World Journal of Social Sciences
Vol. 3. No. 5. September 2013 Issue. Pp. 25 – 33

Electric Rate Policy Scenario in Thailand

Suppanunta Romprasert*

Paper has presented ideal of studying an active area of electric rate policy by trading an energy for shortage electrified province in Thailand case. Simulate empirical exploration is an important emerging welfare impacts. As the demand on electricity drastically increases in present years, the power used from electricity has been skyrocketing. While most existing research focuses on reducing consumptions of electricity power, the power is charged as electric rate created the electric rate policy problem for maximinzing the social welfare has been overlooked. This is an important problem faced by public, especially by the simulation number on electric rate, the price of electricity may exhibit time and location be set. This paper studies the problem of maximizing social welfare on electric rate policy while assuming quality of location and time of electricity price. The model is set through the problem as a constrained mixed variables and purpose an efficient solution method. The evaluations based on real-life electricity price data for illustrate the efficiency and efficacy of paper's appraoch. Key benefit contributes to promote economic and social development.

JEL Codes: D00, D60

1. Introduction

Electricity Generating Authority of Thailand (EGAT) generates electricity that is a keen engine for country's growth, development and prosperous in economic and social well-being of Thailand. From economic theory, it can be concluded that "the allocation on resources will be efficient when price of goods and services equals to the proportion of additional cost along with process of production" (Lorchirachoonkul and Vikitset, 1986). In the case of electricity, the efficient on electricity rate is created when electric rate equals proportion on additional cost along with process of electricity supply. Increasing welfare being involvement assumes that the resources are better allocated through market mechanism in a competitive rather than through the bureaucratic decisions of government. This paper would like to apply by using welfare economic idea to guide the effective electricity rate related to two scenarios which are: first scenario is to define rate of electric power policy in Thailand is equilibrium and the rate of electric power is not depending on time line of electric power used. In this case, Government will depict the electric fee equal marginal capacity cost (MCC) of Thailand; second scenario is to distribute rate of electric power policy in Thailand is under province rate fee policy. In this case, electric fee in each province equal to MCC in that province.

EGAT was established in 1969 and was solely owned by government which was later corporative by National Energy Policy Office (NEPO). In 1986, it is a huge adjustable rate of electricity in Thailand on the reason of giving an important for resource

* Dr. Suppanunta Romprasert, Assumption University (Suvarnabhumi Campus)
Bang Na Trad Rd., Km.26 Bang Sao Tong Samut Prakan Thailand 10540
E-mail: thailandsuppanunta@yahoo.com

allocation efficiently (Lorchirachoonkul and Vikitset, 1986). Again in 1991, there was a change in electricity framework as followed by the objectives: a) giving electricity rate to mirror the cost of economic; b) giving "The Metropolitan Electricity Authority" to have enough revenue extending the electricity line system to serve people in Thailand; c) giving the electricity rate to be easily on operation (Monenco in Association with the National Institute of Development Administration, 1991). The electric rate policy, in addition to the concern of maximizing the social welfare, how to guarantee the quality of electric rate such as service on time guarantee to users is equally important. This is because an upgraded service by outsourcing may be fast to clients.

For this paper, it will concentrate on the first objective mentioned above relating to economic aspect in term of social welfare. So, in an aspect, if there is no external effect, resource allocation will be efficient. And if there is perfect competition and Government let it monopolized as reason on minimize size to increase social welfare, the Government should intervene by setting the price of products equal to the additional cost (Glaeser and Ujhelyi, 2009). Producing electric power in Thailand in the hand of The Metropolitan Electricity Authority (MEA) only, so it seems like monopoly that contrasts to competitive electricity market where all generators are paid the market clearing price under a uniform price auction structure, even a small reduction in demand can outcome in an appreciable break down in system marginal costs of production (Blumsack, Apt, and Lave, 2006). Moreover, Joskow (2006) mentions in his article by assuming that a perfectly competitive model where the firms bid their units at marginal cost can expect to show that the supply curve will not reflect the marginal costs of the available technologies.

