

智慧公廁的淨零轉型：AIoT如何讓城市更永續

黎明時分，當城市甦醒，一間不起眼的公廁，開始以全新的方式運作。

燈光僅在有腳步接近時才亮起，水龍頭只在手伸出時才流動，每一次沖水都根據實際需求精確調節——不浪費一滴水。這不是未來科幻，而是智慧公廁搭載 AIoT(人工智慧物聯網)技術的現在進行式。透過AI運算與感測器的聯動，公共設施從被動變為主動節能、智慧運行，減少碳排、提升效率，同時確保使用體驗更加直覺且舒適。

在這場公廁的綠色革命中，智慧科技讓看似微不足道的公共設施，成為推動永續城市的隱形力量。

一間公廁如何改變城市？

想像一座能夠「理解」人潮流動的公廁——當通勤高峰來臨，通風系統自動增強，燈光保持明亮；當夜幕低垂、訪客稀少，設備則進入節能模式，調降功耗。這一切，不再是固定排程，而是由AI自動學習並調整，根據實際使用情境，動態適配能源與水資源配置。這不僅提高了營運效率，更讓公廁變成城市綠色基礎建設的一部分，成為低碳永續的象徵。

AIoT：看不見的環保管家

在公廁的背後，AIoT技術如同無形的管家，透過感測器+智慧分析，實時監測並優化水電使用：

✅ 智能用水管理：每次沖水皆由AI計算需求，不浪費多餘水量。若偵測到漏水或異常耗水，系統即時通報維護人員，避免長期水資源流失。

🔧 成果：節水**20%**以上(相比傳統沖水馬桶)，減少城市每日數千公升水資源的浪費。

✅ 智慧照明與節能：LED燈光與換氣系統依據人流變化自動調整，無人時降到最低功耗，僅在必要時啟動。

💡 成果：減少**25%**用電，並降低公廁碳排放 **10-20%**。

✅ 智慧維護預測：AI分析感測器數據，可偵測設備異常，如馬桶水箱故障、排風扇老化等，提前通知維修，避免突發損壞導致公廁停用。


🔧 成果：設備壽命延長**40-50%**，維護成本減少**30%**。


滴水不浪費、每度電都算數

水，城市的藍色黃金。過去，公廁的沖水量往往固定，不論實際需求。但在AIoT管理下，公廁的每一滴水都被精確計算，根據需求適量沖水，達成**20%**以上節水效益。這代表，每天數千人次的使用下，可為城市省下數百萬公升水量。

能源方面，公廁搭載智慧照明與感測調控系統，自動調整燈光與通風，減少不必要的能源消耗，預計可降低**25%**以上的用電量，碳排放也隨之減少。這不僅幫助城市節能減碳，更能讓有限的公共預算更有效利用。

智慧化管理 = 降低營運成本 + 提高ESG績效

 節約開支：水費與電費降低20-25%，維修成本減少30%。

 降低碳排：每座智慧公廁每月可減少約**10-20%** CO₂排放，累積至全市數量後，將是極具影響力的碳減排方案。

更重要的是，這些數據可直接轉化為 **ESG** 企業永續報告的績效指標，幫助政府機關、企業或公共機構達成減碳承諾，符合國際標準（如 ISO 50001、SBTi 等）。

讓公廁成為 ESG 碳管理新工具

AIoT智慧公廁不只是節能設備，更是推動**ESG**管理效率的關鍵場域。

環境 (E) — 減少資源消耗

- 節水 **20%** 以上，減少公共水資源浪費
- 降低用電 **25%**，並結合太陽能發電進一步減碳
- 減少**10-20%** CO₂ 排放，為城市永續發展助力

社會 (S) — 提升公共服務品質

- 公廁環境乾淨、智慧管理確保備品充足，改善市民使用體驗
- 推動淨零公廁聯盟，與其他機構共同實踐綠色建設
- 改善都市生活品質，讓市民感受科技帶來的便利與舒適

治理 (G) — 數據驅動的ESG績效管理


- 碳、水、電使用數據即時追蹤，提升 ESG 透明度
 - 數據化報表對接 **TNFD**、**GRI** 等國際永續標準，幫助政府與企業提升永續財務披露能力
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未來的城市，每一座公廁都能成為環保英雄

想像未來的城市，每一座公廁都如同智慧永續的微型綠能站，每一次沖水、每一盞燈光、每一度電都被最有效率地使用，每一間公廁都能為減碳、節能、提升社會福祉做出貢獻。

這不只是科技的進步，而是城市治理的一場新革命——讓最基礎的公共設施，也能成為ESG轉型的核心。

當我們能讓公廁如此聰明、如此節能、如此永續，那麼我們對於其他城市基礎建設的未來，將充滿無限可能。這是一個開始，一個城市邁向智慧、低碳、永續的起點。

智慧公廁，讓永續從「最基本的日常」開始。 

The Net-Zero Smart Toilet: A Sustainability Story for Cities

In the quiet moments before dawn, as the city stirs awake, an unassuming public toilet comes to life in a new way.

