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Bornova Baseline Report on Sustainability

Climate Change Adaptation Grant Programme (CCAGP) TR 2017/ESOP/MI/A3/04)

CCAGP 090 STORMLOG (Sustainable Transportation and Water Management in Local Governmental Services) Project

Output 5

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Technical References

Proje Kısaltması	STORMLOG
Proje Adı	Sustainable Transportation and Water Management in Local Governmental Services
Proje Koordinatörü	Bornova Municipality
Proje Süresi	18 months
Çıktı No.	O5
Yaygınlaştırma Düzeyi	CO*
Etkinlik	F.2
Lider Ortak	Yaşar University (YAŞAR)
Katkıda bulunan yararlanıcı(lar)	

*PU = Public, PP = Restricted to other programme participants (including the Commission Services), RE = Restricted to a group specified by the consortium (including the Commission Services), CO = Confidential, only for members of the consortium (including the Commission Services)

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Versions

TABLE 0-1: CONTRIBUTIONS & VERSIONS OF THE DELIVERABLE

Version	Person(s)	Partner(s)	Date
V0.1	Dr. Emin Selahattin UMDU	YAŞAR	January 2024
	Prof. Dr. Nurdan YILDIRIM	YAŞAR	January 2024

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1. INTRODUCTION

This report aims to define current status on the city of Bornova for points that are critical for climate mitigation and adaptation studies. Thus, related data was gathered and processed based on the methodology stated in detail in Covenant of Mayors (CoM) and Intergovernmental Panel on Climate Change (IPCC) guidelines. Bornova has been a signatory for CoM. And cities that have signed the Covenant of Mayors, committing to the 2030 climate and energy framework, are required to follow methodology for reporting emissions and related impact, and information on methods to help them conduct the assessment and complete the relevant sections is provided on the reporting platform MyCovenant[1].

2. BASIC INFORMATION, DEMOGRAPHICS AND CLIMATE OF BORNOVA

Bornova is a city in İzmir, in Turkey. Bornova is located on the latitude of 38.48492 and longitude of 27.25235 and has a geohash; which is a is a unique identifier of a specific region on the Earth of swg6ujuwcv0c. The height above sea level varies between 20 and 200 meters in residential areas. This height reaches up to 600 m in mountainous regions and even exceeds it. The flat plain located in the south of the district centre is the Bornova Plain. It consists of the merger of the plains of Bozalan, Hacılarkırı, Karasuluk, Mersinli, and Bayraklı. These plains are generally formed by the accumulation of alluviums brought by the waters descending from the slopes. The area of the district is 220 km^2. Mediterranean climate prevails in the district. Summers are hot and dry; winters are warm and rainy. In summer, imbat (sea breeze) and poyraz (northeaster) winds are effective. In the winter, northwest winds, southwest and northeaster winds bring dry cold. There are Calabrian forests at heights up to 600 meters, and larch forests at higher heights. The forest areas in the district are rich in water. There is water flowing from the slopes and there are rivers fed by precipitation. Manda Stream, Kavaklıdere Stream, Şeytanderesi Stream, Bornova Stream, Nif Stream are important rivers. There is İkizgöl located on Yamanlar Mountain. It consists of one of the important resting areas of the district among pine forests.

According to the results of ABPRS (Address-based Population Registration System)[2], the population of the district is 447,553 people in Bornova where 98% of the district population lives in the city centre. The rural population of the district (2%) has been concentrated in 12 villages (Çamiçi, Çiçekli, Betonyol, Karaçam, Kavaklıdere, Kayadibi, Kurudere, Sarnıç and Yaka).

[1] https://eu-mayors.ec.europa.eu/en/resources/reporting
[2] Gözde Emekli and Füsun Baykal / Procedia Social and Behavioral Sciences 19 (2011) 181–189

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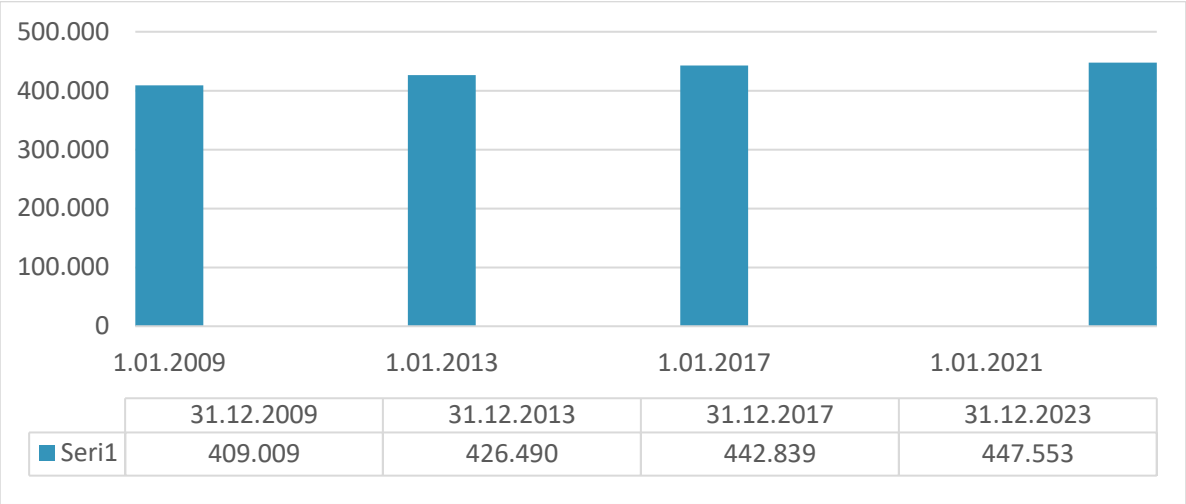

	31.12.2009	31.12.2013	31.12.2017	31.12.2023
Seri1	409.009	426.490	442.839	447.553

FIGURE 2-1 THE POPULATION DEVELOPMENT OF BORNOVA.

