

Towards Optimal and Sustainable Energy Systems in HU Campus.



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Outlines



01 PV projects at HU

02 Smart and new energy projects

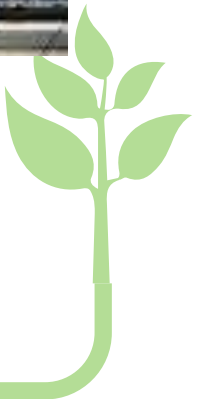
03 Research lab, Training Courses
and Community service

PV projects at HU

The Hashemite University is considered as leading university in the country specially in renewable energy sector. The University built a solar-power plant with a capacity of 5 Mega watts to cover the energy and electricity needs of the university.



4 MW PV FARM





12,954

Total # of PV modules
(310 Wp)



127

Total # of Distributed Generation
DC/AC Inverters



70,000 m²

Total Area of Solar Farm



4

Number of LV-MV Transformers



81.2%

Coverage of total campus
power needs



40.8%

Internal Rate of Return (IRR)



JD 4.5 million

(US\$6.35 million)
Initial Investment



JD 14.74

(US\$20.82 million)
20-year Net Present Value (NPV)



3.28

Return On Investment



2 year 4 months

Payback Period



7.23 GWh

Annual Energy Generation



1,414

Total # of Homes That can be
completely powered
(@ 426 kWh/month/home)



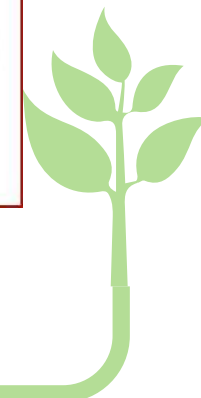
3,615 tons

Amount of Annual
CO2 Emissions Reduction

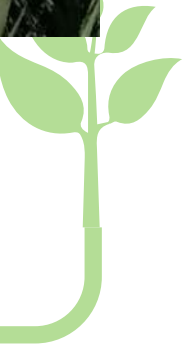


20,510 Oil Barrels

Reduction in the dependency on-
and burning of fossil fuels



1 MW - Pedestrian Walkways and Carparks





3,284

Total # of PV modules
(310 Wp)



48

Total # of Distributed Generation
DC/AC Inverters



7,000 m²

Total Solar Canopies' Shaded
Area



178

Total # of Solar Car Parks



18.8%

Coverage of total campus
power needs



27.8%

Internal Rate of Return (IRR)



JD 1.5 million

(US\$2.12 million)
Initial Investment



JD 2.96

(US\$4.18 million)
20-year Net Present Value



1.97

Return On Investment



3 year 4 months

Payback Period



1.68 GWh

Annual Energy Generation



328

Total # of Homes That can be
completely powered
(@ 426 kWh/month/home)



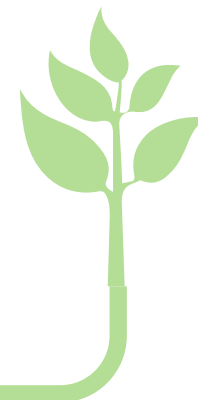
840 tons

Amount of Annual
CO2 Emissions Reduction

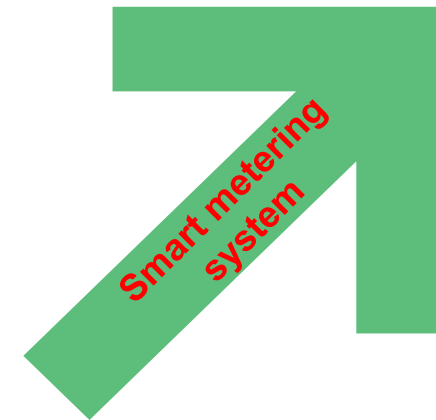
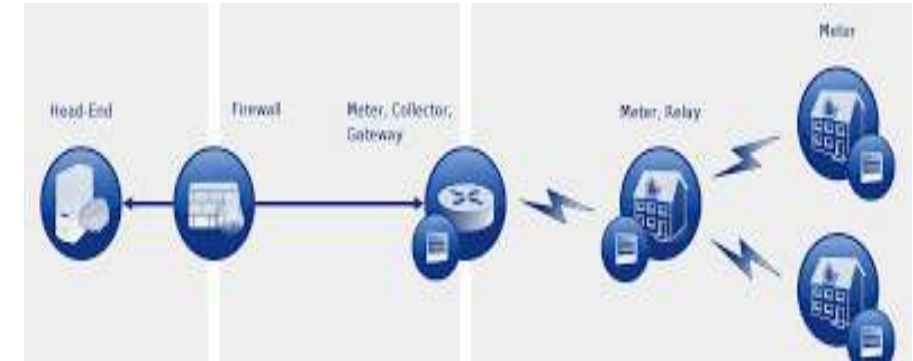


