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● **Palestine  
Municipality of Tulkarem  
Sustainable Energy  
Action Plan (SEAP)**





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# **Sustainable energy action plan (SEAP)**

**Municipality of Tulkarem**  
**- Palestine -**

**Integral document of the sustainable  
energy action plan**

(4 January 2016)



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# Section I: SEAP Summary

## 1. Strategic vision

### 1.1. Municipal strategy

The development of a municipal strategy – in consultation with elected officials and other local stakeholders – that is endorsed by the municipal council is critical for the effective implementation of national policy at the local level. The strategy, which comprises quantifiable objectives, is the basis for developing actions and measures to reduce energy consumption and integrate renewable energies in the territory.

The development of the sustainable energy action plan (SEAP) constitutes the basis for implementing the municipal strategy. It requires:

- The **strong involvement of local elected officials** during all of the phases of the SEAP project in order to direct and ensure a coherent overall municipal policy. To implicate elected officials' actions must be carried out to inform, educate and train them on national energy efficiency and renewable energy policies.
- **The action plan must be developed based on the specific energy situation of the municipality outlined in the baseline emissions inventory (BEI):** the sectors that consume the most energy and emit the most greenhouse gases in municipal property as well as other sectors in the municipality
- **Setting up and training of a municipal sustainable energy unit:** energy is a transversal issue that touches several levels of municipal services. In order to manage it properly, a team, with well-defined roles and responsibilities, will be created to manage and monitor the action plan, as well as to provide feedback on and evaluation of the implementation process, so as to ensure its efficiency.

In addition, in order to guarantee the development and efficient implementation of projects, the municipal local authorities must:

- Follow energy efficiency and renewable energy regulations
- Define a clear and long-term local energy policy for the municipality
- Set aside an annual budget, based on the action plan laid out in the SEAP, for energy efficiency and renewable energies
- Inform, educate and train municipal employees on an on-going basis
- Create partnerships with local professionals for energy efficiency and renewable energies
- Search for additional funds to complement the municipal budget and financial backing to support the execution of the SEAP (energy efficiency and renewable energies)
- Develop public private partnerships (PPP)

The public promotion of the local energy efficiency, renewable energy and environmental protection strategy will provide visibility for all of the local actors and stakeholders that take part as providers or beneficiaries. The regulatory and incentive measures put in place will stimulate the local market, attract national investors and local entrepreneurs to contribute to the development of the market and will create local jobs.

### 1.2. Municipal vision

The municipal vision is based on the strategy and medium to long-term objectives of the municipality, as well as those at the national level. Keeping in mind its specific context, the municipality is developing a strategy consistent with the Palestinian energy strategy and the sustainable development needs of the territory.

This strategy is structured around two levers:

- Reduce energy consumption in all sectors through energy conservation and efficiency, in order to provide better services while reducing costs and impacts.
- Promote energy production from locally available renewable resources in order to cover, as much as possible, energy needs from these decarbonized sources.

As energy consumption is dependant on many stakeholders within a given territory, the strategy needs to include all of the concerned actors. All of the activities that take place within the territory will be included in the energy consumption reduction and renewable energy promotion measures. These measures also strive to protect the local environment (air, water, soil, waste) and contribute to the protection of the national and global environment (GHG).

On-going information and awareness raising actions must lead to the strengthening of energy consumption reduction commitments and the increase in production of local renewable energy by actors operating in the territory. These activities include the following sectors:

1. Housing stock (energy conservation and efficiency / renewables energy development)
2. Housing market (mobilisation of professionals)
3. Transport and mobility (planning and reduction of urban traffic)
4. Active mobility (development of a cycling policy and promotion of walking pathways)
5. Mobilisation of the local industrial sector
6. Management and treatment of solid waste and wastewater
7. Development and integration of renewable energies
8. Development of a local renewable energy market.

### **1.3. Municipal objectives**

In accordance with national policy, the Municipality adopted the following strategic objectives within the framework of its sustainable energy development policy:

1. Reinforce and promote energy efficiency in municipal property, public infrastructure and other local activities.
2. Promote the integration of energy efficiency and renewables into public and private housing construction projects in the municipality.
3. Integrate the development of energy efficiency and renewable energy into the municipal sustainable development plan (job creation, local energy efficiency and renewables market, market for local services, etc.).
4. Implicate all of the territorial actors in the promotion of energy efficiency and the development of renewables,
5. Develop a sustainable energy action plan (SEAP) in the city.
6. Develop partnerships with all of the providers that are favourable to the implementation of the SEAP.
7. Reduce energy consumption and GHG emissions by 20% in the Municipality by 2020.
8. Inform the public about the true cost of energy and make known the incentives and initiatives that encourage energy conservation and efficiency.
9. Create energy conservation and efficiency, renewable energy development and environmental protection communication plans that target the local population and the socio-professional categories present in the territory of the city.
10. Reduce energy needs during peak periods by managing electricity demand and by changing energy and gas consumption behaviours and habits.
11. Coordinate with the government on the national strategy and energy efficiency and renewable energy action plan, as well as on the review of the municipal sustainable energy action plan.

Among these objectives, the primary objectives of the municipality are to:

- Reduce energy consumption across the board by around 20 to 25%

- Reduce GHG emission by 20 % in 2020, compared to the business as usual scenario and using the 2014 baseline.
- Continue efforts to reduce energy consumption and improve efficiency resulting in a continuous trend of improvement of energy intensity (Energy consumption compared to Gross development product)
- Continue reducing GHG emission with the objective of containing GHG per capita below 1,8 tons or less on the long term as a significant contribution to global efforts to combat climate change, in application of the Paris Agreement adopted at COP21.
- Improve services to inhabitants and all stakeholders in order to promote a better quality of life in the city.

To place the issues of the territory into perspective, it is important to note the results of the Baseline emissions inventory (BEI) of the municipality:

- **Consumption:** Transport and residential buildings account for 40% and 44%, respectively, of Tulkarem's energy consumption.
- **Emissions:** Transport, residential buildings and waste management are the largest emitters of greenhouse gases and account for 83% of Tulkarem's emissions.
- **Emissions from municipal property:** Public lighting and water management are the main sources of emissions for municipal assets and represent approximately 3% of the city's overall emissions.

#### 1.4. Implementation of the strategy

In order to implement the strategy, it is necessary to develop a municipal sustainable energy action plan. The SEAP is based on the assessment of all the sources and types of energy consumed and the GHG baseline emissions inventory (BEI).

The action plan must include actions to reduce energy consumption as well as support measures to ensure that the plan is executed according to the set calendar.

**The action plan is structured in two parts:**

- **Actions for municipal buildings and services:** presentation of the activities that fall under the direct responsibility of the municipality (the buildings it manages and the services that fall under its authority).
- **Actions on the territory of the municipality:**
  - Presentation of the activities that can be put in place independently of municipal actions, but that need to be supported and facilitated by the municipality in order to ensure the coherence of the different projects.
  - Presentation of the main potential actions to create and develop a renewable energy market, as well as the constraints and barriers that must be overcome.

## 2. Actions on municipal buildings and services

### 2.1. Municipal buildings

The municipality owned 15 buildings in different location representing 5.300 square meters of offices, warehouses and technical facilities. These buildings include, the city hall main building, the water and sanitation office, the electricity management building, the library, a maintenance facility, the public works building, the citizen centre "one stop shop" and six other small buildings.

Municipality buildings (without schools and mosques) consume **669 MW/h of electricity per year** (2014 reference), which represents an annual expense of 334 K ILS (equivalent to 73 K€/y). This consumption comes from lighting offices, cooling and heating, office equipment, elevators, etc.

In 2012, an investigation was conducted on electricity consumption in municipality buildings and services. This study was the first one focusing on the subject. It highlights the potential of energy saving for the municipality. The report made some practical recommendations in various domains: lighting in offices, heating and cooling, street lighting, and electricity grid management...

As a follow up of this investigation some pilot projects were developed regarding street lighting. However, this 1<sup>st</sup> approach wasn't followed by a comprehensive energy management strategic plan.

Regarding renewable energy, although some projects were identified, and despite the fact that municipal buildings offer significant space to install solar PV, there is no project implemented yet.

#### **Short-term actions**

More efforts should be done in **raising staff awareness** to adopt new behaviour favouring energy conservation: Opening curtains and window shutters during daytime to reduce artificial lighting; Shutting down electric equipment at end of working time or when not actually used; Controlling temperature (at 23°C) to limit heating / cooling energy consumption.

**Lighting in buildings** represents **around 20%** of electricity consumption in municipality buildings. Some efforts were made to switch to efficient bulbs, however there is still no tight control of lighting and no automatic device to turn it off after a certain time or when there's nobody in a room.

To help reducing energy consumption at the municipality building, it is possible for example to install motion sensors in the offices to turn the lights off during the un-occupied periods. This will reduce the lighting consumption by around 20% to 80% based on the occupancy type of these areas. The 2012 case study demonstrates that a 30% cut could be achieved pretty easily installing "motion sensors" in key areas, with an overall cost of less than 50,000 ILS (11,000€) and a return on investment of two and a half year, as cost saving will reach 20K ILS – 4,500€ / year<sup>1</sup>.

**Cooling and heating:** Electricity consumption for heating and cooling **represents 74%** of the overall consumption in municipality buildings. Buildings and offices are equipped with more than 65 split AC/Heater reverse units. There is no central control system for temperature.

In June 2015 a new rule was established setting temperature limits as follows: not less than 22°C in summer, and not more than 25°C in winter. These limits have also been set according to public health recommendations specifying that the gap between outside and inside temperature couldn't exceed 7 to 8°C. The rule has been enforced after distribution of an official notice in all municipality services. One person ensures regular temperature controls: when measures exceed the limits, the AC/heater get disconnected for the rest of the day, as a penalty for the room regular users.

**Electric equipment:** So far office electric equipment (computers, copiers, printers, etc.) is basic. Reduction in consumption could come, on the short term, from a more rigorous management to turn off any device not used, and on the longer term, from switching to more energy efficient units

#### **Long-term actions**

##### **On the long term, energy consumption could be further reduced through two mechanisms:**

- Replacing old equipment by more energy efficient ones.
- Renovating old building with adoption of low carbon technologies - improved insulation, double-glazing or low emitting windows, central heating cooling systems, efficient lighting etc.

Tulkarem Municipality already launched the rehabilitation process for the ground floor of the city hall main building (insulation, electric grid renovation, new lighting system, etc.). The return on investment should be carefully assessed before engaging more renovation. It seems preferable to include energy efficiency measures in renovation plans motivated by other reasons (apart from promoting energy efficiency) as the pretty low level of energy consumption per square meter (XX KWh/sqm) will make it difficult to reach sufficiently attractive return on investment.

## **2.2. Street lighting**

Street lighting in Tulkarm consumes 4,500 MWh of electricity per year (2014 reference), which represents an overall annual cost of 2.6 Million NIS (Equivalent 572,000 €/y).

Like in other Palestinian cities, various types of lamps are used for street lighting: High Pressure Sodium (400 and 250 watt), Metal Halide (400 watt) and Mercury Vapor (125 watt). The entire service requires around 7.000 lamps and is controlled by a central and manual on/off system.

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<sup>1</sup> Promotion of Energy efficiency & renewable energy in strategic sectors in Palestine, Tulkarem Municipality Report 19, June 2012

Street lighting represents almost 1/3 of the electricity consumed by Tulkarm municipality facilities and services, so it's worth improving the energy efficiency of the street lighting system.

### **Short-term actions**

The Municipality launched different pilot projects to explore ways to improve street lighting efficiency. This first test was run on installing 250 new lamps on a 6 km road on the boundary of the city. The result appears to be interesting offering a 52% reduction of energy consumption compare to classical lamps. That means saving 116,000 ILS (25,500€) per year ensuring a R.O.I of two years considering the high cost of lamps (200€ per unit). Over a longer period of time (12 years as the guaranteed life time of LEDs) the investment will generate significant budget saving, which will allow for additional investment capacities. Such a move is very important considering that street lighting represents 1/3 of the overall municipality energy bill.

Another test will also be launched in Mega Land Street, where HPS 250 watt lamps will replace with LED lamps. 143 units will be provided with the financial support of the World Bank. Initial calculation reveals a 50% cut in electricity consumption offering 2 years return on investment.

Additionally, a pilot plan is under preparation to redesign street lighting at one of the entrance of the city (road from Kalkilya).

### **Long-term actions**

#### **Revolving fund to replace HPS lamps / PRIORITY ACTION #1**

From initial investigations, and whatever will be the technical solution, replacement of old lamps by modern technologies (HPCF or LED), appears to be very cost effective.

The Municipality looks for a 400 K€ financial support to feed in a revolving fund dedicated to old lamps replacement. The Electrical department, managing street lighting, will set up a specific budget monitoring mechanism and put aside financial resources preserved due to more efficient lamps replacing, step by step all devices. Resources saved will be invested again in lamp replacement. This set up could ensure full replacement over time (in seven years if replacement by LED, and even less if part of the lamps would be replaced by HPCF lamps instead of LED) ensuring at the same time replenishment of the initial investment fund.

The detailed process for this revolving fund is detailed in the priority action fiche.

#### **Street lighting strategic plan**

Based on the Master plan produced in 2012 with the support of the EU, it now should be possible to design a **street lighting strategic plan** identifying areas of differentiated usage, where lighting would be then adapted to the actual needs per specific area.

- Main roads, avenue and city entrances where high intensity lighting should be necessary at least between sunset and midnight and before sunrise. Note that lighting intensity could be easily reduced, even in these areas between midnight and few hours before sunrise.
- Secondary streets where reduced lighting intensity should ensure safety while allowing low energy consumption.
- Specific areas (parks, narrow streets, pedestrian areas, etc.) where moving sensors should be installed to light up when people are around and avoid lighting when nobody is there.

Such an improvement in urban planning and street infrastructures linked with a tighter management of public demand, should lead to designing a lighting system combining qualitative lighting and reduced energy consumption. This evolution will require a combination of technical solutions (moving sensors, midnight automatic reduction, etc.) and social dialog to improve acceptance of different approaches (i.e. reduced lighting after midnight, appropriate lighting in narrow streets, parks, etc.).

## **2.3. Water distribution**

Municipality ensure water delivery for the city, two refugee camps and few villages on the outskirts of the city. There are 6 pumping stations owned and managed by the Municipality. Water from the underground table gets pumped into a main reservoir (1000 cubic meters) and 5 secondary reservoirs (500 cubic meters). The water distribution network ensures delivery all over the city from these reservoirs. Note that the highest multi stores buildings need additional pumping devices.

The system is set up and running for 100 litres/capita/day. Municipality uses 12 million CbM/year. This amount represents almost 50% of PNA allowed capacity from the western water table.

As per Oslo Peace Agreement, PNA was allowed to use 25MCbM/year. Thus, there is now a lot of pressure from the National water authority to contain water consumption in areas like Tulkarem (in the Northern part of West Bank) to allow more quotas to the Southern part of West Bank where cities (like Hebron) are facing real difficulties due to water shortage. Tulkarem Municipality doesn't want to reduce its pumping capacity and would, logically, prefer that PNA negotiate additional pumping capacities for the entire West Bank area.

One way to significantly improve the water distribution system would be to reduce leakage, which represents up to 40%. Leakage is due to the pretty old water network. It results in energy wastage for pumping additional water to compensate the leakage.

Note that individuals are incentivized to save water as the tariff depends on the amount of water consumed. Tariff is set at 2,5 NIS / CbM up to 30 CbM/year, and 3,5 NIS /CbM beyond this limit.

### **Short-term actions**

Efforts will continue to promote energy efficiency through working on pumping engines (adopting variable speed pumps). The 2012 study indicates that the average pumping efficiency can be less than 40%, with 10% of pumps operating below 10% efficiency. Oversized pumps and the use of throttled valves were identified as the two major contributors to the loss of efficiency. Energy savings in pumping systems of between 30% and 50% could be realized through equipment or control system changes. Short-term actions could be as follows:

- Shut down pumps when they are not required.
- Maintain clearance tolerances at pump impellers and seals.
- Check and adjust the motor driver regularly for belt tension and coupling alignment.
- Clean pump impellers and repair or replace if eroded or pitted.
- Implement a program of regular inspection and preventive maintenance to minimize pump component failures.
- Trim the pump impeller to match system flow rate and head requirements.
- Replace out-dated / unsuitable equipment with correctly sized new units.

### **Long-term actions**

On the long term the Municipality is committed to work on water leakage reduction, which will have a direct impact on energy consumption reduction, as less water would need to be pumped into the network. Initial investigation where already launched to assess the needs. The overall plan to upgrade the water network still need to be designed, funded and implemented.

## **2.4. Water treatment**

62% of the population in Tulkarm is connected to the sewage system. Most of the sewage network is new, well designed and efficient. However, no more than 10% of the city is covered by rainwater collection system.

The Municipality uses pre-treatment ponds on the western part of the city, and then transfer the grey water to the Israeli treatment plant for final processing. 85% of wastewater is pre-treated and around 15% is running through natural streams without any treatment.

One of the agreed projects with KFW is to build a treatment plant at the western side of the city. The project is under negotiations with the Israeli authorities. Most probably the Israelis authority will not grant the permit for the plant as they prefer to continue treating Tulkarem waste water and benefit from the use of the treated water in local agriculture (for Israeli farmers).

### **Long-term plans**

If the project of a wastewater treatment plant had to be confirmed, it would be good to consider promoting the addition of a bio-digester that could process sludge from the wastewater treatment, and bio-waste that could be generated from a separate collection project to be promoted.

If Tulkarem had to continue with the current pre-treatment pounds, it will have to deal with the sludge from the pool (700 cubic meters to be processed every 3 years). As the sewage network will expand to neighbouring villages, it will have to treat another 300 cubic meters every 3 years.

This amount of organic material has to be considered, along side with organic waste potentially collected in the city, as resource for feeding a possible bio-digester unit.

## 2.5. Solid waste management

The Municipality service operates 8 trucks with compactors (on the city perimeter). This service collects 22.000 tons/year in the city itself, and 7.500 tons/year from the two refugee camps embedded in the city boundaries. The Municipality service also collects 30,000 tons/year in the other parts of the district. This represents 1 kg per capita / per day in the city and in the camps, slightly less in rural areas around the city.

Waste composition breakdowns as follows: 25 to 30% bio-waste – 15% carton and plastic, the remaining part (50 %) being a mix that cannot be recycled.

The total amount of waste collected represents 50 to 60 tons/day from the city (and the 2 refugee camps) and reaches 100 tons/day when joining with other parts of the district. The amount of waste collected goes every day to the transfer point managed by the Jenin joint service council, and then to the Jenin sanitary landfill servicing the northern part of West Bank.

### Short-term actions

The Municipality is committed to work on reducing waste to be collected as the major solution to reduce energy consumption generated by waste management.

In that sense, Tulkarm already benefits the support of the EU to run a **pilot project** to reduce waste, developing selective collection of bio-waste starting with local markets. The project already collects 5 to 7 tons a day through this separate channel (10% of the overall amount of waste collected in the city).

Beginning of September 2015 another work stream will open for selective collection of paper and cardboard. This will be managed by private contractors, granted permit by the Municipality, and selling back such material to specific companies in Jordan.

Step by step the Municipality learnt how to reduce the total amount of waste transferred to landfill, through using part of the bio-waste to produce compost in cooperation with the Dhinnabeh Agricultural Society, as well as separating carton for recycling. By 2020, the Municipality aims at diverting 30% of waste to compost avoiding GHG emission from landfilling. On the long term, the objective is to reduce waste transferred by 50%, recycling 80% of cartons and 50% of bio waste.

The Municipality will continue developing **public awareness** to reduce waste generation, promote recycling and separation. The idea is to draw experience from the pilot project to then be extended to the entire city.

### Long-term actions

As the follow up of the pilot project mentioned above, it would be good to promote the recycling business that would stimulate the separate collection and ultimately reduce the amount of waste going to landfill. The Municipality is committed to follow a step-by-step approach to do so.

It is also important to define what would be the best use of collected bio-waste. Ideally this product could be mixed with sludge from wastewater treatment to produce methane in a bio-digester. However, such a project should be designed at district level to reach the appropriate scale for a good technical and financial efficiency of the project.

Biogas recovery from Jenin landfill is another option to produce energy from domestic waste. However, the Joint Service Council can only manage such a project.

## 2.6. Other services and long-term responsibilities

### Municipal fleet

The Municipality run 40 vehicles in the municipality fleet. To reduce these emissions and save energy few options can be develop:

- Tighter monitoring of the fleet is used to ensure that actual usage is in line with the purpose of the Municipal fleet, and to optimise this usage based on accumulated experience.
- Drivers training to adopt eco-efficient driving behaviour (improving ones driving patterns might result in 10 to 20% consumption cut)

In the longer term, old vehicles should be replaced by low emitting ones (either gas powered vehicles or electric ones when electricity can be provided by renewable sources).

### **Public procurement policy**

The Municipality being an important “buyer” of goods and services could introduce energy and climate change criteria in its public procurement rules.

The Tulkarm Municipality through few tenders (e.g. for water pumps) already considered criteria regarding energy savings allowed, as the main issue for awarding the purchased equipment.

### **Sustainable urban planning**

The Municipal Council, by defining how urban development will shape, has a very important role to play on long term climate and energy performance of the entire city.

A dense city, where services are easily reachable; and where people can live close to where they work will result in decreasing mobility demand, meaning less cars, less traffic congestion, less GHG emissions... On the contrary linear extension along the entry roads will impose long commuting distance between living places and working places or services...

Tulkarm already established a detailed mapping. It would be could to check how the development plan that could be designed from this mapping could help reducing energy consumption.

A strategic development plan should promote specific areas for industrial development, for greenery and recreation, specifying for each of these areas the type of road infrastructure, street lighting, water management, waste collection services, which will be organised to cope as closely as possible with the demand and avoid wastage of space, energy, water...

### **Skills and expertise development**

Availability of a local authority staff presenting the adequate skills and expertise in terms of technical knowledge (energy efficiency, renewable energies, efficient transport) or project management (data management, financial forecasting and investment planning, communication skills, green public procurement, etc.) need to be developed everywhere in Palestine.

Tulkarm Municipality is looking to improve its staff experience and to implement the good knowledge for serving the city and surrounding, and expect to improve its team experience.

## **2.7. Awareness campaign**

It is not only good to raise awareness among Municipality staff for them to make necessary efforts to promote energy conservation in their daily work, it is also important to continue developing awareness programme among citizens and stakeholders in Tulkarem.

Many plans have been already implemented in Tulkarem: leaflets, TV programmes, posters, article in local newspaper, face-book pages, etc. The Municipality organize such campaign twice a year. There is no specific team in charge of public awareness, thus such are carried on and coordinated by the technical teams dealing with energy, waste and water. These people consider that, although awareness remains important, it is very hard to assess the impact of awareness campaigns.

### **Possible actions**

As local population and local stakeholders are always in need for additional mobilization in the field of energy conservation and renewable energy development, it would be good to develop a strategic road map to raise awareness among all stakeholders in Tulkarm.

This could be done through the following actions:

- Spreading **information and training material** (posters, brochures, stickers, etc.) to remind everyone of the importance of energy saving as a driver to save money as well to contribute to a cleaner environment.
- Develop an annual event “**Energy festival**” where best practices could be demonstrated and innovative projects celebrated. Such a festival could be promoted through a large advertising campaign mobilising all traditional media but also social networks online.
- Unroll specific awareness campaigns among specific target groups, for example through the development of a network of “**Positive energy schools**” that would produce more energy than they actual consume, with a combination of energy conservation / energy efficiency measures and the development of Solar PV on schools roofs to generate electricity. Teachers should be engaged in such programmes to use all the potential of the technical development, as support for training students.

### 3. Action plan for Tulkarem's urban area

#### 3.1. Residential and tertiary buildings

The residential and tertiary building sector is the first one in terms of energy consumption (51% with 161 GWh/year) and GHG emission (43% with 82 ktCO<sub>2</sub>eq/year).

The electricity used in residential and tertiary buildings is purchased from the IEC, which offers rather poor performance regarding CO<sub>2</sub> content per KWh. Electricity costs 0,58 ILS / KWh for residents. The average consumption per households reaches 350 KWh/month, meaning a 200 ILS budget per month (2,450 ILS/year or 500 to 550 €/year).

Solar heating (for water) is widely spread in Tulkarm: around 70% of dwellers are equipped with such devices (compare to 64% in West Bank).

Liquid gas is also used in housing mainly for cooking.

#### Short-term actions

It is still necessary to **raise public awareness** on energy issues, inviting inhabitants to reduce their consumption and, as a consequence, cut their energy bill. However, the margin for improvement remains pretty low. People care about their expenses and they naturally tend to control their energy consumption.

Public awareness should then concentrate on simple actions that inhabitants can implement with good result in energy budget cuts:

- Tighter control of temperature at home: usually homes are too hot in winter and too cold in summer when a reasonable heating/cooling temperature can result in 20 to 30% cut in energy consumption.
- Promoting behavioural changes at home: turning off lights, proper management of refrigerator, replacing classical bulbs with efficient device...
- Promoting energy efficient cooling/heating devices, as the one on the market are not good enough. People buy cheap equipment without taking into account the higher level of energy consumption, which results in a higher "global cost" over a certain period of time.

Public awareness could be also stimulated through practical demonstration of efficient equipment and responsible behaviour backed by actual cost saving for the household.

#### Long-term actions

On the longer term, the municipality plans to work in two complementary directions:

- Improving **energy performance in new buildings**
- Promoting a **renovation programme** targeting less energy efficient building where basic retrofitting work could improve comfort while reducing energy consumption.

#### Energy efficient rules for new buildings

The Municipality is willing to promote **energy high-performance recommendations** for any new building to be constructed. This will be done through developing a **new local building regulation** that will make it compulsory to reach a certain level of energy efficiency in all new buildings. The Municipality will take advantage of new regulation currently developed at national level in Palestine. However, Tulkarem authorities want to lead the development of energy high-performing building and will look for any innovation in that sense.

#### Retrofitting existing building

Even if there a lot of new buildings in Tulkarem, it is important to consider that the biggest gain in energy consumption would come from improved energy performance in existing buildings.

To design and implement an adequate retrofitting plan for housing and tertiary buildings, the Municipality should engage in the following steps:

- Assess the need through detailed mapping of housing registering average IEC consumption, date of construction, location...
- Train small local companies, which will have the flexibility to work in different type of condition while performing adequate retrofitting programmes that result in significant reduction of energy

consumption.

- Develop a partnership with a bank acting as a “third party investor” that will support the investment (for example through a process where the bank will cover the cost of the loan from a part of the savings allowed by the refurbishment programme).
- Promote retrofitting programme to selected targets offering the best potential in return on investment and, elaborating on these showcases, further deploy the plan.

### 3.2. Transport

Transport is one of the key concerns to be addressed, as this sector is both a significant domain of energy consumption and the third GHG emitter (with around 43.000 tons CO2 equivalent / year).

Transportation in the city depends on private cars, shared taxi, private taxi... and the same for outside the city with larger buses and shared taxis. There is no public transport service operated by the Municipality itself.

There are currently 3 different private buses companies and 50 taxis. Awareness is very low among bus and taxi drivers regarding energy saving. There are no real incentives to improve transport efficiency. Note also that Tulkarm doesn't suffer major traffic congestion problems.

In 2011 and 2012, Tulkarm municipality in cooperation with the local community prepared a Strategic Development Plan for Tulkarm and its suburbs for a period of 25 years. The first two years of the plan (ending 2013) were dedicated to setting up a GIS system as to facilitate work with citizens, the private sector and public institutions. The municipality is now in the process of redesigning its Master plan. It will be the right time to connect strategic thinking regarding traffic management and the design of the Master plan to define which structural decision could be taken in order to reduce the need for transport of people and goods within the city, thus reducing energy consumption from the transport sector.

#### Actions already planned

The Municipality already started a plan for reducing the number of cars entering the city centre, and put some restriction for the heavy vehicles to get access to certain roads.

#### Short-term actions

The Municipality will work in two directions to start addressing impact of transport in the city:

- Building a **car park in the main centre** to reduce traffic in the city (**PRIORITY ACTION #2**)
- Promoting use of **electric bicycles** as an alternative to cars for short distance travels.

#### Long-term actions

Ideally a city committed to reduced energy consumption and GHG emission would design and implement a Sustainable Urban Mobility Plans (SUMP) that could entail the following:

- Integrating transport and city planning policies, while prioritising public transportation and active modes of mobility for people, low emission modes for goods.
- Structuring the urban transport sector by empowering a public transport authority to take action for the improvement of urban transport in the city. In the case of Palestine, this would mean a closer collaboration between the Municipality council and Ministry of Transportation.
- Supporting the development and improvement of integrated public transport systems to make them more attractive to local inhabitants.
- Developing incentives, as well as regulation measures, in order to control the use of private motor vehicles and to make other modes a more attractive choice.
- Developing communication and participation strategies involving the public, with the aim of facilitating behavioural changes.
- Promoting active modes of transport, especially walking and cycling, in particular by providing safer conditions for the users.
- Implementing a common methodology to measure GHG emissions, report on them and monitor all other benefits deriving from the development of sustainable urban mobility.

Long-term transformation of the transport system will also require additional investment:

- To improve roads quality in the city.

- To implement a more efficient management of the overall traffic, while promoting more collective transports.
- To promote the replacement of fleet and switch to more efficient vehicles.

### 3.3. Industry

There are only few industries in Tulkarm and most of this industrial activity is coming from small businesses, shops and warehouse. None of these industries can be defined as energy intensive, or high emitters.

The industry is a rather “small” contributor in energy consumption (with 19 GWh/year or 6% of the total) and in GHG emissions (with 5% and 11 ktCO<sub>2</sub>eq/year).

The Municipality has allocated two areas as manufacturing and industrial area, where it implemented all needed infrastructure. However, the site lacks sufficient electricity power to service all activities. Tulkarm in cooperation with other villages in the district, and with the Chamber of Commerce, is looking to establish a separate industrial zone for the entire district, in addition to the manufacturing zones in the city.

