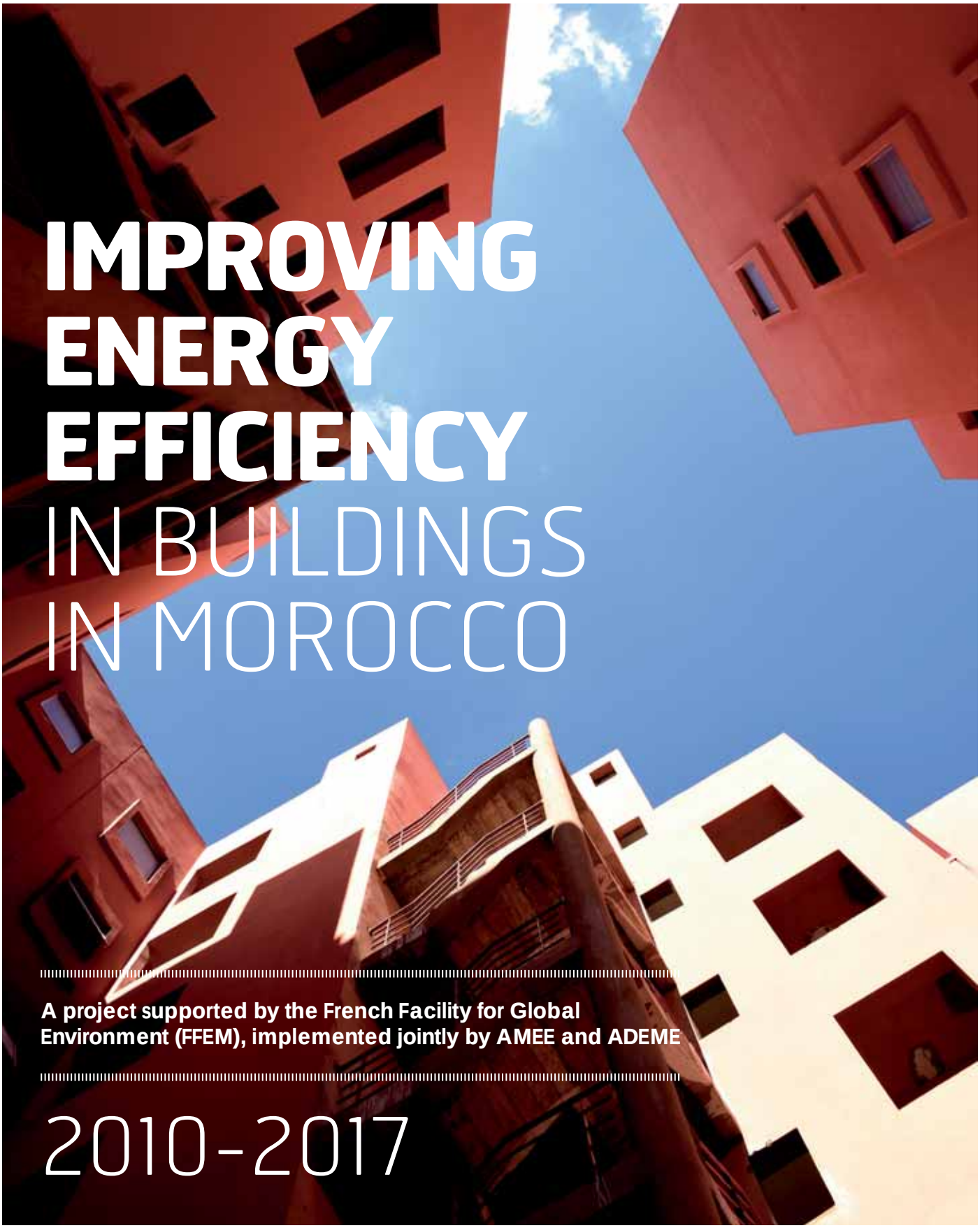

IMPROVING ENERGY EFFICIENCY IN BUILDINGS IN MOROCCO

A project supported by the French Facility for Global Environment (FFEM), implemented jointly by AMEE and ADEME

2010-2017

In partnership:

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Overall view of the El Fal Hanaa low-cost housing development near Casablanca (Laben).

FOREWORD

The aim of this publication, produced by the French Environment and Energy Management Agency (ADEME) in association with its Moroccan counterpart, AMEE, is to report on the progress made with regard to the financial backing provided by a number of international funding agencies for the Moroccan authorities' building energy efficiency programme.

