

AN OPTIMIZATION-BASED FRAMEWORK FOR THE SCHEDULING OF OPERATIONS OF COMPRESSED NATURAL GAS FUELLING STATIONS: A CASE STUDY OF MUNICIPAL BUS FLEET IN SOUTH KAZAKHSTAN

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Introduction. This work introduces an optimization-based framework for the scheduling of operations of Compressed Natural Gas (CNG) fuelling stations for municipal bus fleets. The problem under study considers technical characteristics of the bus engines as well as the distance of their routes. This allows the planning of operations of the compressor network of the CNG fuelling station in accordance with the electricity price, storage capacity and time.

Materials and methods. We used mixed integer linear programming in order to produce a schedule for the operation of compressors of the CNG fuelling station of fast-fill and time-fill types (Figure 1). Its objective function is to minimize the overall operating cost of the underlying system. Specifically, the total cost involves electricity and fuel purchases as well as the operating, storage and startup costs for the above-mentioned network of compressors, while satisfying the fuel demand of the bus fleet [1]. A salient feature of the proposed mathematical framework is that it considers the minimization of compressors startup.

Results and discussion. The optimization of the operations of the compressors could positively affect the lifetime and the performance of the compressors while maintenance tasks could also be reduced [2]. A case study of the CNG fuelling station for the municipal bus fleet of 140 buses in South Kazakhstan is considered and presented to highlight the major features of the proposed optimization-based approach.

Conclusions. The case study demonstrates that our approach results in schedules that lead to lower total cost and a more smooth operation of the overall system.

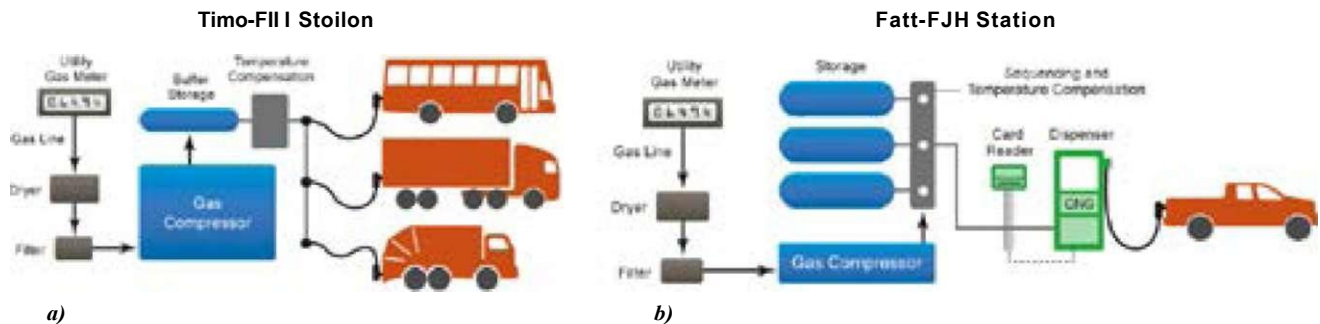


Figure 1. a) Time-fill stations deliver the CNG "directly" from the Gas Compressor, b) fast-fill stations - from the Gas Compressor and Storage Tanks [2].

References.

1. Smith, M. and J., Gongales, 2014. *Costs Associated with Compressed Natural Gas Vehicle Fueling Infrastructure*. Available at: <http://www.afdc.energy.gov/> [Accessed 22 October 2014].
2. Alternative Fuels Data Center, 2014. *Filling CNG Fuel Tanks*. Available at: http://www.afdc.energy.gov/vehicles/natural_gas_filling_tanks.html [Accessed 22 October 2014].