#### Short-term actions

Two options could be promoted on the short term to prepare a more interesting long-term impact:

- Get a **better understanding** of energy consumption and GHG emission of the industry in Tulkarm, in order to built a comprehensive action plan on a robust analysis of the sector.
- Raise **awareness** among business owners to invite them to think about any change they could promote to reduce their own energy consumption or to promote products and services that will help their clients to reduce their own energy consumption.
- Raise **awareness** among the business sector on the benefit of developing renewable energy solutions and the industry, which support this development.

#### Long-term actions

Depending on the detailed understanding of energy consumption from the industry, it will then be possible to define more precise actions to be implemented on the long term.

### 3.4. Agriculture and forestry

Inside the Municipality boundaries, around 20% of the local economy depends on agriculture, which offers a mix of vegetable, fruits and animal production. The Municipality cooperates with local NGO's and cooperatives to encourage the development of this sector.

Even if the Ministry of irrigation is the responsible for the quantity of water for irrigation, the Municipality actually supply water from wells with electricity. Irrigation consumes 10M m<sup>3</sup>/year.

The Municipality considers agriculture as one of the important component of its economic development and is willing to support this sector.

#### Possible actions

- **Raising awareness among farmers** to promote behavioural changes that would help reducing energy consumption
- Promotion of **sophisticated irrigation system** (drip irrigation) to reduce water needed and thus reduced energy consumption
- Develop a **comprehensive plan to collect green waste and animal manure** to potentially combine with bio-waste to feed in the compost production unit, and could be directed later to a bio-digester that could be developed in the city (see waste treatment).

## 4. Results of action in the SEAP

Three documents complete the action plan (see below):

- The census and quantification table of all of the actions.
- The results in terms of energy consumption reductions (as well as the production of renewable energies).
- The results in terms of GHG emissions reductions (as well as the production of renewable energies).

Even though certain actions cannot be detailed, the implementation of different actions will enable the municipality to reach a **20% reduction in GHG emissions, compared to the BAU**, by 2020.

The total amount of avoided emissions, not including the knock-on effect (or only the actions included in the action plan), corresponds to 237,545 tCO<sub>2</sub>eq/year. The knock-on effect is noticeable mainly for the pilot projects, which can be reproduced by other local actors and thus generate additional GHG emissions reductions.

## Section II: Overall strategy of the municipality

### 1. Introduction

The sustainable energy action plan (SEAP) is a strategic document as well as an operational tool. It defines a global framework, with quantifiable objectives to be reached by 2020, based on an emissions reference inventory and the detailed assessment of energy consumption.

Before providing a detailed account of the concrete measures undertaken to reduce greenhouse gas emissions and promote the development of sustainable energy, it is essential to describe the overall municipal strategy and its connection with the national energy transition and climate change mitigation policies.

Being totally dependant on imported energy, West Bank and Gaza Strip will obviously benefit from converging efforts to reduce energy consumption in all sectors and develop energy production from all renewable sources available. However, there is no clear and consistent energy transition policy promoted by the Palestinian Authority.

As a first step, the Palestinian Energy Authority (PEA) launched, in 2010, its sustainable energy policy road map with the aim to increase the operating and technical efficiency of distribution utilities, improve energy conservation and load management and diversify the sources of the regional electricity supply. In accordance with this policy, Resolution n°162012 on the use of renewable energy in Palestine was adopted. This resolution stipulates that, by 2020, 25% of total electricity consumption should come from renewable sources from Palestinian territories.

Other programs specifically target energy efficiency. This is the case of the Palestinian Energy Authority's National Energy Efficiency Action Plan (NEEAP), which is the result of regional and international efforts known as the "End-use electricity efficiency improvement and conservation guideline", a MED-ENEC EU funded project. This plan aims to achieve an initial target, specified in the National Energy Strategy, of a 5% reduction in electricity consumption by 2020. The plan is consistent with regional and international efforts known as the "Arab End Use Electricity Efficiency Improvement and Conservation Guidelines" which were approved by the Arab Ministerial Council of Electricity in 2010.

Despite these regulatory efforts to promote sustainable energy policies, Palestine lacks clear and coherent energy action plans at the national and local levels. Palestinian renewable energy and sustainability laws have had a limited impact due to their inconsistent enforcement.

Palestine must revise its strategic approach towards its energy resources and their use. One aspect of this new approach will be to significantly accelerate the adoption and implementation of energy efficiency and sustainability measures, as well as investments in carbon emission reduction targets. It is important to notice that the PNA acknowledges the fact that local authorities are playing and will continue to play a key role in the necessary energy transition the country should go through.

As a sign of this attention paid to local authorities, the Ministry of local government took the lead in promoting the deployment of the Covenant of Mayors in the West Bank. It is also with the support of the Local government development fund that this ministry supports efforts from municipalities to design their SEAP.

Today any local authority can adopt incentives for energy efficiency and development of renewable energy sources according to the regulations already in place. Local authorities can also develop information tools to stimulate the local or regional market of energy efficiency and renewable energy development in their city.

## 2. Objectives and targets

### 2.1. At the national level

At the national level, there are many initiatives, programs and projects that have been implemented by the PEA, governmental and non-governmental organizations, institutions and the private sector. They are summarised as follows:

#### **Sustainable Energy Policy Roadmap Targets**

Described in the introduction of this document, the goals of this roadmap are threefold:

- 1) 25% of total electricity consumption sourced from renewables by 2020.
- 2) 50% of electricity demand from local generation (of all fuels) by 2020.
- 3) 10% of total new electricity generation from renewables by 2020.

#### **Palestinian Solar Initiative**

In 2013, based on the Sustainable Energy target and in accordance with the Palestinian energy strategy, the PEA launched the PV solar initiative. The initiative's objective is to reach 5MW by the end of 2015 by installing 5 kW solar systems on the rooftops of 1000 Palestinian households. The output of these units will feed directly into the electrical network, with an allocated tariff subsidized by the Palestinian finance ministry.

#### **The Palestinian National Energy Efficiency Action Plan (NEEAP)**

Based on regional and international efforts known as the "End use electricity efficiency improvement and conservation guideline", a MED-ENEC EU funded project, the Palestinian Energy Authority developed the National Energy Efficiency Action Plan (NEEAP). The NEEAP's objective is to achieve a 5% reduction in electricity consumption by 2020. This plan is in keeping with regional and international efforts known as the "Arab End Use Electricity Efficiency Improvement and Conservation Guideline" which was approved by the Arab Ministerial Council of Electricity in 2010.

Considering current and projected total electricity consumption (until 2020), in current electricity prices, the target's achievement would result in energy savings of approximately 384 GWh/year by 2020. This would lead to savings of at least \$55 M/year in total electricity costs in Palestine and a reduction of 285,000 tons per year in CO<sub>2</sub> emissions. In order to achieve this target, the PEA and PEC will have to implement a number of measures, scheduled according to a 3 years plan. In order to measure progress and complete a comprehensive review at the end of each phase, and before proceeding to the next, evaluation indicators will be identified.

### 2.2. At the local level

The SEAP is a road map for municipalities to integrate energy efficiency and renewable energy development into their short and medium-term objectives with an overall target of reducing greenhouse gas emission in order to fight climate change. The Municipality aims at cutting GHG by 20% in 2020 on the basis of 2014 emissions' level compared to the business as usual scenario.

Membership in the Convention of Mayors of the European Union provides leverage for the transmission of knowledge and good practices. It is also a forum to capitalise on the lessons learnt from the past experiences of other municipalities that have implemented SEAP.

Participation in the CES-MED project enables municipalities to:

- Conceive, develop and refer to SEAP by sector, including energy efficiency in public and private buildings, public lighting, etc. It also enables municipalities to specify which investments will be undertaken in order to reach consumption reduction objectives (within a publicly known schedule) and to calculate financial profitability (cost-benefit approach).
- Have access to a trained and mobilised team in the domain of sustainable energy.
- Have access to reference documents, developed according to a reference methodology, that facilitate the exchange of experience with other countries in the region and the EU.
- Share and acquire experiences as well as actively participate in international discussions, supported by the EU with southern and eastern EU countries, on renewable energy and GHG

emissions reductions at the local level by having access to a platform such as the Convention of Mayors.

- Replicate successful projects implemented by other municipalities.
- Search for climate change adaptation and sustainable development funding from international backers.

### 3. Policy and legal framework

#### 3.1. Current laws and regulations

##### 3.1.1 Existing legal and administrative framework regarding energy supply

The Oslo II Interim Agreement and Paris Protocol Agreement of 1995 formally established the Palestinian Authority (PA) and created a new set of economic and political relations between the PA and neighbouring countries. Through these agreements, the PA acquired certain monetary, taxing, licensing, and policing authorities.

The PA currently maintains territorial and functional control over 29% of the West Bank and 70% of the Gaza Strip. 95% of the Palestinian population resides in these territories, with the remaining 5% located in East Jerusalem. The PA provides administration (civil and legal) and security services in the West Bank and Gaza Strip. It does not enjoy full authority in terms of foreign relations or security related issues in the autonomous areas and international crossing points. This is also true in terms of water resources and the movement of people and goods within the West Bank and Gaza Strip. This situation negatively impacts the efficiency of the activities of the executive, legislative, and judicial branches of the PA government.

##### **Petroleum and liquid gas**

In 2012, The Palestinian Territories consumed 23,300 barrels per day (bbl/d) of petroleum and liquid gas. As the territories do not have domestic refining capabilities, these resources had to be imported. In recent years the majority of imported refined petroleum products have been either distillate fuel oil or liquefied petroleum gases. This sector is mainly distinctive of the following:

- Full dependence on Israel for imports,
- Vulnerability due to the PNA's incapacity to import from other sources.
- Lack of local storage capacity. Local market needs are imported on a semi-daily basis.

This creates risks and crises in the distribution system and difficulties in meeting local consumption demand for gas and petroleum derivatives in the Palestinian Territory.

**Solar energy**, through solar heater represents the most important renewable energy source, covering 18% of Palestinian energy needs. 70% of household are equipped with solar heater.

**The electric sector** also faces many obstacles, mainly:

- Almost no independent electricity production in the West Bank. High cost of electricity generated from the Gaza Power Plant and inability to exploit plant's full power.
- Thus, the Palestinian Territories are dependent on the Israel Electric Co. (IEC) for nearly all of their electricity needs in the West Bank. Close to 97% of electricity is imported from IEC at high tariff compared with neighbouring countries. There is no purchase agreement with the IEC and the level of electrical services provided by the IEC is inadequate.
- Electrical Energy represents (31%) of total energy consumed. 75% of consumption is in domestic and services sectors, with a high annual rate of electricity consumption growth (7%).
- High electricity losses (25%) due both to the poor status of the electricity grid and to inefficient collection system and net lending issues, as well as illegal connections, and losses in electricity meters.

With an electricity consumption level of 583 kWh/person/year, the lowest consumption level in the region, the Palestinian Territories barely manage to satisfy their electric needs, whereas in Israel electricity consumption exceeds 6000 kWh/person. This gap can be mainly explained by an inadequate electricity infrastructure.

Five electricity distribution utilities are ensuring the connection between IEC production and final consumption: Gaza Governorate Distribution Company (GEDCO), Jerusalem District Electricity Company (JDECO), South Electric Company (SELCO), Hebron Electric Power Company (HEPCO),

and Northern Electricity Distribution Company (NEDCO). In addition, certain municipalities and rural councils provide power distribution services.

The legal and regulatory framework in the Electricity Sector can be outlined as follows:

**Law N° 12/1995** establishes the Palestinian Energy Authority (PEA) as an independent institution, with its own budget, falling under the direction of the President of the Palestinian National Authority. The Law determines that this official authority will work in the area of energy production, transfer and distribution in Palestinian, with the tasks of “providing sufficient power to satisfy Palestinians’ current and future needs”. PEA is responsible for rural electrification, regional interconnection, energy conservation and research that cannot be commercialized. Additionally, PEA focuses on the rehabilitation of the existing networks, extension of services to non-served communities and conducting research and studies for all energy resources.

**General Electricity Law, N° 13/2009** defines new institutions and their duties within the electricity sector (PERC, NTC). It also establishes an open licensing system for generation and distribution (with non-integration between generators and distributors), defines NTC as the Single Buyer in the system, and obliges all agents in the sector to be registered as commercial companies (even NTC though will continue to be a State owned monopoly).

**Electricity tariff Law No. 04/2012** concerns tariffs and determines the selling price of electricity that electricity companies can charge their consumers. The price has been determined on the basis of transparency and fair issues for Licenced distribution companies and customers and is currently being defined by the Palestinian Electricity Regulatory Council (PERC).

There are several laws that do not directly concern the electricity, but relate to it as well as the institutions working in the sector. This is the case for the Corporations and **Environment Law #7/1999** which is tasked with protecting the environment from pollution in all its forms. It lays the foundation for environmental protection plans in the sphere of economic and social development and promotes the sustainable development of vital resources by taking into account the right of future generations. Moreover, it promotes the collection and dissemination of information about various environmental topics and increases public awareness of environmental issues.

### **3.1.2 Building sector**

The Palestinian Engineers Association and the United Nations Development Program (UNDP) launched the National Green Building Guidelines in partnership with the Palestinian Higher Green Building Council on 23 May 2013, in Ramallah. The Green Building Guidelines will lay the foundation for a green building code and encourage the implementation of eco-sustainable infrastructure, using environmentally friendly materials and deploying renewable energies. It will also benefit the infrastructure sector in terms of improved architectural quality, reduced energy consumption, better quality of life, health and security.

The new guidelines have been developed over a two-year period in partnership with sustainable development experts and the different disciplines of the construction industry. The Palestinian Engineers’ Association is also working with the Palestinian government on developing the Palestinian Green Building Code within the future Palestinian Construction Code.

### **3.1.3 Road transport sector**

There are no legal instruments geared at reducing energy consumption from transport. Even more difficult, the complexity of the rules and regulations used to organized public and goods transports doesn’t allow local authorities, like municipalities to design measures that would reduce the number of cars or to regulated car traffic in their jurisdiction.

As a result, to transport sector will remains one of the more complex domain to address when looking for energy saving and service efficiency improvement.

## **3.2. Complementarity between national actions and municipalities**

Ideally, Municipalities should be able to count on a national set of rules and services allowing them to design and implement strategies to reduce energy consumption, improve energy efficiency and develop renewable energy production. However, as mentioned above the legal framework is still lacking bits and pieces and lacks consistency in order to fully promote locally designed energy strategies that are truly sustainable and economically performing.

For example, the fact that electricity distribution utilities are not allowed to produce electricity from renewable sources is another limitation to such development although resources are available (particularly the sun) and current technologies offers interesting returns on investment.

One of the issues the PNA will have to address very soon is the electric grid organisation in the West Bank and in Gaza Strip to reduce electricity losses and to allow for more connection fuelling into the grid, electricity coming from local production units relying on renewable sources.

### **3.3. Capacity reinforcement**

#### **3.3.1. Training actions**

There are huge needs for training and capacity building on energy issues in all sectors and all types of institutions and stakeholders. This is particularly true in Municipality services where key players are too often lacking the basic skills to ensure a proper management of the issue.

Various initiatives are now taking place to provide technical support and training. For example, the AFD mobilized expertise from INES – National Institute on Solar Energy in France – to provide technical guidance and training to Municipalities and companies willing to develop solar energy.

However, needs are by large surpassing the offer and international funding agencies should be invited to support more initiatives of this type.

#### **3.3.2. Awareness raising actions**

Awareness and communication are indispensable tools for the dissemination of good practices, to help reduce energy consumption on a day-to-day basis. However, the PNA is not equipped to develop campaigns all across the West Bank on this issue. One has to recognize that the PNA has other major priorities to address. On the contrary Municipalities, concerned with energy management on their territory and benefiting from a direct connection with their constituencies are the right institutions to develop awareness activities.

## **4. Strategic vision for sustainable energy**

### **4.1. Guiding principles for the municipal strategy on sustainable energy**

The Municipality adopted certain fundamental principles that aim to integrate sustainable development into all decision-making processes related to local development. The Municipality systematically considers these principles when taking into consideration future action programmes and their energy implications.

- Ensure the optimisation of energy consumption and the integration of renewable energy development into all on-going activities and projects taking place in the territory in order to reduce fossil-based energy consumption.
- Include energy consumption reduction and renewable energy development in the city's development vision.
- Utilise energy cost-benefit analyses in on-going and future projects.
- Set an example in terms of responsible energy management, especially by promoting concrete initiatives energy efficiency and conservation research and innovation and infrastructure development, as well as.
- Partnerships: encourage individual, private sector, NGO participation in the development and management of energy resources and renewables in the municipality,
- Educate and inform the local population and actors about the new municipal vision in favour of energy efficiency and renewables.

### **4.2. Municipal vision and objectives**

#### **4.2.1. Municipal vision**

The municipal vision is based on the strategy and medium to long-term objectives of the municipality, as well as those at the national level. Keeping in mind its specific context, the municipality is

developing a strategy consistent with the Palestinian energy strategy and the sustainable development needs of the territory.

This strategy is structured around two levers:

- Reduce energy consumption in all sectors through energy conservation and efficiency, in order to provide better services while reducing costs and impacts.
- Promote energy production from locally available renewable resources in order to cover as far as possible energy needs from these decarbonized sources.

Obviously, this strategy will help the Municipality to reduce its dependency on energy imports from Israel, reducing by the way its financial needs to fund these imports. The strategy will also generate additional resources in the municipal territory through energy production from local and renewable resources.

As energy consumption is dependant on many stakeholders within a given territory, the strategy needs to include all of the concerned actors. All of the activities that take place within the territory will be included in the energy consumption reduction and renewable energy promotion measures. These measures also strive to protect the local environment (air, water, soil, waste) and contribute to the protection of the national and global environment (GHG).

The municipality will develop a SEAP that includes short and medium-term actions to reduce the consumption of energy and to increase the production of renewable energy in its territory.

In conformity with current regulation, the Municipality wants to promote a mix of incentive and coercive measures. These measures are in accordance with the municipal code and public policies that favour local development and the protection of energy resources and the environment. Doing so, the Municipality is participating in the reduction of greenhouse gas emissions and taking action to adapt to the impacts of climate change.

On-going information and awareness raising actions must lead to the strengthening of energy consumption reduction commitments and the increase in production of local renewable energy by actors operating in the territory. These activities include the following sectors:

1. Housing stock (energy conservation and efficiency/ renewable energy development)
2. Housing market (mobilisation of professionals)
3. Transport and mobility (planning and reduction of urban traffic)
4. Active mobility (development of a cycling policy and promotion of walking pathways)
5. Mobilisation of the local industrial sector
6. Management and treatment of solid waste and wastewater
7. Development and integration of renewable energies
8. Development of a local renewable energy market.

#### **4.2.2. Municipal objectives**

In accordance with national policy, the Municipality adopted the following strategic objectives within the framework of its sustainable energy development policy:

1. Reinforce and promote energy efficiency in municipal property, public infrastructure and other local activities.
2. Promote the integration of energy efficiency and renewables into public and private housing construction projects in the municipality.
3. Integrate the development of energy efficiency and renewable energy into the municipal sustainable development plan (job creation, local energy efficiency and renewables market, market for local services, etc.).
4. Implicate all of the territorial actors in the promotion of energy efficiency and the development of renewables,
5. Develop a sustainable energy action plan (SEAP) in the city.
6. Develop partnerships with all of the providers that are favourable to the implementation of the SEAP.

7. Reduce energy consumption and GHG emissions by 20% in the Municipality by 2020.
8. Inform the public about the true cost of energy and make known the incentives and initiatives that encourage energy conservation and efficiency.
9. Create energy conservation and efficiency, renewable energy development and environmental protection communication plans that target the local population and the socio-professional categories present in the territory of the city.
10. Reduce energy needs during peak periods by managing electricity demand and by changing energy and gas consumption behaviours and habits.
11. Coordinate with the government on the national strategy and energy efficiency and renewable energy action plan, as well as on the review of the municipal sustainable energy action plan.

The primary objectives of the municipality are:

#### **Short-term objectives 2020**

- Reduce energy consumption across the board by around 20 to 25%
- Reduce GHG emission by 20 % in 2020, compared to the business as usual scenario and using the 2014 baseline.

#### **Medium and long term objectives 2030**

- Continue efforts to reduce energy consumption and improve efficiency resulting in a continuous trend of improvement of energy intensity (Energy consumption compared to Gross development product)
- Continue reducing GHG emission with the objective of containing GHG per capita below 1,8 tons or less on the long term as a significant contribution to global efforts to combat climate change, in application of the Paris Agreement adopted at COP21.
- Improve services to inhabitants and all stakeholders in order to promote a better quality of life in the city.

### **4.3. Implementation of the strategy**

The strategy's implementation requires the creation of a municipal SEAP based on detailed energy consumption and greenhouse gas emissions inventories.

The action plan will contain consumption reduction measures and put in place a set of supportive mechanisms to ensure that actions are implemented according to the agreed timeframe.

## **5. Organisation and financial aspects**

The CES-MED project produced two national reports to be used as reference documents for the municipalities implementing their SEAP. The first concerns funding sources for energy efficiency and renewable energy development in local municipalities, whereas the second provides an institutional and regulatory analysis of energy efficiency and renewable energy development at the municipal level.

The first report summarizes the existing national and international funding available to support initiatives in energy management and renewable energy development that the municipalities are eligible to apply for. It also lists the types of funding available in order to assist developers seeking to finance their projects.

The second report provides an overview of existing energy efficiency and renewable energy legislation in Palestine, as well as the main institutions assigned to promote their development and create a specific market. It presents all of the texts related to legislation that promotes investment in the energy efficiency and renewable energy sectors.

### **5.1. Local and national coordination**

The municipality should build relationships with regional actors that have a role to play in the exploitation, study and analysis, management and use of energy resources within the territory. These include various public institutions and administrations, local agencies and organisations, industries,

public and private enterprises, universities and research centres and civil society actors (NGOs, neighbourhood councils, etc.).

## **5.2. Organisational structures created to implement the SEAP**

In order to implement the SEAP, the municipality should create a sustainable energy activity unit. The unit will be in charge of all municipal energy related questions. This unit is directly connected with the Strategic planning unit in order to ensure that the sustainable energy strategy is deeply embedded in the strategic development plans the city will follow.

### **5.2.1. Constitution of the sustainable energy team**

The implementation of the municipal sustainable energy policy requires the mobilisation of human resources in order to develop and revise the sustainable energy action plan (SEAP). In addition, it will be critical to develop sustainable energy projects, assemble financial packages and establish partnerships and accompany the project at the political, technical and administrative level. Taking into account the existing political, technical and communication skills available within the municipality, members of the sustainable energy team will be selected during the first stages of the SEAP's implementation. Those with the knowledge, professional skills and the desire to participate may be designated as team members.

**The estimated workload per person to ensure the project's success:** Team members must be available during working hours. To maintain a reasonable workload, all new or additional tasks allocated to members must be balanced by delegating existing tasks to other colleagues.

**Team stability is a condition for the longevity and continuity of the SEAP's implementation:** The replacement of any team member may affect the implementation process and diminish overall team capacity through lost experience and time spent finding a replacement. In order to prepare for a replacement, any departure from the team must be planned for by training and reinforcing the skills of future members.

**Project stability:** To support the project development, its permanent improvement and refinement, the team will identify external actors with specific expertise, such as university researchers, companies or NGOs that could help strengthening the dynamic of the SEAP.

The implication of specialised university researchers can contribute to the development of projects through studies and the integration and transferability of new technologies. The sustainable energy team also contributes to the understanding of and gives visibility to energy management in municipal property and buildings. The team must ensure the coherence of the overall municipal policy and all energy and renewable energy management actions.

**Team missions include:**

- Educating users about the implementation of the municipal policy on sustainable energy management.
- Training the technical personnel in charge of the service and ensuring the maintenance of renewable energy facilities.
- Communicating the results of implemented actions to municipal personnel and inhabitants.

The energy team's role also includes:

- Tracking energy consumption in municipal buildings, identifying problems and proposing solutions by reviewing how buildings are used and whether they require renovations.
- Ensuring the maintenance of facilities
- Working on the interaction between users and facilities. Listening to users and considering them as partners since they are first hand observers of what occurs in buildings.
- Carrying out technical studies and developing requirements specifications in order to choose materials best suited for buildings and overall energy efficiency.

### **5.2.2. Appointment of the elected official tasked with energy**

Among municipal elected officials, it is critical that there be an elected official in charge of sustainable energy. This sends a strong political signal of the municipality's political will to local, regional and national authorities and gives political visibility to energy management at the international level (Convention of Mayors and other partners).

The elected official in charge of energy is appointed to:

- Demonstrate the political will of the municipality,
- Give political visibility to energy management,
- Provide direction to facilitate the development of partnerships with national and international backers,
- Manage transversal issues related to the energy transition.

Through the dynamism of the elected official in charge of energy and the sustainable energy team, energy management must progressively occupy a greater role in the different sectors that fall under the municipality's responsibility.

The official must work in collaboration with other elected officials and with the technical head of energy. They are a spokesperson for all subjects related to energy policy and municipal property and must be attentive to municipal personnel and users and provide momentum for the SEAP's implementation.

They also ensure the:

- Creation of inter-thematic connections and the integration of energy management into all municipal projects and actions.
- Facilitation of information sharing (completed tasks, projects, etc.) among different services, municipal departments and external actors.
- Communication with diverse audiences on energy management.

### **5.2.3. Role of the municipal council**

The principle responsibilities of the municipal council are:

- Directing policy by setting priorities and objectives for the municipal energy policy;
- Integrating the action plan into the budget planning process and prioritising/ensuring its implementation;
- Validating the completion of the actions and managing the budget;
- Adapting the objectives and action plans to the evolution of the projects as well as human and financial capacity (budget);
- Proposing new actions and integrating them into the action plan;
- Delegating and assigning tasks to implement the SEAP.

## **5.3. Involvement of stakeholders and citizens**

The municipality adopted a participative approach during the elaboration phase of the SEAP. In addition, its implementation phase engages all of the stakeholders, including: institutions, agencies and organizations, professional organizations, socio-economic actors, NGOs, local councils, etc.

The consultation and exchange meeting contributes to and enhances the SEAP by incorporating stakeholders' opinions, criticisms and propositions. Stakeholder participation is a measurement of the SEAP's successful implementation.

To ensure to success of project implementation within the framework of the sustainable energy strategy, certain capacity reinforcement and awareness-raising actions for different sectors of the local population must be carried out. These include:

- **Lectures:** organizing and facilitating a series of conferences and lectures given by professionals and experts. These meetings are meant for a diverse audience: local authorities, enterprises and the general public. The main objective is to educate local actors and encourage them to take action.
- **Workshops:** holding thematic workshops on sustainable energy (energy consumption reduction, energy efficiency and renewable energies) that enrich municipal personnel's knowledge on the subject and, thus, facilitate the SEAP's implementation.

## 5.4. Citizen awareness promotion plan

The elaboration of the « Citizen awareness promotion plan » is meant to educate and inform the municipal population and actors. It allows all actors to be involved in and contribute to the SEAP's implementation.

It could encompass several actions, including:

- The creation of a permanent municipal information point
- The organisation of an open house
- The publication of articles in local and regional newspapers
- The distribution of brochures and posters
- The distribution of an information letter that includes current events on sustainability as well as local success stories.
  - ✓ Information on national energy policies and local implications
  - ✓ The prevailing energy conditions in the municipality
  - ✓ The state of progress of the different actions implemented within the framework of the sustainable energy strategy and the SEAP.
  - ✓ Successful projects in national and foreign municipalities, notably in municipalities that are members of the Convention of Mayors.

**Facilitating a local skills network:** The municipality's information and awareness raising actions contribute to demand creation in the sustainable energy market. To create supply, similar actions that support the local economic fabric should be undertaken.

To promote the local economy, the municipality will organize meetings to exchange with different socio-economic actors. As part of its SEAP and sustainable development strategy, these meetings enable the municipality to ensure that the supply of skills within its territory responds to existing, or future, demand.

The elaboration of a regional skills directory (municipality and neighbouring territories), which includes the renewable energy and energy efficiency sectors, gives visibility to the skills and actors present in the territory.

## 5.5. Budget

In its annual budget, the municipality should undertake certain sustainable energy priority actions and initiate communication campaigns that inform and educate all of the stakeholders.

Access to national and international financing will help assure the SEAP's success by tapping into funds that support the implementation of its activities.

## 5.6. Foreseen financing sources for the investments within the action plan

### 5.6.1. Financing of the national EE programme and renewable energies

Municipalities can get direct access to funding agencies but also can count on the support of additional resources coming from funding agencies through the Municipal Development and Lending Fund that connect the PNA negotiated supports with municipalities presenting specific projects.

Palestinians in the West Bank and Gaza Strip receive one of the highest levels of aid in the world due to the on-going political conflict. The international community, including international NGOs, offers aid to the PNA and other Palestinian NGOs. Entities that provide aid to the Palestinians can be categorized in seven groups: Arab nations, the European Union, the United States, Japan, international institutions (including agencies of the UN system), European countries and other nations. Some of international funding agencies include:

- The World Bank
- The Islamic Development Bank (IDB)
- The United Nations Development Program
- The Arab Fund for Social and Economic Development
- The European Commission (EC)
- The United States Agency for International Development (USAID)

- The French Development Agency (AFD)
- The Kreditanstalt für Wiederaufbau (KfW)
- The German Technical Cooperation (GIZ)
- The Japan International Cooperation Agency (JICA)

#### Funding the energy sector

Since the creation of the Palestinian Authority in 1995, most energy projects have been funded by international aid. Aid usually comes from donors seeking to improve the security and stability of the Palestinian energy sector in the WBGS. Norway, Italy, France, the World Bank and the E.U. have provided support to reform the institutions and regulations in the sector.

Some new grants for sustainable energy and sustainability actions include the EU's SUDEP grant for local governments and municipalities, as well as the World Bank's recently created Trust Fund programme, a funding assistance mechanism for the Palestinian Territories. The European Union, along with the World Bank -International Finance Corporation (IFC)-, issued programmes for knowledge products and grants for the fiscal year 2016 that focus on municipal services, energy, water and solid waste management. Palestine is a beneficiary of these grants.

#### Application and awarding process

Each grant has a unique set of requirements and application process. Generally, however, the first step includes the submission of concept notes and, after an initial agreement, the beneficiaries submit a full proposal.

Most often, grants are awarded based on the number of people who will benefit from, as well as the sustainability and lasting impact of, the proposed project.

