



LESSONS LEARNED IN NRW-REDUCTION

FROM 8 RVO-SUSTAINABLE WATER FUND CO-FINANCED

INTERVENTIONS WITH 19 WATER OPERATORS

Based on the Reviewer's Final
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Introduction and background

This Practice Note presents the results of a joint *review* commissioned by RVO and executed by VEI of achieved results, underlying approaches and contributing factors to success of 8 Non-Revenue Water (NRW) reduction interventions by 19 water operators between 2012 and 2019. Presented conclusions and recommendations in this Practice Note can assist water operators and consultants in designing and implementing future NRW interventions. See [this elaborated version](#)¹ if you are interested or contact VEI for further information.

In order to assess the up-scaling potential, reduced NRW volumes were translated to cost savings and revenue increments (with the established commercial/physical losses ratio) in an effort to evaluate the Return on Investment i.e. the *business case*. The Practice Note also evaluates the extent in which NRW-reduction can effectively contribute to *improving service delivery to the urban poor*.

Thirteen water operators implemented NRW-reduction strategies in District Metered Areas (DMAs), the other 6 on a company-wide scale (jointly covering 435,000 service connections).

NRW-reduction achievements and business case evaluation

Substantial to moderate reductions in NRW (in *1,000 m³/year or L/connection/day) were achieved at most operators:

1. **Substantial NRW reduction** (6-20% of System Input Volume) was achieved by 13 water operators: 10 utilities in Kenya (27 DMAs), Kigali (2 branches), Mzuzu (company-wide focus) and Gia Dinh², see Table 1 overleaf.
2. **Moderate NRW reduction** (<6% of System Input Volume) was achieved by 3 water operators:
 - Soc Trang and Tra Vinh (the 2 other beneficiary partners - Vietnam) though minimal TA input was directed towards NRW reduction activities.
 - Beira (company-wide focus).
3. **Water operators in Addis Ababa and Harar did not achieve a sustained reduction in NRW** due to technical set-backs and institutional (motivational) constraints.

The calculated Return on Investment (RoI)³, typically between 2 and 4 years, confirms the cost-effectiveness of the capital investment(s) in NRW-reduction.

Overall, the RoI's confirm that *low-cost* strategies do have *high impact* on the reduction of NRW, as pay-back periods of less than 10 years in the public water sector are considered favorable. Improved financial returns enable these water utilities to improve their service delivery standards for existing and new consumers, including the urban poor. The longer RoI for Beira is plausible since: i) a large portion of the hardware budget (50%) was used to replace capital-intensive pipelines in the network, ii) new (additional) production capacity increased the supply pressure and time in the distribution network, inducing new NRW.

¹ See Table of Contents in Appendix 1. Please get in touch with us for further details on the Final Report (review process, calculations) and/or other queries: reint-jan.deblois@vei.nl.

² NRW-reduction at Gia Dinh is not representative for the other SWF-projects since the project: i) only financed 10 km of distribution network replacement, but ii) relied heavily on investment and TA under a parallel ADB project executed by VEI.

³ By using the *marginal cost of water production* (treatment and electricity) cost/m³ and *average water tariff* to calculate the monetary value physical/real and commercial/apparent losses respectively.

Table 1: Reduced NRW (volume, %) and Return on (capital) Investment

Utility	Population	No. of connections NRW component	Project duration		Business case (ROI) evaluation						
			Start	Finish	Investment amount hardware	NRW reduction (%)	Investment period (years)	NRW reduction average per year (1,000 m3)	Monetary value per year (1,000 €)	ROI in years	Operating Cost Coverage (%)
Addis Ababa	no data	1.600	2013	2019	136.211	no data	5	no data	no data	N/A (no data)	no data
Harar	no data	2.000	2013	2019	183.452	45% - 45%	5	no data	no data	N/A (no data)	no data
PEWAK	varies per utility	59.741	2015	2019	1.049.545	50% - 43%	3	676	379	2,8	improved for all but 4 utilities
SUSWAS											
• Remera	51.611	15.546	2013	2017	575.441	42% - 21%	3	320	134	2,6	121-136%
• Kanombe	54.064	17.193	2013	2017		45% - 31%		208	88		
Beira	385.000	62.729	2015	2019	1.179.365	44% - 38%	3	197	96	12,3	80% - 105% (2015-2017)
Mzuzu (2015 - 2018)	187.000	26.743	2013	2018	557.206	43% - 31%	3	272	178	3,1	175% - 300% (2013-2017)
Cagayan de Oro	566.373	101.138	2018	2022	410.000	54% - 54%	3	tbd	tbd	tbd	121%
Mekong Delta											
• Tra Vinh	274.755	42.270	2013	2017		16% - 10%		78	no data		>100%
• Soc Trang	486.551	74.854	2013	2017		16% - 12%		77	no data		>100%
• Trung An	1.220.000					no data		no data	no data		>100%
• Gia Dinh	663.565	132.713	2013	2017	822.234	53% - 29%		9.821	no data		>100%

