



FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF CHEMICAL AND PROCESS ENGINEERING

BSc. Thesis

A SOLAR POWERED FOOD AND CROPS DRYING SYSTEM FOR UTILIZATION OF
REFRIGERATION WASTE HEAT

BY

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ABSTRACT

One of the main goals of the majority of cold chain operations is to decrease perishable post-harvest losses. Another useful technique for lowering post-harvest loss is drying. Nevertheless, the commercial drying methods currently in use require a lot of energy. High levels of greenhouse gasses are released during operation. Drying applications could make use of low-grade waste heat recovered from the refrigeration system's condenser. The technique involves the efficient use of heat that is intermittently produced by a refrigeration system's condensing unit with an external energy source of a solar collector that was used for drying during day as a source of heat to the condenser heat. The system was tested using cassava and tomatoes under various loading conditions, with performance assessed through temperature monitoring in both chambers, moisture content of cassava, and economic evaluation. An average temperature of 13°C was maintained in the cooling chamber and for the drying chamber, a temperature of 32.0 °C was used for the drying process at night and a 50.3°C during day time with combined heat from the solar collector and condenser heat. Results showed effective drying and cooling performance, reduced energy demand, and promising economic indicators, including a favourable net present value and internal rate of return. This proved to be a viable alternative to the comparatively more energy-intensive industrial drying technologies in use today.

DECLARATION

DECLARATION

We hereby declare that the information in this research proposal is out of our effort under the guidance our supervisors Asso. Prof. Tumutegyreize Peter and Mr. Menya James and that has never been presented to any institute of higher education for any award.

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APPROVAL

APPROVAL

This is to certify that this research project has been carried out under our supervision and that it is ready for submission to the department.

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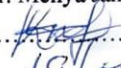
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DEDICATION

We dedicate this final project report to our parents for the support rendered. We also dedicate it to our lovely friends and relatives for the unwavering support they gave to us. May the good Lord bless you.

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We thank the almighty God who made the final project a success. We acknowledge with great pleasure the lecturers at Busitema University Faculty of Engineering for offering the knowledge that helped me do this research project. Great thanks go to Chemical and Process engineering Department for instilling in us the skills and knowledge. Sincere thanks go to the research supervisor Asso. Prof. Tumutegyereize Peter and Mr. James Menya, for the theoretical knowledge they rendered to us which made the research project a success. We take this opportunity to appreciate our course mates whom we attended this program with for the support they rendered to us.

Table of Contents ABSTRACT

.....	i
DECLARATION	2
APPROVAL	3
DEDICATION	4
ACKNOWLEDGEMENT	viii
.....	iii
1 CHAPTER ONE: INTRODUCTION	2
1.1 Background.....	2
1.2 Problem Statement	5
1.3 Main Objective.....	5
1.4 Specific Objectives.....	5
1.5 Hypothesis	5
1.6 Significance	5
1.7 Justification.....	6
1.8 Scope	6
<i>1.8.1 Conceptual scope</i>	<i>6</i>
<i>1.8.2 Conceptual framework</i>	<i>6</i>
2 CHAPTER TWO: LITERATURE REVIEW	7
2.1 Waste heat reuse	7
2.2 Incorporating Solar Energy as an Alternative Energy Source	11
2.3 Waste Heat Utilization in Food Drying	12
2.4 Economic analysis.....	14
<i>2.4.1 Economic variables</i>	<i>16</i>
3 CHAPTER THREE: METHODOLOGY	19
3.1 Design of the waste heat reuse unit.....	19
<i>3.1.1 Conceptual design of the system</i>	<i>19</i>
<i>3.1.2 Cooling load</i>	<i>23</i>
<i>3.1.3 Sizing of the system components</i>	<i>25</i>
<i>3.1.4 Creation of drawings of the proposed system</i>	<i>28</i>
3.2 Physical construction of the prototype	28
3.3 Test and evaluation of the performance of the constructed prototype	28
<i>3.3.1 No Load test of the system</i>	<i>28</i>
<i>3.3.2 Load Test</i>	<i>29</i>
<i>3.3.3 Energy Consumption</i>	<i>31</i>

3.3.4	<i>Coefficient of performance</i>	31
3.3.5	<i>Quality of the food</i>	32
3.4	Assessing the economic benefit of the system.....	32
3.4.1	<i>Economic variables</i>	32
4	CHAPTER FOUR: RESULTS AND DISCUSSIONS	33
4.1	Design of the waste heat reuse unit	33
4.1.1	<i>Cooling load</i>	33
4.1.2	<i>Sizing of components</i>	36
4.1.3	<i>Solar panel selection and battery sizing</i>	39
4.1.4	<i>Simulation results for solar collector</i>	44
4.1.5	<i>Simulation Results for Drying Chamber</i>	47
4.2	Construction of the waste heat reuse unit for drying in a cooling system.....	51
4.2.1	<i>Fabrication and assembling of the cooling and drying system</i>	51
4.3	Test and evaluation of the performance of the constructed combined cooling .. 53 and drying system.....	53
4.3.1	<i>No Load test of the system</i>	53
4.3.2	<i>Load Test</i>	56
4.3.3	<i>Energy Consumption Analysis and Comparison</i>	62 . 63
4.3.4	<i>Coefficient of performance</i>	64
	vi	
4.3.5	<i>Quality of the food after the machine loading tests.</i>	63
4.4	Benefit analysis of the system	66
4.4.1	<i>Benefit cost ratio</i>	67
4.4.2	<i>Net present value</i>	67
4.4.3	<i>Pay back period</i>	68
4.4.4	<i>IRR</i>	68
5	CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS	70
5.1	Conclusion	70
5.2	Recommendation	71
5.3	Challenges	72
6	APPENDIX I	73
6.1	APPENDIX II	81
7	REFERENCES	85