#### **5.6.2. Financing the SEAP**

The municipality must identify all of the potential funding sources for the investments to be made within the framework of the SEAP. One of the principle issues for a successful strategy is the municipality's ability to finance ambitious energy management and renewable energy projects.

The traditional systems of public and private funding may not be able to adapt to the new projects that come out of the SEAP. As a result, new and innovative finance mechanisms will be needed. It will be necessary to innovate by mixing loans, subsidies, third party financing, cooperative solutions and funds, etc.

Guaranteeing the funding of the SEAP's actions is the most critical step. The municipality cannot finance the entirety of its SEAP in its annual budget and will have to turn towards external funding at the national and international level. There are additional benefits to attracting external funding, including:

- The involvement of various actors in the SEAP's implementation helps to create a local, or even regional, sustainable energy market that the actors can participate in as suppliers, installers and beneficiaries, etc.
- The engagement of local actors is a gage for the socio-economic integration of sustainable energy.
- The cooperation with international backers gives more visibility to local actions and attracts greater investment and funding in case of success. It also encourages local deciders to support the projects and actions undertaken in the framework of the SEAP.

## Section III: Baseline emissions inventory

### 1. Considered scope and methodological principles

#### a. Some orders of magnitude

To apprehend the results of this Baseline Emissions Inventory (BEI), it is useful to know the main orders of magnitude in the world and in Palestine.

- World human GHG emissions: 50 billion tCO<sub>2</sub>eq/year
- Palestine GHG emissions in 2010: 4,15 million tCO<sub>2</sub>eq/year
- Palestine GHG emissions per capita: **1,0 tCO<sub>2</sub>eq/capita/year**

These average values are valid for the whole Palestinian Territory, including Gaza Strip. In all 3 West Bank cities studied by the team, GHG emissions per capita are twice higher (between 1.9 and 2.3 tCO<sub>2</sub>eq/capita/year). This is not surprising as GHG emissions mainly come from urban and industrialized areas. As industry and agriculture remain limited in Palestine, the main part of emissions comes from urban areas.

Knowing that the IPCC set a target of dividing by 2 the global human GHG emissions, currently reaching in average 7 tCO<sub>2</sub>eq/capita/year, we observe that emissions of Palestinian citizens are already far lower than the target (3.5 tCO<sub>2</sub>eq/capita/year). However, Palestinian GHG emissions tend to increase and could exceed this limit in the coming years. This is another reason why, Palestinian cities need to develop strategic plans to reduce their energy consumption and their GHG emissions.

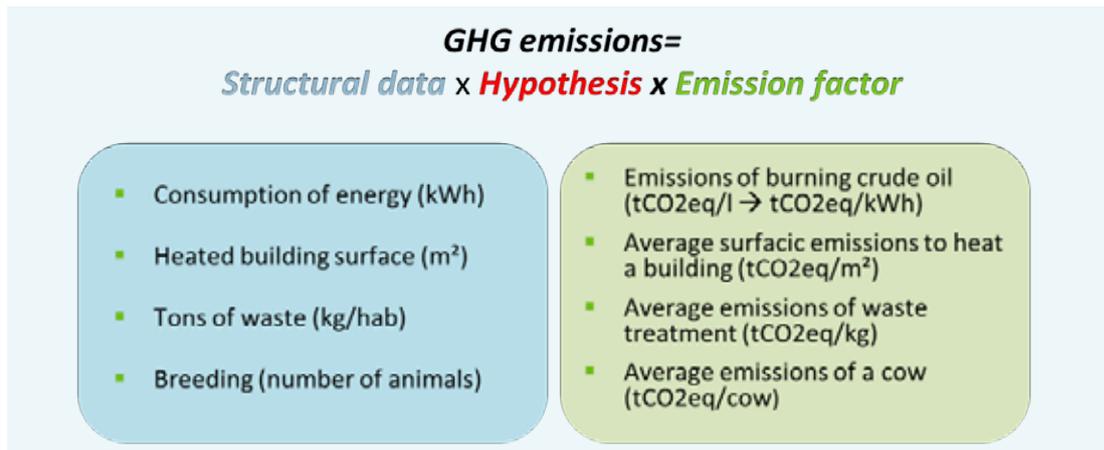
#### b. Methodological principles of the inventory

The methodological principles of an inventory are the following:

- Emissions are **assigned to energy consumers**.
- Inventories **must be** addible: For example, if all localities of the governorate make their inventory, the sum of inventories equals the governorate inventory.
- A recent reference year: 2014, to describe a territory evolving rapidly.

#### c. Calculation method

The BEI is a calculation, not a measure. In order to get a complete consumption and emissions inventory, we used several statistical data from reliable sources (electricity distribution, building surface, energy bills for municipal buildings, etc.) on which calculation hypothesis were applied when necessary (energy costs, unitary consumption of buildings, etc.) to obtain energy consumptions (all sectors) and non-energetic emissions (waste, water, agriculture).



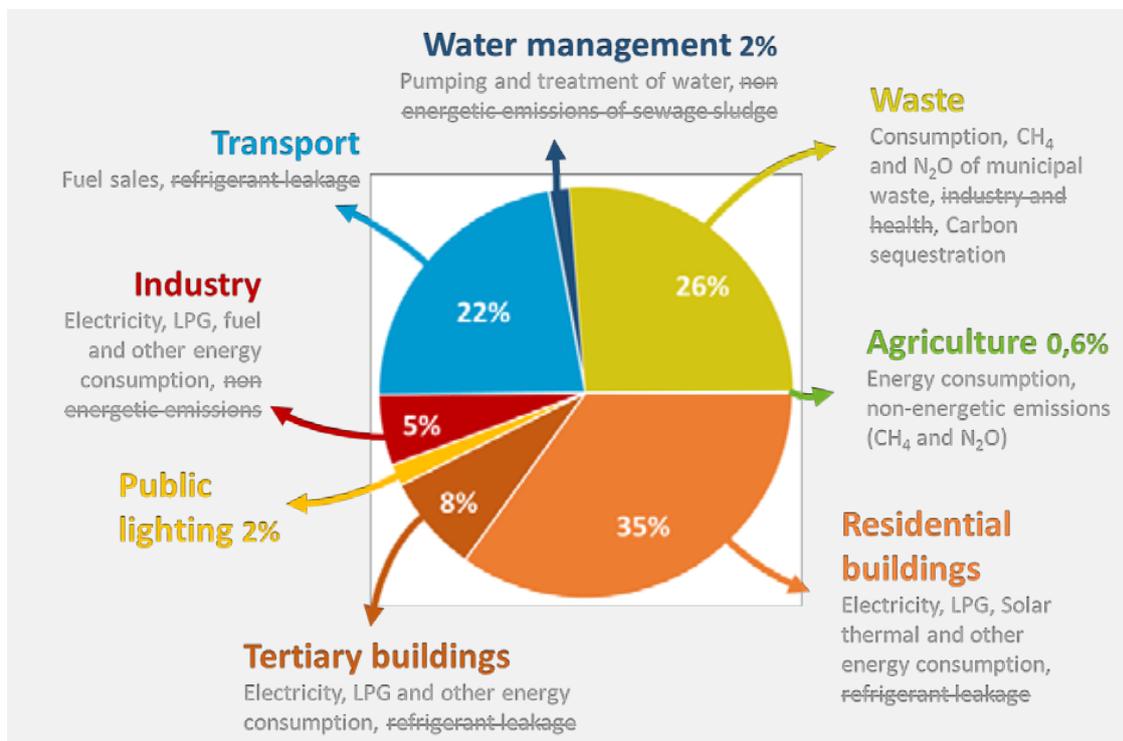
**Calculation principle of the inventory**

This simplified calculation approach is likely to be tainted by various uncertainties:

- Structural/Activity data: low uncertainty
- Hypothesis medium to high uncertainty
- Emission factors: low to medium uncertainty

**d. Considered scope**

Building this BEI, we have judged necessary to include the following sectors, but we couldn't find sufficient hypothesis or structural data on stroke out topics:



**Considered themes in BEI (%tCO<sub>2</sub>eq/an) – Tulkarem city 2014**

Compared to the Convention of Mayors recommendations for SEAPs:

- Have been taken into account: non-energetic and energetic GHG emissions for waste management, energetic GHG emissions for water and wastewater management (pumping, treatment, etc.), because all 3 cities are planning actions on both of these topics.
- Have not been taken into account: Non-energetic emissions of industrial activities, refrigerant leakage of buildings and vehicles, sewage sludge of wastewater treatment since information on these topics wasn't sufficient and not mandatory to be included in the BEIs.

It is important to understand what are called tertiary buildings, namely all buildings that are neither residential, nor industrial or agricultural: stores, offices, hospitals, transport buildings, sport buildings, leisure, and other private services.

## 2. Detailed methodology per sector

We adapted our methodological targets to Tulkarm, according to what has been described in the last chapter. This part explains details on the methodology used to build the first Tulkarem BEI. An Excel file has been created in order to collect and work on data provided by the municipality or obtained from the Palestinian Central Bureau of Statistics (PCBS), describing each source, year of reference and calculations made. Helped by this report, the Excel file named *150921\_BEI-Tulkarm-v10* is the best way to understand precisely the methodology and sources used.

### a. Common data sets

#### i. Population statistics

Population statistics have been downloaded directly from PCBS website for the localities<sup>2</sup> and Palestine<sup>3</sup>. PCBS estimation are based on the 2007 national census using an annual growth index. In Tulkarem, the municipality wished to correct this value for 2014 using their own estimation. The localities Tulkarm municipality is in charge of are the following: Tulkarm city, Tulkarm camp, Al Jarushiya, Al Masqufa, Nur Shams Camp and Kafa. Provided statistics are for the city and its surroundings. Sometimes, the value for the city itself is shown. Population is often used in order to create or apply national or district ratios to the population.

	2007	2008	2009	2010	2011	2012	2013	2014
Tulkarem All								
PCBS Estimation	69 386	70 727	72 091	73 475	74 884	76 324	77 774	79 228
Municipality data	69 386	-	-	-	-	-	-	101 000
Tulkarem District	156 566	159 594	162 668	165 791	168 973	172 224	175 494	178 774
Palestine	3 719 189	3 825 512	3 935 249	4 048 403	4 168 860	4 293 313	4 420 549	4 550 368
West Bank	2 323 469	2 385 180	2 448 433	2 513 283	2 580 168	2 649 020	2 719 112	2 790 331

In 2014, the population of localities governed by Tulkarem municipality services is **101 000 inhabitants**. The only value that can be compared to governorate data is the PCBS estimation, thus we will consider that about 44.3% of the governorate population lives in Tulkarem perimeter.

#### ii. Employment statistics

The PCBS offers two different data sets on employment with an important difference:

<sup>2</sup> Localities in Tulkarm Governorate by Type of Locality and Population Estimates 2007-2016, PCBS, 2007  
<sup>3</sup> Estimated Population in the Palestinian Territory Mid-Year by Governorate 1997-2016, PCBS, 2007

- Number of employed persons among the population, in the national 2007 Census on Population, Buildings, Housing and establishment for all governorates. The numbers correspond to inhabitants of a locality who have a job, wherever this job is actually located.
- Number of employed persons in the Private Sector, Non-Governmental Organization Sector and Government Companies inside the locality, delivered in national and governorate Statistical Yearbooks<sup>4</sup>. Since we need this information to estimate the consumption of tertiary and industrial building of the locality, we use the following dataset.

		Number of Employed Persons (Private, NGO, Gov)			
		Mining and quarrying	Manufacturing	Construction	Total
Tulkarem (2009)	City and surroundings	nd	nd	nd	7 584 8 681
	Governorate	65	3 759	97	14 212
Palestine (2007)		<b>1 851</b>	<b>62 832</b>	<b>4 557</b>	<b>296 965</b>
Palestine (2012)		<b>1 796</b>	<b>74 667</b>	<b>5 530</b>	<b>384 778</b>

### iii. Energy demand in Palestine per sector and type of energy

One of the key reports used for making these BEI is the Energy Balance report made by the PCBS for 2008<sup>5</sup>. One of its tables describes energy consumption in TJ/year or in sectorial units (kg, MWH, etc.) by energy (Solar, Electricity, Gasoline, Bitumen, Kerosene, Diesel, Oils, LPG, Olive cake, Wood and charcoal) and sector (Mining, Manufacturing industry, Construction, Road transport, Households, Internal trade and services, Agriculture).

	Solar	Electricity	Gasoline	Kerosene	Diesel	LPG	Olive cake	Wood and charcoal
Consumer	MWh/y	MWh/y	1000ltr/y	1000ltr/y	1000ltr/y	tons/y	tons/y	tons/y
Households	1 074 237	2 187 428		2 664	1 564	109 284	12 348	253 992
Internal trade		68 050		151		2 766		242
Services		484 632	303	32	1 182	4 879		259
Agriculture		10 928	164	93	3 398	338		963
Water and Elec		66		1	125	127		4
Mining		4 575	24		5 218	119		3
Manufacturing		282 148	128	432	6 053	5 456		723
Construction		8 553	1 405	111	3 267	101		2
Road transport			129 845		127 948			
Other transport		7 759		83		61		

We will often refer to this table in the following chapters, usually by calling a *consumption ratio per capita or employee for a given energy and sector from PCBS report on Energy Demand 2008*.

For example, to estimate LPG consumption in Tulkarem, we use the following formula:

$$\text{Ratio} = \text{LPG Pal 2008} / \text{Pop Pal 2008} = 28.5 \text{ kg/capita/year}$$

*LPG Pal 2008*: Consumption of LPG for households in 2008 = 109 million kg/year

*Pop Pal 2008*: Population of Palestine in 2008 = 3 825 512 inhabitants

This figure is then multiplied by the city population in 2014.

<sup>4</sup> Tulkarm Governorate Statistical Yearbook n°2, May 2010

<sup>5</sup> Energy Balance in the Palestinian Territory 2008, PCBS, December 2009

#### iv. Emissions factors of energy consumption (IPCC, UNFCCC)

Emission factor for energy combustion used in the BEI to convert consumption in GHG emission come from IPCC Guidelines 2006<sup>6</sup>, using default values provided. In this report, a distinction is being made for different activity sectors, but also between stationary and mobile combustion. Considered gases are CO<sub>2</sub> (Carbon dioxide), N<sub>2</sub>O (Nitrous Oxide) and CH<sub>4</sub> (Methane).

Since the territorial inventory method consists in assigning emissions of the whole energy production chain to the consumers, emission factors were added for upstream emissions (extraction, refining, production and transport of energy). These factors come from 2006 UNFCC publication<sup>7</sup>.

For electricity, the emission factor is the one provided by the GHG Protocol, via a tool to calculate GHG emissions of purchased electricity<sup>8</sup>. The emission factor is the Israeli one, and is equal to 727 gCO<sub>2</sub>eq/kWh, since all electricity consumed in the city comes from Israel producers. It includes all upstream emissions, such as transport and losses. For other fossil fuels, all average emission factors are resumed in the following table:

	Combustion gCO <sub>2</sub> eq/kWh	Upstream gCO <sub>2</sub> eq/kWh	Global gCO <sub>2</sub> eq/kWh
Electricity	-	-	727
Natural gas	203	40	243
LPG	228	41	269
Diesel	269	79	348
Gasoline	251	64	315
Other fossil fuel	266	71	337

#### b. Residential buildings

In Palestine, households consume various type of energy for their homes: Electricity, Liquid gas, Diesel (rarely gasoline), solar thermal, and sometimes wood, though wood is marginal in urban areas, such as the city of Tulkarm.

The municipality provided yearly consumption per energy sources. Some values seem consistent compared to households' energy surveys conducted by PCBS, some are not and had to be put aside. The following table shows what information was provided and judged consistent or not, and what method was used to estimate lacks:

	Value provided	Method	Final value
Electricity	77 500 MWh/y	Consistent	77 500 MWh/y
Liquid gas	Not provided	National Ratio per capita	36 500 MWh/y
Diesel and gasoline	Not provided		420 MWh/y
Solar energy	23 900 MWh/y	Consistent	23 900 MWh/y

In case a value could not be used or wasn't provided, estimation was made using a ratio per capita, built out of PCBS report on Energy Demand 2008, and the population of Palestine in 2008.

Refrigerant leakages in residential buildings have not been considered in these BEI.

#### c. Tertiary buildings and public lighting

Tertiary buildings are composed of two different categories: municipal buildings and other buildings. In fact, we call tertiary building every building which is not a dwelling, nor an industrial company or dedicated to agriculture. It is composed of: shops, office building, administration, hotels, restaurants, transport building, health buildings, sport centre, cultural building, leisure buildings, etc.

Energy consumption for all energies has been provided for municipal buildings and public lighting. All data was kept as such.

<sup>6</sup> IPCC 2006 Guidelines for National Greenhouse Gas Inventories (Chapter 2-3), IPCC, 2006

<sup>7</sup> Methodological tool "Upstream leakage emissions associated with fossil fuel use" version 1, UNFCCC, 2006

<sup>8</sup> GHG emissions from purchased electricity calculation tool, Greenhouse Gas Protocol, December 2014

	Consumption
Municipality buildings	668 MWh/year
Schools	1 766 MWh/year
University	<i>Not available</i>
Mosqs	492 MWh/year
Street lighting	4 462 MWh/year

For private tertiary buildings, a first value of electricity consumption of 50 GWh/y was provided but judged inconsistent compared to global private consumption of electricity consumption: 103 GWh/y. For other types of energies, consumption has been estimated using a ratio of consumption per capita extracted from PCBS report on Energy Demand 2008 (Internal trade + Services, each energy).

	Value provided	Method	Final value
Electricity	50 000 MWh/y	Not consistent, national Ratio per capita	16 000 MWh/y
Liquid gas	Not provided	National Ratio per capita	2 800 MWh/y
Diesel and gasoline	Not provided		430 MWh/y
Other	Not provided		100 MWh/y

Refrigerant leakages of tertiary buildings have not been considered in these BEI.

#### d. Industry

For industrial buildings, a first value of electricity consumption of 80 GWh/y was provided but judged inconsistent compared to global private consumption of electricity consumption of the city: 103 GWh/y. Moreover, 80 GWh would correspond to 28% of Palestine Industry energy demand in 2008.

	Value provided	Method	Final value
Electricity	80 000 MWh/y	Not consistent	11 400 MWh/y
Liquid gas	Not provided	National Ratio per capita	2 700 MWh/y
Diesel and gasoline	Not provided		4 300 MWh/y
Other	Not provided		290 MWh/y

As there are no statistics on number of employees per sector at city scale, a first estimation is made at district scale using a ratio of consumption per employee based on PCBS report on Energy Demand 2008 per energy source (electricity, LPG, Diesel, gasoline, wood and charcoal, kerosene) and per sector (mining and quarrying, manufacturing industries, construction). Then, a percentage of the district consumption is charged to the city using the percentage of total employed persons in the city.

Energy consumption for manufacturing industries is not distinguished between agro-food and other manufacturing industries. To do so, we apply the part of employees for each sector in Palestine (Economic survey series 2008, PCBS). Non-energetic emissions have not been considered in the BEI.

#### e. Transport

Municipal fleet fuel consumption (diesel and gasoline) were given by the municipality and are all judged consistent, although as high as Tulkarem consumption for half of its population.

	Volume	Consumption
Gasoline	6 000 litres/year	54 MWh/year
Diesel	223 000 litres/year	2 100 MWh/year

The Ministry of Finance of Palestine has given information on fuel sales at district scale in 2014. Since Tulkarem city and considered surroundings contains 44.3% of the governorate population (cf. population statistics) the same ratio is applied to fuel consumption for transport.

### f. Waste management

Diesel consumption for waste treatment and transport has been provided and judged consistent.

The Municipality service collects 22.000 tons/year in the city itself, and 7.500 tons/year from the two refugee camps embedded in the city boundaries. The Municipality service also collects 30,000 tons/year in the other parts of the district. That is 1.1 kg per capita per day in the city and the camps, and slightly less in rural areas around the city. This is consistent with figures from Hebron and Nablus, and with data provided by the SweepNet report<sup>9</sup> on waste production per capita in urban areas.

According to Palestinian statistics, waste composition breakdowns as follows:

	% of mass
Glass	2%
Plastic	14%
Metal	3%
Paper and cardboard	10%
Organic waste	59%
Other	12%

Figures provided by the municipality show a lower level of organic waste (30%), but a higher proportion of "other" (50%), most probably meaning that there is still a significant proportion of organic waste in the portion registered as "other".

In the West Bank, 42% of all waste is landfilled<sup>9</sup>, but in Tulkarem, the municipality declared that 100% of waste is landfilled without methane capture. Then, an emission factor of CH<sub>4</sub> and CO<sub>2</sub> sequestration for landfilling waste without CH<sub>4</sub> capture is applied, from an international study directed by the RECORD<sup>10</sup> Institute, and selected in the Bilan Carbone method.

	CH4 leakage kg eqC/t	CO2 Sequestration kg eqC/t
Cardboard	720	224
Paper	746	198
Organic waste	466	36
Other waste	320	63

Emissions for open burning waste are not considered, since they mainly appear in rural areas.

### g. Water management

The municipality provides electricity consumption for water management: 4.226 MWh/y in 2014. This value is considered consistent, since it comprises pumping, production and wastewater treatment.

Since water treatment non-energetic emissions have a low importance for urban BEI, non-energetic emissions have not been considered in the BEI.

### h. Agriculture

From the Agricultural Census 2010 at city scale and Palestine scale, we extract for each species the number of animals, and for each culture the surface of crops, we apply a ratio from Palestinian level using:

- For energy: An estimation of electricity consumption provided by the municipality is used: 140 MWh/year. For other energies, PCBS report on Energy Demand 2008 is used to define a ratio applied per ha of crops.

<sup>9</sup> Country report on the solid waste management in Occupied Palestinian Territories, SWEEPNET, 2014

<sup>10</sup> Application de la méthode « bilan carbone® » aux activités de gestion des déchets, RECORD, 2008

- For non-energetic emissions (CH<sub>4</sub>): Emission factors are directly taken from the national inventory of emissions<sup>11</sup> or estimated from it, and applied to local number of animals.

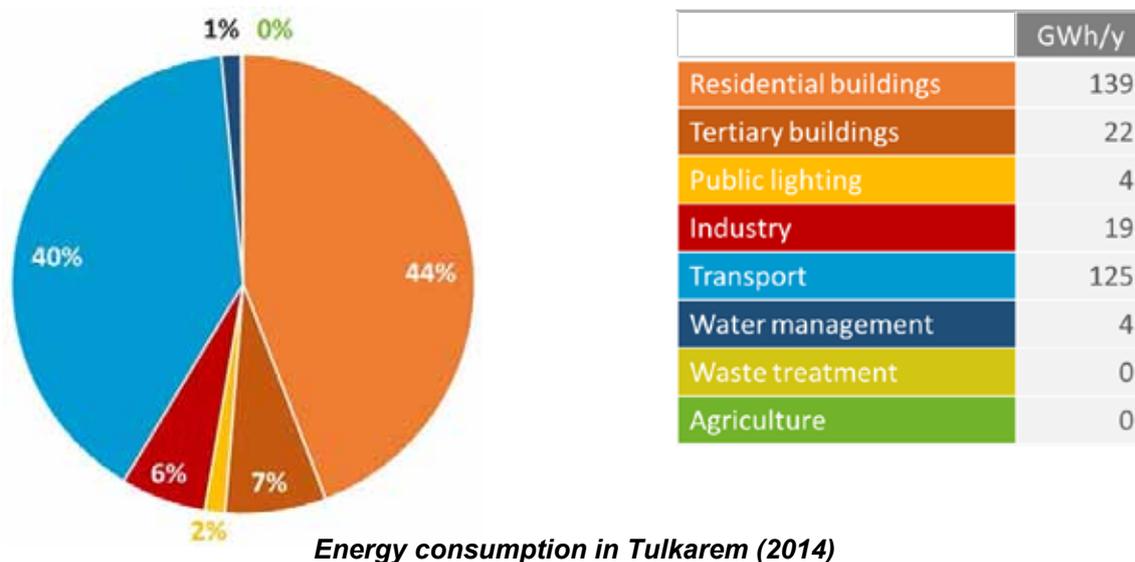
	Number of animals	in kgCH <sub>4</sub> /animal/y	
		Manure management	Enteric fermentation
Dairy Cows	-	2	40
Other cattle	263	1	31
Sheep	2 739	0	5
Goats	434	0	5
Camels	0	2	46
Horses	12	2	18
Mules & Asses	38	1	10
Poultry	1 822	0	0
Other	-	0	0

- For non-energetic N<sub>2</sub>O emissions: A ratio of N<sub>2</sub>O emissions per dunum of crops is built from the national inventory of emissions<sup>11</sup> to estimate N<sub>2</sub>O due to artificial fertilization, crop residues and pasture. It is applied to the 6 677 dunums of Tulkarem and surroundings, around 668 ha.

### 3. Results

#### a. Energy consumption

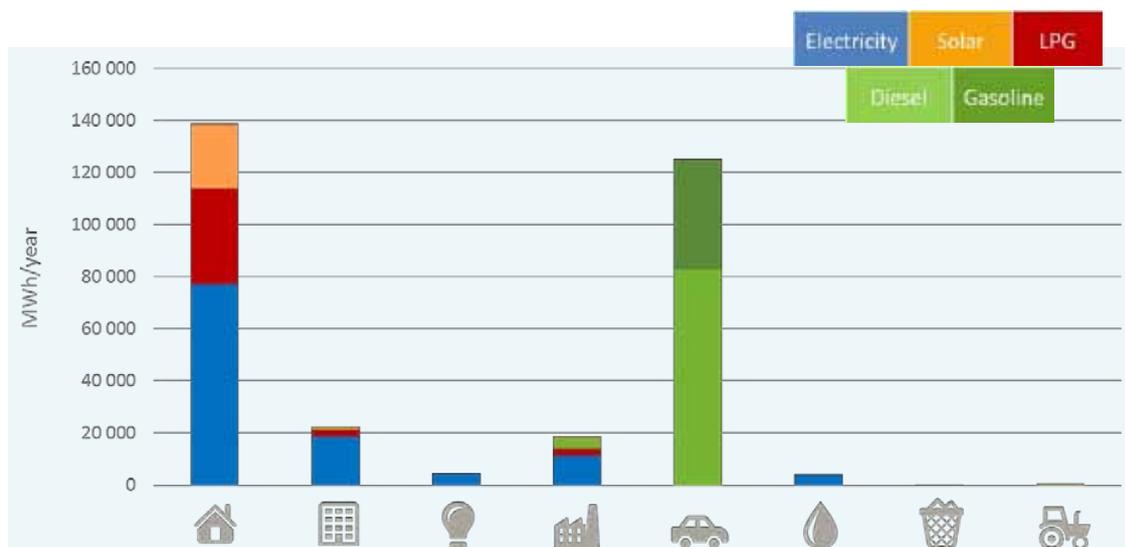
The total energy consumption (final energy) for Tulkarem city perimeter is estimated to be **314 GWh/year** in 2014, which corresponds to about **3.11 MWh/person/year** (equivalent to 1.9 barrel of oil per year per person). The following table and pie chart shows distribution among sectors:



Municipal buildings consumptions are here included under tertiary buildings, although it is detailed in the dedicated chapter (cf. zoom on municipal assets) and in the BEI Excel file. If we look more precisely at consumption per energy and sectors, we realise that the main energy demand sources are fuels for transport and electricity for buildings, especially residential buildings. Compared to other

<sup>11</sup> Inventory of emissions in Palestine 'Emission to air', 2010

Arabic countries, solar thermal energy production in dwellings is very high as it is equivalent to half of household's electricity consumption. If all the water was being heated with electricity instead of sun, it would use 23 GWh and increase residential GHG emissions by 26%.



**Energy consumption per sector and per energy in Tulkarem (2014)**

GWh FE/year	Electricity	Solar	LPG	Fuels	Other	Total
Residential buildings	77,5	23,9	36,5	0,4	0,7	<b>139,0</b>
Tertiary buildings	18,9	0,0	2,8	0,4	0,1	<b>22,2</b>
Public lighting	4,5	0,0	0,0	0,0	0,0	<b>4,5</b>
Industry	11,4	0,0	2,7	4,3	0,3	<b>18,7</b>
Transport	0,0	0,0	0,0	125,4	0,0	<b>125,4</b>
Water management	4,2	0,0	0,0	0,0	0,0	<b>4,2</b>
Waste	0,0	0,0	0,0	0,1	0,0	<b>0,1</b>
Agriculture	0,1	0,0	0,0	0,2	0,0	<b>0,4</b>
<b>Total</b>	<b>116,6</b>	<b>23,9</b>	<b>42,0</b>	<b>130,9</b>	<b>1,1</b>	<b>314,5</b>

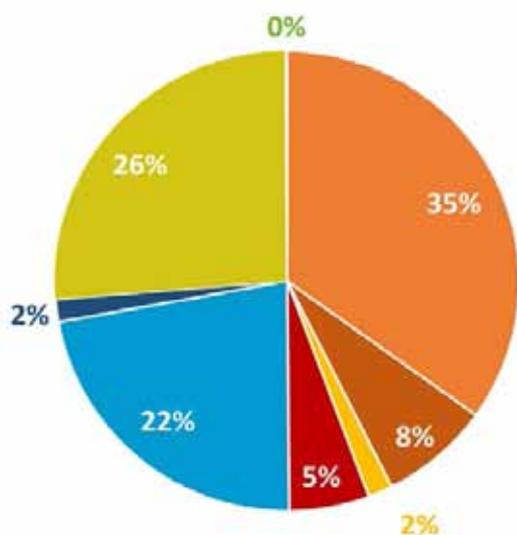
**Table of energy consumption per sector and per energy in Tulkarem (2014)**

Note that electricity losses have not been shown in this energy inventory to comply with the Covenant of Mayors tables, but the GHG Protocol emission factor used considers it. Losses are substantial in all Palestinian cities (22 GWh in Tulkarem). They are due to a combination of technical problems on the grid, unregistered and illegal connections, and customers not able or not willing to pay due to their status (for example refugees). Despite the fact that losses are not registered in the inventory, Tulkarem municipality is willing to continue improving grid efficiency and customers' relation management to reduce losses from 16% to 12%, which appear to be an acceptable threshold for such losses.

