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Economic Evaluation of Leak Monitoring System in Water Supply System

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Abstract. In constructing a leak monitoring system for active management of potential leaks in a water supply system, the level of performance as well as the cost required to maintain good economic feasibility have been calculated. Based on analysis of the current status of domestic water supply networks and international scholarly research materials, the price must be kept under 10 million KRW (assuming 30 items are included in 1 set) for cases in which the distance between sensors is approximately 300m (latest technology applied) in large metropolitan areas, and under 3.4 million KRW for cases in which the distance between sensors is approximately 100m in order to secure economic feasibility and, subsequently, be applied in actual situations.

Keywords: Leak monitoring system, Water supply system, Economic evaluation, unreported leakage

1 Introduction

The water supply network leak monitoring system, which is experimentally operated in certain regions overseas, has been installed primarily by companies in regions such as Europe that boast advanced water supply network leak monitoring technology, for the purpose of promoting their products' level of performance, or constructed as a way to show the world the economic development of such regions. In reality, however, installing many sensors in the water supply system network, which cost millions of KRW per item, as well as operating the system, typically leads to expenses that exceed the effect of reduced water loss and cost attributed to leak monitoring.

In order to construct a leak monitoring system, the local governments that control the water supply network must be convinced by the system's economic feasibilities. To evaluate these economic feasibilities, a leak monitoring system must be installed first and then a thorough investigation and analysis must be conducted to discern how much of a cost reduction effect may be generated from leak control. In this research, various statistical data and international scholarly articles, which have studied the current conditions of domestic water supply systems, are referenced to come up with

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the means to equip the leak monitoring system with economic efficiency and effectiveness.

2 Contents of Research

2.1 Investigating current status of constructed, domestic, water supply systems

The current status of constructed water supply systems in Korea refers to the water supply statistics in 2012. The target regions for this investigation were set to include all 162 sectors overseen by local governments. Large metropolitan areas (including Sejong city), which are considered to be able to establish their own leak monitoring systems, have been categorized and examined separately. Among the entire water supply system network, the total distribution length of water pipes in which a monitoring system may be constructed, was found to be 165,046km for the nation in general and 43,607km for the large metropolitan areas only.

2.2 Calculating target amount for reduction of water loss

Typically, leaks are categorized into background leakage, unreported leakage, and reported leakage, based on how they are generated. Unreported leakage is the leakage that can be diminished when performing an active control of the water supply system. The amount of economic unreported leakage has been calculated to be the amount of unreported leakage generated to the point where the limit cost of tap water (cost for water loss) and the cost needed for active leakage control are the same. This research assumes that active water supply system control, the prerequisite for calculating economic unreported leakage, can be materialized by utilizing a leak monitoring system. Therefore, the amount of water loss that can be reduced by applying the leak monitoring system, has been calculated to be the difference between the actual amount of loss currently being generated and the economic water loss (sum of economic background leakage, reported and unreported leakage). It is predicted that, at the national scale, about 119,785ML (Mega Liters, 106L) and, in large metropolitan areas, 49,164ML of leakage can be reduced annually.

2.3 Cost reduction effect through leak monitoring system

The effect of cost reduction has been calculated to be the sum of the manufacturing cost reduction due to diminished water loss and the cost invested in an active water supply system control. The results of the analysis show that, at the national scale and in metropolitan regions, about 357.6 billion and 44.3 billion KRW of cost can be reduced, respectively.

2.4 Calculating proper price for leak monitoring system

If the cost to install a leak monitoring system exceeds the cost reduction obtained from installing and operating the system, economic feasibilities do not exist for the system to be commercialized. Thus, the price at which system installation cost and leakage reduction cost coincide has been specified as the maximum cost to secure economic feasibility. Results show that the maximum price of 1 set (30 items) of a leak monitoring system is about 8 million KRW nationally and 3.4 million KRW in large metropolitan areas, based on the level of technology in the domestic market (distance between sensors at approximately 100m). If the distance between sensors is improved to 300m later on through system enhancements, it has been analyzed that economic feasibilities can be obtained if it costs about 24 million KRW (national) and 10 million KRW (metropolitan) per set.

Table 1. Proper prices for leak monitoring system

Distance between installed sensors	Evaluation items	National	Large metropolitan areas
300m	Number of sensors installed	550,154	145,359
	Cost for 1 set (30 items) (KRW)	24,259,456	10,083,989
100m	Number of sensors installed	1,650,461	436,078
	Cost for 1 set (30 items) (KRW)	8,086,485	3,361,320

3 Conclusion

In this research, the target amount of leakage reduction through the construction of a leak monitoring system, as well as its proper price once constructed, have been calculated. The results of the analysis show that, at the national scale, about 357.6 billion KRW can be reduced while, in metropolitan regions, 44.3 billion KRW can be reduced due to the system. Moreover, it has been found that economic feasibilities can be obtained only if the price of the system is maintained at about 10 million KRW (assuming 30 items in 1 set) for large metropolitan areas and cases in which the distance between sensors is approximately 300m (latest technology applied), and under 3.4 million KRW per set for cases in which the distance between sensors is approximately 100m.

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