GENERAL DIRECTORATE OF
DEVELOPMENT AGENCIES

İZMİR
DEVELOPMENT
AGENCY

GREEN TRANSFORMATION AND BLUE
OPPORTUNITIES PERSPECTIVE FOR İZMİR

POTENTIAL GAINS of GREEN TRANSFORMATION and BLUE OPPORTUNITIES IN İZMİR

BACKGROUND DOCUMENTS NO. 3

2022

GREEN TRANSFORMATION AND BLUE OPPORTUNITIES PERSPECTIVE FOR İZMİR - POTENTIAL GAINS OF GREEN TRANSFORMATION AND BLUE OPPORTUNITIES IN İZMİR BACKGROUND DOCUMENTS - NO. 3

2022, İZMİR

Published by

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Printing

Metro Matbaacılık
Yahya Kemal Beyatlı Cad. No: 94
Begos 3. Bölge Buca 35400 İzmir

Printing Information

1. Pressing
September 2022
500 Pcs

ISBN

978-605-5826-30-7

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ABBREVIATIONS

EU	: European Union
CO_2	: Carbon Dioxide
SES / SEPP	: Solar Energy System / Power Plant
İZKA	: İzmir Development Agency
İZSU	: İzmir Water and Sewerage Administration
KMB	: Küçük Menderes Basin
OIZ	: Organized Industrial Zone
WES / WEPP	: Wind Energy System/ Power Plant
TOE	: Ton of Oil Equivalent
TurkSTAT	: Turkish Statistics Institute
MoEUCC	: Ministry of Environment, Urbanization and Climate Change
EMRA	: Energy Market Regulatory Authority
NACE	: European Community Nomenclature of Economic Activities
TÜBİTAK	: Scientific and Technical Research Council of Turkey
TÜBİTAK MAM	: TÜBİTAK Marmara Research Center
ARS	: Address-based Record System
AGED	: Paper Recycling Industrialists Association
MoIT	: Ministry of Industry and Technology

CHAPTER 1.
Purpose And Scope

Green Transformation and Blue Opportunities Perspective for İzmir has been prepared by using a methodology that differentiates and specializes in line with the general framework of national green and blue transformation strategies, taking into account the needs of İzmir.

In this perspective study initiated with the methodology preparation process, qualitative and quantitative evaluations are included at all stages from macro level to sub-sectors, in determining the areas to focus on and the benefits to be obtained. The perspective study is based on a long process of research, learning, analysis and synthesis in the background. The studies carried out in these processes not only form the basis of the perspective document, but also include various analyses, evaluations and calculations.

The Background Documents are organized as a series of reports in which these studies that provide input to the perspective document are presented in detail. The Potential Gains of Green Transformation in İzmir Report, as the third and final report of this series, includes calculations and evaluations for estimating the potential gains that the transformation will offer, separately at macro and sectoral scales.

Potential gain calculations were made for two different scales at the macro and sectoral level, covering the transformation/opportunity fields of the perspective study. Macro gains assessment includes revealing the economic, environmental and social gain potential that will occur with the effect of transformation/opportunity in İzmir and evaluating its share in İzmir's economy. In this context, gain and cost calculations were carried out based on transformation scenarios in the fields of resource efficiency, sustainable waste management and renewable energy.

Sectoral gains, on the other hand, include the economic, environmental and social impacts that the sectors prioritized within the scope of perspective study reveal on the basis of interventions in spatial focus and detailed in the reports prepared for each sector.

CHAPTER 2.
Methodology And Data

Studies conducted in the past in the fields of resource efficiency, waste recycling and renewable energy for İzmir and for national scale, and the studies that reveal the potential gains, the analyzes and reports that support them provided important inputs as methods and data to the gain calculations. The reports and publications used are as follows:

- In terms of resource efficiency gains, "Identification of Resource Efficiency Potential in Industry Project" carried out by TÜBİTAK MAM with the support of the Ministry of Industry and Technology,
- In terms of clean energy gains, "Industrial Development, Trade Opportunities and Innovation-Analysis of Side Benefits of Decarbonizing the Electricity Sector with Renewable Energy in Turkey" published by İstanbul Policy Center,
- In terms of employment gains, "Skill and Employment Development with Renewable Energy in Turkey - Analysis of the Side Benefits of Decarbonizing the Electricity Sector", published by the same institution,
- In terms of waste management gains, İzmir Waste Characterization study carried out by the Waste Paper and Recyclers Association.

The Project for Determining the Resource Efficiency Potential in Industry, prepared in 2018, reveals the resource efficiency potential of the manufacturing industry in İzmir in the fields of raw materials, water and energy and the relevant gains to be achieved. In respect to resource efficiency gains, the achievements determined at İzmir scale in the relevant report were transferred to this report by making numerical updates when necessary, and the achievements determined at Turkey scale were brought to İzmir scale within the framework of certain assumptions by using indicative data sets. Then, environmental gains were calculated in relevant areas over the gains brought to the scale of İzmir. In the calculations, scenarios designed to give minimum, maximum and average values were used, as in the relevant report, and new scenarios specific to achievements relevant for İzmir were also created.

In the calculations of potential gains, primarily open databases were used to provide the resource usage, waste management data and basic economic indicators needed at the scale of İzmir province.

In the waste management recovery calculations, three scenarios were developed considering different recycling rates. In waste management gain calculations, population and waste production data by years were obtained from TurkSTAT. The results of the İzmir waste characterization study carried out in 2018 by the Waste Paper and Recyclers Association were utilized for the composition ratios of the waste generated in İzmir. While determining the waste management costs, it has been taken into account that the waste management unit costs determined for the country in general in the publications of the Ministry of Environment, Urbanization and Climate Change and the disposal cost for the materials that need to be disposed of by being subjected to the regular storage process determined for İstanbul are also valid for İzmir.

CHAPTER 3.

Macro Gains From Transformation And Opportunities

The transition to green transformation offers important potentials for İzmir to reduce the environmental, social and economic risks created by the current economic system. The basis of the transformation is to reduce the risks created by resource bottlenecks and to sustain economic growth by ensuring the protection, development and increase of natural resources with efficient use of resources and effective waste management. Blue opportunities, on the other hand, deals with the development of the current potential of sea and coastal areas, which are among the critical natural resources of İzmir, within the framework of green transformation.

With the realization of green transformation and blue opportunities for İzmir, the increase in new investments with high environmental performance, the widespread use of clean production practices, increased energy efficiency and use of clean energy will ensure the development of new sectors and new technologies. Thus, it is expected to create new job opportunities, increase employment and income.

In order to reveal the macro gains that will be created by green transformation and blue opportunities in İzmir, the topics that can be achieved, the approach to be discussed and the method to be used under each topic are determined on the axis of waste, water and energy transformation/opportunity fields. In this respect, gain and cost calculations were carried out based on transformation scenarios in the fields of resource efficiency, sustainable waste management and renewable energy.

3.1. Resource Efficiency Gains

Within the scope of the Project for Determining the Resource Efficiency Potential in the Industry, the raw material, water and energy saving potentials of the manufacturing industry were determined over three scenarios: ordinary, realistic and ideal scenarios. In the ordinary scenario, regardless of the efficiency levels of the businesses, it is assumed that there is a saving potential equivalent to the good practice examples in the study sample; in the realistic scenario, it is assumed that there is a saving potential at the level of the ratio of these scores on the basis of sector efficiency and business efficiency; and finally, in the ideal scenario, it is assumed that there is a saving potential on the basis of full efficiency and business productivity (1). In conclusion of the analyses, the ordinary scenario revealed the minimum and the ideal scenario revealed the maximum savings potential.

Economic Gains

The raw material, water and energy saving potentials calculated on an annual basis for the İzmir manufacturing industry within the scope of the Project for Determining the Resource Efficiency Potential in Industry are presented in Table 1.