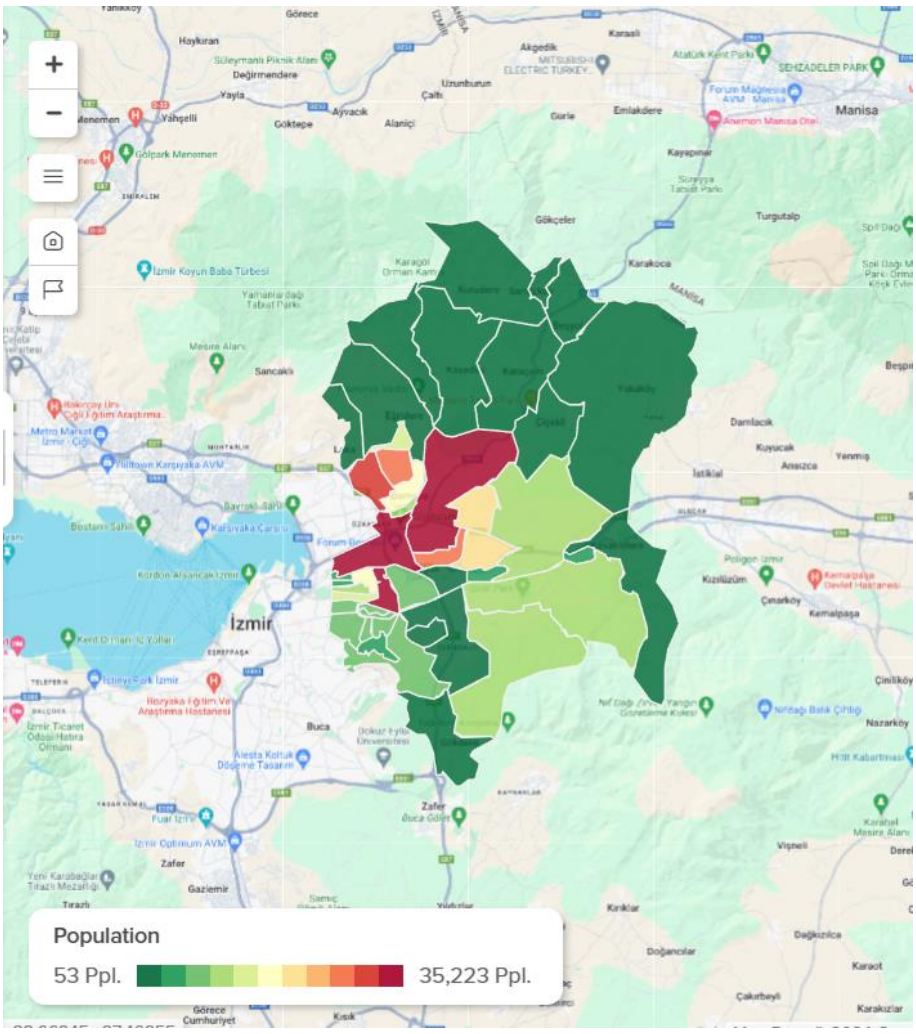

FIGURE 2-2 POPULATION CHART OF BORNOVA[3]

The climate in Bornova is warm and temperate. The winter months are much rainier than the summer months in Bornova. According to the Köppen-Geiger classification, the prevailing climate in this region is categorized as Csa. In this classification Csa defined as hot-summer Mediterranean climate; coldest month averaging above 0 °C or −3 °C, at least one month's average temperature above 22 °C, and at least four months averaging above 10 °C[4].The mean yearly temperature observed in Bornova is recorded to be 16.0 °C. Annually, approximately 742 mm of precipitation descends. Bornova is in the northern hemisphere. The balmy days of Summer commence at the end of June and conclude in September. This period encompasses the months: June, July, August, September. The best time to travel is June, July, August, September.[5]

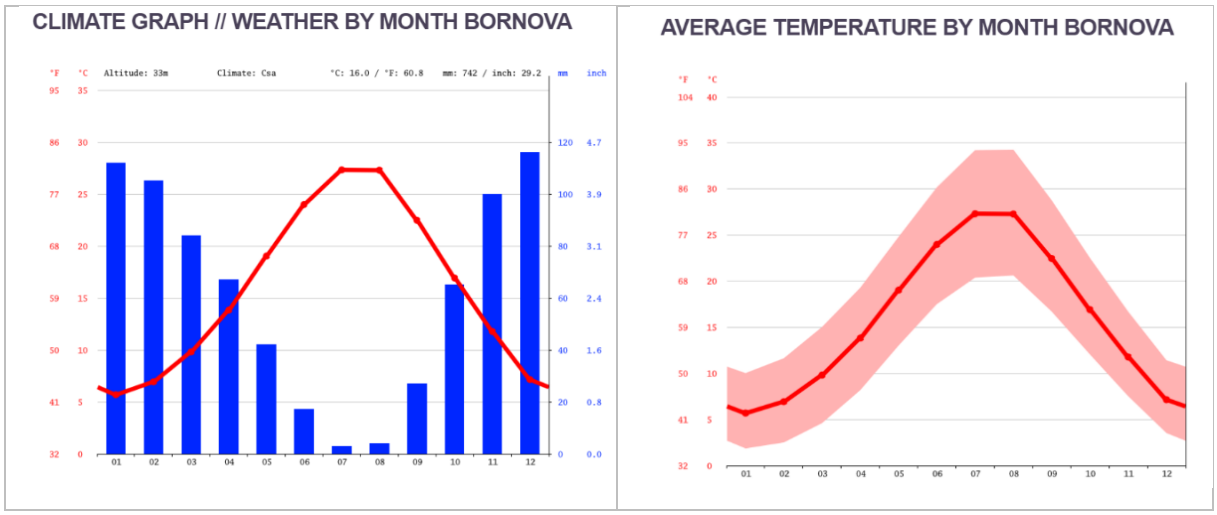

FIGURE 2-3 DATA AND GRAPHS FOR WEATHER & CLIMATE IN BORNOVA

There is a difference of 113 mm | 4 inch of precipitation between the driest and wettest months. Throughout the year, temperatures vary by 21.6 °C | 38.9 °F. The month with the highest relative humidity is December (80.15 %). The month with the lowest relative humidity is July (41.18 %). The wettest month is December (11.57 days). The driest month is July (1.13 days).

	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
Avg. Temperature (°C)	5.7	6.9	9.8	13.8	19	24	27.3	27.3	22.5	16.9	11.8	7.1

3 https://citypopulation.de/en/turkey/izmir/TR31002__bornova/

4 https://geodiode.com/climate/koppen-classification/, accessed in 19/09/2024

5 https://en.climate-data.org/asia/turkey/izmir/bornova-26653/#climate-graph

Min. Temperature (°C)	1.9	2.5	4.6	8.2	13	17.5	20.4	20.6	16.7	12.1	7.5	3.5
Max. Temperature (°C)	10	11.6	15	19.3	24.8	30.2	34.2	34.3	28.8	22.5	16.7	11.4
Precipitation / Rainfall (mm)	112	105	84	67	42	17	3	4	27	65	100	116
Humidity (%)	79%	75%	70%	66%	58%	48%	41%	43%	53%	65%	74%	80%
Rainy days (d)	7	8	7	6	5	3	1	1	3	4	6	9
avg. Sun hours	5.8	6.5	8.3	9.9	11.8	12.8	12.9	12.1	10.7	8.9	7.3	6.1

FIGURE 2-4. DATA: 1991 - 2021 MIN. TEMPERATURE °C, MAX. TEMPERATURE °C, PRECIPITATION / RAINFALL MM, HUMIDITY, RAINY DAYS. DATA: 1999 - 2019: AVG. SUN HOURS FOR İZMIR

In this location, the month that receives most sunshine is July, with a mean number of daily hours being 12.94. Across the entire duration of said calendar period there are an aggregate total of 401.25 hours' worth of sunlight. In Bornova, the month that experiences the least number of daily sunshine hours is January with an average duration of 6.06 hours per day. The total amount of sunlight recorded during this period in question stands at a sum of 187.76. In Bornova, an average of 113.04 hours of sunshine are counted per month and around 3444.18 hours throughout the year.

