Swiss Simulation Study Examines Conversion of Heating Centers

The Swiss and Czech governments have undertaken a joint project called "Conversion of Heating Centers" (CHC) from 1996 until 1999. Financed by the Swiss Financial Assistance Program, it included the rehabilitation of nearly 80 small and medium heating centers in seven Czech cities. Recently, a study was published, which analyzes this project from a JI perspective.

Simulation study objectives

The study starts with the statement that Switzerland does not intend to file the CHC project as an AIJ project at a later stage (nor does it want to receive credits), as it was started before the AIJ pilot phase. The overall objectives of the simulation study are to:

- gather experience with handling AIJ energy projects in order to strengthen capacity building;
- contribute to solving methodological problems with respect to AIJ;
- determine eligibility and attractiveness of various types of energy AIJ projects.

Baselines for the projects

The CHC project consists of three main components: fuel switch, cogeneration and woodchip boilers (see box 1). For each component the Swiss consulting firm Ernst Basler+Partners developed a bottom-up baseline scenario in order to estimate what would most probably have occurred without the project.

In the fuel switch subproject it was assumed that the old heating centers would gradually have moved to natural gas anyway, since in general they were in poor condition, resulting in unreliable heat supply, high maintenance costs, and excessive air pollution. Moreover, the Czech National Clean Air Program promotes the large-scale transition of residential and public heating to cleaner fuels and electricity. A 7% annual replacement rate is assumed in absence of other data.

The cogeneration subproject was assumed to replace generation in Czech thermal power plants. An average emission factor of 1.08 kg/kWh_{el} was used, representing generation in low-efficiency brown coal fired plants in early years, and a mix of efficient coal and gas fired plants in later years.

The baselines for both the cogeneration and woodchip boiler cases assume heat production in the modern gas fired boilers installed under the fuel switch project. The CO_2 offsets and incremental costs represent the situation where a heating center, in addition to being switched to natural gas, is equipped with a small-scale cogeneration unit (gas motor) or designed as a bivalent gas and wood fired plant.

The lifetime of the joint project was set at 15 years. The total CO_2 emission reduction was calculated at 238,000 tons: 175,000 tons for the fuel switch subproject; 41,000 tons for the cogeneration subproject; and 22,000 tons for the woodchip boiler subproject.

Standardized baselines

The study discusses two fundamental problems encountered in the ad hoc approach that has been used so far in baseline setting. First, project-specific baselines require a lot of detailed information and are therefore expensive. They also leave room for project developers to engage in strategic behavior, so that regulators in turn must check things carefully.

Second, the transparency of a project may be hindered because sensitive commercial information is involved, which project developers are reluctant to publish. The study argues that the review process may thus to a certain extent be subjective and not entirely equitable. The study recommends that governments and the CoP develop simple and transparent rules for baseline setting.

Box 1. Components "Conversion of Heating Centers" study.

Fuel switch: rehabilitation of 76 heating centers in seven cities with 162 modern gas fired burner/boiler units; the old units were fired with brown coal (41% of fuel consumption), coke (34%), light oil (12%), city gas (10%), and natural gas (3%). The total peak capacity of the new units is 41.6 MW thermal.
Cogeneration: installation of two gas fired combined heat and power (CHP) engines (0.5 MW thermal and 0.32 MW_{el} each) in the city of Celakovice. The CHP units supplement gas fired boilers installed in the Fuel Switch project and cover basic heat demand; the cogenerated electricity is sold to the grid.
Woodchip boiler: this subproject, to be carried out in Kraslice, was cancelled in 1998. Since it is interesting from the JI viewpoint, it is evaluated in the report as far as possible with the data.

With respect to this the study recommends an aggregated approach for complex projects, *e.g.* involving numerous sites such as in the case of the fuel switch subproject. Ideally, in the case of the CHC project, there should be standard values for the Czech heating sector to be applied to all such projects, covering *e.g.* fuel consumption and efficiencies in existing heating plants, baseline renewal and/or fuel switching rates, as well as average operation and maintenance costs.

When calculating emissions reduction for small-scale cogeneration projects, one needs to make assumptions about emissions reduction achieved in a central power plant as a result of electricity fed into the grid. There are high contingencies involved here, which could be limited by shorter crediting times (which also reduces competitiveness), or by a partial re-evaluation of the project baseline after about eight years. Again, host countries are advised by the study to establish standard values.

Free rider effects

The study considers free rider effects as the main consequence of standardized baselines, that host country governments may want to avoid. If any reduction below the standardized baseline were additional, a large percentage of regular (*i.e.* non-additional) energy efficiency improvements might be carried out as JI projects. Thus, the resulting GHG offsets would be transferred abroad instead of contributing to the host country's compliance with its national assigned amount. This might make it much more difficult for the host country to reach the target.

