

Green Growth, Innovation and Sustainable Development

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Abstract

Sustainable development is certainly a key issue in both developed and developing countries. Finding the balance between the consumer's demand and the carrying capacity of Earth's natural resources with regards to economic growth is crucial and the key element of sustainable development. This report explores various aspects of the green growth concept, which builds on a number of existing sustainable development initiatives. Green growth supports the development of green industries, jobs and technologies, whilst allowing for a smooth transition into a green economy. The overall objective is to integrate the key aspects of economic performance, such as poverty reduction, job creation, social responsibility, and improving environmental performance, through mitigation of climate change and biodiversity loss and security of access to clean water and energy. The advantage of the 'Green Growth' concept is that it could be applied to advanced and developing economies. It is an analytical concept that looks at shaping a macroeconomic framework, which allows certain sectors to accelerate in their development. Our current socio-economic progress and the overall growth paradigm need to be rethought and restructured as the current focus on quantitative growth has shown to have had detrimental effects on our environment and the preservation of various natural resources for our future generations. Instead, our growth concept should evolve around a more sustainable and qualitative growth, which invests in and embraces new ideas and innovations. Furthermore, this paper presents the necessities of a Green Growth Strategy and one of the tools necessary to help countries shift towards green growth – the Innovation System Framework. It discusses its structure, benefits and limitations, as well as the role UNIDO plays in their Innovation System Programme.

Keywords: *Green growth, Sustainable development, Innovation System Framework*

1. Introduction

This paper explores various aspects of the green growth concept, which builds on a number of existing sustainable development initiatives and the role Innovation System Frameworks play in helping countries achieve environmentally sustainable development.

Sustainable development is certainly a key issue in both developed and developing countries. It stands for meeting the needs of present generations without jeopardizing the ability of future generations to meet their own needs and their quality of life. Finding the balance between the

consumer's demand and the carrying capacity of Earth's natural resources with regards to economic growth is crucial and a key element of sustainable development. It will be a vital step in addressing the multiple and interrelated global crises, which are impacting on the international community. These range from the financial crisis in 2007, the food crisis in 2008 and 2009, to the current environmental crisis and its threat of irreversibility.

The Middle East and North African (MENA) region has experienced a recent turmoil and various demonstrations due to unequal access to

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economic opportunities and social welfare, as well as a high rate of unemployment, especially amongst the educated young population. Despite this, the region seems to have recovered relatively well from the financial crisis, however they still face a critical issue with their food and water supplies. The World Economic Forum has released a report in which they state that in fact twelve of the world's 15 most water-poor countries can be found in the MENA region. Another key problem the region faces is the high unemployment rate, especially amongst the educated youth population and women, which is a direct result of the mismatch and gap between the demands of the private sector in terms of job skills and the curricula of the current educational institutions.

The conditions for macroeconomic stability and growth in the Arab world will be of fundamental value for their sustainable development. As illustrated above these may range from economic and educational reforms to political and policy reforms, which will require good governance and as a result provide employment opportunities and a great potential for growth.

2. Green Growth

The Green Growth (GG) concept supports the development of green industries, jobs and technologies, whilst allowing for a smooth transition into a green economy. The overall objective is to integrate economic development, environmental sustainability and social equality into all levels of decision making – ranging from the government, industry, right down to the consumer.

Green Growth can be defined as “economic progress that fosters environmentally sustainable, low-carbon and socially inclusive development”, whilst utilizing fewer resources and generating fewer emissions in meeting demands for food production, transport, construction, housing and energy (UNESCAP). It integrates key aspects of economic performance, such as poverty reduction, job creation, social responsibility, whilst also improving a nation's environmental performance through the mitigation of climate change and biodiversity loss, as well as the security of access to clean water and energy.

The advantage of the GG concept is that it could be applied to advanced economies as well as developing economies, or those that are small or large, market-led, or state-led. It is an analytical concept that looks at various ways to shape a macroeconomic framework, in order to allow certain sectors to accelerate in their development.

