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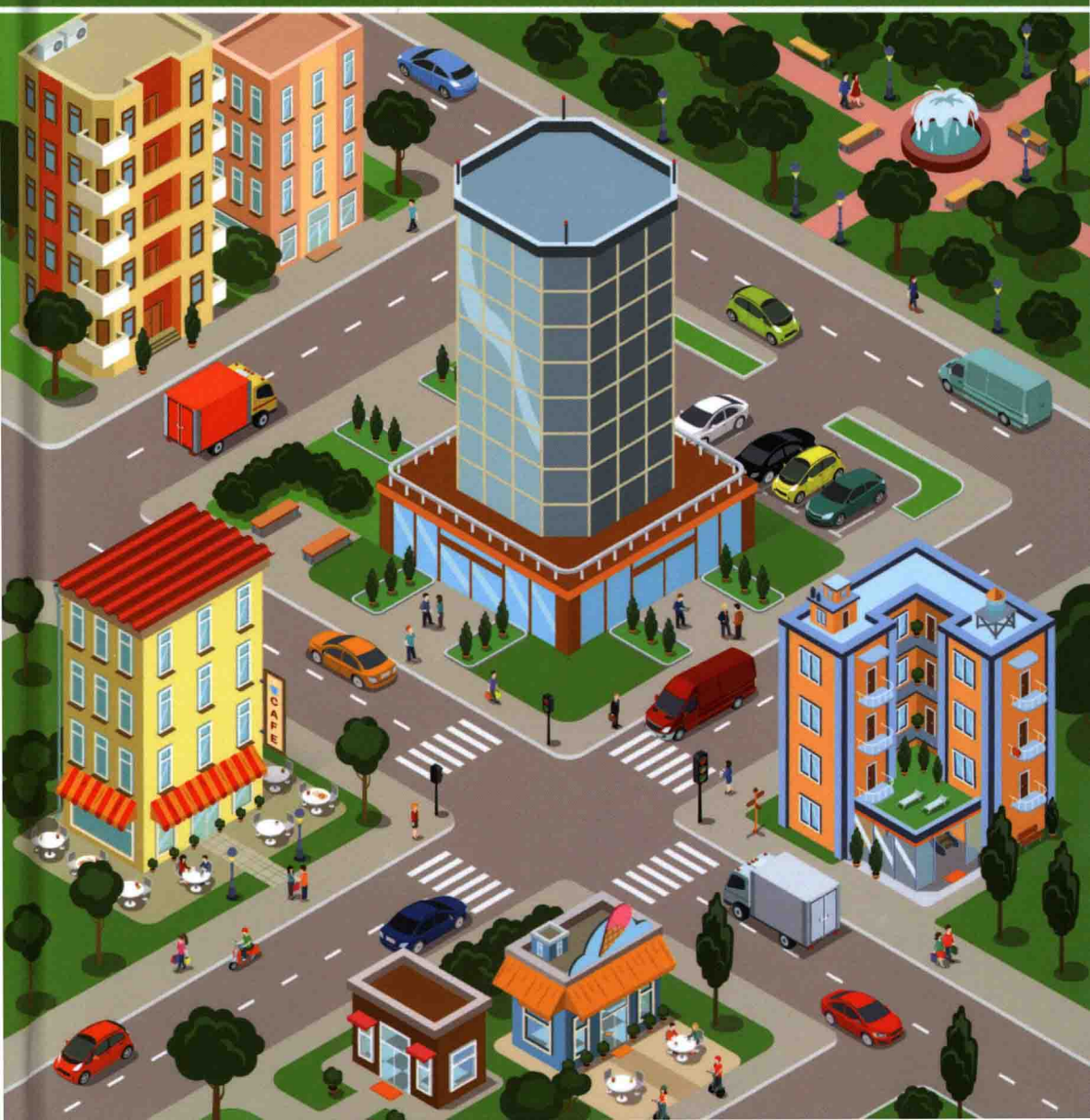
# DISTRICT COOLING

