Ben-Gurion University of the Negev

The Negev Center of Sustainability

Eilat Municipality Plan to Reduce Greenhouse Gas Emission

The plan is being submitted as part of the Eilat Municpality's Commitment to the Covenant of Mayors on Climate Protection and Energy Efficiency

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1. Introduction

The plan was prepared as part of Eilat's joining the European Covenant of Mayors, in which member cities in the covenant undertake to increase energy efficiency in accordance with the goal set forth by the European Union, and act reduce greenhouse gas emissions generated by their operations. The core document of the organization is the Sustainable Energy Action Plan or SEAP, which is designed to define the ideal actions and assessments needed to achieve this goal. Following the survey of emissions in Eilat, which was completed and submitted several months ago, this document presents the municipal plan of action to achieve the goals.

The Eilat municipality is home to approximately 50,000[1] permanent residents and another 10,000 temporary residents who reside in the city for some of the year. Although they are not permanent residents of the city, their activity in the city affects the volume of emissions in the various municipal sectors. Alongside the city residents, approximately an average of 19,000 tourists lodge in Eilat, significantly increasing the population. The city of Eilat includes 17,000 homes. The city is home to dozens of hotels and businesses that make a living off tourism, which is the general main industry in the city and a main source of energy consumption and greenhouse gas emissions in Eilat.

The city of Eilat is unique in terms of its climate and geography, as well as municipal function in comparison with other cities that are subject to similar emission surveys and emission reduction plans. The city lies on the 29º latitude, and is positioned in the subtropical ridge, so that its climate is extreme desert that is characterized by two main seasons, with temperatures the majority of the year exceeding 40ºC. Eilat is located at the southernmost tip of Israel, at a large distance (in Israeli terms) from any other major populated centers. Aviation represents a significant component in transportation to and from the city, in addition to buses and private vehicles. In light of these factors, the emission characteristics can be expected to differ from other Israeli cities.

This document is designed to present the impact of implementation of various measures on emissions in the city. On a municipal level, this type of projection

[1]The Central Bureau of Statistics, Local Authorities in Israel 2014, Publication No. 1642.

can prioritize various policy measures in addition to plan emission reduction in the city over the next decade. The emissions reduction plan presented here begins with a presentation of the main points of the emissions report, which presents the current situation, followed by a series of steps that are being advanced today as well as a long list of possible measures, while addressing the potential contribution to reducing the emissions of each step relative to the projected emissions in ensuing years. Finally, the document presents a series of directions of action that the city will implement in the coming years in order to meet emission reduction targets.

2. Main findings of the emissions review

The total greenhouse gas emissions in Eilat, which is based on 2014 data, reveals that the total greenhouse gas emissions in Eilat in 2014 amounts to 531,970 tons of carbon dioxide equivalent (CO2e). Diagram 1 presents the project framework and emphasizes the emission components included in the carbon accounting prepared for the city to date alongside the components to be reviewed later in the project.

Diagram 1: *Emission factors emphasized in orange appear in the report at this stage.

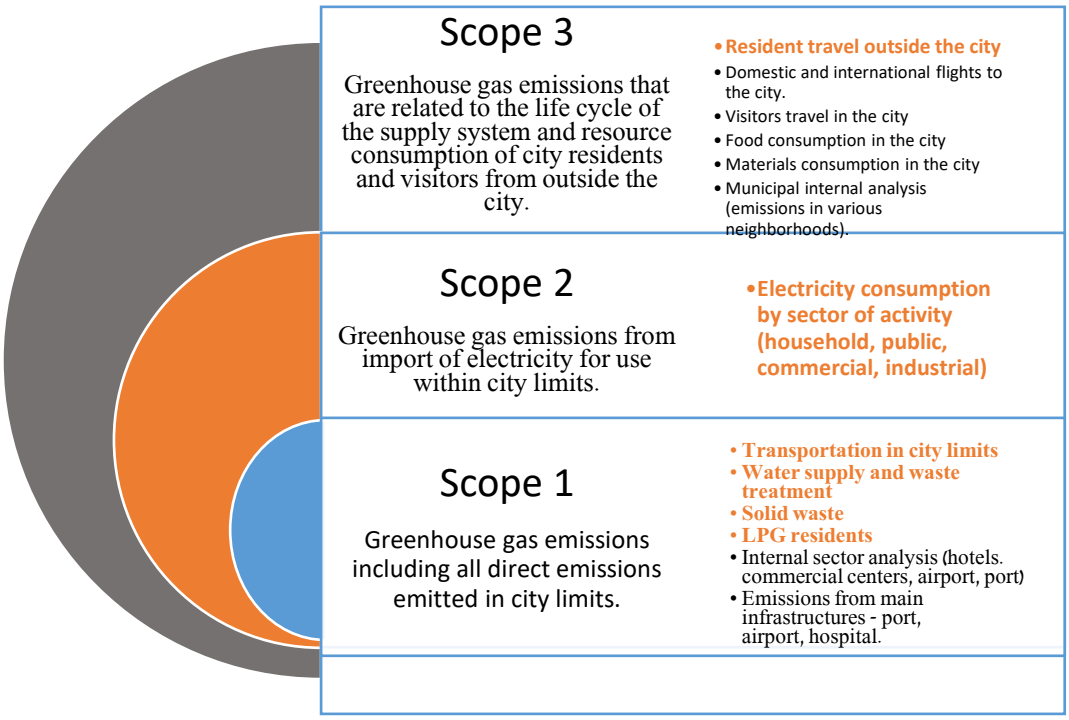


Diagram 2 displays the breakdown of emissions of the city into main emission components based on emission sources (electricity, transportation, water, waste and cooking gas). The diagrams reveal that the most significant factor is the emission from electricity consumption, which comprises almost 80% of all emissions in the city. Table 1 displays the quantities of emission based on source. It is important to note that whereas the electricity component is the most significant component in urban emissions, the assumption can be made that continued monitoring and review of other components related to indirect emissions in the city (travel of visitors, flights to the city, food consumption, etc.) will reduce the relative share of this component.

Diagram2 Breakdown of all emissions in the city by source of emission

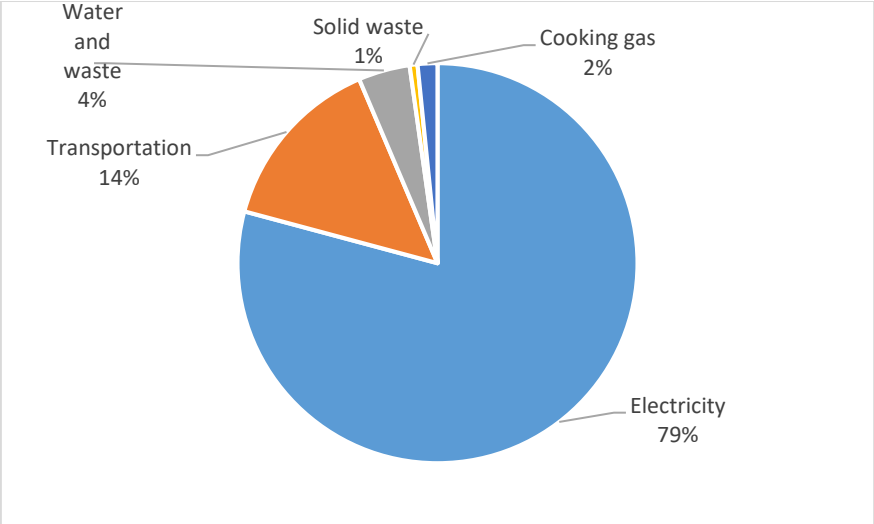


Table 1 - Greenhouse gas emissions by source

Source of emission	Greenhouse gas emissions **(CO_2e ton)**
Electricity	421,180
Transportation	76,720
Water and waste	24,020
Solid waste	1,550
LPG	8,490
Total	**531,970**

Diagram 3 and Table 2 display a breakdown of emissions between various sectors in the city (public, commercial, industrial and household sectors). These scenarios reveal that the most significant sector is the commercial

sector, which comprises 59% of all emissions in the city, followed by household, which contributes 35%. It should be noted that the share of households in emissions also includes emissions of vehicles outside of Eilat, whereas the other sectors include emissions only related to operations inside the city. As a result, if an assessment is made of emissions in the city itself, the share of households is expected to decrease whereas the share of the other sectors, particularly the commercial sector, is expected to increase.

