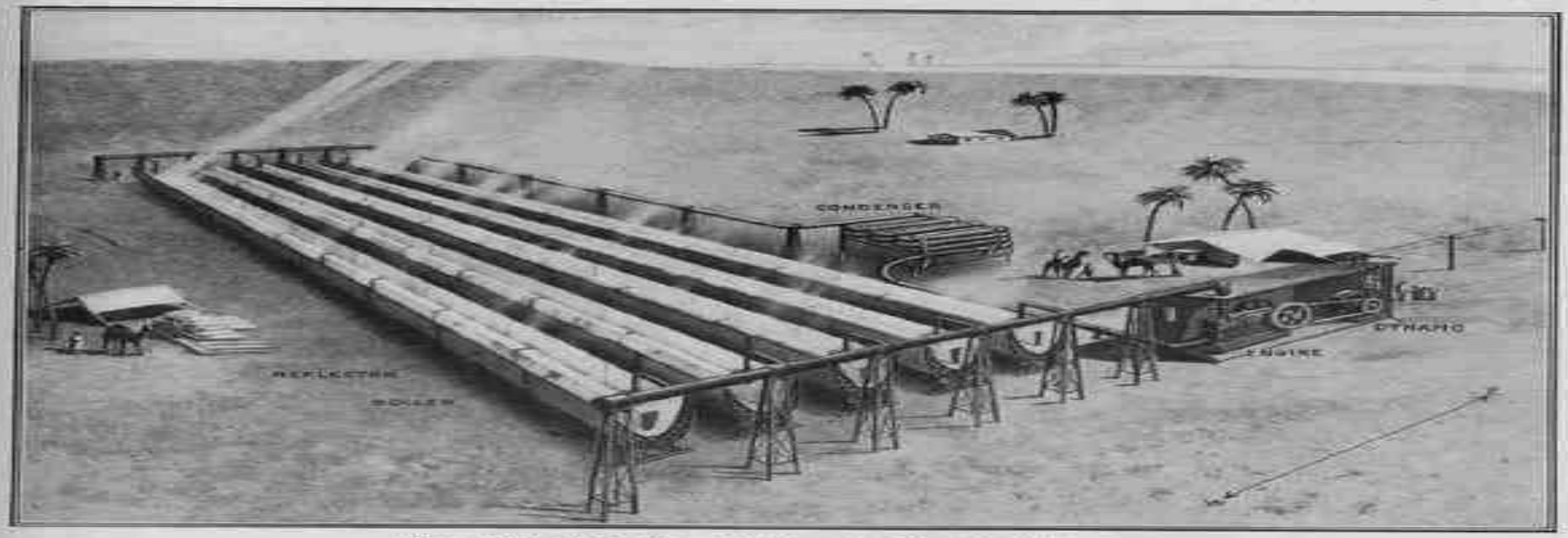
Vol. III. Whole No. 35 MARCH, 1916 Number 11

