Aqua Optima
水智優

AquaOptima Smart Water Pump Management AI Platform

Cut energy costs by 20-30%; 3-yr payback
Fully automated operation

DataXquad

AI Cities

Jul 2025

Contents

1) Solution Overview

WSD Energy Saving Challenges

Rising Electricity Prices Trends

- Electricity prices have experienced significant volatility in the past years (e.g.7% increases in 2022, fuel surcharge increases in 2023) with cumulative increases of 12-15%.
- Each 1% electricity price increase costs WSD millions in HKD annually, creating mounting financial pressure on departmental operations.

Carbon Emission Targets - Green initiatives

- Hong Kong's commitment to carbon neutrality includes targets of 50% emission reduction by 2035 & 70% carbon intensity reduction by 2030 - with WSD contributing to the 6% energy reduction target for 2020-2025.
- Achieving the government's ambitious targets requires accelerated decarbonization efforts across water infrastructure without compromising reliability.

Pumps account for up to 90% of total electricity consumption at water supply facilities, offering the greatest potential for energy savings.

But complex pump optimization makes manual operation nearly impossible for optimal efficiency.

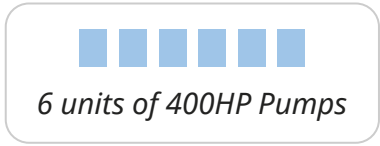
Water Pump Operation - Major Challenges

1 Poor Energy Efficiency	Pumps operating far from optimal efficiency points cause significant energy waste.
2 High Pump Maintenance Costs	Poor operating conditions shorten equipment lifespan, leading to unexpected downtime & costly emergency repairs.
3 Resource-Intensive Operations	Manual monitoring and control ties up valuable staff resources while increasing the risk of error & oversights.
4 Inability to Optimize Flow	Human operations influenced by biases and habits limit real-time optimization and adaptability.
5 System Instability & Disruption	Poor control may creates pressure surges that damage infrastructure and threaten reliable water supply.

The Solution - Smart Pump Management

Operational Challenge	Improvements	Solution Deployed
1 Poor Energy Efficiency	20 - 30% energy savings	AI-optimized pump combinations and frequency control
2 High Maintenance Costs	5 - 20% reduction in equipment wear	Maintaining pumps at optimal efficiency points (above 90% ER)
3 Resource-Intensive Operations	1+ hour daily staff time savings	Up to 50 automated daily pump control replacing manual operations
4 Inability to Optimize Water Flow	> 95% time within supply target range	Intelligent predictive control with real-time demand forecasting
5 System Instability & Disruption	100% automatic fault detection	Comprehensive anomaly detection and response logic

Taiwan ROI Analysis - Hardware Retrofitting vs. AI



Example: A typical water supply station with 2400HP capacity and high flow variability incurs annual electricity costs around US$1.39 million (NT$44.38 million at current rates of NT$3.8/kWh)

A

Hardware Only

Replace 4 units of 400HP pumps

Cost > **US$625,000 (**NT$20M)

Estimated savings **5%**

ROI payback over **9 years**

High investment; limited returns
Infra & operation disruptions;
Reliance on manual operation

B

Optimal AI Deployment

Install 4 units of 400HP VFDs + AquaOptima AI

Cost **US$606,250** (NT$19.4M) including VFD

Estimated savings **15%**

ROI payback **2.9 years**

Optimal energy savings;
high operational flexibility
Fully automated operation

C

Selective AI Deployment

Install 3 units of 400HP VFDs + AquaOptima AI

Cost **US$520,300** (NT$16.65M) including VFD

Estimated savings **10%**

ROI payback **3.8 years**

Cost-effective energy savings;
lower upfront investment
Fully automated operation

Smart Pump Solutions - Market Review

Domestic energy-saving solutions in Asia still mainly rely on hardware replacement and equipment upgrades, while internationally, smart operational optimization solutions have emerged.

Hardware-Dependent Solutions

- *Requires integration of specific brand pumps/sensors*
- *Increases setup costs & complexity*
- *Extends implementation time*

EU

USA

Large-Scale Network Management

- *Citywide or multi-station deployments*
- *Unsuitable for single pumping stations*
- *Over-engineered for small-to-medium scale facilities.*

Canada

EU

The Right Solution - Flexible, Smart, Cost-Effective

Hardware Independence

- ✓ Seamlessly integrates with existing or new industrial hardware (VFDs, sensors, PLCs) and software systems.
- ✓ Avoid costly hardware replacement, maximizes current asset efficiency.

Scalable Deployment

- ✓ Start with a single station and scale as needed
- ✓ Delivers results even with partial deployment

Triple Efficiency: Energy, Water & Labor

- ✓ Optimizes pump efficiency and supply precision, prevents excessive water usage.
- ✓ 24/7 automated operation, reduces manual monitoring & on-site workload.

Low Investment; Rapid Returns

- ✓ Delivers 15 – 30% operational savings with minimal overhead.
- ✓ Costs a fraction of international competitor while offers exceptional value

Innovation Partner with Asia’s Water Utilities

Developed in Asia

- ✓ Full compatibility with existing systems.
- ✓ Localized interface (Chinese, English etc).
- ✓ Enhanced cybersecurity with local data control

Tailored Solutions

- ✓ Customized for your company workflows and procedures.
- ✓ Seamless integration from external interfaces to AI-powered operational intelligence

Long-Term Support

- ✓ Local team available online and on-site.
- ✓ Continuous optimization and system improvements.

