



## WATER, SANITATION, ENVIRONMENT and DEVELOPMENT

### Pricing water to recover costs

P J Barker



#### Introduction

Bangalore is the fifth largest city of India and is characterised by an average rate of population increase of approximately 4% p.a.

#### Selected census recorded populations:

	(m.)	Projected population	
1901	0.228		
1941	0.510		
1951	0.991	1995	5.2
1961	1.201	1999	6.1
1971	1.780	2000	6.4
1981	2.915	2005	7.8
1991	4.5	2010	9.5

Responsibility for the water supply and sanitation is vested in the Bangalore Water Supply and Sewerage Board. The water supply to the city is drawn from three sources:

- 1) Hesaraghatta source - 18 kms. NW of the city. (22.5 mld.) 1884-1885
- 2) T.G. Halli source - 28 kms. W of the city. (143 mld.) 1933, 1951, 1964.
- 3) River Cauvery - 100 kms. SW of the city.  
Stage 1 - 1970-74 (135 mld.)  
Stage 2 - 1980-83 (135 mld.)

During Cauvery Stage 1 the entire city distribution system was remodelled and designed for a supply of 435 mld. inclusive of the 135 mld. Stage 1. (Based on a peak demand factor of 2.25 and consumption of 200 lpcd).

The history of the water sector in Bangalore is of one demand, (due to population growth, immigration and industrialisation) successively outstripping supply. The authorities have made a series of investments to fill this shortfall.

By 1967 the population had reached 1.5m. and per capita supply was only 100 lpcd. inclusive of industrial and commercial consumption. The response was sanctioning of Cauvery Stage 1.

*Note that the application for World Bank loan assistance foundered due to the differences in opinion regarding 2500 litres monthly free allowance to consumers. In the event it was financed by the State Government, LIC and Debenture Loans.*

Cauvery Stage 1 eased the supply position for two or three years from commission in January 1974 but rapid population growth by 1977 meant that supply was again inadequate with per capita consumption a maximum of 85 lpcd.

The response to severe shortages was essentially to duplicate Stage 1 in the form of Cauvery Stage 2 for a new increment of water, again of 135 mld. Improvements to distribution under Stage 1 accommodated this addition to supply.

Despite these additions to the system unremitting population growth has resulted in water delivery falling far short of the 140 lpcd. recommended by GOI guidelines.\* A realistic estimate of availability put actual domestic per capita consumption at no more than 60 litres per day in early 1982 with an expectation that this would reach only 100 lpcd. after Stage 2 came on stream. The same analyst reported even this level of consumption would rapidly decline without further major investments (B.R. Nagendra, 1982). In order to avoid this deterioration the Board in 1985-86 started Cauvery Stage 3 at a cost of Rs.240m. and designed to bring an additional 270 mld. to Bangalore. The stage is due to be completed by mid 1993.

#### Metering and revenue

All house service connections and non-domestic connections are metered. Water supplied to domestic consumers up to 2500 litres is charged as per slab rate. The Bangalore City Council includes water charges in the House Tax and reimburses to the Board Rs. 7.50 per house for the free allowance.

#### Financial position

The income and expenditure of the Board over the period 1984-1992 was:

	Revenue (00,000's)	Expenditure	Surplus (+) Deficit (-)
84/85	1848	2089	-241
85/86	2127	2708	-581
86/87	2281	3060	-779
87/88	3582	3733	-151
88/89	3414	4018	-604
89/90	3530	4413	-883
90/91	3731	4410	-678
91/92	4049	4408	-359

The Board has incurred a loss every year since 1981. The revenue deficit (as a proportion of expenditure) was 20% for 89/90, 15% for 90/91 and 8% for 91/92. The Board stopped paying interest and principal to Government in March 1986. At present the Board has a deficit of Rs. 2.5m. even without repayment of Government loans.

In September 1990 the Chairman of the Board applied for permission to the State Government to increase rates which had last been revised in April 1987. These rates failed to provide sufficient revenue even to cover operation and maintenance costs and had resulted in large and growing budget deficits despite the cessation of repayment of Government debt. The main reason for failure to charge realistic tariffs seems to have been the desire of local politicians to curry favour with the electorate especially the poorer classes. In particular the Board's financial position was worsened by the escalation of establishment costs but also by the energy intensive nature of conveying water long distances from the points of extraction (up to 100 kms). Throughout the 80's the Board had been subject to a succession of energy price increases. The Board is heavily dependent on charges, over the period 84/85 to 89/90 between 85% and 93% of total revenue came from water rates and water meter service charges. Other receipts was a minority item ranging from 7% to 15%.

This brief review establishes the serious and escalating adverse financial situation faced by the Board and the importance of water charges as a revenue generator. It is essential that water charges should cover the full cost of production and delivery if the Board is to meet its mandatory 'no profit - no loss' obligation. In particular given the importance of energy and maintenance costs water rates must be revised so as to compensate for increases in these two items.

### Revision of the tariff structure

The objectives of the tariff structure are:

- i) To recover the cost of water produced and delivered. This enables the organisation to meet its financial obligations, to provide a sustainable service and to signal to consumers the need to avoid waste and to provide an incentive to conserve water. Finally the tariff should allow the Board to make provision for future necessary increments to supply.
- ii) To ensure that payments are consistent with local ability to pay bearing in mind the various income levels and the need to meet public health objectives. In this latter regard the cost of basic needs water is particularly pertinent.

