4. Renewable Resources From Sea Waves Energy (ICWRCOE’15).pdf

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RENEWABLE RESOURCES FROM SEA WAVES ENERGY

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Abstract

Natural energy source that is known so far is from wind, water and sun. For a natural energy source of water is known mainly energy stream. Source of water power from ocean waves flow is still very little attention. In this paper the author will address the source of natural energy from tidal currents and waves of the sea, which turned out to potential and can be very rewarding.

Evidence of the influence of natural energy resources of the sea wave currents expressed here are: The influence of ocean currents in the spatial form of Banjarmasin City, South Kalimantan, which is an average of 0.16 meters below sea level. Due to the low position and very gently sloping, inclined flat, located at the mouth of the river, then the hundreds of large and small rivers flow through the city encountered, so that the life of the population is strongly influenced by the natural conditions. Proven for example with urban spatial structure formed by water transport networks and tenuous housing arrangement, as a result of the condition of the city is split by hundreds of rivers.

The first part of this paper addresses the influence of tidal currents on the city located at the mouth of the river, with examples of Banjarmasin City. Part Two presented the benefits to be gained from the pounding waves of the ocean currents, to develop power generation by the power of ocean waves and very simple currents sea water distillation. This equipment has been developed by the Lecturers of the Faculty of Mechanical Engineering, led by Ir. Rahmad Samosir, MT and exhibited in SMESCO KRENOV FAIR 2014 in Jakarta, and won the championship for the third inter-university inovativ work in Greater Jakarta.

Keywords: Concepts Wetlands and Renewable Energy

Detailed map of Indonesia, Wikipedia-Google Map

BACKGROUND

Indonesia is a country Islands, which stretches 5,120 kilometers (3.181 mi) from west to east and 1,760 kilometers (1,094 mi) from north to south, with an estimated number of 17,508 islands island. Only about 6,000 of which are inhabited by a population. Is the biggest island of Sumatra, Java, Kalimantan, Sulawesi and Irian

Jaya, two of the Islands (Nusa Tenggara and Maluku) and approximately 60 Small Islands. The area of Indonesia is 1,919,317 km² (741.052 sq mi). Additional marine areas surrounding bring Indonesian general territorial recognition (land and sea) about 5 million km². The government later claimed an exclusive economic zone, which adds wide to around 7.9 million km² (Wikipedia, Google).

The condition of the Republic of Indonesia in the form of islands resulted largely Islands region consists of lowland. It is mainly found in the larger islands such as Borneo, with an average depth of swamp over 5 meters. To Indonesian water transport is the most appropriate, which has been somewhat lagging behind its development over land and air transportation. The position of Banjarmasin city, known as the city of a thousand rivers, which lies at the mouth of the river, is about 23 km from the sea, proved to be very influenced by tidal currents, which occur at least 2 per day, plus tidal monthly, yearly and decades. Here we can see the strong influence of tidal currents on the mainland, which in low-lying areas could reach tens of kilometers inland. How much energy can be obtained from the flow of ocean waves like this.

As a simple form of current utilization of ocean waves has been tested by researchers at the Faculty of Mechanical Engineering Christian University of Indonesia, led by Ir. Rahmad Samosir, MT. Two of their research results presented here, namely Energy Power Plant of the waves of the sea and the water distillation machine using the power of the waves of the sea. To two types of these tools I have to say in this paper, to further inspire us to seek the most appropriate benefit from the power that has been available in natural, inexpensive and very environmentally friendly.

LOW LAND AREA CITY DEVELOPMENT

Cities in Indonesia are generally in the low-lying areas. An example is Banjarmasin, South Kalimantan provincial capital, known as the "City of a Thousand Rivers" with an average elevation of -0.16 meters below sea level. Martapura and Barito river is the largest rivers that pass through the city, has the characteristics of the river tides (tidal river). Central area of the Old Town is located in the outskirts of Banjarmasin tidal river Martapura, referred to as a tidal river area or shortened to "kasupasut". This urban development is strongly influenced by the conditions Kasupasut. Its spatial planning should consider the conditions to maintain the sustainability of development.

