

Efficient Water Distribution: OPPORTUNITIES AND CASE STUDIES

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GreenGov ♦ 6 October 2010

Why Water Distribution Efficiency?

❖ ENERGY & WATER inexorably linked

- *Large amount of energy embedded in every gallon of water moved*

❖ Enormous opportunities, often neglected

- *VERY LIKELY to yield significant AND cost-effective energy & water savings unless a proactive program already in place*
- *Cost-effective: paybacks generally from a few months to ~3 years*

❖ Relevant for:

- **Water utilities** (usually PUBLIC)
- **PRIVATE Facilities:**
Those multi-building facilities that distribute water *inside the fence-line*

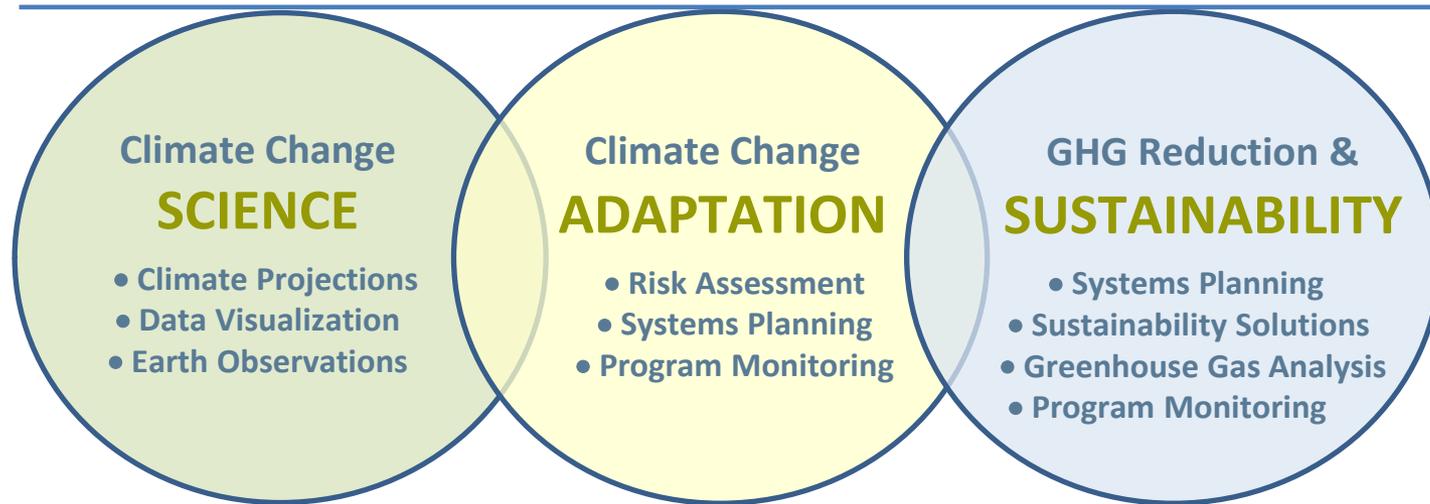


noblis **SUSTAINABILITY SOLUTIONS**

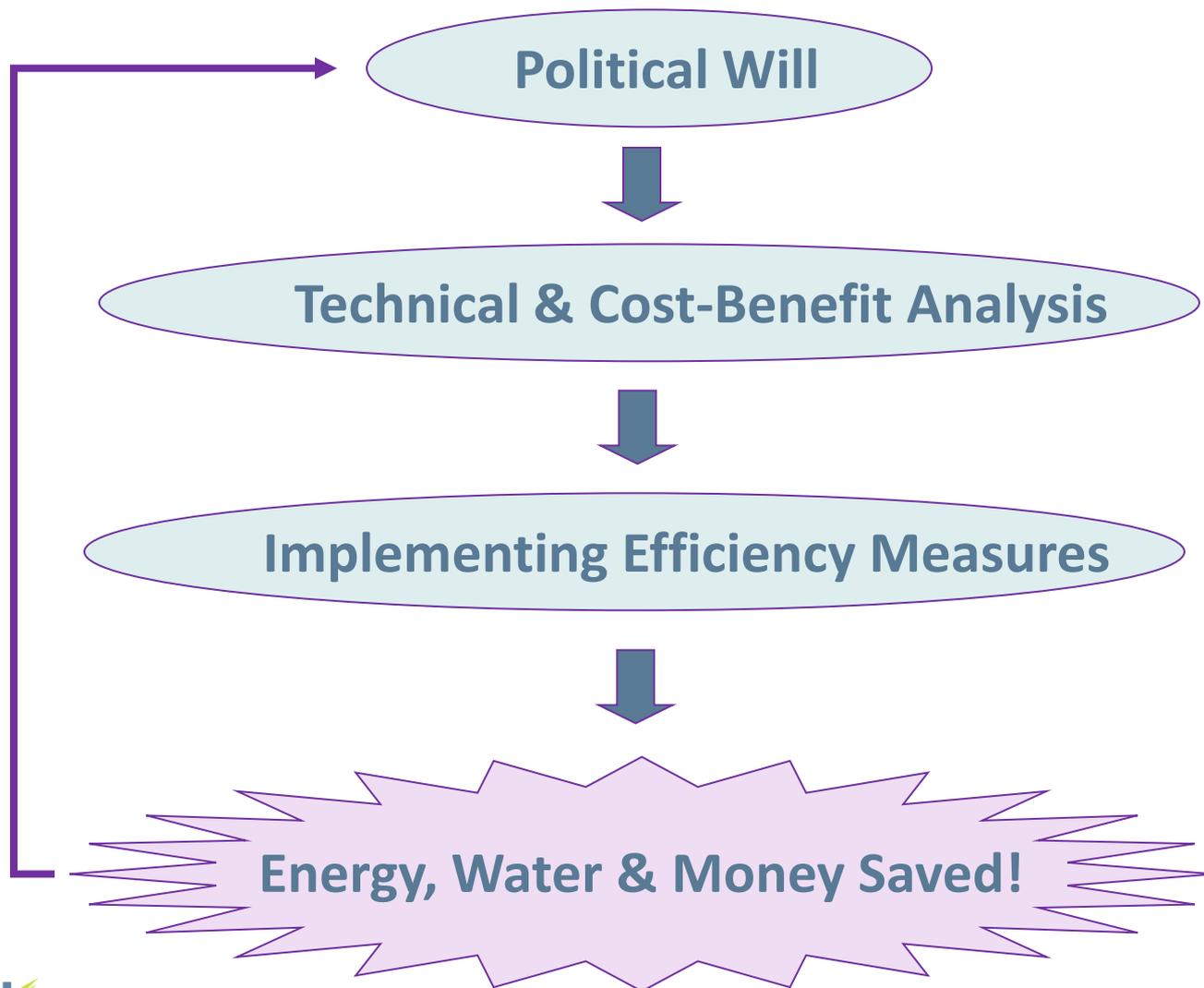
For the best of reasons

Comprehensive, System-Wide Solutions
to Complex Climate Change and Sustainability Challenges

- ✓ Non-profit, 800 employees
- ✓ Specialize in **systems approaches** to solving problems in the public interest
- ✓ Supporting the public sector for >40 years



Stages of Water Efficiency



POLITICAL WILL

Buy-in from Senior Management

❖ Leadership from the top is essential

How to Sell to Management?

Talk in terms they understand:

- High productivity & efficiency
- Maintaining high reliability
(downtime is expensive)
- Improved service
- Life Cycle Costs
- Lower operating costs



❖ Illustrative POLICIES

- Reduce non-revenue water (or water losses for a facility) to 10%
Mostly reducing leaks and replacing old meters
- Reduce energy intensity (kWh/gal) of water supply by X%
(also works for wastewater treatment)

Four Basic Approaches to Efficient Water Distribution

1 Improve **Pump System** Efficiency

- ✓ Efficient pumps
- ✓ Variable speed drives
- ✓ Regular inspection & maintenance

