# Ex post evaluation – India

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**Sector:** Electricity transmission & distribution (CRS code 23040)
**Project:** REC Energy Efficiency Programme phase I –
BMZ no: 2005 66638*, 2006 70 026
**Project Executing Agency:** Rural Electrification Corporation (REC)


### Ex post evaluation report: 2014

| | | Project (Planned) | Project (Actual) |
|---|---|---|---|
| Investment costs (total) | EUR million | 77.80 | 93.60 |
| Counterpart contribution | EUR million | 7.80 | 23.60 |
| Funding | EUR million | **70.00 | **70.00 |
| of which BMZ budget funds | EUR million | ***0.50 | ***0.50 |

*) Random sample 2013
**) Interest rate subsidy
***) Complementary measure

**Description:** An energy efficiency credit line in the amount of EUR 70 million for energy supply companies (ESCs), which was provided at a subsidised rate of interest to the Rural Electrification Corporation (REC), an Indian public sector finance institution. Under this line of credit, financing was provided for investments to convert rural electricity distribution to a high voltage distribution system (HVDS). A total of 16 individual projects were implemented in the federal state of Andhra Pradesh with, in this instance, just one local ESC, the Andhra Pradesh Southern Power Distribution Company (APSPDCL). The individual projects were located in the districts of Chittoor and Kadapa. The project was supplemented by a complementary measure aimed at institutional strengthening of REC and APSPDCL.

**Objectives:** The project objective was to raise the energy efficiency of rural electricity distribution by issuing sub-loans to energy supply companies (ESCs) and by institutional strengthening at the REC and the supply companies. The overall objective was to fulfil a fundamental prerequisite for the economic development of the federal states that were being assisted. The project also aimed to contribute to environmental protection and resource conservation by making more efficient use of the energy generated.

**Target group:** Electricity consumers in the productive sector were the priority (over 140,000 small farmers at the time of EPE) in their respective distribution networks.

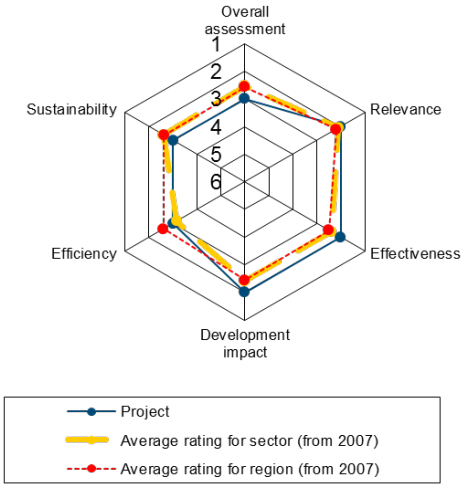
## Overall rating: 3

**Rationale:** The project achieved good results in the fields of relevance, effectiveness and overarching developmental impact. Some weaknesses were noted, especially in the areas of efficiency and sustainability.

**Highlights:**

Positive aspects: This was the first electricity distribution project in the world whose climate protection impact was certified in accordance with Kyoto Protocol criteria.

Negative aspects: The construction of numerous power supply lines has required considerable tracts of land, also leading to problems over rights of way. Technical alternatives (solar or wind power) were not considered.



# Rating according to DAC criteria

## Overall rating: 3

Under this FC project, REC, the Indian public-sector finance institution, received a reduced-interest loan in the amount of EUR 70 million for the purpose of setting up an energy efficiency credit line. REC passed the FC funds in their entirety on to APSPDCL, the sole borrower. A total of 16 individual projects were financed in the federal state of Andhra Pradesh through this line of credit. The individual projects presented by APSPDCL were subject to REC's technical as well as financial appraisal and approval.

The project achieved good results in the areas of relevance, effectiveness and overarching developmental impact. It addressed the area of power distribution networks – an important feature within the sector – and was appropriately integrated into national and international strategies. It is reasonable to assume that positive effects were achieved in terms of over-arching developmental impact and also in the areas of environmental protection and re-source conservation. Less satisfactory results emerged under the efficiency and sustainability criteria. Particularly problematic features were the poor level of cost recovery ratio (which is common in this sector), inadequate construction standards and the practice of providing electricity for agricultural use free of charge.

Within the local context, the project achieved good overall results and created capacities of a satisfactory quality. These have benefited small farmers in particular.

