On Capex Forecasting of District Heating Networks in Existing Neighbourhoods

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On Capex Forecasting of District Heating Networks in Existing Neighbourhoods

I. Pothof*[1], R. Van Den Oever[2], L. Huesken[2]

[1]TU Delft / Deltares, Netherlands; [2]Deltares, Netherlands (*i.w.m.pothof@tudelft.nl)

Abstract

The energy required for space heating amounts to approximately 70% of the total energy demand of existing buildings in Europe. Decarbonization of the heat demand of existing buildings is one of the grand challenges in the energy transition and sustainable district heating is a promising solution in many neighborhoods. The construction cost of district heating networks (DHNs) in an existing neighborhood is associated with large uncertainties and therefore investment risk. We have hypothesized that the CAPEX of DHNs is determined by spatial parameters that characterize the subsurface space scarcity. We have investigated this hypothesis by collecting construction cost data of 66 recently finished projects in close collaboration with Dutch district heating companies. Furthermore, we have collected construction cost data on replacement of 68 water distribution and 52 gas distribution networks. The replacement costs of these critical infrastructures might be affected by similar spatial parameters. The analysis of the district heating data reveals that the unit construction costs (€/m routing) are affected by the presence of water bodies, the road width, the zip code and the age of the neighborhood. The combined analysis with data from three infrastructures reveals that the unit construction costs (€/m routing) are affected by the presence of water bodies, soil contamination, the age of the neighborhood, the relative footprint of buildings and the zip code. The relevance of the zip code in this analysis is an indication that local regulations may have a significant impact on construction costs. Given the large number of drivers for the DHN construction costs, the datasets are too small for a statistically reliable construction cost model. We conclude that it is practically impossible to develop a project database of recently executed DH construction works with sufficient variation on all relevant characteristics. Future work will focus on automated generation of an activity-based construction cost model, using multiple GIS-layers. The improved construction cost model will be validated against traditional construction costing methods by 4 or 5 contractors.