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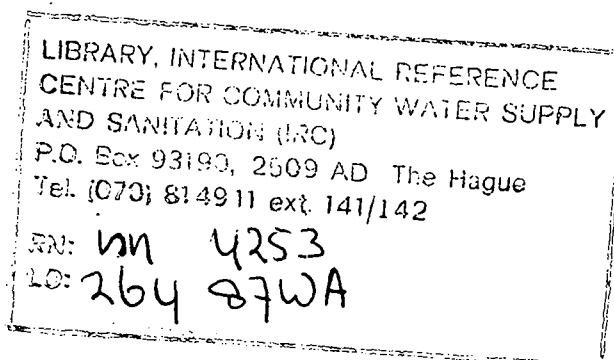
ACTIVITIES OF ESCAP IN REGARD TO NATURAL RESOURCES:
WATER RESOURCES

(Item 7 (b) of the provisional agenda)

WATER TARIFFS AS A POLICY INSTRUMENT TO PROVIDE BETTER
MANAGEMENT OF WATER RESOURCES

Note by the secretariat

Owing to the nature of the problem addressed, this paper is prepared and presented in two chapters, one on the water tariff applications in irrigation system and the other on rural and urban water supply systems.



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I. USE OF WATER TARIFFS AS A POLICY INSTRUMENT TO PROVIDE
BETTER MANAGEMENT OF WATER RESOURCES IN
IRRIGATION SYSTEMS IN THE REGION

Introduction

1. Asia had a total population of 2,818 million in 1985, representing 58 per cent of the world population of 4,837 million.^{1/} The total arable land in Asia was 426.7 million ha in 1984, which was only 31 per cent of the world arable land area, and the irrigated area amounted to 137 million ha in 1984, which accounted for 62 per cent of the total world irrigated area.^{2/} Irrigation is the principal water user in the region, consuming more than 80 per cent of the water diverted from rivers and pumped from underground aquifers.

2. The Governments have been drawing considerable amounts from their limited financial resources for the expansion of irrigated areas and undertaking the responsibility of operation and maintenance of existing irrigation systems. However, owing to inadequate water charge returns to cover the costs of operation and maintenance and improvement of existing irrigation schemes, many systems have become operated inefficiently and have deteriorated, causing wastage of large amounts of water and low productivity.

3. One of the main reasons for low revenue is the inadequacy of existing water tariffs and low collection rates partly brought about by the unreliable and inadequate supply of water. In turn, failure to raise sufficient revenues to meet operation and maintenance and improvement costs of the systems has resulted in unreliable and inadequate supply of water. This has become a vicious circle in many developing countries of the ESCAP region.

4. This section of the paper is prepared based on a study of capital and operation costs of irrigation projects and water charges levied in seven countries of the region (China, India, Indonesia, Nepal, the Philippines, the Republic of Korea and Thailand).

A. Status of water tariff applications in irrigation
systems in the region

1. Capital costs, and operation and maintenance costs of irrigation
development and management in the region

5. In most countries of the region considerable areas are developed by farmers themselves for irrigation. Such projects, small in size, close to

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1/ United Nations World Population Chart 1985 (ST/ESA/SER.A/98/Add.1).

2/ FAO Production Yearbook, 1985.

the water source and simple to manage, are designed, constructed and maintained by farmers, and based on either simple diversions or tube wells as their water supply. The farmers may obtain loans and technical assistance from the Government but generally the capital costs are low, that is, \$US 21-46 per ha in Thailand and \$US 260-590 per ha in the Philippines^{3/} and the maintenance work is carried out by the farmers. However, owing to lack of storage of water such projects are seriously affected by drought.

6. Farmers' projects make up about 30 per cent of the total irrigated area in Indonesia, 40 per cent in India, 50 per cent in the Philippines and the Republic of Korea, and 70 per cent in Nepal.

7. However, the most significant projects in the region are the public irrigation projects in which the respective Governments are involved in varying degrees. In India, Indonesia, Nepal, the Philippines and Thailand, the responsibilities of development and management of such projects are centralized at the levels of state or provincial governments. In China, it is decentralized to local governments. In the Republic of Korea, the responsibilities are entrusted to the semi-autonomous corporations.

(a) Capital costs of irrigation projects

8. Typical capital costs of irrigation projects in the region, as experienced in the seven countries included in this study, are presented in table 1. The magnitude of costs indicates a considerable variation depending upon the size of the project and the type of the water source. The unit cost per ha varies from country to country, between \$600 and \$6,000, with the average costs around \$1,500-2,000, where surface water is the source. In the case of tube wells, the cost varies between \$900 and \$US 3,400 per ha.

9. In China, in recent years beneficiary farmers have borne the capital costs of the projects repaid at low interest rates. Among the other countries included in this study, only in the Republic of Korea do the farmers bear 15-30 per cent of the capital costs of the government-initiated projects at subsidized interest rates (3.5 per cent). It has also been reported that in Japan farmers contribute 20-60 per cent of the capital costs.^{4/} The other countries included in the study, as well as in Australia, the Lao People's Democratic Republic, Malaysia and Viet Nam, the farmers' contribution to the capital cost is practically non-existent.

/Table 1.

^{3/} International Irrigation Management Institute (Sri Lanka), "Regional study on irrigation service fees", vol. 2, February 1986.

^{4/} Ibid.

