Journal of Material Science and Mechanical Engineering (JMSME)
p-ISSN: 2393-9095; e-ISSN: 2393-9109; Volume 5, Issue 4; October-December, 2018, pp. 192-197

http://www.krishisanskriti.org/Publication.html

Development of EHEEM with Dynamic Optimization Technique for Evaluating the Households HE

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Abstract—*Heat exchangers are frequently employed in order to warm the water in households. The heat exchangers perform the function to transform the cold water into warm water. The heat exchangers are regarded as a mechanical device, which convert the cold water into warm water at working on low pressure under atmospheric pressure. Heat exchangers significantly are more expensive and the cost-effective action in selecting them is imperative to be carried out. In the present research, a dilemma related to assessment of households heat exchangers are taken into account. To assist the householders to choose the households heat exchangers, the authors proposed an EHEEM included the five sizzling evaluation parameters such as Efficiency, Maintenance, Reliability, Environmental Performance, and Deprecation cost. To simulate the EHEEM, the objective data vs EHEEM- parameters are gleaned via empirical survey from households. A dynamic optimization technique is applied to select household's heat exchanger. The results are flaunted in conclusion section.*

Keywords*: Households, EHEEM, Heat Exchanger, Data, Evaluation.*

1. INTRODUCTION AND LITERATURE REVIEW

A households heat exchangers is a machine or mechanical unit, is employed to condense a hot water from its gaseous to its liquid condition or fluid into gaseous form. Households' heat exchangers are constructed considering the numerous design parameters, and available in a variety of ranges. Heat exchangers are explored to aid the air conditioning, manufacturing chemical processes such as distillation, vapor power industries and other heat exchanger devices too. The assessment of household's heat exchangers solicits the proper psychiatry. A few of household's heat exchangers are fabricated based on the shell and tube design consideration, are enormously expensive, however require the maintenance. Other selections parameters are impact the household electric bills also. It has been observed that empirical survey of householders, there is a necessity to advise the sizzling EHEEM (Economic Heat Exchanger Assessment Model) with a dynamic optimization technique to aid the householders to select the household heat exchanger. To build the EHEEM, the author has escaped to recent literature review, are depicted below.

Described that the steam generated from boiler in medical waste incinerator is seldom used due to its production and parameters are unstable. The three different utilization systems, namely power generation with adoption of condensing steam turbine, co-generation and combined cooling heating and power system (CCHP) of steam generated from the heat recovery boiler of 72t/d medical waste incineration in a hazardous waste disposal center are investigation respectively. The result showed that the CCHP may be a good choice taking into account cooling in summer and heating in winter. Investigated the recovery of low waste heat, which can generate the electricity for saving energy and reducing pollutant and CO_2 emission. In order to improve the waste energy recover rate and energy utilization efficiency, it is concluded that heat transfer analysis, thermal heat exploitation is indeed. Described the design of three unique thermoelectric generators developed to supply electric power in natural gas fields. This generator used in the gas field as the first generator *(1948)*, described uses the difference in temperature between the hot and cold legs of the glycol natural gas dehydrator cycle to produce power for cathodic protection of the well. The second system uses waste heat from the pilot light of the gas dehydrator boiler to produce power for electronic instruments. The third system used waste heat from the gas dehydrator boiler stack to provide power for instruments, communications, and other uses around the well site. Designed the energy recovery technology of aquatic products processing plant, including refrigeration heat recovery and ice-making cooling recovery. Three heat recovery plans are compared and analyzed, and two ways about cooling recovery of ice-melting pool are compared. The results of analysis show that different heat recovery modes have different energy efficiency [4]. Proposed a theoretical research to work out the basic key theory of fluidized bed, the Eulerian continuum model was adopted to research the fluidized bed, which focuses the complex heat and mass transfer accompanied by the process that high-temperature blast furnace slag particles were cooled by air stream, and the theoretical research was carried out to gain the optimized parameter matches of the fluidized bed. The simulation was carried out from the size of particle and the gas supply velocity, and showed that for the particle of 3mm and 4mm size, v=2.68m/s is the best condition for the both size particle.