Izmir is one of the most urbanized and third most populous cities in Turkey. Composed of 30 districts, Izmir, has been exposed to rapid growth both in its population and in built-up areas with an increasing pressure on natural resources[6]. While the rapid urban growth and accompanying ecological, social and environmental changes set the expectation for current planning, the Izmir Metropolitan Municipality responded this with a new urban development strategy based on a series of projects within the scope of the struggle with climate change (i.e. the Green Re-vision: A Framework for the Resilient Cities and Urban GreenUP projects). In this respect, the Izmir Metropolitan Municipality underlined the importance of green infrastructure and ecosystem services in the creation of resilient cities; as well as making a commitment to build a healthy and climate friendly city by to reducing its total CO_2 emissions by 20 % in 2020[7].

Bornova metropolitan district of Izmir is a special case in terms of its historical development through time[8]. Bornova has experienced a high-density expansion of urban areas and scattered urban development patterns especially in the 20th century and thereafter. Currently, almost half of Bornova

[6] "2021 İzmir İl Afet Risk Azaltma Planı" https://izmir.afad.gov.tr/kurumlar/izmir.afad/E-KUTUPHANE/Il-Planlari/Izmir-IRAP.pdf, accessed 28/10/2024

[7] "İzmir Yeşil Şehir ile Sürdürülebilir Enerji ve İklim Eylem Planı", https://skpo.izmir.bel.tr/Upload_Files/FckFiles/file/2020/WEB_SAYFASI_SECAP-ingilizce.pdf

[8] Coskun-Hepcan, Cigdem, and Serif Hepcan. "Assessing ecosystem services of Bornova's green infrastructure, Izmir (Turkey)." Fresenius Environ. Bull 27 (2018): 3530-3541.

district is urbanized with high-density urban areas, high levels of industry and services developments. This urbanization processes have unknown consequences for the potential ecosystem services. Land cover changes might have negative impacts on the immediate suburbs and semi-natural areas[9] , but the biological and cultural diversity created by urbanization process can also increase the resilience of cities to anthropological disturbances along urban-rural gradients[10].

Bornova experienced a high-density expansion of urban areas towards its surrounding peripheries. Whilst this rapid process of urbanization has been thought to reduce the quality of natural and semi-natural areas together[11].

The spatiotemporal changes in the potential ecosystem services along the urban-rural gradient of Bornova district were assessed by global climate regulation (carbon storage), microclimate mitigation (Land Surface Temperature) and ecological integrity. The total vegetation cover in Bornova district increased from 18.41 % to 27.95 % to the last 28 years, particularly in peri-urban areas[11.]

State of vegetation

The spatiotemporal change of vegetation in Bornova district is given in Figure 2-5 The spatiotemporal change of vegetation 11.. Surprisingly, the total vegetation in Bornova district was increased from 18.41 % to 27.95 % between 1990 and 2018. Bornova district had around 5 % vegetation in the core urban areas in 1990 and this proportion was doubled in 2018. However, the largest shift in vegetation occurred in peri-urban areas by approximately 14 % (from 18 % to 33 %). As expected, the largest vegetation in Bornova district was found in its rural parts (around 50 % for both dates). The vegetation in the rural parts of Bornova district also increased to some extent (by 1 %).

[9]Alberti, Marina, and John M. Marzluff. "Ecological resilience in urban ecosystems: Linking urban patterns to human and ecological functions." Urban ecosystems 7 (2004): 241-265.
[10]Robson, James P., and Fikret Berkes. "Exploring some of the myths of land use change: Can rural to urban migration drive declines in biodiversity?." Global environmental change 21.3 (2011): 844-854.
[11] *Tonyaloğlu, Ebru Ersoy. "Spatiotemporal dynamics of urban ecosystem services in Turkey: The case of Bornova, Izmir." Urban Forestry & Urban Greening 49 (2020): 126631.*

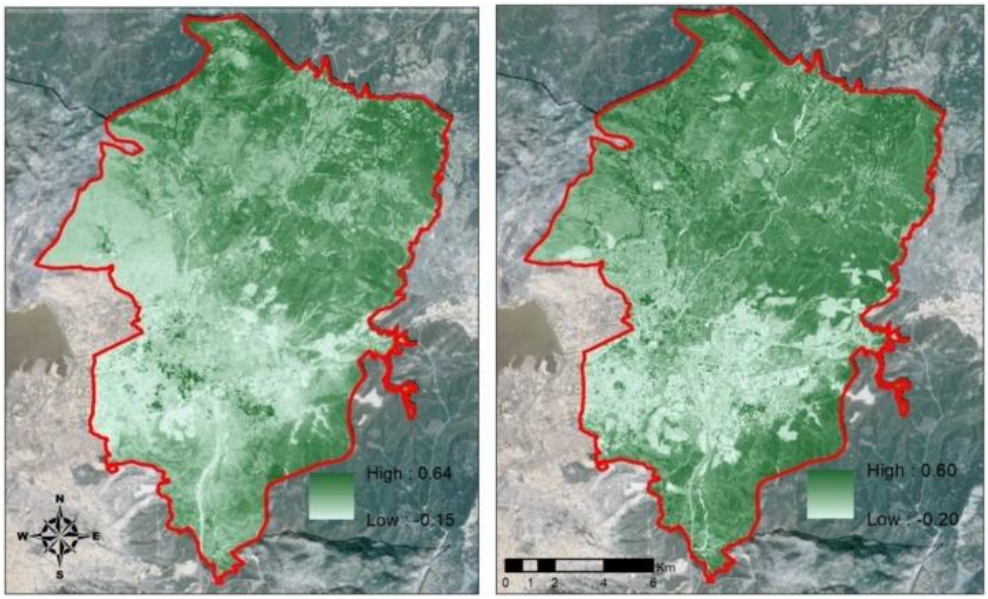

FIGURE 2-5 THE SPATIOTEMPORAL CHANGE OF VEGETATION [11].

The total carbon stored by vegetation in 1990 and 2018 were 152,542 and 229,796 tons, respectively (Figure 2-6 The spatiotemporal change of carbon storage11.).

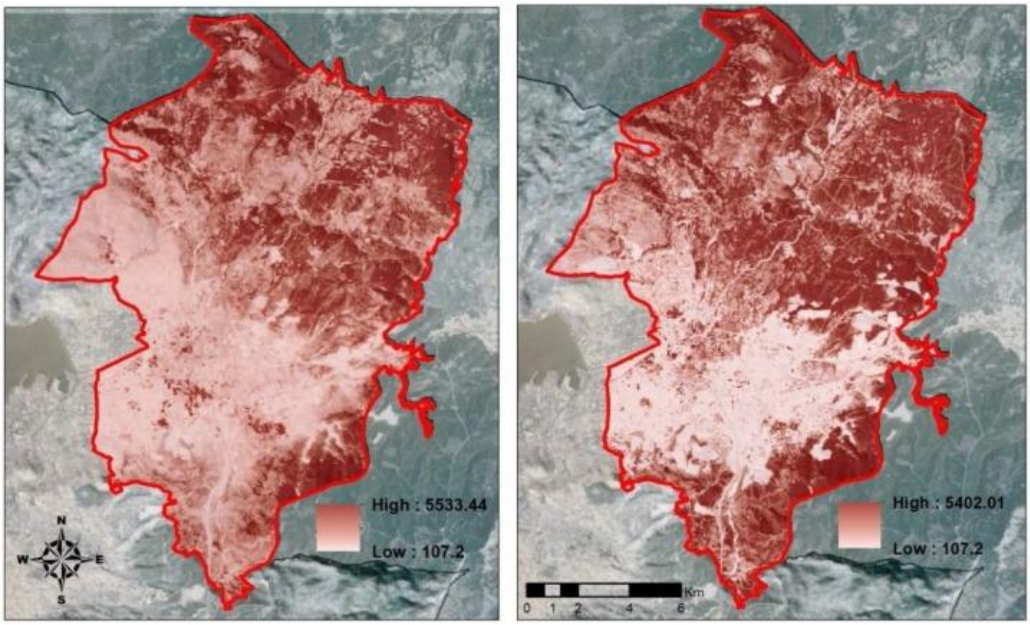

FIGURE 2-6 THE SPATIOTEMPORAL CHANGE OF CARBON STORAGE[11].

