Demolition of a building in Cottbus, Germany. Photo: Stefan Schroeter

Shrinking cities

a new challenge for energy providers

Since 1989, East German industrial centres have lost a large part of their population. Due to large-scale demolition of residential buildings and strongly decreased demand, energy providers have to make changes they have very little experience with. As Europe's population is or will be shrinking in many other places, the German example holds interesting lessons for other countries as well.

by Stefan Schroeter

All that is growing in Halle-Silberhöhe, a drab residential area with prefab apartment buildings, is the lawns. Many of the buildings have been torn down during the last few years. However, on the open spaces of Residential Complex 7 there are no children playing in the afternoon, and only a few people are on the move in the streets. The area is losing its residents. Some of the neighbouring apartment buildings are already uninhabited; they will soon be torn down. Two schools and a gymnasium are not used any more.

As the buildings disappear, the streets remain to bear witness of the former scale of the area. Beneath the surface, the pipelines for electrical supply, district heating, water and sewage still remain. 'We don't physically remove every service pipe', explains Jens Böttcher, Department Manager of Planning and Building with the municipal provider, EVH, Energieversorgung Halle GmbH. 'The lines remain in place as long as there is no danger from them'. It saves money. The city administration is considering building a commercial centre in the vacant areas of Silberhöhe. However, nothing has been decided yet.

In the historical year 1989, the residential area Silberhöhe had 40,000 inhabitants. Many worked only a few kilometres away, in the industrial zones Leuna and Buna with their large chemical companies. Today, only a fraction are still employed. Tens of thousands couldn't find work any more and relocated to other areas with better possibilities for employment, often in West Germany. In addition, many a former resident of these quarters who does have a job and who does make a good living has got himself a renovated traditional house (Altbau) near the city centre. These houses are now as comfortable as the prefabricated apartment buildings, or even more so. They had been coveted in GDR times because they had central heating and hot water. Other families have built their own homes in the suburbs, which only few could afford in earlier days. As a result, only 14,000 people live in Silberhöhe today. In all of Halle, a town in the federal state of Saxony-Anhalt, the number of inhabitants went down by some 84,000 since 1990, and is currently about 232,000. In the coming years, the city administration anticipates a further decline.

A similar trend can be seen in other East German industrial centres such as Cottbus, Eisenhuttenstadt, Hoyerswerda, Weißwasser and Zeitz. The resulting high vacancy in the prefab building districts and the old debts from GDR times which still loomed over the buildings, put the housing corporations in economic difficulties in the 1990s. In the end the


Matthias Krause. Photos: Stefan Schroeter


Sabine Froning


Andreas Huke

federal government and federal states could be convinced to start up an urban redevelopment programme called "Stadtumbau Ost", which costs €2.5 billion and which supports the demolition of vacant houses and the improvement of city accommodations between 2002 and 2009. The programme is intended to make East German cities more attractive and to decrease the high vacancy of over 1 million houses. It includes the demolition of 350,000 lodgings. 193,000 apartments had been demolished by February 2007. This would have been inconceivable in GDR times because of the ever-present need for housing.

> *The lines remain in place as long as there is no danger from them*

Approaching evil

The support programme initially focused on work above ground. The underground lines and installations for energy and water hardly appeared in the subsidy applications. Which houses were to be torn down was determined largely by the housing companies and the city planner's urban-development concepts. The fact that the technical infrastructure should be a part of the redevelopment process, including the pipelines and installations for water, sewage, city heating, gas and electricity, was not taken into consideration in the first years.

Even many service providers seemed to only gradually recognize the approaching evil. A status report from the Federal Department of Transport, Building and Housing on 5 years of Stadtumbau Ost, issued in May 2007, still states that 'location-related decisions of utility companies (e.g. the reconstruction or repair of pipelines) are often still made without a long-term view of the actual development of demand in the respective supply areas.'

The technical infrastructure is greatly affected by urban redevelopment, as is shown in a study published in 2006 by the Brandenburg Technological University of Cottbus. Central water systems, sewage systems and city heating systems function in a suboptimal way if their capacity is underused. It takes drinking water so long to reach the consumer through the main lines, for example, that its quality can be impaired. To avoid this, and to be able to maintain German drinking water standards, the providers increase the capacity artificially with so-called line rinses. With these, drinking water is discharged in fire hydrants.

Sewage pipes are constantly obstructed by pollution and require extra cleaning. With the waste water flowing so much longer, decay sets in, producing more than just a bad smell. It also causes chemical processes that can damage pipes and pumping installations. In some cases installations have to be rebuilt, as the public utility company of Weißwasser reports. In their case, the inflow pumping installation of the sewage treatment plant was designed for 46,000 inhabitants. Since there are only 20,000 residents left in this East Saxony city, only one of the two processing lines of the sewage treatment installation was used, with a capacity suitable for 23,000 residents. This means that the pumps operated only in the lowest performance range, incurred high wear and had to be replaced with new, more efficient pumps.

