



Lebanon Energy Efficiency & Renewable Energy Finance Facility



SUPPORTED BY **Banque du Liban**

Sustainable Energy Investment ➔ ***Improved Business Results***



WHAT IS LEEREFF?

LEEREFF stands for 'Lebanon Energy Efficiency & Renewable Energy Finance Facility'. LEEREFF is a dedicated credit line for sustainable energy investments in:

- Renewable energy
- Green Buildings
- Energy Efficiency in business and industry

Investing in energy efficient or renewable energy technologies, companies benefit directly from energy cost savings as well as modern technologies, whilst making a contribution to lowering the overall energy demand in Lebanon. LEEREFF offers investment support through loans from The European Investment Bank (EIB) and Agence Française de Développement (AFD), with interest rate subsidies provided by the Banque du Liban (BDL), for investments in energy efficiency and in renewable energy, and free technical assistance provided by an international team of engineers, financed by the EU.

WHO CAN APPLY?

All private enterprises formed under the laws of Lebanon and operating in Lebanon:

- Production companies, ranging from large factories through to bakeries, small technical and crafts workshops
- Service businesses, ranging from media companies, tourism companies through to hair dressing salons and dry cleaners
- Sole proprietors

Any other private legal entities, including Energy Service Company (ESCO). ESCOs should ensure that the energy performance contract includes a guarantee for a certain percentage of energy savings and that the loan incentives made available to the ESCO are at least partially passed on to the end-user.

Excluded from LEEREFF financing are residential and public sector projects as well as companies that conduct business in:

- Gambling
- Real estate with the aim of making profit on sales in the short and medium term
- Manufacture, supply or trade in arms
- All other activities excluded by the EIB and/or AFD (see this link for details: <http://www.eib.org/about/documents/excluded-activities-2013.htm>)

WHICH LEEREFF LOAN IS BEST FOR YOUR COMPANY?

LEEREFF offers two different loan types to meet the varying investment needs of companies. A

STANDARD LOAN (€40,000 - €250,000) for standard equipment selected from our List of Pre-Assessed Technologies and **NON-STANDARD LOAN** for investments >250,000 - €15 million, for all non-standard technologies.

STANDARD LOANS:

Loans for standard investments are designed for clients who are planning to implement more simple energy efficiency or renewable energy measures, with an investment volume from €40,000 to €100,000 for single measures and up to a maximum of €250,000 for multiple measures.

Standard investment loans are restricted to devices and models, which have been pre-assessed by the LEEREFF team of experts.

This list currently covers the following technologies:

- Thermal insulation and windows
- HVAC systems
- Monitoring and Control Systems
- Pumps, compressors and Motor systems
- Renewable Energy systems (PV, SWH)

All items on the List of Eligible Technologies (LET) were selected on the basis that they meet the LEEREFF requirement of saving at **least 20% energy**.

The full LET is available on our website: www.leereff.com, or upon request from info@leereff.com. For items currently not listed, please contact the project office with product details and our team of engineers will evaluate the technology for possible inclusion.

ENERGY SAVING EXAMPLES:

- Energy efficient LED lighting and save up to 40-70% per lighting unit (Based on LED T8 or T12)
- Energy efficient ventilation systems and save up to 50%
- Installing variable speed drives on motors can achieve energy savings of 50- 80%.
- Fitting a Greenhouse with a Thermal Blankets can achieve 20%-50% energy savings
- Solar Water Heaters can reduce the operating cost of water heating by more than 50%

NON-STANDARD LOANS:

These are for investments of >€250,000 - €15 million. Eligible investments include:

- General energy efficiency investments in industrial and commercial companies
- Green Buildings (Commercial)
- District Heating and Cooling Systems
- Co-generation of Heat and Power
- Renewable Energy, including:
 - Wind
 - Biomass
 - Hydro Power
 - Solar energy
 - Geothermal Energy

LEEREFF loans can cover up to 80% of the investment cost. LEEREFF loans can be supplemented by companies' own funds, a NEEREA loan or a conventional bank loan.

ELIGIBILITY CRITERIA

For investments to be eligible for LEEREFF financing, the project should meet certain technical and financial eligibility criteria:

STANDARD investments should generate energy savings of at least 20%. Technologies included in the LEEREFF List of Eligible Technologies were pre-assessed and selected by the LEEREFF team of consultants in order to meet this goal.

NON-STANDARD investments are very diverse and the eligibility criteria for non-standard investment projects vary depending on the project type.

Green Buildings (Commercial):

- LEED (or equivalent) Platinum standard: LEEREFF can finance up to 36%
- LEED (or equivalent) Gold standard: LEEREFF can finance up to 28%

General Energy Efficiency Projects (Non-Standard Investments)

- Project generates >20% energy savings OR energy savings cover 50% of investment costs over the project lifetime, using 5% discounted rate. Investments aimed at replacing production equipment have to comply with the 50% coverage ratio.

District Heating / Cooling:

- Heat mainly produced from high efficiency co-generation or RE
- Must be competitive vis-à-vis individual boilers in buildings

High Efficiency CHP

- Meets EU Directive 2004/8/EC

Renewable Energy:

- Solar: certified technology; site-specific irradiation yield assessment for >0.5 MWp.
- Hydro: Electricity generation cost base load <€120/MWh based on 5% real discount rate and 20 years economic lifespan. Large hydro-dams are excluded.
- Biomass: uses sustainable resource; Electricity generation cost base load <€120/MWh based on 5% real discount rate and 15 years economic lifespan. Biofuels are excluded.
- Geothermal: Electricity generation cost base load <€120/MWh based on 5% real discount rate and 20 years economic lifespan. Drilling excluded from LEEREFF financing.
- Wind: On-shore only; >1 year on-site wind measurements; Electricity generation cost base load <€120/MWh based on 5% real discount rate and 15 years economic lifespan.

A complete and detailed overview of the technical and economic eligibility criteria for non-standard investments can be found on the LEEREFF website (www.leereff.com).



BENEFITS FROM SOLAR PV INVESTMENT EXAMPLES

A winery installed 517 kW DC rooftop system and generates 80% of the power needed for their production facility and hospitality center. The annual electricity production is 827,000 kWh, enough electricity to power 86 homes.

Industrial company installed 801 kW DC system on their factory roofs. Annual production is 1,116,000 kWh DC. This covers 60% of their annual energy needs.



BENEFITS FROM BIOMASS INVESTMENT

Wood furniture company turns waste into a heating source by investing in a Woodchip Heating System. The new 540,000 kW (1.8 MMBtu/hr) boiler now heats the 2,790 square meter facility and uses practically all of the wastewood the operation produces—scraps, shavings, and sawdust, solving the wastewood problem at the same time.



How to Apply for a LEEREFF Loan?

Please contact one of the LEEREFF Partner Banks with your application. The current list of LEEREFF Partner Banks and more information is available on our website — www.leereff.com. If you need any assistance, please contact our project office at +961 1 389 588 or email us at info@leereff.com



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Energy Efficiency and Renewable Energy in Animal and Crop/Fruit Farming

The agricultural sector offers a very large range of energy efficiency and renewable energy opportunities, including those related to farm and operational buildings, those related to specific farming processes as well as associated mobile equipment. Below you can find many examples on energy saving opportunities.

OUR ADVICE: Consult with our engineers before making any new 'energy saving' purchases to make sure they will be appropriate for your needs.

