Unit Reference Value: Application in appraising inter-basin water transfer projects

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ABSTRACT

Unit Reference Value (URV) is a common measure in South Africa to assess the economic efficiency of proposed water projects. This is a companion article to an earlier one establishing that the current approach of appraisal of inter-basin water transfer projects (IBTs) with significant pumping costs overestimates likely future water transfers and thereby variable operational costs. Those findings are taken further and it is established that the URV, as currently applied, fails as a suitable measure to appraise such IBTs. From rooting URVs in fundamental cost effectiveness analysis theory a revised URV approach is proposed that provides for a conceptual separation between water transfers affecting operating costs and water transfers used as a proxy measure for effectiveness. The prominent effect of the revised URV approach is demonstrated by means of the example of the proposed Thukela Water Project in South Africa.

Keywords: unit reference value, cost effectiveness analysis, inter-basin water transfers, project appraisal

INTRODUCTION

A preceding article by Van Niekerk et al. (2013; henceforth also called 'the companion article') reported on research showing that the actual experience of water transfers and life-cycle costs of inter-basin transfer (IBT) projects with significant variable costs does not correspond with the assumptions made originally at the planning stage. The deterministic method of appraisal, called the Incremental Approach, substantially overestimates the quantities of water to be transferred and thereby the life-cycle costs of the IBT. It does not take into account the uncertainty regarding the year-to-year future need for water transfers. A revised approach, called the Comprehensive Approach, is recommended to allow for the explicit consideration of the uncertainty of future water transfers and associated costs. This approach provides greater realism in predictions of likely water transfers and life-cycle costs.

This article now reports on further research (Van Niekerk, 2013) regarding the implication of the above findings on the application of the unit reference value (URV) measure, used in South Africa to assess, inter alia, IBT projects.

The URV measure has its origin in the South African Department of Water Affairs (DWA) in the 1980s. It was conceptualised for use by planners of Government water works, being public projects, to assess best sizes, layouts, and configurations of such schemes. For that purpose, the cash flow to construct, operate and maintain a particular scheme is projected over its economic life, usually 30 to 45 years. These costs are determined at constant prices, adjusted to exclude any taxes and subsidies, sometimes also shadow priced to allow for market distortions, e.g., the cost of unskilled workers in an environment of surplus labour but minimum wages. The value of such a cash flow stream at a specific point in time, usually present day, is determined using an economic discount rate, sometimes also called a 'social discount rate'. Any remaining value at the end of the discounted period is credited to the cost stream and accounted for in the discounting calculation.

To determine the URV of a particular scheme, the water supplied (i.e. the primary benefit derived from it) is projected over the same period and 'discounted' at the same rate to derive a 'present value' in cubic meters. In the Incremental Approach it is assumed that all of the demand exceeding the capability of the existing system has to be met from new resource development. Variable costs, i.e., costs that are directly related to the water quantities delivered, such as pumping (energy), water treatment (energy and chemical) and royalty (international payment) costs, would follow the same pattern.

The URV of the scheme is derived by dividing the PV of the costs with the PV of the water supplied, as shown in Eq. (1).

$$\text{URV} = \frac{PV\ of\ Costs}{PV\ of\ Quantity\ of\ water\ supplied} \qquad (1)$$

The URV measure should not be confused with tariffs. Tariffs are determined primarily for cost recovery purposes, i.e., to ensure that the actual monetary outlay to bring projects to fruition, and to run and maintain them, is recovered over a specified repayment period, usually between 10 and 20 years. Commercial (bank) lending rates apply and depend on the capital market situation and projections of interest rates that pertain at the time the calculations are made. Inflation has to be factored into the cash flow requirement over the construction period and beyond, when the project is in operation.

Water sales are projected over the repayment period and an associated unit tariff is determined (by iteration) that will lead to break-even exactly at the end of the period. The tariff is expressed in Rands per cubic meter (or kilolitre). The URV determination can be expected to lead to a lower figure than its calculated tariff. This is mainly due to the shorter discount period and the higher discount rates applied to the tariff calculation.

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