Smart Microgrid

OZTRON ENERGY
The Technology Source for Green Energy

A **Smart Microgrid** is a small electrical network which utilizes advanced power electronics and control systems to optimally manage various energy resources.

- It can function independently, with or without grid connection
- It can be a building, a farm, a factory, a community, a village or an island
- It may have one or more sources of electricity like Solar, wind, gas or diesel
- Would often include battery storage

Applications

Operate within constrained grid capacity

Problem:

A community, a farm or a plant is supplied by an electricity grid connection. The connection does not have sufficient capacity for supplying the full load, especially at times of high demand. Upgrading the line would be costly.

Solution:

Use distributed and roof-top solar with storage in a microgrid. The microgrid control manages the Solar, Storage and Loads to ensure that the locally generated electricity is utilized for meeting the additional requirement from local generation while always maintaining the electricity import within the permissible level. It can also regulate electricity import from grid when the cost is high to maximize savings. It may even be possible to disconnect from the grid and supply electricity locally in case there is a disruption in supply.

PV Generation for Weak Grids

Problem:

A community or a farm is located in an area served by a weak regional grid. Electricity cost is high, which can be reduced by solar. But solar cannot be installed without Generation Management (smoothing). Sudden fluctuations in the solar output can cause instability in the network.

Solution:

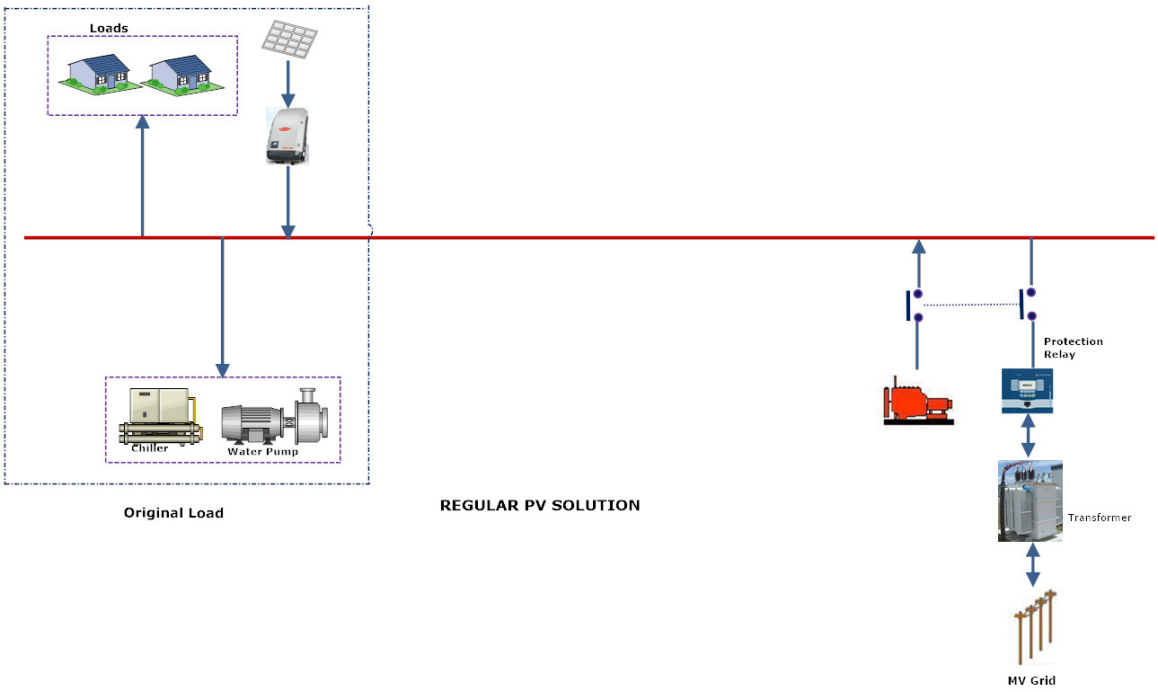
Install distributed solar on roof-tops, together with distributed or central battery storage. The microgrid control manages the battery and the loads so that the electricity import/export at the point of connection only varies smoothly as specified by the utility.