For both dates, the total carbon storage was the highest in rural areas compared to the urban centres. Contrary to expectations, there were gains in total carbon storage at different proportions throughout

the Bornova district. The largest gain in total carbon storage occurred in the rural parts of, and the fringes of the central Bornova district.

In terms of microclimate mitigation, both dates for Bornova district showed different trends. Whilst the maximum and minimum LST values for 1990 were 45.57 ℃ and 24.11 ℃, respectively with a mean LST of 34.36 ℃; the LST values for 2018 were considerably lower than 1990 (41.74℃, 23.96 ℃ and 32.16 ℃, respectively) (Fig. 4). Bornova district had a decrease in the mean temperature by 2.26 ℃ between 1990 and 2018. The mean LST value for both dates in Bornova district decreased from urban to rural areas (by 3.94 ℃ in 1990 and 7.45 ℃ in 2018). Also, the spatial variability of temperature in rural areas for both dates was less than the urbanized sections. For both dates, the largest temperature change occurred in rural areas (from approximately 2℃ to 6℃ between zones 1 and 27).

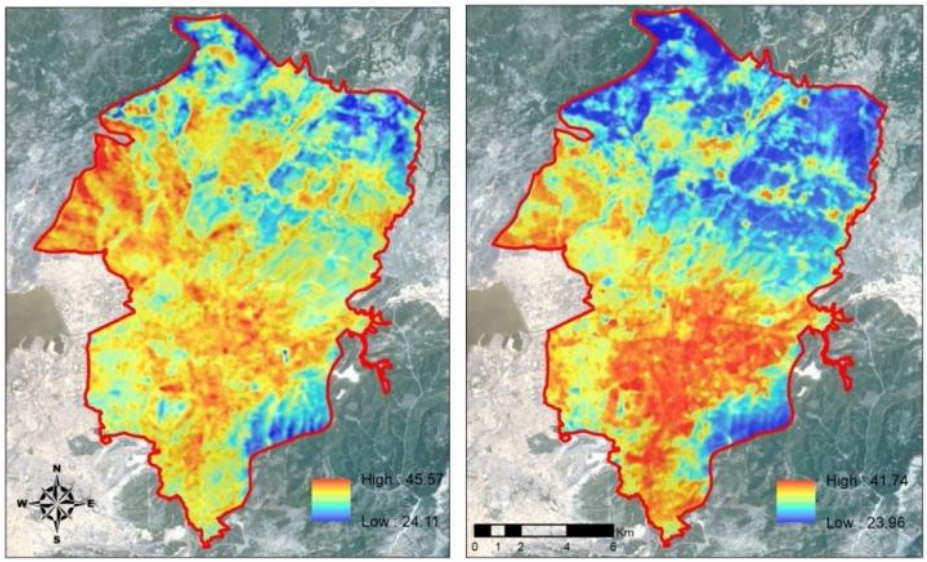

FIGURE 2-7 THE SPATIOTEMPORAL CHANGE OF LAND SURFACE TEMPERATURE (LST)[11].

Ecological integrity for the whole area of Bornova district showed a decrease with the mean EI index value from 52.21 – 48.27. The EI index was also decreased from urban to rural zones for both dates. Overall, Bornova district represented a positive spatiotemporal gradient for the global climate regulation and microclimate mitigation services, while the opposite was shown for ecological integrity service.

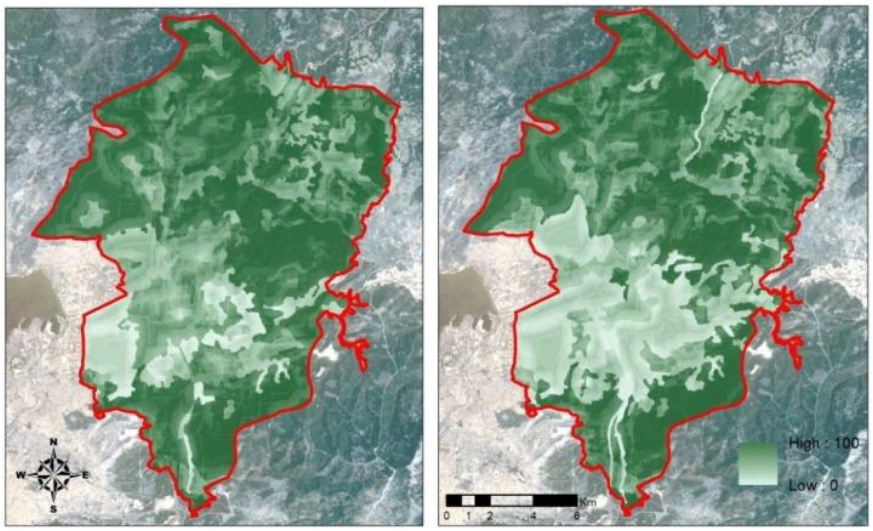

FIGURE 2-8 THE SPATIOTEMPORAL CHANGE OF ECOLOGICAL INTEGRITY INDEX (EI)[11].

In the case of Bornova district, multiple ecosystem service potential was generally higher in areas with low impervious cover around the peri-urban and rural parts of Bornova district. Multiple ecosystem services correlate with each other because of the interactions between different ecological processes where synergies emerge at different spatiotemporal scales[12]. Whilst green policies and management decisions in Bornova district and Izmir metropolitan city had significant impacts on their urban environments, they also alter the magnitude of spatiotemporal synergies among potential ecosystem services[13]. The loss of natural and semi-natural lands in the study area due to urban sprawl did not have a visible net effect on the overall ecosystem services potential, as it was more than outweighed by the increased artificial vegetation cover. These findings suggest that each urban area should be considered on its own merits avoiding the general assumptions about the unknown effects of urbanization process on ecosystem services potential. Thus, a better understanding and accounting of urbanization process and its possible effects on ecosystem services' potential can be used to develop management plans and policies at different spatiotemporal scales[14].