Table 1. Summary of capital and operation and maintenance costs of irrigation projects in selected countries and areas of the region

Country	Capital costs			Operation and maintenance costs				
	Reference year	Project type	Cost per ha	Reference year	Project type	Desirable for proper O & M per ha	Expenditure per ha	Farmer's payment for O & M per ha
China	Up to 1986	Gravity	*\$670-1 340	1985	Assuming 10 000 cu m water per ha <u>Idem</u>	\$64 (Shaanxi)	\$18	\$20
		Tube well	\$870-1 100				(Shaanxi)	(Shaanxi)
		Low head pump	\$530-670				\$10 (National)	
India	1977/78	Major	\$1 605	1983	Excluding special repairs	\$20 (Gujarat)	\$7.5 (Gujarat)	\$9.2 (Maharashtra, mixed crops)
		Medium	\$2 593 (Maharashtra province)				\$11-16 (Gujarat, mixed crops)	
Indonesia	1985	Major (more than 10 000 ha)	\$2 800	1983	Gravity type (main system only)	\$10-38 (National average)	\$8-12 (National average)	(for main system)
		Medium (2 000-10 000 ha)	\$1 400		Technical	\$13.6	\$4-40 (for tertiary system)	
		Small (less than 2 000 ha)	\$740		Semi-technical Simple Tertiary system (farmers' responsibility)	\$9.7 \$5.4		
Nepal	1984	Run-of-river	\$2 285-3 050	1984	Gravity	\$5.5-11.0	\$5.5-11.0	
		With storage	\$4 300-6 200		Tube well	\$18-55 (National average)	\$17-39.0 (National average)	\$3.30 (standard rate)

- Sources: (1) International Irrigation Management Institute (Sri Lanka), "Regional study on irrigation service fees", vol. 2, February 1986.
(2) Food and Agriculture Organization of the United Nations, "Report on the Expert Consultation on Irrigation Water Charges", September 1986.
(3) World Bank Staff Appraisal Report No. 5028-IN, Gujarat Medium Irrigation II Project, 18 May 1984.
(4) World Bank Staff Appraisal Report No. 5376-IN, Maharashtra Composite Irrigation III Project, 18 June 1985.
(5) "Study and analysis of irrigation water prices", Water Economics, No. 4, 1986 (in Chinese).
(6) Tong Guang-qun, "Irrigation water charges in the People's Republic of China", February 1987.

* Assuming most of the projects being constructed before 1980 and an exchange rate of 1.5 yuan per US dollar.

Table 1. (continued)

Country	Capital costs			Operation and maintenance costs				
	Refer- ence year	Project type	Cost per ha	Refer- ence year	Project type	Desirable for proper O & M per ha	Expenditure per ha	Farmer's payment for O & M per ha
Philippines	1980- 1982	Foreign assisted actual cost	\$1 863-2 876	1984	National average (per ha of service area)	\$27.6 (P 386)	\$16.8 (P 237)	\$25.8 (P 284 for 1983)
	1984	Estimates: National system Pumping shallow wells Tube wells	\$700-1 200 \$770 \$1 510					
Republic of Korea	1973- 1981	Including tidal reclamation and drainage	\$9 500-19 000	1983	National average	\$195-210	\$195-210	\$195-210
	1983	Tube well	\$1 680-3 440					
Thailand	1984	Large (total cost more than \$8.4 million)	\$880-2 900	1984	National average	Present level of spending inadequate	\$27	Nil (However, due to controlled price of rice, charges are recovered indirectly. Implicit tax is estimated to be 6.2 per cent of the farmgate price of paddy in 1984)
	1984	Tertiary and on-farm development Chao Phya Stage II land consolidation Intensive Extensive	\$1 160 \$240					

10. In China, until quite recently, the implementation of major and medium irrigation projects was financed by the Government, with the labour provided by the local farmers at regular wages. Since the new economic initiative of 1980, attempts have been made to finance irrigation projects with low-interest loans from banks to local government agencies. The subsidiary funds from the Government are paid back by the beneficiary farmers, and are then utilized in funding new projects.^{5/}

11. In the Republic of Korea, funds for the construction of medium and large projects are provided from the general tax revenues channelled through the budget of the Ministry of Agriculture and Fisheries. For such projects, the capital cost, reimbursed by the water users, is financed by long-term loans from the central government channelled to the Farmland Improvement Association, a semi-autonomous organization in each county.

12. In India, Indonesia, Nepal, the Philippines and Thailand, the Governments' policy for financing the capital cost of irrigation projects has been to rely on general government revenues and grants from the central government and international financing institutions, through the budgetary procedure of the department of irrigation or public works. There has been little or no attempt to recover the capital cost from the farmers, except in the Philippines, where about 17 per cent of the total charges established in 1983 was for capital cost recovery.

(b) Operation and maintenance costs of irrigation projects

13. Typical operation and maintenance costs of irrigation projects in the region, as experienced in the seven countries included in this study, are presented in table 1. Except for the Republic of Korea, the expenditures on operation and maintenance in these projects generally varied between \$5 and \$40 per ha. However, these rates constitute only a portion of the desirable levels of expenditure for proper functioning of the irrigation systems, and the result is usually deterioration of the systems. Furthermore, the amounts contributed by the farmers do not even meet the actual expenditure in some countries, where the deficit is met from government funds. In Thailand, the farmers' contribution is nil, in Indonesia it covers the operation and maintenance cost of the tertiary systems only, and in the remaining countries, the farmers' contribution to the actual expenditure varies widely. In other words, the funds are

/inadequate

^{5/} Tong Guang-gun, "Irrigation water charges in the People's Republic of China", February 1987.

inadequate for proper operation and maintenance owing to low water charges collected from farmers or insufficient budget allocation from Governments. It has been observed that only in the Republic of Korea is the actual expenditure fully met by the farmers. The operation and maintenance costs of irrigation systems vary widely with the different types of systems and the nature of the facilities in each country.

14. In China, the provincial water conservation bureau collects water charges through its water management offices and reallocates the collected amounts according to the budgeted expenditure, any deficit being subsidized from the government budget.

15. In Indonesia, the responsibility for the operation and maintenance of the main irrigation systems (including secondary canals) formally lies with the provincial governments. However, the inadequate level of available provincial funds has led to central government funding of these operation and maintenance activities. There is no charge to the farmers for the operation and maintenance of the main system, but that of the tertiary system is the responsibility of farmers.

16. In India and Nepal, the funds for operation and maintenance of major and medium irrigation projects are allocated from the government budget. The water charges are collected by state finance departments in India and by the finance ministry in Nepal. There appears to be no linkage between the levels of the revenues generated from water charges and the funds provided for operation and maintenance of the irrigation systems.

