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ARPN Journal of Engineering and Applied Sciences

May 2021 | Vol. 16 No. 10

Title: Effect of atmospheric temperature and soil load on flow in high density polyethylene (HDPE) pipe

Author (s): O. M. Oyewola and O. B. Ajaja

Abstract: In a bid to reduce the incessant failure of buried pipes, due considerations have been given to the effects of external factors on the pipe structure while the effects of such factors on flow in buried pipes remain unknown. This paper employs the versatility of Comsol Multiphysics to numerically simulating flow in buried pipes in order to examine the effects of atmospheric temperature and soil loads on the temperature, pressure and velocity of fluid. The results show that the temperature, pressure and velocity of water in an unburied HDPE pipe at a distance 1.52m from the inlet are 303.9K, 101235.8Pa and 1.19m/s respectively. Considering the effects of atmospheric temperature on water at the same point in HDPE pipe buried at a depth of 1m in Sandy soil results in a temperature of 293.15K, pressure of 101780.4Pa and velocity of 2.651m/s. Combining effects of soil loads with atmospheric temperature results in a change of these values to 303.91K, 90457.81Pa and 823423.6m/s. The results reveal a need for due consideration of the effects of atmospheric temperature and soil loads on flow in buried pipes before fixing the operating conditions of the pipeline.

[Full Text](#)

Title: Calculating optimal gear ratios for three stage bevel helical reducer for minimal reducer cross-section

Author (s): Tran Thi Hong, Tran Thi Phuong Thao, Bui Khac Khanh, Luu Anh Tung, Nguyen Hong Linh, Nguyen Thanh Tu, Tran Ngoc Giang and Vu Ngoc Pi

Abstract: This work deals with the determination of optimal gear ratios of three-step bevel helical reducers. To find the optimal ratios, an optimization problem was created and solved. In this problem, the minimal reducer cross section was selected for the target. Also, seven main design parameters counting the total ratio, the allowable contact stresses and the face width coefficients of all steps and the output torque were chosen for the examination of the effects of them to the optimal gear ratios. In addition, to estimate the weight of these parameters on the optimum ratios, a simulation experiment was carried out by programming. From the experimental results, the influence of the design factors on the optimal gear ratios was found, and an equation to find the optimal gear ratios was presented.

[Full Text](#)

Title: Textural and mineralogical study of lava from Mount Gamalama, North Maluku, Indonesia

Author (s): Yanny, Mohammad Marshus Hi Ibrahim, Asri Jaya, Adi Maulana and Muliadi

Abstract: Petrographic analysis using a polarizing microscope was carried out to determine the texture and minerals of Mount Gamalama's lava in North Maluku, Indonesia. Microscopic observations were made on seventeen representative samples. The results of these observations indicate that in general the lava is classified as an extrusive rock in the form of basalt. The mineral composition of the lava consists of phenocryst plagioclase and pyroxene set in the groundmass of needles and plagioclase microlites, pyroxene, opaque minerals and volcanic glass. Sericite mineral and iron oxide occur as secondary minerals. The general textures of the rock are micro aphanitic porphyry, inequigranular, and vesicular, while the special textures found are hyalopilitic, glomeroporphyritic, oscillatory zoning, and sieve.

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Title: Development of a stator drying machine applied to the oil industry

Author (s): Faiber Robayo Betancourt, Daniel Suescún-Díaz and Ferley Medina Rojas

Abstract: Stator drying is a process carried out in the repair of induction motors used in the oil industry. In this work, the development of a stator drying machine is proposed to have greater efficiency in the number of repaired motors to be put into service. The offered stator drying machine is robust and has electronic elements that support high current levels, such as SCR (Silicon Controlled Rectifier) used in power electronics. Power control is obtained by on-off control. In the SCR trigger control stage, a central device called Raspberry Pi is used. The user interface is an LCD screen (Liquid Crystal Display) that connects to the Raspberry Pi via USB port and communicates via serial. As a result, the drying time motor is less; and the number of stators ready to be put into operation is increased.

