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Title: Redesign of bread box with considering ergonomic aspect

Author (s): Ayu Bidiawati J. R.

Abstract: To distribute the products, the company uses tools such as breadbox that is place in the motorcycle seat. However, the tools used for these motorists complain of discomfort, this is due to the rigid box shape (on the back of the rider) and the improper size of the box. Ergonomics or human factors considerations are very influential in the driving comfort. This study aimed to design an ergonomic breadbox, accordance with aspects of anthropometry. Ergonomic breadboxes are useful for bikers to bring bread to the stalls. The purpose of the breadbox design is to enhance the previous design. Specifications of breadbox concept design are; box shaped, forming a body curves and ergonomic seating position on the side of the backrest, made of fiber material, backrest follow the shoulder width, and box cover is not covered with plastic.

Full Text

Title: Thermal image, partial discharge and leakage current correlation of ceramic insulator under different contamination level

Author (s): Darwison, Syukri Arief, Hairul Abral, Ariadi Hazmi, M. H. Ahmad and Aulia

Abstract: This paper reports correlation on leakage current and thermograph infrared (IR) images of the ceramic outdoor insulator for the condition based monitoring purposes. In this work, laboratory pollution performance test using sodium chloride was performed according to the IEC 60507 standard with applied AC voltage from 12 kV to 18 kV. The severity level of pollution were controlled and represented by ESDD values of 0.00 to 0.25. Also relative humidity conditions were controlled on the range between 60% to 100%. Statistical parameter of infrared images were evaluated to assess the severity level of contaminated ceramic insulator. The output IR images of the insulator were categorized as safe state, necessary maintenance and dangerous based on the level of contamination severity. The results showed that the severity of the pollution can be identified based on the analysis of infrared images, where each severity level of leakage current was correlated with a particular color. Also, it was found that the phase difference between the leakage current to the reference voltage decreased along with the increase in the severity level of pollution.

Full Text

Title: Energy saving potential of solar cooling systems in hot and humid region

Author (s): M. M. S. Dezfouli, K. Sopian, Ali Najah Al-Shamani, Husam Abdulrasool Hasan, Azher M. Abed, A. M. Elbreki, B. Elhub and Sohif Mat

Abstract: In this study energy consumption of conventional fan coil unit and five models of desiccant cooling system are evaluated for application in one seminar room in hot and humid area. The energy usage of FCU and desiccant cooling systems are detected by measurement and simulation respectively. The measurement results demonstrated that the average energy consumption of FCU per day is 61.8 kWh that 7%, 27%, and 66% of the total energy consumption of FCU belong to the fan, pump, and chiller, respectively. Simulation results shows that among the five proposed models, the one-stage hybrid desiccant cooling system (model C) can produce suitable conditions for the room.

Full Text

Title: Effect of the nozzle exit position on the efficiency of ejector cooling system using R134a

Author (s): K. Sopian B., Elhub Sohif Mat, A. N. Al-Shamani, A. M. Elbreki, Azher M. Abed, Husam Abdulrasool Hasan and M. M. S. Dezfouli

Abstract: Ejectors have been used in refrigeration systems application for ages. researches are applying ejectors in refrigeration systems to minimize energy consumptions by harnessing renewable energy. This paper presents CFD model to study and analyse the effect of exit nozzle position (NXP) on the ejector performance. The most important parameters that affect the performance of an ejector are the pressure and temperature, variable pressure and temperature were applied in this study to find the optimum entrainment ratio at different position of NXP. The NXP can be controllable by using a spindle feature which moves NXP forward or backward. Also the mass flow rate that enters the ejector is controlled by another spindle. By using these both features, two parameters can be controlled separately. From the simulation results, it was found that the optimal entrainment ratio Er can be obtained at different position based on the operating conditions. The range of Er was from (0.24-1.12) at constant area ratio and varied operating conditions.

