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District Heating in China – an investment in improved environment

Background

China´s air and water, particularly in urban areas, are among the most polluted in the world. The World Bank has shown that investments in abating air pollution – e.g. by introducing modern district heating systems – can yield benefits valued several hundred per cent higher than the investment cost. So far, about a third of approximately 150 cities in northern China have district heating. The first district heating systems in China, using a Soviet model, were installed around 1950. Today, less than a dozen cities have a modern (so-called indirect) system.

Sida contributed to five district heating investments in China during 1993–1995. Concessionary credits totalling SEK 145 million funded the introduction of modern district heating in five of China's most polluted cities: Dalian, Taiyuan, Shijiazhuang, Jiamusi, and Fushun. The project objectives were given as environmental protection and energy conservation through reduced pollution and savings in coal consumption. Equipment imported from Sweden covered mainly heat exchangers, valves, pumps, flowmetres, prefabricated insulated pipes, hard- and software for a monitoring system, along with supervision, documentation, and training.

The Evaluation

An external evaluation of the five investments was carried out in the first half of 1998, i.e. three years after completion of the Swedish project contribution, by economist Karlis Goppers. Apart from a routine reason of evaluating completed Sida projects (investments), the district heating projects in China are seen as important demonstration cases with assumed high potentials and it was therefore of particulrar interest to Sida to make an assessment of the results from them, of which Sida had little or no information. The evaluation, entitled *Environment-friendly District Heating in China – Five Investment Projects Supported by Concessionary Credits from Sweden* (Sida Evaluation 98/17), is termed comprehensive in the sense that it intended to cover all levels of the projects´ goal hierarchies (viz. inputs, activities, outputs and effects). Of the five week assignment, three weeks were spent in the field visiting five cities in four provinces.

All project information was arranged in a logical framework (LFA) schedule, on the basis of which a goal hierarchy model was created for each of the five projects. Within the limitations set on access to data, project results were then assessed against planned targets at five levels: planning stage, implementation, outputs, effects, and impacts. Because of language constraints, all interviews had to be conducted through interpreters, an important restriction on the possibilities of gathering information and insights. Hardly any written documentation was made available to the evaluator.

Findings

The Swedish equipment has been purchased at competitive prices, generally delivered according to contract, and found to be of expected quality and function. All projects, however, are experiencing delays of between one and two years. As of May 1998 only about two-thirds or more of the equipment had been installed. Most equipment had, however, been put into operation on schedule and, after test runs, found to be performing satisfactorily, the major part running smoothly and efficiently. Operational staff, however, point out a number of problems, most of them, however, no more severe than they may be seen as normal occurrences. Lack of original spare parts, pumps not

Environment-friendly District Heating in China – Five Investment Projects Supported by Concessionary Credits from Sweden
By Karlis Goppers
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Sida Evaluation 98/17

functioning satisfactorily, and insufficient training and supervision were the most serious problems. In one project a number of computers were delivered two years ahead of their intended installation, making them obsolete by the time they were put into operation.

Some of the equipment purchased from Sweden could have been bought locally from the Chinese market. The reason for choosing the Swedish equipment was twofold: quality and price were competitive, and Sweden offered the best credit.

The intended effects of the district heating projects include: energy conservation of the order of fifty per cent through savings in coal, savings in gasoline due to less transportation of coal and ashes, less pollution through dramatic reductions in toxic particulate emissions (primarily CO, SO_2 and NO_x), and a more reliable and technically sustainable system. Since none of the projects had as yet been completed to the final phases, only some of the expected effects had begun to manifest themselves. There is, however, nothing to indicate that the effects as planned will not be forthcoming once the projects are fully completed and systems running on a regular basis.

All the projects are deemed to become highly profitable from an economic point of view, and the expected benefits are of such magnitude that their profitability would not be threatened by the projects suffering the odd technical set-back or even a few years delay. World Bank studies indicate that when health and mortality effects are included in the analysis, the economic rate of return could be of the order of a few hundred per cent. It should be noted that imported technology makes the gains from introducing district heating bigger, but is not a condition for economic viability. All five projects are seen as uniformly benefiting all inhabitants in the respective cities, not favouring any particular group in society.

The report holds that contributing to district heating projects in China is not consistent with one of the fundamental requirements in Sida´s policy on aid in the field of energy, namely that assistance to the energy sector is not to be appropriated to countries that in their national energy policy rely on increased coal dependency. However, for compelling economic reasons, coal will for a long time yet remain the only economical option for China´s cities. The evaluator's conclusion is that there is an inadquacy in Sida's policy here, rather than anything wrong with these particular projects.