17. In the Philippines, the farmers pay for the operation and maintenance expenditures through the National Irrigation Authority. Although the water charges are established to cover expenditure on operation and maintenance and part of the capital cost, owing to low collection rates the total amount collected is lower than the actual expenditure.

18. In the Republic of Korea, the farmers are responsible for almost the entire operation and maintenance expenses. For large and medium projects, the Farmland Improvement Association in each county is responsible for such expenditure, which is met from the revenues collected as water charges from the farmers.

19. In Thailand, the Royal Irrigation Department is responsible for the operation and maintenance costs of the public irrigation systems with funds allocated from the regular budget of the Government. While the farmers' contribution is practically nil, effective implicit tax due to the

/Government's

Government's price policy was estimated at 6.2 per cent of the farmgate price of paddy in 1984.^{6/}

20. It has also been reported that in Japan farmers contribute 20-60 per cent of the operation and maintenance costs, in Malaysia 50 per cent, and in Australia a varying portion. In the Lao People's Democratic Republic, and in Viet Nam, the responsibility for operation and maintenance of irrigation systems lies fully with the respective Governments.

2. Water charges and ability of farmers to pay

(a) Water charges

21. In the countries included in this study, the water charges are generally area-based, although there is considerable variation in the details of how these charges are established. Procedures for assessment and collection also differ among countries and the water charges are generally not based on the cost of water. It appears that water charges are levied on the farmers not as a means of allocating water but for recovering some portion of the cost of operation and maintenance of irrigation systems.

22. In China, after a nation-wide investigation into water charges, the Government adopted the policy in 1985 that irrigation water charges should be calculated based on the cost of water, including operation and maintenance costs, administrative, major repair and depreciation costs. However, at present the charges can meet only the first two of these costs. As mentioned earlier, the farmers pay back the capital costs separately at subsidized interest rates.^{7/}

23. In India, the water rates are based on the area irrigated and type of crop and are fixed roughly in proportion to the amount of water a crop uses and to the value of water in the season of use. The water charges are uniform throughout the state and are reviewed every five years, but vary widely from state to state. They are not at levels to cover the costs for proper operation and maintenance.

24. In Indonesia, the farmers bear only the operation and maintenance costs of the tertiary systems of the scheme to which they are attached, but do not pay water charges.

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^{6/} International Irrigation Management Institute (Sri Lanka), "Regional study on irrigation service fees", vol. 2, February 1986.

^{7/} Tong Guang-gun, "Irrigation water charges in the People's Republic of China", February 1987.

25. In Nepal, water charges have been defined by the Government within a fairly standard rate structure and are in effect in nearly all of the government irrigation systems. However, water charges have not been implemented consistently in all projects, and the collection of already low water charges has been ineffective. In Nepal, while typical charges amount to about 90 per cent of the operation and maintenance costs, the rate of collection is only about 20 per cent.

26. In the Philippines, the water charges are levied at a flat rate per ha varying seasonally and with the crop. In the gravity systems, different rates apply to run-of-the-river and storage systems. National policy aims at recovering the full cost of the operation and maintenance plus recovery of the capital cost within 50 years at no interest. However, generally they cannot be applied fully owing to the limited ability of the farmers to pay. The water charges collected from the farmers are at rates which are more or less equal to the actual expenditure, but below the desirable amounts. The collection percentage is of the order of 60 per cent.

27. In Thailand, there are no water charges.

28. In the Republic of Korea, in addition to paying back a part of the capital cost at a subsidized interest rate, the farmers pay water charges to cover the operation and maintenance costs, the administrative cost, and the costs of other items such as rental of assets and watershed management. The Government has established guidelines setting limits on many Farmland Improvement Association expenditures.

(b) Ability of farmers to pay water charges

29. The ability of farmers to pay for irrigation services is determined by their net income after payment of taxes and other production costs. The net income is affected by several factors, such as farm size, crop pattern, crop yields, production cost and farmgate price of products.

30. The low income and low ability of farmers to pay for irrigation services are the principal reason and justification for the subsidy policy of Governments towards operation and maintenance expenses of irrigation projects. However, if a comparison is made between the incomes of farmers without irrigation projects and with irrigation projects, the increased income could be large enough to pay the water charges required for proper operation and maintenance in some cases. In addition to water charges, the farmers in many countries of the region also make payments to the Government

/through

through indirect financing mechanisms. Rice, the staple food in the majority of the Asian countries, is the commodity generally used as a unit in establishing water charges. The price of rice is generally regulated by the Governments. The policy of distribution of rice at a low price to the consumers and maintaining staple low prices conflicts with the objectives of providing incentive prices to producers and raising the income of the farmers. In turn, Governments usually supply agricultural inputs, that is, fertilizers, electricity for pumping and irrigation services, at subsidized low prices. This situation distorts the functioning of a free market mechanism. Furthermore, the international trade environment also strongly affects the formulation of agricultural price policies of the developing countries. In table 2, the farmgate price of paddy is listed for the countries included in this study. Such prices were much lower than the corresponding international prices in all the countries, except in the Republic of Korea, where the farmgate price was about 4-6 times that of the other countries.

31. The average yields of irrigated paddy, as shown in table 2, vary considerably among the seven countries. The total annual yield would be much increased if two crops could be grown in a year. In south and south-east China, two crops of paddy are commonly grown, producing an annual yield of 11.8 tons per ha. Owing to the low temperatures, only one crop is usually grown in the Republic of Korea. Increase in the yield of paddy varies considerably from place to place, but can be as high as 1.5 ton per crop ha in adequately operated and maintained systems compared with those having inadequate operation and maintenance.

