DELTA
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Delta Research Paper

Utility Engagement with Distributed Generation: Gaining Momentum

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How - and why - are utilities increasingly engaging with distributed generation?

The benefits to many utilities of distributed generation used to be unclear, its economic value was often uncertain. Today, there is growing evidence that some utilities see potential value in DG, and an associated trend towards exploring how they can deploy it most effectively.

This Delta White Paper highlights some examples and anticipates how this trend may continue.

Ten years ago, distributed generation (DG) had little to offer to many utilities. Engagement usually took place on the basis of specific policy incentives, with subsequent disengagement when these were withdrawn. Today, however, there is growing evidence that utilities are engaging with DG on the basis of a range of emerging drivers that can increase the value of DG for utility businesses. As a result there are now a range of examples around the world of utilities using it to improve their long-term business performance.

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- ***We deliver rigorous and in-depth research –*** *alongside clear and concise analysis*
- ***We have a track record for impressing clients –*** *Delta secures a large proportion of repeat business from its clients.*

There is a business case for distributed generation across several parts of the utility business

Distributed generation can add value across utility businesses (**Figure 1**):

FIGURE 1: Distributed generation can provide value across the chain.

SOURCE: Delta Energy And Environment, 2009

- Retail – some utilities can compensate for the prospect of falling commodity revenue by selling DG technologies to customers, and providing an array energy services alongside.
- Congestion relief – some distribution network operators use dispatchable distributed resources to reduce network loads, especially during system peaks.
- Trading – some utilities control DG to dispatch at peak demand, and sell the high value electricity on the energy exchange or balance supply and demand.
- Generation – large-scale industrial-scale CHP has proved to be attractive to generation businesses in several countries for some time, but is not addressed in detail in this paper.

This White Paper explores examples of utilities engaging with DG, and the value this brings to their business. It then considers whether these examples signal a wider trend - or will prove transient.

How can distributed generation generate value for utilities?

Retail – selling distributed generation technologies and providing energy services

In a competitive market environment, electricity utilities can offer DG technologies to customers to differentiate their offering from competitors. Gas utilities can use CHP to protect retail sales from encroachment by electric heating. Both can choose from a growing menu of new DG technologies that are emerging in the market, due to improving DG performance and falling product costs.

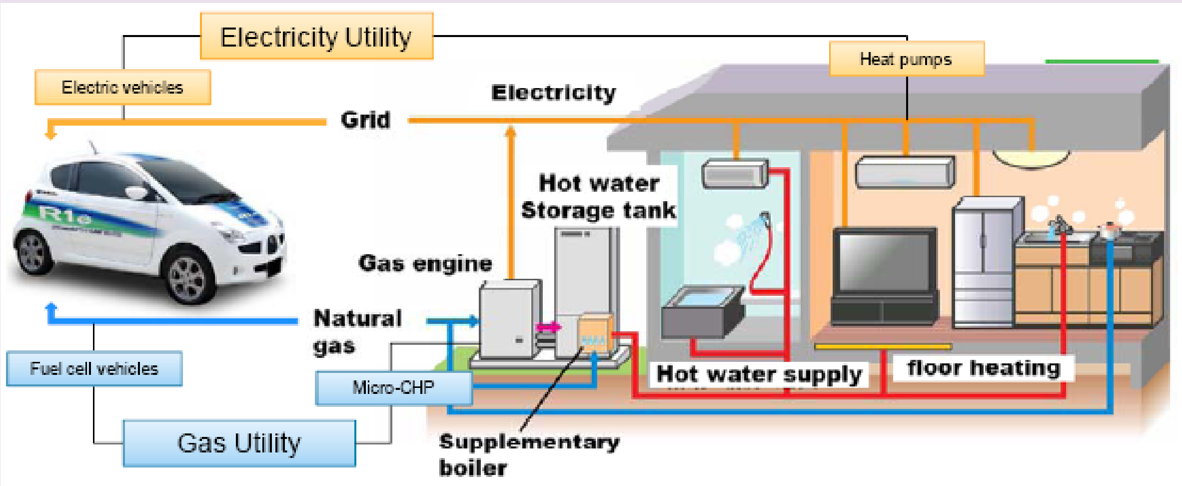
Customer retention is already an important driver for DG, but income from technology sales and services could substitute declining commodity sales in the future, as energy efficiency measures reduce demand and enable demand side management.