An explicit objective of the Swedish support to district heating in China is that the projects should serve as demonstration cases, showing the feasibility of mixing advanced technology imported from abroad with equipment produced in China. However, given the delays experienced by the project, and given the uncertainty that today seems to exist regarding the possibility of replacing some of the imported equipment with cheaper domestic equipment, the evaluator does not believe this objective has been achieved. At least not yet.

Recommendations

The report discusses these recommendations addressed to Sida:

- Sida should review its energy policy so as to make it compatible with future Swedish aid to district heating development in China.
- In order to eliminate misconceptions surrounding the projects, Sida should consider the idea of staging a "wrap-up" seminar with the participation of project staff, suppliers, consultants, and key representatives of Sida and the Chinese government.
- Given that none of the parties has complied with the contractual obligation of providing Sida with a completion report (covering the Swedish project contribution), and given that this seems to be the normal state of affairs in virtually every concessionary credit granted by Sida, it is recommended that Sida either abolish this rule *or* begin to insist that it is complied with.
- If Sida continues to support district heating, it should seek cooperation with the World Bank which is involved in similar projects.

Lessons learned

The analyses of these projects confirm an old and well-known but all too often not applied lesson, namely that it is not wise to try to economize on the amount of spare parts, training and supervision that should be included in a project. Other lessons or insights of generic value are the following.

Because of higher quality in terms of functionality and durability, imported equipment may well be so superior that even at double the price it is more economical than procurement of the domestic equivalent. Imported equipment can also have a positive, competitive effect on the further improvement of domestically manufactured equipment.

In a regulated economy, where taxes, subsidies, tariffs etc, can be changed at any point in time through a political or administrative decision, financial analysis determining the financial rate of return becomes an unreliable measure of the strengths and qualities of a company's operation. Economic analysis is the necessary condition for assessing the latter, and thus whether a project is worthwhile.

Finally, introducing district heating in urban areas of developing countries, where none existed before, is highly profitable for the country's economy, and benefits are of such magnitude that their profitability is not threatened by normal technical set-backs or long delays.

Railway for opening up of India's west coast to development

Background

The Konkan Railway Construction Project was to build and operate a railroad stretching 837 kilometres (km), with 2000 bridges and 84 km of tunnels through mountainous terrain, from south of Bombay to Mangalore along the coastal area known as Konkan. The project started in 1991 and is the biggest railway undertaking during this century in Asia and one of the largest ever in the world. Completed, the project was to substantially cut travel time and to promote economic development of Konkan, a relatively neglected region. Sweden, as the only foreign contributor and through a concessionary Sida credit of SEK 45 million, financed nine hydraulic drilling machines and seven electro-hydraulic loaders for the tunnel excavations. The total cost of the project has been estimated at some 12 billion Rupees (SEK 3.6 billion).

The Evaluation

The evaluation, entitled *Swedish Contribution to the Konkan Railway Construction Project in India* (Sida Evaluations 97/25), was undertaken by economist Karlis Goppers in the first half of 1997, an ex-post evaluation of project implementation, outcome and impact, with a specific reference to the tunnel drilling part of the project completed two years earlier. The evaluation covered financial and economic as well engineering, administrative and organizational aspects. The assignment was for 25 person-days, fifteen of which were spent at the Konkan project headquarters in Bombay and visits to construction sites along the line. Project data were organized in a logical framework (LFA) schedule. Results were assessed against planned targets at the different levels of the goal hierarchy.

Findings and conclusions

The first stretch of track was opened to passenger traffic already in March 1993, and by December 1996 a total of 466 km were in operation for passenger traffic. By spring of 1997 an overwhelming majority of the tasks comprising the project, had been carried out. Construction of all bridges and tunnels had been successfully completed, some in record time, and some with innovative techniques. Considerable delays were caused by drilling problems in some of the soft soil tunnels, for which no effective drilling technique apparently exists anywhere in the world. Swiss experts consulted were unable to come up with a ready answer. The project was delayed by about 9 months because of litigations and court proceedings following an indictment by environmentalist groups in Goa.

The project is impressive not only for the large amount of work accomplished in a short period of time. It has also introduced innovations in railway technology, in some cases of international significance. The Swedish drilling machinery completed the tasks it was set to do. In the judgement of Konkan project engineers in the field, the machines did their job, albeit with some problems, and the investment proved to be efficient.

Another interesting finding is that in spite of a long-held suspicion of the financial market against Government infrastructure programmes, the project was able to raise two thirds of its capital needs by selling bonds in the private capital market. And in spite of cost-overruns, of which almost half are due to inflation, and the fact that the project is running two years behind original schedule, the company expects the financial rate of return to be around 15 per cent.