Economic Growth Paradigm

The overall demand for green growth has been steadily increasing in the past years, with a number of countries having already adopted the green growth concept into their public policies, such as Korea with their ‘Green New Deal’ policy implemented in January 2009, as part of their economic recovery package. The basis for their success has been on their ability to decouple economic growth from environmental degradation, especially in energy and resource consumption and production. This required a structural change and an introduction of a number of policy reforms.

Our current socio-economic progress and the overall growth paradigm need to be rethought and restructured as the current focus on quantitative growth has shown to have had detrimental effects on our environment and the preservation of various natural resources for our future generations. Instead, our growth concept should evolve around a more sustainable and qualitative growth, which invests in and embraces new ideas and innovations. Thus, changes in our economic and social structures, as well as our production and consumption patterns will be vital for this transition.

Furthermore, policymakers need to look beyond the conventional conception of growth, a country's Gross Domestic Product (GDP), in order to appropriately assess the role that the environment plays in supporting growth and the possible trade-offs between economic growth and environmental degradation. Other key necessities for the transition into a green economy are highlighted in the following section.

Necessities to Green Growth

There are a few requirements for the shift to GG; the key issue will be to break the old habits of consumption and production, by shifting the path dependency away from the heavy reliance on finite resources such as oil to renewable energy sources. Investing into educational reforms and capacity

building programmes will be of great use for the country's advancement. Skills development and the adaptation of the labour force have both previously been highlighted as strategically necessary and a vital condition for a quicker transition into a green economy.

The essential factor is to create a conducive environment for the development of sustainable enterprises, by providing the right incentives and limiting the bureaucratic access to finance to a minimum— the key is transparency, predictability and longevity. Introducing innovation, entrepreneurship and the soft skills that go with it at school-level is vital; this way one could ingrain the necessary skills demanded by the market into the educational system, which allows them to be independent and competitive in the long-term.

Furthermore, the widespread diffusion of new innovative technologies and solutions across the world, the provision of firms with a number of incentives to transfer knowledge across borders, whilst also lowering the barriers to trade and foreign direct investment are necessary, as that again helps strengthen the flow of technology across borders. The emerging mechanisms needed to accelerate the transfer green innovations will also be of value to countries. Market-based instruments such as green taxes and budget reforms will allow for an improved overview and monitoring of the success of the shift to green growth. The use of consultants and feedback mechanisms may be useful for such matters. Also, regional and international cooperation, as well as South-South cooperation will play a critical role, as countries can learn from one another and share experiences and weaknesses. Cooperation could exist on a number of levels, communicational – through the transfer of knowledge know-how and expertise as previously mentioned, also technical and financial cooperation, both of which may overlap in the development aid of a country.

Barriers to Green Growth

There is a lack of knowledge and skills in enterprises and amongst consumers, given that a vast number of enterprises are not aware of the challenges that lie ahead, nor do they have the skills to deal with them.

They are also not aware of the business opportunities that environmental issues open. On

the other hand, the consumer also lacks information and general knowledge on environmental matters, as well as the skills to deal with them. Thus, the private sector job creation opportunity is still low, as the jobs that do exist cannot adequately be filled because the skills required are not produced through the educational system.

Furthermore, government bureaucracy and corruption are big barriers to green growth. The current approach of policies and strategies has followed the 'pollute now and clean up later' concept, which has proven to be ineffective, and has resulted in our society being locked-in and dependent on finite fossil-fuel intensive energy, such as coal, oil and gas. Lastly, ineffective policy frameworks are quite a big barrier to GG, due to the lack of incentives and reward systems and the lack of a supportive environment for businesses, given the difficulty in accessing finance.

UNIDO's Green Industry Programme

UNIDO has introduced the Green Industry initiative to provide the international community, national governments and the private sector with a platform for fostering the positive role of industry in achieving sustainable development.

The Green Industry vision grasps the potential for industries to decouple economic growth and revenues from excessive and increasing resource use and pollution. The concept of 'decoupling' is critical to the greening of industries and sustainable economic growth, as it breaks the link between environmental 'bads' and economic 'goods'. The concept allows for the measurement of resource effectiveness and energy efficiency measures.

It foresees a world where industrial sectors minimize waste in every form, utilize renewable resources as input materials and fuels, and take every possible precaution to avoid harming employees, communities or the environment. Green industries will be creative and innovative, constantly developing new ways of improving their economic, environmental and social performance.

