PN-ABC-991

# Policy Brief

# FULL-COST WATER AND WASTE PRICING: AVOIDING LOW-LEVEL EQUILIBRIUM TRAPS ON THE ISLAND OF PHUKET, THAILAND

Direk Patmasiriwat et al./TDRI
J.R. Deshazo/HHD

*Water is an increasingly scarce resource because of a high rate of growth in demand and dwindling supplies.*

Consumers treat water as both a private good for consumption and a public good for sewerage and waste disposal. Governments provide water and wastewater services because both exhibit economies of scale and the latter is a public good. Historically, however, governments have failed to provide services that are financially sustainable and economically efficient. A common cause of these problems is supply-side planning in which officials consider neither the full costs nor the benefits of these services when making investment, production, and pricing decisions.

The full cost of service provision includes production costs (the costs of fuel, capital, and labor), user costs (the costs of foregone future use), and external costs (the costs associated with consumption and production externalities). There are two different rules for setting prices that capture these costs. For a private good like water provision, the marginal benefits of water consumption should equal the marginal cost of provision. This rule ensures that both the service is financially sustainable and those consumers who value water the most are the first to enjoy it. For a public good like wastewater treatment, the sum of consumers' marginal benefits should equal the marginal cost of provision. This rule also ensures that the service is financially sustainable and that water flows to its highest value use.

## Potential Low-Level Equilibrium Traps on Phuket

Using the Island of Phuket, we illustrate how these economic principles can be used to enhance the provision of water and wastewater services and, thus, the potential for economic growth. Often called the Pearl of the Indian Ocean, Phuket is a premier tourist destination with great promise and a rapidly growing economy. As in many dynamic urban areas, demand for water and wastewater services exceeds the Government's current supply capacity. Our findings for Phuket suggest that the Island's economic growth may be retarded if investment and pricing policies are not reformed. Based on these findings, we recommend several changes in current policies.

If economic principles are not followed, Phuket's Provincial Government may face two low-level equilibrium traps that will severely retard its future growth. The first low-level equilibrium trap arises from the absence of full-cost pricing for water services. If water prices are set below the cost of provision, water utilities will experience a shortfall in revenues causing the quality of their water service to decline. Consumers may respond to this decline in quality by turning to alternative water supply arrangements (by investing in water wells or purchasing from water vendors), thereby decreasing their demand for piped water. This, in turn, means even less revenue for the cash-starved water utilities whose only choice is to further

* *Donald Alford, Hansa Vathananukij, Areeya Boon-Long*

reduce the quality and reliability of the service. This downward spiral damages not only the public utility, but also the consumers who must turn to other alternatives that have both higher individual and environmental costs.

The second potential low-equilibrium trap results from the absence of full-cost pricing for wastewater treatment and is particularly damaging for a beach resort like Phuket. As more tourists come to enjoy pristine beaches, more wastewater is generated. If the supply of treatment facilities does not keep pace with the aggregate production of wastewater, untreated sewerage begins to accumulate in seawater near beaches and in ground water. Highly polluted seawater and ground water will result in beach closings and health scares. If no action is taken, the untreated sewerage will destroy the very natural resource that drives the economy.

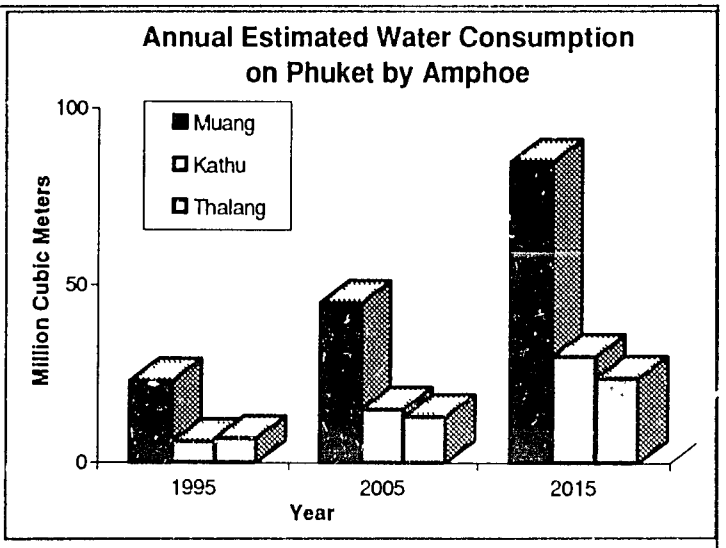
## Our Findings

Consumer demand for water and wastewater services is unequally distributed across Phuket's three Amphoe (districts): Muang, Kathu, and Thalang. The majority of residents and tourists currently reside in Amphoe Muang, although dramatic growth is expected in Amphoe Kathu because of its many undeveloped beaches. The number of tourist days spent on Phuket has grown at an average *annual* rate of 28% from 1983 to 1995. Public water service, provided by either the Provincial Waterworks Authority (PWA) or the Phuket Municipal Waterworks (PMW), has not kept pace with growth in demand. Similarly, only a fraction of the current wastewater produced is collected, and even less is treated.