Advantages of a Smart Microgrid:

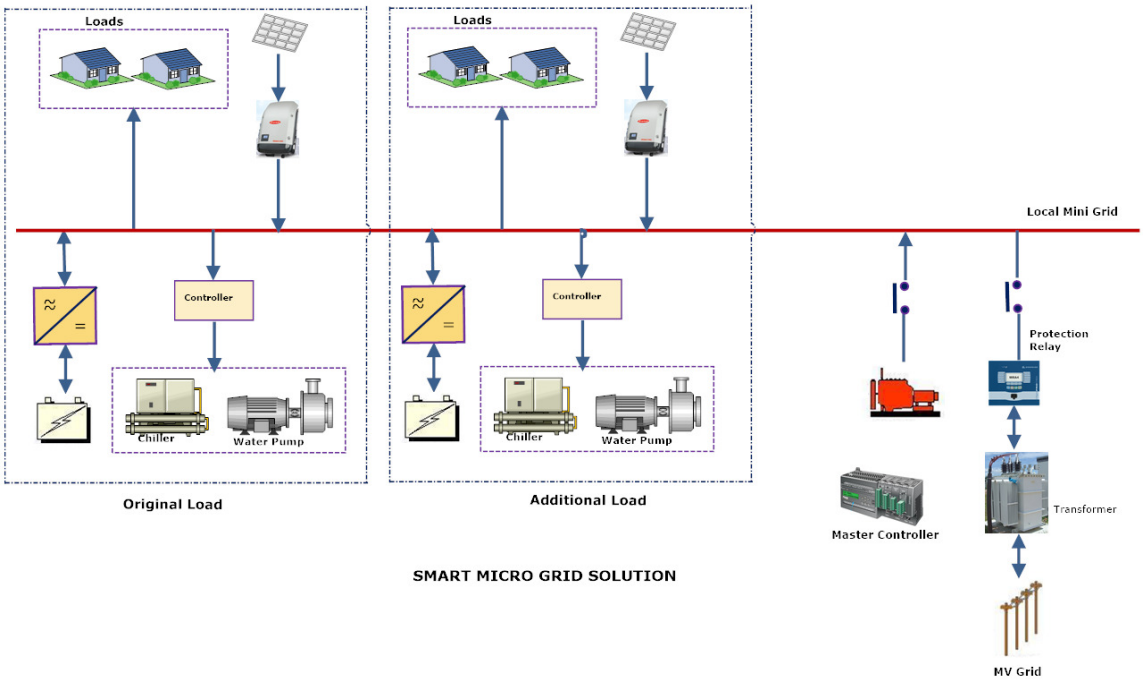
- Costly line upgrades can be avoided
- Saving in total energy consumption
- Increase renewable energy penetration, lower fuel cost
- Higher reliability and lower maintenance because of close monitoring of the assets

How the Smart Microgrid concept can be applied to avoid line upgrade?

An agricultural farm installs solar on the factory roof to reduce the cost of electricity. The excess electricity is exported to the grid when demand is low.



Later they want to expand their operation and decide to double the electrical load. The rural network does not have the capacity to supply the additional capacity and the network provider demands a very high cost for line upgrade. Just adding more solar is not going to solve the problem as even then it will not be possible to ensure that the power drawn will be within the line capacity, especially in view of the varying nature of the solar resource and the load.

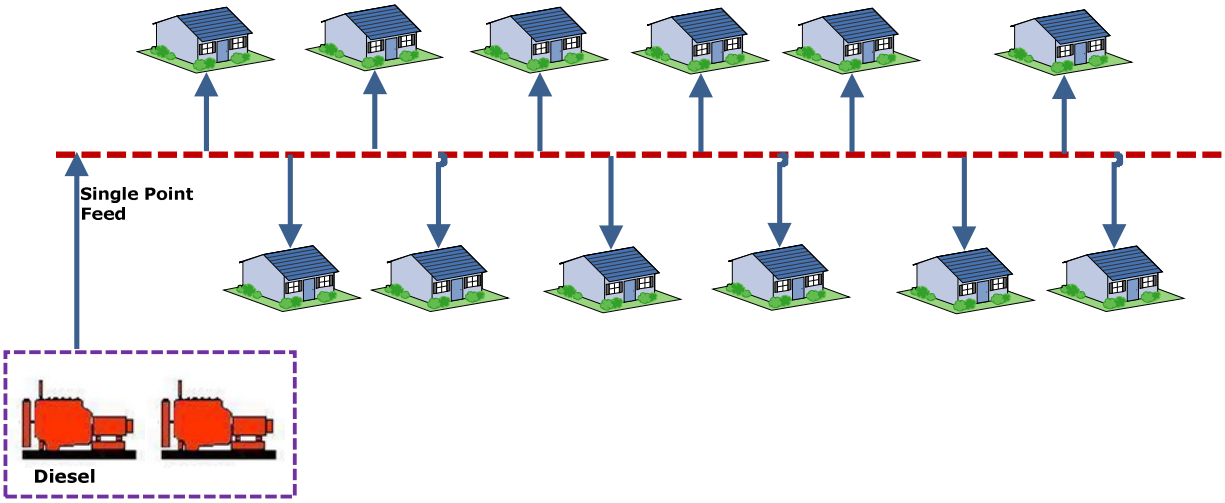


A Smart Microgrid can solve the problem by integrating the resources and managing the local network so that the additional load can be supplied without exceeding the line capacity. The costly line upgrade is avoided at a much smaller cost, while reducing the overall cost of electricity consumption.

