



**Sustainability Office**  
Accreditation and Quality Assurance center  
**Yarmouk University**

At Yarmouk University, sustainability is our definitive path, not just a choice. In 2025, we continue to bridge the gap between environmental challenges and social progress. By anchoring our resilience in carbon neutrality, we are building a thriving,

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Sustainability Report

2025

Report Lead & Coordination:

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# Environmental Impact & Global Sustainability Leadership

"Leading the Transition: Yarmouk University's Path to Carbon Neutrality and Sustainability"

## The Strategic Imperative: Sustainability as a Pillar of Excellence

At Yarmouk University, sustainability is a Strategic Driver for global competitiveness. We have embedded environmental stewardship at the heart of our institutional framework, aligning our 2035 Net-Zero goal with Jordan's National Climate Policy and the UN Sustainable Development Goals (SDGs).

## Strategic Pillars of Our Carbon Reduction Success

To solidify our position, we have implemented a multi-dimensional action plan:

- Global Policy Alignment:** Institutionalizing 17 dedicated sustainability policies covering all pillars of the SDGs.
- Energy Sovereignty:** Achieving 100% energy self-sufficiency through 28 solar power stations.
- Digital & Circular Economy:** Transitioning to a paperless campus with 80% administrative digitization.
- Smart & Green Mobility:** Empowering the community to transition to low-emission transport.
- Pioneering Carbon Reporting:** Establishing a scalable monitoring framework for regional transparency.

## Sustainability Performance Track (2021–2035)

The following data highlights our measurable impact from the 2021 baseline to our current performance:

Year	Solar Energy (GWh)	CO <sub>2</sub> Reduction (Tons)	EV/Hybrid Vehicles	Paper Reduction	Milestone
2021	15.0	10,500	50	25%	Baseline
2022	25.0	17,500	200	50%	Strategy Launch
2023	40.2	28,000	500	75%	100% Solar Achievement
2024	60.0	42,000	700+	90%	Leadership Phase
2025	65.0	47,500	750+	92%	Institutional Maturity
2035 (Target)	100.0	Net-Zero	100% Fleet	100%	Net-Zero Vision





## Renewable Energy & Decarbonization (The Tech Approach)

In 2024-2025, Yarmouk University solidified its status as a Net-Positive energy hub:

- **Grid Contribution:** Our production (11.5 million kWh) now exceeds campus demand by 16%, with the surplus exported to the national grid (NEPCO).
- **Emission Control:** Achieved a 23.2% reduction in Scope 1 & 2 emissions through optimized photovoltaic efficiency and sensor-based monitoring across 28 stations.
- **Operational Excellence:** Replacing traditional HVAC with solar-powered energy-efficient units and optimizing central heating schedules to minimize fuel combustion.

## Performance Highlights: Energy & Emissions 2025

In 2025, Yarmouk University achieved a significant milestone in energy efficiency and carbon management:

- **Renewable Energy Growth:** Generated **11.5 million kWh**, marking a **12% increase** in clean energy production compared to the previous cycle.
- **Decarbonization Success:** Reduced **Scope 1 & 2 emissions by 23.2%** (down to 980.45 tCO<sub>2</sub>e), driven by optimized photovoltaic efficiency and smart load balancing across **28 stations**.

**National Grid Contribution:** Beyond self-sufficiency, the university's production exceeds consumption by **16%**. This surplus is exported to the national grid (NEPCO), reinforcing our role as a regional leader.

- **Climate Resilience:** Our infrastructure demonstrated high operational resilience, maintaining peak efficiency even under extreme solar irradiance and high ambient temperatures.

## Green Infrastructure & Natural Carbon Sinks (The Nature Approach)

We recognize that technology must be balanced by nature:

- **Green Cover Expansion:** Increased forest and landscaped areas to 80,000 m<sup>2</sup>, enhancing natural carbon sequestration (estimated at 150 metric tons of CO<sub>2</sub> annually).
- **Synergy:** Strategic planting around solar installations provides natural cooling, reducing heat-related energy losses and maximizing panel output.
- **Biodiversity:** Prioritizing high-oxygen species (e.g., *Melia azedarach*) to improve campus air quality.