Full Text

Title: Synthesis and characterization of films TiO2 for solar UV-TiO2 photocatalytic reactor

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EVALUATION OF MICRO HYDRO POWER PLANT (MHPP) USING OVERALL EQUIPMENT EFFECTIVENESS (OEE) METHOD

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ABSTRACT

This paper focuses on evaluation of micro hydropower plant (MHPP) that applies overall equipment effectiveness (OEE) method. MHPP are used on the rural electrification and does not necessarily supply electricity to the PLN grid. They are utilized in isolated and off-grid systems for decentralized electrification. Some identified issues or problems are the results of insufficient site assessment, poor quality of power plant facilities and electro-mechanical equipment, controller equipment and inadequate operation and maintenance. To determine performance of MHPP is done the evaluation using OEE method especiallysomeof the MHP in districts South Solok. The first step is observing the real condition of MHPP to find technical or nontechnical of primary and secondary data. The data are classified according to wich needed by OEE method. It has three main components such as availability, performance and quality. There are seven MHP as the research object. The results are obtained an availability averageie 68%, performance average ie 52% and quality average 67%. These achievements shown the MHPP production only reached a value of OEE ie 38%. Therefore,the production in the standard of the Japan Institute of Plant Maintenance (JIPM) is a bad class. The strong issues or problems of MHPP that found are management 17,2%, control systems 7,3%, turbine 10,6%, generator 32,7% and transmission 31,9%. Management includes costumer payment, skill of the operator and maintenance. Generators are major contributors to the problem because there are many MHPP does not have automatic control equipment.

Keywords: evaluation, MHP, OEE, JIPM.

INTRODUCTION

Micro Hydro Power Plant (MHPP) is that utilizes the river flow (run off river). MHPP is typically used on the rural electrification and does not necessarily supply electricity to the PLN grid. They are utilized in isolated and off-grid systems for decentralized electrification. Some identified issues or problems are the results of insufficient site assessment, poor quality of power plant facilities and electro-mechanical equipment, control equipment and inadequate operation and maintenance [1].Today, MHPP has been developed into a grid system to serve a region.The controller equipment is required to ensure the parallel operation of power plants in power system. Such controller is also required for Micro hydro power plants to work in interconnected micro hydro power plants. The approach with frequency droop to make a Mini-Grid model has been studied that describes performance of simulated droop based electronic load controller for interconnected micro hydro power plants or mini-grid [2].Therefore, it is required quality of power generation in accordance with the standard. Similarly, the equipment that used must also be standard but it is limited. West Sumatra Province has abundant water potential to be used as a electric power generation renewable energy in the large, medium and small capacity. Utilization of water as small scale power plants, that called micro hydro power plant (MHPP) is widely used in remote areas.More than 150 power plant station in West Sumatra Province with capacity are various 10 kW, 16 kW, 20 kW, 22 kW, 24 kW, 26 kW, 40 kW, 50 kW, 64 kWetc. Base on investigation, several problems are found in MHPP such as; short life time, short duration operation, bad voltage and frequency quality[3],[4],[5]

The main objective of this study is to evaluate of MHPP quality that applies the overral equipment effectiveness (OEE). To determine the condition of MHPP is used the standard of the Japan Institute of Plant Maintenance (JIPM) [6]. It is required to determine the main issues of MHPP, so it can be obtained the step to be grid system or mini grid system.In this research is taken eighteen of MHPP as sample that location in South Solok district.Recently, several researcher have found the voltage and frequency control equipment of MHPP such as micro hydro power generation based on fuzzy logic control such as micro hydro power generation based on fuzzy logic approach in order to improve voltage profile of alternative power generation [7].

MATERIAL AND METHODS

a) Overall equipment effectiveness (OEE)

OEE is the simple method to evaluate that practical and powerful to evaluate the production system. This method usually takes the most common sources of manufacturing productivity losses and places them into three categories such as; Availability (A), Performance (P) and Quality (Q). Generally, that are represented in percent (%). OEE is defined as the ratio of fully productive time to plan production time [8],[9]. The schema of OEE System is shown in Figure-1. Detemine of Overall Equipment Effectiveness (OEE) is used "the six big losses", such as;

1. Down time loss that influence of availability.
2. Speed loss that influence of performance.
3. Quality loss that influence of quality.