UNIDO also provides technical support and builds local capacity for the design and implementation of green growth projects, programmes and strategies. It helps countries create action-oriented policy

options and institutions tailored to their respective economic circumstances.

3. Innovation

Innovation tends to spring from the creative generation and application of knowledge, and the application of a wider range of methodologies to guide and foster creativity. It is a driving force for sustainable industrial development, poverty reduction, and of economic growth and competitiveness.

The significance of innovation for sustainable industrial development cannot be over-stated; even the poorest countries cannot afford to neglect innovation. It offers new ways of adding value, as the innovation process itself is a series of methodologies that reduces the uncertainty of the outcome of change processes; in effect, it is a risk management tool improving the chances to deal successfully with change, be it local or global, incurred by social, economic or sustainability pressures. It has also been defined to be vital for the survival of thriving economies, as it equips them with a certain level of independency and the ability to match challenges to human, financial and institutional resources and the knowledge infrastructures required to solve them.

However, there is a strong presumption remaining that Green Growth and Innovation can only stem from developed countries. This is a false presumption, as innovation requires deliberate effort to create the ideal conditions and despite a lack of resources to heavily invest in R&D, an opportunity remains for improving the level of innovativeness in developing countries to ultimately achieve a competitive knowledge-based economy.

4. Innovation Systems Framework (ISF)

The Oslo Manual (OECD 2005) distinguishes four types of innovations: product, process, marketing, and organizational innovations. Product innovations may be goods, services, or product-service combinations. Within the realm of process innovation, design and incremental process innovations are more common in recent years.

Previous conceptions of innovation have changed from a linear model of innovation to a more integrated, dynamic, and holistic framework that is composed of a set of interconnected institutions, agents, organizations and the linkages between them that contribute to the development and diffusion of knowledge, which are in the form of processes or products. It is considered that this holistic approach to innovation would help developing countries work smarter and more efficiently in achieving Green Growth. Dubbed as the Innovation System Framework (ISF) by its initial architects some twenty years ago, the perspective acknowledges that the innovation performance of a country depends on many actors, their individual capacity to support aspects of innovation, the linkages that connect them into productive networks, as well as a range of framework conditions.

Together these essential elements, linkages, and framework conditions constitute an Innovation System, which is determined by a unique historical, cultural and geographical context and a certain level of cohesion between the economic, social and political framework conditions and the economic basis for an Innovation System. The framework builds on UNIDO's success and helps Least Developed Countries (LDCs) in making improved choices.

The Innovation System (IS) is composed of a core and some determinants, with the prior including interactive, innovative businesses and knowledge support infrastructures and the latter the wider set of economic policy and social conditions outside of the company's or nation's control. UNIDO has highlighted that a functional IS needs to perform the following functions:

- Research & Development
- Competence building (developing human capital)
- Networking and changing organizations
- Incubating activities
- Financing for innovation processes
- Consultancy services for innovation
- Formulation of new product markets

- Articulation of quality requirements emanating from the demand side
- Creating and changing organizations

Benefits and Limitations of ISF

There can be a number of benefits and limitations arising from the systems approach towards innovation. Some of the key benefits have been the fact that it shatters pre-conceptions of traditional roles of actors within IS, as it considers all actors, functions and their interdependencies.

Furthermore, it helps balance timeframes and identifies obstacles of the diversification and industrialization process, whilst providing the structure for monitoring and coordination and the overall adaptive flexibility needed to change. One of the key benefits of the innovation framework is its role as a source of job creation and employment opportunities, especially for the Youth.

On the other hand, some of the key limitations of the ISF are the looseness of the terminology and the consequences of that. Additionally, the framework is neither normative nor prescriptive and lastly, the general notion of optimality doesn't seem to match the dynamic nature of the system.

5. UNIDO's Innovation Systems (IS) Programme

UNIDO has a rich history of support to distinct activities and initiatives that foster aspects of Innovation Systems strengthening, covering several initiatives that support innovation at the level of the firm, different sectors, regions and even at the global level. The implementation of these activities has leveraged the synergies making the Innovation Systems Framework more vivid. Recognizing the tremendous importance of innovation, UNIDO seeks to enhance its role in helping developing countries develop the capacity needed to address innovation-related challenges. Thus, UNIDO organizes the Expert Group Meeting (EGM), which is attended by over 30 top-level experts on innovation, selected from government, industry, and university and representing a diverse range of countries, including Tanzania, the Republic of Korea, Egypt, the Netherlands, and Brazil among others.