### *Water Availability*

The primary source of water on Phuket is ground-water reserves; in addition there are a few flooded mining pits and reservoirs We estimate that total runoff on the Island is 495 million cubic meters (MCM) annually, of which 200 to 240 MCM can be economically captured. While total water consumption in 1995 is estimated at only 35 MCM, it is expected to exceed 70 MCM in the year 2005 and 130 MCM by the year 2015 The cause of this rapid increase in water consumption is the high rate of growth in tourism. Tourists' share of total water consumption will be 27% in 1995, and we estimate it will grow to 39% by the year 2005 and 45% by the year 2015

Because neither tourist growth rates nor water resources are distributed equally across the three Amphoe, two of the three Amphoe will experience chronic water shortages within 10 years (see Figure). We estimate Amphoe Muang to have on average 67 MCM of water annually,




of which it consumed 22 MCM in 1995. By 2015, it is expected to need 85 MCM, 20 MCM more than its available annual supply. Amphoe Kathu has on average 31 MCM annually, of which it consumed 6 MCM in 1995. Due to rapid growth in tourism, it is expected to need 30 MCM by 2015. In contrast, Amphoe Thalang has on average 125 MCM annually, of which it consumed 7 MCM in 1995 and will need only 24 MCM by 2015. (New water sources and the possibility of transfers are discussed below.)

### *Satisfaction with Public Piped Water*

Based on our survey of 1106 households in urban and resort areas in December 1994, we found that 73% of households were connected to piped water and 25% used water from shallow wells. Only 13% of households that were connected to public water were satisfied with the water services, 29% of households said the piped water services were poor. Over 80% of households complained of high turbidity, 66% of malodorous, and 57% of discoloration. Furthermore, 36% reported unreliable service and 22% complained of low water pressure.

Based on a survey of 96 hotels carried out in 1990 by JICA, we found that only 10% of hotels in 1990 were connected to piped water. Some 80% used only ground water, while 10% used some combination of piped water and ground water. Many hotels also bought large amounts of water from vendors. Hotels registered similar complaints about the quality of piped water service. Over 52% complained of high turbidity, 52% of malodors, and 28% of discoloration. In addition, 61% reported unreliable service, and 71% reported low water pressure. Aside from higher prices, which we discuss below, hotels and households had very few complaints about the quality of water or service provided by private wells and vendors.

### *Water Consumption and Prices*

On average, each household used 38 cubic meters of water per month, this figure may be on the low side because some households used shallow wells in addition to piped water The price of water varies as a function of the source of the water and the type of consumer Households paid between 4 and 5 baht per cubic meter for piped water depending on whether they are served by the PWA or PMW We calculated the implied cost of well water at 7 baht per cubic meter, using reported fixed and variable costs and assuming a 25-year life span and an interest rate of 5% Finally, households reported paying between 24 and 35 baht per cubic meter for vended water

***The major challenges for public water management in Phuket are: a) to find newer sources of raw water for piped water production, and b) to raise water service quality.***

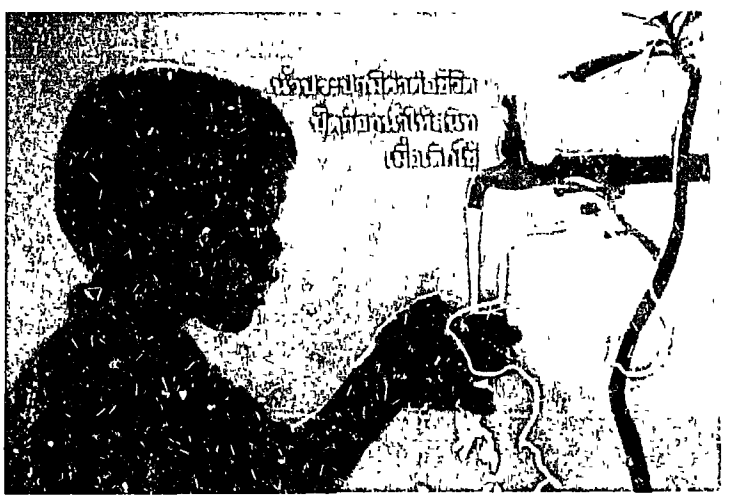
Hotels paid between 9 and 14 5 baht per cubic meter for piped water because of the increasing block tariff imposed by both the PWA and PMW Hotels probably paid a slightly higher price per cubic meter than households did for well water because higher operating expenditures are needed to offset the draw-down effects of extracting larger quantities of ground water Some hotels could not meet all their water needs from local ground water because of low aquifer yields Hotels reported paying between 33 and 75 baht per cubic meter for vended water, and this price varied seasonally This difference in the price of vended water for hotels versus households may be due to price discrimination by water vendors

### *The Full Cost of Water and Consumers' Willingness to Pay*

Households stated willingness to pay for piped water was generally below our estimated full production cost price of 12 25 baht per cubic meter Even this estimate does not fully capture all user and external costs of the water service When households with a water connection were asked how much they would be willing to pay if current water quality and reliability problems were eliminated, they stated 6 26 baht per cubic meter, and increase of 2 5 baht per cubic meter or 25% over the current price When households without a water connection were asked what they would be willing to pay for a water connection that provided reliable and high quality water, they stated 8 5 baht per cubic meter

