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Water pricing in Ireland: A techno-economic and political assessment

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Abstract

Ireland is one of a very small number of countries in the world which do not charge for domestic drinking water supply. Recent developments have indicated that the reintroduction of domestic charges in Ireland is being planned. Ireland has a daily average water usage per person of around 150 litres and an increasing demand for clean water reserves and talks of imminent water metering and charges. This paper investigates the current status of water resources and water supply in Ireland, and assesses the technical, economic and political challenges involved with the reintroduction of domestic water charges accompanied by the implementation of a domestic metering programme. The study highlights the need for a system of water charging and metering in Ireland to ensure more careful management of water resources, to promote more sustainable use of water, and to provide a more stable revenue stream for local authorities.

Keywords: Water, pricing, treatment, supply, Ireland

1. Introduction

Historically, freshwater has been considered globally as a never-ending resource. In reality, with rising world population and increased pollution, the availability of freshwater has been reducing steadily and water scarcities and droughts are becoming more frequent and widespread. There is a need for new policies and practices in order to conserve water and give it the value that it deserves. Efficient ways to reduce water use need to be researched and implemented. A recent study claimed that water use in the European Union (EU) could be reduced by about 40% by using water efficiency techniques such as water saving technologies, irrigation management and compulsory water metering [1]. A number of countries have applied policies and practices that achieve these goals, and Ireland needs to join their ranks.

Water pricing affects the management of water resource and their effective use. This principle appears in the words "Water has an economic value in all its competing uses and should be recognised as an economic good", a statement from the International Conference on Water and the Environment (ICWE), held in Dublin in 1992 [2]. Yet, there are several different interpretations of this statement and the implications. For example, Garc á [3] believes that the view of water as an economic good means that it has an economic value, and therefore charges must be levied for its use, while Savenije and van der Zaag [4] argue that the idea of considering water as an economic good involves making integrated choices, not about determining the 'right price of water' On the other hand, human rights activists and some Non-Governmental Organisations (NGOs) argue that water is a human right and therefore should be available to all free of charge [4].

The definitions of water pricing may differ, but its key objectives remain more or less the same. Howe [5] defines water price as "the

market price that would affect a rational user's decisions concerning their pattern of water use, including quantities of water and water related investments", while Ayoo and Horbulyk [6] describe water pricing as "a means of influencing the processes by which water is provided and used, and as a means of cost recovery or revenue generation". Qdais and Nassay [7] define the objectives of water pricing very well as one or a combination of the following: 1) To allocate resources efficiently between sectors within the economy and within the sector itself; 2) To satisfy the consideration of equity or the ability to pay of consumers, especially the poor; 3) To raise revenues to meet financial requirements of providing the service; 4) To subsidise special areas to encourage development; and 5) To take into account political consideration for a special area or subsector of the population. Water policies generally contain some variation or combination or the above objectives, depending on the particular goals that policy hopes to achieve, such as conservation, cost recovery, efficiency, fairness, etc.

Currently, Ireland is unique in Europe in that it does not charge for domestic water services, the cost of which is covered by general taxation. Increasing water shortages, leaking infrastructure and massive revenue shortfalls in the water supply sector have fuelled debate that the reintroduction of domestic water charges in Ireland is now inevitable and the government plan to begin charges in 2014. This paper aims to assess the situation, challenges and prospects of water supply in Ireland and the implementation of charging and metering in the domestic sector. The objectives, policies, and benefits of water pricing in Ireland will be investigated, and the issues involved in reintroducing domestic water charges and metering in Ireland will be explored from a technical, economic and political point of view. Conclusions and recommendations

will be put forward and a path for the future suggested. The paper will be approached mainly from an engineering perspective.

2. Current status of Ireland's water resources and pricing

2.1 Water resources in Ireland

Ireland has one of the highest rates of water availability in the world. Average annual precipitation in Ireland is between 750 – 1,250 mm [8] and actual renewable water resources are about 13,000 m^3 per capita per annum [9]. By comparison, France's actual renewable water resources are 3,371 m^3 while Israel's are just 255 m^3 per capita per annum.

Between 1.6 and 1.9 billion litres of treated water are produced in Ireland every day [10, 11]. Of this total, roughly 60% is consumed by the domestic sector and 40% by the non-domestic sector (industry, agriculture, etc.). According to a recent environmental protection agency (EPA) report, the vast majority of drinking water in Ireland is abstracted from surface water (81.9%), with a much smaller fraction coming from groundwater (10.3%) and springs (7.8%) [12]. The supply of water in Ireland is a fragmented system. There are numerous different ways in which water is supplied to the domestic and non-domestic sectors, depending on local circumstances and authorities. These include public water supplies (84.8%), public group water schemes (2.6%, by a contractor on behalf of a local authority), private group water schemes (5.2%), small private supplies (0.7%), and exempted supplies (6.7%, These are supplies serving fewer than 50 persons and not supplying water as part of a public or commercial activity. The majority of these supplies are private wells serving individual houses) [12].

