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Acceptance Analysis of PDAM Sleman's Water Tariff, Based on Revenue and Willingness to Pay Projection

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ABSTRACT In Sleman, the Regional Water Company (PDAM) provides clean water to the community and charges a tariff for each cubic meter of water sold to customers. According to the Minister of Home Affairs Regulation No. 71 of 2016 states, PDAM tariffs requiring an annual review in November. The most recent tariff was set by PDAM Sleman in 2016, therefore, a recalculation is required. In addition, there is a need to analyze the tariff acceptance from the service provider, and service recipient's point of view. In this study, the calculation tariff method utilized a formula based on the Minister of Home Affairs Regulation No. 71 of 2016. Meanwhile, the acceptance analysis from profit point of view conducted by calculating the projection of water sales revenue, profit to earning assets ratio, and customer willingness to pay (WTP). Furthermore, revenue projections were obtained by multiplying tariffs with the water sold volume, while the WTP projection is obtained using the inflation method, based on the PDAM Sleman customers' wTP, from the 2007's research. PDAM Sleman tariffs based on calculations resulted in low tariffs of IDR3727.48, basic tariffs of IDR4659.36, and full rate of IDR9460.17. Based on the WTP analysis, the tariffs are feasible from the service recipient's (PDAM customers) point of view, because this is affordable by customers, for the average water consumption. However, from the service provider's (PDAM Sleman) point of view, the tariffs are not feasible a 0.31% profit ratio is much lower, compared to the 10% profit ratio. Therefore, tariff adjustments are required to increase profits. These strategies include determining tariffs based on consumption blocks alone, without breaking down based on customer group categories and adjusting the second and third consumption blocks' rate.

KEYWORDS Water tariff; Calculation; Profit, Willingness to pay, Earning assets.

1 INTRODUCTION

The Regional Drinking Water Company (PDAM) of Sleman, as a business company with the role of organizing clean water supply to the communities (Bupati Sleman, 2019) and distributing water to customers, earns income from the tariff charged to customers. This tariff charge is calculated, using a formula from the Minister of Home Affairs Regulation Number 71 of 2016, to obtain basic tariffs, low tariffs, and full tariffs. Subsequently, these three tariff types are arranged in a tariff table, and this is broken down according to customer groups and consumption blocks (Menteri Dalam Negeri Republik Indonesia, 2016). Basic tariff is the water rate determined from business cost divided by production volume, minus standard water loss. Meanwhile, low tariff is water rate determined from basic tariff minus subsidy. Also, full tariff is water rate determined from basic tariff, plus subsidy and profit.

Prior to determination, the proposed tariff ought to be evaluated by the supervisory board, and disseminated to customers through the mass media (Menteri Dalam Negeri Republik Indonesia, 2016). In March 2016, the District Secretariat Service Note of Sleman Regency stated the PDAM Sleman's proposed tariff, evaluated by the supervisory board, by considering the people's ability to pay, as well as the obtainable profit. In addition, this proposal was also requested for approval from customer

forum representatives, through socialization with the Customer Forum Association (IFP), based on Sleman Regency Regulation Number 10, Year 2020, regarding the Sleman Regional Drinking Water Company. However, this evaluation is limited, because the profit to earning assets ratio, as well as acceptance analysis based on customers' willingness to pay projection have currently not been calculated. The profit to earning assets ratio is one of the considerations in determining tariffs, and shows the reasonable profit ratio obtained by PDAM, in order to improve services (Menteri Dalam Negeri Republik Indonesia, 2016). Meanwhile, willingness to pay (WTP) is a reference for determining tariffs, and describes the community's willingness to pay these tariffs (Damayanti and Sudrajat, 2017).

According to Minister of Home Affairs Regulation Number 71 of 2016, PDAM tariffs are recommended to be reviewed annually, in November. However, the most recent water tariff was set by PDAM Sleman in 2016. Thus, there is a need to calculate the current tariff and conduct evaluation, based on revenue projections, the profit to earning assets ratio, as well as the customer's WTP projection. A comprehensive analysis is expected to generate a proposed tariff with the capacity to provide improved arguments to the supervisory board and customer representatives.

