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Innovation in the economic performance of a power station through monetised carbon dioxide credits

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Abstract
It is proposed to generate part of the future base load power requirements of South Africa using natural gas as a substitute for coal. By this substitution, combined-cycle gas turbine power stations will be built instead of pulverised fuel coal-fired power stations to generate base load power. This substitution will lead to abatement in the emission of greenhouse gases, especially carbon dioxide.

In this paper, an innovative mode of amortizing capex is applied to reduce the payback time of a bank loan through the combined use of proceeds from the sale of electricity and monetised carbon dioxide credits. This innovation stems from the reduction in emission of carbon dioxide due to the proposal to generate part of the future base load power requirements using natural gas as a substitute for coal.

The carbon credits emanate from undertaking projects resulting in the reduction of greenhouse gas emissions under the Clean Development Mechanism of the Kyoto Protocol. This is possible because South Africa is regarded as a developing country. This additional revenue results in reducing the loan payments by 2.1 years, saving 19% in interest payments. Furthermore, this innovation would allow scarce finance available for project funding to be extended to other projects to the advantage of national economic development.

Keywords: carbon dioxide credits, combined-cycle gas turbine power stations, Te-Con's techno-economic simulator model

1. Methodology

In this paper, only the capital expenditure and operating expenditure of a combined-cycle gas turbine (CCCT) power station financed by equity and a bank loan is examined. This is done to accentuate the effect of monetised carbon dioxide credits on interest payments and payback time on the loans used for building and running the CCGT power station.

The CCGT power station is fired by natural gas. A Te-Con simulator model (Te-Con Consultants, 2004) (Figure 1) is used to model the substitution of natural gas for coal for power generation. In addition, the Te-Con Techno-Economic simulator model is used to analyse the simultaneous redemption of the bank and shareholders' loans (Figures 2) using accrued monetised carbon dioxide credits.

2. Te-Con's techno-economic simulator model

The model consists of a number of modules that can be plugged and unplugged to provide the required configurations. The model assists in the determination and comparison of the life-cycle economic performance of a combined-cycle gas turbine power station with that of a pulverised fuel coal-fired power station (H. Simonsen, personal communication, 2003).

3. Redemption of bank loans using monetised credits

From the Te-Con Techno-economic simulator model, payment of the loan started in January 2005 (A in Figure 2). Monetised carbon dioxide credits would start to accrue when electricity is generated by the CCGT power station in September 2007. The monetised carbon dioxide credits will immediately be used to redeem the loan from September 2007 (indicated by B).

During the redemption period, fifty percent of the monetised carbon credits will be used to pay for the bank loan. Without monetised carbon dioxide credits, the bank loan will be fully paid in November 2014 (D). However, with carbon dioxide credits (shown by the steeper sections of the lower curves), the loan is paid off in November 2009 (C), which is after 5 years. The significance of this is that the use of carbon dioxide credits reduces the payment of

