**1. The Environmental Impact and Cost of Food Waste and Loss**

**NIS 3.6 billion – The environmental cost of food waste in Israel**

**Approximately NIS 1.4 billion are the result of wasted natural resources,[[1]](#footnote-1) NIS 1.4 are due to greenhouse gas and air pollutant emissions, and more than NIS 800 million for the direct cost of treating the waste.**

The food production process requires various resources, including land, water, fertilizers, chemicals, and energy. It accounts for approximately one fifth of all greenhouse gas emissions worldwide.[[2]](#footnote-2) Many of these resources are nonrenewable,[[3]](#footnote-3) and their use runs the risk of adversely affecting water, land, and air quality, as well as global biodiversity.

The environmental cost of food waste in Israel in 2021 is estimated at approximately NIS 3.6 billion, out of which NIS 1.4 billion are due to the unnecessary use of natural resources, NIS 1.4 billion are due to greenhouse gas and air pollutant emissions, and NIS 800 million is the direct cost of waste collection and processing. Food waste (including packaging) in all segments other than agriculture produced 1.9 million tons of municipal waste, which constitutes approximately 34% of all municipal waste in Israel.

**The Environmental Cost of Food Waste in Israel in 2021**

**In NIS Billions**

|  |  |
| --- | --- |
|  | **Cost in Billions of NIS** |
| Greenhouse Gas Emissions | 0.84 |
| Air Pollutant Emissions | 0.53 |
| Waste Treatment Costs | 0.82 |
| Wasted Land Resources | 0.81 |
| Wasted Water Resources | 0.64 |
| **Total** | **3.6** |

Despite the negative environmental impacts of growing and producing food, agriculture is not perceived to be a polluting industry and environmental taxes and fees are generally not imposed on it. This is because the positive external impact of consuming the food is greater than the negative external impact of producing it. Many developed countries even subsidize production and consumption either directly or indirectly.

However, when food is wasted, in other words produced but not consumed, there remains the full environmental impact from growing, producing, and disposing the food, as well as treating the resulting waste, without anyone deriving any positive benefit from its consumption. Therefore, food waste is pure damage to the environment.

In recent years, the problem of food waste is gaining recognition around the world. To support the global effort, the United Nations, UN Food and Agriculture Organization (FAO) and the United Nations Environment Program (UNEP) have been working on instituting a uniform international index for estimating the volume of global food loss and waste. In addition, in 2019 the United Nations launched a report[[4]](#footnote-4) emphasizing the importance of examining the environmental contexts of food waste, in addition to the socioeconomic ones. According to the report, using the life cycle assessment (LCA) approach to food waste and treatment may assist in developing a policy for reducing food waste.

A policy to reduce food waste could include a variety of measures that would lead to a reduction in food surpluses at the source, encourage the rescue of surplus food, and promote the use of composting and anaerobic digestion rather than disposing of waste in landfills. Numerous countries are using various policy tools to reduce food waste.

This report presents a study of the environmental impact of food waste and loss in Israel. The examination in this chapter focuses on the environmental impact in 2021 caused by greenhouse gas and air pollutants emitted as wasted food was produced, consumed, and discarded, the natural resources (water and land) that were lost as a result of this waste, and the environmental impact resulting from the need to treat this waste. The external costs of greenhouse gas and air pollutant emissions were quantified according to the FAO’s methodology.[[5]](#footnote-5) The external environmental impacts on land and water quality as well as damage to biodiversity were not examined at this stage. Therefore, the estimated environmental cost of food loss and waste in Israel presented in this chapter is an underestimation and provides a foundation for assessing the environmental cost of food waste and loss in Israel in the upcoming years.

It is important to note that **the environmental impacts quantified and presented in this chapter include only those that occurred within the geographical boundaries of the State of Israel.** Natural resources invested in growing food outside of Israel and the emissions from the growing and production processes were not included in this report. A relatively large part of certain foods that are consumed in Israel, such as grains and meat products, are imported. Therefore, the environmental impact of food consumed and discarded in Israel is greater than the total environmental impact quantified in this chapter.

**6% of greenhouse gas emissions in Israel are the result of food waste**

The environmental impact of food production at all stages (production, processing, sales, consumption, and disposal) results from the use of energy and resources, and these vary according to the crop type. These costs are added to the economic and environmental cost of treating the food and packaging waste.

Additional resources that were lost along with the food wasted in Israel in 2021 include 1,290 million kWh of electricity, a quantity sufficient to manufacture all the computers and electronic and electric devices in Israel in one year; 77 thousand tons of fuel, which is enough to fuel about 170 thousand cars for one year; 185 million cubic meters of freshwater - enough to fill 57 thousand Olympic swimming pools, as well as 215 million cubic meters of wastewater; and one million dunams of agricultural land – 20 times the area of Tel Aviv. In addition, 200 thousand tons of waste (packaging, industrial waste, etc.) were created, 60 thousand tons of fertilizer were used, and livestock emitted 3,000 tons of ammonia over the course of the year.