VEI's approach focused on implementing low-cost-high-impact intervention, the so-called "quick wins" - typically the commercial/apparent loss reduction measures⁴:

- Improved meter reading/updated customer database (based on house-to-house surveys), curbing illegal water use.
- Improvement customer billing: meter management (selection, installation, maintenance, replacement) and meter reading -> billing.

Highlights of (the more capital intensive) physical/real loss reduction measures are captured in Appendix 1 of the elaborated Practice Note (see Table of Contents in Appendix 1).

Impact on O&M cost coverage and credit-worthiness

Operating Cost Coverage (OCC) levels, the ratio between the collected revenue and operational expenditure (OPEX), increased for most of the beneficiary utilities (see last column in Table 1). This demonstrates that NRW-reduction *contributes to* improved financial performance and credit-worthiness. It is important to note, however, that this is not only the result of reduced NRW losses but also project-independent tariff adjustments, other cost savings (e.g. staff, energy), revenue collection efforts and numerous other internal and external factors

Lessons learned moving forward

Emerging insights and proposed adjustments to the VEI promoted (IWA-compliant) approach to NRW-reduction by our local water operator partners include:

1. **Need for a company-wide focus beyond 'pilot' DMAs** in TA intervention design. Projects often zoom in on DMAs as a building block for scaling-up (based on achieved results in one

⁴ *Update of customer database* involves the identification of ghost (on the ground non-existent) consumers, double entries (disconnected consumers who have registered under the same name or name of their spouse), *addressing illegal practices* involves the identification of reversed meters, tampered meters, meter by-passes, illegal connections from the mains (including issuance and collection of fines), *Door-to-Door surveys* can serve to identify illegal practices, evaluate meter installation and (correct) reading, identify leaks on the service connections/at the meter, etc., *improved meter management* focusses on reviewing the meter design (sizing), (proper) installation, (accurate) reading, servicing and replacement (above a certain age or m3 through-put).

or two 'pilot' DMAs) whereby the 'demonstrated' approach is replicated on a DMA-by-DMA basis is the line of thought. While this remains one of the key objectives of DMAs, the Review underlines the need⁵ to:

- Use the DMAs as a diagnostic tool to validate the results of the company-wide NRW assessment (i.e. top-down assessment using EasyCalc) in establishing an evidence-based NRW Reduction Strategy/Plan.
 - Complement the above captioned *quantitative* top-down assessment (IWA water balance) with a *qualitative* NRW organizational assessment, see Appendix 2.
 - Identify low hanging fruit at company-level (e.g. meter replacement, improved meter reading starting with large consumers in ALL DMAs); which, if prioritized, by senior management will pave the way for a DMA-by-DMA up-scaling process.
2. **Need to differentiate between commercial and technical losses** in the start-up phase of the TA intervention. on the basis of a comprehensive top-down (see explanation above) ↔ bottom-up assessment.

In most interventions, NRW-targets were set up without differentiating between commercial and technical losses. This presents a risk of agreeing on overly ambitious and unachievable NRW targets during the proposal phase. See the Practice Note for further clarifications.

3. **Nurturing ambition and generating resources for post-intervention up-scaling purposes.** The lower the NRW levels, the more difficult and costly further NRW-reduction becomes. While the RoI i.e. business case speaks for itself (see Table 1 on page 2), capital intensive network extensions are politically more attractive - as they are visible to constituents/consumers. Up-scaling of demonstrated achievement company-wide (at DMA or higher level) is challenging as it requires perseverance of a motivated Management Team and Board.

Key success factors and constraints are presented in the Practice Note (Table 4). *Success factors* include:

- the promotion of NRW problem ownership by introducing steering committees
- operational NRW Units to boost the day-to-day implementation capacity
- a proper baseline during start-up phase (see 1. and 2. above)

Frequently mentioned *constraints* are also outlined in Practice Note.