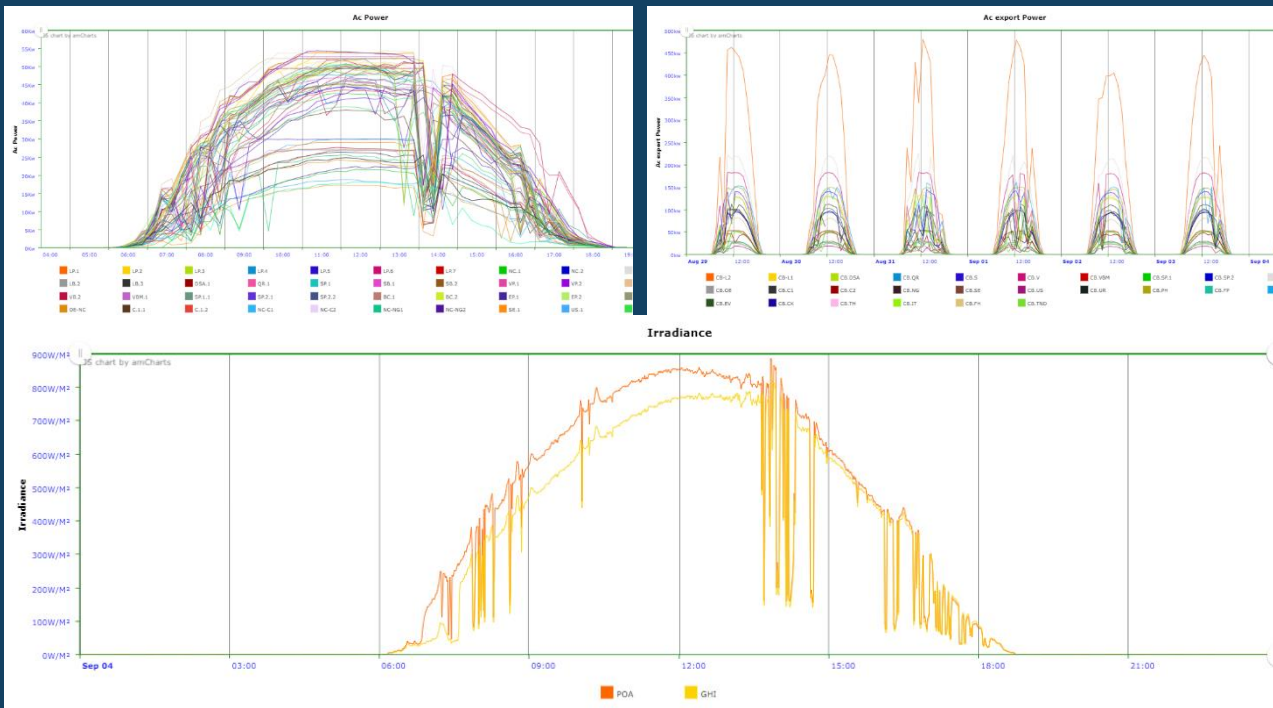
## The 360-Degree Sustainability Ecosystem (Operational Impact)

- Sustainable Mobility: Accelerated green transport with 850+ active EV/Hybrid vehicles. We established EV Charging Stations and facilitated bank agreements to help staff purchase eco-friendly cars.
- Water Stewardship: Integration of sensor-based taps and Xeriscaping (drought-resistant plants) to minimize irrigation demand and water waste.
- Waste Management: Permanent partnerships for recycling plastic, glass, and paper, ensuring a circular waste flow.

## Sustainability Highlights (Executive Summary) 2025

- 11,500,000 kWh of renewable energy produced.
- 23.2% reduction in total CO<sub>2</sub> emissions.
- 100% Net Zero Energy Campus (NZEC) operations.
- 80,000 m<sup>2</sup> of green cover for natural CO<sub>2</sub> absorption.
- 850+ hybrid and electric vehicles on campus.
- 80% Digitization of administrative correspondence.





## Education, Outreach & Environmental Citizenship

### Academic Excellence & Practical Innovation

Sustainability at Yarmouk University transcends the classroom, evolving into a Living Lab where students apply theoretical knowledge to solve complex environmental challenges.