Hot water in district heating systems also travels longer distances when the heat intake decreases. Therefore, there is a higher relative heat loss while at the same time, the heat level available to the consumer decreases. This in turn leads to problems in the regulation of the equipment and also to higher losses. The experiences in Halle show how much heat distribution can decrease due to the industrial decline of an area and to the decline in population – since 1993, the EVH's heat distribution decreased by 1,000 GWh to 702 GWh in 2006. 250 GWh of this distribution decline, Krause assigns to industrial heating; he attributes the large remainder to the decline in population, an improved energy efficiency of the buildings and a

more efficient consumption behaviour on the part of the residents. However, as the heating plants and pipes had actually been designed for increasing amounts, reduced distribution led to less efficiency and greater pipeline losses.

This phenomenon was particularly noticeable in the district heating pipeline that runs from the Dieselstrasse plant in the eastern section of town to the Halle-Neustadt, more than 6 km to the west. 'With our above-ground pipelines, we cannot prevent transmission losses', says Matthias Krause, technical manager of EVH. 'However, we aim to minimize them by system adjustments and a flexible operating method'. Moreover, the Dieselstrasse plant was already modified in the mid-1990s so that it could feed hot water of different temperatures up to 130°C into the pipes. EVH equipped the pumping stations with pumps with rotary speed control. 'As a result, we can use variable temperatures and quantities, and reduce the heat losses', explains Krause.

City network

EVH connected two district heating systems, which until then had been supplied from their own stations, to the city network. This improved the effective operation of the city heating system. In addition, the provider simplified the structure of the heating network in the shrinking Silberhöhe district. Instead of six, there is now only one secondary network that draws hot water from the primary network and feeds it to the respective private connection stations. 'We used sections of the previous primary network to build the secondary network', says Krause. For this €1.2 million project the company was able to acquire €217,000 from the "Stadtumbau Ost" programme. 'So far this has been the only time we managed this', says the EVH manager. All in all, he estimates that the urban redevelopment programme has cost his company €4.5 million. District heating alone took up €3.5 million of that amount.

First and foremost, the heat-generation capacities of the Dieselstrasse and Trotha power stations needed to be restructured towards a flexible operating method. When EVH replaced the equipment of the old power station in Dieselstrasse in 2005, it built two gas and steam turbines that, through combined heat and power (cogeneration), could provide 34 MW heating capacity each. In winter, both plants are operated using the highly effective cogeneration system with a fuel utilization level of up to 89 percent. In summer, when the heat demand is much lower, one plant is sufficient. The cogeneration plant at Trotha, which already dates back to 1993 and which has a heat capacity of 70 MW, currently still covers the basic heat load in winter. The gas turbine used there cannot be operated in partial load mode, and is therefore not suitable for the targeted flexible heat-generation system of EVH any more. Krause and his colleagues are considering building one or two smaller GuD plants, with 20 to 30 MW each in Trotha after 2010. They could easily be used in the summer.

In Zeitz, a medium-sized town in the south of Saxony-Anhalt, the public utility

The areas with prefab apartment buildings in Halle get their heating from two heat and power plants. The renovation of the city heating systems constitutes the greatest expense for energy provider EVH. Photo: Stefan Schroeter

company registered a decline in heat distribution similar to Halle. Selling 85 million kWh of heat annually in the early 1990s, it sold no more than 34 million kWh in 2006. Sure enough, the heat plant that was built in the mid-1990s with four modules and 5.5 MW electricity as well as 5 MW heat still works flexibly and heat controlled. 'But we cannot optimize it any further, either electrically or thermally', states general manager Andreas Huke. The three peak-load boilers are hardly used any more, even in winter. Thanks to the special write-offs possible in Eastern Germany at the time and the reimbursement recently introduced for electricity produced in cogeneration, the plant is still cost-effective.

Where investments in the city supply networks are concerned, the enterprise mainly focuses on demographic developments. Two institutions have been forecasting these developments in the past six years. In this manner the public utility company knows which areas will show population growth and so in which areas the modernisation of transformers and pipelines is worthwhile. The information does not affect the heating network, because it was already totally renewed when the cogeneration plan was built.

With its two cogeneration installations, the new Dieselstrasse heat and power station can respond flexibly to heat demand in winter and summer. Photo: Stefan Schroeter

The experiences in Halle show that renovating electrical networks is less complicated than renovating heat networks. Transformer stations and pipeline sections are taken out of action completely in the event of extensive demolition. A transformer station for Silberhöhe is only used at half capacity. 'We are discussing whether we should close it down or modify it', explains Böttcher. Power supply lines need to be rerouted by EVH only if specific buildings disappear. The gas network doesn't even play a role in the redevelopment project in Halle, because gas is rarely used for cooking in the prefab areas. Most of the households use an electric range.

