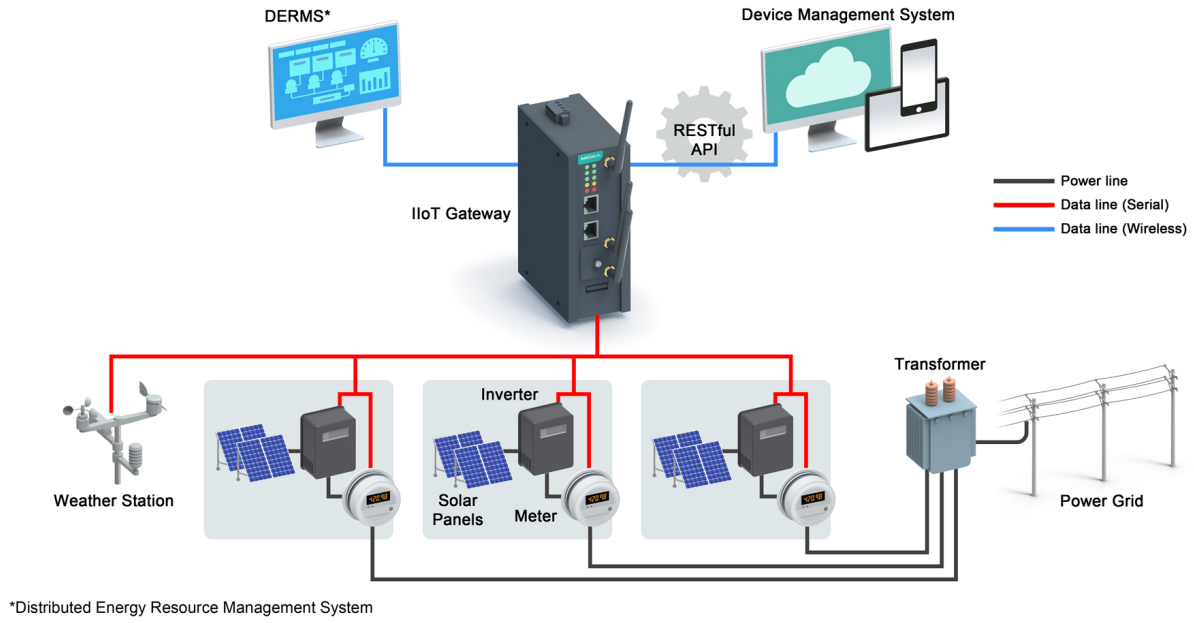
# How to Enable IIoT Connectivity for Virtual Power Plants

## In the new power economy, virtual power plants (VPPs) are showing the way by making it possible to aggregate power from various distributed energy resources, providing and efficient platform for green energy trading. We discuss the key challanges faced by VPP operators and how IIoT connectivity can help them overcome these challenges




Declarations of climate emergencies in many countries around the world have created
awareness for the needs to switch to clean energy sources, which in turn has prompted the power
industry and governments to take action or set definite goals. Governments around the world
now provide incentives to individuals, industries, and communities who are interested in
generating and using power from renewable energy sources such as solar and wind energy
Power grids have seen many changes that have enabled the integration of power from

