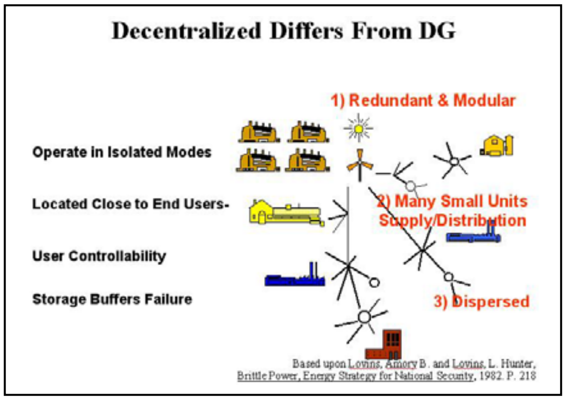
Microgrids and Utility Value Streams

Introduction. One definition of a microgrid is "an aggregate of small loads and distributed energy resources which operate as a single system that provides both power and heat."[1] Earliest generation often partly conformed to this model but the need to lower the cost of power led to abandonment of this concept in order to obtain economies of scale then only available through centralized power systems made possible via regulated monopolies. The industry has come full circle and new technology has driven deregulation of the electric industry. This became possible through higher efficiency, once only afforded by large steam plants, in relatively small generators that could be economically located for on-site use. Environmental concerns provide powerful drivers for renewable energy and other short-term arguments which are economic-based such as reliability, power quality and energy security are also important. How microgrids will interact with the main grid and whether they can provide value to utilities remains to be seen but some initial examples are provided below.



Distributed Resources. Often misunderstood, the definition below is a composite of governmental and industry definitions:

Distributed resources include conservation and load management with modular electric generation and/or storage located near the point of use either on the demand or supply side. DR includes fuel-diverse fossil and renewable energy generation and can either be grid-connected or operate independently. Distributed resources typically range from under a kilowatt up to 50 MW. In conjunction with traditional grid power, DR is capable of high reliability (99.9999%) and high power quality required by a digital society.

Decentralization. (see diagram above)

- Consist of many small units of supply and distribution with redundancy to back each other up;
- Units are geographically dispersed but close to demand centers;
- Interconnect with many units and not dependent on just a few critical links and nodes;
- Continue to operate if in isolated modes, so failures tend to be more isolated;
- Provide storage as a buffer so that failures tend to be gradual and more “elegant” rather than abrupt;
- Short links at the distribution level;
- Employ qualities conducive to user-controllability, comprehensibility, and user independence.

Enter the Smart Grid[2]

- Improved reliability, security and efficiency through digital control technology
- Optimization of grid operation
- Easier interconnection of distributed resources and end use smart appliances
- Control of demand response down to the consumer appliance level
- Provision for storage technology including plug-in hybrid electric vehicles and all-electric vehicles
- Real time information on electric pricing for transactive actions
- Requires standards/security provisions for communications and interoperability of connected devices
- Requires overcoming barriers to adoption of Smart Grid technologies

Some Potential Values of Microgrids/Smart Grids to Utilities

- A living laboratory for incremental deployment of new technologies
- Finer degree of peak load control at potentially less cost to all parties
- Greater reliability during adverse conditions
- Satisfaction of RPS requirements
- Aid in meeting carbon reduction goals
- Re-entry into the generation realm
- Establishment of premium power zones or energy improvement districts

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[1] (SAIC) San Diego Smart Grid Study Final report (San Diego: October 2006)

[2] ISO-NE. Overview of the Smart Grid Policies, Initiatives, and Needs. February 17, 2009. Pp. 2-3