TABLE 1. İzmir manufacturing industry saving potential

Scenarios	İzmir Saving Potential (million $/Year)*			İzmir Total ($/Year)	Turkey
	Water	Raw Material	Energy		
Ordinary Scenario	13.17	584.15	207.05	804.37	8,708.99
Realistic Scenario	14.86	642.61	225.25	882.72	9,562.57
Ideal Scena-rio	23.01	957.17	350.35	1,330.53	14,423.12

Source: MoIT (2017)

Although varies according to scenarios, the annual savings to be achieved from water, raw material and energy consumption for İzmir will be between 804.37 million and 1330.53 million dollars. While some of the practices aimed at realizing this potential do not require investment, some require investments with a payback period of less than one year.

Within the scope of the project, the investment amounts needed throughout Turkey in order to realize the raw material, energy and water saving potentials, as well as the level of providing the total savings potential of the investments with a payback period of more than one year were calculated. In determining the investment amount needed for İzmir, the ratio of İzmir savings potential to Turkey's savings potential in the fields of water, raw materials and energy was taken as basis. According to the calculation made as per this approach, the investment needs and investment return periods determined for İzmir are presented in Table 2.

TABLE 2. Investment amount needed for İzmir savings potential

Scenario	Investment Amount with Payback Period (PP) Under One Year ($ million)			Gains to be Provided by Investment with PP Less than One Year (million $/year)			İzmir Total Investment Need ($ million)			İzmir Total Saving Po-tential		
	(million $/ year)	Energy	Water	Raw Ma-te-rial	Energy	Water	Raw Ma-te-rial	Energy	Water	Raw Ma-te-rial	Energy	Water
Ordinary Scenario	51.98	63.64	5.77	408.90	124.23	11.59	547.15	374.36	7.40	584.15	207.05	13.17
Realistic Scenario	61.96	69.18	6.54	449.82	135.15	13.08	652.20	406.95	8.39	642.61	225.25	14.86
Ideal Scenario	87.30	106.12	10.74	670.02	210.21	20.25	918.90	624.25	13.77	957.17	350.35	23.01

Source: Calculated by the authors using MoIT (2017) data.

Within the scope of the study, it is stated that most of the savings potential can be achieved if investments with a payback period of less than one year are realized. 9.5% of the total investment amount in terms of raw materials, 17% in terms of energy and 57% in terms of water necessitate investments with a payback period of less than one year. These investments represent 70%, 60% and 88% of the total savings potential that can be provided, respectively.

The gains to be achieved during a period of 10 years in the case of realizing investments with a payback period of less than one year for İzmir and of realizing the entire investment are presented in Table 3 and Table 4. When the overall investment and gains in the tables are examined, it is seen that 67.7% of the total savings potential can be achieved with approximately 13% of the investment amounts determined for the three scenarios.

TABLE 3. 10-year savings potential if all the investment determined for İzmir is realized

Scenario	İzmir Total Investment Need ($ million)			10-Year Saving Potential for İzmir ($ million)			Total Investment (million $)	10-Year Total Gains (million $)
	Raw Material	Energy	Water	Raw Mate-rial	Energy	Water		
Ordinary Scenario	547.15	374.36	7.40	5,841.47	2,070.46	131.74	928.91	8,043.67
Realistic Sce-nario	652.20	406.95	8.39	6,426.06	2,252.48	148.62	1,067.54	8,827.16
Ideal Scena-rio	918.90	624.25	13.77	9,571.74	3,503.49	230.09	1,556.92	13,305.32

Source: Calculated by the authors using MoIT (2017) data

TABLE 4. 10-year savings potential in case of realizing investments with a payback period of less than one year for İzmir

Scenarios	Investment Need with Payback Period of Less than One Year ($ million)			10-Year Savings Potential (Million $) with an Investment with a Payback Period of Less than One Year			Total Investment (million $)	10-Year Total Gains (million $)	10-Year Water Saving Amount (million m³)
	Raw Mate-rial	Energy	Water	Raw Mate-rial	Energy	Water			
Ordinary Scenario	51.98	63.64	5.77	4,089.03	1,242.28	115.93	121.39	5,447.24	119.7
Realistic Scenario	61.96	69.18	6.54	4,498.24	1,351.49	130.79	137.68	5,980.51	134.9
Ideal Scena-rio	87.30	106.12	10.74	6,700.22	2,102.09	202.48	204.16	9,004.79	209.1

Source: Calculated by the authors using MoIT (2017) data.

The saving potential in the water field is considerably lower than the saving potential in the raw material and energy fields. One reason for the low savings potential is that businesses with less than 50 employees were not included in the analysis due to data constraints. However, this is mainly due to water pricing policies. Businesses supply water free of charge or at very low prices compared to other costs. This situation results in a lower saving potential in the field water compared to other fields. It would be a grave error not to prioritize investments for water saving by evaluating them merely according to the economic gain to be obtained from water costs. Economic evaluation of water should be considered as the cost of stopping and continuing business activities in the presence or absence of water, and water efficiency investments should be considered as the top priority investment, especially in water-poor regions such as İzmir.

Environmental Gains

In the environmental impact analysis carried out by using life cycle impact assessment analysis and eco-efficiency analysis methodologies, air emissions that can be prevented before they occur thanks to energy saving for Turkey in general have been determined. In order to determine the emission amounts that can be prevented in İzmir, the emission values for Turkey in general were multiplied by the ratio of İzmir's energy saving potential to Turkey's energy saving potential. In this approach, it is assumed that the sectoral distribution in İzmir is similar to the sectoral distribution in Turkey. In Table 5, the types and amounts of emissions that can be prevented in a 10-year period in İzmir, if the full saving potential can be achieved, are indicated on a scenario basis.

TABLE 5. Emission amounts that can be prevented before occurrence in İzmir in a 10-year period

Scenarios	Manufacturing Industry Energy Savings (TOE/ year)	SO equivalent (kg)	PM 2,5 equiva-lent (kg)	CO_2 equivalent (kg)	Equivalent Number of Persons in terms of CO_2 Emissions
Ordinary Sce-nario	4,354,652	126,638,078	27,308,111	8,820,094,432	1,764,019
Realistic Scena-rio	4,765,267	138,579,217	29,883,086	9,651,771,345	1,930,354
Ideal Scenario	7,335,996	213,338,847	46,004,179	14,858,633,343	2,971,727

Source: Calculated by the authors using MoIT (2017) data.

With the savings to be achieved in energy consumption, emissions equivalent to 1 year's carbon equivalent emissions of 1.7 million people in the ordinary scenario and 2.9 million people in the ideal scenario will be prevented.

Considering the amount of water savings, a savings level will be achieved that corresponds to the annual water consumption of a minimum of 1.4 million and a maximum of 2.5 million people (Table 6). Due to the data constraints within the scope of the project, the quantitative savings of the raw material and therefore the amount of waste that can be prevented before occurrence could not be calculated, and therefore, the potential at the scale of İzmir could not be specified in this context.

The following assumptions were made in the calculations;

- Annual equivalent CO_2 emission of a person is 5 tons,
- Annual water consumption of a person is 83,950 liters on average.

TABLE 6.. The amount of water that can be saved in İzmir in a 10-year period

Scenario	Water Saving Amount (million m^3)	Equivalent Population (person/year)
Ordinary Scenario	119.7	1,425,849
Realistic Scenario	134.9	1,606,909
Ideal Scenario	209.1	2,490,768

Source: MoIT (2017)

3.2. Sustainable Waste Management Gains

The recycling rate of the currently collected wastes in İzmir is around 10%, and they are disposed of in landfills that have a significant recovery potential. Every waste that is disposed of without being utilized for recycling and recovery causes significant resource loss in terms of eliminating demand for raw materials and energy and of environmental effects. Effective waste management includes the recovery of recyclable waste in the generated waste and the use of organic wastes as compost and energy source. If the efficiency of the separate collection at source is increased, it will be possible to reduce the recyclable waste sent to landfill to a great extent and to save on environmental problems.