[Full Text](#)

Title: Green energy water supply system in Tidore Island: A design

Author (s): Wati A. Pranoto, Tri Suyono, Witono Hardi, Lita Asyriati Latif, Joshua Chang and Ahmad Fudholi

Abstract: Tidore Island is a small island which its domestic and non-domestic water requirements at 2018 was 125.21 l/sec and expected to be 167.98 l/sec by 2038. The existing data show the average of water source in the form of Deep Well in Tidore Island is 2.5 - 5 l/sec, in other words Tidore Island needs around 60 Deep Wells. The plant of Green Water Supply Concept is to make Shallow Wells with depths between 24 - 40 meter below ground level and pump them into 500 m³ capacity reservoirs at an altitude of 469 meter and Micro Hydro Water Turbine which installed at an altitude of 134 meter. The potential of ground water in Rawa Lembah Kramat is around 55 l/sec, make it suitable to be planted with a capacity of 50 l/sec water turbine and estimated will produce 105 KW electrical energy if it's total efficiency is 65% and it's difference falling altitude is 346 meter. The Calculation show the electrical power requirement for 50 l/sec capacity 120 meter head pumps is 98KW, this means the electrical energy generated by micro hydro turbine is able to meet the energy requirements of raw water pumps.

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Title: The effect of raw material composition on composting result with the biopore infiltration hole (BIH) method

Author (s): Yenni Ruslinda, Rizki Aziz, Novita Sari, Larasati Sekar Arum, Resti Ayu Lestari and Hendra Gunawan

Abstract: Besides functioning as water infiltration, biopore infiltration holes (BIH) also work as composting of organic waste. This study aims to analyze the effect of raw material composition on the quality and quantity of compost using the BIH method. Composting was done in duplicate in the yard area with clay soil type and water infiltration rate was 0.3 cm/hour. The holes were made with 10 cm of diameter, 100 cm of depth and the distance between the holes are 50 cm. There were 4 composting variations i.e. 100% yard waste, 100% food waste, 50% yard waste and 50% food waste, and 70% food waste and 30% yard waste. The analysis was done toward compost maturity, compost quality (physical and macro elements) and compost quantity. The results showed that all variations of compost raw materials had met the standard of maturity and quality of physical and macro-compost elements according to SNI 19-7030-2004 regarding compost specifications from domestic organic waste, with composting time ranging from 65-75 days. Composts that consist of food waste and yard waste can accelerate the composting time by 5 days, compared to compost without



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mixture. The best variation in terms of maturity, quality and quantity is a variety of raw materials consisting of 50% yard waste and 50% food waste.

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Title: Cross-Drainage culvert design under global climate and land use changes

Author (s): Wirat Nuannukul, Anujit Phumiphan and Anongrit Kangrang

Abstract: The objective of this research is to assess the effects of climate and land use changes on the amount of runoff that flows through 3 types of hydraulic structures: pipes, R. C. box culvert and bridges using a SWAT model and Rational Method. Hydraulic structures in Roi-Et Province, Thailand were selected as a case study. We also reviewed the suitability of the hydraulic structures by comparing their cross-sectional areas obtained from the SWAT model and Rational Method with the original drainage structures sizes obtained from the survey data. The results showed that runoff volume estimated from the SWAT model was greater than with the Rational Method, which used the graph of the rainfall intensity-duration-frequency curve (IDF Curve). However, the SWAT model evaluated runoff using the simulation of climate scenarios with the data from the PRECIS model under the emission conditions of B2 and did consider the current land use data. Therefore, the resulting cross-sectional areas of the hydraulic structures evaluated from the SWAT model have more hydraulic cross-sectional areas than the estimated cross-section by Rational Method and cross-sectional area determined from the survey data.

[Full Text](#)

Title: Scheduling and resource allocation for filter bank multicarrier millimeter-wave Device-to-Device communication

Author (s): Filbert Onkundi Ombongi, Heywood Ouma Absaloms and Philip Langat Kibet