Japanese utilities – selling distributed generation to secure market share

In Japan, gas and electricity companies have battled over customers in the domestic energy market for years (**Figure 2**).

- Electricity utilities promote the ‘all-electric house’, using grid electricity with electric heat pumps for space and water heating. They are also investing heavily in electric vehicle development to grow their commodity business in the future.
- Gas utilities have supported the development of fuel cells for residential CHP applications, aiming to protect their gas sales in the domestic heating market, and capture part of the power market. They are investing in fuel cell cars and natural gas-derived hydrogen fuelling stations to enter the transport market.

FIGURE 2: Japanese electricity utilities promote the all-electric house, while gas utilities support micro-CHP and fuel-cell vehicles

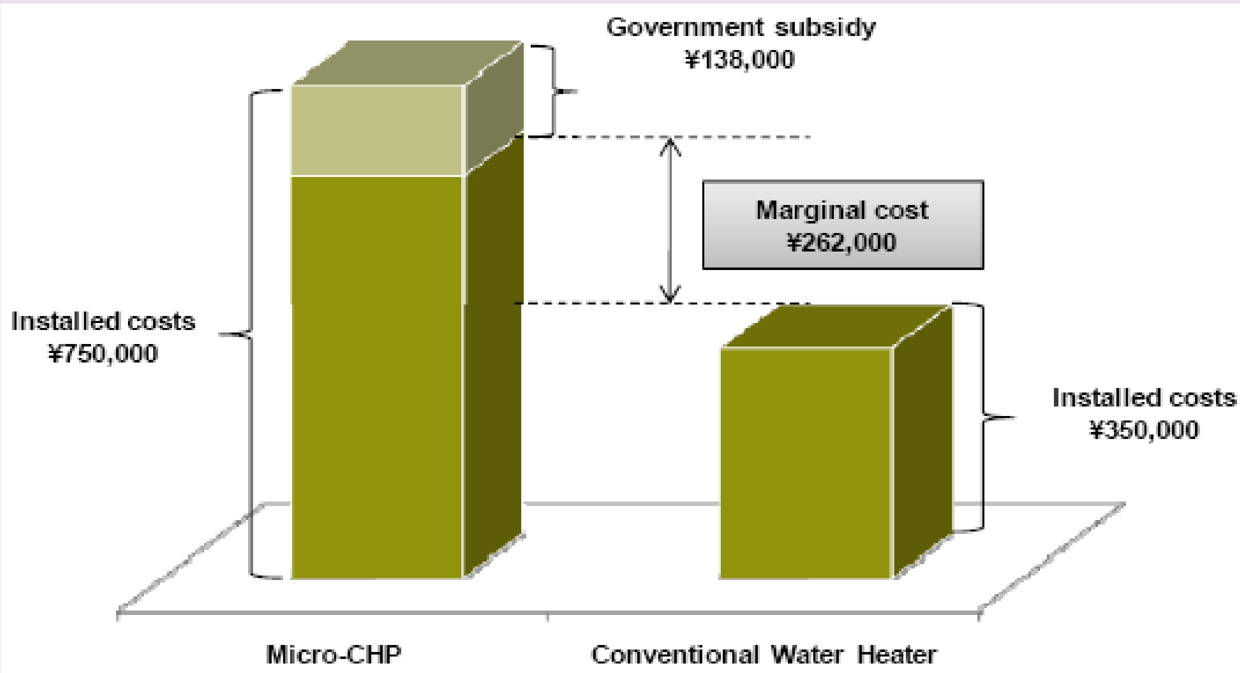


SOURCE: Delta Energy And Environment, 2009

As a start, Japanese utilities have worked with product manufacturer to develop efficient and reliable DG systems. Osaka Gas, for example, one of the most active gas utilities, has partnered with Eneos Celltech (ex-Sanyo) and Toshiba to develop a fuel-cell micro-CHP system. It launched the ENEFARM unit in spring 2009, and expects to exceed its 1,000 unit sales target in the first year. Tokyo Electric Power Company (TEPCO) partnered with Denso, resulting in the EcoCute, the first residential CO2 heat pump in the world.