Significant economic, social and environmental impacts will be achieved by implementing a waste management system in which different types of waste are separated at the source, collected separately, and industrial raw materials are obtained by classifying such in recycling facilities in accordance with the composition of the waste generated.

The gains that these effects will create for the next 10-year period are calculated for three scenarios based on the recycled waste rates. Scenario 1 represents the current situation for İzmir, and the recycling rate is taken as 10%. Scenario 2, as the realistic scenario, assumes achieving a 35% recycling target for the country in general until 2023 in the National Waste Management Plan. The last scenario, as the ideal scenario, covers the situation where the waste recycling rate is accepted as 65%, the average rate for the EU countries that are successful in waste management.

In the calculations of gains, the amount of waste for the next 10-year period has been calculated with the projection calculation over the amount of waste that İzmir has generated in the past years. While the İlbank method was used in the population projection calculation, the per capita waste production amounts were calculated by use of the linear increase method (Table 7).

TABLE 7. The amount of waste generated in İzmir

YEAR	Population (ARS, person)	Waste Per Capita (kg/person.day	Total Waste Amount (ton/year)
2015	4,168,415	1.25	**1,901,839**
2016	4,223,545	1.32	**2,034,904**
2017	4,279,677	1.34	**2,093,190**
2018	4,320,519	1.36	**2,144,706**
2019	4,367,251	1.41	**2,247,606**
2020	4,394,694	1.46	**2,341,932**
2021	**4,438,641**	**1.47**	**2,381,553**
2022	4,483,027	1.50	**2,454,457**
2023	4,527,858	1.53	**2,528,582**
2024	4,573,136	1.56	**2,603,944**
2025	4,618,868	1.59	**2,680,560**
2026	4,665,056	1.62	**2,758,448**
2027	4,711,707	1.65	**2,837,626**
2028	4,758,824	1.68	**2,918,111**
2029	4,806,412	1.71	**2,999,922**
2030	4,854,476	1.74	**3,083,078**

Source: Calculated by the authors using TurkSTAT data.

The waste composition of İzmir shows that 23% of the total waste produced is recyclable, while 60.3% is biodegradable and organic. In the calculations, it has been taken into account that recyclable wastes are recovered as raw materials according to the recycling rates specified in the scenarios, biodegradable and organic wastes are used to produce energy and products through compost and biogas processes, and other wastes with a 16.7% share are stored (Table 8).

TABLE 8. Waste types according to the waste composition of İzmir

İZMİR WASTE COMPOSITION (%)				
Kitchen Waste	60.0	**Biodegradable/ Organic Waste Rate (%)**	**Recyclable Waste Rate (%)**	**Stored Waste Rate (%)**
Paper	4.4			
Cardboard	1.1			
Bulk Carton	0.7			
Plastic	9.0			
Glass	6.4			
Metal	1.3			
Bulky Metal	0.1			
Electrical and Electronics Scrap	0.7	**60.3**	**23.0**	**16.7**
Park and Garden Wastes	0.3			
Hazardous Wastes	0.8			
Other Non-Combustibles	1.5			
Other Combustible	10.5			
Other Combustible Bulky Wastes	0.5			
Other Non-Combustible Bulky Wastes	2.0			
Others	0.8			
TOTAL	100.0			

Source: AGED 2018

Economic Gains

By using the recycling rates determined in the scenarios, the annual amounts of waste generated, recycled, used in compost and energy production and stored on an annual basis were calculated. Waste amounts for the next 10-year period are summarized in Table 9.

TABLE 9. Total amount of waste generated, recycled and stored over the next 10 years

	Total Waste Amount (ton/year)	Recyclable Waste Amount (ton/year)	Biodegradable/Organic Waste Amount (ton/year)	Stored Waste Amount (ton/year)
Scenario 1	40,010,457	920,241	2,412,631	36,677,586
Scenario 2		3,220,842	8,444,207	28,345,408
Scenario 3		5,981,563	15,682,099	18,346,795

Source: Calculated by the authors using AGED (2018) data.

Recyclable waste consists of paper-cardboard, plastic, metal and glass materials and is recycled and used as an alternative raw material for the metal, plastic, glass and paper industries. The amounts of recyclable waste types for the next 10-year period and the gains to be obtained from such wastes are calculated on the basis of scenarios and presented in Table 10.

TABLE 10. Amounts of recyclable waste types and income to be generated for the 10-year period

	Waste Amount (ton/year)					Gains to Achieve ($/year)				
	Paper -Paperboard	Plastic	Metal-Al, Fe	Glass	TOTAL	Paper -Paperboard	Plastic	Metal-Al, Fe	Glass	TOTAL
Senaryo 1	183,447	266,294	41,423	189,365	680,529	25,115,445	84,004,388	25,808,015	2,986,823	137,914,671
Senaryo 2	642,064	932,029	144,982	662,776	2,381,851	87,904,059	294,015,359	90,328,052	10,453,879	482,701,349
Senaryo 3	1,192,405	1,730,910	269,253	1,230,870	4,423,438	163,250,395	546,028,524	167,752,096	19,414,348	896,445,362

Source: Calculated by the authors using AGED (2018) data.

In the economic gain calculation, the scrap sales prices stated in the report prepared by AGED were taken as the basis for the waste unit values, and the scrap prices were indexed to foreign currency at the exchange rate of $/TL as of September 2018, the date of access (Table 11).

TABLE 11. Scrap sales prices

	Paper-Paperboard	Plastic	Metal-Al	Metal-Fe	Glass
$	137	315	1104	142	16

Source: AGED (2018)

In sustainable waste management, biodegradable/organic wastes are used in energy and compost production. In this respect, it is assumed that 50% of the organic wastes generated can be composted and the other half can be converted into methane and then into electrical energy in anaerobic digesters. In compost production, it has been taken into account that 17% of the total waste is used for compost and the organic matter content of biodegradable/organic waste is 14%. It has been taken into account that methane gas is produced at the rate of 0.48% of the total methane production capacity by the breakdown of the waste in the anaerobic digester, and 40% efficiency is obtained when the methane is burned and converted into electrical energy by means of an electric generator. The compost and energy gains to be obtained in the next 10 years for all three scenarios are summarized in line with these assumptions in Table 12.

The following assumptions were made in the calculations;

- Unit compost price is 126$ based on the current dollar rate (1$=6.34 TL), based on the 2018 figures of 800TL/ton,
- Electricity energy fee generated from biomass-based production facilities determined by EMRA is 13.3 $ cent/kWh

TABLE 12. Compost and energy gains to be obtained from waste during a 10-year period

	Biodegradable /Amount of Organic Waste (ton)	Compost Product (ton/year)	Market Value of Compost ($)	Organic Matter Content of Waste (ton)	Electrical Energy (kwh, 40% Efficiency)	Electricity Yield ($)
Scenario 1	1,784,169	503,000	63,469,982	249,784	89,162,901	11,858,666
Scenario 2	6,244,592	1,760,499	222,144,938	874,243	312,070,153	41,505,330
Scenario 3	11,597,100	3,269,497	412,554,885	1,623,594	579,558,855	77,081,328

Source: Calculated by the authors using AGED (2018) data

In the event that recyclable wastes are utilized through separate collection and biodegradable/organic wastes are utilized as energy and compost raw materials, these wastes will not be sent to the landfill. Therefore, the lower amount of stored waste will reduce the required storage volume. This will save on the construction and storage costs of the sanitary landfills. The total gains calculated for the next 10-year period in line with the recycling rates accepted in the scenarios are given in Table 13.

The unit waste storage service fee assumed as 60$, the healthy average waste storage height in the landfills assumed as 35 m, and the compressed density of the waste assumed as 0.7 t/m^3.