OVERVIEW OF EXAMPLES FOR ENERGY SAVING AND RENEWABLE ENERGY INVESTMENTS IN THE AGRICULTURAL SECTOR

ADMINISTRATIVE AND OPERATIONAL BUILDINGS

Insulation
Heating and Cooling
Lighting
Solar PV
Solar Water Heaters

CROPS AND FRUIT

Grain Storage and Processing
Fruit and crop drying, including solar dryers
Fruit processing
Tractors, seeders, harvesting machines
Greenhouse insulation, heating and cooling
Energy efficient motors and pumps

ANIMAL FARMING - CATTLE / DAIRY

Building insulation
HVAC
Solar PV
Solar Hot Water Heaters
Barn lighting
Energy efficient dairy lighting
Energy efficient milking equipment
Energy efficient cooling tanks
Tractors, farm equipment

ANIMAL FARMING - POULTRY

Energy efficient poultry lighting
Ventilation and heating/cooling systems
Solar PV and Solar Hot Water for stables
Tractors, farm equipment

DAIRY OPERATIONS

More than most other agricultural operation, dairies rely on electrical energy for milking (vacuum pumps), cooling and storing milk, heating water, and lighting. With rising energy costs, unstable energy supply and static dairy prices, energy costs can be the difference between making and losing money. Savings opportunities include for example energy efficient:

- **Lighting** – use energy efficient LED lighting and save up to 40-70% per lighting unit (Based on LED T8 or T12)
- **Ventilation** – use energy efficient ventilation systems and save up to 50%
- **Milking units and Milk cooling** – replacing old milking equipment and milk coolers versus modern ones can save up to 30-50% in electricity
- **Water heating** – use solar hot water heaters, which can save up to 90% in energy costs (compared to a solid fuel boiler)
- **Vacuum pump motors** (e.g., variable speed drives) – you can save up to 60% in energy costs. A Variable Frequency pump or drive which changes the pumps capacity to meet the milking need resulting in energy savings of 50- 80%. It is recommended that Variable Frequency Drives be used for varying loads such as milk pumps, vacuum pumps and ventilation fans
- Heat extracted from a milk during cooling by a **heat recover system** (e.g. plate heat exchanger) can be recycled to preheat water for sanitation use in the barn
- In addition, dairy operations are perfect for **biogas** plants and help you to increase your energy supply by making your own
- Install **PV panels** on stable and building roofs to make your own energy
- On-demand livestock watering systems reduce water consumption and energy

MINI CASE - FARM MACHINES



For processing of fields, a company operated several types of tractors. Some of them were quite old and showed high fuel consumption. In order to

increase productivity and reduce fuel costs the company replaced 3 of the old tractors against modern efficient models.

This resulted in annual fuel savings of 11,200 liters (25% saving) and a 30% decrease in processing time.

MINI CASE - FARMING



A crop farmer replaced his continuous cross flow dryer with a continuous flow in-bin dryer. The investment was USD 60,000 and reduced annual energy consumption

by 120 MWh – which represented a 40% reduction. Additional savings were achieved by installing a control system for measuring grain humidity.

MINI CASE - POULTRY FARMING



Ventilation is essential for keeping air quality in poultry breeding. Speed controlled ventilation limits energy consumption and heat demand of the facility

can be reduced. A poultry breeder equipped 25 fan motors with a total capacity of 100 kW with variable speed drives. The average energy consumption of motors was reduced by 45% annually! In addition, egg conveyors, fodder and manure transportation were modernized.

GREENHOUSES

Typical annual greenhouse energy usage is 75% for heating, 15% for electricity and 10% for vehicles.

Energy conservation solutions range from common sense to extremely efficient heating, cooling and watering systems. Reduce Air Leaks by using door closers, weather stripping (doors, vents, fan openings) and lubricating louvers (a partially open louver may allow several air changes per hour):

- Poly film with an infrared inhibitor on the inner layer can give 15% energy savings
- Thermal Blankets can achieve 20%-50% energy savings
- Insulation of foundation and sidewalls
- Solar PV
- Heat exchanger and greenhouse control for ventilation will improve energy efficiency

GRAIN DRYING

In some situations, more energy is used to dry a crop than to grow it. Planting techniques and moisture monitoring can help. If mechanical drying is required, the selection of a modern system can save up to 40% energy. It may also be possible to consider a solar drying system.

BUILDINGS

Improve farm buildings, including administrative buildings and housing for workers by insulating buildings and using efficient heating and cooling. LED lighting can be installed in barns and in other areas of the farm to reduce the electric bill. Use solar Hot Water Heaters for your warm water needs and install solar PV panels to replace part of the electricity you buy of the grid. Consider solid fuel boilers, which can use part of the bio-waste produced on the farm to heat water and spaces.





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Energy Efficiency and Renewable Energy in Restaurants, Cafés and Canteens

The catering and restaurant services industry is very complex in its diversity and establishment sizes. Restaurants are extremely energy intensive. Normal restaurants use up to 7 times more energy per m² than other commercial buildings, such as office buildings and non-food retail stores. High-volume and quick-service restaurants use even more energy than that. The lion's share of energy consumption is in food preparation. However, HVAC and lighting together consume up to 45% of a restaurant, whereas refrigeration consumes only 6%. Energy used in sanitation represents around 18%.

OVERVIEW OF EXAMPLES FOR ENERGY SAVING AND RENEWABLE ENERGY INVESTMENTS IN THE CATERING SECTOR

IN THE KITCHEN

- Highly efficient **combination ovens save 30%** over old models
- **Convection ovens** reduce the cooking time and consume **20% less energy** than conventional ovens
- Replacing old hot **food holding cabinets** can save up to **70%** energy
- Replacing old **commercial dishwashers** against efficient new models can save up to **40%** energy
- Modern efficient **steam cookers use 60% less** energy than their predecessors
- **Highly efficient freezers and fridges** use **30%** less energy than older models. Pick solid door models and the energy saving increases
- Maintain compressors and/or exchange **compressors on walk-in fridges and freezers** regularly. Also, install **LED lighting** as that saves energy AND reduces the heat emitted by the light.
- Use **heat recovery** on extraction fans and use for air/water heating
- Hot water preparation: install **solar hot water heaters** to cover as much as possible of your hot water requirement by solar power
- Investing in energy efficient lighting such as **LED** can reduce energy consumption up to 75%
- Install **solar PV**, if you have your own roof, and substitute part of your energy needs with solar energy

IN THE SERVING / GUEST ROOM:

HVAC: ambient air temperature and air quality are very important in catering establishments. Ensure correct equipment sizing (industry estimates show that at least 25% of all rooftop HVAC units are oversized, resulting in increased energy consumption). Replace fans against energy efficient models to save 70% energy. Consider that ceiling fan/light combinations are more than 50% more energy efficient than conventional units.

Fast food outlets also require heating/cooling to optimise guest comfort, but this can be costly. Even if you implement 'zones' within the building where separate timers and temperature controls can be adjusted, it's difficult to maintain a steady temperature whilst ensuring complete energy efficiency.

One of the simplest ways for food outlets to optimise the efficiency of their heating system is to seal the building against potential drafts, and keep external doors and windows closed whenever possible to reduce the amount of heated or cooled air allowed to escape. If your business hasn't already done so, consider adding a self-closing entrance door. When the business is closed, ensure that all doors, windows and vents are closed to capture and store any residual heated or cooled air overnight, reducing the amount of energy required to heat or cool the building the next day.

Install a **building energy management system**.

MINI CASE – MULTIPLE EQUIPMENT UPGRADE



A Burger restaurant saves 20,000 kWh annually by:

- Replacing existing pre-rinse spray nozzle with a low-flow pre-rinse spray nozzle. The energy saving is generated by the reduced

water heating requirements.

- Replacing standard fryers with highly efficient gas fryers
- Fitting the exhaust fan with a variable speed controller
- Replacing the walk-in freezer with a smaller more efficient model

MINI CASE - LIGHTING



- The owner of a hip café, had two goals for energy efficiency improvements:
- Create a cozy, inviting atmosphere for customers
 - Save energy

In the main seating area alone he was able to cut energy used for lighting by 85% by investing in LED lighting. Throughout the rest of the café, energy consumption for lighting has been cut in half, reducing the café's annual energy use by over 10,000 kWh. The lighting upgrade will have paid for itself after just eight months, and because LEDs last up to fifty times longer than older light sources, the change is generating other savings too. It's not just the cost of buying the light bulb, but needing to drive to the store, spending time to install it... time and maintenance savings are vastly undervalued. Furthermore, LEDs produce significantly less heat than most traditional light sources, reducing the load on the cooling systems.

MINI CASE – REFRIGERATION



In a restaurant, refrigeration systems, a vital food and wine storage component, are typically amongst the biggest energy consumers. After conducting a detailed on-site audit, the restaurant

identified: inefficient and poorly maintained reach-in freezer, un-insulated suction pipes, inefficient and poorly maintained remote condensing units, and inadequate strip curtains. Through replacement and upgrades, energy consumption for the refrigeration was reduced to 53% of the old installations.