As the R&D partnerships delivered commercial products, the utilities started developing attractive customer propositions to drive early uptake. Financial incentives are by far the strongest element of these. TEPCO for example, offers peak export tariffs for PV around ¥30 per kWh, while retail rates are roughly ¥20 per kWh (€0.15). Gas utilities offer discount gas tariffs, as Osaka Gas does for customers installing the ECOWILL gas-engine micro-CHP system. This results in an annual benefit of ¥46,000 per year (€340), so that the extra costs of ¥262,000 (€1,940) over a conventional water heater is recovered in 5.7 years (**Figure 3**).

FIGURE 3: Discount gas tariffs help customers achieve a 5.7 year payback on micro-CHP investment.



SOURCE: Adapted from Osaka Gas, 2009

Networks – DG as a tool for meeting peak demand on congested networks

Network congestion is an increasing challenge for network operators as peak demand grows.

Building additional grid capacity is expensive everywhere, and spatial constraints make it near to impossible in some places, like Manhattan. Many network operators have therefore started assessing opportunities for alternative solutions. Demand response – a combination of reducing and shifting peak use – is already a common strategy in North America, and increasingly so in Europe. The Californian utility PG&E, for example, gives customers technical and financial support to develop demand reduction systems (for instance by optimising lighting control), which it can initiate during peak load.

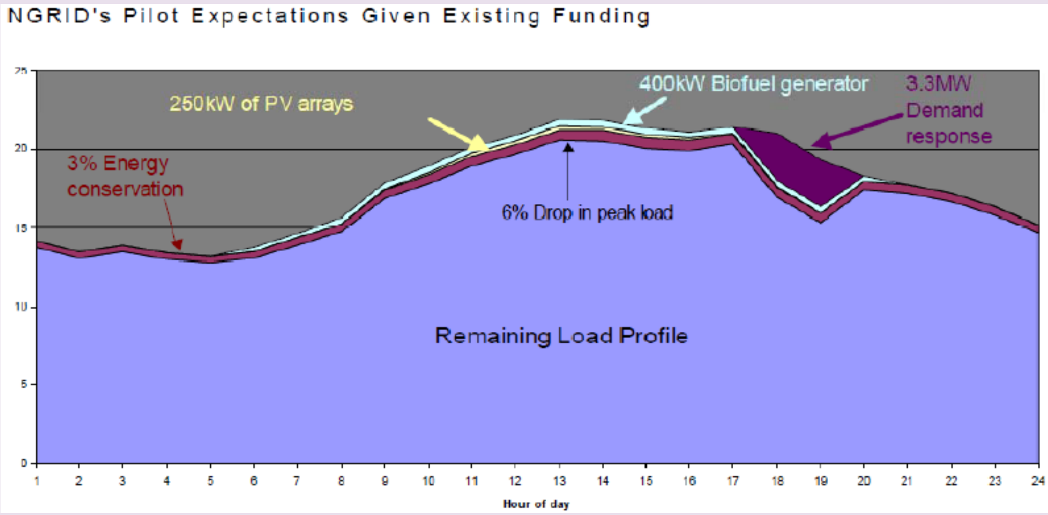
Several network operators have also used DG to ease the load on strained networks by producing power for on-site consumption, reducing demand on the grid. Two examples are highlighted in the box below.

National Grid – testing distributed generation for congestion relief[1]

The Massachusetts city of Everett has experienced rapid load growth, so that the two 23 kV supply lines are now barely capable of meeting the summer peak load. National Grid, the local network operator, therefore started a congestions relief pilot in 2006 to evaluate the business case for using DG to displace network load, combined with demand response and energy conservation.

To drive the uptake of DG, National Grid started offering free energy audits to customers to identify opportunities to install such technologies. Project grants financed feasibility studies, as well as installation subsidies. A total of thirteen PV and biomass systems are now being deployed, delivering 510 kW capacity, equivalent to 1.8% daily load relief to the distribution network. National Grid expects to enable another 140 kW of DG, which, together with the 3% energy conservation and 3.3 MW demand response, adds up to a 6% drop in peak demand (**Figure 4**).

FIGURE 4: National Grid's Congestion Relief Pilot has resulted in a 6% drop in peak demand.



