CLIX: Documentation

AI Driven Smart Utility Management System for Bangladesh

Executive Summary

CLIX (Convenient Living & Integrated Experience) is a transformative smart utility management system designed to modernize Bangladesh's electricity, water, and gas infrastructure. This documentation compiled extensive research findings, implementation strategies, and technical specifications for CLIX, supported by evidence from government reports, news sources, interviews, and surveys conducted across Bangladesh.

1. Critical Infrastructure Challenges in Bangladesh

1.1 Water Supply Crisis

Chattogram Water Supply and Sewerage Authority (WASA) faces significant operational challenges that impact service delivery and financial sustainability:

- **Non-Revenue Water Losses**: "Chattogram WASA experiences 25-30% non-revenue water loss, much higher than the global standard of less than 5%" (The Business Standard, 2024).
- **Financial Impact**: "A loss of Tk14-17 crore worth of water every month" (The Business Standard, 2024).
- **Inadequate Monitoring**: "42 Meter Inspectors for 78,000 connections" leading to inaccurate readings (The Business Standard, 2022).
- **Service Disruptions**: Recent incidents of water supply disruptions have affected at least 18 areas including Agrabad, with damages to transmission lines occurring during development work (The Business Standard, 2025).
- **Corruption Concerns**: Evidence that "meter inspectors in collusion with WASA officials show less reading and provide illegal connections in exchange for illegal financial benefits" (The Business Standard, 2022).

1.2 Electricity Distribution Failures

Bangladesh's electricity distribution system suffers from multiple inefficiencies:

- **Defective Meters**: "5 lakh defective meters out of 3.5 crore" nationwide (ATN News, Jul 16, 2024).
- **User Interface Issues**: Elderly users struggle with "token codes with over 100 digits" (CLIX interview with an informed citizen, 2025).
- **Safety Hazards**: "Four people were electrocuted when the power cable fell into the waterlogged area in Mirpur" (DhakaTribune, 2023).

- **Complaints Handling**: When informed about illegal power lines, "Desco did not take permanent action" leading to fatalities (DhakaTribune, 2023).
- **System Losses**: Documented electricity losses of 5.72% according to DESCO Annual Report 2023.

1.3 Gas System Inefficiencies

The gas distribution network experiences substantial losses and service quality issues:

- **System Losses**: Titas Gas reported system losses of "7.67%, where BRC standardized 2%" (Independent TV, 2025).
- **Financial Impact**: Losses costing "3000 Cr BDT annually" (Independent TV, 2025).
- **Industrial Impact**: Factories "cutting production by almost a third" due to inadequate gas pressure (Daily Star, 2025).
- **Household Disruptions**: "Inadequate gas supply has been forcing Farzana Akter and Rabiul Islam to eat at restaurants every morning for two weeks" (Daily Star, 2022).
- **Prepayment Issues**: NFC-based prepaid gas meters require physical trips to recharge, creating accessibility problems especially for elderly citizens (CLIX interview with an informed citizen, 2025).

2. CLIX System Architecture

2.1 Technical Foundation: LoRaWAN Technology

CLIX is built on LoRaWAN (Long Range Wide Area Network) technology, which offers significant advantages for utility management:

- **Technology Definition**: "LoRa, short for Long Range Radio, is a wireless communication technology designed for low-power, long-range data transmission, primarily used in IoT and M2M applications. Unlike Wi-Fi or Bluetooth, LoRa uses Chirp Spread Spectrum (CSS) modulation, which spreads a narrowband signal over a wider channel bandwidth to achieve remarkable range and resilience against interference." (LoRaWAN Documentation, 2025)

- **Key Technical Capabilities**:

    - Long-range connectivity (10-15km) with minimal power consumption
    - Battery life of 7-10 years on a single charge
    - AES-128 encryption for secure end-to-end data protection
    - Operation on license-free spectrum, eliminating ongoing frequency licensing costs
    - Support for thousands of devices per gateway with minimal infrastructure
    - Bi-directional communication for comprehensive device management

2.2 Core Components

CLIX integrates several technical components:

1. **LoRaWAN-enabled Smart Meters**:
    - Tamper-resistant design with real-time monitoring
    - AES-128 encryption for security
    - Battery life of 7-10 years
    - Examples include models like STK25MI gas meters (OIML R137-1(2012) certified)
2. **LoRaWAN Network Infrastructure**:
    - Carrier-grade gateways with 10-15 km range
    - Hybrid connectivity options for reliability
    - Mesh network capabilities for urban environments
3. **Centralized Management Platform**:
    - Real-time dashboard for utility monitoring
    - Outage mapping and management
    - Payment integration system
    - Analytics engine for pattern detection
4. **User Interfaces**:
    - Mobile application for consumers
    - Web portal for utility authorities
    - API integration for third-party services

3. Global Evidence for LoRaWAN Effectiveness

LoRaWAN technology has demonstrated success in multiple international contexts:

3.1 Indonesia Implementation

"Singapore-based Sindcon is retrofitting 50,000+ smart meters in Jakarta with STM32WLE5 LoRaWAN microcontrollers, enhancing remote meter reading in diverse environments while providing 10-year battery life." (The GPS Time, 2023)

The deployment includes:

- Retrofit of electricity, gas, and water meters
- Remote meter reading in diverse environments including apartments, residential areas, industrial utilities, and shopping malls
- Battery life extension to 10 years through advanced power management

3.2 Singapore Results

"Sindcon achieved 90%+ data success rates and up to 7-year battery life with their LoRaWAN smart meters, significantly improving utility management efficiency." (Smart Energy, 2025)

Benefits included:

- Improved tenant satisfaction by over 50%
- Enhanced transparency in billing
- Daily monitoring capabilities for consumers

3.3 Switzerland Deployment

"Elvexys and Oiken implemented LoRa-enabled sensors for real-time power grid fault detection, reducing deployment costs by 90% compared to traditional methods." (Semtech, 2021)

The implementation demonstrated:

- Immediate communication of power failures
- Precise failure location identification
- Significant cost reduction for deployment and maintenance

3.4 France Application

"CAHORS Group's Sentinel® line fault detection solutions use LoRaWAN to monitor power lines, enabling immediate fault identification and preventing costly outages." (Semtech, 2019)

Key achievements:

- Real-time monitoring of overhead voltage lines
- Detection of single phase grounded faults
- Prevention of power outages through early detection

4. Existing LoRaWAN Implementation in Bangladesh

Bangladesh has already begun adopting LoRaWAN technology for utility management:

4.1 Chattogram WASA Pilot Project

"3,000 Pure Ultrasonic Digital meters (LoRa)" have been implemented in Chattogram (The Business Standard, 2022)

- **Implementation Cost**: "The initial cost of the pilot project has been estimated at around Tk5.8 crore." (The Business Standard, 2022)
- **Security Benefits**: "With digital meters no one can tamper with it nor can steal. Also all the bills will automatically come to their server." (Md Samsul Alam, Deputy Managing Director, Chittagong Wasa)
- **Testing Areas**: "Initially the meters will be installed in Chittagong's Halishahar's three residential areas" (The Business Standard, 2022)

4.2 Karnaphuli Water Supply Project Results

- Successfully "reduced non-revenue water to 10%" (The Business Standard, 2024)
- "The Karnaphuli Service Area... with DMA system providing uninterrupted supply to 46,000 connections" (The Business Standard, 2024)

4.3 Planned Expansion

"The Chattogram Water Supply Improvement Project, with financial backing from the World Bank, aims to replace 300km of existing pipelines and install 87,000 smart meters across the city." (The Business Standard, 2024)

- Project value: Tk3,745 crore
- 46 District Metering Areas (DMAs) planned
- 40 deep tube wells for emergency supply

5. Technical Superiority of LoRaWAN Over Current Systems

Current utility management systems in Bangladesh rely primarily on:

1. **Manual Meter Reading**:
    - "Manual meters are only read once a month for billing purposes." (Interview with government employee, 2025)
    - Subject to human error and corruption
    - "It's very tough for people of such areas to do fasting without water. On Wednesday night, I could not even drink a glass of water during Sehri." (The Financial Express, 2008)
2. **GSM-Based Prepaid Systems**:
    - "DESCO, BRIB, BPDC, DESCO, OJOPADICO, NESCO are institutions that are providing prepaid meters." (ATN News, 2024)
    - Require individual SIM cards for each meter, increasing operational costs
    - "When they try to read a file in the analysis tool, they may encounter an error. This is normal -- it can be hard to read a file correctly on the first try." (Government interview, 2025)

LoRaWAN offers significant advantages:

- **Coverage**: 10-15 km range vs. 1-2 km for GSM
- **Battery Life**: 7-10 years vs. 2-3 years for GSM-based systems
- **Infrastructure Requirements**: One gateway can serve thousands of devices
- **Operating Costs**: No ongoing SIM card or cellular data costs
- **Security**: End-to-end encryption with AES-128

6. Consumer Research Findings

CLIX conducted extensive consumer research to validate market needs:

6.1 Survey Methodology

- Total respondents: 79 (26 online, 53 offline)
- Geographic distribution: Dhaka (54.4%) and outside Dhaka (45.6%)
- Demographic breakdown:
    - Age groups: 18-25 (35.4%), 26-35 (25.3%), 36-45 (19.0%), 46-55 (12.7%), 56-65 (6.3%), 66+ (1.3%)
    - Occupations: Students (44.3%), Businessmen (21.5%), Service holders (19.0%), Householders (7.6%), Teachers (3.8%), Others (3.8%)

6.2 Feature Preference Findings

Feature ratings from "Highly Helpful" to "Not Helpful at all":

Feature	Highly Helpful	Helpful	Neutral	Not Helpful	Not Helpful at all
Emergency gas leak alert at night	88.60%	10.10%	0.00%	0.00%	1.30%
Real-time electricity bill tracking	67.10%	29.10%	3.80%	0.00%	0.00%
Water leak alert when away from home	70.90%	27.80%	1.30%	0.00%	0.00%
One-click bill payment via mobile	74.70%	24.10%	1.30%	0.00%	0.00%
Preventing payment for others' illegal connections	74.70%	24.10%	1.30%	0.00%	0.00%
Load-shedding timing notifications	75.90%	20.30%	3.80%	0.00%	0.00%
Integrated system for electricity, gas, water	65.80%	27.80%	6.30%	0.00%	0.00%
Tech & job opportunities from smart systems	72.20%	24.10%	3.80%	0.00%	0.00%
Accurate billing with usage record	75.90%	17.10%	6.30%	0.00%	0.00%
Disaster-time live utility map	70.90%	25.3%	3.80%	0.00%	0.00%
Usage-based saving recommendations	69.60%	24.10%	5.10%	1.30%	0.00%

Adoption of global smart utility models	73.40%	13.90%	12.7%	0.00%	0.00%
Prior notification of utility personnel arrival	65.80%	22.80%	10.10%	1.30%	0.00%
Knowing which appliances use the most electricity	67.10%	31.60%	1.30%	0.00%	0.00%
Leaving reliable systems for future generations	68.40%	22.80%	8.90%	0.00%	0.00%
Average	**72.07%**	**23.00%**	**4.65%**	**0.17%**	**0.09%**

6.3 Key Consumer Pain Points Identified

From in-depth interviews with consumers:

1. **Difficult Payment Mechanisms**:
    - "I'm exhausted and have to wait in line at my local shop to recharge my NFC-enabled gas card." (As Is System documentation)
    - "An elderly man in Cumilla faced a serious problem when he tried to recharge his electricity meter. He received a token code with over 100 digits, but was unable to enter it correctly." (CLIX interview with an informed citizen, 2025)
2. **Lack of Transparency**:
    - "I don't understand, if my electricity usage has changed overnight, why do I have to wait 24 hours just to get an updated reading? It feels so outdated!" (As Is System documentation)
    - "Earlier, gas charges followed a per-minute model (Tk. 6.90/min), where Tk. 6.00 was for gas usage and Tk. 0.90 covered VAT and maintenance. Now with the modern per-unit prepaid system, the VAT and maintenance costs still exist, but are not clearly communicated." (an informed citizen interview)
3. **Service Unreliability**:
    - "I had no idea my pipe was leaking that much until now!" (As Is System documentation)
    - "Many rural areas are still using traditional non-digital meters." (As Is System documentation)