Banjarmasin city located approximately 23 miles from the mouth of the Barito river, from the Java Sea. Occur in periodic tidal cycle once a day. Periodic tidal cycle is also changing on a monthly basis by the blistering force of the earth-moon-position sun, and the annual cycle of the rainy season and dry, until the extreme cycles in decades. (Tidal cycle in the water rivers are diurnal tide Banjarmasin city, Wyrtki, 1961)

ARCHITECTURAL CONCEPT

Orientation of the river and the Mainland.

Various experts acknowledge Banjar Banjarmasin community life centered on their presence in the waters. For example, the movement of their entire hand rests on the ability of paddling a canoe (Beckman and Saleh-1960, Muhammad and Mentayani-2007). Making the construction of buildings in determining the height limits of space activities and place of residence and traditional irrigation canals also anticipate the ups and downs until the balance and stability in the cruise.
Because water transportation is a very important for the city of Banjarmasin, the city architecture concepts is very oriented to the water or river. Ocean tides affecting the life of the city resulted in the building structure and must anticipate the ups and downs, which is addressed through the floor height gradually and very flexible, following the sea level. Population growth and the increasing need for housing land has put pressure on city and regional spatial tidal river as city open spatial land. Tidal river region much intervention by the new development, which increases the transformation and urban

congestion. At this time the symptoms of architectural transformation tidal river area of the old city center tend to be land oriented. As a result, a total of 31 river becomes inactive, shrink or die, by eliminating most of the water drainage network to the main river.

Mainland City

Banjarmasin city development orientation today tends to shift to the land sector. The existence of the river is very negligible, even often omitted for the convenience of city dwellers and the modes of tidal rivers and vast puddles. Meandering river with many branches plus artificial canals of the Dutch colonial era considered to hinder and complicate the arrangement of the construction area of the city of Banjarmasin.

Various changes were found:

1. Construction of bridge flat type, prefer the convenience of vehicles passing over it hinders the movement of water transport, especially when the tide of the river water. As a result, many creeks and canals can no longer navigable by water transport
2. The architecture oriented to the road has become a meeting building, close access and a view of the road to the river space. Space river into insignificance
3. Through regulation, the regulation of river border lines that limit and eliminate settlement building architecture type of water in the tidal river

1. Comparison of Old and New Conditions

Figure 1.1 versus Figure 1.2.

Figure 1.1 The concept of Banjarmasin orientation towards the river (Water-based architecture) Source: CollectieTropen Museum,

Figure 1.2 The concept of Banjarmasin orientation towards land (Land-based architecture) Source: BAPPEDA city of Banjarmasin, 2013

City Water Pockets

Rivers network and canals have the same important position in the city of Banjarmasin, support shipping activities. Urban Development today's highly oriented land, tend to alter the pattern of water flow into the environment pattern of water pockets, that soaking and cause flooding.

1. The irrigation and drainage system interrupted by a land fill for exaltation piel mainland, forming water pockets of city and patterns of water-land space boundaries in the city and changing patterns of structure-based city road or river flow patterns
2. The Board of the river and canal is narrowed due to the construction meeting, oriented to the road corridor; and silting by domestic sewage and water weeds
3. Many creeks and city canals can not navigable anymore, because it is covered by bridges or blocked by cities installation pipes, as well conditioned as "backyard", which tends to be a residential sewer line, as well as the construction of promanade of the tidal river city area that tends to abolish the natural phenomena space dynamics of tidal river, and change the channel profile rivers into the city canal.

Figure 1.3. versus Figure 1.4.