Provided the first experimental report they draw out the effect of heat transfer coefficient on the basics of length, thickness and pitch of fins and also reduced the friction factor and Colburn modules. As the practical demand of plate fin heat exchanger has increased experimental studies [**5**]. The authors brought to a conclusion that small offset spacing (length/dh), fin thickness and a large number of fins per inch will give better heat transfer [6]. set up a statically relationship between the variables from earlier experimental heat transfer and fluid flow friction data for plate fin heat exchanger of offset fin and by using these statically relationship (untested offset fin geometries can be predicted realistically and accurately within the parameter range of the correlation) one can predict virtually and correctly within the parametric range of newest offset plate fin heat exchanger having no previous tested data **[7]**,[**8],[9],[10].** The references [11-26] helped the author to understand data analysis and choosing effectual technique. Sunil, Dwivedi and Sandip **[11]** studied on the Effect of Low Acute Side Angles on Heat Transfer in Rhombic Shaped Microchannel. Vishal, Anand and Ivan **[12]** studied on the enhancement of heat transfer and reduction of entropy generation by asymmetric slip in pressure-driven non-newtonian microflows. Mustafa Erguvan and David **[13]** a numerical case study: effect of heat leakage on thermodynamic efficiency of cylinders in cross-flow. Ayoub, Rajnish, Hussein & Ashkan **[14]** Heat transfer and flow analysis of Al2O3-Water nanofluids in interrupted microchannel heat sink with ellipse and diamond ribs in the transverse microchambers. Longsheng Lu, Xiaowu , Shuai & Xiaokang **[15]** Optimal Structure Design of a Thermosyphon Solar Water Heating System with Thermal and Dynamic Models.

Research gaps:

- There is a necessity to advise the novel EHEEM - parameters to build EEHEEM (Economic Heat Exchanger Assessment Model).
- There is need to develop a dynamic optimization technique to tackle the EHEEM, aid to select the households household heat exchanger.
- To assist the householders to choose the household's heat exchangers using novel EHEEM included the five sizzling evaluation parameters such as Efficiency, Maintenance, Reliability, Environmental Performance, and Deprecation cost.

Research objective:

- To develop the novel EHEEM (Economic Heat Exchanger Assessment Model)- parameters, can be simulated by empirical data survey.
- To propose a dynamic optimization technique to tackle the EHEEM model, aid to select the household's heat exchanger**.**
- To assist the householders to choose the household's heat exchangers using novel EHEEM included the five sizzling evaluation parameters such as Efficiency, Maintenance, Reliability, Environmental Performance, and Deprecation cost.

2. HOUSEHOLDS EHEEM DYNAMIC TECHNIQUE:

The formula is employed for normalization process:

$$x_{ij}^{*} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^{2}}} \qquad (1)$$

Here x_{ij}^{*} denotes i_{th} house hold HE of j_{th} C .

(X*ij Reliability+ X*ij Efficiency- X*ij Maintenance+ X*ij Environmental Performance- X*ij Deprecation) (2)

3. CASE RESEARCH:

This is a case research of household/domestic HE. It is assumed that a housekeeper desire to select a households heat exchanger for own house. The home keeper desire to choose HE in accordance with objective data, are represented in Fig. 1.

Table. 2, Table. 3 and Table. 4 show data vs households' heat exchanger's parameters. Tbale.5 shows aggregated data. The Table. 6 reveal the normalized data. The final results are depicted by Histogram, fig. 4. **Fig. 2-3 showed the** normalized data interpretation by line chart

Novelties of conducted research work:

- The authors built novel EHEEM (Economic Heat Exchanger Assessment Model)- parameters, can be simulated by empirical data survey.
- The authors proposed a novel dynamic optimization technique to tackle the EHEEM model, aid to select the household' heat exchanger**.**
- To assist the householders to choose the household's heat exchangers using novel EHEEM included the five sizzling evaluation parameters such as Efficiency, Maintenance, Reliability, Environmental Performance, and Deprecation cost.

Limitation, application and future scope:

- The novel EHEEM is only limited to choose Heat exchangers or solve only HE evaluation dilemmas. LPP programming cannot be tackled. The application of research work is for households, need economic HE for their own home. The new EHEEM model can be build in future and propose technique can be used from same purpose.

