

**Azerbaijan: Rehabilitation Programme in the field of Electricity Transmission (Phase 1)**

**Ex post evaluation report**

<b>OECD sector</b>	23040 - Electrical transmission and distribution	
<b>BMZ project ID</b>	1998 66 039	
<b>Programme-executing agency</b>	Azerenerji Joint Stock Company (JSC)	
<b>Consultant</b>	Arge BEA / DECON Consultants, Düsseldorf / Bad Homburg	
<b>Year of ex post evaluation</b>	<b>2006</b>	
	<b>Project appraisal (planned)</b>	<b>Ex post evaluation (actual)</b>
<b>Start of implementation</b>	August 1998	September 1998
<b>Period of implementation</b>	20 months	18 months
<b>Investment costs</b>	EUR 15.9 million	EUR 15.9 million
<b>Counterpart contribution</b>	EUR 0.5 million	EUR 0.5 million
<b>Financing, of which Financial Cooperation (FC) funds</b>	EUR 15.4 million	EUR 15.4 million
<b>Other institutions/donors involved</b>	Not applicable	Not applicable
<b>Performance rating</b>	3	
<b>• Significance/relevance</b>	3	
<b>• Effectiveness</b>	2	
<b>• Efficiency</b>	3	

**Brief description, overall objective and project objectives with indicators**

The project, which was designed as an emergency aid programme with a reduced level of expectation, comprised rehabilitation work in the field of electricity transmission, especially in substations and switchboard plants, which are extremely important for supplying the economic centres in and around Baku in Azerbaijan. Owing to the limited availability of FC funds, the measures at the plants and substations focused on those parts that were most in need of rehabilitation. The primary programme objective was to contribute to enhancing electricity supply reliability by improving the stability and reliability of electricity transmission. The aim was to contribute to the economic development of Azerbaijan (overall objective). The target group comprised primarily the productive electricity users in the region covered by the programme.

The supplies and services consisted mainly of circuit-breakers, air compressors and switch material. In addition, a consultant provided the programme executing agency Azerenerji with support in preparing and carrying out the measures. The project was carried out in accordance with the time frame and concept, without any major changes and in line with the budget. The total cost of the programme measures was approximately EUR 15.85 million – EUR 15.34 million in foreign currency costs which were financed completely out of the FC loan, and an estimated EUR 0.51 million in local currency costs, which were financed by the project executing agency out of its own funds.

The primary programme objective was to contribute to enhancing electricity supply reliability by improving the stability and reliability of electricity transmission and distribution in the load centres in the greater Baku area. The aim was to contribute to the economic development of Azerbaijan (overall

objective). The target group comprised primarily the productive electricity users in the region covered by the programme.

The programme objective was considered to have been achieved if it led to the plants that were to be rehabilitated functioning largely without disruption. The indicators were: (1) Reduction in downtimes owing to operational disruptions at the rehabilitated plants to no more than five hours per annum; (2) selective restriction of the transmission errors that occurred in the field concerned. At the same time, the programme was intended to achieve an increase in the technical safety standards at the rehabilitated plants and a reduction of potential environmental damage caused by used oil disposal at the plants in which oil pressure tank switches were replaced.

### **Programme design / major deviations from the original programme planning and their main causes**

The programme executing agency was the vertically integrated electricity supply company Azerenerji joint stock company, a public limited company established under Azerbaijani law and fully owned by the state. Top management at the project executing agency is directly answerable to the political leadership of Azerbaijan. The President and Vice-President of Azerenerji are therefore appointed directly by the state president and there is no independent supervisory board. The ministerial cabinet and the ministers for economic development and for fuels and energy are the state supervisory authorities, with lead-management changing frequently. Important decisions are taken by the President of the Republic. Azerenerji has fairly extensive freedom in the field of daily operations but is subject to government decisions for important matters such as tariffs and investment plans. The autonomy of the enterprise is thus limited.

The programme measures are used to make electricity supply in the capital of Baku more reliable and to improve the quality of supply for consumers with regard to tension stability and downtime frequency. Execution of the measures, which were designed as an emergency aid programme, was urgently needed as the plants were so outdated that there were frequent disruptions to the electricity supply and operating conditions were dangerous for both staff and the plant. On account of the high costs, it was not financially feasible to completely replace the old plants by modern Western technology (although this was needed) in a single programme. As in similar projects in Georgia and Armenia, the selected rehabilitation concept therefore made provision, with the funds available, for the replacement of only a limited number of the most important and most dilapidated elements of the switchboard plants needed to supply the population. A maximum rapid impact was to be achieved with the limited FC funds, with the result that during the long-term technical transformation, new and old equipment would operate in tandem. From the technical perspective, this concept worked and was also taken as the basis for Phase II of the programme.