MINI CASE – LEBANESE RESTAURANT



The restaurant used a very large underfired conveyor broiler to produce their specialty grilled meat kebabs with their signature charred texture. The broiler emitted substantial amounts of heat, making the kitchen too hot for staff comfort. Optimisation in kitchen comfort without sacrificing the classic kebab flavor was achieved by replacing the existing underfired broiler with an enclosed, energy-efficient conveyor broiler with burners above and below the conveyor belt. The new broiler features dual modulating conveyor belts, allowing for

different cooking times of multiple food products. With this investment, the restaurant achieved more than 80% reduction in energy consumption due to a decrease in energy required for kitchen exhaust, ventilation and cooling systems and a drastic decrease in the broiler's energy consumption.

In-door Lighting

Effective lighting is central to the success of a fast food restaurant or takeaway, affecting not just practical elements such as health and safety, but also the comfort of customers. Lighting may be one of the most expensive energy costs food outlets face, but by implementing efficient lighting controls and investing in innovative lighting technologies, businesses could reduce their lighting costs by more than 50%, depending on the lighting chosen.

One of the simplest things your business can do to improve its lighting efficiency is to install low-energy bulbs. By upgrading traditional light bulbs to compact fluorescent lamps (CFL) or LEDs, you can expect to use 75% less energy. It's a good idea to consult a specialist lighting technician before upgrading the lighting setup of your premises. They will be able to help you choose the correct bulbs and systems from the LEEREFF List of eligible technologies (LET) to adequately illuminate your business whilst saving on energy costs.

Another tip to save on the cost of lighting is to install occupancy sensors in halls, staff rooms and bathrooms. These systems detect movement, and will only trigger the light to switch on when someone steps inside. Occupancy sensors are excellent when used in rooms like the ones listed above, helping to achieve savings of up to 30% on the cost of lighting a particular space.

Lighting of Parking Lots and Signage

The same advantages described above can be gained by installing LED lighting in the parking lot. Consider digital signage, which is at least 20% more efficient than conventional signage.



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Energy Efficiency and Renewable Energy in Food and Beverage Production

Food and Beverage production is one of the most energy intensive industries with diverse sub-sectors. This leaflet concentrates on technologies and management techniques that offer the greatest potential for energy saving and that are common to the widest range of sub-sectors. The relative importance of each area will also depend on the sub-sector. For example, refrigeration cost will make up a large proportion of energy bills in the frozen and chilled foods sub-sector. Equally, for a business that produces confectionery, boilers and heat distribution systems will make the largest contribution.

Please make sure that you contact the LEEREFF team for additional ideas and support.

OVERVIEW OF EXAMPLES FOR ENERGY SAVING AND RENEWABLE ENERGY INVESTMENTS IN FOOD & BEVERAGE PRODUCTION

PRODUCTION PROCESS

- Process control optimisation, including computer-based automatic control systems
- Replacement of process machinery, including cookers and ovens
- Distillation, drying and evaporation equipment
- Inter-process material and product handling and transport (e.g. conveyor motors)
- Compressed Air systems
- Installation of heat recovery system
- Water distribution pumps
- Steam generation (e.g. CHP)
- Refrigeration technology and cold storage rooms

AUXILIARY SYSTEMS

- Optimization of air conditioning and cold storage temperatures
- Minimising transmission and ventilation losses from cooled rooms, cold stores and freezing tunnels
- Heat recovery from cooling system
- Optimization of compressed air systems
- Application of combined heat and power technology, especially in processes that demand steam
- Optimization of insulation by selecting effective coating materials with low conductivity values and high thickness
- Installation of heat pumps for heat recovery from warm cooling water
- Use IEC2 class efficiency motors and variable speeds drives for the process and auxiliary equipment
- Reduction of the load on motors and drives by ensuring that regular servicing and basic maintenance steps such as lubrication of machinery are undertaken
- Improving the efficiency of a heat generator by reducing the heat losses through the chimney

PRODUCTION AND ADMINISTRATIVE BUILDINGS

- Insulation of the building envelope
- Energy efficient space heating and cooling
- Heat recovery
- LED lighting and motion sensors for on-demand lighting, especially in utility rooms, corridors and outside areas
- Solar PV on factory and administrative roofs for own energy production
- Solar Water Heaters for hot water used staff bathrooms, showers and to cover hot water needs

RENEWABLE ENERGY OPPORTUNITIES

- Use biogas and biomass boilers, which allows you to utilize production wastes to produce heat
- Install PV systems to supplement the energy you purchase off the grid with energy produced on your premises
- Use solar water heaters for warm water preparation

MINI CASE – BAKERY



A bakery installed a state-of-the-art efficient lighting system that includes both high-efficiency T5 fluorescent lamps and 35W metal halide lamps. The system provides the same lighting levels

as standard lamps, but with 64% less energy consumption. Additionally, the system is split into two circuits, with one being small enough to provide safe access when the bakery is not operational.

MINI CASE – CHEESE FACTORY



The project envisaged replacement of the old filtering system for cheese production. The old system was producing cheese by means of evaporation of the liquid semi-product,

consuming large amounts of gas to heat up the liquid and evaporate it. The new nano-filtration system has a conceptually different approach based on mechanic separation of solid and liquid particles, eliminating heat and gas consumption in principle and, hence, being energy efficient. With the USD 1 million investment the company reduced its natural gas consumption by 7.6 million m³ per year and additionally saves over 25% of electricity (290 MWh per year). The project had a payback of less than one year.

MINI CASE – ICE CREAM MANUFACTURER



An Ice-Cream manufacturer undertook a comprehensive multi-measure energy efficiency project including:

- complete re-design and re-build of the ammonia refrigeration plant

- lighting improvements and lighting controls improvements
- installation of a new more efficient HVAC system for the production areas
- improved insulation and staging in the product storage and buffer areas

The project resulted in a 59% reduction in annual electricity consumption while simultaneously improving lighting, comfort, and productivity.

COMPRESSED AIR

Compressed air is used as a power source for many food and drink operations as it is a versatile, safe and flexible way to transmit energy. Compressed air is common in processes requiring conveyors and mixers. Other applications include blow molding plastic bottles in the soft drinks industry and using air knives to lift products off conveyor belts. Exchanging compressors can save up to 50% energy.

HEAT RECOVERY

Up to 90% of heat generated by compressors, production machinery and e.g. canning processes can be used to heat water or air. Consider whether the heat generated can be reused to provide space heating in warehouses or workshops and staffed production lines.

MOTORS AND DRIVES

Electric motors drive the vast majority of processes used in the food and drink industry. However, many sites have relatively inefficient motor operations. Improving the efficiency of a plant's motors can deliver significant energy and cost savings.

Example: A fully loaded motor consumes its own purchasing cost in electricity in 30 to 40 days of continuous running. Installing a variable speed drive can save up to 30% of running costs.

BOILERS AND HEAT DISTRIBUTION

By ensuring efficient steam generation and distribution, energy costs can be reduced by 30%. Almost all of the sub-sectors in the food and drink processing industry need some form of process heating. This is often supplied by on-site boilers. The boilers may be installed to supply hot water or steam (at various temperatures and pressures) depending on the process requirements.

COMBINED HEAT AND POWER

CHPs are a good alternative in cases where boilers need to be replaced, as they produce both, heat and steam. Steam is used in a variety of cooking applications and in the food canning process.

REFRIGERATION - CHECK YOUR PIPING

A refrigeration system for cold storage in food and beverage production consists of many components that act together as one system. Walk-in cold storage rooms and freezers for raw materials and finished goods, compressor racks, condensers, are the major energy consuming components. Walk-in cold storage chambers, freezers and compressors are typically located at the beginning (raw materials) and the end (finished goods) of the process whereas condensers are typically on the roof. In this conventional "remote condensing" refrigeration system configuration, an extensive network of piping delivers refrigerant gas from the compressor to the condenser to various cold and freezing chambers and back to the compressor, posing substantial opportunities for refrigerant leaks along the way. While the cold storage cases and compressors together account for about 85% of the system's energy consumption, engineering studies have identified "win-win" opportunities within extensive piping system to improve energy efficiency and net cost savings.



