Green Economy Initiatives

Success Stories and Lessons Learned in the Arab Region

Issue No. 2

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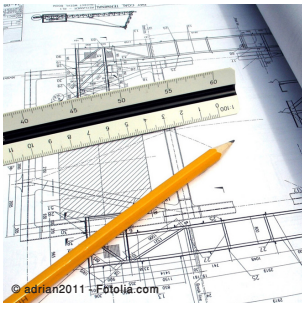

ESCWA

United Nations Economic and Social Commission for Western Asia

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Acknowledgments

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Contents

Introduction

In 2013, the Economic and Social Commission for Western Asia (ESCWA), through its Sustainable Development and Productivity Division (SDPD), continued to work with member countries to explore fruitful and successful green economy opportunities in the Arab region. Backed with a clear mandate by the Council of Arab Ministers Responsible for the Environment (CAMRE), steps to develop a green economy investment road map for the Arab region have been undertaken, and a plan of action for the preparation of this road map has been discussed with several regional partners.

In line with this objective, and as part of the ESCWA project on Strengthening National Capacities in the ESCWA Region on Developing Green Production Sectors, two documents, namely Regional Mapping of Green Economy Activities and related sPolicy Guidelines to Support Green Productive Sectors, were published, complemented by the report on Monitoring the Transition towards a Green Economy in the Arab Region. To support these studies, SDPD has engaged in the collection of promising green economy case studies from the region and, following the publication of a first booklet on Green Economy Initiatives, Success Stories and Lessons Learned in the Arab Region during the first half of 2013, this second booklet contains 17 case studies, one per member country.

The first booklet provided a response to the call for disseminating information and best practices in the area of green economy, providing a series of success cases, initiatives and programmes related to selected sectors with a clear thematic, rather than country-related, focus.

This second issue contains a successful project from each member country, illustrating that transition towards a green economy is, in fact, currently going on. As will be clearly shown in this publication, member countries are transitioning to the resource-efficient and sustainable economic paradigm through projects and initiatives led by public or private actors, benefiting from big or small budgets, and characterized by a local or national dimension. Despite evident differences, all the case studies reveal a common commitment to the new inclusive and sustainable economic approach that supports the sustainable development process in the region.

Key green sectors are introduced in the first part of the booklet, including green buildings, sustainable agriculture and ecotourism, as well as more focused ones, including energy efficiency in rural areas and renewable energies. The second part of the booklet presents the specific case studies. Each individual case is introduced by a description of the project or initiative, followed by an elaboration on its impact on economic, social and environmental sustainability.

1. Green Sectors

1.1. Green building

The term "green building" refers to structures and processes that are environmentally responsible and resource-efficient throughout the life cycle of a building.[1] Building sustainably in the region often faces multiple challenges. The ever-growing need for freshwater, which is a scarce resource in the region, imposes a dependency on costly and energy-consuming desalination processes.[2] Moreover, climate control and air conditioning are indispensible to ensure comfortable living conditions. As a result, countries in the region, especially in the Gulf area, leave some of the biggest per capita ecological footprints in the world. For instance, the yearly per capita levels of carbon dioxide (CO_2) emissions in metric tons for Qatar, Kuwait and the United Arab Emirates are 44, 30.3 and 22.6, respectively.[3] In the United States, for instance, buildings use up to 40 per cent of the energy; in the Gulf area, however, buildings can use up to 70 per cent of the energy consumed in the country.[4] As a result, the efficient use of energy becomes a very important need. Furthermore, under normal conditions, general construction work uses large amounts of energy, resources and raw material, generating a lot of waste and possibly harmful emissions. Therefore, construction companies face the growing need to build in an environmentally friendly, eco-efficient, manner to reduce the environmental impact.

Building green structures does not necessarily require intricate and expensive processes.[5] There are many relatively affordable green technologies available, including rainwater harvesting and storage systems, efficient water fixtures, lighting, and heating and cooling systems to reduce energy costs and electricity consumption. Energy efficiency is another important aspect of green building; it can be achieved by using proper insulation, internal climate control and clean energy. Green building promotes the use of such renewable energy as solar, wind or biomass, which can help further reduce the carbon footprint left by building activities.[6]

1.2 Ecotourism

According to the International Ecotourism Society, ecotourism is based on a number of principles, including the minimization of environmental impact; the creation of environmental and cultural awareness and respect; the provision of

positive experiences for both visitors and hosts; and the opportunity of providing direct financial benefits for conservation and for the empowerment of local people.

This type of tourism remains integrated within the traditional tourism value chain, while promoting sustainability. Ecotourism ensures that the protection of the environment extends beyond mere ecological concerns to include socioeconomic aspects as well. It takes the consumer into consideration, namely low-end, mid-range and high-end local and foreign visitors; and tour operators, both outbound operators, including those in the "source" countries and international travel agents, and inbound operators, with a particular emphasis on local retailers, tour providers and transport. The ecotourism concept extends the traditional tourism value chain to include local providers of such tourism products and services as local guesthouses, tourist guides and traditional restaurants, and uniquely promotes specific natural and historical attractions and local providers, including handicrafts and local products.[7]

Ecotourism thus entails economic and social aspects that mirror the three pillars of sustainable development. It ensures that green economy principles applied to the protection of the environment create job opportunities, enhance social inclusion and reduce poverty. This is particularly important for the fragile ecosystems of the Arab region. Ecotourism adds sustainability to the tourism sector at the economic, social and environmental levels, which makes it one important manifestation of green economy. At the economic level, it can contribute to generating direct revenues and, at the same time, enhance sustainable production and increase the sale of local products. Socially, it can involve tourists in responsible agricultural activities, therefore providing considerable opportunities for poverty alleviation in rural areas in such countries as Egypt, Iraq, Jordan, Lebanon, Syrian Arab Republic and Yemen; and ecotourism guarantees the preservation and protection of the environment.

The promotion of ecotourism at the national level requires an integrated strategy and cooperation between concerned stakeholders, including governments, ministries, financial bodies, non-governmental organizations (NGOs), the private and public sectors, and individuals.

1.3. Waste management

The improper management of solid wastes, including the lack of adequate collection systems and disposal mechanisms, leads to the pollution of air,

water and soil. Landfills, for instance, may become a source of contamination of drinking water and a breeding ground for infectious and transmissible diseases. Even the generation of debris and harmful substances associated with solid, electronic and industrial waste pose a threat to humans and the environment. Ideally, the minimization of waste is the first solution to the solid waste problem, recycling and reuse is another. The large waste production levels associated with increasing consumption are a consequence of economic expansion, increasing urbanization and population growth that characterize the region. As a result, such countries as Bahrain, Kuwait, Qatar, Saudi Arabia and the United Arab Emirates have among the highest per capita rates of waste generation in the world.[8] The growing amounts of waste being generated by modern economy are resulting in serious threats to the ecosystem and human health. Annually, around 11.2 billion tons of solid waste are being collected around the world, generating, through the decomposition of organic matter, up to 5 per cent of greenhouse gas emissions. The annual net waste generation rate in Arab countries exceeds 150 million tons.[9]

Generally speaking, the waste management sector in the Arab region is characterized by underdevelopment, underinvestment and insufficient regulations and standards. Despite the increase in waste generation, there is weak political commitment and limited availability of national strategies or integrated plans for waste management in most countries of the region.

Most municipal solid waste (MSW) is directed to open or controlled dumpsites, where it is burnt in the open air. What is worse, MSW is usually mixed with industrial and medical wastes.[10] Inappropriate dumping and open burning of solid waste allow decomposed waste products to pollute the air, ground and surface water, and soil. Waste management at the country level requires well-prepared national strategies/master plans and strong cooperation between all stakeholders, including Governments, municipalities, the private sector, NGOs, financial bodies and individuals, among others.[11]

1.4. Renewable energies

Renewable energies are considered an important pillar of a transition to green economy. The engagement in the production of, and research on, alternative forms of energy can contribute sizably to the sustainable development process in Arab countries. At the social level, they contribute to the provision of green jobs and access to energy sources; at the enviromental level, their adoption has a

strong impact on the reduction of harmful emissions; and at the economic level, they help fostering the emergence of private businesses. Moreover, renewable energies are particularly important for the social development of rural and remote areas, as they can provide cost-effective access to the energy needed for lighting, cooking, health-care facilities, schools, television and Internet. Activities related to renewable energy can lead to the creation of a considerable number of jobs. For instance, in 2009, the number of jobs in renewable energy industries, mainly solar and wind, globally exceeded 3 million.[12]

Implementing national renewable energy projects requires strong cooperation between various stakeholders, including Governments, the private sector, NGOs and financial institutions. In addition, it might be useful to implement pilot projects and include strong monitoring and follow-up processes in the pilot implementation period to ensure the documentation of lessons learned.

Rural areas in ESCWA member States continue to face significant challenges as a result of limited access to modern energy services.[13] While some countries have extended electricity grids and gas supplies to rural areas, most of the rural population in the region, which in 2009 constituted some 45 per cent of the total population, still lacks energy supplies and services or is undersupplied. In certain cases, rural inhabitants still rely on wood and other traditional fuels to meet their energy needs.[14] Poverty is a serious problem in many rural areas in the region, and there is a clear need for vigorous initiatives to increase energy accessibility to rural areas to satisfy energy needs, alleviate rural poverty, enhance sustainable development and improve the quality of life.

Renewable energy resources, namely solar and wind sources, are widely available in the region and offer a potential solution to the problem of energy access in remote rural areas. However, the widespread use of renewable energy technologies in rural areas continues to face a number of physical, technical, economic and social barriers, underlining the need for intensive efforts to secure the dissemination of such applications to rural areas in the region.