**b. GHG emissions**

Global GHG emissions of Tulkarem city are estimated to be **192 ktCO<sub>2</sub>eq/year** in 2014, which corresponds to about **1.90 tCO<sub>2</sub>eq/person/year** (equivalent to 9500 km drive by car). This is twice higher than average emissions per person in Palestine including Gaza Strip (1.0 tCO<sub>2</sub>eq/person/year),

which is due to two factors: urban areas consume more energy, and the BEI scope does not exactly correspond with the national inventory one (in which electricity production is assigned to Israel).

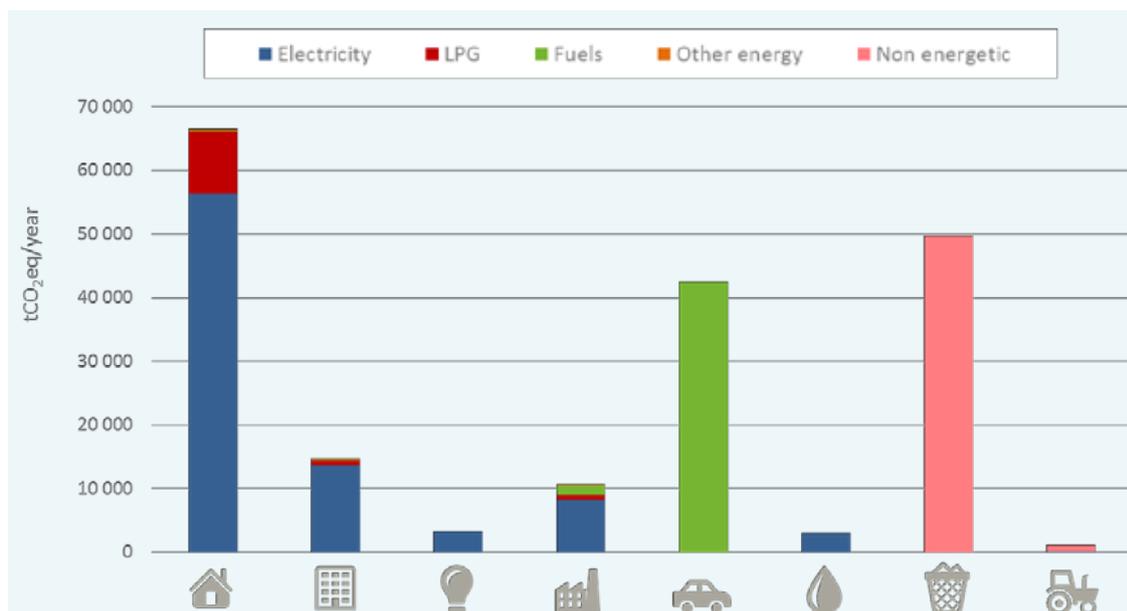


	ktCO <sub>2</sub> eq /year
Residential buildings	67
Tertiary buildings	15
Public lighting	3
Industry	11
Transport	43
Water management	3
Waste treatment	50
Agriculture	1

**GHG emissions in Tulkarem (2014)**

The distribution of GHG emissions among sectors is as presented in the graph above. Municipal buildings consumptions are here included under tertiary buildings, although it is detailed in the dedicated chapter (cf. zoom on municipal assets) and in the BEI Excel file.

Emissions comprise combustion (IPCC Guidelines 2006) and upstream emissions for producing and delivering energy (UNFCCC Guidelines). The emission factor used for electricity is the Israel value which is 727 gCO<sub>2</sub>eq/kWh (GHG Protocol).



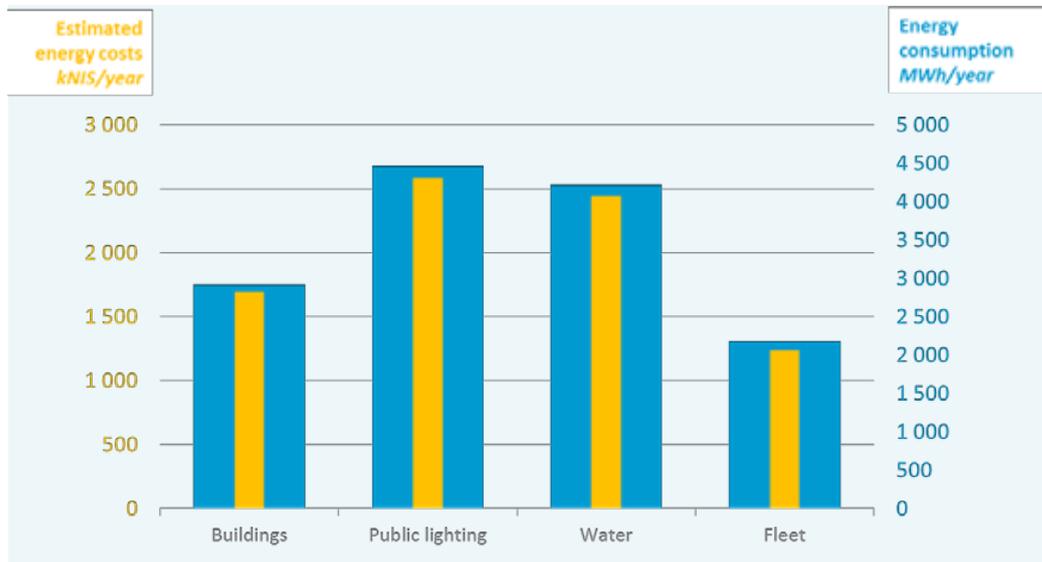
**GHG emissions per sector and per energy in Tulkarem (2014)**

<i>ktCO<sub>2</sub>eq/year</i>	Electricity	LPG	Fuels	Other energies	Non energetic	Total
Residential buildings	56,3	9,8	0,1	0,2	0,0	<b>66,5</b>
Tertiary buildings	13,7	0,7	0,1	0,0	0,0	<b>14,6</b>
Public lighting	3,2	0,0	0,0	0,0	0,0	<b>3,2</b>
Industry	8,3	0,7	1,5	0,1	0,0	<b>10,6</b>
Transport	0,0	0,0	42,5	0,0	0,0	<b>42,5</b>
Water management	3,1	0,0	0,0	0,0	0,0	<b>3,1</b>
Waste	0,0	0,0	0,0	0,0	49,8	<b>49,8</b>
Agriculture	0,1	0,0	0,1	0,0	0,9	<b>1,1</b>
<b>Total</b>	<b>84,8</b>	<b>11,3</b>	<b>44,4</b>	<b>0,4</b>	<b>50,7</b>	<b>191,6</b>

**GHG emissions table per sector and per energy in Tulkarem (2014)**

**c. Zoom on municipal assets**

The energy consumption of Tulkarem municipality belongings (buildings, public lighting, water management and fleet) is **13.8 GWh FE/year**, about 4.4% of the total consumption of the city. For an external point of view, this value seems high since it is 20% more than Hebron assets for half the population. The following chart shows the distribution of consumption and costs among different services of the city. Costs have been estimated using average energy costs (0.54 NIS/kWh for electricity).

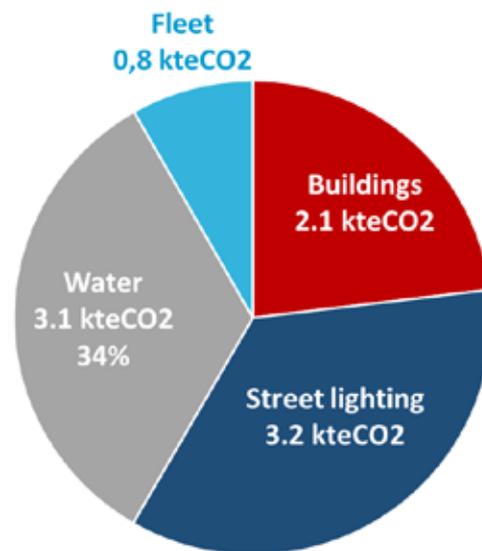


**Energy consumption of municipal assets in Tulkarem (2014)**

Total GHG emissions (except waste treatment) are **9.2 ktCO<sub>2</sub>eq/year**, about 4.8% of all city emissions.

Public lighting and water management are the main sources of emissions of the municipality assets, but also in terms of energy costs and consumption, about 3% of the global city emissions.

**Distribution of GHG emissions of Tulkarem municipality services (2014)**



	Consumption <i>MWh/year</i>	Costs <i>kNIS/year</i>	GHG emissions <i>tCO2eq/year</i>
Municipal buildings	2 900	1 700	2 120
Public lighting	4 500	2 600	3 250
Water management	4 200	2 450	3 070
Municipal fleet	2 200	1 250	760

**Consumption, costs and GHG emissions of municipal assets in Tulkarem (2014)**

#### d. Business-as-usual scenario

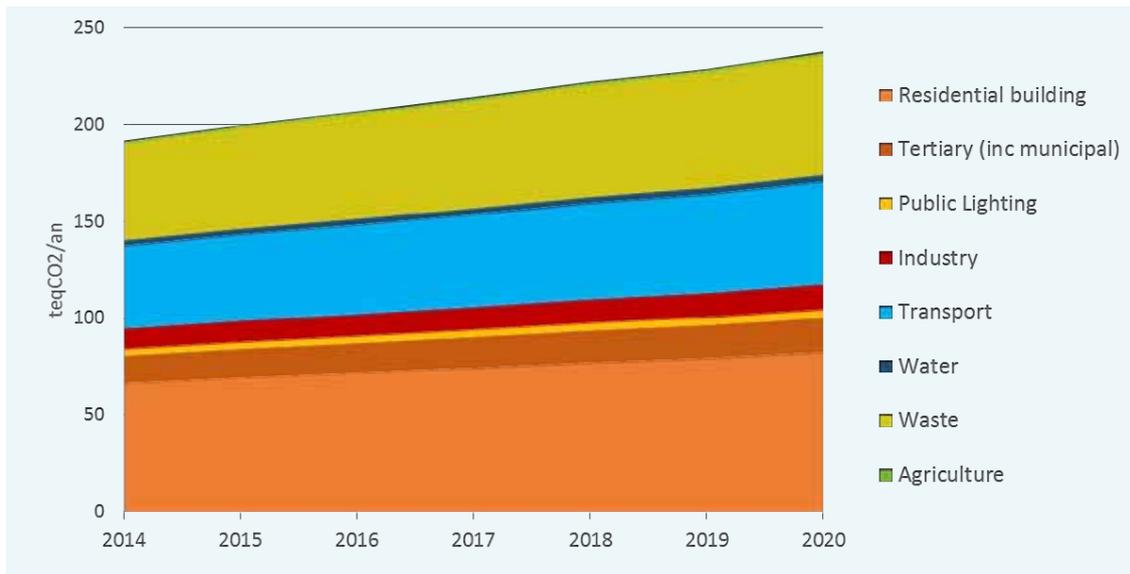
Information isn't consistent enough in Palestine to define a BAU factor<sup>12</sup>. Thus, as advised by the JRC report, we apply BAU factor for Jordan GHG emissions assessment. Applying these factors, we can imagine how GHG emission will evolve in Tulkarem.

	2014	2015	2016	2017	2018	2019	2020
BAU factor for Jordan	1,24	1,19	1,15	1,11	1,07	1,04	1

**BAU factor in Palestine/Jordan**

Supposing an increase of 24% of GHG emissions on all sectors, total GHG emissions in Tulkarem will reach a total of about **238 teqCO<sub>2</sub>/year** in 2020.

<sup>12</sup> Projection to 2020 for setting emission reduction targets in the Southern Mediterranean Partner Countries, JRC, 2013



***BAU trend scenario for Tulkarem GHG emissions 2014-2020***

## 4. Complete BEI tables

### Energy consumption in MWh EF/year in 2014

		Electricity	Liquid gas	Diesel	Gasoline	Coal	Other fossil fuel	Solar thermal	Total
Non municipal	Tertiary buildings	15 933	2 788	350	79	53	51		<b>19 255</b>
	Residential buildings	77 504	36 506	424			684	23 880	<b>138 998</b>
	Industry	11 416	2 708	4 078	231	107	182		<b>18 722</b>
	Agriculture	140	19	183	8	22	5		<b>377</b>
	Transport			80 528	42 672				<b>123 199</b>
	<b>Total</b>	<b>104 993</b>	<b>42 021</b>	<b>85 563</b>	<b>42 990</b>	<b>182</b>	<b>922</b>	<b>23 880</b>	<b>300 551</b>
Municipal assets	Municipal buildings	2 927							<b>2 927</b>
	Public lighting	4 463							<b>4 463</b>
	Waste								<b>0</b>
	Water	4 226							<b>4 226</b>
	Municipal Fleet			2 126	54				<b>2 181</b>
	<b>Total</b>	<b>11 616</b>	<b>0</b>	<b>2 126</b>	<b>54</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>13 797</b>
<b>Total</b>	<b>116 609</b>	<b>42 021</b>	<b>87 689</b>	<b>43 044</b>	<b>182</b>	<b>922</b>	<b>23 880</b>	<b>314 347</b>	

### GHG emissions in tCO<sub>2</sub>eq/year in 2014

		Electricity	Liquid gas	Diesel	Gasoline	Coal	Other fossil fuel	Non energetic	Total
Non municipal	Tertiary buildings	11 583	749	122	25	24	17		<b>12 520</b>
	Residential buildings	56 345	9 811	147			230		<b>66 534</b>
	Industry	8 300	727	1 415	73	48	61		<b>10 622</b>
	Agriculture	102	5	64	2	10	2	911	<b>1 095</b>
	Transport			28 225	13 524				<b>41 748</b>
	<b>Total</b>	<b>76 330</b>	<b>11 292</b>	<b>29 972</b>	<b>13 624</b>	<b>81</b>	<b>310</b>	<b>911</b>	<b>132 520</b>
Municipal assets	Municipal buildings	2 128							<b>2 128</b>
	Public lighting	3 245							<b>3 245</b>
	Waste							49 793	<b>49 793</b>
	Water	3 072							<b>3 072</b>
	Municipal Fleet			745	17				<b>762</b>
	<b>Total</b>	<b>8 445</b>	<b>0</b>	<b>745</b>	<b>17</b>	<b>0</b>	<b>0</b>	<b>49 793</b>	<b>59 000</b>
<b>Total</b>	<b>84 775</b>	<b>11 292</b>	<b>30 717</b>	<b>13 641</b>	<b>81</b>	<b>310</b>	<b>50 703</b>	<b>191 520</b>	

## Section IV: Sustainable energy action plan (planned actions)

*The document is structured in four parts*

- **Background information** – Brief overview of basic information on Tulkarem city
- **Action plan on Municipality building and services** – Presentation of activities that fall under the direct responsibility of the Municipality council (the buildings it manages and the services it implements as part of its core competencies)
- **Action plan on Tulkarem area** – Presentation of activities that can be run by stakeholders independently from the Municipality, but that need a to be stimulated and steered by the Municipality services in order to ensure everyone is acting in a consistent plan

NOTE: These two parts will mainly focus on energy conservation and energy efficiency measures, while the fourth part will focus on renewable energy production.

- **Energy supply and renewable energy development** – Presentation of main constraints faced regarding energy supply and plans to development renewable energy production.

### 1. Background information

Overall population	101.000 inhabitants		
Municipality area	13,793 dunams		
Energy consumption	314 GWh / year	Energy per capita	3,108 KWh / year
Electricity consumption	117 GWh / year <sup>13</sup>	Electricity per capita	1,158 KWh / year
GHG emission	192 KTon eqCO2/y	GHG per capita	1,9 t eqCO2/y

Mayor: **Iyad A. K. Jallad**

Tulkarem or Tulkarm is a Palestinian city in the Tulkarm Governorate in the extreme North West of the West Bank. Despite the catastrophes and disruptions that affected the city in the last 100 years, it hasn't lost its distinctiveness. Saturdays are still the main marketing days since Ottomans: citizens of the city and the neighbouring villages and cities refer to Saturdays by saying: "going to Saturday Market" or to Tulkarm. The city remains an active commercial centre at the crossroad of northern West Bank routes.

The market is crowded with buyers, sellers and different goods while restaurants cafes and recreational centres are crowded with visitors and shoppers. It has been a weekly marketing festival day for the past 124 years and it still reflects the nature of authentic Eastern markets. Boasting such a remarkable day, Tulkarm Municipality works hard to provide all facilities to visitors and residents through developing public services, beautifying the city's landscape and providing help for various services organizations that serve the needy citizens.

Tulkarem is also proud of the homely nature of the city represented through its recreational cities, gardens, halls, sports stadiums, public and private parks and a surrounding forest carefully managed and preserved.

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<sup>13</sup> Note that Tulkarem imports 138GWh of electricity from Israel, but only consumes 117GWh due to 16% losses. Electricity gets bought form Israel at 0,4 to 0,5 ILS /KWh \_ Electricity tariff in Palestine goes from 0,58 to 0,70 depending on customers.

Tulkarm seeks to utilize its distinctive location, being connected to its surrounding cities and governorates in addition to the whole country, and being a border city that connects the West Bank cities – especially the Northern ones.

## 2. Municipal vision and ambition regarding sustainability

*Tulkarem wants to be an attractive city, offering integrated infrastructure and excellent urban services, preserving its cultural heritage, promoting scientific and technic, leading agriculture development and providing a clean and sound environment to its inhabitants.*

As local resources remain limited compared to current and future needs, the Municipality has to define priorities and strategic goals for the next four years, to take advantage of available resources, building consensus on the best options and looking for partnership to mobilize public and private stakeholders. Following this approach, the Municipality designed its four year development plan, supported by a four year investment plans in key areas, engaging community organizations according to their competence and capacities.

Being an important urban centre on the Northern part of the West Bank and on the Israeli border, Tulkarem has a special responsibility in maintaining commercial, humanitarian, social and family ties that bind the people of the city and the surrounding villages with Palestinian leaving on the other side of the green line. Like wise the city complies with its role as Governorate Centre, where people can find departments and directorates from various public institutions, banks and services.

To strengthen this role of important hub in the region, Tulkarem has to maintain a network of roads linking the city and its surroundings, needs to develop infrastructures, such as industrial zone or handicraft area, to absorb the many companies and workshops willing to develop their activities to reduce unemployment and generate incomes, and consolidate services, including medical services that provide support to many people in the region. Through these developments, Tulkarem aspires to be a performing urban centre with integrated infrastructure that properly service citizens.

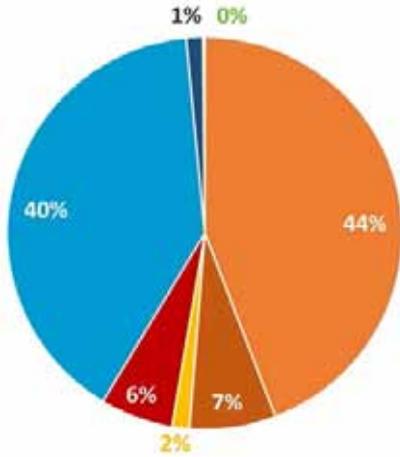
Tulkarem is also known as one city very engaged in promoting science and education. It is the home of one of the oldest educational institutions in Palestine (khadouri), which became one of the first Palestinian public universities, and still attracts today a lot of interest and visitors. Following this heritage, the Municipality still works to provide land for educational and cultural facilities.

Last but not least, Tulkarm still suffers from nuisances and pollutions, mainly originated from the neighbouring Israeli factories in the Western settlement, known as the chemical plant zone. Such problems reinforce Tulkarem's determination to be environmentally clean, green, with clean air and healthy environment for all its inhabitants. In this logic, the Municipality aims at preserving natural area, urban agriculture, forest and greenery, as well as it wants to improve sewage and storm water drainage and development a modern waste management system.

## 3. Summary of the Baseline emissions inventory

### 3.1. Energy consumption

The total energy consumption (final energy) for Tulkarem city perimeter is estimated to be **314 GWh/year** in 2014, which corresponds to about **3.11 MWh/person/year**. This is the equivalent to 1.9 barrel of oil per year per person. Distribution among sectors is as follows.

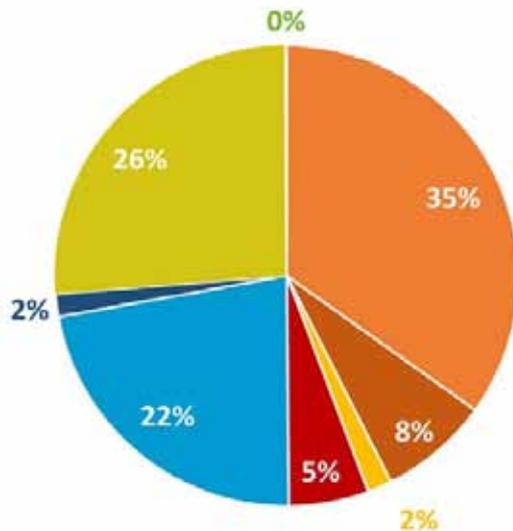


	GWh/y
Residential buildings	139
Tertiary buildings	22
Public lighting	4
Industry	19
Transport	125
Water management	4
Waste treatment	0
Agriculture	0

Note: Municipal buildings consumptions are included here under tertiary buildings. One can find the details in the dedicated chapter of the BEI document.

### 3.2. GHG emissions

Global GHG emissions of Tulkarem city are estimated to be **192 ktCO<sub>2</sub>eq/year** in 2014, which corresponds to about **1.90 tCO<sub>2</sub>eq/person/year** (equivalent to 9500 km drive by car).



	ktCO <sub>2</sub> eq /year
Residential buildings	67
Tertiary buildings	15
Public lighting	3
Industry	11
Transport	43
Water management	3
Waste treatment	50
Agriculture	1

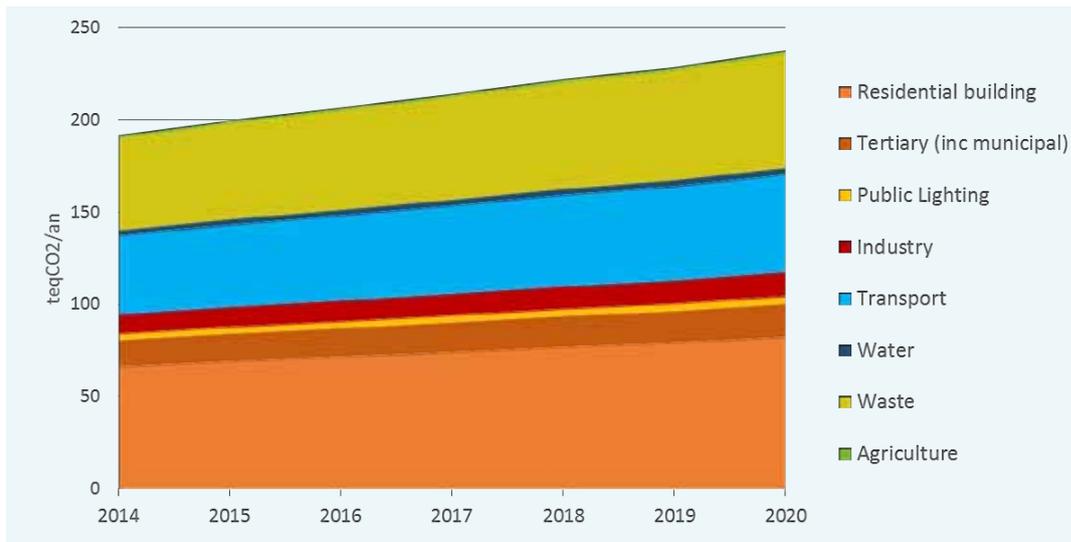
This amount of GHG per capita is pretty low compare to other countries in the region: 2,5 in Jordan; 2,4 in Egypt; 4,6 in Algeria, 9,4 in Israel. However, this shouldn't refrain Tulkarem to develop all efforts to contain these emissions while the city will continue to expand.

### 3.3. Business-as-usual scenario

The BAU scenario gives an indication on how GHG will evolve if no actions were implemented. As data are not consistent enough to define a specific BAU for Palestine, and following JRC recommendation, BAU factors from Jordan were used.

Applying such BAU factors and considering an evenly shared growth among the different sectors, the overall GHG emission will go through a 24% increase by 2020.

GHG emissions in Tulkarem will then reach a total of about **238 teqCO<sub>2</sub>/year** in 2020.



## 4. Action plan on municipal buildings and services

As its first priority, the Municipality Council is committed to act on its direct scope of responsibility: municipal buildings and services (street lighting, water distribution, sanitation, waste management). Through such a commitment, being exemplary on its own perimeter, the Municipality Council will be able to promote the mobilisation of all stakeholders, inviting them to reduce their energy consumption and contribute to the development of renewable energy capacities.

This commitment to act on its own perimeter, also constitutes a field for investigation to test actions, assess results, in order to design appropriate recommendation to be proposed to the citizens, the companies, the citizen groups that will have to act to promote the local energy transition.

### 4.1. Municipal buildings

#### 4.1.1. Current status

The municipality owned 15 buildings in different location representing 5.300 square meters of offices, warehouses and technical facilities. These buildings include, the city hall main building, the water and sanitation office, the electricity management building, the library, a maintenance facility, the public works building, the citizen centre "one stop shop" and six other small buildings.

Municipality buildings (without schools and mosques) consume **669 MW/h of electricity per year** (2014 reference), which represents an annual expense of 334 K ILS (equivalent to 73 K€/y). This consumption comes from lighting offices, cooling and heating, office equipment, elevators, etc.

In 2012, an investigation was conducted on electricity consumption in municipality buildings and services. This study was the first one focusing on the subject. It highlights the potential of energy saving for the municipality. The report made some practical recommendations in various domains: lighting in offices, heating and cooling, street lighting, and electricity grid management...

As a follow up of this investigation some pilot projects were developed regarding street lighting. However, this 1<sup>st</sup> approach wasn't followed by a comprehensive energy management strategic plan.

Regarding renewable energy, although some projects were identified, and despite the fact that municipal buildings offer significant space to install solar PV, there is no project implemented yet.

#### 4.1.2. Energy saving/short-term actions

More efforts should be done in **raising staff awareness** to adopt new behaviour favouring energy conservation: Opening curtains and window shutters during daytime to reduce artificial lighting; Shutting down electric equipment at end of working time or when not actually used; Controlling temperature (at 23°C) to limit heating / cooling energy consumption.

This can be done without significant investment, spreading recommendations to everyone in municipality services: leaflets, meetings, official notices, posters, "save energy" stickers...

It would be interesting to promote a challenge between services / units to invite all workers from the Municipality to make efforts to save energy. The best performing service would be granted an “energy saver/ climate saver” diploma... and would get a special gratification.

**Lighting in buildings** represents **around 20%** of electricity consumption in municipality buildings. Some efforts were made to switch to efficient bulbs, however there is still no tight control of lighting and no automatic device to turn it off after a certain time or when there’s nobody in a room.

To help reducing energy consumption at the municipality building, it is possible for example to install motion sensors in the offices to turn the lights off during the un-occupied periods. This will reduce the lighting consumption by around 20% to 80% based on the occupancy type of these areas. The 2012 case study demonstrates that a 30% cut could be achieved pretty easily installing “motion sensors” in key areas, with an overall cost of less than 50,000 ILS (11,000€) and a return on investment of two and a half year, as cost saving will reach 20K ILS – 4,500€ / year<sup>14</sup>.

**Cooling and heating:** Electricity consumption for heating and cooling **represents 74%** of the overall consumption in municipality buildings. Buildings and offices are equipped with more than 65 split AC/Heater reverse units. There is no central control system for temperature.

In June 2015 a new rule was established setting temperature limits as follows: not less than 22°C in summer, and not more than 25°C in winter. These limits have also been set according to public health recommendations specifying that the gap between outside and inside temperature couldn’t exceed 7 to 8°C. The rule has been enforced after distribution of an official notice in all municipality services. One person ensures regular temperature controls: when measures exceed the limits, the AC/heater get disconnected for the rest of the day, as a penalty for the room regular users.

It appears that these limits are above the one recommended in the 2012 study, proposing 23°C as a standard all along the year, controlled by a thermostat. This recommendation would result in a 45% reduction in electricity consumption for heating and cooling. As the necessary investment is very low (less than 5,000 ILS / 1,200 €) the return on investment is very short: 1.3 month!!!<sup>15</sup>

The rule recently enforced could be improved with this automatic control to optimise the energy cut.

**Electric equipment:** So far office electric equipment (computers, copiers, printers, etc.) is basic. Reduction in consumption could come, on the short term, from a more rigorous management to turn off any device not used, and on the longer term, from switching to more energy efficient units.

This set of short-term measures could lead to a 30% reduction in electricity consumption of municipality building, in less than two years, reducing expenses by 100,000 NIS / year (24,000€).

#### **4.1.3. Energy saving in municipal buildings/long-term actions**

On the long term, energy consumption could be further reduced through two mechanisms:

- Replacing old equipment by more energy efficient ones.
- Renovating old building with adoption of low carbon technologies - improved insulation, double-glazing or low emitting windows, central heating cooling systems, efficient lighting...

Tulkarm Municipality already launched the rehabilitation process for the ground floor of the city hall main building (insulation, electric grid renovation, new lighting system, etc.). The return on investment should be carefully assessed before engaging more renovation. It seems preferable to include energy efficiency measures in renovation plans motivated by other reasons (apart from promoting energy efficiency) as the pretty low level of energy consumption per square meter (XX KWh/sqm) will make it difficult to reach sufficiently attractive return on investment.

Obviously the design and construction of new buildings should follow more stringent rules and new requirements allowing better energy performance for public buildings.

#### **4.1.4. Expected results**

<sup>14</sup> Promotion of energy efficiency & renewable energy in strategic sectors in Palestine, Tulkarm Municipality Report 19, 2012

<sup>15</sup> Promotion of energy efficiency & renewable energy in strategic sectors in Palestine, Tulkarm Municipality Report 19, 2012

Energy in MWh/year GHG in tCO <sub>2</sub> eq/year	Situation in 2014		Cut expected in 2020		Situation in 2020	
	Energy	GHG	Energy	GHG	GHG (BAU)	Cut / BAU
<b>All municipality buildings</b>	<b>669</b>	<b>486</b>		<b>-145</b>		<b>24%</b>
Staff awareness campaign			- 134	- 97		16%
Switch to LED lighting and sensor systems in buildings			- 67	- 48		8%

Note: Impact of long-term measures can't be assessed without more detailed plans

## 4.2. Street lighting

### 4.2.1. Current status

Street lighting in Tulkarm consumes 4,500 MWh of electricity per year (2014 reference), which represents an overall annual cost of 2.6 Million NIS (Equivalent 572,000 €/y).