2 METHODS

This study comprises four stages, tariffs calculation, income projection calculation, WTP projection calculation, as well as tariff acceptance analysis, based on the profit to earning assets ratio and WTP. The tariff calculation was performed using the formula from Minister of Home Affairs Regulation Number 71 of 2016, as listed in Appendix 1 Table A1.1. In addition, the data required for the calculation include volume of water produced, sold, as well as lost, and business costs as well as inflation factor. Data on the water volumes were obtained from the 2018 PDAM Sleman technical report, while the business cost data was obtained from the 2018 PDAM Sleman financial report. Also, the inflation factor was obtained using Yogyakarta City's inflation rate in 2018, 2.66% (Badan Pusat Statistik Kabupaten Sleman, 2019).

Subsequently, the income projection calculated after determining the basic, low and full tariffs, are multiplied by the volume of water sold to the low tariff customer group, as well as the full and particular tariff customer group, using the formula listed in Appendix 1 Table A1.1. The profit to earning assets ratio is determined by dividing profits obtained from projected income reduction by total business costs, while the earning assets value is obtained from tariff calculation.

Furthermore, the WTP value to be used in the analysis was not obtained by primary data collection, but was used with projections based on secondary data from results of the previous study conducted by Saptono (2007) on PDAM Sleman customers. The WTP value is to be converted from 2007 to 2019, using the inflation method, where the following year's value of money is obtained by multiplying the previous year's counterpart with the previous year's inflation rate, using Equation (1).

$$GP_t = \left(\frac{IR_t}{100} \times GP_{t-1}\right) + GP_{t-1} \quad (1)$$

Where, IR_t represents inflation rate at t year / period, GP_t denotes general price at t year / period, and GP_{t-1} signifies general price at t-1 year / period (Insukindro, 1995).

Meanwhile, the tariff acceptance analysis is conducted by comparing the profit to earning assets ratio with the determinant of reasonable profit percentage obtained by the PDAM, meaning the profit to earning assets ratio, as 10% amount. In addition, acceptance is also visible by comparing the WTP projection value with the average water account to be paid by customers, based on the calculated tariff. The average water bill paid is calculated by multiplying the tariff with the water volume, based on the specified consumption block, comprising the first, second and third blocks with ranges 0 – 10 m^3/month, 11 – 20 m^3/month, and 21 m^3/month, respectively.

3 RESULTS AND DISCUSSION

3.1 Tariff and Revenue Projection

Appendix 1 Table A1.1. shows the tariff calculation details. Based on the calculation results, the basic, low and full tariff values are IDR4659.36, IDR3727.48, and IDR9460.17, respectively. Table 1 shows the revenue projection derived from the water sales, based on the calculated tariff value.

The revenue projection from water sales is IDR38,020,593,869.18, with a DR249,268,166.54 possible profit. This implies a 0.31% profit ratio to earning asset is 0.31%, and this is much lower, compared to 10% target (Menteri Dalam Negeri Republik Indonesia, 2016).

The reasonable profit level in this region is comparable to other regions, for instance, Magelang Regency. The Magelang Regency PDAM has the advantage of a large potential spring water with discharge reaching over 9400 liters / second (USAID Indonesia, 2006). Also, the treatment costs are low, thus, PDAM is able to set a low price for customers in this region. However, despite setting a low tariff, based on the 2006 financial condition analysis report, the profits obtained by PDAM Magelang in 2001 – 2006 were about 4 – 6% of earning assets. Meanwhile, the planning scenario for 2007 – 2013 targets a 13 – 17% a profit ratio of earning assets. Therefore, improving the PDAM Sleman's profit projection from the water sales at the calculated tariff is a reasonable idea. Water sales are not PDAM's sole revenue source. However, because this is the organization's main activity, the profits obtained from must be reasonable.

The tariff's feasibility is also visible through comparison with the average tariff, to indicate whether the full cost recovery target has been achieved. In tariff determination, cost recovery is a priority to yield sufficient revenue to cover production costs (Lopez-Nicolas *et al.*, 2018). Non-full cost recovery tariffs are pond to cause PDAM difficulties, in allocating investment for service improvement, and consequently, lead to decline in service quality (Indayani, 2013). Furthermore, there are two provisions in Minister of Home Affairs Regulation Number 71