In practice OEE is calculated as;

OEE = Availability x Performance x Quality (1)

1) Availability(*A*); Availability is defined the ratio of operating time (which is simply planned time productionless down time) to planned production time , and accounts for loss down time. It is calculated as:

$$A = \frac{\text{Operating Time}}{\text{Planned Production Time}} x\ 100\% \quad (2)$$

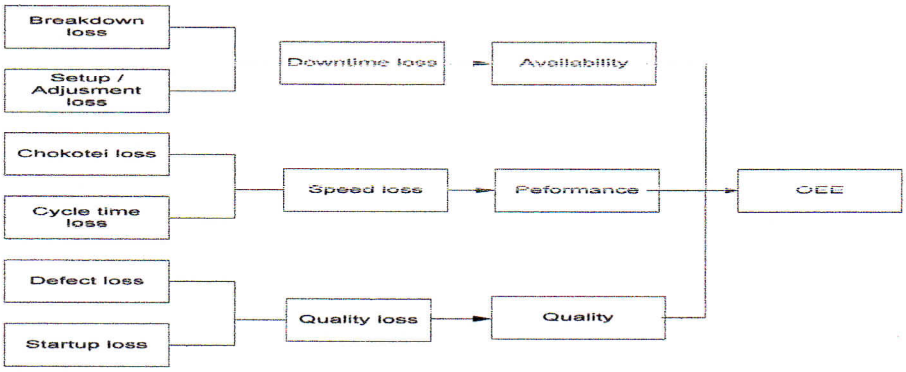

Figure-1. The schema of OEE system.

Operating time is the length of MHPP operational a year, and planned production time is length of operating expectations a year ie 8760 hours.

2) Performance *(P)*: Performance is defined the ratio of net operating time to operating time, and accounts for speed loss. In practice it is calculated as;

$$P = \frac{\text{Ideal Cycle Time x Total Pieces}}{\text{Operating Time}} x\ 100\% \quad (3)$$

Ideal cycle time is defined the ideal time that used to result a product. Total pieces are number of product. Operating time is the real time of length operating a year ie 8760 hours.

3) Quality *(Q);* Quality is defined the ratio of fully productivetime (time for good pieces) to net operating time (time for total pieces). In practice itis calculated as;

$$Q = \frac{\text{Good Pieces}}{\text{Total Pieces}} x\ 100\% \quad (4)$$

Japan Institute of Plant Maintenance (JIPM) had been had standard benchmark of OEE that implemented in the world. OEE base on the standar benchmark JIMP that shown in Table 1.

Table-1. OEE standard benchmark of JIMP.

OEE(Overall Equipment Effectiveness) JIMP	Presentage value OEE (%)
Perfect	100 %
World Class	$\geq$ 85 %
Normal	$\geq$ 60% and < 85 %
Low	$\geq 40 and < 60\%$

Usually, OEE world class according to standard that recognized is; Availability ≥90% Performance ≥ 95% Quality 99.9% and OEE ≥ 85%.

b) Flowchart

The step-by-step process on how to evaluate the MHPP is illustrated in Figure-2.

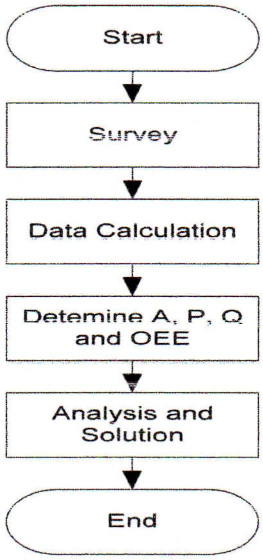

Figure-2. Flowchart evaluation of MHPP using OEE method.

