A new energy law likely to be passed in Germany this summer will be crucial in determining the future growth of distributed generation (DG). So too will the development of a robust regulatory regime to administer the law, writes Uwe Leprich. If successful, DG production could reach 40% of the total by 2020.

DG in Germany

heading into the mainstream?

Distributed generation (DG), if defined as electricity that is fed into the low- and medium-voltage grid and is produced near the end-users and the load, can be found in Germany in two market niches:

- Renewables accounted for slightly more than 10% of total electricity production in 2004. For the first time, wind energy had the highest share with around 45%, followed by hydro power with 40%, and biomass with less than 10%. Since large hydro power cannot be considered as decentralized production, the renewables market niche roughly embraces 7% of total production.
- Cogeneration covered slightly less than 10% of total electricity production in 2004. Nearly half of it comes from industrial autoproduction, while the other half is from municipal power production. All of the municipal, and the largest part of the industrial, production can be considered as decentralized, as defined above.

Germany's decentralized plants currently contribute around 85 TWh to the country's electricity production, a market share of around 16%.

Both renewables and cogeneration are supported by state laws: renewables by the Renewable Energy Sources Act (EEG), and cogeneration by the CHP law. However, the remuneration mechanisms for EEG and CHP plants are quite different. While EEG plants get a fixed rate according to technology and plant size, the payment for CHP plants consists of three components:

- a price linked to the current market price (as a minimum, the average baseload price at the power exchange)
- an additional CHP premium that is legally fixed for different types of plant and technology, and which will gradually decrease over time
- the compensation for avoided network costs, discussed below.

While distribution system operators (DSOs) are required to connect all these plants to the grid and to accept their entire output, plant operators are not required to sell their output to the DSO. Instead, plant operators can cover their own demand

If the CHP law remains unchanged, there will be no growth in cogeneration

when prices are high, or can negotiate their own contracts at prices above the respective rate, if they can the find buyers. Under the EEG, plants do not even need a contract with the DSO in order to sell their output.

Both renewables covered by the EEG and CHP plants covered by the CHP law have priority access to the grid. The remaining DG plants do not have priority and hence have to find a third-party customer by themselves for their output, to be supplied via the grid. Such grid access and electricity purchase follow conditions:

- The EEG provides an obligation on all DSOs to buy power from well defined renewables at rates fixed above market price.

A CHP plant at Wolfring uses biogas to fuel its gas engines. The existing CHP law requires distribution system operators to buy electricity from cogeneration (GE Energy Jenbacher)

Saar Energie has taken part in one of the first approaches to develop marketable DG products in Germany (Saar Energie AG)

- The CHP law requires all DSOs to buy electricity from well defined CHP plants at a rate above the market price.
- Besides the EEG and the CHP law, there is no legal obligation for DSOs to buy electricity from autoproducers.

As both renewables and CHP plants sell their output directly to the DSO and not to a third party, they would not have to pay grid charges even if the charges for plants were not set to zero, as is the case in Germany. The EEG (amended in August 2004) has improved the conditions for the plant proceeds of biomass, offshore wind and geothermal such that it would guarantee sufficient revenues. The share of decentralized renewables[1] might now increase up to 20%, with biomass as the most significant contributor to that growth.

If the CHP law remains unchanged, there will nearly no growth in cogeneration. This is despite the fact that Germany has a CHP potential of half of the total electricity production. Under more favourable conditions, the market share of cogeneration could grow to 20% by 2020, in which less than 2% would be micro-CHP, and where gas CHP would undoubtedly dominate.

DSOs are 'passive' in that they try to avoid going beyond their original 'wires business'

Altogether, decentralized energy production in Germany could easily have a 40% share of the market by 2020.

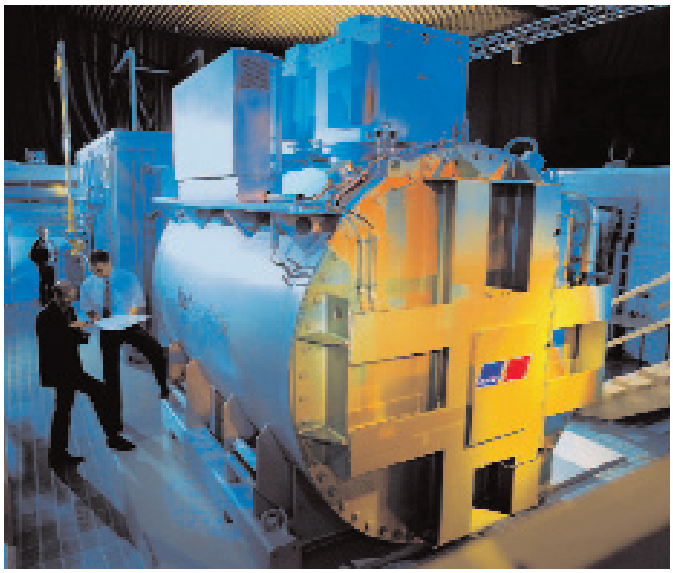
FIRST STEPS TO MARKET PARTICIPATION

With a potential market share of 40%, decentralized energy cannot remain locked into niches but must participate fully in the markets, provided that they are liberalized with low barriers to market access and information.

