Improving renewable energy studies in the Maghreb. Lessons learned from the MOMATE project

Universidade Vigo

momate

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Preamble

Presently, modern societies rely heavily on fossil fuels such as coal, oil or natural gas for their progress and to provide transportation, heat and the power that requires a productive economy. However, fossil fuels are non-renewable, that is, they draw on finite resources that will eventually become scarce, being too expensive or too environmentally damaging to obtain. In contrast, renewable energy resources such as wind and solar energy are constantly replenished and will never run out.

Thus, our societies shall become aware of this situation and understand that Renewable energies are reliable and plentiful, and have the potential to substitute all fossil fuels once technology and infrastructure improve. Here, education plays a fundamental rol.

MOMATE dramatically contributed to the dissemination of the potential of renewable energies through education, as it established the foundations of academically solid education and training programes and, through them, a solid partnership with relevant higher education institutions in Morocco, Algeria and Tunisia, and also helped to reinforce existing collaborations with some our most relevant partners in Europe. Besides, this contributed to increase the international presence and prestige of our universities through the integration in an international university network, the participation in academic events of international relevance, the deployment of a network of students, lecturers and staff, and the development of innovative instruments for promoting learning in a multicultural environment

I want to express my appreciation for all the staff and students that contributed to make MOMATE such a success. You have

done a remarkable work. The University of Vigo feels proud to be an active member of this excellent partnership, and is very happy to be a part of the MOMATE community.

Vigo, February 2018

Manuel José Fernández Iglesias
Vicerrectorado de Extension Universitaria y
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1. Introduction to the MOMATE projet

This publication concerns the European project Tempus Momate, which aims to accompany recent developments in the renewable energy sector in the Maghreb countries and to ensure quality training in universities compatible with European standards and responding to the socio-economic needs of the Country of destination. Its direct objective is to strengthen training capacity in order to meet the growing needs of the employment market in the field of renewables energies (RE).

- Capacities in the field of renewable energies and the development of new concepts and approaches for the promotion of renewable energies,
- Practical training centers on national and regional RE, equipment testing laboratories in RE and platforms for technological innovation, by promoting the link between laboratories and companies,
- Efficient know-how, particularly in terms of engineering and project management,
- Specialized documentation centers serving students, young promoters and university researchers in the field of RE,

This objective will be achieved through the following activities:

- Exercise of the analysis of the state of play in consortium institutions, and documentary research with a survey and interviews with appropriate stakeholders,
- The adequate determination of theoretical and practical content to be integrated into the curriculum and capable of meeting the real market requirements,
- Evaluations and execution of the curriculum materials and content in a distance learning platform,
- Training and capacity building of teachers in beneficiary countries,

- All partners in the consortium have a rich experience in training and experience in the field of renewable energies as well as various active participants in Tempus projects.

Global warming, persistent volatility in oil prices and rising global demand have all contributed to the emergence of renewable energies as an alternative to conventional sources. Given the scarcity of resources, increased energy needs, concerns about security of supply and the impacts of climate change, by 2020, the European Union aims to cover 20% of its energy needs from Renewable energy and reduce greenhouse gas emissions by 20% below 1990 levels.

On the other hand, the Maghreb countries are now confronted with a series of problems such as high population growth, water scarcity, rapid urbanization and economic growth of around 6% (sustained by the deployment strategic infrastructure and development programs). As a result, energy demand growth of around 6% is expected to increase significantly. Therefore, the essential energy challenges facing the Maghreb countries are numerous and diverse if one considers the specificities of each country.

The strategic importance of the Mediterranean on the other hand and the economic interdependence of the countries of the region have led to the creation of a multilateral framework for cooperation in various fields, including energy and sustainable development. The primary objectives of the Mediterranean solar plan are the construction by 2020 of 20 GW of additional electricity generation capacity, in particular solar power, in the South and East of the Mediterranean and the development of interconnection lines allowing the export of part of this green electricity to the European Union.

In order to be able to respond to this demand and meet the challenges, multidimensional powers and a great enthusiasm for the promotion of renewable energies have been felt for some time in the Maghreb countries. Consistent with this approach, the Maghreb countries have initiated solar and wind projects that are part of national strategies for the development of renewable energies, respect for the environment and sustainable development. This reflects the ambition of these countries to master innovative technologies in the various fields of renewable energies, to use them as leverage for industrial and social development.

Faced with this equation of several unknowns, experts in the field of RE point to a series of dysfunctions: legal framework, support of the sector, or governance of research and higher education. This mega project will generate the creation of several jobs, and obviously the need to supply the market with a large number of qualified personnel is an important factor for the success of this mega project.

The MOMATE project responds to the lack of undergraduate and master programs in the field of RE. However, these training courses tend to be rather theoretical and do not meet the growing needs for skilled personnel, particularly where demand will be felt, namely that of technicians in the field of RE technologies.

An education and training program therefore becomes a necessity. It should be based on extensive broad spectrum training and up-to-date knowledge of the latest developments in new technologies to enable future winners to better respond to evolving needs and labor market requirements.

The overall objective of the project: Modernizing RE training in the Maghreb; Transfer of the EU experience, is therefore to accompany the various solar and wind projects, by ensuring that universities in the Maghreb can offer quality training compatible with European standards and responding to the socio-economic needs of the new knowledge society by strengthening and modernizing the teaching of renewable energies. Specifically, the project aims to improve, in collaboration with our European partners, a training program in RE engineering and the development and emergence of technologies specialized in renewable energies.

1.1. Objectives

The aim of the project is to improve, in collaboration with the European partners, a training program in RE engineering, and the development and emergence of RE technologies. The objective is to acquire the basic knowledge on the production of electrical energy from renewable energies (wind, solar photovoltaic, ...)

The specific objectives of MOMATE are as follows:

- To Develop and accredit a training program in renewable energy engineering jointly taught in Maghreb universities as well as the development and emergence of technology parks specializing in renewable energies;
- To Improving the human capacities of Maghreb universities through training in EU countries.
- To Engage professors in the development of interactive teaching techniques through lectures, courses and experience sharing with EU partner universities.

- To Develop and put online the content of the course and practical exercises, using the platform of distance learning,
- To Expand services and training in collaboration with local and regional industry and community

These specific objectives contribute to a solution that promotes the teaching of renewable energies in a sustainable way.

1.2. Partnership and organizational structure

- General Committee: The General Committee is composed of a maximum of 2 representatives from each partner, including the components of the Quality Committee, the managers of the work packages and the Academic Coordinator.
- Quality Committee: the object is to guarantee the quality of the project
- Academic Coordinator: The academic coordinator of the project is the University Abdelmalek Essaâdi (UAE).
- Coordinator of each WP: for each WP there is a coordinating partner who reports to the General Committee and to the project coordinator

1.3. Needs analysis

The project began with a situation study followed by a survey, bibliographic search and interviews with appropriate stakeholders, including national firms and government agencies to reflect real market requirements, trends and needs as well as government policies and regulations. The results of the needs analysis activity determine the most appropriate nature of the theoretical and practical content to be integrated

into the courses A provisional or mock-up list of courses will be drawn up in collaboration with the various partners, in particular European.

The target groups are universities, national companies and government agencies, as well as international projects and initiatives. The results of this activity helped to determine the theoretical and practical contents best suited to be integrated into the curriculum and that are capable of satisfying the real demands of the market. A seminar was organized in Rabat, Morocco on 23 and 24 October 2014 to present the results.

- Survey and analysis of needs in renewable energies

Methodology:
Two surveys have been carried out to better serve the different target audiences. This questionnaire is distributed as part of a preliminary study carried out training in renewable energies: transfer of EU experience, with a view to finalizing a qualitative training program that meets the nneds of the actors involved and policies in the field of renewable energies.

- Synthesis of survey results

The general aspects for the training needs to be examined from two angles: The first is to know what are the "targets" of teaching? (where of course the needs of today depend on the current employment prospects); and the second is to decline them into subjects that must be taught.

Questionnaires (for actors involved in the renewable energy sector) were carried out in order to know precisely the training needs and thus to better respond to the training / employment adequacy in this field.

The objective is to have a precise knowledge of the capacities required for specialized technicians who will have to intervene at the level of the laboratory, test centers, industrial production, commercial distribution, assembly systems, their installation and maintenance.

This questionnaire enabled us to better identify the training programs, in particular the technicians specialized in photovoltaics, wind and solar water heaters. This questionnaire can be completed directly by the head of educational services or by any other teacher in charge of the field to the extent that the identification of the person providing the questionnaire is provided

To better match training and employment, the first phase aims to identify the projects and the challenges of the actors involved for which training actions will have to be carried out. For this purpose the following questions were considered:

- What improvements and changes are envisaged?,
- What are the expected results?,
- What are the training objectives ?

- Work methodology

Purpose of the study:

- Identification of training issues in renewable energies.
- Identification of training needs to ensure that benefits address the concerns of beneficiaries,
- The survey should also provide usual classical job analyzes,
- The headings concerning difficulties encountered and training needs,

The analysis of the results was carried out at two levels:

- the analysis of the tasks and difficulties of the different players on RE in the exercise of their function,
- the analysis of their needs expressed in training.

The analysis of the results shows the following points:

- Inventory
  - Lessons in renewable energies are taught by academics,
  - Lack of specific material for vocational training in renewable energies,
  - The academic training provided is the initiative of a group of teachers. They are, in general, not related to the socio-economic sector,
  - Local companies that accompany academic institutions are generally not specialized in renewable energies,
  - The lack of knowledge on the part of the companies and the users is causing a real disadvantage to the appearance of this technology,
  - Companies working in the renewable energies sector suffer from the lack of qualified RE technicians, ,
  - Equipment and materials used mainly come from abroad (France, Spain, Italy, China and USA).
  - Maintenance is often provided by the companies that have installed the equipment.
- Needs and Remedies
  - Learning sizing of different thermal energy systems (Solar heating and cooling),
  - The same applies to photovoltaic power plants, particularly for isolated sites,
  - Aerodynamics and wind energy,
  - Photovoltaic converters,
  - Solar water heating, installation and maintenance,
  - Hybridization of PV and Wind generators,

- Protection and security of all systems.

- Maintenance of systems
  - Technical-economic studies and energy efficiency.
  - Continuing education, practical workshops, seminars, etc.
- Summary of results

The identification of training needs has been carried out in a way that genuinely responded to the concerns of the beneficiaries. The survey should add value to the analyses of traditional jobs, by including the heading difficulties and training needs.

The results are presented according to the actors involved in the renewable energy sector.

2. Renewable energies in North Africa

Renewable energy is growing rapidly around the world, driven by economics, environmental concerns and the need for energy security. The use of modern renewable energy technologies is also on the rise across North Africa, where countries are uniquely positioned to leapfrog the traditional centralised energy supply model.

The North Africa region is endowed with large renewable energy potential. Solar resources are abundant everywhere and wind resources are of the highest quality.

The potential for wide-scale deployment of renewable energy technologies in the region is considerable. Rapid demographic growth and the rising need for economic development call for additional, stable energy sources that can satisfy demand while protecting the environment.

The possible applications for all these resources include power generation, heating and cooling for both industrial and domestic applications, lighting, transport and direct uses of mechanical energy. Renewable energy technologies can be deployed locally, at small scale, opening up new forms of financing and productive uses, as well as broadening electricity access.

Most North Africa countries have scaled-up their interest in renewable sources of energy, especially in wind and solar power generation.

North Africa has an exceptional solar resource that can be harnessed for electricity generation and for thermal applications. The desert regions enjoy particularly long sunny days with a high intensity of irradiation. Solar energy can be utilised at various scales, making it suitable from the household

and community levels to industrial and national scale operations.

POWER APPLICATIONS

Solar

Two types of technologies exist for power generation: solar photovoltaic (PV) and CSP. The former can be universally used, in applications ranging from household systems to utility-scale, while the latter is typically a technology that performs optimally in utility scale projects situated in the desert regions. Overall, Africa's solar power generation potential exceeds future demand by orders of magnitude. Even the smallest countries on the continent have at least a few gigawatts of potential for either technology.

Deployment of CSP is in the earliest phase. Algeria and Morocco have deployed a CSP project as of March 2015. Their installed capacity amounts to just over 180 MW.