32. In Asia, with a large population and limited arable land, the holding of most farmers is small. In 1985, the number of economically active people engaged in agriculture per ha of arable land was 0.99 in Thailand, 1.22 in India, 1.26 in the Philippines. 2.15 in Indonesia, 2.54 in the Republic of Korea, 2.78 in Nepal and 4.57 in China.^{8/} In the Republic of Korea, farmers with land under 1.0 ha comprise about two thirds of all farm households. The small farm holding in the region also represents the small amount of income in each farm. On the other hand, it also indicates that there is ample labour force for better operation and maintenance of the irrigation systems and for more intensive cultivation of land.

/Table 2.

Table 2. Paddy yields and farmgate prices of irrigated lands

Country	Location or programme	Reference year	Average yield of paddy per crop tons/ha	Farmgate price of paddy \$US per ton (national currency)
China	Hunan	1982-1984	5.90	120 (348 yuan)
India	Gujarat	1984	3.40	120 (Rs 1,520)
Indonesia	National	1984	5.67 (annual)	120 (Rp 131,000)
Nepal	Chandra	1982	3.40	150 (NR 2,200)
Philippines	NISIP* I and II	1982	6.27	133 (P 1,460)
Republic of Korea	National	1983	6.50	630 (504,000 won)
Thailand	National	1982	3.1 (annual)	123 (B 2,840) (in 1984)

Sources: (1) International Irrigation Management Institute (Sri Lanka), "Regional study on irrigation service fees", vol. 2, February 1986.

(2) Food and Agriculture Organization of the United Nations, "Report on the Expert Consultation on Irrigation Water Charges", September 1986.

(3) World Bank Staff Appraisal Report No. 5028-IN, Gujarat Medium Irrigation II Project, 18 May 1984.

(4) World Bank Staff Appraisal Report No. 5376-IN, Maharashtra Composite Irrigation III Project, 18 June 1985.

(5) Tong Guang-qun, "Irrigation water charges in the People's Republic of China", February 1987.

* National Irrigation Systems Improvement Programme.

33. In the seven countries, the rate of direct taxation is very modest.^{9/} In India, farmers paid Rs 20-50 (\$1.60-\$4) per ha of medium soil quality irrigated land in 1984. In the terai of Nepal, the tax on irrigated land was Rs 79 (\$3.82) in 1985. In the Republic of Korea, there are separate property taxes and farmland taxes. In 1983, farmers paid property tax, at the rate of 0.1 per cent applied to the taxable value of the land, amounting to 6,000-14,000 won (\$7.5-\$17.5) per ha. For farms under 1.0 ha in size, little or no farmland tax would be due. For farmers with land between 1.0 and 1.5 ha, the farmland tax was estimated at 20,000 won (\$25) per ha. In Indonesia, the land-based tax, known as IPEDA varied between Rp 800 and Rp 25,400 (\$1.28-\$40.5) per ha for farms with less than 0.5 ha in holdings, and between Rp 1,400 and Rp 42,200 (\$2.23-\$67.3) per ha for farms larger than 5 ha, depending upon the productivity class of rural paddy-land with yield varying from 1.1 tons/ha to 8.0 tons/ha. In the Philippines, the agricultural lands may be taxed from 0.1-0.2 per cent of their market value. In some provinces, the market values of irrigated rice land varied between ₱ 2,900 and ₱ 18,000 (\$382-\$2,368) per ha in 1980, implying a tax range of ₱ 6 and ₱ 36 (\$0.80-\$4.74). In Thailand, the farmers' incomes are not significantly affected by the government's tax policies. The tax rate on agricultural land is quite low, with a ceiling of ฿ 31.25 per ha (\$1.15 in 1985). Furthermore, there is an exemption for each household of 0.8 ha.

34. The farmer's gross income and return to family labour and investment vary depending on many factors. Table 3 shows the gross incomes and returns to family of some typical farms under irrigation in the seven countries included in this study. It reflects the general levels of crop yield, farmgate prices of agricultural products, production costs of farm and returns to family labour and other inputs (including property and farmland tax) before the payment of water charges.

/Table 3.

^{9/} International Irrigation Management Institute (Sri Lanka), "Regional study on irrigation service fees", vol. 2, February 1986; World Bank Staff Appraisal Report No. 5028-IN, Gujarat Medium Irrigation II Project, 18 May 1984; World Bank Staff Appraisal Report No. 5376-IN, Maharashtra Composite Irrigation III Project, 18 June 1985; United Nations, Statistical Yearbook for Asia and the Pacific, 1984 (United Nations publication, Sales No. E/F.85.II.F.21).

Table 3. Gross and net incomes and water charges per hectare of typical irrigated paddy projects in the region

	China	India	Indonesia	Republic of Korea	Nepal	Philippines	Thailand
Project/location	Hunan	Gujarat	Java	National indicative	National indicative	National indicative	National indicative
Reference year	1985	1984	1985	1983	1984	1983	1984
National currency	Yuan	Rupee	Rupiah	Won	Rupee	Peso	Baht
Gross income	4 261 (\$1 435)	8 828 (\$706)	839 500 (\$763)	3 276 000 (\$4 095)	7 608 (\$423)	11 161 (\$1 015)	8 875 (\$375)
Hired labour	-----	788 (\$63)	247 400 (\$225)	179 400 (\$224)	592 (\$33)	2 969 (\$270)	934 (\$40)
Other inputs (including tax)	1 790 (\$603)	2 280 (\$182)	120 000* (\$109)	355 800 (\$445)	915 (\$51)	1 768 (\$161)	2 465 (\$104)
Returns to farmer for labour and investment (including water charges)	2 471 (\$832)	5 760 (\$461)	472 100 (\$429)	2 740 000 (\$3 426)	6 101 (\$399)	6 424 (\$584)	5 476 (\$232)
Water charges	188	170	27 000*	203 600*	165	379	0
Actual amounts	(\$63.3)	(\$14.2)	(\$24.5)	(\$254.5)	(\$9.2)	(\$34.5)	0
Percentage gross income	4.4	1.9	3.2	6.2	2.2	3.4	0
Percentage net return	8.2	3.0	6.1	8.0	2.8	6.3	0
Net return to farmer	2 283 (\$769)	5 590 (\$447)	445 100 (\$405)	2 536 400 (\$3 170)	5 936 (\$330)	6 045 (\$550)	5 476 (\$232)
Number of economically active people engaged in agriculture per hectare of arable land	4.57	1.22	2.15	2.54	2.781.26	0.99	
Gross national product 1983	\$290	\$260	\$560	\$2 010	\$170	\$760	\$810

Sources: (1) FAO Production Yearbook, 1985.