AI-Driven Water Supply Management

Three Integrated Modules for Complete Pump Optimization

A) IoT Integration

Seamlessly **integrates existing sensors and control hardware**, establishing data flow and control command for smart energy foundation.

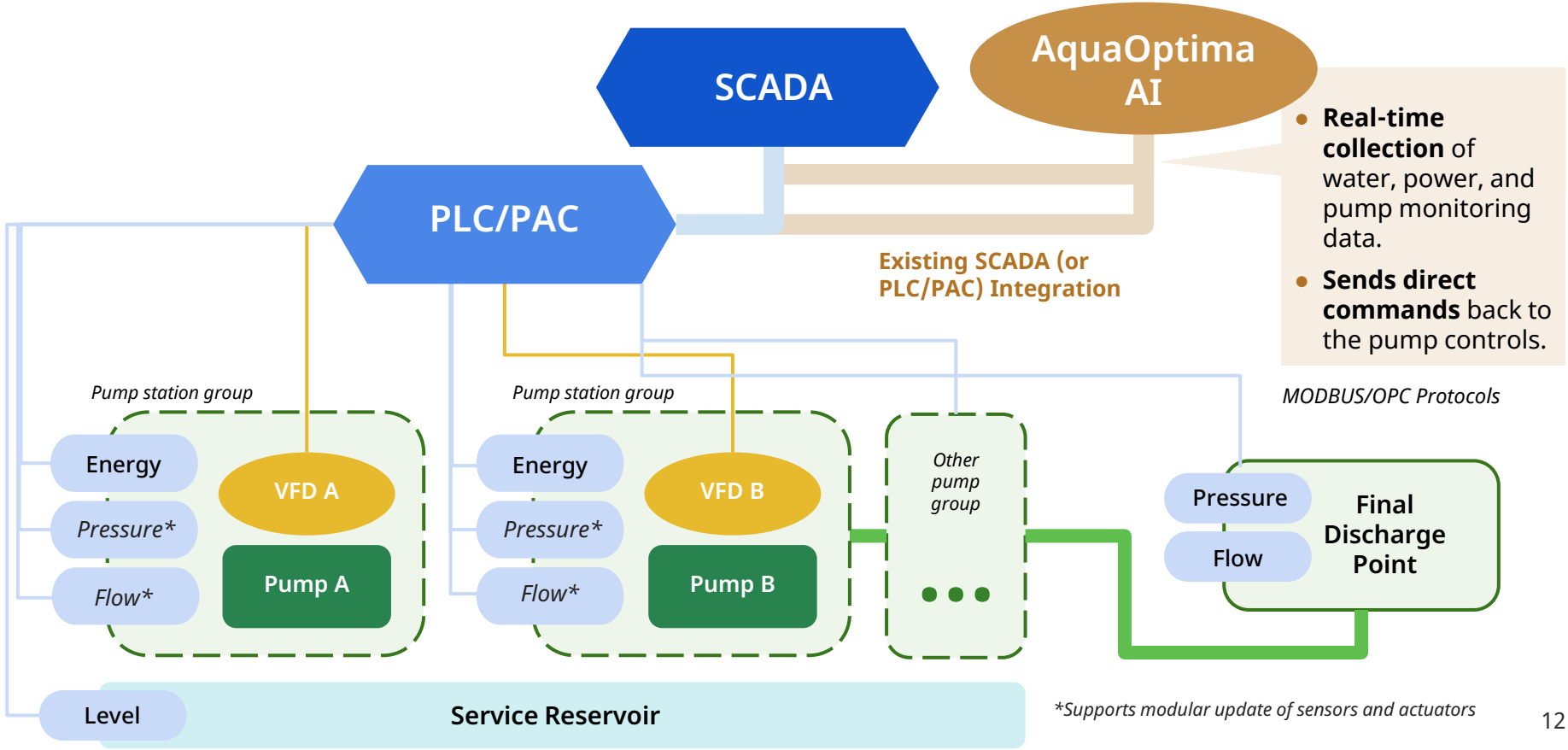
B) Management Platform

Comprehensive monitoring, control, management and recording capabilities, serving as the **central digital hub** for operational personnel.