4,765 Oil Barrels

Reduction in the dependency on-
and burning of fossil fuels



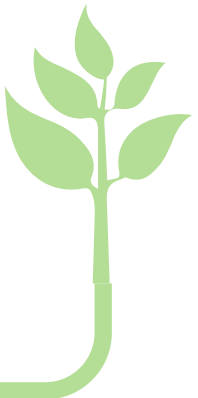
Smart and new energy projects



Upgrading the PV projects

In 2023, to upgrade the university's solar energy projects system "Advance PV SCADA System" at the university is established for enhancing its production efficiency, and monitoring maintenance using smart and modern systems. This project aims to:

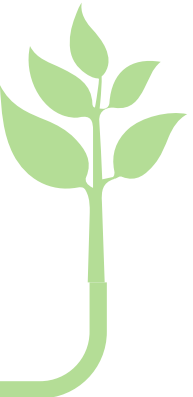
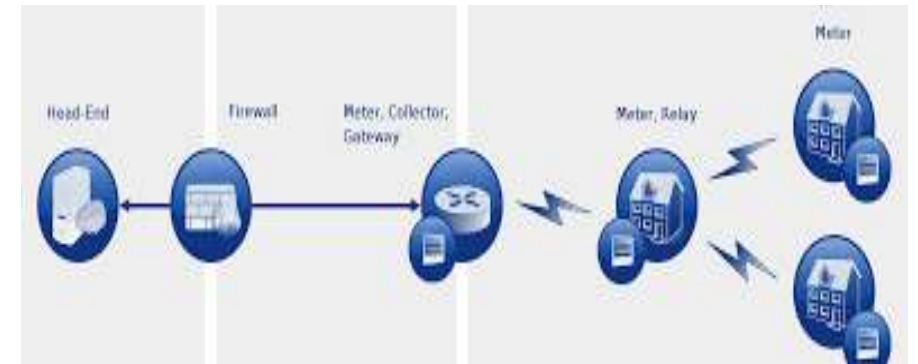
- ✓ Improve generation efficiency and reduce maintenance costs
- ✓ Provide accurate data on productivity and maintenance.
- ✓ Establish a research database
- ✓ Establish as a student training station.
- ✓ Establish a national expertise center to disseminate energy auditing experience and awareness.



Smart Energy Meter and Energy Management System

This project aims to remotely monitor and control building energy consumption and improve energy efficiency. The IoT-based Smart Meter system implementation began at the end of 2023 and will be operational in the coming months for all buildings at Hashemite University. This project aims to:

- ✓ Monitor energy consumption in buildings remotely.
- ✓ Improve energy usage efficiency.
- ✓ Provide accurate data on energy consumption, maintenance, and loss.
- ✓ Establish a research database.
- ✓ Establish a student training station.
- ✓ Establish a national expertise center to disseminate energy auditing experience and awareness.

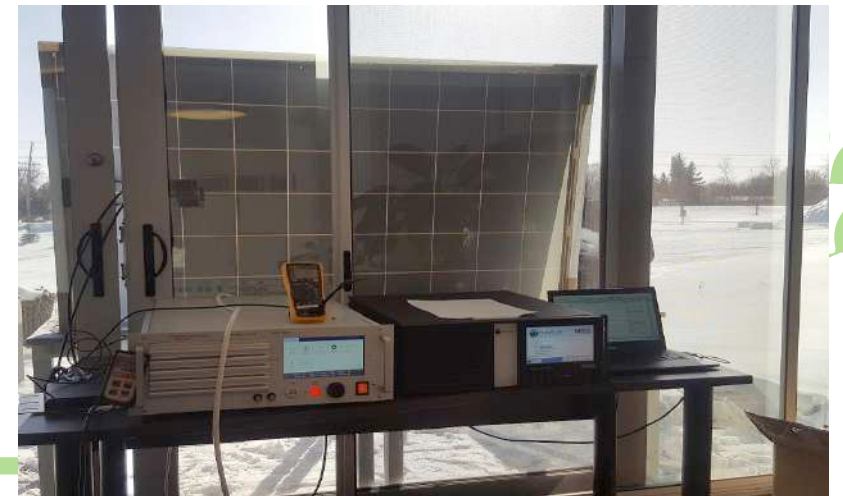
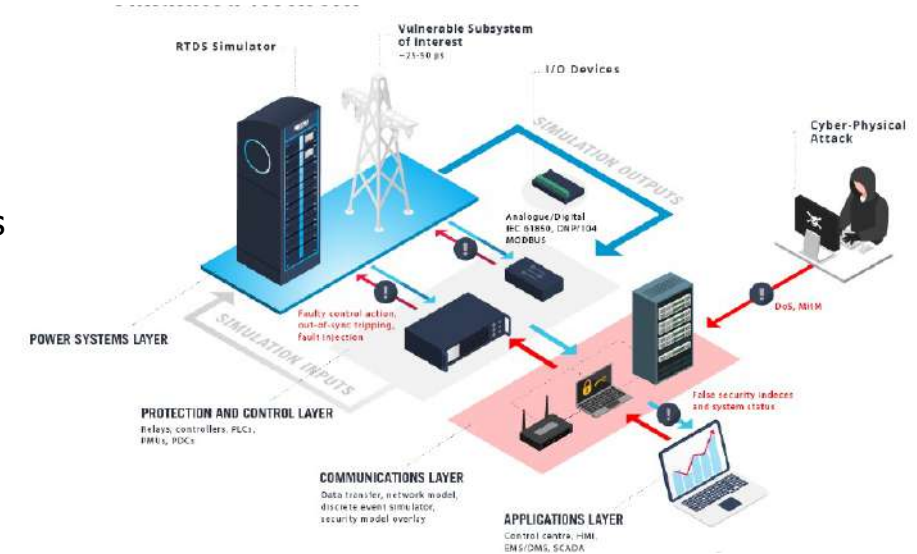