Table 1 Calculation of revenue projection form PDAM Sleman's water tariff

Num	Description	Unit	Notation	Formula	Calculation result
1.	Low tariff	IDR/m^3	LT	(from calculation result at Appendix 1 Tabel A1.1 number 3.g)	3,727.48
2.	Sold water volume at low tariff customer group	m^3/year	SVLT	Historical data	3,957,391
3.	Revenue from low tariff	IDR/year	RLT	RLT = LT × SVLT	14,751,114,445.62
4.	Full tariff	IDR/m^3	FT	(from calculation result at Appendix 1 Table A1.1 number 4.k)	9,460.17
5.	Sold water volume at full and particular tariff customer groups	m^3/year	SVFPT	Historical data	2,459,732
6.	Revenue from full tariff	IDR/year	RFT	RFT = FT × SVFPT	23,269,479,423.56
7.	Total revenue projection	IDR/year	TRP	TRP = RLT + RFT	38,020,593,869.18
8.	Total business cost projection	IDR/year	TBCP	TBCP = TBCY[1]	37,771,325,702.64
9.	Profit/loss	IDR/year	P/L	P/L = TRP – TBCP	249,268,166.54
10.	Earning assets	IDR/year	EA	(from calculation result at Appendix 1 Table A1.1 number 4.e)	81,209,340,350.13
11.	Ratio of profit to earning assets	%	RPEA	RPEA = [(P/L) / EA] × 100%	0.31%

[1]TBCY obtained from calculation at Appendix 1 Table A1.1 number 1.c.

of 2016 concerning full cost recovery tariffs, and these are the minimum average tariff equal to the basic costs to cover operational costs, as well as the average tariff covering the full costs for developing drinking water services.

The average tariff is calculated by dividing the total tariff revenue with the water volume sold. Thus, based on tariff revenue data and water sold volume data in Table 1, the average tariff below is obtained.

$$\text{average tariff} = \frac{\text{IDR38,020,593,869.18}}{(3,957,391+2,459,732)\text{m}^3}$$

$$= \text{IDR5,924.87 /m}^3$$

The average tariff value is higher, compared to the basic tariff (IDR4,659.36), but lower compared to the full tariff (Rp9,460.17). Therefore, this tariff is currently feasible to cover operational needs, but not to obtain revenues utilizable drinking water services' development.

3.2 Tariff Feasibility based on Willingness to Pay

A study the PDAM Sleman customers' WTP was conducted by Saptono in 2007, using 400 samples of prospective household customers as respondents. Table 2 shows the study's results.

Table 2. Willingness to pay of PDAM Sleman customers at 2007(Saptono, 2007)

WTP (IDR)	Percent of Respondent (%)
< 30,000.00	29
30,000.00 – 40,000.00	55.1
40,000.00 – 60,000.00	14.5
> 60,000.00	1.4

The WTP value in Table 2 is comparable with the current conditions, by adjusting the currency value utilizing the inflation method. Calculations with the inflation method use inflation data in Indonesia from 2007 to 2019, using Equation 1. Table 3 shows the results of this calculation. Meanwhile, Table 4 shows the 2019 adjusted WTP values, based on the calculations in Table 3.

Calculation example: 2007's currency value is IDR30,000.00, 2008's inflation rate is 11.06%, thus, 2008's currency value is IDR30,000.00 × (1 + 11.06%) = IDR30,000.00 × (1 + 0.1106) = IDR33,318.00.

Table 3. Adjustment of currency value from 2007 until 2019, based on inflation rate per year

Year	Inflation rate[1]	2007's currency value		
		IDR30,000.00	IDR40,000.00	IDR60,000.00
2007	6.59	30,000.00	40,000.00	60,000.00
2008	11.06	33,318.00	44,424.00	66,636.00
2009	2.78	34,244.24	45,658.99	68,488.48
2010	6.96	36,627.64	48,836.85	73,255.28
2011	3.79	38,015.83	50,687.77	76,031.65
2012	4.3	39,650.51	52,867.34	79,301.02
2013	8.38	42,973.22	57,297.63	85,946.44
2014	8.36	46,565.78	62,087.71	93,131.56
2015	3.35	48,125.74	64,167.65	96,251.47
2016	3.02	49,579.13	66,105.51	99,158.26
2017	3.61	51,368.94	68,491.92	102,737.88
2018	3.13	52,976.79	70,635.72	105,953.57
2019	2.72	54,417.76	72,557.01	108,835.51

[1](Badan Pusat Statistik, 2020)

Table 4. Adjustment of PDAM Sleman customer's WTP in 2019, based on 2007's WTP

WTP (IDR)	Percent of Respondent (%)
< 54,417.76	29
54,417.76 – 72,557.01	55.1
72,557.01 – 108,835.51	14.5
> 108,835.51	1.4

Assuming the respondent percentages are similar, majority of respondents stated willingness to pay IDR54,417.76 – 72,557.01, for water. Table 5 shows an estimation the water accounts paid by customers, to discover the WTP position value in each consumption block range. According to Table 5, the water consumption in first, second and third blocks are assumed to be charged with low (IDR3,727.48), basic (Rp4,659.36), and full (Rp9,460.17) tariffs, respectively. Meanwhile, the calculation results show the WTP value of Rp54,417.76 – 72,557.01 is in the second consumption block (11 – 20 m^3/month).