(2) International Irrigation Management Institute (Sri Lanka), "Regional study on irrigation service fees", vol. 2, February 1986.

(3) World Bank Staff Appraisal Report No. 5028-IN, Gujarat Medium Irrigation II Project, 18 May 1984.

(4) Tong Guang-hun, "Irrigation water charges in the People's Republic of China", February 1987.

(5) World Bank Atlas, 1985.

* Water charges include the land-based tax.

** Including 32,280 won (\$40.40) for capital repayment.

35. The gross income as well as returns to family per ha in the Republic of Korea is the highest, with the highest yield of paddy and the highest government purchasing price of rice. The Government raised the purchasing price of rice in order to raise the farmers' income and reduce the difference in income between rural and urban population. At the same time, with the high price of rice the farmers had an incentive to produce more and were able to pay the full cost of operation and maintenance of irrigation systems.

36. The gross income and return to family per ha in China are the second highest with its high yield of about 12 tons of paddy per ha. The return to family is almost double that of India and Indonesia and three and a half times that of Thailand. However, this yield is not the national average.

37. The prevailing water charges are also included in table 3, presenting the wide variation of the water charges as percentages of gross income and return to family among these seven countries. The table also indicates that 6-8 per cent of the gross income of farmers should theoretically be allocated for the payment of water charges to cover the operation and maintenance expenses of irrigation facilities adequately. The prevailing rates of water charges are quite low in the countries included in this study with the exception of China; there are no water charges in Thailand. However, gross incomes are also quite low in those countries.

38. Assuming a farm holding size of 1.0 ha and 5 persons per family, the per capita income of paddy-growing farms in the Republic of Korea is estimated to be about \$US 640, which is much lower than the national average per capita GNP of \$US 2,010 in 1983. Similarly, per capita income of farmers of other six countries are also much lower than the national average per capita GNP level.

B. Conclusion and recommendations

39. Inadequacy of capital funding frequently results in inferior design and low standard construction of irrigation projects, requiring reconstruction or major repairs after only a few years of operation. Except for the Republic of Korea, owing to the low level of water charges and ineffective collection, irrigation systems in the countries concerned have been operated and maintained with insufficient funds, usually resulting in early deterioration and improper functioning of the systems. In the past decade Indonesia spent large amounts on rehabilitation and renovation of many

/irrigation

irrigation schemes. The other countries are also undertaking such programmes. However, the rehabilitated schemes will soon deteriorate again if they are not operated and maintained adequately.

40. The low level of water charges also leads to management of water on farms at low efficiency with great losses. In turn, the unreliable and inadequate supply of water is usually the main reason for the low level of these charges. Farmers are usually willing to pay a much higher water charge for the operation and maintenance of tube well irrigation, because of the reliable supply and the close link of the operation and management cost with the quantity of water supplied. Therefore, it would be desirable to assess the water charge based on the quantity of water used in order to attain high efficiency in water use. Among the countries included in this study, only in China is the assessment of the water charge based on the quantity of water used. For practicality, arrangements of the bulk sale of water can be made to a group of farmers from the outlets of main canals or intakes of tertiary systems. However, strong farmers' organizations and proper water distribution and control facilities are needed for the levying and collection of charges from its members to pay for both the cost of the water purchased from the water management agency and its local distribution cost. In such cases the local governments should attempt to link the level of the water charge with the quality of the service rendered. Accordingly, the budget of the water management agency would include the ordinary operation and maintenance expenses in the field, administrative costs, and major repair costs for proper operation and maintenance of an irrigation project. In view of the low ability of the farmers to pay for irrigation services in the developing countries, the budgetary procedures, institutional arrangements and administration should be sound and efficient in order to attain the desired economic objectives.

41. In most developing countries of the region, the authorization for an irrigation project is made based on its economic merits or a favourable benefit cost ratio of the project, rather than on its financial feasibility. In addition to the construction costs, the Government also undertakes the main responsibility for operation and maintenance on the assumption that the total benefits to be generated during the design life of the project will exceed the capital cost plus its operation and maintenance expenses. However, as the project operates, the funds for proper operation

and maintenance are not adequately provided by the Government and/or the water charges are inadequate, leading to deterioration of the project and gradual decrease in benefits.

42. While the project costs are usually borne by all tax payers, only the farmers appear to be reaping the benefits. However, quite often owing to the government-regulated prices of agricultural commodities, farmers do not receive the due returns on their investments and labours, and their incomes fall way below the national per capita income levels. Therefore, the issue of raising water charges is a very sensitive political matter. But the strong will of a government to take a just and persistent course of action may be justified in order to improve the financial and physical management of irrigation systems. There may be a number of measures that can be taken, such as promotion of other farm-related production activities, including growing cash crops, agricultural product processing, aquaculture, poultry and livestock raising, handicrafts and others.

43. In order to ensure improvement of irrigation services through adequate funding for operation and maintenance, it is recommended that the concerned Governments of the developing countries of the region consider taking the following action:

(1) Review the policy on the criteria for funding irrigation projects and for pricing products. Financial feasibility criteria, without considering subsidies and price distortions, must be considered for adoption in evaluating the viability of planned irrigation projects. Full costs of operation and maintenance and major repairs and corresponding adequate water charges must be considered for sustained successful operation of the irrigation project.

(2) Review the adequacy and reliability of the water supply of all existing irrigation schemes and endeavour to remedy the deficiencies so that the farmers become willing to pay a suitable rate as water charges for the improved services. Strong consideration should be given to levying water charges based on the quantity of water used in order to link the water charge with the quality of irrigation services and to ensure maximum efficiency in the use of water.