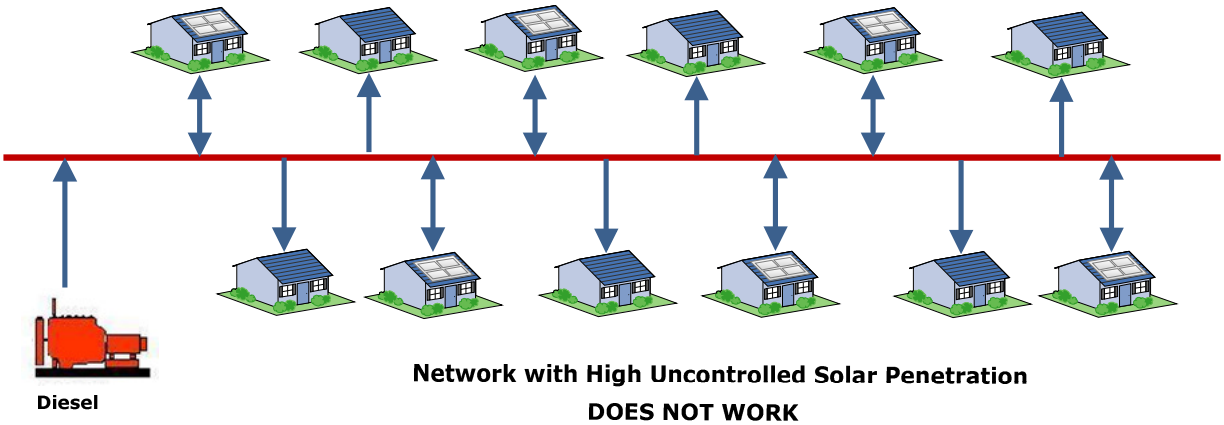
How the Smart Microgrid concept can be applied to an Island Resort?

Existing System:

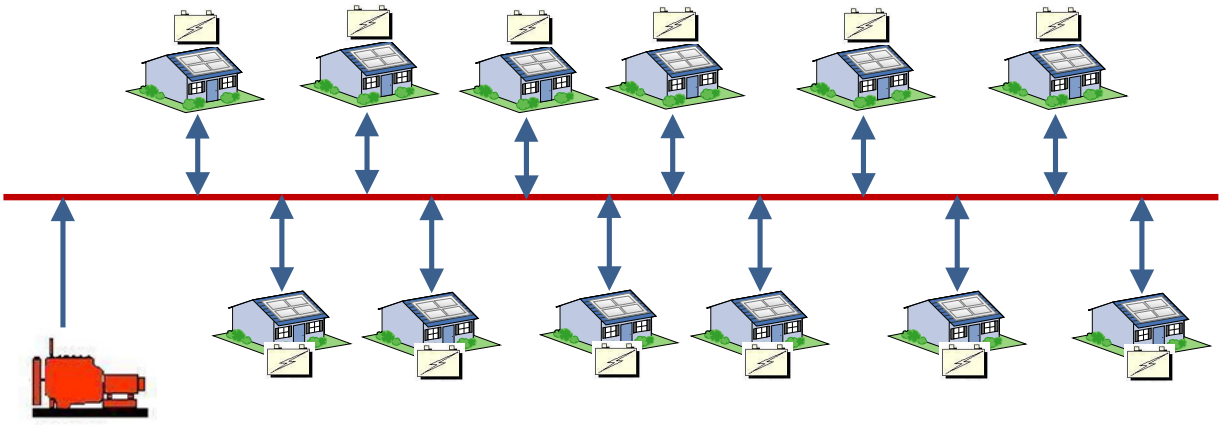
Two or more Diesel Generators feeding into a dedicated Microgrid:



Putting Uncontrolled solar distributed along the system can work only if the penetration is low, but can cause stability problems if the penetration goes higher. Does not yield significant savings.



Penetration can be increased, even higher than 50%, with smart storage and Generation Management (The PV is ramped up/down at a controlled rate). Day time diesel consumption can be reduced significantly.



Network with High Solar Penetration
With Generation Management

A Smart Microgrid is the next step. It achieves further savings by:

1. Controlling the solar generation to maintain optimum loading on generator
2. Use a small battery storage to reduce the spinning reserve on the generator
3. Use controllable loads to smooth out the intermittency in renewable generation and load and improve system stability
4. Shift discretionary loads (pool pumps, freezers, water purifiers etc.) to maximize renewables utilization and reduce peak loading on generators.
5. Integrate and enhance energy saving capabilities of the BMS.

An optimum combination of different resources and techniques are employed, depending on a particular installation.