SOURCE: National Grid, 2009

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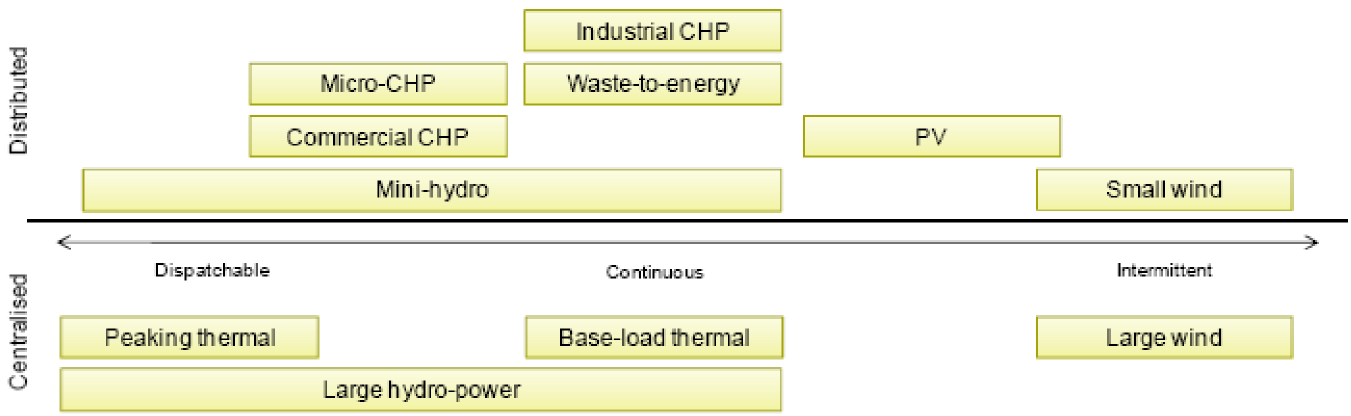
[1] **The information for this case study is based on research by IDC Energy Insights**

Trading – DG as a dispatchable trading resource, and for demand management

In liberalised energy markets, electricity trading can be an important source of revenue for utilities, for example by scheduling generation to coincide with peak power demand and prices. DG can be a source of such value if it can be dispatched directly by the utility's trading desk.

Not all DG technologies are suitable for electricity trading and load balancing – they need to be directly controllable. This excludes intermittent resource, such as wind (**Figure 5**), and the trading value of continuous generators, like run-of-water hydro is limited. Back-up generators are a commonly used dispatchable resource, and examples of such aggregators include Flexitricity in the UK and Portland GE in the US. CHP plants are also suitable, where generation can be decoupled from heat demand by using a heat store.

FIGURE 5: Dispatchable DG has most value for trading in liberalised markets



SOURCE: Delta Energy & Environment, 2009

Essent – selling CHP electricity at peak prices

Essent, a leading utility in the Netherlands, has developed dispatchable CHP gas engine systems with its horticultural customers since the 1990s, allowing it to increase its generation rapidly at peak times. An on-site heat store ensures that farmers can heat greenhouses when needed, independently from power production. Essent now operates over such 3,000 installations, all controlled from a central dispatch centre. The units run to a pre-programmed schedule, but Essent can intervene remotely at any time. The business unit responsible for these systems now has an annual turnover of €15 million.

Horticultural customers have proved a fertile customer group for dispatchable DG because energy accounts for a large part of their costs and government subsidies have provided additional incentives. Essent offers different business models and bespoke contracting arrangements to share risks and revenues with customers. This cooperative approach has helped secure customer buy-in and strengthened client relations.

EWE – balancing supply and demand

The North-German utility EWE has seen a large number of offshore wind farms connecting to its network, so renewables now supply almost 18% of its electricity. The resulting intermittency creates the risk that there is a mismatch between supply and demand. The utility is therefore trialling the use of DG as a reliable and cost-effective source of energy and power.

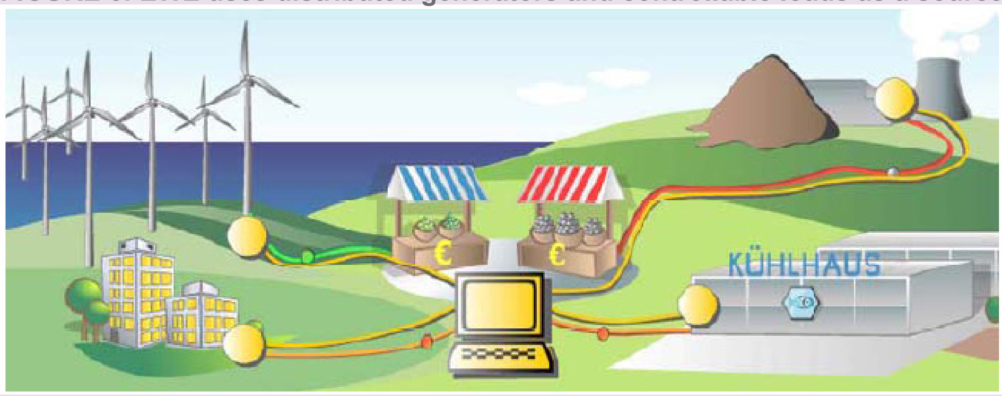
EWE's eTelligence pilot project in the city of Cuxhaven is exploring the use of DG and controllable loads to provide power during peak times and fill valleys during off-peak. It has created two networks linking all large loads and generators (**Figure 6**).