Although biodiversity in cities generally stands out as fauna richness, there are also fauna groups such as birds, insects, small rodent groups, and small-sized animals such as turtles and frogs, which continue their existence in urban green spaces (UGSs) without harming urban life[15], and stray animals. It should

[12] Armatas, Christopher A., et al. "An integrated approach to valuation and tradeoff analysis of ecosystem services for national forest decision-making." Ecosystem services 33 (2018): 1-18.
[13] Thapa, Rajesh Bahadur, and Yuji Murayama. "Urban growth modeling using the Bayesian probability function." Progress in Geospatial Analysis. Tokyo: Springer Japan, 2012. 197-214.
[14] Nowak, David J., et al. "Carbon storage and sequestration by trees in urban and community areas of the United States." Environmental pollution 178 (2013): 229-236.
[15]Faeth, Stanley H., Christofer Bang, and Susanna Saari. "Urban biodiversity: patterns and mechanisms." Annals of the New York Academy of Sciences 1223.1 (2011): 69-81.

not be forgotten that it creates biodiversity. This group can also include pets that can participate in urban life.

Veterinary services for stray animals, a dog activity area for pet dogs in Kazımdirik Neighbourhood, and urban equipment for flora such as feeders, nests and feeding machines can be counted as the Municipality's work. However, most of this equipment is old, dirty, and broken. The Fauna score is 3 in all dimensions.

Due to the negative effects of urbanization on the flora, municipalities need to seriously address this issue. Flora in cities is an important part of the urban ecosystem[16]. The Municipality grows plants suitable for Izmir's climate to use in UGSs. At the same time, because of sustainable agriculture studies, different types of ancestral seeds were obtained and shared with farmers[17].

3. GREENHOUSE GAS EMISSIONS OF BORNOVA

The Baseline Emission Inventory (BEI) was developed under the Emission Inventory Guidance, used by the European Covenant of Mayors and the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC), used by the Compact of Mayors. Both refer to the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventory. Thus, the baseline CO2 inventory should essentially be based on final energy consumption, including both municipal and non-municipal energy consumption in the local authority's territory. The main categories for the Baseline Emission Inventory (BEI) are stationary energy, transportation, waste and local energy production.

3.1. Stationary energy

All GHG emissions from fuel combustion and the consumption of grid-supplied energy, in stationary sources within the municipality boundary is considered**.** Emission data is disaggregated into residential buildings, commercial buildings and facilities, institutional buildings and facilities, industry, as well as agriculture, forestry, and fishing.

TABLE 3-1 ELECTRICITY CONSUMPTION IN MWH FOR THE YEAR OF 2023

	Bornova Mun.	Bornova Lighting	General Lighting	Residential	Industry	Agricultural Activities	Commercial Premises	Total
Jan.	53.1	305.0	1,607.7	40,358.7	47,971.2	263.1	46,300.4	136,859.2
Feb.	101.1	206.2	1,262.2	42,706.1	47,413.3	249.9	45,404.8	137,343.7
Mar.	89.4	239.7	1,336.0	39,804.3	50,936.9	257.8	45,080.4	137,744.5

[16] Eskin, Bülent. "A Research on Determination of Environmental Factors Affecting Urban Flora of Aksaray Province." Kent Akademisi 11.1 (2018): 76-85.

[17] https://bornova.bel.tr/bornova-belediyesi-500-bin-fide-dagitiyor/, accessed at 28/09/2024

	Bornova Mun.	Bornova Lighting	General Lighting	Residential	Industry	Agricultural Activities	Commercial Premises	Total
Apr.	76.8	170.0	1,153.0	30,844.4	44,294.3	231.6	35,578.6	112,348.7
May	117.1	150.3	1,101.9	32,738.5	48,245.4	235.8	39,414.1	122,003.1
Jun.	46.5	151.2	1,041.6	28,799.8	43,322.6	254.4	42,863.2	116,479.4
Jul.	55.9	182.0	1,030.7	42,206.8	48,943.4	314.0	53,470.0	146,202.9
Aug.	71.7	229.0	1,160.9	49,548.3	52,599.1	330.1	56,929.8	160,869.1
Sep.	124.4	159.6	1,270.7	47,738.6	50,155.5	292.7	52,085.8	151,827.2
Oct.	146.4	143.4	1,438.5	31,593.7	46,173.6	280.9	42,950.3	122,726.8
Nov.	157.3	117.5	1,506.2	30,490.3	49,493.2	252.9	41,428.3	123,445.6
Dec.	165.4	130.3	1,606.3	36,556.0	43,782.5	267.6	44,115.5	126,623.7
Total	**1205.0**	**2184.3**	**15,515.7**	**453,385.5**	**573,331.0**	**3,230.9**	**545,621.4**	**1,594,473.9**

Monthly electrical energy data consumed in 2023 within the boundaries of Bornova Municipality are presented in Table 3-1. The data given under the heading of lighting are taken as electrical energy consumed within the scope of Bornova Municipality buildings and enterprises.

Natural gas consumption (in m^3) data were obtained from İzmirgaz in the categories of Residential, Bornova Municipality, Tertiary (non-municipal) buildings, and Industry, and are presented in Table 3-2 for 2023.

TABLE 3-2 NATURAL GAS CONSUMPTION IN M^3 FOR THE YEAR OF 2023

Month	Residential	Bornova Municipality	Tertiary Buildings	Industry
Jan.	11,627,264	52,144	1,857,300	6,765,334
Feb.	16,017,277	59,246	1,894,092	6,213,371
Mar.	11,353,171	59,805	1,549,559	6,820,063
Apr.	9,694,267	35,497	1,092,612	6,572,817
May	4,475,276	19,930	428,887	7,108,948
Jun.	1,496,309	7,640	240,525	5,909,322
Jul.	1,245,487	4,336	220,003	5,722,859
Aug.	1,015,909	8,030	219,211	6,356,440
Sep.	1,104,983	5,429	246,227	6,093,326
Oct.	1,281,217	19,267	363,726	6,733,187
Nov.	1,536,162	29,614	692,873	6,188,583
Dec.	8,826,214	52,052	1,490,014	6,765,646
Total	**69,673,536**	**352,990**	**10,295,030**	**77,249,896**

For the fuels used for heating purposes within the boundaries of Bornova Municipality, the consumption on the scale of Bornova was estimated as 235.2 tonne by using the ratio (0.096) between

the number of independent sections in the district/city, considering the consumption values given for İzmir Province[18].

Table 3-3 Data of the total independent Sections[19]

Total independent Sections in Izmir	2,552,649
Total independent Sections in Bornova	245,759
The ratio between the number of independent sections in the district/city	0.096

TABLE 3-4 FUEL-OIL CONSUMPTION FOR THE HEATING PURPOSE IN RESIDENCES IN TONNE[18]

	İzmir	Bornova	The ratio between the number of independent sections in the district/city
Fuel-oil	2442.9	235.2	0.096

According to the 2023 LPG Sector Report, the distribution of LPG sales in the form of Cylinder (Tüplü), Bulk (Dökme) and Autogas (Otogaz) within the scope of Izmir Province is given in Table 3-5 and Table 3-6. It has been accepted that the values in the cylinder category are used in residences, especially in the kitchen, the bulk category is used in industry, and the autogas category is used in vehicles.

