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Waterwheel Recirculating Filtration System "WRFS"

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ABSTRACT: Waterwheel Multistage Filtration System "WMFS" is an alternative to conventional drinking water sources available in remote areas. Conventional waterwheel is modified in such a way that it captures some amount of river water and filters it which later can be used by peoples in remote areas. This paper describes Design & evaluation of full-scale WMFS driven by waterwheel and its performance while installed in a river near a village. It's easy for us to enjoy pure water when we live in the city, but people in remote villages and small towns can have difficulties to find clean source of water. WMFS has been designed to provide a solution for that problem. The filtering process of WMFS is very simple, yet very efficient and reliable due to its proposed overall design and operation. The design is based on traditional waterwheel but this time, it's combined with modern water filtration equipment. Waterwheel Multilayer Filtration System "WMFS" works by sending water from bucket to the waterwheel, the system would filter dirty water by the pressure of the water flow. This smart system provides clean, potable water without needing any external energy. This system can be installed on existing abandoned waterwheels; it carries forward the wisdom of archaic mechanism to benefit a lot of people. This water filtration system works by sending water from bucket to the waterwheel, the system would filter dirty water by the pressure of the water flow. This smart system provides clean, potable water without needing any external energy. This system can be installed on existing abandoned waterwheels; it carries forward the wisdom of archaic mechanism to benefit a lot of people. WMFS essentially captures water on a waterwheel which moves upward due to water stream after which it falls on the filtration unit while storing the filtered water for daily use.

KEYWORDS: Waterwheel Multistage Filtration System, Filtration System, conventional drinking.

I. INTRODUCTION

Waterwheel Multilayer Filtration System "WMFS" works by sending water from bucket to the waterwheel, the system would filter dirty water by the pressure of the water flow. This smart system provides clean, potable water without needing any external energy. This system can be installed on existing abandoned waterwheels; it carries forward the wisdom of archaic mechanism to benefit a lot of people. This water filtration system works by sending water from bucket to the waterwheel, the system would filter dirty water by the pressure of the water flow. This smart system provides clean, potable water without needing any external energy. This system can be installed on existing abandoned waterwheels; it carries forward the wisdom of archaic mechanism to benefit a lot of people. WMFS essentially captures water on a waterwheel which moves upward due to water stream after which it falls on the filtration unit while storing the filtered water for daily use.

II. LITERATURE REVIEW

- This water filtration system works by sending water from bucket to the waterwheel, the system would filter dirty water by the pressure of the water flow. This smart system provides clean, potable water without needing any external energy. This system can be installed on existing abandoned waterwheels, it carries forward the wisdom of archaic mechanism to benefit a lot of people. WMFS essentially captures water on a waterwheel which moves upward due to water stream after which it falls on the filtration unit while storing the filtered water for daily use.
- A product is something sold by an enterprise to its customers. Product development is the set of activities beginning with the perception of a market opportunity and ending in the production, sale, and delivery of a



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product. Although much of the material in this book is useful in the development of any product, we explicitly focus on products that are engineered, discrete, and physical. Exhibit 1-1 displays several examples of products from this category. Because we focus on engineered products, the book applies better to the development of power tools and computer peripherals than to magazines or sweaters. Our focus on discrete goods makes the book less applicable to the development of products such as gasoline, nylon, and paper. Because of the focus on physical products, we do not emphasize the specific issues involved in developing services or software. Even with these restrictions, the methods presented apply well to a broad range of products, including, for example, consumer electronics, sports equipment, scientific instruments, machine tools, and medical devices.[9]

- Supplying power to many remote locations in the world from central generators using customary distribution methods is either economically unfeasible or will be many years in coming. Power, where desirable, will therefore need to be generated locally. Various commercial machinery is marketed, but the required capital expenditure or maintenance/running cost is beyond the capability of many potential users. Some effort hasbeen expended at the Papua New Guinea University of Technology to devise low cost means of generating modest amounts of power in remote locations. This paper reports on one such project involving the development of low cost machinery to provide mechanical power.[1].
- At low head sites and at low discharges, water wheels can be considered among the most convenient hydropower converters to install. The aim of this work is to improve the performance of an existing breasts hot water wheel by changing the blade shape using computational fluid dynamic (CFD) simulations. Three optimal profiles are investigated: the profile of the existing blades, a circular profile and an elliptical profile. The results are validated by performing experimental tests on the wheel with the existing profile. The numerical results show that the efficiency of breasts hot wheels is affected by the blade profile. The average increase in efficiency using the new circular profile is about 4% with respect to the profile of the existing blades.[5]

III. METHODOLOGY

Figure below illustrates the steps in the product ideation process for WMFS. First, multiple opportunities are prioritized and a set of promising projects is selected. Resources are allocated to these projects and they are scheduled. These planning activities focus on a portfolio of opportunities and potential project and are sometimes referred to as portfolio management, aggregate product planning, product line planning, or product management. Once projects have been selected and resources allocated, a mission statement is developed for this project. The formulation of a product plan and the development of a mission statement therefore precede the actual WMFS development process.