Figure 1.3 Network integration rivers canals Banjarmasin
Source: BAPPEDA Banjarmasin, 2013

Figure 1.4 inundation zone into the water pockets of Banjarmasin City
Source: BAPPEDA city of Banjarmasin, 2013

Tidal River Culture

The rapid development of road construction has left the water transportation. Another problem that occurs for example narrowing the river and widening the roads, narrowing of the canal body and closing the bridge to the parking area or expansion of the front yard by private housing. Enforcement of the demarcation line of the river tends to restrict and eliminate settlement in tidal river water areal and keep the river as a residential space for the life of city dwellers. Current development in wetland environments, the floating system or stage systems are being abandoned. Now people tend to avoid life on the water, culture increasingly abandoned tidal river, and the river tends to just be a city drainage.

Figure 1.5. versus Figure 1.6.

Figure 1.5 Market buoyant as economic socio cultural symbol of tidal river Banjar traditional society
Source: BAPPEDA city of Banjarmasin, 2013

Figure 1.6 Banjarmasin city gate symbol of culture-oriented urban development land.
Source: BAPPEDA city of Banjarmasin, 2013

USE OF RENEWABLE ENERGY OF SEA WAVES

The principle of using the water pump power of the waves of the sea were developed by researchers at the Faculty of Mechanical Engineering CIU under Ir. RahmadSamosir, MT. The principle is to use water waves ashore as driving the plunger and the water in the cylinder. Water is pressed into the high-pressure tank. By the time the water back into the middle of a lake or sea, the plunger back to the starting position, causing tooth movement back and forth. The wind causes waves on the surface of the sea (and lake) and transfer some of its energy to the water to happen waves and water waves to the shore. This style is used as a plunger pump drive.

Advantages

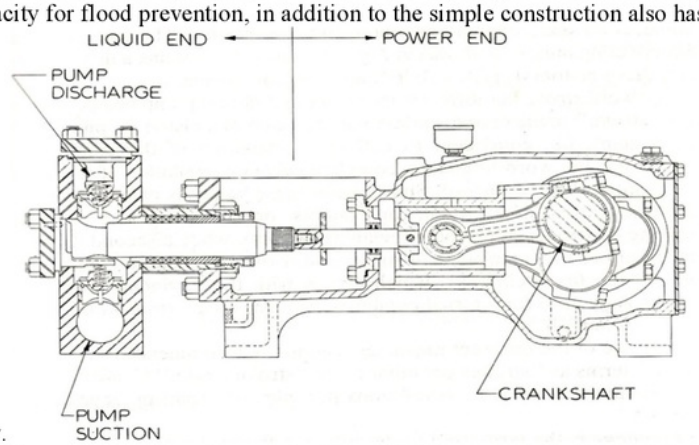
Water pump using wind energy has been widely used, but from the construction side the water waves pump is much simpler and the price is expected to be much cheaper. In the form of a table below is presented excess water pump driven than the beach water waves windmill-driven pumps.

Table 1. Advantages water waves beach pumps than windmills pumps.

No	The pump driven by water waves	Windmill-driven pumps
1	Its construction is very simple, does not require wind towers	Must make a high wind towers, so that its construction is complicated
2	For weak water waves, although the water pump generates pressure remains low.	At low wind, the pump does not work at all.
3	It is estimated that the price is very cheap	The price is quite expensive

Pump function is to remove liquid from one place to place, either to higher ground or to a place that has the same height, with two types of methods:
- Displacement and
- Dynamic

Dynamic systems generally work by centrifugal force and displacement system works by compression. Pumps with dynamic system is widely used in daily life, such as household pumps to pump large capacity for flood prevention, in addition to the simple construction also has high efficiency.



Gbr.2.1. Plunger pump driven by a motor (type of displacement) -Ir. Rahmad S.

Pump with displacement systems generally used on the use of high pressure, even used for measuring devices. Displacement pumps (reciprocating pump) was chosen to take advantage of the beach water waves move back and forth, is expected to move water from the surface of a lake or the sea to a higher location. Its working principle is to use the momentum water waves, whereby if a moving object crashing into other objects, the object that was hit will absorb some or all of the energy of the object that crashed (RahmadSamosir)

Fig. 2.2. The waves of the sea water morbidly likely tsunami (Samosir)

Fig. 2.3. The waves of the sea water likely tsunami (Samosir)

Tool model that has been developed by researchers at UKI as follows.