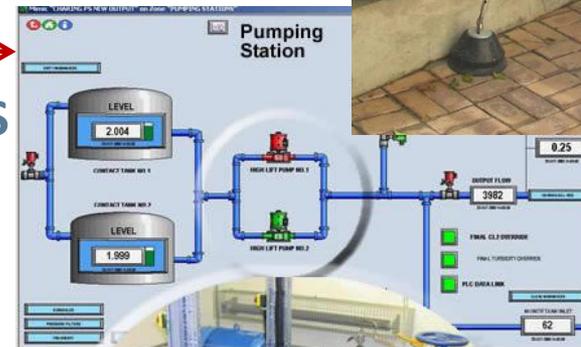


2 Manage **Leaks**

3 Automate **Controls**

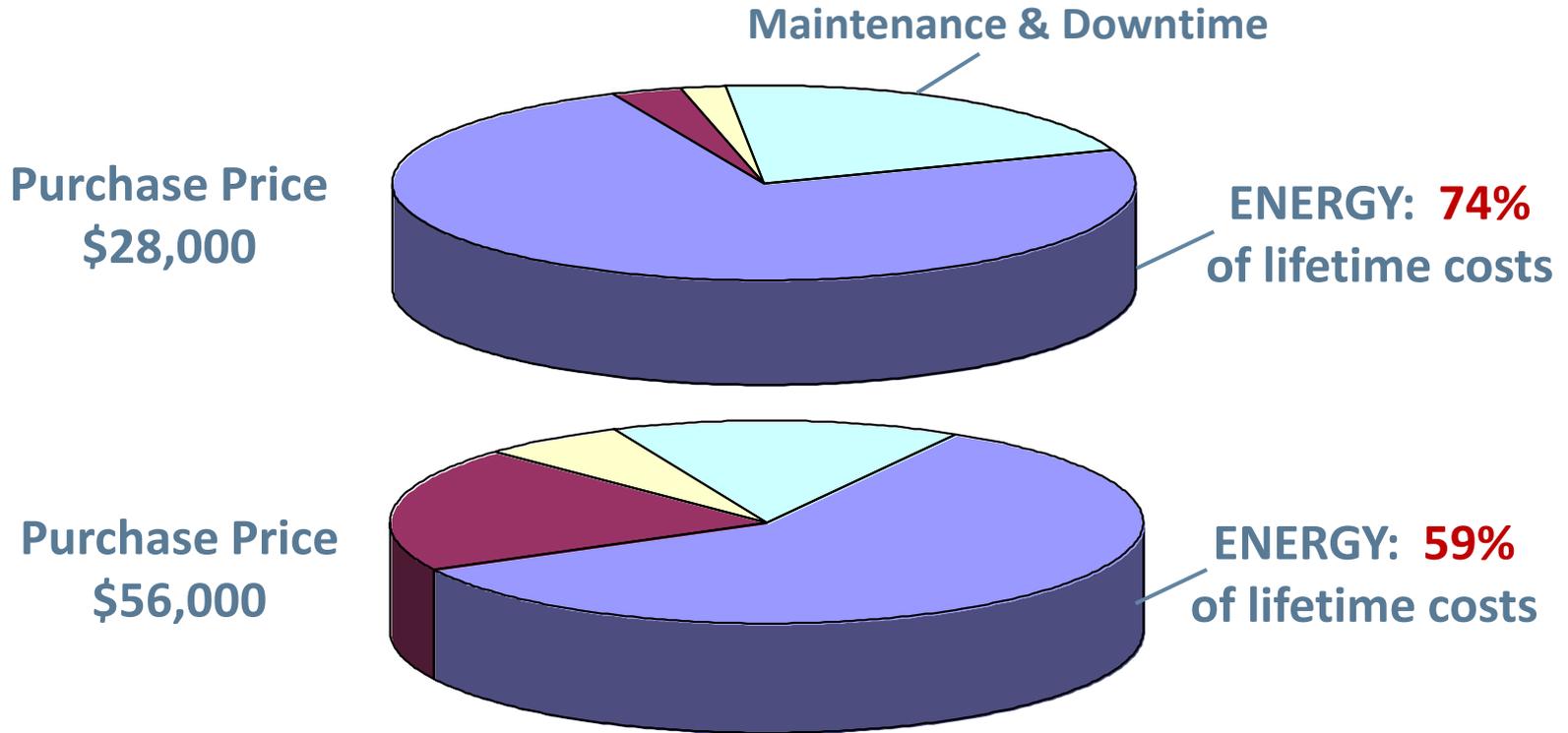
4 **Metering & Monitoring**

- ✓ Install and maintain water METERS
- ✓ Regular monitoring protocol
- ✓ METRICS to track performance



1 Pump System Efficiency

Buy Pumps Based on Efficiency, Not Purchase Price



The efficient pump saves \$21,000 in the first year and ~\$50,000 per year, every year, thereafter.