As the public users, hence it is important to design efficient solution methods in order to get the social welfare from electric rate policy provided properly. Through extensive simulation based on real-life electricity price data of certain main, the two provinces, paper shows the efficacy of the designed models as well as the total electricity capacity cost. Electric system in Thailand has so many stations expanding around country and each station has interconnected. Then the different of station area and the interconnected causes the different on marginal cost of producing and distributing services in each area. To consider the policy used, one important aspect is "either defined the electric rate being equal in all areas or defined the electric rate in each area being different". Up to this point, the paper will create two scenarios according to the policy considered.

The rest of this paper is organized as follows: Introduction gives background and main motivation for carrying out and what objectives it hopes to achieve. Literature is devoted towards understanding concept on cost of produce electricity and economic model being related. Methodology provides scenarios related to three main costs. It also provides highlight information importance of social welfare linked. Discusses are on possible operation of scenarios to bring in benefits. Conclusion and summarizes the whole content of paper and advantage of proposed on electricity and social welfare by keeping options open for improvement.

2. Literature Review

The suggestion of demand response into constrained electricity networks can significantly lower peak energy costs and can capacity as a check against the exercise of market power by generations (Rassenti, Smith, and Wilson, 2002; Talukdar, 2002; Violette, Freeman, Neil, 2006) that concentrates on the minimize cost. A discussion of a mathematical construct has been an important part of the economics literature relating to firm and industry behavior, the cost function of a profit – wealth – maximizing firm. Specifically, it would like to determine the properties of a function that specifies the total cost of producing any given level of output. Since total costs will obviously be affected by the prices of the inputs that the firm hires, the cost function must be written $C = C^* (y, w_i, ... w_n)$ (equation: 1), where y is the output and w is the prices of the factors $x_1, ..., x_n$, respectively. The factor prices are assumed to be constant, for convenience. Thus, in order to be able to assert the existence of a well-defined cost function, it is necessary, at the very least, to have previously asserted a theory of the firm. In doing so, it explicitly recognize that the cost of production depends on what the firm's owners or managers intend to do the theoretical assertions and what their constraints are, such as the production function itself, the rules of contracting, and, in some contexts, the factor prices. A wealth-maximizing firm is apt to have a different cost function than a "socialist cooperative" type of firm, which seeks to maximize, say, output per labor in the firm. Not only are the objective functions of these two firm types' different – different behavioral assertions – but if the latter firm is located in into two different countries, the property rights and contracting rules are likely to differ. Cost functions must be derived from models in which output Y enters as a parameter. That is, it has to assert that a firm is behaving in a particular way, with regard to the production of some arbitrary level of output y^0, where the superscript is added to indicate that this is a parametric value.

Perloff (2007) mentioned that social welfare involves with consumers' and producers' surplus. The previous is a calculation, specifying the benefits consumers receive from using the product taking away the money they pay for that, and the latter is the difference between the amount for which a good sells and the minimum amount necessary for generators to be willing to produce electricity. To measure this concept, there are many different mythologies have been suggested. Some economists play the utility functions of consumers and suppliers to measure the amount of consumption and generation which benefits both players. However, this way is not practical used, since it is a complicated job to search utility functions of all individuals in a market. This part gives an overview of how cost of produce electricity uses to implement the electric fee set up and how the production and consumption efficiency conditions are distinct from the interpersonal ethical values of the social welfare function.

Thailand faces an outstanding challenge of meeting its growing electricity demand to maintain the electricity supply at a satisfaction level (Williams and Ghanadan, 2006). The cost of electricity generated by different sources while calculating costs, variety internal cost factors have to be considered (Heptonstall, 2006) such as capital costs, fuel costs, costs of waste. The scenarios are analyzed under two different assumptions of policy linked with social welfare be explicitly considered in the electricity capacity.