Together, these contributed to 5 million tons of greenhouse gas emissions resulting from food waste in Israel in 2021, constituting approximately 6% of total greenhouse gas emissions in the country. In Government Decision No. 171 dated July 25, 2021 on the topic of transitioning to a low-carbon economy,[[6]](#footnote-6) the Israeli government set an updated national goal of reducing greenhouse gas emissions by 27% by 2030 and by 85% by 2050 compared to greenhouse gas emissions in 2015. Moreover, in October 2021, the Prime Minister declared a goal of zeroing Israel’s carbon emissions by 2050.[[7]](#footnote-7)

To achieve these goals, in that same decision the Israeli government also set sectorial targets to reduce greenhouse gas emissions and make energy consumption more efficient. These included “reducing greenhouse gas emissions caused by solid waste by at least 47% by 2030 compared to emissions measured in 2015,” “reduce greenhouse gas emissions from municipal waste by at least 92% by 2050 compared to emissions measured in 2015, which stood at 5.5 million tons a year,” and “a 71% reduction in the volume of landfilled municipal waste by 2030 compared to the amount of municipal waste landfilled in 2018, which stood at 4.5 million tons a year.” Reducing the amount of food waste in Israel would assist the national effort to meet the targets of reducing greenhouse gas emissions and the amount of municipal waste landfilled.

**The water lost as a result of food waste could fill 57,000 Olympic pools**

In an arid country such as Israel, water is a valuable and limited resource. The 185 million cubic meters of freshwater lost as a result of food waste could fill 57 thousand Olympic swimming pools, or alternatively, raise the water level in the Sea of Galilee by over 1 meter, or provide enough water for about 3.6 million residents for an entire year.[[8]](#footnote-8) An examination of the water costs wasted along with the food reveals that the lost water cost the Israeli economy approximately NIS 640 million.

Land is another limited and valuable resource in Israel. The one million dunams (1000 square kilometers) of agricultural land used to grow wasted food is valued at approximately NIS 800 million.

**Distribution of Environmental Costs Resulting from Food Waste in 2020 by Cost Driver, in Billions of NIS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Cost Driver** | **Wasted Resources** | **Cost of Emissions** | **Waste Treatment Cost**  | **Cost of Natural Resources (Land and Water)** |
| **Waste** | 1.9millions tons of municipal waste0.9million tons of agricultural waste | 0.5 | 0.8 |  |
| Electricity generation (not including electricity for water desalination & purification) | 1,290million kWh | 0.2 |  |  |
| Emissions From Animals | 3,000tons of ammonia | 0.4 |  |  |
| Fuel Combustion | 770thousand tons | 0.1 |  |  |
| Water | 185 million m3 of freshwater; 215 million m3 of wastewater | 0.1 |  | 0.6 |
| Fertilizer Use | 60thousand tons | 0.03 |  |  |
| Land | 1 million dunams (1000 km2) of agricultural land |  |  | 0.8 |
| **Total** |  | **1.4** | **0.8** | **1.4** |
| **Total Environmental Cost, 2020** |  | **NIS 3.6** |

Source: BDO

**Food waste constitutes about a third of total household waste in Israel**

The environmental impact of food waste stems not only from excess food production and consumption patterns that involve the wasting of natural resources and air pollution, but also from the way food is treated once it is discarded. Treating food waste once it is discarded and in particular, transferring it to landfills, cause additional environmental impacts. It’s known that 34% of household waste in Israel consists of organic matter originating in food.[[9]](#footnote-9) Thus, food waste increases the total amount of waste that needs to be treated, and when unsorted, makes it difficult to recycle other materials found in household waste.

Most of the waste in Israel is landfilled, and this has many negative environmental impacts. Landfills require large areas of land and thereby contribute to the depletion of land resources in Israel. In addition, a variety of air pollutants and greenhouse gases are emitted when waste is transported to distant landfill sites around the country. Moreover, landfills can potentially contaminate adjacent land and water resources due to environmentally harmful substances seeping through layers of water and soil.[[10]](#footnote-10)

The amount of municipal waste produced in Israel each year is estimated at approximately 5.6 million tons.[[11]](#footnote-11) Food waste in Israel in 2021 was estimated at around 2.6 million tons, out of which about 1.7[[12]](#footnote-12) million tons requires end facility treatment (as part of the municipal waste that is treated in Israel). Added to this were approximately 200 thousand tons of waste from food packaging, leading to a total of 1.9 million tons of food and packaging waste, which constituted about a third of the waste in Israel requiring treatment. Treating this amount of waste required approximately 190 thousand compacting garbage trucks,[[13]](#footnote-13) which is the equivalent of 520 loaded trucks operating every day for an entire year.

