The Discount Rate - A Tool for Managing Risk in Energy Investments

By Hisham Khatib*

Introduction

The life-cycle costs of a project and its feasibility, for a given output, depend on three factors: (i) the investment cost, (ii) the operational costs and (iii) the discount rate utilised. Many planners think that the discount rate is the most important of these three factors. It greatly affects the whole economics of the project and the decision making, particularly in capital-intensive projects like those of the energy industry[1]. The discount rate almost governs the project's feasibility and the decision to proceed with the investment or not. It is also the base for calculating the levelised cost of electricity (LCOE) for different generating facilities.

The Discount Rate

The discount rate is the opportunity cost of capital (as a percentage of the value of the capital). The opportunity cost of capital is the return on investments forgone elsewhere by committing capital to the investment under consideration. In investment decisions, the opportunity cost of capital is the cut-off rate, below which it is not worthwhile to invest.

The value of the nominal discount rate is a function of three factors: inflation, risk-free real return and the extent of risk in the project.

Calculating the Discount Rate

In many countries, energy projects financed by the government use a different discount rate than that used by the private sector investors operating in a liberalised market. Normally, government investments are less risky, because they are mostly in regulated utilities and industries. The discount rate of the private energy sector investments is influenced not only by risk, but also by returns in the bond market which can change significantly from one period to another. Both discount rates are, however, significantly influenced by availability of capital for investment and the cost of borrowing.

Energy Business Investment Projects

Investors in energy projects expect a rate of return from projects to compensate them for the following: a minimum acceptable real return available in the market (risk-free rate of interest), the risk of investing in the project, taxation and also inflation. The rate of return will be calculated in real terms thus ignoring inflation.

Return on equities (capital gains plus dividends) fluctuates in the stock market. Recently, this equity risk premium was 5.75%, in mature markets[2].

Period	Arithmetic Average (%)		
	Stocks	Treasury Bills	Treasury Bonds
1928-2012	11.26	3.61	5.38
1962-2012	11.10	5.17	7.19
2002-2012	8.71	1.65	5.64

Period	Risk Premium(%)	
	Stocks-Treasury Bills	Stocks-Treasury Bonds
1928-2012	7.65	5.88
1962-2012	5.93	3.91
2002-2012	7.06	3.08

Source: Aswath Damodaran, January, 2013

Average rates of return on treasury bills, government bonds, corporate bonds and common stocks, 1926–2012 (figures in annual percentages)

Regulated energy utilities have a risk, which is lower than the average market risk. A stock's sensitivity to change in the value of the market portfolio is known as beta. In a competitive market, the expected risk premium varies in direct proportion to beta. This is the capital asset pricing model (CAPM)[3], simply defined as

expected risk premium on a stock = beta × expected risk premium on market

real discount rate = real risk-free rate + (market risk premium × beta)

Therefore, investment in an asset/project that has a beta of 0.6 means that the real discount rate for this investment will be equal to 4.2 per cent; (0.7 per cent (which is the risk free rate) + (5.75 per cent market risk premium x 0.6)).

* Hisham khatib is Honorary Vice Chairman – World Energy Council. He may be reached at khatib@nets.com.jo

Risk in Energy Investments

It is necessary to discuss the risk in energy investments – mainly the discount rate of electricity utilities. Utilities, in many cases, are regulated monopolies, particularly in developing economies. They have well-defined markets and also established technologies; correspondingly, they have a lower discount rate, a lower beta than the average equity.

Electricity utilities, because of their secure market and established consumer base, have less risk than the market average. This has also allowed them to borrow at lower rates, thus reducing the burden on their consumers. To allow for expansion, their borrowing requirements are at least twice their depreciation allocation. It has also to be realised that the discount rate for such projects can be reduced by capital structuring and allocating risk.

In liberalised markets generation projects have a higher risk and correspondingly higher beta value than distribution utilities. Nuclear installations have a higher risk than other forms of thermal generation and, correspondingly, utilities with nuclear generation have a higher beta than other generating utilities, depending on the extent of their nuclear component. Long-life facilities, like large coal-firing plants, carry more risk than modern CCGT gas-firing facilities. Investments in big long-lead-time pulverised coal-firing generating units are riskier than investment in smaller short lead-time CCGT plants that easily fit the load curve. Generally speaking, regulated utilities have a lower risk/discount rate than the average equity. Beta between 0.4 and 0.9 are normal for regulated utilities depending on the type of business and extent of regulation. The regulatory environment, in particular, has a marked influence on the discount rate of investment in energy projects. The prospects of future carbon pricing will increase the risk for certain generation investors, which need to be considered in their discount rates.

The introduction of new renewables (solar and wind) produced new challenges that significantly increased the risk of returns on existing and new investments in base load generation. Renewables carry less risk, their investment cost is reducing, and execution times are short, also in most cases they are assisted by subsidies, therefore their discount rate is low. Renewables are a must dispatch generation and their output can be on the expense of established traditional base load generation, significantly reducing the base load generation output and correspondingly its profitability and increased its risk. This rendered negative electricity pricing to become not uncommon in few European markets.

For nuclear generation, the risk in investment, execution times, financing costs and regulations are considerable. They would not be carried by a market investor in the OECD without firm guarantees and subsides, which are becoming scarce. An important factor behind these high estimated costs to build nuclear reactors is the delay that these projects often face during licensing and construction that increases the capital burden, often at high interest rates. This is also a reason why the economics of nuclear power may be more favourable in countries such as Russia, China, UAE and South Korea where projects tend to stay on schedule. A recent MIT study recommended that the discount rate for new nuclear projects should be as high as 11.5%[4].

Weighted-average Cost of Capital

For project evaluation, mostly in North America, utilities use the revenue requirements method (RRM). It is a project evaluation method that discounts future costs (revenue requirements) into their present value using the utility's weighted-average cost of capital (WACC). WACC is the weighted-average cost of the firm's equity and debt:

$$\text{After-tax WACC} = r_d(1-T_c)D/V + r_eE/V$$

Where: r_d is the return on debt, r_e return on equity and T_c corporate tax rate, and D is debt ratio, E equity ratio and V = E + D = 1.

WACC is a common tool used by energy investors for discounting cash flows and assessing the viability of the investment. It, unlike the discount rate, does not directly reflect risk; but this should be embedded in the choice of the expected return and the cost of debt.

Footnotes

[1] Khatib, Hisham: "Economic Evaluation of Projects in the Electricity Supply Industry", 3rd Edition, The Institution of Engineering and Technology (UK), 2014.

[2] Damodaran, Aswath: "The Global Landscape in Jan. 2015". http//aswathdamodaran.blog.com.

[3] Brealey/Myers/Allen: "Corporate Finance", McGraw-Hill Int. Ed., 2006 and later.

[4] Massachusetts Institute of Technology (2003). "The Future of Nuclear Power" .