



**Cost and Benefit Analysis from Using Automatic Metering Reading
for Groundwater Revenue Management :
Case Study From Thailand Groundwater Crisis Area**

By

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Introduction

- According to The Groundwater Act, B.E. 2520 and its amendments, licensed groundwater users [hereafter licensees] are required to pay groundwater usage and groundwater preservation fees at the rates set forth in the Ministerial Regulations.
- Groundwater laws require licensees to keep a record of their groundwater usage and submit it to the local groundwater staff for the specific groundwater area.
- However, some licensee reports contradict the actual usage recorded by the water meters, and some users have failed to submit their groundwater usage reports and have refused to pay the groundwater usage fees.



Introduction (cont.)

- ❑ Even though there is a default fee and punishment for late payments, **there is still a significant revenue loss due** to law enforcement due to a lack of government personnel and a low penalty rate.
- ❑ Furthermore, **uneconomical groundwater use** in excess of the permitted amount may **cause damage and the risk of land subsidence, as well as a drop in groundwater levels**, resulting in future water shortages.
- ❑ Aside from that, **payments are made on a quarterly basis** due to the metering groundwater usage collection and bill operating process with a limited number of government officers.



Introduction (cont.)

- ❑ Due to the significance of the problems, **it is necessary to study and collect data/in-depth facts**, as well as the issues, obstacles, and limitations in the management of revenue collection from groundwater usage fees and groundwater preservation fees.
- ❑ The AMR is an alternative for increasing the efficiency and efficacy of revenue collection from groundwater usage fees.



Why revenue collection with AMR ?

- ❑ The benefits of AMR, such as automated leak detection, water measurement and verification, water theft prevention, and so on, will provide efficiency/effectiveness/sustainability, and will be economically cost-effective.



Objectives

This study attempts to examine the cost and value of shifting the collecting process of groundwater revenue and groundwater preservation fees from a manual system to an automatic metered reading system [AMR] utilizing marginal cost and marginal benefit.



Scope of the Study

- The data in this study are gathered in 2021 from **groundwater crisis areas in seven provinces**: Bangkok, Samut Prakan Province, Nonthaburi Province, Pathum Thani Province, Samut Sakhon Province, Nakhon Pathom Province, and Phra Nakhon Si Ayutthaya Province.
- **Surveys and questionnaires would be collected** from stakeholders and connected sectors, which are sample groups/representatives in the **commercial and industrial sectors, agricultural sector, and household sector, as well as related government organizations.**



Benefits from the Study

1

The guidelines on the management of revenue collection from groundwater usage fees and groundwater preservation fees that are appropriate and efficient.

2

A guideline in making amendments to the law in order to improve the efficiency of revenue collection from groundwater usage fees and groundwater preservation fees



Steps of the Study

Step1 Identifying scope of the study and Group sampling

Step2 Data collection and surveys

Step3 In-Depth interview stake holders; officers, licensee, etc.

Step4 Conducting focus groups and public hearings

Step5 Analysis of Alternatives; hire representatives from the private sector to collect the groundwater usage fees and groundwater VS AMR

Step6 Constructing Costs-Benefits of AMR

Step7 Sensitivity Analysis

Step8 Comparison the cases of the current groundwater management system and the possible alternatives and conclusion



Methodology

The methodology is based on a marginal benefit-cost analysis that takes into account the time value of money.



Methodology

For **tangible benefits**, we classified AMR benefits as follows:

- (i) switching to AMR allows the possibility of shifting payment frequency from quarterly to monthly basis, creating reinvesting opportunity from revenue or interest on interest.
- (ii) the AMR system and the IOT system helping to reduce the workload of the Department of Groundwater Resources staff.
- (iii) the marginal benefit derived from an efficient collection process.

For **intangible benefits**, we evaluate

- (i) Reducing the Department of Groundwater Resources personnel budget, and
- (ii) Providing economic value by reducing the chance of an accidental rate arising attributable to licensee monitoring travel.