Figure 1IDEATION.

Explanation of Concept Design and Generation of WMFS work in 4easy steps as follows;

- STEP 1:- River water flowing through river will flow and drive waterwheel. Which has cleverly design buckets? This Bucket will catch some of the flowing water and carry it.
- STEP 2:- This buckets will drop water at top side which has cleverly placed top meshes. Top Mesh will remove primary impurities/ organic waste/ fishes Etc.
- STEP 3:- After Pre-Filtration water will travel downside due to gravity. Hence we will pass water through filter core. Filter Core will be constructed keeping in mind that large amount of water to be filtered. Water from core will be stored in tank. The volume or capacity of the tank can be amplified or reduced based on the consumption per instalment.



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• STEP 4:- This is final step in which individual or peoples can use simple tap to get filtered water directly. In remote areas like India water filtration cost is high due to energy consumptions. Sometimes even required electricity is not available to add to filtration systems. This system does not require any external energy it runs on its own.

IV. CALCULATIONS

Bucket Design:-

The optimum bucket design is taken to be that which produces the greatest torque on the wheel shaft. The upper limit to this condition is that the buckets fill completely at the top, carry the full water weight with no spillage to the bottom and dump their loads there. There is not a practical method of achieving this maximum. With fixed buckets, the best we can do is minimize spillage from the buckets as they travel from the top, where they are filled, to the bottom where they should be empty (so as to limit losses incurred by carrying water up the back side of the wheel). Historically, bucket shapes have varied considerably. They were, as far as I can determine, chosen empirically. (In a historical sense this is a euphemism for "arbitrarily" or "by educated guesswork"). By the time engineers, rather than carpenter-craftsmen, were considering the problem the water wheel's usefulness was already on the decline). Even in relatively recent manuals for construction, circa 1850, while wheels were still in general use in the U.S., bucket side angles of 45° were recommended - a choice which can easily be shown to be less efficient than smaller angles. The 20° - 25° figure is, however, in close agreement with the design of two wheels that I know are still in use in the U.S. The number of buckets to use depends upon the volume consumed by the bucket wall material. The ideal wheel has closely spaced buckets of very thin wall thickness. A reasonable figure to design by is that not over 10% of annular volume should be consumed in bucket material. Typical values for the size wheels discussed here would be 25 - 30 - 1/4 in. thick buckets on a 3 foot wheel and 50 - 1-1/4 in. thick buckets on a 14 foot wheel.



Fig 3 – Bucket Calculations

Bearing Design:-

The wheel itself has only one rubbing or sliding part subject to wear, viz. the bearings upon which the axle is supported. Standard bearing design is covered in almost any machine design text. In the manufacture of such a device as is discussed here, the value of such "standard" bearings is questionable. Fully weather-proofed ball or roller bearings are too expensive and complicated to satisfy the initial criteria. The detail explanation of design is bifurcated into two tables as explained below

Table I shows the approximate weight on each bearing per foot of width of wheel. Total weight carried on each bearing is then the product of the Table entry and the width of the wheel in feet. This of course assumes that the wheel is simply supported at each end of the shaft and does not allow for additional loads imposed by the attached machinery. It is important that significant loads due to the Table I values for the purposes of determining bearing size from Table II. For the side of the wheel where the machinery is attached. In this event the bearings will apparently need to be of different sizes. In practice, unless the indicated sizes are very different, we usually make both the size indicated by the larger load. Thus one is really longer than it needs to be.