4. **Nurturing ambition and generating resources for post-intervention up-scaling**

The lower the NRW levels, the more difficult and costly further NRW-reduction becomes. While the RoI i.e. business case speaks for itself (Table 2), capital intensive network extensions are politically more attractive - as they are visible to constituents/consumers. Up-scaling of demonstrated achievement company-wide (at DMA or higher level) is challenging as it requires

⁵ This has been mainstream in our way for working through a 'NRW master class' for project managers/short-term experts and utility staff that we developed 2 years ago (and continue to update based on emerging insights).

perseverance of a motivated Management Team and a Board (of Directors) that supervises the implementation of a comprehensive NRW Strategy/Plan. Intervention design (Planning) and M&E should:

- *demonstrate the business case* with tangible data on reduced water volumes, achieved cost savings and revenue increments (Cost Benefit Analysis) and re-investing *ring-fenced revenue increments* in scaling-up of prioritized NRW reduction measures.
- monitoring progress in *improving/sustaining financial resourcing of commercial and technical operations*: i) financing of material (spares), equipment, transport (OPEX) and ‘small but smart’ investments (CAPEX), ii) staff capacity i.e. hiring of qualified managers/staff, intensive training and coaching.
- *sharpening CAPEX priorities and leveraging resources* with investment programmes of International Financing Institutions to finance capital-intensive network rehabilitation/replacement.

5. Good utility governance essential in ‘making the difference’

High NRW-levels are an indicator of poor utility management. Board guidance in leadership transformation (avoiding micro-management, managing political interference), NRW Strategy/Action Plan implementation (i.e. resource allocation), sustainable tariff setting (covering justifiable O&M costs) etc. is key.

High NRW-levels are typically the result of underperforming Commercial and Technical Operations and inadequate facilitation by- or immaturity of the underlying management processes themselves (see Figure 1). The Review underlined the importance of:

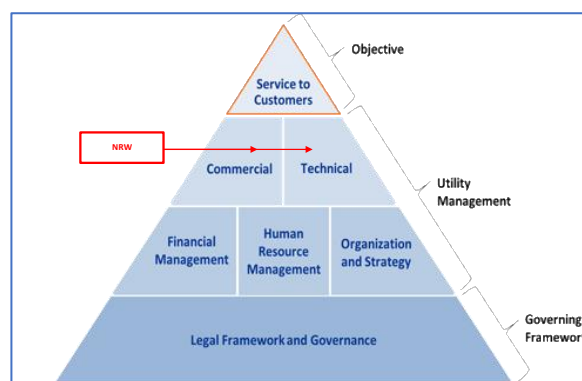


Figure 1: NRW-management inter-related with management processes

- Conducting a comprehensive Organisational Assessment during the start-up phase to establish utility *readiness*: evaluate current working processes, resourcing (financial position), human capital (leadership, change management competences besides technical skills), level of applied technology, and investment in utility ownership of the NRW-reduction process.
- Institutionalizing tasks for NRW-reduction in the organization; building on successes (in an appreciate inquiry style), address emerging bottlenecks pertaining to the 5 utility management elements in “The pyramid of Success” (Figure 1).

6. Resourcing to ‘make (and sustain) the difference’

The allocated hardware budget for NRW reduction per service connection varies per intervention, ranging from € 4 to € 92. While the allocated budget in two of the projects (Cagayan de Oro and Mekong Delta, € 4 and € 6 per connection) is small, these projects provide TA parallel to investment in infrastructure - financed ADB and USAID respectively.

In summary:

- Allocate sufficient (at least € 40) budget per -DMA- connection and/or leverage resources with third parties. With modest hardware budgets tangible reduction in NRW can be achieved by applying low-cost-high-impact interventions (focusing on commercial losses).
- Spreading out a relatively small hardware budget per connection (< € 20 per) on a company-wide scale reduces the NRW reduction potential.
- The level of OPEX allocated by the recipient utility dictates which strategy can be sustained by the utility; commitment up-front, during and after (e.g. Sustainability Compact, Board approval of budget increment/tariff adjustment) the project is crucial.

Implications for service delivery to the urban poor

Through grant (co-) financing under the 8 interventions, an estimated 340,000 un(der)served Low Income Area (LIA) residents acquired access to safe drinking water services. With an average investment of € 20 per capita towards 'last mile connectivity' (network extensions and service connections to shared water kiosks/standpipes or private connections on premises), the SDG6 impact is evident.