TABLE 3-5. LPG CONSUMPTION IN IZMIR IN TONNE FOR THE YEAR OF 2023[20]

	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Total	(%)
Gas cylinders	4,376	3,978	4,086	4,517	4,466	4,453	4,626	4,421	4,170	3,841	4,022	4,203	51,158	21.2
Bulk	9,593	13,453	8,421	737	870	603	637	790	813	835	1,061	1,051	38,863	16.1
Autogas	11,868	10,613	11,654	12,956	12,843	13,591	14,598	14,638	13,073	12,383	11,319	12,139	151,676	62.8
Total	25,837	28,043	24,161	18,209	18,179	18,647	19,861	19,849	18,056	17,059	16,402	17,393	241,696	100

TABLE 3-6 LPG CONSUMPTION IN BORNOVA IN TONNE FOR THE YEAR OF 2023

LPG	İzmir	Bornova	The ratio between the number of independent sections in the district/city
Gas cylinder (m^3)	51158	4925,3	0.096
LPG	İzmir	Bornova	The ratio between the population in the district/city
Bulk Tonne (m^3)	38863	3882,8	0.010

[18] EPDK Petroleum Market 2023 Sector Report (pp. 117-118)
[19] *https://izmirinrakamlari.izmir.bel.tr/tr/2020/43/IlceTuruneGoreBagimsizBolumler*
[20] *2023 LPG Sector Report*

In the 2022 environmental status report of Izmir province, the coal consumption data given on the scale of İzmir Province is estimated as follows, considering the total number of independent sections of Bornova / Izmir.

TABLE 3-7 COAL CONSUMPTION IN RESIDENCES IN BORNOVA[21]

	İzmir	Bornova	The ratio between the number of independent sections in the district/city
Coal (tonne)	21871	2106	0.096

PS: It is assumed that the above-mentioned coal consumption is used for heating purposes in residential buildings.

All the stationary energies of Bornova region are summarized in Table 3-8. As it can be seen from the table, the total amount of the region's energy is 3,345,290 MWh. While Bornova Municipality buildings cause 0.2 percent of the stationary energy in the region, the industry has a share of 42.5% with an energy consumption of 1,421,922 MWh.

TABLE 3-8 2023 BORNOVA REGION STATIONARY ENERGY DISTRIBUTION

Buildings, Equipment/Facilities and Industries	Electricity	Fossil fuels				Total
		Natural gas	Liquified gas	Heating oil	Coal	
Municipal buildings, equipment/facilities	3,389	3,751				7,140
- Municipal buildings, equipment/facilities	1,205	3,751				4,956
- Public lighting	2,184					2,184
- Other						-
Tertiary (non-municipal) buildings, equipment/facilities	**561,136.7**	**109,405**				**670,541.7**
- Institutional buildings	545,621	109,405				
- Other (Public lighting)	15,515.7					
Residential buildings	453,386	740,421	35,082	2,640	14,157	1,245,685
Industry (excluding IPPU)	**573,331**	**820,935**	**27,656**			**1,421,922**
- Non-ETS	573,331	820,935				
- ETS (not recommended)						-
Buildings, equipment/facilities and industries not allocated (incl. non-municipal buildings, equipment/facilities related to transport, waste, agriculture)						-
Subtotal	**1,591,243**	**1,674,513**	**62,738**	**2,640**	**14,157**	**3,345,290**

[21] *2022 Environmental Status Report of Izmir Province, pg. 10*

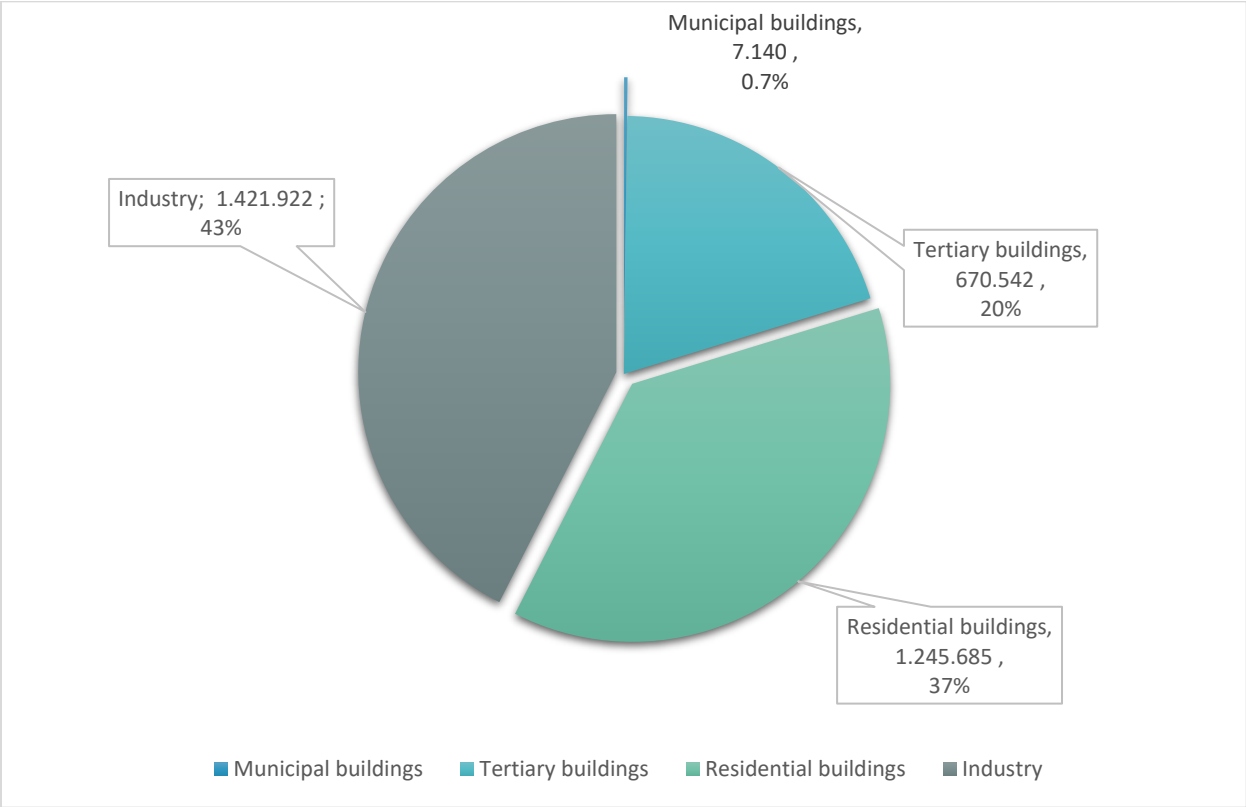

FIGURE 3-1 STATIONARY ENERGY DISTRIBUTION IN BORNOVA FOR THE YEAR OF 2023

Electricity-Fuel-oil distribution in Bornova is shown in Figure 3-2. The percentage of the fossil fuel is %53 with 1,754,047 MWh.