CSP is attractive because its efficiency increases with irradiation level, which is not the case for solar PV where efficiency declines with rising collector temperatures. Given that the irradiation level corresponds also with the demand for air conditioning, solar CSP would reduce the need for peak capacity. This feature is attractive in desert countries where solar irradiation is particularly strong. CSP systems offer the opportunity to store solar energy as heat, for use to generate electricity during periods of low or no sunshine. CSP systems with thermal storage have higher investment costs, but they allow higher capacity factor and dispatchability.

Distributed solar PV

Smaller scale PV systems can be used with or without connection to a power grid. Off-grid PV markets have seen particularly dynamic development in a wide range of African countries. Small-scale distributed solar PV systems can provide power to houses and buildings for essential services such as lighting and charging electric appliances. They are already providing alternatives in rural settings to electricity from distribution lines connected to national transmission lines. Extending a national or regional grid to remote villages has often been an expensive solution to rural electrification. Solar PV (with or without battery storage) can also help significantly reduce fuel costs in existing mini-grids. Even where a connection to the existing network is available, if an uninterrupted supply is required, such as in health-care settings, solar PV systems with battery storage can be an economic solution.

Small-scale stand-alone PV systems are also used for mini-grid service in rural communities as well as for other community services, such as street lighting, solar kiosks, mobile-phone charging stations, telecom towers and pumping water.

Solar PV is especially suited for water pumping, as the operation can be adjusted to the availability of solar electricity. Sizeable markets for solar water pumping include nearly 300 MW of installed capacity in Algeria.

In addition to generating electricity, a number of modern technology applications have been deployed to provide heat for domestic and industrial heating needs. Two major domestic heating needs in Africa are cooking and hot water. For cooking, there have been many projects aimed at deploying solar cookers and they have met with mixed success. The initial cost

of a solar cooker is often above the means of the rural communities and eating at the time when the solar irradiance is at its best is not always convenient or traditional. On the other hand, domestic water heating using solar power has been encouraged in many parts of North Africa, and the market is growing fast in selected countries including Algeria, Tunisia, and Morocco. By the end of 2013, over 0.5 gigawatt-thermal (GWth) of solar thermal capacity was installed in Tunisia, followed by Morocco at 0.4 GWth (IEA Solar Heating and Cooling Programme, 2015). The primary use is residential applications.

It is also possible to utilise solar energy for cooling. These installations are of particular relevance for remote medical clinics as well as industries, such as the dairy industry, that require cooling to enable product storage.

Solar energy has been used for water desalination in North Africa, a region facing increasing stress on freshwater resources. Current global capacity for renewable-energy desalination accounts for less than 1% of total desalination capacity. Of that small amount, 43% of renewable capacity uses solar PV and 27% solar thermal (European Union, 2008). In North Africa the total volume of desalinated water is estimated to account for less than 1% of total regional water demand. Yet the amount of energy used for desalination in Algeria, for example, is as high as 10% of the total electricity consumed in 2010. With desalination increasingly important it could be relied on to meet as much as 50% of new water demand. The combination of solar technologies and desalination technologies also provides a flexible demand option for non-dispatchable solar technologies.

Wind

Wind is converted into useful energy utilising wind turbines, for use either to drive electrical generators or to directly power pumps and other machinery.

The theoretical potential for wind in Africa exceeds demand by orders of magnitude, and about 15% of the potential is characterised as a high-quality resource. This enormous capacity is not evenly distributed: East, North and Southern Africa have particularly excellent wind resources. Countries with especially high wind quality include all those in North Africa.

Renewable Resources and Power Capacity

The region's renewable energy potential is high, particularly for wind and solar projects. Most countries are part of the SunBelt1, and benefit from solar insolation levels that are among the highest in the world (as high as 6.5 kWh/m² per day).

Since 2014, an impressive scale-up of renewable installed capacity has been observed in many North Africa countries. In 2015, renewable energy accounted for 6% of the region's total power generation capacity, mostly in the form of hydropower (4.7%), wind (0.9%) and solar energy (0.4%).

Morocco continues to lead the region in terms of total installed renewable generation capacity (excluding hydropower). As a result of its long-term efforts and successes in implementing its renewable energy action plan, Morocco has increased its share of solar from 35 megawatts (MW) in 2014 to 198 MW in 2015, and wind from 290 MW in 2012 to around 790 MW early 2016.

Renewable power: Installed capacity (2015)

	Wind	PV	CSP	Hydro	Other	Renewables excluding hydro (2015)		Total Renewables including hydro (2015)	
	[MW]	[MW]	[MW]	[MW]	[MW]	[MW]	[%]	[MW]	[%]
Algeria	10	270	25	228	-	305	2.2	533	4.1
Morocco	790.5	15	183	1,770	-	988.5	12.05	2,758.5	33.63
Tunisia	245	20	-	66	-	265	5.82	331	7.37

National Renewable Energy Targets in Arab Countries

Most countries in the region have set targets as part of their national renewable energy plans or sustainable energy strategies, be these medium-term (2020s) or long-term (2030s) targets. Such targets demonstrate a political commitment to the transition towards renewables. Many targets can be seen as relatively ambitious, considering the high and ongoing reliance on fossil fuels in most of the region.

The targets confirm an overall shift towards solar and wind in the region, as Arab countries focus on the renewable energy technologies that are perceived as mature.

One area gaining interest is waste-to-energy plants. These generate electricity and help minimise the negative impact of waste.

Renewable energy targets in the region

	Renewable energy targets							Target Date
	Wind	PV	CSP	Biomass	Geothermal	TOTAL		
	MW	MW	MW	MW	MW	MW	%	

Algeria	1,010	3,000	-	360	5	4,375	15	2020
	5,010	13,575	2,000	1,000	15	21,600	37[1] 27[2]	2030
Morocco	2,000	2,000		-		6,000[6]	42[3]	2020
	4,200	4,560						
Tunisia	1,755	1,510	460	-	-	3,725	30[3]	2030

[1] Including hydro [2] Electricity generation [3] Installed capacity

National Renewable Energy Actions Plans

The primary objective in harnessing the renewable energy potential in the region is to meet the increasing demand for energy and water from growing populations. Renewables can supply secure, clean energy, providing an efficient solution to climate change by abating harmful greenhouse gas (GHG) emissions.

Morocco is taking the lead in terms of deployment of renewable energy and carbon dioxide abatement, with a pledge to produce 52% of its electricity through renewable energy by 2030 and to reduce emissions by 13% below the business-asusual scenario (BAU). Similarly, Tunisia's INDC advocates 14% of electricity production by renewable energy in 2020 and 30% in 2030. Following the same path in its INDC, Algeria indicated a target of 27% of electricity generated from renewable energy by 2030 contributing to emission reduction targets of 7-22% from BAU, with the lower end being unconditional and the upper end of this objective being provisional on climate finance and access to technology.

Renewable energy evolution

Total renewable energy										
(MW)	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Algeria	251	251	232	230	230	255	255	255	266	537
Morocco	1795	1857	1863	1992	2090	2095	2097	2294	2598	2599
Tunisia	82	82	83	117	117	118	239	267	322	322

Hydropower										
Algeria	249	249	230	228	228	228	228	228	228	228
Morocco	1721	1721	1726	1770	1770	1770	1770	1770	1770	1770
Tunisia	62	62	62	62	62	62	62	62	62	62
Wind energy										
Algeria	-	-	0	0	0	0	0	0	10	10
Morocco	64	124	124	253	286	291	291	487	787	787
Tunisia	19	19	19	53	53	53	173	200	245	245
Solar energy										
Algeria	2	2	2	2	2	27	27	27	28	29
Morocco	11	12	13	13	34	34	35	36	40	41
Tunisia	1	1	1	1	2	3	4	5	15	15

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3. PLAN AND TRAINING PROGRAMS

3.1. ALGERIA

3.1.1. Description of education in the country

The Algerian education system is based on the twin foundations of the settler focused French colonial system and a determined expansion, reform and Arabization of what little remained after independence.

In 1962 less than a third of Algerian Muslins went to primary school. Only 30% of students at secondary and 10% at university were native Algerians. The education was seen as being right at the heart of rebuilding the nation, training a skilled workforce.

Today education accounts for 20.27% of government expenditure. Algerians can access free education at all levels if they qualify by passing the previous cycle. The first two cycles (9 years from age 6 to 14) are obligatory and have very high assistance. The secondary education is obligatory too. To progress from primary to middle school, from middle school to secondary and from secondary to tertiary education evaluation or exams have to be taken.

The school system

The Algerian school system consists of three stages, or cycles, which have been redesigned over the last decade from a 6-3-3 (Primary/ Middle School/ Secondary), to the current 5-4-3 which was instituted in 2003.

The fundamentals of school education have been modified in recent years. The previous system had unsatisfactory results in terms of class size, high drop-out repetition rates, shortage of qualified teachers and not outdated teaching programs and pedagogies.

According to UNESCO data sources (2014), the school age population by education level are:

- Pre-primary (810.291);
- Primary (3.379.461);
- Secondary (4.056.674);
- Tertiary (3.492.401)
- Total of [11.738.857] in the system.

In 2009, there were 24.600 schools at all levels, and 370 thousand teachers, and the Ministry intended the addition of 300 primary, 1.000 middle, 850 secondary and 2.000 boarding schools (important for the education of children from remote rural communities).

In 2010, the rate of promotion from primary to secondary schools was by evaluation, and many failed on the first attempt. The pass rate was 66.4%.

At the end of second cycle, grade 9, the "brevet d'enseignement fundamental" is issued, permitting progression to Secondary School to those who succeed - 66.4% pupils in 2010.

Secondary School begins with a foundation year, known as the "tronc comun", which is divided into three sections, general, science and technical.

In 2010 the baccalaureate pass rate on first sitting was 61.2%.

- The university system

Since Independence, the French model has dominated higher education, and only in the decade since 2004 has there been serious reform, with the progressive adoption of the LMD system under the Bologna Process, to which international comparability and outcome defined learning are central.

The oldest university in operation in Algeria today is the University of Algiers, which was founded in 1879 and maintains courses of study that include law, medicine and science.

While the University of Algiers has the highest enrolment rate, the University of Mentouri and the University of Oran are very popular, too. The three universities are in the Northern part of the country.

3.1.2. Types of higher education

The Ministry of Higher Education lists a total of 95 public institutions of higher education:

- 39 universities;
- 1 university of continuing education;
- 17 dispersed university campuses;
- 18 national tertiary vocational schools;
- 6 teacher training colleges;
- 2 university annexes;
- 10 preparatory schools;
- 2 integrated preparatory classes.

Universities are administered by the Ministry of Higher Education and Scientific Research. The rest of schools and institutes are supervised by the Ministry of Higher Education and by the Ministry that is closely related to the courses or study specializations offered by the institution.

The University of Continuing Education (Université de la Formation Continue – UFC), was created by decree in 1990. This University permits those who did not obtain the baccalauréat at school to enter higher education through 50 continuing-education centres distributed all along the national territory.

The region with the majority of the universities of the country is the coast zone.

Universities are divided into academic departments and offer a wide variety of courses at the undergraduate, postgraduate and graduate levels.

The university centres are scattered all over the country. In these institutions, the number of programs is limited, and educational offerings generally focus on professional areas, taking into account the labour needs of the region where the centre is established.

In recent years, many university centres have reached the category of university by expanding the number of disciplines in their training programs.

The institutes and specialized schools are not exclusively under the ambit of the Ministry of Higher Education and Scientific Research, generally another ministry shares the responsibility. In the highly selective national schools ("écoles nationals"), the Ministry of Science and Technology is amply involved in areas such as curriculum, admissions and staff.

The model of higher education in Algeria has been modified. The structure was adopted in three phases, bachelor (3 years), masters (2 years), Doctorate (3 years).

This structure is in force in most of the Western world as a result of the Bologna Process, which consists of a system of restructuring higher education to standardize the system of degrees and credits in universities across Europe.

Access to postsecondary studies is open to holders of the baccalaureate or a foreign equivalent. In addition to passing the baccalaureate, students must also meet requirements set

annually by the Ministry of Higher Education and Scientific Research.