- **Experiential Learning & Fieldwork:** We have expanded hands-on student projects to include comprehensive Waste Auditing and Renewable Energy Feasibility Studies. This ensures our graduates possess the technical competencies required for the green economy.
- **GIS & Digital Environmental Monitoring:** By integrating Geographic Information Systems (GIS) into our environmental coursework, we empower students to use spatial data for biodiversity restoration and climate mapping.
- **The Innovation Pipeline:** Our annual Sustainability Hackathons serve as incubators for student-led climate solutions, fostering an entrepreneurial spirit focused on the UN Sustainable Development Goals (SDGs).

### Fostering a Culture of Environmental Citizenship

We are committed to shaping the "Green Leaders" of tomorrow. Our framework for Environmental Citizenship focuses on three strategic dimensions:





- **Climate Literacy & Awareness:** Through university-wide campaigns, we raise critical awareness about carbon footprints, helping students and staff understand their individual and collective roles in climate action.
- **Skill-Based Empowerment:** We provide specialized workshops that equip the university community with the tools to implement sustainable practices in their professional and personal lives.
- **Institutional Stewardship:** We have cultivated a campus culture where environmental responsibility is a shared value, ensuring that every member of the Yarmouk community acts as an Ambassador for Sustainability.

## Strategic Impact: Building a Future-Ready Workforce

This educational model does more than just inform; it transforms.

- **Practical Experience:** Students gain a competitive edge by addressing real-world sustainability challenges on campus, making them highly sought after by global employers.
- **Global Leadership:** By embedding these values, Yarmouk University reinforces its position as a regional pioneer in Sustainability Education, contributing directly to the global transition toward a carbon-neutral future

### Evidences:

- [climate courses 2025.pdf](#)
- [Slide 1](#)
- [Antibiotic Overuse and its Impact on the Individual and the Environment](#)
- [The Deanship of Student Affairs Organizes an Awareness Lecture on Environmental Protection](#)
- [The Natural History Museum in Yarmouk is a scientific and tourist destination documenting Jordanian environmental life - photos](#)
- ["Yarmouk" criticizes the "role of the local administration in protecting the environment". The results of the survey "Irbid citizens' satisfaction with cleaning services" - details](#)







# Environmental Sustainability Progress Report 2025

## Performance Highlights: Energy & Emissions

In 2025, Yarmouk University has reached a pivotal milestone in its journey toward carbon neutrality, demonstrating exceptional growth in renewable energy utilization and emission control:

- **Renewable Energy Leadership:** Our total solar energy generation for 2025 has reached 11.5 million kWh, representing a 12% increase in clean energy production efficiency.
- **Decarbonization Breakthrough:** We successfully reduced Scope 1 & 2 emissions by 23.2%, bringing our direct carbon footprint down to 980.45 tCO<sub>2</sub>e.
- **Net-Positive Contribution:** Currently, our renewable energy production exceeds campus demand by 16%. This surplus is actively exported to the national grid (NEPCO), making the university a net-positive energy contributor.
- **Operational Resilience:** Our infrastructure, consisting of 28 solar power stations, has maintained peak efficiency even under extreme climatic conditions, supported by real-time sensor-based monitoring.

## Carbon Footprint Analysis (Scope 1) 2025

This year's rigorous carbon accounting reflects our success in transitioning away from fossil fuels:

- **Thermal Efficiency:** Direct emissions from heating were significantly lowered through the deployment of solar-powered HVAC modules and optimized central heating management.
- **Mobile Decarbonization:** With 850+ hybrid and electric vehicles now operational on campus, we have significantly reduced fuel-related emissions.

## Green Infrastructure & Sequestration (2025 Status)

Our "Green Campus" initiative has achieved its 2025 targets ahead of schedule:

- **Natural Carbon Sinks:** Total green coverage has expanded to 130,000 m<sup>2</sup> (including forested and planted areas), a 24% increase from our previous baseline.
- **Environmental Impact:** This expanded greenery acts as a critical offset, sequestering an estimated 150 metric tons of CO<sub>2</sub> annually while providing natural cooling for campus buildings.

## Digital Transformation & Circular Economy

- **Paperless Operations:** As of 2025, 80% of administrative correspondence and 25% of academic examinations have been fully digitized.