The Global Environment Facility (GEF), through the United Nations Development Programme (UNDP) and the European Union (EU), together with the French Facility for Global Environment (FFEM), have contributed to the implementation of this national strategic programme.
In addition, the initiatives and outcomes reported in this document share the same aims and in some cases go beyond the strict framework of the FFEM's role as funder.

GENESIS OF THE PROJECT

« *Morocco's development process is leading to a steady increase in energy demand which can only be met by increasing supply and controlling energy consumption», emphasises the Moroccan energy efficiency law 47-09 of 2009. This is a particularly sensitive issue in the building sector which is seeing rapid growth accompanied by high energy consumption.*

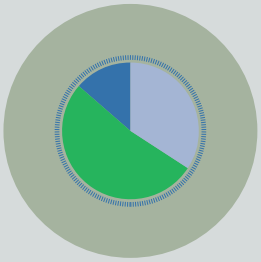
This is the context that gave rise to the French Facility for Global Environment (FFEM) project, which aims to support the Moroccan authorities' drive to improve building energy efficiency and introduce statutory thermal regulations for the construction industry.
This project will benefit from the leveraging effect provided by the Global Environment Facility (GEF) via the UNDP, and the European Union, and will be incorporated into a coordinated programme in support of Morocco's national energy efficiency pact. It was launched in February 2010.
The funds mobilised by the funding agencies amount to €13.2 million, broken down into €2.3 million from GEF/UNDP, €10 million from the EU and €0.9 million from FFEM, plus the funds that Morocco itself is investing in this project, estimated at €14 million. Only €3.5 million approximately of the EU funds have been used (for administrative and contractual reasons), bringing the total funding envelope for the programme to a little over €20 million over a period of more than six years.
The intention is clear: to support the Moroccan authorities and their partners in the private sector in their commitment to succeed at the «building» component of the country's National Energy Efficiency Programme in the startup phase.

FFEM's contribution is mainly concerned with:
• Sharing experience of energy efficiency in buildings
• Reinforcing the capabilities of ADEREE, which became AMEE in October 2016
• Supporting efforts to increase skills in the building sector, through training
• Supporting pilot projects.

The contracting authority for the FFEM portion is ADEME, which has since 2010 been working closely with AMEE (formerly ADEREE), the agency chosen by the Moroccan authorities to conduct the country's energy efficiency programmes.

Funds committed for 2010-2016

(in millions of euros)



Total amount: **€20.7M**

- €2.3M GEF/UNDP
- €3.5M EU
- €0.9M FFEM
- €14M Moroccan equity

VIEWPOINT
DOMINIQUE CAMPANA, DIRECTOR OF INTERNATIONAL ACTION, ADEME

"The building energy efficiency code (CEEB) programme, launched in 2010, gave rise to the first thermal regulations for construction in Morocco, passed in late 2015. ADEME, with internationally recognised experience, lent its expertise to define and implement building standards, set up a vocational training scheme (FORMABAT), and provide technical support for pilot operations. On a global scale, the building sector accounts for 35% of energy consumption and 30% of greenhouse gas (GHG) emissions, making it a key factor in the energy transition process."

ISSUES AT STAKE FOR MOROCCO

The project is concerned with not just energy but also economic, social and environmental issues. The process of implementing a building energy efficiency policy generates multiple dividends which make it a factor in the country's development: improving living conditions and purchasing power for households, developing production facilities, creating business and jobs, increasing skills in the building sector and achieving national climate goals.

Controlling energy consumption in the building sector is a key factor in Morocco's energy strategy.

Morocco is a highly energy-dependent country with approximately 95% of the energy consumed being imported(1). The energy bill accounted for 10% of GDP in 2008. Final energy consumption increased by approximately 6% per year between 2002 and 2011.
Controlling energy consumption in the building sector is therefore a key factor in Morocco's energy strategy. In the residential sector, the number of existing dwellings stood at around 6.4 million at the end of 2016(2). The number of new dwellings built annually has been upwards of 150,000 in recent years. In the tertiary sector, there is steady growth in the construction of hotels and holiday apartments, offices, schools, universities and hospitals.

The rate of urbanisation in Morocco has more than doubled in the last fifty years. It was mainly to address this problem that the country embarked on a plan to build six new towns. While a significant number of property development projects are conducted by property developers, a large proportion are self-managed development and self-build projects. Morocco has some 5,000 architects, a profession that is fairly well developed, and tens of thousands of contractors of all sizes.

ENERGY AND THE BUILDING SECTOR

In March 2014, Morocco published its National Energy Efficiency Strategy up to 2030, which confirms the National Energy Efficiency Programme objective to reduce final energy consumption by 12% by 2020 and by 15% by 2030. The construction industry is the second biggest energy consumer after the transport sector, accounting for 25% of total final energy consumption, and over half of final electricity consumption, which has quadrupled since 1990.

