EBR – SUCCESSFUL TECHNICAL CO-OPERATION BETWEEN COMPANIES IN SWEDEN AND THE INFLUENCE OF DEREGULATION

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ELECTRICITY DISTRIBUTION IN SWEDEN

When the electricity network was established in Sweden, a lot of different companies were created. The state and the local municipalities established their own distribution companies, and in rural areas many small distribution associations were formed. Some larger industrial manufacturers formed their own electricity supply, primarily for their own use, but also for supply of surrounding areas. The electrical network was thus constructed and expanded by a large number of different companies, different in size and with various kinds of owners. These companies used to a large extent their own construction designs and working methods for their networks.

EBR CO-OPERATION

With this background the EBR (= “ElByggnads-Rationalisering” in Swedish, which might be translated as “Rational Construction of Distribution Networks”) was developed. The co-operation started with overhead lines, and was later gradually extended to other parts of the network, until it today covers most of the distribution and even parts of the transmission networks, from 0.4 kV to 400 kV.

During the period of EBR, the number of network companies has decreased from around 900 in 1970, to around 200 in 1999. In reality the decrease is larger, as many companies today are included in larger concerns, but statistically are counted as separate ones.

EBR today comprises of a whole system, covering the procedures from planning/budgeting to the completed construction, including control of the costs and the construction time spent. EBR covers the following types of publications:

- Construction and design standard for overhead and underground lines and for substations
- Material handling
- Preparation of projects
- Rational construction technique
- Rational maintenance
- Personnel training
- Safety rules
- Control of costs spent and construction time used, by help of a yearly updated Cost Catalogue

The work of EBR is done by a small secretariat at the branch association, Svensk Energi, and by participation of many people from different distribution companies in committees and working groups. This participation is done as a kind of voluntary contribution to the EBR work, and may be affected by the deregulation of the electricity market in Sweden.

CONSEQUENCES OF THE DEREGULATION

The new situation has increased competition between companies, and the resulting downward press on profit has made all companies much more aware of costs. The companies are now trying to reduce the costs by different means, also for the distribution network, although this remains a monopoly. Some of the measures have been:

- Early retirement pension schemes and other measures to slim the organisations and reduce the staff
- Minimising investments in the distribution network
- Division of the companies in new ones, with technical consultants and contractors separated from the distribution companies, which will more take the role of purchasers
- Outsourcing of services to other companies
- Rationalisation of operation and maintenance

CONCLUSIONS

The distribution companies in Sweden have during more than 30 years saved a substantial amount of money by voluntary co-operation under the name of EBR. During that time, EBR has been extended to cover a large part of construction and maintenance work on the network. Today, with deregulation and increased competition between the companies, the demand for EBR and for rational advice and solutions remain very large. But the efforts in the companies to save costs may also reduce the number of people with knowledge and experience, and will make it more difficult to find people who want, and have time enough, to participate in the committees and working groups of EBR. Mergers and acquisitions will make the largest companies even larger in the future, and their interest to participate, and share their experts’ knowledge with smaller companies might decrease. The smaller companies will gain most of the co-operation, but will have limited resources to participate in the work. EBR will have to face this challenge, in order to continue to be the main force for rationalisation of electricity distribution in Sweden.
EBR – SUCCESSFUL TECHNICAL CO-OPERATION BETWEEN COMPANIES IN SWEDEN AND THE INFLUENCE OF DeregULATION

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SUMMARY

In a small country as Sweden, where the electricity distribution network is divided on many companies of different size, there is an obvious risk that different technical solutions and choice of material and methods will increase the costs. In order to avoid this, a voluntary co-operation between almost all of the companies in Sweden has been going on since more than 30 years under the name of EBR, “Rational Construction of Distribution Networks”. The co-operation has under the years been extended, from constructions for overhead lines, to later include underground constructions, cost estimates and calculations, material handling, safety rules, maintenance etc, until it today is a whole system for a rational distribution of electricity.

The work is done by a small secretariat, at the central branch association, Svensk Energi, and with participation of many voluntary experts from the distribution companies in committees and working groups. After the deregulation of electricity in Sweden, the companies have changed in many ways, by reorganisations, mergers, outsourcing etc. The increased competition on the sales of electricity has also forced the companies to find methods to reduce the costs, also for the distribution network. This has made the use of EBR more important, and also created a need to look more in detail at the maintenance costs of the networks than before. On the same time the companies also have reduced their technical staff, and sometimes people with the right knowledge are now working in consultancy and contracting firms, and are more reluctant to participate in committees and working groups without adequate compensation. The report describes briefly the EBR co-operation and history, and discusses its future in a changing environment.