Local authorities are responsible for supplying water to the vast majority of the households and businesses in Ireland. Since there are 34 different local authorities supplying 952 different public water supply

zones through 22,000 kilometres of mains, and there are over 5,500 group water schemes in the country [11], it is clear that developing a coordinated approach is desirable.

The demand for treated water has been increasing steadily in Ireland for many years as a result of rising population and because of the period of prosperity and rapid economic growth Ireland experienced between 1995 and 2007, the 'Celtic Tiger' period. During this, government water policies and water management strategies reflected the fact that water was seen as a free and renewable resource. There was no encouragement to conserve water resources in any way. The thousands of houses built during the Irish housing boom were not required to be fitted with water saving equipment and the provision of new water supply infrastructure could not keep up with the pace of construction.

As a result, the domestic per capita consumption (PCC) of water in Ireland is high relative to other countries in Europe and is set to continue rising. The PCC of water in Ireland was between 130-139 l/p.d (litres per person per day) in 2000, and will be 146-158 l/p.d in 2018 [13]. Currently, it is believed that the PCC in the Greater Dublin Area is 150 l/p.d [14], indicating that the projections of the National Water Study seem to be on track. Figure 1 shows the PCC of various European countries. From this, it may be seen that Ireland is on the higher end of the scale when it comes to domestic PCC, despite its small size and population relative to some other, larger countries with much lower PCC such as Germany.

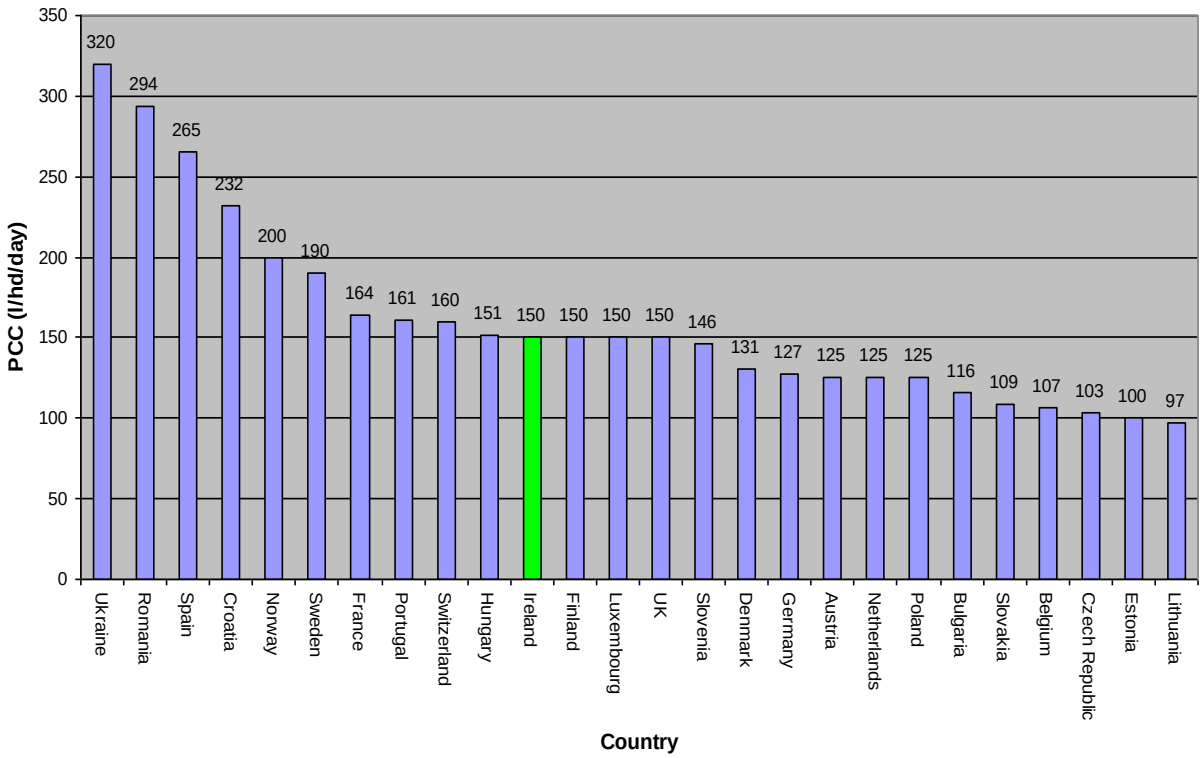

Figure 1: Comparison of PCCs of various European countries [15]

Over the past decade, the Irish government has invested €4.6 billion in water and wastewater services – €3.7 billion through the Water Services Investment Programmes, along with €900 million of local authority resources [11]. The primary objectives of the Water Services Investment Programmes are to reach compliance with EU drinking and wastewater standards in the form of the Water Framework Directive (WFD, i.e. Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, http://ec.europa.eu/environment/water/index_en.htm), and to expand drinking water and wastewater treatment facilities in response to increased water demand and wastewater production from a rising population. Another objective of the Programmes is to replace thousands of kilometres of ageing and leaking water mains around the country, some mains being over 200 years old.

