NRW Performance Based Contracting

World Bank Group

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Why is NRW reduction so important?

• Reducing NRW delivers multiple benefits:
  1. Improves customer service levels – higher pressures and/or better continuity and/or expanded coverage
  2. Enhances asset lives and utility management – if NRW reduction leads to 24/7
  3. Improves utility financial performance (and/or reduces local government subsidies) by reducing costs and increasing revenues
  4. Makes cities more competitive when accompanied by service improvement
  5. Improves climate resilience by reducing demand on scarce water resources
  6. Reduces emission of GHGs – less energy/m³ delivered

This is not a “win win” ($W^2$) - it is a “win win win win win win” ($W^6$)
Utilities worldwide lose a total of $1.4 billion/year in revenues to non-revenue water

Comparators in MENA (2010)

<table>
<thead>
<tr>
<th>Country</th>
<th>Utility</th>
<th>Non-Revenue Water</th>
<th>Losses</th>
<th>Appx. Annual Operating Loss to NRW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahrain</td>
<td>EWA</td>
<td>40%</td>
<td>25,000 m3/day</td>
<td>USD 15 million</td>
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<tr>
<td>Egypt</td>
<td>Alexandria</td>
<td>31%</td>
<td>730,000 m3/day</td>
<td>USD 34 million</td>
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<td>Jordan</td>
<td>Miyahuna</td>
<td>35%</td>
<td>140,000 m3/day</td>
<td>USD 29 million</td>
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<td>Yemen</td>
<td>Aden</td>
<td>30%</td>
<td>28,000 m3/day</td>
<td>USD 4 million</td>
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Source: Author’s calculations based on IB-NET data
Compared to other interventions, NRW reduction represents largest gains in increased cash flows

Based on 690 utilities reaching a desired cash flow level of 120% of operating costs

- Current level with cash cost recovery > 120%
- Collection rate increased to 100%
- Non-labor cost reduced by 15%
- With reduction of current level of NRW to 25%

Compared to other interventions, NRW reduction represents largest gains in increased cash flows.
Failure to actively manage NRW is not an option in many countries where water security is a key issue.
Why is this happening?

1. Lack of hard budget constraints?
2. Plenty of available water resource?
3. Lack of consumer accountability?
4. New production facilities easier, more attractive, and more certain?
5. Weak staff capacity and lack of equipment?
6. Absence of staff incentives?
7. All of the above and more…..

BUT with growing push back on elements 1 – 4 how can we address elements 5 & 6?
Solution?

A reinvigorated public sector
or
The private sector (skills and equipment)
+
Performance based contracts (incentives)
The expected benefits of PBCs

- Faster reduction of NRW => faster service and finance improvements
- Accessing latest technology
- Tapping into hard-won experience
- Working around some public sector constraints
- Paying for results – and not for inputs
Initial Design Considerations – What is my problem?

- How much water is lost? Where? Why?

<table>
<thead>
<tr>
<th>System Input Volume</th>
<th>Authorized Consumption</th>
<th>Billed Authorized Consumption</th>
<th>Unbilled Authorized Consumption</th>
<th>Commercial Losses</th>
<th>Billed Metered Consumption</th>
<th>Unbilled Metered Consumption</th>
<th>Unbilled Unmetered Consumption</th>
<th>Physical Losses</th>
<th>Leakage on Transmission and Distribution Mains</th>
<th>Leakage and Overflows from the Utilities Storage Tanks</th>
<th>Leakage on Service Connections up to the Customer Meter</th>
<th>Revenue Water</th>
<th>Non-Revenue Water</th>
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Initial Design Considerations – How might a PBC help me?

1. **Functional Scope**: Is the contract for physical loss reduction? Commercial loss reduction? Both?

2. **Physical Loss Reduction** – three broad scenarios which can be optimized based on assessment of Economic Level of Leakage:
   
   a. Continuous water supply but high levels of leakage – PBC can be used to reduce leakage closer to the ELL
   
   b. Intermittent supply but sufficient water production – PBC can be used to deliver continuous water supply by reducing leakage levels down to ELL
   
   c. Intermittent supply and with insufficient water production – stand alone PBC could aggressively find and fix leaks to improve duration of supply OR could be linked to activities to enhance production and thereby deliver continuous supply.
Initial Design Considerations – Backlog, Maintenance or Both?

Stage 1: Non-revenue water management & leakage reduction (Dealing with Backlog)

- **Commercial Losses**
  - Surveys to identify missing or unmetered connections
  - Repairing or recalibrating meters
  - Improving meter reading and data transfer to customer accounting systems
  - Improving customer accounting systems

- **Physical Losses**
  - Establishing District Metering Areas (DMAs), which isolates water supply to a small sub-set of the utility’s customers, improving water inflow and pressure measurement and facilitating leakage detection
  - Leakage detection;
  - Pressure management;
  - Repairing leaks;
  - Replacing service connections;
  - Replacing leaking pipes, valves, hydrants, etc

Stage 2: Maintenance (Maintaining lower levels of leakage)

- Maintenance of water savings achieved for a period of time; and
- Training of utility staff
Some Typical Approaches to the PBC Design

1. Bundling everything together in one package
   – Advantages: Strong incentives and single point responsibility
   – Disadvantages: Maximum risk transferred to contractor

2. Have one package for planning and overseeing NRW reduction strategy and one package for the construction work
   – Advantages: Reduces risks to the NRW contractor and ensures best value for each component (design vs. implementation)
   – Disadvantages: More complex to manage, diffuse responsibilities