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Bearing diameters required to support the various loads are given in Table II calculated on the basis of 100 psi in parallel usage and 200 psi for end grain usage and L/D = 1. Values are given to 20,000 lb. to allow for the largest reasonable bearing loads

Table 1Approximate weight carried by each bearing excluding loads due to attached machinery (per foot of
width of the wheel).

t (in.)			Out	side Diameter	(ft.)		
~ /	3	4	6	8	10	14	20
2	24	32	50	-	-	-	-
3	35	47	70	95	120	-	-
4	44	60	89	125	160	-	-
6	-	86	140	185	235	335	470
8	-	-	180	240	305	440	675
10	-	-	-	290	370	530	765
12	-	-	-	330	445	635	920
16	-	-	-	-	-	820	1215
20	-	-	-	-	-	1020	1500
24	-	-	-	-	-	-	1760

Table 2Minimum Bearing Diameter Required for Various Loadings (in.)

		Load (lb.)						
	100	200	500	1000	2000	5000	10000	20000
Parallel Usage	1	1-1/2	2-1/4	3-1/4	4-1/2	7	10	14
End Grain Usage	1/2	1	1-3/4	2-1/4	3-1/4	5	7	10

Shafts:-

Shafting may be wooden or steel. The diameter is of course dependent upon which material is used and the dimensions of the wheel. Minimum permissible shaft diameters d, may be estimated from the equation for stress for solid metal shafting,

$$d^{3} = \frac{16\sqrt{M^{2} + T^{2}}}{\pi S}$$
..(1)

In this equation M is the maximum bending moment occurring where the wheel sidewall attaches to the shaft. It can be estimated as the product of the bearing load (entry in Table I for the appropriate wheel) and the distance from the wheel side wall to the center of the bearing. In the interest of keeping the shaft as small as possible, it is therefore desirable to locate the bearings as close to the side of the wheel as possible. (Note that in most cases, it is not critical to include the additional machine load on the bearing, discussed in connection with the use of Table II. It must be included only when the external machine load times the distance along the shaft from the point of application of the load is larger than the bearing load from Table I times the distance along the shaft from the bearing to the point where the wheel is attached.;



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T is the torque acting on the shaft and a conservative estimate is found from Table I. S is the allowable shear stress of the metal. It is around 15,000 psi for ordinary steel shafting and pipes.

For solid wooden shafts two equations are used and the larger diameter of the two results is chosen as the diameter of the shaft.

$$d^{3} = \frac{16T}{\pi S}$$

$$..(2)$$

$$d^{3} = \frac{32M}{\pi B}$$

..(3)

..(4)

For hollow shafting like a pipe, the equation to determine the outside diameter is:

$$d^{3} = \frac{16\sqrt{M^{2} + T^{2}}}{\pi S(1 - k^{4})}$$

Where K - Ratio of inside to outside diameter.

The values of O.D. and I.D. are standardized for pipes. For bearing loads tabulated in Table II, on the assumption that the center of the bearing is 1 foot from the edge of the wheel, the standard pipe sizes shown in Table III should be satisfactory. Table III automatically allows for torque that would be reasonable to expect from a wheel of such a size that the bearing load would be given in Table II. The values are approximate only since exact values cannot be given until all the details concerning the loads due to the attached pump or machine are known. The values given should serve as a guide only and the final decision should be checked against the equation to be sure. When making substitutions, in assembly, of one pipe size for another, it is permissible to use larger pipe than shown in Table III but not smaller pipe.

Table 3Minimum Standard Pipe Sizes for Use as Axles with Bearings at 12 inches from Wheel Edge.

Bearing load (lb)	100	200	500	1000	2000	5000	10000
Pipe Diameter (in.)	1"	1 ¹ / ₂ "	^{2 1} / ₂ "	3"	4"	6"	8"

Stall Torque:-

The stall torque capacity of the machine, ignoring the velocity effect of the water impinging on the stalled buckets, is easily calculated by a simple summation of moments about the shaft due to the weight of water in each filled or partially filled bucket. Obviously this will depend in part on the amount of spillage from the bucket which in turn depends on bucket design. Bucket configurations used in the 18th and 19th century varied depending on the skill of the builder. They were empirically determined on the criterion of maximizing torque by maximizing water retention in the buckets while recognizing that optimum design on this criterion also required increased construction complexities. Buckets of shape shown schematically, were used for overshot and breast configurations. The straight sided buckets are less efficient but simpler to construct. The width of the bottom of the bucket was typically 1/4 of the width of the annulus where that configuration was chosen. Purely radial buckets were used in undershot wheels.Results for wheels of various dimensions are given in Table IV. Blank spaces are left for t/r ratios outside the limits given above. Experience has shown that many non-technically trained users of this information will be more confident of their ability to use data given in tabular than in graphical form. Both will be presented here when appropriate.