1/4

OF MOROCCO'S ENERGY CONSUMPTION IS ATTRIBUTABLE TO THE BUILDING SECTOR.

12% by 2020

AND 15% BY 2030. THE NATION'S ENERGY CONSUMPTION REDUCTION OBJECTIVE, SET BY THE NATIONAL ENERGY EFFICIENCY PLAN

The Oudayas Kasbah in Rabat.

Three assistance schemes have been set up by the Ministry of Housing and Urban Policy (MHPV) for the 2010-2020 period:
- Social housing, based on specifications including an energy efficiency component, with living space of 50-80 sqm and an overall value not exceeding MAD 250,000 excl. VAT
- Middle-class housing, designed for dwellings with living space of 80-140 sqm and a selling price not exceeding MAD 7,200 excl. VAT per sqm
- Low-cost housing (FVIT)(3), with a construction cost of less than MAD 140,000 excl. VAT, which is struggling to develop.

In terms of construction products, those involved in structural work are predominantly locally produced, while thermal insulation materials and equipment such as heating, air conditioning, lighting, solar water heaters, etc. are largely imported. Ultimately, the drive to improve energy efficiency in buildings should be a powerful incentive to develop homegrown products.

(1) This figure has come down in the last few years with the rise in renewable energy.
(2) Source: 2015 survey by the Ministry of Housing and Urban Policy (MHPV).
(3) Housing with a low overall property value

AMEE SUPPORTING THE BUILDING SECTOR AND CONSUMERS

To successfully make the energy transition, the building sector needs a guiding hand. This role has been fulfilled by AMEE (formerly ADEREE) since 2010. Thanks to the GEF/UNDP-EU-FFEM project, AMEE has been able to substantially strengthen its own capabilities. A specialist building energy efficiency department with competent personnel has been created within its technical division. Thanks to the financial backing it has received, AMEE has been able to progressively put in place the appropriate environment:

- Consultation on the various elements of the legislative, regulatory and normative framework
- Characterisation of thermal performance of materials
- Publication and dissemination of reference works *(see inset)*
- Development of Binayate, a software application for regulatory thermal calculations for buildings *(see inset)*
- Setting up the FORMABAT system *(see below)*
- Training in energy diagnostics for existing buildings
- Training in thermal regulations and use of Binayate *(see inset)*
- Raising awareness in the building sector
- Campaigns to promote energy efficiency in buildings.

AMEE also has the capability to develop and implement a multi-target, multimedia communication policy (written communication, TV/radio/press campaigns, trade shows, web, etc.). As a result, after just a few years, there is a genuine awareness of the issue of energy efficiency in buildings in Morocco, both in the building sector and among the public at large. It is certainly a nationwide issue but one that must be approached differently in each of Morocco's twelve regions. It was in this spirit that AMEE designed the Jiha Tinou programme which aims to encourage local initiatives.

BINAYATE SOFTWARE

Binayate is a software application to assist architects and energy performance assessors with the regulatory thermal calculations for buildings. It includes two very useful databases:
- Average meteorological data based on 30 years of readings from 30 weather stations spread over the country's six climate zones
- Thermophysical properties of construction materials.

AMEE PUBLICATIONS ON ENERGY EFFICIENCY IN BUILDINGS

For professionals:
- Building energy efficiency best practice
- Moroccan thermal regulations for construction (RTCM), full and simplified versions
- Technical guide to heating, ventilation and air conditioning (HVAC)
- Nine examples of efficient construction in Morocco
- Technical guide to thermal insulation for buildings in Morocco
- Guide to energy efficiency in the tourism sector in Morocco
- Technical guide to efficient lighting.

For consumers:
- Leaflet on the fundamentals of energy efficiency in everyday life.

VIEWPOINT
SAÏD MOULINE, DIRECTOR-GENERAL OF AMEE

"When the regulatory, technical, training and financial issues are tackled together, it is possible to change habits and achieve decisive results in terms of energy efficiency. The "building energy efficiency code" project was initiated by the government to address the rapid growth in demand for energy in the construction sector. AMEE has received financial and technical support from FFEM and ADEME, together with UNDP/GEF. A number of projects have been carried out with the aim of lifting the institutional and regulatory barriers and creating the right conditions for a market to emerge. Improving energy efficiency basically relies on changing the attitudes of citizens and on the building sector being fully aware of the environmental and energy-related implications of the new regulations. Of course, habits are sometimes difficult to change. AMEE will continue to support the building sector through training initiatives - particularly for the Binayate software -, partnerships, practical guides for building professionals, as well as creating a practical demonstration platform and developing a specific certification system."