The EGM asserted that an Innovation System Framework develops the capacity of countries to identify and combat various Innovation Systems bottlenecks to encourage additional, better, and more relevant innovation for development.

Innovation and Bottlenecks

Furthermore, the IS approach helps to highlight some of the challenges and barriers impeding the progress towards increased and improved innovation. Generally, there are four kinds of system bottlenecks – ranging from capability, institutional and network to framework failures – all of these can be barriers to growth and development. Capability failures can involve the meagerness in an innovator's ability to act in their own interests, whilst the institutional failures would be a result of a lack of integration and configuration of the various institutions within the Innovation System. Network failures could result from problems in the linkages and relations between the numerous actors in the Innovation System. Lastly, framework failures could be the result of an intervention of regulatory frameworks and background conditions, such as consumer demand sophistication, culture and social values into the process. All of the above mentioned failures can and should be identified by a systems bottleneck analysis framework.

Four Pillars of ISF

The emerging UNIDO Innovation Systems programme initiative operates from the premise that the current gaps between developed and developing countries are neither irreversible nor inevitable. These gaps can range from a country's innovation capabilities, linkages between IS components, as well as awareness and capacity for IS strengthening and governance.

UNIDO's strategy offers a vision of innovation that contributes to equitable and sustainable industrial development in developing countries by supporting innovation and innovation-related activities in an integrated way, allowing them to become more independent. The integrated systems approach also provides countries with a broader and more comprehensive view of innovation, which assists them in diversifying their economies away from the primary production to a higher value addition in their export base. To maximize the impact of UNIDO's efforts towards helping

developing countries build their capacity to foster and strengthen their Innovation Systems, UNIDO continues to focus its activities and interventions on the following four pillars.

Pillar I —System Elements:

Support the building blocks of Innovation Systems (actors and institutions, linkages, and framework conditions) so that the innovative capacity of the system's actors (skills and knowledge) is enhanced.

Pillar II —International Linkages:

Foster synergies between Innovation Systems by supporting the formation and strengthening of international linkages and by including benefits from other IS components outside of the original system boundaries.

Pillar III —Gearing for the Future:

Nurture the ability of Innovation Systems to adapt to changing contexts through monitoring, benchmarking, forecasting, planning, and policy setting. It is vital to endow systems with greater flexibility and resilience in building the capacity to forecast and prepare for the future.

Pillar IV —Global Sharing:

Deepen and share knowledge through global partnerships, capitalizing on UNIDO's Global Forum function. Provide opportunities to share insights and experiences between stakeholders on various aspects of IS strengthening.

Overall the four pillars are meant to increase the success rate of innovation in enterprises, as well as measure and improve the functionality of IS in changing circumstances. However, the vital aspect is the integration of the ISF into a country's national policy encouraging growth and competitiveness.

Key Elements of IS Strategy

UNIDO highlights the following elements of its forthcoming IS strategy to be essential for its success, which will aid developing countries to remain at the frontier of knowledge on Innovation Systems and thereby translate cutting-edge research and practitioners' experience into opportunities for them. Another key element is the widespread integration of the framework across the various UNIDO Programmes, as well as into Country Assessments and Technical Assistance Planning.

Outputs of IS Strategy

The outputs of the strategy articulation exercise benefits developing countries in preparing regional assessments and an IS Diagnostic Study, which will help with the integration into the design, implementation, and monitoring of specific activities and interventions. Furthermore, these will be maintained and supported with a UNIDO IS website and an IS Leadership Training Academy, with the prior one showcasing research, case studies, assessments, as well as other material, while the latter one will nurture a cadre of global leaders in IS design, strengthening advocacy and policy articulation, as displayed in Figure 1.