Like in other Palestinian cities, various types of lamps are used for street lighting: High Pressure Sodium (400 and 250 watt), Metal Halide (400 watt) and Mercury Vapor (125 watt). The entire service requires around 7.000 lamps and is controlled by a central and manual on/off system.

Street lighting represents almost 1/3 of the electricity consumed by Tulkarm municipality facilities and services, so it's worth improving the energy efficiency of the street lighting system.

### 4.2.2. Short-term actions

The Municipality launched different pilot projects to explore ways to improve street lighting efficiency. This first test was run on installing 250 new lamps on a 6 km road on the boundary of the city. The result appears to be interesting offering a 52% reduction of energy consumption compare to classical lamps. That means saving 116,000 ILS (25,500€) per year ensuring a R.O.I of two years considering the high cost of lamps (200€ per unit). Over a longer period of time (12 years as the guaranteed life time of LEDs) the investment will generate significant budget saving, which will allow for additional investment capacities. Such a move is very important considering that street lighting represents 1/3 of the overall municipality energy bill.

Another test will also be launched in Mega Land Street, where HPS 250 watt lamps will replace with LED lamps. 143 units will be provided with the financial support of the World Bank. Initial calculation reveals a 50% cut in electricity consumption offering 2 years return on investment.

Additionally, a pilot plan is under preparation to redesign street lighting at one of the entrance of the city (road from Kalkilya).

Based on these different experiments, the Municipality plan to expand the replacement process of old lamps by more efficient solutions. The main difficulty comes from LED lamps costing 6 to 7 times more than classical devices.

It would be good to conduct a first assessment of this programme at the end of 2016, in order to assess energy consumption reduction resulting from these new technologies and evaluate cost saving during the entire life time of the new equipment proposed.

The budget saved could be then dedicated to upgrading street lighting overtime.

### 4.2.3. Long-term actions: structural upgrading of the street lighting system

#### **Revolving fund to replace HPS lamps / PRIORITY ACTION #1**

From initial investigations, and whatever will be the technical solution, replacement of old lamps by modern technologies (HPCF or LED), appears to be very cost effective.

The Municipality looks for a 400 K€ financial support to feed in a revolving fund dedicated to old lamps replacement. The Electrical department, managing street lighting, will set up a specific budget monitoring mechanism and put aside financial resources preserved due to more efficient lamps replacing, step by step all devices. Resources saved will be invested again in lamp replacement. This set up could ensure full replacement over time (in seven years if replacement by LED, and even less if part of the lamps would be replaced by HPCF lamps instead of LED) ensuring at the same time replenishment of the initial investment fund.

The detailed process for this revolving fund is detailed in the priority action fiche.

### **Street lighting strategic plan**

Based on the Master plan produced in 2012 with the support of the EU, it now should be possible to design a **street lighting strategic plan** identifying areas of differentiated usage, where lighting would be then adapted to the actual needs per specific area.

- Main roads, avenue and city entrances where high intensity lighting should be necessary at least between sunset and midnight and before sunrise. Note that lighting intensity could be easily reduced, even in these areas between midnight and few hours before sunrise.
- Secondary streets where reduced lighting intensity should ensure safety while allowing low energy consumption.
- Specific areas (parks, narrow streets, pedestrian areas, etc.) where moving sensors should be installed to light up when people are around and avoid lighting when nobody is there.

Such an improvement in urban planning and street infrastructures linked with a tighter management of public demand, should lead to designing a lighting system combining qualitative lighting and reduced energy consumption. This evolution will require a combination of technical solutions (moving sensors, midnight automatic reduction, etc.) and social dialog to improve acceptance of different approaches (i.e. reduced lighting after midnight, appropriate lighting in narrow streets, parks, etc.). A possible work plan could unroll as follows:

1. Based on the existing Master plan and elaborating on the first return on experiments of the two tests performed since July 2015, identify 3 or 4 types of streets and areas according to their specific lighting needs.
2. Organise public consultation to ensure proper acceptance of the new lighting system propose and collect ideas to continue improving the plan.
3. Define the appropriate technical solutions for each type and design the implementation program tacking into account priorities per type of areas (for example, identifying one specific block of streets, places and avenues where the new lighting system would be implemented as a show case for the rest of the city).
4. Implement step by step the plan, organising all along the implementation process, a control and assessment mechanism – including public participation – to continuously improve the system based on performance assessment of the option adopted. Such monitoring must measure energy consumption reduction and highlight what it means in budget cuts.

#### **4.2.4. Expected results**

Energy in MWh/year GHG in tCO2eq/year	Situation in 2014		Cut expected in 2020		Situation in 2020	
	Energy	GHG	Energy	GHG	GHG (BAU)	Cut / BAU
<b>Street lighting</b>	<b>4,463</b>	<b>3,245</b>	<b>-2,667</b>	<b>-1,938</b>	<b>4,023</b>	<b>48 %</b>
Expand LED deployment (priority 1)			-2,218	- 1,612		40 %
Street lighting strategic plan			- 449	- 326		8 %

### **4.3. Water distribution**

#### **4.3.1. Current status**

Municipality ensure water delivery for the city, two refugee camps and few villages on the outskirts of the city. There are 6 pumping stations owned and managed by the Municipality. Water from the underground table gets pumped into a main reservoir (1000 cubic meters) and 5 secondary reservoirs (500 cubic meters). The water distribution network ensures delivery all over the city from these reservoirs. Note that the highest multi stores buildings need additional pumping devices.

The system is set up and running for 100 litres/capita/day. Municipality uses 12 million CbM/year. This amount represents almost 50% of PNA allowed capacity from the western water table.

As per Oslo Peace Agreement, PNA was allowed to use 25MCbM/year. Thus, there is now a lot of pressure from the National water authority to contain water consumption in areas like Tulkarem (in the Northern part of West Bank) to allow more quotas to the Southern part of West Bank where cities (like Hebron) are facing real difficulties due to water shortage. Tulkarem Municipality doesn't want to reduce its pumping capacity and would, logically, prefer that PNA negotiate additional pumping capacities for the entire West Bank area.

One way to significantly improve the water distribution system would be to reduce leakage, which represents up to 40%. Leakage is due to the pretty old water network. It results in energy wastage for pumping additional water to compensate the leakage.

Note that individuals are incentivized to save water as the tariff depends on the amount of water consumed. Tariff is set at 2,5 NIS / CbM up to 30 CbM/year, and 3,5 NIS /CbM beyond this limit.

#### 4.3.2. Short-term actions

Efforts will continue to promote energy efficiency through working on pumping engines (adopting variable speed pumps). The 2012 study indicates that the average pumping efficiency can be less than 40%, with 10% of pumps operating below 10% efficiency. Oversized pumps and the use of throttled valves were identified as the two major contributors to the loss of efficiency. Energy savings in pumping systems of between 30% and 50% could be realized through equipment or control system changes. Short-term actions could be as follows:

- Shut down pumps when they are not required.
- Maintain clearance tolerances at pump impellers and seals.
- Check and adjust the motor driver regularly for belt tension and coupling alignment.
- Clean pump impellers and repair or replace if eroded or pitted.
- Implement a program of regular inspection and preventive maintenance to minimize pump component failures.
- Trim the pump impeller to match system flow rate and head requirements.
- Replace out-dated / unsuitable equipment with correctly sized new units.

Such efforts could easily result in 20 % reduction of electricity consumption in water distribution.

#### 4.3.3. Long-term actions

On the long term the Municipality is committed to work on water leakage reduction, which will have a direct impact on energy consumption reduction, as less water would need to be pumped into the network. Initial investigation where already launched to assess the needs. The overall plan to upgrade the water network still need to be designed, funded and implemented.

#### 4.3.4. Expected results

Energy in MWh/year GHG in tCO2eq/year	Situation in 2014		Cut expected in 2020		Situation in 2020	
	Energy	GHG	Energy	GHG	GHG (BAU)	Cut / BAU
<b>Water delivery</b>	<b>4,226</b>	<b>3,072</b>	<b>- 845</b>	<b>- 614</b>	<b>3,809</b>	<b>16 %</b>
Water distribution improvement			- 845	- 614		

### 4.4. Water treatment

#### 4.4.1. Current status

62% of the population in Tulkarm is connected to the sewage system. Most of the sewage network is new, well designed and efficient. However, no more than 10% of the city is covered by rainwater collection system.

The Municipality uses pre-treatment ponds on the western part of the city, and then transfer the grey water to the Israeli treatment plant for final processing. 85% of wastewater is pre-treated and around 15% is running through natural streams without any treatment.

One of the agreed projects with KFW is to build a treatment plant at the western side of the city. The project is under negotiations with the Israeli authorities. Most probably the Israelis authority will not grant the permit for the plant as they prefer to continue treating Tulkarem waste water and benefit from the use of the treated water in local agriculture (for Israeli farmers).

#### **4.4.2. Long-term plans**

If the project of a wastewater treatment plant had to be confirmed, it would be good to consider promoting the addition of a bio-digester that could process sludge from the wastewater treatment, and bio-waste that could be generated from a separate collection project to be promoted.

If Tulkarem had to continue with the current pre-treatment pounds, it will have to deal with the sludge from the pool (700 cubic meters to be processed every 3 years). As the sewage network will expand to neighbouring villages, it will have to treat another 300 cubic meters every 3 years.

This amount of organic material has to be considered, along side with organic waste potentially collected in the city, as resource for feeding a possible bio-digester unit.

### **4.5. Solid waste management**

#### **4.5.1. Current status**

The solid waste issue gained significant attention in recent years, not only due to its environmental impacts, but also for its social and economical consequences.

The Municipality service operates 8 trucks with compactors (on the city perimeter). This service collects 22,000 tons/year in the city itself, and 7,500 tons/year from the two refugee camps embedded in the city boundaries. The Municipality service also collects 30,000 tons/year in the other parts of the district. This represents 1 kg per capita / per day in the city and in the camps, slightly less in rural areas around the city.

Waste composition breakdowns as follows: 25 to 30% bio-waste – 15% carton and plastic, the remaining part (50 %) being a mix that cannot be recycled.

The total amount of waste collected represents 50 to 60 tons/day from the city (and the 2 refugee camps) and reaches 100 tons/day when joining with other parts of the district. The amount of waste collected goes every day to the transfer point managed by the Jenin joint service council, and then to the Jenin sanitary landfill servicing the northern part of West Bank.

#### **4.5.2. Short-term actions**

The Municipality is committed to work on reducing waste to be collected as the major solution to reduce energy consumption generated by waste management.

In that sense, Tulkarem already benefits the support of the EU to run a **pilot project** to reduce waste, developing selective collection of bio-waste starting with local markets. The project already collects 5 to 7 tons a day through this separate channel (10% of the overall amount of waste collected).

Beginning of September 2015 another work stream will open for selective collection of paper and cardboard. This will be managed by private contractors, granted permit by the Municipality, and selling back such material to specific companies in Jordan.

Step by step the Municipality learnt how to reduce the total amount of waste transferred to landfill, through using part of the bio-waste to produce compost in cooperation with the Dhinnabeh Agricultural Society, as well as separating carton for recycling. By 2020, the Municipality aims at diverting 30% of waste to compost avoiding GHG emission from landfilling. On the long term, the objective is to reduce waste transferred by 50%, recycling 80% of cartons and 50% of bio waste.

The Municipality will continue developing **public awareness** to reduce waste generation, promote recycling and separation. The idea is to draw experience from the pilot project to then be extended to the entire city.

### 4.5.3. Long-term actions

As the follow up of the pilot project mentioned above, it would be good to promote the recycling business that would stimulate the separate collection and ultimately reduce the amount of waste going to landfill. The Municipality is committed to follow a step-by-step approach to do so.

It is also important to define what would be the best use of collected bio-waste. Ideally this product could be mixed with sludge from wastewater treatment to produce methane in a bio-digester. However, such a project should be designed at district level to reach the appropriate scale for a good technical and financial efficiency of the project.

Biogas recovery from Jenin landfill is another option to produce energy from domestic waste. However, the Joint Service Council can only manage such a project.

### 4.5.4. Expected results

Energy in MWh/year GHG in tCO <sub>2</sub> eq/year	Situation in 2014		Cut expected in 2020		Situation in 2020	
	Energy	GHG	Energy	GHG	GHG (BAU)	Cut / BAU
<b>Solid waste management</b>	<b>143</b>	<b>49,843</b>	<b>-28</b>	<b>- 14,947</b>	<b>61,805</b>	<b>24 %</b>
Improve waste management through better monitoring of the collect process	143	50	- 28	- 10		0,01 %
Waste separation and recycling, reducing waste to landfill by 30%				- 14,937		24 %

## 4.6. Other services and long-term responsibilities

### 4.6.1. Municipal fleet

The Municipality run 40 vehicles in the municipality fleet. To reduce these emissions and save energy few options can be develop:

- Tighter monitoring of the fleet is used to ensure that actual usage is in line with the purpose of the Municipal fleet, and to optimise this usage based on accumulated experience.
- Drivers training to adopt eco-efficient driving behaviour (improving ones driving patterns might result in 10 to 20% consumption cut)

In the longer term, old vehicles should be replaced by low emitting ones (either gas powered vehicles or electric ones when electricity can be provided by renewable sources).

Energy in MWh/year GHG in tCO <sub>2</sub> eq/year	Situation in 2014		Cut expected in 2020		Situation in 2020	
	Energy	GHG	Energy	GHG	GHG (BAU)	Cut / BAU
<b>Municipality fleet</b>	<b>2,181</b>	<b>762</b>	<b>- 436</b>	<b>-152</b>	<b>945</b>	<b>16 %</b>
Improve fleet management			- 218	- 76		8 %
Develop eco-friendly driving practices			- 218	- 76		8 %

### 4.6.2. Public procurement policy

The Municipality being an important “buyer” of goods and services could introduce energy and climate change criteria in its public procurement rules.

The Tulkarm Municipality through few tenders (e.g. for water pumps) already considered criteria regarding energy savings allowed, as the main issue for awarding the purchased equipment.

### **4.6.3. Sustainable urban planning**

The Municipal Council, by defining how urban development will shape, has a very important role to play on long term climate and energy performance of the entire city.

A dense city, where services are easily reachable; and where people can live close to where they work will result in decreasing mobility demand, meaning less cars, less traffic congestion, less GHG emissions... On the contrary linear extension along the entry roads will impose long commuting distance between living places and working places or services...

Tulkarm already established a detailed mapping. It would be could to check how the development plan that could be designed from this mapping could help reducing energy consumption.

A strategic development plan should promote specific areas for industrial development, for greenery and recreation, specifying for each of these areas the type of road infrastructure, street lighting, water management, waste collection services, which will be organised to cope as closely as possible with the demand and avoid wastage of space, energy, water...

### **4.6.4. Skills and expertise development**

Availability of a local authority staff presenting the adequate skills and expertise in terms of technical knowledge (energy efficiency, renewable energies, efficient transport) or project management (data management, financial forecasting and investment planning, communication skills, green public procurement, etc.) need to be developed everywhere in Palestine.

Tulkarm Municipality is looking to improve its staff experience and to implement the good knowledge for serving the city and surrounding, and expect to improve its team experience.

## **4.7. Awareness campaign**

### **4.7.1. Current situation**

It is not only good to raise awareness among Municipality staff for them to make necessary efforts to promote energy conservation in their daily work, it is also important to continue developing awareness programme among citizens and stakeholders in Tulkarem.

Many plans have been already implemented in Tulkarem: leaflets, TV programmes, posters, article in local newspaper, face-book pages, etc. The Municipality organize such campaign twice a year. There is no specific team in charge of public awareness, thus such are carried on and coordinated by the technical teams dealing with energy, waste and water. These people consider that, although awareness remains important, it is very hard to assess the impact of awareness campaigns.

### **4.7.2. Possible actions**

As local population and local stakeholders are always in need for additional mobilization in the field of energy conservation and renewable energy development, it would be good to develop a strategic road map to raise awareness among all stakeholders in Tulkarm.

This could be done through the following actions:

- Spreading **information and training material** (posters, brochures, stickers, etc.) to remind everyone of the importance of energy saving as a driver to save money as well to contribute to a cleaner environment.
- Develop an annual event "**Energy festival**" where best practices could be demonstrated and innovative projects celebrated. Such a festival could be promoted through a large advertising campaign mobilising all traditional media but also social networks online.
- Unroll specific awareness campaigns among specific target groups, for example through the development of a network of "**Positive energy schools**" that would produce more energy than they actual consume, with a combination of energy conservation / energy efficiency measures and the development of Solar PV on schools roofs to generate electricity. Teachers should be engaged in such programmes to use all the potential of the technical development, as support for training students.

#### **Warnings:**

1. Tulkarem, like many other Palestinian municipalities, already run awareness campaign in the past and continue to do so on a regular basis. It will be then essential to first assess the

efficiency of what has been done so far, before “reinventing the wheel”...

2. Due to the complex political background in West Bank, where energy shortage is perceived more as an component of the persistent pressure from Israel, than as a consequence of daily overconsumption, any message to call for energy conservation should be crafted carefully. The key argument for people will remain the reduction of their energy bill and the limitation on dependency towards Israeli sources.

Raising awareness should also be seen as a tool to push citizen to take ownership of the energy issues, engage in energy conservation efforts or participate in renewable energies take off, and doing so, actively contribute in the implementation of the local and sustainable energy strategy, that will reduce dependency on Israeli energy sources and will improve local economy.

Note: Results of awareness activities are specifically noticed in sectors (municipal building, tertiary and residential buildings, mobility) where these activities will be developed.

## 5. Action plan on Tulkarem’s urban area

Beyond its direct scope of responsibility (on buildings and services), the Municipality council is committed to mobilize all stakeholders acting in its boundaries. It is only through the overall commitment of residents, shops, businesses, local groups, farmers, etc. that significant reduction in energy consumption and development of renewable energy will be achieved.

### 5.1. Residential and tertiary buildings

#### 5.1.1. Current situation

The residential and tertiary building sector is the first one in terms of energy consumption (51% with 161 GWh/year) and GHG emission (43% with 82 ktCO<sub>2</sub>eq/year).

The electricity used in residential and tertiary buildings is purchased from the IEC, which offers rather poor performance regarding CO<sub>2</sub> content per KWh. Electricity costs 0,58 ILS / KWh for residents. The average consumption per households reaches 350 KWh/month, meaning a 200 ILS budget per month (2,450 ILS/year or 500 to 550 €/year).

Solar heating (for water) is widely spread in Tulkarm: around 70% of dwellers are equipped with such devices (compare to 64% in West Bank).

Liquid gas is also used in housing mainly for cooking.

#### 5.1.2. Short-term actions

It is still necessary to **raise public awareness** on energy issues, inviting inhabitants to reduce their consumption and, as a consequence, cut their energy bill. However, the margin for improvement remains pretty low. People care about their expenses and they naturally tend to control their energy consumption.

Public awareness should then concentrate on simple actions that inhabitants can implement with good result in energy budget cuts:

- Tighter control of temperature at home: usually homes are too hot in winter and too cold in summer when a reasonable heating/cooling temperature can result in 20 to 30% cut in energy consumption.
- Promoting behavioural changes at home: turning off lights, proper management of refrigerator, replacing classical bulbs with efficient device...
- Promoting energy efficient cooling/heating devices, as the one on the market are not good enough. People buy cheap equipment without taking into account the higher level of energy consumption, which results in a higher “global cost” over a certain period of time.

Public awareness could be also stimulated through practical demonstration of efficient equipment and responsible behaviour backed by actual cost saving for the household.

#### 5.1.3. Long-term actions

On the longer term, the municipality plans to work in two complementary directions:

- Improving **energy performance in new buildings**
- Promoting a **renovation programme** targeting less energy efficient building where basic retrofitting work could improve comfort while reducing energy consumption.

#### **Energy efficient rules for new buildings**

The Municipality is willing to promote **energy high-performance recommendations** for any new building to be constructed. This will be done through developing a **new local building regulation** that will make it compulsory to reach a certain level of energy efficiency in all new buildings. The Municipality will take advantage of new regulation currently developed at national level in Palestine. However, Tulkarem authorities want to lead the development of energy high-performing building and will look for any innovation in that sense.

#### **Retrofitting existing building**

Even if there a lot of new buildings in Tulkarem, it is important to consider that the biggest gain in energy consumption would come from improved energy performance in existing buildings.

To design and implement an adequate retrofitting plan for housing and tertiary buildings, the Municipality should engage in the following steps:

- Assess the need though detailed mapping of housing registering average consumption, date of construction, location...
- Train small local companies, which will have the flexibility to work in different type of condition while performing adequate retrofitting programmes that result in significant reduction of energy consumption.
- Develop a partnership with a bank acting as a “third party investor” that will support the investment (for example through a process where the bank will cover the cost of the loan from a part of the savings allowed by the refurbishment programme).
- Promote retrofitting programme to selected targets offering the best potential in return on investment and, elaborating on these showcases, further deploy the plan.

The main constraints of such a plan will be the mobilization of appropriate resources to fund renovation programmes, as in many cases house owners will not have the fund to invest at the appropriate level. This is why such a programme requires a partnership between the municipality, which will offer the guarantee that retrofitting will result in actual cuts in the energy bill, and the bank providing the necessary funds for engaging the retrofitting process.

Such a plan should include adoption of efficient cooling/heating devices. It could also include the installation of solar PV to contribute to renewable electricity production.

New rules regarding access to energy, i.e. imposing a limit on power per square meter could also represent a constraint that will steer both innovation and more responsible practices.

#### **5.1.4. Expected results**

Energy in MWh/year GHG in tCO2eq/year	Situation in 2014		Cut expected in 2020		Situation in 2020	
	Energy	GHG	Energy	GHG	GHG (BAU)	Cut / BAU
<b>Residential &amp; tertiary buildings</b>	<b>160,511</b>	<b>80,696</b>	<b>- 17,695</b>	<b>- 14,006</b>	<b>100,063</b>	<b>14,0 %</b>
Awareness to reduce consumption			- 15,354	- 11,162		11,2 %
Housing renovation plan			- 4,454	- 2,239		2,2 %
New construction rules			-1,203	- 605		0,6 %

## 5.2. Transport

### 5.2.1. Current situation

Transport is one of the key concerns to be addressed, as this sector is both a significant domain of energy consumption and the third GHG emitter (with around 43.000 tons CO<sub>2</sub> equivalent / year).

Transportation in the city depends on private cars, shared taxi, private taxi... and the same for outside the city with larger buses and shared taxis. There is no public transport service operated by the Municipality itself.

There are currently 3 different private buses companies and 50 taxis. Awareness is very low among bus and taxi drivers regarding energy saving. There are no real incentives to improve transport efficiency. Note also that Tulkarm doesn't suffer major traffic congestion problems.

In 2011 and 2012, Tulkarm municipality in cooperation with the local community prepared a Strategic Development Plan for Tulkarm and its suburbs for a period of 25 years. The first two years of the plan (ending 2013) were dedicated to setting up a GIS system as to facilitate work with citizens, the private sector and public institutions. The municipality is now in the process of redesigning its Master plan. It will be the right time to connect strategic thinking regarding traffic management and the design of the Master plan to define which structural decision could be taken in order to reduce the need for transport of people and goods within the city, thus reducing energy consumption from the transport sector.

### 5.2.2. Actions already planned

The Municipality already started a plan for reducing the number of cars entering the city centre, and put some restriction for the heavy vehicles to get access to certain roads.

### 5.2.3. Short-term actions

The Municipality will work in two directions to start addressing impact of transport in the city:

- Building a **car park in the main centre** to reduce traffic in the heart of the city
- Promoting use of **electric bicycles** as an alternative to cars for short distance travels.

#### **Car park in the main centre / PRIORITY ACTION #2**

The attractiveness of the city centre generates a lot of traffic. People are desperately looking for parking places and spend a lot of time – and thus a lot of diesel or gasoline – before finding one. This results in traffic congestion, air pollution, GHG emissions and other nuisances.

To counter this problem, the Municipality wants to build a big parking place close to the main centre. This building will include a 12 stores building of 1000 square meter each: 6 levels of parking (3 underground and 3 above ground) and another 6 levels of shops and offices. Construction costs will be partly covered by marketing the spaces dedicated to shops and offices.

The entire building will be conceived and realized to be a showcase of high-energy efficiency. It is absolutely essential to set up an efficient shuttle system that will bring people from the parking to the main centre. This is the condition for a really positive impact of this investment

#### **Electric bicycle development**

Recently one can observe that some people bought an electric bicycle as a good alternative for short distance travel in the city. It has been proven that bicycles, with electric assistance, are very efficient alternatives for travel distances up to 10 kilometres. In a city like Tulkarem, pretty extended and with some hills, electric bikes are a very good solution.

Instead of letting this alternative growing at a slow pace, the Municipality plans to invite investors to develop this solution through different incentives:

- Offering specific spaces to install bicycles parking places close to the key area to be visited (market, city hall, citizen centre, hospital)...
- Provide support to set up a bike renting service that will help citizen to test the electric bike solution before buying one.

- Provide a subsidy for the first 1000 bikes to be bought...

Note that the experience from various cities around the world shows that after a 1<sup>st</sup> period of “assisted development” the fleet of electric bike develops by itself, as citizens see the benefit of this mobility solution: practical, healthy, cheaper and very convenient! Additionally, the development of bike usage also results in job creation for the bikes fleet maintenance.

#### 5.2.4. Long-term: designing a Sustainable Urban Mobility Plan

Ideally a city committed to reduced energy consumption and GHG emission would design and implement a Sustainable Urban Mobility Plans (SUMP) that could entail the following:

- Integrating transport and city planning policies, while prioritising public transportation and active modes of mobility for people, low emission modes for goods.
- Structuring the urban transport sector by empowering a public transport authority to take action for the improvement of urban transport in the city. In the case of Palestine, this would mean a closer collaboration between the Municipality council and Ministry of Transportation.
- Supporting the development and improvement of integrated public transport systems to make them more attractive to local inhabitants.
- Developing incentives, as well as regulation measures, in order to control the use of private motor vehicles and to make other modes a more attractive choice.
- Developing communication and participation strategies involving the public, with the aim of facilitating behavioural changes.
- Promoting active modes of transport, especially walking and cycling, in particular by providing safer conditions for the users.
- Implementing a common methodology to measure GHG emissions, report on them and monitor all other benefits deriving from the development of sustainable urban mobility.

Such a comprehensive plan would require a strong coordination from the Municipality Council for its design and implementation.

Long-term transformation of the transport system will also require additional investment:

- To improve roads quality in the city.
- To implement a more efficient management of the overall traffic, while promoting more collective transports.
- To promote the replacement of fleet and switch to more efficient vehicles.

#### 5.2.5. Expected results

Energy in MWh/year GHG in tCO2eq/year	Situation in 2014		Cut expected in 2020		Situation in 2020	
	Energy	GHG	Energy	GHG	GHG (BAU)	Cut / BAU
<b>Transports</b>	<b>123,199</b>	<b>41,748</b>	<b>- 17,863</b>	<b>- 6,053</b>	<b>51,768</b>	<b>11,6 %</b>
Car Park in city centre			- 4,927	- 1,670		3,2 %
Electric bicycle development			- 1,232	- 417		0,8 %
Sustainable urban mobility plan			- 11,704	- 3,966		7,7 %

### 5.3. Industry

#### 5.3.1. Current situation

There are only few industries in Tulkarm and most of this industrial activity is coming from small businesses, shops and warehouse. None of these industries can be defined as energy intensive, or high emitters.

The industry is a rather “small” contributor in energy consumption (with 19 GWh/year or 6% of the total) and in GHG emissions (with 5% and 11 ktCO<sub>2</sub>eq/year).

The Municipality has allocated two areas as manufacturing and industrial area, where it implemented all needed infrastructure. However, the site lacks sufficient electricity power to service all activities. Tulkarm in cooperation with other villages in the district, and with the Chamber of Commerce, is looking to establish a separate industrial zone for the entire district, in addition to the manufacturing zones in the city.

So far, the business sector doesn't feel concerned with energy saving strategy and it is not easy for the Municipality services to engage with this sector.

### 5.3.2. Short-term actions

Two options could be promoted on the short term to prepare a more interesting long-term impact:

- Get a **better understanding** of energy consumption and GHG emission of the industry in Tulkarm, in order to build a comprehensive action plan on a robust analysis of the sector.
- Raise **awareness** among business owners to invite them to think about any change they could promote to reduce their own energy consumption or to promote products and services that will help their clients to reduce their own energy consumption.
- Raise **awareness** among the business sector on the benefit of developing renewable energy solutions and the industry, which support this development.

### 5.3.3. Long-term actions

Depending on the detailed understanding of energy consumption from the industry, it will then be possible to define more precise actions to be implemented on the long term.

### 5.3.4. Expected results

Energy in MWh/year GHG in tCO <sub>2</sub> eq/year	Situation in 2014		Cut expected in 2020		Situation in 2020	
	Energy	GHG	Energy	GHG	GHG (BAU)	Cut / BAU
<b>Industry</b>	<b>18,722</b>	<b>10,622</b>	<b>-1,872</b>	<b>- 1,062</b>	<b>13,171</b>	<b>8,1 %</b>
Awareness among business holders			-1,872	- 1,062		8,1 %

## 5.4. Agriculture and forestry

### 5.4.1. Current situation

Inside the Municipality boundaries, around 20% of the local economy depends on agriculture, which offers a mix of vegetable, fruits and animal production. The Municipality cooperates with local NGO's and cooperatives to encourage the development of this sector.

Even if the Ministry of irrigation is the responsible for the quantity of water for irrigation, the Municipality actually supply water from wells with electricity. Irrigation consumes 10M m<sup>3</sup>/year.

The Municipality considers agriculture as one of the important component of its economic development and is willing to support this sector.

### 5.4.2. Possible actions

- **Raising awareness among farmers** to promote behavioural changes that would help reducing energy consumption
- Promotion of **sophisticated irrigation system** (drip irrigation) to reduce water needed and thus reduced energy consumption
- Develop a **comprehensive plan to collect green waste and animal manure** to potentially combine with bio-waste to feed in the compost production unit, and could be directed later to a bio-digester that could be developed in the city (see waste treatment).