In Germany, the DG community has taken its first steps to develop marketable products and take part in the market:

- In December 2004, the municipal utility of Unna in Northrhine-Westfalia launched a so-called 'virtual power plant', which integrates different decentralized plants. Among them are five small CHP plants, two wind parks, one small hydro plant and a photovoltaic facility. The integration tool is in addition to standard automation and control technology, specialized software which optimizes the electricity supply according to customer demand. One of the goals of this project is to lower the procurement costs of the utility and to fully utilize the value of decentralized options, by balancing the intermittency of some of these options.
- Saar Energie, a subsidiary of STEAG, one of the largest IPPs in Germany, has set up a 'virtual power plant' for the balancing market. Among its 31 partners are decentralized power plants, as well as large industrial customers who can switch off their load for a short period of time. Together, they currently combine 680 MW in a pool controlled by modern information and communication technology. Within one year, Saar Energie has gained a market share of more than 5% in a €1 billion market and is heading for more. According to one of the innovators of the approach, decentralized power plants and large industrial customers together could cover the whole balancing market in Germany.
- In the city of Hattersheim, the local parliament has decided to supply a CHP plant to a new-build district of the city and to operate the district's low-voltage grid separate from the existing grid, which is owned by the regional utility. This so-called 'area net', or 'power park', has only one connection to the medium-voltage level and will be maintained by the local utility. The reasons behind this decision were mainly economic, and despite the efforts of the regional utility to fight against it, it was finally willing to co-operate.

A fuel cell being tested in Hamburg. Fuel cells produce electricity and heat in an environmentally friendly manner (European Fuel Cells GmbH)



The use of fuel cells is well underway in Germany. A unit at the Rhön-Klinikum hospital in Bad Neustadt, Franconia, has reached well over 21,000 hours in operation (MTU Fuel Cells)

These approaches may indicate that the decentralized generation options are moving closer to the markets and are discovering their economic value, which can be exploited in liberalized markets. If this development proceeds with the help of the new energy law (discussed below), it could lead to a paradigm shift in the German electricity market.

DSOs AS KEY PLAYERS FOR A LEVEL PLAYING FIELD

Currently, the main purpose of Germany's 700+ DSOs is to provide distribution network services, mainly the transport of electricity. These DSOs are 'passive' in the sense that they try to avoid measures that go beyond their original 'wires business'. They clearly favour a situation in which they get their power from big suppliers, transport it to their customers, and ensure the security of supply through network maintenance and reinforcement. This is mainly due to the incentive structure that is determined by the current regulatory framework.

If DSOs stick to this role in the future, they are likely to regard decentralized electricity production as troublesome, a cause of additional costs that may not be totally recoverable through the network charges. All costs connected with distributed generation are then additional costs to the DSOs compared with when they still get centralized electricity.[2] Unless the DSOs are compensated for the trouble they would have with DG, the playing field between centralized and decentralized generation will remain clearly biased in favour of centralized generation. Furthermore this compensation must be indicated beforehand in order to neutralize the 'natural' resistance against DG.

As for renewables and decentralized CHP plants, there is an obligation on DSOs to connect them to the grid, accept their output, and pay a fixed rate for renewables or a rate above the market price for CHP plants, as discussed earlier. However, despite this formal obligation, a DSO may try to make it more difficult or more costly for a DG plant to get grid access, making projects less profitable or even unprofitable. The weak regulation and the heavy reliance on court rulings has given DSOs significant scope for doing this.