1.5. Sustainable agriculture

Agriculture still represents an extremely important source of income for developing countries. It plays an important role in food security and land management and in the fortunes or misfortunes of the ecosystem, being the

second source of greenhouse gas emissions and the main cause of water pollution worldwide. For these reasons, a transition to green economy must aim to redefine traditional agriculture by promoting a gradual shift to sustainable agriculture. Organic agriculture constitutes one form of sustainable agriculture.

In the Arab region, even though the market size is limited, the economic benefits of sustainable agriculture in the context of green economy include a higher income for producers as a result of higher prices for green products or the sale of carbon sequestration and biodiversity conservation services. Moreover, a considerable potential exists for an increase in exports of niche products, together with the associated spin-off business opportunities through educational farms and ecotourism.

Sustainable agriculture is defined as "the ability of satisfying the food needs of a growing population while preserving the environment and natural resources. Agricultural sustainability is evaluated from different perspectives including economic viability, environmental sustainability and social acceptability".[15] Economic viability is assured through the preservation of such necessary inputs as land, labour and manufactured capital to the economic process to keep producing enough food. Environmental sustainability is attained through the creation of long-term benefits in the building-up of natural capital, in particular in soil and water management, namely the reuse of wastewater and promotion of water efficiency, minimization of agricultural waste and improvement of the efficiency of agriculture equipment. Social acceptability is assured by a fair distribution and access to food for all, by an improved quality of life and the creation of employment opportunities in the whole value chain.

1.6. Energy efficiency

Securing economical, reliable and environmentally friendly energy supplies is one of the top priorities in national policymaking in a number of countries. Improving energy efficiency is a major priority in any comprehensive green economy programme as it achieves energy savings and an associated reduction of emissions; increases profitability through a reduction of energy costs, which in turn increases revenues for oil and gas exporters and reduces the balance-of-payment deficit for oil and gas importers; and provides job opportunities. The additional funds could be used to advance other government priorities, such as

enhanced social welfare to poor, remote and rural areas, including education, health, lighting and cooking.

Energy efficiency does not refer exclusively to the industrial sector. In rural areas, local communities still suffer from unsustainable practices in their daily activities. For instance, the use of ancestral and traditional cooking tools, wood fuel and construction materials are characterized by high energy dispersion and resource depletion.

1.7. Sustainable transport

Cities are growing all over the world. According to United Nations estimates, by 2025, over 50 per cent of the world population will be living in urban agglomerations.[16] Non-sustainable transport in major cities is already causing significant problems for transport management, resulting in high local levels of air pollution, noise and congestion even outside rush hours, as well as in decreasing safety levels, especially for non-motorized road users.

It is estimated that transportation of all types is responsible for around 39 per cent of energy-related greenhouse gas emissions in the Arab region.[17] The transportation sector is one of the major consumers of fossil fuels and one of the main contributors to climate change, registering the fastest-rising carbon emissions. The increasing use of cars, trucks and airplanes for passenger and freight movement is leading to a critical and unsustainable situation.

More sustainable means of transportation have the potential to consume less energy per passenger or freight per kilometer than ordinary vehicles. They also help to reduce traffic congestions and provid a more inclusive and affordable solution for commuting and the transportation of goods.

Examples of green transport are already available in the Arab region and include green cabs in Cairo, the tram in Rabat and the green railway in Tunis. Other countries are investing in green infrastructure, which can also lead to the creation of green jobs in the Arab region.

1.8. Cleaner production

According to the United Nations Industrial Development Organization (UNIDO), "cleaner production is the continuous application of an integrated

preventative environmental strategy to processes, products and services to increase efficiency and reduce risks to humans and the environment". A full range of cleaner production practices and techniques can be adopted at the company level to optimize the use of production inputs and increase the overall quality of outputs. These practices include good housekeeping, input material change, improved process control, equipment modification and technology change.

The scarcity of water and energy resources is one of the main challenges for economic and social development in the Arab region. In addition, in some countries, dependency on foreign energy sources is very high. Energy and water conservation is essential in all sectors and, in particular, in the production sector, making cleaner production an important tool to ensure sustainability.

1.9. Water management

The management of water resources in the Arab region is a pivotal issue which has not been given sufficient attention in government policies and strategies in the past years. As a matter of fact, according to ESCWA, the total demand for water in the Arab region, which is characterized by severe water scarcity and accounts for less than 1 per cent of the world water resources,[18] is expected to increase by some 50 per cent by the year 2025 to 247,753 million cubic metres (m^3), aggravating even more the water problems of the local communities.[19] If water resources are not well planned, developed, distributed and managed, the situation will soon be completely unsustainable.

The challenges arising from natural water scarcity are further aggravated by the increasing demand on water resources by all sectors, especially agriculture. The achievements in water and food security issues are, therefore, tightly interlinked.

Water scarcity presents crucial constraints, in particular, for existing agricultural systems. Considering that existing data and forecasts seem to indicate changing patterns and increasingly extreme water events, without proper water management, climate change risks to endanger current efforts to harness agriculture as a vehicle for economic growth and poverty reduction in the Arab region. Climate change also affects rural development, as it fully depends on the proper management of water resources.

In this context, the management of water resources is particularly critical for communities in Arab countries, where water scarcity is a constant challenge. With

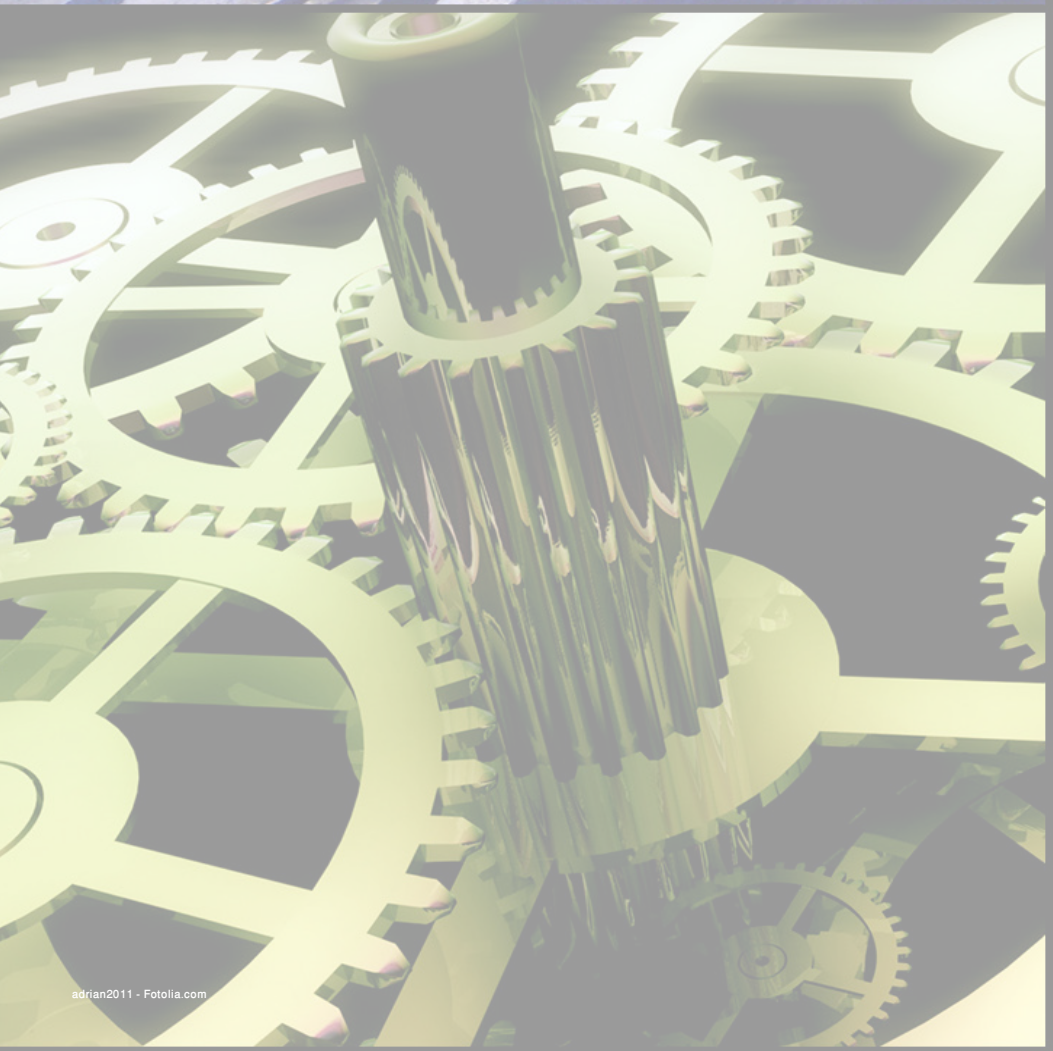
the lifestyle and agricultural practices of the past, it was sufficient to harvest water resources for specific needs and rely on climatic stability. However, nowadays, population growth and economic development are putting increasing pressure on the inland water system, making the need for proper water management ever more critical. To be effective, such management needs to adequately incorporate local knowledge and traditional systems and practices, in addition to taking into account climate change impacts.

1.10. Natural resources management

Natural resources management represents one of the sectors where a green economy approach can play an important role for the sustainable development of the Arab region. The natural resources that are typically referred to in this context are land and soil, water, and flora and fauna. The protection of these ecosystems is strongly interconnected with human activities; the mismanagement of natural resources thus has a direct negative impact on the social, economic and environmental sustainability of present and future generations.