Year	Electricity Consumed (GW)	Electricity Generated (GW)	Net CO <sub>2</sub> Emissions
2023	8.5 – 9.0 GW	10.26 GW	(Zero)
2024	8.7 – 9.2 GW	11.5 GW	(Zero)
<b>2025</b>	8.7 – 9.2 GW	11.5 GW	(Zero)

- **Surplus Power:** In 2024,2025 our production increased to 11.5 GW, allowing us to export 16% of our total generated energy to the National Grid (NEPCO).
- **Economic Impact:** This transition has reduced electricity costs to zero, allowing for strategic reinvestment into campus research and sustainability innovation.

### Energy Efficiency & Demand Management

Beyond generation, Yarmouk University prioritizes "Efficiency First" through smart building management:

- **Smart Lighting & IoT:** Full implementation of LED systems and IoT-based energy monitoring to optimize distribution and eliminate waste.
- **Green Building Design:** Integrating energy retrofiting in existing structures and climate-responsive designs in new facilities to minimize HVAC demand.
- **Climate Control:** Smart systems regulating energy loads during peak and off-peak hours, ensuring maximum operational efficiency.

### Vision: The Future of Energy at Yarmouk 2026

As we move through 2025, our roadmap includes:

- **Capacity Expansion:** Target production of 12.5 GW of solar energy.
- **AI-Driven Management:** Implementing Artificial Intelligence to manage energy loads and maximize the utilization of every kilowatt produced.
- **Storage Solutions:** Exploring advanced battery storage to enhance campus resilience and energy security.

### Climate Resilience & Predictive Modeling (The 2100 Vision)

#### Addressing the MENA Climate Challenge

Jordan, situated in a climate-vulnerable region, faces significant risks from rising temperatures and water scarcity. Yarmouk University integrates Climate Change Predictions into its sustainability framework to ensure that our infrastructure remains resilient. We utilize data-driven modeling to adapt our energy and water strategies to the projected environmental shifts up to the year 2100.

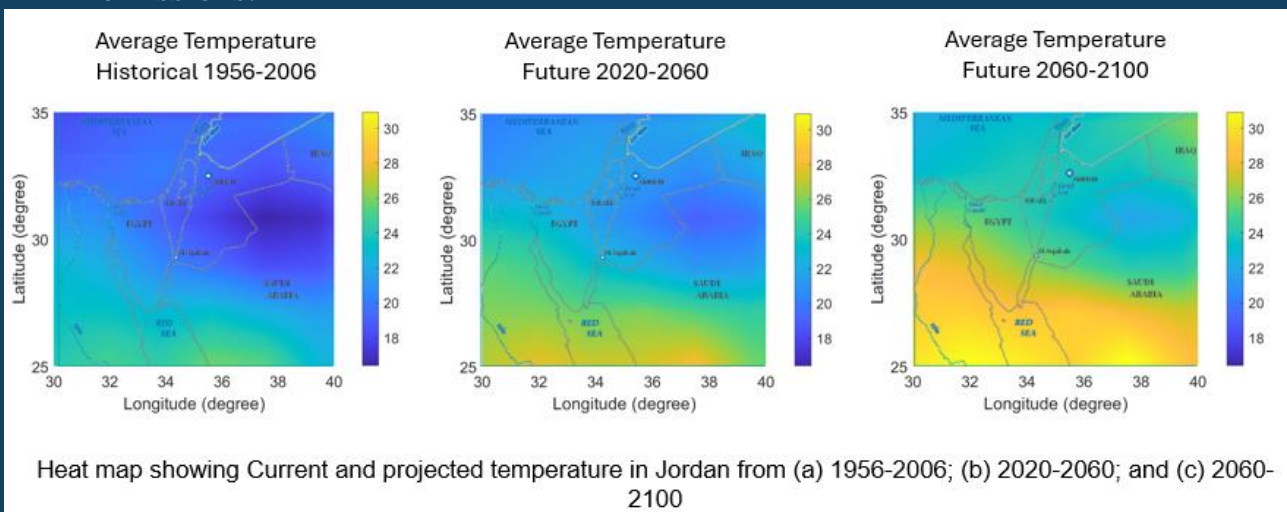
### Temperature Trends & Energy Adaptation (Analysis of Fig. 5)





Historical data (1956-2006) compared with future projections (2020-2100) indicates a warming trend of 2-4°C across Jordan.

