Introduction
District cooling systems (DCS) offer the possibility of obtaining significant energy savings in city centre locations where advantage may be taken of load diversity and economies of scale in the plant. The layout of the piping network is a highly constrained problem, but principally a compromise between the capital cost of the network and the recurrent cost of operating the chilled water circulation pumps. Conventional optimization methods do not work efficiently with this kind of problem: the goal of this research is to find new, more effective methods for identifying optimal designs.

A District Cooling System (DCS)
The objective is to optimize the network below the dotted line.

Optimizing a DCS network
The problem is similar to the classical ‘optimal communication spanning tree’ problem.

The capital and running costs of the network are determined by the sizes of the pipes and by the way in which the demand points (nodes) are connected using tree/branch/spoke configurations.

The research was based around a city centre site in Hong Kong, with the demand points being a mix of commercial, industrial and residential buildings.

Conclusions
A weather data Test Reference Year for Hong Kong was developed in this work, along with a new hybrid optimization algorithm. The optimization was based on the classical genetic algorithm combined with a specialised local search. This proved very effective in identifying optimal network designs as well as standard test problems.

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Reference

http://www.iesd.dmu.ac.uk