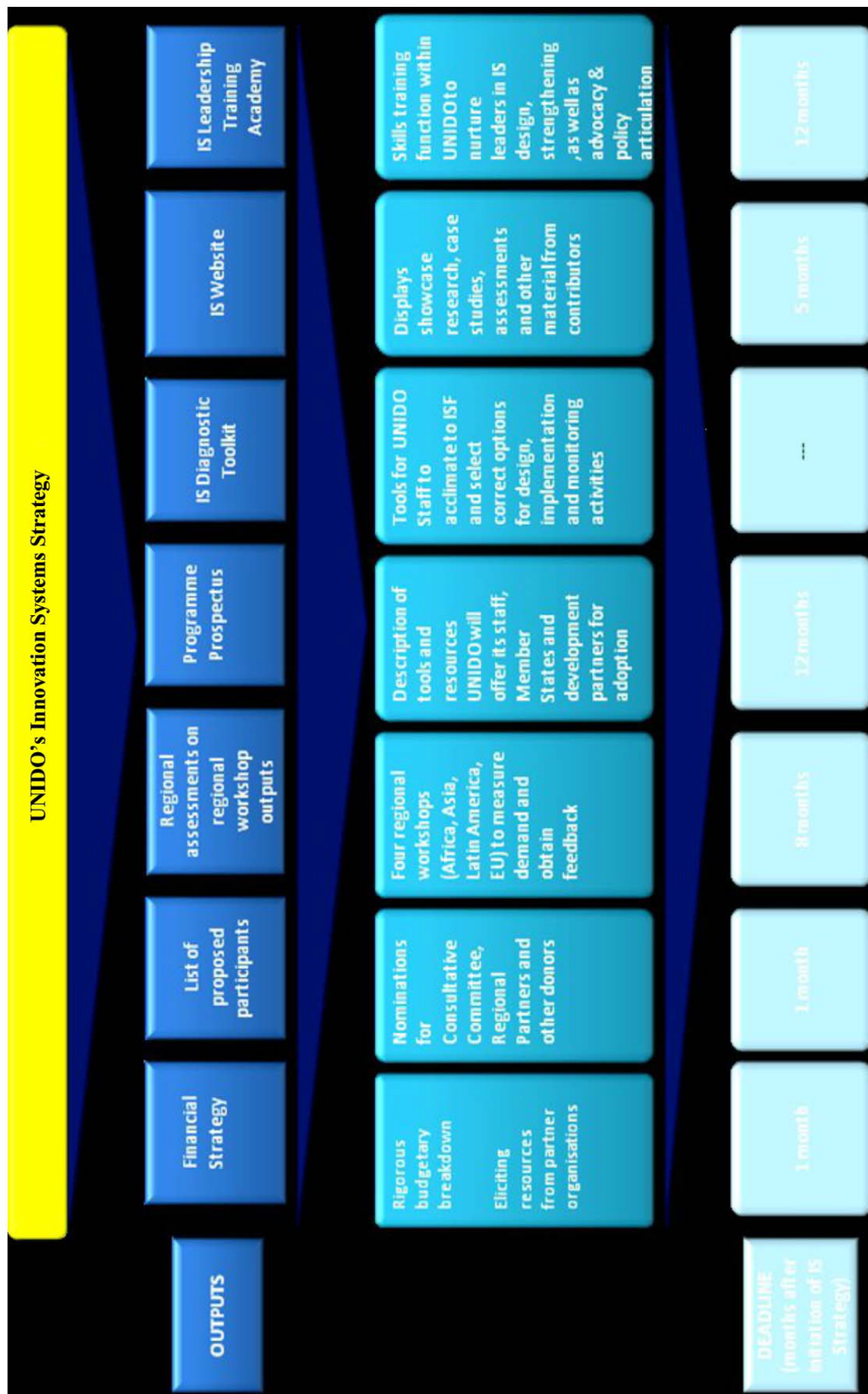


Figure 1: UNIDO's IS Strategy

6. Conclusion

The current economic development paradigm has steadily contributed to the deterioration of the environment, including air, water and soil quality. This calls for a focal shift from short-term economic growth to the achievement of long-term sustainable development. This will require a multifaceted paradigm shift, ranging from the introduction and implementation of national policies right down to the individual consumer's behavior. There are a number of public policy challenges that need to be met during the shift to green growth – these range from clean technology development, industrial and job restructuring to changing consumer habits.

