

# DEVELOPMENT AND APPLICATION OF INFORMATION & COMMUNICATION TECHNOLOGIES (ICT) IN INTEGRATED RENEABLE ENERGY & WATER SUPPLY FOR LIBYA (LIREWS)

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**Abstract**— Libya is a country that is being faced by two key challenges; the need of adequate water supply and the need for sustainable renewable energy development. Past and current strategies have not helped Libya to experience sustainable water resources and reduce overdependence on petroleum as the source of energy.

LIREIW project is proposed. The project encompasses the use of ICT to foster research and development within and across research centers on matters related to renewable energy and sustainable water supply.

This research uses a case study qualitative approach, where a related case, JoRIEW has been identified to form a framework that can be used in Libya.

Through effective integration of ICT into the LIRIEW project, Libyan organizations within the network will be able to apply innovation policy projects and further research jointly, promoting social and economic development in Libya.

Index terms— LIRIEW, JoRIEW, ICT and Renewable Energy Technologies (RE)

## 1 INTRODUCTION:

### 1.1 Background:

Clean, sustainable water supply and the need to develop appropriate and sustainable energy remains the core issues in Libya. Sustainable energy realization usually focuses on the development of renewable energy resources. The location of Libya provides it with huge potentials on the development of renewable energy resources such as solar and wind energies, but at the same time being a challenge for water resource creation and conservation. With this, there has been the need to focus more attention towards research projects that can provide solutions to challenges facing sustainability of these two important resources. One of the revolutionary strategies in such cases is the adoption and integration of ICT into water supply and renewable energy development.

Of particular concern, is the integration and development of ICT in the energy and water supply sector. As a success factor, such projects will require political, economic and social support from all the concerned parties. One of key areas is through research and development. Libya has been enjoying a considerable benefits from international collaborations, especially in the oil and petroleum development issues.

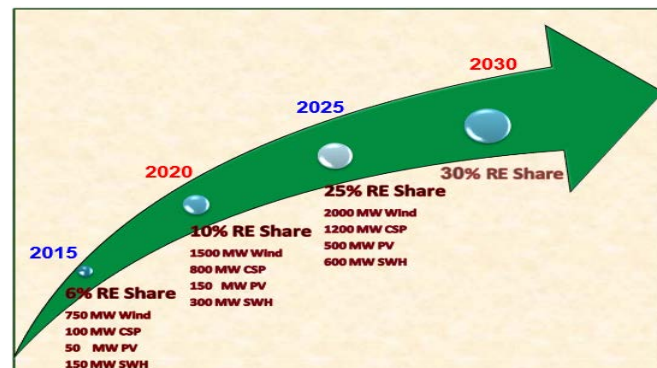
These collaborations can extend to cover scientific and science research areas, especially in the world of information technology. Libya boasts as one of the countries in the Arab world with high literacy levels [1]. This extends to institutions of higher learning, where Libya has a number of recognized universities such as the Libyan Academy and Garabouli high institute. Within this line, this paper examines the possibility of developing a framework through a LIRIEWS project, that will see greater cooperation capacities between Libya and several European research centers. To do this, the paper will cover how the LIRIEWS project can increase the overall energy conversion efficiency and costs efficiency that will see a significant reduction of electricity production costs from indigenous renewable energy resources. This will also add significantly towards environmental conservation that has been threatened by current overreliance issues on petroleum products in Libya.

### 1.2 Status of water supply in Libya:

Libya is a country that is being faced by challenges related to dry climate conditions and desert like environment, resulting to water scarcity. Like any other nation, the country has crucial demands resulting from the growth of population as far as agricultural and industrial needs. Primary water sources in Libya are mainly made of erratic rainfall and fossil ground water that is contained in the four main sandstone aquifers, which is scarce [2]. Freshwater supply in Libya is estimated to be 3820 million cubic meters annually, with an estimated 3000 million cubic waters depleted annually [2]. This leaves the nation with a 21-percent deficit. Agricultural water supply remains the key water consumer, occupying 85% of the total water consumption, with domestic water consumption taking 11.5 percent and industrial consumption assuming 3.5 percent [2][3]. Currently, the government is at the early stages of implementing a project known as "Manmade River Project" abbreviated as (MMRP) that has been stalled due to insufficient funding and civil unrest [2]. Therefore, there has been the need for research to develop ways of increasing water efficiency, discovering or creating new water sources and improvement on the water conservation strategies.