Currently about 1% of the water mains in Ireland are being replaced annually. This is slow in comparison to the replacement rate in Europe where 3% of the water mains are replaced annually [16].

Water that is lost in the distribution system before it reaches the customer is called unaccounted-for-water (UFW). These losses can include water lost through leaking pipes or illegal connections. Ireland has a high level of UFW (34%); much worse than that of other countries, such as Germany (6.8%), Denmark (10%), Finland (15%), UK (22%), France (26%) and Italy (28%) [17]. In fact, the water loss of 34% appears to be a significant underestimation because Irish studies show that on average, 43% of all treated water is lost before it reaches the customer [18]. UFW levels vary from authority to authority, from under 17% in Limerick City Council to nearly 59% in Roscommon County Council. This means that in Roscommon, only 41% of the water pumped through the distribution system reaches the end consumer. Figure 2 summarises levels of UFW for each local authority in Ireland. It is believed that leakage in the Dublin Area is about 60 litres per property per day. This situation is clearly not sustainable. To solve this problem, Ireland needs to recognise the value of water and develop a strategy to treat water as an economic good. That strategy is water pricing.

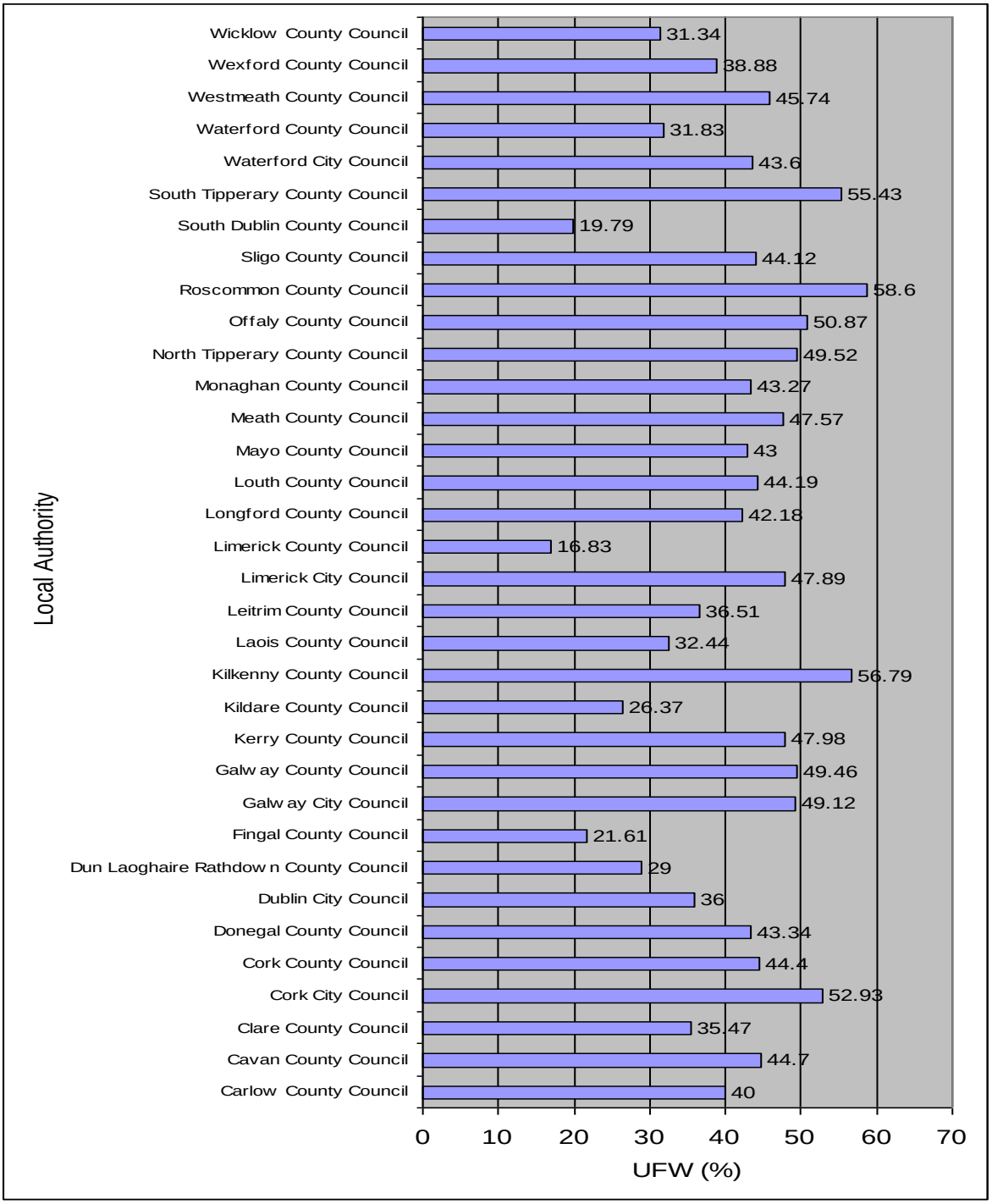

Figure 2: UFW in each local authority in Ireland [10]

2.2 Water pricing in Ireland

The price of water varies greatly around the globe, as does the pricing structure or tariff used depending on particular pricing policies, water management objectives and local, economic or political considerations.