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Energy Efficiency and Renewable Energy in Healthcare

Hospitals and clinics are complex organizations from a sustainable energy point of view. They comprise wards, treatment facilities and equipment, kitchens and common areas, all aspects of building energy efficiency, and at the same time they have to fulfill stringent health and safety requirements. Hospitals and clinics are very energy-intensive. Hospitals operate 24 hours a day and aim to provide patient comfort and optimum health care at the push of the emergency call button. And hospitals are bound by stringent medical standards and ventilation and air cleanliness requirements. Hospitals have higher requirements for outside air, heating, cooling, dehumidification and humidification than other building types. As a result, their energy consumption is substantially higher than e.g. office or retail buildings. Electricity alone accounts for over 50% of a hospital's energy costs and with the constantly increasing use of specialist medical equipment that generally relies on electricity, consumption is set to increase. The specialist nature of a hospital environment means that there is a significant amount of energy-intensive equipment, such as medical fridges, mortuary and pharmacy cold stores, laboratory equipment, and X-ray machines.

OVERVIEW OF EXAMPLES FOR ENERGY SAVING AND RENEWABLE ENERGY INVESTMENTS IN THE HEALTHCARE SECTOR

GENERAL

Building energy management systems

Building insulation

HVAC

Heat recovery

CHP

Solar PV

Solar Hot Water

Lighting

ADMINISTRATIVE AREAS AND OFFICES

Lighting

Occupancy sensors

TREATMENT FACILITIES

Compressors

Specialized HVAC

Lighting

Refrigeration

SUPPORT FUNCTIONS

Hospital kitchens

Ovens & cookers

Refrigerators and freezers

Food distribution service

Laundry

MEDICAL TREATMENT DEVICES

Many treatment facilities require compressors. Applications may range from the distribution of medical gases, via inflation/deflation of special air mattresses used in treatment facilities, blood analyzers, etc. Efficient compressors can generate significant energy savings.

LAUNDRY

High efficiency commercial washing machines use 63% less energy and half the water of conventional washing machines. As an alternative, also consider Ozone Laundry systems, which can significantly reduce energy costs. The process of an ozone laundry involves completion of the wash cycle by using water saturated with ozone, instead of standard tap water. Laundry disinfecting has been traditionally accomplished by bleaching with chlorine at high temperatures along with agitation. This bleach is normally a slow reactant at cold temperatures, so hot water is used in conventional washers to enhance the oxidation reaction of chlorine bleach. Ozone, which carries an electrical charge, does the disinfecting without hot water. Ozone works well in cold water and reacts very rapidly, dissolving soil on contact. Hot water is unnecessary for most ozone laundry systems. By eliminating the need for hot water (85-100%) and reducing both washing and drying times. Ozone laundering can generate energy savings of up to 75%. In addition they reduce overall water consumption by about 20% and detergent/chemical usage by around 40%.

COMBINED HEAT AND POWER (CHP)

In an appropriate application, CHP can reduce a hospital's energy bill by around 20–30%. Hospitals are good candidates for CHP due to their year-round demand for heat.

MINI CASE – FOOD DISTRIBUTION



A Hospital tested insulated ‘hot boxes’ as replacements for traditional, electrically-heated food trolleys.

After making a few minor adjustments to working routines, it was possible

for food to reach patients at the correct temperature without the need for trolleys. The hospital withdrew 33 traditional trolleys at a saving of almost 145,000 kW per year.

MINI CASE – SOLAR POWER



A Community Hospital installed solar power on its roof and cut its energy consumption by 30%.

MINI CASE – MULTIPLE MEASURES



A large hospital complex uses waste biogas created at a nearby landfill site to create electricity and heat that fully powers one of its multiple building healthcare sites.

A geothermal heat pump system heats and cools one hospital, and a biomass boiler at the main hospital’s site takes care of 38% of the system’s energy needs. In addition, solar panels power the underground parking garage, and a solar hot water unit offsets 85% of the Child Care Center’s hot water needs.

LIGHTING

In a typical hospital, lighting can account for over 20% of the total energy used or over 35% of the electricity used in a typical hospital. Good lighting design can reduce costs and have the added benefit of decreasing internal heat gains, thus reducing the need for air conditioning too. Upgrade lights to the most efficient suitable options. For example, any ‘standard’ tungsten light bulbs can be upgraded directly to energy saving compact fluorescent lamps (CFLs) which use 75% less energy, produce less unwanted heat and last 8–10 times longer.

OCCUPANCY SENSORS

Occupancy sensors can achieve savings of up to 30% on lighting costs because ensure lights only operate when there is somebody there to require them. These are especially useful in, for example, the following spaces:

- Intermittently used office areas
- Toilets and washroom facilities
- Storerooms
- Areas where lighting is zoned and/or corridors

Occupancy sensors can also be used to lower light levels in corridors at night time, which can be an effective cost-saving measure. However, it is imperative to maintain minimum light levels so as not to compromise health and safety standards. This measure not only saves energy, but also helps to prevent the spread of disease because staff no longer needs to touch switches.





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Energy Efficiency and Renewable Energy in Hotels and Guest Houses

The hotel sector is diverse, comprising hotels, motels, guesthouses, hostels and tourism apartments. Energy is one of the main cost factors, which greatly influences the establishment's profitability. At the same time, energy use is often difficult to control, as guests and staff have a direct influence on the energy consumption. Efficient performance hotels operate sustainably, using energy more effectively than hotel buildings that are simply operating in line with legislation. Efficient performance hotels capitalize on the opportunity to enhance their positioning in the hotel market vis-a-vis both, customers and potential investors. Travellers are increasingly aware of the environmental impact of tourism and like to use hotels that are making an effort to minimize energy consumption and carbon emissions. Investors and owners benefit from the positive financial impact that results from energy saving.

This is NOT difficult!! And it is made much easier with a LEEREFF loan:

- very competitively priced
- includes free technical assistance helping hotels, guest houses and restaurants find the best solution.

OVERVIEW OF EXAMPLES FOR ENERGY SAVING AND RENEWABLE ENERGY INVESTMENTS IN THE HOSPITALITY SECTOR

GENERAL BUILDINGS

Building Insulation (exterior walls and roof)
 Efficient windows
 Efficient boilers
 VRF systems or efficient chillers and split systems
 LED Lighting (inside and outside areas)
 Occupancy sensors for lighting systems in halls, utility rooms, common bathrooms, etc.
 Motion sensors on outdoor lighting
 Solar PV
 Solar Water Heaters
 Building energy management system

GUEST ROOMS

Key card systems (to switch off electricity in guest rooms)
 Motors with variable frequency command in HVAC applications
 Sensors on windows and sliding doors – switching off heating and cooling automatically when open (linked with building energy management system)

KITCHEN

Energy efficient cookers and ovens
 Refrigerators
 Cold storage and walk-in freezers
 LED Lamps (also in refrigerators)
 HVAC
 Heat recovery
 Biogas (from food waste)
 Energy efficient extractor fans

LAUNDRY

Highly efficient laundry machines
 Ozone laundry machines
 Heat recovery from laundry room air extractors

SPORTS FACILITIES

Efficient pumps for swimming pools
 Spa boilers

Hotels are among the top five energy consumers in the tertiary building sector. Operating in a 24/7 environment, there is much energy saving potential. **The biggest energy wasters in hotels are:**

- Space conditioning (cooling and heating)
- Lighting
- Domestic hot water
- Laundry (if not outsourced)

SPACE CONDITIONING

The ambient air temperature and quality directly influence guest comfort and largely define the guests' experience. Key card systems and window sensors, which enable shut-down of cooling/heating together with a building energy management system minimize losses and maximize savings, while maintaining high guest comfort.