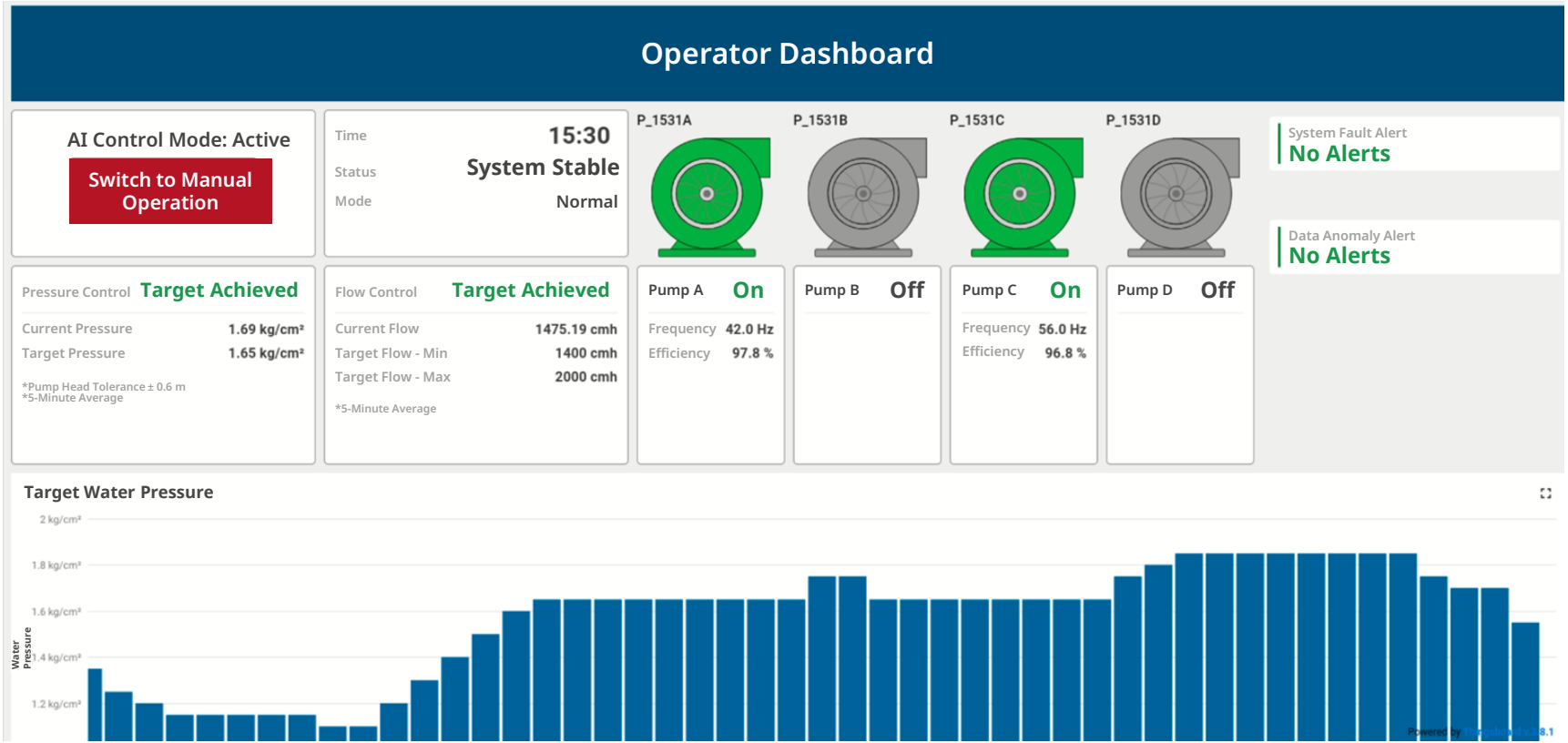
C) AI Optimization Algorithm

Three-layer AI intelligence (equipment / demand / control) ensures stable supply while **maximizes energy efficiency automatically**.

Module A: IoT Integration - Zero Disruption to Existing Systems



Module B: Operation Platform - Digitized Management



Module B: Operation Platform - Complete Feature Sets

Dashboard

- Customized interfaces for operators and managers
- Real-time data monitoring and system configuration adjustment
- Historical data analysis with comprehensive reporting

Alerts

- Smart alert categories (15+ alert types)
- Alert status tracking with acknowledgement capabilities
- Audio notifications for critical anomalies

Data Export

- Time-based data filtering for system and alert downloads
- Export AI control logs and operational parameter history

Setpoints/Goal

- Set upper & lower limit targets for water pressure & flow
- System automatically adjusts according to pre-set schedules
- Manual override capability for specific time periods