Abstract: The deployment of Device-to-Device (D2D) communication in the millimeter-wave (mm-wave) band has shown the potential of significantly improving performance in terms of capacity, energy efficiency, and transmission latency. The high mm-wave frequencies offer a broader spectrum, compared to the current cellular networks, which enhances the deployment of highly directional antenna arrays to reduce interference problems. However, deployment of D2D communication in the mm-wave band is faced with a challenge of signal blockage by obstacles. In addition, if users are subjected to some mobility, there will be beam misalignments between the transmitter and the receiver and frequent monitoring and handovers. In dense D2D communication in the mm-wave band, there is interference between the multiple D2D devices. All these cases increase interference in the mm-wave D2D communication network. Therefore, an effective mechanism needs to be developed to reduce this interference to maximize the D2D user capacity by allocating resources effectively. The paper aims to formulate a joint uplink scheduling and resource allocation scheme to maximize the user capacity in a MIMO-enabled mm-wave D2D network with user mobility. The developed mm-wave D2D model integrates Filter Bank Multicarrier/Offset Quadrature Amplitude Modulation (FBMC/OQAM), MIMO Space-Time Coding (STC) and Spatial Multiplexing (SM) which are implemented separately and their performance compared. The developed mm-wave D2D model is simulated and its results compared with the conventional Orthogonal Frequency Division Multiplexing (OFDM) scheme. The results indicate that the FBMC/OQAM outperformed OFDM by an average factor of 2.03 times for I=64, LOS, 2.53 for I=64, NLOS, 2.08 for I=256, LOS, 2.45 for I=256, NLOS, 2.08 for STC, LOS and 2.30 for STC, NLOS.

[Full Text](#)

Title: VLSI implementation of Complex Multiplier using Vedic Mathematics and study its performance

Author (s): Ansha Noushad and A. R. Abdul Rajak

Abstract: In this paper, an attempt to implement an optimal complex multiplier using the "Urhdva Tiryakbhyam" Sutra of the ancient Indian Vedic Mathematics is presented. Signal Processing is based on mathematical analysis of complex numbers. Many DSP operations are based on complex operations like Fast Fourier Transform, z-transform, linear systems, multimedia applications, and telecommunications. The multiplier determines system performance as it is the slowest element and generally occupies a large area. Due to such conflicting constraints designing a complex multiplier has always been a challenge with significant tradeoffs. The proposed 16-bit Complex Multiplier using Vedic Multiplication is coded in VHDL, simulated and synthesized in Xilinx Vivado 2016 Software and compared to a standard Booth Complex multiplier.

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Title: Design and implementation of traffic violation detection systems with deep learning to support electronic traffic law enforcement (E-TLE)

Author (s): Kusworo Adi, Catur Edi Widodo and Aris Puji Widodo

Abstract: In this paper we investigate a method based on machine learning to identify types of motor vehicle traffic violations with image processing techniques to support electronic traffic law enforcement. Machine learning is a machine learning method that performs well when applied to data outside of the training set. In this study, data collection was carried out using a camera with a resolution of 13 megapixels. This data processing carries out a training process so that it requires high quality hardware such as a laptop / computer to get a result that can predict objects well. In this system it uses the CPU to train a model where the data is relatively small. The output in this system is a traffic violation image taken by using a camera. This system will work if a vehicle violates traffic, such as a violation of not wearing a helmet for motorcyclists and passing road markings. The system formed is a training result model with a total of 100 000 steps with 32 and 16 batch sizes, namely in the form of an inference graph consisting of a checkpoint file, frozen_inference_graph.pb, and there are 3 ckpt-model files. The accuracy rate of the model obtained ranges from 70% to 96%.

[Full Text](#)

Title: GeneTaS - An optimized Task Scheduling strategy using Genetic Algorithm for parallel and distributed computing environment

Author (s): P. Muthalakshmi, D. I. George Amalarethinam and P. Yogalakshmi

Abstract: The proposed genetic algorithm could solve the problem of task scheduling with a new initialization strategy to generate the initial population and new genetic operators to ensure best task-resource mapping that preserves good characteristics of the found solutions. Genetic Algorithm for Task Scheduling (GeneTaS) uses bio-inspired genetic algorithm to find an optimal schedule and adapts new fitness function to find the suitability of task and resource pair for best allocation. The use of evolutionary operators; crossover and mutation are found to move the solution very close towards optimality. The proposed algorithm is implemented using Gridsim, a simulator for task allocation problems and tested with arbitrary task graphs that are generated using DAGitizer. In the experimental setups thousands of arbitrary task graphs are used and it is observed that the results of the proposed GeneTaS algorithm is found better than the compared scheduling algorithms, when scaled on performance metrics namely; makespan, resource utilization and speed up.

