Energy Efficiency Improvement

Renewable Energies | Energy Efficiency Improvement

As already stated, there are two main solutions to reducing CO_2 emissions and to overcoming the climate change problem: replacing fossil fuels with renewable energy sources as much as possible and through enhancing energy efficiency. Energy efficiency for an electricity network could be considered in different stages, such as the power generation, transmission, distribution and consumption. The different technologies that are currently available include electric vehicles (EV), combined heat and power (CHP), virtual power plants (VPP) and smart grids.

Electric Vehicles

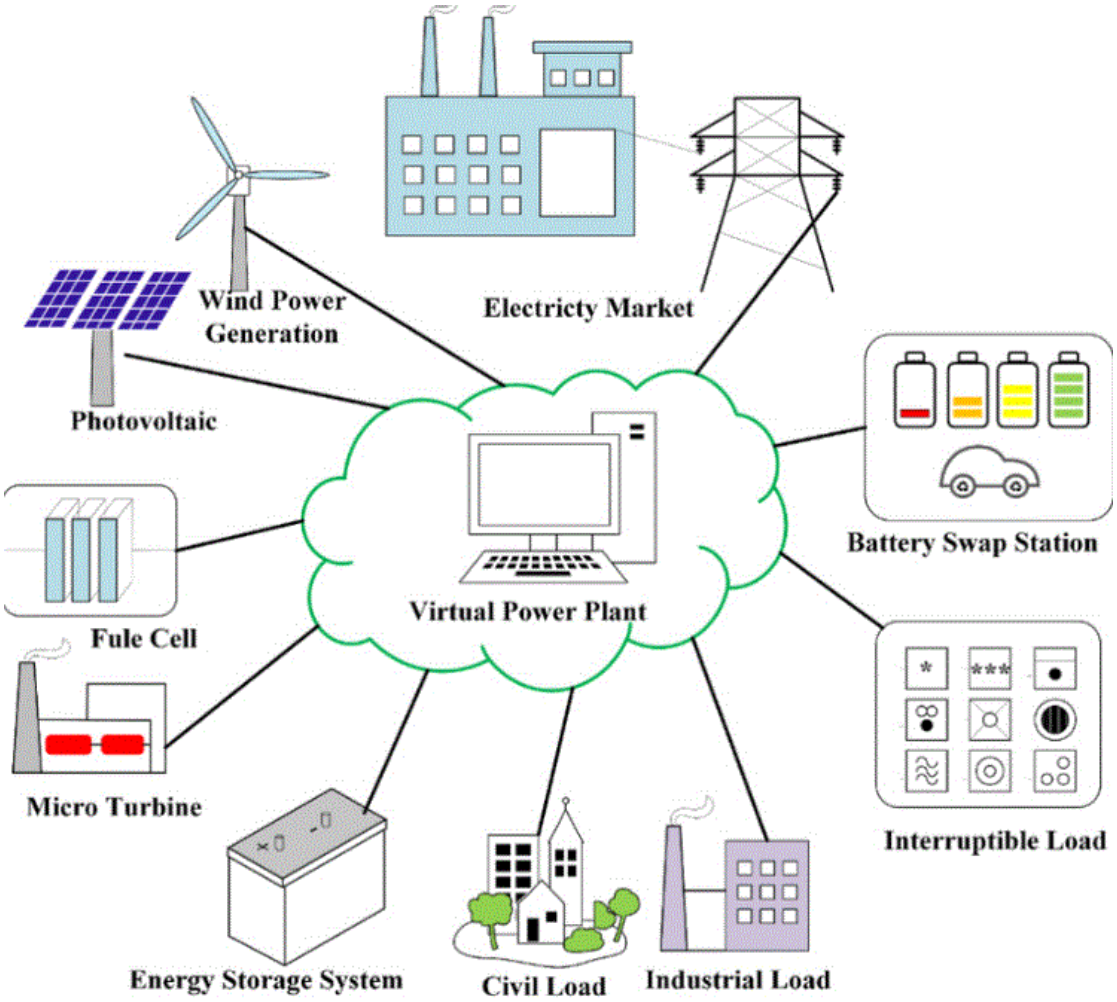
Electric vehicles (EV, including the battery, fuel cell, and hybrid types) have the potential to be considered viable options for both electricity storage and power generation. Considering that the transportation sector is one of the main sources of emissions, improving fuel efficiency enables us to achieve the largest fuel savings and CO_2 reduction in the short term. Thus, the increased usage of EVs and increasing their share of the vehicle fleet can play a key role in the long term. IEA forecasted an increased share of plug-in hybrid electric vehicles (PHEV) over the next two decades, with a total increase of up to 50% by 2050. In long-term, smart grid technology may enable EVs to be used as distributed storage devices, feeding electricity stored in their batteries back to the system when needed (vehicle to grid), to help provide peak-shaving capability. Environmental and transportation

policy, as well as public financial incentives regarding a carbon tax, can influence the early and comprehensive implementation of EVs[31]

Combined Heat and Power

Cogeneration, or combined heat and power (CHP), is the use of heat and electric power together. It is expected to have a substantial gain in efficiency over each source separately. Most power distribution companies supply only electricity, not hot water or steam. Considering that almost 30-40% of a country's total energy load is used for heating, CHP is an efficient use of fuel when a portion of the energy is discarded as waste heat. It captures some or all of the waste energy as a by-product for heating. According to the WEO report, the average efficiency of power plants is 41% worldwide, with almost 60% of the primary energy being converted to waste heat [32]. CHP could transform a significant part of the waste heat into a positive economic value for industrial processes or heating in residual and commercial buildings. It is estimated that new CHP units could improve energy efficiency to a level greater than 85% [33].

Virtual Power Plant



A Virtual Power Plant (VPP) is a cluster of distributed energy resources, such as micro-CHP, wind turbines, and solar photovoltaic panels, which are controlled and managed by a central control unit. The term distributed energy resources (DER) can be used for fossil or renewable energy fuels. A DER system has been defined in order to overcome energy waste problems due to long distances and transmission losses. Therefore, DERs are generally located close to the distribution networks. The concept of VPP is used for DER integration. According to the Europe FENIX project, there are two types of VPPs, the Commercial VPP (CVPP) and the Technical VPP (TVPP) [34]

DERs can simultaneously be part of both a CVPP and a TVPP. A

commercial VPP is defined as a portfolio that could be used by a DER to participate in electricity markets. CVPPs can represent a DER from any geographic place in an electricity network. A technical VPP enables operators to facilitate DER energy capacity and optimize the power balance in the system with the minimum cost [35] .

The share of distributed generation (DG) in an electricity network is increasing in importance and VPP is considered to be an emerging technology that enhances energy efficiency.

Smart meter

The most important objective for power generation companies in demand side management is to reduce peak demand during a certain period. In this regard, a smart meter is a device to record the consumption of electricity in hourly intervals and the information is monitored by both the utility and customer. A smart meter is able to have two way communication and intelligence management for home appliances.

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[31] *IEA. World Energy Outlook 2012: OECD Publishing*

[32] *https://www.iea.org/newsroom/news/2016/november/world-energy-outlook-2016.html*

[33] *A Review of Renewable Energy Supply and Energy Efficiency Technologies, IZA DP No. 8145*

[34] *Kieny, C., Berseneff, B., Hadjsaid, N., Besanger, Y., & Maire, J. (2009). On the concept and the interest of Virtual*

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[35] *Pudjianto, D., Ramsay, C., & Strbac, G. (2007). Virtual power plant and system integration of distributed energy resources. Renewable power generation, IET, 1(1), 10-16.*