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The 23rd International Asset Facility and Maintenance Management Conference

Advancing Drinking Water Distribution Systems through Smart Water Applications: Insights, Benefits, and Lessons Learned

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Presentation Outlines:

1. Introduction
2. Smart Water Metering (SWM)
3. Objectives
4. Methodology
5. Implementation of (SWM) in Different Countries
    (A) United States of America (USA)
    (B) United Kingdom (UK)
    (C) Australia
    (D) South Korea
6. Conclusion

1. Introduction

- The global water sector is facing **unprecedented challenges** due to Population growth, Economic development, Rapid urbanization, and Climate change
- World population projected to reach **9.8 billion by 2050 (UN)**
- Over **40% of the global population** expected to face **severe water stress**
- **55% increase in global water demand** by 2050 compared to 2000 levels
- Urban water demand is the primary driver
- Increasing pressure on already stressed water resources
- Rising risks to **urban water security**, especially in water-scarce regions

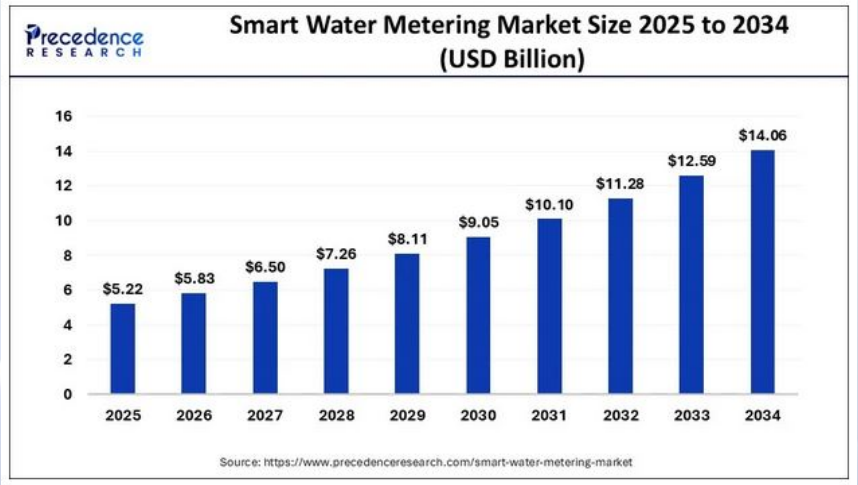
1. Introduction (Continue)

Smart Water Technologies (SWT), particularly Smart Water Metering (SWM), have emerged as key tools for:

- Sustainable water management
- Addressing water scarcity and system inefficiencies
- Supporting digital transformation of water utilities
- An international survey involving 64 utilities from 28 countries highlights that water distribution systems are often the entry point for digital adoption across the urban water cycle,

Smart Water Metering Market:

- Global smart water metering market is **rapidly expanding**
- Market value **USD 4.67 billion (2024)** Projected to reach **USD 14.06 billion by 2034 (**Expected **Compound annual growth rate (CAGR) of 11.65%**



2. Smart Water Metering (SWM)

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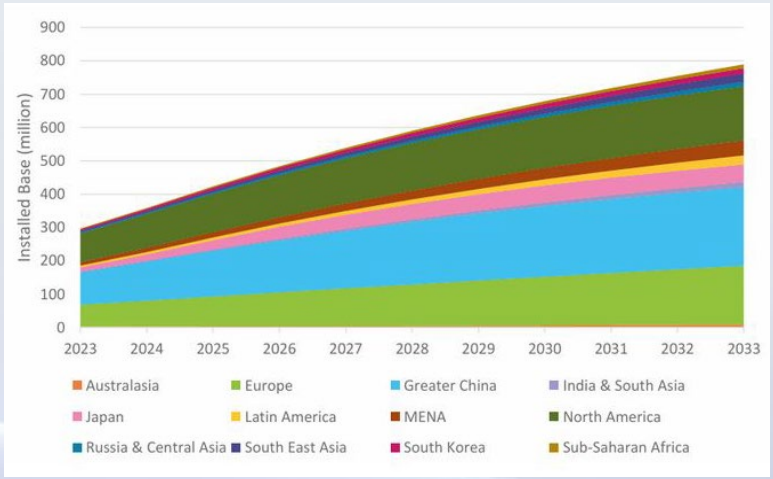
Global Shift Toward Smart Metering
Transition from traditional to smart meters represents a major **Internet of Things (IoT)** initiative
Smart metering supports:

- Water conservation
- Data-driven utility operations



Global deployment outlook (Transforma Insights):

- Nearly **789 million smart water meters** expected worldwide by **2033**

2. Smart Water Metering (Cont.)

Key Drivers of SWM Growth:

- Escalating water scarcity
- Increasing water consumption
- High leakage and non-revenue water losses
- Need for improved monitoring across:
  - Domestic users
  - Commercial users
  - Industrial users
- Enhanced cost tracking and optimized resource utilization

Growth of Scientific Research on SWM

- Rapid expansion of SWM-related research since **2000**
- Leading contributing disciplines:
  - Engineering
  - Computer science
  - Energy systems
- Major contributors by country: (United States-India-China)
- Reflects strong global commitment to innovation in water management

3. Objectives

- Examine the **adoption, implementation, and outcomes** of Smart Water Metering (SWM) in drinking water distribution systems
- Assess **SWM diffusion and deployment** (pilot and full-scale) in the **USA, UK, Australia, and South Korea**
- Analyze **operational, economic, and environmental benefits**, including:
  - Water conservation
  - Leakage reduction
  - Cost savings
  - Improved customer engagement
- Identify **key barriers and enabling factors** affecting scalability and sustainability