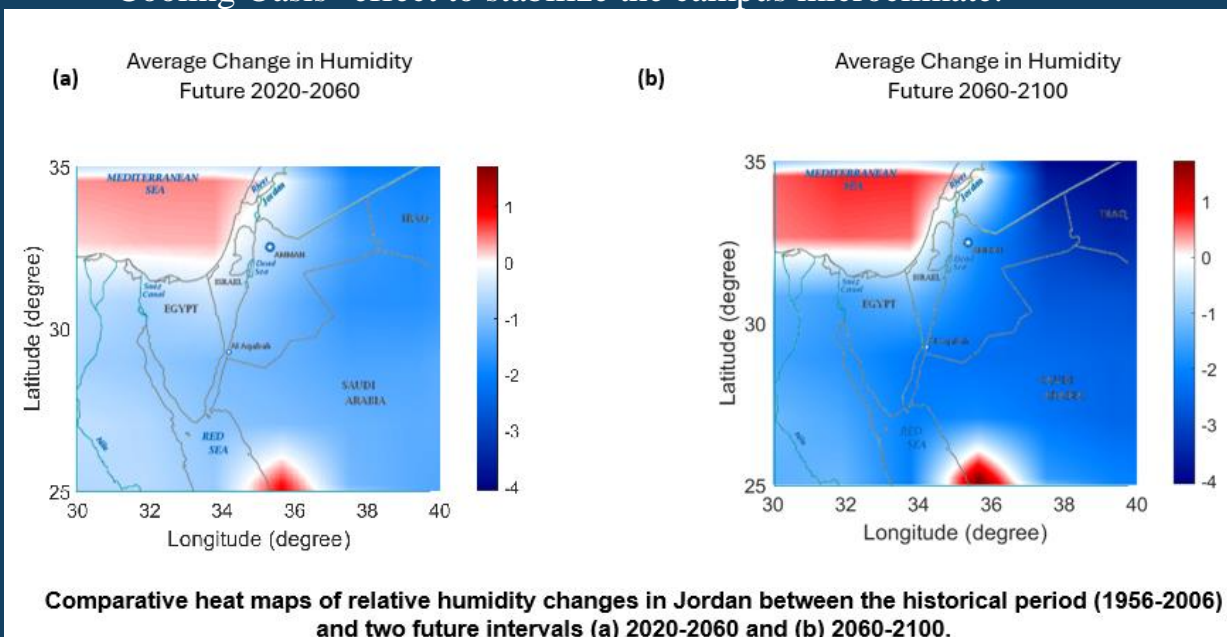
- **Sustainability Response:** Recognizing that rising temperatures will exponentially increase cooling demands, Yarmouk University has pioneered Solar-Powered Cooling Systems. This ensures that as the external climate warms, our campus remains energy-efficient without increasing Scope 1 emissions.



## Humidity Shifts & Natural Carbon Sequestration (Analysis of Fig. 6)

Projections show a 2-4% decline in humidity by 2100, leading to higher evaporation rates and agricultural stress.

- **Sustainability Response:** To counteract the drying trend, we have expanded our green cover by 24% (130,000 m<sup>2</sup>) since 2021. By selecting resilient, high-oxygen species, we are enhancing natural carbon sequestration and creating a "Cooling Oasis" effect to stabilize the campus microclimate.