### 5.4.3. Expected results

Impacts are to be considered as marginal.

## 6. Energy supply and renewable energy development

Tulkarm city as other cities and villages in Palestine rely almost entirely on Israel for its energy supply. Electricity, gas, fuel and gasoline are all imported from Israel. Solar heaters are widely spread like anywhere in Palestine, but solar PV development is still in its infancy. As energy demand continues to grow, energy conservation, energy efficiency and development of renewable sources are key challenges to be taken in Tulkarm.

Inside the Municipality boundaries 98% is covered by electrical network, but in the surrounding area the percentage is slightly lower (around 80%).

Regarding electricity, Tulkarm municipality decided not to join NEDCO, but instead to buy its electricity directly from Israel, as purchasing prices appear to be more interesting. The Municipality acts like a distributor for the electricity bought from the Israeli company.

Before end of 2015, Tulkarem will set up its own “electric company” dealing with distribution and production of electricity.

So far, there is no electricity production plant in the municipality boundaries. The objective of the Municipality is to reduce electricity consumption and develop renewable electricity production in order to minimize its dependency on IEC. This is also motivated by the fact that Tulkarm suffers at time electricity shortage due to constraints put by the Israeli company. In summer time, due to intense use of air conditioners, there are cuts in electricity delivery (2 hours / day, rotating from one area to the other). As a matter of fact, citizens are equipped with diesel generators to compensate when the grid doesn't supply them.

Moreover, the Municipality would need an extra 20 GWh of electricity per year to set up and handicraft zone, which, so far, lacks energy supply.

The grid is old and would need significant improvement including to reducing technical leakage. Important effort was made to install prepaid meter for electricity. Nowadays 90 % of the city area is covered, which means that over 95 % of them are paying their bills. For water, the estimate is that around 70% of inhabitants are paying their bills.

### 6.1. Grid improvement/ **PRIORITY ACTION # 3**

The Municipality still face a 16% loss in the electric grid. Such loss comes from a combination of technical problem (old cables, inappropriate transformers, etc.) and electricity being stolen from the grid by un-registered / illegal connections.

Since 2010, the Municipality already invest 200.000 € / year to improve the grid (switching to isolated wires and upgrading electric transformers where necessary). This level of investment needs to be maintained for another 10 years. This investment need to be compared with 2.3 m€ losses per year due to the actual 16% loss on the grid.

On the short term it would be good to run a complete investigation of the electricity grid to assess status and identify necessary improvements.

On the longer term, recommendation from the assessment mentioned above would be necessary to ensure higher grid efficiency. Like everywhere in West Bank, an important element of the grid improvement is to ensure it will support the connection of a growing number of small capacity solar PV units that could be spread on private buildings, small companies, parking places...

### 6.2. Solar PV development

There are many opportunities to develop solar PV and it would be very efficient to promote a comprehensive plan for the Tulkarm area, targeting different objectives: Municipality buildings and other public buildings and residents and private investors.

Taking into account the fact that cost of PV installations is going down and considering the pretty high cost of electricity in Palestine, return on investment is now getting attractive (5 to 6 years).

#### **Solar PV on all public buildings and available public spaces / PRIORITY ACTION #4**

The plan is to develop solar PV units connected to the grid wherever possible and appropriate. A rough inventory demonstrates that close to 50.000 square metres could be equipped only using

buildings roofs. This includes Municipality buildings, schools, university, hospital, marketplace, bus terminal, etc.

If only 50% of this surface would be equipped the system will represent a 6.25 MW capacity, will produce close to 10GWh per year and will ensure a pay back over 5 years.

Assumptions:

- Cost of a 1KW unit = 1500 US\$ - 1335 €. Annual production 1600 KWh / installed KW
- Assumptions: KWh purchased at 0,58 ILS / Change ILS to € at 0,23 / Change € to US\$ at 0,89

Various options could be proposed to exploit this PV potential:

- **Negotiate an 8 Million € loan** to install 1,500 KW/ year over 4 years. In the fourth year and beyond, the Municipality will produce 9,600 MWh annually and generate revenues of 1.1 Million€ per year from reducing electricity imports. The Municipality will be able to reimburse the initial investment after 9 years.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Investment	2 000 000	2 000 000	2 000 000	2 000 000					
Installed capacity/year KW	1 500	1 500	1 500	1 500					
Total installed capacity KW	1 500	3 000	4 500	6 000	6 000	6 000	6 000	6 000	6 000
Production in KWh	2 400 600	4 800 000	7 200 600	9 600 000	9 600 000	9 600 000	9 600 000	9 600 000	9 600 000
Revenues in €	276 069	552 000	828 069	1 104 000	1 104 000	1 104 000	1 104 000	1 104 000	1 104 000
Cumulated revenues	276 069	828 069	1 656 138	2 760 138	3 864 138	4 968 138	6 072 138	7 176 138	8 280 138

- **Negotiate a 1 Million € subsidy** to install 1,000 KW in 2 years. The production of year n-1 will be then invested to install as much capacity as possible, growing from 70 KW in year 3, and up to 350 KW in year 10. In this process, after 10 years the Municipality will save 479K€ (in year 10) from reduction in electricity import, and will be able to continue developing solar PV units at a good pace to reach 10MW installed in year 20 without any additional support. By then (after 20 years) Tulkarem will be able to produce up to 15GW from solar PV.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Capacity installed / year	300	600	70	140	160	190	220	265	300	350
Total capacity in KW	300	900	970	1 110	1 270	1 460	1 680	1 945	2 245	2 595
Investment in €	400 500	801 000	93 450	186 900	213 600	253 650	293 700	353 775	400 500	467 250
Initial subsidy	400 000	600 000								
Production in KWh		480 000	1 440 000	1 552 000	1 776 000	2 032 000	2 336 000	2 688 000	3 112 000	3 592 000
Production in €		64 032	192 096	207 037	236 918	271 069	311 622	358 579	415 141	479 173
Net income in €		64 032	-38 822	20 137	23 318	17 419	17 922	4 804	14 641	11 923
Cumulated net income	0	64 032	25 210	45 347	68 665	86 084	104 006	108 811	123 451	135 374

- **Pass a deal with a private company** that will invest and pay a rent to the municipality for using the roofs. The Municipality will buy the electricity produced reducing its dependency on IEC. This model is probably easier to manage for the municipality but it will not provide as much resources on the long run than the previous one.

#### **Solar PV for residents and private owners / PRIORITY ACTION #5**

The plan is to develop solar PV units in every possible place invited residents to contribute to this development. Through this process residents will benefit additional income after the pay back period and will become energy producers as well as being energy consumers.

Assumptions:

Cost of a 1KW unit = 1500 US\$ - 1335 €. Annual production 1600 KWh / installed KW  
KWh purchased at 0,58 ILS  
Change: ILS to € at 0,23 / € to US\$ at 0,89

		US \$	Euro	KWh/an	Prod €	Prod \$	ROI
Cost	5kv	7 500	6 675				
Prod	5kV			8 000	1 067	1 199	6,3

The economical model could be as follows: The investor installs a 5KW unit. He sells the electricity produced to the Municipality. After 6 years, the investment has been paid back and the owner gets additional revenue from its production unit.

Different options could be proposed to develop this process:

- **The municipality proposes residents to invest and install 5KW units on their roof.** The electricity produced goes to the Municipality (or the Electric company it will have set up for this purpose). After 6 years the total value of electricity produced matches the initial investment and the PV unit get transferred to the resident who will then get incomes from the electricity sold to the Municipality. In this system the financial balance remains the same for the Municipality. It covers the initial investment and receives in return electricity, which will not be bought from IEC generating an economy equivalent to the initial investment. When the PV unit gets transferred to the resident, it buys electricity for him and not from IEC, reducing the dependency from Israel.
- **The municipality invites resident to share the investment.** In that case the resident will cover part of the investment and will then get parts of the revenue from the production as soon as the PV unit gets installed. The pay pack period remains more or less the same or could be slightly longer depending on the way the investment gets shared. The overall economy of the system remains the same. However, one can consider that sharing the investment with residents will push them to get more ownership on the energy issue and been then more conscious on the benefit of working for energy conservation and efficiency.
- **The municipality pass a deal with a bank that will offer attractive loans to residents.** Resident, benefiting form the loan, covers 100% of the investment. The Municipality offers its guarantee to secure the loan, as it commits to buy all the electricity produced. This mechanism could allow a faster development of PV units.

If the Municipality sets up a 1 million € fund to be engaged over a 4 years period of time it will allow itself to install 188 KW each over 4 years reaching 750 KW installed in the fourth year. In this set up, the Municipality will avoid imports 138K€ of electricity from Israel every year and will be able to reimburse the initial 1 million € required to set up the revolving fund after 9 years.

If the investment gets split between the Municipality and residents the amount of units possibly installed every year would grow according to the share of investment covered by residents.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Investment	250 000	250 000	250 000	250 000					
Installed capacity/year KW	188	188	188	188					
Total installed capacity KW	188	375	563	750	750	750	750	750	750
Production in KWh	300 075	600 150	900 225	1 200 300	1 200 300	1 200 300	1 200 300	1 200 300	1 200 300
Revenues in €	34 509	69 017	103 526	138 035	138 035	138 035	138 035	138 035	138 035
Cumulated revenues	34 509	103 526	207 052	345 086	483 121	621 155	759 190	897 224	1 035 259

Such a mechanism will also require a proper maintenance unit to be set up in order to ensure that PV units are producing at their full potential, offering the shortest pay back period possible. This will obviously generate jobs and more business around the development of solar PV.

### 6.3. Other renewable energy sources

Solar heating is widely used for covering households' needs. However, Solar heating could also be used in some industries, shops restaurants, etc. that require hot water. Modern equipment is allowing very good performance to match specific industrial needs.

This component of the plan could then:

- Identify specific need of industry related to heat and hot water requirement.
- Identify technical solutions to match these needs with solar heating devices.
- Develop pilot projects to promote these new usages

The programme should also explore other option to produce energy, among which one can mention the following:

- Processing waste into energy: If the Municipality develops separate waste collection, then bio-waste could be processed into a digester (to produce methane and then electricity), and non recyclable material could be used as fuel in specific units.
- Shallow geothermal source, pumping heat from underground (to produce heating/cooling with a small addition of electricity).

### 6.3.1. Expected results

Energy in MWh/year GHG in tCO <sub>2</sub> eq/year	Situation in 2014		Cut expected in 2020		Situation in 2020	
	Electricity*	GHG	Energy	GHG	GHG (BAU)	Cut / BAU
<b>Electricity supply &amp; renewable energy</b>	<b>116,609</b>	<b>84,775</b>		<b>- 8,654</b>	<b>105,121*</b>	<b>8,2 %</b>
Grid efficiency improvement Base line losses in 2014: 22,182 MWh Gain in losses reduction 221 MWh/y			- 1,105	- 803		0,8 %
Solar PV in public buildings			+ 9,600	- 6,979		6,6 %
Solar PV for households & private buildings			+ 1,200	- 872		0,8 %

\* 105,120 tCO<sub>2</sub> equivalent is the expected GHG generated from electricity (bought from Israel) in 2020, according to the Business as usual scenario (24% growth from 2014 to 2020).

In 2014, 100 % of electricity comes from Israel where it is produced with a significant carbon load: 0,727 tCO<sub>2</sub> eq / kWh. When locally produced electricity from PV replaces electricity from Israel, the carbon load per kWh goes down to 0, reducing GHG emission on electricity consumption.

## 7. Conclusion

The current action plan will result in achieving a 20% reduction in GHG emission compare to the business as usual scenario, where emission would reach 237,545 tCO<sub>2</sub>eq/year in 2020. Such a plan allows Tulkarem to be in line with the Covenant of mayor commitments. The following tables propose a synthesis of this action plan.

## 8. Tulkarem SEAP overview

Title / Type of action /Content		Situation in 2014		Expected results in 2020		GHG cut in %	Economy		Time frame
		Energy MWh/year	GHG emissions tCO <sub>2</sub> eq/year	Energy MWh/year	GHG emission tCO <sub>2</sub> eq/year		Cost Investment	Return €/y	
<b>Municipal building</b>		<b>669</b>	<b>486</b>		<b>-145</b>	<b>24%</b>			
<b>1</b>	Staff awareness campaign to reduce energy consumption (light, cooling/heating, equipment) <i>Assumption: 20% efficiency gain through appropriate behaviour promoted by awareness campaign</i>			- 134	- 97	16%	20K€/y	18 K€/y	Starts 2016
<b>2</b>	Switch to LED lighting and sensor systems in 100% of buildings (5 unit x 1000sqm x 4K€)			- 67	- 48	8%	20K€	8,900 €/y ROI 4,5 y	Starts 2017
<b>3</b>	Energy rehabilitation programme Improved insulation and EE in heavy equipment			Still to be defined					
<b>Street lighting</b>		<b>4,463</b>	<b>3,245</b>	<b>- 2,667</b>	<b>- 1,938</b>	<b>48%</b>			
<b>4</b>	Expand LED deployment based on lessons learned from the pilot project <i>Assumption: All lamps replaced by LED in 4 years</i>	<b>1</b>		- 2,218	- 1,612	40%	400K€	269K/y5 ROI 6y	Starts 2016
<b>5</b>	Street lighting strategic plan <i>Assumption: additional gain of around 20%</i>	<b>1</b>		- 449	- 326	8%	50K€	59K€/y	Starts 2016

Title / Type of action /Content		Situation in 2014		Expected results in 2020		GHG cut in %	Economy		Time frame
		Energy MWh/year	GHG emissions tCO <sub>2</sub> eq/year	Energy MWh/year	GHG emission tCO <sub>2</sub> eq/year		Cost or Investment	Return €/y	
<b>Water delivery</b>		<b>4,226</b>	<b>3,072</b>	<b>- 845</b>	<b>- 614</b>	<b>16 %</b>			
6	Water distribution system improvement <i>Assumption: Continuous efforts in improving equipment will reduce energy consumption by 20%</i>			- 845	- 614	16 %	20M€	280K€/y	Starts 2015
7	Long term: rehabilitation of the network should reduce leakage, reducing energy consumed <i>Assumption: Water pumped could be reduced by 20 to 30% as leakage are estimated over 40%</i>			No clear plan yet to act on this issue					
<b>Solid waste management</b>		<b>143</b>	<b>49,843</b>	<b>- 28</b>	<b>- 14,947</b>	<b>24 %</b>			
8	Improve waste management through better monitoring of collect process ( <i>Gain 20%</i> )	143	50	- 28	- 10			28K€/y	Starts 2016
9	Waste separation and recycling, bio waste being used to produce compost <i>Assumption: 30 % of waste diverted to compost</i>				-14,937	24 %	tbd	tbd	Starts 2016
<b>Municipality fleet</b>		<b>2,181</b>	<b>762</b>	<b>- 436</b>	<b>-152</b>	<b>16 %</b>			
10	Short term: Improve fleet management			- 218	- 76	8 %	tbd	58K/y	Starts 2016
	Short term: more eco friendly driving practices			- 218	- 76	8 %			
11	Long term: Progressive fleet replacement <i>No precise plan sets at this stage</i>								

Title / Type of action /Content		Situation in 2014		Expected results in 2020		GHG cut in %	Economy		Time frame
		Energy MWh/year	GHG emissions tCO2eq/year	Energy MWh/year	GHG emission tCO2eq/year		Cost or Investment	Return €/y	
<b>Residential and tertiary buildings</b>		<b>160,511</b>	<b>80,696</b>	<b>- 17,695</b>	<b>- 14,006</b>	<b>14,0%</b>			
<b>12</b>	<b>Public awareness unit</b> action to promote energy consumptions <i>Assumption: the unit will generate 30 % saving in electricity consumption in 50 % of private households and tertiary buildings.</i>			- 15,354	- 11,162	11,2%	Already mentioned in block 1		Starts 2016
<b>13</b>	<b>Housing renovation plan</b> Promote renovation plan to reduce energy consumption at home / Train local companies to develop expertise / Develop partnership with a bank to support funding for renovation programmes. <i>Assumption: this work will generate 30 % saving in energy consumption in 10 % of private households and tertiary buildings.</i>			- 4,454	- 2,239	2,2 %	12K€/household	1,200€/y household ROI 10 y	Starts 2017
<b>14</b>	<b>New rules for construction</b> Develop new rules to promote energy efficient buildings and develop a new business expertise <i>Assumption: New buildings will replace 1% of existing total and will allow 75% reduction/sqm</i>			-1,203	- 605	0,6 %	50K€	130 K€/y	Starts 2017

Title / Type of action /Content		Situation in 2014		Expected results in 2020		GHG cut in %	Economy		Time frame
		Energy MWh/year	GHG emissions tCO <sub>2</sub> eq/year	Energy MWh/year	GHG emission tCO <sub>2</sub> eq/year		Cost or Investment	Return €/y	
<b>Transport</b>		<b>123,199</b>	<b>41,748</b>	<b>- 17,863</b>	<b>- 6,053</b>	<b>11,6%</b>			
<b>15</b> <b>Cark park city centre</b> <i>Assumption: The park will result in 4% less traffic in the city (reduction of 2000 cars/hour/day)</i>	<b>2</b>			- 4,927	- 1,670	3,2 %			Starts in 2016
<b>16</b> <b>Electric bicycle development</b> <i>Assumption: On the long run 1% of car users will switch to bicycle</i>				- 1,232	- 417	0,8 %			
<b>17</b> <b>Sustainable urban mobility plan</b> <i>Assumption: The plan when actually implemented should result in generating an additional 10 % reduction in traffic all over the city</i>				- 11,704	- 3,966	7,7 %	200K for the study	1.6m€/y benefit for drivers + Indirect benefits for the city	Study in 2017
<b>17</b> <b>Industry</b>		<b>18,722</b>	<b>10,622</b>	<b>-1,872</b>	<b>- 1,062</b>	<b>8,1 %</b>			
Raise awareness on energy efficiency <i>Assumption: this process will generate 10% energy efficiency gains</i>				-1,872	- 1,062	8,1%		Benefit depends on type of industry	Starts 2017
Long term: Development of the Eastern industrial area focusing on energy efficiency				Further investigation required to assess what could be the costs and impacts on the long term					
<b>18</b> <b>Agriculture and forestry</b>		<b>377</b>	<b>1,095</b>						
Promote EE among farmers while demonstrating the benefit for their business Promote drip irrigation Organise green waste collection				Impact on the sector will remain marginal for the city.					Starts 2017

Title / Type of action /Content			Situation in 2014		Expected results in 2020		GHG cut in %	Economy		Time frame
			Energy MWh/year	GHG emissions tCO <sub>2</sub> eq/year	Energy MWh/year	GHG emission tCO <sub>2</sub> eq/year		Cost or Investment	Return €/y	
<b>Energy supply and renewable development</b>					- 1,105 + 10,800	- 8,654	8,2%			
19	Continue Grid efficiency improvement <i>Assumption: Improvement generates 1% per year losses on the grid over a period of 5 years</i>	3	2014 losses 22,182 Mwh		- 221/y - 1,105/y5	- 803 in 2020	0,8%	200K€/y	150K€/y after year 5	Starts 2016
20	Develop Solar PV in public buildings, schools, mosques, parking place, markets... <i>Assumption: 10 Mw capacity installed over 5 years</i>	4			+ 9,600 per year (year 4)	- 6,979 in 2020	6,6 % on total elec consumption	8 m€	9 years	Starts 2016
21	Develop Solar PV for households & private <i>Assumption: 1 Mw capacity installed over 5 years</i>	5			+ 1,200 per year	- 872 in 2020	0,8 % on total elec consumption	1m€	160K€/y ROI 6,2 y	Starts 2016

Note: 1MWh in transport generates on average 140 € in energy expenses.

## TULKAREM SEAP Expected results

Title / Type of action /Content		Situation in 2014		Expected results in 2020			
		Energy MWh/year	GHG emission tCO2eq/year	Reduction energy consumption MWh/y	Additional energy production MWh/y	Reduction in GHG emission tCO2eq/year	Reduction in % compare to BAU
Non Municipal	Residential and tertiary buildings	160,511	80,696	- 17,695		- 14,006	
	Transport	123,199	41,748	- 17,863		- 6,053	
	Industry	18,722	10,622	-1,872		- 1,062	
	Agriculture and forestry	377	1,095				
	Solar PV development				1,200	- 872	
		<b>302,809</b>	<b>134,161</b>	<b>- 37,430</b>	<b>1,200</b>	<b>- 21,993</b>	<b>13 %</b>
Municipal assets	Municipal building	669	486	- 201		- 145	
	Street lighting	4,463	3,245	- 2,667		- 1,938	
	Water delivery	4,226	3,072	- 845		- 614	
	Solid waste management	143	49,843	- 28		- 14,947	
	Municipality fleet	2,181	762	- 436		-152	
	Electricity grid improvement			- 1,105		- 803	
	Solar PV development				+ 9,600	-6,979	
	<b>11,682</b>	<b>57,408</b>	<b>- 5,282</b>	<b>+ 9,600</b>	<b>- 25,426</b>	<b>29 %</b>	
<b>TOTAL</b>	<b>314,491</b>	<b>191,569</b>	<b>- 42,712</b>	<b>+ 10,800</b>	<b>- 47,419</b>	<b>20 %</b>	

The current work plan results in a 20% GHG emission cut compared to the BAU scenario where GHG emissions would reach 237,545 tCO2eq/year

## 9. Monitoring

In order to ensure the longevity of the Sustainable energy action plan (SEAP), and to verify that Tulkarem is on track to meet its commitments, it is necessary to provide the municipality with a simplified tool to evaluate the SEAP's actions. For actions with quantifiable impacts, an action's impact is evaluated with the use of monitoring and piloting indicators for the actions with quantifiable impacts.

To estimate impacts in terms of energy, energy efficiency gains (or unitary gains) will be applied to each action depending on the availability of data at the municipal level. As a result, it will be necessary to rely on local experiences (for example, an assessment of thermal renovation projects in the municipality) and the work undertaken by the municipal energy advisor.

The work done on the SEAP in 2015 made it possible to develop a piloting and decision-making tool to consolidate the action plan for 2015-2020 and to highlight the level of effort required to meet the SEAP's objectives. On the basis of a summary table that aggregates the data concerning GHG emissions, energy consumption and the development of renewables, a monitoring process will be carried out on a yearly basis. All of the impact measures from the 2015-2020 SEAP may not be implemented simultaneously nor updated at the same pace. Thus, the tool must indicate the state (on-going, under consideration, etc.), the coordinator, the indicator, the quantified objective and emissions targets (numbers and percentages) for each action.

A simplified excel tool (see above) will be provided to the municipalities so that all of the parties involved in implementing an action, or actions, will be able to use the evaluation tool. The tool must enable the user to verify if the objectives set by the action plans are met and to identify which actions are problematic in terms of implementation.

The municipality should routinely monitor the SEAP's implementation in order to support and promote the actions. Several options will be developed depending on the expectations of the municipality:

- Holding an annual or semi-annual meeting of municipal actors based on the technical consultation workshops organised in 2015. In order to limit the number of meetings held and to encourage transversal collaboration that reinforces synergies between actors and to deal more efficiently with the interactions between the SEAP and other public policies, the meetings will be organised thematically.
- Accompanying strategic actors in formulating their commitments (based on the ranking produced during the consultation phase in 2015).
- Holding a yearly assessment meeting with all of the actors mobilised after the consultation in 2015. This meeting will provide the opportunity to:
  - present the updated territorial and regulatory carbon assessments
  - present the monitoring tool that measures the action plan's effects on the reduction of GHG emissions and the progression of renewable energy production.
  - recognise new commitments that have been made since the first celebration organised after the consultation.
- Updating, if necessary, the documents which promote the SEAP in order to mobilise actors and encourage new commitments
- Responding to the specific requests of the municipality

In 2016, actors that were still wavering in their commitments in 2015 should be targeted. Depending on their strategic importance (in terms of their ability to influence the action plan's objectives) the municipality should closely accompany these actors so that they become fully committed and engaged participants.

In order to convince more actors to participate, the municipal council should highlight the benefits that actors engaged in the SEAP have experienced and the overall benefits that the monitoring tool provides.

Sector	Subsector	Year	Content of the action	Status	Responsible for action	Indicators	Quantified goal	Cut of GHG emission expected	Goal achievement	Achievement of emission goal	% goal
Municipal building	Staff	2016	Staff awareness campaign to reduce energy consumption			Persons reached		97 tCO2eq/year	0	0	tCO2eq/year 0
Municipal building	Lighting	2017	Switch to LED lighting and sensor systems in 100% of buildings			LED lamps and sensors		48 tCO2eq/year	0	0	tCO2eq/year 0
Municipal building	Equipment	TBD	Energy rehabilitation programme					TBD	0	0	0
Street lighting	Lighting	2016	Expand LED deployment			LED lamps		1.612 tCO2eq/year	0	0	tCO2eq/year 0
Street lighting	Strategic plan	2016	Street lighting strategic plan			LED lamps and sensors		326 tCO2eq/year	0	0	tCO2eq/year 0
Water delivery	Distribution system	2015	Water distribution system improvement			Loss of water	liters	614 tCO2eq/year	0	0	tCO2eq/year 0
Water delivery	Network	TBD	Long term: rehabilitation of the network					TBD	0	0	0
Solid waste management	Waste management	2016	Improve waste management through better monitoring of collect process			tons	tons	10 tCO2eq/year	0	0	tCO2eq/year 0
Solid waste management	Waste separation	2016	Waste separation and recycling, bio waste being used to produce compost			tons	tons	14.937 tCO2eq/year	0	0	tCO2eq/year 0
Municipality fleet	Fleet management	2016	Short term: Improve fleet management			Persons reached		76 tCO2eq/year	0	0	tCO2eq/year 0
Municipality fleet	Fleet management	2016	Short term: more eco friendly driving practices			Persons reached		76 tCO2eq/year	0	0	tCO2eq/year 0
Municipality fleet	Fleet replacement	TBD	Long term: Progressive fleet replacement			Vehicles	TBD	TBD	0	0	0
Residential and tertiary buildings	Public awareness	2016	Public awareness unit action to promote energy consumptions			Persons reached		11.162 tCO2eq/year	0	0	tCO2eq/year 0
Residential and tertiary buildings	Housing renovation	2017	Housing renovation plan			Number of houses		2.239 tCO2eq/year	0	0	tCO2eq/year 0
Residential and tertiary buildings	Rules for construction	2017	New rules for construction					605 tCO2eq/year	0	0	tCO2eq/year 0
Transport	Car park	2016	Car park city centre			Car parks		1.670 tCO2eq/year	0	0	tCO2eq/year 0
Transport	Electric bicycle	TBD	Electric bicycle development			Number of bicycles		417 tCO2eq/year	0	0	tCO2eq/year 0
Transport	Mobility plan	2017	Sustainable urban mobility plan					3.966 tCO2eq/year	0	0	tCO2eq/year 0
Industry	Awareness	2017	Raise awareness on energy efficiency			Persons reached		1.062 tCO2eq/year	0	0	tCO2eq/year 0
Industry	Energy Efficiency	TBD	Long term: Development of the Eastern industrial area focusing on energy efficiency					TBD	0	0	0
Agriculture and forestry	Awareness	2017	Promote EE among farmers while demonstrating the benefit for their business			Persons reached		Marginal impact	0	0	0
Energy supply and renewable dev	Grid efficiency	2016	Continue Grid efficiency improvement					803 tCO2eq/year	0	0	tCO2eq/year 0
Energy supply and renewable dev	Solar PV	2016	Develop Solar PV in public buildings, schools, mosques, parking place, markets			PV panels	m2	6.979 tCO2eq/year	0	0	tCO2eq/year 0
Energy supply and renewable dev	Solar PV	2016	Develop Solar PV for households & private			PV panels	m2	872 tCO2eq/year	0	0	tCO2eq/year 0

# ANNEXES



## **ANNEX I – PROJECT FICHES**



TULKAREM – Priority action # 1 for SEAP		
<b>1. General presentation</b>		
<b>TITLE: STREET LIGHTING EFFICIENCY IMPROVEMENT</b>	<b># 1</b>	Area(s) of Intervention: <b>A</b>
Summary of the Action		Location: <b>TULKAREM</b>
<p>Street lighting in Tulkarm consumes 4,500 MWh of electricity per year, which represents an overall annual cost of 572,000 €/y. Various types of lamps are used for street lighting: High Pressure Sodium (400 and 250 W), Metal Halide (400 W) and Mercury Vapor (125 W). The entire service requires around 7.000 lamps and is controlled by a central and manual on/off system.</p> <p>Various pilot projects were conducted changing existing lamps to more efficient devices. All these tests demonstrate the benefit of changing lamps. Minimum gain in energy consumption was 52% in the last operation conducted.</p> <p>Based on these experiences, the Municipality wants to launch a process to change all lamps in the city and improve the overall management of street lighting system.</p>		Start date: <b>2016</b>
		Project lifetime: <b>5 years</b>
		End date: 2021
		Estimated cost €
400K€ initial investment (to be reimbursed after 4 to 5 years)		
General Objectives of the project		Status of the Action:
<p>Replacing low efficiency street lamps to reduce energy consumption and cost, while improving street lighting quality. Reduction in electricity consumption will reduce GHG linked to this electricity consumption.</p>		<ul style="list-style-type: none"> <li><del>• New</del></li> <li><del>• Planned</del></li> <li><del>• Under implementation</del></li> <li>• Following previous action.</li> </ul>
Principal partners and stakeholders		Contact person in the local authority
<ul style="list-style-type: none"> <li>• Tulkarm Street Lighting unit</li> </ul>		Nehad Abu Sheika Tulkarem Strategic Planning Director
<b>2. Technical description</b>		
Link to municipal development plan		
<p>The street lighting improvement is one of the change processes to be promoted to demonstrate possible reduction in energy consumption in public services. Even if street lighting remains a rather small consumption centre, it is highly symbolic to demonstrate that the right choice can result in close to 50% energy consumption reduction.</p>		
Implementation plan ½		
<p><b>Component 1:</b> The project consists in replacing all old lamps with LED ones. This should be done in a dynamic way (reaching a critical mass of streets concerned with the change) in order to emphasize the fact that change is possible and will benefit the entire city. The following investment plan could be proposed. It depends on an initial contribution of 400.000 € (as a loan) to change close to 50% of all lamps in year 1. The savings will be reinvested in new replacement. After year 6 the Municipality will be able to reimburse the initial loan.</p>		

	A1	A2	A3	A4	A5	A6	Total 5Y
Investment	400 000 €	200 000 €	200 000 €	140 000 €			940 000 €
Lamps replaced	3 200	1 600	1 379	966			
New lamps	3 200	4 800	6 179	7 145	7 100	7 100	
Still to be replaced	3 800	2 200	821				
Cost without changing	595 000 €	595 000 €	595 000 €	595 000 €	595 000 €	595 000 €	4 165 000 €
Actual lighting cost	470 200 €	407 800 €	354 007 €	328 662 €	326 600 €	326 600 €	2 808 869 €
						<b>Net saving</b>	<b>416 131 €</b>

Assumptions:  
Average cost per LED lamp 125€ - Average consumption per lamp (before replacement): 85€/y  
Energy saving for each lamp replaced by a LED one: 39 €/y. Note: some figures have been rounded up.