The overall prospects for the new railway are deemed most favourable. Expected traffic passenger volume has been revised upward by 30 to 100 per cent compared with original project estimates. The project is expected to result in enhanced employment opportunities in the affected region, not least for poorer groups. In fact, the only threats to expected project impacts are factors outside the control of the project, mainly the complementary transport investments needed in the adjoining regions, such as those aimed at feeder lines and forward communications.

Remarkably, for such a gigantic infrastructure project, no study of its economic viability has been made. No document exists where expected benefits and costs for the regional or national economies, be they direct, indirect or in the form of externalities, have been calculated. None of the four participating state governments have performed any economic analysis in support of their equity investments. Decision-makers interviewed were nevertheless convinced that the project would be highly profitable for the Indian economy.

Overall, the project is deemed as very successful. According to the evaluation, it is likely to prove itself economically, politicaly and environmentally sustainable. Environmental analyses, some of which were carried out in response to environmentalist claims, conclude that the new railway does not pose any serious threat to wild life, flora, fauna and natural ecosystems of the area.

Swedish Contribution to the Konkan Railway Construction Project in India
By Karlis Goppers
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Sida Evaluation 97/25

Posttidning B

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Combating a deteriorating environment in Asia

The rapidly growing economies of recent decades in East, Southeast and South Asia have, for their growth, been heavily dependent on fossil fuels. In fact, the excessive use in the region of fossils fuels has created widespread and growing concern about the local and global environmental consequences, in particular global climate change, urban air pollution, oil spills and acid rain.

An important contribution in combating a deteriorating environment was the introduction in 1993 of the Asian Regional Research Programme in Energy, Environment and Climate (ARRPEEC). This programme, coordinated and led from within the Asian Institute of Technology (AIT) in Bangkok, is a research network involving institutions and researchers in selected Asian countries. The programme is focused on research in energy efficiency, fuel switching, reduction of greenhouse gas emissions and the development of sustainable energy strategies. In addition to promoting actual research work and strengthening the research capacities of collaborating institutions, the idea of the programme is to disseminate research results in the area of energy-environment-climate (EEC) and to promote a multi-disciplinary and policy-oriented approach to EEC issues by policy-makers and governments.

Sida funded the activities of ARRPEEC during a first three-year phase, 1994-1997, with a grant of SEK 9 million. The programme was organized under a set of research themes, aimed *inter alia* at appropriate industrial technologies and energy efficient options for mitigating greenhouse gas emissions from the electricity sector, together with a research training component based on short-term fellowships. An evaluation was commissioned by Sida at the end of the first phase, in late 1997, to assess the extent to which ARRPEEC was fulfilling the objectives set for it.

The evaluation, entitled *The Asian Regional Research Programme in Energy, Environment and Climate* (Sida Evaluations 98/12), was conducted by Dr. John M. Christensen and Dr. Gordon A. Mackenzie of the UN Environmental Programme (UNEP) Collaborating Centre on Energy and Environment based in Denmark. The evaluators spent time at AIT in Bangkok conducting in-depth interviews with programme leadership and staff, participated in a programme review workshop and reviewed research outputs of the programme. The evaluation report covers issues referring to programme relevance and overall programme performance, research output, strengthening of research capacity, policy applicability of results, and cost-effectiveness.

Findings and recommendations

The evaluators found the programme based on a sound and relevant rationale and the choice of themes for Phase 1 well in line with key EEC issues in the region. Research output from Phase 1 was of notably high quality and quantatively impressive. However, the programme had not integrated or even sufficiently established links with related activities at national and regional levels, nor utilized the possibility of interaction with other related research programmes within AIT. In addition, efforts to promote capacity building of national institutions and to establish communication with policy makers in order to impact on government strategies had received insufficient attention. The voluminous output of reports lacked overviews, summaries, systematic peer review and comparative assessment, and were also poorly targeted. The total cost of the progamme was, in comparison with similar research programmes and networks, found reasonable in view of the activities undertaken and the output produced.

A major reason for the shortcomings, the report says, appears to be different interpretations of the programme objectives, on the part of Sida and AIT respectively. The evaluators recommend continued Sida support of a new phase from 1998, on condition this phase be based on a set of more explicit and mutually understood objectives, with corrresponding activities, that reflect a more equal focus on and attention to all three aspects of quality research, capacity building and policy impact. They also recommend that the national research institutes be more actively involved in programme formulation and implementation. Other recommendations concern the need for closer integration of the research programme with the actual research themes, and the development and adoption of a publication strategy including a specification of target groups for research outputs.

The Asian Regional Research Programme in Energy, Environment and Climate
By J.M. Christensen and G.A. Mackenzie
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Sida Evaluation 98/12

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