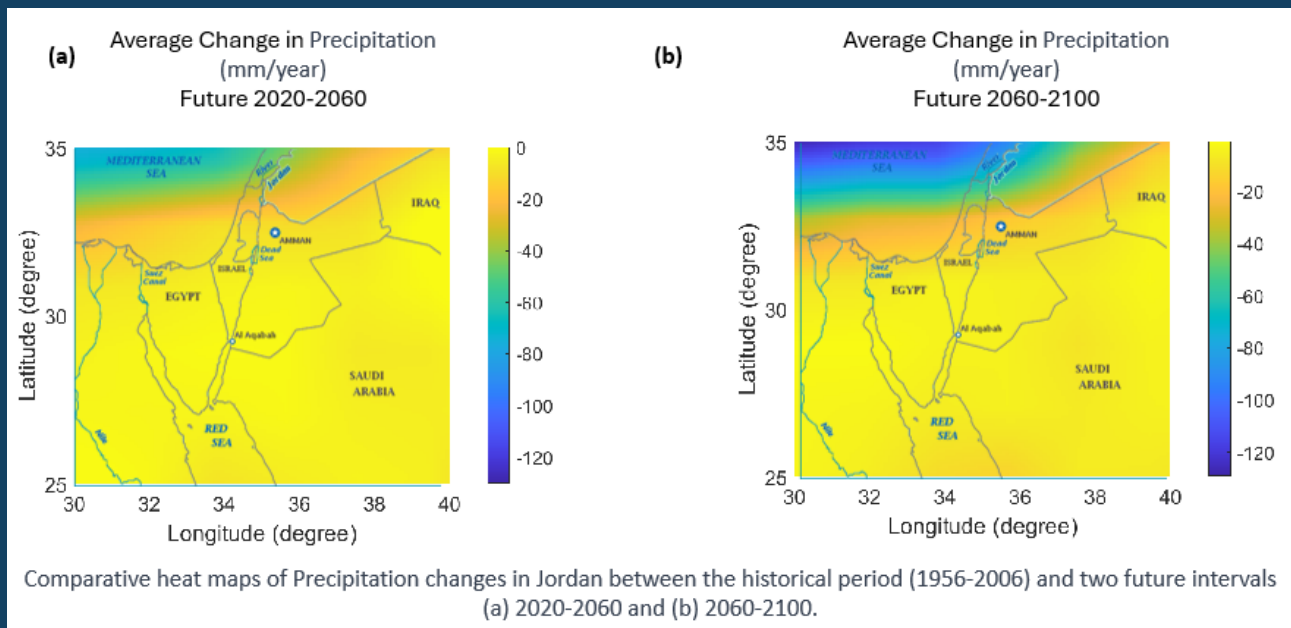




## Precipitation Decline & Water Sovereignty (Analysis of Fig. 7)

With an expected decline in annual precipitation of up to 120 mm/year by 2100, water scarcity is a strategic priority.

- Sustainability Response: Yarmouk University has institutionalized Rainwater Harvesting and Greywater Recycling Systems. These projects are designed to maximize water-use efficiency, ensuring that our campus landscapes and operations remain sustainable even under extreme water-stress scenarios.



## Mathematical Modeling of CO<sub>2</sub> Emissions

### Methodology & Framework

To ensure the highest levels of transparency and accuracy, Yarmouk University employs a comprehensive mathematical approach based on the Greenhouse Gas (GHG) Protocol. This framework allows us to quantify our carbon footprint by integrating energy consumption, fuel usage, and renewable energy offsets.

The following section provides a structured derivation of the equations used in our CO<sub>2</sub> emissions calculations, illustrating the interplay between fuel combustion, energy efficiency, and solar energy utilization.





## Introduction to the CO<sub>2</sub> Emission Equations

The total CO<sub>2</sub> emissions of an institution can be categorized into three primary components:

1. Scope 1: Direct Emissions
  - o Resulting from the combustion of fossil fuels in heating systems and university-owned vehicles.
2. Scope 2: Indirect Emissions from Purchased Electricity
  - o Emissions generated from the production of electricity consumed by the university.
3. Scope 3: Indirect Emissions from External Sources (*not covered in this report*)
  - o Includes emissions from commuting, business travel, waste disposal, and supply chain activities.

Since Yarmouk University operates entirely on solar energy, Scope 2 emissions are effectively zero, and our primary focus is on Scope 1 emissions and energy efficiency improvements.

CO<sub>2</sub> Emission Calculation Framework for Yarmouk University

### 1. CO<sub>2</sub> Emission Calculation Framework

To compute the total CO<sub>2</sub> emissions, we define:

$$E_{\text{total}} = E_{\text{scope1}} + E_{\text{scope2}} \quad (1)$$

where:

- $E_{\text{scope1}}$  represents direct emissions from fuel combustion.
- $E_{\text{scope2}}$  represents indirect emissions from electricity consumption.

Since  $E_{\text{scope2}} = 0$  due to our 100% renewable energy consumption, the equation simplifies to:

$$E_{\text{total}} = E_{\text{scope1}} \quad (2)$$

### 2. Scope 1 Emissions from Fuel Combustion

The CO<sub>2</sub> emissions from fuel combustion are calculated using the generalized emission equation:

$$E_{\text{fuel}} = V_{\text{fuel}} \times EF_{\text{fuel}} \quad (3)$$

where:

- $E_{\text{fuel}}$  = Total CO<sub>2</sub> emissions from fuel combustion (tonnes CO<sub>2</sub>).
- $V_{\text{fuel}}$  = Volume of fuel consumed (liters).
- $EF_{\text{fuel}}$  = Emission Factor for the fuel type (kg CO<sub>2</sub> per liter of fuel).