Demolition works

In order for the energy networks in "Stadtumbau"-areas to be designed as effectively as possible it is essential that the demolition of apartment buildings is carried out on adjacent plots wherever possible. In addition, demolition works should be organised in such a way that service pipes need not be rerouted in order to continue the supply of the buildings that temporarily remain. In prefab apartment buildings, the pipelines for both power and heating, which supply several buildings, run through the basements. Since 2002, the organisation has gone well in Silberhöhe thanks to a steering committee to which Mayor Dagmar Szabados, the housing corporations and the suppliers belong. This committee determines the dates and the order of demolition and the distribution of development funds, and lays everything down in legally binding agreements. Krause explains that it is not always easy to balance the various interests: 'We occasionally had even more rigorous ideas on the demolition'.

In many other East German cities, the providers have also succeeded in promoting their interests in city renovation strategies. Just like in Halle, the Hoyerswerda city administration, housing companies and providers reached agreement on extensive revitalization. City revitalisation in Weißwasser is performed from the outside inwards, allowing the utility companies to rebuild their networks in the same order. In 2001, five of the seven large local housing corporations of Chemnitz combined forces in a new company, Stadtumbau GmbH, joined later by the public utility company. Erfurt has a master plan for urban redevelopment. As the development

works proceed, it is updated every two years. And in Leipzig, the public utility companies report on considerable cost reductions in the rerouting of the heating pipelines, achieved as a result of timely communication and integrated planning of the revitalisation of the prefab area of Leipzig-Grünau.

Torn down

The situation is more complicated in areas where buildings have different owners – as is the case in the eastern outskirts of Zeitz. Many apartment buildings, which belong to smaller housing corporations, have already been renovated and are now rented successfully. Other apartment buildings in the immediate neighbourhood, not yet renovated, belong to the city's housing corporation. Many of the apartments are vacant, some of the buildings have been torn down, with more to follow. 'When that happens, we will need to reroute heating, gas, water and electricity in order to clear the construction area', explains Huke. From a supply perspective it would be ideal to tear down entire areas from the outskirts of town to the centre and then shut down the redundant sections of the network. However, that would imply tearing down renovated buildings as well. 'It is a problem that cannot be solved', says the manager. Until now, the Zeitz utility companies have been able, at least to some extent, to promote their interests in the renovation process, which was determined by the house owners. Only a few months ago they discussed whether a certain building could be demolished instead of another one, because from a supply perspective it was more favourable.

Meanwhile, a new trend is developing: the new mayor, Ulf Altmann, made urban redevelopment a theme in his campaign. He wants to commit himself to preserve more of the existing buildings and to be more attentive to the supply interests.

Companies in other areas in central and eastern Europe can benefit from the experiences of providers in East Germany when they are dealing with similar processes. However, Matthias Koziol, Professor of Urban Technology at the Brandenburg Technological University of Cottbus, says that the problem of population moving away was not as extensive there as it was in East Germany in the 1990s. People are slower to catch up on the idea of building their own houses, though. 'That will not be taken up as quickly as in East Germany, and will be a long-term development'. Moreover, he expects population figures to drop in many European regions. In Greece, Lithuania, Poland and the Czech Republic, for instance, the birth rates are lower than in Germany.

> *'If energy consumption decreases drastically, the supply systems need to be adjusted'*

He recommends that suppliers affected by this problem talk with their city planners in order to influence spatial development. 'In East Germany, this was very successful to some extent, because the discussion partners were just a handful of housing associations with large numbers of houses. If you can reach an agreement with them to rebuild the residential areas from the outskirts of town inwards to the centre of the city, and from the end of the utility lines, a lot can be gained'. In addition, Koziol advises the providers to invest sensibly and to make long-term plans. The question is whether they should still want to operate central supply systems in shrinking residential areas, or if restructuring to de-centralised or semi-centralised systems makes more sense.

According to Sabine Froning, the discussions about city renovation are limited to Germany, at this moment. 'However, it may become a subject to which European policies and regulations must be adjusted', thinks the Manager of the Brussels-based Federation of Euroheat and Power. Although she does not believe that other European countries will experience such a strong exodus, 'there are huge areas with prefab apartment buildings in countries like Estonia, Latvia and Romania, which in future can only be modernized to comply with the European energy standards at huge expenditure', says Froning. 'On the one hand this is a financial matter. On the other hand, if energy consumption decreases drastically, the supply systems need to be adjusted to guarantee sufficient primary energy efficiency'. Suitable pilot projects could be supported, in principle, with the EU research support programmes. In actual practice, not enough attention is paid to the interaction between the energy efficiency of buildings and the efficiency of energy supply systems. The expert on cogeneration advocates the inclusion of the modernization of the energy infrastructure if European structural funds are set up for housing modernization. Currently both are still considered separately. ■

Urban redevelopment in West Germany

Currently, 16 pilot cities in the western part of Germany are testing strategies for urban redevelopment. On the one hand, this involves cities in an infrastructural crisis, such as Bremerhaven, Essen and Gelsenkirchen. In these cities it is mainly a matter of healing the town-planning wounds from the industrial age and creating new quality. On the other hand, pilot plans are deployed in individual parts of towns suffering from extensive vacancy, such as Bremen-Osterholz-Tenever, Lübeck-Buntekuh, and Oer-Erkenschwick-Schillerpark. Several pilot cities are applying a method using an electricity meter in order to reliably tackle the vacancy problem.