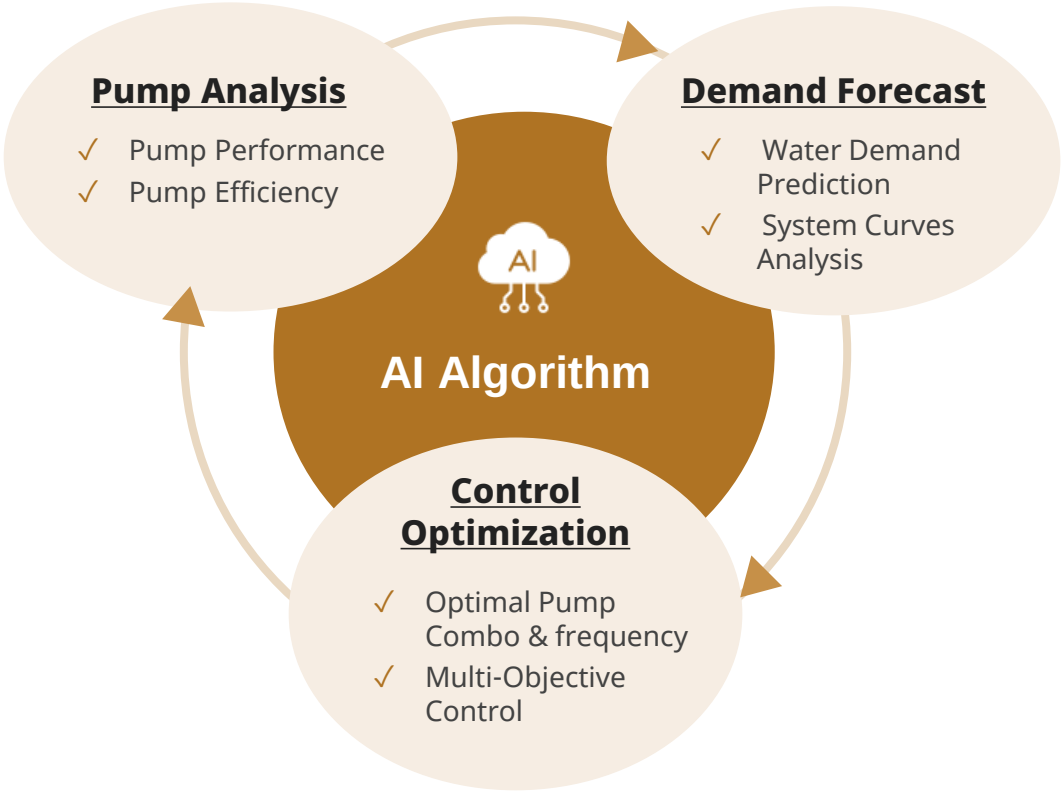
Asset Management

- Detailed pump specifications and asset management records
- Real-time pump operational status (e.g standby, maintenance, decommissioned)

Smart Logs

- Detailed minute-by-minute logging of intelligent control cycles
- Complete system transparency - input data, output commands, and decision logic

Module C: AI Algorithms - Optimization for Maximum Efficiency

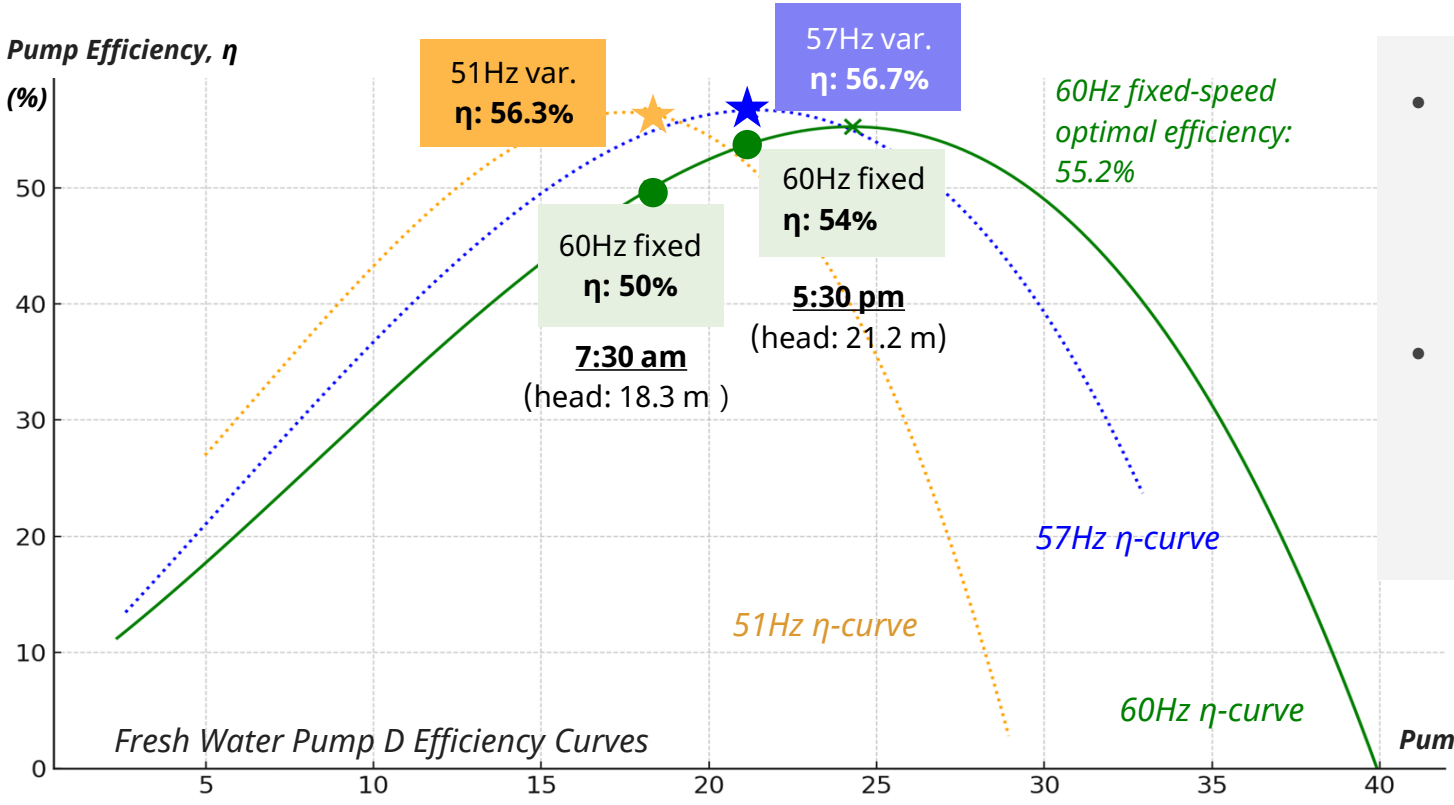


Our in-house developed three-layer AI scheduling algorithm using structured data AI modeling technology:

- ✓ Minimal initial data required for quick, accurate model training.
- ✓ High precision enables stable pumping efficiency optimization
- ✓ Highly adaptable; algorithms easily extendable to various scenarios.
- 📌 Patentable technology; filing process currently underway.

