Smart-Meter Installation Scheduling in the Context of Water Distribution

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Abstract:

In this work, we propose a Mixed Integer Linear Programming (MILP) formulation to model a Smart-Meter Installation Scheduling Problem (SMISP) in the context of water distribution. The model has been used to solve a real case study from a multi-utility company operating in the Italian market. Specifically, in compliance with the European and the Italian regulations on metering, a distribution company is obligated to periodically control meters and substitute them in case they have reached their lifespan. In the examined case study, the multi-utility company has opted for a massive substitution plan in order to install innovative "walk-by smart-meters" in place of traditional mechanical meters.

The MILP formulation aims at integrating both the operational and the financial perspective of the SMISP. In particular, the objective function has been carefully defined in order to maximize the Net Present Value (NPV) of the massive substitution plan, including the operational savings produced by using the walk-by smart-meters, the additional incomes originating from the gradual charge of substitution costs on customers' invoices as considered by the Italian Authority, the depreciation of walk-by smart-meters, the investment costs, and the impact of income taxes on the objective function. The final goal of the proposed formulation is to define a scheduling for the massive substitution plan that satisfies a number of operational constraints and produces the maximum NPV.

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1. Accounting
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