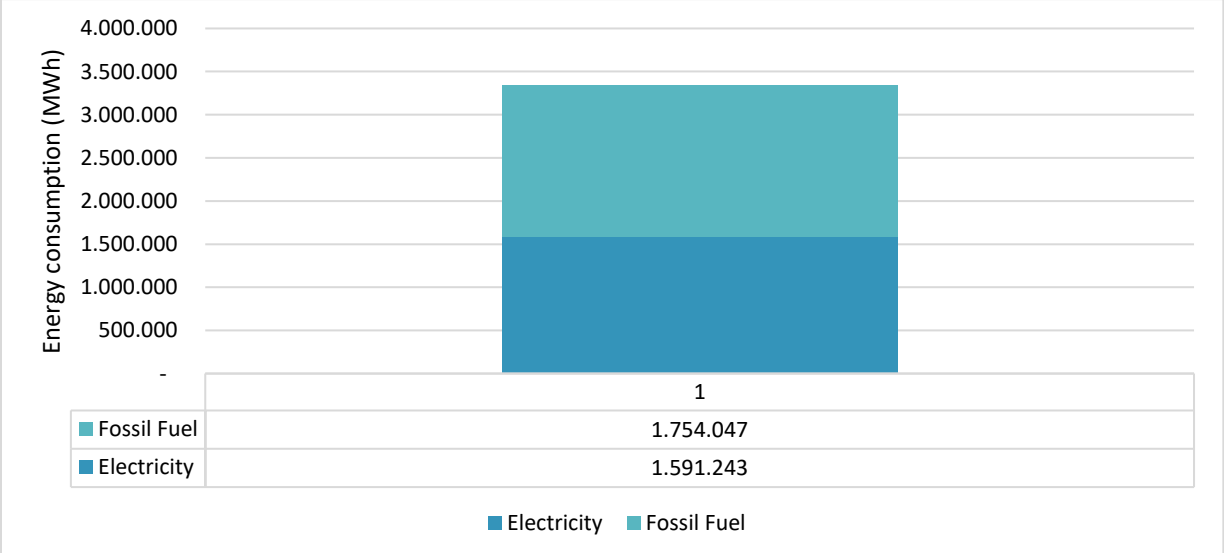

FIGURE 3-2 STATIONARY ENERGY ELECTRICITY-FUEL-OIL DISTRIBUTION IN BORNOVA FOR THE YEAR OF 2023

Stationary energy fossil fuel distribution in Bornova for the year of 2023 is represented in Figure 3-3. Natural gas has the highest ratio (97%).

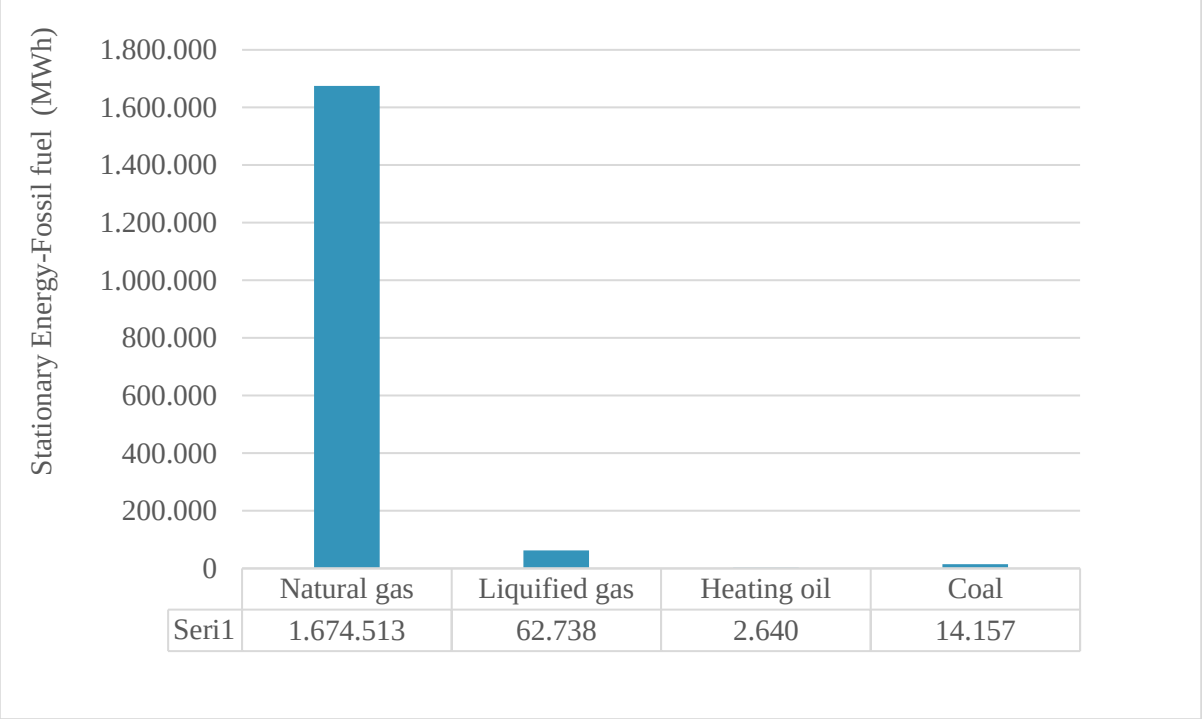

FIGURE 3-3 STATIONARY ENERGY FOSSIL FUEL DISTRIBUTION IN BORNOVA FOR THE YEAR OF 2023

3.2. Transportation

The vehicle fleet of Bornova Municipality has fuel consumption data in terms of "Diesel" for approximately 8 months between 03.05.2023 and 31.12.2023.

TABLE 3-9 BORNOVA MUNICIPALITY VEHICLE FLEET FUEL CONSUMPTION IN 2023.

Fuel	Data Period		Amount	Unit
Diesel	03.05.2023	31.12.2023	880,782.9	litre

With the approach made in the light of the available data, the fuel consumption of the municipal vehicle fleet for 2023 is estimated as 1,321,174 lt.

Within a total of 1 million 798 thousand 709 vehicles registered to traffic in İzmir, cars accounted for 53.1%, followed by motorcycles 21.7%, small trucks 15.8%, tractors 4.5%, trucks 2.7%, minibuses 1.1%, buses 0.8% and special purpose vehicles 0.3%.

TABLE 3-10 TOTAL NUMBER OF VEHICLES REGISTERED TO TRAFFIC IN İZMIR IN 2023[22]

Type of vehicles	Number of vehicles	%
Car	955,517	53.1
Motorcycle	390,542	21.7
Mini truck	284,087	15.8
Tractor	80,237	4.5
Truck	48,712	2.7
Minibus	18,948	1.1
Bus	14,638	0.8
Special purpose	6,028	0.3
TOTAL	**1,798,709**	**100**

TABLE 3-11 NUMBER OF VEHICLES IN BORNOVA IN 2023

Type of vehicles	Number of vehicles
Commercial	81,124
Car	96,759

Using the number of cars in Table 3-10 and Table 3-11, the ratio between the number of cars in Bornova and Izmir was determined as 10.13%. Fuel fuel used by vehicles within the boundaries in the Bornova scale was estimated by using the ratio between the number of registered cars, considering the consumption values given for İzmir Province[23].