3. Have one package with the NRW contractor which also acts as construction manager to hire and supervise works contractors
   – Advantages: Single point responsibility, NRW contractor risks are reduced compared to the bundled model
   – Disadvantages: How to reward NRW contractor for “intermediate” level of risk transfer
Preparation of PBC: Overview

• Determine project area
  – If not whole system then hydraulically separable

• Define contract type (bundled/unbundled) and scope (physical, commercial, both)

• Prepare basic analyses
  – Initial water balance, economic level of leakage, investment estimates

• Determine performance targets
  – Use appropriate output based indicators

• Set out performance verification protocol

• Collect data for the RFP documents
  – Enough for contractor to determine strategy
Examples of NRW PBCs

- Ho Chi Minh City, Vietnam
- New Providence, Bahamas
Ho Chi Minh City PBC for leakage reduction

Contract
- 4 year leakage reduction
- 1 year maintenance

Scope of work
- DMA establishment
- System expansion
- Leak detection
- Leak repair
- Training
Leak reduction results in Ho Chi Minh City
DMA establishment results in Ho Chi Minh City
Summary Results - HCMC

What:
- Service population of ~ 1 million people
- Number of connections 140,811
- Length of distribution system 662,063m

Result:
- Volume of water saved = 92,000 m3/d (final amount ~100,000m3/d)
- Almost half the pre-project amount of leakage
- Saved water could serve 500,000 people in HCMC
- Saved power (23,000 kwh/d) could serve 2,500 HH in HCMC

How:
- Number of DMAs created: 114
- <1% of distribution system replaced (3422m/662063m)
- 8535 connections replaced = 6%
- 12,000 leaks fixed in 662km of pipe = one every 50m
- Performance based payment – fixed + variable per m3/d saved
New Providence, Bahamas NRW Reduction Project

- Over 90% of the water came from desalination and once it entered the water supply system, 58% was lost to NRW (31,000 m$^3$/d in 2012)
- Average price to consumers in New Providence: $3.45 per m$^3$ compared to $1.74 per m$^3$ in the U.S. (IB-Net, 2016)
- 10 Year; $83Mn; tendered in 2009 and awarded to Miya in 2012
- The project is delivering:
  - In excess of performance targets
  - Avoiding spiral into intermittent supply operation in 2013
  - Reduced water purchase costs
  - Increased revenue
  - Reduced break repairs
  - Improved customer service
  - Improved infrastructure
  - SCADA / Netbase
New Providence NRW Reduction 2013-15

Graph showing the change in MIGD from January 2013 to November 2015, with lines representing different categories:
- Water Supplied
- Revenue Water
- NRW
- 2013 Annual Avg. Target
- 2014 Annual Avg. Target
- 2015 Annual Avg. Target
## Summary of results in New Providence

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<thead>
<tr>
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<th>Jan-2013</th>
<th>Sept-2015</th>
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<tbody>
<tr>
<td>NRW (M l/d)</td>
<td>31.2</td>
<td>12.5</td>
</tr>
<tr>
<td>NRW (%)</td>
<td>57.7%</td>
<td>32.2%</td>
</tr>
<tr>
<td>NRW (l/con/day)</td>
<td>758</td>
<td>300</td>
</tr>
<tr>
<td>Real losses (l/con/day)</td>
<td>699</td>
<td>267</td>
</tr>
<tr>
<td>ILI</td>
<td>29.7</td>
<td>8.55</td>
</tr>
<tr>
<td>Service Breaks/1,000 no./year</td>
<td>90</td>
<td><strong>29</strong></td>
</tr>
<tr>
<td>Mains Breaks/1,000km/year</td>
<td>485</td>
<td><strong>228</strong></td>
</tr>
<tr>
<td>Reported Break Repairs 2012</td>
<td>3,912</td>
<td></td>
</tr>
<tr>
<td>Reported Break Repairs 2014</td>
<td>613</td>
<td></td>
</tr>
</tbody>
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Highlights from case studies

- Essential starting point is to **understand what drives losses**
- Definition of **appropriate contract objectives**
- Demonstration that **third party (private sector) partnership** can be an effective way of overcoming technical and financial constraints and achieve loss reduction objectives
- A well-structured performance based contract **incentivizes** the private party to **achieve targets** but allows **flexibility in implementation strategy**
- Training of the utility to **maintain the results** or allow private party a maintenance period (Stage 2) with appropriate incentives that may differ from the early management period (Stage 1)
Maintaining low levels of NRW

Keeping NRW low is often a challenge. Some factors should already be considered during initial contract design.

• Inclusion of “maintenance” period in the contract (shorter or longer period)

• Comprehensive training of utility staff to ensure that NRW is properly managed in all aspects – with special emphasis towards end of contract life

• Establishment of systems and equipment that are serviceable at hand-back

OR

• Design follow on “maintenance” PBC
WBG Program to Scale Up NRW PBCs

- Are NRW PBCs always feasible or are there some pre-conditions to be met? If so what are they?
- Focus has been on NRW PBC to address backlogs of leaks – how can we ensure long term sustainability of lower leakage levels?
- How much risk should be transferred to operators – bundled versus unbundled contracts, incentive structures?
- Commercial or physical losses or both?
- Can preparation of NRW PBCs be simplified and speeded up?
- Market capacity to respond to scale up?
Summary

• NRW management is good practice – more so in water constrained environments
• NRW management has a multitude of benefits (W6)
• The cost-benefit analysis determines the economic level of NRW
• Sound options analysis needed to define model, scope, targets and risk allocation
• Performance based contracts give strong incentives but allow contractor flexibility on how to deliver results
• There are a range of resources available to help interested groups
Thank You