7. CLIX Implementation Framework

The CLIX implementation follows a comprehensive project lifecycle designed for sustainable and scalable deployment:

7.1 Comprehensive Project Lifecycle (36 months)

1. **Research Phase (3 months)**:
    - Needs assessment across urban and rural areas
    - Regulatory compliance research with utility authorities
    - Stakeholder mapping and engagement
2. **Design Phase (4 months)**:
    - System architecture specification
    - UI/UX design for consumer and enterprise interfaces
    - Security protocol development
    - Integration framework design
3. **Development Phase (6 months)**:
    - Core platform components
    - Integration with existing utility systems
    - Analytics engine development
    - Mobile and web application development
4. **Testing Phase (3 months)**:
    - Quality assurance and performance testing
    - Security validation and penetration testing
    - User acceptance testing
    - Compliance verification
5. **Pilot Deployment (3 months)**:
    - 5,000 households in selected urban area
    - Performance monitoring and optimization
    - User feedback collection and system refinement
6. **Full Deployment (12 months)**:
    - Phased rollout to urban, suburban, and rural areas
    - Training and capacity building for utility staff
    - Public awareness campaigns
    - Integration with payment systems
7. **Maintenance & Enhancement**:
    - Ongoing system support
    - Feature enhancements based on usage data
    - Performance optimization
    - Security updates

7.2 Key Implementation Milestones

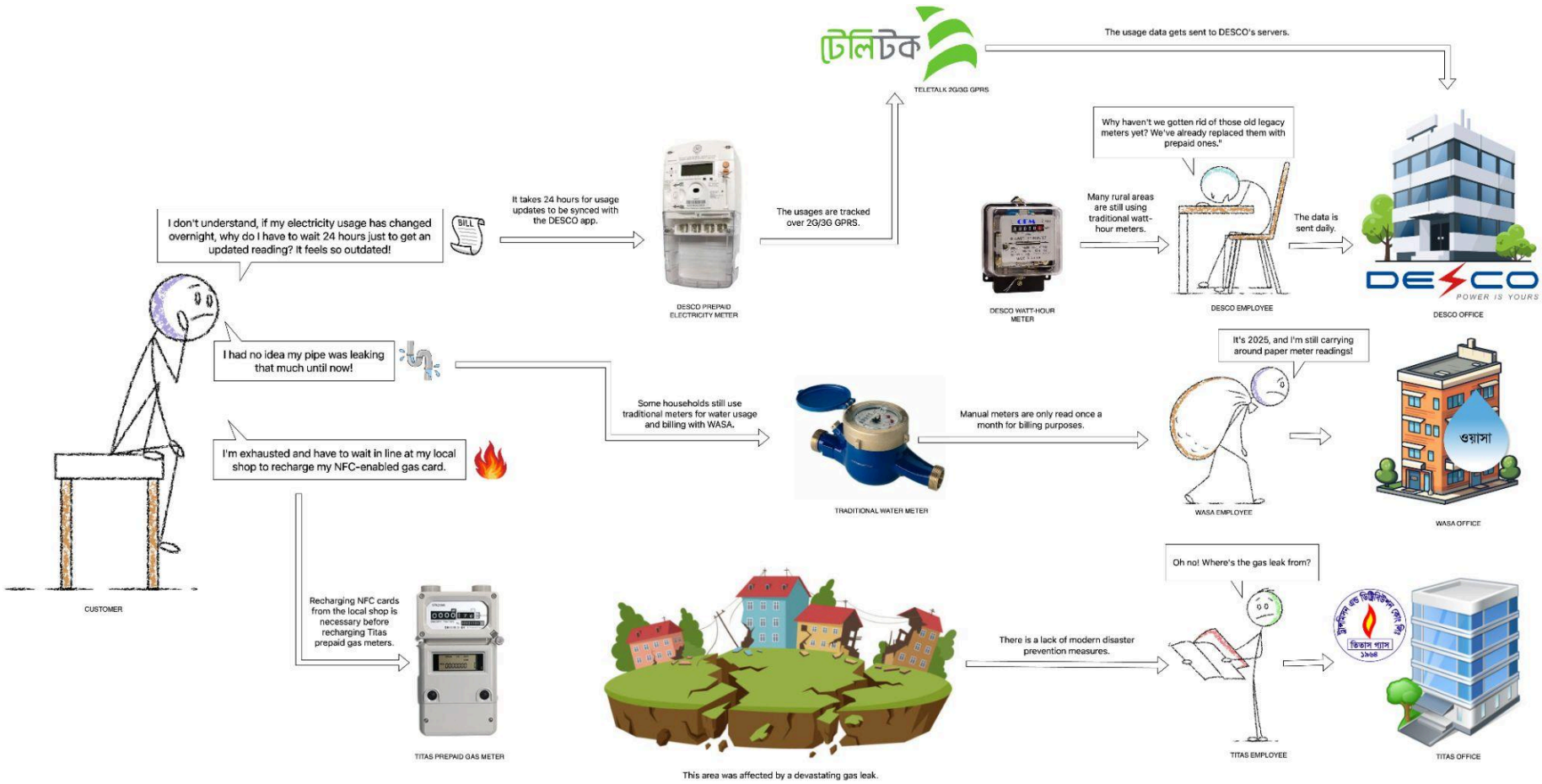
- **Urban Deployment (Month 25)**: 100,000+ connections in major cities
- **Full Deployment (Month 31)**: Nationwide coverage of target areas
- **System Integration (Month 33)**: Complete integration with all utility providers
- **Performance Optimization (Month 36)**: System refinement based on first-year usage data