ELECTRICITY DISTRIBUTION IN SWEDEN

When the electricity network was established in Sweden, a lot of different companies were involved. The government formed Vattenfall, a wholly state owned company, which was mainly dealing with hydro power production and transmission, later also with nuclear power. In the field of distribution Vattenfall was mainly dealing with rural areas in the northern parts of Sweden. In the towns and cities, the local municipalities established their own distribution companies, and in the rural areas many small distribution associations were formed. Some larger industrial manufacturers also formed their own electricity supply, primarily for their own use, but their networks also were used for supply of the surrounding areas. The electrical network was thus constructed and expanded by a large number of different companies, different in size and with various kinds of owners. These companies used to a large extent their own construction designs and working methods for their networks. As a consequence, many designers were needed, and the variety of material used was considerable. The possibility to increase the efficiency of material production was limited, and thus the costs remained high.

TABLE 1- Number of network companies

<table>
<thead>
<tr>
<th>Owner</th>
<th>1974</th>
<th>1994</th>
<th>1999</th>
</tr>
</thead>
<tbody>
<tr>
<td>State</td>
<td>20</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>Municipalities</td>
<td>182</td>
<td>155</td>
<td>130</td>
</tr>
<tr>
<td>Private</td>
<td>138</td>
<td>45</td>
<td>30</td>
</tr>
<tr>
<td>Associations</td>
<td>233</td>
<td>48</td>
<td>30</td>
</tr>
<tr>
<td><strong>Summary</strong></td>
<td><strong>573</strong></td>
<td><strong>273</strong></td>
<td><strong>200</strong></td>
</tr>
</tbody>
</table>

With this background the EBR (= “ElByggnadsRationalisering” in Swedish, which might be translated as “Rational Construction of Distribution Networks”) was developed in the mid 1960s in order to create rational standards and construction methods for electricity distribution networks. It started with overhead lines, and was later gradually extended to other parts of the network, until it today covers most of the distribution and even parts of the transmission networks, from 0.4 kV to 400 kV.

During the period of EBR, the number of network companies has decreased from around 900 in 1970, to around 200 in 1999. In reality the decrease is larger, as many companies today are included in larger concerns, but statistically are counted as separate ones.
The EBR is a system, including control of the costs and the procedures from planning/budgeting to the completed construction. EBR today comprises a whole system, covering the areas, mainly as overhead lines. For these a large number of constructions were used. The design engineers in each company often used constructions based on experience, and the design margins were large. Through selection of one common standard, among many available, and a thorough calculation of design parameters, it was possible to reduce the number of components used for the construction work, and with larger numbers of each component the material prices also dropped. The common standard was successfully introduced to the involved companies, and soon other companies started to use the same standards. From the beginning EBR also strongly focused on the economic advantages and cost estimating, and a common cost base through work-studies have been established as a part of EBR. EBR has always tried to be in close contact with people out in the field. The proposed solutions shall be a good help for the engineers and linesmen, and these staff categories have also been involved to develop and describe the recommendations of EBR.

In 1973 a formal extension was made, to also include underground networks in towns and cities. EBR has also been extended to include safety rules for operation of electrical installations, based on governmental regulations, but which describe the work more in detail. The voltage area has gradually been increased, from in the beginning 0,4 – 24 kV to cover up to 400 kV. The main emphasis, however, still remains on distribution. During the last years more efforts have been laid on maintenance instructions and recommendations, as the volume of investment in new installations has decreased.

**BACKGROUND AND HISTORY OF EBR**

EBR started as a co-operation between Vattenfall, the state owned company, and VAST, a research and development branch for some of the larger private distribution companies. Their networks supplied rural areas, mainly as overhead lines. For these a large number of constructions were used. The design engineers in each company often used constructions based on experience, and the design margins were large. Through selection of one common standard, among many available, and a thorough calculation of design parameters, it was possible to reduce the number of components used for the construction work, and with larger numbers of each component the material prices also dropped. The common standard was successfully introduced to the involved companies, and soon other companies started to use the same standards. From the beginning EBR also strongly focused on the economic advantages and cost estimating, and a common cost base through work-studies have been established as a part of EBR. EBR has always tried to be in close contact with people out in the field. The proposed solutions shall be a good help for the engineers and linesmen, and these staff categories have also been involved to develop and describe the recommendations of EBR.