FROM THE BUILDING ENERGY EFFICIENCY CODE...

Traditional Moroccan homes took the climate into account and followed the principles of bioclimatic housing: building orientation, choice and proportioning of construction materials, wall colour, small window area, sun protection, etc.
The rapid development of modern construction has resulted, in Morocco as in the majority of countries, in these principles being abandoned. This has resulted in dwellings that require heating and air conditioning equipment that consumes a lot of electrical and fossil fuel energy, or which, if they don't have such equipment, are uncomfortable to live in. Such dwellings are expensive to run, both for the low-income families who live in them and for the state which subsidises the cost of energy.
This was the motivation behind the plan to correct the situation through simple, proven measures, including thermal wall and roof insulation, double glazing, sun protection, low-energy bulbs and solar heating systems to produce domestic hot water.
There was a need to build energy-efficient buildings: the Moroccan building energy efficiency code (CEEB) programme was set up in 2009 with the aim of introducing minimum thermal and energy performance requirements for new-builds in both the residential and tertiary sectors.
With the support of its partners, in particular UNDP, the European Union, FFEM and ADEME, AMEE (formerly ADEREE) drew up a code with two components:
• Thermal regulations for construction in Morocco (RTCM), defining the thermal performance of the building envelope
• Energy performance certification for domestic equipment (lighting, heating, air conditioning, electrical appliances).

3D model of the Terrasses d'El Menzeh project (architect: Meriem Tahiri).

VIEWPOINT
MAJIDA EL OUARDIRHI, DIRECTOR OF QUALITY AND TECHNICAL AFFAIRS, MHPV[1]

"The energy efficiency regulations for construction represent an opportunity to tap the energy-saving potential of the construction sector. They aim to reduce the heating and air conditioning requirements of buildings while at the same time improving thermal comfort and optimising the design of the building envelope. Initiatives such as raising awareness and training all those involved, particularly architects, boosting human and technical resources for monitoring and inspection in urban planning agencies and local councils, and training a locally-based skilled workforce should ensure that the regulations are widely implemented."

(1) Ministry of Housing and Urban Policy

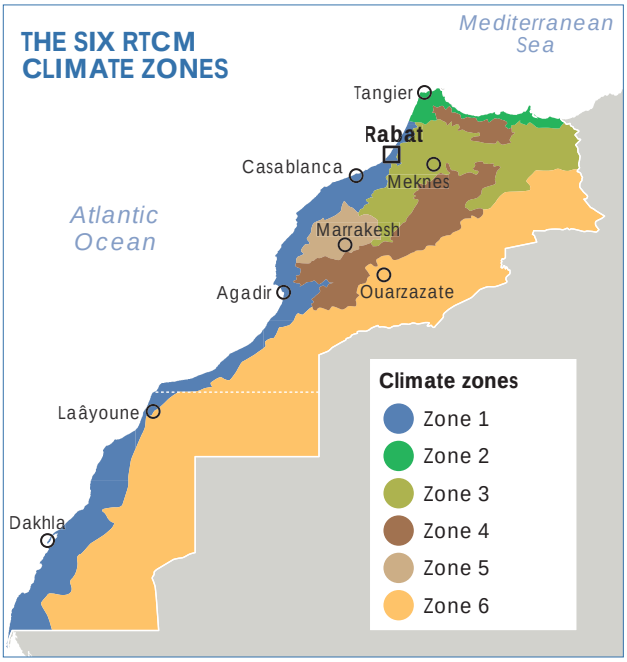
...TO ITS THERMAL REGULATIONS FOR CONSTRUCTION

The RTCM links the thermal performance requirements for buildings with a climate zoning system that takes into account average winter and summer weather conditions. Morocco is divided into six climate zones *(see map)*. Following a broad-based consultation with stakeholders in the public and private sectors, a government decree was issued in October 2014 making the RTCM a component of the general building regulations. It concerns new-builds for residential and tertiary use. Implementation has been mandatory since December 2015.

The RTCM proposes two complementary approaches:
• **A «performance-based» approach** which sets the maximum energy consumption for the building's heating and air conditioning, expressed in kWh/m²/year
• **A «prescriptive» approach** which sets targets for the thermal properties of the various components of the envelope, according to the climate zone and window ratio.