8. Comparative Analysis: Current vs. CLIX System

8.1 Current System Limitations ("As Is")

The current utility management system in Bangladesh suffers from numerous inefficiencies:

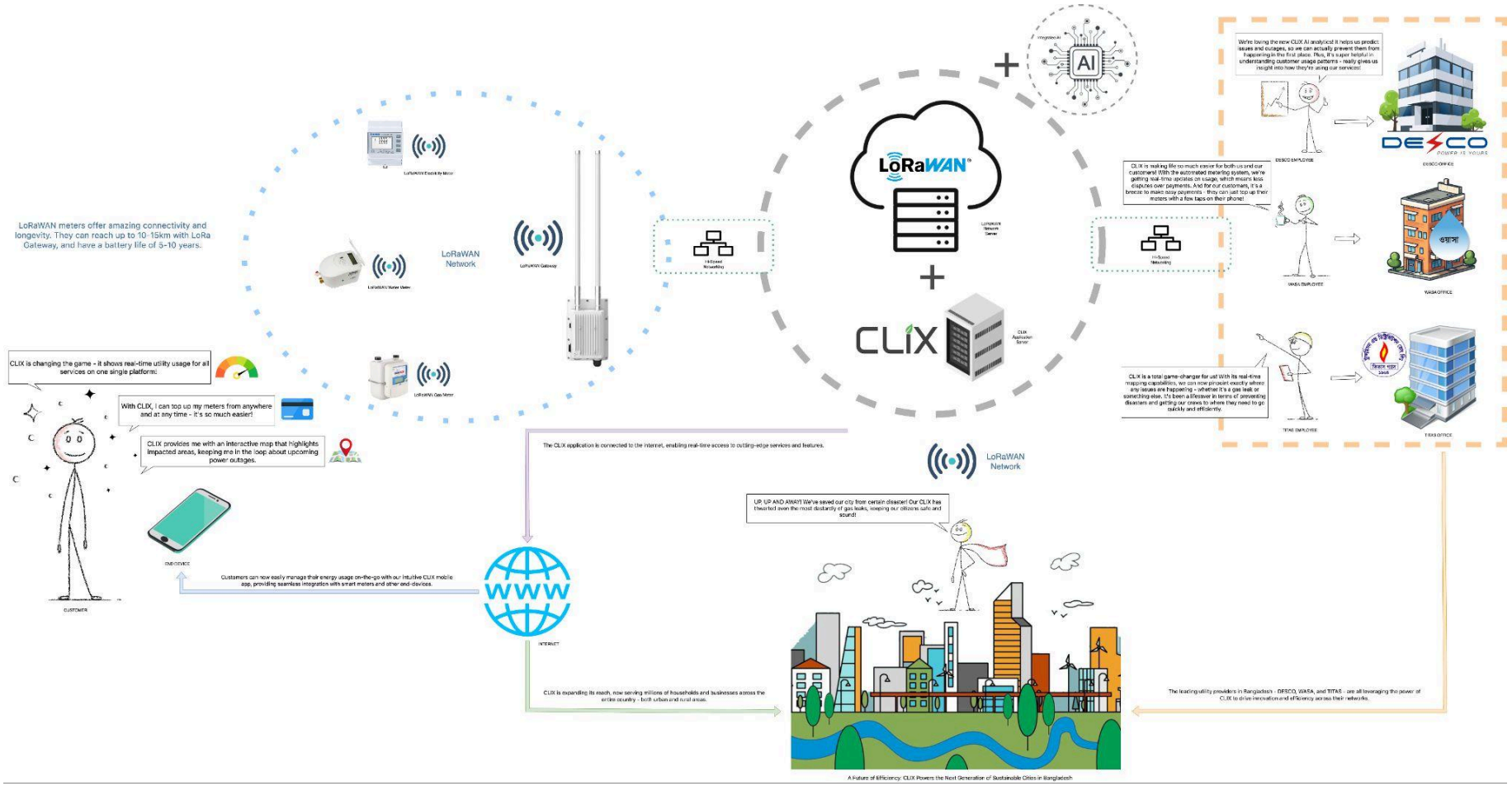
1. **Manual Meter Reading**:
    - "Chattogram Wasa still calculates the bill by taking meter readings by visiting every house." (The Business Standard, 2022)
    - "It takes 24 hours for usage updates to be synced with the DESCO app." (As Is System documentation)
    - "Traditional non-digital meters are often read once a month by meter inspectors." (As Is System documentation)
2. **Limited Consumer Visibility**:
    - "I don't understand, if my electricity usage has changed overnight, why do I have to wait 24 hours just to get an updated reading?" (As Is System documentation)
    - "I had no idea my pipe was leaking that much until now!" (As Is System documentation)
3. **Fraud and Theft**:
    - "There are allegations that meter inspectors in collusion with WASA officials show less reading and provide illegal connections in exchange for illegal financial benefits from customers." (The Business Standard, 2022)
    - "There is a lack of modern disaster prevention networks." (As Is System documentation)
4. **Outdated Payment Systems**:
    - "Recharging NFC cards from the local shop is necessary before recharging." (As Is System documentation)