(3) In order to reduce the maintenance costs of major works which require frequent repairs, better design and construction techniques should

be followed in the design of barrages and intakes, spillways, pumping, flood protection, silt reduction facilities, major canal works and so on. Local material should be used as much as possible to facilitate rapid and inexpensive repairs.

(4) The administrative cost would usually account for a considerable portion of the operation and maintenance budget. Central or provincial governments should accordingly provide adequate guidance and supervision to the local water management agencies to ensure efficient and economical management. The personnel of the water management agencies should be adequately trained to undertake their duties and responsibilities efficiently.

(5) The farmers should be encouraged to establish farmers' irrigation associations to which the duty of operation and maintenance of the systems could be delegated. Through such organizations, the farmers should be directly involved in the operation and maintenance of the system, so that the labour costs of the water management agency, payable from the water charge revenue, could be reduced accordingly. In this manner, the labour force in the irrigated areas in low-income developing countries can be efficiently mobilized and utilized, the water management at tertiary level improved, and the responsibility and financial burden of the water management agency reduced.

/II.

II. USE OF WATER TARIFFS AS A POLICY INSTRUMENT TO PROVIDE
BETTER MANAGEMENT OF WATER RESOURCES IN URBAN AND
RURAL WATER SUPPLY SYSTEMS IN THE REGION

Introduction

44. This section of the paper provides a brief overview of water tariffs as a factor in better management of water supplies, the status of pricing of urban and rural water supply in the ESCAP region, and experience of selected countries regarding the setting of water charges for urban and rural water supply.

45. In most developing countries of the region the growing demand for water has created a condition in which water is gradually becoming a scarce resource which in turn calls for better management of water resources in line with the targets of the International Drinking Water Supply and Sanitation Decade. As in the case of irrigation projects, there are two aspects of water management regarding urban and rural water supply: supply-side management and demand-side management. While supply-side management alone was effective in an era of abundant water resources, demand-side management has become a necessity in an era of rapidly increasing overall demand. Demand-side management is particularly important for the developing countries because it helps to manage growing water demand through minimizing wastage and conservation.

46. A key towards achieving improved water demand management is to establish and implement appropriate water pricing policies that encourage efficiency and discourage waste. Water tariffs play an important role in the management of urban and rural water supply because realistic tariffs, when properly introduced and administered, can help ensure efficient use of water, meet operation and maintenance costs, recover capital investments and also generate funds for the extension of water supply services to other areas. In this part of the study, the water tariff structures of one developed country of the region (Japan) and two developing countries - one with a central government (Thailand) and another with a federal system (Malaysia) - were analysed, and information regarding other countries was also presented.

47. The urban and rural population served with water supply in some countries in the ESCAP region is presented in table 4.

/Table 4.

Table 4. Urban and rural population served with water supply in some developing countries or areas of the ESCAP region in 1983

Country or area	Total population (thousands)	Urban population (thousands)	Rural population (thousands)	Urban population served with water supply (thousands)		Rural population served with water supply	
				Total	Percentage of urban population	Total (thousands)	Percentage of rural population
	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Afghanistan ^{a/}	13 390	2 068	11 322	521	28	1 100	8
American Samoa	32	6	26	22	100	7	64
Bangladesh	94 660	12 237	82 423	3 200	29	35 000	43
Bhutan	---	---	---	---	---	157	14
Brunei Darussalam	214	126	88	124	100	78	95
Burma	36 750	8 455	28 295	3 065	36	5 776	21
Cook Islands	18	10	8	9	100	7	85
Fiji	672	350	322	258	100	200	48
Guam	106	42	64	46	100	69	100
Hong Kong	5 310	4 573	737	4 947	100	360	93
India	722 000	159 727	562 273	128 300	80	255 000	47
Indonesia	156 400	32 846	123 554	22 500	40	30 000	29
Iran (Islamic Rep. of) ^{b/}	33 020	15 524	17 496	11 798	76	---	---

/Kiribati

Sources: Column (2) - ESCAP, Statistical Yearbook for Asia and the Pacific, 1984.
Columns (3) and (4) - United Nations, Demographic Yearbook, 1984 (New York, 1986).
Columns (5) through (8) - WHO World Health Statistics Annual (Geneva, 1985).

Notes: a/ Figures correspond to the year 1980;

b/ Figures correspond to the year 1976.

Three dashes indicate that information is not available.

Table 4. (Continued)

Country or area	Total population (thousands)	Urban population (thousands)	Rural population (thousands)	Urban population served with water supply (thousands)		Rural population served with water supply	
				Total	Percentage of urban population	Total (thousands)	Percentage of rural population
	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Kiribati	---	---	---	---	---	2	5
Lao People's Democratic Republic	4 210	---	---	164	28	653	20
Malaysia	69 979	8 570	61 409	4 859	97	6 718	71
Maldives	168	37	131	19	54	10	7
Nepal	15 830	957	14 873	787	71	1 658	11
Pakistan	90 480	25 560	64 920	12 812	78	15 144	24
Papua New Guinea	3 190	393	2 797	216	55	277	10
Philippines	52 060	10 943	34 117	10 660	53	17 634	55
Republic of Korea	39 950	21 434	18 516	---	---	8 616	60
Samoa	157	34	123	36	95	115	94
Singapore	2 500	2 500	0	2 500	100	---	---
Solomon Islands	252	18	234	24	96	100	45
Sri Lanka	15 420	3 194	12 226	2 550	76	3 120	26
Thailand	49 460	12 100	37 360	6 100	50	26 000	70
Tokelau	---	---	---	---	---	2	100
Trust Territory of the Pacific Islands	133	38	95	26	68	21	24
Vanuatu	111	20	91	---	---	52	50
Viet Nam	57 180	---	---	---	---	14 000	31

A. Status of water tariff applications to rural and urban water supply in the region

1. Capital cost and operation and maintenance cost recovery of urban and rural water supply systems

48. The capital cost as well as the operation and maintenance costs can be either fully or partly recovered through water tariffs, depending upon the policy of a government in this regard. A discriminatory water tariff system may also be adopted for various categories of users, for example, domestic supply may be subsidized whereas the industrial users may have to pay full charges.