[Full Text](#)

Title: Comparative exploratory study of usability evaluation techniques for he'i's websites

Author (s): Aktooba Akhtar, Abdul Mateen, Muhammad Atif Bajwa and Saeed Ullah

Abstract: University websites are vital for students as well as faculty member for providing updated information. These websites can be accessed by general public for accessing certain piece of information. Hence, the role of university website become critical, therefore, usability becomes significant. Various interaction problems have experienced by the users while accessing university websites. To minimize these interaction problems different usability evaluation techniques have been adopted lately. Instant paper compares two usability evaluation techniques named questionnaire based (QB) and focus group (FG) by performing three user studies for evaluating the university websites. These techniques have been applied to evaluate and compare usability factors; efficiency, learn ability, memorability, satisfaction and error. The results have been verified using WAVE accessibility tool and validated by ANOVA. The results have shown that the focus group testing technique performs better than questionnaire-based testing technique in terms of efficiency, number of errors, learn ability and satisfaction.

[Full Text](#)

Title: Design of a competencies-based software tool for training in the research of bacterial behavior on robot swarms

Author (s): Eyder A. Rodríguez C., Daniel M. Romero S. and Fredy H. Martínez S.

Abstract: Higher education in Colombia since 2000 began to consolidate a training model oriented towards the competitive transformation of the student, in which processes are focused on problem-solving, which implies not only knowing the problem but also its conceptual and real approach. This trend has been structured over 20 years in what is known as competencies-based training and corresponds to the current state of higher education programs in the country. Although this approach has had a high degree of identification with the work environment, the truth is that the skills, knowledge, and abilities generated by the model are also applied to organizations and/or institutions. This article describes the design model of a specialized competencies-based software tool. The tool is part of the specialized training strategy of the research group and corresponds to the first of an integrated system of specialized research training. The design contemplates key elements at the pedagogical, didactic, and software engineering levels. The design architecture is made up of four stages which characterize each one of the tool's creations stages: educational design, computational design, production, and application. In the prototype, the problem of autonomous navigation of robots has been addressed, specifically, the implementation of a decentralized algorithm of the research group inspired by bacterial interaction. The preliminary evaluation of the tool has been advanced with undergraduate students linked to the research seedbed of the research group.