The transfer of experience afforded by the various support projects from which the Moroccan authorities have benefited is key to implementing the RTCM effectively.
There are a large number of preliminary steps to be carried out:
• Informing stakeholders in the sector, including clients, architects, assessors and contractors as well as staff in the urban planning agencies responsible for checking that the plans are compliant with the RTCM and inspecting completed buildings
• Developing technical standards for construction materials, under the aegis of the Moroccan Standards Institute (IMANOR)
• Ability of test laboratories to measure the performance of construction products

Maison du Développement Humain linked to the El Fal Hanaa pilot project (Laben).



• Ability of Moroccan manufacturers to make sufficient products of the right quality
• Adapting the training (initial training and professional development) of all the industry players concerned
• Maintaining and developing a national research and development effort in building energy efficiency
• Carrying out, monitoring and instrumentation of the first pilot schemes to learn from
• Raising public awareness.

To some extent the entire construction ecosystem is impacted and all branches have to adapt to a new way of working. A successful transition calls for a strong political will, which is unquestionably present in Morocco with the commitment to an ambitious energy strategy at the highest level of the Kingdom. It then takes time, because a complex system like the construction industry, with hundreds of thousands of people involved, cannot be changed overnight. Lastly, it is necessary to coordinate a programme broken down into a large number of initiatives, all of which are essential to its success.

The RTCM can only be implemented progressively therefore, to enable all stakeholders to adapt to their new remit and new practices.
This is the situation as it stands in 2017, as described by Moroccan professionals in the public and private sectors.

ONE PRIORITY: BUILDING ENERGY EFFICIENCY TRAINING

The best thermal regulations, like the best construction products, will have only limited effect if the chain of stakeholders, from architect to site foreman, has not taken on board the new ways of designing and erecting energy-efficient buildings.

ADEME, assigned by FFEM, and its Moroccan counterpart AMEE both believe strongly that improving skills in the building sector is a priority. So in 2011 an analysis of training needs (initial training and professional development) in the construction sector in Morocco was carried out. The first part was a survey of existing resources for the implementation of training courses on energy efficiency in buildings in Morocco[4]. This exhaustive analysis, which covers initial training and professional development, clearly shows:
• Significant training needs
• The need to strengthen the building energy efficiency training offer
• A training implementation strategy, necessary to adapt supply to demand.

For professional development, an estimate of the number of people to be trained was drawn up. It was estimated that there were just over 720,000 people working in the sector and that approximately a third of those would need to be trained, split between the main areas of specialisation:
• Architects
• Assessment engineers
• Management (building owners/contracting authorities and urban planning agencies)
• Supervisory personnel (site managers, project managers and foremen)
• Semi-skilled labourers.

In initial training, it was estimated that 23,000 people would need to be trained each year, broken down as follows: 3% architects, 5% engineers, 15% technicians and 77% labourers. It emerged from analysis of the existing offer that the initial training for engineers and architects could be adapted to encompass energy efficiency in buildings, and that initial training for technicians would require more work. Initial training for labourers was not considered. In terms of professional development, the idea was so new that in 2011 when the analysis was done, there was everything to do. At the end of the project, six years down the line, much has been achieved, as we will see.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1. Professionals involved in the AMEE/ADEME training programme and their partners. 2 & 3. Closing seminar of the CEEB programme (Rabat, April 2015).

THE FORMABAT SYSTEM...

Based on a status report and analysis of building energy efficiency requirements, the project was focused on vocational training for construction industry players, in accord with the conclusions of the national debate on energy efficiency which took place in Morocco in spring 2013. Following the Grenelle Environment Forum in France, ADEME was closely involved in supporting the sector to change its practices. It is this experience that ADEME has been able to share with AMEE, adapting approaches that have proved effective in France to the situation in Morocco.

This gave rise to FORMABAT, a unique professional development programme for Moroccan instructors, entirely designed, produced and trialled within the project between 2013 and 2015.

The basic structure of the programme is as follows:
• Six technical modules[5] *(see inset)*, which can be adapted to different audiences, delivered over a total of 18 days
• Theory sessions[5], taught in the classroom, enabling future instructors to grasp the issues, understand the principles of building thermal

(4) Survey conducted by ICARE.
(5) Designed and produced by EMENDA which also ran the pilot sessions.

1. and 2. Instructor training session: the practical component (FORMABAT).

performance and learn teaching methods geared to people working in the sector
• Practical sessions, taught using a "technical platform[6]" set up within AMEE's green platform in Marrakesh, enabling students to familiarise themselves with the materials and building techniques (wall and ceiling insulation, treatment of thermal bridges, double glazing installation, etc.), and learn techniques hands-on
• At the end of the course, after they have completed Module 7 in which they are assessed[7], the future instructors receive a diploma and accreditation from AMEE. This accreditation recognises both the future instructor's understanding of the technical content and their ability to teach it to others.