Smart Pump Management - Concept #1

How Fixed-Speed Pumps Energy Waste Happens?



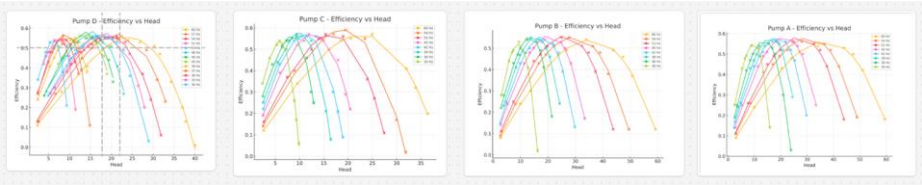
- Fixed-speed pumps operate at constant frequency, unable to adapt to head changes, causing efficiency to drift from optimal points and reduce performance.
- Variable frequency control automatically adjusts to corresponding frequency to match real-time head requirements, maintaining peak performance.

Smart Pump Management - Concept #2

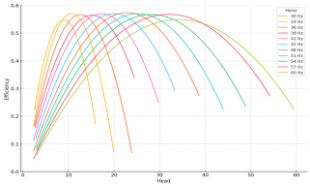
Why Optimal Pump Control requires AI?

Multi-objective optimization with competing goals creates an NP-hard computational challenge, requiring data science expertise and AI modeling to handle complex calculations.

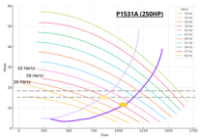
1 **Maintain Pump Efficiency Ratio Above 90%**



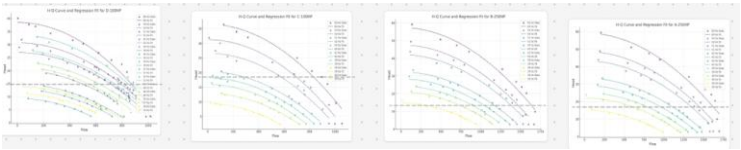
2 **Maximize Overall System Efficiency**



3 **Meet System Pressure/Head Targets**



4 **Meet System Flow Targets**



2) Case Study

Taiwan Water Corp: Qingzhou Plant Optimization

Under Taiwan's SMESA initiative, we partnered with Taiwan Water Corporation to tackle critical energy efficiency challenges facing modern water utilities. Qingzhou Water Plant was selected as the pilot deployment site.

After completing a comprehensive two-week testing and validation phase, the system transitioned to full operational deployment on March 17th. Its stable operation since then has successfully validated its immediate applicability for other sites.

#	Phased Testing & Rollout
1	**Basic Control Testing** - Start / Stop and frequency control validation
2	**Controlled Operation** - 2-hour test with no pump switching
3	**Multi-Pump Testing** - 10-hour test with 3 pumps switching
4	**Continuous Operation** - 24-hour reliability validation
5	**Extended Validation** - 10+ days of real time operation
	Full Deployment - Complete system activation

Pump Operation Transformation

Before - Existing Operation

Pump A	Pump B	Pump C	Pump D
VFD			VFD
250HP	250HP	100HP	100HP
Primary	Backup	Backup	Secondary
24h variable frequency			15h fixed freq + 4h variable frequency

Pump A Efficiency Ratio as low as 70%

Pump D Efficiency Ratio as low as 80%

After - Optimized Operation

Pump A	Pump B	Pump C	Pump D
VFD	VFD	VFD	VFD
250HP	250HP	100HP	100HP
Primary	Backup	Secondary	Secondary
24h variable frequency		18h variable frequency	5h variable frequency