② Leak Management

Two Types of Activities Fundamental to Proactive Leak Management:

- ✓ Leak Detection
- ✓ Pressure Management

Leak Detection

- I.D. largest 20% of leaks → usually accounts for 80% of losses
- Measure night flows (1-4 am) → Night flow should be close to ZERO

Pressure Management: *Lower Pressure* → *Less Leakage*

- *Cost-effective* when repairs too costly
- Can *automate* pressure adjustments, e.g., depending on incoming pressure and time of day



③ Efficiency Through AUTOMATION

*Automation saves: ✓ water ✓ energy ✓ operating costs ✓ time ✓ money
...and it improves reliability & service*

Three Levels of Automation

1) **Stand Alone devices** - perform simple actions *only where placed*

2) **Telemetry** - automatically measures & *transmits data* from a distant source to a receiving station

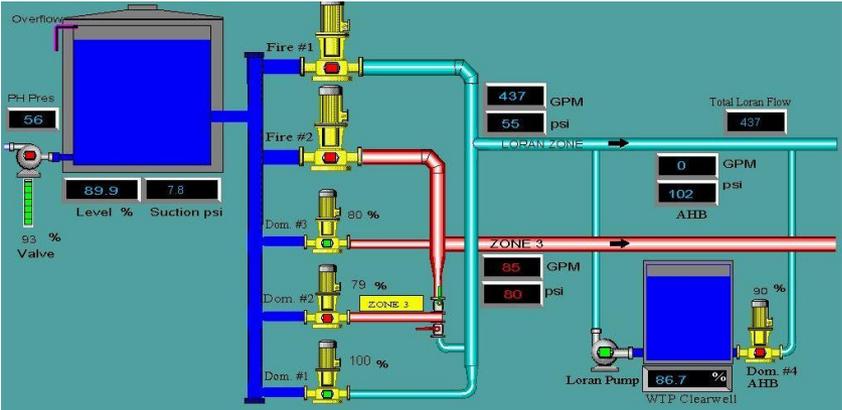
3) **Supervisory Control & Data Acquisition (SCADA)**

- Remotely monitors *and controls*—in real time
 - ✓ *controls components* such as pumps, fans, meters
 - ✓ provides access to *performance information*
 - ✓ *communication via radio, fiber optics, and/or phone lines*
- Can cover *large geographic areas* & large array of *components*

AUTOMATION: Benefits of SCADA

Typical Savings from a SCADA Control System

- water savings. ~10%
- energy savings. 12 - 30%
- downtime reduction. up to 30%
- maintenance & personnel cost savings. . .15-30%



④ Metering and Monitoring

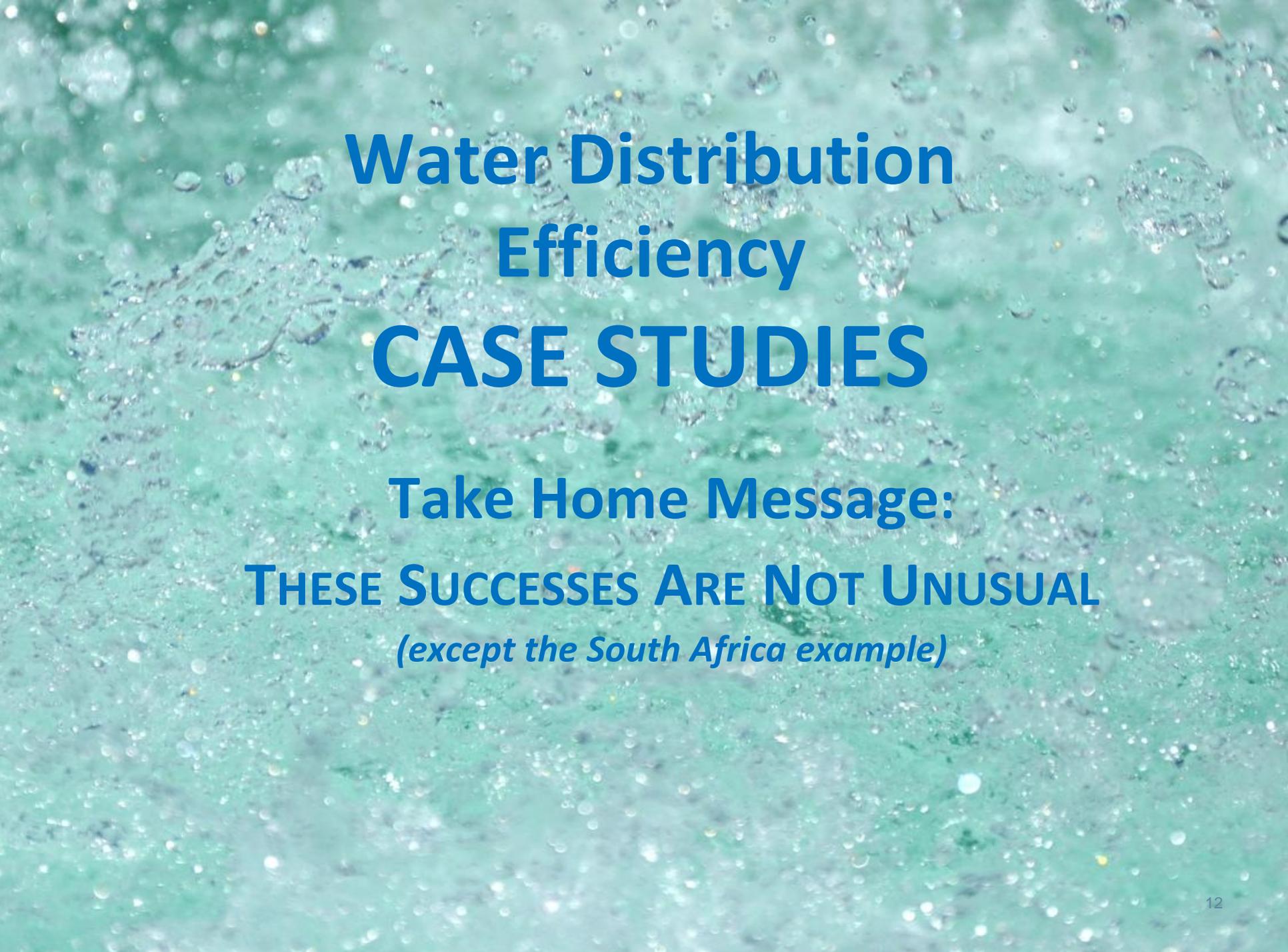
“You can't manage what you don't measure”