LIGHTING

Lighting represents about 25% of electricity costs in hotels. But effective lighting is essential for safety and comfort in hotels. The financial arguments for implementing a full LED retrofit are compelling and result in

MINI CASE – BIOGAS



A hotel chain with integrated restaurants catering for a total of 2,000 customers per day piloted the possibility of using food wastes for biogas production. Waste used included plate scraps and

food preparation waste. An anaerobic digester was installed in a central location serving outlet restaurants. The result of the pilot showed that approximately 600 lb of food waste per day produces almost 44 m³ biogas per day, which is equivalent to almost 27 m³ natural gas per day. This amount of gas produced per day is equal to one week's worth of natural gas consumption of an average British household. The biogas, without any cleaning, can also be bottled and used directly for cooking again, vastly reducing the restaurant's need for purchasing cooking gas.

MINI CASE – ENERGY CONTROL SYSTEMS



A hotel installed an Energy Control system in the kitchens of one of its properties. Previously, the extractor fan ran 24 hours a day at full speed, using about 220.67kWh/day.

The new equipment continuously monitors cooking activity and, based on the conditions, adjusts the following:

- speed of the extractor and supply fans
- adjustment in air conditioning requirements

As a result, energy consumption drop to 105.59kWh/day. Together with the reduction in the need for conditioned air, the hotel's total annual savings are around USD 6,301 or 42,004kWh/year

MINI CASE – SOLAR INSTALLATION



A hotel location planned to reduce its costs associated with heating the outdoor swimming pool for use in the winter, while using the same solar thermal collectors to preheat water for use in

indoor showers April through November. The 320m² panel array produced a 35% reduction in annual gas consumption with a 1.8 year Rol.

two impacts:

1. a substantial reduction in energy bills
2. a significant increase in the asset value.

DOMESTIC HOT WATER

Domestic hot water is commonly the second largest user, accounting for up to 15 per cent of the total energy demand. Solar Hot Water Heaters can easily cover most of hot water needs, especially in a country like Lebanon.

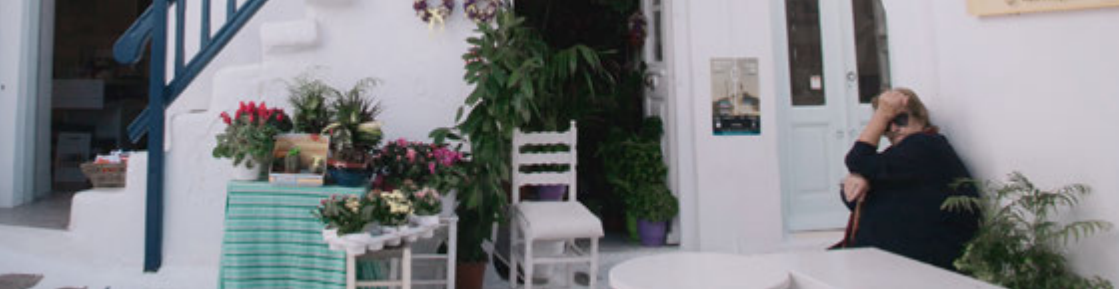
LAUNDRY

Laundry services in general account for roughly 15-20% of the **TOTAL** energy consumption of a full-service hotel and are also responsible for 16% of a hotel's total water consumption. High efficiency commercial washing machines use 63% less energy and half the water of conventional washing machines.

The case for **Ozone Laundry Machines**: In the least 10 years however, ozone laundries have become popular for diminishing the overall environmental impact of the laundry while achieving significant reductions in energy costs. The process of an ozone laundry involves completion of the wash cycle by using water saturated with ozone, instead of standard tap water. Laundry disinfecting has been traditionally accomplished by bleaching with chlorine at high temperatures along with agitation. This bleach is normally a slow reactant at cold temperatures, so hot water is used in conventional washers to enhance the oxidation reaction of chlorine bleach. Ozone, which carries an electrical charge, does the disinfecting without hot water. Ozone works well in cold water and reacts very rapidly, dissolving soil on contact. Hot water is unnecessary for most ozone laundry systems. By eliminating the need for hot water (85-100%) and reducing both washing and drying times. Ozone laundering can generate **energy savings of up to 75%**. In addition they reduce overall water consumption by about 20% and detergent/chemical usage by around 40%.

QUICK-WIN EXAMPLES FOR HOTELS

- Installing efficient ice makers generated annual energy savings of 230,400 kWh
- Installing water efficient shower roses and a temperature setback system: capital cost of USD 3,600, generating annual energy savings of 75,035 kWh, delivering annual costs savings of USD 11,255.
- Filling north facing rooms first: capital operating cost of USD 3,200, generating annual energy savings of 182,400 kWh, delivering annual costs savings of USD 27,360.
- Installing timers on external lighting: capital cost of USD360, generating annual energy savings of 26,280 kWh, delivering annual cost savings of USD 3,942.
- Installing timers in hallways: capital cost of USD 883, generating annual energy savings of 14,717 kWh, delivering annual costs savings of USD 2,208.



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Energy Efficiency and Renewable Energy in Industrial Sectors

Globally the industrial sector is responsible for around one-quarter of total energy consumption. The industrial sector spans a wide variety of activities. While the energy saving potential in industrial application regularly exceeds 30% (except for very modern production plants), finding the most efficient solutions for reducing energy consumption is often a complex task.

LEEREFF offers loans for standard technologies and for non-standard projects. Both approaches can be applied in industrial energy efficiency projects:

Standard Technologies: LEEREFF has developed a list of standard technologies, which includes pre-approved devices, such as compressors, lighting, motors, Solar PV, etc. For simple energy efficiency improvements in production facilities, the list offers a wide variety of solutions.

Non-standard projects: Industrial complexes often require improvements in their production facilities. While machine replacements can produce substantial energy savings, it is advisable to combine these (often high) investments with a more complex review of energy saving potential throughout the process. For example, consider a new machine being connected by conveyors with other process steps. Are the conveyors equipped with the most efficient motors and/or are the motors fitted with variable speed drives, which can easily produce energy savings in excess of 50%? For non-standard projects, you can get free technical advice from the LEEREFF team of engineers.

As a general note, access to energy is the life-blood of all manufacturing industries, but energy is often in short supply in Lebanon.



Consider making your own energy: factories generally have large roofs. These can be perfect for rooftop solar PV installations. Why not replace part of the energy purchased off the grid by solar energy produced on your roof? The benefits include cost savings AND improve your security of energy supply.

Also see our sector flyers for Food & Beverage Production and Textiles.

OVERVIEW OF EXAMPLES FOR ENERGY SAVING AND RENEWABLE ENERGY INVESTMENTS IN THE INDUSTRIAL SECTOR

MAIN ENERGY CONSUMERS ACROSS ALL INDUSTRIES

- **Electrical energy:**
 - Compressors
 - Pumps
 - Motors
 - Fans
 - Lighting, cooling & refrigeration
- **Gas and fuel oils:**
 - HVAC
 - Furnaces & kilns
 - Steam & Heat

MAIN ENERGY EFFICIENCY MEASURES

- Efficient Manufacturing / process equipment
- Efficient models and variable speed drives for motors, fans and pumps
- Compressor replacement
- Efficient boilers
- Combined Heat & Power (CHP) or Tri-generation
- Heat recovery systems

MINI CASE – FURNITURE



A manufacturer of high quality chairs and tables invested in a air compressor, efficient power staple guns, finishing spray guns and a programmable thermostat and benefited from a 58.8% reduction in the consumption of natural gas, electricity.

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MINI CASE - PHARMACEUTICALS



A pharmaceutical production company aimed to reduce the energy consumption in the warehouse and production buildings without compromising

on product quality. The focus of the initial assessment was on the energy performance of the pharmaceutical HVAC systems. The agreed projects were implemented in order to reduce energy consumption, whilst maintaining quality, safety and regulatory requirements. The projects consisted of replacement and optimization of fans and fan controls in AHUs of the warehouses and installation of temperature demand controlled ventilation for the production area, producing energy savings of 2.5 MWH/a and 1,950 MWH/a respectively.

