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NAMENCLATURES AND SYMBOLS

Nomenclature

A	area
C	first cost
C_p	price of electric power
c_p	specific heat
D	diameter
d	interest rate
Gr	Grashof number
H	operating lifetime
IRR	Internal rate of return
k	thermal conductivity
L	length
M	mass
m	mass flow rate
NPV	Net present value
Nu	Nusselt number
Q	heat transfer rate
r	discount rate
Ra	Rayleigh number
Re	Reynolds number
$RMSD$	Root-Mean-Square Deviation
ROI	Return on investment
R_v	resale value
SSE	sum of squares for error
SSR	sum of squares for the regression
SST	total sum of the squares
STD	standard deviation
T	temperature
t	time period
U_L	overall heat transfer coefficient
V	velocity
Z	thermal resistance

Subscripts

air	air
am	ambient
c	collector
$cond$	condenser
$evac$	evacuated tube
$evap$	evaporator
fin	fin

Subscripts

<i>g</i>	glass tube
<i>i</i>	inner/inlet/x-direction
<i>ins</i>	insulated
<i>j</i>	y-direction
<i>k</i>	z-direction
<i>loss</i>	heat loss
<i>o</i>	outer/outlet
<i>r</i>	r-direction
<i>ST</i>	storage
<i>sophon</i>	thermosyphon
<i>t</i>	tank
<i>tank</i>	tank
<i>tot</i>	total/overall
<i>w</i>	water
<i>wind</i>	wind
<i>z</i>	z-direction

Greek symbol

α	absorptance
ε	emissivity
η	efficiency
θ	θ -direction
σ	Stefan–Boltzmann
τ	transmittance
Φ	merit number



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ข้อความแห่งการริเริ่ม

- 1) คุษฎีนิพนธ์นี้ได้นำเสนอแบบจำลองทางคณิตศาสตร์ของเครื่องทำน้ำร้อนแสงอาทิตย์แบบท่อเทอร์โมไซฟอน เพื่อใช้สำหรับการคำนวณและออกแบบ ซึ่งสามารถวิเคราะห์ผลกระทบของขนาดของท่อเทอร์โมไซฟอนและจำนวนของท่อแก้วสุญญากาศ โดยใช้หลักการของการวิเคราะห์เศรษฐศาสตร์ความร้อน (Thermoeconomics analysis) ในการออกแบบระบบเครื่องทำน้ำร้อนแสงอาทิตย์แบบท่อเทอร์โมไซฟอนที่เหมาะสม เพื่อประสิทธิภาพสูงสุดในการใช้งาน
- 2) การประเมินผลกระทบเชิงเศรษฐศาสตร์ (Economics analysis) เปรียบเทียบกับเครื่องทำน้ำร้อนแบบไฟฟ้า นั่นก็เพื่อใช้ในการตัดสินใจทางด้านเศรษฐศาสตร์และสิ่งแวดล้อม ซึ่งการประเมินผลเชิงเศรษฐศาสตร์นั้นได้ทำการวิเคราะห์ผลกระทบครอบคลุมทั้งระยะเวลาดำเนินทุน ผลตอบแทนสำหรับการลงทุน ที่สามารถกำหนดตัวชี้วัดที่น่าสนใจในการลงทุนระบบเครื่องทำน้ำร้อนแสงอาทิตย์แบบท่อเทอร์โมไซฟอนนี้

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STATEMENT OF ORIGINALITY

- 1) This dissertation is designed to propose the mathematical model of evacuated tube solar water heater system with thermosyphon for calculating and designing. Thus, the effects of dimensional thermosyphon and number of evacuated tube can be analyzed by thermoeconomics analysis to design the suitable parameters for efficient using.
- 2) Economics analysis of evacuated tube solar water heater system is brought to compare to the electric water. Therefore, the analysis is including the impact of the simple payback period, net present value, as well as internal rate of return use in the evaluation. Also, this economics analysis can be used as the comprehensive indicator to evaluate the investment cost of the evacuated tube solar water heater system.



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