~ **Regular monitoring is essential, including metering** ~

STEPS TO TAKE:

- ① *Create a system for water metering and monitoring (or expand it)*
- ② *Develop baselines and metrics for regular monitoring*
- ③ *Create targets and gauge success towards them against baselines & benchmarks*
- ④ *Procure the proper measurement instrumentation*





Water Distribution Efficiency CASE STUDIES

Take Home Message:
THESE SUCCESSES ARE NOT UNUSUAL
(except the South Africa example)

Case Studies: Pumping Efficiency



1 East Bay Municipal Utility District

❖ ACTIONS

- ✓ Replaced 9 old pumps and motors with high efficiency ones
- ✓ Variable Frequency Drives (VFDs) installed on all

- ❖ RESULTS: Electricity use cut by 51%
Annual Savings: \$273,000

...and a new policy to replace all worn-out motors with efficient models



2 San Juan Water District

❖ ACTIONS

- ✓ VFDs on flocculation & chemical feed pump motors

- ❖ RESULTS: 31% reduction in energy costs
Annual Savings: \$11,000/year



Case Study: AUTOMATED CONTROLS



Moulton Niguel Water District

- **Water** (48 million gal/day)
- **Wastewater** (17 million gal/day)
- 77 pumping stations

❖ ACTIONS

- automated controls and programmable logic controllers
- automation so:
 - ✓ PUMPS run only off-peak
– *previously ran 24-7*
 - ✓ RESERVOIRS filled only during off-peak hours

❖ RESULTS

- ✓ \$320,000 saved per year (>21%)
- ✓ Improved water quality (by allowing reservoir levels to fall)



Case Studies: AUTOMATED CONTROLS



East Bay Municipal Utility District

❖ ACTIONS

Automated Pump Control Program

- Improved existing **SCADA** system
- Scheduled 20 water distribution pumping plants to **fill reservoirs** when electricity rates & demand low

❖ FINANCING

- Shared-savings **performance contract**

❖ RESULTS

- \$500,000 saved/year



Case Study: Wastewater Treatment



Metropolitan Syracuse Wastewater Treatment Plant

❖ ACTIONS

- Evaluated energy with DOE's Pumping System Assessment Tool
- Motors on sludge pumps replaced with efficient ones
- VFDs installed on all
- Impellers upgraded (some repaired, others replaced)
- Operational improvements reduced # of blowers needed



❖ RESULTS

- *Annual Savings:*
 - ✓ 2.8 million kWh
 - ✓ 270 M btu gas
 - ✓ \$207,500
- *Simple Payback:* 13 months (cost: \$233,000)



Case Study: Leak Management and Performance Contracting



Emfuleni, South Africa

PROBLEM

- 80% of water flowing to homes in the area lost through leaking plumbing fixtures!