These requirements are based on considerations such as the area of study in high school, the student's average score, or the number of places available.

3.1.3. Programs and degrees

Higher education has experienced significant changes in Algeria since the country's independence. The number of graduated students increased from 2.275 students in 1962 to 221.000 students in 1990. Since then, the number has been multiplied by five.

Today Algeria has more than 1 million Algerian students of higher education, of which 40% are male and 60% are female.

In Algeria, there are two types of institutions in the field of higher education.

- *Institutions under the supervision of the Ministry of Education and Scientific Research:*
  - universities;
  - dispersed university campuses;
  - "écoles normales supérieures";
  - national tertiary schools devoted to
  - particular scientific or vocational
  - disciplines ("écoles nationales supérieures").
- Public Institutions under the authority of other ministries but under the educational supervision of the Ministry of Higher Education and Scientific Research:
  - higher national training institutes;
  - "écoles d'ingénieurs";

The specific feature of the Algerian system of higher education is the existence, in addition to universities, of dispersed university campuses. These campuses are a decentralised component of a university and allows the higher education to flourish at the local level.

The objective of the tertiary schools and institutes is to train engineers.

The function of the "écoles normales supérieures" is to train primary and secondary teachers.

- Programs, degree and recognition of studies

Current System (universities)

The specific degrees awarded by institutions of higher education are determined by the field of study and not by the institution.

Students who graduate from university programs tend to do so from long-term programs, while those who graduate from non-university institutions tend to do so from short-cycle programs.

All degrees are awarded by the Ministry of Higher Education and Scientific Research or in professional fields by the associated ministry.

Programs

- State I:

There are two routes, the first is the short track of three years, which in most cases does not give access to further studies. Students graduating from short-track programs are awarded the "Diplôme d'Études Universitaires Appliqués (DEUA)".

The four- to five-year long programs leading to the Licence or "Diplôme d'Etudes Superieures" (both four years) or, in

technological institutes the "Diplôme d'Ingénieur" (five years), which is awarded in technological fields and some natural and earth sciences.

The Licence is awarded in the humanities and social sciences to graduates of universities, teacher-training institutes and specialized institutes. The "Diplôme d'Études Supérieures" is awarded in scientific and technological fields.

Other five-year degrees include the "Diplôme d'État d'Architecte", "Diplôme de Pharmacien" and the "Diplôme de Doctor Vétérinaire".

In engineering, students who have completed a DUEA in a related field can enter the third year of a "Diplôme d'Ingénieur "program. The "Diplôme de Docteur en Médecine" requires seven years of study.

- State II:

The research degree ("Diplôme de postgraduation") offered to graduates of relevant first-tier long programs (Licence, DES) is the two year "Diplôme de Magister".

The students have practical and theoretical classes in their area of specialization and are obliged to study a foreign language and carry out an investigation culminating in the defence of their thesis.

If they want to be teachers, they should receive pedagogical classes. In addition to completing a long first-tier program, students must pass an entrance examination to enrol in a magister program. In most cases the diploma certificate will mention the field of studies, specialization, overall grade and thesis title. Magister programs are offered at both universities and institutes with qualified faculties.

- State III:

The highest degree awarded in Algeria is the doctorate. It is open to holders of the magister and requires three to five years of original research, publication of at least one article in a scholarly journal and the preparation and defence of a dissertation.

a) Reforms:

The reform, known as the "L.M.D," is set to introduce a degree structure based on the new French model of bachelor's, masters and doctoral degrees (Licence, Master, Doctorate). These reforms are being undertaken as a pilot project at 10 Algerian universities, which are working in consultation with a number of European universities. The new degree framework is similar in structure to the reforms being undertaken in Europe through the Bologna process.

Process:

- The licence, corresponding to three years of study beyond the "baccalauréat" (bac+3);
- The master, corresponding to two years further study beyond the licence (bac+5);
- The doctorate, corresponding to three years of research beyond the master (bac+8).

The objective is that this system offers university programs of Algerian universities more compatible with universities around the world, thereby increasing the international mobility of Algerian faculty and students.

The reforms also aim to increase student flexibility in the choice of courses, making the system more efficient in aspects such as:

- the time it takes for students to graduate
- increasing lifelong learning opportunities
- increasing institutional autonomy
- producing learning outcomes more in line with the needs of the working market.

Instruction and assessment for each module is organized on a semester and is composed of a certain number of academic credit hours which are transferable as part of the overall module of study. One credit is equal to a student workload of 20 to 25 hours, and one semester of full-time study constitutes 30 credit hours. In line with the newly introduced European Credit Transfer System (ECTS), credit loads under the new academic structure are as follows:

- Licence (BAC+3, BAC+6 semesters) = 180 ECTS
- Master (licence + 2years, licence + 4 semesters) = 120 ECTS
- Doctorate (master + 3 years, master + 6 semesters) = 180 ECTS

The higher education is organized into semesters, composed of teaching units, the courses are grouped into areas of learning. A training area is a coherent structure covering several disciplines.

Credits are the unit of account to measure the student's work during the semester (courses, tutorials and practical, training, memory, personal work). The credits can be accumulated and transferred from one course to another.

b) Non university / institutes professional higher education

The tertiary education "non-university" instruction is offered at national institutes of professional higher education ("institus

nationaux *de* formation supérieure (INFS)"), which fall under the joint control of the associated ministry and the Ministry of Higher Education. As in the academic sector, administration of the non-university sector is highly centralized, and the ministries are responsible for determining admission requirements, length of studies, and program and institutional recognition.

3.1.4. Renewable energy training plan and program

- University of Aboubekr Belkaid Tlemcen (UABT)

Abou Bekr Belkaid University of Tlemcen (UABT) was founded in 1974. Since then it has continued to grow and become the second university in western Algeria with more than 40,000 enrolled students of which 300 from 27 Arab and African countries. More than eighty degrees are currently provided within the UABT, which has adopted the LMD system since 2004. The UABT delivers 4.000 diplomas per year, all specialties combined. The supervisory staff consists of 1.500 teachers, of whom 30% lectures.

The UABT has forty two research laboratories, one research unit and one Associated International Laboratory (LIA), employing a total of one hundred hundred teachers. UABT has a tele-education center that has been operating for three years.

The UABT is involved in the AVERROES and EU-METALLIC projects funded in the framework of Erasmus Mundus ECW. In addition, it has initiated cooperation projects with 40 foreign institutions.

UBAT participated in all project activities, from management, training or dissemination:

Coordinate the WP7

- Participate in the investigation and analysis of training needs in the field of renewable energy.
- Design and curriculum and content of courses in the field of renewable energies
- Establish and manage the environment of distance education
- Participate in the development of the capacity building program, training of staff and organization of European visits.
- Manage the installation of the educational station and the laboratories;
- Participate in events and conferences;
- Maintain effective communication with all stakeholders,
- Contribute to the monitoring and evaluation plan;
- Open training in renewable energy training.

Educational programs

Semester 1

Modules	Hours week 15 weeks	Hours			Other 15 weeks	Coef	Cr	Evaluation method	
		C	L	P C				Course	Exam
Base module 1.1									
Mathematics 1	67.5	3.0	1.5	-	82.5	3	6	40%	60%
Physics1	67.5	3.0	1.5	-	82.5	3	6	40%	60%
Lesson structure	37.5	3.0	1.5		82.5	3	6	40%	60%
Methodology module 1.1									
(exercises) Physics 1	22.5			1.5	27.5	1	2	100%	
(exercises) Chemistry 1	22.5			1.5	27.5	1	2	100%	
Computer Science 1	45.0	1.5		1.5	55.0	2	4	40%	60%
Writing Methodology	15.0	1.0			10.0	1	1		
Practical module 1.1									
Courses in science and technology 1	22.5	1.5			2.5	1	1		100%
Transversal module 1.1									

Foreign Languages 1	45.0	3.0			5.0	2	2		100%
Total Semester 1	375	16	4.5	4.5	375	17	30		

Semester 2

Modules	Hours week 15 weeks	Hours			Other 15 weeks	Coef	Cr	Evaluation method	
		C	L	PC				Course	Exam
Base module 1.2									
Mathematics 2	67.5	3.0	1.5	-	82.5	3	6	40%	60%
Physics 2	67.5	3.0	1.5	-	82.5	3	6	40%	60%
Thermodynamics	67.5	3.0	1.5		82.5	3	6	40%	60%
Methodology module 1.2									
Physics 2	22.5			1.5	27.5	1	2	100%	
Chemistry 2	22.5			1.5	27.5	1	2	100%	
Computer Science 2	45.0	1.5		1.5	55.0	2	4	40%	60%
Presentation Methodology	15.0	1.0			10.0	1	1		100%
Practical module 1.2									

Courses in Science and Technology 2	22.5	1.5			2.5	1	1		100%
Transversal module f1.2									
Foreign Languages 2 (French and/or English)	45.0	3.0			5.0	2	2		100%
Total Semester 2	375	16	4.5	4.5	375	17	30		

Semester 3

Modules	Hours per week 15 weeks	Hours			Time schedule By module	Coef	Cr	Evaluation method	
		C	L	P C				Course	Exam
Base module 3.1									
Fluid Mechanics	67.5	1.5	1.5	1.5	4.5	4	6		
Electricity	67.5	1.5	1.5	1.5	4.5	4	6		
Optics	45.0	1.5	1.5		3.0	2	4		
Methodology module 3.1									
Technical Drawing and	67.5	1.5		3.0	4.5	3	6		

Schematization Combinatory and Sequential Logic	60.0	1.5	1.0	1.5	4.0	2	6		
Practical module 3.2									
Environment and Sustainable Development	45.0	3.0			3.0	1	1		
Transversal module 3.1									
Economics and Business Management	22.5	1.5			1.5	1	1		
Total Semester 3	375	12	5.5	7.5	25	17	30		

Semester 4

Modules	Hours week 15 weeks	Hours			Time schedule By module	Coef	Cr	Evaluation method	
		C	L	PC				Course	Exam
Base module 4.1									
Renewable Energy 1	90.0	1.5	1.5	3.0	6.0	4	9		
Electrical Machinery	67.5	1.5	1.5	1.5	4.5	3	6		

Thermal Transfers	45.0	1.5	1.5		3.0	2	2
Methodology module 4.1							
Applied Thermodynamics	67.5	1.5	1.5	1.5	4.5	2	6
Mini-projects training 1	22.5	1.5		3.0	3.0	2	2
Practical module 4.1							
Regulation and control	37.5		1.5	1.0	2.5	2	3
Transversal module 4.1							
Communication Techniques 1	22.5	1.5	1.5		1.5	3	2
Total Semester 4	375	9	9	10	25	17	30

Semester 5

Modules	Hours week 15 weeks	Hours			Time schedule By module	Coef	Cr	Evaluation method	
		C	L	PC				Course	Exam
Base module 5.1									
Renewable Energy 2	90.0	1.5	1.5	3.0	6.0	4	9		

Thermal building and Energy Efficiency	67.5	1.5	1.5	1.5	4.5	3	6
Power Electronics	45.0	1.5	1.5		3.0	2	4
Methodology module 5.1							
Electrical Networks and Equipment	67.5	1.5	1.5	1.5	4.5	3	6
Mini-projects training 2	22.5			3.0	3.0	2	2
Practical module 5.1							
National Programme and Renewable Energies Legislation	37.5	1.5	1.5	1.0	2.5	1	2
Transversal module 5.1							
Communication Techniques 2	22.5	1.5	1.5		1.5	1	2

Semester 6

Modules	Hours week 15 weeks	Hours			Time schedule By module	Coef	Cr	Evaluation method	
		C	L	PC				Course	Exam

Base module 6.1						
End of studies project	180.0				8	15
Internship in a company	105.0				5	8
Methodology module 6.1						
Topography	45.0	1.5	3	4.5	2	3
Practical module 6.1						
Hygiene and Safety	15.0	1.5		1.5	1	2
Transversal module 6.1						
Project Management	30.0	3.0		3.0	1	2
Total Semester 6	375			25	17	30

❖ University of Constantine 1 (UC1_DZ)

Algeria, which faces a significant shortfall in access to renewable energy, needs long-term strategic visions and a training and research program that must be accompanied by policy decisions and addressing these challenges.

