Impacts and promotion of SDGs

SE technologies hold substantial potential for promoting SDG 1 (No Poverty), SDG 9 (Industry, Innovation, and Infrastructure) and SDG 13 (Climate Action) by enhancing energy access and reliability, improving living standards, driving economic growth, increasing efficiency and sustainability of industrial processes and infrastructure. The integration of digital technologies such as AI, ML, and IoT into energy systems amplifies these impacts by optimizing energy distribution and consumption.

The promotion of SDGs occurs at both the country level, where governments establish enabling environments for adopting smart energy solutions, and the technology level, where technological innovations optimize energy efficiency, integrate renewables, and reduce emissions.

Key Technologies	1 NO POVERTY	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	13 CLIMATE ACTION	Co-Benefit SDGs	Rationale for Co-Benefit SDGs
Smart grids				7, 11	Enable better integration of renewable energy sources, improve energy efficiency, and enhance the sustainability and resilience of urban energy systems.
Digital twin				4, 8	Promotes quality education through advanced learning tools and improves industry processes
Virtual power plants				7, 11	Fosters affordable clean energy access and helps cities manage energy more sustainably and efficiently
Supercapacitor in hybrid storage				7, 11	Enhances clean energy use and enhances the resilience and efficiency of urban energy systems
Cloud and edge computing				4, 8	Supports quality education with better data management and creates new job opportunities
Distributed ledger technology (DLTs) / Blockchain				8, 16	Streamlines business processes and facilitates secure and transparent transactions
Cell-to-chassis battery technology				7, 11	Enhances sustainable energy use and supports industry innovation and the development of greener cities
Rail-to-grid energy storage system				7, 11	Stores and manages renewable energy and supports sustainable cities manage energy more efficiently

VPPs provide an example of how innovative systems can enhance energy reliability and sustainability by integrating distributed energy resources such as solar panels, battery storage systems, and smart grid technologies into a decentralized network. Utilizing advanced IoT, AI, and real-time data analytics, VPPs optimize energy production and consumption, supporting various SDGs.

VPPs address SDG 1 by providing access to affordable and reliable electricity to underserved communities, thereby reducing energy poverty, and facilitating economic activity.

They contribute to SDG 9 as they enhance the resilience of energy infrastructure using innovative technologies. SDG 13 is promoted through the optimized use of renewable energy and improved energy efficiancy which lead to significant reductions in greenhouse gas emissions.

There are also co-benefits for other SDGs. VPPs support SDG 7 (Affordable and Clean Energy) by ensuring access to sustainable energy sources, and benefit SDG 11 (Sustainable Cities and Communities) by enhancing the sustainability and resilience of urban and rural environments.

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Vienna International Centre
Wagramerstr. 5, P.O. Box 300,
A-1400 Vienna, Austria

https://a2dfacility.unido.org

A2DFacility@unido.org

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