Efficient use of natural resources, eco-efficiency mechanisms and waste management schemes will be vital for the shift to a green economy, as well as the investment into research and development and Innovation and Technology Business Clusters. These are all factors which will create an enabling environment for private sector development, which need to be back by reforms and policy changes. The utilization of the large unemployed young professional population will be of critical value to

the Arab region as more stream out of the higher educational system seeking employment and future opportunities, which creates pressure and highlights the current mismatch in skills developed in the educational system and the skills demanded in the industry.

Furthermore, countries need to be independently competitive and have a knowledge-based innovative economy. This can be achieved through the introduction of an Innovation System Framework, which states that a country's innovation performance depends on many actors, their individual capacity to support aspects of innovation and the linkages connecting them into productive networks, as well as the various framework conditions. UNIDO's Innovation Systems Programme will aim to provide countries with a broader and more comprehensive view of innovation, whilst assisting them in the diversification of their economies by increasing the variety and quality of their export base. The impact of UNIDO's efforts will be maximized through their focus on four pillars, ranging from system elements, international linkages to gearing for the future and global sharing.

Annexes

Annex A

Green Energy Success Stories

Green Energy

Definition: Green Energy is composed of those energy sources which cause zero or almost zero emission at the production phase. Examples are Renewable Energy sources, most important of which for Egypt are Solar (thermal & PV), Wind Turbines and biomass including plantation and utilization of Jojoba and other modern ZET (Zero Emission Technology) for waste utilization as Chemical Oxidation of bio-waste (Figure 2) and Thermo-chemical Breakdown (Pyrolysis) for other solid waste (Figure 3).