Figure 3 shows domestic water prices in various places around the world [19] and the large variations between them. The striking feature lies in the "free" domestic water service in Ireland.

Domestic water charges were firstly abolished in Ireland in 1977; but were reintroduced with little success under the 1983 Local Government (Financial Provisions) Act [20]. Thereafter, water charges were abolished again in 1997 and integrated into central taxation (more specifically through a road tax) after a general election in 1996. Although this was welcomed by the general public at the time, many experts and studies have argued that this move has had severe adverse effects. Scott [21] suggests that, without metered charging, a generation of people is growing up without realising that water is expensive to deliver. With excessive water use not discouraged, Ireland is climbing up the marginal cost curve more quickly than necessary, owing to wastage by customers and suppliers [21].

Another report - by the Commission on Taxation - argues that because households in Ireland do not pay for water, there is no incentive to conserve. Thus, Ireland's consumption per capita is around 30% more than consumption in countries that charge according to amount used [22]. This leads to a heavier burden on treatment plants and supplies, which need to be constantly improved at huge cost with major engineering projects. The Commission's report also finds that consumers who use water sparingly are in effect subsidising those who use water wastefully. An OECD Environmental Review of Ireland [23] further notes that the absence of charging and metering not only gives households zero incentive to save, but creates inequalities between households and compounds water users' low awareness of the amount of water they use and the costs involved in supplying that water.

Figure 3: World water prices [19]

Charges continue to be levied on the non-domestic sector in Ireland. Where a building has both domestic and non-domestic purpose (e.g. a pub or shop with a residence overhead), a domestic allowance of 450 litres per day is allowed. Individual local authorities set their own rates for services provided each year. For example, the consolidated charge for water and effluent services in Dublin City Council for 2010 is €1.72 /m³ (€1.07 for water supply and €0.65 for effluent). The Department of the Environment, Heritage and Local Government (DOEHLG) pays the full cost of public water supply to the domestic sector through the Local Government Fund and the non-domestic sector is supposed to cover the extra capital and operational costs it incurs through collection of non-domestic charges.

Local authorities borrow to cover the costs of providing water to the non-domestic sector and then repay the loan when charges are collected. Loan charges or interest incurred as a result of borrowing are integrated into the charges levied. Loan charges for Dublin City Council amounted to about €2.7 million in 2010. Local authorities are not permitted to make profit through charging non-domestic customers. Any over or under collection of costs is factored into the consolidated charge for the following year. Money from the Local Government Fund is distributed between the 34 local authorities in the form of a block grant. Each local authority can then choose to appropriate funds as it sees fit. Local authorities are coming under increasing pressure as the amount received in the block grant has been reducing steadily in recent years. In 2010, 15% of local government expenditure was appropriated to water services [10].

The method by which the Irish government finances the costs of water supply in Ireland is unsustainable and cannot continue. In 2010, Local authority current expenditure on water services amounted to €722

million and income from non domestic charges, etc. came to €269 million [10]. Therefore, the operational cost of providing water services to the domestic sector in 2010 was €453 million. The funds provided through the Local Government Fund are not sufficient to cover the full costs of domestic water and wastewater services in Ireland. A new source of revenue is required if these costs are to be met. The reintroduction of domestic water charges is one such source.

2.3 The reintroduction of domestic water charges in Ireland

A number of policy reviews, reports, economists and engineers have called for the reintroduction of water metering and charging in Ireland since they were abolished in 1997. Recently, there has been a renewed push to reintroduce domestic charges as a way of reducing the cost burden of water supply on central taxation by providing a new revenue stream at a time of economic hardship. The Report of the Special Group on Public Service Numbers and Expenditure Programmes, the McCarthy report [24], suggested that all local authorities should be self financing and that charging for domestic water supply would be "consistent with this approach". Both the Irish Commission on Taxation [22] and the OECD review report [23] recommended the reintroduction of domestic water charges as a means of providing better incentives to conserve water and use it efficiently. The Report of the Local Government Efficiency Review Group [10] also advocates these views, stating that the Group endorses both the proposal for an annual local tax and the reintroduction of domestic water charges, and suggests that they be implemented as soon as possible.