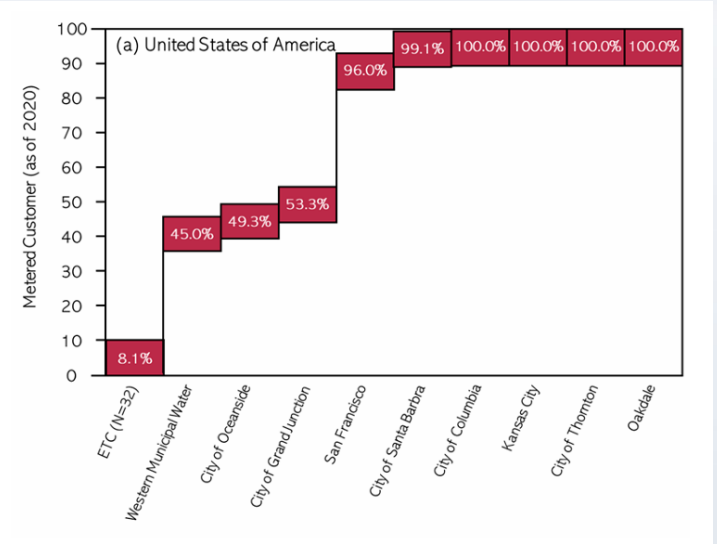
4. Methodology

- Qualitative multiple case study approach
- Analysis of **real-world SWM projects** across selected countries
- Review of **pilot and full-scale implementations**
- Assessment of:
  - Deployment strategies
  - Successes and challenges
- Evaluation of **operational**, **economic**, **and environmental benefits**
- Focus on **asset management, maintenance integration, and infrastructure optimization**
- Examination of how smart technologies improve:
  - System efficiency
  - Service delivery
  - Sustainable water distribution management

5. Implementation of (SWM) in Different Countries

(A) United State of America (USA)

- **41 SWM projects** analyzed (pilot and full-scale)
- Implementations at both **municipal and metropolitan** scales
- Full deployments achieved in cities such as (Columbia-Kansas City-San Francisco)
- Ongoing installations in several other cities
- **Severe droughts**, particularly in California (2012–2016) is one of key drivers
- Federal and state **grant funding** (Bureau of Reclamation & State of California)
- **In Kansas City**, SWM serving **~167,000 customers** over **318 sq. miles**
- Slower progress in some cities due to Lack of federal mandates and Limited large-scale government support
- Despite this, clear benefits drive adoption (Reduced water losses - Accurate billing - Improved operational efficiency)
- **Overall trend indicates continued nationwide expansion**



5. Implementation of (SWM) in Different Countries

(B) United Kingdom (UK)

- SWM diffusion in Europe is **slower** than in electricity and gas sectors
- Progress in the UK is **gradual** due to regulatory constraints
- **Thames Water** leading one of the largest SWM deployment programs Coverage across **England and Wales**
- **Water Industry Act (1991)**:
    - No mandate for universal smart meter installation
    - Customers are **not legally required** to adopt SWM
    - Utilities cannot enforce compulsory deployment
- **Adoption Strategy - Voluntary installation model**
- Targeted deployment in **water-stressed regions**
- Selected utilities involve ed:

    Affinity Water - Anglian Water - Essex & Suffolk Water - South East Water

    Southern Water - Sutton & East Surrey Water - Thames Water

Regulatory flexibility enables **targeted adoption**

5. Implementation of (SWM) in Different Countries

(C) Australia

- 43 SWM projects reviewed; early initiatives (pre-2015) were pioneering.
- Kalgoorlie Smart Metering Trial (Queensland): 13,800 meters, AUD 4M cost, annual savings AUD 4.5M, 13% consumption reduction, improved leak management.
- TasWater (Tasmania): **46,000 meters**, AUD 36M investment, **37% water supply cost reduction**, **10% consumption decline**, **strong customer acceptance**.
- City West Water (Victoria): Early adopter informing national strategies.
- SWM adoption not mandatory; AS4747 standards allow mechanical meters alongside smart meters
- Early projects showed strong technical and economic benefits; adoption slowed after 2015 due to regulatory flexibility, high costs, and competing infrastructure priorities.

5. Implementation of (SWM) in Different Countries

(D) South Korea

- **SWM Adoption** Began ~2000 with integration of water management and ICT.
- 137 pilot/trial projects across multiple cities.
- Total of 146 SWM projects: 137 pilots + 9 full implementations.
- Gochang, Taean, Damyang – near-complete deployment, facilitated by smaller populations and lower service densities.
- **Seosan Smart City Project (2016):**
  - Response to drought and high leakage rates.
  - 1,550 smart meters, 30 base stations, 9 sub-district areas, real-time monitoring platform.
  - Investment: ~USD 0.4M (Seosan City + national government).
  - Benefits: reduced leakage, improved monitoring accuracy, enhanced customer satisfaction.
- Strong government support and successful pilot outcomes indicate accelerated SWM adoption and an expanding role in national water management.

6. Conclusion

- Global adoption of SWM is accelerating, reflecting growing integration of digital technologies in water management.
- Success depends on effective regulatory frameworks, financial support, technological readiness, and stakeholder engagement.
- SWM delivers measurable benefits including improved efficiency, reduced water losses, cost savings, enhanced leak detection, and higher customer satisfaction.
- Key challenges include high initial investment, integration with legacy systems, and variable policy enforcement.
- Continued research is needed to understand the roles of regulation, organizational mindset, and consumer participation in supporting digital transformation.
- Overall, SWM represents a strategic tool for sustainable, efficient, and resilient water management globally.

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