THE GRID OF THE FUTURE – A BIRD'S-EYE VIEW

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A "mumuration" of starling is a remarkable thing. Huge numbers of birds — thousands and hundreds of thousands — fly together in unison and don't collide. Scientists have found that each bird monitors the state of adjacent birds and responds to minute changes in direction from its neighbors. There is no control from any leadership, and yet the flock operates smoothly. This approach enables a large number of birds to fly successfully as a flock.

A power system with a high penetration of distributed resources will need a similar autonomous yet distributed control system that can allow local measurements to be used to provide immediate local control. This will augment central management and coordination in order to maintain overall power system control.

Ultimately, I believe we'll need to take local measurements, e.g. at the neighborhood Walmart store, using phasor measurement units (PMU). Also called synchrophasors, these devices will capture phase angle and magnitude of the voltage signal at each location on a distribution feeder, which will give utilities real information on the state of the feeder, unlike the measurement of watts and VARs measured at a load drop, which provides information on the load itself.

Any change in generation or load at any device will impact phasor values of all devices on the line. Each node in the network will sense a change and will attempt to return the node to its pre-determined target. So, a change in generation at a solar site may be automatically offset by adjusting the power consumption in a load capacity system at one or more nearby sites, while a voltage change may be corrected by the management of one or more solar smart inverters.

Put another way, when clouds pass over the solar array atop the Walmart, the device at the Home Depot will know, and it will shed load according to customer constraints at the do-it-yourselfer's store. Or, when voltage needs correction, the smart inverters at the Walmart could kick in to do the job.

What everybody is doing now with demand management is collecting data, doing calculations somewhere up above and sending signals back down to devices with instructions. But, you need to be fast about this. You need to take measurements locally and act based on those measurements. You have to have enough intelligence and control at grid edge so that devices know what to do.

That's what the Enbala platform is capable of doing. It's our vision for the grid of the future.