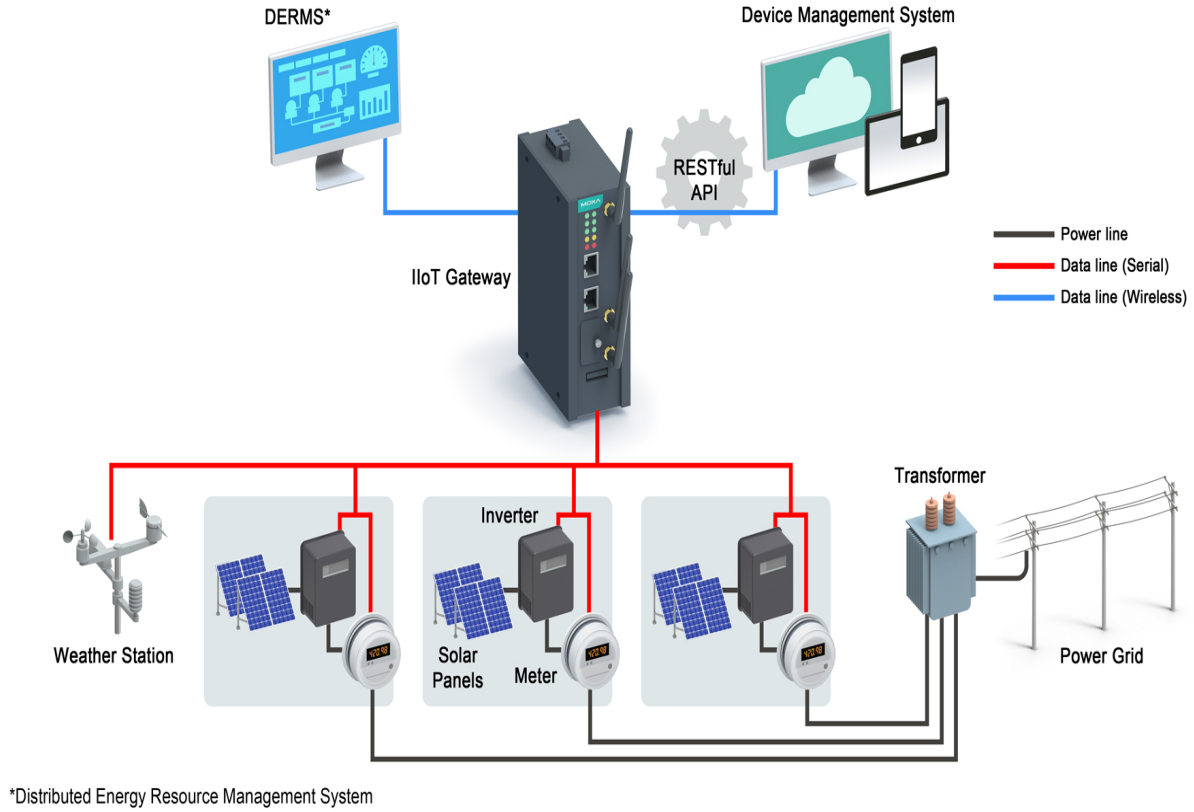
distributed energy sources (DERs). in the new power economy that is emerging, virtual power
plants (VPPs) are showing the way by makingit possible to aggregate power from different
DERs and energy sources, and providing an efficent platform for energy trading. Here, we
discuss some of the challanges faced by VPPs and how IIoT connectivitiy is helping them
overcome these challanges

## Leveraging IIoT Connectivity to Overcome Key Challenges in VPPs

The idea of VPPs that are able to solve all power issues of the future sounds very encouraging. However, deploying the devices and technology
that are requrired by a virtual power plant is an uphill task. Some of the challanged faced by VPP operators are discussed below:

### Integrating DERs Into the Grid

Inegrating power generated from DERs into a grid is easier said then done. A high penetration of DERs in the grid can introduce a variety of
detrimental conditions, including voltage swings and reverse power flow, which can cause instability in the grid. Most grids have to be retrofitted
to be ablte to integrate power from DERs, increase hosting capactiy, and optimize power from DERs. Consumers also need a convenient way to
bu power from DER aggregators at an economical price. Controlling and monitoring the devices at the grid edge, especially those associated
with DERs, is a major issue. Edge devices, such as inverters, need to be monitored for better integration of the system and to prevent grid
instability.VPPs require seamless commnication solutions to maintain the stability of the grid: northbound communication to acquire data from
power devices such as inverters, and southbound communication to monitor and control the devices. IIoT gateways, with their computing power
and integrated commmunication interfaces, can help provide the platform for seamless data acquisition and processing. Data acquired from
inverters, meters, transformers, and other edge devices can be snd to a DER management system to maintain the grid in a stable state and
meet the energy requirements of customers.