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Table 4Stall Torque per foot of width (ft.lb) (No allowance for volume consumed by Bucket wall Thickness; 0.05< t/r <0.25 only)</td>

Annulus Width	Ou	tside D	iameter (ft.)			
t (in.)	3	4	6	8	10	14	20
2	2	4	95				
	0	0					
3	3	5	13	23	365		
	0	5	0	5			
4	4	7	16	30	485		
	0	0	0	0			
6		9	24	43	695	143	2910
		5	0	5		5	
8			30	55	905	185	3840
			0	5		0	
10				65	108	222	4660
				5	0	0	
12				77	127	262	5560
				5	0	0	
16						330	7190
						0	
20						400	8750
						0	
24							10100

CALCULATIONS FOR WMFS:-

Total water requirement in gallons per hour,

$$\frac{20 \text{ gal}}{Person/Day} \times 300 \text{ People} \times \frac{Day}{24 \text{ hrs}} = 250 \text{ gal/hr}$$

..(5)

• Assuming storage facilities at the village to allow larger draw at peak hours. Power required to meet this pumping rate from (Table V). 250 gal/hour at approx. 400 ft. head (350 actual ft. rise + some losses as yet uncalculated) requires about 1/2H.P. under steady conditions.

Table 5Horsepower Required For Water Pumping At Various Flow Rates and Heads (Both Assumed Steady)

Flow Rate	Total Head (ft.)						
(imp. gal/hr.)	50	100	200	300	400	500	
5	0.00125	0.0025	0.0050	0.0070	0.0	0.0125	
					1		
10	0.0025	0.0050	0.01	0.015	0.0	0.025	
					2		
25	0.00625	0.0125	0.025	0.375	0.0	0.0625	
					5		
50	0.0125	0.025	0.05	0.75	0.1	0.125	
100	0.025	0.050	0.1	0.15	0.2	0.250	
150	0.0375	0.0750	0.15	0.225	0.3	0.375	
200	0.05	0.1	0.2	0.3	0.4	0.500	
250	0.0625	0.125	0.25	0.375	0.5	0.625	
300	0.075	0.15	0.3	0.45	0.6	0.75	
500	0.125	0.25	0.5	0.75	1.0	1.25	
1000	0.25	0.5	1.0	1.5	2.0	2.5	

Т



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Table V. Horsepower Required For Water Pumping At Various Flow Rates and Heads (Both Assumed Steady) WRFS arrangement used, the wheel will need to be designed for 2.5 times that for a single acting pump (equivalent), 2 times that for double acting pump or 1.5 times that for 2 double acting pump. Assuming the simplest case of 1 single acting pump we need a wheel of 1.25 H.P. potential. Can we get that much power from a water wheel under the stated conditions at the stream? The largest diameter possible is limited by the drop in the stream in a useable distance – about 8 feet. An 8 ft. wheel will operate at about 12 rpm or less. The stream has a flow rate of at least.

$$10 ft \times \frac{1}{2} ft \times 1 \frac{ft}{sec} = 5 \frac{ft^3}{sec}$$

$$..(6)$$

$$5 \frac{ft^3}{sec} \times \frac{6 \frac{1}{4} gal}{ft^3} \times \frac{60 sec}{min} = 1800 \frac{gal}{min}$$

$$..(7)$$

At 1800 gal/min we should be able to produce 2 H.P. at least from an 8 ft. wheel or slightly less depending upon the exact t/r values finally chosen. Therefore we conclude that the job, in theory, is possible. Had the flow rate been, for example, only 500 gallons per minute, the task of pumping 250 gal per hour to the village would probably have been impossible. At an estimated 12 rpm and 4 ft. width (maximum usually used is half the diameter) we can estimate the annulus width necessary.

$$\frac{1\frac{1}{4}H.P.Needed}{12 rpm \times 4 ft wide} = 0.025 H.P. per rpm ft of width.$$
..(8)

In the entry under 8 ft. diameter wheels we see that all annulus widths listed will provide at least that much power. We now know we can make the wheel less than 4 ft. wide if desired and the annulus width can be between 3 in. and 12 in. It is now completely established that an 8 ft. diameter water wheel in this location will do the job required. If the wheel operates at 12 rpm and the pump is directly coupled so that there is one stroke per rpm with no added leverage (for instance, as with the wire connection suggested in Part Two, Section IB), there will be one stroke per revolution. To accomplish 250 gal/hr. we need:

$$250\frac{gal}{hr} \times \frac{hr}{60\min} \times \frac{min}{12 \ strokes} = 0.35 \ gal/stroke$$

