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## Microgrids – more-than-micro growth

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 MICROGRID  RENEWABLES  SMART GRIDS

*The microgrid represents a new paradigm in the generation, distribution and consumption of energy. A number of experimental or demonstrator microgrids are highlighting their benefits and challenges. At the same time, more and more fully operational microgrids are coming on stream.*



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Navigant Research, a market research and consulting company with special expertise in the energy sector, expects global microgrid capacity to increase from 685 MW in 2013 to over 4 GW by 2020, a compound annual growth rate of close to 30%.

But what exactly is a microgrid? The IEC defines a microgrid as “a group of distinct distributed resources such as generators or loads, located within close geographical proximity of each other so that they represent a single generator or load to the wider electricity system.” Rodolphe de Beaufort, Alstom Grid Smart Grid Marketing Director, takes the definition one step further: “A microgrid is an ‘ecosystem’ where multiple functionalities and technologies can be integrated together, the level of integration defining how much added value the microgrid brings to its users.” In short, a microgrid satisfies three basic criteria:

- Geographically limited;
- Containing generation, consumption and/or storage;
- Local optimisation (including interconnection to other networks such as hot water and gas).

De Beaufort sketches out three typical microgrid scenarios.

### **1. Managing local grid nodes/islands with a high penetration of distributed generation**

The rise in renewables and decentralised generation can create issues of power quality, protection, forecasting, and so on. These issues can be resolved by a microgrid management strategy allowing the DSO to maintain grid control and to optimise costs.

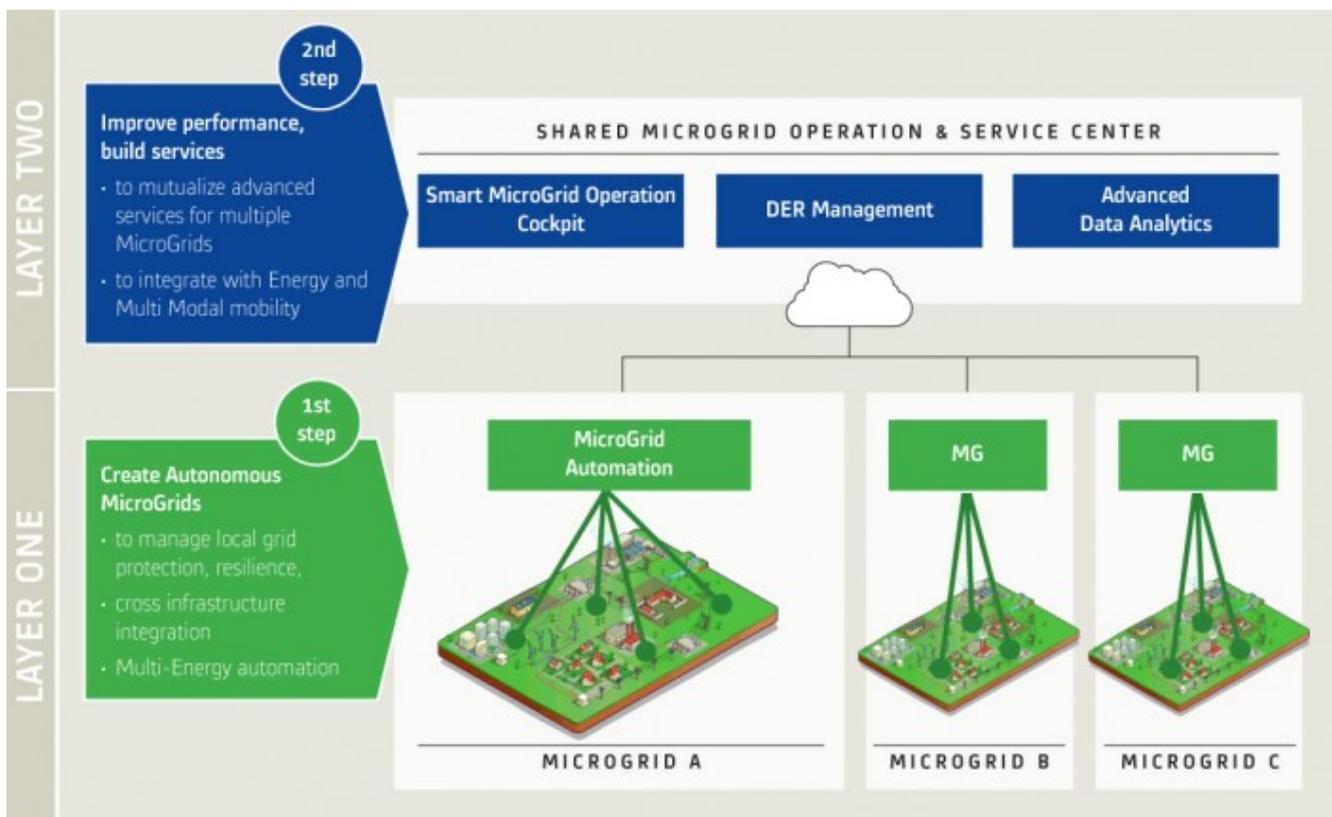
### **2. Microgrids in developing countries**

Urban areas of many developing countries face increasing electricity demand. Their ageing networks, generally based on diesel generation, have trouble meeting this demand. A microgrid approach can ease this situation by increasing capacity, improving service quality and connecting larger numbers of users. Alstom has developed a layered architecture with one microgrid cockpit for multiple microgrids. Over time, these independent microgrids may be progressively connected to the public distribution grid and their microgrid cockpit integrated into the Distribution Management System.

### **3. Campuses or eco-districts**

In some countries that are transitioning from an industrial focus to a service environment, industrial parks are being transformed into campuses or eco-districts, which need a new eco-system and new services provided by energy service companies. Microgrid technology is ideal for this situation. A layered architecture facilitates deployment.

## **The layered architecture**



De Beaufort explains: “Our microgrid solution is based on a stepwise approach. Step 1 creates autonomous microgrids to manage the local energy balance and grid operations in real time. Step 2 improves performance and builds new services using a shared IT host in a cloud environment to control multiple microgrids.”

In the first layer, the Alstom microgrid controller DAP (Digital Automation Platform) server is the engine of the microgrid, managing energy balance between generation, consumption and storage. In an eco-district, it optimises the power mix and improves energy efficiency, load shifting and resilience. On a microgrid node, it improves RES penetration and enables microgrid islanding.

Through layer 2, microgrid cloud services, operators can improve their multiple microgrids by setting up a single hosted Microgrid Control Centre. This is the remote brain of multiple microgrids, enabling better performance and new services for each. It delivers the following functions as a service:

- Smart microgrid operation cockpit;
- Distributed resource management;

- Advanced data analytics services.

## Microgrid Power Mix Management (PMM) in Singapore

Alstom is working with the National Technical University of Singapore (NTU), a leading university and research centre. Their joint project focuses on multi-source, multi-storage and multi-load power mix management in a microgrid. “The key objectives”, according to Alstom Smart Grid Innovation Director, Said Kayal, “are to develop a novel PMM solution for microgrids based on Alstom’s DAP platform, deploy the solution at NTU’s eco-campus and then deploy it at the Semakau island landfill.

“One of the innovations of the project is to expand the optimisation of the power mix on a system-wide basis using honeycomb architecture. This architecture is built out of a constellation of microgrids. The design of the power mix management will enable wide-area PMM, expanding control to a cluster of microgrids. This function is to be tested on Semakau, combining two potential microgrids (islands).”

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