DEVELOPMENT OF ENERGY CENTRE COOLING PLANT

A dissertation submitted to the
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Degree of Master of Science

by
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Abstract

This work study reviews the conceptual development of optimization strategies of an Energy Centre based on operational task of daily thermal load contours and interaction of weather profiles of the environment in the selected area of the project. The weather profile analysis was primarily done by the interactive plotting of temperature/humidity sensor data against historical data. Gray Model was also employed in order to predict much accurate data patterns in the fuzzy areas of weather prediction process. However, by introduction of genetic algorithm on the historical samples would able to predict the anticipated weather profile more accurately and thereby the thermal load required for the future trend on the following day. The current thermal energy storage (TES) technologies and their applications using the traditionally available methods are the common practice of any ice storage design in the industry; however in this analysis dedicated low freezing media (Glycol) is used to chill the common chilled media (water) and also the chilled media is used as storage medium with phase change. Latent heat storage on the other hand, is a young and developing technology which has found considerable interest in recent times due to its operational advantages of smaller temperature swing, smaller size and lower weight per unit of storage capacity. Design methodology and its prime results of simulation show the effectiveness of the proposed solution for an Energy Centre for efficient operation.

DECLARATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated.

It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

UOM Verified Signature

Mahinda Gallage

I endorse the declaration by the candidate.

UOM Verified Signature

Professor Lanka Udawatta

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List of Abbreviations and Symbols

Acronym	Definition
BMS	Building Management System
TCP/IP	Transmission Control Protocol/Internet Protocol
TES	Thermal Energy Storage
CWP, ChW	The Chilled Water Plant ,Chilled water
BACnet /IP	Building Automation Control Network protocol over the Internet protocole
ITES	Ice Thermal Energy Storage
COP	Co-efficient of Performance
CPCS	Chilled plant Control System
GCPCS	Glycol Chiller plant Control System
HXCS	Heat Exchanger Control System
VFD, VSD	Variable Frequency Drive , Variable Speed Drive
MS/TP	Master – Slave/ Token – Passing
ANN	Artificial Neural Network
θ	Ambient temperature in °C (Air in temperature of cond.)
χ	Coefficient of Performance: 1/Efficiency
τ	Glycol supply temperature °C (Evaporator to the system)
φ	Chilled water temperature of the system °C
ψ_i, ω_i, μ_i	Polynomial functional constants (Curve)
ψ	Chiller part load ration (PLR)
$f_c(\chi, \theta, \tau)$	Thermal(cooling) capacity by the Chiller operation with χ COP, θ ambient and the τ refrigerant temperature
$f_s(\chi, \theta, \tau)$	Thermal(cooling) capacity by the Ice storage with χ efficiency, θ ambient and the τ refrigerant temperature
$B(\theta, \varphi)$	Thermal(cooling) capacity of the Base load chilled water
$f_o(\chi, \theta, \tau, \varphi)$	Objective function of Total Cooling of the Energy Centre
Open Protocol	Standard Convention for Communications available to all to develop compliant devices that can talk to each other consistently and coherently

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