The fisrt step is survey to take the data to MHPP area excspecially South Solok Distinct. The data include MHPP equipment, operation, management, maintanance, capacity, costumer, distrubent and load.The data are grouped and calcuated in accordance with purpose of the OEE method. Further, determining value of availibiliy (A), Performance (P), Quality (Q) and the overral equipment effectiveness (OEE). These results are analyzed to asses the condition of MHPP, and then used to determine the corrective measures.The cause of disruption MHPP are recorded and calculated the percentage value of interference. It is required to determine the cause of the biggest distrubents of MHPP.

c) Data and calculation

The data are colected by survey to each MHPP location, that include rating capacity, actual generated energy, customer amount, actual time operation, total available time, total set up time and total break down time in a year. There are eighteen MHPP as sample data, such as (1) MHPP Ulu Suliti II, (2) MHPP Ulu Suliti IV, (3) MHPP Koto Baru, (4) MHPP Pulakek, (5) MHPP Karang Putih, (6) MHPP Sungai Bangku and (7) MHPP Simancuang. (8) MHPP Manggih, (9) MHP Wonorejo, (10) MHPP Berta, (11) MHPP Liki Tengah, (12) MHPP Sungai Aia Ateh, (13) MHPP Batang Lolo, (14) MHPP Paninjauan, (15) MHPP Taratak Tinggi, (16) MHPP Pasie Panjang, (17) MHPP Sapan Salak, (18) MHPP Sapan Sungai Nan Duo. Operating data of MHPP that have been found in location can be shown in Table 2.

Base on data in Table-2, availibility (A) of MHPP Ulu Suliti II can be calculated using equation. (2), where operating time can be obtained of total availibility time minus time breakdown minus time set up, so;

$$A = \frac{\text{Total Time} - (\text{Time Breakdown} + \text{Time Setup})}{\text{Total Time}} x\ 100\%$$

$$A = \frac{8592H - (4439H + 18{,}9H)}{8592H} x100\% = 48\%$$

Table-2. Operation data of MHPP in a year.

No MHPP	Rating Capasity (kW)	Effective Day of Operation (Days)	Loading Time: Setup (Hours)	Loading Time: Breakdown (Hours)	Total Operation (Hours)	Actual Time (Hours)	Energy Generated (kWH)	Energy Capasity (kWH)
1	10	358	17.9	4439.67	8592	4134.43	41344.3	87600
2	10	358	287	3759	8592	4546	45460	87600
3	10	351	254.5	3539.25	8424	4630.25	46302.5	87600
4	16	358	59,67	347	8592	8185.33	130965.3	140160
5	40	358	60,83	5905,67	8592	2625.5	105020	350400
6	20	358	89.5	317.16	8592	8185.34	163706.8	175200
7	20	365	73	182.5	8760	8504.5	170090	175200
8	10	365	91.25	91.25	8760	8577.5	85775	87600
9	50	358	182.5	182.5	8592	8227	411350	438000
10	20	358	182.5	182.5	8592	8227	164540	175200
11	64	358	180	180	8592	8232	526848	560640
12	24	358	358	2864	8592	5370	128880	210240
13	22	358	89.5	89.5	8592	8413	185086	192720
14	50	358	89.5	1163.5	8592	7339	366950	438000
15	50	358	89.5	89.5	8592	8413	420650	438000
16	20	358	182.5	5910.5	8592	2499	49980	175200
17	40	358	89.5	89.5	8592	8413	336520	350400
18	26	358	89.5	89.5	8592	8413	218738	227760

Several issues or problems that cause MHPP fail operate as shown in Table-3. Performance of MHPP Ulu Suliti II can be determined using equation. (3), where ideal cycle time can be obtained by multiplied customer amount with generated energy multiplied actual time, then;

$$P = \frac{\text{Costumer x Generated Energy x Actual Time}}{\text{Costumer x Energy Capacity x Total Time}} x100\%$$

$$P = \frac{25\ KK\ x\ 41344\ kWh\ x\ 4134h}{825\ KK\ x\ 87600\ kWh\ x\ 8595\ h} x100\% = 23\%$$

The Quality of MHP Ulu Suliti II can be determined using equation. (4), where good peace can be obtained with to devide total generated energy with total energy capacity, then;

$$Q = \frac{\text{Total Generated Energy}}{\text{Total Energy Capacity}} x\ 100\%$$

$$Q = \frac{41344\ kWh}{87600\ kWh} x100\% = 47\%$$

Further, OEE can be determined by using equation. (1), then;

OEE = 48% x23% x 47% = 5 %

The parameter A, P, Q and OEE for the others MHPP can be calculated same as way the above, further the result as shown in Table $4.