Table 5. An estimation of PDAM Sleman customer's monthly water account

Tariff Type	Consumption blocks (m^3/month)		
	0 – 10	11 – 20	> 21
Customers' water account value	Rp37,274.80	Rp41,934.16 – 83,868.40	> Rp93,328.57

The monthly WTP of IDR54,417.76 – 72,557.01, divided by the tariff used (Table 5), obtained a WTP value of 13.7 – 17.6 m^3/month, and this is appropriate for water consumption. Figure 1 shows the average water consumption of Sleman PDAM customers in 2018 – 2019 based on technical report data is approximately 16.21 m^3/month, with the average water consumption dominantly in the block range of 11 – 20 m^3/month, 91.41%. In comparison with the data, the tariff applied has facilitated the customer's WTP, based on the average water consumption adjustment. Therefore, in cases where the tariff set is higher, customers are bound to consume lesser amount of water to pay with the same WTP value, or to pay higher for water consumed, in equality with average water consumptions (16.21 m^3/month).

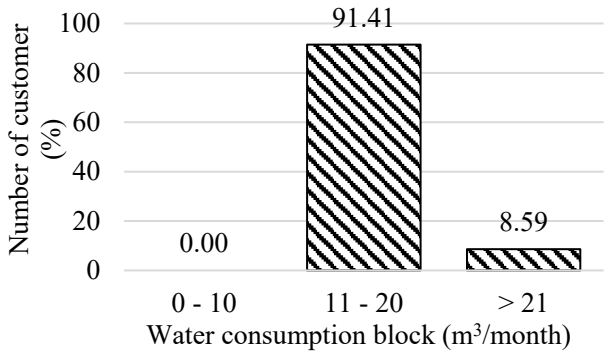

Figure 1. PDAM Sleman customers percentage, based on average water consumption.

3.3 Discussion

Drinking water tariffs charged to PDAM customers are determined by stages initiated by tariff calculation and feasibility analysis, evaluation by the supervisory board and customer group representatives, and eventually established into regulation, by the region head. Furthermore, a tariff feasibility analysis is required to ensure the water tariff established is beneficial to all parties (Istichori, Wiguna and Masduqi, 2018). The water tariff design requires a balance in terms of financial independence for service providers, PDAM in this case, and justice for low income households, as well as economic efficiency for the community (Nauges and Whittington, 2017). In addition to this, the water conservation aspect is also a concern, thus, tariffs were designed to ensure the community practiced water saving (Whittington, 1992). Based on the financial aspects, justice for low income households, as well as conservation aspects, tariff design called increasing block tariff (IBT) is well known. Here, the tariff increases with increase in water consumption and low water tariff are established for basic needs consumption in a bid to subsidize costs for low income households (Whittington, 1992; Klassert *et al*., 2018; Lopez-Nicolas *et al*., 2018). This IBT tariffs were applied by PDAM in Indonesia, including in Sleman.

Tariff feasibility analysis is conducted in several ways, including comparing the tariff applied with theoretical tariffs from the calculation results (Indayani, 2013), using break-even point analysis to assess revenue feasibility from the tariff applied (Mauliyah, 2016), or based on the water

supply investment feasibility, assessed from net present value (NPV), internal rate of return (IRR), and payback period (PBP) (Istichori, Wiguna and Masduqi, 2018). In addition the methods previously mentioned, a feasibility analysis is also conducted by utilizing income projections and WTP is also useful, based on Minister of Home Affairs Regulation Number 71 of 2016. Several studies have also utilized WTP as a tariff analysis reference (Lopez-Nicolas *et al*., 2018; Herdiansyah *et al*., 2019). In this study, a feasibility analysis was conducted, based on revenue projections, profit to earning assets ratio, and customer's WTP projection to determine the acceptance of tariffs from the service providers, as well as service recipients' point of view.