All pumps' Efficiency Ratio above 95%

Overall System Efficiency: 41%

22% Increase

Overall System Efficiency 51%

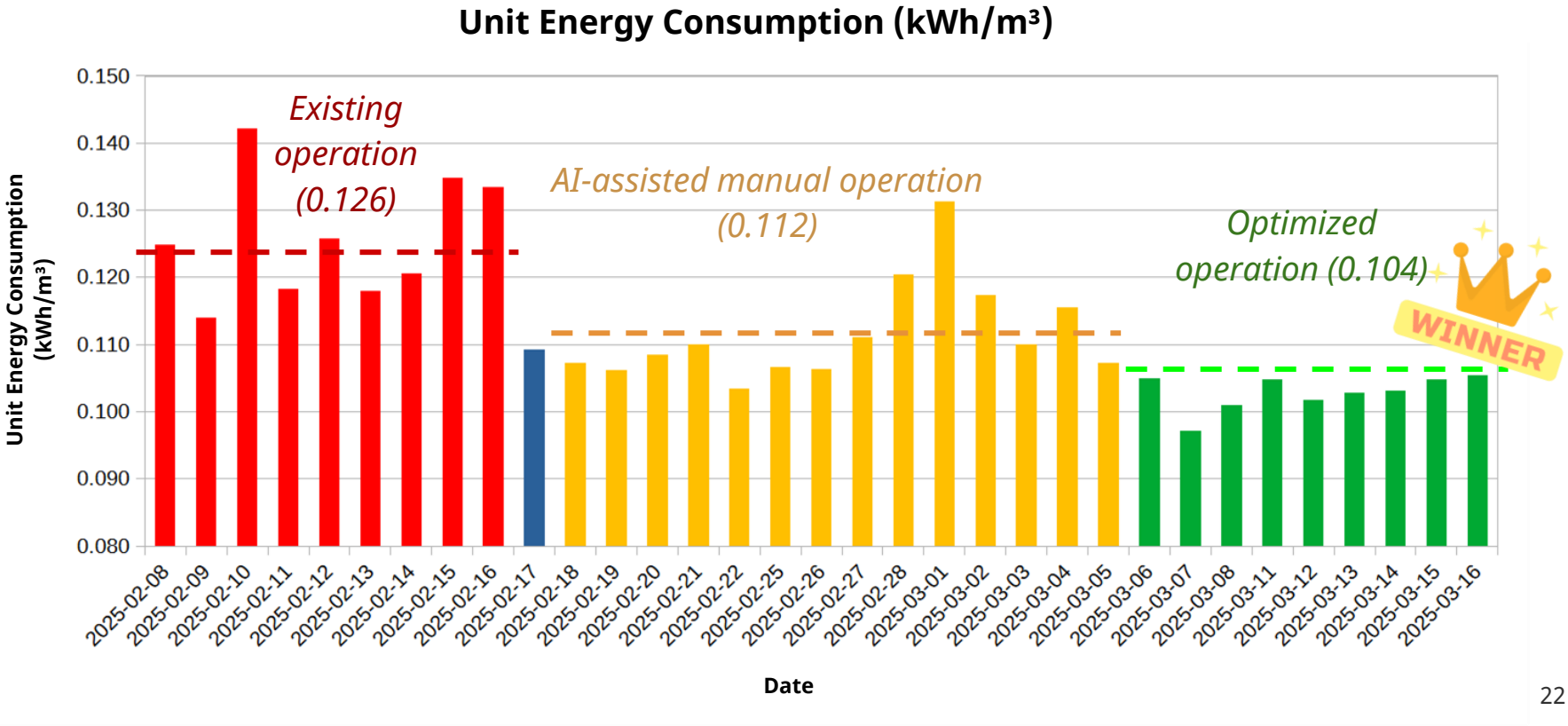
Note: Total Efficiency = Pump × Motor × VFD Efficiency

Proven Energy Savings - How It Works

A) Reduce unnecessary water supply	+	B) Improve pump efficiency	=	C) Overall energy reduction

Daily Average Data	Water Volume (CMD)	Reduction (%)	Energy Intensity (kWh/m³)	Reduction (%)	Energy Consumption	Energy Savings (%)
Jan (Existing operation)	34,415	**2%**	0.121	**15%**	**4,153**	**17%**
Early Feb (Existing operation)	35,586	**6%**	0.126	**18%**	**4,473**	**23%**
Mar (Existing operation - projection)	38,077	**12%**	0.126	**18%**	**4,786**	**28%**
AI-Assisted Manual Operation (Feb / Mar)	34,205	**2%**	0.112	8%	**3,826**	10%
Full AI Automation (Mar)	32,768		0.104		**3,419**	

Proven Pump Efficiency Improvement



Individual Pump Optimization

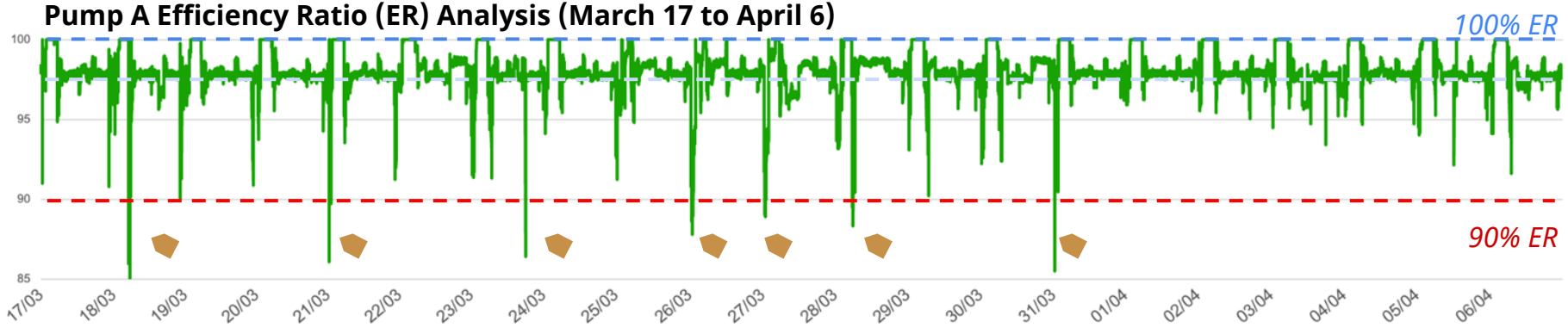
Pump Efficiency Ratio (ER): $$ER = \frac{\eta_{act}}{\eta_{BEP}}$$

The ratio between actual operating efficiency and the Best Efficiency Point (BEP) efficiency of a given pump.