The initial FORMABAT pilot sessions doubled as trial sessions. They were monitored and assessed with a view to correcting the programme's weak points and making it more relevant. These sessions took place between January and July 2015. At the end of the final assessment, twenty professionals received the accreditation enabling them to become instructors themselves[8]. They form the central core from which training in the RTCM and building energy efficiency more broadly will radiate out to the entire Moroccan building sector. A second FORMABAT course is planned for 2017 and will enable a further twenty instructors to gain AMEE accreditation.

FORMABAT BUILDING ENERGY EFFICIENCY AND ASSESSMENT MODULES

1. Designing an energy-efficient building
2. A deeper look at building practices specific to energy-efficient buildings
3. A deeper look at choosing energy-efficient equipment
4. Quality control on an energy-efficient building project.
5. Placing orders with the Moroccan thermal regulations for construction.
6. Implementing thermal insulation materials.
7. Assessing trainees' grasp of the subject.

In the words of Thierry Méraud (Mediterranean Manager ADEME, FFEM Project Manager), *"this new training programme is an integral part of the current process of upgrading AMEE's "green platform" in Marrakesh. It develops all*

(6) Designed by the French institute of solar energy (INES).
(7) Designed with the assistance of AERE.
(8) With the assistance of CAFOC.

innovative aspects of sustainable building, using the technical platform which is a means of showing the different ways of designing buildings, giving priority to the thermal behaviour of the envelope, reducing the use of heating and air conditioning, and improving comfort".

The technical platform, developed by INES, consists of three elements:
• The outdoor learning area
• The indoor learning area for demonstrating different building techniques and the various types of insulation
• The materials library.

"The practical part of the course is the essential complement to the theoretical part. For site supervisors, as for architects and engineers, it is an opportunity to learn about the products they will be required to stipulate or implement, and to focus on the method, which is key to quality and achieving the performance expected."

...AND ROLLOUT

Since 2015, a large number of training sessions for professionals (architects, engineers and site supervisory personnel) have been delivered all over the country by the instructors who were granted accreditation at the end of the initial pilot sessions.
In general, they take the form of a two-day course (1.5 days theory and 0.5 day practical) based on a summarised version of the six FORMABAT modules. AMEE, with five FORMABAT-accredited instructors to its name, taught several sessions of this type at the Marrakesh facility to a total of 200 professionals.

The Moroccan national council of the order of architects (CNOA) offers its members a two-day course on building energy efficiency and the RTCM. It plans to add a specific module on getting to grips with the BINAYATE software and a more practical module that would be taught at the green platform. The same goes for the other instructors, assessors, academics and the EMC cluster that are accredited.


1


2

AMEE's technical training platform in Marrakesh, part of the green platform: 1. The indoor learning area. 2. The outdoor learning area.

VIEWPOINT
MERIEM TAHIRI, VICE-PRESIDENT OF THE NATIONAL COUNCIL OF THE ORDER OF ARCHITECTS

"The RTCM provides for certain obligations relating to energy efficiency in the site analysis and design building phase. A building's design must take the climate zone into account, orient the building correctly and use building materials that comply with the regulatory thermal performance requirements. These new measures relating to the design of architectural spaces should lead to innovation in building techniques that will contribute to sustainable environmental performance more widely. To maximise awareness of the challenges of building energy efficiency, it is imperative to increase awareness among all stakeholders, particularly in the political sphere. To help us improve the energy efficiency of new and existing buildings, a number of public and private sector actions have been identified, including:
• Setting up information, advice and support services
• Incorporating energy and environmental aspects in the urban planning programmes of Moroccan cities
• Providing targeted subsidies to support the development of new technologies."

THE IMPORTANCE OF DEMONSTRATION PROJECTS

Al Karama social housing pilot scheme near Meknes (Al Omrane).

Table 1: Description of the seven pilot demonstrators

Developer	Project	Location	Operation	Climate zone	Status (March 2017)
Al Omrane[9]	Jacaranda	Tamansourt	272 dwellings	Z5	Nearing completion
Al Omrane	Al Ouroud 2	El Aroui (near Nador)	144 social dwellings	Z3	Marketing
Al Omrane	Al Karama	El Hajeb (near Meknes)	96 social dwellings	Z4	Operating, occupied since 2016
Al Omrane	Head office of Al Omrane	Chrafate (near Tangier)	1,200 m^2	Z2	Occupation underway
Laben[10]	El Fal Hanaa	Ain Sebaa (near Casablanca)	637 low-cost dwellings	Z1	Operating
SGTM[11]	Hotel Club Oasis Lixus	Port Lixus (near Larache)	255 rooms	Z2	Completed
SGTM	Head office of SGTM	Casablanca	3,500 sqm	Z1	Building phase

(9) The Al Omrane Group, the secular arm of the Ministry of Housing and Urban Policy, with 14 regional branches, is a major public planning and construction operator.
(10) Property development company.
(11) Société Générale de Travaux du Maroc.