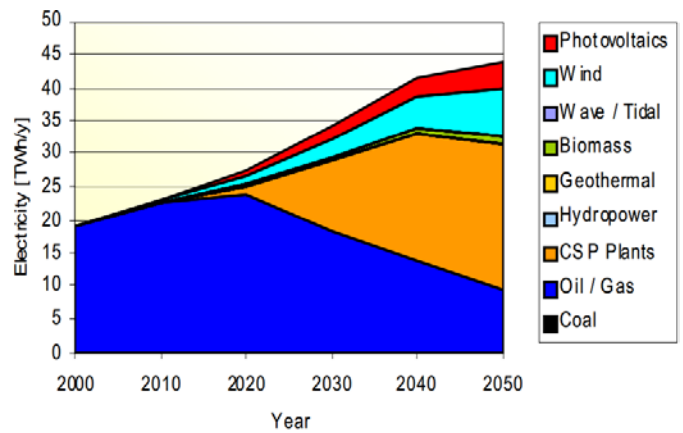
### 1.3 Status of RE development in Libya:

In terms of energy, Libya boasts of being a key producer of oil and related resources. The petroleum industry remains the key driver of Libya's economy. Key strategies have focused to reduce overreliance on petroleum. By the end of the year 2012, the country consumed an average of 170,000 bbl/ d of petroleum, with almost everything from domestic refineries. However, dependency on oil poses other challenges, that are mostly economical and environmental in nature. One main strategy has been focus on renewable energy sources such as electricity and solar power production [4]. Applications involving renewable energy in Libya started in the middle 70's but have picked momentum in the last decade. Currently, there is a proposed national Renewable Energy (RE) plan that is aimed at adding 10% of electricity production by the year 2020. This prompted the development of the Renewable Energy Authority Of Libya (REAOL). This includes the use of solar and wind power (based on the country's climate advantage) and production of hydropower . This plan is represented by the figure below:



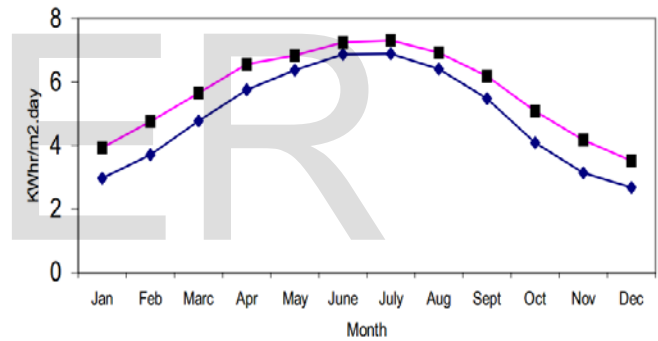
Source: Independent Statistics & Analysis-U.S Energy Information Administration, 2013[5]

As earlier stated, Libya enjoys a great potential for renewable energy. The following graph can be used to illustrate this:



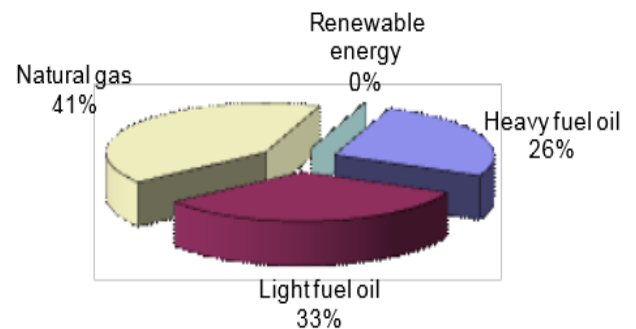
Source: Independent Statistics & Analysis-U.S Energy Information Administration, 2013 [5]

The current status of solar energy is described by the following graph:



Solar heat patterns across the year, Source: Independent Statistics & Analysis-U.S Energy Information Administration, 2013 [5]

However, the benefits of these projects have not yet been released. This is despite the fact that Libya is a great potential of wind and solar energy. The chart below illustrates various energy sources and their development in Libya.