In line with its main objectives, Constantine University has for several years developed training and research programs based on these themes related to energy resources and engineering. We can cite as such:

Training Licenses: Energy Physics, Electrical Energy Control and Management, Thermal and Energy Engineering, Industrial Energy Systems

Masters Courses: Energy Physics and Renewable Energies, Climate and Energy Engineering, Refrigeration Systems and Renewable Energies, Thermal and Energy Engineering.

The UC1 has just created a department of renewable energies within the faculties of the exact sciences

The UC1 will participate in all the activities of the project whether it is steering, management, training or dissemination:

- Coordinate the WP7
- Participate in the investigation and analysis of training needs in the field of renewable energies
- Design and curriculum and content of renewables energies courses
- Establish and manage the environment of distance education
- Participate in the development of the capacity building program, training of staff and organization of European visits;

- Manage the installation of the educational station and the laboratories,
- Participate in events and conferences,
- Maintain effective communication with all stakeholders,
- Contribute to the plan for monitoring and evaluation of activities.
- Open Training in RE.
- Ensure the sustainability of the project.

Semester 1									
Modules	Hours week	Hours			Other	Coef	Cr	Evaluation method	
	14-16 weeks	C	L	PC	(14-16 weeks)			Course	Exam
Base module									
Base module 1.1	202.5	9.0	4.5	-		9	18	x	x
Mathematics 1/ Algebra and Analysis 1	67.5	3.0	1.5	-	45.0	3	6	x	x
Physics 1/ Mechanics of Point Particle	67.5	3.0	1.5	-	45.0	3	6	x	x
Chemistry 1/ Course structure	67.5	3.0	1.5	-	45.0	3	6	x	x
Methodology module									

Methodology module 1.1	90.0	1.5		4.5		4	8	x	x
Mechanics	22.5	-	-	1.5	45.0	1	2	x	x
Chemistry I	22.5	-	-	1.5	45.0	1	2	x	x
Computer science 1/ Web Office technology Introduction to Algorithms	45.0	1.5	-	1.5	45.0	2	4	x	x
Practical module									
Practical module 1.1. Subjects to choose from:	22.5	1.5				1	2	x	x
Exploring Methods of University Work	22.5	1.5			45.0	1	2	x	x
Environment									
Biotechnology									
Transversal module									
Transversal module 1.1	22.5	1.5				1	2	X	X
Foreign Languages I	22.5	1.5	-	-	45.0	1	2	X	X
Total Semester I	337.5	12	6	4.5		15	30		

Semester 2									
Modules	Hours week 14-16 weeks	Hours			Other (14-16 weeks)	Coef	Cr	Evaluation method	
		C	L	PC				Course	Exam
Base module									
Base module 2.1	202.5	9.0	4.5	-	-	9	18	x	x
Mathematics 2/ Algebra and Analysis 2	67.5	3.0	1.5	-	45.0	3	6	x	x
Physics 2/ Electricity	67.5	3.0	1.5	-	45.0	3	6	x	x
Chemistry 2/ Thermodynamics and Chemical Kinetics	67.5	3.0	1.5	-	45.0	3	6	x	x
Methodology module									
Methodology module 2.1	90.0	1.5		4.5		4	8	x	x
Electricity	22.5	-		1.5	45.0	1	2	x	x
Chemistry 2	22.5	-		1.5	45.0	1	2	x	x
Computer science 2/ Programming Languages	45.0	1.5		1.5	45.0	2	4	x	x

Practical module									
Practical module 2.1 Subjects to choose from:	22.5	1.5				1	2	x	x
Science History	22.5	1.5	-	-	45.0	1	2	x	x
Transversal module									
Transversal module 2.1	22.5	1.5				1	2	X	X
Foreign Languages 2	22.5	1.5	-	-	45.0	1	2	X	X
Total Semester 2	337.5	12	6	4.5		15	30		

Semester 3

Modules	Hours week 14-16 weeks	Hours			Other (14-16 weeks)	Coef	Cr	Evaluation method	
		C	L	PC				Course	Exam
Base module									
Base module 3 (O/P)	202.5	9.0	6.0	-	275	10	20	33%	67%
Series and Differential Equations	67.5	3.0	1.5	-	82.5	3	6	33%	67%
Analytical Mechanisc	67.5	3.0	1.5	-	82.5	3	6	33%	67%

Vibrations and Waves	45.0	1.5	1.5	-	55.0	2	4	33%	67%
Geometric and Physical Optics	45.0	1.5	1.5		55.0	2	4	33%	67%
Methodology module									
Methodology module 3 (O/P)	90.0	1.5		4.5	85.0	4	7	50%	50%
Practical exercises of vibrations and waves	22.5	-	-	1.5	27.5	1	2	50%	50%
Practical exercises of Geometric and Physical Optics	22.5	-		1.5	27.5	1	2	50%	50%
Numerical Methods and Programming	45.0	1.5	-	1.5	30.0	2	3	50%	50%
Practical module									
Practical module 3 (O/P) Subjects to choose from:	45.0	1.5	1.5		5.0	2	2		100%
Probability and Statistics	45.0	1.5	1.5		5.0	2	2		100%
Transversal module									
Transversal module (O/P)	15.0	1.0			1.0		1		100%
Foreign Languages 3	15.0	1.0	-	-	10.0		1	-	100%

Total Semester 3	375	13	7.5	4.5	375		30		

Semester 4

Modules	Hours week 14-16 weeks	Hours			Other (14-16 weeks)	Coef	Cr	Evaluation method	
		C	L	PC				Course	Exam
Base module									
Base module 4 (O/P)	202.5	7.5	6.0	-	247.5	9	18		
Thermodynamics	67.5	3.0	1.5	-	82.5	3	6	33%	67%
Function of a Complex Variable	45.0	1.5	1.5	-	55.0	2	4	33%	67%
Quantum Mechanics	45.0	1.5	1.5	-	55.0	2	4	33%	67%
Électromagnetism	45.0	1.5	1.5		55.0	2	4	33%	67%
Methodology module									
Methodology module (O/P)	112.5	3.0		4.5	87.5	5	8		
(practical exercises) Thermodynamics	22.5	-	-	1.5	27.5	1	2	50%	50%
Fluid Mechanics	45.0	1.5		1.5	30.0	1	2	50%	50%
Consumer Electronics	45.0	1.5	-	1.5	30.0	2	3	50%	50%

Practical module									
Practical module 4 (O/P) Subjects to choose from :	45.0	1.5	1.5		30.0	2	3		
Atomic and Nuclear Physics	45.0	1.5	1.5		30.0	2	3		100 %
Transversal module									
Transversal module 4 (O/P)	15.0	1.0			10.0	1	1		100 %
Foreign Languages 4	15.0	1.0	-	-	10.0	1	1	-	100 %
Total Semester 4	375	13	7.5	4.5	375	17	30		

Semester 5

Modules	Hours week 14-16 weeks	Hours			Other (14-16 weeks)	Coeff	Cr	Evaluation method	
		C	L	PC				Course	Exam
Base module									
Base module 5 (O/P)	202.5	7.5	6.0	-	247.5	9	18		
Fluid Transfers	67.5	3.0	1.5	-	82.5	3	6	33%	67%
Semiconductor Physics	45.0	1.5	1.5	-	55.0	2	4	33%	67%
Electrical Energy	45.0	1.5	1.5	-	55.0	2	4	33%	67%

Electromagnetism	45.0	1.5	1.5		55.0	2	4	33%	67%
Methodology module									
Methodology module 5 (O/P)	112.5	3.0		4.5	87.5	5	8		
Thermal Transfers	22.5	-	-	1.5	27.5	1	2	50%	50%
Fluid Mechanics	45.0	1.5		1.5	30.0	1	2	50%	50%
Consumer Electronics	45.0	1.5	-	1.5	30.0	2	3	50%	50%
Practical module									
Practical module 5 (O/P) Business Management	45.0	1.5	1.5		30.0	2	3		
Computer Science Practical Exercises	45.0	1.5	1.5		30.0	2	3		100%
Transversal module									
Transversal module 5 (O/P)	15.0	1.0			10.0	1	1		100%
Foreign Languages 5	15.0	1.0	-	-	10.0	1	1	-	100%
Total Semester 5	375	13	7.5	4.5	375	17	30		

Semester 6

Modules	Hours week 15 weeks	Hours			Time Schedule By module	Coef	Cr	Evaluation method	
		C	L	PC				Course	Exam
Base module 6.1									
End of studies project	180.0					8	15		
Internship in a company	105.0					5	8		
Methodology module 6.1									
Renewable Energies	45.0	1.5		3	4.5	2	3		
Practical module 6.1									
Thermal Machines	15.0	1.5			1.5	1	2		
Transversal module 6.1									
Project Management	30.0	3.0			3.0	1	2		
Total Semester 6	375				25	17	30		

3.2. Morocco.

3.2.1. Description of education in the country

Higher education in Morocco is regulated by Statute No 01-00, and it is within the responsibility of the State, which provides for the planning, organization, development, regulation and guidance of the system. The National Education and Training Charter of 1999 laid down the principles and guidelines for the reform of the Moroccan education system. Statute No 01-00 of May 2000 provided for the implementation of these principles and guidelines in the realm of higher education.

Statute No 01-00 reinforces the educational, administrative and financial autonomy of universities. For these provisions to be implemented, the tasks of universities have to be broadened in the framework of a reorganized educational structure. There is also a need to enhance vocational courses by establishing an evaluation and accreditation system for courses and a system for auditing institutions.

- Admission

Admission to postsecondary institutions is open to baccalaureate holders and many higher schools and faculties request that students also pass an entrance examination. Most institutions or faculties will also require that students have minimum grades in their proposed majors. Furthermore, some institutions will only accept students who have obtained their baccalaureate in the year of application for registration. These extra requirements have been introduced over the last 10 to 15 years as Moroccan higher schools have become unable to meet the burgeoning demand created by the official Moroccan policy of open access for baccalaureate holders.

The academic year runs from October to June. The language of instruction in the humanities and social sciences is Arabic, while French is the language of instruction in scientific subjects.

Degree syllabus in all fields is for the most part standardized by the Ministry of Higher Education.

All Moroccan Universities use a 20-point grading scale. Any score over 10 is considered a passing grade; very few students average higher than 14 across all subjects. Students must score above 50 percent on end-of-year written and oral examinations to progress to the next year of studies. The proportion of students required to repeat a year is high, especially in the first year of studies and it is not uncommon for students to take more than six years to complete a four-year degree

- Institutions

According to the Ministry of National Education, higher education in Morocco is offered at institutions that can be classified into three broad categories: universities, ("grandes écoles") and other institutes under the tutelage of the higher education branch of the ministry; higher schools ("grandes écoles") and institutes under the direction of other ministries (relevant to the technical or professional orientation of the higher school); and private higher education.

University education is offered at 14 universities encompassing a combined total of 49 faculties and higher schools. Three main types of universities have been established in Morocco: public institutions set up immediately after independence and during the 1970s; newer universities established during the 1980s in response to the burgeoning demand for higher educational opportunities; and the private not-for-profit university of which Al Akhawayn is currently the only one.

In both the private and public non-university sector, training is offered at specialized professional training institutions ("établissements de la formation des cadres") and vocational training institutions in three broad fields: science and technology, law/economics/administration/social sciences,

and teacher training. Access to some is by entrance examination, while access to the eight highly competitive ("grandes écoles d'ingénieurs") is reserved for those who have completed two-year preparatory courses offered at 13 select preparatory schools known as classes preparatory aux "grandes écoles" (CPGE). CPGE classes are open only to holders of the" baccalauréat" sciences mathematics and "baccaluréat" technique (with electrical or mechanical engineering concentrations). Admission is highly competitive and students must pass a competing entrance examination and have exceptional grades on the "baccalauréat".

3.2.2. Programs and degrees

- Stage I :

Most first degrees in the Moroccan university system last two years in duration and are considered as a preparatory phase for further studies.