- Example: Pump A has a BEP efficiency of 58% at 41Hz. If actual operational efficiency is 57%, the efficiency ratio is 97%, indicating near-optimal operation.

Current Performance: All pumps consistently maintain Efficiency Ratio (ER) above 90%.

Pump A Efficiency Ratio (ER) Analysis (March 17 to April 6)



Marked areas show temporary efficiency drops during major operational adjustments (pump start / stop or large frequency changes) necessary to minimize water hammer effects and protect equipment and pipeline infrastructure.

Qingzhou Plant: Solution Investment ROI

Plant Profile: 1.66 million kWh annual energy consumption

Based on US$0.125 (NT$4) per kWh electricity costs, the following annual savings are **projected & achieved!**

Estimated Savings (%)	Energy Savings (kWh)	Cost Savings (USD)
15%	249,000	**$31,125**
20%	332,000	**$41,500**
30%	498,000	**$62,250**

Project investment: US$72,250
(equipment and implementation)

Payback timeline: ~ 1.8 years
(conservative 20% savings estimate)

⚡ *Note: Rising electricity costs will accelerate payback timeline*

3) Partnership

DataXquad x Water Utility Partnership

Building Next-Generation Water Systems

DataXquad

- ✓ Data analysis & AI modeling *(Data Scientist)*
- ✓ System development & ongoing support *(Full Stack Engineer)*
- ✓ IoT pump operation management *(IoT Engineer)*
- ✓ Project management and advisory support *(Consultant)*

Water Utility

- ✓ Water system expertise and operational knowledge
- ✓ Real-time system data for analysis
- ✓ Hardware procurement and installation support
- ✓ Integration with existing SCADA/PLC systems

Proven Path to Optimization: Pre-Implementation Assessment

A

Preliminary Assessment

Energy savings potential & feasibility

- Analyze pump operation combinations, water usage patterns & electricity costs
- Evaluate pump operational performance
- Analyze current situation vs. optimal efficiency gaps, assess optimization feasibility

USD 3,000
(2 days)
Assessment Report

B

In-Depth Assessment & Solution Validation

Complete data collection & deep analysis

- Complete data collection (guidance & processing)
- Accurate assessment and verification of pump performance & operational efficiency
- Provide specific optimization solutions & implementation plans

USD 10,000
(10 days)
Assessment Report, Operation Manual & Validation Report

C

Recommendations & Validation

Validate with staff manually operating recommendations

- Share manual operation optimization solutions & implementation plans
- Design and assist with optimization implementation; analyze and validate effectiveness

Energy Savings Feasibility Report

TC Industrial Park Station 5 (Indirect Water Supply)

	Time	Pump Combo	Duration (Hour)	Hourly Head (m)	Water Volume CMH	Calculated Output CMD	WHP (KW)	Power Usage (KW)	Efficiency
Current Status									
Supply - Day / Night	0730 - 0030	Single unit (1,2,3)	17	43	290	6960	34	59	57.6%
Storage - Midnight	0030 - 0730	2 / 3 units	7		588	14105	78	131	59.4%
		4-pump single unit		44.4	509	12216	62	101	61.0%
		2 units (1, 2, 3)		49.5	498	11952	67	114	58.9%
		4-pump 2 units (1, 2, 3)		50.3	671	16104	92	156	59.0%
Total									58.8%

Current efficiency: 59% overall pump system performance.

Individual pump: 61% - 64% Best Efficiency Points (BEP) range.

A preliminary assessment indicates a potential electricity savings of approximately 4% – 9%.

Complete Solution Package & Service Options

Core Scope

- Software licensing
- Hardware (computer, monitor)
- On-premise deployment
- Testing & implementation
- Comprehensive training & online materials
- Ongoing technical support (troubleshoot & resolution)

Value-Added Services

- On-site technical support
- System updates & new features
- Configuration updates
- Pump replacement services
- Custom reporting & analytics
- Operator retraining
- Data backup & recovery
- Integration with other systems

POC Price: USD 160 per pump horsepower (hp)

Staged Deployment Approach (Optional)

No need to wait for all equipment - our modular system design enables flexible deployment with hardware readiness, delivering immediate energy savings.

Three-Phase Deployment

1	Manual Control System diagnostics & optimization recommendations	• Power & flow sensors installation • Provide historical data insights	5% savings (2 weeks)
2	Partial Automated Control Frequency optimization without pump switching	• VFDs installation • SCADA system integration	15% savings (1 month)
3	Fully Automated Control Automatic pump switching & operation combinations	• Check valve installation • SCADA-controlled operations	25% savings (1 month)

Appendix:
Company Profile

Company Overview

AI Cities

- AI-Cities.Biz is AI and Robotic arm of MapKing and MapAsia group
- We are investor and partner of DataXquad

DataXquad

- **AI Startup**: Founded in 2023, headquartered in Taichung, Taiwan.
- **Core Mission**: **Facilitating rapid digital transformation for traditional industries**, reducing barriers to cutting-edge technology adoption in public and industrial sectors through proprietary development and global solution integration.
- **Diverse Interdisciplinary Integration**: Team expertise brings over 40 years of combined industry experience across Artificial Intelligence (AI), Internet of Things (IoT), and Robotics, excelling in end-to-end integration from demand analysis to practical system implementation.
- **Main Applications**: Smart energy-saving solutions that reduce operating costs through intelligent automation, supporting ESG and Sustainable Development Goals (SDGs).