AMR installation expenses can be broken down into four categories:

- (i) network security devices [Firewalls]
- (ii) core network devices [Core Switches]
- (iii) server computers for system development, and
- (iv) backup devices for ready maintenance backup programs.



Data Sampling

Table 1 The number of samples in the primary data collection from the 7 provinces.

Province	Number of samples (persons)		
	Officials	Groundwater Operators	Total
1. Bangkok	≥ 30	≥ 20	≥ 50
2. Samut Prakan	≥ 5	≥ 60	≥ 65
3. Nonthaburi	≥ 5	≥ 40	≥ 45
4. Pathum Thani	≥ 5	≥ 80	≥ 85
5. Samut Sakhon	≥ 5	≥ 80	≥ 85
6. Nakhon Pathom	≥ 5	≥ 80	≥ 85
7. Ayutthaya	≥ 5	≥ 80	≥ 85
Total	≥ 60	≥ 440	≥ 500

Results

The **AMR meter installation will increase the efficiency and effectiveness** of revenue collection from groundwater usage fees and groundwater preservation fees, with the benefits measured in monetary terms as follows:

1. Benefits from changing the water meters to the AMR system allow for more efficiency in revenue collection. This is supported by the studies of the local government organizations in many states of the United States. This study references the study from Las Virgenes, California, which **determined that the AMR meter system led to a 2 percent increase in collected revenue** compared to the current revenue collection.
2. Collection through the AMR meter system allows for the **shift from quarterly payment collection to a monthly** payment collection.



Results (cont.)

3. The use of the AMR meters will reduce the workload and accidental rate of the personnel of the Department of Groundwater Resources as followings;
 1. Changing to an AMR meter can provide additional benefits in terms of time-savings for current personnel, as administrative work related to revenue collection from groundwater usage fees and groundwater preservation fees can be reduced by 70 percent. In this study, based on 2 personnel per province, using the rate of 26,397.46 baht per person per month to calculate, 70 percent will equate to an opportunity cost of 18,000 baht per person per month.



Results (cont.)

2. It will help reduce the accident rate from personnel having to travel to perform examinations of groundwater usage by licensees. This study calculates the benefits from reducing accidents equal to 98,652.57 baht per person per month.
- **Sensitivity Analysis;** In the case that the assumption of the marginal benefits in revenue collection through the AMR meter system fails to increase by 2 percent as assumed, the implementation of the project could still be carried out as long as the increase in collection efficiency is at or **above 1.613 percent, which is the project's breakeven point.**



Conclusion

- The study tries to construct an **economic cost-benefit analysis table** of installing an AMR meter in **groundwater crisis areas in seven provinces**:
- The results from the site surveys, focus groups, and public hearings created the assumptions used in the analysis of the AMR [Automatic Meter Reading] installation.
- In the case that the Department of Groundwater Resources installs 100 percent of the AMR meters, **it was found that this will create efficiency/effectiveness/sustainability, and will be economically cost-effective**, based on the Benefit-Cost Analysis [BCA] criteria.



Conclusion (cont.)

- However, as the costs of installing an AMR meter is relatively high, installing it in all the companies in the business sector is not feasible, and will not be effectively carried out if attempted.



Policy Recommendations

- Because the **AMR system is complicated and customizable**, transitioning from manual to AMR systems is not a one-size-fits-all proposition.
- We propose that, in order for the AMR installation project to be implemented properly, **a pilot project be carried out, and licensees to join the project be selected** based on the following criteria:
 1. Choose licensees from four groundwater crisis provinces: Pathum Thani Province, Samut Sakhon Province, Nakhon Pathom Province, and Phra Nakhon Si Ayutthaya Province, **with a minimum of 1 million baht per quarter in groundwater usage and groundwater preservation fees.**
 2. For the groundwater crisis areas in Bangkok, Samut Prakan Province, and Nonthaburi Province, **a criterion should be utilized to pick 10 to 15 wells among the enterprises with the highest groundwater usage fees and groundwater preservation fees** to participate in the AMR meter installation project