TABLE 3-12 FUEL CONSUMPTION IN BORNOVA FOR TRANSPORTATION IN 2023[24]

	İzmir	Bornova	The ratio between the number of cars in Bornova and Izmir
LPG Tonne (m^3)	151676	15366	0,101
Gasoline (Sm^3)	256,861	26.02	
Diesel (Sm^3)	1,429,214	144.788	

TABLE 3-13 BORNOVA REGION TRANSPORTATION ENERGY CONSUMPTION

Transport	Fossil fuels			Total
	Liquified gas	Diesel	Gasoline	
Municipal fleet		**14,126.5**		**14,126.5**
Road		14,126.5		14,126.5

[22] TUIK, 2023 https://data.tuik.gov.tr/Bulten/Index?p=Motorlu-Kara-Ta%C5%9F%C4%B1tlar%C4%B1-Aral%C4%B1k-2023-49432&dil=1
[23] EPDK Petroleum Market 2023 Sector Report (sy 117-118).
[24] EPDK Petrol sektör raporu, 2023, LPG Sector Report, 2023

Transport	Fossil fuels			Total
	Liquified gas	Diesel	Gasoline	
Other				
Public transport				
Road				
Rail				
Local and domestic waterways				
Other				
Private and commercial transport	**109,447.8**	**1,548,130.0**	**251,827.5**	**1,909,405.3**
Road	109,447.8	1,548,130.0	251,827.5	1,909,405.3
Rail				
Local and domestic waterways				
Local aviation				
Other				
Transport not allocated				
Subtotal	**109,447.8**	**1,562,256.5**	**251,827.5**	**1,923,531.8**

Total energy consumption of transportation is reported as 1,923,531.8 MWh as shown in Table 3-13.

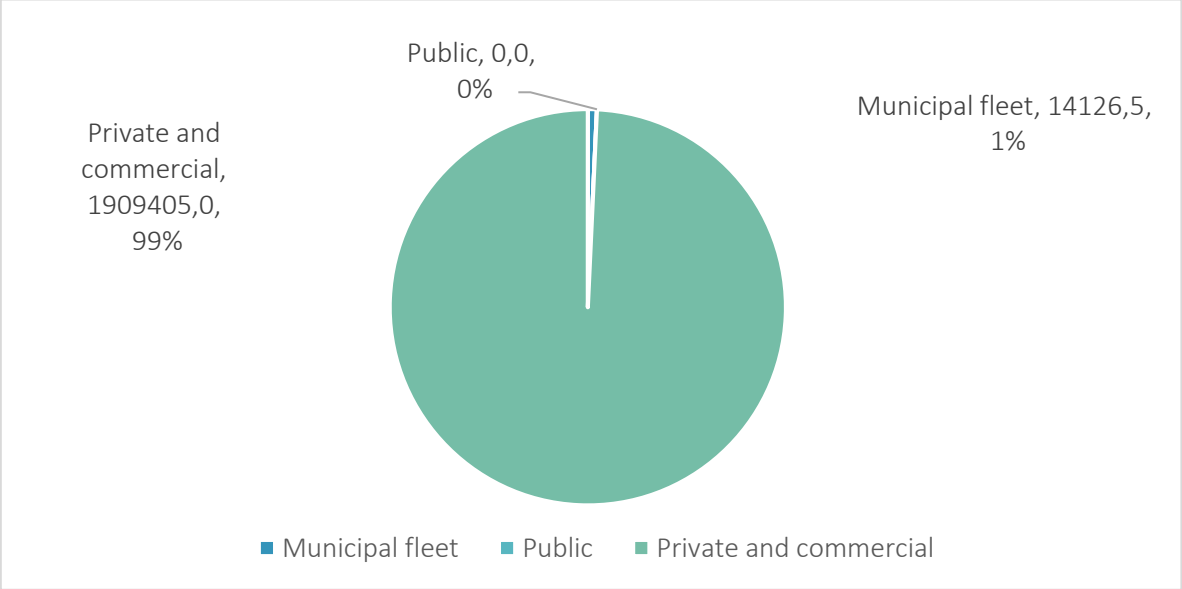

FIGURE 3-4 CATEGORIZED TRANSPORTATION ENERGY CONSUMPTION IN BORNOVA FOR THE YEAR OF 2023

3.3. Waste

Domestic wastes generated in Bornova District, which has 45 neighbourhoods, and 76 pieces of 15 m^3 domestic solid wastes are collected by the Municipality's self-owned collection vehicles.

The wastes collected between the neighbourhoods are forwarded to the Bornova Transfer Station, which was put into service in April 2021, and then transferred to the waste disposal facility.

TABLE 3-14 BORNOVA MUNICIPALITY 2023-2024 MONTHLY WASTE COLLECTED AMOUNTS[25] (IN TONNE)

Month	Domestic Waste	Packaging Waste	Textile Waste	Vegetable (Oil) Waste
Jan.	13,361	35.46	23.305	4.46
Feb.	11,980	37.33	31.12	4.08
Mar.	13,800	74.46	36.625	9.93
Apr.	13,605	71.97	38.65	8.79
May	14,256	80.15	56.135	3.27
Jun.	14,266	60.48	64.51	5.67
Jul.	12,550	70.52	37.80	5.23
Aug.	12,466	108.57	24.425	7.90
Sep.	13,033	114.00	31.574	4.92
Oct.	13,713	131.31	42.160	5.34
Nov.	12,962	149.74	43.410	5.34
Dec.	13,870	150.36	35.750	6.48
Total	**159,862**	**1,084.35**	**465.44**	**66.08**

The practices carried out in the Zero Waste Workshop in the waste collection centre are as follows;

- Making usable bags and phone cases from textile wastes
- Picture frame design from wood waste
- Making picture boards from used wood materials
- Repairing electronic wastes that have lost their functionality and making them reusable
- Creating design products from vases, stones and plastic flowers

Solid waste is collected and deposed by Metropolitan municipality and reported in its emission inventory[26]. Thus, waste-based emissions such as methane and CO_2 are not covered to prevent double reporting.

4. Local Energy Generation

According to Energy Market Regulatory Authority (EMRA) electricity generation license information, the facilities in operation in İzmir-Bornova and the approximate capacity and annual production information are given in Table 4-1. As can be seen from the table, the annual energy production of natural gas power plants is 205,812 MWh and natural gas consumption corresponds to 22,639 m^3.

Additionally, Bornova Municipality has a PV plant with installed capacity of 300 kWhe. The annual electricity generation is 438 MWh

[25] Bornova Belediyesi Sıfır Atık Yönetim Planı 2024.docx
[26] *https://skpo.izmir.bel.tr/Upload_Files/FckFiles/file/2020/WEB_SAYFASI_SECAP-ingilizce.pdf*

TABLE 4-1 LOCAL ENERGY GENERATION IN BORNOVA[27]

Plant	Foundation Year	Type of Plant	Source of Plant	Installed Capacity (MWe)	Annual Production (MWh)
Desa Enerji Elektrik Üretim A.Ş.	2009	Cogeneration	Natural Gas	15.6	122,990
Küçükbay Yağ Ve Deterjan Sanayi A.Ş.	2014	Auto-production	Natural Gas	1.505	11,865
BATIÇİM Batı Anadolu Çimento Sanayi A.Ş.	2014	Waste heat	Natural Gas	9	70,956
Bornova Municipality	2013	PV	Solar PV	0.3	438

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