..(9)

That means we need 3.5 pump with 12" stroke or 4" pump with 9" stroke etc. If we limit the velocity in the pipe to 10 ft/sec then the pipe size with the 3V pump (chosen because It Is cheaper than the 4" pumps) is related to the peak piston velocity and the pump size. The peak piston velocity at 12" stroke 12 rpm is 0.624 ft/sec. The delivery pipe cross section area must be approximately.

$$0.624 \times 11 \frac{\left(3\frac{1}{2}\right)^2}{4} \times \frac{1}{10} = Pipe Area = 0.64 in^2$$
..(10)

This would require a nominal 1" diameter pipe. The pipe would need to be galvanized iron to withstand the pressure of heads exceeding 350 ft. If a nominal 1" pipe is used, the actual peak velocity is about 7 ft/sec. The friction head loss would be (Table VI),



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Table 6Estimated Friction values for cool water.

		Wate	er V	Velocity		
		(ft/sec.))			
		1	5	10		
Old	Iron	0.0	0.0	0.0		
Pipe		45	40	38		
New	Iron	0.0	0.0	0.0		
Pipe		30	23	21		
Plastic	Pipe	0.0	0.0	0.0		
		25	17	15		

Friction loss = $0.022 \times \frac{750}{1/12} \times \frac{7^2}{2 \times 32.2} = 150 \text{ ft}$

..(11)

Thus the total peak head causing forces on the pump rod would be 350 (elevation) + 150 (loss) = 500 ft. Commercial 3.5 m. pumps are fitted with 2 in. pipe outlet holes and if 2 in. pipe is used the loss is much less because the velocity is less and the diameter is greater.

Friction loss =
$$0.028 \times \frac{750}{2/12} \times \frac{2^2}{2 \times 32.2} = 8 ft$$
...(12)

The saving is obviously substantial but the cost of doubling the pipe size may be unattractive. Assuming we use the 1" pipe we find the required pump rod force is about 1850 lb. For a 12" stroke a crank length of 6" is required and so the peak torque on the machine is 925 ft/lb. From Table 1 we see that this is well within the capacity of the wheel if it is 4 ft. wide. To allow for reasonable future expansion of needs without adding unnecessary weight to the wheel I would select a 4" annulus. Having done that, the bearing loads are about 500 lb. each. Assuming the bearings can be located fairly close to the wheel, say 6" away, the solid steel shaft size required is found from:

$$d^{3} = \frac{16\sqrt{(6 \times 500)^{-2} + (925 \times 12)^{2}}}{\pi(13000)}$$
...(13)

$$d^3 = 1.65 in$$
 ..(14)

Any solid steel shaft larger than this will be satisfactory

Analysis based on CAD Models

Bucket Analysis:-

The optimum bucket design is taken to be that which produces the greatest torque on the wheel shaft. The upper limit to this condition is that the buckets fill completely at the top, carry the full water weight with no spillage to the bottom and dump their loads there. There is not a practical method of achieving this maximum. With fixed buckets, the best we can do is minimize spillage from the buckets as they travel from the top, where they are filled, to the bottom where they should be empty (so as to limit losses incurred by carrying water up the back side of the wheel).

Shaft and Bearing Analysis:-

The simulation is carried out by choosing the static and free boundary condition. The simulation result shows that the stress distribution of the scale varies from 0.002MPa to 3.978MPa and this result based on Von Mises criterion. The calculation result of effective stress in Von Mises criterion is 4.833MPa.Calculation and simulation results of stress on Von Mises criterion is in the minimum range of the using material.



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Figure 4 Bearing Shaft CAD Model.

Figure 5 Bearing Shaft Tetrahedral meshes Model.



Figure 6 Bearing Shaft Stress analyses.

COST ESTIMATION

Table 7Bill of Materials.