49. In Japan, the general principle followed in pricing and financing water supply services is the self-support principle. In Malaysia, state governments are responsible for the development, operation and maintenance of water supplies, which they carry out through their own water supply authorities. Each state has its own pricing policy and water tariff structure. In Thailand, urban and rural water supply is handled by many government agencies, depending on the level of service. The general policy of the government is that these agencies should be able to generate the necessary funds to become financially self-sufficient. However, the government has covered deficits in the past in the form of equity contributions.

50. The status regarding the ability of some countries of the ESCAP region to recover urban and rural water supply expenses through water tariffs is summarized in table 5. It will be observed from table 5 that out of 20 countries, only 2 could fully recover the capital investment costs as well as the operation and maintenance costs. In general, most of the countries are more successful in the recovery of operation and maintenance costs as compared with capital investment costs through water charges. The rate of cost recovery is also higher with regard to urban water supply when compared with that of rural water supply. The latter situation is quite understandable in view of the socio-economic factors affecting the pricing policies of those countries, which generally favour consumers in rural areas.

/Table 5.

Table 5. Ability of countries or areas to recover water supply expenses through water tariffs

Country or area	Recovery of fixed costs (capital investment)			Rural water supply	Recovery of recurrent costs (operation and maintenance)			Rural water supply
	Urban water supply				Urban water supply			
	Domestic	Commercial	Industrial		Domestic	Commercial	Industrial	
Afghanistan	P	P	---	---	P	P	---	---
Australia	P	P	P	P	F	F	F	P
China	---	---	---	---	P	P	P	P
Fiji	P	P	P	P	P	P	F	---
Guam	---	---	---	---	P	P	P	---
Hong Kong	P	P	P	P	P	P	P	P
India	P	P	P	P	P	P	P	P
Indonesia	P	P	P	P	F	F	F	F
Japan	F	F	F	F	F	F	F	F
Malaysia	P	P	P	P	P	P	P	P
New Zealand	P	P	F	P	F	F	F	F
Papua New Guinea	P	P	P	---	F	F	F	---
Philippines	F	F	F	P	F	F	F	F
Republic of Korea	P	P	P	P	P	P	P	P
Singapore	F	F	F	F	F	F	F	F
Sri Lanka	P	F	F	P	F	F	F	P
Tonga	P	P	P	P	P	P	P	F
Thailand	P	P	P	P	F	F	F	P
Trust Territory of the Pacific Islands	---	---	---	---	P	P	---	---
Vanuatu	---	---	---	---	F	F	F	F

Source: Progress in the implementation of the Mar del Plata Action Plan, Summary of Government Responses (E/ESCAP/NR.13/4).

Notes: P = Partly; F = Fully.

Three dashes indicate that information is not available.

2. Water charges: structure and magnitude

51. There are various considerations which are taken into account by different countries of the region in establishing the structure and magnitude of water charges as well as their collection. Whether the systems are metered or not plays an important role in the effectiveness of water charges.

52. In Japan, all water supply works are fully metered, and consumers are charged according to the amount they consume. There are two general systems for levying water charges: a per object charge, that is, users are classified as domestic, commercial, industrial and public bath, and charges correspond to the sharing ability of each category; and a per diameter charge, where the basic charge is determined based on the diameter of the water meter and the water rate is added according to the amount of water consumed.

53. In Malaysia, all the states follow the same principle of classifying consumers into three major groups, namely, domestic supplies, commercial supplies, and supplies at a special rate.

54. In Thailand, the Government has established guidelines that require water tariff rates to be classified according to the customer class system determined by its water-use characteristics, which allow higher rates to be charged to those consumers who consume water in excess of an established level. The Metropolitan Water Works Authority (MWA), which serves Bangkok, levies two types of water rate, namely, for domestic consumers and other categories (that is, commercial, state enterprises and government institutions). The Provincial Water Works Authority (PWA), which serves the remaining areas of the country, applies a uniform tariff to all users. Both agencies follow the increasing block rate pricing system.

55. The pricing policies followed by selected countries of the ESCAP region for urban water supply are summarized in table 6. In structuring the water charges, some countries set prices in order to recover the costs partially from domestic customers and to recover from other users fully, whereas other countries levy charges to enable full recovery of costs from all users. The information contained in table 6 indicates that out of 23 countries, 11 have fully-installed meters in their urban water supply systems. In the same table, the pricing structures currently used in the

/Table 6.

Table 6. Structure of water charges levied on urban water supply in selected countries or areas

Country or area	Extent to which water supply is metered	Structure of charges levied			Peak demand/drought pricing used
		Flat rate	Volume/block rate	Other	
Afghanistan	P	X	X		N
Australia	P	X	X		N
China	P		X		---
Fiji	F		X		N
Guam	F		X		N
Hong Kong	F			X	N
India	P	X	X		N
Indonesia	P		X		N
Japan	P		X		N
Malaysia	F	X	X		N
New Zealand	P			X	---
Niue	P	---	---	---	---
Pakistan	P	---	---	---	N
Papua New Guinea	P		X		Y
Philippines	F	X	X		N
Republic of Korea	F		X		N
Singapore	F		X		N
Sri Lanka	P		X		N
Tonga	F			X	Y
Thailand	F	X	X	UR	Y
Trust Territory of the Pacific Islands	P	X			Y
Vanuatu	F		X		N
Viet Nam	P	---	---	---	N

Source: Progress in the implementation of the Mar del Plata Action Plan, Summary of Government Responses (E/ESCAP/NR.13/4).

Notes: P - Partly; F - Fully; Y - Yes; N - No; UR - Uniform rate.
Three dashes indicate that information is not available.

countries of the region are presented. It appears that most of the countries employ block rates based on the volume of water consumption. Peak demand/drought pricing, as an instrument of policy to ration water for households and industries during periods of shortage or excessive demand, is generally not practised in most countries.