But, the reintroduction of domestic water charges is unpopular with the public, with a recent survey finding that two out of three people are against water charges [25]. Although a government official confirmed in

2008 that water charges were not on the agenda during the lifetime of that government (Irish Times, 8th August 2008), the Renewed Programme for Government published on 10th October 2009 contained a statement under 'Local Taxation and Charges' which called for the reintroduction of a domestic water charge that is fair, significantly reduces waste and is easily applied.

The method of charging envisaged by the government is based on a free allocation of water to every household with charges in excess of the allowance. Local authorities are expected to set their own rates. The Water Services Investment Programme 2010-2012 [11] predicts that the installation of meters would begin during 2011 and would be accompanied by other demand reduction measures. The recently published National Recovery Plan 2011-2014 has pledged to introduce water metering and billing by 2014, which would start to reduce the level of general government investment required and lead to significant capital expenditure savings [26].

Currently in Ireland, because the water running from the taps is free, people have no idea of the cost or consequences of their actions. If water charges had been in place, those same people would certainly not have left their taps running without use, as every drop wasted would have cost them money. In any case, it seems it is only a matter of time before domestic charges and metering are introduced in Ireland. Metering and charges cannot simply be brought in overnight. There are many aspects, issues and difficulties involved.

3. Technical aspects of water pricing in Ireland

Potable water is a product, which must be sourced from nature, treated to remove dirt, pollutants and micro-organisms, and distributed through a

network system of pipelines to the end consumer. All this needs investment, like any other commercial or industrial product.

Raw water must firstly be sourced from a river, stream, lake or aquifer, or captured and impounded behind a dam/embankment, where it can then be abstracted for treatment. The water is then subjected to the processes of coagulation and flocculation, sedimentation, filtration and disinfection to achieve the high standard of water quality before it is ready to be supplied as potable water. Dedicated infrastructure needs to be built in order to carry out these treatment processes in treatment plants. In addition, infrastructure of dams and embankments (to impound water), reservoirs (to store water before distribution) and pipelines and water mains (to distribute the potable water to consumers) also need to be constructed.

In addition to this complex matter, the introduction of charging for domestic water supply through metering is a huge undertaking from an infrastructure and engineering point of view and brings up a range of issues that will have to be confronted.

According to the most recent statistics, there are 1.5 million households in the State [27]. Since 87.5% of the households rely on the public water supply system, almost 1.3 million meters should be installed. Most local authorities plan to install a matrix box or a boundary box, into which a meter can be slotted at a later time, with every new build or maintenance of an existing stopcock. Dublin City Council has already installed 30,000 matrix boxes in this way. Nevertheless, this approach is not really feasible due to the substantial amount of time it would take to install the meters.

The most likely approach and the one currently being considered by government involves an ‘all in’ strategy, where a massive engineering project would be undertaken with the aim of installing water meters (see

Fig. 4) in every household on the public supply as soon as possible. Such a project would be an immense logistical and infrastructural task in terms of scope, schedule and budget and would require careful planning and implementation. The scope of a domestic metering project would include carrying out all surveys, civil works and performance testing involved with the installation of meters, the procurement of materials and labour, and possibly the maintenance and operation of the meter network. By most estimates, metering of the domestic sector is likely to take 3–5 years to implement. In addition, detecting leakage along with the meters network maintenance is another engineering matter requiring investment.

Figure 4: Installation of a water meter

Anyway, Ireland is in a strong position to implement domestic water metering from an engineering point of view. Firstly, the metering and charging of the non-domestic sector has been successfully rolled out, so there is a substantial amount of experience in the field of metering which could be applied to the domestic programme. Secondly, a huge number of construction workers are available to work as a result of the

construction industry downturn, so there is a workforce present and ready for training. This will provide experienced labourers for the task of meter installation.

The National Water Authority would be a state body. It would be responsible on a national level for the planning and construction of a meter network, in both technical and practical respects. This authority would co-ordinate with contractors and local authorities to install meters. It would oversee the testing, operation and maintenance of water meters and of the water supply network by local authorities. As installation of meters progressed, the National Water Authority would become responsible for the co-ordination, consolidation and administration of billing for water use by local authorities through a centralised billing system.

4. Economic aspects of water pricing in Ireland

An economic analysis of water use in Ireland shows that the shortfall of local authority receipts against expenditures in 2010 rose to €453 million [11]. With the shortfall between expenditures and receipts increasing year on year, and less funding available to the local authorities annually through the local government fund, it is clear that taxation alone is not sufficient to cover the costs of Ireland's water and wastewater services. Thus, to pay for the water infrastructure, Ireland must charge a fair price for the water supplied.

While metering provides network management benefits and modifies consumption patterns, water charges provide a revenue stream directly to the service provider. The National Recovery Plan [26] identifies annual savings of up to €500 million in operating costs due to the revenue collected from domestic water charges. Another source has

stated that the reintroduction of domestic charges could raise annual revenue of €450 million [22].

In addition to savings accruing from revenue collection, operational and capital savings resulting from reduced water demand (due to the water charging) have been identified. A detailed analysis of estimation of the water metering indicates that it could be expected to save between €780 and €980 million over a twenty year timeframe [10].