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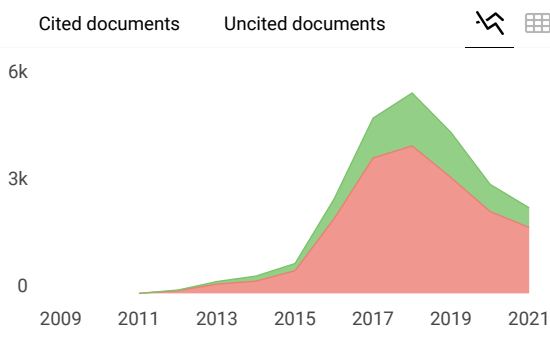
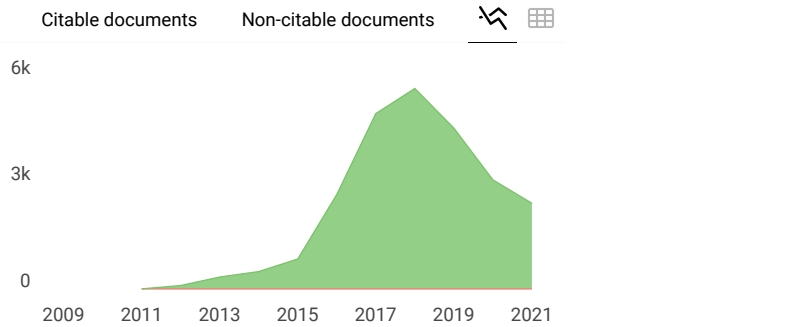
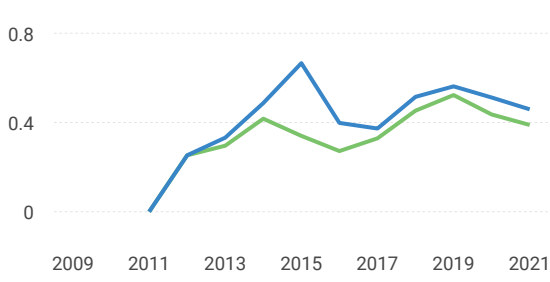
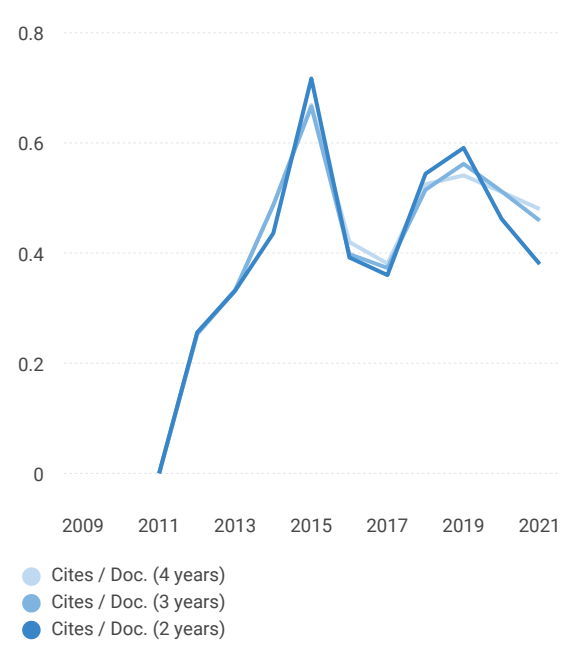
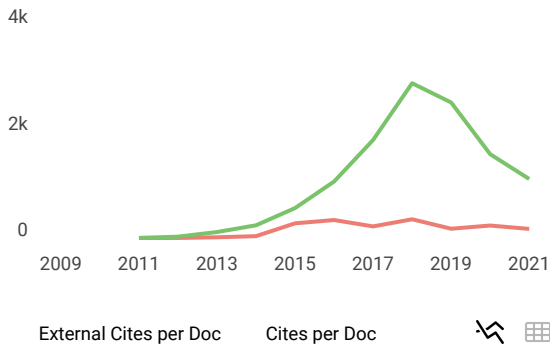
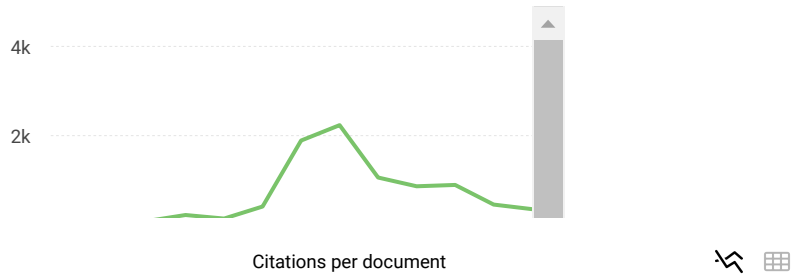
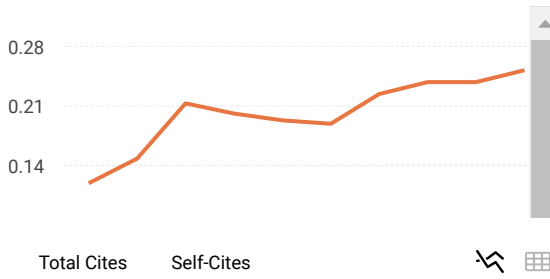
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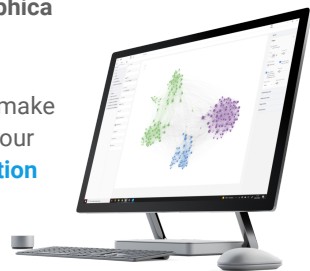
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GREEN ENERGY WATER SUPPLY SYSTEM IN TIDORE ISLAND: A DESIGN

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ABSTRACT

Tidore Island is a small island which its domestic and non-domestic water requirements at 2018 was 125.21 *l/sec* and expected to be 167.98 *l/sec* by 2038. The existing data show the average of water source in the form of Deep Well in Tidore Island is 2.5 - 5 *l/sec*, in other words Tidore Island needs around 60 Deep Wells. The plant of Green Water Supply Concept is to make Shallow Wells with depths between 24 - 40 meter below ground level and pump them into 500 m³ capacity reservoirs at an altitude of 469 meter and Micro Hydro Water Turbine which installed at an altitude of 134 meter. The potential of ground water in Rawa Lembah Kramat is around 55 *l/sec*, make it suitable to be planted with a capacity of 50 *l/sec* water turbine and estimated will produce 105 KW electrical energy if it's total efficiency is 65% and it's difference falling altitude is 346 meter. The Calculation show the electrical power requirement for 50 *l/sec* capacity 120 meter head pumps is 98KW, this means the electrical energy generated by micro hydro turbine is able to meet the energy requirements of raw water pumps.

