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Distribution of Costs and Environmental Impacts of Water Services in OECD States: Affordability Measurement and Policies

by

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I. INTRODUCTION

1. Government and utility policies in the provision and pricing of core fabricated water services to households (water supply, and sewerage and sewage treatment) increasingly reflect, sometimes formally, *economic*, *environmental* and *social* objectives. **OECD** reports on water services have documented this trend in higher- and middle-income countries over the last twenty years (OECD, 1987; OECD, 1999; OECD, 2003)[1]. Often today the *economic* and *environmental* targets are in close harmony, and numerous examples of this phenomenon as related to pricing are listed in those three reports: e.g., selective extension of metering of individual households (sometimes instead of 'block' metering), moves towards marginal cost pricing, retreats from the practice of minimum charges and reaching towards full cost recovery (FCR).

2. Outside pricing matters the economic and environmental messages also frequently point in the same direction. Thus past pollution of groundwater in **Denmark** has led to the Copenhagen utility recently choosing to impose strict targets for average household per capita consumption: estimated as 164 litres per head per day (lhd) in 1991, the target was 129 lhd for 2002 (probably met) and is currently set at 120 lhd for 2005 and 110 lhd for 2010, to be reached by a mixture of regulations, and education and moral suasion, as well as pricing policy (Environment Agency National Water Demand Management Centre, 2003). Economic (least-cost programme identification) and environmental objectives have both argued for a demand-side approach.

3. The *social* objective is, however, often not a compliant partner in the troika identified in para.1. It is a particular variant of the broader *equity* objective, and typically defined to include two issues – that of household *private health* needs for water (for a limited range of medical conditions) and of *affordability*, which may be interpreted as the provision for all of an affordable supply of basic water services for essential needs. It is with the latter that the OECD Working Party on Global and Structural Policies has been most concerned in its recently completed report on *Social Issues in the Provision and Pricing of Water Services* (OECD, 2003), from which document much of this paper will be drawn. Note the basic services do not have to be – and are not always – of the piped variety.

4. The superficially uneasy association of the environmental and affordability objectives is best exemplified in the compulsory switch of a poor household, assumedly receiving piped services, out of an unmeasured into a measured charging structure embodying a simple two-part tariff structure (fixed + volumetric charges). The new incentive to self-manage demands more sensibly – and thus generate environmental gains both 'backwards' and 'forwards' (fewer demands upon both water resources and sewerage and treatment services) – may conceivably also induce (i) water consumption-reducing behaviour which is injurious to private and public health and/or (ii) more general financial stress for the household.

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1 In 1987 as well as public health two notions of equity were identified as among the important principles of water pricing being used in the OECD. One was 'social' or 'broad' equity, which included the needs of low-income households as well as development in agricultural and industrial sectors, and the other a narrower variant which sought parity or 'equalisation' among all consumers in localised areas. By 1999 narrow equity was not being stressed so much, but the broad equity concern was figuring more prominently and had been transformed into 'affordability'. Two ways of approaching and measuring it were christened *macro-* and *micro-affordability*, the former dealing with a country's average water charges burden on an average household and the latter highlighting differences across the income distribution or other social characteristics. Policies used to address affordability problems were divided into income-support and tariff-related categories. The 2003 report dug much deeper into measurement and policies, bringing together data and information previously unpublished or only available in diffused form but failing to build upon the limited information on health-related household water needs which had been collected four years earlier. It also examined links between water industry and utility governance and social issues, and the issue of access in middle-income countries.

Whether that is the result, and, if so, the extent of such effects would depend on the size of the household and the extent of its 'original' poverty as well as its pattern of preferences and the rates and parameters of the pre- and post-switch charges.

5. The same effects may ensue for already-metered poorer households – and especially larger ones – from both tariff re-balancing towards volumetric elements and increases in real volumetric prices either to recover higher costs (economic and environmental) or to move towards FCR. In the **United Kingdom** two of the larger privatised water companies (Anglian and Yorkshire) were forced to withdraw sizeable compulsory selective metering programmes in the mid-1990s following protests by households and campaigning groups at the effects on poorer families (OECD, 1999). Furthermore, **throughout the OECD** unit prices of household water services have been rising in real terms since the 1990s – most recent real annual increases being in the range +2% to +6% in the early 1990s (average 3.7%) and 0% to +5% (average 1.6%) in the later part of the decade (OECD,1999; OECD, 2003). Forecasts are that significant real increases will continue for at least the next ten years, for FCR and environmental rather than scarcity reasons.

6. The structure of the remainder of the paper is as follows. Section II first reports on whether affordability is perceived to be "an issue" in individual OECD countries, and then presents data relating to the burden of piped water charges across the income distribution in eight countries. Section III uses an a priori approach (no empirical studies available) to examine the distributional implications of present commonly-used means of financing piped services in OECD countries, before reporting on the use of (i) tariff-related measures (both actual and potential) and (ii) (briefly) income-support measures, which directly address the affordability question (and how the distribution of financial costs might thus be altered). IV briefly examines the issue of the lack of access to piped water services in some OECD countries, and V lists some conclusions and unresolved issues.

II. THE PERCEPTION AND MEASUREMENT OF AFFORDABILITY

Affordability Perception

7. An examination of existing country-specific studies, and contacts with over 150 government officials, representatives of water utilities and industries, academics, consultants and researchers, were undertaken to explore affordability perception. It was possible to come to a preliminary view, for 22 of the 30 OECD countries, as to whether or not household water affordability is regarded as a significant issue in each country. For three other countries, a "possible" view has been formulated, and for the remaining five, insufficient information was found to support any conclusion. No formal scoring system or weighting criteria were used.

8. Figure 1 (below) maps the results against the less subjective observation as to whether water-specific measures and tariff structures to 'deal with' affordability problems are in place in individual countries. The seven (plus two possible) countries in the *Affordability Problems* column (i.e. those countries so perceived) all have in place *some* relevant measure(s), while the other 16, with no *perceived* affordability problem, divide up into ten with no recognised measures in place and six countries (plus one possible) with measures that on the surface appear to have been successful enough (in the **Irish**[2] case, tautologically so) to

[2] From 1 January 1997 all domestic water charges in Ireland were abolished (for political reasons), having spread over 1983 to 1996 to cover 86 out of 88 local authorities for the public (piped) water supply and 31 for wastewater. Costs were thus financed out of general taxation after 1996. The same 'no domestic charges' situation obtains in Northern Ireland, and the only other country known to provide 'free' water services is Turkmenistan, where 50% of the 5.3 m. population has access to "centralised water supply services". In the latter case there is a legal maximum consumption of 250 litres/head/day. In all these countries the distribution of the costs of financing the piped water services may therefore be said to follow the distribution of the burden of general taxation.

have caused any problem to be perceived as insignificant. This is particularly true in **Australia**, where some time (and emails) elapsed before contacts realised that there was in fact a major water-specific affordability policy in operation in that country in which this OECD researcher might well be interested! It is thus to the countries in Quadrants 1 and 2 that we shall turn in order to locate the more interesting affordability policies in section III.

Figure 1 The Perception of Affordability Problems and Measures/Structures in Place

	AFFORDABILITY PROBLEMS	NO AFFORDABILITY PROBLEMS
AFFORD-ABILITY MEASURES/ STRUCTURES IN PLACE	**Quadrant I** **Belgium** (IBTs, free allowance) **UK** (some tariff choice and capping) **France** (Commissions Solidarite-Eau) **Mexico** (IBTs) **Portugal** (IBTs) **Spain** (IBTs) **Turkey** (IBTs) *(POSSIBLE* *(***Hungary***, central. govt. subsidies;* **Greece,** *IBTs)*	**Quadrant II** **Australia** (concessions) **Ireland** (no household charges) **Japan** (IBTs, welfare) **Italy** (IBTs) **U.S.** (various) *ENTRIES)* (**Luxembourg**, *social tariffs)*
NO AFFORD-ABILITY MEASURES/ STRUCTURES IN PLACE	**"Unknown"** Czech Rep. New Zealand Korea Slovak Rep. Poland **Quadrant IV**	**Austria** **Canada*** **Denmark** **Finland** **Germany** **Iceland** **Norway** **Netherlands** **Sweden** **Switzerland** **Quadrant III**

Note: IBTs = Increasing Block Tariffs in use; * it has been argued that Canada should be in Quadrant II, with sizeable central government subsidies preventing affordability problems coming to the surface.

Affordability Measurement

9. *Macro-affordability* data - average household water charges expressed as a proportion of one or other definition of household income (usually disposable) or (in three countries) aggregate household expenditures - were calculated for a recent year in the 1995-2000 period for 17 OECD countries. They ranged from 0.5% for the **United States** to 2.3% for **Poland**, with the median group being **Austria** (1.0-1.3%), **Germany** (1.2%), **England & Wales** (1.2%) and **Denmark** (1.1%). Because the share of the population in households classified as living in relative poverty (less than 50% of median household income) varies considerably among OECD members (from 5% in Finland to 22% in Mexico), the estimated macro measure cannot be used to convey the affordability situation faced by less well-off households in that country. It is what it says – merely an average, which may apply to no household at all.

10. We therefore turn to *micro-affordability*. Deconstructing macro-affordability indicators may be undertaken by: (i) income distribution class; (ii) geographical area; or (iii) family type. An additional route into micro-affordability is (iv) to select a particular burden threshold (e.g. 3% of disposable incomes) and use household budget studies to estimate the proportion of households with water expenditures at or above that figure. References to the estimation and policy application of (i), (ii) and (iv) are now presented, but no evidence is available for (iii).

11. Evidence from eight OECD countries, measuring water charges burdens across income groups for a recent year, is presented in Table 1. For five countries the burden is estimated across a formal description of the income distribution (deciles, quintiles or quartiles), with the UK divided into **England and Wales** and **Scotland** due to different water charging systems. Information has been located in national statistics offices' household budget studies on websites (**Mexico**, **United States**), and via publication (**Hungary**), private communication (**Netherlands**), and new academic research using a data archive (UK). Budget studies are all based on sample surveys (diaries and interviews), ranging in size from 1850 households (Netherlands) to nearly 110,000 (in the US). For three other countries percentile income distributions were unavailable but various publications could be used to calculate water charges burdens across a number of specified income classes (or expenditure classes, for **Italy**) with convenient absolute boundaries encompassing the whole income (expenditure) range – six classes for each of Italy and **Denmark**, and nine for **France**.

Table 1 Water charges burdens across the income distribution in eight OECD countries

	E&W 1999-00	Scotland 1999-00	Hungary 1999	Nether-lands 1999	Mexico 2000	U.S. 2000		France 1995	Italy 1995	Denmark 1998
% of what?	Gross Y	Gross Y	Net Y	Disp.Y	Disp.Y	Disp.Y		"Y"	∑Expds.	Disp.Y
average	0.85%	0.76%	1.81%	1.42%	1.26%	0.49%		0.88%	0.43%	1.13%
percentiles of income distribution							income class			
0% (low)	3.75%	2.24%	2.53%	2.38%	3.84%	0.66%	1 (low)	2.18%	0.90%	1.93%
	2.61%	1.43%	2.31%		2.74%		2	1.33%	0.60%	1.63%
20% 25%	2.18%	1.22%	1.99%		2.23%	0.67%	3	1.18%	0.47%	1.15%
	1.82%	1.12%	2.09%	1.89%	1.89%		4	1.02%	0.43%	1.03%
40%	1.63%	1.00%	1.88%		1.79%	0.57%	5	0.90%	0.40%	0.86%
50%	1.34%	0.91%	2.03%	1.45%	1.53%		6	0.79%	0.27%	0.61%
60%	1.11%	0.79%	1.92%		1.35%	0.49%	7	0.65%		
75%	0.93%	0.66%	1.76%		1.22%		8	0.52%		
80%	0.75%	0.58%	1.78%	0.97%	0.84%	0.33%	9 (high)	0.37%		
100% (high)	0.41%	0.39%	1.25%		0.73%					

1. Notes: all data cover piped water supply and wastewater charges, except for Mexico (water supply only), and 40% -50% of households in Hungary are not connected to public sewerage.