In some cases (e.g. Beira), NRW reduction interventions specifically targeted LIAs with high suspected NRW levels as well (among other company-wide priorities). This directly contributed to improved water availability (through reduced physical losses), and/or financial performance/debt financing capacity (through reduced commercial losses) of the beneficiary utility. In most cases, however, NRW reduction measures focused on low-cost-high-impact interventions within specific DMAs or company-wide and thus did not explicitly target LIAs.. Reduced NRW levels within these utilities contributed to favorable financial conditions for utilities to sustainably finance O&M expenses of the newly developed infrastructure.

The 'cross-subsidization' of the urban poor by large consumers⁶ that is in-built in the tariff structure of most utilities in emerging economies has the same effect; regardless of the project scope and firmness of the link between NRW-reduction and pro-poor (service delivery improvement) activities in a specific project, NRW-reduction results in cost savings, increased sales and revenue collection on the basis of which service delivery to existing and un(der)served consumers, both rich and the poor, is improved in the medium/long term.

The influence of the regulatory framework on inclusiveness (e.g. 'human right to water incorporated in sector policies/strategies/guidelines'⁷, benchmarking of pro-poor service delivery indicators) and the availability of grant (co-)financing as an incentive are both far greater than an inclusive intervention logic of a 'one-off project'.

⁶ Who pay more per m3 consumed – typically on the basis of a 'rising block' tariff.

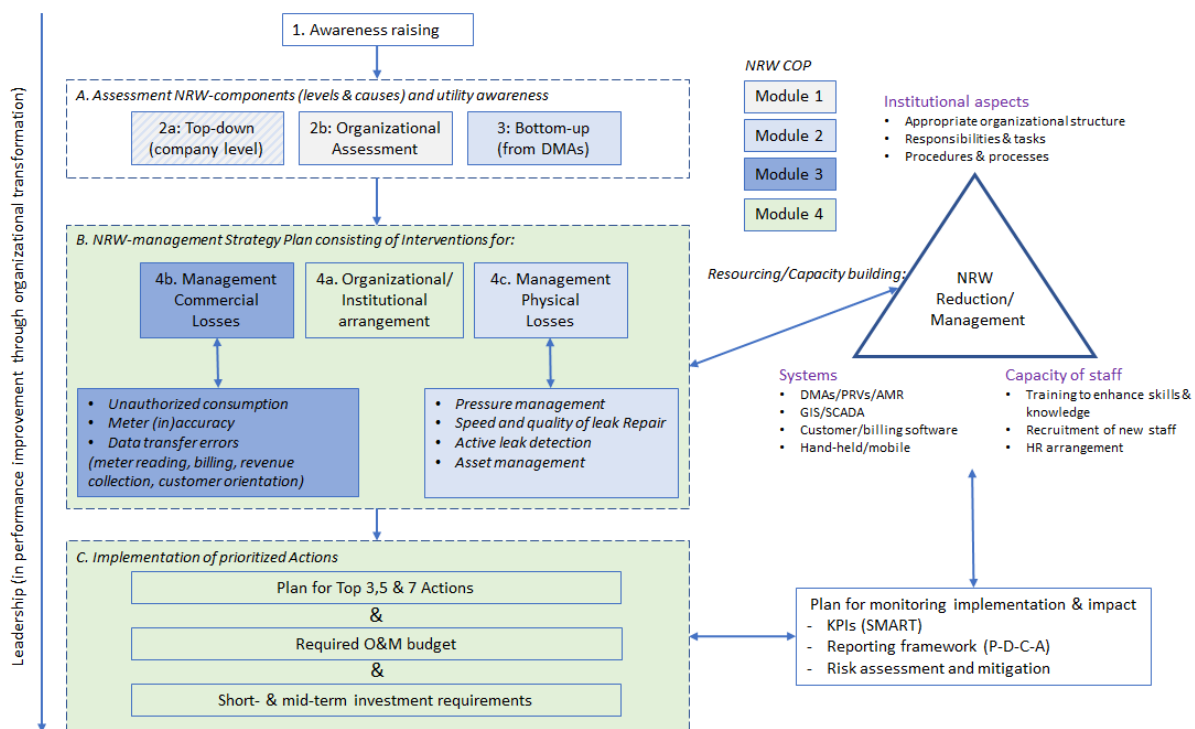
⁷ See e.g. the [Pro-Poor Water and Sanitation Services Guidelines](#) of the Water Services Regulatory Board (WASREB) in Kenya.

Appendix 1: Table of Contents for the elaborated version of the Practice Note

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Appendix 2: Top-down and bottom-up approach to NRW-reduction



NRW red. strategy/plan **Top-down + bottom-up is key!**

At utility level = "Top-down" + "bottom-up"