Lights flicker on only as footsteps approach, faucets flow only when hands are present, and every flush is precisely calibrated—never a drop wasted. This isn't science fiction; it's the reality of **AIoT (Artificial Intelligence and the Internet of Things)-enabled smart toilets**, where technology transforms ordinary facilities into active participants in the city's sustainability mission.

With every sensor-driven adjustment, these toilets **optimize resource use, cut carbon footprints, and enhance operational efficiency**, all while ensuring an intuitive and seamless user experience.

A once-overlooked facility is reborn as an agent of sustainability, an invisible force shaping the future of eco-conscious cities.

How Can a Public Toilet Change a City?

Imagine a **public restroom that "understands" the rhythm of city life**—airflow increases during rush hours, lighting brightens for midday crowds, and energy-saving mode activates during off-peak hours. No longer running on rigid schedules, these smart toilets **adapt dynamically** based on real-time data, ensuring optimal use of energy and water.

This is more than efficiency; it's a **new kind of infrastructure—one that actively contributes to a greener urban ecosystem.**

AIoT: The Unseen Guardian of Efficiency

Behind the scenes, AIoT technology serves as **an invisible caretaker**, seamlessly managing resources through **real-time monitoring and automated adjustments**:

✔ **Smart Water Management**: AI determines the precise amount of water needed for each flush, preventing unnecessary waste. If a leak or abnormal usage is detected, **instant alerts** notify maintenance teams.

🔧 **Impact: Over 20% water savings**, preventing thousands of liters of water waste daily.

✔ **Intelligent Lighting and Ventilation**: Sensors detect occupancy and adjust **lighting and airflow accordingly**, reducing energy waste when the facility is empty.

💡 **Impact: 25% reduction in energy use**, leading to a **10-20% drop in carbon emissions**.

✔ **Predictive Maintenance**: AI continuously analyzes sensor data, detecting early signs of wear in toilets, faucets, or ventilation systems before failures occur.

🔧 **Impact: 40-50% increase in equipment lifespan**, reducing maintenance costs by 30%.

Every Drop Counts, Every Watt Matters


Water—our **blue gold**—is too precious to waste. Traditional public toilets flush with a **fixed volume**, regardless of actual need. AIoT changes this by **adjusting each flush precisely**, cutting **water usage by at least 20%**. Across thousands of daily users, this translates into millions of liters saved annually.

On the energy side, **motion-activated LED lighting and adaptive ventilation** reduce unnecessary electricity use, lowering power consumption by **at least 25%**. The result? A **cleaner city with reduced energy demand**, lowering both costs and carbon footprints.

Smart Management = Lower Costs + Better ESG Performance

Beyond sustainability, **smart automation significantly cuts operational costs**. Reduced water and electricity bills, efficient cleaning schedules, and optimized maintenance **increase efficiency while reducing financial strain**.

 **Savings: 20-25% reduction in water and electricity costs, 30% lower maintenance expenses.**

 **Carbon Footprint: Each smart restroom cuts CO₂ emissions by 10-20% monthly, contributing to large-scale climate action goals.**

Most importantly, AI-driven tracking converts these savings into measurable ESG performance metrics, helping governments and institutions meet sustainability targets while complying with international standards like ISO 50001 and SBTi.

Transforming Public Toilets into ESG Carbon Management Hubs

AIoT-powered smart toilets aren't just about conservation—they're essential to **advancing ESG management strategies**:

Environmental (E) – Resource Efficiency

- **20%+ reduction in water consumption**
- **25% reduction in electricity use** (further boosted by solar integration)
- **10-20% CO₂ emissions reduction**, accelerating net-zero targets

Social (S) – Public Well-being & Smart Cities

- Clean, well-stocked restrooms with optimized sanitation schedules
- **Collaboration with Net-Zero Toilet Alliance**, integrating sustainability best practices
- **Enhancing quality of life**, showing citizens how technology can improve daily experiences

Governance (G) – ESG Data Transparency & Compliance

- **Real-time tracking of carbon, water, and energy data**, increasing ESG reporting accuracy
 - **Integration with TNFD, GRI, and other sustainability disclosure standards**, supporting long-term financial and environmental strategies
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The Future: Every Public Toilet as a Sustainability Champion

Imagine a future where every public toilet functions as a **micro green energy hub**—where **each flush, each light, and each watt of power** is managed **with precision** to create a net-positive impact.

This is not just a **technological upgrade**; it's a **governance shift**—a recognition that **even the most basic facilities must become sustainability leaders**.

When **public restrooms can be this intelligent, efficient, and sustainable**, the possibilities for **the future of our cities** become limitless.

This is just the beginning—a **starting point for urban environments to transition toward smarter, greener, and net-zero solutions**.

Smart Toilets: Making Sustainability an Everyday Reality.   