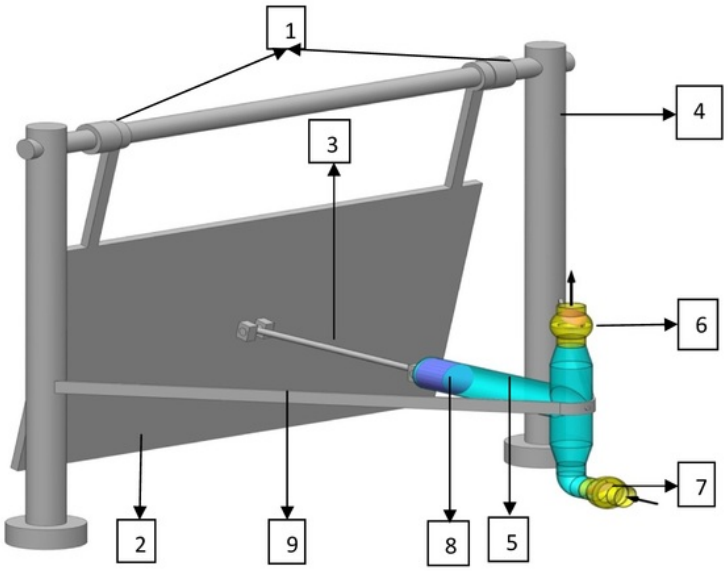


Fig 3.2.Planned sketch system

Caption.

1. Bearing
2. Energy Conversion Plate
3. The piston rod
4. Column
5. Cylinder
6. Discard valve
7. Suction Valve
8. The plunger
9. retaining plate cylinder

Next is developed picture-drawing tool models (R.Samosir).