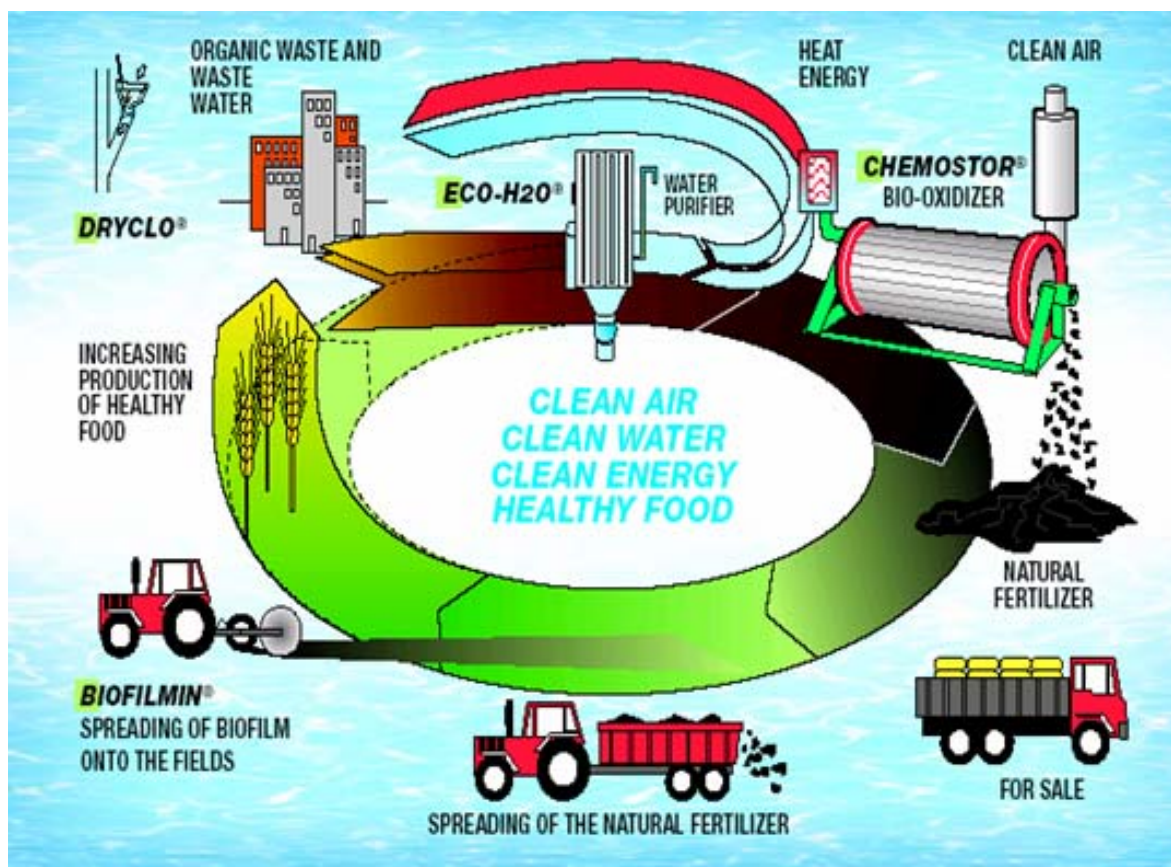


Figure 2: Chemical Oxidation

Examples of Existing Green Energy Projects in Egypt/Zaafarana

- Wind Energy Projects at Zaafarana (about 360 MW), Solar
- Thermal Project as part of combined gas-steam turbine cycles. The solar thermal power is 20MW (Figure 4).