The sustainable management of natural resources relies on coherent land planning, strong engagement in biodiversity conservation and good environmental practices adopted by industries working in agriculture, tourism, mining and fisheries, which have a major impact on the environment. A sustainable and participatory approach involving the public and private sectors and civil society is needed to improve, or at least maintain, the health and productivity of natural landscapes.

It is important to emphasize that keeping the ecosystem healthy benefits not only local development but also the health and welfare of the global community; it is of extreme importance for the well-being of the generations to come.



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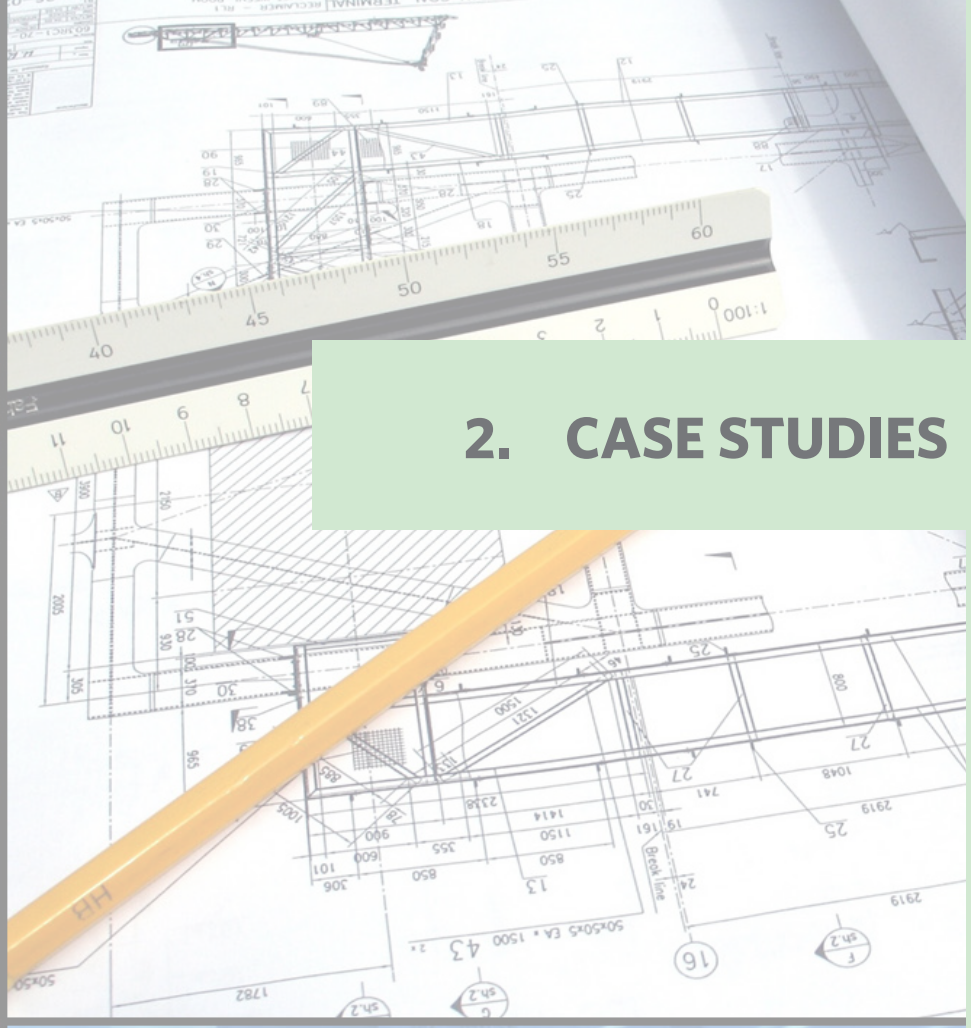

2. CASE STUDIES

Green Economy Initiatives in ESCWA Member States

States	Green Economy Initiatives	Sector
Bahrain	√ Green Building and Sustainability Programme	Green buildings
Egypt	√ Vehicle Scrapping and Recycling Programme	Sustainable transport
Iraq	√ System of Rice Intensification	Sustainable agriculture
Jordan	√ Cleaner Production in Village Dairy plants	Cleaner production
Kuwait	√ NewAir: Managing Office Waste	Waste management
Lebanon	√ Shouf Biosphere Reserve	Ecotourism
Libya	√ Wind Farms project	Renewable energies
Morocco	√ Community-based Watershed Mapping	Water management
Oman	√ Eco-house Initiative	Green buildings
Palestine	√ Solid Waste and Environmental Management Project	Waste management
Qatar	√ Sustainable Biofuel project	Renewable energies
Saudi Arabia	√ Renewable Resource Monitoring and Mapping Programme	Renewable energies
Sudan	√ Fuel Efficiency Cooking	Energy efficiency
Syrian Arab Republic	√ Integrated Wetland Management	Natural resources management
Tunisia	√ Recycling of Lubricating Oils	Waste management
United Arab Emirates	√ Eco-friendly Mosque	Green buildings
Yemen	√ Improving Rural Livelihoods through Photovoltaic Electrification	Renewable energies

BAHRAIN

Green Building and Sustainability Programme
Green buildings

Background

Bahrain, in its economic vision for 2030, adopted sustainability, with its economic, social and environmental pillars, as a core principle of development, alongside competitiveness and justice.[20] In line with this vision, and recognizing the impact of the buildings sector on the environment, the Ministry of Works (MOW) launched, in 2011, the Green Building and Sustainability Programme, in order to minimize the sector's negative environmental impacts, optimize energy use and improve overall quality of urban life.[21] In the initial pilot phase, special attention was given to public buildings, including the MOW building, and to the design of new public schools in cooperation with the Ministry of Education.[22] An integrated implementation strategy was adopted, which included three components:[23]

(a) An awareness-raising campaign targeting government and non-government stakeholders;
(b) The establishment of green building design guidelines and checklist and an update of the MOW general building standards and specifications. In order to ensure the highest level of professionalism, consultants accredited under the Leadership in Energy and Environmental Design or the Qatar Sustainability Assessment System were appointed to the project;
(c) A retrofitting initiative to review existing buildings, and recommend and implement energy saving and other improvements.

Five design and construction parameters were included in green building solutions:[24]

(a) Site planning and orientation: the objective is twofold, namely, to locate buildings in areas that minimize environmental impact, and to orient them in such a way as to minimize summer cooling and winter heating energy requirements, while taking advantage of such natural sources as light and wind;
(b) Enclosure: the objective is to maximize use of daylight to increase visual comfort and integrate natural ventilation systems through atriums and other internal open spaces, resulting in decreased energy use for lighting and air conditioning;
(c) Mechanical works: the dual objective is to ensure optimal thermal comfort and occupant control over individual zones in the building, and provide a safe indoor air quality through effective ventilation systems and the use of non-toxic materials and cleaning products;

(d) Electrical works: the target is to reduce electricity use through various means, including maximizing use of natural light, adopting energy-efficient lighting and other certified equipment, in addition to enabling occupant control over lighting rather than going for inefficient, uniformly lit, interior areas;
(e) Plumbing: the target is to reduce the water footprint, for instance through the installation of certified water-efficient fittings, including low-capacity flushing cisterns and delay/sensor water taps.

Economic impact

The use of high-efficiency equipment and materials forms an important component of green buildings. This efficiency typically translates into economic savings, notably less maintenance and operating costs (through, for instance, pre-insulated air ducts and high-efficiency air filters) and reductions in the energy bill (through, for instance, variable voltage and variable frequency lifts, programmable thermostats and programmable lighting systems with occupancy and light level sensors) and water bill (through, for instance, reverse osmosis, delay and sensor taps).[25]

Social impact

By applying green building specifications in public schools currently under construction, only non-toxic and environmentally friendly materials will be used in mechanical works, namely ventilation channels and air-conditioning conduits. This will contribute to ensuring a safe and healthy environment for students.

Moreover, the application of green building concepts in various public buildings, including the use of Building Management Systems (BMS), will enhance comfort in the work environment and provide occupants with full control over temperature and lighting.[26]

Environmental impact

The building sector is a major consumer of electricity in Bahrain. With electricity being generated mostly in conventional thermal power stations, reduction in energy consumption through the application of green building concepts is expected to reduce carbon dioxide emissions considerably. Furthermore, savings in water use will translate into reductions in the quantity of wastewater generated, which would have to be treated and discharged into water bodies otherwise.[27]

EGYPT

Vehicle Scrapping and Recycling Programme
Sustainable transport

Background

The Egypt Vehicle Scrapping and Recycling Programme provides a mechanism through which owners of taxis, microbuses, trailer trucks and buses may voluntarily surrender their vehicles for managed scrapping and recycling. They receive a financial compensation, which they may use for the purchase of new vehicles from participating vehicle dealers. The first stage, launched in 2009 for taxis only, aimed to reduce the greenhouse gas emissions and air pollution associated with ageing taxi vehicles in Greater Cairo. Taxi vehicles operational for more than 20 years qualified under the programme for voluntary replacement with newer models that meet Egyptian environment law specifications, are more energy-efficient, less polluting and safer. Currently, the scope of the programme includes Cairo, Giza, Qalubiyah, Hulwan and 6th October.

Interested taxi drivers head to a "scrapping and intermediate storage site" for vehicle eligibility inspection and temporary on-site storage, where each vehicle battery is drained. Drivers are given the subsidies as well as tax and customs waivers they are entitled to and have the option to purchase a new car from car dealer representatives available on site. Storage for newly acquired cars is also available on site, until drivers are granted appropriate legal licensing, which usually requires little time.