Source: OECD (2003).

12. For the percentile analyses it is obviously desirable to use *equivalised* income distributions but only in the cases of **England and Wales** and **Scotland** was this possible, with *equivalent adult* corrections having been made in the generation of income distributions (but gross household income still providing the denominators for burden measures).

13. Table 1 provides some interesting results. In nearly every data set, it is seen that the percentage water charges burden on households (henceforth the *burden*) declines noticeably as we pass from a lower to a higher income group. This is as would be expected for a utility service that is still dominated by "basic uses", and for which the array of possible luxury demands remains relatively narrow (no matter how important they are at the margin). The rate at which the burden declines as income increases to the highest group, however, varies enormously. Compare the cases of **England & Wales** and **Mexico** (falling from

nearly 4% to about 0.4% and 0.7% respectively) with those of **Hungary** (from 2.5% to 1.25%), the **Netherlands** (2.4% to 1%), the **US** (from 0.66% to 0.33%).

14. A number of factors are at work here. First, the smaller the number of divisions of the income distribution (e.g., quintiles rather than deciles, six classes rather than nine), the more hidden are the burdens at the extremities, because of averaging. Second, use of gross or net incomes (equivalised or not) or aggregate expenditures in the denominator will affect burden measurement in a manner that is highly country-specific, because it depends on, inter alia, fiscal policy (affecting the gross/net income relationship), savings behaviour (affecting the net income/expenditures relationship) and household occupancy (influencing equivalisation). Indeed, with **Denmark,** for which country survey data for average gross income, average net income and average aggregate expenditures are *all* known for *each* income class, not even the *qualitative* relationships between the net-income-based and the aggregate-expenditure-based burdens for the different income classes could be predicted on the basis of knowledge of just one of them (because of negative net saving in the two lowest income groups). Third, in any country in which households have a significant volumetric element in their water charges, we would expect there to be an income effect on water demand (and thus on water charges paid) as well as an effect due to variation in household occupancy in different income groups.

Lorenz Curves and Gini Coefficients

15. How could and should we compare the inequality between the charges burdens in the different countries (and, speculatively, possibly under different affordability policies)? One approach is to enter the world of Gini coefficients and Lorenz curves in order to incorporate all segments of the income distribution. It is first necessary to decide what situation should be taken to represent ‘pure equity’, and an initial candidate, merely to set thoughts in motion, would be to define equity as the payment by all households of exactly the same overall water charge per cubic metre of water consumed. In order to measure inequities suffered by households it would be necessary to rank them by income (ideally, equivalised), and measure along the horizontal axis of the Lorenz curve, left to right, the cumulative proportion of water consumed – lowest income households first, moving through the income distribution up to those with the highest incomes (0% to 100% along the axis).

16. Points on this aquatic Lorenz curve are then identified by the corresponding cumulative proportion of charges paid, and the usual familiar results follow: for example, all points being on a straight diagonal line reflects perfect equity (Gini coefficient [G] = zero, say), the single richest household paying everyone’s charges is shown by a reverse-L shape (G = +1, extreme ‘progressive’ charging), and a moderately regressive charging scheme would be shown by the poor paying a higher charge per m3 and the Lorenz curve being concave downwards (G = **-** 0.5, say). Strictly, G would be measured by the absolute extent to which the Lorenz curve ‘bowed downwards’ from the diagonal, divided by the total area beneath that bottom-left to top-right diagonal. However – and it could be a large ‘however’ – any possible regressiveness suffered by the poor (or any progressiveness enjoyed) would appear to count for less, the lower is their relative consumption of water. More equitable procedures might therefore be (i) to transpose each point on the Lorenz curve to the *right*, so that the households – still ranked by income – are *equally* distributed along the horizontal axis but the cumulative charges paid are spread along the vertical axis just as before or (ii) to undertake the same exercise so that it is the *population* in the households (perhaps equivalised) that are spread equally along the horizontal axis rather than the households themselves.

[diagrams here to show Lorenz curves]

Water Services as Social and Private Goods

17. This implicit question about the role of the volume of consumption in the measurement of inequality is underlined when it is realised just how much the public water supply enjoyed by many householders in higher-income OECD countries is in fact a mixture of a 'social' good (often with considerable externalities: essential sanitation and other basic use) and a private good (e.g., power showers, sprinklers, swimming pools and pressure washers). Such a dichotomy has potentially profound implications for tariff design (see section III, below) as well as the equity of charges considered above, and its effect in the OECD's *Social Issues in the Provision and Pricing of Water Services* (OECD, 2003) study was to abandon the Gini/Lorenz exploration in favour of a simpler emphasis on the relative charges being paid by poorer households in each country.

18. The private good argument just put forward suggests the absolute or relative burden of the *highest* income group (or groups) is of little or no relevance to our affordability concerns (so long as there are no outright cross-subsidies travelling from poor to rich – more of this also in section III). Table 2 therefore presents, for each country featured in Table 1, the actual percentage burden of the lowest income group as well as the ratio of its percentage burden to the average burden for the whole income distribution. These two statistics are shown *both* as calculated from Table 1 *and* (for England and Wales, Scotland and Italy) as amended to reflect *disposable incomes* as the denominator, so that data in the last two columns are rendered broadly comparable, at least within each of the two country groupings.

Comparing Micro-affordability Burdens across Countries

Table 2 Comparative water charges burden statistics for eight OECD countries

Country	Year	Percent-iles or number of classes?	'original' basis for measurement of water charges burden		'disposable income' as basis for measurement of water charges burden	
			burden of lowest income group	ratio of lowest income group burden to average burden	burden of lowest income group	ratio of lowest income group burden to average burden
England & Wales	1999-00	Deciles	3.75%	4.4	3.75%[1]	3.1[2]
Mexico[3]	2000	Deciles	3.84%	3.0	3.84%	3.0
Hungary	1999	Deciles	2.53%	1.4	2.53%	1.4
Scotland	1999-00	Deciles	2.24%	2.9	2.24%[1]	<2.9
France[4]	1995	Nine	2.18%	2.5	2.18%	2.5
Netherlands	1999	Quartiles	2.38%	1.7	2.38%	1.7
Denmark	1998	Six	1.93%	1.7	1.93%	1.7
Italy	1995	Six	0.90%	2.1	0.90%[5]	>2.1
United States[6]	2000	Quintiles	0.66%	1.3	0.66%	1.3

Notes: 1 The assumption is that average gross and average net incomes for the lowest income group are equal.

2 Separate data provided by the UK Office of National Statistics enabled this figure to be estimated directly.

3 It is believed that for Mexico the data only refer to the public water supply.

4 For France, it is assumed that the 'income' measures used in the sample survey referred to disposable income.

5 It has been assumed that for the lowest income groups total expenditures are equal to net incomes.

6 For the US data, it was assumed, following communications with the Federal Bureau of Labour Statistics, that in the case of the three lowest income quintiles the reporting of incomes was so incomplete that the average total household expenditures for each of those groups would be a better guide to average disposable income.

19. Consider initially the first group of countries, each with nine or ten income groups. **England and Wales** and **Mexico** show a high burden for the lowest decile group, *both* in absolute terms (nearly 4%) *and*

relative to the average burden in those countries (more than three times its value). For **Scotland** and **France** the lowest income burden is not so high (just over 2%), but this is (probably, in the Scottish case) at least still 2.5 times the average burden. For **Hungary,** however, the distribution of the burden is much "flatter", so the lowest income burden is much more in line with the average burden than for the other countries.

20. For the second group – the other four countries – all the Table 2 lowest income group percentage burdens will, as already explained, understate the burden on the lowest 10% of households in those countries. Taking account of the patterns of the burdens across the income distributions in the *first* country group, it is suggested that only the **Netherlands** would be likely to produce a 'lowest decile' burden of more than 3%, and only in **Italy** might the 'true' lowest decile burden (still probably less than 2%) be more than 2.5 times the country average. For all the reasons spelt out in the text and in the notes to Table 2, however, these conclusions should be treated with caution.

21. The only country for which water charges burdens have been publicised for the lowest percentiles in the income distribution (below 10%) is **England and Wales.** Smets reproduces (2002a) and reports on (2002b) UK government data made available to him in 1999, suggesting the 1997-98 percentage water bills out of *disposable* income for the lowest decile, 5%, 2% and 1% of households were, respectively, greater than 4.1%, 5.6%, 8% and 10.5%. If applied to the whole of England and Wales, the last figure suggests about 200,000 households had to commit over 10% of their disposable incomes to water and sewerage charges in 1999.

Table 3 Regional Variations in Water Charges Burdens in Three Countries

Country and (for Italy) expenditures class	Year	Annual water services charges (regional ratios)		Water charges as a percentage of ∑expenditures or net incomes		
		highest/ lowest	highest/ average	national average	regional ratios	
					highest/ lowest	highest/ average
Hungary (7 regions)	2000	1.8[1]	1.3[1]	2.0% (net Y)	1.4[1]	1.1[1]
England & Wales (10 regions)	1997-2000[6]	1.4[2]	1.1[2]	1.2% (disp.Y)	2.0[2]	1.4[2]
Italy (5 regions)	1995	-	-	0.4% (∑expds)	1.9[3]	1.3[3]
Expds. class I (low)		-	-	0.9%	1.6[4]	1.2[4]
II		-	-	0.6%	2.1	1.4
III		-	-	0.5%	1.7	1.3
IV		-	-	0.4%	1.7	1.2
V		-	-	0.4%	2.0	1.4
VI(high)		-	-	0.3%	1.5[5]	1.2[5]

Notes: 1. highest: Central Hungary (incl. Budapest) 11,148 HUF/year, = 2.31% of average net income lowest: Northern Great Plain 6,305 HUF/year, = 1.68%.

2. highest: Wales £5.20/week, = 1.69%; lowest: London £3.80/week, = 0.84%.

3. highest: Islands = 0.56%; lowest: North-West = 0.30%.

4. highest: Central = 1.06%; lowest: North-West = 0.68%.

5. highest: Central = 0.33%; lowest: North-West = 0.22%.

6. England & Wales data are averages from 3 Family Expenditure Surveys for 1997-98 to 1999-00.

Source: OECD (2003).

22. Summaries of regional data available are presented in Table 3, and two results stand out. First, for **Hungary** the regional burdens are much more closely bunched than those for **Italy** and **England & Wales**, this following the inter-decile results of Tables 1 and 2. This seems to be a consequence of the water affordability policies followed in Hungary since 1992, where large central government subsidies have been directed at the highest-cost water services suppliers. Second, the Italian data show that the regional spread can be very significant for lower income groups; thus the *highest* regional burden for class II (low) was 40% above the national figure and 110% above the *lowest* regional value. Policies based on national information therefore run the risk of not having the regional effect that would be desired.