- Energy efficient lighting
- Energy management systems
- Solar PV (factory roofs are large!!)
- Solar hot water

MAIN ENERGY EFFICIENCY MEASURES IN FACTORY AND ADMINISTRATIVE BUILDINGS

- Building insulation
- Energy efficient windows
- LED lighting inside administrative buildings and in parking lots
- HVAC
- Office equipment

MINI CASE – PRINTING



A printing company with the capacity to produce 8,000 square meters of printed materials undertook a simple energy audit to improve its energy consumption. Resulting

from the consultants' recommendations, the company made the following improvements:

- Compressed Air – installed a properly sized air compressor, delivering the required 6 bar instead of 10, saving approximately 23 % of energy
- Installed LED lighting throughout and saved more than 60% on lighting energy
- Replacement of HVAC system reduced system related energy consumption by 30%

MINI CASE – METAL PROCESSING



A large metal processing company with the production capacity of three thousand reinforced concrete units per month invested in optimizing the energy efficiency

of its plant. The project consisted of installation of new press scissors to reduce operational costs and energy consumption in the melting furnaces, decentralization of compressed air system, heat recovery and automatic control systems. The investment resulted in annual energy savings of 30,000 MWh per year and also reduced production wastes and operation time.





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Energy Efficiency and Renewable Energy in Retail

The retail sector spans a wide variety of businesses. However from an energy conservation point of view, there are two main differences: food retailers, i.e. those that require on-site refrigeration of perishable goods and non-food retailers, i.e. those who don't. No matter which of these two categories your business belongs to, all retailers benefit greatly from becoming energy efficient whilst increasing the comfort of customers and the productivity of their employees. Higher profitability is the reward that retailers enjoy as a result of sustainable energy investments. Hard to believe? According to evidence presented by the Carbon Trust, a **20% cut in energy costs generates the same profit as a 5% increase in sales**. This means that retailers can improve their profit margin simply by reducing their energy costs.

OVERVIEW OF EXAMPLES FOR ENERGY SAVING AND RENEWABLE ENERGY INVESTMENTS IN THE RETAIL SECTOR

ALL RETAIL BUILDINGS

Insulation of building envelope

General building HVAC

LED lighting of common areas, outside lighting, LED signage

Solar PV

Solar Hot Water

WAREHOUSING (NON-FOOD)

Warehousing (non-food) can account for more than 10% of a retail company's revenue, with heating and lighting as the two largest energy users. The implementation of an energy management system can save up to 20% on energy bills without significant capital investment.

Lighting: for heights below 6 meters, consider high performance T8 lamps. For higher ceilings, high performance T8 or high-output T5 are the most efficient choice. BUT – LED lighting is the most efficient and has dropped sufficiently in price to be cost-effective for many warehouses.

HVAC: warehouses are often unoccupied by humans. Evaluate which comfort level is really necessary in the warehouse and size the HVAC accordingly.

Large warehouses: Conveyors and/or efficient motors on conveyors

FOOD RETAIL

Sales Floor:

LED lighting

HVAC

Refrigerators and freezers – with doors, tight covers

LED lighting in refrigeration cabinets and freezers (do not emit heat)

Compressors

Efficient ovens for in-store bakeries

Warehouses:

Insulation and doors in cold storage rooms

LED lighting

Compressors

Conveyors and motors

ALL ADMINISTRATIVE AREAS

Occupancy sensors in addition to LED lighting for halls and bathrooms

Sensors on windows and building energy management system

HEATING, VENTILATION AND AIR CONDITIONING

Upgrading heating, ventilation and air conditioning (HVAC) systems presents another major opportunity to manage energy consumption in retail space. HVAC accounts for 47% of energy use. HVAC rooftop units (RTUs) are the standard equipment used by retailers and their performance is key to energy consumption.

- Replacing a 15 year old RTU can save 20-30% of energy, assuming the unit is well maintained, or even 40% if it is not.

For small format retailers, rental agreements with landlords can limit opportunities beyond simple temperature setting procedures, which are difficult regarding HVAC upgrades.

Regardless of the approach taken, upgrades should be strategically staged to occur **after other energy efficiency measures are complete** to ensure that new units are properly sized based on facility heating and cooling loads. See below for 'Other Measures': Building Shell, Refrigeration, Lighting, Solar PV.

MINI CASE - LED LIGHTING



Major UK food retailer goes all LED in one of their Express Stores: All external signage at the new store, as well as lighting on the sales floor and in staff areas is made up of energy-efficient LED fittings.

In addition, the store's cold rooms, fridges and freezer are lit by LEDs, which are even more efficient compared with standard lighting in cold temperatures. The only place in-store where standard lighting is retained is in the bakery oven, where temperatures are too high for LEDs to function. The company expects the LED lighting to produce a 30% energy saving for this Express store.

BUILDING SHELL

This refers to the basics of energy efficiency in retail. Ensure that the building is insulated. Strike a balance between maximization of daylighting (to reduce the energy cost on lighting) and energy saving by using low-e glazing.

REFRIGERATION

Commercial refrigeration systems account for 40 to 60% of electricity consumption in food retail (compared to 7-8% for non-food retailers).

Reduce energy consumption by:

- Replacing refrigeration and freezer unit lighting with LED technology. They generate less heat waste. Energy savings of over 40% from the use of LEDs are possible
- Installing refrigeration cabinets with doors can reduce energy consumption by 60% as compared to conventional models

MINI CASE - REFRIGERATION



A small Dutch retailer with six stores in the southern Netherlands installed an integrated CO2 transcritical system (natural refrigeration) in its central warehouse. The installed unit has a capacity of 100 kW at medium

temperature and 16 kW at low temperature. The system also provides heating in the winter thanks to a heat recovery unit that uses the waste heat from the refrigeration rack.

LIGHTING

Lighting can represent up to 35% of energy use. But, retailers rely on lighting to attract customers and maximise sales. Energy savings from changing your approach to lighting can be achieved by:

- Installation of Compact fluorescent lamps (CFLs) – save 20-25% of the energy
- Installing LEDs can save up to 60-80% of lighting costs if they replace traditional lighting fixtures
- Use occupancy sensors in staff and utility areas (including corridors, bathrooms, storage rooms) to reduce the cost of lighting
- Additional savings come from reduced maintenance due to the longer bulb lifespan (nearly double the lifespan of traditional fluorescent lighting)

TAKE ADVANTAGE OF THE LOW-COST LOANS FROM LEEREFF

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CHECK YOUR PIPING

A supermarket refrigeration system consists of many components that act together as one system. Display cases, compressor racks, condensers, and walk-in refrigerators and freezers are the major energy consuming components. Walk-in cold storage chambers and compressors are located in the back of the store, with condensers typically on the roof. In the conventional "remote condensing" refrigeration system configuration, an extensive network of piping delivers refrigerant gas from the compressor to the condenser to the display cases and back to the compressor, posing substantial opportunities for refrigerant leaks along the way. While the display cases and compressors together account for about 85% of the system's energy consumption, engineering studies have identified "win-win" opportunities within extensive piping system to improve energy efficiency at net cost savings.

Low or no-cost energy saving tips on refrigeration:

- Remove anything that might restrict the airflow around the fridge
- Use insulating blinds and covers
- Keep condensers (sometimes installed at the back of the display refrigerator or sometimes externally mounted), free from dust



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***Energy Efficiency and
Renewable Energy in
Small Workshop, Crafts & Services***

Lebanon is rich in small companies, trades and service companies, which comprise a large variety of enterprises as a whole. The sector in itself can broadly be segmented three categories each with several sub-categories:

Wholesale and retail: non-food retail, small supermarkets, wholesale and commission trade

Services: Office spaces, small hotels and guest houses (covered in a separate flyer), hairdressers, professional services, etc.

Smaller crafts and manufacturing companies: Manufacturing of small machinery, iron works, final products, etc., car trade, sales and repair

As a whole the sector comprising these trades and companies has a combined energy efficiency potential of at least 30%. However, these companies also suffer most from the lack of professional advice regarding energy efficiency. Quite often simple standard measures can generate a very good improvement in energy costs and to the end LEEREFF has developed the List of Standard Technologies (LET). The list provides potential investors with the possibility of selecting equipment and be confident, that the technology purchased will produce the desired energy savings. Most technologies are applicable across all sectors.