The project was the first Clean Development Mechanism project to be registered in the transport sector in the United Nations Framework Convention on Climate Change (UNFCCC) in May 2011. By November 2013, more than 41,000 vehicles were replaced under the project.[28]

Economic impact

The programme's first economic impact is the extension of support for local vehicle and automotive component assembly industries and the consequent introduction of technology transfer and best practices for vehicle recycling, which has positive multiplier effects on the local economies. Moreover, the programme creates an increase in business and profits for dealers and commercial banks involved.

Social impact

The project resulted in a general increase of income and improved livelihood of participating taxi drivers through increased taxi fares, justified by newer and

more comfortable cars and longer working hours. In addition, the project is creating a number of new job opportunities for technicians, car dealers and workers involved in the recycling activities. Moreover, a reduction in the number of traffic accidents involving older vehicles could be noted.

Environmental impact

With respect to the reduction of CO_2 emissions, it is estimated that between 350,000 and 470,000 certified emission reduction units will be registered over the period 2013-2018; methane (CH_4) and nitrous oxide (N_2O) emission reductions are also expected.

Average fuel efficiency achieved through the programme is 9.39 liters/100 kilometers (km) for regular fuel cars and 8.34 m^3/100 km for cars that use compressed natural gas.[29]

IRAQ

System of Rice Intensification
Sustainable agriculture

Background

The System of Rice Intensification (SRI), is a climate-smart, agroecological methodology for increasing the productivity of rice by changing the management of plants, soil, water and nutrients. Based on the interrelations of such basic features as limited use of water, enrichment of the soil with organic nutrients and reduced plant density, the SRI system is consistent with conservation and sustainable agriculture. At the same time, it contributes to the conservation agriculture of such natural resources as land and water, and reduces the chemical pollution of the environment.

Data on the Al-Mishkab Rice Research Station, which introduced SRI in Iraq in 2005 on a 0.25 hectare surface using the "parachute method", showed that SRI harvests were 18 per cent higher than the ones yielded with the usual dry method and resulted in 81 per cent seed saving, in addition to substantial water saving. Alternative water intervals were applied in SRI fields with the objective of reducing water and the use of water pumps, together with an increase in the presence and activity of beneficial microorganisms in the soil.

In 2008, field experiments were conducted at four sites in the Al-Muthanna Province in southern Iraq to study the impact of SRI practices on the grain yield and yield components of Jasmine rice. SRI methods had a favourable and significant impact on plant height and panicle length; they also showed significant differences in the yield components of grain number in panicles and per cent sterility.

Economic impact

After the initial introduction in 2005, trials in 2006 showed yield increases of 20-26 per cent in addition to reduced water requirements. SRI practices can, despite greatly reduced plant populations, improve both plant performance and yields under local climate conditions in Iraq (7,040 kilogram (kg)/hectare (ha) compared with 4,668 kg/ha for non-SRI methods) while reducing water use, saving seed up to 80 per cent and lowering production costs.[30]

In 2008, an assessment study compared the economic costs and returns for farmers using both conventional and SRI methods on their farms and those using only traditional methods. A follow-up questionnaire was prepared, and farmers

evaluated SRI positively, flagging a 25-305 per cent reduction in irrigation water required, 50 per cent reduction in fertilizer and 75-80 per cent reduction in seed requirements, in addition to a 100 per cent reduction in agrochemical crop protection. Moreover, with the use of SRI methods, average yields could be increased by 75 per cent.[31]

Social impact

At the individual household level, with the adoption of SRI methods, farmers are less dependent on the inputs market and can increase their agricultural production utilizing locally available resources. Expansion is less dependent on fluctuating prices of imported crops. Harvest increases of 20-50 per cent positively affect the households' food security. When food security is assured, farmers can diversify their economic activities, either on-farm or off-farm.

These new SRI methods can be considered a support programme to poverty reduction strategies. SRI has been very popular among poor producers, which has incited the Government and other stakeholders to include it in their development programmes.

Environmental impact

Positive environmental benefits, particularly water saving, have been noticed. Water management is a very important issue in Iraq, and SRI methods succeeded in reducing water requirements by approximately 38 per cent. According to a field study conducted in 2009, SRI methods resulted in a more vigorous growth of roots, a 42 per cent increase in grain yield, namely 0.291 kg/square metre (m^2) compared with 0.108 kg/m^2 for conventional rice crop, and increased water use efficiency.[32]

The same study revealed that the SRI treatment using organic material combined with traditional fertilizers gave the highest average grain yield (7,360 ton/ha), which is 22 per cent more than the lowest yield (6,036 ton/ha), which was achieved with current transplanting methods. Local farmers have started cultivating clover on rice fields to restore the fertility of their rice-growing lands and to increase the availability of organic matter.[33]

JORDAN

Cleaner Production in Village Dairy Plants
Cleaner production

Background

The Cleaner Production Unit of the Royal Scientific Society has introduced a fast in-plant assessment methodology to 10 small and medium-sized villages' dairy plants distributed within different governorates in Jordan.[34]

The aim of the study was "to improve the production processes, to reduce the consumption of raw materials, energy and water, and also to utilize the whey as a valuable raw material instead of draining it off as waste".[35]

An assessment of the production lines and facilities on the potential to implement a cleaner production was followed by a set of recommendations tailored for each company that was part of the programme. Subsequently, dairy plant owners and managers were enrolled in a training on good operation practices, clean production techniques and hygiene. Key of the success was the fact that the training was tailor-made for village dairy plants, focusing on yogurt and cheese production.

Among the cleaner production options identified for each of the 10 dairy plants, the utilization of the whey residue as drink, animal feed or for irrigation and the production of other side products is worth underlining. Moreover, it was proposed to improve the insulation of the boiler and hot pipes in order to save energy, and to apply a simple clean-in-place system which reuses the water of the last rinsing cycle of the equipment cleansing process and the cleaning acids and soda to reduce cost and wastewater load. Furthermore, the study suggested the installation of a pressure gun to the hose used for manual cleaning to reduce water consumption, and of automatic temperature controllers for the plate heat exchangers of pasteurizers in order to improve process control. Finally, it was proposed to improve milk testing techniques using acidity tests instead of measuring pH and using blue methylene tests for bacterial count. This reduces the risk of low quality milk intake, thus improving the quality of the product.

Economic impact

The reduction of such production inputs as water and energy has a direct impact on the overall manufacturing costs, thus producing a net income increase for small enterprises. Moreover, the quality improvement reduces the amount of scrap material and has positive consequences on the marketability of the

products with an increase of their market shares, in addition to the potential of producing new whey-based products.

Social impact

The project aims to empower small and medium-sized villages' plants by improving their eco-efficiency, image and position in the market. Helping the rural communities to improve their businesses contributes to poverty eradication and encourages villagers to stay in their home villages instead of migrating to the cities in search for work.

Environmental impact

The benefits of the cleaner production options mentioned above include the reduction of water and energy consumption and of the overall environmental impacts, notably due to reduced whey disposal in water bodies.[36]

KUWAIT

NewAir: Managing Office Waste
Waste management

Background

In Kuwait, up to 0.5 tons of waste per capita are generated annually, totalling some 2 million tons of solid waste per year. This surprisingly high waste generation rate is a result of high living standards and a lack of awareness of sustainable waste management. As a result, the costs of waste management in Kuwait are expected to reach 29 million Kuwaiti dinars, or some 102 million United States dollars ($), by 2015, and 33 million dinars, or some $117 million, in 2020.[37] Waste is dumped haphazardly, using what is called the "end tipping" method, which is not recommended by international standards. Household, industrial, chemical and all types of liquid waste are mixed together without any prior planning or separation, forming steeply sloping high heaps that are exposed to the elements.[38]

A very solid initiative implemented by a pioneer company to address the sustainability of waste management in Kuwait is NewAir, a newly initiated corporate social responsibility programme that targets commercial, industrial and governmental entities, and attempts to encourage the adoption of the three pillars of waste management, which are to reduce, reuse and recycle.[39]

Companies participating in the NewAir programme are assisted in the adoption of environmentally friendly practices when disposing office waste. The numerous

Waste management

The quantity of waste generated is largely affected by two major factors, population and consumption patterns, the latter being influenced by the per capita gross domestic product (GDP). Statistics show that the world population is expected to increase by 20 per cent by the year 2025 reaching 8 billion, possibly reaching 9.5 billion by 2050. Furthermore, by 2050, production around the world is estimated to have quadrupled compared to 2005, and, as a result, the global average GDP per capita is likely to show a 1.5 times growth by 2025, and even quadrupling by 2050 if looked at from a strictly business perspective. This growth in population and the GDP per capita will undoubtedly lead to an increase in waste quantities generated. Studies show that a 1 per cent increase in national income is capable of inducing a 0.69 per cent increase in municipal solid waste generation.

Source: Mavropoulos, Antonis (n. d.). Waste Management 2030+. Waste Management World, vol. 11, issue 2. Available from http://www.waste-management world.com/articles/print/volume-11/issue-2/features/wastemanagement-2030.html (accessed 14 November 2013); and UNEP (n. d.). Solid Waste Management. Available from http://www.unep.org/resourceefficiency/Policy/ ResourceEfficientCities/FocusAreas/SolidWasteManagement/tabid/101668/Default.aspx (accessed 14 November 2013).

companies that have already joined the initiative realized that it will contribute to the reduction of the landfill areas used for the disposal of such office items as e-waste, cardboard, toners and plastic packaging. The success of the initiative depends on the quantity and quality of the participants, which include government entities, mosques, schools, universities and households. The programme team works directly with the participating entities to design appropriate waste management plans tailored to the different needs and strictly linked to the individual business models. Moreover, NewAir has created comprehensive guidelines for launching and implementing green programmes from the design to the implementation and reporting phases.