Normally, The cost of generating electricity: it divided by three parts. 1) Capacity cost: it is the cost that extends the power such as cost of investing on substation, transmitted line and other instruments used in producing. 2) Energy cost: it is the variable cost in producing the electric power depending on used ratio of electric power and 3) Customer cost: it depends on the number of customer and causes from the services such as miter fixed, reading the miter and cost on bill in each month. Then, the structure of electric rate that is efficient has to mirror by those three main parts. In generally, it includes with demand charge which it is equal to marginal capacity cost;

energy charge equals to marginal energy cost and monthly fee rate equals to marginal customer cost. Moreover, if there is the case of increasing of demand on electric power is over system capacity and causes long time on out of electric power, MEA can extend the system in long term for reducing the loss on out of electric power unless the marginal capacity cost is lower than the marginal outage cost. Social will gain the benefit from expanding from capacity system and will maximize utility when there is extending on electric power in marginal capacity cost equal to marginal outage cost. In practice, the limitation on estimating from the outage cost, especially on dissatisfaction of the users makes MEA considering expanding the capacity system by depicting the stability of system in which the social can accept.

This paper contributes to the knowledge through the investigation using the implication numerical data for the benefit on suggestion to Thai Government.

3. Methodology

As indicated earlier, paper will set two scenarios as the case of study concerning on the main costs on producing electric power. Regarding to previous section, two cases are considered to investigate different capacity paths. Each case is also analyzed for an assumption set up (Ceteris paribus). The results of the simulations are then subjected to further considering on social welfare.

3.1 Assumption on First Scenario

Defined rate of electric power policy in Thailand is equilibrium and the rate of electric power is not depending on time line of electric power used. In this case, Government will depict the electric fee equal MCC of Thailand.

The first scenario: it classifies the electric system using two provinces. In each province has interconnected. It implies that each province can transmit the electric power to support the needs of the others. The figure 1 shows the Marginal Capacity Cost (MCC) and the demand in each province. MCC1 through MCC2 lines are shown inside.

Figure 1: Scenario of Social Welfare and Defined the Rate of Electricity

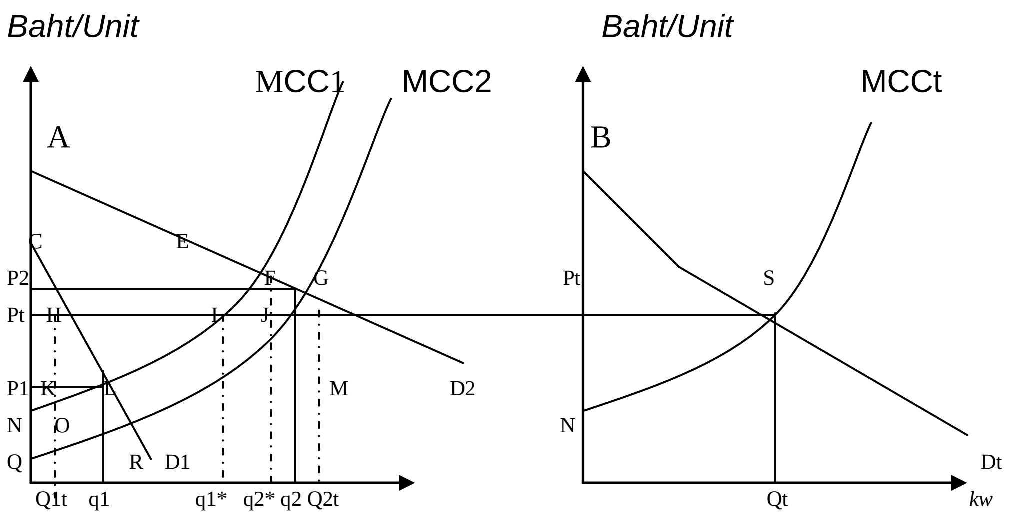

Figure 1 shows MCC and demand to electric power in two provinces. MCC1 line and MCC2 line in the left figure are MCC for interconnected in first and second province respectively. D1 and D2 line are the demand to electric power in first and second provinces. MCCt line is MCC of Thailand from combining MCC1 and MCC2 in horizontal. Also, Dt line is aggregate demand to electric power bringing up D1 and D2 in horizontal.