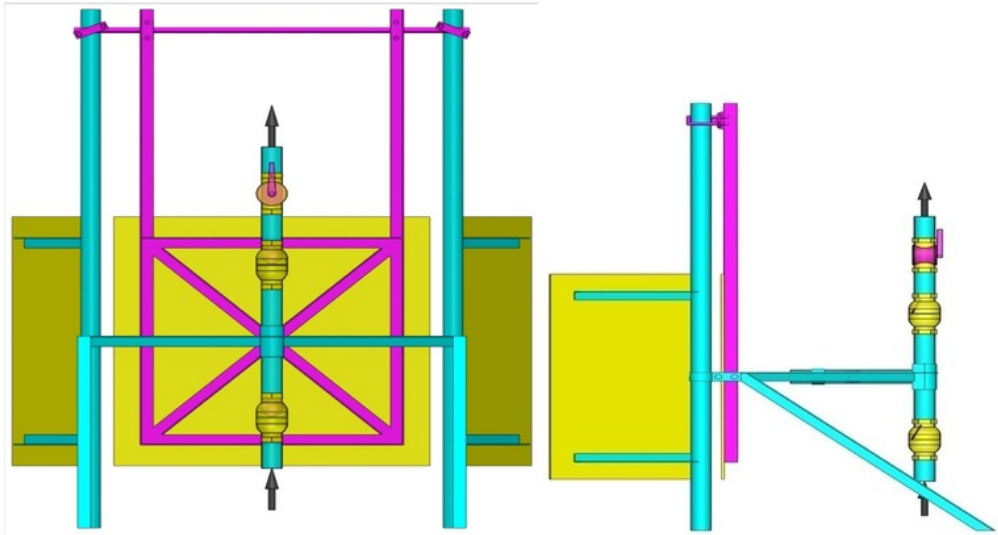


Fig. 3.3.Front ViewFig. 3.5. Side View

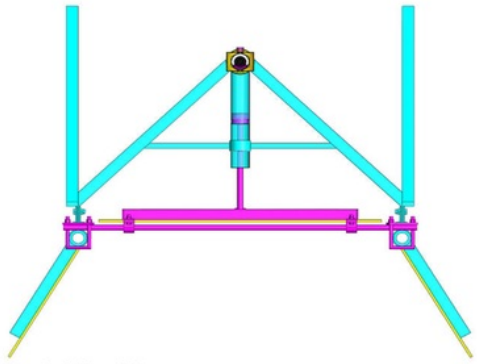


Fig. 3.4.Top View

Water waves speed can be improved by making smaller inlet mouth (referrer water inlet as shown in the image above). Increasing the speed of incoming water can be calculated by using the equation kontunitas:

$$A_1 V_1 = A_2 V_2 \text{ or} V_2 = \frac{A_1 V_1}{A_2}$$

A1 = cross-sectional area of water intake
V1 = water waves speed (the speed of incoming water)
A2 = cross-sectional area of energy absorber plate
V2 = speed of the water hitting the plate

From the equation above, the theoretical ability to move water pump can be more effective, including increasing the output pressure.
To prove the effectiveness and capability of the pump are designed above, needs to be made a prototype and tested.

Tools Production

Fig. 3.1. Built waves water pump

Fig. 4.1. Energy conversion plate on the suction position

Fig. 4.2. The position of energy conversion plate was doing compression

Figure 4.2 shows the suction motion of energy conversion plate. In this step the piston suck the water up to the cylinder plunger pumps filled with water. The suction valve opened and the exhaust valve will be closed, but the faucet which is located about 1 m above the sea level still dispense water. Testing was done on March 11, 2013 on the beach Ancol - North Jakarta from 11:30 to 15:00 o ´clock.

Analysis of Test Results

In the test by the maximum pressure obtained by the pressure of more than 2 kg / cm2, is evident because the connection pipe out of TEE apart at a pressure of 2 kg / cm2 . To obtain a greater pressure, then the diameter of the cylinder should be minimized. If the pressure can be generated at 5.5 kg/cm2, the pump can raise water up to 55 meters.

Sea Water Distillation

With the success of the Waves Water Pumps, trying to take advantage of the pump to the next function, which is to supply sea water for distillation.Sea water distillation has been carried out since

1872 (1), but the distillation process does not use a condenser, thereby running the steam condensation process occurs slowly. In theory, the distillation process using the condenser will be faster than not using a condenser, because water vapor condenser will force more quickly into the condensate. The study began in early 2014 with testing using the natural power of steam condensation Condenser. The study has not reached satisfactory results, which still need to be improved.

Byproducts of water is also salt, because the sea water as raw material distilled water containing salt. In the first semester of 2013/2014, the same test was performed using the aluminum pipe as a condenser, this research is still ongoing.

Working Principle Tool

The water will evaporate when heated, but the water evaporation occurs not only at 100oC temperature. At a relatively low temperature water can also evaporate. One extreme example is the phenomenon of cavitation in the pump. This happens because the water at low temperature is sucked by the pump. Because the pressure is too low on the suction side will result in evaporation which causes the symptoms of cavitation. Similarly, if the sea water entered the enclosed space that is covered by the glass will undergo evaporation without over heating.

The workings of the distillation apparatus is as follows:

The sea water is pumped by pump water waves beach (swing system) (3) to the storage tower. From the water storage tower water flowed into the greenhouse (evaporation chamber), the surface of the water in the evaporation chamber thickness of surface water must be kept no longer than 3 cm, it is intended that the water temperature can be high. Water vapor in the evaporation chamber will rise to the coolant through the pipeline. Initially, the steam flow to the cooler will have trouble, but if you have started the process of cooling steam, the steam line to the cooling will decrease until the pressure in the evaporation chamber will drop as well. It will also accelerate the process of evaporation which further accelerate the process of distillation. Water at a relatively low temperature will undergo evaporation if the pressure on the water surface is derived.

