SPOTLIGHT ON MICROGRIDS

Today, energy autonomous systems that can operate independently, called Microgrids, have been gaining more and more attention. A Microgrid is an electrical system that includes one or multiple loads as well as one or several distributed energy sources that can be operated in parallel or disconnected from the electrical utility grid. Microgrids can address energy access or energy distribution challenges, where power network development can be both economically and technically challenging such as in developing countries. Likewise, in developed countries, a Microgrid allows greater independence from the larger electricity grid which can lead to a more resilient energy infrastructure for the end-users during disturbances.

1. The context

According to the International Energy Agency (IEA, 2014), the global demand for electricity is set to expand by over 70% between 2010 and 2035, or 2.2% per year on average. Over 80% of this growth is expected to take place in non-OECD countries. The question is: how to deliver this electricity to all these consumers? And how can developing countries' economies grow with such a challenge ahead of them? Globally, over 1 billion people still live without access to electricity today, putting them at a major developmental disadvantage. It is a known fact that communities with power enable children to study during the night hours with electrical lights, people can charge cell phones to stimulate their business activities and appliances can complete the household comfort.

Furthermore, with an overall determination to move to a carbon free world – power network operators, cities and governments around the world are taking steps for lower environmental impact. To achieve this, the integration of intermittent renewable energy sources unto the existing grid has become vital. Connecting clean local energy sources such as wind and solar plants reduces the need to rely on other distant polluting source of generation. Shifting to a carbon free distributed energy generation will also give way to an increased use of electrical transport - the shorter the distance from generation to consumption, the more efficient, economical and green it becomes.

2. Microgrids meet these challenges

Microgrids connect together infrastructures (houses, commercial buildings, public lighting, public transport, etc.) within a district or a city or on an island. Microgrids systems can be used to optimise the dispatch of electricity subject on demand. They can also apply for a better use of local resources (such as small-scale photovoltaic panels or wind mills). They enable a better and combined optimisation on a territory, and aggregate local flexibilities such as demand response or storage.

3. How are Microgrids built?

To build a Microgrid, essential constituents are needed:

The first component needed in any Microgrid system is the power source. Renewable energies such as solar or wind power have grown progressively successful due to their reduced carbon footprint. They also provide energy access to rural areas or to peripheries of transmission grids, which can represent a structural handicap for electricity supply when transmission lines are disrupted.

The second one is the power management system that operates the transfer of electrical power from the power source to the electricity consuming devices. The power management system controls and balances with specific software systems the supply and demand within the Microgrid. The Microgrid energy manager can therefore monitor and operate the Microgrid depending on conditions affecting network operations—such as sun or wind forecasts, consumption patterns, and/or technical issues on the network —in an efficient and reliable manner.

Batteries Storage systems are also essential to any Microgrid. They allow balancing the electrical power across the Microgrid. Electricity is then made accessible when it is required by the user. The Microgrid operator charges or drains these batteries based on electricity demand. Batteries, installed with a power converter and software which controls the storage facilities, can react quickly to weather conditions and consumer demand. Power supply is consequently automatically balanced across the Microgrid while ensuring safe, efficient load management. The system also considerably improves capacity to integrate intermittent renewable energy sources. Battery storage within a Microgrid may participate also to the main grid system services by supplying voltage and frequency regulation services. As such, Many Microgrids in developed countries have an integrated connection to the larger electrical network. This connection enables the Microgrid to exchange power system services with the larger utility network.