The measures mainly included:

- Replacement of defective circuit-breakers, disconnecting switches, converters and antenna fuses as well as protective relays;
- Appraisal and refitting of air pressure plants and rehabilitation of the premises required for them;
- Supplying battery equipment and rehabilitation of the premises required for it;
- Supply of medium high voltage cables.

The measures were carried out by the general contractor, Siemens, accompanied by the consultant BEA/Decon in accordance with specifications, within the ambitious time frame of one and a half years and in line with the budget.

From the technical point of view, Western standards were followed or introduced but with account being taken of the simpler Azerbaijani requirements and situation with regard to automation, remote control technology and ease of use. The intention was to accommodate the operating staff's experience and knowledge. The supplies and services were based on international regulations but, in some cases, Russian standard were also taken into account with regard to connecting the equipment to the existing plants.

As a result of the programme, high-voltage equipment and build-up material was fitted in the switchboard plants, which now ensure regulated, low-disruption operation. It thus proved possible to eliminate key deficiencies in the transmission network and in the switchboard plants in the economic hub and load centre of Baku and the Absheron Peninsula. The greater Baku region now has almost

completely disruption-free transmission and supply of electricity. Overall, the programme design, which covered the replacement of existing switchboard plants, many of which were outdated and unreliable, at the critical places with new, modern technology, proved well suited for the purpose and in line with the requirements.

Operation of the rehabilitated plants appears to be running largely without problems and the frequent downtimes at certain plant components (circuit-breakers) noted at the time of the project appraisal were reduced to zero after their rehabilitation. However, it must be noted that at the end of the guarantee period some of the seven compressor units replaced at the Churdalan substation turned out to have a regular manufacturing defect, with the result that Azerenerji had an unexpected financial burden in recent years. Owing to the generous size of the compressor units, this defect did not lead to power failures. However, the seven compressor units will soon be redundant as all the old air compression switches that are dependent on these compressions will be replaced at Churdalan in Phase II.

The training in new Western technology for staff which was planned during the preparation and fitting of the new plant components was carried out in accordance with plans but had to be repeated at regular intervals in order to achieve a sustainable impact. According to Azerenerji, these regular staff training courses, particularly on standard emergency procedures, have also been provided since the rehabilitation measures were completed and the intention is for them to be retained over the long term. As part of the ex post evaluation, however, it was not possible to check whether this was actually the case. The consultant, who, in the context of Phase II, was still on site during the ex post evaluation, was fairly critical of the project executing agency's training efforts and of the qualifications of the operating staff. Although we assess the current operating situation as less than optimal, also because of the limited funds provided by Azerenerji for maintenance, it is not so critical as to endanger long-term use of the rehabilitated plants.

According to Azerenerji, there are plans to build a training centre for the entire energy system. The idea is also for experienced staff to pass on their knowledge to younger colleagues. In addition, explicit account is to be taken of the specialised knowledge of the existing Russian technology on which all plants will undoubtedly still be based in the coming years and decades.

The practice of keeping – handwritten – operating statistics at the individual plants does not comply with international standards. This antiquated way of recording data should change after the modern load distribution centre, to which all important substations will be connected, has been completed. We assess this development towards modern, sustainable operation as positive.

### **Key results of the impact analysis and performance rating**

The occasional power failures in the greater Baku area since the end of the FC financed rehabilitation work were, according to Azerenerji, all due to errors in the non-rehabilitated transmission area and not to errors in the rehabilitated transforming stations. According to the data provided, transmission failures are in each case restricted to the field in question. In accordance with agreements, Azerenerji keeps operating statistics at each substation; they are handwritten by the operating staff but are not compiled or evaluated centrally. The two technical indicators defined at the programme design stage have thus clearly been met. From the current perspective the selection of indicators on the achievement of the programme objective can also be described as appropriate for a rehabilitation project in the field of electricity transmission. The safety standards in the plants concerned have increased considerably since the rehabilitation work was carried out and the risk of accidents has decreased markedly. The replacement of environmentally critical oil pressure tank switches by uncritical SF6 circuit-breakers makes a significant contribution to reducing environmental risk.