European Union support for Morocco's energy efficiency programme has been focused on demonstration projects, i.e. pilot schemes that meet and even exceed the energy efficiency requirements laid down by the RTCM.

EU support included meeting the additional costs associated with energy efficiency, the training of operators on the ground involved in carrying out these projects and monitoring these trials[12]. Of the nine demonstration projects envisaged in 2010, seven were actually built *(Table 1, page 11)*:

- Five projects received this support
- Two other projects were completed and are therefore part of the pilot scheme but did not receive EU support for administrative reasons.

These demonstration projects had the immense merit of placing construction sector players in new situations and testing the requirements of the RTCM under real-life conditions in five of the six climate zones. AMEE has published a document describing these achievements and in particular the main energy efficiency measures listed in Table 2.

These projects were also an opportunity to estimate the additional construction costs in comparison with reference buildings without thermal insulation. The additional costs are estimated at between 5% and 8%, which is reasonable bearing in mind that these are demonstration projects and at the experimental stage.

(12) The assessment agencies AETS and ALGEES were involved in this part of the project.


1

Table 2: Products and equipment implemented for the demonstration projects

	Jacaranda	Al Ouroud 2	Al Karama	Al Omrane HQ	El Fal Hanaa	Oasis Lixus	SGTM HQ
Roof insulation	✓	✓	✓	✓	✓	✓	✓
External wall insulation	✓	✓	✓	✓	✓	✓	✓
Ground floor insulation	✓	✓	✓	✓	✓		
Double grazing	✓	✓	✓	✓	✓	✓	✓
Self-closing stairwell door	✓						
Brise-soleil		✓					
Reflecting canopy	✓						
Roller shutters		✓			✓		
Solar water heaters		✓	✓				
Awnings			✓				
Presence sensors in circulation areas			✓				
Energy-efficient light fittings				✓			
Dual-flow air handling unit				✓			
Single-flow ventilation system					✓		
Dual-flow ventilation system						✓	✓
Air-to-water heat pump						✓	✓

VIEWPOINT

BADRE KANOUNI, CHAIRMAN OF THE EXECUTIVE BOARD, AL OMRANE GROUP

"EU-funded demonstration projects fit in perfectly with the scheme of the building upgrade projects carried out by our company, which makes sustainable development a priority. They have enabled us, since 2011, to become pioneers in this field, well before the new regulations came into force. We have been able to incorporate the energy efficiency dimension in our projects in a concrete way, and test the techniques and measures that could become a standard requirement. These projects have been invaluable, enabling us to gather feedback from buyers to better evaluate and adapt our practice. We are now capitalising on these different experiences and plan to share them in the form of a practical guide to energy efficient building. The experience of the demonstration projects has enabled us to demystify the concept, which can be adapted to all types of dwellings, provided it is taken into account from the design phase. Now that the regulations are in force, we have a number of tried and tested tools and a database of partners and stakeholders, and are in a position to make recommendations. Energy efficiency is something that concerns us all - government, professionals and citizens. Property developers play a crucial role and we as public operators even more so. An energy-efficient dwelling is above all a well designed, oriented, ventilated and insulated one. Householders are well informed and aware of the impact of their behaviour, and therefore committed to saving energy at every stage, from buying equipment to using it in their everyday lives. In the study that we hope to share, the Group has defined new commitments incorporating the RTCM, as well as additional measures and actions that will lead ultimately to housing that has minimal environmental impact and is even energy positive."

2

1. and 2: Jacaranda social housing pilot scheme in Tamansourt (Al Omrane).

WHAT NEXT?

The FFEM project, coupled with similar projects run by GEF/UNDP and the European Union, has unquestionably provided a framework for the Moroccan programme. It was only possible due to the commitment and determination of Moroccan public and private sector stakeholders, determined to implement a building energy efficiency strategy. The status at the end of this project can be summarised as follows:

- A committed public-sector agency with resources and expertise - AMEE
- A functioning legislative, regulatory and normative framework
- An operational professional development programme on two levels: instructor training and training for those working in the building trade
- Initial training courses gradually integrating energy efficiency into the syllabus
- Manufacturers of products and high-performance equipment starting to adapt their offer to the new requirements set out in the RTCM
- Functioning test laboratories for characterisation of materials
- Demonstration projects that continue to deliver results as they are occupied
- A construction "ecosystem" that is changing as it takes on board the new energy order
- Citizens starting to become more aware of the energy and environmental issues affecting their homes.