According to the income projection analysis, as well as the profit to earning assets ratio, the PDAM Sleman's tariff based on the calculation is not feasible because the calculated tariff only has a profit ratio of 0.31%, while the reasonable profit to asset ratio is 10%. However, based on the customer's WTP projection, this rate is reasonable. Therefore, the calculated tariff resulting in low (IDR3727.48), basic (IDR4659.36), and full (IDR9460.17) tariffs, is feasible and acceptable from the service recipients or PDAM Sleman's customers' viewpoints, but not from the service provider's perspective. This condition needs to be considered by PDAM Sleman, low profits are bound to cause difficulties in service development, through new piping network investment or existing pipe network maintenance (Indayani, 2013).

In this study, the 0.31% profit to asset ratio obtained is likely to be even lower, from the Sleman PDAM's tariff structure already applied. The tariff structure not only varies based on the consumption block, but also based on customer groups and categories (Table 6). Based on Table 6, the determined tariff was rearranged to enable customers receive lower tariff from the basic tariff. This is bound cause a reduction in PDAM Sleman's income, and consequently, profits.

Thus, the tariff structure must consider the revenue projections capable of supporting profit increment. A list of possible alternative adjustments is given below.

a) Establish a tariff structure merely differentiated based on consumption blocks, without breaking down or detailing for each customer group.

Table 6 PDAM Sleman's 2016 drinking water tariff [1]

Num	Customer Groups	Consumption Blocks		
		0 – 10 m^3 (IDR)	11 – 20 m^3 (IDR)	> 21 m^3 (IDR)
1.	Group I			
	General social	2,650.00	2,650.00	2,650.00
	Particular social	2,650.00	2,650.00	2,650.00
2.	Group II			
	Household A1	3,250.00	3,400.00	3,600.00
	Household A2	3,400.00	3,700.00	3,900.00
	Household B	3,500.00	4,000.00	4,500.00
	Government institution	3,500.00	4,000.00	4,500.00
3.	Group III			
	Small commercial	6,250.00	6,500.00	7,500.00
	Small industry	7,500.00	8,500.00	9,500.00
4.	Particular Group			
	Big commercial	8,100.00	9,250.00	10,500.00
	Big industry	8,500.00	9,750.00	11,000.00
	Airport	8,500.00	9,750.00	11,000.00

[1](Bupati Sleman, 2016)

b) Adjustments consideration for the second and third consumption blocks range, based on the average data of customers' water consumption. Ensure this alteration does not violate the Minister of Home Affairs Regulation Number 71 of 2016, only regulating the first block range. Therefore, considering the average water consumption level of 16.21 m^3/month, the second block's range is possibly 11 – 15 m^3/month, while the third block is bound to exceed 15 m^3/month. The addition of consumption blocks is also possible because consumption blocks is divisible between two to four blocks, in several countries (Fuente, 2019).

4 CONCLUSION

Based on calculations utilizing the formula from Minister of Home Affairs Regulation Number 71 of 2016, PDAM Sleman obtained low, basic and full tariffs of IDR3,727.48, IDR4,659.36, and IDR9,460.17, respectively. According to the WTP projection analysis, these tariffs are feasible from the service recipients or PDAM Sleman's customers' perspectives, because the rate is affordable by customers for average water usage. However, from the service provider or PDAM Sleman's perspective, these tariffs are not feasible because a 0.31% profit ratio is much lower, compared to the 10% fairness profit ratio. Thus, there is a need to adjust tariffs to increase profits, by determining tariffs based on consumption blocks alone, without breaking down according to customer group categories and by adjusting the range of the second as well as third consumption blocks.

DISCLAIMER

The authors declare no conflict of interest.

AVAILABILITY OF DATA AND MATERIALS

All data are available from the author.