The first objective may be referred to as an economic efficiency aim and the second as a distributional (or social equity) aim.

Because water supply in the immediate future is a mixture of different vintages produced from past and current investment each producing at different costs the tariff

should reflect these various costs. The system recommended is to:

- a) Calculate the cost of 'new' water (i.e. Cauvery Stage 3) to find its Average Incremental Cost.
- b) Determine the AICs for each of the past investments i.e. for each vintage of water.
- c) Calculate the weighted average cost of water currently consumed according to the contribution made by each vintage in total production.
- d) Distribute the weighted AIC across the income classes in such a fashion so as to recover costs and to simultaneously fulfil the equity requirement.

The AIC is defined as Present Value of Total Costs divided by the Present Value of Output (where output is in effect acting as a proxy for benefits). AIC was calculated for each vintage or tranche of water. These were:

Rs. .45 for pre-Cauvery water	(165 mld)
Rs. 1.70 for Cauvery Stage 1 water	(135 mld)
Rs. 2.70 for Cauvery Stage 2 "	(135 mld)
Rs. 5.82 for Cauvery Stage 3 "	(270 mld)
<i>Total</i>	<b>705 mld</b>

These costs were weighted according to their individual contributions in the total supply of 705 mld after completion of Stage 3. On this basis the weighted AIC of water from all existing sources is Rs. 3.17 (say Rs. 3.2) per 1000 litres.

It was estimated that making allowance for failure to use the full potential of water and water losses would reduce the total actually available for consumption from 705 mld to 541 mld. Thus the average weighted price sufficient to recover costs becomes:

$$\text{Rs. } 3.17 \times 705 / 541 = \text{Rs. } 4.13 \text{ per cu. meter}$$

Say Rs. 4.2 per cu. meter

### The proposed tariff

A simple tariff was designed to achieve the aims of efficiency and equity. Simplicity, fairness and cost recovery are essential elements of the tariff (Table 1).

Annually this is Rs.1017m. Currently, the Board levies a sanitation charge equal to 25% of the water charge. It would actually like to charge 40%. Using the former figure generates (Rs.1017 x 1.25) = Rs. 1271 m. per annum.

The annual total cost of water production calculated on the basis of weighted AIC = Rs. 4.2 x 705 Mld x 1000 x 365 = Rs. 1080.7m. Thus the proposed tariff would generate sufficient funds to cover the full annual cost of water production. An increase in sanitation charges would allow a more generous contribution to future systems expansions.

Table 1

Monthly flow (in litres)	No. of Connect's	Ave. flow (l.p.m.)	Total (MLD)	Tariff/1000 l.	Rev/Rs./m. (mills)
<i>DOMESTIC</i>					
0 - 10000	60000	10000	20	Rs.1	.6
10 - 25000	90000	20000	61	2	2.7
25 - 50000	60000	40000	97	3	5.1
50 - 100000	18000	90000	54	4	4.95
100000 +	2000	165000	110	3	24.3
Pub. Taps.	5300		102	1250 tap/m.	6.6
<i>NON DOM.</i>					
0 - 10000	4000	7500	1	4	.12
10 - 25000	2200	13600	1	5	.15
25 - 50000	2000	45000	3	6	.54
50 - 100000	1300	92000	4	8	.095
100000 +	1200	2200000	88	15	39.6

GRAND TOTAL = 84.75 per month

Table 2

Econ Group	% of Pop.	No. of Families	Ann. Inc. Rs./Fam.	Monthly Income Rs./Fam.	Ave. Consumption /month./family cu.m		Total Cons. Mnth. 000s
					(a)	(b)	
Slum	7	60000	20000	1700	3.75	9.75	585
V. Low	33	300000	35000	3000	5.25	12.00	3600
L. Mid.	30	270000	50000	4200	10.5	15.00	4050
Up. Mid.	20	180000	75000	6300	13.5	18.00	3240
High.	10	90000	150000	12600	17.25	19.5	1755

(a) Monthly Family Consumption Pre-Cauvery.

(b) Monthly Family Consumption Post-Cauvery. The sum of the 5 classes of consumption = 13,230,000 cubic meters per month which is equivalent to 441 MLD and is thus within the capacity of the Post-Cauvery system.

The average weighted cost of Post-Cauvery 3 water was as reported found to be Rs. 4.20 per cubic meter.

## The affordability of the proposed tariff

On the basis of data relating to consumption and discussions with Board officials with accumulated knowledge of local socio-economic conditions the above data was assembled (Table 2).

The most vulnerable group are the slum dwellers who have an estimated family income of Rs. 1700 per month. Under the old tariff arrangements this group had received 'free water' an arrangement which had contributed to the Board's poor financial position. The estimated monthly consumption (post-Cauvery 3) is 9.75 cubic metres. Thus at the proposed slab the poorest would pay Rs. 1 per cubic metre or Rs. 9.75 per month. Even allowing for a 40% sanitation charge this would amount to less than 1% of average share family income. Such a burden for a superior service is well within accepted guidelines for an economically efficient and socially equitable system.

It is interesting to note that even if the poorest paid the full AIC and sanitation was set at 25% of the water charge the poorest would pay only 3% of family income per month.

(\*) Recommended at the Conference of Secretaries, Chief Engineers and Heads of Implementing Agencies. Mysore 1989.

Project Formulation and Appraisal Techniques Applied to a Water Supply Case Study. Unpublished Postgraduate Thesis, Anna University, 1982.