    - "Some households still use traditional meters for water usage." (As Is System documentation)


I don't understand, if my electricity usage has changed overnight, why do I have to wait 24 hours just to get an updated reading? It feels so outdated!
BILL
It takes 24 hours for usage updates to be synced with the DESCO app.
DESCO PREPAID ELECTRICITY METER
The usages are tracked over 2G/3G GPRS.
TELETALK 2G/3G GPRS
The usage data gets sent to DESCO's servers.
DESCO WATT-HOUR METER
Many rural areas are still using traditional watt-hour meters.
Why haven't we gotten rid of those old legacy meters yet? We've already replaced them with prepaid ones."
DESCO EMPLOYEE
The data is sent daily.
DESCO
POWER IS YOURS
DESCO OFFICE
I had no idea my pipe was leaking that much until now!
Some households still use traditional meters for water usage and billing with WASA.
TRADITIONAL WATER METER
Manual meters are only read once a month for billing purposes.
It's 2025, and I'm still carrying around paper meter readings!
WASA EMPLOYEE
ওয়াসা
WASA OFFICE
I'm exhausted and have to wait in line at my local shop to recharge my NFC-enabled gas card.
CUSTOMER
Recharging NFC cards from the local shop is necessary before recharging Titas prepaid gas meters.
TITAS PREPAID GAS METER
This area was affected by a devastating gas leak.
There is a lack of modern disaster prevention measures.
Oh no! Where's the gas leak from?
TITAS EMPLOYEE
তিতাস গ্যাস
TITAS OFFICE

