Impact of Incentives and System Efficiency on the Life Cycle Cost of Photovoltaic Systems

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The solar photovoltaic (PV) market has experienced unprecedented growth over the past decade. Europe leads the PV market while the US lags behind. While the feed-in tariff (FIT) mechanism, a performance-based solar energy incentive scheme, is popular in Europe, the US has been devising capacity-based incentive programs. A capacity-based incentive scheme includes tax credits, state and local rebate programs, and even property tax credits. It helps in reducing the large, upfront cost which is considered as one of the barriers of quickly deploying solar photovoltaic (PV) systems in the US and in some high solar resource states. The other concern is the aggregate unit price which is a measure in evaluating the investment of solar PV systems. The study applies the life cycle cost analysis method to analyze the feasibility and affordability of deploying residential PV systems in the United States, especially Florida. It helps potential users to determine the most economical PV system, in terms of upfront cost and aggregate unit cost, based on household income, incentive rebate programs, and the efficiency of the PV system. This research explores the impact of economic and technical factors on the affordability and feasibility of grid-connected solar PV systems.

Keywords incentive programs, life cycle cost analysis, solar photovoltaic system, system efficiency

Introduction

Renewable energy has become a significantly important research area for many researchers as well as for governments of many countries as they attempt to ensure the safety, long-term capability, and sustainability of the use of global alternative energy resources (Jager-Waldau, 2007). Solar energy is considered one of the leading technologies with respect to electrical power generation (Song et al., 2008). Solar power systems that are connected to the electricity grid, known as grid connected solar photovoltaic (PV) systems, generate electricity for users and feed excess energy back into the electricity grid system. The application of residential grid connected solar PV systems has been taking place for a number of decades as homeowners seek...
NEGOTIATING CONSTRUCTION CONTRACTS THROUGH PRACTICAL CASH FLOW PLANNING AND ANALYSIS MODEL

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Abstract
Under-capitalization, difficulties in getting credit, substantial cost of getting financed, etc. cause contractors to complete projects with negative ending balances. Predictability and control of the cash flow through negotiating financial provisions of construction contracts mean differences between success and failure of a project or a contracting company. Despite many practical insights provided by professionals, structured procedures and tools are seldom used, and few contractors take advantage of the existing techniques which can enable them to identify the effects of their decisions on negotiating contract terms. In addition, commercial finance software is expensive and complicated. This paper presents the multi-period dynamic model on the project level which maximizes final cash balance through negotiating financial terms of contracts without time-consuming data collection and with reasonable accuracy. This allows industrial practitioners to define the cash flow planning horizon, as well as predict and maximize the final cash balance. Microsoft's Excel spreadsheet software with its add-in optimization programs is used in solving these models. Through scenarios and sensitivity analysis on contract financial provisions, contractors can predict the impact on project cash inflows and outflows. The approximate solution of this deterministic model gives decision makers an excellent insight for making the optimal decisions.

Keywords
Cash flow, construction contract negotiation, retained percentage, billing period, initial capital, and multi-period dynamic optimization model

INTRODUCTION

Many of the contracting firms failing are profitable ventures at the time of bankruptcy. There are many reasons for the failure of a construction company, events such as a recession, tight money, etc. Credit is hard to get currently, and the cost is substantial if it can be obtained at all, leading to undercapitalization. However, these events affect all business enterprises when they affect one. What are the differences between firms which survive and firms which fail? The cash position of a contracting firm has a great deal to do with its success or failure.

Each individual project cash position is collectively the base of company cash positions. The nature of a construction project often causes contractors to be caught in
CONSTRUCTION PROJECT CASH FLOW PLANNING USING THE PARETO OPTIMALITY EFFICIENCY NETWORK MODEL

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Abstract. Cash flow is crucial for ensuring the viability of a project. It consists of a complete history of all cash disbursement, cash shortage, loans, cost of money, and all earnings received. Although significant research work has been conducted on cash flow forecast, planning, and management, the objective is constantly the maximization of profit/final cash balance, or minimizing of total project cost. Moreover, cash flow forecasting needs to be effective and fast. The paper develops multiple-objective cash flow planning model – Pareto optimality efficiency network model, which considers typical banking instruments, the constraints of the financial market, the budget constraints, and retention of money. A case study illustrates the multi-objective project cash flow management approach by applying the proposed model to a real world problem. A what-if-analysis depicts the tradeoff between profitability and loan interests, which are major issues in project cash flow planning and management. The model presents an effective decision making tool to be used by industry practitioners with reasonable accuracy.

Keywords: cash flow planning, pareto optimality, network model, multiple-objective.

1. Introduction

Cash is the most important resource for a construction company, because more companies become bankrupt due to lack of liquidity for supporting their day-to-day activities, than because of inadequate management of other resources (Singh, Lakanathian 1992). Many construction projects have negative net cash flows until the very end of construction when the final payment is received or advanced payment is received before starting the project. It is very difficult to convince creditors and potential lenders that these inadequacies in cash flow are only temporary. Perhaps this is one of the main reasons that insolvency is more likely to occur in this industry than any other (Kaka, Price 1993). Moreover, the construction industry is a sector where significant uncertainties arise in many aspects of the problem, including the business and the financial environments. The financial risks come from several sources, encompassing the need for intensive capital, cash retainage from clients, the exposure to interest rate changes during the period between the contract closing and the end of the payment plan, leading to difficulties in good cash flow forecasting (Barbosa, Pimentel 2001). Inaccurate cash forecasts and inadequate cash flow management incurs financial stress (Kaka, Price 1991). Companies of different sizes face this kind of problem which requires distinct approaches and proper tools according to the nature and complexity of the operations (Barbosa, Pimentel 2001).

Cash flow at the project level consists of a complete history of all cash disbursement, cash shortage, loans, cost of money, and all earnings received as a result of project execution. A firm with higher cash flow variability increases the level of expected external financing costs, which incurs high cost of money and accordingly high project cost. Although significant research work has been conducted on cash flow forecast, planning, and management, the objectives of most of research is to maximize profit/final cash balance, or minimizing total project cost, or more accurately forecast the cost-in flow or cost outflow. Furthermore, cash flow forecasting needs to be effective and fast, considering the short time available and the associated cost at the tendering stage. Contractors rarely prepare a detailed construction plan at this stage, and usually wait until being awarded the contract. Therefore an effective and fast technique for forecasting cash flow is required, which is with reasonable accuracy and which takes into consideration the tradeoff of greater profitability and the cost of money.

This paper addresses cash flow management at the project level for the tendering and construction stages. The proposed model considers the typical instruments and constraints of the financial market, including earnings from depositing excess cash, long term and short term loans from banks. The budget constraints and minimum cash reserves for a project are also taken into account. The significance and useful potential attributed to the proposed Pareto optimality efficiency network model