TABLE 13. Savings to be made in storage volume and storage costs in the 10-year period

	Non-Stored Waste (m^3/year)	Non-Stored Waste Rate (%)	Storage Tariff ($/ton)	Storage Fee($)	Storage Volume Saving (m^3) between 2020-2030(d=0,7)	***Storage Space Saving (m^2)
Scenario 1	3,520,997	8	60	211,259,836	3,520,997	100,600
Scenario 2	12,323,490	29		739,409,426	12,323,490	352,100
Scenario 3	22,886,482	54		1,373,188,933	22,886,482	653,899

Source: Calculated by the authors using AGED (2018) data.

The reduction in the amount of waste to be stored and the volume of required landfill will also reduce the volume of leachate that must be managed. Thus, the initial investment and operating costs for the collection and treatment of leachate will decrease and significant savings will be achieved. The savings to be achieved in the leachate costs in the 10-year period are presented in Table 14 based on the scenarios.

TABLE 14. Savings to be made from leachate treatment in a 10-year period

	Amount of Waste Recovered (ton)	Warehouse unit cost (Euro/ton of waste)	Leachate treatment cost (Euro/ton of waste)	Storage construction cost savings (Euro)	Sızıntı suyu arıtım maliyeti tasarrufu (Euro)	Storage construction cost savings ($)	Leachate treatment cost savings ($)
Scenario 1	2,464,698	9,05	0,55	22,305,518	1,355,584	19,499,967	1,185,081
Scenario 2	8,626,443			78,069,312	4,744,544	68,249,884	4,147,783
Scenario 3	16,020,538			144,985,865	8,811,296	126,749,785	7,703,026

Source: Calculated by the authors using AGED (2018) data. The cross rate for 2020 is taken as EURO/$ = 1.14.

The revenues and savings in the 2020-2030 period for the three scenarios are summarized in Table 15. Accordingly, it is estimated that an economic gain of $ 445 million will be achieved in the 10-year period with the 10% recycling rate realized in İzmir in the current situation. If the recycling rate is increased to 35%, $1.56 billion will be gained for the same period.

TABLE 15. All revenues and savings in the 10-year period with waste management

	Saving ($)			Revenue ($)		Saving + Revenue ($)
	Storage construction cost savings	Storage cost savings	Leachate treat-ment savings	Recyclables revenue	Compost and energy production revenue	Total
Scenario 1	19,499,967	211,259,836	1,185,081	137,914,671	75,328,648	445,188,203
Scenario 2	68,249,884	739,409,426	4,147,783	482,701,349	263,650,268	1,558,158,710
Senaryo 3	126,749,785	1,373,188,933	7,703,026	896,445,362	489,636,212	2,893,723,319

Source: Calculated by the authors using AGED (2018) data.

Environmental Gains

The most important advantage of using recycled materials in production is the elimination of all energy demands, carbon emissions and wastes occurring during the production of the raw materials required to produce the product in question.

In 2008, the World Health Organization determined the unit CO_2 emission rates to be reduced by recycling certain materials. Based on these rates, 10-year CO_2 emission reductions to be obtained from recycling paper, plastic, glass and metal in İzmir are presented in Table 16. Accordingly, it is estimated that 3.3 million tons of CO_2 emissions can be eliminated between 2020-2030 if the 35% recycling rate considered in the realistic scenario is achieved. Considering that 5 tons of CO_2 emissions are generated annually in our country, this amount is equivalent to the emissions produced by approximately 957 thousand people.

TABLE 16. CO_2 emission reduction to be achieved by waste recovery

(WHO, 2008)	Paper	Plastic	Glass	Metal	TOTAL ton CO_2	Equivalent population
	0,9 kg CO_2/kg paper	**1,5** kg CO_2/kg plastic	**0,3** kg CO_2/kg glass	**8,1** kg CO_2/kg metal		
Scenario 1	165,102	399,441	56,809	335,530	956,883	191,377
Scenario 2	577,858	1,398,043	198,833	1,174,356	3,349,090	669,818
Scenario 3	825,511	1,997,204	284,047	1,677,652	4,784,414	956,883

Calculated by the authors using WHO (2018) data.

Social Gains

The recycling sector plays a key role in sustainable waste management where wastes are separated at the source and converted into value with high value-added recycling.

A recycling-based waste management will create new business areas and employment in the sector, which includes different sub-branches from the collection of waste to its transportation, reprocessing and conversion into alternative raw materials. As a matter of fact, it is stated in the National Recycling Strategy that recycling creates more employment than incineration or storage.

The recycling sector in İzmir has shown a significant increase in the number of businesses and employees in the last ten years. According to 2020 data, a total of 6746 people are employed within 336 companies in the sector. Between 2010 and 2020, the number of businesses operating in the sector increased by 149% and the number of insured employees increased by 132%. Considering the increase in the amount of produced and imported waste, it is considered that this increasing trend will continue in the future as well. In this regard, calculations have been made to predict the increase in employment that will be created in the sector by the transformation scenarios based on recycling rates.

In case the 10% recycling accepted in scenario 1 continues, it was considered that the upward trend in the past period will persist, and the number of businesses and employees for the next period was determined accordingly.

Scenario 2 and Scenario 3 include an increase in the amount of waste processed in recycling compared to the current situation. In this case, it is expected that the capacities of the businesses and accordingly their net sales will increase. Considering that the rate of increase in net sales of recycling companies between 2008 and 2018 will continue in the future, employment for each scenario was calculated by years. The total employment values estimated to be created in the 2020-2030 period are presented in Table 17.

TABLE 17. Employment to be created in the recycling sector in the next 10 years

EMPLOYMENT		
Scenario 1 %10 Recycling	**Scenario 2 %35 Recycling**	**Scenario 3 %65 Recycling**
95,511	334,288	620,821

Source: Calculated by the authors using SSI (Social Security Institution [SGK]) 2010-2020 data.

If the realistic scenario is actualized, it is predicted that 334,288 new jobs will be created in the recycling sector in the 10-year period. This value includes formal employment and excludes street collectors operating informally in the recycling value chain. With the inclusion of street collectors, mostly composed of vulnerable groups such as immigrants, women and children, into the system, the employment value to be created will be higher than expected and the development of decent work environments for these groups will be ensured.

Waste Management Investment and Operating Costs

Waste management costs, including collection, transport and disposal costs, consist of investment and operating costs. Although the systems where the wastes are collected separately at the source involve costs such as initial investment and training, it is considered a less costly method than the approach of re-separating and processing mixed collected wastes into all the waste branches.

In our country, where waste is collected in a mixed manner and a large part of it is stored, the management cost of waste per ton is around $38 on average. The collection-transportation cost of the waste is $30 per ton and constitutes a significant part of the operating costs (MoEUCC, 2017). These costs vary according to the level of urbanization, topographic structure, equipment and vehicle infrastructure, and the number of personnel.

In an ideal waste management system, the level of separation and collection method of waste at the source affects the necessary initial investment and operating costs. There is a significant cost difference between the central collection of recyclable wastes and their collection from the sources.

It is thought that the waste management cost will vary according to the recycling rate in estimating the waste management cost that will occur for the scenarios designed for the waste management system. It is assumed that with the increase in the recycling rate, the initial investment and collection costs and the amount of collected recyclable waste will increase. Accordingly, waste management cost per ton was determined for each scenario and total costs were calculated (Table 18).

TABLE 18. Waste management costs based on scenarios

	Total Waste Amount (ton/year)	Total Waste Management Cost* ($/tonne)	Cost ($/year)
Scenario 1	27,246,280	34	926,373,516
Scenario 2		36	977,886,014
Scenario 3		53	1,439,410,948

Source: Calculated by the authors using AGED (2018) data.