56. In 1983, the water charges in Japan varied between \$US 0.046 and \$US 1.893 per cu m in urban areas and between \$US 0 and \$US 2.398 in rural areas. The consumers can make payment at either banks or post offices. Other arrangements, such as automatic bank payment or collection by waterworks, are also made available to consumers. In Malaysia, the domestic users pay between \$US 0.065 and \$US 0.383 per cu m in 1987, whereas the commercial users, including industry, pay between \$US 0.138 and \$US 0.507, depending upon the rates charged by each state. The states follow a uniform rate system. In Thailand, the water rates charged by MWA and PWA in 1986 had an increasing block nature, and the rates for domestic supply varied between \$US 0.142 and \$US 0.333. In the rural areas, the charges were either on a flat rate or of a block nature and varied between \$US 0.074 and \$US 0.221 per cu m.

57. A summary of the range of urban and rural water supply charges levied in selected countries and areas of the region is given in table 7. It will be observed from that table that urban water supply charges are generally higher than those of rural water supply charges and that in some developing countries (Bangladesh, Fiji and India), rural water supply is provided free of charge. In three countries (Nepal, Pakistan and Sri Lanka) water charges for urban areas are on a flat rate, whereas the remaining countries apply an increasing block rate system.

B. Conclusions and recommendations

58. Within the ESCAP region in general, the operation and maintenance costs are recovered by water charges, particularly in the urban water supply systems, with higher rates being charged to commercial users. In rural areas, however, it is observed that charges for water supply are more lenient in view of the comparatively lower level of income of the rural people. However, there is a need to establish a system for levying appropriate water charges, particularly in rural areas, in order to minimize wastage as well as to recover the funds necessary for operation and maintenance and also for extension of water supply services.

Table 7. Summary of urban and rural water supply charges levied in selected countries and areas of the region

Country or area	Year	Range of water charges (US dollars per cu m)	
		Urban	Rural
Australia	1982	0.182-0.354	0.005-0.379
Bangladesh	1976	0.043-0.255	Free
Fiji	1983	0.074-0.404	Free
Hong Kong	1986	0.150-0.590	0.150-0.590
India	1976	0.023-0.093	Free
Indonesia	1978	0.064-0.160	---
Japan	1983	0.046-1.893	0-2.398
Malaysia	1987	0.065-0.383	0.065-0.383
Nepal	1977	0.040	0.4 per month per connection
New Zealand	1984	0.058-0.579	0.014-0.260
Pakistan	1981	0.067	---
Philippines	1984	0.036-0.252	---
Republic of Korea	1985	0.123-0.880	0-0.057
Singapore	1986	0.252-0.524	---
Sri Lanka	1976	0.017	---
Thailand	1986	0.142-0.333	0.074-0.221

Source: Information collected by ESCAP through direct inquiries in countries concerned.

Note: Three dashes indicate that information is not available.

59. The principal considerations which must be taken into account in designing the price structure are equity, capacity to pay, conservation, demand elasticity, cost of the system and the service, and the cost of developing an alternative water supply. As regards the last point, the price of water should not be higher than the cost of water than can be developed from alternative sources of water supply such as ground water. The choice of an appropriate pricing policy involves judgements on equity and income distribution, financial and fiscal implications, and on the cost of implementing the tariff structure itself. The financial objectives of a water utility require the setting of a sufficiently high tariff level to yield the desired rate of return, while the social or income distributional objectives require cross-subsidies to allow low-income groups to have access to safe water.

60. It will be observed from information presented earlier (table 1) on the urban and rural population served with water supply in some countries in the ESCAP region that in almost all of the developing countries the majority of the population is located in rural areas, and that the percentage of rural population served with water supply is very much lower than that of the urban population. These facts obviously indicate the need for extension of water supply services to rural areas in the efforts to meet the targets of the International Drinking Water Supply and Sanitation Decade. Introduction of appropriate water tariff policies aiming at generation of the necessary funds to cover the cost of extension of services in addition to recovery of recurrent and capital costs could serve this purpose significantly. The following recommendations are proposed for the consideration of the member countries in improving their water tariff structures, as a policy instrument to provide better management of their water resources utilized in urban and rural water supply systems:

(1) Countries which have not done so should consider taking the necessary steps to start formulating and establishing appropriate water tariff policies, taking into account the need for cost recovery as well as the ability and willingness of consumers to pay. In the selection of an optimum tariff structure to suit a particular set of conditions, it is necessary to strike a proper balance between the following objectives in order to meet both the economic and social objectives:

/(a)

(a) To raise revenue to a certain level not only to cover all recurrent costs and to ensure capital recovery but also to make some contribution to future expansion of services, although this should not be profit-oriented in the ordinary sense;

(b) To share the burden of raising the revenue equitably among the different users of the system; the tariff should be classified according to a customer class system determined by its water-use characteristics;

(c) To provide incentives for conservation and efficiency of water use, the tariff structure should be set in such a way that higher rates are charged to the customers who consume water in excess of an established level;

(d) To achieve administrative simplicity and efficiency in the collection of water charges, the tariff structure should be revised from time to time if necessary, in order to maintain a sound financial basis and efficient management.

(2) Effective implementation of water pricing policies will require full metering of all consumers, which in turn will call for adequate meter repair and maintenance facilities as well as adequate supply of spare parts. As a large number of countries have not yet fully installed meters on their water supply systems, there is considerable room for improvement with regard to reducing wasteful consumption and distributing the cost of water equitably among the users.

(3) Public information campaigns and educational programmes concerning the health benefits, labour-saving and other justifications of water supply services should be launched in order to gain public acceptance of the water tariff policies. In this connection, public information and education programmes which provide explanations regarding health, labour-saving and other benefits of water supply services could result in people becoming more aware of the value of these resources.

(4) International organizations should assist countries in their efforts towards formulating appropriate water tariff policies by disseminating information regarding cost-recovery practices with analyses of their reasons for success and failure in particular instances.

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