At the time of the project appraisal, it was assumed that the achievement of the programme objective, the achievement of the defined overall objective and the defined target group would be plausible. Owing to the non-availability of data and statistics (number of the productive users in the greater Baku area and the amount of electricity used, the contribution of this target group to economic growth), it is unfortunately not possible to show the chain of impact between the programme objective and the overall objective, although this would have been desirable in accordance with today's standards. From today's perspective, it is questionable whether reducing the overall objective to the growth criteria constitutes a sufficient objective as in the case of programmes in the electricity sector, the criterion of an economically efficient electricity supply should also normally be applied; the fulfilment of that criterion is to be measured using the change in the operational appraisal criteria over time. Only

because of the aforementioned emergency aid nature of the programme, do we consider the reduced criterion regarding the definition of the overall objective as appropriate from a current perspective.

The investment measures in the programme were measures to rehabilitate existing substations which were not to be replaced by new buildings. The rehabilitation measures cannot therefore be compared with a cost-effective alternative investment measure but raise the question of the profitability of the project in the scenarios with and without the execution of the rehabilitation programme. It is assumed that the measures considered here are preliminary investments which Azerenerji would otherwise made at a later point in time.

The microeconomic value of the programme is therefore primarily derived from the now early avoidance of unplanned shut-offs and hence the earlier increase in supply reliability. In evaluating these factors, the considerations set out in the project appraisal report must be followed. The second factor, the increase in supply reliability for everyone (i.e. from the point of view of the target group) cannot be directly measured in quantitative terms but it is plausible to assume that the advantages for every member of the target group have been increased. By contrast, the first factor, the avoidance of unplanned shut-offs, can be evaluated in quantitative terms. According to the project appraisal report, this took place by measuring the additional income for the project executing agency Azerenerji as the difference between the average (nominal) tariff revenues and the variable costs of electricity supply (programme executing agency perspective). Assuming an average tariff per unit of electricity above the variable incremental costs of supplying electricity produces a yield which is regularly decidedly positive, thanks to failure avoidance, the lower downtime frequency and duration, the time horizon considered (advancement of investment in years) and the discount rate applied. It was therefore decided not to repeat the rough profitability calculation as plausibly presented in the programme appraisal report – which put microeconomic yields at between 4% and 12% in the scenarios analysed.

The above-mentioned assumption that the average tariff per unit of electricity is above the variable incremental costs of supplying electricity is therefore decisive for a microeconomic profitability from the perspective of the project executing agency. This is actually a trivial minimum criterion for the continuation of every operational electricity supply enterprise. In the case of Azerenerji, not even this minimum criterion has been met, with the result that, theoretically, every increase in electricity sales further increases the losses sustained by the programme executing agency. As also rightly presented in the project appraisal report, the enterprise will be profitable from the perspective of the programme executing agency only if a considerable improvement in the underlying conditions in the sector (tariffs, collection efficiency) is achieved. From the perspective of the programme executing agency, microeconomic profitability of the investment has not been achieved at present.

In summary, it needs to be evaluated whether, from the point of view of the target group or of the programme executing agency, more weight should be given to the microeconomic view. Since Azerenerji, as it is at present, cannot be described as an enterprise with Western standards based on the principle of the “going concern” but is rather part of the state-induced sectoral problem, there would appear to be no point in introducing even the simplest microeconomic benchmarks at the programme executing agency. The fact of the matter is that the FC financed rehabilitation measures would in any case make good operational sense if the sector environment were “normal”, i.e. an environment which was at least broadly in line with the minimum requirements of the operational assessment criteria. If this paradoxical operational sector-related situation is discounted (particularly with regard to the reduced level of requirements of the emergency aid programme, i.e. not aimed at the sector), we consider the individual, microeconomic increased benefit among members of the target group as achieved by more reliable electricity supply to be crucial, i.e. to be given a far greater weighting, thus producing a positive overall microeconomic analysis. The ex ante observations at the time of the project appraisal report can be confirmed ex post. Based on the assumption that power failures experienced by consumers are detrimental to the economy, which mostly leads to an increase in tariffs, the measures carried out and the ensuing stabilisation of the electricity supply have, if viewed from the macroeconomic perspective, a clearly positive impact on profitability, which is probably above the target minimum rate of 6% at present, as it was in the past. In particular, consideration needs to be given to the dynamic multiplier effects which arise as a result of securing a reliable energy supply. The dynamic economic growth which has been sustained since the end of the 1990s and was accompanied by a decline in power failures supports this view.