Although water pricing is the most appropriate solution to Ireland's water services costs, cost recovery is not the only desired objective. Other pricing objectives may include efficiency, equity, institutional stability, demand management, and conservation, etc. In setting a water pricing policy, the policy maker must identify the pricing objective or objectives and structure pricing tariffs accordingly. The Irish Government's planned pricing structure, outlined in the 2009 Renewed Programme for Government and reiterated in the 2010 National Recovery Plan, states that the charging system would be based on "a system where households are allocated a free basic allowance, with charging only for water use in excess of this allowance" [11]. This is to emphasize the need for responsible choice, and to encourage economic use by householders.

Although the government is in favour of giving every household in Ireland a free allocation of water, engineers and economists oppose this approach for a number of reasons. Murray [28] states that free water is a burden on the tax payer, and a subsidy for the wealthy. Somebody has to pay for free allocations of water; they are not really free. Tol [29] describes the charging system envisioned as a bilinear tax, and argues that because a large amount of the water a household will use is untaxed, there will be no incentive to conserve water below the free allowance. If the volume of free water a household receives is set too high, demand will not be reduced and water will not be conserved. It is possible that many

households will only use water up to the free allocation, and the money invested in installing meters in those households will never be recouped. But this is to ignore the possibility that rising incomes may create a sense of entitlement to more water. More cynically, one might suggest that most people will lose sight of the limit by reason of habit.

Other problems arise. If a system based on free allocations of water is introduced, detailed information about the number of people living in each household and the number of people per connection would need to be collected. A system that allocates the same volume of water to each household would be unfair. It is unreasonable that a two person household would be allocated the same volume of water as a six person household. The allocation of free water would need to be based on the number of people using a supply.

A number of other pricing structures have been put forward. A report by the Shannon Protection Alliance [14] supports a variation of the free water allocation favoured by Government, stating that every person should be entitled to a reasonable amount of water at no cost for the purposes of washing, drinking, cooking and cleaning, but proposes that the free allocation could vary seasonally. The report suggests that the free allocation could vary depending on the supply available at that time. The report also suggests higher charges for peak time use of water. This is an interesting strategy, and warrants further investigation.

Convery [30] advocates the use of increasing block tariffs, where consumption is charged at a very low rate for the first block of 50 litres per person, rising sharply with each block of 50 litres above that. This approach, it is stated, is the fairest and the most effective at reducing consumption.

The Commission on Taxation [22] recommended that domestic charging should be introduced with a flat rate charge and change to a

volumetric charge once meters were installed. The introduction of a flat rate charge is an approach favoured by Murray [31], who proposes two bands of flat charges based on household occupancy, i.e. €500 for the upper band (high occupancy) and €300 for the lower band (low occupancy). Using this structure, customers would have to specify why they were eligible for the lower band, and would otherwise be charged at the higher rate.

It is generally agreed that two-part pricing structures are the way forward in modern water policy and are the most effective tools for achieving a compromise in pricing objectives, in spite of the disagreement about how the fixed and volumetric portions of a two-part charge should be approached [3-5,32,33]. The most important pricing objectives in Ireland's pricing policy should be cost recovery, efficiency and equity. Keeping these objectives in mind, the current study recommends the introduction of a two-part charging structure in Ireland, featuring a fixed charge related to volume consumed and a volumetric charge based on increasing block rates.

The fixed charge would be proportional to the average domestic consumption of water in each particular local authority and would satisfy the objectives of cost recovery and efficiency, with the revenue collected being proportional to the amount of treated water produced and therefore the cost of producing that water. The volumetric charge would be based on an increasing block rate tariff, with the first volume, say 50 litres per person per day (l/p/d) as the basic standard for human needs, being free or especially cheap, and increasing charges for the next four 50 l/p.d blocks after that, i.e. 50-100 l/p.d, 100-150 l/p.d, 150-200 l/p.d, and 200+ l/p.d. The charge for each block would be a sharp increase over the previous block, especially for the two highest blocks, and would satisfy the efficiency objective by influencing people to conserve. Supplying the first

block free of charge or at very low cost would go some way towards satisfying the equity objective, but further relief would need to be provided through social welfare, as proposed in the next section. Using this recommended charging structure would satisfy the Government's promise to provide a free allocation of water and would do so in a fair, efficient and economically viable manner.

5. Political aspects of water pricing in Ireland

The Water Framework Directive (WFD) must be applied by Irish law as deemed appropriate by the Irish government. Article 9 of the WFD concerns the recovery of costs for water services. The article requires that the member states shall take into account the principle of costs recovery of water services, including environmental and resource costs. The introduction of domestic water charges would ensure that Ireland is in full compliance with the WFD.

