PERFORMACE ANALYSIS AND ECONOMICAL ASSESSMENT OFA DISTRICT COOLING SYSTEM

BY

ENG. Hussein Bunyan Ismail

A Thesis Submitted to the

Faculty of Engineering at Cairo University

in Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE

In Mechanical Power Engineering

Faculty of Engineering, Cairo University

Giza, Egypt

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Title of Thesis: PERFORMACE ANALYSIS AND ECONOMICAL ASSESSMENT OFA DISTRICT COOLING SYSTEM

Key Words: DC, Central Plant , Water Network, cooling equipment,

Summary:

The objective of the present thesis is to make hydraulic analysis and economical assessment to district cooling system. the hydraulic analysis was designed by using engineering program (**Bentley watergems V8i**) which depended on representation of a given lengths and diameters and required flow for each building to establish the required cooling had been found that there is some problems concerning water flow rate speed inside pipes moreover , rising of pressure beyond upper limit of the allowed values of pressure. According to that modifications in network design were done to avoid this obstacle. While from the economical aspect an economical study performed and comparison were done among district cooling systems and central cooling units from side and chillers work by natural gas and others work by electricity power from the other side (the natural gas was used in Egypt because of its relative cheapness) From this economical study we discovered that district cooling system operating on natural gas better economically from the one that operating on electricity power whereas the central cooling system came in the bottom of list if it compared with district cooling system . This study found that application of this technology will increase when there is high thermal loads for area unit and that occur in high buildings.

ACKNOLODGEMEN

I have to hand this work to Allah, after that to my supervisor, Prof. Dr. Mahmoud fouad, who supported and helped me to select the right research and provided me with the required data to finish my thesis.

Also many thanks to my advisor, Dr. Ashraf Ibrahim Sayed for his support and guide.

On the other hand I cannot deny the support that was given by, Dr. Othman H.Othman

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ABBREVIATION	DESCRIBTION
AACS	Air-Cooled Air-Conditioning Systems
ADDS	Absorption Driven District System
CHCP	Combined Heating, Cooling and Power
CHP	Combined Heat and Power
DCP	District Cooling Plant
DCS	District Cooling Systems
DHC	District Heating and Cooling
EDDS	Electricity Driven District System
GDHS	Geothermal District Heating Systems
HVAC	Heating Ventilation and Air Conditioning
IBCU	Individual Building Central Units
IPF	Ice packing factor within ice-slurry (wt%)
LRT	Low Return Temperature
TES	Thermal Energy Storage
WACS	Water-Cooled Air-Conditioning Systems

ABBREVIATION	DESCRIBTION
A	Annual payments, EGP
A_s	Cross section area, m^2
c	Specific heat, KJ/Kg ^oC
d	Burial depth to centerline of pipe or conduit, m
D	Pipes diameter, m
e	Surface roughness for pipes, m
f	Inflation rate, %
F	Friction factor, dimensionless
g	Acceleration of gravity, m/s^2
h	Convective heat transfer coefficient, KJ/s m ^oC
H	Hydraulic grade line, m H_2O
H_{loss}	Head loss, m H_2O
i	Interest rate, %
i_f	Total equivalent for interest and inflation rates, %
k	Thermal conductivity, W/ m ^oC
K	Loss factor for fittings, dimensionless
L	Pipe length, m
n	Life time, years
q	Annual average rate of heat loss
Q	Flow rate, m^3/s
r	Radius of pipe, m
R	Thermal resistance, m $^oC/W$
t	Temperature, ^oC

ABBREVIATION	DESCRIBTION
V	Velocity, m/s
ν	Kinematic viscosity, m^2/s
ρ	Density, Kg/m^3

ABSTRACT

The objective of the present thesis is to make hydraulic analysis and economical assessment to district cooling system. the hydraulic analysis was designed by using engineering program (**Bentley watergems V8i**) which depended on representation of a given lengths and diameters and required flow for each building to establish the required cooling had been found that there is some problems concerning water flow rate speed inside pipes moreover , rising of pressure beyond upper limit of the allowed values of pressure. According to that modifications in network design were done to avoid this obstacle. While from the economical aspect an economical study performed and comparison were done among district cooling systems and central cooling units from side and chillers work by natural gas and others work by electricity power from the other side (the natural gas was used in Egypt because of its relative cheapness) From this economical study we discovered that district cooling system operating on natural gas better economically from the one that operating on electricity power whereas the central cooling system came in the bottom of list if it compared with district cooling system . This study found that application of this technology will increase when there is high thermal loads for area unit and that occur in high buildings.