3.3. Clean Energy Gains

In order to determine the gains to be created by the increase in clean energy generation in İzmir in terms of manufacturing industry and employment, "Industrial Development, Trade Opportunities and Innovation with Renewable Energy in Turkey-Assessing the Co-Benefits of Decarbonising the Power Sector" and "Future Skills and Job Creation through Renewable Energy in Turkey: Assessing the Co-Benefits of Decarbonising the Power Sector" published by İstanbul Policy Center were utilized. Based on the results reached for Turkey in general within the scope of the reports, the gains of İzmir were calculated over certain assumptions. In the study, wind energy power plants (WEPP) and solar energy power plants (SEPP) were used as clean energy sources, while other clean energy sources were excluded from the scope of the report. The installed generation capacity of WEPP and SEPP in Turkey were determined as of 2018 and the installed capacity projections for 2028 were made according to 4 different scenarios. Data sets accessed through the Entrepreneur Information System of the Ministry of Industry and Technology were analyzed and the gains to be obtained for the aforementioned scenarios were determined. The main findings reached according to the results of the analysis are stated below, and the calculations for İzmir are based on these findings:

- 1 MW energy capacity increases industrial production by 452.5 thousand dollars in the solar sector and 3.6 million dollars in the wind sector.
- The value chain consists of 4 stages, namely, intermediate input producers and service providers (Stage-1), energy machinery-equipment manufacturers and service providers (Stage-2), companies producing electricity from renewable resources (Stage-3), businesses purchasing from companies producing electricity from renewable resources (Stage-4). The impact of clean energy capacity increase on industrial production occurs at different rates at different stages of the value chain. For the SEPP sector, industrial production increases by 76%, 23%, 1%, respectively; while for the WEPP sector, industrial production increases by 31.09%, 32.39% and 36.52%, respectively, in the first three stages.
- Every 1 MW increase in solar energy generation provides a 2.46 increase in the number of full time equivalent (FTE) employees. 92% of such increase is indirectly created in stages 1 and 2 of the value chain and 8% is created directly in stage 3 of the value chain.
- Every 1 MW increase in wind power generation provides a 6.34 increase in the number of FTE employees. 64% of this increase is indirectly created in stages 1 and 2 of the value chain, and 36% is created directly in stage 3 of the value chain.

Economic Gains

While projecting the increase in clean energy generation in İzmir, two scenarios related to renewable energy capacity increase in aforementioned reports were used. The first scenario is New Policy Scenario based on the announcement by the Ministry of Energy and Natural Resources that as a part of the "National Energy and Mining Policy", an annual increase of 1 GW will be made in solar and wind energy capacity for 10 years starting from 2018. Advanced Renewables Scenario based on a SHURA (2018) study used as the second senario. According to this study, increasing installed wind and solar capacity to 20 GW each is feasible without additional investment in the transmission system.

In order to determine İzmir share of projected increase in renewable energy capacities for two scenarios, the ratio of WEEP and SEPP capacities of İzmir to WEEP and SEPP capacities of Turkey were calculated and It is assumed that these ratios will remain same during the 10-year capacity increase period (Table 19).

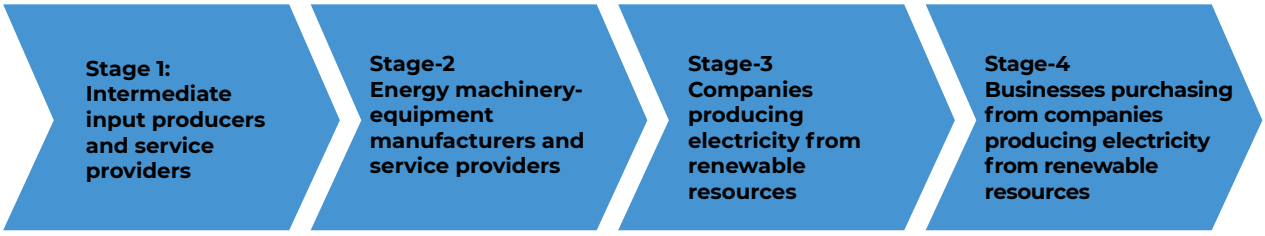
TABLE 19. WEPP and SEPP capacities in the current situation and after 10 years of capacity increase in İzmir

Scenario	Clean Energy Resource	Current Situation	Capacity Increase	Investment Cost (million $)
New Energy Scenario	WEPP Installed Capacity (MWe)	1,798.15	1,932.45	224,164
	SEPP Installed Capacity (MWm)	16.10	24.08	13.24
Advanced Renewables Scenario	WEPP Installed Capacity (MWe)	1,798.15	3,864.90	448,32
	SEPP Installed Capacity (MWm)	16.10	48,16	26,48

Source: Calculated by the authors using TWEA (Turkish Wind Energy Association) and www.enerjiatlasi.com data.

Minimum and maksimum gains to be achieved with the clean energy capacity increase in İzmir were calculated over three sub-scenarios related to the value chain stages (Figure 1). As stated in the main findings section, increases in employment and industrial production occur at different ratios within the first three stages of the value chain so the presence level of renewable energy value chain stages in İzmir affects the gains to be achieved. With this point of view, three sub-scenarios were prepared for New Energy and Advanced Renawables Scenarios are given below:

FIGURE 1. Renewable energy value chain, Source: IPC (2020)



Sub-Scenario-1: it is assumed that only Stage 3 of the WEPP and SEPP value chains is located in İzmir (minimum gain),

Sub-Scenario-2: it is assumed that 50% of the first two stages and the entire third stage of the WEPP and SEPP value chains are located in İzmir,

Sub- Scenario-3: it is assumed that all of the first three stages of the WEPP and SEPP value chains are located in İzmir (maximum gain).

The gains that can be achieved in a 10-year period according to these scenarios are given in Table 20. It is predicted that an increase of 2.54-6.97 billion dollars for New Energy Scenario and 5.08-13.94 billion dollars for Advanced Renewables Scenario can be achieved in the manufacturing industry production if the predicted values are reached in the WEPP and SEPP installed capacities in İzmir within the 10-year period.

Amount of electrical energy and the economic gain that can be produced through the two main scenarios are given in Table 21. With increase in capacity of SEPP and WEPP in İzmir, it will be possible to generate a total of 57.8 thousand – 115.6 thousand GW electricty energy in a 10-year period and it seems possible that the economic gain from the energy to be produced will be up to 5.8 billion- 11.6 billion dollars.

TABLE 20. Industrial production increase to be achieved in the value chain in a 10-year period with clean energy capacity increase in İzmir

Gains		Scenario -1	Scenario -2	Scenario -3
New Energy Scenario	The Effect of SEPP Capacity Increase on Industrial Production (thousand $)	108.96	5,502.34	10,895.72
	Effect of WEPP Capacity Increase on Industrial Production (thousand $)	2,540,632.66	4,748,729.06	6,956,825.46
	TOTAL (thousand $)	**2,540,741.61**	**4,754,231.39**	**6,967,721.17**
Advanced Renewables Scenario	The Effect of SEPP Capacity Increase on Industrial Production (thousand $)	217.92	11,004.68	21,791.44
	Effect of WEPP Capacity Increase on Industrial Production (thousand $)	5,081,265.32	9,497,458.12	13,913,650.92
	TOTAL (thousand $)	**5,081,483.24**	**9,508,462.8**	**13,935,442.36**

Source: Calculated by the authors using IPC (2020) data.

TABLE 21. The amount and price of electrical energy that can be produced in a 10-year period with clean energy capacity increase

Scenario	Projected Capacity Increase in İzmir WEPP (MWe)	Projected Capacity Increase in İzmir SEPP (MWm)	Electiric Energy Generation in a 10-year Period with Targeted Capacity (MWh)	Electricity Price ($)
New Energy Scenario	1,932.45	24.08	57,797,937	5,779,793,758
Advanced Renewables Scenario	3,864.9	48.16	115,595,875	11,559,587,517

Source: Calculated by the authors.

Environmental Gains

Within the scope of the study, the equivalent carbon emissions that can be prevented before occurrence due to the electrical energy that can be generated in a 10-year period according to New Policy Scenario and Advance Renewables Scenario are presented in Table 22.