'Official' Use and Policy Applications

23. Only two examples of the "burden-threshold" method of measuring micro-affordability –estimating the proportion of households spending more than x% of income on water charges – have come to light among OECD countries, for **England and Wales** and the **U.S**. In 1999, the UK government selected "for illustrative purposes" 3% as the "threshold for the percentage of disposable income above which water charges may represent hardship", and reported the proportion of households so classified as 21.8%, 20.2%, 19.3% and 18.4% over the years 1994-95/1997-98. Although falling over time, this was a high proportion and suggests that in 1997-98 most of the lower two deciles were probably spending more than 3% of their net income on water. Probably few of the 18% were households choosing to spend a relatively large share of their incomes on 'discretionary' water use - e.g. garden watering and luxury showers. This is supported by the additional information that in 1999-00 the average expenditure on water charges of households in the three lowest income decile groups was 3.2% of average net income. Also, Smets quotes a claim at U.S. Federal hearings in 2002 that 5% of US households have water charges burdens of 3 to 4% and 10% burdens >4% (2002a).

24. Apart from its use by the **United States** Environmental Protection Agency to help in the assessment of small water supply systems' compliance costs in meeting proposed new drinking water quality regulations, the only known policy application to household water charges of this type of affordability measure is that by the World Bank, assisting its decisions on infrastructure investment financing in developing countries. For many years the received oral wisdom has been that the Bank normally requires the post-loan water charges to be no more than a figure variously quoted – but always without documentary evidence - in the range of 3% to 5% of household incomes. The difficulty in understanding the Bank's precise position is illustrated by (i) the range quoted and (ii) the lack of evidence as to whether the figure is meant to relate to the *average* burden (among *all* households affected), the burden for a low income group (decile? quintile?) or even the burden for *any* single household. Despite extensive enquiries and research, only one 'publication' of such a figure was found, in a Powerpoint presentation in Riyadh in 2000 by a senior consultant to the Bank, specifying a *World Bank Guideline* of "...Maximum 3.3%" for "Water Charges as a Share of Income". This figure has, however, been characterised by Stottmann (2002) as "no more than a very imperfect rule of thumb".

Affordability Projections

25. Two examples are known of *projections* of affordability measures, the implications of full cost recovery for piped water services being calculated for (i) the four Cohesion Fund and four Non-Cohesion Fund countries (**Gre, Ire, Port, Sp, Den, Fr, Ger, UK**) in a Ecotec report (1996) for EU's DG XVI and (ii) **Poland** on the assumption of full implementation of EU directives on urban wastewater treatment and drinking water quality over the 2000-2015 period (J. & K. Berbeka, 2001). In the former study, average existing 1996 household water charges burdens of only (a) 0.3%-0.5% and (b) 0.8%-1.2% in the Cohesion Fund and Non-Cohesion Fund groups respectively were projected to be transformed into (a) 1.6%-2.8% and (b) 0.9%-1.5%, with the stipulation of FCR on a new greenfield site development for a 20,000+ population. Much more dramatic, however, was the projection with existing tariff structures of the burden change on the lowest income group (of six income classes): from (a) 0.5%-0.6% (CF) and (b) 1.5%-2.0%

(N-CF) with existing (1996) tariff levels to (a) 2.8%-4.9% and (b) 1.7%-2.6% with FCR, meaning CF low-income households would find burdens rising 4 to 7 times while the corresponding N-CF increases were only 10%-30%.

26. The Polish authors – making numerous assumptions about existing demands, costs and prices and future income and price elasticities of the demand for water, as well as future real income growth, and thus in effect modelling the whole Polish water sector – projected that average household burdens would rise from 2.3% (of disposable income) in 1999 to anything between 3.1% in 2015 ('maximum' EU aid) and 4.3% (no EU aid), very high figures by any standards. Perhaps understandably, no projections for lower income households were offered.

III. DISTRIBUTIONAL IMPLICATIONS OF FINANCING WATER SERVICES: TRADITIONAL MEANS AND NEW MEASURES

Existing Means of Charging

27. Traditional methods of charging for water services in single family houses (SFHs) in developed and middle-income economies vary widely, from *no domestic charges* (**Ireland** and Northern Ireland), through *flat-fee* charges, which are at their most prevalent at the northern and southern extremities of the OECD (**Iceland**, **UK** [especially Scotland]**, Norway, New Zealand** and parts of **Canada**), out to a pluralism of weird and wonderful *varied volumetric tariffs* (the rest of **Canada**, **Australia**, **Luxembourg** and the **United States**), the familiar *two-part tariff* (fixed charge + single volumetric rate; most of **OECD Europe**), a *single volumetric charge* alone (**eastern Europe**) and finally *increasing-block tariffs* (IBTs) of one form or another (**OECD Asia**, **Belgium**, the **Mediterranean countries** and **Mexico**).

28. Despite this apparent predominance of *measured charging* (M), it is possible that most OECD households are *unmetered* (UM). This is because such is the situation of the vast majority of apartment-dwellers (in multi-family dwellings [MFDs]), who constitute the majority of the population in a number of European and Asian countries. For these households, too, flat-fees are charged, often to recover apartment block charges calculated from the reading of a single master-meter. The flat-fees are typically based, for SFHs, on property/rental values and lot/garden size, with occasional use of numbers of taps or appliances, whereas in MFDs allocation of the overall bill will most often be determined by relative floor area (m2) or apartment size (m3), although rental/rateable values may be used[3].

29. Annex 1 of this paper shows in more detail what is presently known about the tariff structures applying to SFHs in OECD countries (OECD, 2003). Because similar information was collected together in 1998 (OECD, 1999) and, for a few countries, in the mid-1980s (OECD, 1987), it is possible to discern the changes which have been occurring, often prompted by environmental concerns. The most noteworthy are the spread of domestic metering[4] and, within measured charging, moves away from decreasing and towards increasing block tariffs (DBTs and IBTs). The former is seen most clearly in **England & Wales** (0.5% of households M in 1985 up to 23% in 2002), but also in **Netherlands**, **Canada** and **France** (where

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3 The correlation coefficient between water consumption and rateable value flat-fee charges for 419 households in SFHs in Fylde, Lancashire, in 1970-71 was found to be +0.56, implying that only about 30% of the variation in water rates could be associated with consumption differences (Jenking, 1973).

4 Optional metering policy is responsible for perhaps half of the present 'stock' of household metering in England & Wales, but although in existence elsewhere (Scotland, Norway, Antwerp and Calgary), it is quantitatively insignificant in those locations. Optional metering generates a positive income effect (on demand) to set against the negative substitution effect, as against the two negative effects of much compulsory metering, but the small reported household income elasticities of demand (more recently, 0.1 to 0.4) mean that the demand effect to be expected from optant metering would be only slightly less than that from compulsorily metering a whole, or significant part of a, community.

flat fees for SFHs are now illegal). There have been significant moves via local and national legislation to promote the metering of individual apartments in **Germany** and **Denmark**, and also growing interest in **Belgium**, **Italy** and **Spain**. Moves away from DBTs and/or into IBTs have been reported from **Australia**, **Canada, Japan, Korea** and the **United States** (where sampled utilities with IBTs are up from 4% to 34% over 1982-2001).

Environmental Signals from Present Charging Structures

30. That, then, is the current picture, but what are the implications of these structures for the environment and affordability? There is no need to dwell for long on the former, since the messages are very clear. Individual household metering leads to more rational use of water in home and garden (and thus less waste), more interest in low-water use appliances, and more interest in the substitution of rainwater for piped supplies. Such interest feeds its way through to appliance manufacture and design, while the effects on household demands eventually feed *their* way through to the volume-related cost elements of sewerage transportation and sewage treatment. Even in individual apartment metering, water savings in the range 15% to 45% are reported (OECD, 1999). The economic costs of household metering should not be ignored, but the balance swings towards metering as the real price of water rises (see para. 5, above), water demands shift at the margin towards luxury uses, peaks grow, meter reading technology advances (and cheapens) and the valuation put on resulting environmental gains increases.

31. The use of minimum charges can also seriously blunt the conservation message. In **Korea** after the government issued the 1996 *Comprehensive Water Management Countermeasures* large numbers of local authorities abandoned minimum charges. In **Canada**, too, the proportion of households which have to make a payment related to a minimum volume has fallen from 20% to 16% over 1991-99, and over the same period the average consumption volume relating to the payment has declined 25% to 12 m3/month.

32. Switches into IBTs from constant volumetric rate tariffs, or to the latter from DBTs, are more difficult to analyse. The ‘general message’ sent out by such switches may be argued to be one stressing the importance of conservation, but whether this would be expected *in itself* to have an effect on demands is another question. Conventional demand analysis would suggest that in a revenue-neutral tariff switch to an IBT the demand effect would be largely restricted to the substitution effect from the higher marginal price, and with household price elasticities estimated outside the United States generally restricted to the –0.1 to –0.4 range this effect would be likely to be very small (unless the ‘early’ blocks in the tariff were relatively wide and had a zero/low price). In the limited number of cases of such tariff structure changes analysed in the literature (including some where an additional higher-priced block was added to an existing IBT), however, demand savings in the 10% to 14% range have been reported (OECD, 1999; Table 17). Admittedly, these are all pure time series studies, notoriously difficult to undertake and interpret, but they are at least consistent with the notion that the introduction of IBTs has an ‘extra’ effect on water use which orthodox microeconomic analysis finds difficult to handle.

33. Something similar has been reported anecdotally in **Denmark,** where the Copenhagen water utility has been keen to introduce separate water billing, albeit of UM charges, to individual apartments, instead of letting the water costs lie hidden, wholly or partly, in a general services charge delivered to each flat. The claim has been made that such a change has had an effect on demand, even though the marginal price remains zero and the (flat fee) charge remains the same, but no evidence has been presented for public examination

34. Of course it may be argued that such changes in tariff structure or billing arrangements, almost by definition occasioned by the need or desire to restrict demands, will inevitably be accompanied by considerable (and unusual) publicity, which amounts to the economist’s ‘change in tastes’ and thus presumably shifts the demand curve. The question, then, turns on whether any observed demand effect wears off or is permanent, which takes us back to more doubtless intricate questions of data analysis.

Whether conservation or some other objective has driven IBTs, however, the structure continues to dominate in a quarter of OECD members.

35. Table 4 is an OECD (1999) attempt to rank individual countries' household tariff structures by the strength of the embedded conservation signal (but abstracting from the extent of FCR). The Slovak Republic, a recent OECD entrant, has been added to rank 3.

Table 4 Household Tariff Structures Ranked by Strength of Conservation Signal (late 1990s)

Rank	Category	Countries Included	No. of Countries
1	"Cutting Edge" Conservation Pricing	Korea	1
2	Conservation or Social Pricing	Belgium, Greece, Japan, Italy, Mexico, Spain, Portugal, Turkey	8
3	Price times Quantity Volumetric	Czech Republic, Hungary, Poland *Slovak Republic (added, 2000)*	3 *(+1)*
4	Traditional Volumetric	Austria, Denmark, Finland, France, Germany, Netherlands, Sweden, Switzerland	8
5	Pluralist Volumetric	Australia, Luxembourg, US	3
6	General Pluralist	Canada	1
7	Predominantly Flat-Fee	Iceland, New Zealand, Norway, UK	4
8	No Domestic Water Charges	Ireland	1
			29 *(+1)*

Affordability Implications of Present Charging Structures

36. That is the *environmental* dimension; what can now be said about the *affordability* implications of these tariff types, and the possible conflicts which may arise between the two? First, flat fees. As traditionally levied, these have often been assumed to be broadly in accordance with ability-to-pay. This stems from their connections with the householder's residence – owned or rented. In the former case, lot size/floor space/rental/rateable value would often all be closely bound up with the size and 'quality' of a house or apartment, which would in turn be expected to bear some relationship with the household's wealth and thus with ability-to-pay. Even in renting, a broad correlation between the size of a household's chosen apartment and its ability-to-pay housing and related costs would be expected. The exceptions are for the larger poor family, where a larger home is arguably more a social need than a function of income or wealth, and it is for this reason that assistance with water bills through housing allowances was often the norm in the past and still is in some countries.