The volume of waste requiring treatment necessitates the allocation of significant resources, including economic and statutory support for sorting and end solutions. Waste treatment costs consist of several factors, including the costs associated with waste storage, collection, and removal, sorting and transit facilities, and transportation, as well as the cost of the treatment itself, depending on the type of treatment required and landfilling fees. The direct annual cost for treating food waste and associated packaging[[14]](#footnote-14) in Israel stands at NIS 800 million (based on waste treatment cost estimates conducted by the Ministry of Environmental Protection, *Waste Policy 2030*). In addition, the external costs of greenhouse gas and air pollutant emissions caused by treating the waste stands at NIS 500 million. The total direct external economic cost for treating waste resulting from food loss in Israel in 2021 stands at approximately NIS 1.3 billion.

**50% of the environmental impact is caused by food waste in the consumption stage**

The environmental impact related to agricultural produce is quantified in regard to the product’s entire lifecycle, including production, post-harvest handling, storage, processing, distribution, consumption, and disposal. The further along a product is in its lifecycle when it is wasted or discarded, the greater its environmental impact. This is because the environmental footprint of food waste stems from three different components: impacts resulting from the stage of the value chain when the product is discarded; impacts stemming from the product ending up as waste; and impacts stemming from previous stages of the value chain (if there are any).

Food wasted at the **consumption stage** accounts for approximately 50% of the environmental cost of food waste. Consumer food waste includes all the cumulative environmental impact resulting from its production, transport, processing, and distribution prior to reaching the consumer. In 2021, food worth NIS 12 billion and weighing 1.2 million tons (including packaging) was discarded during the consumption stage.[[15]](#footnote-15) In addition to the cost of the food waste itself, there was the unnecessary cost of waste treatment, which consumers paid indirectly through municipal fees totaling at around NIS 500 million, and environmental damage of around NIS 800 million was caused due to greenhouse gas and air pollutant emissions.

**Environmental Costs Resulting from Food Waste in Israel in 2021,**

**By Stage at which the Food Was Discarded, in NIS Millions**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Agriculture\*** | **Processing** | **Distribution** | **Consumption\*\*** | **Total** |
| Fruit & Vegetables | 402 | 29 | 424 | 803 | 1,658 |
| Grains & Legumes | 116 | 65 | 109 | 325 | 614 |
| Dairy  | 111 | 42 | 69 | 247 | 469 |
| Meat, Eggs & Fish | 131 | 139 | 182 | 454 | 906 |
|  **Total**  | **759** | **274** | **784** | **1,830** | **3,647** |
| Percentage of Total | 21% | 8% | 21% | 50% | 100% |

\* The agricultural stage also includes waste and losses from the processing and packaging stage.

\*\* Emissions due to the use of water, electricity, and gas were not included in the consumption stage.

Source: BDO

An examination of the environmental impact of food waste according to the stage at which the waste was created reveals that around 60% of the impact is attributable to the agricultural stage. This is because the costs associated with food discarded at later stages - processing, distribution and consumption – include costs resulting from the impacts of prior stages.

**Infographics – Environmental Cost Resulting from Food Waste in Israel in 2021**

**By Stage when the Food Was Discarded, in NIS Millions**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Emissions** | **Water Resources** | **Land Resources** | **Waste Treatment** | **Total** |
| Agriculture | 315 | 184 | 260 | 0 | **759** |
| Industry | 92 | 57 | 84 | 42 | **274** |
| Distribution | 249 | 139 | 180 | 216 | **784** |
| Consumption | 711 | 265 | 287 | 567 | **1,830** |
| **Total**, in Billions of NIS | **1.4** | **0.6** | **0.8** | **0.8** | **3.6** |

Source: BDO

**Animal-based food products have the greatest environmental impact**

Examination of the different food product categories reveals that **animal-based food products have the greatest environmental impact**. The environmental cost (as a result of air pollutants and GHG emissions) to the economy for meat, eggs, and fish wasted during the agricultural production stage is approximately NIS 5.2 per kilogram. If those foods are wasted in the consumption stage, the environmental cost is NIS 7.4 per kilogram. The environmental cost to the economy for milk and dairy products wasted during the agricultural production stage is approximately NIS 2.0 per kilogram. If dairy foods are wasted in the household consumption stage, the environmental cost is NIS 2.8 per kilogram. Fruit and vegetables left in the field have an environmental cost of NIS 0.90, and nearly double that if discard by the consumer.