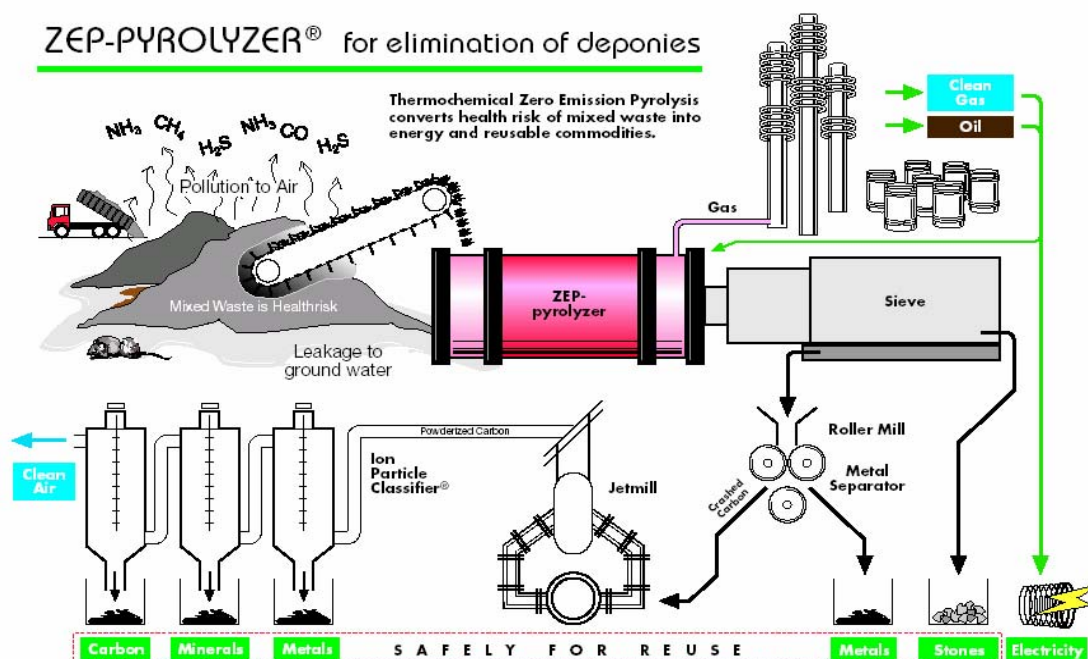


Figure 3: Thermo-Chemical Breakdown (Pyrolysis) of Solid Waste

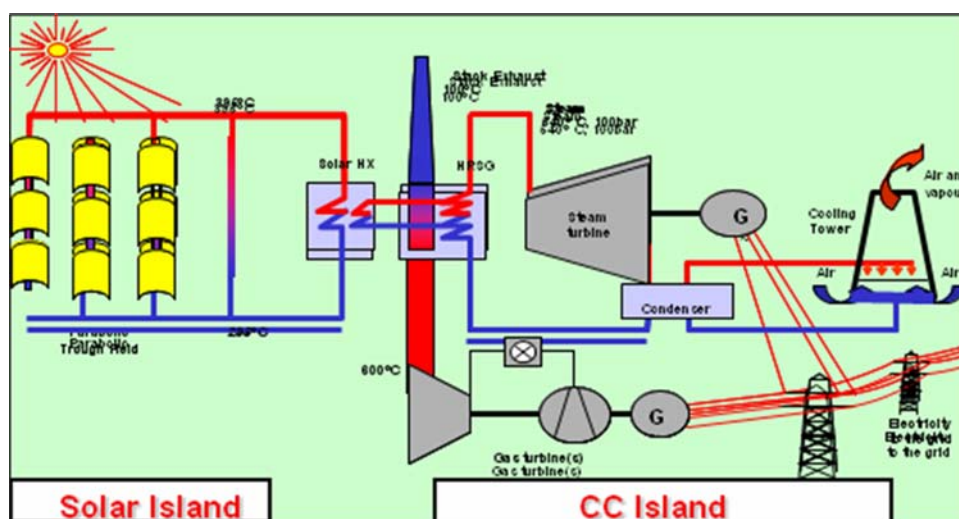


Figure 4: Solar Combined Cycle in Morocco

Use of PV (about 5 MW) for lighting, water pumping, wireless communications, cooling and commercial advertisements on highways

Green Industry:

Definition: Industry which has zero or almost zero emission, wastewater and solid waste is called green Industry.

The Industry should minimize its electricity consumption from the grid by:

- Using Solar Heat for Industrial Process (SHIP) to decrease/eliminate dependency on fossil fuel as illustrated in Figure 5 below.



Figure 5: Use of Solar Heat (1.33 MW) in Industrial Process in El-Nasr City, Egypt

- Use of Solar Air Conditioning instead of dependency on electricity of grid (Figure 6).



Figure 6: Solar AC Plant built by Siemens in Spain

- Improving the Energy Efficiency of processes and equipment to consume less energy.
- Using Best Available Technology (BAT) to decrease energy consumption and wastes.
- Recycling wastewater and regaining chemicals/elements in the wastewater.
- Reusing, recycling or recovering energy from solid wastes using ZET and other modern technology with minimum emissions (Figure 2 and 3).

Examples of Projects being investigated

- Turning New Borg El-Arab into Zero Emission City by the year 2025.
- Using PV/LED combination in street lights in Egypt (Figure 7).



Figure 7: Use of PV/LED combination in street lighting

Annex B

Success Stories from Sudan

Sweet Sorghum – Ethanol Production from 300,000 Acre of Sweet Sorghum



Figure 8: Steps to produce Sweet Sorghum

- Produce ethanol from Sweet Sorghum, and manufacture composite boards from Sweet Sorghum fiber.
- Energy security.
- Employment opportunities in rural areas.
- Local industrial bases.
- Economic benefits arising from the export of ethanol.

What is needed?

- Pilot biodiesel reactor.
- Small pressing machines.
- Technical assistant (Laboratory equipments & Training)

The Miracle Tree (Moringa)

The Moringa Tree is rich in multi-vitamins and minerals, ranging from Vitamin A, B1, B2, C, Calcium, Magnesium all the way to Zinc, just to name a few.

Its uses are as unique as the names it is known by, such as clarifier tree, horseradish tree and drumstick tree (referring to the large drumstick shaped pods).

Uses of Moringa tree



LEAVES

- Human food (Nurtition)
- Pharmaceutical products (Medicine)



TREES

- Alley Cropping
- Fighting desertification (Erosion control)



FLOWERS

- Pharmaceutical products (Medicine)



PODS

- Human food (Nurtition)
- Pharmaceutical products (Medicine)





ROOTS

- Pharmaceutical products (Medicine)



SEEDS

- Water Purification
- Pharmaceutical products (Medicine)
- Oil



GUM

- Pharmaceutical products (Medicine)

BARK



- Pharmaceutical products (Medicine)

Other uses:

- Animal and fish feed
- Plant growth hormones
- Fighting desertification
- Climate change and carbon dioxide re-absorption

What is needed?

- Seed press.
- Capsule unit.
- Packaging unit.
- Technical assistant (Laboratory equipments & Training)