Because consumers are actually paying much higher prices for water from wells and vendors it is unlikely that consumers truly believed our enumerators when they claimed that the future piped water service would be of high quality This skepticism is understandable since households have paid over 10,000 baht a year for several years to purchase bottled drinking water because their piped water is not potable

The major challenges for public water management in Phuket are a) to find newer sources of raw water for piped water production, and b) to raise water service quality From the long-term perspective, there are 3 policy options for obtaining new sources of raw water to feed the needs of the Phuket economy They are 1) transporting water from Pang-nga and nearby provinces, 2) using more abandoned mine pits to store water and constructing a network linking these pits, and 3) constructing underground dams to tap runoff water that is currently useless These options have implication in terms of investment requirements and water pricing



### *The Impacts of Increased Wastewater Generation*

While the supply of piped water has grown at 10% a year, planning for wastewater treatment facilities has only recently begun. A treatment plant in Patong began operating in 1985, but can only serve a fraction of that area's needs Large hotels are required to treat their own wastewater, spot checks revealed, however, that although many have treatment facilities, very few actually use them Other facilities are currently under construction, but will

not meet the island's current wastewater treatment needs. The levels of fecal coliform in the beach waters and many water wells at resorts have exceeded 100 MPN/100 ml since 1986. (The standard for drinking water is 0 MPN/100 ml.) As recently as 1993 several beach water samples revealed fecal coliform levels in excess of 5,400 MPN/100 ml. This upward trend may threaten the health of swimmers and cause the closing of some of Phuket's finest beaches.

Our survey of households revealed that 78% of the households were willing to pay to have their wastewater treated. However, their average willingness to pay was only 79 baht per month or about 2.08 baht per cubic meter. This is far below our estimate of 7 baht per cubic meter needed to cover existing treatment costs. Moreover, the cost of treatment is likely to rise in the future as the land costs increase on the Island.

## Policy Recommendations

Our findings reveal that Phuket's residents and tourists, water and sewerage utilities, and business community would all benefit from the implementation of full-cost pricing. Currently, the absence of full-cost water pricing means consumers receive low-quality and unreliable services, forcing them to use more expensive alternative water services. Meanwhile, water utilities continue to run deficits and defer investments in maintenance and capacity expansion. Similarly, the absence of full-cost wastewater pricing threatens to destroy Phuket's prized beaches — the very resource that attracts tourists and thus the resource that has fueled Phuket's stellar economic growth. To prevent these conditions from retarding growth, we recommend the following policy changes.

### *Water Pricing and Capacity Expansion*

Simultaneously increase the price and quality of the piped water. At a minimum, the new price of the piped water should cover its production costs and the cost of future capacity expansion. In order to make piped water potable, we estimate this price to be 12 to 14 baht per cubic meter. Recall consumers are already paying between 16 and 75 baht per cubic meter for water from private wells and vendors. The true full-cost price of water is likely to rise rapidly over the next 5 to 10 years in the Amphoe of Muang and Kathu as demand for water exceeds the naturally occurring supply. Unless policies are enacted to curb the rate of growth in tourists and residential demand for water, local and central government agencies should plan to expand their capacity to between 60 and 100 MCM over the next 15 years.

### *Policies for Ground Water and Water from Mining Pits*

Ground water and water in mining pits should no longer be treated as an open access resource that can be exploited by both households and hotels. A system of permits should be developed that requires consumers of water from mining pits to pay a fee that covers the user costs and external cost of extraction. Water in mining pits should not be considered private property since these pits receive ground water from the adjacent aquifers, which are owned by the central government. A provincial agency should be appointed to monitor and enforce the permit system and to ensure that the exploitation of ground water does not lead to salt-water intrusion or other long-term environmental damage and that user fees are reinvested in the management of the resource.

### *Water Vending*

Water vending should be allowed to continue. However, all vendors should be charged the full cost of the water they receive from private or public wells, mining pits, and public piped water.

### *Wastewater Pricing and Capacity Expansion*

Immediately, the central and local governments should increase their commitment to the enforcement of existing laws that require large hotels to treat their wastewater and require new buildings to have an adequate septic system. In addition, an effluent tax should be levied on all water consumers who return wastewater to the environment. This fee should include both treatment costs and the cost of infrastructure investments needed to transport wastewater to the treatment plant. In addition, the cost of future capacity expansion should be included in the current price charged for wastewater treatment. Our rough estimate of the total cost of wastewater treatment in 1995 is 7 baht per cubic meter.

The Island of Phuket can realize its potential as Southeast Asia's premier beach resort, but only if it provides the infrastructure needed to mitigate the effects on its environment of achieving that status.

*A Collaborative Effort by*

**Thailand Development Research Institute (TDRI)**
**Harvard Institute for International Development (HIID)**

Supported by the
U.S. Agency for International Development (USAID)
under the Management of Natural Resources (MANRES) Project for Thailand