

**Construction and Performance Analysis of a Single Slope and  
a Pyramid Cover Solar Still with Storage Media  
and Electrical Backup**

By

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**A Thesis Submitted to**

**Avinashilingam Institute for Home Science and Higher Education for  
Women, Coimbatore – 43**

**In Partial Fulfilment of the Requirements for the Degree of  
Doctor of Philosophy in Physics**

**July - 2014**

## Certificate

This is to certify that the thesis entitled "**Construction and Performance Analysis of a Single Slope and a Pyramid Cover Solar Still with Storage Media and Electrical Backup**", submitted to Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, for the award of Degree of **Doctor of Philosophy in Physics** by **Mrs. S. Kalaivani**, is the record of original research work carried out by her during the period from July 2009 to July 2014 under my supervision and guidance and the thesis has not formed the basis for the award of any Degree / Diploma / Associateship / Fellowship or similar title to any University or Institution.

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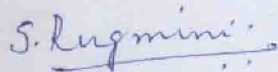
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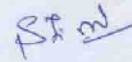
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## Declaration

I hereby declare that the matter embodied in the thesis entitled **“Construction and Performance Analysis of a Single Slope and a Pyramid Cover Solar Still with Storage Media and Electrical Backup”**, is the results of investigations carried out by me in the Department of Physics, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, under the supervision and guidance of **Dr. S. Rugmini Radhakrishnan**, Professor (Retd), Department of Physics, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, and it has not been submitted for the award of any Degree / Diploma / Associateship / Fellowship of any other University or Institution.



Signature of the Supervisor



Signature of the Candidate

## ACKNOWLEDGEMENT

*I owe my sincere thanks to **ALMIGHTY** for showering HIS generous blessings upon me in all my endeavors.*

*I extend my profound gratitude to **Dr. T.S.K. Meenakshisundaram**, Chancellor, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore for providing the conducive infrastructure for the conduct of the research study.*

*I express my sincere thanks to **Dr. Sheela Ramachandran**, Vice Chancellor, **Dr. Saroja Prabhakaran**, Former Vice Chancellor, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore for granting permission and encouragement to carry out this work.*

*I am thankful to **Dr. Gowri Ramakrishnan**, Registrar, **Dr. G.P. Jeyanthi**, Controller of Examinations, **Dr. P. Santhana Krishnan**, Former Director (R & C), Avinashilingam Institute for Home Science and Higher Education for Women for providing all the administrative support and help required to carry out this work.*

*I am immensely pleased to express my deep sense of gratitude to **Dr. A. Parvathy**, Dean Faculty of Science and **Dr. S. Parvatham**, Former Dean Faculty of Science, Avinashilingam Institute for Home Science and Higher Education for Women for their constant encouragement and valuable support.*

*I extend my thanks to **Dr. J. Shanthi**, Associate Professor and Head of the Department of Physics, **Dr. Rachel Oommen**, Former Professor and Head of the Department of Physics, Avinashilingam Institute for Home Science and Higher Education for Women for her valuable support and motivation.*

*My deepest appreciation and gratitude to my supervisor, **Dr. S. Rugmini Radhakrishanan**, Professor (Retd), Department of Physics, Avinashilingam Institute for Home Science and Higher Education for Women for her excellent, outstanding guidance, constructive criticism, motivation, valuable advice, untiring support, timely suggestions, constant encouragement and inspiration throughout my research work, holding me strong in all the places I faltered .*

*I wish to enunciate my heartfelt gratitude to **Dr. B. Selvakumar**, Assistant Professor, Department of Physics, R.M.D Engineering College, Chennai, for his valuable suggestions and timely help rendered by him to complete the study.*

*I thank my friends **Miss N. Karthika**, **Miss. E. Vaishnavi** and **Miss Guna Sundari** for their support, understanding and co-operation for this completion of this study.*

*Here words are not enough to express my gratitude to my beloved **parents**, **brother** and **my husband and my son** for their unbeaten love, affection, confidence, care, support, understanding and encouragement towards me in the completion of this work.*