Participating entities are provided with a waste audit worksheet and green office checklist, which represent useful tools to conduct waste audits and help estimate the waste generated by the different businesses, with the final outcomes of enhancing environmental practices and reducing operating costs.

Economic impact

By participating in the NewAir initiative, partners are encouraged to reduce and manage their waste, with the consequence of reducing their carbon footprint with the likely additional benefit of lowering operational costs.

Social impact

A first social impact of NewAir is the creation of a healthier environment in every participating company or institution. Companies that join the NewAir initiative in Kuwait will have, in addition to a positive effect on the environment, enhanced employee morale and corporate profile.

The programme contributes to the reduction of the generation of debris and harmful substances associated with solid, electronic and industrial waste that pose a threat to humans and the environment.

Environmental impact

If improperly managed and inadequately collected and disposed, waste leads to the pollution of air, water and soil. Landfills may become a source of contamination of drinking water and a home for infectious and transmissible diseases.[40] The recycling and reuse programmes of NewAir are solid measures to reduce the environmental impacts of waste.

Lebanon

Shouf Biosphere Reserve

Ecotourism

Background

The Shouf Biosphere Reserve was established around the Al-Shouf Cedar Nature Reserve and includes the protected area of the Aammiq Wetlands between the eastern and western sides of the Barouk and Niha mountains in Lebanon.

The reserve promotes a bottom-up management model, in line with pro-poor green business models, involving local communities in the planning, decision-making and implementation processes. The financial contribution of the Government of Lebanon covers only approximately 32 per cent of total expenditures [41] and the reserve has to partially secure its own funding through donations, cooperative partnerships and tourism. These donations have been rising since 2005, when the reserve was declared a Biosphere Reserve by the United Nations Educational, Scientific and Cultural Organization (UNESCO),[42] based on its potential for biodiversity conservation and size (it accounts for 25 per cent of the remaining cedar forests in Lebanon).[43]

The reserve has the following three main objectives: (a) conservation, namely of landscapes, ecosystems, species and genetic variation; (b) sustainable development that takes into account both economic and cultural needs; and (c) education and training, in addition to environmental research and monitoring.

Economic impact

The reserve has a strong local economic impact, because it is designed to engage the local communities in green economy by focusing on such sustainable sources of income as ecotourism. The reserve thus helps to promote the local economy in a region that encompasses twenty-four villages,[44] from the eastern and western sides of the Barouk and Niha mountains. It has already become a popular destination for ecotourism offering such activities as hiking, snowshoeing and bird watching. It is conceived to involve local microenterprises in rural communities through a tourism value chain that helps provide decent, safe, affordable and environment friendly jobs.[45]

Social impact

In general, rural communities in Lebanon are heavily dependent upon remittances from former inhabitants who live and work in the cities or abroad because of the general lack of local opportunities for employment.

Thanks to proper planning, the reserve guarantees benefits to local people through the following:

(a) The promotion of sustainable livelihoods in rural local communities, particularly related to such specific issues as providing seasonal transhumance paths and sustainable grazing, as well as an ecologically sustainable production of such products as wood and charcoal;

(b) An ecotourism approach that both socially and economically engages the local community. In this manner, the success of the reserve will serve as an example to the rest of the rural areas of the region as to how best to enhance social development while stimulating green economic growth.

Environmental impact

Many rural areas of Lebanon are vulnerable to the overexploitation of local resources, and thus fall into patterns of unsustainable resource extraction and consumption. By promoting pro-poor green business practices in its rural areas, the reserve would support the use of environmentally sound technologies and techniques in the villages of the region.

The environmental benefits of the reserve include the promotion of the local biosphere and the naturally occurring mix of floral and faunal species, a decreased pollution and land erosion, and an enhanced protection of natural resources.

Libya

Wind Farms Project

Renewable energies

Background

The Renewable Energy Authority of Libya (REAOL) is a governmental agency that was established in 2007 and whose main objective is to develop and implement various projects in the field of renewable energy.[46] Under its renewable energy development plan, REAOL assessed that, by 2015, Libyan wind farms would have the capacity to generate power of up to 750 megawatts (MW); this number is even expected to double by 2020.[47] In line with this, multiple wind farm projects were proposed for different regions of Libya, with capacities ranging between 60 and 250 MW.

The Al Fateh wind farm near the north-eastern coastal city of Dernah will be the location of the first project of this kind. Proposed in 2011, this wind farm has an overall budget of 84 million euros (€) and was estimated to reach the capacity to produce up to 60 MW of power.[48]

The choice of the location for this pilot project was based on its proximity to an active port, in addition to its good connection with the electric grid and, most importantly, its relatively windy conditions with an average wind speed of approximately 7 metres per second (m/s) making it a suitable location for such a project. Each wind turbine is a 1.65 MW direct-drive turbine, and up to

Wind energies

In 2012, the global wind energy capacity reached 282,275 MW with up to 16 per cent added in the same year. Wind turbines installed in 2012 alone are capable of providing 580 terawatt-hours per year, which constitutes more than 3 per cent of the worldwide electricity needs.

Furthermore, the wind energy sector generated €60 billion in the same year. Iceland was the most recent country to introduce the generation of wind energy, making the total number of countries and regions using wind energy 100.

Worldwide, wind energy has experienced a growth rate of 19.2 per cent, with the United States of America and China in front. However, Asia has by far the largest share of wind farm installations (36.3 per cent), followed by North America (31.3 per cent) and Europe (27.5 per cent). The smaller investors in wind energy are Latin America (3.9 per cent), Australia (0.8 per cent), the smallest being Africa with only 0.2 per cent, with Tunisia and Ethiopia in front.

Source: World Wind Energy Association (2012). World Wind Energy Report 2012. Available from http://www.wwindea.org /webimages/WorldWindEnergyReport2012_final.pdf (accessed 15 November 2013).

37 turbines will be included in this project under phase 1, allowing this wind farm to produce 60 MW. Work on this project was resumed, and it is expected to be completed by the end of 2014. Following the successful completion of the first phase, a second phase is intended to upgrade the wind farm's capacity by an additional 60 MW.[49]

This project is part of the Libyan plan to produce 10 per cent of its energy needs from renewable resources by the year 2020. Wind is expected to contribute 1.5 gigawatts (GW) of the country's energy needs, although, according to REAOL estimates, Libya is capable of producing 5 GW or more. It is important to point out that Libya has a notable interest in renewable energies, even though it is one of the largest oil producers on the African continent.

Economic impact

Of all the forms of alternative energy sources, wind power is considered to be the least expensive. Studies have shown that wind-generated electricity costs approximately 5 cents/kilowatt-hour (KWh);[50] and these costs are expected to drop with the advancement of technology, as almost all the costs of wind energy are in manufacturing the turbine itself.[51] Furthermore, in addition to its ability to enhance the local economy, wind energy is expected to have a positive effect on taxes collected locally, especially municipal taxes.

Social impact

Wind turbines are a source of sustainable income, especially for the owners of the land on which the structures are set up. In addition, wind turbines will create job opportunities, mainly in procurement and maintenance services.

Environmental impact

Wind energy is clean energy, no greenhouse gases are produced as the turbine produces electricity. Studies show that one functional 1 MW wind turbine is capable of reducing CO_2 emissions by up to 2,000 tons per year.[52] This project is expected to reduce CO_2 emissions by up to 188,000 tons per year.[53] Moreover, wind as an energy source is renewable and, in this particular location, relatively reliable.

Morocco

Community-based Watershed Mapping
Water management

Background

The Agricultural Water Management (AWM) project in Morocco is a collaboration between the Near East Foundation, the United States Agency for International Development (USAID) and local partners. The AWM project addresses the need for local communities to adapt to climate change, particularly in the context of the unprecedented climatic conditions that North Africa is expected to experience. This concern was already raised by the Intergovernmental Panel on Climate Change (IPCC) in its Fourth Assessment Report, where it noted that, under its various climate-change scenarios (designated A1, B1, A2 and B2), there was "a likely increase in the number of people who could experience water stress by 2055" in North Africa.[54]

The critical nature of this development was confirmed with the creation of the Green Morocco Plan, or Plan Maroc Vert, Morocco's national agricultural strategy. The agricultural sector in Morocco contributes 19 per cent of the gross national product (GNP).[55] It is already facing considerable challenges, such as poor and irregular rainfall, consequent drought and the inefficiency of existing irrigation systems, which would be exacerbated by a further limitation in water resources. In the case of Morocco, water scarcity is also exacerbated by soil degradation in connection with sand dune encroachment, particularly in areas bordering with the desert.

In order to meet these challenges, it is important that local adaptation measures take into account specific local needs and knowledge. With this in mind, the AWM project was intended as a new planning tool, based on watershed mapping that helps agricultural communities better understand and manage their water resources. Key to the success of the AWM project is the understanding that local people acquire knowledge and skills to a considerable extent, independently from the formal educational system. This includes knowledge that forms the traditional basis for decision-making on issues related to water and food security, as well as natural resource management.[56] By doing so, the AWM project acknowledges the need for the adoption of sustainable development practices.

AWM project partners have organized watershed-mapping workshops in 22 villages since 2011, and helped develop maps that not only raise awareness on water resources, but also help identify locations facing water challenges.[57] Various local stakeholders have learned to use a combination of participatory mapping techniques and high-resolution satellite images to visually assess

their sources of water, agricultural holdings, major causes of water loss and opportunities for increasing water availability. This, on the one hand, helped simplify existing problems by enabling farmers to find solutions; and, on the other hand, helped anticipate any potential local challenges and, therefore, enhance the management capabilities of local stakeholders.