37. Two-part measured tariffs may well have the virtue of economic efficiency as well as simplicity, most obviously when they reserve the fixed charge for those costs that do not vary with volumes consumed, even in the very long run. But such structures are accepted as generating possible inequity for low users (and thus, in water, for small households). In telecommunications this could trigger non-use of the service among the poor, so that attractive low-user tariffs (low or zero fixed charge, higher volumetric rate) have seemed to represent a convenient way of getting over the problem, albeit at the cost of limited cross-

subsidisation from other consumers. The scope for such policies in water services is obvious, and reference will be made to a few examples in para. 60, below.

38. The other situation in which affordability may be threatened by the conventional two-part tariff is that of the larger poorer family either faced by rising (or already high) real water charges or being switched in a water-scarce region from an UM to a M tariff (see also para.4). This has constituted the classic argument in the **United Kingdom** against compulsory metering since the 1980s, with various campaigning bodies highlighting the dramatic increases in water charges for larger households (typically 50%, with average water charges burdens of 4%) following compulsory metering programmes on local authority estates in Bradford, Essex and Middlesex (McNeish, 1993; and Cuninghame, Griffin and Laws, 1996).

39. A different approach to such compulsory UM to M switches is provided by the predictions of metering impact effects for different properties thrown up by income/ substitution effect analysis. In the **UK,** one would expect (i) the negative income effect to be particularly high among those (poorer) households living in low rateable value homes and (ii) the substitution effect to be high (and the income effect not to be so noticeable) among the richer households with high discretionary or 'luxury' water use. In between, both effects might be less marked. That is exactly what seems to have occurred in the first UK domestic metering trial in 1971-72 [300 households in the Fylde Water Board: see Jenking (1973)]; in the two lowest value property bands the impact effects were 19% (the lowest band) and 11%, in the two highest 16% and in the remaining two middle bands only 6%, to give an overall effect of 11%.

40. Minimum charges laid over volumetric pricing can also have adverse affordability effects, since they transfer purchasing power from low users (who pay more than their 'fair share') to high users, who gain most from the lower volumetric rates that minimum charges permit. The lowest of the low users will generally be poor (pensioner households, for example) and most of the high users tend to be better-off. Both environmental and affordability considerations thus argue against minimum charges, the main advantage of which appears to be to make life easier for the financial division of the water utility.

41. Of the block tariff structures, DBTs, which *both* do most for the very well-off (with high water use) *and* give all the wrong messages on the environment, are dying a death (very slow in places), and few will shed a tear. IBTs, however, pose many more interesting analytical issues. In Mediterranean countries the rationale for IBTs is usually offered as one or a mixture of the environmental and social (what is now termed affordability) objectives. Thus in **Italy** the current form of the IBT dates from 1974, when it was explicitly introduced "to control consumption and the wasting of water" (OECD, 1987), while in **Turkey** the perception is that IBT exists for affordability reasons *and* to act as a consumption disincentive[5] (OECD, 2003). The environmental objective has already been discussed in paras. 32-34, while the affordability argument runs (indeed, has to run) as follows. The poor use less water, and therefore a cheaper first block or two of water (and wastewater services, if the two service tariffs are linked) will benefit the poor most. This is because the relative losers must be those whose consumption takes them "into" the increased price blocks to the greatest extent, and they are the consumers who use most water – i.e., the most well-off.

42. Now the fallacy in this argument will be obvious. It makes no allowance for the problems faced by the larger poor household, and, similarly, appears not to recognise the existence of the well-off small household, which may end up paying far less per m3 for its water services than its large poor neighbour. And to the extent that the 'early' cheaper blocks might then be (foolishly) rendered wider and/or cheaper to attempt to assist the larger poor household, well-off (and, indeed, all) small households will simultaneously gain *relatively* – in 'intensity' (cheaper blocks) and/or in numbers (more entering as the blocks are

5 Note that Turkey also has many examples (including Istanbul) of a particularly severe form of IBT (SBT = Severe Block Tariff?) in which a household pays for all its water consumption at the price of the block that it has reached at the end of the billing period. This of course generates sky-high marginal prices at block boundaries, which has strange effects on incentives. In any case the affordability rationale is completely demolished by SBT, although the disincentive effect must presumably be strengthened overall.

widened) – and the larger households suffer. Table 5 now presents some data which should permit some broad-brush judgements on this issue for those countries in which IBT structures dominate, by invoking the notion of the household's 'basic use' and making alternative assumptions about its size.

Table 5 Typical first block widths and household consumption in 'IBT countries'

Country	Typical Billing Period	Typical size of first block [and as litres/ household/day]	Average per capita consumption (litres/ head/day)[1]	'Basic use' of how many people is 'covered' by first block?[2]	
				'basic use'= half per capita consumption	'basic use' = 60 litres/ head/day[3]
Belgium					
Flanders	3 months	15 m3/h/yr [41 l/*head*/d]	120 (2000)	all (2/3 of it)	all (2/3 of it)
Wallonia	?	20-30 m3/yr. [55-82]	120 (2000)	1-1.4	1-1.4
Greece	3 months	5 m3/mnth. [164]	140 (1995)	2.3	2.7
Italy	3 or 4 months	100 m3/yr. [274]	213 (1997)	2.6	4.6
Japan	2 months	10-20 m3/mnth.[329-658]	275 (1999)	2.4-4.8	5.5-11.0
Korea	?	10 m3/mnth. [329]	183 (1997)	3.6	5.5
Portugal	?	6 m3/mnth. [197]	119 (1994)	3.3	3.3
Spain	1 – 3 months	6-16 m3/mnth.[197-526]	144 (2000)	2.7-7.3	3.3-8.8
Turkey[4]	1 – 1.5 months	10 m3/mnth. [329]	195 (1995)	3.4	5.5

Notes: 1. Some consumption data are out of date; typical first block sizes, however, are fairly constant over time.

2. Two alternative measures of what constitutes basic use are considered in these two columns.

3. Most suggestions for basic use in OECD countries give a 40-50 lhd minimum: see Smets(1999) and section 6.5.

4. About half of the local IBTs in Turkey are believed to charge a household's water consumed at the price of the block reached (SBT). This entry therefore applies to the other half, who use 'true' IBTs.

Sources: various country data submissions, as listed in Annex A of OECD (2003).

43. Five countries of the eight in Table 5 (all except **Italy**, **Korea** and **Japan**) are included in the list of those countries in which household affordability appeared to be regarded as a significant issue (in Figure 1). Of those five, the **Wallonian** region of Belgium, followed by **Greece** and parts of **Spain**, and then **Portugal**, would be predicted to have, according to Table 5's last two columns, the *least* satisfactory IBTs in terms of the assistance that generally accrues to larger poorer households, the coverage of a typical low-price first block in those locations being restricted (according to the assumptions made)to just over three people or less

44. Those, then, are the locations *where pressures for change and policy adaptation would be expected to be strongest*. Three of them turn out to be *precisely* the places where IBT policies have indeed been rethought, in attempts to lessen the burden on low-income large households. In **Wallonia,** there have been moves recently to emulate the innovation of Flanders, by gearing the first free block to the size of the household; while in parts of **Spain** and **Greece**, initiatives with IBTs to give special treatment to larger households have been reported. It is with those developments, and some other similar ones, that the next section is concerned.

Affordability and the Amended IBTs

45. The related *lifeline tariff* issue (i.e. the basic block being available at a price affordable by *all*) has also featured in the energy pricing literature during this period (e.g. World Bank, 2000), but only two practical

energy examples of what the World Bank terms a ‘floating tariff’ are known. **Moldova** was in 1998-99 known to be using a “heavily subsidised” price for a first tranche of domestic district heating which was linked proportionately to the number of people in the household (World Bank, 2000), while in **Malta** by 1999 the four-block tariff for domestic electricity supply included: (i) a first *free* block of 200 units per *household;* (ii) a second low-price block (at 44% of the full price) geared to *household size* while reflecting economies of scale in use as a household grows larger; and (iii) third (10% discount) and fourth (full price) blocks covering further consumption up to and beyond 6400 units/year.

46. Now turn to the amended IBTs in water. Examples in five countries are detailed in Table 2.1 of Annex 2. In **Spain** at least four cities are believed to have introduced important qualifications to their IBTs in the 1990s decade. The main concern in Barcelona, Madrid, and Seville was to widen the first and/or the second block for larger *households* (of more than four people), whereas in Murcia the basic block extension applies only in the case of three or more *children* (presumably whatever the number of adults). In all cases, there remain relative benefits for smaller households in terms of a wider first block *per capita*, since the first block remains constant up until, and including, household sizes of four (but it can be argued that such gains are offset by the presence of a fixed charge per billing period, which is not considered here). Larger households must demonstrate to the utility that they are indeed “larger” (*familias numerosas)*, with the aid of an official certificate issued by the government. The convention appears to be that the block adjustments are carried over from water supply to cover also abstraction levies and sewerage and sewage treatment.

47. Cities and some larger towns in **Greece** also offer special water tariffs for families with three or more children, as Table 2.1 in the Annex shows. Of the three examples shown, only EYDAP (Athens) formally augments the initial tariff block; EYAE (Thessaloniki) and Larissa instead apply 50% discounts in volumetric charges, up to a certain rate of consumption in each billing period (sometimes determined by the number of children in the household, as is the case in Larissa). Note that the 50% reductions could well ‘buy’ a not dissimilar reduction for larger families in their overall bills, but it would be at a generalised social cost of halving the marginal cost of additional water use. So the equity gain is offset by likely reductions in economic and environmental efficiency. The numbers of families involved may, however, be small. In 2002, out of EYDAP’s 1.8 million domestic accounts, only 20,000 had three or more children. In **Turkey**, however, a new (2002) law prohibits discounts of the water bills of households with 4 or more children, which arrangement used to be found in some cities.

48. In the **US,** the unique Los Angeles Department of Water and Power allowance for very large households in SFHs was part of a package of domestic tariff reforms introduced in the mid-1990s, which abolished the minimum charge, introduced a credit independent of water usage to low-income consumers, and related the size of the first of a two-block tariff for SFHs to “household needs”. The latter is determined by lot size (5 categories), temperature zone (3), season (2), and household size: an extra first-block allowance of 186 l/day for each of the 7th to 9th household members, plus 93 l./day for each of the 10th to 13th members.

49. The “purest” form of IBT tariff adjustments for household size is found in **Belgium** (Flanders) and **Malta**. The Flanders tariff has now been operating since 1997, and should be seen as an evolution of the earlier Flanders scheme, in which a number of utilities each allocated a free block of water of given size to every household in their area. In theory, the new Flanders tariff is in many respects “ideal”, combining (i) equity (a free block of 15 m3/year, = 41 l./day, for each person), a move towards economic efficiency and appropriate environmental signalling (a marginal price necessarily higher than average cost) *and* (ii) the idea that potable water supplies can be divided into basic and discretionary (or luxury) uses.

50. A stylised comparison of a traditional fixed-charge-plus-volumetric rate with a Flanders-style tariff is found in Annex 3. It shows that the only conditions under which the introduction of the free allowance could *worsen* the relative situation of poorer households are when (i) the less well-off are *so* concentrated in smaller households (and the better-off in larger ones) and (ii) water use scale economies are *so* large

relative to the income elasticity of demand that (iii) average per capita consumption in higher-income households is actually *lower* than that in poor families. This combination of social and economic phenomena is most unlikely.

