

LIST OF TABLES

Table 2. 1 Working Area of Smart City [21].....	20
Table 2. 2 Yogyakarta City Complaint [5]	26
Table 2. 3 Criteria for Urban and Rural City of Yogyakarta [11].....	27
Table 2. 4 Classification of Districts in Yogyakarta City [11]	28
Table 2. 5 Sigfox Specification Visualization	35
Table 2. 6 Smart Lighting System Comparison.....	36
Table 2. 7 Smart Wasted Management Algorithm	37
Table 2. 8 AQMS Sensor Parameters.....	39
Table 2. 9 Sensors used in IoT-AQMS	39
Table 2. 10 Bandwidth, NF and SNR Values for LoRaWAN	41
Table 3. 1 Total Population of Yogyakarta City for 10 Years	47
Table 3. 2 Smart Metering Common Scenarios.....	53
Table 3. 3 Smart Metering Requirement	53
Table 3. 4 Yogyakarta City Electricity Customer Data	54
Table 3. 5 Number of PDAM Water Customers in Yogyakarta City	103
Table 3. 6 Calculation Scenarios for LoRaWAN	55
Table 3. 7 Sigfox Calculation Scenario	56
Table 3. 8 Number of PJUs in Yogyakarta.....	57
Table 3. 9 Skenario LoRaWAN Smart Lighting System.....	57
Table 3. 10 Sigfox Smart Lighting System scenario	58
Table 3. 11 Number of TPS, Depot, Yogyakarta City Garbage Container	59
Table 3. 12 LoRaWAN Calculation Scenario	59
Table 3. 13 Sigfox Perhitungan Calculation Scenario	60
Table 3. 14 Number of AQMS Points in Yogyakarta City	61
Table 3. 15 Calculation Scenarios for LoRaWAN	61
Table 3. 16 Calculation Scenarios for Sigfox.....	63
Table 4. 1 Result of Bit Rate Equation, Treamble with Spreading Factor	67
Table 4. 2 Result of Payload, Payload, and Time on Air Equation	68
Table 4. 3 LoRaWAN Gateway Capacity (Packet/Day).....	69
Table 4. 4 LoRaWAN demand for Yogyakarta Smart City planning	70
Table 4. 5 Gateway of LoRaWAN results.....	70
Table 4. 6 Parameter of LoRaWAN.....	71
Table 4. 7 LoRaWAN Coverage Planning Calculation	72
Table 4. 8 Comparison of Capacity Planning & Coverage Planning for Yogyakarta City ...	73
Table 4. 9 Comparison of LoRaWAN Capacity and Coverage	74
Table 4. 10 Transmite Time of Sigfox (3.8), (3.9)	75
Table 4. 11 Packet per Day for Sigfox (3.10).....	75
Table 4. 12 Count Current of Message/Gateway for Sigfox (3.11)	75
Table 4. 13 Total Message per Day of Sigfox	76
Table 4. 14 Demand Sigfox for Yogyakarta Smart City Planning.....	76
Table 4. 15 Sigfox Coverage Planning Calculation.....	77
Table 4. 16 Sigfox Capacity and Coverage Planning Comparison	78
Table 4. 17 Investment Fee (CAPEX) LoRaWAN.....	80
Table 4. 18 Number of LoRaWAN Devices & Gateways	81
Table 4. 19 LoRaWAN CAPEX Comparison	81
Table 4. 20 LoRaWAN Operational Cost (OPEX).....	82

Table 4. 21 OPEX LoRaWAN Comparison.....	83
Table 4. 22 Investment Fee (CAPEX) Sigfox	84
Table 4. 23 Sigfox CAPEX Comparison.....	86
Table 4. 24 Operating Costs (OPEX) Sigfox.....	87
Table 4. 25 Sigfox OPEX Comparison	87
Table 4. 26 NPV LoRaWAN	105
Table 4. 27 NPV Sigfox.....	106
Table 4. 28 Net Cashflow & Cummulative Cashflow	90
Table 4. 29 LoRaWAN vs Sigfox Technical and Economic Calculation Summary	92