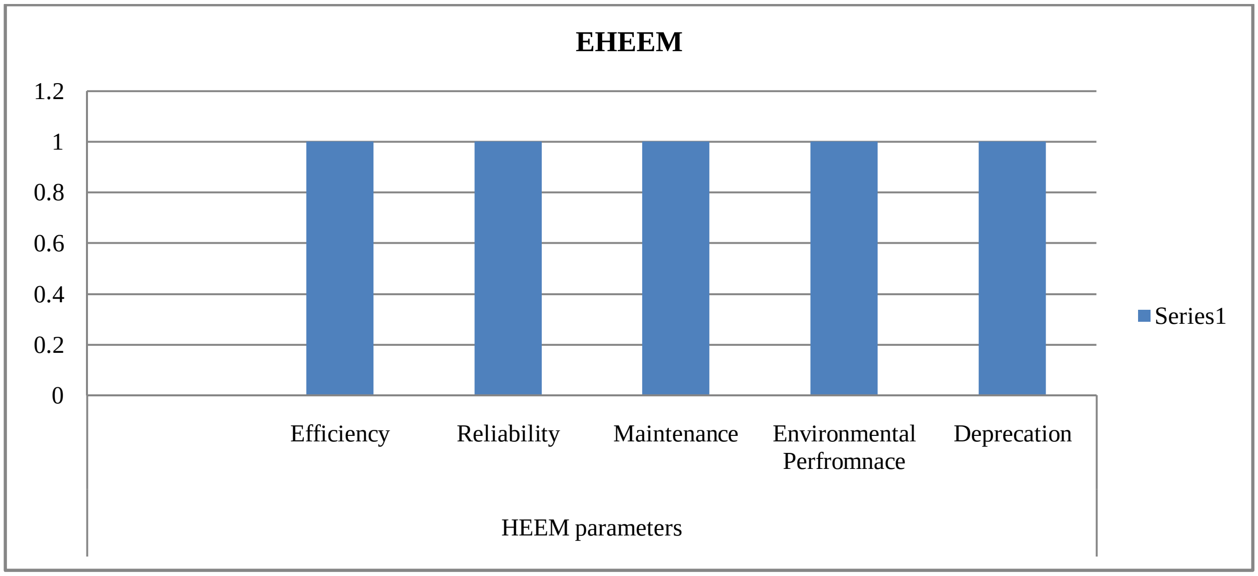

Fig. 1: Households heat exchanger parameters

Table 1: Information assigned by expert's vs EHEE parameters for Households heat exchanger-1

Parameters	E1	E2	E3	E4	E5
Reliability	0.9500	0.9500	0.9000	0.8500	0.8000
Efficiency	80 percent	80 percent	80 percent	80 percent	70 percent
Maintenance	2 percent /year	2 percent /year	3 percent /year	2 percent /year	4 percent /year
Environmental Performance	100%	100%	100%	90%	95%
Deprecation	7% of TC	10% of TC	8% of TC	7% of TC	6% of TC

Table 2: Information assigned by expert's vs EHEE parameters for Households heat exchanger-2

Parameters	E1	E2	E3	E4	E5
Reliability	0.9600	0.9500	0.9200	0.8500	0.8000
Efficiency	80 percent	80 percent	82 percent	80 percent	70 percent
Maintenance	2 percent /year	3 percent /year	3 percent /year	2 percent /year	4 percent /year
Environmental Performance	100%	90%	100%	90%	97%
Deprecation	7% of TC	7% of TC	11% of TC	7% of TC	9% of TC

Table 3: Information assigned by expert's vs EHEE parameters for Households heat exchanger-3

Parameters	E1	E2	E3	E4	E5
Reliability	0.9600	0.9700	0.9200	0.9000	0.8000
Efficiency	80%	85%	82%	85%	75%
Maintenance	2 percent /year	3 percent /year	3 percent /year	2 percent /year	4 percent /year
Environmental Performance	90%	90%	100%	100%	97%
Deprecation	7% of TC	7% of TC	11% of TC	7% of TC	9% of TC

Table 4: Aggregated data vs parameters

Parameters	Households heat exchanger-1	Households heat exchanger-2	Households heat exchanger-3
Reliability	0.8900	0.8960	0.9100
Efficiency	78%	78%	81%
Maintenance	2.6 percent /year	2.8 percent /year	2.8 percent /year
Environmental Performance	97%	95%	95%
Deprecation	8% of TC	8% of TC	8% of TC

Table 5: Normalized data

Parameters	Households heat exchanger-1	Households heat exchanger-2	Households heat exchanger-3
Reliability	0.0110	0.0110	0.0110
Efficiency	0.0080	0.0080	0.0090
Maintenance	0.0920	0.1060	0.1060
Environmental Performance	0.0130	0.0120	0.0120
Deprecation	0.8750	0.8630	0.8620