Source: Independent Statistics & Analysis-U.S Energy Information Administration, 2013 Energy mix in Libya [5]

Uses of electricity which is the main source of RE in Libya is illustrated by the figure below:

Category	Percentage
Residential	32%
Industrial	10%
Agriculture	14%
Commercial	14%
General Services	17%
Street Lighting	13%

Source: Independent Statistics & Analysis-U.S Energy Information Administration, 2013[5]

Despite various current strategies and frameworks to improve water supply and RE development, Libya is yet to experience dependency and sustainable water and energy development. One of the key areas that have yet to gain focus is the development and integration of ICT in water supply and RE development.

#### 1.4 Need for ICT in water resource & RE development in Libya:

ICT and related technologies is not a new concept in Libya. Currently, the country has enjoyed enormous benefits resulting from ICT, especially in the education sector. However, apart from the education sector, Libya still lags behind as far as development of the ICT infrastructure, tools and access are concerned. Through the ministry of Communications and Informatics, the country is at early stages of developing a National ICT Strategic Plan (NICTSP) that will make ICT one of the pillars of the Libyan economy. However, the nation will have to wait to see the benefits of this strategy. Current applications of ICT in water supply and RE development for Libya are still wanting.

## 2 METHODS

### 2.1 Case study as the research methodology:

This research will embark on case study as the research methodology. Case studies provides a better understanding of complex issues from what is already seen, known or perceived from previous related researches. This methodology provides a qualitative approach that can be used to examine real-life projects, and also offer suggestions on how they can be improved or modified to suite other cases. A related case study, where RIEW has done significantly was examined. JoRIEW is a related project that has been adopted by Jordan to enhance cooperation capacities for the research centers through promotion of scientific collaborations with a number of research centers and universities [6]. The research was limited towards the ICT

component towards successful implementation of RIEW project.

### 2.2 Why Jordan?

Jordan and Libya share various similarities in terms of economic, geographical and technological developments. Both countries share similar desert-like conditions, with water and energy issues as the key concerns. In terms of research, both countries are endowed with several research centers and universities. The success factors behind JoRIEW project can be effectively be integrated to suite Libya. However, political differences exists between the two countries. The scope of this paper is limited only to the adoption of ICT in the LIRIEW project and hence will not examine potential issues that relates to the effects of political differences towards the whole LIRIEW project.

## 3 RESULTS

From the JoRIEW, the following three points can be concluded:

ICT plays the key component in connecting researchers and research institutions. This can be evidenced from successful research networks (both internally and externally) like: Ammam Private University, Instituto Tecnológico de Canarias, ELI - The European Labour Institute, Centre for Research and Technology Hellas (CERTH) and so on [6].

ICT can be used to create a pool of knowledge, where parties in the network can be able to share complex knowledge concepts such as understanding water and RE management systems. A case example, is through the realization of the JoRIEW knowledge center [6].

ICT in a RIEW project will foster talent development, creating of an appropriate research policy among research parties, and offers a platform to understand technical aspects that concerns water supply and RE development. This is evidenced from the use of ICT system to visualize, monitor and simulate different environments especially for experimental studies within [6].

## 4 DISCUSSION

This section examines on how the JoRIEW case can be used as the development basis for the LIRIEW project.