Diagram 3 Breakdown of all emissions in the city by sector

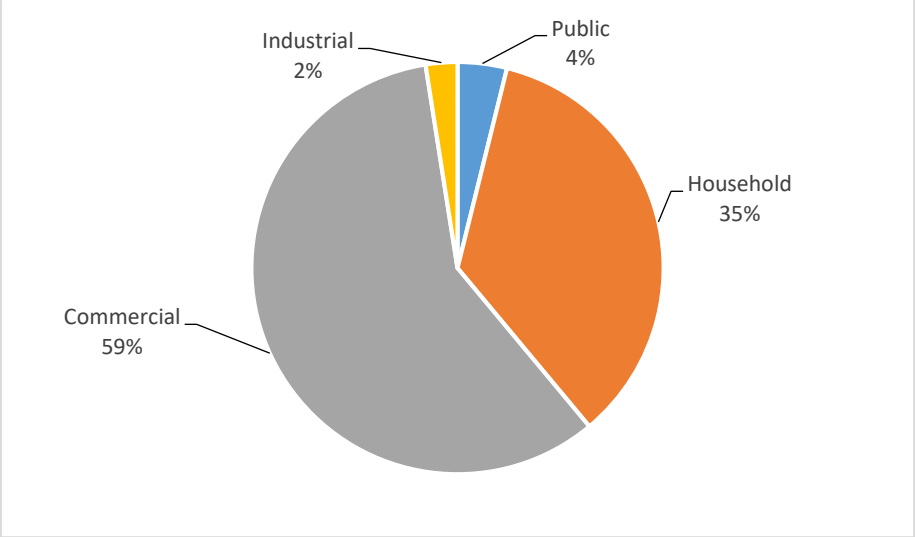


Table 2 - Greenhouse gas emissions by sector and emission components

Sector	Greenhouse gas emissions (CO_2e ton)				
	Electricity	**Transportation**	**Water and waste**	**Other**	**Total**
Public	13,780	190	5,060	1,550	**20,580**
Household	110,350	59,640	8,130	8,490	**186,600**
Commercial	286,090	15,150	8,590	-	**309,830**
Industry	10,960	1,740	2.260	-	**14,960**
Total	**421,180**	**76,720**	**24,020**	**10,040**	**531,970**

The results clearly reveal that the emissions component related to electricity consumption constitutes the main source of emissions (67% in the public sector, 88% in the commercial sector, 59% in the household sector). This identification can constitute the basis for reviewing various actions to reduce

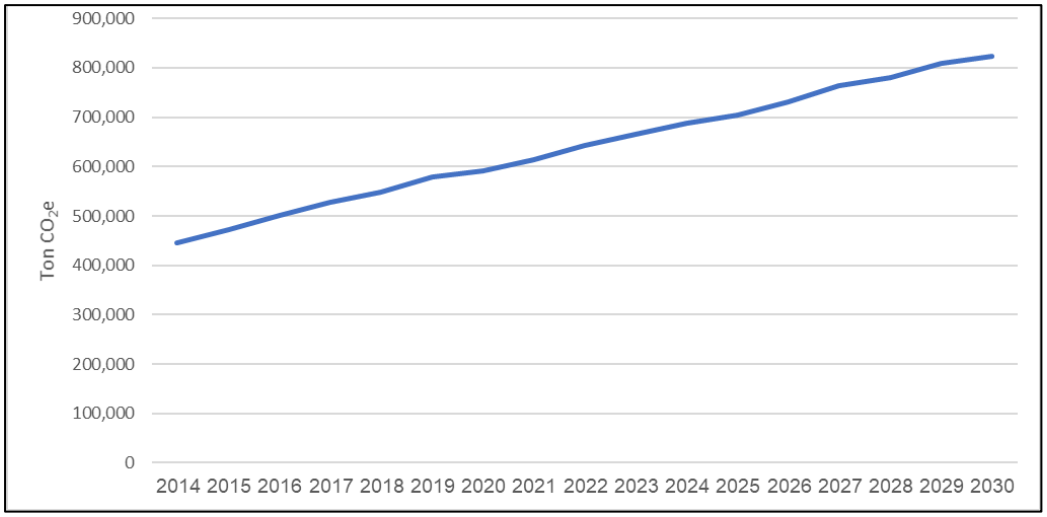
emissions in this key component. Transportation is the second largest source after electricity. In the household sector, this component is a significant percentage. Emissions attributed to the use of water and waste treatment constitute a significant percentage of public sector emissions and includes, inter alia, significant emissions related to irrigation of public areas and public building operations in the city.

In light of the dominance of the electricity consumption and transportation components in the emissions, the plan of action introduced here focuses on these two consumer sectors. In order to assess the contribution of various methods for reducing emissions, a base scenario was used (a 'business-as-usual' scenario) in order to assess the emissions in ensuing years until 2030 under the policy and the conditions as reflected in 2014. The emissions projection for each sector was calculated differently based on the available data (more information below), goals and actions that are currently being promoted and a series of possible measures based on experience in Israel and worldwide.

3. Emissions projection for 2030 and reduction methods

Total emissions for Eilat in a business-as-normal scenario with no implementation of policy measures or implementation of the reduction plan, are expected to increase by 2030 by 85% to 820,000 tons CO2e per year. This assessment is based on a combination of the projections for population growth, economic growth (residential and commercial construction) as well as other processes expected in Eilat according to various sources (Appendix 1 includes a full list of methods, materials and discounts). Diagram 4 displays the projected change throughout the years in emissions in electricity and transportation with no implementation of emission reduction measures.

Diagram 4 – Emissions by business-as-normal scenario



An analysis of greenhouse gas emissions for Eilat as well as projections for continued municipal growth in ensuing years reveals that in order for the city to comply with the reduction targets it assumed for itself, a series of additional measures must be adopted. The plan of action to reduce greenhouse gas emissions in Eilat must incorporate a range of measures that will be promoted by three main sectors in the city - the Local Authority, city residents and the commercial sector.

The role of the Local Authority – the Local Authority plays a key role in municipal compliance with reduction targets. The Authority has several ways in which it can act: the first and most significant being the promotion of policies that encourage emission reduction through municipal regulation alongside national regulation in order to ensure budgets and assistance in promoting emission reduction in various areas. The Local Authority has a series of measures that can facilitate a reduction in emissions such as promotion of municipal bylaws (such as in green construction), municipal district planning by measures that will reduce emissions (such as by way of incorporating land usages, encouraging traffic in alternate platforms, location of various actions, etc.), use of a range of business licenses as a means to advance efficiency and reduce emissions.

The Local Authority will also provide a series of services to city residents as well as to the commercial sector. These services include, inter alia, water supply and waste treatment, waste collection and treatment, education, culture and social services, etc. In each of these services, the Local Authority can

internalize measures that will help streamline and promote emission reduction. The Authority can also lead by example, reducing its own electricity / fuel consumption. In addition to the practical measures of the Local Authority, a change in thinking is important. The Authority must internalize in its economic planning and development environmental thinking that takes into account pollution and emissions generated by every action and weigh them against the decision-making process.