Section 105 (1) of the Water Services Act 2007 specifically prohibits the levying of charges on domestic water supply. In order for provisions to be made for the reintroduction of domestic water charges, amendments to this statute are necessary. The Irish government must secure these amendments before any action can be taken with regard to water metering and charging. Actually, the issue of charges for water supply has been a political issue in Ireland since they were first abolished in 1977. During the reintroduction of charges in 1983, the Dublin anti-water charges campaign of 1994-1997, the abolition of charges again in 1997, and recently because of the planned reintroduction of domestic charges by 2014, this issue has retained its vigour.

Most of the Irish political parties support water charges; including Fianna Fáil, Fine Gael, and the Green Party, who recognise that the reintroduction of water charges will give Local Government greater

flexibility in how it spends and raises money and encourage householders to conserve water [34]. The Labour Party was initially undecided about the issue of water charges, but the Labour Party leader has recently expressed the Party's support for water charges provided they were introduced with metering (Irish Times, 12th October 2010). On the other hand, several political parties such as Sinn Féin, the Socialist Party and the Workers Party oppose the reintroduction of water charges, stating that the introduction is simply a revenue raising scheme to pay back Ireland's debts from the banking crisis, that charges will disproportionally impact low and middle income households, and that it is the first step in privatising the water supply system.

Inevitably with the introduction of water charges, some households will not be able to pay or will struggle to pay for the water they use, no matter how much they cut down. As with the introduction of any charge, tax or levy, there is a need to protect the less well off and the more vulnerable pockets of society. This can and should be done through the social welfare system in the form of increased tax credits, renewable water credits or waiver schemes.

The issues of double taxation and regressivity must also be addressed. Double taxation is a politically sensitive topic at the moment, as most people see the introduction of water charges as a second tax on a service they already pay for through central taxation. Compounding the negative reaction to water charges is the perception that it is a regressive tax, i.e. one that will impose a greater burden on the poor than on the rich. Figure 5 below illustrates this point, showing the total water bill as a proportion of total income in the OECD [35].

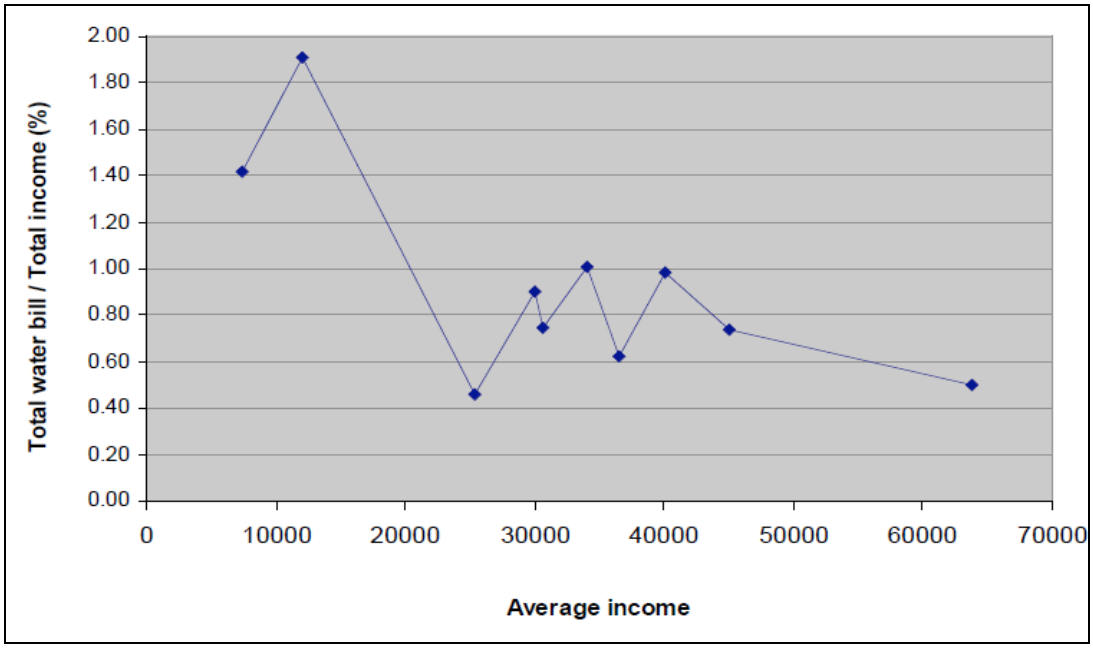

Figure 5: Total water bill vs. total income in the OECD

Price increases in any charge are notoriously unpopular and difficult to implement politically. Gurr á [36] states that water has been significantly under-priced, so price hikes can pose a political challenge. As a result of this political resistance, the consolidated charges levied in the non-domestic sector, for example, are in many cases not a reflection of the true costs of supplying water and wastewater services to customers. In 2010, the consolidated charge in Dublin City Council was €1.72/m^3, whereas the true cost of water supply and wastewater treatment was closer to €2/m^3. This phenomenon may help to explain (ignoring collection rates) why full cost recovery in water services is so difficult to achieve and why it is rarely, if ever, accomplished.