The electric fee is MCC of Thailand being Pt Baht/Unit causing the quantity electric power used in first province equal Q1t kw and Q2t kw in second province that results to Qt kw. Then, the social welfare in Thailand is the area NSB in the right figure which divides by marginal consumer equal to area PtSB and marginal producer equal to area NSPt in assumption setting.

So, if the First province produces electric power equal to q1* kw, it will make the rest of electric power left by q1*- Q1t kw. In contrast, second province is q2* kw, making shortage on electric power by Q2t – q2* kw because the quantity of Thailand electric power equal to the demand on electric power used. Surplus supply of electric power in first province will equal surplus demand in second province. So, the benefit of the users in first province is PtHC. When the producer in first province interconnects the electric power q1* - Q1t kw to second province, the benefit will be NIPt. This interconnected system will give the users in second province used electric power for Q2t kw and the benefit is PtMA meanwhile the benefit of producer in second province is QJPt.

Therefore, in the first scenario case will make the social welfare maximize benefit equal NSB because electric power fee equal to MMC.

3.2 Assumption on Second Scenario

Distributed rate of electric power policy in Thailand is under province rate fee policy. In this case, electric fee in each province equal to MCC in that province. So, electric fee in first province will be P1that is lower than Pt in the same time in second province equal P2 which it is higher than Pt (see in Figure1).

The second scenario: The production and demand in first province will be q1 kw meanwhile in second province will be q2 kw where q1 + q2 = Qt. The benefit of users in first province is P1LC that is increased to PtHLP1 under the assumption in first scenario. In the same time, benefit for second province is P2GA that is decreased to P2GMPt.

When comparing the aggregate benefits of the users under assumption in first scenario to assumption in second scenario, if shows that the benefit earning under the second scenario will be less than the first scenario. Because P1<P2, it means MRS1 < MRS2 (marginal rate of substitution). The aggregate utility of users will be increased if there is the sell-buy at Pt where P1<Pt<P2 which it makes MRS in each province equal. The sell-buy will occur according to the theory of Adam Smith called “invisible hand” theory when it is defined the rate of electric power at Pt. In contrast, the aggregate benefits for producer under the second assumption will be higher than using in the first assumption because the electric power fee at Pt under the first assumption has the higher rate than MCC in the first province and has the lower rate than MCC in the second province.

According to those assumptions, it will make the producer in the first province gaining benefit in the form of producer surplus by producing more electric power and producer in the second province will have producer surplus by producing less electric power until P1 = MCC1 and P2 = MCC2 which it assumes that the government will not allow MEA searching for the maximize profit by calculating the electric fee that makes marginal cost equal marginal revenue.

However, when considering in the whole ideas, the social welfare is under the first assumption will gain the benefit than the second assumption because the second assumption will make [P1 = MCC1] < [P2 = MCC2]. The whole social in Thailand will get the MCC in the first province and interconnect to the second province till [P1 = MCC1] = [P2 = MCC2] = Pt where Pt is the electric power fee under the first assumption.

4. Results/Analysis

Defining a theoretical framework for analyzing is therefore an important prerequisite to an empirical discussion of using the numerical set up effects making theory and measurement go hand in hand easily. Even though, the social from the scenario in previous part will gain the maximum utility under the first assumption, the users in the first province and the producer in the second province are the losers in that particular assumption.

To support on those two scenarios, the number will be used to explore as it set only in this paper (Ceteris paribus).