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**THE EBR IS A SYSTEM**

EBR today comprises of a whole system, covering the procedures from planning/budgeting to the completed construction, including control of the costs and the construction time spent. Let us follow a project. The planning engineer can get rough cost estimates and also compare different design solutions with the help of the EBR Cost Catalogue. Later, when he has selected the preferable design of the project, he can use the same Cost Catalogue to calculate the work, and make time estimates. The catalogue gives information about the normal construction time and the normal total costs for the established EBR types of design. All information given is based on field studies, and the catalogue is updated once a year.

When the engineer has finished his part of the design work, a field preparation is done, with selection of the proper designs and methods, agreements with the ground owners and decisions about pole positions, transports, storage sites etc. A preparation protocol will be used as a guide for the construction work and for handling of the material. The protocol also includes a more detailed calculation of construction time for the crew and machines as well as a more accurate cost estimate.

During the construction, material is supplied in material kits to the selected storage sites, normally at suitable places along the route of the work. The use of kits results in the transfer of a great deal of material handling from the construction crew to the manufacturer or the wholesaler, where the handling can be done in a more rational way. Some material can also be preassembled indoors under controlled conditions, thus facilitating the construction work. The number of components for construction work has been limited through strict selection among established components and designs. Methods have been optimised as regards number of people in crews, as well as equipment and time required.

For underground cable construction works, 0,4-145 kV, EBR has in co-operation with the Government Electricity Authority and the Swedish Committees for Electric Standardisation standardised laying depths, and introduced suitable cable types.

Safety rules have been developed, which supplement the National Safety Regulations, with special regards for the distribution system. They describe the organisation and the responsibilities for the work at electrical installations, in order to avoid injury and damage to health for the employees. The rules go into greater detail than the Regulations. They are intended for the practical use at the point of work.

A special EBR Cost Catalogue gives information about the normal construction time and the normal total cost for different types of designs. The catalogue is updated once a year, and serves as a base for cost calculation and analysis, but also for planning and budgeting.

Recommendations for rational maintenance works, 0,4-420 kV, have been worked out. Annual maintenance

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**TABLE 2 - Number of consumers**

<table>
<thead>
<tr>
<th>Network owner</th>
<th>1974</th>
<th>1994*</th>
<th>1999*</th>
</tr>
</thead>
<tbody>
<tr>
<td>State</td>
<td>340 000</td>
<td>701 000</td>
<td>972 000</td>
</tr>
<tr>
<td>Municipalities</td>
<td>2 740 000</td>
<td>3 256 000</td>
<td>2 362 000</td>
</tr>
<tr>
<td>Private</td>
<td>872 000</td>
<td>1 186 000</td>
<td>1 752 000</td>
</tr>
<tr>
<td>Associations</td>
<td>287 000</td>
<td>173 000</td>
<td>114 000</td>
</tr>
<tr>
<td>Summary</td>
<td>4 239 000</td>
<td>5 316 000</td>
<td>5 200 000</td>
</tr>
</tbody>
</table>

* The statistical series have been changed, and thus the decrease in number of consumers from 1994 to 1999 may not be correct.
costs are at present of the same order as the annual investments, and it has therefore during the last years been an increased interest in reducing the costs through standardised and cost effective methods.

EBR is following the technical development in Sweden and abroad, and is trying to evaluate and introduce technical achievements, regarded as beneficial for the network owners. Different working groups are involved in the continuous task to evaluate and introduce the new techniques. They do this in close co-operation with the Swedish organisations, representing IEC and CENELEC.

Training programmes are initiated within the sphere of operations of the electricity distribution companies, and information material produced.

ORGANISATION OF THE EBR CO-OPERATION

Initially the work of EBR started as a two parts co-operation between Vattenfall and some of the largest distribution companies, mainly dealing with overhead distribution. In 1973 the Swedish Association of Distribution Companies, with also the distribution companies owned by the municipalities as members, was formally included in the co-operation. During the years major changes has been made in the branch associations, and today the work with EBR is organised as a part of Swedish Energy, the new branch association for all companies dealing with production, distribution and sales of electricity. The work is held together by a small secretariat of four persons, and the work is done in committees and working groups.

There is a steering committee, with representatives from different companies, and the committee also includes four representatives from the labour unions. EBR has a strong emphasis on rationalisation, and it is advantageous to keep the union representatives informed about ongoing projects.

Under the steering committee the work is divided on two project steering committees, one for economy and one for technology. Under these two committees there are temporary working groups, normally with a convenor from one of the committees, a secretary from the central secretariat and a number of experts from different companies.

The costs for the EBR include salaries for the central secretariat, printing and distribution of publications, and sometimes also some consultancy services. But the largest part of the cost, all the work that is done in committees and working groups by participants from the distribution companies, is not covered but regarded as a kind of voluntary contribution to the EBR work. This means that EBR is depending on the will of the companies to let their staff participate in the work, and pay their expenditures. Sales of publications and arrangement of conferences and courses in the different subject, which are covered by EBR, cover the costs that remain.