OVERVIEW OF EXAMPLES FOR ENERGY SAVING AND RENEWABLE ENERGY INVESTMENTS IN SMALL WORKSHOP, CRAFTS AND SERVICES

WHOLESALE AND RETAIL

Retailers and wholesalers, regardless of the size, require dry, clean and, in the case of companies handling food products, refrigerated spaces. One factor that differentiates retailers from wholesalers is the need for lighting, which draws in the customers and literally puts the product into the right light. The typically high electricity consumption in the sector can be reduced with investments in the following equipment:

LED and other efficient lighting systems

Split and central air conditioning units

Efficient boilers

Efficient refrigeration and freezers

Efficient ventilation

Efficient ovens for on-site baking and cooking

Energy management systems

Solar PV and solar lighting (wholesalers tend to have more roof space for rooftop installations)

SERVICES

Office spaces are for example companies within banking, finance, insurance as well as consultancies.

They primarily consume energy for heating and cooling rooms, lighting, ventilation and office equipment (PCs, servers, photocopiers etc.). Lighting makes up the largest portion of their energy consumption. The lighting being used is primarily general lighting such as strip light. Most places will also have spot and point lights, most often compact fluorescent lamps or halogen lights. The LEEREFF LET offers:

- LED and other efficient lighting systems
- Split and central air conditioning units
- Efficient boilers
- Solar PV and solar hot water

Other Small Businesses cover a wide range of services such as hairdressers, solariums, laundries etc. In some cases, energy consumption is comparable to that of retailers, whereas others require more energy-intensive equipment like washing machines or sunbeds. The LEEREFF LET offers:

- LED and other efficient lighting systems
- Split and central air conditioning units
- Efficient boilers
- Solar PV and solar hot water
- Efficient commercial washing machines
- Efficient equipment for the leisure and beauty service providers

MINI CASE – AUTO-TRANSMISSION REPAIR SHOP



The nature of the automotive transmission repair business requires working with tools in a complex, hands-on environment. The Automotive transmission repair shop needed a lighting solution

that would improve visibility and safety in their shop. By investing in the replacement of the outdated T12 fluorescent lighting against efficient LED, the repair shop had energy savings of over 50% and improved its working conditions at the same time.

SMALLER CRAFTS AND MANUFACTURING COMPANIES

Small manufacturers of machinery, furniture, household appliances and medical equipment. Energy consumption is typically centered around lighting, cooling, ventilation, air compression and IT, but also some production equipment, including auxiliary devices such as compressors and motors. The LEEREFF LET offers:

- LED and other efficient lighting systems
- Split and central air conditioning units
- Efficient boilers
- Solar PV and solar hot water
- Efficient compressors
- Efficient motors and inverters

Car trade, sales and repair make up a relatively large sector in which energy is mainly consumed for heating and lighting up salesrooms and repair shops, which also use air compressors and process heating (e.g. spray booths). The LEEREFF LET offers:

- LED and other efficient lighting systems
- Split and central air conditioning units
- Efficient boilers
- Solar PV and solar hot water
- Efficient compressors
- Efficient motors and inverters
- Heat recovery systems

MINI CASE – SMALL SEWING COMPANY



The company with not more than 40 employees invested in various energy saving measures and is now saving 60.2 MWh/year:

- Installed a new highly efficient ventilation system
- Installed a modern heat recovery technology
- Replaced all lights with modern LED lamps
- Insulated the building and installed energy efficient windows
- Purchased 26 new and efficient sewing machines





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***Opportunities for
Suppliers***

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- Renewable energy
- Energy Efficiency in business and industry
- Green Buildings (Commercial Buildings only!)

Investing in energy efficient or renewable energy technologies, companies benefit directly from energy savings as well as modern technologies, whilst making a contribution to lowering the overall energy demand in Lebanon.

LEEREFF supports investments in energy efficiency and renewable energy:

- By providing longer-term loans, funded by EIB/AFD and channeled via selected Partner Banks
- Through favorable interest rates, subsidized by BDL
- Supporting investors with free technical assistance, provided by a team of international and local engineers, financed by the EU

Note: the LEEREFF team has no influence over the lending decision of Partner Banks.

WHO CAN APPLY?

All private enterprises formed under the laws of Lebanon and operating in Lebanon:

- Production companies, ranging from large factories through to bakeries, small technical and crafts workshops
- Service businesses, ranging from media companies, tourism companies through to hair dressing salons and dry cleaners
- Sole proprietors
- Any other private legal entities, including Energy Service Company (ESCO)

ESCOs should ensure that the energy performance contract includes a guarantee for a certain percentage of energy savings and that the loan incentives made available to the ESCO are at least partially passed on to the end-user.

Applicants must ensure that their **business activities are not in conflict** with the EIB/AFD rules of exclusion.

Excluded business activities include:

- Gambling
- Real estate with the aim of making profit on sales in the short and medium term
- Manufacture, supply or trade in arms
- All other activities excluded by the EIB and/or AFD (see this link for details: <http://www.eib.org/about/documents/excluded-activities-2013.htm>)

Note: The residential sector (including individual housing) and public sector projects are not eligible for LEEREFF financing.

LEEREFF LOAN PRODUCTS

LEEREFF offers two different loan types to meet the varying investment needs of companies. A **STANDARD LOAN** (€40,000 - €250,000) for standard equipment selected from our List of Pre-Assessed Technologies and **NON-STANDARD LOAN** for investments >250,000 - €15 million, for all non-standard technologies.

STANDARD LOANS:

Loans for standard investments are designed for clients who are planning to implement more simple energy efficiency or renewable energy measures, with an investment volume from €40,000 to €100,000 for single measures and up to a maximum of €250,000 for multiple measures.

Standard investment loans are restricted to devices and models, which have been pre-assessed by the LEEREFF team of experts. This list currently covers the following technologies:

- Thermal insulation and windows
- HVAC systems
- Monitoring and Control Systems
- Pumps, compressors and Motor systems
- Renewable Energy systems (PV, SWH)

All items on the List of Eligible Technologies (LET) were selected on the basis that they meet the LEEREFF requirement of saving **at least 20% energy**.

The full LET is available on our website: www.leereff.com, or upon request from info@leereff.com.

For items currently not listed, please contact the project office with product details and our team of engineers will evaluate the technology for possible inclusion.

NON-STANDARD LOANS:

These are for investments of >€250,000 - €15 million. Eligible investments include:

- General energy efficiency investments in industrial and commercial companies
- Green Buildings (Commercial)
- District Heating and Cooling Systems
- Co-generation of Heat and Power
- Renewable Energy, including:
 - Wind
 - Biomass
 - Hydro Power
 - Solar energy
 - Geothermal Energy

LEEREFF loans can cover up to 80% of the investment cost. LEEREFF loans can be supplemented by companies' own funds, a NEEREA loan or a conventional bank loan.

HOW SUPPLIERS CAN WORK WITH LEEREFF

Suppliers can work with LEEREFF in the following ways:

FOR STANDARD TECHNOLOGIES

If you are a supplier of Thermal insulation, HVAC systems, Monitoring and Control Systems, Pumps, Compressors and Motor systems, PV systems or Solar Water Heaters, the following cooperation possibilities are open to you:

- If your technology generates **at least 20% energy savings**, get your equipment included in our List of Eligible Technologies (LET). This list is continuously updated and is available to Partner Banks and to potential investors from our website and from our project office. Contact our project office with details of the equipment you would like to propose for inclusion in the LEEREFF LET.
- Make your clients aware of LEEREFF availability and advantages and help them apply to one of the LEEREFF Partner Banks.

FOR NON-STANDARD TECHNOLOGIES

Are you in the process of developing an Energy Efficiency project or a project that will lead to energy savings or a renewable energy project for your client? Suggest LEEREFF financing to your client. Even if you are supplying a new production line, the project may meet the LEEREFF energy saving criteria (see below).