DSOs can pass the remuneration for the renewables plants to the transmission system operators (TSO) to whom the DSOs are connected. TSOs in turn can pass it on to the supply companies, which will distribute it to all end-users. This burden-sharing mechanism, introduced by the EEG, has removed one of the

The new law will end the long era of self-regulation

former reasons for DSOs to oppose an increase in renewable generation. Although the remuneration does not affect the DSO's revenue stream once the plant is on-line, there are still a number of reasons for the DSO to be opposed to an increase of independent DG generation in the local area:

- The higher the number of independent DG plants connected to the grid, the more difficult the operation of the grid. For example, if the grid needs to be taken off-line, the DSO would first need to inform all DG plants to stop generating.
- Transaction costs – the DG operator represents an additional counterpart that the DSO has to deal with (in signing contracts, transferring money, etc.) – without any potential for making money out of this relationship. Additionally, the DSO has to deal with the TSO, who has to make a refund to the DSO for payment made to the DG operator. This requires additional staff and thus increases the costs for the DSO.
- The intermittent generation from DG plants can affect the DSOs when they need to provide more balancing energy. It

is not yet clear how the DSOs can recover the costs for balancing.

- Creating an economically level playing field for decentralized electricity production with 'passive' DSOs would incentivize them to consider all additional costs, including transaction costs. This incentivization therefore relies heavily on a sound regulatory regime that not only neutralizes the undesirable incentives, but also gives positive ones.

THE NEW GERMAN ENERGY LAW

For the future of decentralized electricity production in Germany, the new energy law – and as an important part of it, the new regulatory regime – will play a crucial role. This law, Zweites Gesetz zur Neuregelung des Energiewirtschaftsrechts

Establishing a level playing field will depend upon the new regulatory authority

(Second law for the re-regulation of energy law), translates the European Electricity Directive to the national level and will end the long era of self-regulation, in which the large utilities have prevented newcomers from both the generation and supply market.

Besides the overall impact of a more competition-oriented framework, some specific aspects, both in the energy law and the corresponding orders[3], are very important for the future role of DG:

- Compensation for avoided network costs:
  - *plants that are not connected to the high-voltage level* – these will receive compensation for the avoided network costs. As grid charges for all power plants are set to zero, thereby exempting DG plants from paying for the avoided network costs via the lower grid charges, this compensation is the only way for DG plants to appropriate the benefits of avoided network costs. It can be an important source of income for DG operators.
  - *the calculation of grid charges* – these are based on the assumption that all electricity is fed into the high-voltage transmission grid. The payment from the DSO to the TSO, however, is based on the actual annual peak load which the DSO gets from the TSO, reduced by a coincidence factor. As a result, if there are plants connected to the distribution network, the payment which the DSO receives from grid users would exceed the fee passed from the DSO to the TSO. The draft of the order for electricity network charges (Stromnetzentgeltverordnung, Section 18) fixes the compensation for these avoided network costs, especially for those CHP plants that do not receive them as part of the CHP law.[4]
- *system optimization of the decentralized options* – article 14 (7) of the European Electricity Directive states: 'When planning the development of the distribution network, energy efficiency/demand-side management measures and/or distributed generation that might supplant the need to upgrade or replace electricity capacity shall be considered by the distribution system operator.' This article is also part of the draft of the energy law (Section 14 [3]) and is expanded by the government's authorization to pass an order that can define adequate methods and criteria for the DSO planning process. This addendum is very important because without it, the DSOs could not be forced to consider decentralized options within their planning processes.
- *disclosure and transparency of the electricity bills* – Section 42 of the draft of the energy law obliged the electricity suppliers to inform their customers about the share of nuclear, coal, gas, renewables and cogeneration in their portfolio. With respect to the share of cogeneration, this regulation goes beyond the electricity directive and can be recognized as successful for the DG lobbying groups in Germany.
- *market access to the balancing and the reserve market* – Unfortunately, there will be no adequate and transparent rules in the energy law for the design of these two markets, but as a minimum, the government will have the possibility to pass orders that can solidify the conditions for both markets (Section 24). Since the balancing costs (which are very high in Germany) are an important part of the 'use of system' charges of the high-voltage grid, the regulator might especially urge the legislator to improve the balancing market's transparency, access and co-operation.

There is a good chance that the new law will be passed before this summer and come into effect on 1 July. Even if it is, it will be at least another year before the new regulatory authority has enough staff, data and knowledge to start the regulatory process. The establishment of a level playing field, giving decentralized electricity production a fair chance of market participation, will depend heavily upon this new authority. It will also depend on the authority's ability to enforce a rational regulatory process against the market power of the incumbents and their associates in the Federal Ministry of Economic Affairs.

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NOTES

1. Offshore wind is not considered to be a decentralized option.
2. Except the few cases in the short-run where it is cheaper for the DSO to connect a DG plant than to upgrade the network.
3. There may be more than 20 additional orders (Verordnungen) to the law from which four are already drafted.
4. Renewable plants that fall under the EEG do not get avoided network cost payments because the EEG remuneration does already include them.