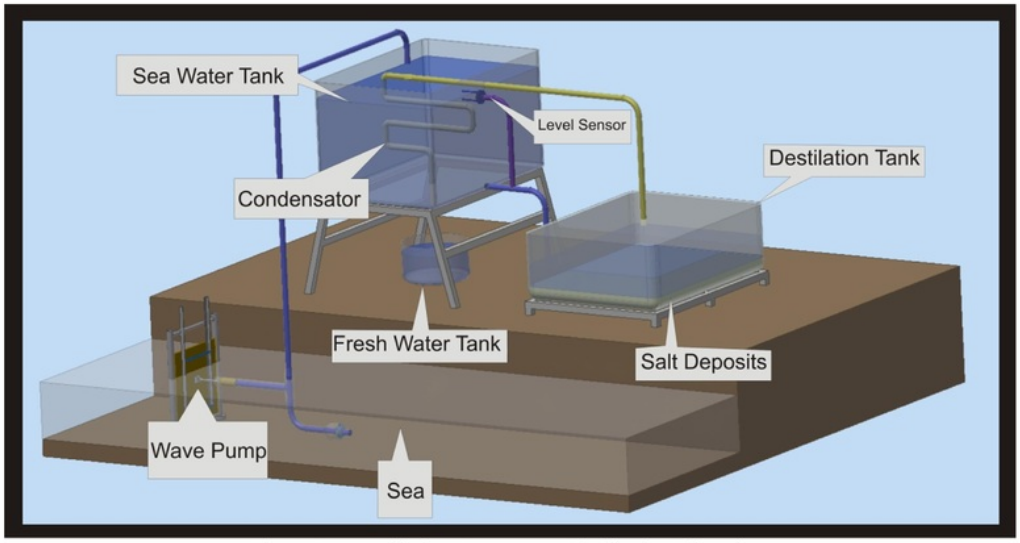


Figure 1.Installation Seawater Distillation Sketch.

In the following table are presented the temperature and pressure of saturated water vapor.
Table 1. The temperature and pressure of saturated vapor of water (4):

Temp (°C)	Saturated Vapor Pressure (N/m2)	(torr = mmHg)
20	$2{,}33 \times 10^3$	17,5
25	$3{,}17 \times 10^3$	23,8
30	$4{,}24 \times 10^3$	31,8
40	$7{,}37 \times 10^3$	55,3
50	$1{,}23 \times 10^4$	92,5
60	$1{,}99 \times 10^4$	149
70	$3{,}12 \times 10^4$	234
80	$4{,}73 \times 10^4$	355

To speed up the cooling (condensation) water vapor flowed into spiral pipe immersed in water up above the tower. From the spiral pipe condensate water flowed into a freshwater reservoir vessel.

In this study examined the effectiveness of sea water distillation equipment to get the most effective way to change the sea water into fresh water.

To facilitate implementation, testing used in freshwater instead of seawater. After the entire distillation equipment and support elements constructed completed, then testing (Research) on the ability of the tool.

Equipment used.
1. Tank distillation and equipment
2. The tank water level regulator and the equipment
3. The cooling water tank (made of fiber), and other ancillary equipment as needed in the field.

Because the plunger pump design has been done first, then in this study were not included anymore, but in the application field later will all be combined.

We also can use the sea water in the tank to generate electricity by turbine as shown below.