SR. No	Parts of WMFS	Material	QTY	Per Qty	COST
	Filtration System.	-	-	-	-
	I Strainer.(Mesh NET)	SS 316	4 KG	220	880/-
				Rs/ KG	
1	II Core Filtration Unit.	Carbon Block, Sediment filter, RO	-	-	12000/-(Direct
		membrane, UV Chamber.			Purchase From Market)
	III Storage tank with	Plastic PP 110	-	-	3000/-
	equivalent faucet.				(Direct Purchase From Market)
	WRFS Structure.	-			
	I Base Pillars.	SS 316	23KG	320	64000
	II Buckets.	Marine Wood/ SS 316	450	50 rs/ Sq.	22500
			Sqft	ft	
2	III Ring Locks o	SS 316	30 KG	320	9600
	Holders.				
	IV Bushing and Shafts.	Bronze Bushing with suitable	105 KG	220	23100
		shaft material			
	V Bearings and Fasteners.	M.S.	-	-	25000
3	Base Structure for WRFS	N/A	-	-	-



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Table 8Total Cost per Installation.

SR. No.	Scope	Description	Estimate d Time	Cost (INR)
Design And 1 Development OF WMFS		3D CAD model for WMFS	1 Month	40000
		CAE analysis (Material FEM/FLOW)	15 Days	15000
2	Material Cost	As per BOM	1 month	160080
3	Assembly Cost	-	10 Days	120000
4	Tools and Labor cost	-	10 Days	80000
		Total cost Per Installation	3 months	415080

V. RESULTS & CONCLUSION

Structural analysis:-

The results of this study were simulated in the UG NX NASTRAN 11 which will be analyzed based on speeds on three variations of undershot water wheel design. Variations in this study based on the axis of the water wheel axis at 1 meter, 1.25 meters, and 1.5 meters. From each variation will be analyzed for 10 seconds. But in the results will only be shown 4 times is 0.4 seconds, 2.08 seconds, 6.66 seconds, and 10 seconds. Where in this simulation used the initial velocity of water on the river is 1.2 m/s and move faster based on time. The simulation will be shown in the picture below.

From the simulation fig, result at 1-meter axis ordinate, the maximum speed of water flow based on the simulation result is 34.6 m/s. And the most stable flow is shown at 6.6 seconds. Based on the simulation fig, result at the time of the ordinate of the shaft 1.25 meter, the maximum speed of water flow based on the simulation result is 28.4 m/s. And the most stable flow shown at 6.6 seconds is also the same when the ordinate of the shaft is 1 meter.Based on the simulation result is 26.1 m/s. And the most stable flow shown at 6.6 seconds is also the same when the ordinate of water flow based on the simulation result is 26.1 m/s. And the most stable flow shown at 6.6 seconds is also the same at the time of the ordinate of the shaft is 1 meter and 1.25 meters. From the three variations can be seen, that the flow of fluid in the river, stable or not, based on the travel time of water (probably due to the same water wheel shape) is 6.6 seconds. As for the fluid velocity in the river is more influenced by the axis ordinate. Where as in the discussion section on the design of water wheels, the efficiency of the water wheel is influenced by the location of the water wheel is correct.



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Figure 7 CAE Flow of Waterwheel.

Results of testing CAD Model of WRMS :-

Table 9Results of testing CAD Model of WRMS

Observation 1mbers	Blade angel, Grad.	Current force A	Voltage, V	Power, Wt.
1	5	0.18	212	38,16
2	10	0.20	218	43,60
3	15	0.22	221	48,62
4	20	0.19	215	40,85
5	25	0.19	215	40,85
6	30	0.17	212	36,04
7	35	0.16	210	33,60

WMFS plant was designed by using undershot waterwheel. The measurements of efficiency and other parameters were calculated for undershot water wheels giving maximum efficiencies of 71 - 76% over a broad range of flows.Water wheels appear to be efficient and ecologically acceptable energy converters. The traditional electricity prices are expected to increase in the next few years. Therefore, using water wheel plant will reduce the difference-cost between the produced electricity from renewable and non-renewable sources. However, there is still slight increase additional costs borne by electricity consumers as part of the price of electricity. In the long term, the opposite direction and adjust the competitiveness of renewable energy at the same rate with lower costs to less conventional energy. Also in the future, establishment of a clearing house to clarify issues relating to the application of renewable energy law will result in key issues to be resolved and the use of legal protection before the civil courts can be avoided.

VI. CONCLUSION

WMFS appear to be efficient and ecologically acceptable Water Filters. Development of water power can be advantages in communities where the cost of fossil fuel is high. In the wheel design, it is rotated by water striking three or four blade at a time near the bottom of the wheel. In shaft design, ASME principle is applied and the shaft diameter is 58mm. In bearing selection, the single row deep grove rolling contact bearing is applied and bearing number is **6213**.



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