JoRIEW project offers a platform that focuses on international cooperation in terms of science and technology talent development. This includes issues such as the research policies, human resource development, and building networks for research institutes and researchers. In Libya, the use of ICT can be used in the LIRIEW project to create and build research networks, both within the nation and across the country. Within Libya, this will involve ICT applications, tools, infrastructures and technologies that can connect higher

learning institutions and research centers such as Libyan Academy and Garabouli high institute. Internal networks will then be linked to international scientific research centers and

institutions, with a special focus on a number of European universities and research centers. Similarly, ICT solutions through the use of human resource systems will be integrated within the LIRIEW to assist in the development of human resources across the collaborating partners.

On the technical application of ICT in development of technical solutions towards RE and water supply in Libya, several concepts have been developed. ICT tools in this case will be effectively to assist in research in the following areas: development of solar energy, wind energy, hydro energy and geothermal energy. In these areas, ICT tools will be used for modeling analysis, simulation techniques, monitoring and visualization tools that can be used to experiment different options applicable to Libya (Ekhlal, Salah and Kreema 2007). Through collaborative research, different parties will be able to use established communication networks to discuss among others the following:

Efficient use of ICT based tools to analyze Heating Ventilation Air Conditioning (HVAC) systems, where potential research areas might involve; switchable vacuum insulated panels, integrated control for temperatures and humidity house conditions, and so on.

Use of ICT tools to increase energy efficiency of lighting systems such as daylight and occupancy sensors.

ICT tools to monitor and evaluate seawater desalination technologies.

The implementations of ICT in enhancing smart grids and research on the possibilities of electric cars.

Use of ICT to identify and manage renewable energy sources such as the use of Prognostics and Health Management (PHM) technologies, Renewable Energy Sources Mapping technologies, and the effectiveness of rural telecommunication systems.

Finally, from the JoRIEW case, the following components will be essential for a successful integration of ICT in the LIRIEW project:

Examination of the potential regulation requirements that involves incentives and quality insurance.

Elaboration of the finance options, for the case of Jordan, this is supported by the European Commission, 7th Framework Programme. In Libya, this can be done through the national government and external fundings to support research and development, together with investments and other studies.

A technological platform, that will be supported by Demo and Pilot projects before complete rollover of the project.

Lastly, a supportive environment, in terms of training, education and information sharing to foster effective collaborations. This will include addition of research

institutions, and the need to engage more collaborative partners.

## 5 CONCLUSION

Integrating ICT in LIRIEW project will offer a lasting solution towards water and RE development challenges in Libya. The

study examines a previous model that has been used in Jordan as a cornerstone for the LIRIEW. Integrating ICT in

LIRIEW will offer a sustainable strategy to connect research institutions and universities within Libya as well as international collaborations. This will touch on human resource development, and effective research policies for Libya. Through LIRIEW, Libyan organizations within the network will be able to apply innovation policy projects and further research jointly, promoting social and economic development in Libya.

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## 7 REFERENCES

- [1] bservatory, 2013, PanaAfrican Research Agenda On The Pedagogical Integration of ICTS: Libya, Viewed 21st December 2013, <<http://www.observatoiretic.org/countries/show/20>>.
- [2] Vidal et al 2001, Case studies on water conservation in the Mediterranean region, Food and agriculture organization of the United nations (FAO).
- [3] Ekhlal, M, Salah, I, and Kreema, N, 2007. Mediterranean and National Strategies for Sustainable Development Priority Field of Action 2: Energy and Climate Change Energy Efficiency and Renewable Energy: Libya - National study.
- [4] Eales, A 2013, Sustainability & Engineering, Mike Clifford University of Nottingham.
- [5] Independent Statistics & Analysis-U.S Energy Information Administration, 2013, LIBYA, Viewed 21st December 2013, <<http://www.eia.gov/countries/cab.cfm?fips=LY>>
- [6] JoRIEW, 2010, JoRIEW Project, Viewed 21st December 2013, <<http://www.joriew.eu/sitegenius/index.php>>.
- [7] Stallo, C, De Sanctis, M, Ruggieri, M, Bisio, I and Marchese, M, 2010, ICT Applications in Green and Renewable Energy Sector, 2010 Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises. December 2013,

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