Assumes that the demand on electric power in the first province as:
$P1 = 9 – q1$ (1)
The demand in the second province as:
$P2 = 15 – q2$ (2)
Where Pi is electric power fee (Baht/Unit); qi is the quantity of electric power (Million-Kilowatt) and i = 1, 2. Moreover, MCC1 and MCC2 are as:
$P1= 4+q1$ (3)
$P2 = 3 + q2$ (4)

Under the first assumption, the aggregate demand on electric power equal to the sum of demand in the first province and the second province in the horizontal which it shows as:
$Q = 15 – P$ if P is greater or equal to 9 (5)
$Q = 24 – 2P$ if P is lower than 9 (6)

If electric power fee is higher than 9 Baht per Unit, aggregate demand on electric power is the demand on electric power in the first province because the users in the second province will not use the electric power if the fee equal to that particular level.

Under the interconnected system, the MCC of the whole system will equal to the sum of MCC1 and MCC2 in horizontal which it will earn the MCC of Thailand in the form as:
$Q = P – 3$ if 4 is greater or equal to P (7)
$Q = 2P – 7$ if P is greater than 4 (8)

MCC of Thailand will equal MCC2 if the fee equal or less than 4 Baht per Unit because the producer in the first province will not produce electric power if the fee is in that specific range.

Under the first assumption, the fee can obtain from equation (6) and (8) causing the condition as:

$$24 – 2P = 2P – 7 \qquad (9)$$

The electric power fee should be 7.75 Baht per Unit and the quantity in electric used is 8.5 Million-Kilowatt where the consumption in the first province is 1.25 Million-Kilowatt (eq.1) and in the second province is 7.25 Million-kilowatt (eq.2). The capacity on electric power of the first province can obtain from equation (3) is 3.75 Million-Kilowatt and the second province is 4.75 Million-Kilowatt (eq.4).

The first province can have surplus left by 2.5 Million-Kilowatt in the meanwhile second province shortage with 2.5 Million-Kilowatt. That means the first province can interconnect to second province and giving the extra to the users there. Therefore, the social welfare can be obtain from [(0.5) * (9 – 7.75) * (8.5 – 6)] + [(6) * (9 – 7.75)] + [(0.5) * (15 – 9) * (6)] or 27.06 Million Baht and producer's benefit is [(4 – 3) * (0.5) * (1)] + [(1) * (7.75 – 4)] + [(0.5) * (7.75 – 4) * (8.5 – 1)] or 18.31 Million Baht. Therefore, the total social welfare for Thailand will be 45.38 Million Baht.

Under the second assumption, the quantity used in the first province can find from equation (1) and (3): 9 – Q1 = 4 + Q1 making the quantity equal 2.5 Million-Kilowatt and the price will be 6.5 Baht per Unit. In the meanwhile for the second province, it obtains from equation (2) and (4): 15 – Q2 = 3 + Q2 receiving quantity equal 6 Million-Kilowatt and price is 9 Baht per Unit. So, the policy via by second assumption causing the higher consumes electric power in the first province because the price is low, but in the second province is in contrast because the price is high. On the other hand, Aggregate consumption in electric power equal 8.5 Million-Kilowatt the same as under the first assumption. Moreover, the benefit for users in the first province equal (0.5) * (9 – 6.5) * (2.5) or 3.13 Million Baht; furthermore, the producer in the first province is (0.5) * (2.5) * (6.5 – 4) or 3.13. Total social welfare in the first province is 6.25 Million Baht. Checking in the second province, users will get (0.5) * (15 – 9) * (6) or 18 Million Baht and benefit to producer is (0.5) * (9 – 3) * (6) or 18 Million Baht. Total social welfare in the second province is 36 Million Baht. Therefore, both social welfares in first and second provinces make Thailand social welfare be 42.25 Million Baht.

