# Review of: "Non-revenue Water Reduction"

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"Review Report on Article 'Non-Revenue Water Reduction'"

This is a well-written and informative article that effectively demonstrates the benefits of SCADA systems for reducing NRW and improving water management in smart cities. By addressing the suggested areas for improvement, you can further enhance the clarity, accessibility, and professional quality of your work.

This comprehensive review has examined each section of your article, offering both strengths and suggestions for improvement. I have provided feedback on the abstract, introduction, methodology, results and Discussion, and the conclusion and recommendations.

**Abstract:** The abstract immediately identifies SCADA systems as crucial for smart city water management. It outlines the advantages of real-time monitoring, efficiency optimization, and data-driven decision support. It also provides a brief mention of flow meter installation, leak detection, and improved billing as strategies for reducing NRW. But the abstract lacks information about the specific study or project it summarizes. The results in the abstract are incomplete; mentioning the initial results of the study or pilot project would strengthen the abstract and pique reader interest. Please provide more explanation about NRW and its importance in enhancing water availability and revenue for WSCs, and also provide a brief summary about NRW reduction methods by mentioning flow meter installation, leak detection, and improved billing as strategies for reducing NRW. Briefly mention the location of the study or project (e.g., Esna, Egypt) and highlight the main outcome or impact of the implemented SCADA-based NRW reduction strategy (e.g., % reduction in NRW). Include 2-4 specific keywords related to SCADA, water management, and NRW reduction. Ensure the abstract flows smoothly and uses concise language without redundancy.

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**Introduction:** The introduction provides a good overview of the importance of Non-Revenue Water (NRW) reduction and some of its benefits. Here are some comments and suggestions for improvement. It clearly states the significance of NRW reduction for both water availability and revenue generation. The introduction also provides a brief introduction of the five main components of the NRW program.

The introduction needs further improvement by taking the following points into consideration:

-Consider starting with a more impactful statement or statistic about the global significance of NRW losses. Include some recent studies (published within the last 2-3 years) demonstrating the effectiveness of SCADA-based NRW reduction

strategies. Focus on studies relevant to your specific context, such as those exploring SCADA implementation in similar regions or dealing with similar NRW challenges. This will strengthen the foundation of your research and show its alignment with current trends.

- While mentioning "lack of accurate information" and "institutional pressures," consider outlining specific challenges like aging infrastructure, inaccurate metering, or unauthorized connections.

- Since the paper seems to focus on SCADA-based solutions, briefly mention how it will address the mentioned challenges or contribute to accurate NRW quantification.

- The introduction only mentions two components (System Input Volume and Billed Authorized Consumption). Briefly introduce the remaining three components for a more comprehensive overview.

- Clearly state the main research question or objective of your study. What gap in knowledge are you trying to address?

- Explain how your project is unique or adds to the existing body of research on SCADA and NRW reduction. What specific methodology or approach are you using?

- Briefly highlight the expected outcomes or potential impact of your project. How will it contribute to improved water management and NRW reduction?

You could add a concise thesis statement at the end of the introduction, summarizing the main argument or objective of the paper. Ensure a smooth transition to the next section where you would likely delve deeper into the five NRW components and their connection to SCADA.

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**Implementation:** The section clearly outlines the collaborative effort between relevant departments (IWSSTA, Luxor NRW, Hydraulic Analysis, O&M, GIS, and Commercial) involved in the DMZ implementation and describes the different tools and techniques used, including customer surveys, leak detection sensors, GIS integration, and satellite imagery. It also provides a basic overview of the DMZ equipment and its data flow architecture.

The section needs improvement by considering the following suggestions:

- Explain how the data collected from various sources is analyzed and used to identify and address NRW issues. Provide specific examples of how department collaboration leads to actionable insights.

-Briefly explain the specific tasks and responsibilities of each department in the implementation process. For example, how does the commercial department use customer survey data? How does hydraulic modeling inform leak detection efforts?

-Specify the communication protocol used for data transfer between field devices, the RTU/PLC, and the server (e.g., Modbus, DNP3). Screenshots of the SCADA interface or data analysis dashboards.

- At the beginning of the "Implementation" section, mention the specific city or region where the pilot project was conducted. For example, you could say "This section details the implementation of the DMZ and SCADA system in the western region of Esna, Egypt."