On the other hand, however, the stabilisation of a national electricity supply system that is obviously inefficient from a macroeconomic point of view and that requires vast subsidies lead to a maintenance of the status quo of misallocation of state funds, i.e. tax revenues. This raises the question of which of the two macroeconomic effects should be given more weighting. Our view is that the positive impact of

a reliable electricity supply is uppermost, particularly given the reduced level of requirements under the emergency aid programme. However, it is clear that after the end of the emergency aid phase, greater importance should be given to macroeconomic efficiency and the matter of misallocation of tax revenues.

Most of the counterpart contributions made by the project executing agency were made by the company's own construction firm, Azenko, with the result that no direct employment effects were achieved under the FC programme.

After the rehabilitation measures were implemented, there was a distinct reduction in the once high safety risk for operating staff at the plant (some danger of explosion in the compressed air switches). The replacement of old, maintenance-intensive oil pressure tank switches by modern, low-maintenance circuit breakers is also considered positive. The SF6 gas used as insulation material in the new circuit breaker is contained in sealed gas chambered in the circuit breakers and is also non-toxic. The measures are thus assessed as having a low environmental impact.

The project had no potential to contribute to gender equality. It did not aim to specifically improve the situation of women in Azerbaijan and is not likely to have contributed to this. Nor was there a stated objective to improve governance. The programme focus was not on achieving a direct impact on poverty but on making a contribution to economic growth in Azerbaijan.

In a summarised evaluation of the above aspects we rate the overall developmental efficacy of the programme as follows:

Effectiveness: The measures which were designed at the time of project appraisal as an emergency aid programme and which were technically successful led, as intended, to a clear reduction in operational downtimes at the rehabilitated substations and hence to a clear increase in the stability of the electricity supply in the greater Baku region. The indicators established at project appraisal and used to measure the achievement of the programme objective, which appear appropriate by today's standards and knowledge, were fully achieved. The technical quality of the rehabilitation work is assessed as very good, with the result that successful use of the rehabilitated plants/components throughout their entire technical and economic life can be expected. We rate the programme's overall **effectiveness** as satisfactory (sub-rating 2).

Relevance/significance: The assumption that achieving the overall objective by ensuring a reliable electricity supply without the risk of power cuts will contribute to economic development in Azerbaijan is essentially plausible. We rate the **relevance** of the project as satisfactory. The significance of the project is apparent from the fact that without stabilisation of the electricity supply there would have been a significant reduction in the impressive economic growth in the country in recent years. On the other hand, the emergency aid project could clearly not be taken as a model for the sector and makes no structure-building contribution to the sector. We therefore consider the **significance** of the project as slightly insufficient. Overall, we judge the project's **relevance/significance** as just sufficient (rating 3).

Efficiency: The budget for the implemented measures was fully adhered to, as was the very ambitious implementation schedule of 20 months. We therefore judge the **production efficiency** to be satisfactory. By contrast, a more varied observation of the **allocation efficiency** of the project must be made. Owing to the problem situation in the sector and at the project executing agency, the question arises as to whether the resources invested can meet the programme objectives over the long term or can be put to sustainably efficient use in the sector. Owing to their uncomplicated, low-maintenance technology, long-term use of the rehabilitated components would seem to be possible even without a particularly strong project executing agency. The programme objective of contributing to an increase in the reliability of the electricity supply in the greater Baku region can thus basically be achieved even in the long term. However, the allocation efficiency in the sector is questionable. This evaluation is compatible with the analysis of the programme results from a microeconomic and a macroeconomic perspective. With regard to the target group and supply reliability, the programme is assessed positively but, from the operational perspective of the programme executing agency or with regard to the macroeconomic allocation, better electricity supply paradoxically increases loss or increases the need for subsidies and reduces the needed reform pressure. Owing to the emergency aid nature of the programme with a reduced level of expectation, we evaluate the positive effects as higher than the negative effects, with the result that we assess the allocation efficiency overall as just sufficient. Overall, we classify the project's **efficiency** as adequate (sub-rating 3).