The most common first degrees are the "Diploma d'Études Universitaires Générales" (DEUG) and the "Diploma d'Études Universitaire de Technologie "(DEUT), that can also be defined by the faculty awarding them. Those graduating from language arts faculties are awarded a "Certificat Universitaire d'Études Littéraires" (CUEL), from science faculties a "Certificat Universitaire d'Études Scientifiques" (CUES), and from law faculties either a "Certificat Universitaire d'Etudes de Droit" (CUED) or "Certificat Universitaire d'Études Économiques" (CUEE). The "Diplôme Universitaire de Technologie" (DUT) requires the baccalaureate for admission and is awarded after two years of study in the faculties of law, economics and social sciences. The DUT is a terminal degree. Students wishing to enter a "grande école" must complete two years of preparatory training in "preparatory classes" aux grandes écoles.

- Stage II :

The second stage of studies is open to holders of the DEUG, DEUT, CUEL, CUES, CUEE or CUED and provides in-depth training in the student's area of specialization. Successful completion of the second cycle leads to the award of the Licence and the "Maîtrise".

The "Diploma d'Ingénieur d'État" is awarded after a total of five years of study – including two years of preparatory CPGE classes – by 'grandes écoles d'ingénieurs' in the fields of engineering and agriculture. A four-year "Diploma d'Ingénieur" degree is also awarded – in a broader range of fields – and requires the baccalauréat for admission. The "Diploma Supérieur" is a four-year degree awarded in business, and the "Diploma d'Architecte" is a degree awarded after six years of study in the field of architecture.

- Stage III :

Studies leading to the award of the Diploma d'Études Supérieurs (DES), the "DES Specialisées (DESS – two years) and the Diploma d'Etudes Supérieurs Approfondies (DESA – two years) are two to three years in length. The program incorporates one year of study toward the "Certificate d'Études Approfondies" and requires the preparation and defense of a thesis. Students wishing to study for the Doctorate must first complete the DES(S/A). Doctoral studies require at least two years of research beyond the DES and the writing and defense of a dissertation. The "Doctorate of Medicine" and "Doctorate of dentistry medicine" require a "baccalaureate from the science" track for entry and studies last seven and five years respectively.

- Vocational :

Holders of the technical baccalauréat are eligible for entry into two-year technical programs leading to the award of the "Brevet de Technicien Supérieur" (BTS). Equivalent diplomas are the

"Diplôme de Technicien Supérieur", "Technicien Spécialisé", "Adjoint Technique Spécialisé". All these programs are terminal, and require the baccalaureate for admission (technical baccalaureate for the BTS).

- University « LMD » Reforms

Beginning in 2004, a pilot group of faculties at Morocco's universities have been undergoing reforms aimed at bringing them closer into line with universities from around the world, especially Europe, while offering students increased flexibility in their studies and universities more autonomy in their program offerings. The reforms will be phased in at other faculties over time.

Studies are being re-organized and offered under a new degree structure, allowing interdisciplinary studies, and quantified through a system of credits and modules measured by the semester rather than the year.

Semesters are 16 weeks long and students are examined at the end of each semester rather than at the end of each academic year.

With the introduction of a credit hour system, students are now able to take classes from different departments and different schools, and are also able to leave university and resume their studies later.

A revision of curricula has also allowed the introduction of new subjects more attuned to the needs of a modern economy while also allowing students to be more proactive in choosing their courses of study.

Studies are being reorganized under a structure based on three years of first-cycle studies (bachelor), two years of second-cycle studies (Master), and three years of doctoral studies (Doctorate). Although the first degree is the bachelor, students will still be

awarded the DEUG if they choose to end their studies after the four semesters that constitute the core curriculum of university studies. Central to the new structure is the introduction of elective modules in addition to required modules, that can be chosen from single or multiple disciplines.

A core curriculum ("tronc commun") will still remain common to all university programs and constitute a majority of classes, but universities and students will be given greater flexibility in offering and choosing elective classes and modules.

Under the new structure, three-year post-baccalaureate programs (introduced in 2003/04) culminate in the award of either a "Licence d'Etudes Fundamentals" or a "Professional Licence" with the later giving access to the workforce and the former to either a two-year Master or "Master Specialized" program. Students who have graduated from a "professional license" program may enter a "master's program" if they have relevant work experience and pass an entrance examination. Graduates from master's programs are eligible for admission to doctoral programs although the general aim of specialized master's programs is to train students for a profession.

Four chapters (modules) constitute a full-time workload per semester (16 chapter "modules" = a master's degree), and it is recommended that one module should require a minimum of 75 hours of student work. Students must pass three modules to pass ("valider") the semester. The student can then transfer a "validated" module between institutions or programs.

The modularization of degree programs is divided into three broad blocks:

- The major, representing 70 percent of overall workload;
- Transferable skills such as languages, communication skills, management and information technology, representing 15 percent of overall workload;

- Ancillary and optional modules, representing 15 percent of overall workload.

At the master's level, students must complete a practical component. In the specialized stream this would generally be an internship; in the academic stream it might constitute a period at a research laboratory or at a public or private research institution.

3.2.3. Renewable energy training plan and program

❖ University of Abdelmalek Essaadi

Since its creation in 1989, the Abdelmalek Essaâdi University has made international cooperation a strategic axis of development. It has thus been able to forge privileged relations with several European universities.

The University of Abdelmalek Essaadi is considered the university of northern Morocco and is made up of 11 institutions (5 in Tangier, 5 in Tetouan and 1 in Larache). This University has more than 45,000 students, 780 faculty members and 550 technical and administrative staff, and offers a fully structured training course on the pedagogical architecture of the LMD (3-5-8). In 2012-2013, 176 courses were open to students, including 80 undergraduate and postgraduate programs. Since 2008, the University of Abdelmalek Essaadi has been a partner in 10 Erasmus Mundus projects (Actions 2 and 3)

In addition, the UAE has a laboratory for renewable energy. It is a national contact point and houses the energy competence center.

The UAE had the role of coordinator at the level of Moroccan universities. It participated in all the activities of the project, be it pilotage, training and dissemination:

- Coordinating the WP1
- Participate in the investigation and analysis of training needs in the field of renewable energies
- Design and curriculum and content of renewables energies courses
- Establish and manage the environment of distance education.
- Participate in the development of the capacity building program, training of staff and organization of European visits;
- Manage the installation of the educational station and the laboratories;
- Participate in events and conferences;
- Maintain effective communication with all stakeholders,
- Contribute to the plan for monitoring and evaluation of activities.
- Open Training in RE.

Educational programs

SEMESTRE	MODULE	ELEMENTS OF MODULE (Balancing)
S1	M 1 : Mechanics – Thermodynamics	E1: Mechanics 1 (40%) E2: Thermodynamics (60%)
	M 2 : Electricity – Optics	E1 : Basics of Electricity (75%) E2: Optics (25%)
	M 3 : Basic mathematics	E1: Analysis (50%) E2: Algebra (50%)

	M 4 : TEC – English	E1: TEC (50%) E2: English (50%)
S2	M 5 :Energy Resources	E1: Different Energies / Consumption and Deposits in Morocco (70%) E2 : Legislation on New Energy Strategies in Morocco (30%)
	M 6 : Fluid Mechanics and Heat Transfer	E1 : Fluid Mechanics (40%) E2 : Heat Transfer (60%)
	M 7 : Analog Electronics - Digital Electronics	E1: Analog Electronics. (40%) E2: Digital Electronics. (60%)
	M 8 : Application Tools	E1 : Probability and Statistics (30%) E2 : Database and Introduction to Software (50%) E3 Tehnical Drawing (20%)
S3	M 9 : Electric and Electrical Engineering and Power Electronics	E1 : Electric Engineering (50%) E2 : Electrical Engineering and Power Electronics (50%)
	M 10 : Solar Thermal Energy	E1: Thermal Energy (70%) E2 : Installation and Practical Case Study (30%)
	M 11 : Photovoltaic Solar Energy	E1: Photovoltaic Energy (70%) E2 : Installation and Practical Case Study (30%)
	M 12 : Wind Energy	E1: Wind Energy (75%) E2: Wind Turbines Technology (25%)

S4	M 13 : Project management and maintenance management	E1 : Market Research and Reliability (40%) E2 : Installation Maintenance and Safety (40%) E3 : Labour Law in Morocco (20%)
	M 14 : Energy Efficiency and Certification	E1 : Energy Efficiency (50%) E2 : Thermal Building Regulations in Morocco (RTCM) (25%) E3: Certification (25%)
	M 15 : End of studies project	End of studies project (100%)
	M 16 : SFE	SFE (100%)

	TIME SCHEDULE (VH)						
	N°	Course	L	PC	P	Knowledge assessment	Total hours
S 1	M 1	44	42	8		6	100
	M 2	41	41	12		6	100
	M 3	38	36			6	80
	M 4	40	34			6	80
	TOTAL	163	153	20		24	360
S 2	M 5	56	10		8	6	80
	M 6	42	40	12		6	80
	M 7	36	30	18		6	100

	M 8	36	12	21	15	6	90
	TOTAL	170	92	51	23	24	360
S 3	M 9	36	30	18		6	90
	M 10	40	30	14		6	90
	M 11	45	30	19		6	100
	M 12	45	30	19		6	100
	TOTAL	166	120	70		24	380
S 4	M 13	79			16	5	100
	M 14	38	15	15	18	4	90
	M 15						
	M 16						
	TOTAL						

❖ University of IBN Zohr (UIZ)

Ibn Zohr University (UIZ) was founded in 1989 to meet the growing needs for Higher Education and Scientific Research in the 4 regions of the Moroccan South. UIZ has 5 university sites: Agadir, Ouarzazate, Taroudant, Laayoune and Guelmim. It covers more than 50% of the national territory (4 regions and 17 provinces). It brings together ten institutions : National School of Commerce and Management (ENCG), Higher School of Applied Sciences (ENSA), Agadir Higher school of technology (ESTA), Guelmim Higher School of Technology (ESTG), Higher School of Technology of Laayoune (ESTL), Faculty of Humanities and Social Sciences (FSJES), Faculty of Humanities and Sciences of Agadir (FSLHA), Faculty of Sciences of Agadir (FSA), Multidisciplinary Faculty of Ouarzazate (FPO), Multidisciplinary Faculty of Taroudant FPT). The large solar power station is planned in the region in Ouarzazate

The UIZ participated in all the activities of the project whether it is steering, management, training or dissemination:

- Participate in the investigation and analysis of training needs in the field of renewable energies.
- Design and curriculum and content of renewable energies courses.
- Establish and manage the environment of distance education.
- Participate in the development of the capacity building program, the training of staff and the organization of European visits.
- Manage the installation of the educational station and the laboratories;
- Participate in events and conferences.
- Maintain effective communication with all stakeholders.

- Contribute to the plan for monitoring and evaluation of activities.
- Open training in renewable energies.
- Ensure the sustainability of the project.