The role of the commercial sector - Since a significant percentage of the city's emissions are generated by the commercial sector, cooperation of this sector is required to achieve significant reduction in emissions. The recruitment of the sector towards reduction (either by technological improvements or by changing behavioral patterns) also requires involvement of the Local Authority. The motivations of the commercial sector are simpler to understand than the other levels, in that business considerations are first and foremost economic ones. Motivating the business sector towards streamlining measures is simpler than on the household level since the motivation is already known. Furthermore, the main barrier of the efficiency projects in the business sector is economic. Subsidies and low-interest loans by the government have been in recent years advancing the scope of streamlining in the market but this volume must be increased.

Possible measures by the household and economic sector - the household level is the most complicated to influence. Whereas commercial businesses are subject to strict regulation by the Local Authority (permits, business licenses, etc.) and in general, operate in a rationale and expected manner, households are diverse with a range of diverse behaviors and are not subject to the same regulation. On the household level, investment is needed in behavior as it pertains to electricity / fuel consumption that in combination with technological measures will facilitate a significant reduction in household emissions.

In recent years, the Eilat Municipality has advanced a series of measures that focused on energy efficiency and reduction of Local Authority emissions. Below is a list of measures that are currently being promoted by the Municipality and

an analysis of the potential contribution of these measures to reducing municipal emissions.

3.1 Current measures being promoted by the Local Authority

Replacement of street lights - Israel's national energy efficiency plan recommends the promotion of plans designed to help Local Authorities implement energy efficiency measures, inter alia, by replacing lighting on streets and in public spaces with energy efficient systems. Data compiled by the Ministry of Energy from 60 authorities across Israel found that street lights in local authorities comprise approximately 50% of all energy consumed by various authority institutions. In Eilat, street lights comprise approximately 40% of all electricity consumption in the authority.

Energy efficiency in public institutions – According to the Ministry of the Environment, electricity consumption by local authorities is estimated at approximately 2.5 billion Kw/hour, comprising approximately 15% of all electricity consumption of the commercial-public sector in Israel and approximately 5% of all electricity consumption in the market. The annual financial expenditure in local authorities amounts to one billion NIS per year. According to projections, the annual growth rate in electricity consumption in local authorities is similar to the annual growth rate in electricity consumption in the commercial-business sector in Israel, amounting to 6% increase per year, which is higher than the growth rate in electricity consumption in the market. According to the same projections, without implementation of energy efficiency measures and measures to reduce greenhouse gas emissions, the electricity consumption rate of Local Authorities will increase to 6-7% of all electricity consumption in the market by 2020. The focal points for energy savings in electricity in local authorities are: municipal lighting systems; lighting switchboards; building lighting; pumping systems for water and sewage installations; energy management systems (lighting management, traffic management, pumping management); air conditioning systems in municipal institutions (schools, preschools, community centers etc.), and the improvement of thermal insulation in building envelopes. Streamlining use of windows and openings (natural ventilation); electronic and electric equipment

(such as water heaters, printers, etc.) The Eilat Municipality consumes 22,000,000 Kw per year, comprising approximately 3% of all municipal consumption. Energy efficiency in public institutions in the city includes the following measures: installation of solar panels in public institutions, installation of energy management systems, courses and training on energy efficiency.

Solar panels in public institutions – use of solar energy is, of course, one of the most popular measures in this sun-drenched region of Eilat. Use of public building roofs for the installation of solar systems is maximizing use of unused space to reduce local authority emissions while minimizing local authority expenses in electricity consumption. In recent years, 12 solar systems of 55Kw each were installed on public buildings. This year, another 2.5 Megawatts will be added with an additional 2.5 Megawatts being added next year. The total solar electricity that has already been generated supplies approximately 4,500,000 kW/hour per year, comprising approximately 20% of all electricity consumption of the local authority. In accordance with the local authority plan, the use of roofs on public buildings may increase so that the full consumption of the local authority will be offset over the next two years.

Solar panels on privet rooftops – A launch of a unique software in conjunction with the startup company "Sol-View", which was developed in the Eilat-Eilot company (REC). The software focuses on the development of smart system that allows access to information to residents of Israeli and international cities and towns regarding solar production while encouraging the public to establish solar roofs to generate electricity. The system will provide the property owner, apartment owner or business owner with all information they require under one room online and will include techno-economic feasibility, price quotes, financing proposals and approvals.

Energy management systems in public institutions – In process with General Electric, as part of development town challenge, there is an attempt to respond to the energy management challenge in a city that manages 140 buildings and 114 light switchboards. The challenge is designed is to facilitate the proper and efficient management of energy by using courseware on automatic energy management in city properties. Continuous management

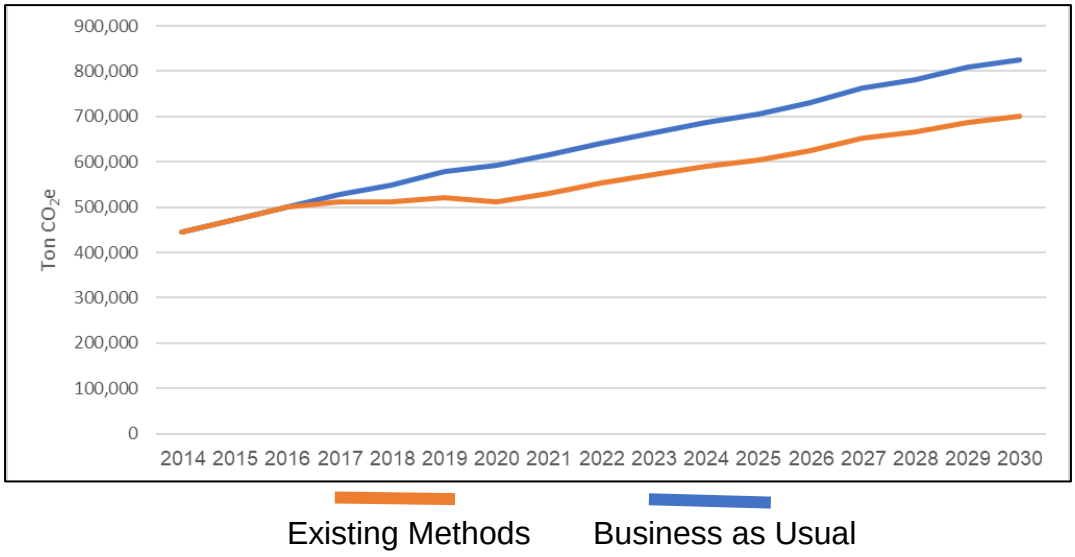
systems are currently being installed in all buildings in the city. The projection is that it will reduce electricity consumption by 15%.

Water use efficiency - this process was implemented by the installation of advanced management system that resulted in a 50% reduction of use by preventing leaks.

Competition between businesses – Regarding energy efficiency. Two main directions of action involve replacement of electronic devices (priority given to a heavy device that will result in greater efficiency) and behavioral change among organizational employees.

These policy measures that are implemented or that are currently being planned can reduce emissions by approximately 18% in comparison with the business-as-normal scenario, so that municipal emissions projected for 2030 will be 700,000 CO2e per year. (Scenario 5). Although this is progress in the right direction, in order to achieve the goals set by the municipality as part of its enrollment in the Covenant, additional measures must be promoted.

Diagram 5 - Emissions by weighing existing and planned policy measures



3.2 Promotion of a series of additional potential measures to reduce emissions in Eilat

Following a review of the contribution of current measures, this chapter will focus on the potential contribution of implementation of a series of additional potential measures. The presented measures incorporate directions introduced in professional literature, and that are advanced by other cities around the world and/or that are in various stages of development in Eilat and the surrounding areas.

Insulation of existing buildings - improved insulation is one of the elements of green construction. Green construction (sustainable construction) is environmentally friendly and healthy construction for tenants and users, encourages efficient use of electricity, water and waste recycling, use of public transportation and increasing the standard of living of building tenants.