The Utilization of the Sun's Energy

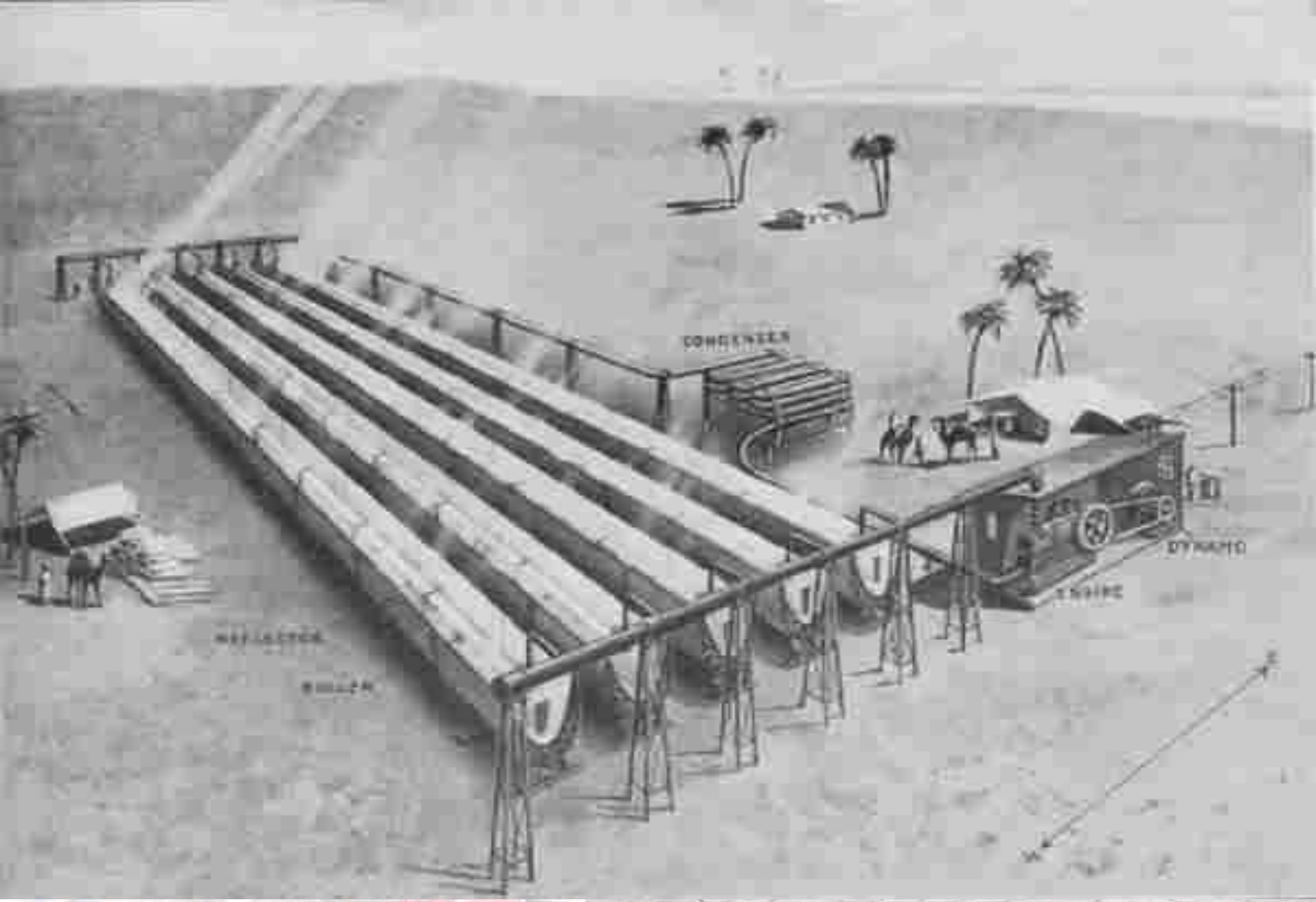
Years Ago Man Endeavored to Make Practical Use of the Energy Contained in the Sun's Rays—Even Tesla, the Electrical Wizard, Has Pottered a Sun Motor. While the Shumman-Boy's Engine and Sun Boiler Has Developed 100 H. P. There Is Great Promise Held Forth to Future Engineers Who May Work on This Problem.

IT has been given to astrophysicists to measure the heat generated by the sun and calculate the force emanating from it. We know that the surface of our luminary gives out a heat estimated to be about 6,000° centigrade, and that its light equals that of 27,000,000,000 candlepower a quarter of a mile away. The heat which the earth receives from the sun in the course of a year would suffice to melt a belt of ice about 35 yards in thickness extending clear around the earth. Only the 2,750-millionth part of the total energy given off by the sun reaches our earth and, if this were lacking, our planet, with all its dreamland life, its thick forests and fruitful plains, would turn into a dead, rigid ball of rock, for the average annual temperature, which is now one of 11° centigrade of warmth for Europe, would, without the heat of the sun, sink to 73° centigrade of frost, it is calculated.

Every sort of light with which we illuminate our home when the greasier light has sunk beneath the horizon; every fire that warms us when the solar rays can no longer do so, is a product originating in the sun. The chip of wood with which the outraught son of nature brightens his hut, the twigs with which he stokes his fire, what are they but pieces of trees that grew in the sunlight? The gas of the city dweller, the coals with which he heats his house and from which the gas has been sucked, what are they but transformed sunbeams? The coal in the grate is the petrified wood of perished forests that covered the earth's surface millions of years ago, and flourished in the rays of the same sun that opens our eyes to-day. Petroleum, that mysterious earth-oil, comes from the bodies of millions of dead and



A Successful 100 H.P. Sun Power Plant Located at Meadi, on the Nile, Egypt.


CONDENSER
DYNAMO
ENGINE


Thank you