Table-3. The causes and frequency of operation failure MHPP.

Issues/poroblems		Failure Frequency of MHPP: 1	2	3	4	5	6	7	8	9
Management	Electric payment	-	-	-	1	2	-	-	-	-
	Operator salary	-	-	-	4	2	-	-	-	-
Control System	ELC	-	-	-	-	-	-	-	-	-
	Ballast	-	-	-	-	-	-	-	-	-
	MCB	-	1	-	-	-	-	-	-	-
	Ampere meter	-	-	-	-	-	-	-	-	-
	Volt meter	-	-	-	-	-	-	-	-	-
	Hertz meter	1	1	-	-	1	-	-	-	-
Turbine	Adapter	-	-	-	-	-	-	-	-	-
	Runner	-	-	-	-	-	-	1	-	-
	Guide Vane	-	-	-	-	-	1	-	-	-
	Turbin Pulley	-	3	-	-	-	-	-	-	-
	Bearing	-	-	-	-	-	-	1	-	-
	BF Turbin	-	-	1	-	-	-	-	-	-
Generator	Generator winding	1	1	2	1	1	1	-	-	1
	Brush	6	1	-	4	2	-	3		3
	BF Generator	-	-	-	-	-	-	-	-	-
	Generator Pulley	-	1	-	-	-	-	-	-	1
Transmission	Pole	1	-	1	1	1	-	1	-	-
	Conductor	-	-	-	-	-	-	-	-	-
	V belt	1	-	1	1	1	1	1	-	-

Issues/poroblems		Failure Frequency of MHPP: 10	11	12	13	14	15	16	17	18
Management	Electric payment	-	1	2	-	1	-	1		1
	Operator salary	-	-	2	-	-	-	-	-	4
Control System	ELC	-	-	-	-	-	-	-	-	-
	Ballast	-	-	-	-	-	-	-	-	-
	MCB	-	-	-	-	-	1	1	-	-
	Ampere meter	-	-	-	-	-	-	-	-	-
	Volt meter	-	-	-	-	-	-	-	-	-
	Hertz meter	-	-	1	1	1	1	-	-	-
Turbine	Adapter	-	-	-	-	-	-	-	-	-
	Runner	-	-	-	-	-	-	-	-	-
	Guide Vane	-	-	-	1	-	-	-	-	-
	Pulley Turbin	-	-	-	-	-	-	-	-	-
	Bearing	-	-	-	-	-	-	-	-	-
	BF Turbin	-	1	-	-	-	-	-	1	
Generator	Generator winding	1	2	1	-	1	2	-	2	1
	Brush	1	-	2	-	-	-	-	-	4
	BF Generator	-	-	-	-	-	-	-	-	-
	Generator Pully	-	-	-	-	-	-	-	-	-
Transmission	Pole	1	1	1	5	8	1	1	1	1
	Conductor	-	-	1	-	-	-	1		
	V belt	1	1	1	-	2	-	2	1	1

Table-4. The result OEE of MHPP.

Number of MHPP	Availability (%)	Performance (%)	Quality (%)	OEE (%)
1	48%	23%	47%	5%
2	53%	27%	52%	8%
3	55%	29%	53%	8%
4	95%	89%	93%	79%
5	31%	9%	30%	1%
6	95%	89%	93%	79%
7	97%	94%	97%	89%
8	98%	96%	98%	92%
9	96%	90%	94%	81%
10	96%	90%	94%	81%
11	96%	90%	94%	81%
12	63%	38%	61%	15%
13	98%	94%	96%	88%
14	85%	72%	84%	51%
15	98%	94%	96%	88%
16	29%	8%	29%	1%
17	98%	94%	96%	88%
18	98%	94%	96%	88%
OEE Average				**57%**

RESULT AND ANALYSIS

The MHPP that had been studied are obtained the average OEE is 57% and it is low category based on JIPM standard. Where there are 38,8% that bad category, 27,7% the normal category and 33,3% only the world class category, as shown in Table V. The result shows that OEE of MHPP Manggih only having near in to perfect class category ie 92%. The reason is MHPP Manggih which a new MHPP that has equipment completely, operating continously and breakdown time briefly.