Encouraging energy efficiency: ad campaign – to change electricity consumer habits of households, an investment must be made in campaigns that explain the importance of energy efficiency and actual steps to become efficient.

Encouraging energy efficiency: smart meters – smart meters allow the consumer to remain updated on real time usage, in addition to serving as an important feedback tool for consumers to better understand their consumption patterns.

Encouraging energy efficiency: remote control – remote control refers to the consumers' ability to remote control electrical appliances. This control enables a reduction in consumption.

Electricity production from renewable sources - Unlike the other measures that pertain to consumption source, this measure refers to the source of electricity that reaches the system. Replacement of the electricity that is generated by fossil fuel (in the Electric Company) with electricity generated by renewable energy significantly lowers the impact of electricity consumption.

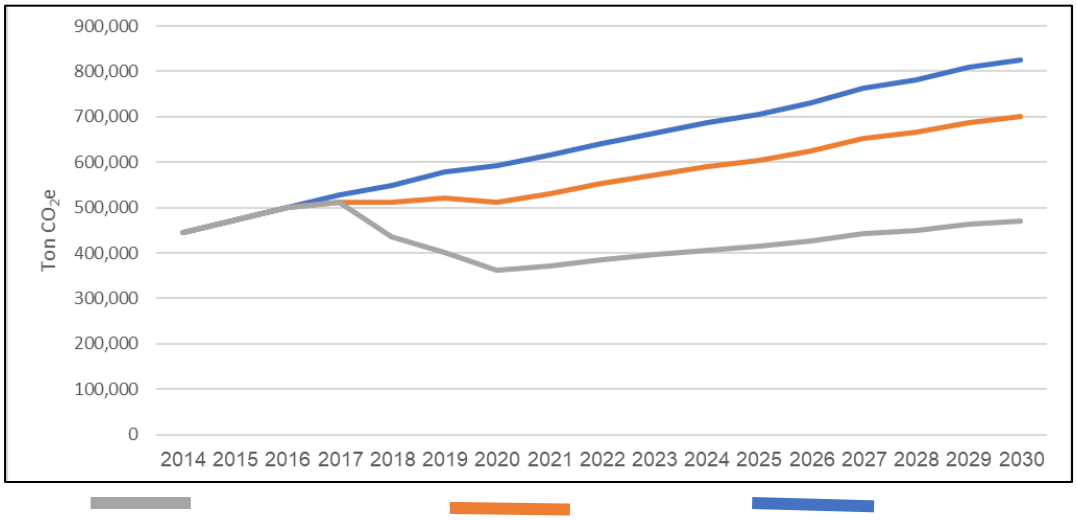
Technological advancement in transportation – under this section, a number of possible means are combined such as the introduction of electric

vehicles (for private and public transportation) that will not only replace the gasoline / diesel engine, but also prevent the spread of air pollution throughout the city. Another possibility of technological improvement in transportation involves improving the engine efficiency of cars and thereby reducing the amount of fuel consumed.

Changing driving patterns - when discussing changing driving patterns, we primarily mean a transition from use of private transportation to public transportation. To encourage the public to make the transition, it is necessary to invest in transportation infrastructures and to establish an efficient and easy-to-understand transportation system.

Implementation of the other proposed methods will increase efficiency by 43% as presented in Diagram 6.

Diagram 6– Emissions with no implementation of a plan of action, and after implementation of measures



To make a decision regarding the measures to be implemented in order to achieve the reduction targets, the potential contribution of implementing each measure must be reviewed. The following pages of this document focus on the two main sources of emissions – electricity and transportation, and present the impact of each measure on total emissions.

4. Greenhouse gas emissions from electricity consumption in the city

As specified, the source of most emissions in the city can be attributed to electricity consumption (421,180 ton CO2e in 2014). Diagram 7 displays the breakdown of emissions attributed to electricity consumption between the various municipal sectors and Table 3 breaks down the total emissions per sector. An analysis of the emissions reveals that most emissions are generated by electricity consumption in the commercial sector. Household electricity consumption constitutes the second largest component.

Diagram 7 Breakdown of emissions from electricity consumption by sector

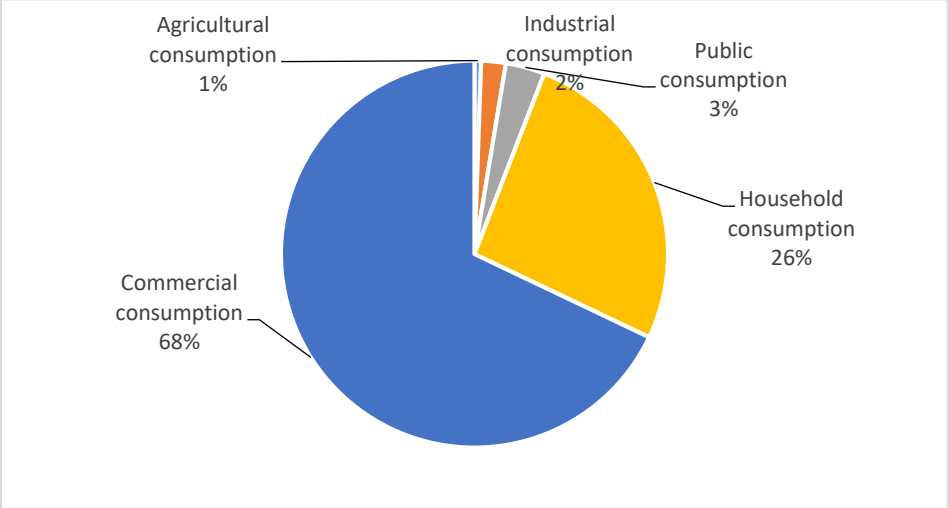


Table3: Electricity consumption and emissions by Mekorot

Sectors	Electricity consumption per year (kW/hour)	Greenhouse gas emissions (CO_2e ton)
Public consumption	21,069,570	13,770
Household consumption	161,100,000	110,350
Commercial consumption	417,650,350	286,090
Agricultural consumption	3,400,000	2,330
Industrial consumption	12,600,000	8,630
Water consumption	32,400,000	22,194
Total	**648,219,910**	**421,180**

Note: The summary of emissions did not include emissions attributed from the consumption / supply of water presented below.

The emissions generated by the city's electricity consumption constitute only 3% of all electricity consumption emissions in the city, but the municipality has the ability to promote various steps to reduce emissions that are under its direct responsibility and to serve as an example for the other sectors. Diagram 6 displays the electricity consumption components of the municipality. Table 4 breaks down the total emissions of the various components. The most significant component is street lighting, which accounts for about 80% of the total emissions from electricity consumption in the municipality.