Educational programs

SEMESTER	MODULE	MODULE ELEMENTS
S1	M 1: TEC – English	E1: TEC (50%) E2: English (50%)
	Module 2: Mechanics 1-Thermodynamics 1	E1: Mechanics 1 (50%) E2: Thermodynamics 1 (50%)
	M 3 : Analysis 1 – Algebra 1	E1: Analysis 1 (50%) E2: Algebra 1 (50%)
	M 4 : Electricity 1 - Optics 1	E1: Electricity 1 (50%) E2: Optics 1 (50%)
S2	M 5 : Algorithm – Software Toold	E1 : Algorithms and Programming Language C (50%) E2 : Software Tools (MatLab, Psim) (50%)
	M 6 : Analysis 2 - Algebra 2	E1: Analysis 2 (50%) E2: Algebra 2 (50%)
	M 7 : Analog Electronics 1 – Digital Electronics	E1: Analog Electronics. (50%) E2: Digital Electronics. (50%)
	M 8 : Fluid Mechanics and Heat Transfer	E1: Fluid Mechanics (50%) E2: Heat Transfer (50%)

S3	M 9 : Quality - Entrepreneurship	E1: Quality Control (50%) E2: Entrepreneurship (50%)
	M 10 : Energy and the Environment	E1: Meteorology (50%) E2: Solar Radiation (50%)
	M 11 : Renewable Energies 1	E1: Photovoltaic Energy (50%) E2: Thermal Solar Energy (50%)
	M 12 : Electricity 2 and Electrical Engineering and Power Electronics	E1: Electricity 2 (50%) E2 : Electrical Engineering and Power Electronics (50%)
S4	M 13 : Energy Efficiency and Dimensioning	E1 : Dimensioning of Energy Systems(50%) E2: Energy Efficiency (50%)
	M 14 :Renewable Energies 2	E1: Wind Energy (50%) E2: Biomass (50%)
	M 15 : End of studies project	End of studies project (100%)
	M 16 : SFE	SFE (100%)

	VOLUME HORARIE (VH)						
	N°	Course	TD	TP	Pratices	Knowledge assessment	Total hours
S 1	M 1	40	40				80
	M 2	36	36	18			90
	M 3	50	50				100
	M 4	36	36	18			90
	TOTAL	162	162	36			360
S 2	M 5	36	14	30			80
	M 6	50	50				100
	M 7	36	36	18			90
	M 8	36	36	18			90
	TOTAL	158	136	66			360
S 3	M 9	45	45				90
	M 10	36	36	18			90
	M 11	36	36	18			90
	M 12	36	36	18			90
	TOTAL	158	136	66			360
S 4	M 13	36	36	18			90
	M 14	36	36	18			90

❖ University of IBN Tofail (UIT)

Founded in 1985, Ibn Tofaïl University is structured around four institutions: Faculty of Sciences, Faculty of Letters and Human Sciences, Faculty of Economic and Social Juridical Sciences, National School of Commerce and Management and National School of Applied Sciences.

In recent years, this university has been able to develop basic infrastructures, a very important potential for training and research: 500 research professors, 15,450 students, 48 research laboratories, 4 UNESCO chairs, 1 university library, 1 language resource center.

Thanks to the experience acquired by its research professors and its administrative teams, the Ibn Tofail University has a pedagogical, administrative and financial potential to carry out its opening on the socio-economic sector.

Aware of the importance of renewable energies in the industrial and economic development of the country, the IU participate in all the activities of the project, whether it be steering, management, training or dissemination:

- Participate in the investigation and analysis of training needs in the field of renewable energies.
- Design and curriculum and content of renewable energies courses.
- Establish and manage the environment of distance education.
- Participate in the development of the capacity building program, the training of staff and the organization of European visits.
- Manage the installation of the educational station and the laboratories.

- Participate in events and conferences.
- Maintain effective communication with all stakeholders.
- Contribute to the plan for monitoring and evaluation of activities.
- Open training in renewable energies.
- Ensure the sustainability of the project.

- Educational programs

SEMESTER	MODULE
S1	Module 1 : Mechanics of point particles
	Module 2: Thermodynamics 1
	Module 3 : Atomistics
	Module 4 : Thermochemistry
	Module 5 : Analysis 1
	Module 6 : Algebra 1
	Module 7 : Language and Terminology
S2	Module 8 : Electrostatics and Electrokinetics
	Module 9 : Geometrical Optics
	Module 10 : Chemical Bonds
	Module 11 : Solution Chemistry
	Module 12 : Analysis 2
	Module 13 : Algebra 2

	Module 14 : Language and Terminology II
	Module 15 : Electricity 2 and Electrical Engineering and Power Electronics
S3	Module 16 : Solid Mechanics
	Module 17 : Thermodynamics 2
	Module 18 : General Organic Chemistry
	Module 19 : Electromagnetism in Vacuum
S4	Module 20 : Analysis 3
	Module 21 : Numerical and Algorithmic Analysis
	Module 22 : Basic Electronics
	Module 23 : Physical Optics
	Module 24 : Geometric Crystallography and Crystallochemistry
	Module 25 : Quantum Mechanics
	Module 26 : Electricity 3
	Module 26 : Computer Science
S5	Module 27 : Applied Computer Science / Technical and Professional English
	Module 28 : Electrical Engineering / Power Electronics
	Module 29 : Numerical Methods and Programming
	Module 30 : Thermal Transfers / Fluid Mechanics
	Module 31 : Photovolaic Energy

	Module 32 : Energy Efficiency / Thermal Comfort
S6	Module 32 : Alternative Solar Energy: Wind Turbines, Bioenergy Module 33 : Dimensioning of Solar Systems and Energy Storage Module 34 : Solar Radiation and Thermal Sensors Module 35 : Internship and Professional Training Project Module 36 : Internship and Professional Training Project Module 37 : Internship and Professional Training Project

	VOLUME HORARIE (VH)					
	N°	Course	TD	TP Pratices	Knowledge assessment	Total hours
S 1	M 1	21	21		4	46
	M 2	21	21		4	46
	M 3	21	21		4	46
	M 4	21	21		4	46
	M5	21	21		4	46
	M6	21	21		4	46
	M7					
	TOTAL	126	126			294
S 2	M 8	21	21		4	46
	M 9	21	21		4	46

	M 10	21	21		4	46
	M 11	21	21		4	46
	M12	21	21		4	46
	M 13	21	21		4	46
	M14					45-50
	TOTAL	126	126			294
S 3	M 15	18	18	10	3	49
	M 16	18	18	10	2	48
	M17	18	18	10	4	50
	M 18	18	18	10	2	48
	M 19	21	21		4	44
	M20	21	24		2	47
	TOTAL	114	114	40	17	285
S 4	M 21	18	18	10	2	48
	M 22	18	18	10	2	48
	M 23	18	18	10	2	48
	M 24	18	18	6	2	44
	M25	18	18	12	2	50
	M26	18	9	15	2	44
	TOTAL	108	96	63	12	282

S 5	M27	16			20	2	40
	M28	16	12	10		2	40
	M29	16	6	6	10	2	40
	M30	22	18			2	40
	M31	16	12	10		2	40
	M32	16	12	10		2	40
	TOTAL	102	60	36	30	12	240
S 6	M33	18	8	10	6	2	44
	M34	18	8	10	6	2	44
	M35	24	12	10		4	50
	TOTAL	60	28	30	12	8	138

❖ International University of Rabat (UIR)

The first private university under contract with the Moroccan State, the UIR is made up of the following training and research establishments:

School of Management, Busines and Finance, Faculty of Electronics, Logistics, IT and Telecommunication, School of Aerospace Engineering, Institute of Political Science and Legal Studies, School of Renewable Energies, Institute of Preparatory Classes.

All courses are developed in partnership with universities and higher education institutions in different countries. Some courses are in double diploma, the evaluation of students also takes into account international standards (GPA, ECTS).

The professors of the academic partners intervene in the training of students and in the contracts and research programs developed at the UIR (security of wireless networks, energy efficiency and renewable energies, materials, ...)

The UIR participated in all the activities of the project whether it is steering, management, training or dissemination:

- Participate in the investigation and analysis of training needs in the field of renewable energies.
- Design and curriculum and content of renewable energies courses.
- Establish and manage the environment of distance education.
- Participate in the development of the capacity building program, the training of staff and the organization of European visits.
- Manage the installation of the educational station and the laboratories;

- Participate in events and conferences.
- Maintain effective communication with all stakeholders.
- Contribute to the plan for monitoring and evaluation of activities.
- Open training in renewable energies.
- Ensure the sustainability of the project.

Educational programs

Semester 1:

Modules	Elements	Time schedule			Total	Coef	Evaluation method
		C	TD	TP			
Mathematics and Computer Science	Mathematics 1	15	15	6	36	3	(CC) :25% (TP) :25% (EF) :50%
	Computer Science 1	8	6	6	20	2	(CC) :25% (TP) :25% (EF) :50%
Mechanics of Point Particles	Mechanics of Point Particles	28	20	8	56	3	(CC) :25% (TP) :25% (EF) :50%
Logic Systems / Electricity	Logic Systems / Electricity	32	16	8	56	4	(CC) :25% (TP) :25% (EF) :50%

Thermodynamics	Thermodynamics	28	20	8	56	3	(CC):25% (TP):50% (EF):25%
Economics	Economics	30	26		56	3	(CC):25% (TP):50% (EF):25%
English/C21/Professional Project S1	English/C21/Professional Project S1	30	16	10	56	3	(CC):25% (TP):50% (EF):25%

Semester 2

Modules	Elements	Time Schedule			Total	Coef	Evaluation Method
		C	TD	TP			
Mathematics and Computer Science 2	Mathematics 2	16	16	8	40	3	(CC) :25% (TP) :25% (EF) :50%
	Computer Science 2	4	6	6	16		(CC) :25% (TP) :25% (EF) :50%
					56		
Introduction to Dynamic Systems and Numerical Simulation		26	16	14	56	4	(CC) :25% (TP) :25% (EF) :50%

Electronic Circuit Modeling	Electronic Circuit Modeling	24	16	16	56	3	(CC) :25% (TP) :25% (EF) :50%
Instrumentation	Instrumentation	22	18	16	56	3	(CC) :25% (TP) :25% (EF) :50%
Optics	Optics	30	16	10	56	4	(CC) :25% (TP) :25% (EF) :50%
Culture/ Languages 2	English C21 S2	30	14	0	44	3	(CC) :50% (EF) :50%
	Scientific Culture	12	0	0	12	2	(CC) :50% (EF) :50%

Semestre 3:

Modules	Elements	Time Schedule			Total	Coef	Evaluation method
		C	TD	TD			
Mathematics and Computer Science 3	Mathematics 3	14	16	8	36	3	(CC) :25% (TP) :25% (EF) :50%
	Computer Science 3 :Matlab	4	6	10	20	3	(CC) :25% (TP) :25% (EF) :50%

Analog Automatic Electronics	Electronics Analog Functions	22	18	16	56	3	(CC) :25% (TP) :25% (EF) :50%
Automatics	Automatics	24	20	12	56	3	(CC) :25% (TP) :25% (EF) :50%
Signal Acquisition	Signal Acquisition	22	24	14	56	3	(CC) :25% (TP) :25% (EF) :50%
Induction Phenomena and Electromagnetic Waves	Induction Phenomena and Electromagnetic Waves	26	22	8	56	3	(CC) :25% (TP) :25% (EF) :50%
Anglais / Projet professionnel S3		30	26	0	56	3	(CC) :25% (TP) :25% (EF) :50%

Semester 4

Modules	Elements	Time Schedule			Total	Coef	Evaluation method
		C	TD	TP			
Maths-info 4	Mathematics 4 Matlab	22	24	10	56		(CC) :50% (EF) :50%

Electrical Engineering	Electronic Logic	6	6	16	28	3	(CC) :25% (TP) :25% (EF) :50%
Electronic Logic	Electrical Engineering	6	6	16	28	6	(CC) :25% (TP) :25% (EF) :50%
Design of Circuit Boards	Automatics	16	0	40	56	6	(CC) :25% (TP) :25% (EF) :50%
Industrial Automatism	Industrial Automatism	18	10	12	40	6	(CC) :25% (TP) :25% (EF) :50%
	Home Automation (pratices)	4	0	12	16	6	(CC) :25% (TP) :25% (EF) :50%
Methodology of Multi-Technology Systems	Induction Phenomena and Electromagnetic Waves	24	20	12	56	3	(CC) :25% (TP) :25% (EF) :50%
Metrology of Sensors and Quality Assurance	Sensors and Instrumentation	20	20	16	56	3	(CC) :25% (TP) :25% (EF) :50%

Semestre 5

Modules	Elements	Volume			Total	Coef	Evaluation

		Horaire						method
		C	TD	TP				
Signal Processing and Fundamentals	Probability and Statistics	16	0	10	26	56	3	(CC) :25% (TP) :25% (EF) :50%
	Signal Processing	22	0	8	30		2	(CC) :25% (TP) :25% (EF) :50%
Numerical Analysis	Numerical Analysis Modeling of Multi-Technology Systems	12	14	30	56		1	(CC) :25% (TP) :25% (EF) :50%
Acquisition Systems	Industrial Computer Science	16	16	24	56		6	(CC) :25% (TP) :25% (EF) :50%
Fundamentals	Fundamentals	20	0	36	56		3	(CC) :25% (TP) :25% (EF) :50%
Industrial Systems	Industrial Systems	20	18	18	56		6	(CC) :50% (EF) :50%
Renewable Energies I	Photovoltaic Energy	20	0	8	28	56	2	(CC) :25% (TP) :25% (EF) :50%

	Wind Energy	20	0	8	28	2	

Semestre 6

Modules	Elements	Time Schedule			Total		Coef	Evaluation method
		C	TD	TP				
Industrial Thermodynamics	Thermal Machines	30	0	0	30	56	6	(CC) :50% (EF) :50%
	Fluid Mechanics	26	0	0	20		3	
Electric Machines	Electric Machines	40	0	16	56		3	(CC) :25% (TP) :25% (EF) :50%
Renewable Energies 2	Solar Thermal Energy	26	0	8	34	56	2	(CC) :50% (EF) :50%
	Biomass	14	0	8	22		2	
Stage/End of studies project	This element should allow students to apply their knowledge.				168			

3.3. Tunisia

3.3.1. Description of education in the country

Higher Education in Tunisia is made up of many institutions that include public universities, Institutes of Technological Studies and other subject-specific schools as well as some private higher education institutions. All higher education institutions are under the supervision of the Ministry of Higher Education and Research.