Economic impact

The AWM project has helped diminish costs of water management by allowing partner communities to develop a clear understanding of watershed issues, and thus identify the appropriate actions to be taken. It was possible to tackle such issues as causes of water loss and opportunities to increase water availability at a larger scale. Irrigation canals with high rates of sedimentation, erosion and seepage were identified as major causes for the loss of water, and practical action can be taken to tackle the challenges caused by poorly maintained springs, areas of high erosion upstream and sand dune formation, resulting in significant savings on investments.

Social impact

The mapping method has empowered partner communities by giving them access to enhanced sources of information. Watershed mapping and assessment, thus, provided a basis for empowering local communities when it comes to dealing with a range of government agencies involved in agricultural development and natural resource management. Cooperation between the local and national levels was intensified, with representatives of such official agencies as the Regional Agricultural Development Authority, the Water and Forests Department and the Watershed Management Authority being closely involved in local projects. This participatory approach contributed to improved coordination of efforts to raise agricultural production in the region under the Plan Maroc Vert.

Environmental impact

Apart from economic and social benefits, the AWM project has had considerable impacts on the environment. Stakeholders were able to clearly identify the necessary structural and vegetative measures that had to be undertaken to protect and stabilize upland soils through afforestation, revegetation of barren lands and degraded pastures, and through the creation of hedges and similar vegetative and other barriers. This has significantly limited dune encroachment, a particularly acute problem in Morocco.

Oman

Eco-house Initiative
Green buildings

Background

In June 2011, the Research Council of Oman launched a national contest called the Oman Eco-house Design Competition, within the framework of its Adaptation towards Sustainable Development Programme.[58] The competition targeted higher-education students in the Sultanate, aiming to promote awareness among them on the use of sustainable energy and the adoption of green standards in the design and construction of buildings. The council invited research and academic institutions to team up with construction companies to take part in the competition. The idea was to design and construct sustainable and energy-efficient houses based on the Omani architectural heritage.

The main objectives of the competition were the following:

(a) Promote a culture of research and innovation, with respect to the cost-effective use of eco-friendly materials in the design and building of houses;
(b) Support innovation in academic institutions and offer students the opportunity to turn creative ideas into tangible structures;
(c) Build national capacity in the field of sustainable development by encouraging the Government to develop national policies for sustainable development, and by encouraging individuals and private enterprises, mainly small and medium enterprises, to use eco-efficient alternatives.

The winning project is being built in the university campus in Halban; it has an indoor area of approximately 300m^2 and stands on a plot of 600m^2, which are the usual dimensions of a typical Omani villa.[59] This eco-house will be composed of five bedrooms with bathrooms, a maid's room, a kitchen and dining area, a family hall and a second living room. It will have a round wall built of traditional mud bricks to protect the house from the acoustic pollution caused by a nearby highway and to provide additional protection from the strong sunlight of Oman.

This eco-house is built in harmony with the natural local environment and has a front garden on the northern side, containing native Omani plants which also contribute to the shade and ventilation of the outdoor space. Water resources for irrigation are provided by reed beds that are planted around the house and are also used to clean the wastewater. Solar panels are the main energy source;

they are placed on the roof to generate the energy needed to maintain a pleasant temperature in the house.

The eco-house, as conceived, can operate at net zero energy, in line with the advanced green building energy-efficiency strategies.[60] Energy needs are reduced through the design and material, and the house generates its own electricity.

Other features of the eco-house are its compact volume and optimal orientation that guarantee natural ventilation; a thermal zoning and radiant cooling to keep the ideal indoor temperature; an extensive use of recyclable materials; energy-efficient appliances; and native plants to guarantee the biodiversity balance.

Economic impact

The strategies adopted to build the eco-house can be wholly or partly translated into future designs for residential and other purposes, allowing new actors to save energy and use recycled materials.

Social impact

It is envisaged that the Eco-house Design Competition will create jobs for partnering enterprises, construction companies and consultancy firms. It will benefit architecture students by showing them that it is possible to construct a green building with little or no extra cost.

Environmental impact

As any other sustainable building initiative, the eco-house in Oman will reduce solid waste because of the use of recycled material. It will wisely use water for irrigation and plants while treating wastewater; and contribute heavily to a reduction in CO_2 emissions through the extensive use of renewable energies and a limited use of air conditioning thanks to its orientation and insulation.

Palestine

Solid Waste and Environmental Management Project
Waste management

Background

In 1998, a comprehensive approach to improve the waste management services in the West Bank was initiated under the Solid Waste and Environmental Management Project (SWEMP) of the World Bank. The project had six main goals: (a) the construction of a regional sanitary landfill for the Jenin Governorate, in the Wadi Ali Wadi D'aouk area, which is intended to eventually become a regional landfill for the northern governorates of the West Bank; (b) the closure of the random dumpsites in the governorate; (c) the development of a comprehensive system for collecting and transferring solid waste, involving the purchasing of collection vehicles, containers and other related equipment; (d) the provision of financial support for the waste collection service and for the operation of the landfill; (e) the provision of technical assistance; and (f) the development of the institutional capacities and abilities of the member municipalities. The overall budget of the project was around $14 million, with contributions from the World Bank, local governments and the European Union.[61]

The landfill, which came into operation in 2007 with a capacity of 2.25 million tons of waste, is now receiving some 400 tons of waste per day from various villages, and the amount of waste received is predicted to increase to 600 tons per day with more villages joining the service.[62]

This landfill, being the first one to be constructed in the West Bank, marks a milestone for Palestine in moving towards a cleaner environment with a suitable management of solid waste. In fact, as a result of this project, several dumpsites have been closed and are being rehabilitated to promote waste recycling. Within the landfill, a unit separates waste in order to extract metals, papers, plastics and glass; another larger recycling unit receives the waste from more remote governorates, separates it and then transfers the waste to the landfill.

Improved waste services are now available to an estimated 600,000 inhabitants of the northern part of the West Bank. Thirty-nine uncontrolled dumpsites, some with multiple disposal locations, were rehabilitated and returned to natural, social or productive use.[63]

Economic impact

The project has, first of all, an important cascade effect on the employment levels of the area. As a matter of fact, some 7,000 work days, were needed to implement

the project, expanding local income opportunities.[64] More interesting economic opportunities might arise with the private sector-led recycling initiative planned to follow the project. Moreover, rehabilitated dumpsites used for new residential development or combined residential/smallholding use have seen their land values double or even triple.

Social impact

The social impact of the project can be measured, at first, in terms of job security. Of the about 50 waste pickers affected by the project, 10 were offered jobs in the formal solid waste management sector.[65] The remaining pickers were waste collection workers whose income has improved with their transfer to the Jenin Joint Service Council.

The local communities also benefited from the closure of unsanitary dumpsites next to their dwellings and from the consequent health improvement and property value benefits. Some 1,200 dumpsites were made usable for community recreational purposes.[66] In addition, in the process of closing the dumpsites, access to relatively poor villages was improved, which has made it easier for people and goods to move in and out. Access to trading opportunities, education and health and social services was thus facilitated, in particular for women and poor people.

Environmental impact

The project included important mitigation measures as part of the Environmental Management Plan that guaranteed the landfill to be constructed and operational in accordance with international standards. Among these are the installation of a polyethylene liner to protect groundwater, the covering of deposited waste to reduce foul odors and the on-site storage of the cover material from the landfill excavation process. These measures have radically changed the environmental impact of solid waste, ending or reducing open burning, rehabilitating land, reducing the risk of groundwater pollution, and improving the air quality and the lanscape of the region.

Qatar

Sustainable Biofuel Project
Renewable energies

Background

Qatar University is an academic institution that has been operating since 1973, serving over 12,000 students and offering more than 60 specializations, in collaboration with Qatar Airways and Qatar Science and Technology Park (QSTP). It has, since 2010, engaged in a groundbreaking research project for the development of sustainable biofuels, an alternative energy resource that might open up interesting scenarios for the Arab region.[67]

This state-backed project is worth 45.5 million Qatari riyals, equivalent to $12.3 million, and its goal is the development and production of biofuels which do not use arable land and, thus, do not compete with food production, and are affordable and efficiently produced even under challenging climate conditions.[68] The partnership with Qatar Airways finds its justification in the research of alternative source of energies for the airline industries, for which fuels represent an important fixed cost. The use of such an alternative source of energy will have positive cascade effects, helping to achieve sustainable development.

The first phase of the project isolated native microalgae from the Qatari natural habitat, namely the desert and marine environments. These organisms were found in almost any high-salinity marine environment in Qatar,[69] from the marinas at the Pearl-Qatar to the wastewaters of Abu Nakhla, and appear to tolerate such extreme environmental conditions as the severe heat and strong sunlight of the desert.[70]

At the same time, the microalgae were subjected to such extensive biochemical and genetic characterization as genomic sequencing of selected strains. As a consequence, the team managed to successfully grow the cultures in the laboratories, extracting the lipids to make fuel while using the carbohydrates to make bioethanol.

During the second phase of the project, to scale up the tests and study growth characteristics, effects on biochemical composition, harvesting and conversion into biofuels, selected strains were grown in ponds located at the Qatar University Research Farm.

Economic impact

The technology, if successfully implemented and produced at a large scale, would represent an important and affordable alternative to conventional energies

sources. It would considerably decrease the costs of mobility and would open up business opportunities for small-scale companies interested in engaging in the sector.