Keywords: rural communities, water quality, infrastructure, water supply, micro hydro turbine.

1. INTRODUCTION

The availability of water sources in the rural communities at a small island is quite limited. To overcome this limitation problems, it requires technological innovation at management of nature water supplying which covers national or global standards such as "4K" standards which stands for "Kuantitas" (Quantity), "Kontinuitas" (Continuity), "Kualitas" (Quality), and "Keterjangkauan" (Affordability). Above all things that cost in all kinds of technological innovation at supplying drinking water, the greatest cost is its electricity cost. As the rural communities of Tidore Island, which the island has a circumference about 48 km with a population of around 99,337 people [1], requires the provision of raw water for drinking water with a large enough capacity. The availability of potential raw water in this area is very limited and until now has relied on ground water sources. Most of the ground water are from deep ground water source which has high cost consequences in the production process. From this concern and conditions, a new breakthrough is needed to minimize the cost of production in the supply of drinking water by optimizing the potential ground water source that exists on the island of Tidore.

Rawa Lembah Keramatis one of potential ground water sources which is suitable to be developed (Figure-1). It's located on the east side of Tidore Island with an altitude of 396 m and can be distributed by gravity after being pumped at appropriate altitude. It is a valley with an area of 11,695,081 m² and surrounded by hillsides which lead to it (Figure-2), make it an effective water catchment area.



Figure-1. Rawa Lembah Keramat.

The Idea of ready-to-drink water treatment equipment installment in this area is potential effort to overcome the problem of drinking water supply in Tidore Island (Figure-3), it goes like another area that are difficult to water, for example for rural areas in coastal areas or remote islands. Processing brackish swamp into ready to drink water is suitable for use in areas such as coastal areas, tidal swamp village areas, densely populated settlements in coastal areas, areas of settlements with poor groundwater quality [2]. One of the key factors in the successful development of swamps is the proper land management and water management techniques, so as to create a good growth medium for plants. By paying attention to technical, socio-economic and environmental aspects, the swamp area development will be carried out in stages which consist of three stages of development; the first stage is the initial stage, the second stage of the advanced stage and the third stage the system is fully



controlled [3]. The role of swamps in supporting regional development and enhancing national food security needs to be increased given the vast potential of the area and several management technologies already available, but must remain cautious given that this agro ecosystem is unstable [4].

The concept of green water supply is also very appropriate along with the increasing amount of pollution due to electricity generation both diesel and steam power. It's because its ability to produce electrical energy with less pollution. With this concept, the provision of drinking water can be done well and is affordable by the community.

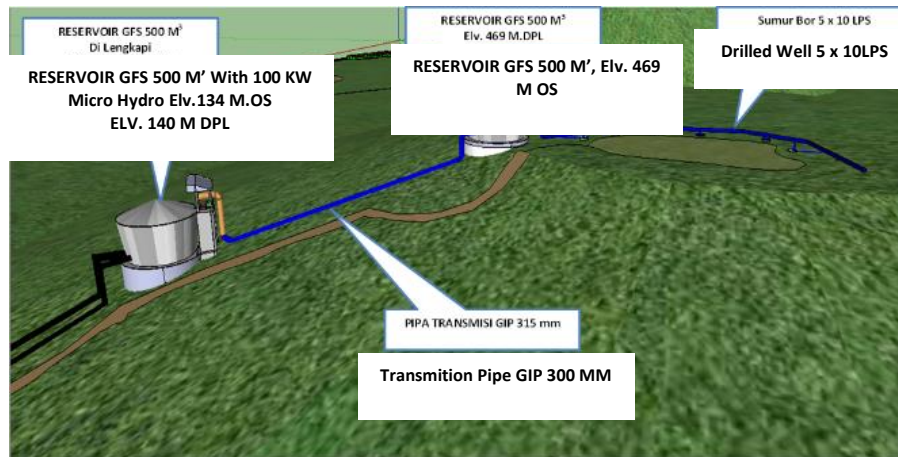


Figure-2. Schematic design of water supply.