1. Physical integration through the power grid allows EWE to balance supply and demand.

2. Virtual integration through a dedicated IT network enables all loads and generators to exchange information, allowing EWE to send price incentives for customers to switch off loads and free up capacity on the physical network.

EWE's distributed generators include biomass and PV plants, while commercial customers provide the flexible loads. For example, a cold store ('Kühlhaus') in Cuxhaven has learned to 'play' the market by switching on and off its freezers, reducing energy costs.

FIGURE 6: EWE uses distributed generators and controllable loads as a source of peak power



SOURCE: EWE, 2009

Sourcing electricity from DG is part of EWE's future vision. It aims to own and control fuel cell systems in the houses of residential customers. It is preparing for this market by entering into long-term heat supply contracts which give it ownership of boilers, allowing it to replace these with fuel cells over time. Initially, EWE would use these systems to reduce demand of the house at peak times – effectively a scaled-down version of eTelligence. If fuel cell production costs fall sufficiently, EWE will be able to supply electricity at a lower cost than through the grid, unleashing a large resource of cheap controllable energy.

Distributed Generation - increasing value to utilities

An emerging mix of pilots, trials and long-term commercial strategies

The examples above highlight some new drivers for utility DG engagement. So far, the rationale is a mix of 'testing the water' and more serious commercial strategies (**Figure 7**).

FIGURE 7: Utility's use of distributed generation varies from early pilots to full commercial strategies

SOURCE: Delta Energy & Environment, 2009

- National Grid's congestion relief programme is a pilot, as the heavy upfront investment to engage customers is not being recovered yet. The company is currently evaluating the benefits for its grid operation, expecting to have a clearer understanding of the long-term business case towards the end of 2009.
- EWE's use of distributed resources to provide both energy and power has benefited from public-sector funding, and is not currently viable on purely commercial terms. However, the company expects that the economics will improve as intermittency on the grid grows and distributed energy technology costs fall. EWE appears to be in it for the long-run.
- Deploying DG as a resource for trading is already fully commercial. For Essent, dispatching its gas engine CHP assets based on market signals is not merely financially attractive, but is essential, as operating them outside peak hours would be unprofitable.
- Investing heavily to drive DG uptake is a commercial necessity for some Japanese utilities.

Expect new approaches and greater electricity sector engagement with DG

We expect the value of DG to utility businesses to grow based on the drivers we have highlighted here. And alongside this, questions that energy companies will increasingly consider when developing their approaches to DG might include:

- How will the costs and performance of technologies develop, and which can be most successfully deployed?
- How can DG, demand management and smart grid initiatives interact to create the best results for utility businesses?
- Will the expansion of nuclear power and CCS shrink the market for DG, or drive its use for flexible back-up?
- To what extent can DG be used alongside the charging infrastructure for electric vehicles?
- What carbon targets will countries adopt, and which governments will incentivise DG to achieve these targets?

We expect utility business models for DG to vary with company structure, strategy and market environment. Some energy companies will stick with what they know best – generating electricity in large plants and selling this on a commodity basis to customers. Growing numbers will look to differentiate and provide DG alongside energy services; or, for example, develop DG alongside smart grid infrastructure and IT systems to drive the uptake of electric vehicles.

Even within a single national market, companies are choosing different solutions. In the UK, Centrica is driving micro-generation, while Scottish Power has, for now, decided to deploy large renewable resources instead. Competition will only enhance diversity as utilities strive to differentiate their offering.

All in all, a new trend of utility engagement in DG is now becoming clearer. We expect this to gather some momentum as new drivers of utility performance strengthen. The question is increasingly shifting from whether using distributed generation makes sense for utilities, to how best to deploy it.

For more information …

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