DEREGULATION OF ELECTRICITY IN SWEDEN

The deregulation of electricity in Sweden has been followed by large changes in the electricity branch, which are still going on. The sale of electricity was set free for all types of consumers at almost the same time. It was also decided that distribution of electricity must be kept separated from production and sales. This meant reorganisation and division of the companies, and has been followed by sales and mergers between many companies, especially for the new parts of the former companies, which are dealing with purchase and sale of electricity.

For transmission and central operation of the system, a new state company was formed, Svenska Kraftnät.

CONSEQUENCES OF THE DEREGULATION ON COMPANIES

The new situation has increased competition between companies, and the resulting downward press on profit has made all companies aware of costs. The management has been focused on sales of electricity, and the reorganisation that the deregulation has forced them to do, and on mergers and take-over of other companies. The companies are now trying to reduce the costs by different means, also for the distribution network, although this remains a monopoly. Some of the measures are:

- Early retirement pension schemes and other measures to slim the organisations and reduce the staff
- Minimising investments in the distribution network
- Division of the companies in new ones, with technical consultants and contractors separated from the distribution companies, which will more take the role of purchasers
- Outsourcing of services to other companies
- Rationalisation of operation and maintenance
CONSEQUENCES ON THE CO-OPERATION WITHIN EBR

For EBR this has created a somewhat new situation, with a greater need for the services and cost assistance that EBR can provide in order to rationalise the work. There has also during the last years been an increased interest in maintenance, and an ambition to improve the efficiency of operation and maintenance. The need for the EBR cost catalogue has increased, and it is now used both for calculation and planning, but also for comparisons in connection with procurements. But on the same time the people who are voluntarily working in the different committees and working groups of EBR are getting fewer, and much of the knowledge and experience from the field will now be in the consultancy and contracting companies. These are less willing to work with EBR without economic compensation, and in some cases they are not willing to share their knowledge with other firms, which they regard as their competitors. Many persons with long experience have also been laid off through the early retirement schemes, and the remaining people are often heavily affected by an increasing workload. So far EBR has managed to find interested people for most of the working groups, but there are some projects which have never got started because of lack of interested people to do the job.

Sometimes the new consultancy and contracting firms are only willing to participate, if they are paid for the duties they perform. This may be done by an order from the network company in the same concern they belong to, but also these are today more reluctant to spend their money on work, where the immediate benefit may not be obvious.

CONCLUSIONS

The distribution companies in Sweden have during more than 30 years saved a substantial amount of money by voluntary co-operation under the name of EBR. During that time, EBR has been extended to cover a large part of construction and maintenance work on the network. Today, with deregulation and increased competition between the companies, the demand for EBR and for rational advice and solutions remain very large. But the efforts in the companies to save costs also reduce the resources of people with knowledge and experience, and will make it more difficult to find people who want, and have time enough, to participate in the committees and working groups. Mergers and acquisitions will make the largest companies even larger in the future, and their interest to participate, and share their experts’ knowledge with smaller companies might decrease. The smaller companies will gain most of the co-operation, but will have limited resources to participate in the work.

THE FUTURE OF EBR?

The future of EBR will thus depend on the will to continue the co-operation between all the companies, and also on how the restructuring of the distribution branch will continue. Today all the three largest companies in Sweden are actively participating in the work, and it would be very difficult to obtain the same result as today, if any of them would chose to abstain from the co-operation.

One question is also the future division of the work between buyers (network companies) and sellers (consultants and contractors)? Where will the expertise work, and are they prepared to work with EBR? The persons with the most valuable knowledge will in the future be divided on these different groups of companies, and EBR must find ways to engage them and their management in the work to update and develop what until now has been achieved. The carrot will be interesting technical tasks, to solve together with dedicated colleagues, and the whip will be the increased alternative costs for finding own solutions in each company.

It will also be necessary to change the way EBR is communicated to all users. The use of the Internet for communication has already started, and in the near future it will replace the use of publications on paper. The web has large advantages – it is rapid, it is more available, soon also out in the field, and it can be easily updated. But also here new ways must be found to cover the costs and ensure the necessary income.

During the third of a century that EBR has been a major help for the Swedish companies, it has got a very good reputation, and saved substantial amounts of money for the electricity distribution network. With combined efforts from involved persons and companies, EBR will be ready to meet future challenges, and continue to be a major force in the rationalisation of construction and maintenance work in Sweden.