51. In practice the Flanders tariff has had a mixed reception. Flemish utilities stress the extra overhead and operating costs (largely IT-based) arising from the need to erect and maintain a comprehensive database on household size. At least one company (VMW) reports that households which do not use all their free allowance are increasing, although the reasons are unclear. It is also said that the new price structure gives "the impression that water is not as important as it seems because we give it away for free."(Hammenecker, 2002). Van Humbeeck (2000) argues low-income households in Flanders have actually been made worse off as a result of the introduction of the tariff, although it seems likely that this may be wholly or partly due to other tariff and social assistance changes which took place at the same time.

52. The two **Maltese** household water tariffs are very much in the Flanders spirit, yet provide an interesting contrast. In the standard *Domestic* tariff there is one large subsidised block of 90 lhd, priced at 15% of the standard price. The *Social Assistance* tariff, however, maintains two blocks each of 45 lhd (one free, one subsidised by 75%) as well as free meter rental. With the 75% lowest consuming *Domestic* sector households averaging only 85 litres/day in 1999-00, and thus a low effective marginal price of water to so many consumers, it is unsurprising that domestic demand grew by 5% over 1999-00 to 2000-01.

53. Table 6 attempts to compare the equity and efficiency aspects of these amended IBTs. This is fully explained in Annex 2, with two dimensions of equity being considered alongside one jointly incorporating economic and environmental efficiency. Barcelona comes out best of the **Spanish** tariffs, with Madrid behind on both equity assessments. Seville and Murcia lag further behind on *one* of the criteria. Data for the former suggest that many households would not consume outside the low-priced block, while in Murcia the first and second block discounts (7% and 4% on the 3rd block price) seem not worth the administrative costs. The **Greek** utilities' assessments are a little better than that for Madrid, because of the larger first block discount. **Los Angeles** only extends the first block width for households of six or more, thus sharing first-block benefits between all households but ensuring that those with five or less members have significantly more than their fair share.

Table 6 Equity and efficiency rating of adapted increasing block tariffs

Utility/ Location	*Equity*[1] (H=no. in household; A=no. of adults): actual assistance to customers from low-priced block	*Equity*[1] (H=no. in household; A=no. of adults): equity as between different-sized households	Economic & Environmental Efficiency[2] (assessed by whether most households, including larger ones, still face a 'standard' marginal price of water)
Barcelona	high	high for > 2H	high (except 1H)
Madrid	low	fairly high for > 2H	high (except 1H)
Seville	high	high for > 2H	very low (wide low-price first block)
Murcia	very low indeed	fairly high for > 2C	high (since block 1 price so high)
Los Angeles	limited	high for > 5H	high (except 1H + 2H?)
Athens	limited	high for > 2C	high (except 1A)
Thessaloniki	limited	fairly high for > 2C	high (except 1A)
Malta			
Domestic	very high	very high	) very low: at least 70% of consumers
Soc.Ass'tance .	very high	very high	) stay in 85%-subsidised (or free) block
Flanders	very high	very high	very high in theory, but not quite so high in practice?[3]

Notes: 1. Judgement made in light of relative price and block allowance data from Table 7.

2. Judgement made in light of size of block allowance (Table 7) and approximate known size of average per capita consumption.

3. Judgement informed by the fact that in VMW, one of the largest Flemish utilities, it is reported that the "group of households who do not use all their free cubic metres is increasing" (Hammenecker, 2002).

54. Although Malta and Flanders both score very highly on the *equity* criteria, with *efficiency* the stories are different. For 1999-00 it appears that at least 70% of domestic households in **Malta** had billing records that showed all their water was being bought at a subsidised rate. This is obviously *potentially* injurious to economic efficiency and environmental protection, depending upon the price elasticity of demand and the scale of any environmental costs resulting from abstractions and other parts of the water and wastewater production processes.

55. **Flanders** clearly emerges with the best all-round picture. This is because, in addition to the equity objectives being met, the likelihood is that a high proportion of resident households would be expected to find themselves outside the 41 lhd basic block, and therefore paying the full price for their marginal units of consumption. It is therefore unsurprising that in both **France** and the Wallonian region of **Belgium,**

there have been moves in recent years to emulate the principles of the Flanders tariff in, respectively, national and regional legislation (these have, however, now foundered).

Assistance through other Tariff-related Measures

56. Other ways of influencing affordability via tariff adjustments range from central government subsidies, as a transitional policy borne of prolonged or shorter-term ‘crisis’, to tariff arrangements either reserved exclusively for particularly vulnerable groups or directed at broader consumer groups in which low-income households are expected to be significant.

57. In **Hungary** and the **Slovak Republic** large subsidy programmes directed at high (water) cost areas and utilities have been used as conscious policies to influence household affordability. In Hungary the aggregate subsidy was worth 4.9 billion HUF in 2002, 27% higher than in 1994. This broad-brush policy clearly gives financial relief to (some of) the better-off as well as the poor with the (geographically) highest bills, and to SFH residents sends environmental messages which may not be too inappropriate, given the continuous underlying decline in per capita consumption in eastern European countries. Presumably the policy helps to explain the relatively low charges burden for the lower Hungarian deciles identified in Table 1. In **Scotland** two shorter-term transitional relief schemes, to assist with the acceptance of expensive adherence to EU directives, have been financed by central government, but there, with 99.986% of households UM, the environmental consequences may not have been too serious!

58. Other than **Malta**’s Social Assistance tariff (see paras. 52 and 54), the only policies directed at vulnerable groups are in **England & Wales**. In 1999 the government introduced at a national level the *Vulnerable Groups Regulations,* narrowly conceived in that they covered only metered households receiving one or more of six designated government benefits or tax credits and *either* having three or more dependent children under 16 years old *or* including someone with a specified medical condition causing significant extra water use.[6] Such a household’s measured charges are capped at its water company’s *average* household bill. Anglian Water reported only 0.2% of M households were making use of these *Regulations* (through what Anglian calls its *Aquacare* tariff) in March 2002; reproduced nationally, this probably represents only 6% to12% of those eligible.

59. Three water companies in **England and Wales** (10% of the population) offer an optional high fixed charge/lower unit rate tariff (120% higher/40% lower than standard) to metered households in receipt of designated social security benefits. These are directed at those large and poor households who are ineligible for the *Vulnerable Groups Regulations*, and prove increasingly advantageous as consumption rises above 100 m3/year. A household of 4 or 5 people should expect to save about 20% of its metered bill (about £80/year). Again, take-up is low, Anglian Water reporting only about 700 (0.1% of its M households) as benefiting from its so-called *Aquacare* Plus tariff in March 2002. Both the Maltese tariff and those in England & Wales have to be financed by cross-subsidisation.

60. Examples of restricted tariffs for broader groups in which lower-income households may be important come from **Spain** and, again, **England & Wales**. Aguas de Murcia offers a special and remarkably generous water supply tariff for pensioner households, with the first 247 litres/day free and the next 164 litres/day priced at 35% less than the rate for other households in their household-size-related initial block. Economic and environmental messages are thus blunted, and cross-subsidisation is very large. In the UK the same three companies as in para. 59 offer an option to any metered consumer to switch into a low-user tariff: in Anglian Water (zero fixed charge – £64/year is the standard – and a unit rate 50% higher than the standard) one in ten metered households has opted in (an estimated 33% of those eligible), and this has added an average £1.47/yr to each Anglian household’s charges.

6 The medical condition must be one of the following: desquamation; weeping skin disease; incontinence; abdominal stoma, and renal failure requiring dialysis at home.

Cost of Cross-Subsidisation

61. No empirical studies have been located analysing the extent to which cross-subsidisation between low- and high-income households occurs through IBTs and amended IBTs, low-user and other restricted-entry tariffs, etc. However, two reports have been published in the last decade in **England & Wales** estimating the implications of switching over UM consumers paying rateable-value-based water bills to alternative charging systems, including different metered structures (among which there were various IBTs). Both studies associated detailed family budget survey results with domestic (water) consumption monitor data, to allow water consumption at individual property level to be regressed on possible explanatory variables common to the survey and the monitor (Institute of Fiscal Studies, 1993; and Department of the Environment, Transport and the Regions, 1998). This allowed water consumption to be estimated for each survey household, so that what-if? exercises imposing alternative tariff forms on the households and their consumption could be undertaken.

62. The more recent study compared rateable-value-based charges for a set of 20,600 households with eight alternative metered tariff structures, with and without a (15%) metering impact effect. Outputs showed the proportions of households gaining and losing different ranges of annual income (+£0-25; +£25-50, etc) by income distribution decile (both unequivalised and equivalised incomes), family type, employment status, water company area, etc. Results showed between 58% and 92% of the households in each of the two lowest-income (unequivalised) deciles *gaining* from the change to various measured tariffs, this being largely explained by the importance of low-occupancy pensioner households in those groups. This range fell to 40% to 68% when households were ranked by equivalised income. In the highest-income decile between 64% and 89% of households lost from a switch to volumetric charging, although equivalisation reduced this to 55%-73% (by pushing some of the larger households into lower deciles). Concentrating on family types – and abstracting from the income distribution – 55% to 70% of pensioner households gained from switches to metering, but 74% to 81% of low-income households with 2 or more children lost.

63. Looking *across* the different metered tariff structures, the familiar trade-off is confirmed: options that tend to benefit the most low-income households overall also tend to affect adversely the most large (more than two children) low-income families. No Flanders-type tariffs were analysed.

64. It is also possible to extrapolate from some fragmented data available from Anglian Water concerning the extra annual charges for each household resulting from the April 2002 operation of its *low-user*, *Aquacare* and *Aquacare Plus* tariffs (see paras. 58-60). Those three tariffs were estimated to be adding respectively an average of £1.47, £0.13 and £0.02 per year to the bills of each Anglian household at that time, with a take-up of 109, 2 and 1 per 1000 metered households, representing, respectively, 33% , 6-12% and (assume) 6%-12% of those eligible. Suppose the take-up of all three schemes were to rise to 66%, well short of 100% because of possibly frequent new entry to and exit from the tariffs, the uncertainty of water consumption and the increasing marginal costs of obtaining increased take-up. Appropriate proportional increases in the additional charges specified would then sum to give an annual cost to non-participating households in the range £3.76-£4.59, representing 1.4% to 1.7% of present average Anglian household bills.

65. The only known OECD evidence concerning households' willingness-to-pay to cross-subsidise poorer and health condition-designated customers is contained in focus group research for the **England & Wales** economic regulator, Ofwat (D.V.L. Smith Ltd., 2000). This suggested that households would be likely to be tolerant of such financing up to about £10 per year (around 5% of the then annual national bill). However, this included the cost of provision of flexible payments options to help people manage their water bills, which were already estimated to be costing 2.5% of the average national household bill in 2000.

Income-Support Measures: Environmental Signals and Affordability Measurement

66. A large range of measures which address individual customers' affordability problems from the income side has been identified in OECD countries[7]. They can be subdivided into:

- capped tariff rebates and discounts, giving rise to reduced charges of a predetermined amount;
- direct income assistance or water services vouchers from government, water utilities, or other private or charitable sources;
- payment assistance in the form of re-phasing and easier payment plans, special loan facilities and arrears forgiveness; and
- other hardship initiatives providing assistance directly to households.

67. Income support measures are favoured because in focussing on income rather than price they leave untouched the allegedly valuable economic/environmental signals presented both by the absolute size of water bills (less emphasis) and by marginal prices (generally more emphasis). Even waiving or reducing the charge on some "early" units of a bill period finds some support because, it is argued, it is analogous to an income increase in that little tampering with scarcity signals results.

68. A more extreme version of this view is still occasionally encountered in the water industry and among policy-makers, regulators and consumer organisations. This is that the distribution of purchasing power in the community is not part of the proper role of a water utility, and should be left either to the redistributive powers of government or to private charity[8]. It is argued that any other interventions would represent an organisation undertaking a task that would not be its primary purpose and for which it was therefore ill-equipped.