- Include a study area map showing the boundaries of the DMZ, relevant landmarks, and infrastructure elements. It will give readers a better understanding of the project's scope and context.

- Include other visuals such as pictures of the specific equipment used, such as flow meters, pressure sensors, or mobile app screenshots. Also, photographs showing the field team activities, like installing meters or using leak detection equipment.

**Methodology:** Overall, the methodology and activities/tasks sections provide a valuable roadmap for DMZ implementation in water companies. It highlights the importance of teamwork between various departments (NRW, O&M, Hydraulic Analysis, Commercial, and GIS) throughout the process. The list of activities and tasks outlines specific actions for each stage of the implementation, ensuring a comprehensive approach. The methodology also incorporates various technologies like mobile apps, GIS mapping, satellite imagery, and leak detection equipment, enhancing efficiency and accuracy.

The methodology section needs improvement by considering the following suggestions:

- Elaborate on the specific criteria used for prioritizing and selecting DMZs at the Governorate level.

- Briefly explain the specific aspects of communication technology and technology development considered in the equipment selection process.

- Describe how the collected data from flow meters, pressure sensors, customer surveys, and leak detection will be analyzed and used to identify and quantify NRW components.

- Provide more details on the methods used to address commercial losses beyond just equipment replacement and meter reading updates. How are illegal connections identified and handled?

- Specify the type of leak detection equipment and techniques used (acoustic, electromagnetic, etc.) and the criteria for prioritizing repairs, and explain how the physical and commercial data will be combined and analyzed to assess the effectiveness of the DMZ intervention.

- Mention any expected challenges and mitigation strategies for each stage of the implementation. Briefly touch upon the cost aspects of implementing DMZs and potential return on investment. Also, provide references or links to resources for further information on specific technologies or methods used.

**Results discussions:** The Results and Discussion section provides a solid foundation for understanding the outcomes of the SCADA implementation. The section is organized into logical subsections focusing on data display, historical data, trends, report generation, and SCADA systems. It highlights the importance of charts, trends, and reports for

understanding and analyzing the collected data. The subsection on SCADA systems provides a clear explanation of their key advantages in water management, including real-time monitoring, early detection, efficiency optimization, resilience, and data-driven decision-making

The results section needs improvements by considering the following suggestions:

- The section could benefit from a more in-depth analysis of the collected data, beyond just presenting it in tables and charts. Explore patterns, trends, and correlations to draw more meaningful insights.

- Provide concrete examples of how the SCADA system's insights led to specific interventions, repairs, or decisions that contributed to NRW reduction. This would make the impact more tangible.

- Explicitly link the results back to the methodology section. Explain how specific data points or trends relate to the activities and tasks undertaken during implementation.

- Briefly address any challenges encountered during implementation or data analysis, and how they were addressed. Also, outline potential future improvements or expansions of the SCADA system, such as incorporating additional sensors or integrating with other data sources

- Include references to relevant studies or publications that support the findings or provide further context on SCADA systems in water management.

**Conclusion:** Overall, the conclusion and recommendations section effectively summarizes the key findings and proposes actionable steps for future advancements. It presents clear data showing a reduction in water production after installing meters and operating the SCADA system, suggesting a decrease in NRW. The section acknowledges the increased accuracy of NRW calculations after SCADA implementation. The recommendations propose practical steps for expanding the impact and utilizing future technologies like AI, ML, and IoT.

The section needs improvement by considering the following suggestions:

- While presenting the data, consider diving deeper into the reasons behind the reduction in production. Analyze whether it primarily reflects reduced physical leaks, improved billing accuracy, or a combination of both.

- Show the actual NRW percentages before and after SCADA implementation, not just production changes. This would provide a more direct comparison and quantify the NRW reduction impact.

- Briefly address the cost-effectiveness of expanding DMZ and SCADA systems. Show potential return on investment or payback periods to justify further implementation.

- Discuss potential challenges associated with expanding to other governorates, such as infrastructure limitations, training needs, or funding constraints. Suggest ways to overcome these challenges.

- Briefly mention any lessons learned during the pilot project in Esna that can be applied to future expansions. Also, provide specific examples of how AI, ML, and IoT could be integrated with SCADA for improved water management.