**Implementation plan 2/2**

**Component 2:** Design a **street lighting strategic plan** identifying areas of differentiated usage, where lighting would be then adapted to the actual needs per specific area.

- Main roads, avenue and city entrances where high intensity lighting should be necessary at least between sunset and midnight and before sunrise. Note that lighting intensity could be easily reduced, even in these areas between midnight and few hours before sunrise.
- Secondary streets where reduced lighting intensity should ensure safety while allowing low energy consumption.
- Specific areas (parks, narrow streets, pedestrian areas, etc.) where motion sensors should be installed to light up when people are around and avoid lighting when nobody is there.

Component 2 and 1 should be implemented at the same time, the component 2, giving guidance to inform and structure the replacement plan.

**3. Organization and procedures**

Formal approval	Staff allocated to prepare, implement, monitor action
City council needs to decide for the implementation of the plan.	Nehad Abu Sheika - City strategic planning XX - Street lighting chief manager
Staff training needs	Role of Partners
The street lighting team need to receive a proper training on two subjects: <ul style="list-style-type: none"> <li>• Technical maintenance of LED lamps</li> <li>• Understanding of strategic street lighting design and implementation.</li> </ul>	Local groups representing citizens should be invited to specific workshop to design the strategic street lighting plan, in order to take into account their recommendations in designing the plan, but also to convince them that a different lighting system (and at time less lighting intensity) will not disturb their life and will offer more collective benefit

**4. Summary of related Awareness Raising (AR) actions**

A communication plan need to be develop to highlight the benefits of the strategic street lighting plan and use it as a show case to demonstrate the benefit of promoting energy savings.

**5. Assumptions and risks (3)**

As tests have already been implemented and as the technology is now mature enough, risks are rather limited.

The design of the strategic lighting plan is probably the more complex aspect of the project, however

<p>the only risk would be to “limit” the saving to the 50% technical reduction allowed by the sole lamp replacement, when a more strategic approach (with differentiated approach per area) could result in saving going far beyond 50%.</p> <p>Bad behaviour of kids could lead to destruction of some devices, this is why it is essential to raise awareness in the population to highlight collective benefits of improved street lighting.</p>	
<b>6. Key success factors (3)</b>	
<ul style="list-style-type: none"> <li>• High cost of electricity means that any saving will be a significant incentive</li> <li>• The time length of LED lamps (3 to four times higher than usual lamps) make the investment more attractive</li> <li>• Public participation can help designing an ambitious street lighting plan</li> </ul>	
<b>7. Cost estimates</b>	
Technical support for designing the strategic plan	30,000 €
Training for Municipality staff	5,000 €
Rolling fund (possibly loan to be reimbursed after 6 years): The Electrical department, managing street lighting, would set up a specific budget monitoring mechanism and put aside financial resources to replace, step by step, old lamps with more efficient ones. The money saved would be reinvested in lamp replacement. This set up would ensure the full replacement, over time (in seven years if replaced by LED, and even less if some of the lamps were replaced by HPCF), as well as the replenishment of the initial investment fund.	400,000 €
Approximate annual cost saving (after initial investment reimbursement)  Taking into account that the Municipality should reserve 40K€ per year to build a fund that would be used to renew lamps after 10 years of time life.	230,000 €/year
Return on Investment (draft calculation)	The loan could be paid back in year 6. The project then generates significant cost saving every year.
<b>8. Available and foreseen sources of funding</b>	
<b>Local authority's own resources:</b> The Municipality allocates staff from its street lighting unit	<b>National Funds and Programs</b>
<b>International Financial Institutions</b>	<b>EU Funds &amp; Programs and other external funds</b>
<b>Public-Private-Partnerships (available or to raise)</b>	<b>Lined up private investments</b>
<b>Loans and potential borrower</b> AFD could be providing the loan, offering to cover cost of loan interests	<b>Expected annual cost savings to City budget</b> 230,000 €
<b>9. Projected Energy Estimates in 2020 (or other set target year)</b>	
Energy savings MWh/y	2,667 MWh/year
Renewable energy production MWh/y	Not relevant

CO2 reduction t CO2/a	
- Reference Year	2014
- Target Year	2020
- Percentage of net reduction on the territory	1.01 %
- Reduction as related to BAU scenario	1,938 tCO <sub>2</sub> eq/year
- Per capita calculated reduction	0,019 TCO <sub>2</sub> equivalent

TULKAREM – Priority action # 2 for SEAP		
<b>1. General presentation</b>		
<b>TITLE: CAR PARK IN THE CITY</b>	<b># 2</b>	Area(s) of Intervention: <b>B</b>
Summary of the Action		Location: <b>TULKAREM</b>
<p>The attractiveness of the city centre generates a lot of traffic. People are desperately looking for parking places and spend a lot of time – and thus a lot of diesel or gasoline – before finding one. This results in traffic congestion, air pollution, GHG emissions and other nuisances.</p> <p>To counter this problem, the Municipality wants to build a big parking place at the appropriate distance to the main centre. The building will count 12 stores of 1000 square meter each: 6 levels of parking (3 underground and 3 above ground) and another 6 levels of shops and offices. Construction costs will be partly covered by marketing spaces dedicated to shops and offices.</p> <p>The entire building will be conceived and realized to be a showcase of high-energy efficiency.</p> <p>It will be associate an efficient shuttle system that will bring people from the parking to the main centre, in order to ensure a positive impact of this investment.</p>		Start date: <b>2016</b>
		Project lifetime: <b>5 years</b>
		End date: 2021
		Estimated cost €
		100,000 K€ project design 12 millions € investment
General Objectives of the project		Status of the Action:
<p>Setting a big car park close to the centre will reduce time spend by drivers to find a parking place, thus reduce energy consumption, traffic jam and air pollution. The building will also be a showcase of energy efficient construction even going as far as being a positive energy building (producing more energy than what it actually consumes).</p>		<ul style="list-style-type: none"> <li>• New</li> <li>• <del>Planned</del></li> <li>• <del>Under implementation</del></li> <li>• <del>Following previous action</del></li> </ul>
Principal partners and stakeholders		Contact person in the local authority
<ul style="list-style-type: none"> <li>• Tulkarm Municipality</li> <li>• Private investors, shop owners, commercial services, etc.</li> </ul>		Nehad Abu Sheika Tulkarem Strategic Planning Director
<b>2. Technical description</b>		
Link to municipal development plan		
<p>This equipment will help redesigning traffic management in the city and will be a key element of raising awareness among inhabitants to promote new behaviours regarding moving in the city. The fact that the building itself will be a showcase of energy high performance will also steer the transformation of the building sector (supported by new rules)</p>		
Implementation plan		
<p>The detailed project still needs to be designed. Key component of the design will be its location. Taking into account availability of land the Municipality should opt for a place which will be at an appropriate distance from the mere centre: not too close to keep cars as far as possible for the centre but, not too far, to be sure that drivers coming to the centre will actually leave their car at the parking considering it is the most efficient solution for them.</p> <p>The design process should engage the public as an essential step in raising awareness of the</p>		

public regarding necessary changes in travel practices in the city itself.							
<b>3. Organization and procedures</b>							
Formal approval	Staff allocated to prepare, implement, monitor action						
City council already adopted the idea of building such a car park. It now waits for the detailed plan.	Nehad Abu Sheika - City strategic planning						
Staff training needs	Role of Partners						
No specific training needed.	Key stakeholders in the city should be engaged in the design of the project to prepare its long-term success. To be sure that such equipment will be actually used at its optimum, it should be designed according to the real need of people taking into account all categories of users (neighbours, shop owners, taxi drivers, etc.)						
<b>4. Summary of related Awareness Raising (AR) actions</b>							
A communication plan needs to be developed from the outset to highlight the benefits of such equipment and to raise awareness regarding new travel behaviours to be adopted by citizens.							
<b>5. Assumptions and risks (3)</b>							
The location of the car park will be absolutely key. If it is too close to the centre, it will not reduce traffic to reach it (see current situation in Nablus). If it is too far, it will not be used at all. So the conception of the car park is probably the most sensitive step of the project. Taxis will also need to be associated to the design in order for them to understand with enough anticipation what will be the impact on their daily work and how they can offer new type of services to contribute to the overall transformation of travel practices in the city.							
<b>6. Key success factors (3)</b>							
<ul style="list-style-type: none"> <li>• Car traffic and search for a parking place can be such a nightmare that the car park will appear as an interesting alternative.</li> <li>• The car park should be connected to the centre with a very efficient public transport system to help people understand the benefit of changing their travel practices.</li> <li>• The car park being also an icon in energy efficient building, it will generate more interest for new type of energy efficient building.</li> </ul>							
<b>7. Cost estimates</b>							
Technical support for designing the detailed project	100,000 €						
Training for Municipality staff							
Approximate annual cost saving	Not relevant						
Investment required Building 12 floor x 1000 sqm / floor x 1000 € / sqm	12 millions €						
Return on Investment (draft calculation)	<p>Half of the investment will be covered through marketing spaces for offices and shops to be installed in floors 7 to 12. The remaining investment will be covered by car park fees collected. Revenues per year could reach 1,2 million€ allowing a 6 to 7 years pay back (conservative approach)</p> <table border="1"> <thead> <tr> <th></th> <th>Hours/day</th> <th>60% capacity</th> </tr> </thead> <tbody> <tr> <td>Number of hours of car parking</td> <td>9600</td> <td>4 800</td> </tr> </tbody> </table>		Hours/day	60% capacity	Number of hours of car parking	9600	4 800
	Hours/day	60% capacity					
Number of hours of car parking	9600	4 800					

	Cost per hour ILS short stay	4	60%	ILS/day 11 520
	Cost per hour ILS long stay	2	40%	ILS/day 3 840
			Total	15 360
<b>8. Available and foreseen sources of funding</b>				
<b>Local authority's own resources:</b> The Municipality allocates staff to manage the car park		<b>National Funds and Programs</b>		
<b>International Financial Institutions</b> AFD could be a potential funder for the feasibility study as part of its "sustainable city" programme		<b>EU Funds &amp; Programs and other external funds</b>		
<b>Public-Private-Partnerships (available or to raise)</b> Need to be considered		<b>Lined up private investments</b>		
<b>Loans and potential borrower</b> AFD could be providing the loan, offering to cover cost of loan interests		<b>Expected additional revenues to City budget</b> 1 million € / year after reimbursement		
<b>9. Projected Energy Estimates in 2020 (or other set target year)</b>				
Energy savings MWh/y <i>We consider a 4% reduction in car traffic in the city with the implementation of the car park (less car entering the city, less time spent in searching a parking place).</i> Assumptions: <ul style="list-style-type: none"> <li>• 25,000 cars in the city meaning 50,000 hours of car used / day (2 hours per car)</li> <li>• 4,800 car hours in car park in average (60% of full capacity)</li> <li>• 2,000 car hours less per day (4%) using car park capacity</li> </ul>			4,927 MWh/year	
Renewable energy production MWh/y			Still to be defined	
CO2 reduction t CO2/a				
- Reference Year			2014	
- Target Year			2020	
- Percentage of net reduction on the territory			0.87 %	
- Reduction as related to BAU scenario			1,670 tCO2 eq/year	
- Per capita calculated reduction			0.017 TCO <sub>2</sub> equivalent	

TULKAREM – Priority action # 3 for SEAP		
<b>1. General presentation</b>		
<b>TITLE: ELECTRIC GRID IMPROVEMENT</b>	# 3	Area(s) of Intervention: <b>A</b>
Summary of the Action		Location: <b>TULKAREM</b>
<p>The Municipality still faces a 16% loss in the electric grid. Such loss comes from a combination of technical problem (old cables, inappropriate transformers, etc.) and electricity being stolen from the grid by un-registered / illegal connections.</p> <p>Since 2010, the Municipality already invest 200.000 € / year to improve the grid (switching to isolated wires and upgrading electric transformers where necessary). This level of investment needs to be maintained for another 10 years. This investment need to be compared with 10M ILS losses per year (2,1 M€) due to the actual 16% loss on the grid.</p> <p>On the short term it would be good to run a complete investigation of the electricity grid to assess status and identify necessary improvements.</p> <p>On the longer term, recommendation from the assessment mentioned above would be necessary to ensure higher grid efficiency.</p> <p>Like everywhere in West Bank, an important element of the grid improvement is to ensure it will support the connection of a growing number of small capacity PV units that could be spread on private buildings, small companies, parking places...</p>		Start date: <b>2016</b>
		Project lifetime: <b>5 years</b>
		End date: 2021
		Estimated cost €
		150,000 € investigation Year 1 20m€ investment (potential) 5m over 4 years
General Objectives of the project		Status of the Action:
Assess current status of the grid and precisely define investment plan to continue reducing losses and prepare the grid for growing connections of renewable energy production units.		<ul style="list-style-type: none"> <li><del>• New</del></li> <li><del>• Planned</del></li> <li><del>• Under implementation</del></li> <li>• Following previous action.</li> </ul>
Principal partners and stakeholders		Contact person in the local authority
<ul style="list-style-type: none"> <li>• Tulkarm Municipality</li> </ul>		Nehad Abu Sheika Tulkarem Strategic Planning Director
<b>2. Technical description</b>		
Link to municipal development plan		
The grid efficiency is key structural component of an efficient energy policy. As Tulkarem want both to reduce its energy demand and improve renewable energy development it, logically, looks for improving the grid performance and adaptation to the new energy policy.		
Implementation plan		
<p>A comprehensive assessment of the current grid status needs to be performed. Bases on this assessment, it will be then possible to design the appropriate investment plan covering different areas:</p> <ul style="list-style-type: none"> <li>• Wires isolation</li> <li>• Transformers dimensioning</li> <li>• Reinforcement of certain lines (to support addition connections)</li> </ul>		

<ul style="list-style-type: none"> <li>• Improvement in tension balance monitoring and management</li> <li>• Develop smart grid in certain areas</li> <li>• Etc.</li> </ul>	
<b>3. Organization and procedures</b>	
Formal approval	Staff allocated to prepare, implement, monitor action
City council already adopted the idea of upgrading the electric grid (allocating 220 k€/year).	Nehad Abu Sheika - City strategic planning
Staff training needs	Role of Partners
The Energy unit at Tulkarem municipality needs to improve its capacity to manage a more efficient grid and get the best of smart grid options.	To promote a smart grid and to get the best use of it, the Municipality should engage with key stakeholder (building sector, big shops, industries) to promote best practices and highlight common benefits of the investment.
<b>4. Summary of related Awareness Raising (AR) actions</b>	
A communication plan needs to be developed to highlight the benefits of such equipment and to raise awareness regarding electricity responsible consumption across all sectors.	
<b>5. Assumptions and risks</b>	
As the municipality already started working on grid improvement, it built a good level of understanding of issues to be addressed and benefits to be expected which will help moving towards a smart grid.	
Risks remain around the level of technical knowledge required to ensure a performing management of the grid and its evolution into a smart grid.	
<b>6. Key success factors</b>	
<ul style="list-style-type: none"> <li>• Cost of imported electricity and the opportunity offered by a more efficient management of the grid that would result in significant cost cutting.</li> <li>• Increased satisfaction of citizens with the performance of municipal service and reduced number of complaints.</li> <li>• Municipality willingness to actually engage on the issue.</li> </ul>	
<b>7. Cost estimates</b>	
Technical support for designing the detailed project	140,000 €
Training for Municipality staff	10,000 €
Approximate annual cost saving <i>Losses amount to 2,1 m€/y. Each % gained will result in 150K€ cut in electricity imports. Increased grid performance can result in 2% losses reduction.</i>	300 K€/year
Investment required <i>According to a very first assessment of the overall grid improvement and smart grid development could amount 20 m€.</i>	20 millions €
Return on Investment (draft calculation)	If investment efforts are engaged over a first period of 4 years (5m€/y) and maintenance ensured at a level of 100K€/y on the long term, losses could go down to 7 or 8% after 5 years and contained at this level over time, knowing that this is a normal rate, even in sophisticated

	<p>economies. Such a process will make it worth the investment on the long term with a payback period of 35 years. This is notwithstanding additional benefits from a smart grid development that could offer additional gains and then significantly reduce the payback period.</p> <p>It is also important to consider that grid upgrading will allow more connections of renewable electricity production units.</p>
<b>8. Available and foreseen sources of funding</b>	
<b>Local authority's own resources:</b> Municipality allocates staff to monitor the grid upgrading	<b>National Funds and Programs</b>
<b>International Financial Institutions</b>	<b>EU Funds &amp; Programs and other external funds</b>
<b>Public-Private-Partnerships (available or to raise)</b>	<b>Lined up private investments</b>
<b>Loans and potential borrower</b>	<b>Expected additional revenues to City budget</b> 300 K€ / year (average)
<b>9. Projected Energy Estimates in 2020 (or other set target year)</b>	
Energy savings MWh/y <i>If we consider reducing losses per 2% per year (compare to over all consumption) energy saving will reach around 2,000 MWh/year (average)</i>	2,000 MWh/year
Renewable energy production MWh/y	Not relevant
CO2 reduction t CO2/a	
- Reference Year	2014
- Target Year	2020
- Percentage of net reduction on the territory	0.7 %
- Reduction as related to BAU scenario	1,460 tCO <sub>2</sub> eq/year
- Per capita calculated reduction	0.015 TCO <sub>2</sub> equivalent

TULKAREM – Priority action # 4 for SEAP		
<b>1. General presentation</b>		
<b>TITLE: SOLAR PV IN MUNICIPAL BUILDINGS</b>	# 4	Area(s) of Intervention: <b>A</b>
Summary of the Action		Location: <b>TULKAREM</b>
<p>Tulkarm Municipality wants to take benefit of the solar potential of the region to increase local production of renewable electricity and doing so reduce its dependency on Israeli sources.</p> <p>The Municipality will at installing PV wherever possible on Municipality buildings' roofs, parking, schools, universities, etc.</p> <p>The development of solar PV in Tulkarem municipal building will help developing local companies and expertise, which then ill be available to develop solar panel for households and the private sector.</p>		Start date: <b>2016</b>
		Project lifetime: <b>10 years</b>
		End date: 2026
		Estimated cost €
		8 millions €
General Objectives of the project		Status of the Action:
<ul style="list-style-type: none"> <li>• <b>Develop renewable electricity production</b> in order to reduce dependency on Israeli source and to improve energy sovereignty                             <ul style="list-style-type: none"> <li>• Install 6MW capacity as a first phase in different location and size to gain experience on the management of such technology</li> <li>• Spread the technology to install another 4MW (depending on financial support / possible loans to cover initial investment).</li> </ul> </li> <li>• <b>Develop technical capacity locally</b> to promote the technology and provide support to any investor willing to develop solar PV in Tulkarm</li> <li>• <b>Contribute to build a sustainable energy strategy</b> for the entire city</li> </ul>		<ul style="list-style-type: none"> <li>• <del>New</del></li> <li>• <del>Planned</del></li> <li>• <del>Under implementation</del></li> <li>• Following previous action.</li> </ul>
Principal partners and stakeholders		Contact person in the local authority
<ul style="list-style-type: none"> <li>• Municipality services</li> <li>• Ministry of Education (for schools)</li> <li>• Local business</li> </ul>		Nehad Abu Sheika Tulkarem Strategic Planning Director
<b>2. Technical description</b>		
Link to municipal development plan		
<p>The SEAP is built on two drivers: reduce energy consumption and develop energy production. Solar energy offers significant potential and is pretty easy to develop. The project will also contribute to creating a “new energy culture” promoted by the Municipality, which means that any citizen can be an energy producer beyond being an energy consumer.</p>		
Implementation plan		

The plan is to develop solar PV units connected to the grid wherever possible and appropriate in Municipal buildings and assets, or in services managed by the Municipality (schools, marketplace, warehouses, bus terminal, etc.) A rough inventory demonstrates that close to 50.000 square meters could be equipped only using Tulkarem Municipality buildings roofs. All combinations are possible, from small 5kW units on a roof to larger units of 200kW or even more when surface available allows it.

**The best option would be to negotiate an 8 Million € loan** to install 1500 KW per year over 4 years.

After 4 years the Municipality will reach a 9,600 MWh/year production, covering 80% of electricity consumed in Municipality services (2014 level), thus saving 1.1 Million € per year from reduction in electricity import.

After 9 years, the Municipality will be able either to reimburse the initial investment or to expend the program to deploy more PV.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Investment	2 000 000	2 000 000	2 000 000	2 000 000					
Installed capacity/year KW	1 500	1 500	1 500	1 500					
Total installed capacity KW	1 500	3 000	4 500	6 000	6 000	6 000	6 000	6 000	6 000
Production in KWh	2 400 600	4 800 000	7 200 600	9 600 000	9 600 000	9 600 000	9 600 000	9 600 000	9 600 000
Revenues in €	276 069	552 000	828 069	1 104 000	1 104 000	1 104 000	1 104 000	1 104 000	1 104 000
Cumulated revenues	276 069	828 069	1 656 138	2 760 138	3 864 138	4 968 138	6 072 138	7 176 138	8 280 138

Basic assumptions:

- Cost of a 1KW unit = 1500 US\$ or 1335 €. Annual production 1600 KWh / installed KW
- Assumptions: KWh purchased at 0,58 ILS / Change ILS to € at 0,23 / Change € to US\$ at 0,89

The second option would be to **negotiate a 1 Million € subsidy** to install 1,000 KW in 2 years. The production of year n-1 will be then invested to install as much capacity as possible, growing from 70 KW in year 3, and up to 350 KW in year 10. In this process, after 10 years the Municipality will save 479K€ (in year 10) from reduction in electricity import, and will be able to continue developing solar PV units at a good pace to reach 10MW installed in year 20 without any additional support. By then (after 20 years) Tulkarem will be able to produce up to 15GW from solar PV.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Capacity installed / year	300	600	70	140	160	190	220	265	300	350
Total capacity in KW	300	900	970	1 110	1 270	1 460	1 680	1 945	2 245	2 595
Investment in €	400 500	801 000	93 450	186 900	213 600	253 650	293 700	353 775	400 500	467 250
Initial subsidy	400 000	600 000								
Production in KWh		480 000	1 440 000	1 552 000	1 776 000	2 032 000	2 336 000	2 688 000	3 112 000	3 592 000
Production in €		64 032	192 096	207 037	236 918	271 069	311 622	358 579	415 141	479 173
Net income in €		64 032	-38 822	20 137	23 318	17 419	17 922	4 804	14 641	11 923
Cumulated net income	0	64 032	25 210	45 347	68 665	86 084	104 006	108 811	123 451	135 374

Another option would be to **pass a deal with a private company** that will invest and pay a rent to the municipality for using the roofs. The Municipality will buy the electricity produced reducing its dependency on IEC. This model is probably easier to manage for the municipality but will not provide as much resources on the long run.

### 3. Organization and procedures

Formal approval	Staff allocated to prepare, implement, monitor action
Municipality council need to decide for option 1 (loan) or option 2 (public private partnership)	Nehad Abu Sheika Tulkarem Strategic Planning Director

Staff training needs	Role of Partners
<p>The team which will be assigned to the unit need to receive a proper training on two subjects:</p> <ul style="list-style-type: none"> <li>• Technical questions related PV development</li> <li>• Project management</li> </ul>	<p>Technical partners (new electricity company, local companies dealing with PV installation and electric equipment maintenance) will be engaged in the programme in order to ensure that a proper network of services can follow on PV development and maintenance.</p>
<b>4. Summary of related Awareness Raising (AR) actions</b>	
<p>Adequate awareness raising actions will be necessary to help people understand the value of electricity production through PV and the benefit both for individual producers and for the entire city of such a move. Awareness should also insist on the fact that Solar PV development doesn't mean that electricity will become abundant. On the contrary such awareness campaign should highlight that combining electricity conservation and efficiency with PV production will allow Palestinian cities to become independent from Israeli sources for their electricity consumption. Some actions may include publicity campaigns (traditional media and online social networks) to spread awareness about the development of PV throughout the city, followed up with a town forum event to explain the project and answer questions that residents may have. It will also be important to educate women about the importance of energy conservation in the home so as to develop better consumption habits at the household level.</p>	
<b>5. Assumptions and risks (3)</b>	
<p>The key challenge will be to organize a proper maintenance system in order to ensure adequate production yields securing interesting enough R.o.I.</p> <p>Main risk remains the potential difficulty in importing equipment as all of these will come through Israel.</p> <p>Last but not least, as renewable electricity production will grow, the grid should be maintained and upgraded to support integration of local production in varying intensity and quantity. Grid upgrade and proper network management will become more and more important.</p>	
<b>6. Key success factors (3)</b>	
<ul style="list-style-type: none"> <li>• High cost of energy means that any saving will be a significant incentive</li> <li>• A lot of efforts can be made without heavy investment</li> <li>• Municipality determination to act in a comprehensive way on the issue</li> </ul>	
<b>7. Cost estimates</b>	
Initial and start-up expenses: technical training for Municipality staff	5,000 €
Rolling fund (possibly loan to be reimbursed after 9 years)	8 million €
Approximate operational Costs (Setting up a Solar PV maintenance unit)	20,000€/y
Approximate annual income for energy producing projects	1,100 k€ after 4 years
Draft calculation of the NPV and return of Investment (IRR).	9 years (see table page 2)
<b>8. Available and foreseen sources of funding</b>	
Local authority's own resources Staff form the municipality	National Funds and Programs

International Financial Institutions Both the <b>EU</b> and the <b>AFD</b> are allocating funds to support renewable energy production development	EU Funds & Programs and other external funds	
Public-Private-Partnerships (available or to raise)	Lined up private investments	
Loans and potential borrower AFD	Expected annual cost savings to the City budget 280 k€ after 10 years	
Other		
<b>9. Projected Energy Estimates in 2020 (or other set target year)</b>		
Energy savings MWh/a		
Renewable energy production MWh/a	9,600 MWh/y after 4 years	
CO <sub>2</sub> reduction t CO <sub>2</sub> /a		
- Reference Year	2014	
- Target Year	2020	
- Percentage of net reduction on the territory	3,6 %	
- Reduction as related to BAU scenario	6,979 tCO <sub>2</sub> equivalent	
- Per capita calculated reduction	0.07 tCO <sub>2</sub> equivalent	

<b>TULKAREM – Priority action # 5 for SEAP</b>																										
<b>1. General presentation</b>																										
<b>TITLE: SOLAR PV DEVELOPMENT REVOLVING FUND</b>	# 5	Area(s) of Intervention: <b>A</b>																								
Summary of the Action		Location: <b>TULKAREM</b>																								
<p>Tulkarm Municipality will support the development of solar energy through setting up a revolving fund to support private owners to install their own production units. The rolling fund will be replenished though valuing the electricity produced.</p> <p>This initiative will come along the development of solar PV in Tulkarem municipal building that will help developing local expertise and contractors to service the development of this energy in all sectors.</p>		Start date: <b>2016</b>																								
		Project lifetime: <b>10 years</b>																								
		End date: 2026																								
		Estimated cost €																								
1 million €																										
General Objectives of the project		Status of the Action:																								
<ul style="list-style-type: none"> <li>• <b>Set up a rolling fund</b> to support solar PV development by private owners.</li> <li>• <b>Support local stakeholders</b> to develop PV units</li> </ul>		<ul style="list-style-type: none"> <li>• <del>New</del></li> <li>• <del>Planned</del></li> <li>• <del>Under implementation</del></li> <li>• Following previous action.</li> </ul>																								
Principal partners and stakeholders		Contact person in the local authority																								
<ul style="list-style-type: none"> <li>• Municipality services</li> <li>• Local business</li> </ul>		Nehad Abu Sheika Tulkarem Strategic Planning Director																								
<b>2. Technical description</b>																										
Link to municipal development plan																										
<p>The SEAP is built on two drivers: reduce energy consumption and develop energy production. Solar energy offers significant potential and is pretty easy to develop. The project will also contribute to promote a “new culture” regarding energy considering that as well as it will be promoted from the Municipality, any citizen could be energy producer beyond being energy consumers.</p>																										
Implementation plan																										
<p>The plan is to develop solar PV units in every possible place invited residents to contribute to this development. Through this process residents will benefit additional income after the pay back period and will become energy</p> <p>Producers, as well as being energy consumers.</p>																										
<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2"></th> <th>US \$</th> <th>Euro</th> <th>KWh/an</th> <th>Prod €</th> <th>Prod \$</th> <th>ROI</th> </tr> </thead> <tbody> <tr> <td>Cost</td> <td>5kv</td> <td>7 500</td> <td>6 675</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Prod</td> <td>5kV</td> <td></td> <td></td> <td>8 000</td> <td>1 067</td> <td>1 199</td> <td>6,3</td> </tr> </tbody> </table>					US \$	Euro	KWh/an	Prod €	Prod \$	ROI	Cost	5kv	7 500	6 675					Prod	5kV			8 000	1 067	1 199	6,3
		US \$	Euro	KWh/an	Prod €	Prod \$	ROI																			
Cost	5kv	7 500	6 675																							
Prod	5kV			8 000	1 067	1 199	6,3																			
<p>Assumptions: Cost of a 1KW unit = 1500 US\$ - 1335 €. Annual production 1600 KWh / installed KW - KWh purchased at 0,58 ILS Change: ILS to € at 0,23 / € to US\$ at 0,89</p>																										
Different options could be proposed to develop this process:																										
1. The municipality proposes residents to invest and install 5KW units on their roof. The																										

electricity produced goes to the Municipality (or the Electric company it will have set up for this purpose).  
After 6,5 years the total value of electricity produced matches the initial investment and the PV unit get transferred to the resident who will then get incomes from the electricity sold to the Municipality. In this system the financial balance remains the same for the Municipality. It covers the initial investment and receives in return electricity, which will not be bought from IEC generating an economy equivalent to the initial investment. When the PV unit gets transferred to the resident, it buys electricity for him and not from IEC, reducing the dependency from Israel.