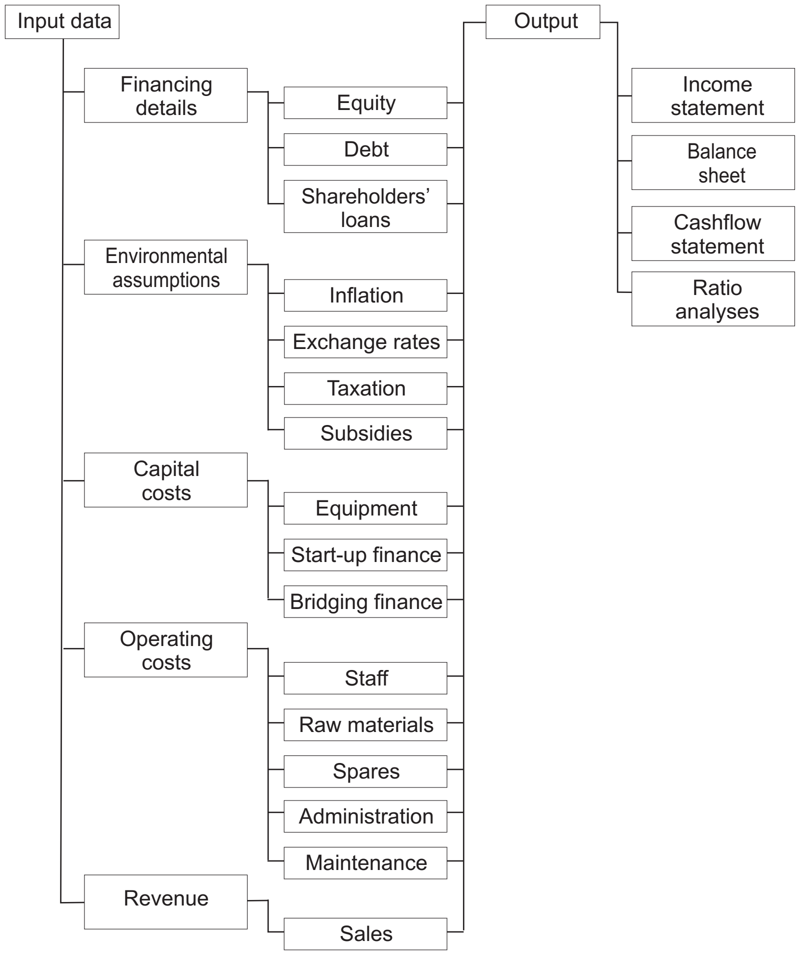

Figure 1: Components of the Te-Con techno-economic simulator
Source: Te-Con Consultants (2003)

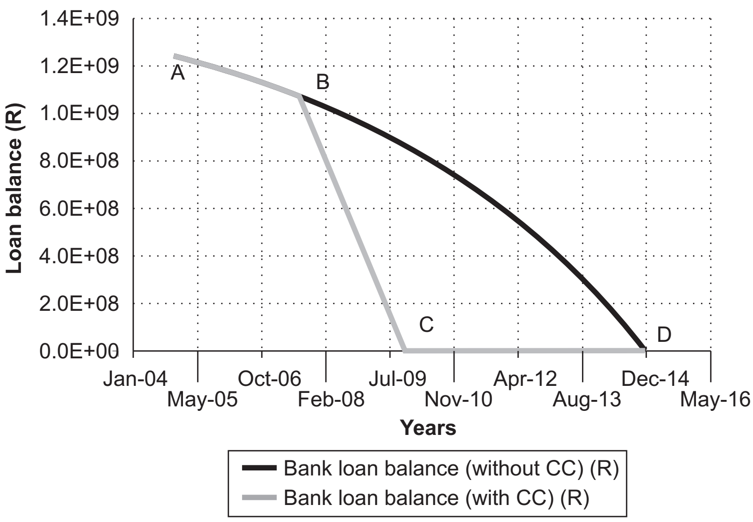

Figure 2: The bank loan balance profile during redemption
Source: Output from modelling

the loan by 4.3 years and saves about 38% in interest payments.

The net savings in interest payments was R450 million. In my view, considering the fact that the CDM is a global novelty and just taking off in South Africa, the payment of loans using monetised carbon dioxide credits is an innovation. This loan amortization mode is worthy of examination by future projects involving reduction in greenhouse gas emissions.

4. Results

The use of carbon dioxide credits reduces the payment of the bank loan by 2.1 years and saves about 19% in interest payments. The net savings in interest payments is R225 million.

5. Implications of the study and emerging policy issues

Project finance is a scarce commodity in that there are always more projects than available finance. Therefore, any financing process that extends the finance resource base to cover more projects may be advantageous to South Africa.

Lowering the cost of project financing and enhancing a project's income stream through monetised carbon dioxide credits, permit the introduction of more environmentally acceptable natural gas-fired electricity generation. In this case, natural gas is used as a substitute for coal, which has a higher generation cost regime (H. Simonsen, personal communication, 2 December 2005).

6. Conclusion

The innovative way of financing the natural gas-fired power generation project by using the monetised carbon dioxide credits under the novel CDM to redeem a bank loan, results in reducing the time for loan payments and savings in interest payments. This would allow scarce finance available for project funding to be extended to other projects to the advantage of national economic development.

Additionally, the above results could be of assistance to the South African government, the national electric power utility (Eskom) and Independent Power Producers, in making informed decisions concerning the choice of natural gas to generate electric power. Such power can be used to forestall the anticipated shortfall in base load capacity from 2010.

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