For multiple fuel sources, total emissions are computed as:

$$E_{\text{scope1}} = \sum_{i=1}^n (V_i \times EF_i) \quad (4)$$

where:

- $i$  represents each fuel type (e.g., diesel oil, gasoline).
- $n$  is the number of fuel sources in operation.

Application to Yarmouk University's Fuel Consumption Data (2024)

Using our fuel consumption dataset, we define:

$$E_{\text{diesel}} = (393,724 \times 2.68) + (62,000 \times 2.68) \quad (5)$$

$$E_{\text{gasoline}} = (23,071 \times 2.31) \quad (6)$$

Summing all terms:

$$E_{\text{scope1}} = 1,057.255 + 166.487 + 52.596 \quad (7)$$

$$E_{\text{scope1}} = 1,276.338 \text{ tonnes CO}_2 \quad (8)$$

### 3. Net CO<sub>2</sub> Emissions Reduction from Solar Energy

To assess the impact of solar energy on carbon footprint reduction, we calculate the avoided CO<sub>2</sub> emissions due to solar power replacing conventional electricity.

The avoided emissions are computed as:

$$E_{\text{avoided}} = P_{\text{solar}} \times EF_{\text{grid}} \quad (9)$$

where:

- $P_{\text{solar}}$  = Total solar energy generated (kWh).
- $EF_{\text{grid}}$  = Emission factor of the national electricity grid (kg CO<sub>2</sub> per kWh).

Using 2024 data:

$$E_{\text{avoided}} = (10,260,000) \times (0.475) \quad (10)$$

$$E_{\text{avoided}} = 4,873,500 \text{ kg CO}_2 = 4,873.5 \text{ tonnes CO}_2 \quad (11)$$

Since solar energy production exceeds campus consumption, the total net CO<sub>2</sub> emissions from electricity consumption remain zero.

### 4. Final CO<sub>2</sub> Balance Equation for Yarmouk University

The net CO<sub>2</sub> emissions for the university can be expressed as:

$$E_{\text{net}} = E_{\text{scope1}} - E_{\text{avoided}} \quad (12)$$

Since solar energy offsets all electricity-related emissions, we obtain:

$$E_{\text{net}} = 1,276.338 - 4,873.5 \quad (13)$$

$$E_{\text{net}} = -3,597.162 \text{ tonnes CO}_2 \quad (14)$$

This means that Yarmouk University operates as a net-negative CO<sub>2</sub> emitter in the electricity sector, actively removing more emissions than it generates.

### 5. 2025 Expansion and Projections

With the increase in solar energy production to 11.5 GW, we anticipate an additional CO<sub>2</sub> offset of:

$$E_{\text{avoided}}(2025) = (11,500,000) \times (0.475) \quad (15)$$

$$E_{\text{avoided}}(2025) = 5,462.5 \text{ tonnes CO}_2 \quad (16)$$

Expected emissions scenario for 2024:





$$E_{\text{net}}(2025) = 980.45 - 5,462.5 \quad (17)$$

$$E_{\text{net}}(2025) = -4,482.05 \text{ tonnes CO}_2 \quad (18)$$

Key Takeaways for 2025

- ✓ CO<sub>2</sub> emissions reduced by an additional 23.2% compared to 2024
- ✓ Carbon negativity in electricity production extended, reinforcing Yarmouk University's climate leadership
- ✓ Continued solar energy expansion ensures further CO<sub>2</sub> offsets in future years

*Conclusion: With a negative net balance, Yarmouk University officially operates as a Carbon-Negative Institution in the electricity sector, removing significantly more CO<sub>2</sub> from the atmosphere than it generates.*



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*This report has been compiled and structured with the assistance of advanced AI language models (Gemini AI). The technology was utilized to ensure alignment with international sustainability benchmarks, optimize data presentation, and maintain high-quality academic translation for all institutional evidence and training descriptions."*