TECHNICAL ELIGIBILITY CRITERIA

Green Buildings (Commercial):

- LEED (or equivalent) Platinum standard: LEEREFF can finance up to 36%
- LEED (or equivalent) Gold standard: LEEREFF can finance up to 28%

General Energy Efficiency Projects (Non-Standard Investments)

- Project generates >20% energy savings OR energy savings cover 50% of investment costs over the project lifetime, using 5% discounted rate

District Heating / Cooling:

- Heat mainly produced from high efficiency co-generation or RE
- Must be competitive vis-à-vis individual boilers in buildings

High Efficiency CHP

- Meets EU Directive 2004/8/EC

Renewable Energy:

- Solar: certified technology; site-specific irradiation yield assessment for >0.5 MWp.
- Hydro: Electricity generation cost base load <€120/MWh based on 5% real discount rate and 20 years economic lifespan. Large hydro-dams are excluded.
- Biomass: uses sustainable resource; Electricity generation cost base load <€120/MWh based on 5% real discount rate and 15 years economic lifespan. Biofuels are excluded.
- Geothermal: Electricity generation cost base load <€120/MWh based on 5% real discount rate and 20 years economic lifespan. Drilling excluded from LEEREFF financing.
- Wind: On-shore only; >1 year on-site wind measurements; Electricity generation cost base load <€120/MWh based on 5% real discount rate and 15 years economic lifespan.





**LEEREFF LOANS CAN COVER UP TO 80%
OF THE INVESTMENT COST**
LESS FOR GREEN BUILDINGS



Developed & Supported by:



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Lebanon Energy Efficiency & Renewable Energy Finance Facility



SUPPORTED BY Banque du Liban

Sustainable Energy Investment ➤ *Improved Business Results*

Energy Efficiency and Renewable Energy in Textile Production

The textile industry holds the record for one of the lowest efficiency in energy utilization and is one of the major energy consuming industry. About 34% of energy is consumed in spinning, 23% in weaving, 38% in chemical processing and another 5% for miscellaneous purposes. In spinning/weaving processes mostly electrical power is consumed, while thermal energy is the major energy in chemical processing.

Electrical energy is mainly for running the various processing machinery, and there is a vast array of different processing machines used in textiles.

The major consumption of electrical energy in the textile industry is in the manufacture of yarn and cloth, which uses 75-80% of the total power requirement in a textile mill.

OVERVIEW OF EXAMPLES FOR ENERGY SAVING AND RENEWABLE ENERGY INVESTMENTS IN TEXTILE PRODUCTION

GENERAL

Building energy management systems
Building insulation
HVAC
LED Lighting
Occupancy sensors
Solar PV
Solar hot water

PRODUCTION PROCESS

Utilisation and production machines (Textile production has a vast number of processes and sub-processes and accordingly a very wide variety of machinery – these are not listed here in detail)
Compressors
Transformers
Motors and drives
Steam/heat production
Heat recovery
Renewable energy and cogeneration (e.g. CHP)

QUICK-WIN MEASURES IN APPAREL MANUFACTURING

Installation of **high-efficiency motors**: Replacing old standard-efficiency engines with new high-efficiency ones (reference: IE3/ IE4) can produce 30% energy savings while generating the same power.

Compressed air distribution: reduction of network leaks in all pipe networks distributing compressed air can save as much as 30% energy.

Compressed air: **decrease of the temperature of intake air and decrease pressure**. Lowering the air temperature and pressure reduces the amount of energy necessary to pump air through the distribution network.

LED lighting: On average, replacing previous generation lighting system with LED lights may offer payback in time of as little as 18 months.

Install inverter (VSD's) on motors with variable regimes. Inverters reduce the engines' speed to guarantee the minimum amount of energy is used, for instance to ventilate rooms. Energy savings can easily be 50%.

Cold Water Storage: Cooling system can use stored cold water (7° degrees), which is cooled down when energy is cheaper. When energy prices changes throughout the day, it may be convenient to cool a large amount of water, store it and use it in a time when the energy price is at its highest.

Insulation of steam pipelines: Appropriate isolation of pipes can reduce heat losses by 90-95%.

Power factor correction: functioning electrical engines generate reactive energy, which is to be neutralized by power factor correction. This can be done either by the energy producer or by the company using energy. Costs to address this point can be very high in some countries and can be avoided if companies invest in the installation of **power correction devices**.

Replace flat belts with **V belts in electrical engines**. V belts are more efficient than flat belts.

Install **low-loss transformers**: Efficient electrical transformers can minimise losses due to constant power supply.

ENERGY EFFICIENCY INVESTMENTS WITH BIGGER WINS IN TEXTILE MANUFACTURING

Introducing **Point-of-Use Water Heating** in continuous washing machine: Point-of-use gas-fired water heaters can be used to enable processes to be run independently of plant central boiler systems.

MINI CASE – LIGHTING



As a pilot project, a textile company tested the installation of LED lighting in a separated area, which covers about 20% of their production facility. With 58% the electricity

savings were very satisfactory. The test also confirmed that there was no negative influence on the microclimate and that the new lighting improved the quality of the working conditions. The company has rolled out the conversion to LED lighting throughout the plant.

MINI CASE – MICROWAVE DYEING EQUIPMENT



A textile company invested approximately USD 360,000 in Microwave dyeing equipment and saved 90% energy in comparison to the old beam dyeing machine.

MINI CASE – HEAT RECOVERY EQUIPMENT



A company that invested around USD 300,000 into heat recovery (air/water), where exhaust air heat is now used to heat up service water for wet finishing (for example washing, dyeing,

and bleaching saved 30% of stenter energy used).

MINI CASE INVERTERS



Adjustable speed drives better match speed to load requirements for motor operations, and therefore ensure that motor energy use is optimized to a given application. Up to 60% of energy can be saved per motor.

This means that boiler and distribution losses associated with centralized systems can be eliminated. **Up to 50% energy savings** can be expected.

Heat Insulation of high temperature/ high pressure dyeing machines: Insulation of pipes, valves, tanks and machines is a general principle of good housekeeping practice that should be applied in all steam consuming processes in textile plants. The insulation material may be exposed to water, chemicals and physical shock. Any insulation should therefore be covered or coated with a hard-wearing, chemical/water resistant outer layer. Savings of 2% in steam consumption per kilogram of dyed yarn.

Use of solar energy for de-sizing and scouring enables almost 40-50% energy saving.

Proper pump sizing and multiple pump arrays:

Replace oversized pumps against correctly sized pumps and save 15% to 25% of electricity consumption for pumping. Also, invest in multiple pumps for varying loads by installing parallel systems for highly variable loads and your savings go up to 50% of the electricity consumed for pumping.

Discontinuous dyeing with airflow dyeing machine:

Airflow dyeing machines have lower liquor ratios than conventional jet dyeing machines. To achieve those low liquor ratios, within the jet dyeing machine, the fabric is moved by moisturized air or a mixture of steam and air only (no liquids), aided by a winch. The prepared solutions of the dyestuffs, auxiliaries and basic chemicals are injected into the gas stream. Up to 60% can be saved on the machine's fuel use.

Vacuum impregnation squeezes out the air from the cloth and provides better dye or chemical impregnation and more uniform application. That means you improve quality AND generate 60-65% fuel saving compared to conventional system.

Vacuum roll extractors save 70-75% in energy.

If you are planning improvements in your production process consider a reduction in processing steps by combining some of the constituent wet processing operations in a given processing sequence. This may help reducing the number of e.g. washing and dryings steps. Here some examples:

- One bath bleaching may reduce electrical inputs by 70%.
- A lower number of ends/turns jiggers may help in saving around 20% electrical input.
- Eliminate curing in printing and save 100% electrical input for the curing step.



WHAT IS LEEREFF?

LEEREFF stands for 'Lebanon Energy Efficiency & Renewable Energy Finance Facility'. LEEREFF is a dedicated credit line for companies who wish to invest in sustainable energy including:

- Renewable energy
- Energy Efficiency in industry and commerce
- Green Buildings (Commercial)

LEEREFF offers investment support through loans from The European Investment Bank (EIB) and Agence Française de Développement (AFD), with interest rate subsidies provided by the Banque du Liban (BDL), and free technical assistance provided by an international team of engineers, financed by the EU.

Please visit our website to find out how you can benefit from and apply for a LEEREFF loan: www.leereff.com



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