No matter what form of domestic pricing policy is introduced in Ireland, it is crucial that the enforcement of that policy and the legislation behind it are strictly and effectively implemented. Even if pricing policies are well designed, their implementation may be stunted by weak governance systems [36]. Ireland may be going through a period of political change, but the challenge of funding and operating our water

supply network is constant and will need to be resolved, no matter what political background exists.

6. Discussion and conclusions

It has already been established in this study that the current water services system in Ireland is unsustainable. Within the next ten years the population of Ireland is predicted to reach 5.3 million, with 2 million people living in the Greater Dublin Area, 1.5 million of whom will be residing in Dublin City. By 2036, it is thought that there will be 5.8 million people living in Ireland and by 2100, the population is estimated to hit almost 8 million [16]. At this rate of population growth, the provision of new capacity will be unable to keep up with demand and the already struggling water supply system will be overwhelmed. It is not clear that increasing water production capacity by the construction or improvement of treatment plants is in itself sufficient to meet demand, but it is certainly neither sustainable nor practical.

The reintroduction of domestic charges and the implementation of a metering programme are necessary. It is known that Ireland has plenty of available water and is not water stressed, but the water resources need to be managed more carefully so that they can be used efficiently. This study has highlighted the many benefits of reintroducing domestic water charges with metering in Ireland, which include:

- Encouraging the conservation of water in the household by influencing consumers to reduce their consumption.
- Promoting the sustainable use of water by providing the incentive to eliminate wasteful practices.
- Putting the onus on customers (consumers) for preventing leakage on their properties, as any water lost between the meter

and the tap will cost customers money. This relates the idea of consumption to value for money.

- The reduction in levels of unaccounted for water through better network management and leakage control in the distribution system.
- Increased system capacity through reduced demand and less water wastage.
- Improved capacity of the service provider to manage the network, reducing operational and asset replacement costs.
- Making the service provider more accountable for the quality of service and quality of water supplied.
- Billing based on actual usage of water, so that no customer is subsidising another's irresponsible use of water.
- Providing a revenue stream for local authorities, therefore diminishing reliance on the Local Government Fund and releasing resources.

Water metering and charging will play a central role in the management of Ireland's water resources, but they should not be the only technique used. Water metering and charging should work in tandem with water saving technologies, such as dual flush toilets, water efficient appliances and rainwater harvesting. Grants and tax reliefs might be an option to encourage use of these technologies to reduce consumption of water. The option of integrating water bills with bills for electricity and gas should also be investigated to seek the possibility of linking the reading of water, electricity and gas meters through the use of smart metering.

Of course, there are a few drawbacks and negative impacts involved with the reintroduction of metering and charging in Ireland.

They are not insurmountable problems. The reduced demand for water following the implementation of metering and the reduction in leakage levels would mean less revenue for local authorities. Because charges are levied volumetrically, less water consumption would mean less revenue collected. The loss in revenue would lead to a proposal of increasing the water pricing as described in a polynomial relationship between consumption of water (Y) and its price (φ) [37].

$$Y = a\varphi^{b}$$

Where, *a* is constant and *b* is a coefficient which measures the elasticity of water demand. Empirical analysis has shown that the price elasticity of demand for water in households is between -0.3 and -0.7. Obviously, integrated effects of water pricing and total water consumption, i.e. the sale of water, should be further investigated.

A more pressing issue should be the possibility that the introduction of a charge on the domestic sector may push up charges on the non-domestic sector by 15-20% [28]. This needs further investigation, but it is worth noting that the consolidated charges levied on the non-domestic sector in Ireland are some of the lowest in Europe, and would likely still be below average even with the increase. The non-domestic sector has also made increased use of water-saving technologies to reduce costs, and will continue to do so.

One of the main arguments against domestic metering and charging in Ireland is the issue of privatisation, as some political parties have argued. Many see the reintroduction of charges and metering as a move towards the privatisation of the water system. The current arrangement with regard to non-domestic water services prohibits local authorities from making any profit in the collection of charges. There is no reason why this avoidance of profit should end if and when domestic charging is

introduced. Nonetheless, the National Parliament can make legal provision to ensure that the privatisation of water services cannot occur.

Finally, the biggest difficulty in introducing water metering and pricing may be Ireland's present economic climate. Water charges will be very unpopular because of financial hardships and reduced incomes across the board. This negative attitude is compounded by a lack of information regarding water supply in Ireland. People simply are not aware of how much water they use, how much water is being lost in the system, how much the water they take for granted costs to produce and distribute, etc. Educating people about the current situation may help change people's perception regarding water supply in this country and encourage more support for domestic metering and charging.

The benefits of introducing domestic metering and charging in Ireland far outweigh the drawbacks, and the charging and metering of water supply for the domestic sector should be implemented. In a land of soft rain, money is still hard cash. Water is not a free good.

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