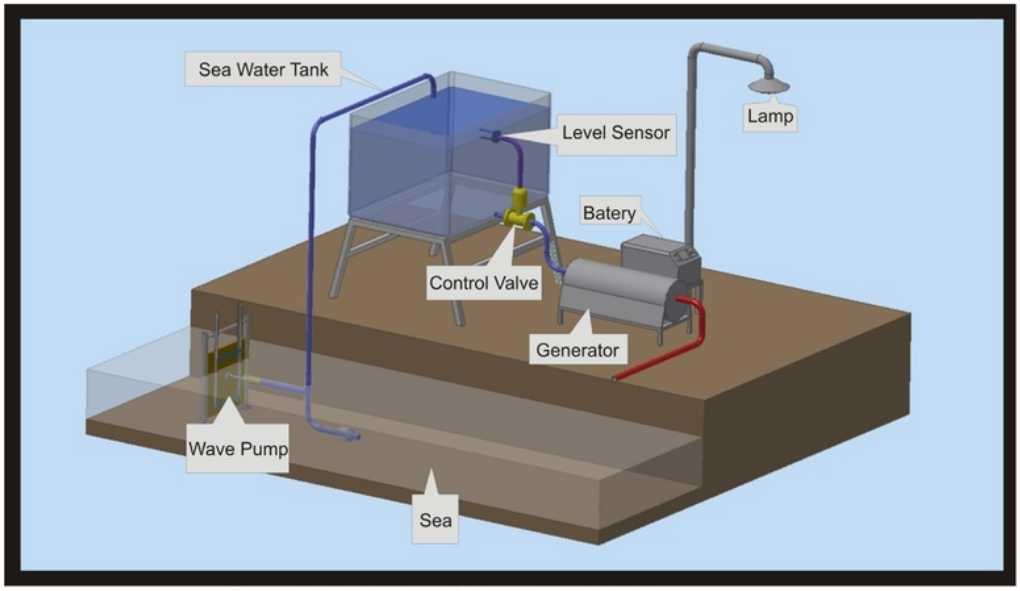


Figure 2. Instalation of Power Electricity by sea water.

Location Research.

The feasibility study carried out on the roof of distillation equipment Machanical Engineering Laboratory with fixed using raw materials sea water. The equipment needed to be done at the

Laboratory of Mechanical Engineering of the Christian University of Indonesia (Universitas Kristen Indonesia or UKI) and partly done by CV. Mighty Enginering located in Industrial Area Pulogadung. Calculated cost is very cheap, around Rp. 10 million.

CONCLUSIONS AND SUGGESTIONS

Banjarmasin City Research
Based on the observation of the conditions that occurred in the city of Banjarmasin, some concluded analysis: Loss of wetland local characteristic

1. Culture of aquatic life have been abandoned
2. River as the center of life turned into a canal transportation and garbage housing disposal
3. Position road as housing orientation has taken over the river
4. How staircase house construction adapted to the height of the water, turned into a flat floor without a stage, on land that may have been filled and avoidance of water
4. The condition of peatlands with a depth of more than 2 meters in filled overcome by without
5. thinking about the possibility of another solution
6. The romance of life on the water changed completely to the type of terraced houses on the land mainland
7. Very important is the loss of local cultural specificities supplanted by the desire ease of convenience only

Repair and proposals in this regard are as following:

1. Preventing generalization regulations in Indonesia
2. Areas that could still retain his trademark, as a result of the isolation of the area, should be quicklyanticipated and recorded
3. Areas that could still retain his trademark, as a result of the isolation of the area, should be quicklyanticipated and recorded, to be able to apply the rules in accordance with local conditions
4. Regional and urban as Banjarmasin need to deepen its characteristic
5. Orientation settlements towards the road and back to housing, can be overcome by the strict rules of river management, the type of design and manufacture of the Master Plan allowed the implementation actually watched closely, especially for sensitive regions as critical land riverbank, beach cliffs and land erosion endangered
6. Development of a more appropriate system development, in accordance with local conditions
7. Return the water transport system developed for areas that still allows for the
8. Research on the utilization of tidal water power must intensive begin

Renewable Energy

1. It is increasingly clear, that research in this direction should be developed and encouraged by the UKI
2. UKI Water Management Laboratory should establish as soon as possible, so that it can be used by Civil and Engineering Study Program simultaneously or alternately
3. Difficulty research development of Ir. RahmadSamosir occurs also because there is no support for a complete laboratory equipment, thus losing the opportunity to make UKI Copyright (Patents) of lecturers researchers such as Ir. RahmatSamosir
4. MONE need to give more opportunities open to researchers at the University, so that they can still be a Professor of through concentration Research

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