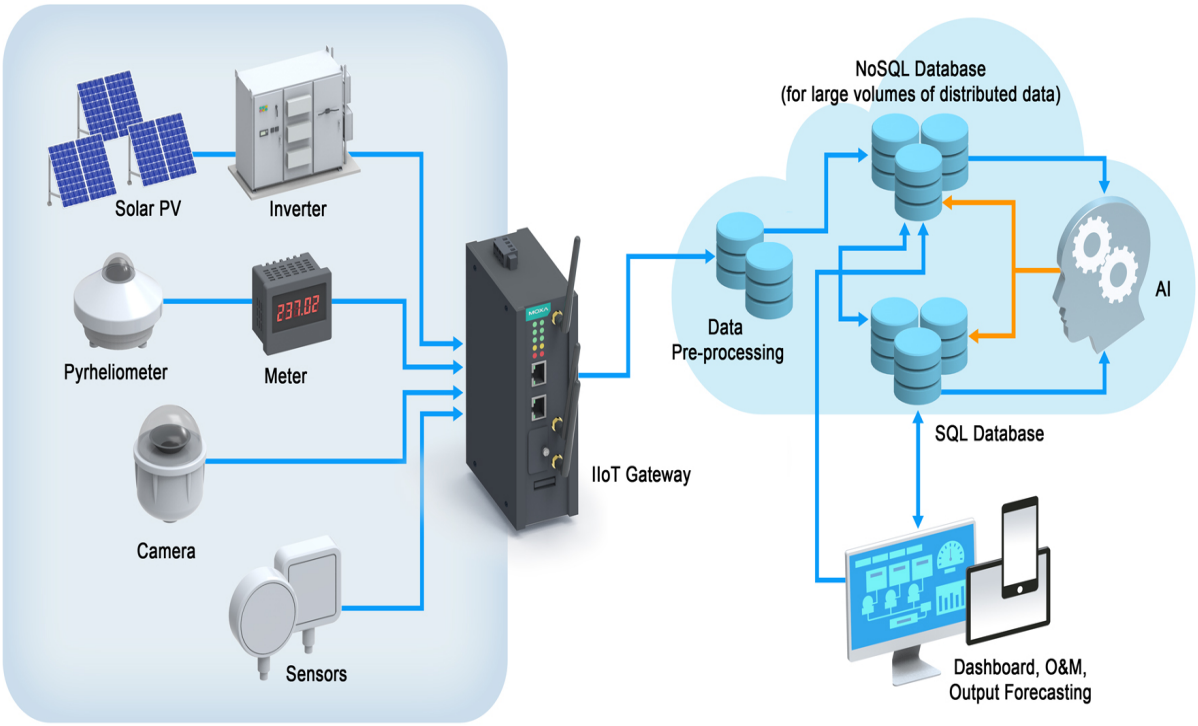



## Estimating the Power From Renewable Energy Sources

A key factor in the success of the VPP model is the ability to estimate the power from renewable energy resoureces that is required to meet the requirements of consumers. In addition, some contries have regulations requiring suppliers, such as solar farm operators, to provide power output forecasts for at least three dasys in advance to ensure a demand-response blanace and stability of the grid. Being able to provide power ouput forecasts is dependent on the ability to acquire multiple weather parameter values (e.g., ambient temperature, realtive humidity, and wind speed), data on the war and tear of equipment in the field, and conversion efficiency of inverters, among other things. Exisiting systems may not be able to deal with the large amount of real-time data that need to be processed and hence the response time may be slow. Ohter problems that operators have to deal with include data integrity, data loss and data security.

A solution consisting of an IIoT gateway and remote I/Os can be used to securely acquire data from various edge devices, such as photovoltaic cells (PVs), located in remote and harsh environments. VPP operators can instantly access huge volumens of data from inverters and weather monitoring devices, and use AI technology to accurately forecast the amount of

power that is requried from renewable energy resources to sufficiently meet the energy requirements of consumers.




**Moxa´s Solution**

In a VPP, reliable communications are critical to acquire large volumes of data in real time from devices and equipment, such as inverters, transformers, and meters, and send this data to the cloud for processing and storage. Moxa´s IIoT gateways are industrial-grade computers that provide reliable data acquisition and computing capabilities at low power consumption, reliable operation in hards environments, and a -40 to 75°C Temperature Range. Moxa´s remote I/Oss allow you to easily acquire data from edge devices such as sensors, and send it tothe cloud for further analysis.