2. MATERIALS AND METHODS

2.1 Calculation of Water Needs

Water needs are divided into two parts, namely domestic and non-domestic needs. Water needs for (domestic) households are calculated based on the number of residents in the planning year. Where this domestic drinking water can be calculated with the following equation:

$$\text{Water Needs} = \% \text{ service} \times a \times b \quad (1)$$

Where:

- a = the amount of water consumption (liters / person / day)
- b = total population of service area (soul)

Non-domestic water needs, namely the need for water in non-domestic activities which constitute urban support activities, consisting of commercial activities in the form of industry, offices, businesses and social activities such as schools, hospitals and places of worship. The determination of non-domestic water needs is based on factors supporting the number of residents and the number of units of the facility. The urban facilities include public, industrial and commercial facilities. Calculation of non-domestic water needs in this calculation is assumed to be 15-20% [5, 6]. Clean water needs are calculated based on the projected population whose growth is analyzed using linear regression analysis. To design a clean water supply system, EPANET 2.0 software is used [7].

2.2 Recharge of Groundwater

The amount of groundwater reserves can be known by knowing the aquifer parameters of the area concerned obtained from drilling data, or from the approach of the amount of water that fills the ground (rock) as a medium for the presence of ground water [8, 9]. This groundwater supply is known as groundwater recharge. The amount of groundwater recharge can be estimated from the amount of infiltration into the ground. The amount of recharge is calculated by the following equation:

$$Rc = \Sigma In \times A \quad (2)$$

Where:

- Rc = Recharge of groundwater mm / year
- In = Infiltration mm / year
- A = The total area of the catch m²

2.3 Calculation of Micro Hydro Power

From the water capacity Q and high water fall H obtained the turbine output power. The turbine output power is calculated using the equation:

$$P = Q \times g \times H \times \rho \times \eta_{tot} \quad (3)$$

Where:

- Pa = Water power (kW)
- Q = Water capacity (m³/s)
- ρ = Density of water (ton/m³)
- g = Gravity (m/s²)
- H = Head/ high water fall (m)



η_{tot} = Total micro hydro efficiency

H_{tot} = Total head (m)

Power generated, if in an area there is potential for water with discharge Q (m^3/s) and falls from a height of H meters, then the energy generated is as the formula above [10, 11].

2.4 Pump Power Calculation

Pump power calculations performed by the following equation:

$$N = \frac{\gamma \times Q \times H_{tot}}{102 \times \eta_p} \quad (4)$$

Where:

N = Water power (Hp)
 Q = Water capacity (m^3/s)
 γ = Density of water (ton/m^3)
 η_p = Pump's efficiency (%)

A water pump can drain water from a low surface to a high surface [6]. Water supply facilities which consist of fixed capacity intake pumps, reservoir tanks, and variable speed pumps [7].

3. RESULTS AND DISCUSSIONS

3.1 Water Needs

Water needs for domestic and non-domestic on the Tidore Island are calculated for the next 20 years projection year, starting at 2018 by taking data on average population growth in the last 10 years. The water needs obtained in the initial year of data is 125.21 liters/ second and until the end of the projected year 2038 with water requirements of 167.98 liters / second as can be seen in Table-1.

Table-1. Calculation of water requirements including the allowable leakage factor of a maximum of 20%.

Sub-district	Domestic Needs (liters/ second)				
	2018	2023	2028	2033	2038
South Tidore	26.5	26.9	29.1	33.4	35.6
North Tidore	31.1	31.6	34.1	39.2	41.7
Tidore	35.9	36.4	39.4	45.2	48.1
East Tidore	15.4	15.7	16.9	19.5	20.7
Total	108.88	110.65	119.50	137.22	146.07
Sub-district	Non-Domestic Needs (liters/ second)				
	2018	2023	2028	2033	2038
South Tidore	3.98	4.04	4.37	5.01	5.34
North Tidore	4.66	4.74	5.12	5.87	6.25
Tidore	5.38	5.47	5.90	6.78	7.22
East Tidore	2.32	2.35	2.54	2.92	3.11
Total	16.33	16.60	17.93	20.58	21.91
Sub-district	Domestic Non-Domestic Needs (liters/ second)				
	2018	2023	2028	2033	2038
South Tidore	30.49	30.99	33.47	38.43	40.92
North Tidore	35.73	36.31	39.22	45.03	47.94
Tidore	41.23	41.90	45.25	51.96	55.32
East Tidore	17.76	18.04	19.49	22.37	23.82
Total	125.21	127.25	137.43	157.80	167.98