Diagram 8: Breakdown of emissions from municipal activity

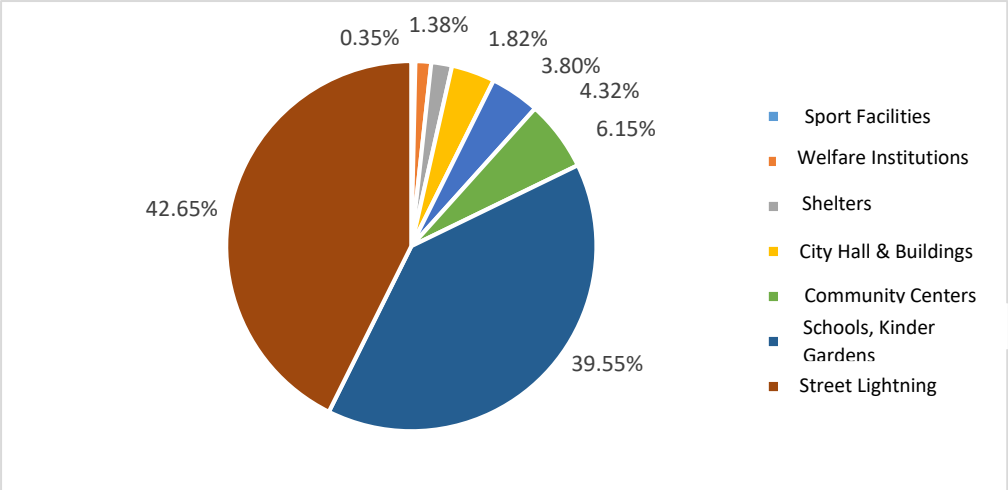


Table 4: Electricity consumption and emissions from the authority sector

Authority sector	**kW/hour**	**Greenhouse gas emissions (CO_2e ton)**
Sports Facilities	73,540	50
Social services institutions	290,070	200
Shelters	382,470	260
Municipal buildings	800,190	550
Preschools	909.530	620
Community centers	1,295,380	890
Schools	8,332,660	5710
Street lighting	8,985,730	6160
Total	**22,069,570**	**14,440**

Note: Without offsetting the emission saving energy resulting from the use of solar energy.

Methods for reducing emissions: electricity

Measures to reduce emissions from electricity consumption are divided into two categories, measures promoted by the municipality and that are within the scope of the municipality's influence and measures based on the government level for the purpose of promoting them (whether by regulation or resources). In the first part of this sub-section, we will review measures already promoted by the Eilat Municipality and examine how they will affect emissions reductions by 2030. In the second part, we discuss measures that are already partially promoted, but in order to maximize them, national involvement is necessary.

4.1 Existing methods for reducing emissions: electricity

As part of the effort to reduce emissions, there are several measures being promoted by the Eilat municipality, including:

Replacement of street lighting - by 2019, 14,000 light fixtures will be replaced in the city's streets at a cost of NIS 13 million. This project is estimated to reduce 6,000,000 kWh per year.

Energy Efficiency in Public Institutions - According to the experts' assessment, energy efficiency in public institutions will be reduced by 3,000,000 kWh per year.

Solar panels in public institutions - a total of 20 roofs were included, approximately 4,625,000 kWh per year. At this stage, emissions attributed to the life cycle of solar energy production were not included. This data refers to implementation by 2019. To calculate the future impact, the premise is that savings will double by 2030.

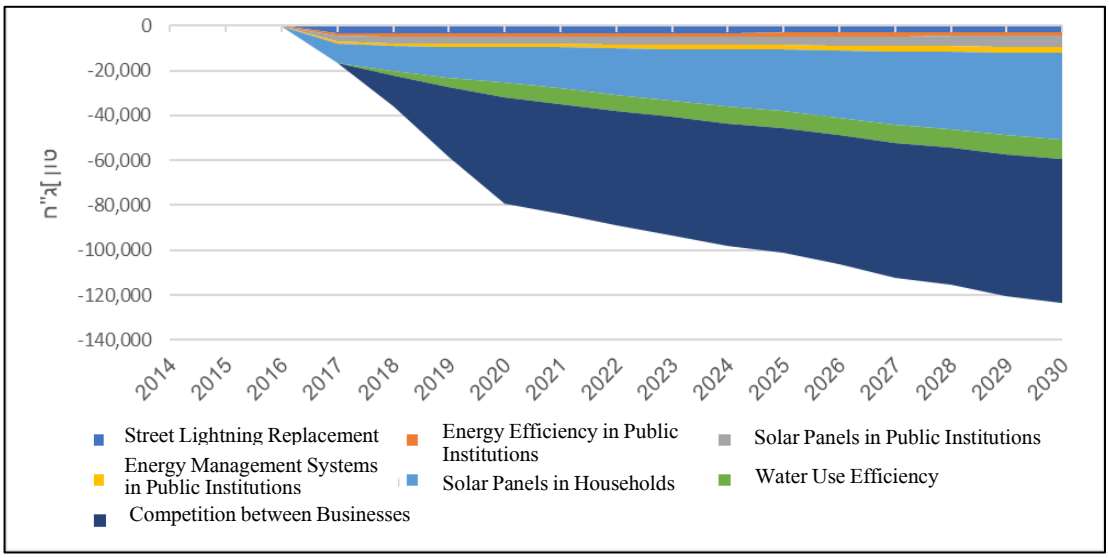
Energy management systems in public institutions - This measure was estimated to save 1,800,000 kWh per year. The premise is that by 2030, the savings in this area will triple.

Solar panels in households -The premise is that by 2030 there will be 5,000 households with solar panels with each household generating 15,000 kWh per year.

Water efficiency – the premise is that by 2020 the water sector in Eilat will increase efficiency by 30%.

Business competition - This measure contains several measures to reduce electricity consumption that combined can effectively reduce electricity consumption in businesses. Two main directions of action involve replacement of electronic devices (priority given to a heavy device that will result in greater efficiency) and behavioral change among organizational employees. The premise is that by 2020, the commercial sector will increase efficiency by 15%.

Table 10 – Breakdown of existing policy measures implemented by the Eilat Municipality in electricity



Drawing 9 – Impact of current reduction measures over time

Policy Measures	Total reduction in 2030 (CO2e ton)	Percentage of reduction from total emissions in 2030	Objectives
Replacement of street lighting	3,090	0.4%	The target was achieved in 2017 (6,000,000 kW/hour)
Energy efficiency in public institutions	1,540	0.2%	3,000,000 kW/hour
Solar panels in public institutions	4,760	0.6%	Doubling savings (4,625,000 kW/hour) by 2030
Energy management systems in public institutions	2,780	0.3%	Tripling savings (1,800,000 kW/hour) by 2030
Solar panels in households	38,570	4.7%	5000 Households in 2030
Efficiency in water use	8,480	1.0%	Savings of 30% in electricity consumption in the water market by 2020
Competition between businesses	64,300	7.8%	Savings of 15% in electricity consumption in the commercial sector by 2020

The total reduction from these measures in relation to the business-as-usual scenario is approximately 15%, with the most influential factor being competition between businesses that will lead to energy efficiency.

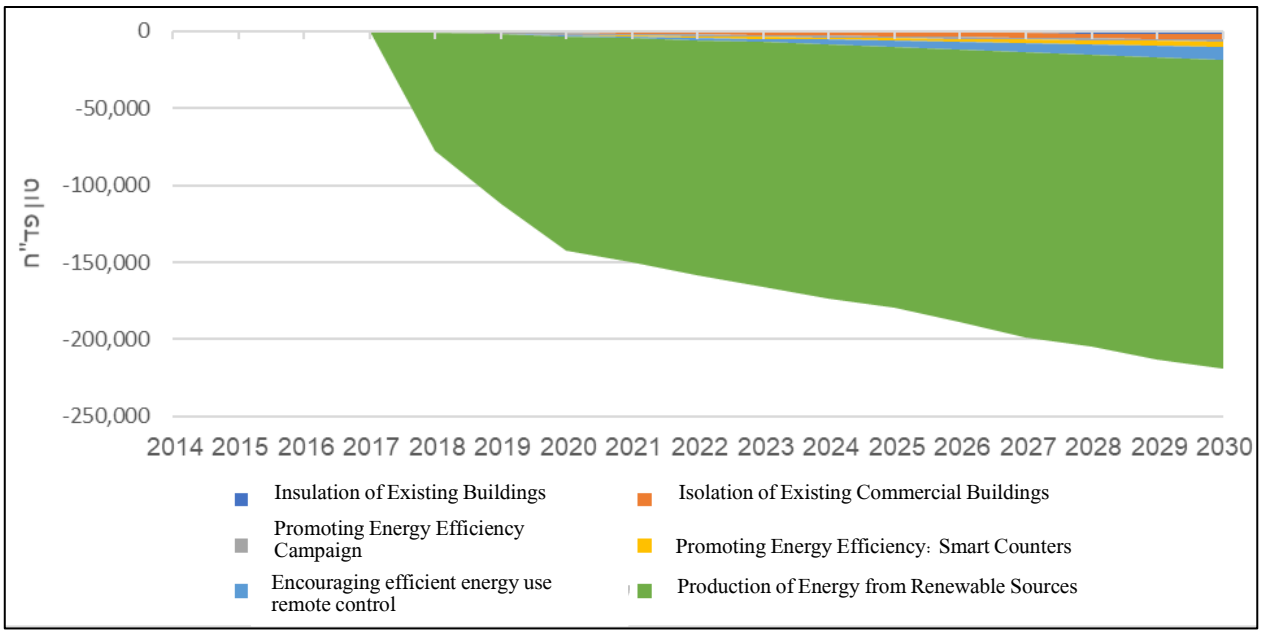
4.2 Methods for reducing emissions: electricity