NVIDIA INCEPTION PROGRAM

Garage+

TWS TAIWAN WEB SERVICE

AppWorks

Recognized by multiple prestigious domestic and international innovation accelerators

Company Overview

Combining Global Vision and Local Expertise

- Offices established in Hong Kong, Malaysia, UK and Singapore
- Extensive experience in international collaboration and solution deployment across multiple markets, with services spanning:
  - ✓ Southeast Asia (Taiwan, Singapore, Malaysia, Vietnam)
  - ✓ North America (United States, Canada)
  - ✓ Oceania and beyond.
- Building a resilient global network that leverages local expertise and international technology resources, empowering partners to launch innovative solutions from Taiwan to global markets

2024 Startup Gathering Media Coverage

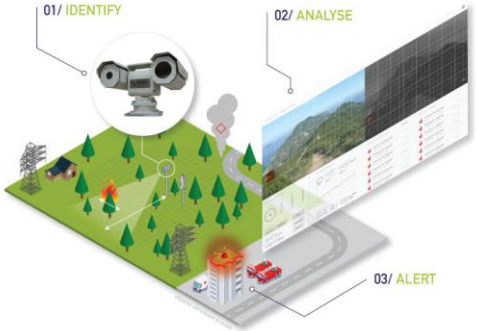
Featured in the 2024 Taiwan AI Startup Map

Case Studies

AI-Powered CNC Tool Management

Taiwan Automotive Parts Manufacturer (SMEA Collaboration Project)

- ✓ 80% reduction in manual inspection time, freeing up skilled technical personnel.
- ✓ 70 - 90% AI accuracy delivered in just 2 weeks with minimal data (30+ records).
- ✓ No sensors required, no workflow disruption - minimal investment, high return.



Intelligent Fire Risk Monitoring & Alert System

Asia/America/Europe - Wildfire agencies, National Parks & Forestry

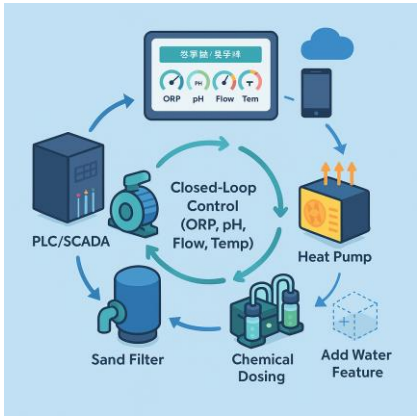
- ✓ Wide detection range - 8 km early fire detection + 15 km smoke / heat monitoring.
- ✓ 95%+ fire incidents detected and alerted within 10 minutes.
- ✓ Modular design for remote deployment with minimal operational costs.

Case Studies

Distributed Smart Water Monitoring Platform

Australia - Regional

- ✓ Connects rural pumping stations to centralized water treatment plants, providing real-time monitoring and alarms.
- ✓ Reduced maintenance work orders and inspection travel costs by 40% through predictive maintenance.
- ✓ Supports compliance with environmental discharge standards for various industries (agriculture, livestock, brewing).

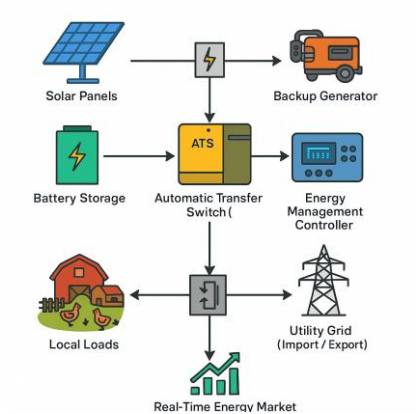


Smart Swimming Pool Management Systems

Australia - Government facilities & private pool / aquatic centers

- ✓ Centralized control of circulation pumps, filters, boilers, and dosing systems.
- ✓ Automatic dosing and temperature regulation with seasonal settings.
- ✓ Reduced on-site response time by 50%, easy integration for future expansions.

Case Studies



Solar & Energy Storage Management Platform

Australia's largest free-range poultry farm

- ✓ Integrated energy management platform with 1.4MW solar panel, 2.28 MWh battery storage, and backup generators.
- ✓ Reduced electricity costs by 70%, ROI within 5 years (with government subsidy).
- ✓ Annual carbon reduction of 1,500 tons (62%), suitable for replication in similar high-energy consumption sectors.

AI-Powered Manufacturing Quality Optimization

World’s largest plastics processing plant

- ✓ Developed process parameter monitoring and simulation for optimal production combinations.
- ✓ Improved product quality by over 50%, significantly reducing human error costs.

Thank You!

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