Research lab, Training Courses and Community service

Smart grid research lab

Project Title: Analysis of Smart Grid Resilience under Cyber-Physical Threats (2023-2025).

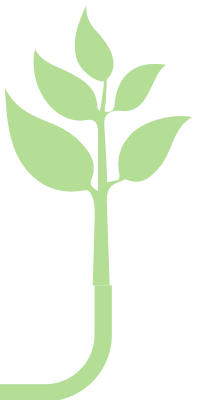
- ✓ Smart grids generally rely on the use of modern communication tools, Internet of Things, and emerging technologies applied to existing power networks to enable users to have bidirectional communication and control capabilities. Therefore, securing the smart grid from these attacks is essential to achieve reliable energy system operation, with reduced possibilities of power outages or equipment failure at high, medium, and low voltage levels.
- ✓ The project aims to enhance understanding of the needs and challenges of smart grid security and address them, as it is important to address and evaluate cyber-physical threats using HIL testbed.
- ✓ Subsequently, a number of practical experiments will be conducted on different parts and devices within the power grid (at various levels) to analyze the impact of cyber-physical threats on them. These experiments will be based on applying proposed cyber-attacks on the power grid to evaluate the performance of Intelligent Electronic Devices (IEDs) and protection plans within substations, remote reading systems, and renewable energy systems.



Training Courses and Community service

The Renewable Energy Center serves as a dynamic platform for students to gain practical training in renewable energy technologies and sustainable practices. Through workshops, seminars, and hands-on sessions, students acquire valuable skills that align with real-world applications. By immersing themselves in renewable energy projects, students learn to harness the potential of green technologies, thus bolstering their competence and expertise in the field

- ✓ During 2022, more than 70 undergraduate and graduate students received their technical field training and research during the commencement and operation of the project.
- ✓ Free renewable energy training course over three weeks for students and local community (more than 30 students) during May 2023.
- ✓ In 2022/2023, the renewable energy center and PV project has received more than 300 visitors from outside the university in 40 visits. The center also holds a free two weeks training for the university student about designing and implementation PV system
- ✓ Supporting Graduation Projects:
- ✓ As the culmination of their academic journey, students undertake graduation projects that address real-world challenges and contribute to sustainable solutions. The Renewable Energy Center serves as a valuable resource, providing mentorship, technical guidance, and research support to students undertaking projects related to sustainability





Student's project

*Nano coating material to enhance PV performance.

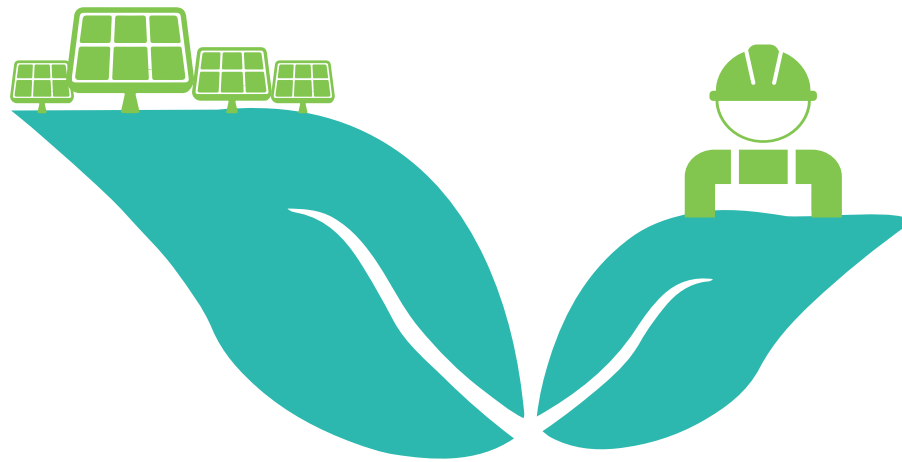


* ION



Visits





Thank You