Examination of the different food product categories reveals that **animal-based food products have the greatest environmental impact**. For wasted meat, eggs, and fish, about half of the environmental cost stems from the loss of natural resources. For dairy products, most of the cost is due to greenhouse gas emissions and air pollutants, while for fruit and vegetables, the cost is evenly distributed between the cost of waste treatment, the loss of natural resources, and greenhouse gas emissions and air pollutants.

**Cumulative Environmental Cost per Kilogram of Wasted Food in Israel in 2021,
in NIS**

Source: BDO

**An International comparison: greenhouse gas emissions caused by food waste**

According to UN assessments, the amount of food wasted globally is approximately 1.7 billion tons per year. The total amount of greenhouse gases emitted as a result of growing and producing unconsumed food was estimated at approximately 4.3 billion tons. This amount includes greenhouse gas emissions from every stage of the food growing and production stages, as well as the emissions caused by food being discarded and treated as waste.[[16]](#footnote-16)

The global cost of greenhouse gas emissions from food waste is estimated at approximately $515 billion a year[[17]](#footnote-17). This cost depends on local conditions and varies according to the specific type of agricultural product.

The comparative international research conducted by FAO, together with the new UN study, shows that the level of greenhouse gas emissions per capita in low income countries is not demonstrably different from those in higher income countries. The UN report found that food waste per capita at the consumption stage is very similar in all countries. The conclusion contradicts the prevailing assumption that most of the food waste in the developed countries occurs during the retail and consumption stages while the source of most food waste in developing countries occurs during the production, packaging and transport stages.

**Greenhouse Gas Emissions Caused by Food Waste by Geographical Regions,**

**Kilograms per Capita**

Source: UNEP, FAO and BDO analyses; data for Israel is from the BDO estimates.

The findings of the UN report, as presented in the graph above, show that food waste per capita in Israel is similar to that in the United States, and lower than in Africa. However, it is also clear that food waste per capita during the consumption stage is lower in Europe.

In Israel, 5 million tons of greenhouse gases are emitted as a result of growing and producing unconsumed food, constituting approximately 6% of greenhouse gas emission in the country each year. Most of the food waste occurs during the consumption stage.

1. The cost of wasted natural resources is internalized at a market cost of about NIS 21.1 billion from food waste. [↑](#footnote-ref-1)
2. <http://www.fao.org/economic/ess/environment/data/emission-shares/en/> [↑](#footnote-ref-2)
3. Cut Waste, GROW PROFIT. How to reduce and manage food waste, leading to increased profitability and environmental sustainability, background paper 2012. [↑](#footnote-ref-3)
4. [https://wedocs.unep.org/bitstream/handle/20.500.11822/27688/WasteNot.pdf?sequence=1&isAllowed=y](https://eur03.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwedocs.unep.org%2Fbitstream%2Fhandle%2F20.500.11822%2F27688%2FWasteNot.pdf%3Fsequence%3D1%26isAllowed%3Dy&data=04%7C01%7CYaelAr%40bdo.co.il%7C49313698ed25495befed08d98343987c%7C3c054339d6c24bdcb99e4aeb43de91ec%7C0%7C0%7C637685148608986662%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=4PM9giFtoSMeNvR4Rt%2FHGccWBvwaddiZHvEyxnYgLqI%3D&reserved=0) [↑](#footnote-ref-4)
5. FAO, Food Waste Footprint Full Cost Accounting, 2014. [↑](#footnote-ref-5)
6. Government Decision No. 171 In Hebrew: https://www.gov.il/he/departments/policies/dec171\_2021 [↑](#footnote-ref-6)
7. https://www.gov.il/he/departments/news/carbon\_emissions291021 [↑](#footnote-ref-7)
8. Based on household water consumption. [↑](#footnote-ref-8)
9. Based on a waste composition survey conducted by the Ministry of Environmental Protection in 2013. [↑](#footnote-ref-9)
10. Water and land contamination costs were not quantified in this report. [↑](#footnote-ref-10)
11. Estimated by the Ministry of Environmental Protection for 2018. [↑](#footnote-ref-11)
12. About 870 million tons were from the agricultural stage where food remained in the field and generally did not require any further treatment. [↑](#footnote-ref-12)
13. Compacting garbage trucks with a 10-ton capacity. [↑](#footnote-ref-13)
14. Not including food waste from agriculture. [↑](#footnote-ref-14)
15. The consumption stage includes household and institutional consumption. [↑](#footnote-ref-15)
16. As the FAO study did not quantify air pollutants resulting from the production and discarding of food, the comparison presented below includes only greenhouse gas emissions caused by food waste. [↑](#footnote-ref-16)
17. Estimated by the FAO in 2014. [↑](#footnote-ref-17)