List of tables

Table 1 shows Electricity Retail Tari rates	15
Table 2 showing temperatures recorded during the no load test.....	29
Table 3 showing temperatures recorded during the only cooling load test	30
Table 4 showing weight of cassava during the “only drying loaded test.”	31
Table 5 showing temperatures during the “only drying loaded” test	31
Table 6 showing the weight of cassava drying in the drying chamber during the both loaded test.	31
Table 7 showing the temperatures during the “both loaded test.”	31
Table 8 showing the components and procedures that were done to achieve the constructed prototype.	51
Table 9 showing temperatures recorded during the no load test.....	73
Table 10 shows the temperatures of the cooling chamber and the ambient temperature during the no load test	74
Table 11 showing the weight of cassava drying during the test when only the drying chamber is loaded	75
Table 12 showing the weight of cassava drying in the drying chamber during the test when both the drying and the cooling chambers were loaded.	75
Table 13 shwoing the project budget	66
Table 14 showing temperatures recorded during the test when only the cooling chamber is loaded	76
Table 15 showing the temperatures of the cooling and drying chambers when only the drying chamber is loaded.....	78
Table 16 showing temperatures recorded in the cooling and drying chambers during the test when both the drying and cooling chambers are loaded.	80

List of figures

Figure 1 showing the conceptual framework	7
Figure 2 showing conceptual design.	19
Figure 3: vapor compression cycle (VCRC)	21
Figure 4 showing the pressure-enthalpy chart for a VCRC under saturated conditions	21
Figure 5 showing a chart to follow when selecting an evaporator	25
Figure 6 showing a chart for fan size selection	27
Figure 7 showing a compressor	37

Figure 8 showing an evaporator	38	Figure 9
showing a condenser	39	
Figure 10 showing the design of the cooling chamber	43	
Figure 11 showing the design of the drying chamber.....	43	
Figure 12 showing the design of the combined cooling and drying system	44	
Figure 13 showing surface temperature distribution	45	Figure 9
14 showing isosurface temperatures	46	
Figure 15 showing a point graph of temperatures of the solar collector.	47	
Figure 16 showing the surface temperatures of the drying chamber.	48	
Figure 17 showing iso-surface temperatures of the drying chamber.	48	
Figure 18 showing a point graph of temperatures in the drying chamber.	49	
Figure 19 showing the design of the solar collectorSimulation results for drying chamber	50	
Figure 20 showing the constructed prototype	52	Figure 9
21 showing a graph for temperatures during the no load test	55	
Figure 22 showing trend of cooling chamber and ambient temperatures over time.	55	
Figure 23 showing the trend of temperatures during the only cooling experiment	57	Figure 9
24 showing the trend of the drying cassava samples on each tray during the test when only the drying chamber is loaded.	59	
Figure 25 showing a graph of the temperatures of the cooling and drying chambers when only the drying chamber is loaded.	59	
Figure 26 showing the trends of the cassava samples drying on the different trays during the test when both chambers are loaded.	62	
Figure 27 showing a graph for the temperatures during the test when both the drying and cooling chamber were loaded	62	Figure 9
28 showing cassava before drying	64	
Figure 29 showing cassava after drying	64	
Figure 30 showing the tomatoes before storage	64	
Figure 31 showing the tomatoes after storage	65	
Figure 32 showing the pattern of IRR at different rates	68	
Figure 33 showing the cold room chamber	81	
Figure 34 showing at the top the constructed prototype and at the bottom the rack	82	
Figure 35 showing a design of trays used in the drying chamber	83	
Figure 36 showing design of the rack in the drying chamber	84	

1 CHAPTER ONE: INTRODUCTION

1.1 Background

In recent studies involving the use of refrigerators for waste heat recovery, (Srithar et al., 2018) investigated energy recovery from a vapour compression refrigeration system using humidification dehumidification desalination. The focus was on heat recovery for desalination. (Lu et al., 2019) investigated a novel hybrid refrigeration system for industrial waste heat recovery. Most heat recovery studies aimed to use recovered heat for refrigeration or industrial processes. Not much attention has been devoted to application of waste heat recovery for domestic use, particularly using waste heat recovered within a household to serve another

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