**Implementation plan**

2. The municipality invites resident to share the investment. In that case the resident will cover part of the investment and will then get parts of the revenue from the production as soon as the PV unit gets installed. The pay pack period remains more or less the same or could be slightly longer depending on the way the investment gets shared. The overall economy of the system remains the same. However one can consider that sharing the investment with residents will push them to get more ownership on the energy issue and been then more conscious on the benefit of working for energy conservation and efficiency.
3. The municipality pass a deal with a bank that will offer attractive loans to residents. Resident, benefiting form the loan, covers 100% of the investment. The Municipality offers its guarantee to secure the loan, as it commits to buy all the electricity produced. This mechanism could allow a faster development of PV units.

The Municipality can set up a 1 million € revolving fund to be engaged over a 4 years' period of time. This will allow installing at least 50 units of 5KW each per year. If the investment gets split between the Municipality and residents the amount of units possibly installed every year would grow according to the share of investment covered by residents.

Such a mechanism will also require a proper maintenance unit to be set up in order to ensure that PV units are producing at their full potential, offering the shortest pay back period possible. This will obviously generate jobs and more business around the development of solar PV.

The work process to implement the action will be the following:

- Set up the revolving fund and decide for the appropriate mechanism for reimbursement
- Ensure technical support can be provided by local entrepreneurs
- Import equipment
- Promote the use of the revolving fund to develop Solar PV units
- Assess performance and provide technical support when needed.

**3. Organization and procedures**

Formal approval	Staff allocated to prepare, implement, monitor action
Municipality council need to decide for the best option to replenish the fund.	Nehad Abu Sheika Tulkarem Strategic Planning Director
Staff training needs	Role of Partners
The team which will be assigned to the unit need to receive a proper training on two subjects: <ul style="list-style-type: none"> <li>• Technical questions related PV development</li> <li>• Project management</li> </ul>	Technical partners (new electricity company, local companies dealing with PV installation and electric equipment maintenance) will be engaged in the programme in order to ensure that a proper network of services can follow on PV development and maintenance. In addition, as the project targets residential PV development, it will be important to engage with residential associations.

**4. Summary of related Awareness Raising (AR) actions**



Adequate awareness raising actions will be necessary to help people understand the value of electricity production through PV and the benefit both for individual producers and for the entire city of such a move. Awareness should also insist on the fact that Solar PV development doesn't mean that electricity will become abundant. On the contrary such awareness campaign should highlight that combining electricity conservation and efficiency with PV production will allow Palestinian cities to become less dependent from Israeli sources for electricity consumption.

Some actions may include publicity campaigns (traditional media and online social networks) to spread awareness about the rolling fund, followed up with a town forum event to explain the project and answer questions that residents may have. It will also be important to educate women about the importance of energy conservation in the home so as to develop better consumption habits at the household level.

**5. Assumptions and risks (3)**

The key challenge will be to organize a proper maintenance system in order to ensure adequate production yields securing interesting enough R.o.I.

Main risk remains the potential difficulty in importing equipment as all of these will come through Israel.

Last but not least, as renewable electricity production will grow, the grid should be maintained and upgraded to support integration of local production in varying intensity and quantity. Grid upgrade and proper network management will become more and more important.

**6. Key success factors (3)**

- High cost of energy means that any saving will be a significant incentive
- A lot of efforts can be made without heavy investment
- Municipality determination to act in a comprehensive way on the issue

**7. Cost estimates**

Initial and start-up expenses: technical training for Municipality staff	5,000 €
Approximate operational Costs (Setting up a Solar PV maintenance unit)	
Rolling fund (possibly loan to be reimbursed after 9 years)	1 million €
Approximate annual income for energy producing projects	Not relevant

Return on investment: Each investment could be reimbursed after 6 years thus a proper management of reimbursement would ensure full replenishment of the revolving fund.

**8. Available and foreseen sources of funding**

Local authority's own resources Staff from the municipality will be assigned to manage the fund	National Funds and Programs
International Financial Institutions Both the EU and the AFD are allocating funds to support renewable energy production development	EU Funds & Programs and other external funds
Public-Private-Partnerships (available or to raise)	Lined up private investments

Loans and potential borrower AFD provides loan without interest when Rol can be secured for a short period of time (5/6 years?)	Expected annual cost savings to the City budget Not relevant	
Other		
<b>9. Projected Energy Estimates in 2020 (or other set target year)</b>		
Renewable energy production MWh : <i>A 1m€ investment will generate 1,200 MWh per year, reducing imports needs of the same amount.</i>	1,200 MWh per year	
CO <sub>2</sub> reduction t CO <sub>2</sub> /a		
- Reference Year	2014	
- Target Year	2020	
- Percentage of net reduction on the territory	0.5 %	
- Reduction as related to BAU scenario	872 tCO <sub>2</sub> equivalent	
- Per capita calculated reduction	0.009 tCO <sub>2</sub> equivalent	

# **ANNEX II – CITIZENS AWARENESS PROMOTION PLAN (CAPP)**



# Tulkarem

## Performing a Better Energy Efficiency Management

### Preparing and including the “Awareness Raising Actions” component in the SEAP

In addition to the requirement linked to the public consultation of the SEAP, a Citizen Awareness Promotion Plan (CAPP) has to be elaborated by the municipality as part of the Sustainable Energy Action Plan document (SEAP).

#### Identification of CAPP actions through participatory training workshops

The CES-MED project has conducted a tailored communication and CAPP training workshop for the local authority and its communication team in coordination with (and attended by) the Focal Point and the SEAP Consultants. Prior to conducting the workshop, which was led by the CES-MED key communication expert (KE), a three parts “Communication Kit” was handed on to the local authority and SEAP Consultant, who were asked to get acquainted with its content prior to conducting the training.

The “Communication Info Kit” (annex1) includes:

- Part 1: the “CAPP Guidelines” document: a tailored comprehensive manual prepared by CES-MED for the use of cities/municipalities on how to identify, plan and conduct awareness raising actions (Arabic, English and French versions)  
[http://www.ces-med.eu/images/CAPP/Annex\\_7\\_CAPP\\_v.4.0\\_02122014\\_EN.pdf](http://www.ces-med.eu/images/CAPP/Annex_7_CAPP_v.4.0_02122014_EN.pdf).
- Part 2 includes;
  - o PPT Presentation of the CAPP Guidelines
  - o Presentation of “how to prepare and implement a communication and an awareness campaign” showing techniques, materials and models
  - o Pools of benchmark examples and references to best practices from across the world towards citizen engagement and behavioral change, with adaptation to the CES-MED cities context
- Part 3: consists of 4 Tables to assess CAPP conditions and identify actions.
  - o Table 1 is used to conduct a rapid investigation to identify awareness situation, levels and needs linked to behavioral change in the city; and to initiate discussions with the workshop participants towards the identification of target audiences and the SEAP CAPP actions.
  - o Table2: presents the content of a plan to implement a CAPP action related to a Pilot Project.
  - o Table 3 presents the proposed actions related to the general sustainable energy challenges and to the city.
  - o Table 4: presents the proposed CAPP actions linked to each SEAP priority projects.

*During the workshop, the “Communication Kit” material was explained. The following discussions, assessment and analysis addressed awareness raising conditions and challenges, communication concepts and CAPP methodologies, tools, techniques before examining and multiple benchmark applications.*

*A practical exercise was then conducted to specify the SEAP’s CAPP actions, whereby the local authority general awareness raising needs and SEAP’s priority actions (proposed in the Project Fiches) were looked over and proposed. In doing so, the template tables were “draftly” filled in by the participants and the KE.*

*Following the workshop, the participants have thoroughly reviewed the tables and finalized them with the CES-MED KE and the SEAP Consultants, prior to including them in the SEAP (below).*

***The Communication Info Kit and specially the CAPP Guidelines are to be used as reference work manuals for the subsequent detailed planning and implementation of the CAPP actions proposed in the SEAP document and other similar awareness raising actions.***

## Preparation of COMMUNITY AWARENESS PROMOTIONAL PLAN (CAPP)

### Template 1- Situation analysis of Tulkarem

#### **Aim**

The questions in the attached templates cover various areas of actions and levels of awareness linked to behavioral change. It has been used to conduct a quick investigation on the awareness situation and level of perception of the citizens in the city concerning renewable energy and energy saving.

The exercise of filling the templates has identified and assessed the conditions in the municipalities prior to preparing a CAPP and to answer a number of questions, including:

- 1) Who are the target audience of a CAPP?
- 2) What are the priority issues to be addressed by the CAPP (that also could be identified by the SEAP as priority actions)?
- 3) What is the level of awareness of key energy problems? And what are the first issues to raise awareness about?
- 4) What are previous awareness raising actions, so that the CAPP can build on them?
- 5) What is the situation as related to public consultation, based on which a public consultation is to be designed?

The exercise of filling the template helped pointing out how raising awareness can be utilized as a tool for improved energy policy to facilitate implementation of its actions; it has allowed initiating discussions in the Communication Workshop and helped identifying appropriate campaigns and actions.

#### **Specific objectives:**

- (i) Provide the necessary information about the current conditions and the situation regarding awareness on energy saving and renewable energy,
- (ii) Help to identify the most appropriate a) **awareness raising campaigns** that would accompany the SEAP vision/strategy and b) the **awareness raising actions** that would accompany the priority actions determined in the SEAP.

#### **Steps to follow:**

- (i) The SEAP team of the municipality has filled the templates based on their understanding and perception of the city's inhabitants. They were free to seek the opinion of a limited number of persons for help in filling in the answers.
- (ii) The filled in templates were discussed in the "CES-MED Communication Workshops", which were led by the CES-MED Communication Expert and attended by the SEAP consultant and the SEAP municipal team. In parallel, the vision/strategy of the city and the proposed pilot actions in the SEAP were reviewed as part of the workshop exercise.

The outcome guided the selection of the most appropriate awareness raising campaigns and actions of the SEAPs including the ones related to priority projects.

<b>I. Identification of the target audience and the importance they give to Sustainable Energy (audience targeted by the awareness raising campaigns and actions)</b>			
Women/Men Age group	Very important	Important	Not important
Youth	X		
Middle Age	X		
Seniors			
Other (Children)			

<b>II. Identification of priority issues to be addressed by a sustainable energy action and their level of importance</b>			
Issue	Level of importance		
	Very important	Important	Not important
High price of energy	X		
Availability/lack of energy	X		
Availability of transport		X	
Waste management		X	
Clean environment		X	
Other			

<b>III. Identification of level of awareness (energy problems) and education of energy related issues</b>			
	Very aware (through media or research)	Aware but not convinced	Not Aware
Impact on environment			X
Cost of energy		X	
Waste of energy			X
Climate change			X
Ways to save energy consumption		X	
Existence of renewable energy	X		

<b>IV. Previous awareness actions conducted by the city/municipality or by other actors</b>	
Has the city or local authority done previous actions	Yes
If yes, who conducted the actions (the city/municipality, NGO, national authority...)	The municipality of Tulkarem
If yes, describe the action	Awareness actions through brochures and TV ads
If yes, what was the budget and how did you fund it	Funded through the Municipality
If yes, outcome, impact and feedback	The outcome results were very minor ones

<b>V. Public consultation</b>	
Does the city practice public consultation?	Not very often
Has the city done public consultations for SEAP?	No
Is it part of the legislative process?	Yes
Foreseen consultation(s)	There will be a presentation of the programme and definition of its importance
Does the city liaise with national institutions, stakeholders?	Yes

### Situation analysis

From this study concerning the target groups and profile, it appears that the groups that are aware and informed about energy challenges and open to any information to behave accordingly are the middle age adults. It would be recommended to carry out the communication with them and get easily their involvement as they could function as opinion sharing people to disseminate ideas and new behavior. Yet, we have no information about any other significant groups such as children, women or elderly in the survey.

The template shows that the important leverages on which we can use and base our communication upon are the price and (non) availability of energy, however the population seems oblivious to the cleanliness of the environment, the waste management and the transport issue.

The ambiguity lays in the fact that even if the citizens of Tulkarem are in general aware about some energy challenges and the existence of renewable energies, they don't seem to be convinced about the level of importance they represent in relation to reducing energy consumption; nor are they conscious about the environmental impact of the climate change influence.

Still, the municipality of Tulkarem has conducted and funded few awareness raising actions related to sustainable energy to the civil society, but it has not been able to get a positive impact through them or attract their interest.

The means of communication, and the tools used were TV spots and brochures; however, we have no data on the media coverage and penetration it has achieved.

Finally, regarding public consultations, in spite of being part of the legislation of the city, they have not been conducted on a regular basis by the municipality. There is one meeting foreseen for the presentation of the project and its promotion.

## Template 2.1

### Proposed Communication or Awareness Raising Action related to Specific/Pilot Project: The solar energy

- **Title of the Pilot Project:**

Encouraging the use of solar cells to generate electricity through using the building's rooftops

- **Title of the Communication Action related to the pilot project**

Developing the electricity sector

- **Location**

Awareness campaigns will be held in Tulkarem Municipality

- **Summary of the Communication Action**

**General Objective:**

- Encouraging the citizens on fixing solar cells on the buildings' rooftops.
- Answering the citizens' inquiries and questions with regards to the new technology.
- Promoting the use of the installation and equipment.
- Reducing electricity cost.
- Increasing the economic and environmental results through the generation of clean electricity.

**Key message:**

**Installing the solar cells would be beneficial for the city on both the economic and environmental levels, and would apply an important sample for the use of renewable energy in the region.**

**Theme:** Solar Energy

**Target group:** All the citizens of Tulkarem

**Tools and channels:**

- Forums and general meetings.
- Local TV stations.
- Municipality's website.
- Municipality's Facebook page.

- **Organization**

**Roles and responsibilities:**

Give a detailed explanation on the use of solar energy for the public and private sectors

**Project lifetime:**

The project will start on 01/2016. It will carry on for about 12 months

**Link to other opportunities and/or events:** N/A

**Principal partners and stakeholders and their roles:**

The Electricity and Public Relations Administration in the Municipality

The Renewable Energy Consultant

**Staff training needs:**

Several trainings will be needed such as:

- Providing Technical Consultancies and Training on the use of solar energy
- Providing training to the teams in charge of implementing the action

Technical assistance and expert needs: N/A

- **Cost estimate**

Estimated implementation cost:

The estimated implementation cost is around 25.000 Euros in total.

Funding source:

The Municipality and another external party is suggested

Initial and start-up expenses and approximate operational Costs: NA

- **Next steps:**

- Positive expected results:
  - Less demand on traditional electricity
  - Reduction of the electricity's price
  - Reduction of the harmful gas emissions
- Negative expected results:
  - The inability of the citizens to use all available spaces

- **Follow-up, evaluation and impact assessment**

## Template 2.2

### Proposed Communication or Awareness Raising Action related to Specific/Pilot Project: The Car parking

1. **Title of the Pilot Project:**

Building a car parking complex

2. **Title of the Communication Action related to the pilot project**

Developing the transportation sector

**Location**

Awareness campaigns will be held in Tulkarem Municipality

3. **Summary of the Communication Action**

**General Objective:**

Limiting the size of the traffic crisis

**Key message:**

**Building a car parking complex will solve the increasing traffic crisis in the city, control the effect of cars gas emissions on health, reduce the costs, gain time and reduce the number of car accidents**

**Theme:** Traffic awareness

**Target group:** All the citizens of Tulkarem, Vehicles' drivers.

**Tools and channels:**

- Forums and general meetings.
- Local TV stations.
- Municipality's website.
- Municipality's Facebook page.
- Traffic Police.
- Directive Signs

4. **Organization**

**Roles and responsibilities:**

- Directive Signs.
- Meetings and introductory brochures.

**Project lifetime:** N/A

**Link to other opportunities and/or events:** N/A

**Principal partners and stakeholders and their roles:** Roads and Public Relations Administration in the Municipality

**Staff training needs:** N/A

**Technical assistance and expert needs:** N/A

5. **Cost estimate**

**Estimated implementation cost:** NA

**Funding source:**

The Municipality will be funding the action

Initial and start-up expenses and approximate operational Costs: NA

**6. Next steps:**

- Positive expected results:
  - Less Traffic Crisis in the city.
  - Less car accidents
  - Reduction of Gas emissions and pollution

**7. Follow-up, evaluation and impact assessment**

## Template 2.3

### Proposed Communication or Awareness Raising Action related to Specific/Pilot Project: Saving Energy

**1. Title of the Pilot Project:**

Installing lighting systems that save energy

**2. Title of the Communication Action related to the pilot project**

Developing the Energy sector

**3. Location:**

Awareness campaigns will be held in Tulkarem Municipality

**4. Summary of the Communication Action**

**General Objective:**

Limiting the street lighting expense

**Key message:**

**Using LED lighting systems will save on street lighting consumption  
and give the street a better light.**

**Theme:** Municipal energy saving

**Target group:** All the citizens of Tulkarem

**Tools and channels:**

- Forums and general meetings.
- Local TV stations.
- Publicity signs.
- Municipality's website.
- Municipality's Facebook page.

**5. Organization**

**Roles and responsibilities:**

- Directive Signs.
- Meetings and introductory brochures.

**Project lifetime:** Three years' project

**Link to other opportunities and/or events:** N/A

**Principal partners and stakeholders and their roles:**

Electricity and Public Relations Administration in the Municipality

**Staff training needs:** N/A

**Technical assistance and expert needs:** N/A

**6. Cost estimate**

**Estimated implementation cost:**

15.000 euros

Funding source:

The Municipality will be funding the project

Initial and start-up expenses and approximate operational Costs: NA

**7. Next steps:**

- Positive expected results:
  - Street Lighting with a higher focus on the streets
  - Saving electricity consumption and limiting the demand on electricity

**8. Follow-up, evaluation and impact assessment**

### Template 3.1

## Identification of CAPP CAMPAIGN TOPIC related to sustainable energy challenges

Once the Sustainable Energy challenges and priorities, general awareness raising priorities, and specific awareness raising needs related to SEAP actions have been identified, the CAPP's main areas of intervention and activities can be defined. The table below portrays the challenges, priorities and related AR activities.

Challenges:	Priorities:	Awareness Raising Priorities, Topic & Activities of CAPP Campaign
<b>Increase of the traffic crisis in the city</b>	<p>Reducing the number of cars circulating in the middle of the city. Increase roads capacity.</p> <p>Limiting the impact of the emission of greenhouse gas.</p> <p>Encourage people to use common transportation vehicles and car sharing</p> <p>Practice responsible behavior towards our planet.</p> <p>Reduce traffic casualties</p>	<p><b>Topic:</b> <b>Procedures to reduce the size of the traffic crisis.</b></p> <p><b>Activities:</b> Raise awareness about decreasing CO2 emissions by introducing citizens to renewable energy technologies through leaflets, carpooling, a day without cars.</p> <p>Using transportation means that consumes less energy and produces less greenhouse gas.</p> <p>Raising awareness among citizens on the use of bicycles and walking.</p> <p>Set a department within the municipality to provide energy advice to the citizens.</p>
<b>Increase of the water consumption.</b>	<p>Promote and practice responsible controlled water consumption (to save water and reduce the water bills).</p> <p>Promote treated waste water to be reused.</p>	<p><b>Topic:</b> <b>Preserving water as a collective wealth and improving the water consumption behaviors.</b></p> <p><b>Activities:</b> Provide facts sheets to explain the risks of water scarcity and the negative effects of high water consumption and how overcoming water scarcity is possible as a collective action.</p> <p>Raise awareness, educate and inform users on water resources, and their limitations.</p> <p>Provide practical tips on how to reduce water consumption with stickers, educational films, documentaries, distribution of water stream reducers.</p> <p>Explain the facts related to water rarity and the effects resulting from the excessive use of water.</p> <p>Convey a message to the community stating that it is possible to overcome water rarity by taking collective measures.</p>
<b>Increase of the energy use.</b>	<p>Reduce energy consumption in town and consume it more</p>	<p><b>Topic:</b></p>

	<p>responsibly</p> <p>Reduce the city's energy bills</p> <p>Limit the impact of the greenhouse gas emissions.</p>	<p><b>Energy-saving measures are easy, daily small steps.</b></p> <p><b>Activities:</b></p> <p>Promote easy, practical daily tips towards citizens at large through a manual to reduce energy consumption that everyone can apply at home.</p> <p>Explain the bad effects of the greenhouse gas (documentaries, conferences in high-schools).</p> <p>AR campaign of being eco-citizen: Explain the side effects of greenhouse gas emission and the usage of renewable energies technologies (electricity from natural resources).</p> <p>Distribution of Led lamps.</p>
<p><b>Production of large quantities of waste.</b></p>	<p>Limit the quantities of produced waste.</p> <p>Implement the principles of the comprehensive and sustainable waste management (in order to improve the quality of life and reduce the cost of waste management).</p>	<p><b>Topic:</b></p> <p><b>Energy-saving measures are easy, daily small steps.</b></p> <p><b>Activities:</b></p> <p>Explain the negative effects of solid waste accumulation.</p> <p>Explain the need to get the support of the local authorities in solid waste management programs.</p> <p>Launch awareness operation: cleaning day and sorting competition in neighbourhood and schools. Issue a «Clean» certificate for deserving ones.</p> <p>Give practical advice on reducing solid waste from the source as well as advice on how to reuse waste and recycle it- Educational kits distributed in houses.</p> <p>Installation by the municipality of recycling bins in all municipal buildings and facilities promoting recycling of plastic bottles, batteries, paper.</p>

### Template 3.2

#### CAPP activities as related to SEAP Priority Actions of Tulkarem

This template will guide the municipality in the implementation of a strategy and the identification of adequate awareness raising activities according to the target group and its needs and related to the priority actions identified in the SEAP.

SEAP Priority Actions	Related CAPP Activities:
<p><b>Importing and fixing LED lighting systems that save energy.</b></p>	<p><b>Target Audience:</b></p> <ul style="list-style-type: none"> <li>- Civil society</li> <li>- Private and public sector</li> </ul> <p><b>Key Message:</b></p> <ul style="list-style-type: none"> <li>- The installation of solar cells would be beneficial for the city on both economic and environmental levels; it would set an important model for the use of renewable energy as well as demand for electricity in the region.</li> </ul> <p><b>Objectives:</b></p> <ul style="list-style-type: none"> <li>- Promoting the use of similar installation and equipment in the common urban regions (Public and Private).</li> </ul> <p><b>Communication Tools:</b></p> <p>Awareness raising documentary through local TV, radio messages and social network sites.</p> <p>Installation of an educational pilot project that all citizens can visit.</p> <p>Posters nailed on street lamps to alert citizens on municipality action and to alert on reduction facts about saved consumption.</p> <p>Promoting the usage of efficient lighting in households through distribution of led lamps.</p> <p>Training to the students (primary and secondary schools) on using the energy correctly.</p> <p>Meetings with the community members to promote the municipal action.</p>
<p><b>Importing and fixing solar cells on the rooftops of houses, schools and public institutions.</b></p>	<p><b>Target Audience:</b></p> <ul style="list-style-type: none"> <li>- Civil society</li> <li>- Service providers in the private and public sectors</li> <li>- Professionals in energy sector</li> <li>- Schools administrators and teachers</li> </ul> <p><b>Key Message:</b></p> <ul style="list-style-type: none"> <li>- Installing the solar cells would be beneficial for the city on both the economic and environmental levels, and would reflect an important sample for the use of renewable energy in the region.</li> </ul> <p><b>Objectives:</b></p> <ul style="list-style-type: none"> <li>- Promoting the use of similar installation and equipment in the common urban regions (Public and Private).</li> </ul> <p><b>Communication Tools</b></p> <p>Exhibitions or demonstration fairs</p> <p>Awareness campaigns: through local TV stations and radios, social network sites</p>

	<p>Installation of an educational pilot project that all citizens can visit. Distribute fact sheets that include data on the importance of solar energy, its advantages and the savings expected in %. Awareness raising in schools through energy days: eco-friendly schools competitions awarded according to the level of energy consumption.</p>
<p><b>Building a cars' parking complex, and specific paths for bicycles and providing bicycles for public use.</b></p>	<p><b>Target Audience:</b></p> <ul style="list-style-type: none"> <li>- Civil society; all vehicle drivers, specifically young people</li> <li>- Private and public operators</li> </ul> <p><b>Key Message:</b></p> <ul style="list-style-type: none"> <li>- Reducing the costs, limiting time and reducing the greenhouse gas emissions and their impact on health and on the environment.</li> </ul> <p><b>Objectives:</b></p> <ul style="list-style-type: none"> <li>- Reduce the fuel consumptions and congestion</li> <li>- Reducing the size of the traffic crisis and the number of car accidents.</li> </ul> <p><b>Communication Tools</b></p> <p>Awareness campaigns to young people (to whom mobility is important) on car sharing Meetings with the community members Creating traffic police and directive signs.</p> <p>Build AR campaigns to transport decision makers and other community groups, through local TV stations and radios, social network sites.</p> <p>Promote a car pooling scheme run on the Internet and co-financed by the municipality, at the disposal of all employees and city dwellers. Define practical advantages for car sharers (public or private sector) when setting up employees' mobility plans (such as free and dedicated parking places, financial contribution from the company for petrol, free bicycles, access to the repair shop, etc.). Promote community benefits of cycling.</p>
<p><b>Improving the electric grid efficiency</b></p>	<p><b>Target Audience:</b></p> <ul style="list-style-type: none"> <li>- Civil society;</li> <li>- Private and public operators</li> <li>- Energy experts in the municipality, industries, utility companies</li> </ul> <p><b>Key Message:</b></p> <ul style="list-style-type: none"> <li>- It makes a difference to the future of the city in its quest for greater energy efficiency</li> </ul> <p><b>Objectives:</b></p> <ul style="list-style-type: none"> <li>- Reducing power quality disruption and energy loss</li> <li>- Improve efficient electrical energy transmission and distribution</li> <li>- Improve quality of life in households</li> </ul> <p><b>Communication Tools</b></p> <p>Awareness raising programmes and guides for changing consumer habits (involving simple things, such as turning off lights in unoccupied rooms, switching off the television at night or setting tasks such as laundry for non-peak hours).</p> <p>Visits to electricity plants for professionals to explain how to reduce resource consumption while delivering more power to users and to demonstrate innovative systems for efficient management of electric energy.</p>

## PV development revolving fund

### Target Audience:

- Project bearers in civil society
- Energy experts, industries, utility companies
- Investors
- Banks networks and financial institutions

### Key Message:

- Making access to financing renewable energy is possible.

### Objectives:

- Explaining the point of view of banking and financing institutions and the benefits associated with renewable energy and energy efficiency projects.
- Presenting the different financing models for renewable energy projects and energy efficiency improvement projects.
- To improve access of the city households and small enterprises to reliable and clean energy services, and helping banking partners develop lending portfolios for financing the projects.

### Communication Tools

Awareness campaigns through conferences explaining the existing financing models, the reasons for their success and the costs of various investment options.

Building a platform for public-private partnership involving banks, and sensitization of bankers.

Reaching out to enterprises in an environmentally sustainable manner through organization of promotional forums and meetings between bank representatives and city councils.

## Recommendations:

These tables have been thought and prepared by the communes and municipalities. In this approach, they aim to promote in a particularly innovative and ambitious way local community's response to current challenges identified in the SEAPs, notably in the management of energy and the promotion of renewable energies. They allow us as well to identify the most appropriate communication actions to reach the local community.

In the case of Tulkarem specifically, it is important to find out what would be the best way to overcome the barriers that affect the population choices and preferences for their environmental behaviors according to cultural norms and beliefs. The actions will be seen as a credible message if promoted through the proper insight: cost of their bills is a concrete concept as where the climate change might sound like a virtual one. The one question they might need an answer to is: "what's in it for me?"

On the other hand, young people and students should be looked at as highly dynamic since they are facing changing situations; they are clearly educated to the energy issues and climate change. Therefore, it is essential to endorse their processes of perception, judgment and reasoning regarding renewable energies information in a bottom up strategy.

As for children, they can be the best censors when convinced of the validity of a behavior. It is necessary to shape their perception with educational approaches so that they will become the cornerstone of energy-saving and respect for the environment.

Tulkarem municipality needs to assess the perception of options it offers to its citizens as viable and sustainable alternatives that will benefit them; use the adequate medium to deliver its message and lead the people in their choices towards a change in behavior, enabling individuals to make informed decisions. Awareness-raising actions should be carried out in an interconnected manner between the municipality and its citizens to create cohesion and therefore persuasion concerning the ongoing projects and the future ones.

Therefore, it is important to use a leverage which we can use and base our communication upon such as:

Establishing a strong and dynamic communication methodology to facilitate the implementation of SEAPs as well as stick to the vision slogan in every communication to highlight the goal aimed at (Performing a Better Energy Efficiency Management); communicating and promoting at the municipality level about the SEAP and its innovative projects and actions towards energy saving and conservation that improves the quality of life in the city and leads to a sustainable change of citizen's behaviour.

Expressing a clear political commitment to involve individual target groups in future planning procedures to adapt/improve measures according to specific demands.

Educating the audience and offering helpful energy efficiency tips to reduce cost and usage through entertainment, talk shows, special guests and happenings.

Boosting lower energy consumption at the municipality level will set the example and encourage citizens to master their consumption, know about renewable and efficient energy, and encourage their production and use.

And finally identifying a communication cell within the municipality, to carry its actions at the level of the municipality, in order to build a sustainable awareness plan adapted to the project of the city and connect with its citizens and implement the concept of eco-responsibility.





The European Union is made up of 28 Member States who have decided to gradually link together their know-how, resources and destinies.

Together, during a period of enlargement of 50 years, they have built a zone of stability, democracy and sustainable development whilst maintaining cultural diversity, tolerance and individual freedoms.

The European Union is committed to sharing its achievements and its values with countries and peoples beyond its borders.

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