### Relevance

India still faces numerous challenges in every area of the power sector (extending and modernising generating capacity, distribution capacity and distribution networks). Improvements in the sector, especially in rural areas, were and remain the Indian government's declared objective. This is also evident in the current Five Year Plan.

Shortcomings in the electricity sector are still one of the key constraints to development in the country; as a stable, reliable and affordable electricity supply is a precondition for raising productivity, especially in agriculture. Increasing energy efficiency by reducing transmission losses thus has a high degree of developmental relevance. Consequently, German development cooperation (DC) and the Indian government have defined raising energy efficiency as one of the priorities of their bilateral DC.

Effective use was made of relevant Indian partner structures by working with REC, the pub-lic-sector project-executing agency which is responsible for rural electrification, and with the Andhra Pradesh Southern Power Distribution Company (APSPDCL), the regional energy supply company. Those structures were further strengthened by the project's complementary measures.

There was no evidence of specific donor coordination. It seems that most donors focus their support in the area of generating new power g, using renewable energies. However, given the sheer size of the Indian electricity sector, no adverse effects can be inferred from the lack of a donor agreement.

It was striking that, by design, each electricity connection only was to provide just two to five small farmers with one small (and rather inefficient) water pump each. The concept of building a large number of power lines has led to a high level of landscape use and to problems over rights of way. As power is provided to farmers free of charge, the project implicitly encouraged inefficient irrigation methods. In retrospect, an alternative would have been to make an additional investment in more powerful, more efficient pumps working in linked systems of irrigation and just supply electricity to those. An integrated energy / agriculture approach would have been even more relevant according to the OECD evaluation criteria.

**Relevance rating: 2**

### Effectiveness

The project objective – increasing energy efficiency by issuing sub-loans to ESCs (in this case only APSPDCL) and by institutional strengthening at REC and the ESCs – seems reasonable and realistic, even from today's perspective.

At project appraisal (PA), a total of four objective indicators were defined. The following table shows their current status of achievement:

| Indicator | Status at ex post evaluation (EPE) |
|---|---|
| At least 90 % of sub-loans repaid as per agreement. | 100 % - effect partially attributable to the project. |
| Technical losses in rehabilitated networks less than 10 % (PA: 15 %). | 8.1 % - 20.8 % - effect is unequivocally attributable to the project. |
| Frequency of transformer breakdowns less than 1.5 % (PA: no change). | < 0.2 % – 0.4 % - effect is unequivocally attributable to the project. |
| Electricity theft reduced by at least 75 % in the rehabilitated networks (PA: no change). | 100 % - effect is partially attributable to the project. |

Out of the four indicators defined, three were formally achieved (repayment rate of sub-loans, transformer breakdown frequency and reduction in electricity theft). The targets set were greatly exceeded.

The indicator for reducing line losses was not formally achieved. However, the initial value set for this indicator at PA was fixed at too conservative a level (15 %). Line losses (including theft) in the 16 investment projects were in fact significantly higher, ranging between 16.5 % and 34 % before work commenced. In relative terms, a reduction in line losses of 50% was anticipated was and, in fact, achieved. As a result, this indicator can also be considered as fulfilled.

Since financing was provided to just one sub-borrower (APSPDCL), the indicator for loan repayment by sub-borrowers is of limited significance. A final assessment will only be possible once all twelve sub-loans issued to APSPDCL have been repaid in full (terms run to 2020). In future projects, this indicator should be formulated more precisely, in order to allow for precise assessment at final review or EPE. Moreover, the target for this indicator was not particularly ambitious; 5 % is the usual maximum level for overdue loans used as performance indicator in financial sector projects.

The indicator for theft was certainly achieved. However, in India electricity has long been supplied free of charge to small farmers, so there is very little incentive to steal electricity. Consequently, this effect can only be attributed to the project to a limited extent.

The investment measures financed by the project (higher-voltage power lines, replacing transformers, connections for small farmers) are considered – even from a retrospective viewpoint – highly appropriate for raising energy efficiency in rural distribution networks. The EPE identified that the project had an undesirable side effect: a comparatively high level of landscape use, this being a consequence of supplying a multitude of small-scale, less efficient pumping stations (see "Relevance").

The project's complementary measures included: a) the construction of a model feeder for use in presentations and training sessions, b) strengthening the REC's energy efficiency unit, c) CDM certification (CDM = clean development mechanism) and d) various individual measures for institutional strengthening at REC and APSPDCL. Viewed overall, these complementary measures have clearly helped in achieving the objective.