The study therefore concludes that the analyzed proaches to standardized baselines - *i.e.* the matrix, benchmarks and top-down approaches - are useful in that they reduce transaction costs for individual JI projects, but they also aggravate the free rider effect. The study argues that the only potentially viable and long-term sustainable approach to standardized baselines without separate additionality testing would unite matrix, benchmarking and top-down elements. Most importantly, it would ensure top-down that the host country's national emissions allowance would not be exceeded as a result of JI.

A promising alternative could be standardization of certain elements of baselines with separate additionality testing. In this approach additionality of reduced emissions is ensured project by project, based on incremental costs and/or qualitative barrier analysis (IEA 1997). Two parameters that may well be standardized

Table 1 Impact of different calculation methods on CO_2 abatement costs of the CHC subprojects

	Abatement costs (US$/$tCO_2$)		
	Fuel Switch	**Cogeneration**	**Wood Chips**
Private/commercial perspective:			
• discount rate 7%			
• fuel: Czech market prices incl. VAT	11.2	23.1	-1.4
• 46 CHF/MWh_{el} sold to grid (1998 average, escalation 2%)			
• externalities: current pollution charge added to fuel price			
National/economic perspective I ("GEF approach"):			
• discount rate 12%			
• fuel: Czech market prices excl. VAT	14	14	9.8
• 70 CHF/MWh_{el} sold to grid (1998, escalation 1%)	(-24.5 incl. externalities)	(-3.5 incl. externalities)	
• excluding/including externalities			
National/economic perspective II: ("Nordic Council approach")			
• discount rate 3%			
• fuel: international market prices	34	9	-13.3
(import price + transport, excl. VAT)	(-14 incl. externalities)	(-18.2 incl. externalities)	
• 70 CHF/MWh_{el} sold to grid (1998, escalation 1%)			

Values of externalities: US$ 700/tNO_x avoided; US$ 1,557.5/tSO_2 avoided.
Source: Ernst Basler + Partners, 1999.Swiss-Czech Cooperation Project "Conversion of Heating Centers", Activities Implemented Jointly (AIJ) Simulation Study, Zurich, Switzerland.

are: average emission factors of existing energy infrastructure and projected infrastructure turnover rates in the absence of JI. In addition, factors for leakage should be included.

Abatement costs

For the calculation of the abatement costs the study compares three approaches, one from a private or commercial perspective and the other two from a national economic perspective (using approaches developed by the GEF and the Nordic Council of Ministers, NCM). The private perspective uses actual costs incurred by the project owner (*e.g.* consumer fuel prices including taxes, commercial discount rate) and is helpful if emission reduction additionality is to be established on the basis of positive incremental costs. However, a national perspective is needed to calculate the real costs for the host country. It uses fuel prices excluding taxes (with cogeneration), the true economic costs of avoided baseline power generation, and a fairly low discount rate. Moreover, it takes avoided externalities (*e.g.* non-GHG emissions) into account.

Table 1 shows that abatement costs mainly depend on the assumptions of each perspective. The high discount rate in the GEF approach generally yields high abatement costs. The cogeneration project shows even higher costs from the private perspective, because the current average selling price for cogenerated electricity US$ 30/MWh_{el}) does not reflect the true economic cost of the avoided power generation (estimated at US$ 47/MWh_{el}). Finally, the NCM method results in a high cost figure for the fuel switch subproject, since Czech coal prices are higher than the world market price. The avoided externalities have been calculated using the following figures: US$ 700 per ton NO_x and US$ 1,560 per ton SO_2. When these are taken into account in the national context, all projects appear to be moderately to highly cost-effective. The authors conclude that benefits in terms of avoided externalities should not be neglected, especially when comparing fuel switching and cogeneration with *e.g.* sink enhancement.

Other benefits

The project was found to be fully compatible with national development strategies in the Czech Republic. The Czech government aims at reducing local air pollution by decreasing the share of coal in the residential and public heating sector. Of course, the downside of this policy is the social hardship for the coal mining sector, which, according to the study, needs specific attention. Additional benefits for the Czech Republic are the training program for operators of heating centers and the demonstration character of the CHC (at least initially), *i.e.* technology transfer and capacity building.

Leakage

Leakage refers to a situation in which GHG emissions increase elsewhere as a result of an AIJ project. The study states that leakages should be a concern to Annex I host country governments, since they might increase the need for domestic action in order to meet their own national emission targets. Leakage effects can be investigated and calculated in a bottom-up (individual project) baseline if they occur at the local level, for instance due to increased use of scarce fuel wood from local forests. Most other leakage effects occur at the national or even international level. They depend on the extent to which fuel supply and demand respond to price changes, and therefore on various socioeconomic factors, such as a government's willingness to give up jobs in the domestic coal industry.

Monitoring

Finally, with respect to monitoring of the results of AIJ projects the study suggests some measures of standardization in monitoring too. In order to maximize reliability and lower transaction costs the study prefers automated measuring and online data transmission to a specialized JI entity (government or third party). Questionnaires and interviews would only be needed at larger intervals and they would mainly include socioeconomic effects, such as satisfaction of residents, employment effects in heating centers (and possibly the coal sector), and the effectiveness of the training program.

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