

# Transformation of microgrid to virtual power plant – a comprehensive review

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**Abstract—** To provide continuity of balancing demand and generation, renewable sources will be more active than today in near future due to the tendency of massive investment on renewable energy sources (RESs) by countries. However, due to the uncertain and intermittent nature of RESs, RESs would create problems on power system operations such as power quality, efficiency, stability and reliability. Owing to having problems with RESs integration, virtual power plant (VPP) has introduced to make this integration smooth without compromising the grid stability and reliability along with offering many other techno-economic benefits. This study reviews structures, types, architecture and operations of VPP along with the status of present implementations worldwide. The types of VPP are introduced in details with the optimisation algorithm used with each type. In addition, VPP is linked with the most of the components in power systems such as distributed generation, active prosumers, transmission system operator and distribution system operator, grid services such as fault ride through, reactive power control as well as with the help of technology such as communications, control and optimisations. This study gives a comprehensive outline of transforming microgrid to VPP that is useful for researchers, consumers, prosumers and utility operators.

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