**Effectiveness rating: 2**

### Efficiency

The investment measures financed are considered standard in the Indian context. Due to delays and essential additional works, investment costs were around 27 % higher than originally estimated. Ultimately,

total investment costs in EUR were only around 20 % higher than estimates, due to favourable exchange rate trends. Specific investment costs were at an appropriate level

Overall, implementation required significantly more time than planned. This is partly due to contract periods for construction companies having been set too ambitiously - and partly, because efficiency reserves in the planning, approval and monitoring processes of REC and APSPDCL were not exploited.

An alternative technical solution to the high voltage distribution system (HVDS) would have been to change the power lines to aerial bundled cables (ABC). This would have also been effective in preventing electricity theft and may have been more cost-efficient. However, this option was not investigated in any greater detail during project appraisal and, further-more, would not have significantly reduced line losses. In addition, the technical solution chosen has the advantage that the small farmers involved feel responsible for their own transformers.

Other technical options for supplying electricity to small farmers (such as photovoltaic sys-tems and small windmills) are common elsewhere, but these did not receive any closer consideration during project appraisal. Such options could have been connected with greater cost efficiency and reduced side effects (i.e. landscape use and problems with rights of way).

Line losses in the 16 individual projects presently range from 8.1 % to 20.8 %. Operational appraisal criteria are basically being met, which indicates a satisfactory level of production efficiency. That said, a further substantial reduction in line losses is feasible from a technical perspective.

Indian electricity tariffs do not cover the costs of electricity generation. Substantial subsidies are therefore needed, encouraging excessive power consumption. Over recent years, APSPDCL has, to a significant extent, succeeded in closing the gap between revenue and expenditure, reducing it from 1.31 rupees/kWh to 0.96 rupees/kWh. However, the company still only covers around 81 % of its costs and is dependent on regular subsidies. In terms of allocative efficiency, this is not satisfactory. In terms of financial capacity and performance capacity, APSPDCL is ranked towards the top of the mid-range when compared with other distribution companies in India.

**Efficiency rating: 3**

### Impact

The overall objective was to fulfil a fundamental prerequisite for economic development in the federal states concerned. The project also aimed to contribute to environmental protection and resource conservation by making more efficient use of the energy generated. At project appraisal, two impact indicators were defined:

| Indicator | Status at EPE |
|---|---|
| Projects to provide an economic return of approx. 10% p.a. (excluding CO2 benefits). | Estimated using an alternative method: the REC's return calculations (which are plausible in our view) show an internal rate of return of between 16.3 % and 18 % p.a.. |
| Avoiding CO2 emissions amounting to 65,000 t/ year. | Documented by CDM at 60,037 t/ year. |

The economic return indicator was not pursued further after project appraisal, so the basic calculation can no longer be tracked ex-post. Economic rates of return for individual projects were calculated by REC for a period of 13 years. These amounted to 16.3 % p.a. for Kadapa and 18 % p.a. for Chittoor.

Under a complementary measure, some of the 16 individual projects financed by this line of credit were registered under the CDM scheme (this being the first power distribution project in the world to achieve CDM certification). Only individual projects financed in the Chittoor district were registered. The CDM registration certifies that these investments achieve annual savings of 60,037 tonnes of $CO^2$. It is therefore

assumed that total savings of $CO^2$ emissions, taking into account the projects in the district of Kadapa, significantly exceed the threshold of 65,000 t/year.

As next step, the emission reductions achieved by the registered projects must be monitored and then verified after a year or so. This process of monitoring and verification falls within the responsibility of the sub-borrower (APSPDCL) and the project-executing agency (REC). Due to present market conditions, however, certificate trading is expected to yield lower returns than originally envisaged. Nonetheless, the successful registration of these projects is a sign of the programme's relevance in terms of climate effects.

From an environmental perspective, are the landscape use described above and the lack of an incentive to save electricity and water constitute critical aspects. Nevertheless, viewed in total, the project has clearly contributed to environmental protection and resource conservation in line with the overall objective.

With regard to economic development, assessing any effects in isolation is naturally difficult. However, the following points offer some guidance: between 2005 and 2010, agricultural productivity rose in both Chittoor (by 14.7 %) and Kadapa (7.5 %). This can in part be plausibly attributed to the improvements in electricity supply and the accompanying improvements in water supply. The majority of small farmers interviewed reported noticeable improvements in their living conditions. These included improved and/or more stable electricity supplies, fewer power cuts, higher productivity, reduced expenditure on pump repairs, fewer accidents and increased incomes. This can reasonably be attributed to the investment measures. It is also expected that the marked fall in electricity losses will tend to reduce the pressure for creating new power generation capacity and for energy imports. On the whole, the project has, in our opinion, helped achieving the overall objective.