69. In practice the main constraints upon affordability assistance being allocated through one or other means of income support have frequently been macroeconomic in nature or, what often amounts to nearly the same thing, political. But with constraints or without, and whether they are borne of principle or political imperative, it remains the case that no fundamental conflict between environmental and social objectives arises in the use of income-support measures. This is because both water bill rebates (the first bullet point in para. 66, above) and income support which directly increases a consumer's disposable income would be expected to have little effect on the household's demand for water, so small is the income elasticity of demand likely to be. There is thus no gain to be had in any extended discussion of the measures used and their impacts upon affordability.

70. One recent trend should be noted which provides income-side support with no necessary cost to government finances. To provide assistance to those unable to pay their bills and thus getting into increasing debt, social funds have been created in a number of countries: in the **United Kingdom** by some

7 The first measure below, absolute-value water bill reductions or waivers which become known to the household before or only well after the act of consumption, was included in this group rather than as a tariff-related measure in OECD (2003), since it is similar to an earmarked and exogenous income increase.

8 Against this view (which would greatly reduce the options open to a local water utility) is the argument that such complete reliance on the beneficence of government and on private charity is at best thoughtless and at worst immoral. In recent years more water utilities, in both the public and private sectors, have come to believe that it is part of their responsibility, as the supplier of such a crucial public service, to attempt to deal with water affordability problems, in a number of relatively affluent countries. Certainly this is the case in the many of the examples highlighted in the discussion of tariff-related measures above. The utilities are, it is argued, in touch with their customers like no one else; and it can thus be alleged that the utilities are in the best position to know how to assess and respond to their needs.

of the privatised water companies setting up charitable trusts, in Wallonia (**Belgium**) via a per m3 levy on household charges, and in **France** through the establishment of departmental ‘conventions’ which mostly agreed to writing-off debts of individual customers when certain social criteria were satisfied (OECD, 2003). In the French case about 40% of financing comes from a levy on water bills and the 60% from public funds.

71. An explanation concerning the impact of income-support assistance on the *measured* micro water charges burdens of Table 1 (above) is also in order. Suppose a low-income consumer group is known to have a water charges burden of, say, 4% (£8/week charges divided by average net income of £200/week) and the government determines that this is unacceptably high and that policies must be put in hand to reduce it to, say, 3%. Tariff-related measures, if successful, should have the effect of reducing charges to £6/week, and thus the burden to 3%. With income-support measures, however, there are two possible results. If a predetermined rebate is paid by, e.g., a regional government direct to the water utility, and the consumer pays that much less in tariffs, the new burden is measured at £6 over £200, equal to 3%. If, however, the government determines that through social security or some other form of assistance (e.g., water vouchers), an average of £2/week in money or its equivalent should be passed over to eligible consumers, then depending on the income definition system adopted it may well be the case that disposable income is recorded as £202/week and water charges still as £8/week, to give an ex post recorded and calculated burden of 3.96% (=8/202).

72. This raises important questions about both the interpretation of recorded changes in micro burdens in a given country or region and also the comparisons of burdens in different countries. The latter may in fact be strictly *incomparable* because of different measurement systems or because of different policy traditions; this means that ‘equal’ water-specific assistance may be being granted in two countries to help relieve the burdens of low-income consumers who face, assume, the same level of ex ante financial stress, but that in one situation (with tariff-related measures) the recorded burden reduction is significant whereas in the other (with income support) it is arithmetically trivial.

IV. QUESTIONS OF ACCESS

73. There are ten countries (one-third of the OECD membership, and most of which[9] are described as ‘middle-income’) in which the extent of coverage of piped connections to individual homes is significantly incomplete. In these countries – listed with relevant data in Table 7 – there are substantial numbers of low-income, rural or marginalised communities which still have no or limited household connections to the piped services provided by orthodox water utilities (the “formal sector”).

9 Czech Rep., Hungary, Korea, Mexico, Poland, Slovak Rep. and Turkey are the OECD countries generally described as ‘middle-income’.

Table 7 Significant[1] Non-connection to Piped Water Services in the OECD

Country	popln. connected to public water supply		population connected to sewerage		
	year	proportion	year[2]	public sewerage (without treatment)	independent/non-public sewerage
Czech Rep.	1997	86%	1999	74.6% (12.2%)	n.a.
Greece[3]	1996	86%	1997	67.5% (11.3%)	n.a.
Hungary	*(1996*	*97%)*	1998	48% (22%)	17.0%
Ireland	1994	80%	1997	68% (7%)	n.a.
Korea	1996	84%	1999	68.4% ++	n.a.
Mexico	2001	65%	1999	73.0% (49.2%)	n.a.
Poland		n.a.	1999	58.0% (6.5%)	n.a.
Portugal	1996	83%	1999	75.0% (20.0%)	n.a.
Slovak Rep.		n.a.	1998	53.9% (5.1%)	n.a.
Turkey[4]	1998	55%	1996	56.4% (44.8%)	n.a.

Source: OECD (2003), Table 5.1.

Notes: 1. Country included if <90% connected to PWS and/or <80% connected to public sewerage.

2. If '1999', indicates 1999 or latest available.

3. Data included connections still under construction (in 1996 and 1997).

4. PWS data based on "piped into house/garden" (urban 65.9%, rural 32.5%) *France* had 79% connected to public sewerage in 1995, but 10% had non-public connections. *Austria* (1997), *Finland* (1997) and *Sweden* (1995) all had only 87% on PWS, assumedly for strong economic reasons.

n.a. signifies 'not available'.

74. Households without individual connections at present typically resort to either (i) community facilities (often free) such as standpipes, fountains, wells and water lorry (supply) and chemical, open and public latrines and other facilities (disposal) or (ii) "informal sector" provision, e.g. sales from water kiosks and water vendors. In OECD countries, however, the general aspiration is usually for piped, individual connections to supply, disposal and treatment. Thus most households not connected to the formal sector are considered to be "in transition"[10], although there will, of course, always be exceptions, when explicit choices have been made *not* to connect certain homes to a piped system. Usually this will be in rural areas with poor natural supplies and/or highly uneconomic possible connection to the piped networks (e.g. isolated areas in **Scotland, Austria**, **Scandinavia**, etc., where sometimes private wells, septic tanks and non-water based technologies for sanitation may be more appropriate, both technologically and economically).

75. Very little information is available concerning the ongoing costs in OECD countries of (free) public provision of alternative supplies (standpipes, fountains, etc.) or those incurred in making demands on the informal sector. A study undertaken by the **Mexican** National Water Commission (CNA) in suburban municipalities of Mexico City showed that low-income families without access to piped water supplies spent between 14% and 28% of their monthly income on water in purchasing from water vendors (OECD, 2003). This contrasts with the figures in Table 1 (above) showing Mexican households spending between 0.7% (most well-off decile) and 3.8% (poorest decile) of their income on piped supplies – and those percentages in Mexico City would have bought on average over twice the per capita amount being purchased by low-income families from vendors!

10 OECD has recently listed the following factors leading to "gaps" in water services where the objective remains to connect to the formal sector: population growth, migration, historic lack of maintenance investment, and topographical and geophysical conditions leading to communities being isolated and socially marginalized for long periods (OECD, 2003).

76. When we turn to the question of what is the best way forward for the transition regions and areas, recent thinking has emphasised the desirability of filling ‘service gaps’ through differentiated types, levels and qualities of service (OECD, 2003). In promoting *differentiated services*, doubt has been cast on the wisdom of the “over-engineered” and often high-cost solutions which have used large economies of scale as the rationale for reliance upon supply provision by a single local or regional authority/utility operating at a ‘standardised level’.

77. In contrast the thinking about *differentiated services* starts with the existing, often inadequate (and sometimes ‘broken down’) service as the short-term reality, and examines possible improvements. Service gap areas are typically not homogeneous, and new water initiatives are best adapted to existing circumstances. If the existing provision is based on the informal sector, relying on networks of social and economic relationships, it may be best to build on or around those relationships. In transition cases, the financial and therefore economic resources available may simply be insufficient to permit the transformation of the whole community to individual household piped connections. Instead, a range of differentiated technology choices could be considered, enabling a given financial budget to go further. Financial resources can be spread even more widely if the mobilisation of human resources in the form of residents’ time and labour occurs in community-level project management and construction. Experience in Latin America leads the World Bank to claim that non-conventional water supply and sanitation can reduce combined installation, operations and maintenance costs by up to 75%.

78. In similar vein, Baker and Tremolet (2000) have argued that the poor could sometimes get easier (and more) access to service if the main provider was permitted to deviate from the uniform standard often laid down by central or regional governments. In particular private providers in developing countries often inherit operating structures and tariffs from a run-down and large-scale city operation with a (failed) culture of pride in high-quality uniform service rather than a concern with innovation in low cost alternatives. Relaxation of the proscribed minimum quality of service might offer more consumers a practical improvement in that an acceptable relaxation of the quality *target* was accompanied by a *lower* price and a *better* practical service.

79. OECD (2003) concluded that in Mexico, with sizeable service gaps remaining, the *business as usual* solution is not an option. There should be a structural change in existing policies. Many rural and peri-urban Mexican communities have characteristics that do not facilitate the conditions to provide standard high-level water services. Differentiated systems, depending on local circumstances and based in the community, should focus on what users want and are able to sustain.

V. CONCLUSIONS AND UNRESOLVED ISSUES

Conclusions

1. Unit water prices have been increasing in real terms in most OECD countries in the last decade and are set to continue.
2. Macroaffordability measurements for countries cannot be used as efficient indicators of significant problems for low income deciles or other groups of water services consumers.
3. Various microaffordability measurement techniques exist which can be used to throw light on the water charges burdens experienced by low-income households.
4. Recent projections of water charges burdens in EU Cohesion Fund countries and Poland suggest serious affordability problems in the future.
5. Moves to individual household water metering lead to benefits for the water environment as well as the potential for economic efficiency gains. Depending on the ‘original’ unmetered charges being paid, however, there may well result sizeable financial problems for low-income households,

especially – according to empirical modelling exercises comparing unmetered and metered tariffs – for larger families.

6. Changes in measured tariff structures for already-metered households may give rise to more complex analysis. Shifts into increasing-block tariffs (IBTs) probably generate environmental gains, but their traditional equity rationale is undermined by the possibility that small well-off households could end up paying in lower-priced tariff blocks than large poorer families.
7. Amended IBTs such as the Flanders tariff, necessarily associated with considerable cross-subsidisation within the household sector, can assist greatly in meeting affordability problems. But they can only work well with regularly updated information on individual household occupancy.
8. Income-support measures generally show no important conflicts between environmental and social objectives, but their use is frequently constrained by government expenditure limits.
9. Recent initiatives in England and Wales, Belgium and France show income-support schemes, incomplete in coverage, being funded from outside the public sector.
10. In areas with significant gaps in service provision, standard solutions introducing high-level service quality for all may not be the best way forward. Differentiated services, responding to local circumstances, based in the local community and sometimes embracing alternative technologies, should be seriously considered.

Unresolved Issues

1. Little evidence has been collected on the ways in which governments and utilities deal with affordability issues stemming from large household water requirements to cope with certain medical conditions.
2. The effects on demand of IBTs and other conservation tariffs as against constant volumetric rate tariffs have not been well-researched.
3. The demand effects of explicit flat-rate water charges sent to individual apartments as against water bills 'hidden' in service charges need to be established.
4. Little is known of the extent of cross-subsidisation (among different household income groups) in orthodox and 'amended' increasing-block tariff systems.
5. Comparatively few countries publish regular data on the water charges burdens borne by lower-income households.
6. There appears to be little empirical evidence comparing the costs of *standard* and *differentiated services* approaches to tackling sizeable water service gaps.

