



ABOVE: Smart grids are already powering suburbs in Shanghai  
 RIGHT: Wind farms are regularly used to power homes in Sweden

## THE POWER INDUSTRY – TECHNICAL EVOLUTION

The industry has for many years been suffering from a lack of technological focus and investment, mainly due to the introduction of personal computers in the 1980s, coupled with the telecom and the worldwide web revolutions in the late 1990s. The new political agenda places focus on the need for a technological evolution in the power industry, allowing this to be the agenda for the 21st century.



# REUSABLE DISTRIBUTION

Ageing assets and a greater array of renewable energy sources are pushing power distribution companies to digitalise their infrastructure through smart grid technology

**T**oday, almost all power distribution companies have a smart grid manager, however, this does not imply that they previously had unintelligent power grids, but a recent paradigm shift in how to structure power distribution has caused power distribution companies to

rethink their power delivery strategies on a global scale.

This paradigm shift is caused by the growing political requirement to lower the carbon footprint throughout the energy sector. This requirement to reduce CO<sub>2</sub> will have direct and potentially immediate implications for power

distribution companies and will lead to significant investment in power distribution grids.

The investments are needed due to a variety of historical factors, one of which is the: ‘Electrical power delivery Today’ (see boxout) which was designed as a black box concept, where power is put into the box on one side and is delivered to the customers on the other side.

Therefore, with the political intentions and demands to lower the carbon footprint, power distribution companies need to rethink power generation, power distribution and the refinement of how that power is used.

## FUNDAMENTAL CHANGE

This fundamental change in how to think of power requires a significant change in how power distribution grids are designed and how they are operated. The new distribution grids must be able to handle bi-directional power flows, absorb power generation from small local power producers and handle new power consumption patterns.

New grid operation technology and more advanced tools are needed to integrate more decentralised power generation. This pushes power distribution companies to handle and operate the new load patterns: like differentiated price structures which are based on consumption and the usage of electrical vehicles.

A fundamental redefinition of their service and operation structure is also needed and investments in advanced IT systems are now inevitable. This redefinition creates a demand for a far more flexible and dynamic power flow; a power flow that must be monitored and controlled and that unlike today’s technology, must be able to supply energy bi-directionally. This new style of power grid is more commonly known as the ‘Smart Grid’.

## PLAN A VS. PLAN B

Plan A – The most straightforward way to solve the new market situation, would be to simply change and upgrade the whole power distribution network by adding new components adapted to meet the new requirements. A number of existing market players – like ABB, Siemens, Schneider and GE Energy have designed full solutions as answers to the new market situation.

However, there are some heavy challenges to Plan A – one is the cost. The existing installed infrastructure is still fully functional and does it make sense to retire a complete infrastructure using CO<sub>2</sub> as an argument? We think not.

The second challenge is that changing the existing infrastructure will require heavy construction work and a substantial number of blackouts together with implementation times running between 25–35 years for a typical power distribution company.

However, building a Smart Grid from scratch is extremely


expensive and time consuming. Therefore Plan B – led by some of the most advanced power distribution companies in the world, is now being defined.

They believe the answer is ‘Reusable Power Distribution’; these frontrunners digitalise their existing infrastructure by using cutting-edge technology, transforming their ageing power grids into state of the art smart grids. The digitalisation of the existing power equipment allows the power companies to prepare for a new power distribution future with more alternative energy sources as well as different load patterns from electrical vehicles.

The great advantages of using new technology to digitalise the power grids are many, but the price of the hardware itself, which is much cheaper than conventional equipment, and the fact that often new sensors and devices can be applied to the power grid without disturbing the power distribution, are the most significant. Once the sensors and devices have been applied to the power grid, the rest will be based on intelligent software which can be upgraded like traditional software without disturbing the customers.

## ON THE HORIZON

From the technological side, a number of new start-up companies like: PowerSense, Locamation, FMC Tech, BPL Global and many others are introducing breakthrough technologies that will revolutionise the power industry and enable the suggested Plan B for Smart Grids.

PowerSense and IBM have designed and installed the biggest Smart Grid in the world at Ausgrid in Australia. As one of the main outcomes, Ausgrid has increased its distribution grid capacity by more than 20 percent, due to better control and monitoring of the power grid and has today a fully digitalised power grid to take on the power grid challenges of the future. 

*For more information*  
[www.sensethepower.com](http://www.sensethepower.com)

## ELECTRIC POWER DELIVERY TODAY EVOLUTION

Historically, the electric power delivery systems of the world were designed and built to deliver energy from large generating plants placed around the country as dictated to by the type of primary energy source (i.e. hydro, coal, nuclear or thermal) delivering energy through a cascade inspired delivering system from the centralised source to the individual customer or consumer. Since the power flow was flowing directly from the power generation plants to the consumer, there wasn’t any need for monitoring and control because there was no need to follow the flow of power and the system was simply designed as a black box concept. Most power distribution systems in the world today are based on this black box concept.