Generation is now shared between first province and second province. Efficiency gains are examined in terms of savings in controllable cost. The data is summarized in Table below as Million Baht:

Table 1: Summarized of Two Provinces on Efficiency Gains

Group	First province	First province	Second province	Second province	Total	Total
Policy	First	Second	First	Second	First	Second
Users	0.78	3.1	26.3	18	27.1	21.1
Producer	7	3.1	11.3	18	18.3	21.1
Social	7.78	6.2	37.6	36	45.38	42.2

Table compares the social welfare under first and second assumption as it considers from Thailand point of view under assumption that MCC has continuously and the first assumption is made the maximize social welfare. Under second assumption, benefit in the first province is 6.2 Million Baht while in second province is 36 Million Baht.

When it defines the electric fee equally in Thailand, the benefit in the first province will gradually increase by 1.58 Million Baht and in second province is by 1.60 Million Baht causing the utility of social welfare increases 3.18 Million Baht. But this policy assumption makes the benefit of users in the first province decreased 2.32 Million Baht; however, total benefit of MAE in Thailand is increased 8.3 Million Baht. And the benefit of users in second province increases 8.3 Million Baht.

The reason why does benefit of users in second province increases is caused by interconnecting from the users in the first province equal 2.32 Million Baht. The utility interconnecting from producer to the users 2.88 Million Baht and the efficiency from allocate resources 3.18 Million Baht. If the users in second province compensate to the users in first province and the producer decreases producing electric power decreased 5.12 Million Baht; however, it still has some benefit left 3.18 Million Baht.

5. Conclusions

Findings show that under the first assumption, the first province can have surplus left by 2.5 Million-Kilowatt in the meanwhile second province shortage with 2.5 Million-Kilowatt. That means the first province can interconnect to second province and giving the extra to the users there. The policy via by second assumption causing the higher consumes electric power in the first province because the price is low, but in the second province is in contrast because the price is high. As it considers under assumption that MCC has continuously; the first assumption is made maximize social welfare.

In practical, electric power production needs to invest in lumpy that cause marginal cost of electric power provided in step function and no continuity. In this case, the social welfare under equality rate of policy comparing to the social welfare under provincial rate of policy depends how to use electric power in each province.

6. References

Blumsack, S, Apt, J, & Lave, L 2006, ‘Lessons from the Failure of U.S. Electricity Restructuring’, *The Electricity Journal*, Vol. 19, no. 2, pp. 15-32.

Glaeser, EL, & Gergely, U 2009, ‘Regulating Misinformation’, *Journal of Public Economics*, Vol. 94, no. 3-4, pp. 247-257.

Heptonstall, P 2006, ‘A Review of Electricity Unit Cost Estimates’, *Working Paper*, pp. 1-23.

Joskow, P 2006, ‘Competitive electricity markets and investment in new generating capacity’, *Working paper*.

Lorchirachoonkul, V, & Vikitset, T 1986, *Thailand Power Tariff Structure Study Bangkok*, National Energy Administration.

Monenco in Association with the National Institute of Development Administration 1991, *Marginal Cost Based Tariff*, Bangkok: National Energy Policy Office.

Perloff, J 2007, *Microeconomics*, 4th ed, Pearson, Boston.

Rassenti, S, Smith, V, & Wilson, B 2002, 'Demand-Side Bidding Will Reduce the Level and Volatility of Electricity Prices', *Independent Review*, Vol. 6, no. 3, pp. 441-445.

Talukdar, S 2002, 'The Power Systems Engineering Research Center and Some Grand Challenges', Seminar presented to the Carnegie Mellon Electricity Industry Center, 28 March.

Violette, D, Freeman, R, & Neil, C 2006, *DRR Valuation and Market Analysis*, Volume I: Overview, A report for the International Energy Agency (IEA) DRR Task XIII.

Williams, JH, & Ghanadan, R 2006, 'Electricity Reform in Developing and Transition Countries: A Reappraisal', *Energy Journal*, Vol. 31, no. 6-7, pp. 815-844.