These results are extremely valuable. At the same time, much remains to be done. An encouraging process has been set in motion.
It needs to be pursued steadfastly and with determination. The RTCM has so far been little implemented but must become progressively more widely applicable. The Eco-Binayate energy efficiency certification needs to be gradually introduced to support those operators who are forging ahead and make their efforts more visible. The discussions ongoing with the Moroccan federation of property developers (FNPI) should enable this energy performance certification to be incorporated into the existing Iltizam system as the energy and environmental innovation component. Particular attention must be paid to a building's equipment - the "active" systems -, all the more since the RTCM is currently limited to the "passive" systems.
COP 22, hosted by Morocco in Marrakesh in November 2016, highlighted the progress made and the Kingdom's ambitions in terms of limiting greenhouse gas emissions and combating climate change. More recently, on 8 May 2017 in Washington, the prestigious Energy Efficiency Visionary Award was presented to His Majesty King Mohammed VI.
Without a doubt, the construction sector is at the heart of these concerns, which align with the aspirations of the Kingdom and the Moroccan people to see their living environment improve.

Solar thermal energy sensor testing at the AMEE facility in Marrakesh.

VIEWPOINT
DOMINIQUE RICHARD, CLIMATE AND ENERGY PROJECT MANAGER, FFEM

Why did FFEM support this project to improve building energy efficiency in Morocco?
The Kingdom of Morocco did not have thermal regulations in place for buildings. However, the country was and is still seeing very rapid growth in this sector (housing, tourism, public buildings including hospitals), a high energy consumer which is responsible for a quarter of the country's CO_2 emissions. Putting in place a set of regulations, certifications, standards and guides aimed at improving energy efficiency in the building sector is a way to reduce Morocco's greenhouse gas emissions and lower its energy dependence.
It was an innovative step for Morocco, one that is reproducible and has a powerful leveraging effect. It was therefore quite logical for FFEM to be involved in this project.

The French Facility for Global Environment

is a public fund supporting French cooperation and development policy, dedicated to environmental protection in developing and emerging countries. Since 1994, it has contributed to the financing of development projects - spearheaded by public organisations, private companies, NGOs and local authorities – with a significant and lasting impact on the major challenges facing the global environment: biodiversity, climate change, international waters, land degradation including desertification and deforestation, chemical pollutants and the ozone layer. Its speciality is to promote action, gather feedback and set up multi-stakeholder partnerships fostering dialogue between the public and private sectors, local government and NGOs. FFEM is steered by an interministerial committee (finance, foreign affairs, environment, research, agriculture) and the French Development Agency (AFD). Administration and financial management are entrusted to the AFD.

Further information:
www.ffem.fr

The French environment and energy management agency (ADEME)[1]

is active in the implementation of public policy in the areas of the environment, energy and sustainable development. The Agency provides expertise and advisory services to businesses, local authorities and communities, government bodies and the public at large, to enable them to establish and consolidate their environmental action. As part of this work ADEME helps finance projects, from research to implementation, in the areas of waste management, soil conservation, energy efficiency and renewable energy, raw materials savings, air quality, noise abatement, transition to a circular economy and combating food waste. ADEME is a public agency under the joint authority of the Ministry for an Ecological and Solidary Transition and the Ministry of Higher Education, Research and Innovation.

Further information:
www.ademe.fr

The Moroccan Energy Efficiency Agency (AMEE)[1]

set up in 2016 is a public institution that intervenes throughout the energy efficiency value chain. AMEE's mission is to contribute to the implementation of government policy on energy efficiency. It advises the Moroccan authorities on the laws and standards relating to the sector, and designs, initiates and steers integrated energy efficiency programmes. The Agency has a technology platform at its site in Marrakesh which incorporates a photovoltaic laboratory, a thermal laboratory and a specialised energy efficiency training centre. AMEE has initiated several energy efficiency programmes in the construction, manufacturing, agriculture and transport sectors, which account for over 90% of Morocco's energy consumption. Together with the authorities, a number of private-sector partners and experts, AMEE has identified sector-specific measures that need to be implemented if Morocco is to achieve its energy efficiency objectives.

Further information:
www.amee.ma

(1) ADEME and AMEE are members of MEDENER, the Mediterranean association of national energy management agencies (for the improvement of energy efficiency and development renewable energies). www.medener.org

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