REFERENCES

Baker, W. and S. Tremolet (2000), *Utility Reform: Regulating Standards to Improve Access for the Poor,* World Bank Private Sector and Infrastructure Network Note No. 219, at www.worldbank.org/html/fpd/notes/

Berbeka, J. and K. Berbeka (2001), "The impact of the implementation of selected EU water directives on households' sustainable consumption in Poland". In: Villacampa, Y., C. A. Brebbia and J-L Uso, *Ecosystems and Sustainable Development III*, *Advances in Ecological Sciences, Volume 10,* pp. 523-32, WIT Press.

Cuningham, C., Griffin, J, and S. Laws (1996), "Water Tight: the Impact of Water Metering on Low-Income Families", Save the Children: London.

Department of the Environment, Transport and the Regions (1998), *The Incidence Effects of Charging for Domestic Water and Sewerage Services*, report prepared for DETR by Maxwell Stamp Plc, DETR, London.

Dinar, A. (ed.) (2000), *The Political Economy of Water Pricing Reforms,* Oxford University Press, for the World Bank, New York.

D.V.L. Smith Ltd. (2000), *Protection for Vulnerable Customers*. Report prepared for the Office of Water Services, Ofwat, Birmingham.

ECOTEC (1996), The Application of the Polluter Pays Principle in Cohesion Fund Countries (Annexes 1 to 4), Ecotec Research and Consulting Limited: Birmingham and Brussels.

Environment Agency National Water Demand Management Centre (2003), *Demand Management Bulletin*, no. 58, April.

Garrido, A. (2002), *Personal Communications* (Departamento de Economia y Ciencias Sociales Agrarias, Ciudad Universataria, Madrid), July – September.

Hammenecker, J. (2002), *Personal Communication* (Commercial Directorate, VMW Brussels), 19 August.

Institute of Fiscal Studies (1993), *The Distributional Effects of Different Methods of Charging Households for Water and Sewerage Services*, Office of Water Services: Birmingham.

Jenking, R. (1973), *Fylde Metering*, Fylde Water Board: Blackpool.

McNeish (1993), Liquid Gold: the Cost of Water in the '90s, Barnados: Ilford.

Ninou, A. (2002), *Personal Communications* (Hydrometers Laboratory, EYDAP, Athens), 24 and 26 September.

OECD (1987), *Pricing of Water Services*, OECD, Paris.

OECD (1999), *Household Water Pricing in OECD Countries*, OECD, Paris.

OECD (2003), *Social Issues in the Provision and Pricing of Water Services,* OECD, Paris.

Smets, Henri (1999), *Implementing the Right to Drinking Water in OECD Countries*, OECD Seminar Social and Environmental Interface Proceedings, Paris, 22-24 September 1999.

Smets, H. (2002a), *Le Droit à l'Eau*. L'Académie de l'Eau.

Smets, H. (2002b), *Personal Communication* (Private Consultant).

Stottmann (2002), *Personal Communication* (Water and Sanitation Program, World Bank), 31 July.

Van Humbeeck, P. (2000), "The Distributive Effects of Water Price Reform on Households in the Flanders Region of Belgium", In: *(ed.) Dinar, A.* (2000), pp. 279-95, *Op. cit*.

World Bank (2000), *Maintaining Utility Services for the Poor: Policies and Practices in Central and Eastern Europe and the Former Soviet Union.* The World Bank, Washington, D.C.

ANNEX 1. PUBLIC WATER SUPPLY: HOUSEHOLD TARIFF STRUCTURES (% OF UTILITIES OR POPULATION WITH A GIVEN STRUCTURE)

	Year	No. utilities in sample (and % of pop. represented)	Unit	Flat fee	**Constant Volumetric Rate**			**Increasing-Block Schedule**			**Decreasing-Block Schedule**			Normal number of blocks
					No fixed charge	plus fixed charge	plus fixed + min	no fixed charge	plus fixed charge	plus fixed + min	no fixed charge	Plus fixed charge	plus fixed + min	
Australia	2000-1	17(72%)	P(U)	-	-	73%(12)	-	-	27%(5)	-	-	-	-	2
Austria	1999	71 (?)	U	1	5	65	-	-	-	-	-	-	-	-
Belgium														
Brussels	2001	2	U	-	-	1	-	-	1	-	-	-	-	2
Flanders	2001	17	U	-	-	-	-	-	17	-	-	-	-	2
Wallonia	2001	46	U	-	4	21	-	-	17	-	-	4	-	2
Canada	1999	1214 (77%)	P	43%	←	36%	→	←	9%	→	←	12%	→	2
Denmark	2000		U,P	Rural	←	most	→							-
Finland	2000		U,P	-	-	100%	-	-	-	-	-	-	-	-
France	1990	500	U	2%	5%	46%	47%	-	-	-	-	-	-	-
Germany	2001	1030	U,P	-	<5%	>95%	-	-	-	-	-	-	-	-
Greece	2002		U	Rural?				-	← most→					5
Hungary	1997	268	U	-	95%	-	-	5%	-	-	-	-	-	2
Iceland	2002		U,P	All	-	-	-	-	-	-	-	-	-	-
Ireland	2002	all domestic water charges have been consolidated into general taxation since 1 January 1997												
Italy	1998		P	-	-	-	-		-	100%	-	-	-	3-5
Japan	1998	1900	U	-	-	-	42%	-	-	57%	-	-	1%	2-7
Korea	1998		P,U	-	-	-	-	←	100%	→	-	-	-	6-10
Luxembourg	1997	118	U	-	←	some	→	←	some	→	←	some	→	2-3
Mexico	2002		U	-	-	-	-	←	most	→	←	most	→	6-7
New Zealand	1998		P	75%	-	25%	-	-	-	-	-	-	-	-
Netherlands	1998	18	U	-	1	16	-	-	2	-	-	-	-	2
Norway	2002		P	87%	-	13%	-	-	-	-	-	-	-	-
Poland	1998		P,U	-		most								
Portugal	2002	23	U	-	-	-	-	-	23	-	-	-	-	3-5
Spain	2001	700	P(U)	-		← 10%(<200) →			← 85% (<500) →		←	5%(15)	→	2-5
Sweden	2000	288	U	-	-	100%		-	-	-	-	-	-	-
Switzerland	1998	all	P(U)	-	-	95%(235)	-	-	5%(1)	-	-	-	-	2

Turkey	1998		P	Rural?	-	-	-	← <100% →			-	-	-	3
UK	1998													
E&W	2002	all (26)	P	77%	-	23%		-	-	-	-	-	-	-
Scotland	2000	all (3)	P	>99%	-	0.014%		-	-	-	-	-	-	-
N. Ireland	2002	all domestic charges met from general taxation												
US	2002	145	U	1%	1%	← 35% →		1%	← 33% →		← 29% →			2-4

Notes and sources:

U = utilities; P = population
Australia: Tariff structure applies to year ending 30 June 2001and is summarised from information in WSAA *Facts 2001*, Figure 10.1
Austria: Raw tariff data for 71 municipalities provided by Federal Ministry of the Environment.
Belgium: Information derived from data provided by Belaqua (Brussels). Tariff structures with free allowances per household or per capita designated as IBT.
Canada: Figures refer to % of population sample (=77% of national population) served by each tariff type; see Environment Canada (2001), Annex 2, Tables 2 and 19. 60% of population served by non-flat fee schedules have a fixed minimum charge, which is included in the average prices given in Table 3.5, and 16% of the population served have a minimum volume included (average, weighted by population served, is 11.9 m3/month; see Annex 2, Table 3 of same reference.
France: Old survey data. 1992 Water Law ruled out (with minor exceptions) (i) flat-fee and (ii) const.vol.rate+fixed+min.charge, which are now in decline.
Germany: Information provided by Stadtfeld (2002), BZW, Bonn. Note that at most 5% of utilities apply a linear tariff with no fixed element.
Italy: A very small fixed charge (meter rent) is applied, and often a free minimum allowance as well. The minimum charge, which constitutes the first (lowest-priced) block, charged at the basic rate, is being phased out over four years, from April 2001.
Japan: While Japanese water utilities levy a minimum charge, they generally do not impose a separate fixed charge.
Netherlands: Information from VEWIN (2002b), pp. 5-6. One utility (Wgron) offers domestic consumers a free allowance of 25 or 28 m3/year/household, and another (Brabant Water) gives household consumers in one of its four districts a free allowance of 15m3/year/household.
Portugal: Information applying to 23 larger water supply utilities published in *Tecnologias do Ambiente*, No. 44, Novembro-Dezembro 2001, pp. 38-9.
Spain: Information from Asociacion Espanola de Abastecimientos de Agua y Saneamiento (2002), p. 114.
England & Wales: Population on unmetered and metered tariffs from Office of Water Services (2002a), Table 18.
Scotland: Estimates of numbers metered from Wilson (2002), Water Industry Commission for Scotland.
United Kingdom: In all parts of the UK except Northern Ireland, a choice of domestic metering (and volumetric charging) is available to all households, except those living in new houses (which are generally metered when they are built) and (i) users of garden sprinklers and swimming pools and (ii) certain other selected groups of high-use houses or households, which are also compulsorily metered.
United States: Data derived from Raftelis Financial Consulting (2002), Exhibit 2.

Apartments: There is no necessary consistency in those data embedded in Table 3.4 that reflect the tariff structures by which individual apartments and apartment buildings are charged in different countries. The best presumption is probably that the percentage figures refer, jointly, to single-family houses and apartment buildings. This is not uniformly true, however; in England and Wales, for example, the option of ‘free metering’ (no installation cost is paid) extends to all individual apartment-dwellers.

[*all above references will be found in OECD (2003)*]

ANNEX 2. EFFICIENCY AND EQUITY ASPECTS OF AMENDED IBTS

Table 2.1 lists fuller details of IBTs amended to 'cope' with family size and referred to in paras. 46-52 of the main text.