TABLE 22. The amount of electrical energy and the equivalent carbon emission to be prevented in 10-year period due to the clean energy capacity increase in İzmir

Scenarios	Electiric Energy Generation in 10-Year Period with Targeted Capacity (MWh)	Equivalent CO_2 emissions to be prevented (tonnes)	Equivalent Number of Persons*
New Energy Scenario	57,797,937.59	25,604,486.35	5,120,897.27
Advanced Renewables Scenario	115,595,875.17	51,208,972.70	10,241,794.54

Source: Calculated by the authors.

It is predicted that a total of 57.8 thousand-115.6 thousand GWh of electrical energy can be generated in 10 years so that a total of 25.6-51.2 million tons of equivalent carbon emissions will be prevented before occurrence and the emission to be prevented will correspond to the annual equivalent carbon emissions of 5.1- 10.2 million people.

Social Gains

The increase in clean energy capacity creates different numbers of full time equivalent employment (FTE) at different stages of the SEPP and WEPP value chains. In Table 23, the increase in employment provided by the 1 MW capacity increase in the WEPP and SEPP value chains and the distribution of this increase between the value chain stages are presented.

TABLE 23. The increase in employment in the value chain by 1 MW increase in clean energy capacity

Clean Energy Type	Total Employment Increase (FTE)	Intermediate Input Producers and Machinery, Equipment, Service Providers (%)	Electricity Generating Company (%)
SES	2.46	92	8
WES	6.34	64	36

Source: IPC (2020)

In determining the employment that the clean energy capacity increase will provide in İzmir, it is aimed to determine the highest, lowest and average values by proceeding through the 3 sub-scenarios specified in the "economic gains" section.

The expected employment increase in İzmir in 10-year period according to each main scenario is given in Table 24. When the table is examined, it can be seen that distribution of employment in the wind sector value chain shows a more homogeneous structure, while in the solar sector, it is mostly focused on intermediate input producers and machinery, equipment and service suppliers.

However, the most employment in both sectors is provided by intermediate input producers and machinery, equipment and service suppliers. İzmir is one of the most prominent cities in the clean energy sector. In this respect, the contribution of the businesses operating in İzmir to the targeted capacity increase throughout the country will be able to carry the employment to be created in İzmir beyond the anticipated values.

TABLE 24. The effect of clean energy capacity increase on employment in İzmir for the 10-year period

	Scenarios	Sub-Scenario 1	Sub-Scenario 2	Sub-Scenario 3
Employment Increase (FTE)	**New Energy Scenario**	4,415	8,363	12,311
	Advanced Renewables Scenario	8,831	16,726	24,622

Source: Calculated by the authors.

3.4. Macro Gain Results

It is estimated that an average of 10.4 billion dollars of economic gain can be achieved for the 10-year period in the fields of resource efficiency and waste management, calculated over the transformation scenarios and it is possible that the economic gain will be up to 16 billion dollars through best scenario. The investment and management cost of the transformation that will provide this gain in these fields is expected to be $2.9 billion over ten years in the best scenario (Table 25).

TABLE 25. Investment costs and economic gain over 10 years ($ million)

		Minimum	Average	Maximum
Resource Efficiency	Investment Cost	929	1,068	1,557
	Economic Gain	8,044	8,827	13,305
Waste Management	Investment/Management Cost	926	978	1,439
	Economic Gain	445	1,558	2,894
Total Gains (million $)		**8,489**	**10,385**	**16,199**
Total Investment (million $)		**1,855**	**2,045**	**2,996**

Source: Calculated by the authors.

In addition to the economic gain that will be obtained through savings and direct revenue, the amount of industrial production within the clean energy value chain is expected to increase in line with the increase in clean energy investments in the transformation process. It is estimated that industrial production will rise by $2.5-7 billion with the investments to be made in clean energy capacity in the 10-year period, and this value is expected to reach $13.9 billion in Advanced Renewables Scenario (Table 26). In addition, with the anticipated increase in SEPP and WEPP capacities, it is estimated that the electrical energy to be generated in the 10-year period will reach 116 thousand GW, and the economic gain of the energy to be generated will reach $11.6 billion.

TABLE 26. Industrial production increase to be created in the value chain with clean energy capacity increase in the 10-year period (thousand $)

	New Energy Scenario			Advanced Renewables Scenario		
	Minimum	Average	Maximum	Minimum	Average	Maximum
SEPP	109	5,502	10,896	217	11,004	21,791
WEPP	2,540,633	4,748,729	6,956,825	5,081,265	9,497,458	13,913,650
TOTAL	**2,540,742**	**4,754,231**	**6,967,721**	**5,081,483**	**9,508,462**	**13,935,442**

Source: Calculated by the authors.

With the transformation, 4.3 million TOE energy savings will be achieved in the manufacturing industry in İzmir, and in return, 8.8 million tons of CO_2 emissions will be prevented from being released into the environment. Through this transformation in resource efficiency and waste management, it is predicted that a total of 13 million tons of CO_2 equivalent greenhouse gas emissions can be prevented during the 10-year period. This value is equivalent to the CO_2 emissions produced by 2.6 million people. In the best transformation scenario, it is foreseen that the amount of emission to be prevented will be 20 million tons, and the population equivalent to this emission will be 3.9 million people. (Table 27).

TABLE 27. CO_2 emissions to be prevented and its population equivalent in the 10-year period

		Minimum	Average	Maximum
Resource Efficiency	CO_2 Emission (ton)	8,820,094	9,651,771	14,858,633
	Equivalent Population (person)	1,764,019	1,930,354	2,971,727
	Manufacturing Industry Energy Saving (TOE)	4,354,652	4,765,267	7,335,996
Waste Management	CO_2 Emission (ton)	956,883	3,349,090	4,784,414
	Equivalent Population (person)	191,377	669,818	956,883
Total CO_2, ton		**9,776,977**	**13,000,861**	**19,643,047**
Equivalent Population (person)		**1,955,396**	**2,600,172**	**3,928,610**

Source: Calculated by the authors.

Through resource efficiency practices, 135 million m^3 of water can be saved in İzmir over the 10-year period, according to the average scenario. This value constitutes 3% of İzmir's total water potential and is enough to meet the annual water needs of 1.6 million people (Table 28).