With regard to the problematic situation relating to the project executing agency and the desperate state of the sector, we see serious **sustainability risks**. First, as part of a medium-term strengthening of the project executing agency, systematic compilation of data (number and groups of customers, meter installations, sources of technical and non-technical losses, etc) and internal reorganisation of the project executing agency (organisational and procedural structures, accounting, IT systems) appears necessary before venturing to gradually liberalise the sector and particularly to release it from state influence.

To summarise the aforementioned sub-evaluations and taking account of the sustainability risks in the sector and at the project executing agency, we assess the **developmental efficacy of the project overall as just sufficient (rating 3)**. It needs to be noted that, without a deliberate ex ante reduction in the level of requirements (emergency aid programme) because of the poor situation in the sector and at the project executing agency, significant non-compliance or even a predominant worsening of the operational assessment criteria, in particular, and the ensuing sustainability risks, the programme would have to be assessed as unsuccessful.

**General conclusions and recommendations**

In the event of projects with clearly policy-based objectives (e.g. emergency aid programmes or projects implemented under other exceptional circumstances), the BMZ should give as detailed a description of the relevant scope for action in its project appraisal assignment to KfW, so that KfW will be able, in the context of the set framework, to make an assessment of the technical facts (e.g. to take the decision not to apply minimum criteria or to compare different alternatives only to a limited extent, etc.).

The FC programme was designed as an emergency aid programme. In this connection, the level of requirements, particularly with regard to compliance with the operational assessment criteria, was limited to a considerable extent. This procedure is legitimate and, as we see it, also justifies rating the programme as developmentally successful with regard to the achievement of the (reduced standard) programme and overall objectives, even if there was no improvement of the underlying sectoral conditions over time. However, in our view, it must be noted that the phase of emergency aid must remain of limited duration and after an appropriate time for follow-up projects, the “normal” developmental level must be applied. If from the outset (at project appraisal) follow-up projects are clearly not going to achieve this level, we consider that involvement in this sector should be ended.

When formulating the overall objective for the project in question, the additional criterion of a “macroeconomic efficient electricity supply” was deliberately excluded although it is normally used in electricity projects with a normal level of requirements. We consider that attention should be paid to ensuring that this criterion and hence, closely related to it, the achievement or significant improvement of the operational assessment criteria, are applied again once the emergency aid phase is over.

With regard to the future design of donor-financed programme measures in the electricity sector in Azerbaijan – at the end of the emergency aid phase – we consider it necessary to apply concrete measures to strengthen the sector or the project executing agency. This conclusion should also be viewed in connection with the fact that Azerbaijan will be increasingly in a position to mobilise financing at market conditions for investment projects in the electricity sector.

**Assessment criteria**

Developmentally successful: Ratings 1 to 3	
Rating 1:	Very high or high degree of developmental efficacy
Rating 2:	Satisfactory developmental efficacy
Rating 3:	Overall sufficient degree of developmental efficacy
Developmental failures: Ratings 4 to 6	
Rating 4:	Overall slightly insufficient degree of developmental efficacy
Rating 5:	Clearly insufficient developmental efficacy
Rating 6:	The project is a total failure.

### **Performance evaluation criteria**

The evaluation of the "developmental effectiveness" of a project and its classification during the ex-post evaluation into one of the various levels of success described in more detail below concentrate on the following fundamental questions:

- Have the **project objectives** been achieved to a sufficient degree (project **effectiveness**)?
- Does the programme generate sufficient significant **developmental effects** (project **relevance** and **significance** measured in terms of the achievement of the overall developmental policy objective defined beforehand and its effects in political, institutional, socio-economic and socio-cultural as well as ecological terms)?
- Are the **funds/expenses that were and are being employed/incurred appropriate** with a view to achieving the objectives and how can the programme's microeconomic and macroeconomic impact be measured (**efficiency** of the programme design)?
- To the extent that undesired (**side**) **effects** occur, can these be tolerated?

We do not treat **sustainability**, a key aspect to consider when a project is evaluated, as a separate evaluation category, but rather as an element common to all four fundamental questions on project success. A programme is sustainable if the programme executing agency and/or the target group are able to continue to use the programme facilities that have been built for a period of time that is, overall, adequate in economic terms, or to carry on with the project activities on their own and generate positive results after the financial, organizational and/or technical support has come to an end.