Social impact

The project managed to create high-level green jobs, as more than one-third of the team members were graduates of Qatar University. More jobs are expected to be created with the expansion of the project and extensive use of the technology.[71]

Environmental impact

If successfully produced at a commercial scale, biofuels will have a sustainable and environment-friendly impact as they reduce the use of fossil fuels. In such a country as Qatar, the use of biofuels will also confirm the possibility of using natural resources in a sustainable manner, without competing with food crops for alimentation purposes.

Saudi Arabia

Renewable Resource Monitoring and Mapping Programme

Renewable energies

Background

The King Abdullah City for Atomic and Renewable Energy (K.A.CARE) was established in 2010 with the mandate of working towards sustainable development in Saudi Arabia by gradually increasing the use of renewable energy resources.[72] The objective of K.A.CARE is the generation of 54 GW of energy from renewable resources by 2032,[73] mostly by utilizing solar power (almost 80 per cent), but also through a mix of wind, geothermal and waste-to-energy resources. The goal of 54 GW is expected to be reached gradually: 5.1 GW should be generated by 2018 and 23.9 GW by 2020.[74]

Part of the efforts to replace conventional energies is the Renewable Resource Monitoring and Mapping (RRMM) Programme, an important national project to collect, measure, map and disseminate data on renewable resources, mainly solar and wind, to support a sustainable energy mix for the country. The project is unfolding through a partnership with the National Renewable Energy Laboratory of the Battelle Memorial Institute, based in the United States, and aims at evaluating the potential for solar, wind, geothermal and waste-derived energy. The data collected is sent to the online Renewable Resource Atlas, which is used to implement renewable energy projects, mainly for electricity production and water desalination, and for research and the development of new technologies to be adopted in Saudi Arabia.

During the first phase of the project, data on solar resources are being collected on annual, monthly and daily bases, and average levels are made available to the public through the online Atlas. Main sources include historical ground-based monitoring data, satellite-derived estimates and two new monitoring stations installed by the RRMM Programme for global horizontal irradiance (GHI) and direct normal irradiance (DNI).

The monitoring stations are situated strategically in areas with a high level of solar resources and strong resource gradients; near electric grids and load centres or hosted by such institutional partners as universities, technical institutes and the Saline Water Conversion Corporation. Their number was planned to exceed 75 at the end of 2013 with the purpose of monitoring GHI, DNI, diffuse horizontal irradiance (DHI) and meteorological data.[75]

Economic impact

The data that collected by K.A.CARE and disseminated through the RRMM Programme will have an important effect on the economic sustainability of similar projects in Saudi Arabia, as it will allow project financers to gather more information to assess the profitability of an initiative, which would reduce investment risks and increase efficient engagement in the projects. Public and private project developers will thus have an increasing amount of information at their disposal, allowing them to make their business more cost-efficient and to increase their income, in short, to maximize the profitability of their solar energy projects.

Social impact

The impact of the RRMM Programme on the social development of Saudi Arabia seems to be quite promising. Green jobs have already been created in the monitoring stations, with hired personnel being trained in good practices for solar resource monitoring according to international standards. Additional jobs will be created in the general framework of the K.A.CARE operations and projects. K.A.CARE has also introduced educational programmes and fellowships which contain "green curricula" and contribute to the formation of a solid generation of well-trained "green professionals".

Environmental impact

The planned gradual replacement of fossil fuels, namely oil and coal, with renewable energy sources will have a considerable positive impact on the environmental situation of the country. Saudi Arabia, in fact, is envisaging that, by 2032, 50 per cent of the energy produced in the country will come from renewable sources.[76]

The Sudan

Fuel Efficiency Cooking
Energy efficiency

Background

Wood and charcoal are the main cooking fuels in Darfur. While in the rural areas, fuelwood is almost the only fuel collected and utilized, mainly by women and girls, households in the urban areas tend to prefer charcoal.

The Darfur Alternative Energy Project (DAEP) was executed with funds provided by the United Kingdom Department for International Development (DFID) and implemented by the non-governmental and non-profit organization ProAct Network from December 2009 to March 2011, in cooperation with the Sudan Integrated Environment Project (SIEP) of the United Nations Environment Programme (UNEP). DAEP aimed at improving the sustainable and equitable management and use of natural resources and environmental assets in conflict and post-conflict contexts in the Sudan. The main objective of the project was to propose alternative energy options for the rural communities of Darfur with the aim of reducing the consumption of fuelwood and charcoal, as it is harmful for the health and has economic and environmental consequences, including the depletion of natural resources.

A good option to reduce the use of charcoal and fuelwood would be liquified petroleum gas (LPG), a modern and clean cooking fuel widely available in the local markets. However, despite a government policy to encourage its use through subsidies, regulations and custom exemptions, households still have difficulties to use LPG due to the high upfront cost of LPG appliances and refilling costs of cylinders. As a pilot activity, Practical Action, in partnership with the Women's Development Association (WDA) Network, has implemented a project which enabled approximately 3,000 households to access LPG appliances through microfinance, using WDA as a guarantor. Key WDA staff have been trained on the management and principles of microfinance and 561 LPG appliance sets were purchased in the village of El-Fasher.

As an alternative and cheaper option, and to further reduce fuel wood consumption, DAEP promoted the introduction of such fuel-efficient stoves as the mud stove, the solar cookers and such improved charcoal stoves as the Kenyan Ceramic Jiko10. The latter stove is made of two different materials, a metal cladding and a ceramic liner, and its efficiency is about 26 per cent. This is a considerable improvement over the traditionally used three-stone fire (thermal efficiency of some 10 per cent) and charcoal metal stoves (thermal efficiency of 15 per cent), which do not completely burn the fuel and whose emissions of smoke and particulate matter cause severe indoor air pollution.[77]

Economic impact

More efficient cooking tools can have a dramatic positive impact on poor households whose expenditure on cooking fuel may reach over 30 per cent of their income. According to semi-structured interviews conducted by DAEP through a field survey in 2011, the monthly expenditure on fuelwood and charcoal as a combined source of cooking energy at the household level reaches 126 Sudanese Pounds (SDG), approximately $28, while LPG is the least expensive cooking fuel and its consumption, especially in urban areas, does not exceed SDG45, approximately $10, per month.[78]

Even though refilling LPG cylinders costs approximately SDG35, or US$8, it is still much cheaper to cook with LPG than with fuelwood or charcoal.[79]

Social impact

Traditional cooking methods are a serious threat to the health as, according to the World Health Organization, indoor smoke is extremely harmful, particularly for women and children, causing serious health problems and contributing to the death of 1.6 million people globally every year.[80]

Moreover, the use of the new efficient stove reduces the expenses of poor urban households previously incurred by purchasing fuelwood and/or charcoal. A considerable proportion of households used to exchange a good share of their food rations for cooking fuel. Efficient allows stoves also rural households to reduce the time spent collecting wood, enabling them to focus on alternative economic activities.

Furthermore, the use of LPG stoves reduces negative social impacts and gender-based violence associated with the collection of fuelwood. Women and girls were subjected to drudgery, security risks, harassment, rape and loss of life while collecting fuelwood.

Environmental impact

Fuelwood collection is one of the major causes of land degradation and deforestation. Therefore, the gradual conversion to LPG will have a positive impact on the natural environment.

Syrian Arab Republic

Integrated Wetland Management
Natural resources management

Background

The Jaboul Wetland is a large shallow-watered seasonal wetland, composed of multiple water bodies of varying salinity. It is considered to be an important agro-ecological zone as it has a large diversity of fauna and flora and represents an important stop for tens of thousands of migratory birds every year.[81] In 1998, it was designated a Ramsar wetland of international importance and a Syrian natural reserve based on its ecological importance.[82] As a result, a Ramsar Small Grant Fund (SGF) project was proposed in 2001 and completed in 2004, aimed at incorporating local communities in the management of the Jaboul Wetland.[83]

The project addressed the Ministry of Irrigation and the local communities by organizing formal and informal training sessions in the areas of participatory wetland and natural resource management; and by shedding light on the impacts of the everyday activities carried out by individuals and stakeholders who rely on the resources provided by the wetland, and on the importance of sustainability.

Wetlands

From a conservation point of view, the Jaboul agroecosystem is of great importance. Surveys by international and Syrian ornithologists carried out in 2006 identified 168 bird species, 6 of which are globally threatened or near-threatened and at least 30 species breeding in the wetland. In November 2007, up to 60,000 birds were counted in the area, including up to 20,000 individuals of the greater flamingo, which constitutes 4 per cent of its world population.

Source: Serra, Gianluca and others (2006). Sabkhat al-Jabbul, A Threatened Ramsar Wetland in Syria. Available from http://www.gianlucaserra.com/28%20(2)%20Sabkhat%20Al-Jabbul%20-%20Serra.pdf.

In addition to the training, and following a participatory approach, field visits were organized to different locations where the impacts of local activities were most prominent. Furthermore, printed posters were distributed to the local population and authorities involved in wetland management, in order to emphasize the importance of wetlands and their conservation in the entire country.

In 2005, as a follow up to the Ramsar grant, Syrian officials and international researchers from the International Centre for Agricultural Research in the Dry

Areas joined hands in establishing a framework for the management of this ecosystem, and the official Jaboul Agroecological System Consultative Committee was established. This Committee was tasked with developing a conservation strategy that creates a balance between preserving the wetland and sustaining the livelihoods of the surrounding communities. An integrated ecosystem management strategy was established to achieve that twofold objective,[84] which will be implemented by 2020. The ecological and economic values and services of the wetland were mapped and threats identified, considering the interest of the local farming communities in playing a participatory role to ensure the sustainability of this system.[85]

Economic impact

Working sustainably around this ecosystem will create various opportunities of economic importance, including the expansion of environmental services and production of environmental goods provided by the ecosystem.