Table 2.1. Adapting Essential or Basic Water Use in IBTs for Household Water

Country/ Location	Year	Hh[1] size or no. of children: H or C	Block changes in tariff for households in single family houses (SFHs)	Block changes in tariff for apartments	Reference
Spain Barcelona Option 1[2]	2002 (since 1991?)	H	Box 1. for *each* extra person in H>4 blocks 1and 2 *each* $\uparrow$ by 4.5 m3/qtr. (49 lhd) on basic 18m3/qtr (197 l/hold/d).	<u>all households have own meters</u>; thus as for SFHs	Garrido (2002) & <u>www.aguas debarcelona.es</u>
Madrid	2002	H	H>4: if cons. < 30 m3/qtr, 1st block extended from 15 m3/ qtr to actual consumption. H>5: if cons. < 40 m3/qtr, 2nd block extended from 30 m3/qtr to actual consmptn.	<u>1 meter for whole building</u>; H>4 [>5]: if building's aver cons.is 45-90 [>90]m3/qtr/ hh, collective receives an extra 45[30] m3/qtr for each large hh, in its 1st[2nd]block	<u>Garrido (2002)</u> & <u>www.cyii.es</u>
Seville	2002	H	for each extra person in H>4, first block increased by 4 m3/month (131.5 lhd) on basic 16m3/month (526 lhd)	<u>1 meter for whole building</u>; for building, hh size=ratio of Σpopln to Σno.of hh's; as hh size increases by s, 1st block $\uparrow$ by 4s m3/qtr./hh	Garrido (2002)
Murcia	2002	C	<u>5-block system</u>; 1st block is C<3: 0-20 m3/bi-monthly C=3: 0-45 m3/bi-m. C=4,5,6: 0-54,63,72/bi-m. C=>6: *all* cons..is 1st block	?	Garrido (2002) & <u>www.emuasa.es</u>
U.S.A. Los Angeles	since 1995	H	<u>2-block system</u>: SFHs have 1st block of 1209 to 6045 l./ property/d [=f(season,temp. .zone, lot size)]; for H>6 to 9 (>9 to 13), block $\uparrow$ by 186(93) l/prop./d/*person*	None	<u>www.ladwp.com</u>
Greece	since 1993	C	<u>5-block system</u>: For C=0 to 2 1st block is 0-15m3/qtr.;	?	Ninou (2002)

Athens			C=3 ⇨ 0-45 m3/qtr..; each extra child, extra 9 m3/qtr.		
	?	C	C=0–2 ⇨ normal tariff; for C>2, cons. in m3 is ↓ 50%	?	Ninou (2002)
	?	C	C=3,4 (5-7; >7) ⇨ for cons up to 50 (80; 100) m3/qtr, only half is charged	?	Ninou (2002)
Thessa- -loniki					
Larissa					
Malta	1999	H	*Domestic*: 0-11 m3/person/ /4-months (90 lhd) is 85% below standard price. *Social Assistance*[3]: first 5.5 m3/person/4-months is free; next 5.5 m3/person/4-months is 85% subsidised.	?	www.wsc.com.mt
Belgium Flanders	1997	H	First 15 m3/person/yr (41 lhd) is free; all other use is charged at full price.	same as for single family houses	OECD (1999)

Notes*:* 1. Hh = H/hold = Household;
2. Barcelona offers two tariffs to households in SFHs; in Option 2 (two blocks only; not summarised in the table) the first block increases by 9 m3/person/qtr for each extra person in H>4;
3. Those eligible for the Social Assistance water tariff follow the eligibility definition for electricity.

The table shows that the arrangements made, particularly by the **Spanish** and **Greek** water utilities, to accommodate larger families are detailed and sometimes complex. It is thus not easy to compare the systems as described in the table. One way of assessing the equity of the tariff schemes in Spain and elsewhere, however, is to examine the extent to which the low-priced block does actually give a significant saving to low-income households (as compared with the "standard" price). Another way is to calculate the extra "width" of the lower-priced first block in per capita terms as family or household size increases. Table 2.2 sets out the results of the calculations relevant to these two considerations.

Table 2.2. IBT first block allowance in per capita terms as household size increases

Water Utility or Region	Block 1 price as % of standard price[1]	litres/head/day for household consisting of								
		1A	2A	2A+ 1C	2A+ 2C	2A+ 3C	2A+ 4C	2A+ 5C	2A+ 6C	2A+ 7C etc.
Barcelona[2]	42%	197	99	66	49	49	49	49	49	49
Madrid	79%	164	82	55	41	66	55	47	41	37↓
Seville	41%	526	263	175	132	132	132	132	132	132
Murcia	96.5%	329	164	110	82	148	148	148	148	nl[3]
Los Angeles[4]	73%	1209	605	403	302	242	202	199	198	196
Athens	66%	164	82	55	41	99	99	99	99	99
Thessaloniki[5]	65%	164	82	55	41	66	55	47	41	37↓
Malta										

Domestic	15% free	90 45	90 45	90 45	90 45	90 45	90 45	90 45	90 45	90 45
Social Assistance										
Flanders	free	41	41	41	41	41	41	41	41	41

Notes: A = adult, C = child(ren); no equivalisation undertaken in deriving these figures.

1. For each Spanish and Greek utility, the first block unit price is compared to that of the block which includes consumption of 15 m^3/mnth (except for Seville, where the second block starts at 16 m3/mnth. For Spanish utilities the price includes charges for abstraction and sewerage and sewage treatment as well as distribution, supply and any water levy, whenever these are determined by the quantity of water consumed by a household.
2. Data are for Barcelona's Option 1 (see Table 2.1, note 2).
3. nl = no limit; in Murcia a family with 7 or more children has all consumption charged in the 1st block.

These data permit a judgement to be made on two aspects of equity: first, the extent of assistance forthcoming to low-income households from the initial cheaper block and, second, the equality of treatment of different-sized households as regards the marginal per capita width of the first block as household size increases. Such judgements are assembled in comment form in Table 6 in the main text, together with those relating to the extent to which economic and environmental efficiency are not impaired in each tariff by the width and price of the lower-priced blocks. Knowledge of the approximate size of per capita consumption in the countries under consideration is used to help make the latter judgement, which ignores the fact that the *overall* recovery of economic (and environmental?) costs in many of these utilities' tariffs may be well below that required by FCR (as was suggested in para. 25 for **Greece** and **Spain**). The efficiency test being adopted here is whether most households' consumption is such that they 'get clear' of the low-priced blocks before the end of the billing period, and therefore face the "standard" price as the "real" marginal price.[11]

11 We ignore here potentially complex questions regarding IBTs and relating to the effect of future demand uncertainty on the course of a household's *actual* and *expected marginal* prices (and thus of its *actual* demands), as a billing period unfolds.

ANNEX 3. OPERATION OF "FLANDERS-TYPE" HOUSEHOLD TARIFF, INCLUDING A FREE ALLOWANCE PER CAPITA

This Annex assesses the working of a *Flanders-type* domestic tariff, by comparing it with the operation of a traditional two-part tariff generating equal revenue to the utility. The former therefore comprises a fixed service charge paid by each household, a free allowance of water per billing period *per person* and a single volumetric rate paid on all other water consumed. The traditional tariff has the same fixed service charge, no free allowance and a necessarily lower volumetric rate charged for all consumption (once the equal revenue assumption is associated with the reasonable working hypothesis that the difference in the volumetric price has no effect on demands).

Assume initially a 'stylised' economy made up of equal numbers (say, one) of each of four types of households – 1-person and 4-person, both "poor" and "rich". Rich households of any given size are assumed to use one-third more water than poor households, not inconsistent with most estimates of the income elasticity of demand for water (which are significantly less than unity). Economies of scale exist in the consumption of water as household size increases, but in line with observation per capita use falls more slowly the larger the household becomes; to be precise, assume that in both poor and rich households *four* people use only *three* times as much water as a single-person household.

Table 3.1 shows the financial outcomes under the two tariffs, assuming 100 litres/day (l/d) consumed for a year attracts a (volumetric) charge of €100 (the price is thus about €2.74/m3). Because there is just one household of each type, the utility's total revenue from the *traditional* tariff (**I**) is 170+220 +470+ 620, = €1480/year. Even though a rich household of any given size uses one-third (33%) more water than the corresponding poor household, the rich households' bills are only 29% (1-person) and 32% (4-person) more than those of the poor households. This is because all households pay the same standing charge, with that standing charge (in a relative sense) being less important the larger the household.

Table 3.1. Comparison of Traditional and "Flanders-type" Tariff: Example 1

HOUSEHOLD type (size and income level)	Water use (l./day)	free/ paid water	Standing Charge (€/yr.)	Volum -etric payment (€/yr.)	Total Water bill (€/yr.)	Rich/ poor bill ratio	Total bill per capita (€/yr.)
I. Two-part tariff with standing charge (no free allowance)							
1-person, poor	150	0/150	20	150	170		170
1-person, rich	200	0/200	20	200	220	1.29	220
4-person, poor	450	0/450	20	450	470		117.50
4-person, rich	600	0/600	20	600	620	1.32	155
II. Two part tariff with (i) standing charge, (ii) free allowance per capita and (iii) compensating increase in volumetric price							
1-person, poor	150	40/110	20	154	174		174
1-person, rich	200	40/160	20	224	244	1.40	244
4-person, poor	450	160/290	20	406	426		106.50
4-person, rich	600	160/440	20	616	636	1.49	159

Assume now the Flanders-style tariff (**II**) has the same standing charge as **I** and a free allowance of 40 litres/day per capita. This means the utility's €1400/year revenue from the volumetric payment has to be raised on 365 m^3 (1000 litres/day x 365) rather than 511 m^3 (1400 x 365), so the unit price has to be increased by 40%. Tariff **II** benefits the poor households more, since rich households now pay 40% or 49% more (1- or 4-person) than poor households. With most of the revenue now coming from the non-free units, the rich/poor water bills ratio (last column but one) approaches the ratio of the quantity of non-basic water used by rich as against poor households. It does not quite reach that ratio because of the continuing effect of the standing charge.

However, while larger households benefit from tariff **II** in absolute terms smaller households actually suffer (final column of Table 3.1). This arises because the free allowance per capita is the same irrespective of household size, thus generating benefits to households enjoying economies of scale in consumption. Given the equal-overall-revenue assumption these benefits have to be paid for by those who don't enjoy either any (or so many) scale economies: the smaller households, both rich and poor.

The importance of this last point is shown in example 2 (shown in Table 3.2). Here, the economy is markedly different, with the poor concentrated in small households and the rich in large. Assume then, that there are just two households – one small and poor; the other large and rich, but now the consumption economies of scale are slightly greater – a 4-person household is now assumed to use 2.8 times as much (rather than three times) than the single person with the same income level. The richer, larger household thus consumes 150 x 4/3 x 2.8 = 560 litres/day, the two factors – income and scale economies – determining the absolute rich/poor difference.

Table 3.2. Comparison of Traditional and "Flanders-type" Tariff: Example 2

Household type (size and income level)	Water use (l./day)	free/ paid water	Standing Charge (€/yr.)	Volum -etric payment (€/yr.)	Total Water Bill (€/yr.)	Rich/ Poor Bill ratio	Total bill per capita (€/yr.)
I. Two-part tariff with standing charge (no free allowance)							
1-person, poor	150	0/150	20	150	170		170
4-person, rich	560	0/560	20	560	580	3.41	145
II. Two-part tariff with (i) standing charge, (ii) free allowance per capita and (iii) compensating increase in volumetric price							
1-person, poor	150	40/110	20	153.14	173.14		173.14
4-person, rich	560	160/400	20	556.86	576.86	3.33	144.22

With the traditional tariff (I), the volumetric price of water is the same as in example 1, so that €710/year is received by the utility from an overall consumption of 710 l./d. After the switch to the Flanders-type tariff, however, and assuming unchanged consumption by both households, €710 needs to be raised on the base of only 510 l./d, since 200 l./d is now 'free'. This mean a unit price increase of 36.36% (710/510), with the result that the bill of the poor household increases while that of the rich household falls. *So here, the richer household has actually gained from the introduction of the Flanders tariff, while the poorer one has lost, both absolutely and relatively.*

Why is this? Essentially, the polarisation of poverty (concentrated in the smaller households), the smallness of the income effect on consumption and the size of the consumption scale economies have combined to generate what is, initially, a counterintuitive result. The crucial point in example 2 is that the per capita consumption of the rich household is less than that of the poor one. This of course *must* then mean that the introduction of an equal free allowance per capita introduces relative benefits for the richer household.

Economies of scale in consumption are, however, unlikely in practice to be so great as to outweigh the income effects on consumption (and thus unlikely to generate a per capita consumption figure for richer households lower than that for those on low incomes). Nevertheless, the gains in practice from the introduction of a Flanders-type tariff should be seen as dependent on the sizes of empirical magnitudes, rather than deriving from "pure theory" alone. Such magnitudes would, of course, need to be carefully checked before the introduction of such a tariff.

However, were the magnitudes to give such a 'perverse' result, a very simple solution is at hand: to incorporate the economies of scale into the free allowances for different-sized households, so the per capita allowance fell as household size increased. Homogeneity in water use would indicate nationally uniform figures could be used. *Then, the poor could never lose from such a tariff.*