Table-5. The result OEE of MHPP south Solok distinct.

OEE(Overall Equipment Effectiveness) JIMP	% Result of OEE
Perfect : 100%	0 %
World Class : ≥ 85 %	33%
Normal : ≥ 60% and < 85%	27%
Low : ≥40*and* < 60%	38,8%

MHPP Pulakek and MHPP Sungai Bangku have OEE value ie 78% that are the normal category. These MHPP operate continous, have equipment completely, however the total breakdown time is longer than MHPP Simancung.

While, the other MHPP having a low category because OEE value is lower than 40%. Caused of MHPP have been operated for long time, equipment incompletely, operating time 8 hours every days and also lack management.To Increase the OEE value of MHPP can be done with to search main issue of MHPP. MHPP issues can be grouped in to 5 parts, such as; management, control system, turbine, generator and transmission line. Table-6 and Figure-3 are shown the issues of MHPP that studied.

The main damage that often happen in the MHPP is at the generator part ie 32,7%, especially the carbon brush and generator winding. That are caused of over load or over frequency of generator, while the generator generally don't have an automatic controller equipment. If they have an automatic control equipment which usualy use an electronic load controller (ELC). The principle of ELC is when the costumer load is decreasing then ELC will throw to dummy load [1]. The impact is that the generator and turbin always operate at full load condition. It can break the generator winding or the bearing of turbine. The transmission line give a constribution to disturb an operation of the MHPP ie 20%. It is caused of a bad construction or struck a fallen tree.

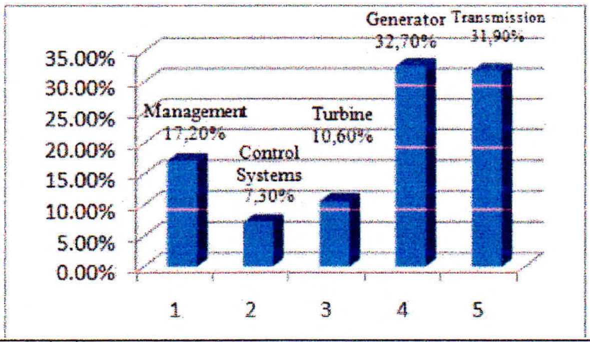

Figure-3. The percent broken of MHPP.

Table-6. The general issues and failure frequency of MHPP.

Issues		**Frequency**	**Percent damage (%)**	
Management	Electric payment	9	7,3 %	17,2 %
	Operator salary	12	9,8 %	
Control System	ELC	-	0 %	7,3 %
	Ballast	-	0 %	
	MCB	3	2,4 %	
	Ampere meter	-	0 %	
	Volt meter	-	0 %	
	Hertz meter	6	4,9 %	
Turbinee	Adapter	-	0 %	10,6 %
	Runner	2	1,6%	
	Guide Vane	2	1,6 %	
	Pulley Turbine	3	2,4%	
	Bearing	1	0,8%	
	BF Turbine	5	4,09%	
Generator	Generator winding	16	13,11%	32,7 %
	Brush	22	18,03%	
	BF Generator	-	0%	
	Pulley Generator	2	1,6 %	
Transmisition	Pole	24	19,6 %	31,9 %
	Conductor	-	0%	
	V belt	15	12,2 %	

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The management of MHPP is the seriously issue because it has strong impact with electricity bills and operator salary. Lack awareness costumer to pay an electricity bills that cause manager of MHPP difficult to pay maintenance cost and operation cost.

CONCLUSIONS

Evaluation of 7 MHPP in South Solok districts has been discussed. Method of evaluation that used is OEE. The result are obtained that the average OEE value is 57%. It is low category. The strong issues or problems of MHPP are management and equipment. Management include costumer payment, operator skill and maintenance while equipment issue is the automatic control equipment.

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