In an effort to support economic growth, Tunisia has put special emphasis on science and technology education at the tertiary level. There have been large investments made in technical infrastructure and educational and research resources to meet institutional goals. Additionally, overall growth in higher education has been substantial in recent years with an increase in the number of higher education teachers and researchers.

Admissions to the public universities and institutes is centrally controlled and placements are made based upon student preferences, exam scores, secondary school coursework and the quotas set for each field of study and institution. Higher Education Act reforms university administration by offering institutions the option of moving from centralized management to a more flexible and autonomous form of management by establishing themselves as public academic and technological institutions (EPSTs), provided that they fulfill conditions relating primarily to the quality of their educational, academic, administrative and financial management.

In order to monitor and support these reforms, the ministry has set up a Higher Education Quality Support Program (PAQ). These new instruments provide universities with greater

autonomy and offer more transparency as regards their pursuit of the main strategic goals of higher education.

The Universities Council ("Majlis al-Jamiat") is the national body responsible for ensuring that the sectoral broad strategic guidelines are applied. The task of that body is to validate the decisions of the sectoral committees and the national committee on the reform of the course structure, comprising professors from 25 different disciplines. It is also responsible for accrediting higher education institutions, thereby enabling them to award Master degrees and Doctorates and to habilitate teaching staff.

The Universities Council is chaired by the Minister for Education composed of the presidents of all the universities of Tunisia and the general directors of the central administration of the Ministry. The president of the council of universities may invite any person whose presence appears useful to him.

3.3.2. Types of higher education

Access to public higher education in Tunisia remains open to anyone who holds the certificate awarded on successful completion of secondary education ("al-bacaluria").

There are 4 main types of institutions for higher Education in Tunisia:

- Universities ("aljamiaat").
- Faculties ("allKuliat").
- Institutes ("almaahid").
- Institutes for Technological Studies (ISETs): that falls under the responsibility of a general directorate for technological studies.

The University (except the Virtual University) is a tutelage of the different types of Universities Institutions. The University is made up of different academic institutions (Faculties, engineering schools, higher institutes, etc.)

The Virtual University of Tunis, whose role cuts across the spheres of activity of the other universities, undertakes all the digitalization of courses and the management of distance learning. All Tunisian universities are multidisciplinary with the exception of Ez-Zitouna University, that has specialized in theology.

There are no tuition fees for students at state universities and students from vulnerable sections of society receive government grants.

The state higher education is considered free. But there are fees that are very modest. Fees are payable for private higher education. These institutions attract no more than approximately 30.669 students, many of whom are from other countries.

The public institutions offer studies to 263.817 students.

Holders of the "baccalaureate" are guided in their choice of university and possible courses of studies with the aid of a computerized system that considers variables such as people merits and wishes or number of places available for each degree.

As a result of the reform introducing the system of Bachelor, Master and Doctorate degrees, all degrees administered by Tunisian universities, with the exception of medical and architecture degrees, are based on the structure of Bachelor degrees, awarded on accumulation of 180 credits; Master

degrees, awarded after a further 120 credits have been accumulated.

Engineering students attend two years of preparatory classes, culminating in a national competitive examination and then get assigned to the School of Engineering on the basis of their grading and their wishes.

Specialized training in a School of Engineering lasts for three years, bringing the total length of engineer training to five years.

There is another way of accessing engineering schools: it is the specific competition which concerns the successful candidates who have a diploma of Licence. It should also be noted that there are engineering schools that have an integrated preparation (2 years) that precedes the specialty training.

In medical studies, the number of places is limited to about 200 first-year students in each institution and studies last five years, followed by one year of clinical training.

Courses in paramedical subjects, i.e. health science and technology and nursing, have switched to the Bachelor, Master and Doctorate system.

There are no longer any university studies in Tunisia offered that are shorter than the three-year Bachelor course.

The rehabilitation process ("ataahil") involves the preparation of a research dossier by a lecturer seeking promotion to the grade of senior lecturer. The lecturer defends the dossier in front of a panel. If it is accepted, they are eligible to enter the national competitive examination for the recruitment of senior lecturers.

- Financial support for students

A third of students received national grants from the Tunisian government, especially those from underprivileged sections of the society.

Students receive the support for the meals served in the university canteens, and also the cost of rent in university halls of residence.

They have the right to access loans allocated by the social security funds and after completing their studies they need to repay these loans.

Tunisian government awards scholarships for overseas to the most deserving students on a particular degree, such as certain engineering studies.

- Admission

There are various types of admission. The most complex operation relates to the initial entry to higher education, that involves an annual intake of about 85 000 new students. This operation is organized by the Ministry of Higher Education.

The allocation of places takes into account applicants' wishes and their merits assessed on the basis of their exam results, the strategic aims of the higher education system, i.e. the priority given to courses in subjects with good employability prospects Education and Scientific Research, which is required to guarantee a university place for every holder of the "bakaluria", the qualification awarded on successful completion of upper secondary education.

- Assessment, progression, certification and degree

The assessment system is governed by the following principles:

- Guaranteeing the national value of the various certificates of higher education;
- Reducing the number and duration of final examinations;
- Adopting the principle of continuous assessment as an integral part of the training process with a view to imbuing students with a work ethic and to follow the progress of their acknowledgment.

The assessment system can work in different ways:

- A mixed system combining continuous assessment with final end-of semester exams and a single reassessment test.
- A system based exclusively on continuous assessment that applies to certain modules designed to be assessed in this way.

Assessment is carried out each semester, but progression is determined on an annual basis.

Students may progress from first to second year if they obtain 75 % of the first-year credits, including at least 45 credits. They are subsequently required, however, to obtain the outstanding quota of up to 15 credits.

Universities and other higher education and research institutions devise appropriate procedures to enable students to do the outstanding modules and to take the accompanying tests. Marks for any module that a student still has to retake are counted as marks for the year in question.

- Academic staff / Teaching staff

The academic Staff of universities is divided into different academic categories:

- an assistant is recruited on the basis of a defended Master dissertation and the current preparation of a Doctorate;
- an assistant lecturer;
- a lecturer (maître assistant) is recruited on the basis of defended doctor thesis;
- a senior lecturer is recruited on the basis of a habilitation dossier;
- a professor is recruited on the basis of a dossier containing thir scientific background;
- research, involving the supervision of young researchers and the production of research findings and a teaching element;
- medical university teacher;
- technologist;
- assistant technologist.

3.3.3. Programs and degrees

- The LMD reform, mainly aims

- to establish a training system characterized by flexibility and international comparability.
- to create flexible pathways and efficient training, providing students at all levels of employment possibilities.
- to promote student mobility nationally and internationally.
- to offer students the opportunity to restructure their courses in training.
- to facilitate the equivalence of diplomas.
- to create a new generation of versatile graduates able to adapt to a changing global context.
- to ensure the participation of all stakeholders (students, families, professionals, employers, etc.) and a higher readability grades of training and employability levels.
- to organize training in large areas with standard courses.
- to promote student success and provide a diverse training offer and a better educational support.

- Organization of studies

- The License, prepared in three years after the baccalaureate.
- The Master, prepared in two years after the license,
- Doctorate, prepared in three years after a Master.
- In Bachelor's degree (license) and Master, lessons are organized by semester and not by years
- Each semester consists of teaching units (UE), each one understood as a coherent set of conclusions.

There are paths that lead either:

- To employability (Applied Professional Master License).
- To continue studies at Masters with studies focused in future PhD.

- System of credits according to the level

- The validation of the student (continuous assessment, exams ...) in education is accompanied by the allocation of credits.
- The number of credits awarded is proportionate to the number of hours of lectures, tutorials (TD), and personal work.
- Credits can be also validated for internships or a thesis.
- One semester (600 hours of student work) is worth 30 credits.
- The Licence (degree) represents 180 credits and the Master 120 extra credits and PhD 180 credits.
- These credits are internationally recognized. They are transferable in Tunisia and Europe thanks to the European Credit Transfer System (ECTS: European Credit Transfer System); they are capitalized, so definitively acquired, regardless of the duration of the course.

3.3.4. Renewable energy training plan and program

❖ University of Sfax

It was founded in 1986 as the University of the South and covers all the university institutions in the south of the country. It was subsequently divided into three universities, including the present University of Sfax, with the creation of the University of Gabes in 2003 and the University of Gafsa in 2004. It currently has 45,233 students in 21 institutions higher education and research institutions, including 5 faculties, 3 colleges, 12 institutes and a research center. The Sfax University, through its components, aims to improve its skills in the field of environmental protection and renewable energy. The University

of Sfax participated in all the activities of the project whether it is steering, management, training or dissemination:

- Participate in the investigation and analysis of training needs in the field of renewable energies.
- Design and curriculum and content of renewable energies courses.
- Establish and manage the environment of distance education.
- Participate in the development of the capacity building program, the training of staff and the organization of European visits.
- Manage the installation of the educational station and the laboratories
- Participate in events and conferences
- Maintain effective communication with all stakeholders
- Contribute to the plan for monitoring and evaluation of activities
- Open training in renewable energies.

▪ Ensure the sustainability of the project

Semestre 1:								
Modules	Elements	Time schedule			Total	Cr	Cf	Asses. system
		C	TD	TP				
Mathematics 1	Analysis 1	21	10.5	0	32.5	2	3	RX
	Algebra 1	21	10.5	0	32.5	2	3	RX
Physics 1	Electrostatics and Magnetostatics	10.5	10.5		22	2	2	RX

	Introduction to Thermodynamics	10.5	10.5		22	2	2	RX
	Physics Workshop 1	0	0	21	22	1	2	CC
Computer Science 1	Algorithmics and Programming	10.5	10.5		22	2	2	RX
	Architecture	10.5	10.5		22	2	2	RX
	Computer Science Workshop 1	0	0	21	22	1	2	CC
Applied Thermodynamics	Applied Thermodynamics	21	21		43	4	2	RX
	Applied Thermodynamics Workshop			21	22	1	2	CC
Transversal module 1	English 1	21			21	2	2	CC
	C2I-1	21			21	2	2	CC
	Human Rights	21			21	2	2	CC
Optional 1	Introduction to Renewable Energies	21	21	0	0	5	6	CC
	System Electronics	21	21	0	0	5	6	CC
Photovoltaic Energy	Photovoltaic Energy	28	21	14		5	6	RX

Semestre 2								
Courses	Elements	Time schedule			Total	Cr	Cf	Ass. system
		C	TD	TP				
Heat Transfer	Conduction and Convection	10.5	10.5	0	22	2	2	RX
	Radiation	10.5	10.5	0	22	2	2	RX
	Heat Transfer Workshop	0	0	21	22	1	2	CC
Mathematics 2	Analysis 2	21	10.5	0	32.5	2	3	RX
	Algebra 2	21	10.5	0	32.5	2	3	RX
Physics 2	Electro-magnetism and Optics	10.5	10.5	0	22	2	2	RX
	General Mechanics	10.5	10.5	0	22	2	2	RX
	Physics 2 Workshop	0	0	21	22	1	2	CC
Fluid Mechanics	Fluid Statics and Kinematics	10.5	10.5	0	22	2	2	RX
	Fluid Dynamics	10.5	10.5	0	22	2	2	RX
	Fluid Mechanics Workshop	0	0	21	22	1	2	CC