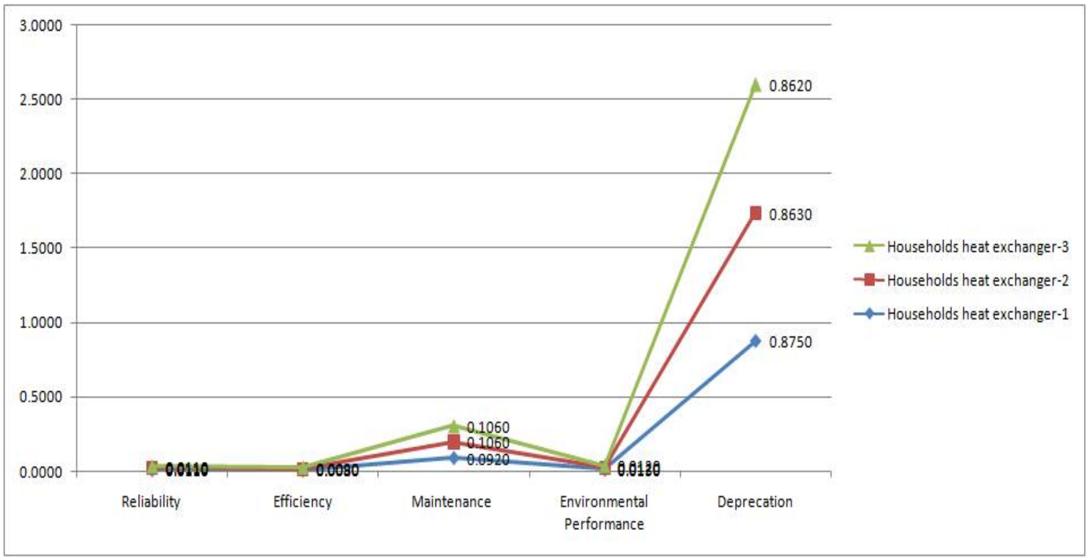

Fig. 2: Normalized data interpretation by line chart

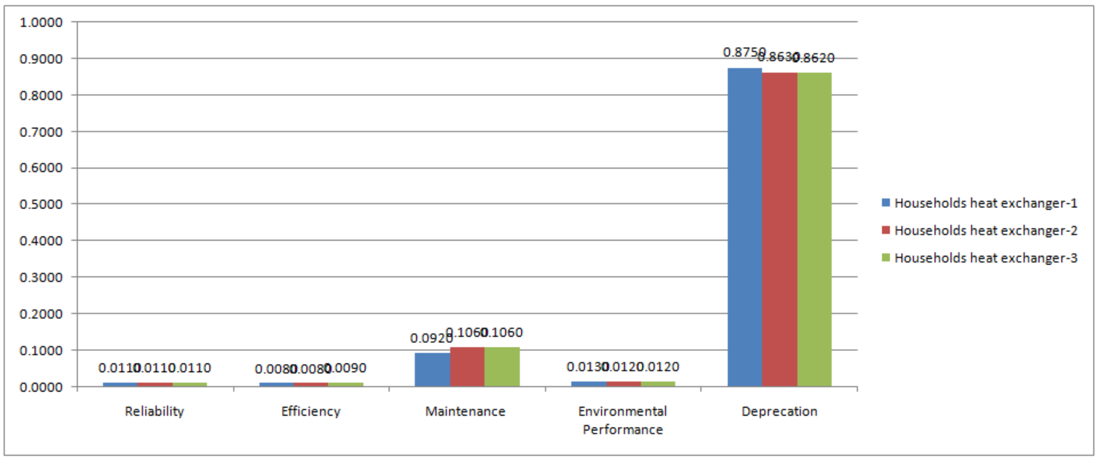

Fig. 3: Normalized data interpretation by histogram chart

4. CONCLUSION

A heat exchanger is a machine, used to transfer the heat from one medium to another, a Hydraulic Oil Cooler or example will remove heat from hot oil by using cold water or air. Heat exchanger work under the conduction and convection. A shell and tube heat exchanger used to passes the fluids via and over tubes. It is seen that heat exchanger selection problem is sizzling problem in present era, which require the multi criteria variation analysis.

To select Households heat exchanger, the author have taken into account five parameters such as Reliability, Efficiency, Maintenance, environmental Performance, and Deprecation. The data have been procured from the five experts of a households vs house hold HE. They assigned the data as they monitor the running performance of same different HE at others home in working condition. Households heat exchanger 3 has scored (-0.935) is seen the best than others two alternatives. The consequences of domestic heat exchanger -1-B, Households heat exchanger -2-0.937, and Households heat exchanger purchasing -3 -0.935. the fig.4 reveals the interpretation of EHEE.

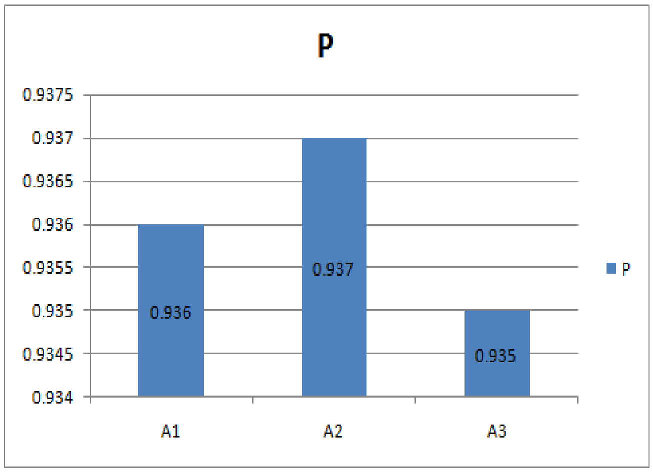

Fig. 4: Evaluation of house hold HE

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