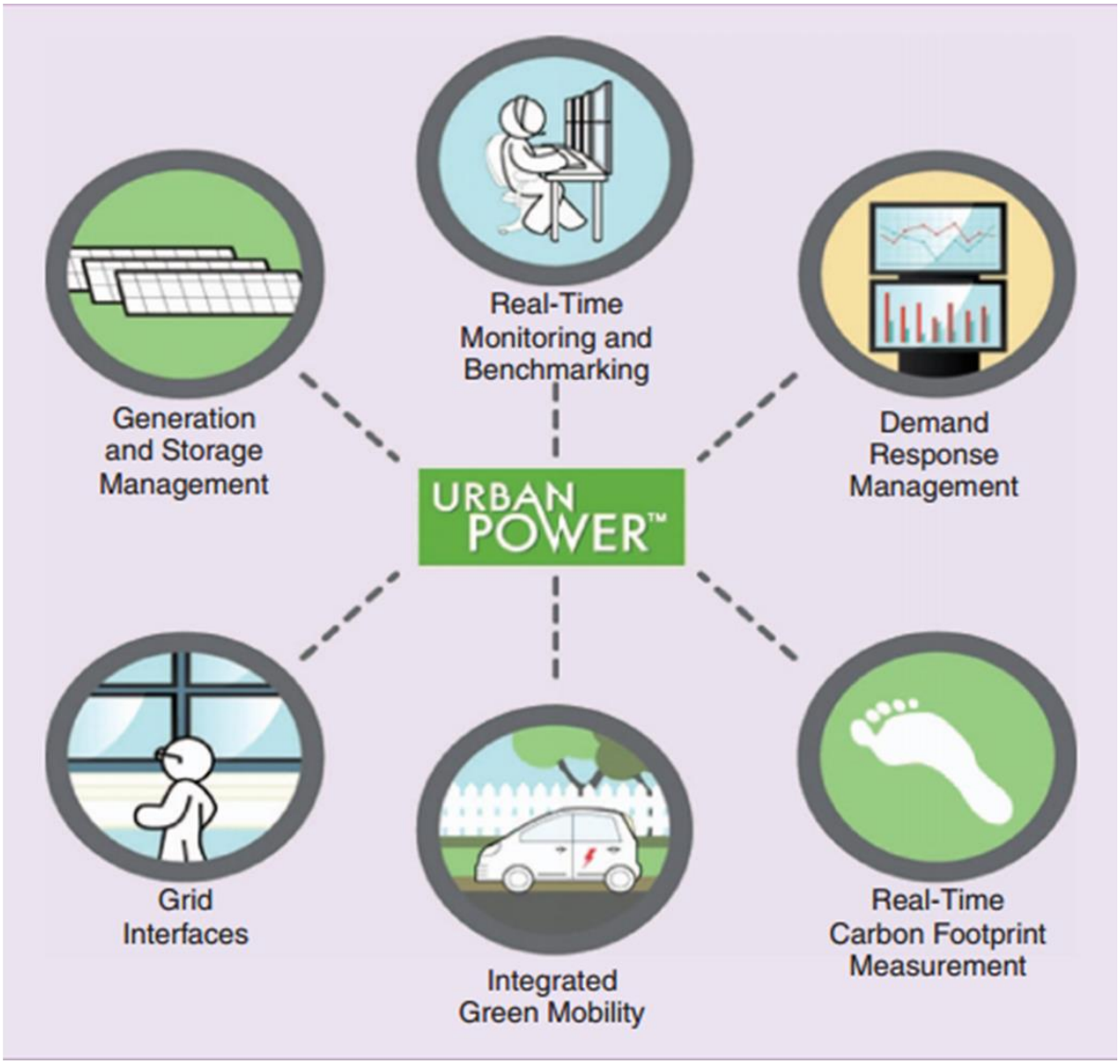
4. Benefits

In some geography, this type of distributed power generation is already a lower-cost alternative to large-scale fossil systems. The Microgrid model places power generation in close proximity to the consumer. The power is generated by the community for the community, and any excess is fed directly into the power company grid or stored in batteries and reused at times of peak demand. The interaction between the Microgrid and the main grid improves sharing of economic and renewable energy, stored capacity and other additional and complementary services.

5. Alstom's solution for Microgrids

Alstom brings the knowledge and capacity to integrate all kinds of power generation - renewable, thermal and storage and while lowering CO2 impact – meaning significant environmental, social, technological and economic impacts.

- Intermittent renewable energy integration on the electrical grid: wind, solar, …
- Distributed generation integration: connecting multiple renewable energy power plants and integrating islanding solutions (becoming autonomous).
- Real-time two-way information technology system
- Energy storage capacity at city level, with integrated dynamic forecasting and communication technologies to store or incorporate renewable energy into the grid and help balance overall demand to production.
- Enabling use of plug-in electric vehicles: providing additional storage services.



IssyGrid's Urban Power project scheme (source: Alstom Grid).

For more information, visit the Alstom website at http://www.alstom.com/microsites/grid/about-us/smart-grid/components-of-the-smart-grid/