TABLE 28.. Water recovery potential and equivalent population

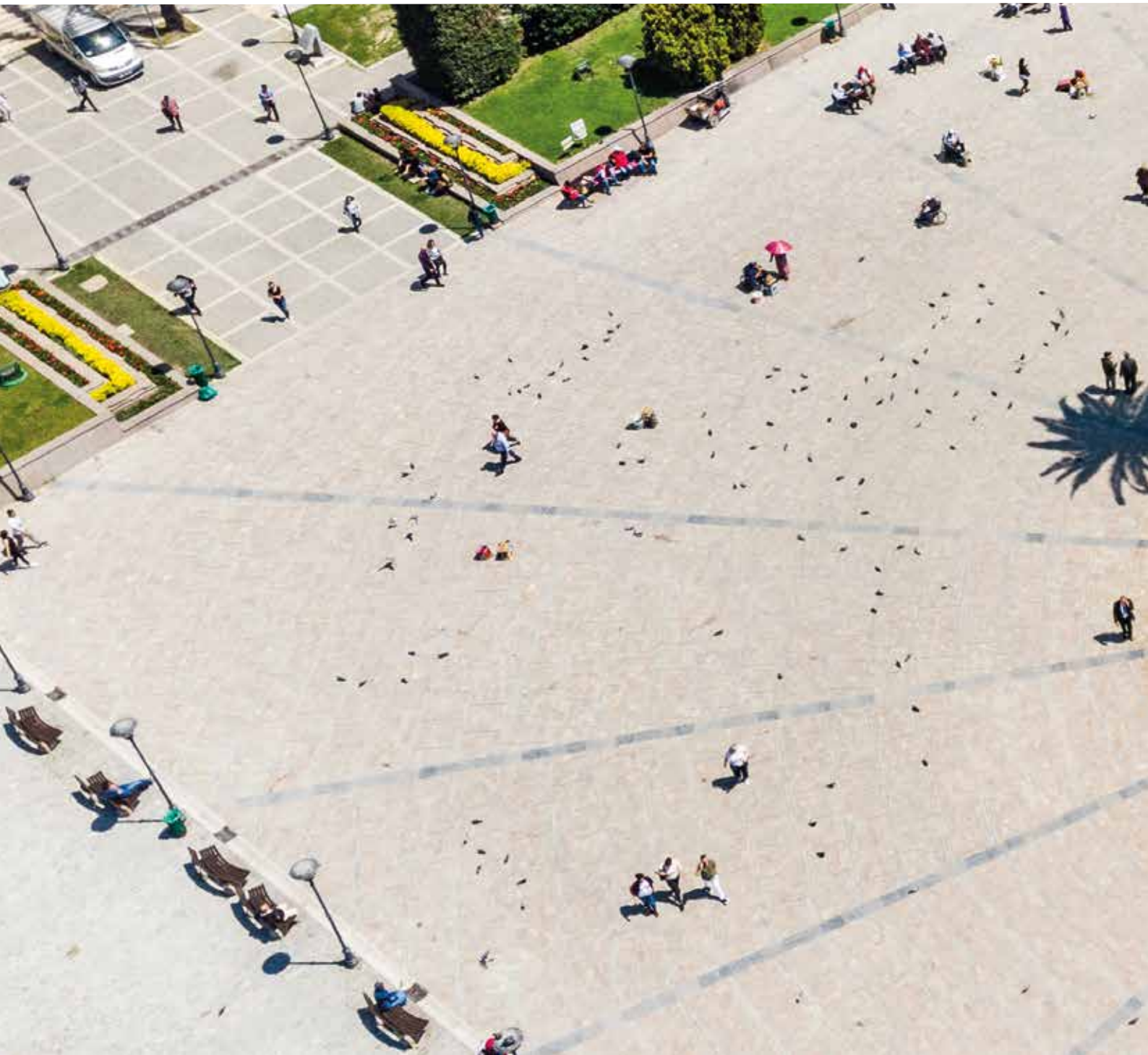
	Water Savings (million m^3)	Equivalent Population (person)	Share within the Water Potential of İzmir (%)
Minimum	119.7	1,425,849	2.66
Avarage	134.9	1,606,909	2.99
Maximum	209.1	2,490,768	4.64

Source: Calculated by the authors using MoIT (2017) data.

The employment creation effect of the transformation is discussed in the social gain calculations. Accordingly, it is predicted that 334 thousand new full-time-equivalent employment can be created in the 10-year period in the average scenario through waste management (Table 29). This figure corresponds to 22% of the total employment value of İzmir for the population over the age of 15 as of the year 2020. In the ideal scenario, it is estimated that the employment to be created may reach 633 thousand and the share in total employment may reach 40%.

TABLE 29. Employment to be created in the 10-year period with the transformation

	Minimum	Average	Maximum
Waste Management	95,511	334,288	620,821
Clean Energy	4,415	8,363	12,311
Total Employment (FTE person)	**99,926**	**342,652**	**633,132**
Share in İzmir's Employment in 2020 (%)	**6%**	**22%**	**40%**

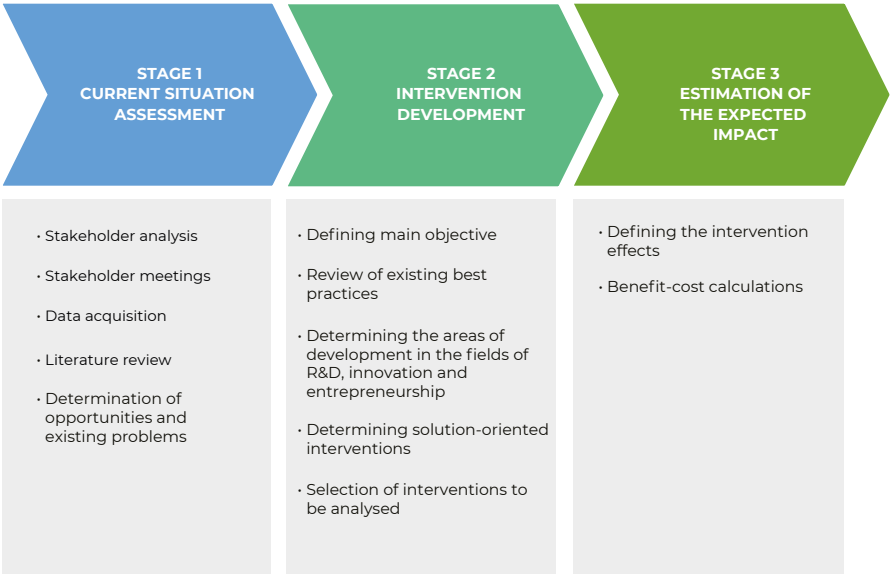


CHAPTER 4.

Sectoral Gains of Transformation and Opportunities

Sectoral opportunity analyzes were carried out for each of the sectors prioritized in the fields of industry, agriculture and blue opportunities in order to reveal the sectoral gains offered by green transformation and blue opportunities in İzmir. In this context, initially a comprehensive current situation assessment was made, which deals with the general economic outlook of the sector, production processes, the current situation in the field of transformation and its main problems. Afterwards, national and international best available techniques, exemplary projects, technology opportunities for solution were researched, intervention options were determined and final intervention sets were created with strategic choice. Finally, the effect that will occur in the sector and the economic, environmental and social gains that will be created by the implementation of the final interventions selected are calculated over a cost-benefit model developed specifically for the study (Figure 1).

FIGURE 2. Sectoral opportunities analysis process



In conclusion of the analysis carried out with the strategic prioritization and focus approach followed in the entirety of the perspective, a "sectoral opportunity report" was prepared for twelve sectors. The transformation interventions in the reports are suggestions that reveal the transformation potential of green transformation and blue opportunities for the sector. The gains obtained are the results of an estimation study made over certain assumptions in order to reveal the size, costs and gains of the transformation opportunities in line with the purpose of the perspective study.

In this respect, the economic, environmental and social gains calculated for the ten-year period for the interventions identified in the relevant transformation/opportunity field are presented in this section by being grouped under agriculture, industry and blue opportunities. In the calculations, the provincial investment costs to be spent for the implementation of the intervention and the operating costs to be incurred for the ten-year period were also calculated and the net benefit was determined by deducting from the economic gain.