**S. Kalaivani**

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## NOMENCLATURE

A	- Area of the still, m <sup>2</sup>
C	- Specific heat, J/Kg °C
g	- Acceleration due to Gravity, m/sec
G <sub>r</sub>	- Grashof number
h	- Thickness of insulation, m
h <sub>be</sub>	- External heat transfer coefficient through base, W/m <sup>2</sup> °C
h <sub>ce</sub>	- External convective heat transfer coefficient from top cover to ambient, W/m <sup>2</sup> °C
h <sub>ci</sub>	- Internal convective heat transfer coefficient from water to top cover, W/m <sup>2</sup> °C
h <sub>ei</sub>	- Internal evaporative heat transfer coefficient from water to top cover, W/m <sup>2</sup> °C
h <sub>re</sub>	- External radiative heat transfer coefficient from top cover to ambient, W/m <sup>2</sup> °C
h <sub>ri</sub>	- Internal radiative heat transfer coefficient from water to top cover, W/m <sup>2</sup> °C
I	- Solar insolation incident on top cover per unit area per unit time, W/m <sup>2</sup> °C
k	- Thermal conductivity of water, W/m °C
L	- Latent heat of water, J kg <sup>-1</sup>
$\dot{m}_e$	- Distillate output per hour, kg/m <sup>2</sup>
M <sub>e</sub>	- Distillate output, kg/m <sup>2</sup>
N <sub>u</sub>	- Nusselt number
P <sub>a</sub>	- Partial pressure of water vapor at atmospheric temperature, Pa
P <sub>c</sub>	- Partial pressure of water vapor at top cover temperature, Pa
P <sub>r</sub>	- Prandtl number
P <sub>w</sub>	- Partial pressure of water vapor at water temperature, Pa
q <sub>l</sub>	- Rate of which heat is lost by convection and re-radiation from the top and by conduction from the bottom and side, W/m <sup>2</sup>
Q <sub>be</sub>	- External conductive heat transfer through base, W/m <sup>2</sup>
Q <sub>ce</sub>	- External convective heat loss from top cover to atmosphere, W/m <sup>2</sup>
Q <sub>ci</sub>	- Internal convective heat loss from water surface to top surface, W/m <sup>2</sup>
Q <sub>ei</sub>	- Internal evaporative heat loss from the water surface to top cover, W/m <sup>2</sup>
Q <sub>e</sub>	- Total amount of solar energy used for evaporation, J/m <sup>2</sup> per day
Q <sub>re</sub>	- External radiative heat loss through radiation from the top cover to atmosphere, W/m <sup>2</sup>
Q <sub>ri</sub>	- Internal radiative heat loss from the water surface to top cover, W/m <sup>2</sup>

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$\Delta t$	- Time interval, sec
$T_a$	- Air temperature °C
$T_{amb}$	- Ambient temperature, °C
$T_c$	- Top cover temperature, °C
$T_{sky}$	- Sky temperature °C
$T_w$	- Water temperature °C
$U_L$	- Overall heat transferred coefficient from absorbing surface of the still to ambient, $W/m^2 \text{ } ^\circ C$
$V$	- Wind speed, m/sec
$x_1$	- Spacing between water surface and top cover, m

### ***Greeks symbols***

$\eta$	- Efficiency, %
$\alpha$	- Absorptivity
$\beta'$	- Coefficient of volumetric thermal expansion, $^\circ C^{-1}$
$\varepsilon$	- Emissivity
$\lambda$	- Thermal conductivity of water, $Wm^{-1} \text{ } ^\circ C^{-1}$
$\mu$	- Dynamic viscosity of water, $Ns \text{ } m^{-2}$
$v_f$	- Fluid velocity, m/sec
$\rho$	- Partial mass density of water vapour, $Kgm^{-3}$
$\sigma$	- Stefan–Boltzman constant, $Wm^{-2}K^{-4}$
$\tau$	- Coefficient of transmission

### ***Indices***

<i>a</i>	- Air
<i>amb</i>	- Ambient
<i>b</i>	- Base
<i>c</i>	- Cover
<i>ce</i>	- External convection
<i>ci</i>	- Internal convection
<i>ei</i>	- Internal evaporation
<i>re</i>	- External radiation
<i>ri</i>	- Internal radiation
<i>w</i>	- Water

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## PAPERS PUBLISHED IN JOURNALS

1. **Kalaivani. S, Rugmini Radhakrishnan, Kalithasan B and Selvakumar. B, (2011), “Enhanced Distillate Yield of Acrylic Pyramid Top Cover Solar Still With and Without Tar Coated Blue Metal”, *IEEE Xplore*, pp.296-305.  
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