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APPENDIX 1

Table A1.1 Tariff calculation formula based on Minister of Home Affairs Regulation Number 71 of 2016

Num	Description	Unit	Period	Notation	Formula	Calculation
1.	Basic cost					
	Operational & maintenance cost	IDR/year	2018	OMC	Operational & maintenance cost amount	14,958,981,739.50
	Depreciation / amortization cost	IDR/year	2018	DAC	Depreciation / amortization cost amount	5,491,188,003.90
	Loan interest cost	IDR/year	2018	LIC	Loan interest cost	25,315,797.00
	Other operational cost	IDR/year	2018	OOC	Administration cost amount excluding depreciation/amortization, allowance account receivable and loan interest	16,317,155,899.93
a.	Total business cost	IDR/year	2018	TBC	TBC = OMC + DAC + LIC + OOC	36,792,641,440.33
b.	Multiplying by inflation factor	%/year	2018	I	(1 + I)	1.0266
c.	TBC estimation at tariff period (Y)	IDR/year	2019	TBCY	$TBCY = TBC \times (1+I)^{Y-X}$	37,771,325,702.64
d.	Volume of produce water	m^3/year	2018	VPW	Historical data	10,133,194
e.	Standard water loss level	%/year	2018	SWLL	20%	20.00%
f.	Standard water loss volume	m^3/year	2018	SWLV	SWLV = SWLL × VPW	2,026,638.80
g.	Basic cost	IDR/m^3	2019	BC	$BC = \frac{TBCY}{VPW-SWLV}$	4,659.36
2.	Basic tariff					
a.	Basic cost	IDR/m^3	2019	BC	(from calculation result number 1.g.)	4,659.36
b.	Basic tariff	IDR/m^3	2019	BT	BT = BC	4,659.36
3.	Low tariff					
a.	Basic tariff	IDR/m^3	2019	BT	(from calculation result number 2.b.)	4,659.36
b.	Sold water volume at low tariff customer group	m^3/year	2018	SVLT	Historical data	3,957,391
c.	Subsidy percentage	%/year	2019	SbP	Subsidy policy of local government	20.00%
d.	Subsidy	IDR/m^3	2019	Sb	Sb = SbP × BT	931.87
e.	Total subsidy	IDR/year	2019	TSb	TSb = Sb × SVLT	3,687,778,611.41
f.	Average subsidy	IDR/m^3	2019	ASb	$ASb = \frac{TSb}{SVLT}$	931.87
g.	Low tariff	IDR/m^3	2019	LT	LT = BT − ASb	3,727.48
h.	Minimum salary of province	IDR/month	2019	MSP	BPS[1] data	1,570,922.73
i.	Low tariff limitation based on MSP	IDR/m^3	2019	LTLP	LTLP = (4% × MSP) / 10	6,283.69

Table A1.1 Tariff calculation formula based on Minister of Home Affairs Regulation Number 71 of 2016 (Continued)

Num	Description	Unit	Period	Notation	Formula	Calculation
j.	Low tariff limitation based on MSP (considering administration & maintenance bill)	IDR/m^3	2019	LTLP2	LTLP2 = [(4% × MSP) – (5000 + 7500)] / 10	5,033.69
k.	Minimum salary of regency	IDR/month	2019	MSR	BPS[1] data	1,701,000.00
l.	Low tariff limitation based on MSR	IDR/m^3	2019	LTLR	LTLP = (4% × MSR) / 10	6,804.00
m.	Low tariff limitation based on MSR (considering administration & maintenance bill)	IDR/m^3	2019	LTLR2	LTLP2 = [(4% × MSR) – (5000 + 7500)] / 10	5,554.00
4.	Full tariff					
a.	Basic tariff	IDR/m^3	2019	BT	(from calculation result number 2.b.)	4,659.36
b.	Current assets	IDR/year	2018	CA	Current assets components amount	10,185,927,385.32
c.	Long-term investment	IDR/year	2018	LTI	Long-term investment components amount	-
d.	Fixed assets	IDR/year	2018	FA	Fixed assets components amount + its depreciation	71,023,412,964.81
e.	Earning assets	IDR/year	2018	EA	EA = CA + LTI + FA	81,209,340,350.13
f.	Profit level	IDR/year	2019	PL	PL = 10% × EA	8,120,934,035.01
g.	Sold water volume at full and particular tariff customer groups	m^3/year	2018	SVFPT	Historical data	2,459,732
h.	Average profit level	IDR/m^3	2019	APL	$APL = \frac{PL}{SVFPT}$	3,301.55
i.	Total subsidy	IDR/year	2019	TSb	(from calculation result number 3.e.)	3,687,778,611.41
j.	Average cross subsidies	IDR/m^3	2019	ACSb	$ACSb = \frac{TSb}{SVFPT}$	1,499.26
k.	Full tariff	IDR/m^3	2019	FT	FT = BT + APL + ACSb	9,460.17

Note: Y = tariff period (2019); X = cost realization period (2018); [1]BPS = badan pusat statistik (statistics central bureau)