Table 11 presents additional measures to reduce emissions from electricity consumption These are not necessarily measures that are not currently being promoted but rather measures that are not fully implemented today and that must be invested in order to maximize their full potential. The table reveals that the most effective measure is the transition to renewable energy. Diagram 9 presents the reductions of the proposed measures over time.

Table 11 – List of proposed policy measures in electricity

Policy Measures	Total reduction in 2030 (CO2e ton)	Percentage of reduction from total emissions in 2030
Insulation of existing buildings (residential)	1,690	0.2%
Insulation of existing buildings (commercial)	3,600	0.4%
Encouragement of energy efficiency: ad campaign	1,400	0.2%
Encouragement of energy efficiency: smart meters	3,870	0.5%
Encouragement of energy efficiency: remote control	7,730	0.9%
Electricity production from renewable sources	200,590	24.3%

Diagram 10 – Proposed measures to reduce emissions in the electricity sector



The total reduction from the addition of these measures to the business-as-usual scenario is 27% in addition to the reduction already achieved in the previous section (a total of 42% reduction in emissions relative to the business-as-usual scenario). The most significant source of reduction is electricity consumption from renewable energy.

4.2.1 List of projects and premises affiliated with the proposed methods

Insulation of existing buildings (residential) - Improving insulation in residential buildings was assumed to result in a 20% reduction in electricity consumption.[2] Electricity consumption for acclimatization accounts for 30% of household electricity consumption. By 2030, an estimated 20'% of the population in Eilat will live in buildings with improved insulation.

Insulation of existing buildings (commercial) - Improving insulation in commercial buildings was assumed to result in a 14% reduction in electricity consumption[3]. Electricity consumption for acclimatization accounts for 30% of commercial electricity consumption. By 2030, an estimated 20'% of the commercial space in Eilat will reside in buildings with improved insulation.

Encouragement of energy efficiency: ad campaign – the impact of an ad campaign is estimated to affect 1% of household electricity consumption[3]. This impact will be felt in 2019.

Encouragement of energy efficiency: smart meters– the impact of smart meters is estimated to result in 5% reduction in household electricity consumption[3]. The rate of installation of smart meters will be 5% per year commencing in 2020 and up to 55% by 2030.

Encouragement of energy efficiency: remote control – the impact of remote control ability is estimated to result in 10% reduction in household electricity consumption[3]. The rate of installation of smart meters that enables remote control will be 5% per year commencing in 2020 and up to 55% by 2030.

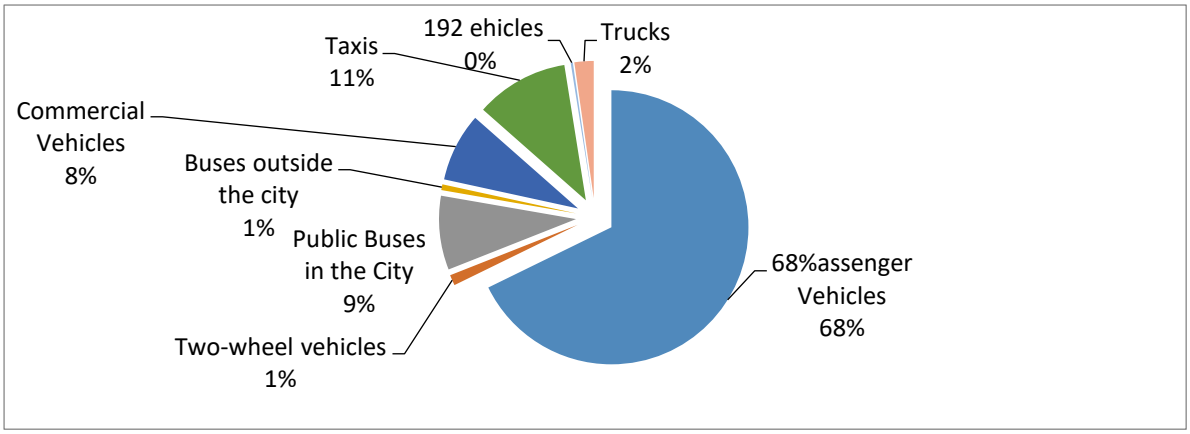
[2]"A review of the potential for reducing greenhouse gas emissions and recommendation for a national target for Israel" Ecotrades 2015

Electricity production from renewable sources – by 2030, it is estimated that the electricity system in Eilat will be supplied with 390,000 MWh per year[3].

5. Greenhouse gas emissions from transportation

Total emissions from transportation amount to 67,720 tons CO2e. Diagram 11 displays the breakdown of emissions by the various forms of transportation included in the report. Table 12 lists the total travel (km/year) and emissions of the transportation vehicles. The analysis of emissions reveals that the most significant emissions are attributed to private vehicles, comprising approximately 70% of all emissions.[4]

Diagram 11: Breakdown of emissions from transportation



[3]From the website "Eilat Eilot Renewable Energy"http://eilateilot.org/he/

[4]The transportation component in the municipal carbon accounting poses a complicated challenge attributed to the limited data and depending on the selected scope by the authority / city that was selected. The most common approach demands that local authorities review emissions attributed to travel in their geographical borders. However, leading cities in the area of sustainability also include emissions that are classified into tier 3, which also includes emissions from residents travel out of town, and emissions attributed to visitors traveling to the city. Due to the limited data, this report presents only part of the emissions of transport belonging to Tier 1 and the first phase of the emissions assessment of tier 3.

Table 12: Transportation and emissions from the transportation segment

	Km per year	Greenhouse gas emissions (CO_2e ton)
Passenger vehicles	170,502,300	52,000
Two-wheel vehicle	7,949,700	960
Public buses in the city	156,700	6,700
Buses outside the city	567,800	520
Commercial vehicles	22,851,900	6,200
Trucks	1,559,900	1,740
Taxis	27,645,400	8,430
Authority vehicles	-	190
Total	**231,233,700**	**76,720**

According to Ministry of Transportation statistics, the city has 12,430 private vehicles and an additional 1,250 two-wheel vehicles registered. Adding to this number at least another 10% for leased vehicles that are not registered in the city (and as a result, there is no information about them at this stage). In addition to the vehicles for private use, the city has 420 taxis and approximately 800 commercial vehicles. As noted in Chapter 2, we are unable to present travel and emissions for the city only. Initial and rather rough estimates take into account daily use of the vehicle in the city's neighborhoods to the city center in both directions will result in mileage of approximately 25 million km per year and emissions of approximately 6,200 tons CO2e per year.[5]

Analysis of emissions from transportation in the approach implemented in this report clearly reveals that private mileage of the city's residents is the most significant component of mileage and emissions. Table 13 presents a breakdown of privately-owned vehicles of city residents by age of vehicles,

[5]Another component to be reviewed in detail below is truck mileage to and in the city. According to Eilat Port data, approximately 200 arrive at the port every day. Travel from the entrance to the city to the port on the byroads that are 20km in length in both directions or annual mileage of over one million km and emissions of 1,250 CO2e per year.