Social impact

Including the local community in the conservation of this ecosystem will help create new livelihood opportunities for the local population living and relying on its goods and services. In addition, use can be made of the knowledge of the indigenous farmers, fishermen and salt gatherers who have been interacting with the land for many years. They could be included in decision-making processes.

Environmental impact

Conserving this unique and fragile ecosystem of international importance will have a significant impact on biodiversity in the region, in particular since it provides a rest stop for migratory birds; not to mention the long-term benefits for the population of the region.

Tunisia

Recycling of Lubricating Oils
Waste management

Background

In 1996, the Tunisian Government enacted Law 96-41 on waste management and control, with the purpose of addressing the problem of solid waste and its mismanagement which was having a negative impact on the environment in the country. This law encouraged private companies to invest in the management, collection, transport and recycling of non-hazardous waste, contributing to the creation of small and medium enterprises interested in operating in this environmental service.

In 2005, the Tunisian Government established the National Agency for Waste Management (ANGed), with the mission of encouraging waste recovery and management, facilitating the implementation of the 1996 law and contributing to the protection of the environment. Supported by public and private funds, ANGed has been offering technical assistance and capacity-building to private green companies that intend to invest in the waste management sector.

With the support of ANGed and within the framework of the national law on waste management, legal and incentive programmes have been established to favour the emergence of private businesses in the waste management sector.[86]

As for the Tunisian lubricating oil market, Decree No. 2002-693 of 1 April 2002 states that such economic actors in the national market as distributors and importers must either pay a contribution for the collection, transportation and storage of used lubricating oils with the non-recovery of their share in regenerated base oil; or recover their share in regenerated base oil and pay the regeneration cost in addition to those of collection, transportation and storage.[87]

As part of the Eco-Zit programme, which was created to implement the law on lubricating oils, an eco-tax of 5 per cent was introduced on the sale of these oils. This tax is used to finance the collection and recycling of waste oils. The amount of lubricating oils that can be collected mainly from gas stations, car wash and oil change shops is roughly estimated at 25,000 tons per year.[88]

ANGed is in charge of the development of the Eco-Zit research programme, producing studies and management plans for oil waste; monitoring and assessing management actions; and overviewing any fundraising and awareness-raising campaigns and pilot programmes in the field of used lubricating oils. The oil is

collected privately via some 10,000 collection points in the country through a network consisting of a main company and 11 subcontractors.[89] The estimated total quantity of lubricating oils marketed in Tunisia is 50,000 tons/year. Currently, the Eco-Zit programme has the capacity to recycle 14,000 tons/year, which constitutes 56 per cent of the collectable quantity in the facility located in the industrial zone of Jarzouna, with a planned 2 to 3 per cent increase per year.[90]

Economic impact

Despite the efforts that are underway, a large number of private households and businesses still pour their used oil directly into the drain. The oil can clog the pipes through which it passes, causing many inconveniences. In the best-case scenario, it generates small flooding and odor and requires relatively expensive periodic cleaning. In the worse-case scenario, the accumulation of oil and other waste causes greater damage, such as the breakage of pipes with extensive flooding, expensive repairs and a suspension in the economic activity, thus generating a considerable loss. A correct collection and recycling of lubricating oils can hence contribute to reducing costs and saving resources.

Social impact

The Eco-Zit programme in Tunisia employs 24 persons and is planning to hire 10 more before the end of 2013.[91] Moreover, the replication of the project can lead to the creation of additional enterprises operating in the sector and to consequent job creation.

Environmental impact

The direct discharge of lubricant oils into the sewage has extremely negative consequences for the environment. The impact of oil discharge into the water is evident and immediate, as the organic components of lubricants reduce the oxygen levels in the water and cause the asphyxiation of fish and other living organisms. The correct recycling of lubricating oils contributes to the protection of the environment and reduces the cost of water treatment in wastewater treatment plants.

United Arab Emirates

Eco-friendly Mosque
Green buildings

Background

The Khalifa al Tajer Mosque will be the first green mosque in the Middle East. Located in Dubai, with an estimated completion date in March 2014, this mosque will be the largest one in Dubai, with the capacity to accommodate up to 3,500 worshipers. It will be built on an area of almost 9,760 m^2 and will have an internal surface of 4,180 m^2, with the rest of the area allocated for landscaping.[92] As a perfect example for green building, this mosque will feature some of the most recent green technologies, including solar panels, water recycling and purification systems, and a roof garden.

With a budget of $6.8 million,[93] this project came to life after religious institutions in the United Arab Emirates started looking into environmentally friendly solutions compatible with the global energy problems and growing CO_2 emissions. Incorporating modern renewable energy solutions into traditional building design would reduce the building's energy consumption by around 20 per cent and cut down on water consumption by one quarter.[94]

The use of smart architectural designs and a change in the orientation of the mosque will let in more sunlight, reducing the consumption of electricity. Moreover, thermal insulation will be introduced using light-reflective colours on the mosque's façade and exploiting the natural insulation of a roof garden. Heated water will be supplied using solar panels, and ablution water will be recycled in

Green buildings

In the United States, buildings use up to 40 per cent of the energy and material use; whereas in the Gulf area in the Middle East, the share of buildings in the national energy consumption can reach up to 70 per cent. The United Arab Emirates and Qatar are leading the sustainability trend in the region, having the highest share of green buildings in the Middle East and North Africa region. There are about 1,200 Leadership in (LEED); accredited green buildings, 65 per cent of which are located in the United Arab Emirates. Qatar is ranked second on the list, with 173 green buildings, followed by Saudi Arabia, Lebanon and Egypt, with 145, 25 and 22 green buildings, respectively.

Source: Katkhuda, Nadine (2013). Green Buildings and the Middle East. EcoMENA: Echoing Sustainability (13 September). Available from http://www.ecomena.org/green-buildings/ (accessed 15 November 2013).

a recycling plant installed within the mosque, for irrigation and washroom use. The regular water consumption within a mosque of this dimension would sum up to more than 10,500 liters per day. An energy-efficient strategy, however, would save up to 2,500 liters per day.

The standard electrical energy requirements of a mosque reach 250 KW/m^2 per year. This mosque's area extending over 10,000 m^2, its electricity requirements are expected to reach some 2,500 MW per year. Using an energy scheme that reduces consumption by up to 25 per cent would lead to 490 MW of electrcity savings per year.[95]

Economic impact

This green mosque is likely to have lower operating costs and will give rise to the development of an associated subcontracting and supply market for eco-friendly goods and services. By optimizing the life cycle and the economic performance of the building process, the green mosque is an example of how to utilize resources with enhanced efficiency.

Social impact

The green mosque will also have social benefits, through boosting the comfort, health and general well-being of users and reducing pressures on the local infrastructure. Moreover, the health and productivity of the inhabitants are improved by providing healthy indoor surroundings, with better air quality and little pollutants.

Environmental impact

Such a green building can help improve and protect the environment by having little negative impact on air and water quality, reducing waste streams and preserving natural resources, especially water, which, in the case of the United Arab Emirates, is a scarce resource. Alongside the efficiency in resource usage, the use of such sustainable building materials as recycled materials, or materials produced through sustainable processes, can also be factored in lowering waste production and energy consumption.

Yemen

Improving Rural Livelihoods through Photovoltaic Electrification
Renewable energies

Background

In the light of the ESCWA mandate to enhance the capacity of member States in the promotion of sustainable energy technologies, a pilot project on solar photovoltaic (PV) electrification in villages was initiated in Yemen with the aim of increasing access to energy services in rural areas.

The inhabitants of thousands of rural villages across the country have no access to electricity services; indeed, in 2007, only 47 per cent of the Yemeni population had access to electricity.[96] Under such conditions, one of the most promising solutions for the electrification of rural areas is the installation of stand-alone solar PV systems for domestic lighting and the operation of low current appliances.[97] The village of Ka'awa was selected for the pilot project, which aims to improve access to a modern energy service through the use of clean renewable energy resources, thus enhancing rural development.[98]

At the start of the project, ESCWA experts visited the village to assess the requirements of a PV system to provide the village with electricity, subsequent to which the scope of work and technical requirements for the supply, installation, testing and commissioning of the pilot project were set. During mid-February 2010, the village electrification was carried out, including the supply, delivery, installation, testing and commissioning of solar PV stand-alone systems for 87 homes, a health centre, including a vaccine refrigerator, a school, a mosque, including a sound system, and three solar PV street lighting lamp-posts.[99]

The project also included two capacity-building training sessions on renewable energy applications in rural villages, one for end users and another for engineers and technicians, both conducted in December 2009. The first session addressed 70 local villagers, explained the operation and maintenance of the PV solar home systems and included the distribution of a user manual in Arabic to all households that provided simple information about the solar PV systems installed in their homes and instructions on how to maintain them. The second training addressed engineers and technicians and introduced participants from the Yemeni Ministry of Electricity and Power, Sana'a University and Ka'awa village to both theoretical and practical tools related to the installation, operation and maintenance of the systems.

Economic impact

The project encouraged the establishment of small enterprises, which will lead to job creation and income generation. The project also enhanced the capacity of Yemeni authorities to replicate the experience elsewhere, with a view to addressing regional sustainable development priorities.

Social impact

The project improved the quality of life of the local community, particularly women and young people, contributed to the reduction of poverty through increased accessibility to modern energy services and facilitated the improvement of health and education services. Furthermore, the project provided better access to educational facilities and connected villagers to the outside world through television and radio, thereby improving living conditions.

Environmental impact

The project created environmental benefits by reducing the greenhouse gas emissions associated with the use of traditional fuels.

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