Industry

Sector		Spatial Focus	Investment Cost($)	GAINS (10-Year)		
				Economic ($)*	Environmental	Social
WASTE	Processing and Preservation of Vegetables/Fruits	Kemalpaşa Torbalı	1-238 million	▸ 182.4 -276.4 million	▸ 1.2 million tons of waste reduction ▸ 0.5 - 1 million tons of CO_2 emission reduction ▸ Protection of 48.2 thousand m^2 land area ▸ 68 million kWh energy savings	▸ Annual emission reduction equivalent to 100 -195 thousand people
	Manufacture of Paper	Kemalpaşa	-	▸ 84.1 million	▸ 0.4 million tons of waste reduction ▸ 2.8 million tons of CO_2 emission reduction ▸ Protection of 16 thousand m^2 land area	▸ Annual emission reduction equivalent to 568.4 thousand people
	Material Recovery	Bornova Torbalı	0,379 million	▸ 1,63 million	▸ 14 thousand tons of waste reduction ▸ 21 thousand tons of CO_2 emission reduction	▸ Annual emission reduction equivalent to 432 people
WATER	Manufacture of Oils	KMB Çiğli Aliağa	10,4-13,8 million	▸ 51-68,5 million	▸ 17 million m^3 water savings ▸ 338-415 thousand m^3 wastewater reduction ▸ 40-80 thousand tons of CO_2 emission reduction	▸ Annual emission reduction equivalent to 7.8-16.6 thousand people ▸ Recovery of annual water demand equivalent to 199 thousand people ▸ Reduction of the annual pollution load equivalent to 7.7 million people
	Manufacture of Milk and Dairy Products	KMB Menemen Bornova	10,4 million	▸ 33,8 million	▸ 24.7 thousand m^3 of water savings ▸ 76.7 thousand tons of pollution load reduction	▸ Recovery of annual water demand equivalent to 293 thousand people ▸ Reducing the annual pollution load equivalent to 4.7 million people
	Material Recovery	Bornova Torbalı	28,8 million	▸ 16,6 million	▸ 12.7 million m^3 water recovery	▸ Recovery of annual water demand equivalent to 151.3 thousand people
ENERGY	Processing and Preservation of Vegetables/Fruits	Kemalpaşa Torbalı	19,6 million	▸ 175,8 million	▸ 0.3 million CO_2 emission reduction ▸ 696.9 million kWh energy savings	▸ Annual emission reduction equivalent to 59.9 thousand people ▸ 1.2 thousand jobs
	Manufacture of Paper	Kemalpaşa	11,5 million	▸ 53 million	▸ 0.2 million CO_2 emission reduction ▸ Protection of 96 thousand m^2 land area ▸ 530 million kWh energy savings	▸ Annual emission reduction equivalent to 45.5 thousand people
	Manufacture of Plastics	Çiğli, Menemen, Torbalı, Kemalpaşa	15,1 million	▸ 31,1 million	▸ 0.03 million CO_2 emission reductions ▸ 56 million kWh energy savings	▸ Annual emission reduction equivalent to 4.9 thousand people

** Economic gain calculations indicate the net gains calculated by deducting ten years of operating costs.*

Agriculture

Sector		Spatial Focus	Investment Cost ($)	GAINS (10-Year)		
				Economic ($)*	Environmental	Social
WASTE	Cattle Husbandry	Küçük Menderes Basin	▸ 101,7-618 million	▸ 413,7 million – 4,9 billion	▸ Improvement of the soil with 1.9 million tons of fertilizer replacement and reduction of 8.1 million tons of animal waste ▸ Preventing water and soil pollution caused by 18.5 thousand tons of nitrogen and 2 thousand tons of phosphorus, ▸ 974.6 thousand tons of reduction in coal consumption ▸ 1.3 billion kWh reduction in fossil fuel-based electrical energy consumption	▸-4.6 million equivalent persons nitrogen, 1.6 million equivalent persons phosphorus disposal ▸-50,4 thousand557 thousand equivalent persons annual emission reduction
WATER	Cattle Husbandry	Küçük Menderes Basin	▸ 47,2-90,2 million	▸ 86,5 – 190,4 million	▸ 21.9-1.3 thousand hm³ water savings ▸ Preventing 15.7 thousand tons of nitrogen and 2.4 thousand tons of phosphorus load ▸ 4.6 million tons of reduction in animal waste ▸ Protection of 29.7% of İzmir water potential and 135.6% of KMB water potential	▸ Recovery of annual water demands of 2.6 million people ▸ 9 million equivalent person nitrogen, 1.8 million equivalent person phosphorus load reduction
	Forage Crops	Küçük Menderes Basin	▸ 5,4-133,2 million	▸ 139,7 million	▸ 140.9 1.3 thousand hm³ water savings ▸ 240-260 million kWh energy savings ▸ Protection of 3.1% -28.6% of İzmir water potential and 14.3-130.8% of KMB water potential	▸ Annual emission reduction equivalent to 21.3-23 thousand people
	Cotton	Menemen-Bergama	▸ 28,4-60 million	▸ 237,8 million	▸ 12.3463.1 hm³ water savings ▸ 32.3-47.2 thousand tons of carbon emission reduction ▸ 72.9-81.3 million kWh energy savings ▸ Conservation of 10.3-11.5% of İzmir water potential and 30.4-33.9 % of Gediz Basin water potential	▸ Annual emission reduction equivalent to 6.5-9.4 thousand people ▸ Recovery of annual water needs of 191.6 thousand people
ENERGY	Forage Crops	Küçük Menderes Basin	▸ 3,9 million	▸ 90,2 million	▸ 0.8 hm³ water saving ▸ 2.3 million liters of diesel fuel savings ▸ 34,3 tons reduction in pesticide consumption ▸ 5.0 tons reduction in carbon emissions	▸ Annual emission reduction equivalent to one thousand people ▸ Recovery of annual water demands of 10 thousand people
	Cotton	Menemen-Bergama	▸ 1,7 million	▸ 93,8 million	▸ 0.6 hm³ water saving ▸ 1.6 million liters of diesel fuel savings ▸ 947.2 tons reduction in pesticide consumption ▸ 3.4 tons reduction in carbon emissions	▸ Annual carbon emission reduction equivalent to 677 people ▸ Recovery of annual water demands of 6.8 thousand people

Blue Opportunities

Sector / Field		Intervention	10 Year Gains			Total Cost
			Economic	Environmental	Social	
PORTS	**Revitalization of TCDD İzmir (Alsancak) Port**	Strengthening the capacity of TCDD İzmir Port	▸ $1,307 million increase in port revenues		▸ Employment of 700 people at the port ▸ Employment of 1.2 thousand people in non-port sectors	▸ $269.8 million infrastructure investment cost
		Realization of Kemalpaşa Logistics Center superstructure investment	▸ $200 million operating income		▸ Employment of 1.5 thousand people	▸ $67.7 million superstructure investment cost
		Establishment of the railway connection between TCDD İzmir Port and KLC	▸ 2 million TEU port handling capacity increase			▸ $162.5 million investment cost
	Restructuring of the North Aegean (Çandarlı) Port	Development of Çandarlı Port on the basis of wind energy	▸ $610 million increase in port revenues ▸ Increased wind equipment export revenues of $1,099 million ▸ Increased income tax revenues of $64.5 million		▸ Employment of 700 people at the port ▸ Employment of 8.5 thousand people in the wind energy equipment production sector	▸ $118 million investment cost
		Construction of the highway connection				▸ $13.5 million investment cost
		Clean Energy Specialized Organized Industrial Zone Investment	▸ Increase in wind equipment export revenues of $1,062 million ▸ Increase in income tax revenues of $64.5 million			▸ $66 million investment cost
		Construction of the railway connection				▸ $49.5 million investment cost
SHIP RECYCLING	**Development of the Rehabilitation Program**	Replacing the oxypropane gas cutting method with waterjet cutting	▸ $2.9 million reduction in oxygen consumption cost ▸ $9.9 million reduction in acetylene consumption cost	▸ 139 thousand tons of reduction in CO_2 emissions ▸ 69 thousand tons of reduction in acetylene consumption	▸ Emission reduction of 70 thousand people ▸ Keeping 1400 people away from fire risk	▸ $450 thousand investment cost
		Separating the wastewater, which is collected by the grids on the coastline, with the help of a separator and reducing the volume of wastewater	▸ $884 thousand reduction in transportation cost	▸ 11 tons of reduction in CO_2 emissions ▸ 396 thousand m^3 reduction in wastewater amount		▸ $220 thousand investment cost
		Establishment of a camera system that continuously monitors certain points in the coastal region	▸ $75 million reduction in petroleum contaminated shoreline cleanup cost	▸ Preventing 10 cases of petroleum marine pollution		▸ $12 thousand investment cost
AQUACULLTURE AND FISHING	**Identification of Opportunity Areas**	Development of coastal logistics facility infrastructure				
		Carrying out R&D activities for alternative feed use				
		Breeding of new species				
		Supporting blue biotechnology studies				

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