Water loss (determination of leakage) is done by looking at water loss in the existing network, the percentage value can be taken multiplied by the average needs where the average needs are the total number of domestic needs and non-domestic needs) [7]. Water must be provided in a sustainable manner that is managed from

nature. The concept of sustainable development is actually based on five main ideas. First, the development process must take place continuously which is supported by natural resources, the quality of the environment and people who develop continuously as well. Second, natural resources - especially air, water and land - have a



threshold, where their use will reduce the quantity and quality. Third, environmental quality is directly correlated with quality of life. Fourth, the current pattern of natural resource use should not rule out the possibility of choosing other options in the future. And fifth, sustainable development presupposes transgenerational solidarity which make the welfare of the present generation does not reduce the possibility for future generations to improve their welfare. This is the main principle adopted and developed by the World Commission on Environment and Development [12-14].

3.2 Potential of Raw Water

Potential raw water is calculated based on hydrological and climatological data by calculating groundwater recharge. Groundwater recharge is used as a reference for groundwater potential. The data used in this calculation are the data of the last 10 years of rainfall, soil infiltration, and catchment area of Rawa Lembah Keramat. According to the results of calculations, Rawa Lembah Keramat has a groundwater recharge of 55 liters / second and this is quite helpful in the supply of drinking water for the Tidore islands, especially for the East Tidore region and Soasiuville [15].

Catch Area	=	11,695,081.00 m ²
Catch Area	=	0.00
Free Area	=	11,695,081.00
∑ Infiltration	=	148.57 mm/year (0.148570185 m/year)
Recharge	=	1,737,540.35 m ³ /year
	=	144.80 m ³ /month
	=	4.76 m ³ /day
	=	55.05 l/sec (recharge)

Potential raw water is calculated based on hydrological and climatological data by calculating groundwater recharge [16, 17]. Groundwater recharge is used as a reference for groundwater potential. Swamps have a variety of functions both ecological functions as freshwater tendons, a place to live flora and wildlife and economic functions for various activities to support human life [18]. Ecosystem-based swamp management has been extensively developed, with an approach to maintaining or improving the composition, structure and function of ecosystems to achieve long-term sustainability [19].

3.3 Potential Electric Power

With a water supply schematic as shown in Figure-3, the water supply system will be able to produce electrical energy from a system designed to drive a production pump. The working principle of this water supply system has three stages, namely:

a) Groundwater from a well at an altitude of 398 meters above sea level with a depth of 24 meters is pumped to a reservoir located at an altitude of 469 m with a distance of 287 meters, with initial pumping using PLN electricity or generators.

b) In the next stage, after the water has been filled up, it will be flowed to the next reservoir which also functions as a pressure relief tank at an altitude of 140m with a distance of 960 meters, so that it has a difference of 329 m height, it is used to move the micro hydro and after generating stable electrical energy. Then the electricity is supplied to the raw water pump by turning off the electricity of the PLN or generator set first. Furthermore, the pump will work based on the energy produced by water pressure.

$$P = 0.05 \times 9.81 \times 329 \times 1 \times 0.65 = 105 \text{ kW}$$

c) The water from the second reservoir, which at the same time acts as a press release tub, is used as a distribution reservoir that will serve the water needs of the East Tidore region and part of Soasiu city with a gravity system.

With this schematic, this water supply system becomes a drinking water service system that is energy efficient and environmentally friendly.

4. CONCLUSIONS

From the results of the calculations that have been made, it can be concluded that Tidore island's drinking water needs for the next 20 years are quite large, reaching 167.98 liters / second and with limited groundwater potential, raw water supply is needed to optimize the available potential. Groundwater reserves in the Rawa Lembah Keramat that located in the village area of Talaga which reaches 55 liters/ second in accordance with the topographical conditions are suitable to be used with the concept of a green water supply system. In the schematics, The pump energy needs can be answered by electrical energy produced by micro hydro. Utilization of the potential energy of water from the transmission reservoir in the water supply system is very appropriate because it can generate electricity to drive the raw water pump. This concept can be developed and applied to areas with the same potential and topographic conditions, so that the production costs of drinking water supply can be reduced which will automatically reduce the selling price, making it affordable for the community.

Conflicts of Interest

The authors declare no conflict of interest.

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