	English 2				21	2	2	CC
Transversal module 2	C2I-2				21	2	2	CC
	Human Rights 2				21	2	2	CC
Thermal Machine	Machine thermique	21	21	0		5	6	CC

Semestre 3

Courses	Elements	Time schedule			Total	Cr	Cf	Ass. system
		C	TD	TP				
	Electric Machines	10.5	10.5	0	22	2	2	RM
Electrical Engineering	Electrical Engineering Workshop	0	0	21	22	1	2	CC
	Electric Circuits	10.5	10.5	0	22	2	2	RM
	Polymers and Composites	10.5	10.5	0	22	2	2	RM
Materials	Semi-conductors	10.5	10.5	0	22	2	2	RM
	Materials Workshop	0	0	21	22	1	2	CC
Measurement and Instrumentation	Measure Theory and Computer Processing	10.5	10.5	0	22	1.5	2	RM

	Sensors	10.5	10.5	0	22	2.5	2	RM
	Measurement and Instrument Workshop	0	0	21	22	1	2	CC
Combustion and Environmental Impact	Environmental Impact and Treatment (traitement)	21	10.5	0	32.5	2.5	3	RM
	Thermochemistry of Combustion	21	10.5	0	32.5	2.5	3	RM
Transversal module 3	Communications Technology : French 1	0	0	0	21	1	2	CC
	English 3	0	0	0	21	2	2	CC
	Business Culture 1	0	0	0	21	2	2	CC
Optional 3	Facility Safety	21	21	21		5	6	CC

Semestre 4

Modules	Elements	Time schedule			Total	Cr	Coef	Asses. system
		C	TD	TP				
Boiler Burners and Exchangers	Boilers and Burners	10.5	10.5	0	20	2	2	RX
	Exchangers	10.5	10.5	0	20	2	2	RX

	Boiler Burner and Exchanger Workshop	0	0	21	20	1	2	RX
Design Technology	Technical Drawing	10.5	10.5	0	22	2	2	RX
	Functional Analysis	10.5	10.5	0	22	2	2	RX
	Computer-Aided Design Workshop	0	0	21	22	1	2	RX
Individual Tasks	Individual Tasks	0	0	63	63	5	6	RX
Power Electronics and regulation Servo controls	Power Electronics	0	0	21	20	1	2	RX
	Regulation and Control Servo controls ?	10.5	10.5	0	20	2	2	RX
	Power Electronics and regulation, Workshop	10.5	10.5	0	20	2	2	RX
Transversal module 4	English 4	0	0	0	21	2	2	CC
	Communications Technology : French 2	0	0	0	21	1	2	CC
	Business Culture 2	0	0	0	21	2	2	CC
Optional 4	Air-conditioning of Buildings	21	21	21		5	6	CC

Semestre 5

Modules	Elements	Time schedule			Total	Cr	Coef	Asses. system
		C	TD	TP				
Renewable Energies	Design of Photovoltaic Installations	22.5	10.5	6		1	2	RX
	Wind Energy Conversion Chain (P1)	16.5	6	6		2	2	RX
	Electrical Energy Management	10.5	6	6		2	2	RX
Identification and Control	Design of Static Converters	16.5	6	8		2	2	RX
	Machine Control	16.5	6	8		3	3	RX
	System Identification	16.5	6	9		2	2	RX
Transversal module 5	English 5	0	0	0	21	2	2	CC
	Communications Technology : French 3	0	0	0	21	1	2	CC
	Business Culture 3	0	0	0	21	2	2	CC
	Sensor Networks	16.5	6	15		2	2	CC

Networks and Supervision	Supervision of Electrical Networks	16.5	6	15	1	2	CC
	Architectures and Application of REI	16.5	6	0	2	2	CC
Embedded Computing	Mini Project Embedded Computing			21	5	6	RX

Semestre 6			
Course type (module)			
	Coef	Cr	Assessment system
End-of-studies practical activity	1	30	RX

❖ University of Sousse

The University of Sousse offers a range of academic and professional training in basic sciences, legal, economics and management, technical, agronomic, medical, paramedical, handicrafts and humanities. The application of the License - Master -Doctorate (LMD) system is widespread in all institutions concerned by the reform, namely 17 Higher education institutions : (4 faculties, 3 schools, 10 institutes)

- 29112 Students
- 2011 Teachers
- 164 Courses
- 51 International Cooperation Conventions and145 Conventions of co-supervision of thesis.

At the Hamman Sousse Higher School of Technology Sciences at the University of Sousse, three training courses were created in materials engineering (2 Applied Licenses, 2 Professional Masters and a Master's Degree in Materials and Energy Research).

The University of Sousse participated in all the activities of the project, be it piloting, management, training or dissemination:

- Coordinate the WP5
- Participate in the investigation and analysis of training needs in the field of renewables energies,
- Design and curriculum and content of courses in the field of renewable energies,
- Establish and manage the environment of distance education.
- Participate in the development of the capacity building program, the training of staff and the organization of European visits.

- Manage the installation of the educational station and the laboratories
- Participate in events and conferences
- Maintain effective communication with all stakeholders
- Contribute to the plan for monitoring and evaluation of activities
- Open training in renewable energies.

Educational programs

Semester 1							
Modules	Elements	Time schedule			Cr	Coef	Assessment system
		C	TD	TP			
Mathematics 1	Analysis 1	21	10.5		2	3	RX
	Algebra 1	21	10.5		2	3	RX
Physique 1	Electrostatics and Magnetostatics	10.5	10.5		2	2	RX
	Introduction to Thermodynamics	10.5	10.5		2	2	RX
	Physics 1 Workshop			21	1	2	CC
Computer Science 1	Algorithmics and Programming	10.5	10.5		2	2	RX
	Architecture	10.5	10.5		2	2	RX
	Computer Science 1 Workshop			21	1	2	CC

Applied Thermodynamics	Applied Thermodynamics	21	21		4	4	RX
	Applied Thermodynamics Workshop			21	1	2	CC
Transversal module 1	English 1	21			2	2	CC
	C2I-1	21			2	2	CC
	Human Rights	21			2	2	CC
Optional 1			63		5	6	CC
TOTAL		378			30	36	

Semester 2

Modules	Elements	Time schedule			Cr	Coef	Assessment system
		C	TD	TP			
Mathematics 2	Analysis 2	21	10.5		2	3	RX
	Algebra 2	21	10.5		2	3	RX
Physics 2	Electrostatics and Magnetostatics	10.5	10.5		2	2	RX
	Introduction to Thermodynamics	10.5	10.5		2	2	RX
	Physics Workshop			21	1	2	CC
Heat Transfer	Conduction and Convection	10.5	10.5		2	2	RX

	Radiation	10.5	10.5		2	2	RX
	Heat Transfer Workshop			21	1	2	
Fluid Mechanics	Statique & Cinématique des fluides	10.5	10.5		2	2	RX
	Dynamique des fluides	10.5	10.5		2	2	RX
	Atelier de Mécanique des fluides			21	1	2	CC
Transversal module 2	English 2	21			2	2	CC
	C2I-2	21			2	2	CC
	Human rights 2	21			2	2	CC
Optional 1			63		5	6	CC
TOTAL		378			30	36	

Semester 3							
Modules	Elements	Time schedule			Cr	Coef	Assessment system
		C	TD	TP			
Measurement and instrumentation	Measurement Theory and Computer Processing	10.5	10.5		1.5	2	RX
	Sensors	10.5	10.5		2.5	2	RX
	Measurement and Instrumentation Workshop			21	1	2	CC
Materials	Polymers and Composites	10.5	10.5		2	2	RX
	Semiconductors	10.5	10.5		2	2	RX
	Materials Workshop			21	1	2	CC
Electrical Engineering	Electrical Circuits	10.5	10.5		2	2	RX
	Electrical Machines	10.5	10.5		2	2	RX
	Electrical Engineering Workshop			21	1	2	
Combustion and Environmental Impact	Environmental Impact and Treatment (traitement)	21	10.5		2.5	3	RX
	Thermochemistry of combustion	21	10.5		2.5	3	RX

Transversal module 3	English 3	21			2	2	CC
	Français 1	21			1	2	CC
	Culture d'entreprises 1	21			2	2	CC
Electives 1			63		5	6	CC
TOTAL		378			30	36	

Semestre 4

Modules	Elements	Time schedule			Cr	Coef	Assessment system
		C	TD	TP			
Energy Systems	Thermal Machines	10.5	10.5		2	2	RX
	Fluidic Equipment	10.5	10.5		2	2	RX
	Energy Systems Workshop			21	1	2	CC
Production du Froid	Refrigerant Fluids and Environmental Impact	10.5			1	1	RX
	Refrigerating Machines	21	10.5		3	3	RX
	Electrical Machines Workshop			21	1	2	CC

U.E. Transversales 4	English 5	21	2	2	CC
	Tech. Com : French 3	21	1	2	CC
	Business Culture 3	21	2	2	CC
Optional		63	5		RX
Optional		63	5	6	RX
Optional		63	5	6	CC
TOTAL		378	30	36	

Semestre 5

Module	Elements	Time schedule			Cr	Coef	Assessment system
		C	TD	TP			
Design Technology	Technical Drawing	10.5	10.5		1.5	2	RX
	Functional Analysis	10.5	10.5		2.5	2	RX
	Computer-Aided Design Workshop			21	1	2	CC
Power Electronics and	Power Electronics	10.5	10.5		2	2	RX
	Regulation and control	10.5	10.5		2	2	RX

	Servo controls						
	Power Electronics and regulation and control			21	1	2	CC
	Servo controls Workshop						
Boilers Burners and Exchangers	Boilers and Burners	10.5	10.5		2	2	RX
	Exchangers	10.5	10.5		2	2	RX
	Burners and Exchangers Workshop			21	1	2	
Transversal module 4	English 4	21	10.5		2.5	3	RX
	Communications Technology : French 2						
	Business Culture 2	21	10.5		2.5	3	RX
Individual Tasks		63	5	6	CC		
Optional 1		63	5	6	CC		
TOTAL			378		30	36	

Semestre 6		
Courses (module)	Number of credits granted	
	Per element	Total (module)
Internship or other practical activities (case study or its simulation, business plan, tutored project)	30	30
TOTAL	30	30

4. Conclusions

The creation of the renewable energy network, based on the principles of the Tempus Momate project, aims to support the recent development of the renewable energy sector in the Maghreb countries by strengthening training capacity.

To maintain the momentum created by this fruitful collaboration between the partners, the partners have put in place a charter that regroups them with the actors involved in the promotion of renewable energies. The guiding principle of this approach is that the Charter constitutes a moral contract to continue this fruitful collaboration and to allow the visibility of the group.

The network created is complemented by a group created within the framework of the LinkedIn social network and called "MOMATE: Tempus Project to Modernize Training in Renewable Energies in the Maghreb" which serves as a contact point and the dissemination of the latest news related to the world of renewable energies in new universities. It is an open and unrestricted group where members can exchange news of interest.

As part of the European MOMATE project, Abdelmalek Essaadi University has set up a remote laboratory for renewable energies "REMOTE LAB". The laboratory offers distant learners the opportunity to carry out remote practical work in the field of renewable energies. The implementation of this laboratory represents a pedagogical innovation and allows the development of synchronous collaborative work; students and teachers can indeed control laboratory equipment together and interact simultaneously. After describing this method of experimental training, we give an example of manipulation.

Indicators will be set up to study the pedagogical effectiveness of this laboratory by feedback.

The MOMATE project aimed at the major objective of contributing to the support of major projects open to the Maghreb in the field of renewable energies. The aim was to strengthen training capacities to contribute to the ambition of these countries in order to master innovative technologies in the various renewable energies fields and to use them for industrial and social development.

Through seminars organized in the Maghreb and through the numerous training workshops held in Europe, the partners sought to shed light on the issues of renewable energies, in particular in education and training, innovation to provide quality training compatible with European standards and responding to the socio-economic needs of the new knowledge society.

Our wish, which we share with all our Maghreb and European partners, is to continue to work together for the development of renewable energies.

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