Another component that is not reflected in this report is the mileage of visitors to the city, both in private vehicles and on flights, a component that is expected to significantly increase the emissions of the transportation sector.

mileage and emissions. Table 14 presents this breakdown by compliance with the mileage ranges of vehicles of city residents.

Table 13 – emissions for private vehicle mileage broken down by vehicle age

Vehicle age	Number of vehicles	Average mileage per vehicle per year	Annual mileage	Total emissions CO2e ton
2012-2016	2,500	15,180	42,685,500	13,000
2001-2011	8,240	11,110	111,642,200	34,000
1990-2000	1,600	6,820	14,515,200	4,400
Up to 1990	90	2,620	1,659,300	600
Total	**12,430**		**170,502,000**	**52,000**

Table 14 – Emissions from use of private vehicles based on mileage ranges for the vehicle per year

Annual mileage range	Number of vehicles	Annual mileage	Total emissions CO2e ton
Up to 5,000 km	1,500	5,000,000	1,530
5,000-10,000	3,500	26,000,000	7,950
10,000-30,000	6,500	104,000,000	31,810
30,000-50,000	450	14,500,000	4,440
Over 50,000 km	60	3,500,000	1,070
Other	420	17,502,000	5,200
Total	**12,430**	**170,502,000**	**52,000**

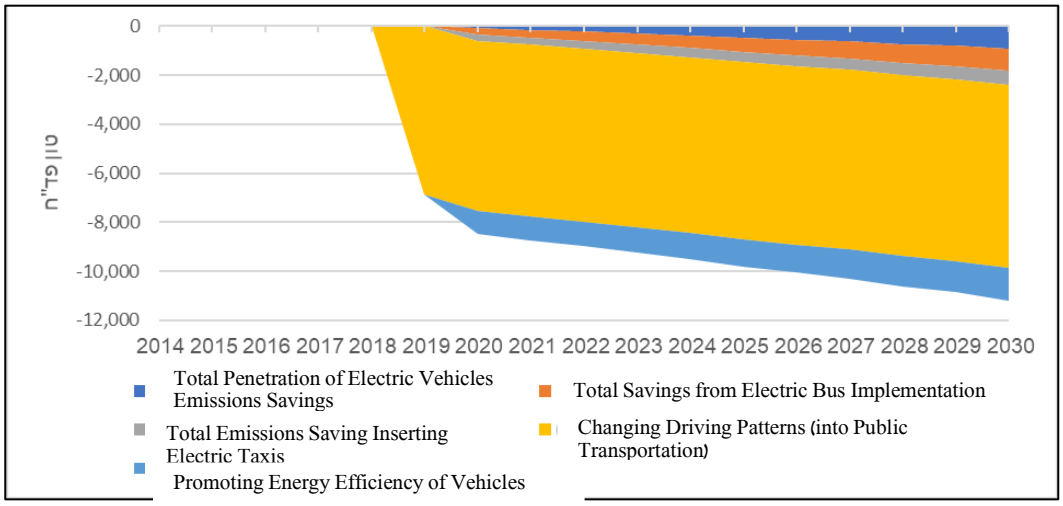
5.1 Methods for reducing transportation emissions

Unlike measures to reduce electricity emissions, in order to promote transportation measures, a large investment in infrastructure and involvement of national entities, particularly in the areas of regulation, is required. Table 15 specifies the various directions of action as well as quantifies the impact in 2030 and Diagram 11 presents the development over time.

Table 15 – List of proposed policy measures in transportation

Policy Measures	Total reduction in 2030 (CO2e ton)	Percentage of reduction from total emissions in 2030
Introduction of electric vehicles	920	0.1%
Introduction of electric buses	910	0.1%
Introduction of electric taxis	560	0.1%
Change in driving patterns (switch from private vehicles to public transportation)	7,460	0.9%
Promotion of energy efficiency of vehicles	1,320	0.2%

Diagram 12 – Proposed measures to reduce emissions from transportation



5.1.1 List of premises affiliated with the proposed methods in transportation

Introduction of electric vehicles – by 2020, an estimated 100 vehicles will be on the road with an increase of 100 vehicles by 2030.

Introduction of electric buses – by 2020, an estimated 10 vehicles will be on the road with an increase of 2 vehicles by 2030.

Introduction of electric taxis – by 2020, an estimated 50 vehicles will be on the road with an increase of 5 vehicles by 2030.

Change in driving patterns (switch from private vehicles to public transportation) – in 2030, an estimated 5% of all mileage (km-passenger) will be on public transportation.

Promotion of energy efficiency of vehicles – estimated improvement of 1% per year in vehicle efficiency.

6. From analysis of possible measures for selecting future measures

An analysis of municipal emissions and a review of the contribution of a series of possible measures presented above indicate that the city of Eilat has a range of options that will help the city advance towards its desired reduction target.
As presented in Table 16, the city faces three main courses of action: adoption of new technological means, promotion of regulation and planning, and changing the behavior / behavior of the local authority, while encouraging residents and the commercial sector to adopt patterns of behavior that will reduce emissions. While the local authority is a major player, several of the measures that the city needs to promote require involvement, cooperation and support from other levels - the national, households and businesses.

The table reveals that three main directions of action for reducing Eilat's emissions are **generating electricity from renewable energies, competition between businesses (energy efficiency in businesses) and the installation of solar panels in households**. An analysis of the type of activity shows that in two measures (generation of electricity from renewable energies and solar panels in households), the type of activity is technological and requires the involvement on the national level and households alongside the activity of the local authority. In addition to the aforementioned measures, the promotion of a series of energy efficiency measures and the encouragement of behavioral change will also lead to the emissions reduction.

Table 16: main reduction measures, types of activity and involved parties

Field	Measures	Percentage of reduction in 2030 in relation to the business-as-usual scenario	Type of activities			Level of involvement required			
			Technology	Regulation	Conduct	National	Local authority	Household	Businesses
Electricity	Replacement of street lighting	0.4%	+				+		
Electricity	Energy efficiency in public institutions	0.2%	+		+		+		
Electricity	Solar panels in public institutions	0.6%	+				+		
Electricity	Energy management systems in public institutions	0.3%	+				+		
Electricity	Solar panels in households	4.7%	+					+	
Electricity	Efficiency in water use	1.0%	+				+		
Electricity	Competition between businesses	7.8%	+		+		+		+
Electricity	Insulation of existing buildings (residential)	0.2%		+				+	
Electricity	Insulation of existing buildings (commercial)	0.4%		+					+
Electricity	Encouragement of energy efficiency: ad campaign	0.2%			+			+	
Electricity	Encouragement of energy efficiency: smart meters	0.5%	+					+	
Electricity	Encouragement of energy efficiency: remote control	0.9%	+					+	
Electricity	Electricity production from renewable sources	24%	+			+			
Transportation	Introduction of electric vehicles	0.1%	+	+		+			
Transportation	Introduction of electric buses	0.1%	+			+			
Transportation	Introduction of electric taxis	0.1%	+			+			
Transportation	Change in driving patterns (switch from private vehicles to public transportation)	0.9%			+			+	
Transportation	Promotion of energy efficiency of vehicles	0.2%	+			+			

Table 17 lists the implementation times, feasibility and main barriers of each measure. The two measures related to electricity production from renewable energy (at the national level and households) are long-term projects that require a relatively large economic investment. Electricity production from renewable energy on the national level is highly feasible in the Eilat region since several solar fields are already operating in the area and a large number of fields are scheduled to be

built.[6] Eliat's geographical proximity to production sites makes it highly likely that a high percentage of electricity will be diverted for Eilat consumption.