8.2 CLIX System Improvements ("To Be")

The CLIX system addresses these limitations through:

1. **Automated Meter Reading**:
    - "LoRaWAN meters offer amazing connectivity and longevity. They can reach up to 10-15km with LoRa Gateway, and have a battery life of 7-10 years." (To Be System documentation)
    - "CLIX is changing the game. It sends real-time usage to all vendors (not just those platforms)." (To Be System documentation)
2. **Enhanced Consumer Control**:
    - "With CLIX, I can top up my meters from anywhere and at any time. It's so much easier!" (To Be System documentation)
    - "CLIX provides me with an interactive map that highlights impacted areas, helping me to be more aware concerning power outages." (To Be System documentation)
3. **Fraud Prevention**:
    - "CLIX is a total game-changer for what we are able to see too! It allows us to identify suspicious patterns, which our engineers can now directly investigate with way more information." (To Be System documentation)
    - "CLIX is essential to reach near-zero errors of households and businesses across the entire country." (To Be System documentation)
4. **Integrated Payment**:
    - "Customers can easily manage their energy usage on-the-go with our intuitive CLIX mobile app, avoiding expensive integration with other vendors." (To Be System documentation)
    - "The LoRaWAN network is connected to the internet, enabling real-time billing services and features." (To Be System documentation)



A Future of Efficiency: CLIX Powers the Next Generation of Sustainable Cities in Bangladesh

9. Market Size and Opportunity

CLIX addresses a substantial market opportunity in Bangladesh:

9.1 Target Market

- 40M+ households across Bangladesh
- 500K+ commercial and industrial entities
- Utility infrastructure serving 160+ million citizens

9.2 Addressing Critical Infrastructure

- Water supply networks serving major urban centers
- Electricity distribution covering 3.5 crore connections nationwide
- Gas utility systems with documented 7.67% losses

9.3 Corruption Elimination Potential

Evidence shows significant corruption in current utility systems:

- "Meter inspectors in collusion with WASA officials show less reading and provide illegal connections in exchange for illegal financial benefits" (The Business Standard, 2022)
- CLIX removes human intervention points that enable corruption

10. Sustainability & Revenue Model

- **Customer-Based Revenue:** Utility providers will share a portion of their revenue with CLIX.
- **Enterprise-Based Revenue:** CLIX will provide advanced monitoring systems to enterprise users. These users will pay utility providers, and CLIX will receive a share of this revenue. Additionally, CLIX will earn income through subscription fees

11. Expert Assessments

Utility authorities have expressed support for smart metering technologies:

- **Chattogram WASA**: "Hopefully, if the project is successfully implemented, water wastage will be prevented and Chattogram Wasa's revenue will increase." (Maksud Alam, Chief Engineer, The Business Standard, 2022)

- **Titas Gas**: "They are trying to reduce system loss by removing illegal connections." (Shah Newaj Parvej, The Managing Director of Titas Gas Transmission)

- **Power Division**: "The Ministry of Power, Energy and Mineral Resources and Power Division Committee has taken the matter seriously regarding citizens' problems after the meeting conducted on 11 July 2024 at Bangladesh National Parliament House." (ATN News, 2024)

12. Conclusion

CLIX represents a transformative approach to utility management in Bangladesh, addressing critical infrastructure challenges through innovative technology. Based on extensive research, proven international precedents, and local pilot implementations, CLIX offers a comprehensive solution to improve service delivery, reduce losses, enhance consumer experience, and strengthen utility infrastructure nationwide.

The documented system benefits include:

- Reduction in non-revenue losses across utilities
- Improved billing accuracy and transparency
- Enhanced service reliability through real-time monitoring
- Decreased operational costs for utility providers
- Simplified payment processes for consumers
- Increased infrastructure security and resilience

As evidenced by successful implementations in Chattogram and international case studies, LoRaWAN technology provides the optimal foundation for Bangladesh's next-generation utility management system.

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