**Impact rating: 2**

### Sustainability

At project appraisal, the lifetime assumed for the investments financed was 25 years. In all probability, this will not be achieved, and a period of 15 years is more realistic. The facilities visited during the mission (on the basis of a random sample) have been in operation for up to five years. They were certainly all in working order, but they were in a poor condition (e.g. rust, poor workmanship, sub-standard materials, open meters, mountings ripped out, inferior spare parts). With regard to building work, REC specified high technical standards to its customers; however, these were not observed in reality, and they could scarcely be influenced by KfW. This assessment is consistent with the one made in the final review. There is a significant risk that maintenance costs will raise in the near future, which could jeopardise the project's long-term sustainability.

In order to sustainably safeguard the positive effects achieved by the project, APSPDCL's financial and staffing situation must also allow for the facilities to be regularly serviced and maintained – as well as for the repair of system components that are prone to damage. That is basically the case here. At this point in time, service intervals and repairs are satisfactory. Defects are normally resolved within 48 hours. Customer satisfaction is reported to be high. APSPDCL has staff who are adequately trained to meet the demand for maintenance and repairs. The work is relatively simple from a technical standpoint. However, the focus here is on repairs and not on preventive maintenance, which is essentially confined to pruning trees in order prevent power line short circuits.

As explained above, electricity tariffs in India only partially cover production costs. Even though the situation in reform-oriented Andhra Pradesh is better than in other states in India, our sustainability assessment must still be qualified.

In terms of sustainability, the free supply of electricity for agricultural purposes is particularly problematic: it provides a false incentive to consume electricity for pumping and thus overuse groundwater resources. From a macro-economic perspective, it would be desirable for small farmers to share – on a progressive basis, and at least to a partial extent – in the costs of electricity distribution.

**Sustainability rating: 3**

## Notes on the methods used to evaluate project success (project rating)

Projects (and programmes) are evaluated on a six-point scale, the criteria being **relevance, effectiveness, efficiency** and **overarching developmental impact**. The ratings are also used to arrive at a **final assessment** of a project's overall developmental efficacy. The scale is as follows:

| | |
|---|---|
| **Level 1** | Very good result that clearly exceeds expectations |
| **Level 2** | Good result, fully in line with expectations and without any significant shortcomings |
| **Level 3** | Satisfactory result – project falls short of expectations but the positive results dominate |
| **Level 4** | Unsatisfactory result – significantly below expectations, with negative results dominating despite discernible positive results |
| **Level 5** | Clearly inadequate result – despite some positive partial results, the negative results clearly dominate |
| **Level 6** | The project has no impact or the situation has actually deteriorated |

Rating levels 1-3 denote a positive assessment or successful project while rating levels 4-6 denote a negative assessment.

**Sustainability is evaluated according to the following four-point scale:**

Sustainability level 1 (very good sustainability): The developmental efficacy of the project (positive to date) is very likely to continue undiminished or even increase.

Sustainability level 2 (good sustainability): The developmental efficacy of the project (positive to date) is very likely to decline only minimally but remain positive overall. (This is what can normally be expected).

Sustainability level 3 (satisfactory sustainability): The developmental efficacy of the project (positive to date) is very likely to decline significantly but remain positive overall. This rating is also assigned if the sustainability of a project is considered inadequate up to the time of the ex post evaluation but is very likely to evolve positively so that the project will ultimately achieve positive developmental efficacy.

Sustainability level 4 (inadequate sustainability): The developmental efficacy of the project is inadequate up to the time of the ex post evaluation and is very unlikely to improve. This rating is also assigned if the sustainability that has been positively evaluated to date is very likely to deteriorate severely and no longer meet the level 3 criteria.

The **overall rating** on the six-point scale is compiled from a weighting of all five individual criteria as appropriate to the project in question. Rating levels 1-3 of the overall rating denote a "successful" project while rating levels 4-6 denote an "unsuccessful" project. It should be noted that a project can generally be considered developmentally "successful" only if the achievement of the project objective ("effectiveness"), the impact on the overall objective ("overarching developmental impact") and the sustainability are rated at least "satisfactory" (level 3).