80% of the water supplied at night entered the wastewater system

- Exacerbated by high bulk pressure in the pipelines:
 - ✓ made existing leaks worse
 - ✓ causes pre-mature failure of plumbing fixtures

→ *The water lost was enough to fill two Olympic swimming pools every hour!*



EMFULENI CASE STUDY, cont.



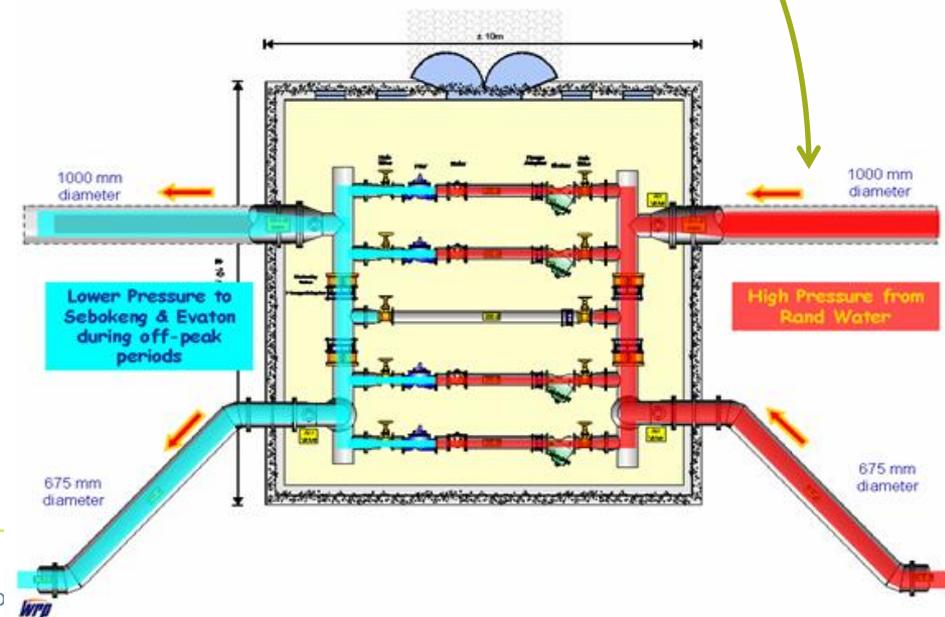
ACTIONS

❖ TECHNICAL SOLUTION: *Pressure Management*

- Advanced pressure management valves on each supply line
- Installation Cost: \$800,000
- Reduced high bulk pressure; further reductions @ night

❖ FINANCING SOLUTION: *Performance Contracting*

- Water pressure management firm acted as an ESCO
- Build-Operate-Train-Transfer to municipality after 5 years
- Firm gets 20% of savings in water costs



EMFULENI CASE STUDY, cont.

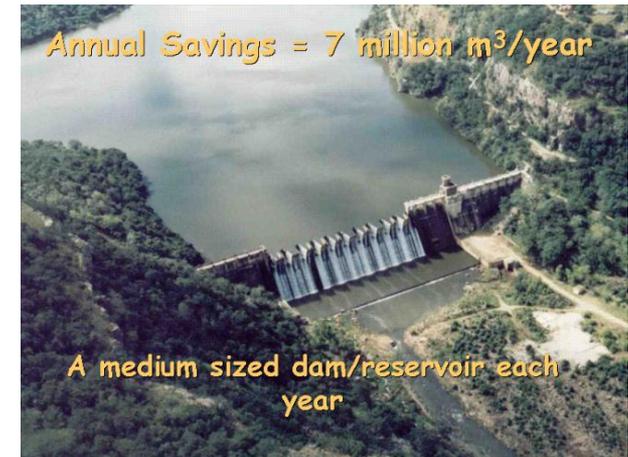


RESULTS

- Payback period: <3 months!
- Performance contracting applied to water supply

Annual Savings:

- Cost: US\$ 3.8 million
- Water: >30%
- Energy: >14 million kWh
- GHG Emissions avoided: 12,000 tonnes



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Questions?

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