## Theory and Practice

Alaa A. Olama



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# DISTRICT **COOLING**

## Theory and **Practice**

# HEAT TRANSFER

*A Series of Reference Books and Textbooks*


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# *Dedication*

*In Memory:*
*Knowledge builds a pillarless house while ignorance destroys a house of glory and honour.*

**A. Shawky (1868–1932)**
*To my father who engraved it into my soul.*

# Preface

I have been working in refrigeration and air-conditioning, both academically and in the industry, since 1971. In 2002, I came face to face with district cooling. This was when I was asked to conduct a study for a city, in a high-ambient temperature country, to adopt an air-conditioning strategy for the next 50 years. A major place of assembly was located in the city center. Chilled water from a dedicated remote district cooling plant supplied the air-conditioned systems for this place of assembly. Its capacity was about 105,000 kW (30,000 TR). Hotels, hostels, motels, and other lodging facilities, in total 320 such establishments, surround this major place of assembly. These air-cooled establishments were rejecting so much heat that a steady increase in ambient temperatures occurred in the city center and over the years, the comfort conditions for the whole city center progressively deteriorated.

An obvious solution to this problem was to connect all these buildings to a second district cooling plant and locate the plant in a remote area well away from the city center. But where should this station be located? How far away should it be from the center—5 or 10 or 15 km away? Would there be enough room in the underground utility tunnels that connected the buildings together to install supply and return chilled water piping? Would I need to decrease the size of the pipes, using perhaps ice-slurry solutions, to accommodate the unplanned chilled water piping in the tunnels?

All these issues made me realize that a heating, ventilation, and air-conditioning (HVAC) engineer is not necessarily qualified to answer these questions. I searched for references on district cooling; there were a few available on district heating, but when it came to district cooling, it was a different matter. Sometimes, if I was lucky, I would come across a spattering of information in the district heating references, which also addressed district cooling issues, but not extensively and certainly not for a high-ambient temperature country.

Slowly, a district cooling best practices guide appeared in 2008, together with information in the American Society of Heating, Air-Conditioning, and Refrigeration Engineers (ASHRAE) handbooks. There was, however, no district cooling reference book available, neither on the principles nor on the theory and practice.

In 2005, I became obsessed with forming a district cooling company and started exploring this field. Once I left the company, which I established in 2012 with four other partner companies, a close friend and colleague suggested that I write about district cooling. The resulting effort is this book. I hope you find it useful.

**Alaa A. Olama**
*Independent Consultant*

# Author

**Alaa A. Olama, Ph.D.,** has 35 years of experience in designing refrigeration and air-conditioning. He received both an M.Sc. and Ph.D. from King's College, London University, England, in mechanical engineering specializing in refrigeration and air-conditioning. He is a member of the Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee (RTOC) formed by the Technical and Economical Assessment Panel of the United Nations Environment Programme (UNEP) to assess the development of relevant technologies to replace ozone-depleting substances (ODSs) in the fields of refrigeration and air-conditioning, under the Montréal Protocol. He is the past president of the board of directors of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Cairo Chapter, 2002–2003; and was general chair of the Second Annual Regional Conference (ARC) of ASHRAE's Region-at-Large held in Cairo in September 2003.

Dr. Olama is the founder, board of directors member, and vice chair of the first district cooling company in Egypt. He is the head of the committee writing the first District Cooling Code for Egypt. Recognized as an international expert in district cooling, he is also a member of the committee writing the Egyptian Code of Air-Conditioning, Refrigeration, and Automatic Control, and a member of a committee writing the Arab Refrigeration and Air-Conditioning Code. He is a member of the International Reviewer's Panel of PRAHA, formed by the United Nations Industrial Development Organization (UNIDO) and UNEP for testing new Low-Global Warming Potential (GWP) refrigerants in high-ambient temperature countries in the Gulf. He is the technical advisor for the Egyptian Low-GWP Refrigerants testing program in Egypt (EGYPRA) and a member of the expert panel of the Low-GWP Refrigerants testing program for high-ambient countries for the U.S. Department of Energy (DoE) at Oak Ridge National Laboratory (ORNL). Dr Olama is an independent consultant.

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