Table 17

Field	Means	Implementation Time	Feasibility	Main Barriers
Electricity	Replacement of street lighting	Short range	High	
Electricity	Energy efficiency in public institutions	Medium range	Moderate	Behavioral
Electricity	olar panels in public institutions	Short range	High	
Electricity	nergy management systems in public institutions	Medium range	High	Behavioral
Electricity	Solar panels in households	Long range	Moderate	Regulatory
Electricity	Efficiency in water use	Medium range	Moderate	echnological
Electricity	mpetition between businesses	Long range	High	Economic, behavioral
Electricity	nsulation of existing buildings (residential)	Medium range	Moderate	Economic, regulatory
Electricity	nsulation of existing buildings (commercial)	Medium range	Moderate	Economic, regulatory
Electricity	Encouragement of energy efficiency: ad campaign	Short range	Moderate	Behavioral
Electricity	Encouragement of energy efficiency: smart meters	Medium range	High	Behavioral, regulatory
Electricity	Encouragement of energy efficiency: remote control	Medium range	High	Regulatory
Electricity	Electricity production from renewable sources	Long range	High	Regulatory
Transportation	ntroduction of electric vehicles	Long range	Moderate	Regulatory
Transportation	ntroduction of electric buses	Medium range	High	Regulatory
Transportation	Introduction of electric taxis	Medium range	High	Regulatory
Transportation	ange in driving patterns (switch rom private vehicles to public transportation)	Long range	Moderate	Behavioral
Transportation	omotion of energy efficiency of vehicles	Long range	Moderate	echnological

In order to stimulate the means of producing renewable energies, national entities must be recruited because investments in large scale solar fields require government support and encouragement. Beyond the fields themselves, there is a need to take care of the infrastructure for the transmission and storage of renewable energy. This requires the involvement

[6] http://www.eilateilot.org/he/%D7%9E%D7%A4%D7%AA-%D7%A4%D7%A8%D7%95%D7%99%D7%99%D7%A7%D7%98%D7%99%D7%9D/

of the Electric Company. The ability to implement reforms in the national electricity system and to recruit the IEC to implement measures that will increase electricity production from renewable energy requires actions on a national scale that only the government can spearhead. At the same time, the Eilat municipality's continued activity in ensuing years centers around the promotion of renewable energies in the southern Arava region will facilitate maximization of the potential inherent in this measure.

Over the next several years, in addition to the continued measures promoted by the local authorities, the Eilat Municipality will promote the following:

(1) Maximization of the use of alternative energy sources within and outside the city;

(2) Competition between businesses; and

(3) A series of measures to promote energy efficiency.

(1) Maximizing the use of alternative energy sources inside and outside the city

(a) Promoting measures in the city - In ensuing years, the city of Eilat will continue to promote a series of measures that will maximize the use of renewable energy sources in its area. These measures will include:

- Expansion of installation of solar panels on the roofs of public buildings
- Encouragement of households to install panels - a public information campaign is currently being promoted to provide the public with information regarding options available to them regarding installation of solar rooftop. The information will include a detailed explanation of the various stages of the process, the physical conditions of the building required for system installation (size and type of roof, etc.), financing options and subsidization.
- Locating open spaces suitable for the construction of solar installations within the municipal area
- Encouraging and motivating the commercial sector to install solar panels on roofs and commercial areas

(b) Promoting measures outside the city - Over the past few years, the solar energy sector in the southern Arava has developed. Already the production capacity of the solar fields bordering the city generates electricity of 70 MW.

The city of Eilat will remain involved in the promotion and expansion of solar fields in the area as well as the development of storage capacities to maximize municipal dependence on these energy sources while reducing dependence on fossil sources. Promotion of this direction of action is expected to reach an energy supply of 200 MW by 2030.

(2) Competition between businesses – Two main directions of action involve replacement of electronic devices (priority given to a heavy device that will result in greater efficiency) and behavioral change among organizational employees.

(3) Measures to promote energy efficiency - Promoting a range of measures in energy efficiency is expected to contribute to the reduction of urban emissions. Already, a series of steps are being advanced and will be expanded and expanded in the coming years. In addition to these measures , the city will promote a series of additional measures as presented in this plan of action, including:

(a) Measures to increase efficiency that are already being promoted today–

- Replacement of street lighting
- Energy efficiency in public buildings
- Efficiency in water use

(b) Efficiency measures that will be promoted in the implementation of this plan

- Competition between businesses
- Insulation of existing buildings (residential)
- Insulation of existing buildings (commercial)
- Internalization of green construction principles in the implementation of the plans for new neighborhoods in the city
- Municipal ad campaign to promote energy efficiency in households and businesses

- Installation of smart electricity meters and remote control in households
- Installation of charging stations for electric vehicles
- Introduction of electric taxis

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Appendix 1: Formulating a Greenhouse Gas Emissions Reduction Plan - Methods and Materials

Business-as-normal scenario: Electricity

To estimate the future emissions under the business-as-usual scenario in the electricity sector, key factors were used to estimate future consumption. For every sector (household, commercial, etc.) a key factor was adapted. The premise being that the increase in consumption in said sector will correspond with the increase in the key factor adjusted to the segment. For public, domestic and water consumption, the assumption is that the key factor is the size of the population, since consumption of public services and water is determined by the size of the population and domestic consumption is the direct consumption of the population. For commercial, agricultural and industrial consumption, field data were preferred because they represent growth trends in the specific sectors and include related effects such as demand, revenue, regulatory preferences, foreign investment, and more. Projections for key factors were taken from outline plan 270/02/2 of the Eilat Municipality, which includes projections for various factors (population growth, commercial space, housing units, etc.) in the city until the target year 2030. The projections are listed in Table 18.

Table 18 - Projections of Key Factors from Outline Plan 270/02/2

Key figure	Current value	Target for 2030
Population (not including tourists)	58,946	100,000
Commercial space (square meters)	1,352,900	2,700,000
Area Industry (square meters)	212,200	2,500,000

For each sector, consumption intensity was determined per unit (eg per capita consumption, consumption per square meter, etc.). The intensity does not change throughout the business-as-usual scenario. Intensity of consumption was calculated based on 2014 data. Table 19 presents 'key factors' and consumption intensity for the various sectors. To calculate the emissions resulting from electricity consumption from the Electric Corporation, we used the projection for the fuel mixture according to the Ministry of Energy and the

emission coefficient for electricity production of coal and natural gas, in order to create an emission factor for KWH consumption. The cumulative consumption each year was multiplied by the emission factor per kWh in order to calculate the amount of emissions each year from electricity consumption.

Table 19 – Key Factors and Intensity of Emissions for the Electricity Sector

Sectors	Key figure	Consumption intensity
Public consumption	Population	357 kW/hour per person
Household consumption	Population	2.733 kW/hour per person
Commercial consumption	Commercial space	309 kW/hour per square meter Commercial space
Agricultural consumption	Agricultural space	10 kW/hour per square meter Commercial space
Industrial consumption	Industrial consumption	59 kW/hour per square meter Commercial space
Water consumption	Population	550 kW/hour per person

Business-as-normal scenario: Transportation

In terms of transportation, calculation of the increase in mileage traveled was based on past trends (2007-2014) for each type of vehicle. The premise being that the average increase in said years will continue until 2030. Table 20 summarizes the trends in change as documented by the CBS for 2007-2014. The premise being that the emissions coefficient for mileage km in each category remains unchanged until 2030 based on 2014.

Table 20 – Trend in Transportation Growth between 2007-2014

Type of vehicles	Growth rate in mileage
Passenger vehicles	4.6%
Two-wheel vehicle	1.8%
Public buses in the city	1.4%
Buses outside the city	1.4%
Commercial vehicles	-0.6%
Trucks	-4.6%
Taxis	0.3%