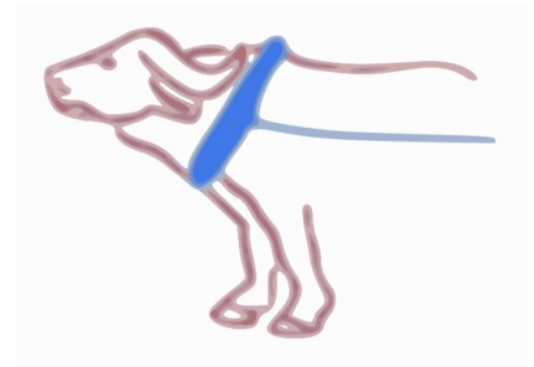


# **THE DRAFT ANIMAL POWER: NEW PERSPECTIVES, FOR WATER LIFTING AND GRAIN MILLING, IN REMOTE VILLAGES**

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# A promising framework

**The draft animal power is ready to offer new tools for water lifting, for grain milling, for fruit squeezing and fruit sorting, for threshing and winnowing, this in remote villages where the rural economy is prevailing.**

**The draft animal power, today in the world, is offered by at least 200.000.000 working animals.**

**If all the work performed today, in the world, by the animal traction should be supplied by fuel engines, the parts per thousand of fossil CO<sub>2</sub> emitted in the atmosphere and the oil consumed - by any kind of engines and for any kind of transports and duties – should increase of a rough 5 per thousand.**

**The energy developed by working animals is a percentage of 1.4% of all the renewable energies produced in the world**

# The technological assessment

**An original design of a, new, draft animal powered electric generator has demonstrated that a medium sized animal is capable to lift - up to a six meter distribution tower - at least 2500 liters of water per hour..**

**Videos are available in  
<http://www.wedap.eu/fl/videofl.html>**

**and in  
[www.wedap.eu/ii.html](http://www.wedap.eu/ii.html)**



# **The technological assessment**

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**These performances have been certified by an independent engineer and by an independent veterinarian during a test performed, in Italy in Crispiano, TA.**

**The test has been conducted within the framework of the Empowering a Billion Lives global competition, promoted by the IEEE, and prized as finalist in a awards ceremony, in March 2023, in Orlando in Florida.**

# The economic assessment

## The starting point

**There are large areas where the average monthly salary of the farmers is of approximately of 67,93 US\$, where the cost of fuel is of approximately of 1,43 US\$ per liter and where the draft animal power is still in use.**

**As an example five states hare here shown.**

TABLE 1						
	SALARY	FUEL	ASSESS	BUFFALOES	CATTLES	HORSES
BANGLADESH	\$ 59,76	\$ 1,13	=	725.000	23.935.000	=
MADAGASCAR	\$ 73,90	\$ 1,31	157	=	10.322.680	496
BURUNDI	\$ 105,00	\$ 1,56	=	=	1.077.539	=
SIERRA LEONE	\$ 63,00	\$ 1,52	=	=	700.000	438.219
MALAWI	\$ 38,00	\$ 1,60	5.613	=	3.848.948	87
AVERAGE	\$ 67,93	\$ 1,43				

# The economic assessment

**Many services, in remote villages, may require, usefully, less than 1 kW power.**

**Among these there are water pumping, grain milling, fruit squeezing and sieving, threshing and winnowing.**

**These services are now supplied only through the man labor.**



# The economic assessment

## kWh COST OF THE ELECTRICITY FROM DRAFT ANIMAL POWER

TABLE 2			
AVERAGE SALARY	\$ 67,93	\$ 67,93	67,93 €
ANNUAL SALARY	\$ 815,18	\$ 815,18	815,18 €
COST OF FEED OF 2 ANIMALS (estimated)	\$ 163,04	\$ 163,04	163,04 €
YEARLY COST OF THE TEAM	\$ 978,22	\$ 978,22	978,22 €
DAYS IN TRANSPORTS AND SOIL CULTIVATION	120	120	120
DAYS IN WATER LIFTING AND GRAIN MILLING	120	180	180
% PURCENTAGE ATTRIBUTABLE TO THE WATER LIFTING ETC.	50,00	60,00	30,00
COSTS ATTRIBUTABLE TO THE WATER LIFTING ETC.	\$ 489,11	\$ 586,93	293,47
YEARLY COST OF THE EQUIPMENT DEPRECIATED IN 10 YEAR	\$ 40,00	\$ 40,00	40,00
YEARLY COSTS: TEAM, EQUIPMENT IN ELECTRICAL GENERATION	\$ 529,11	\$ 626,93	333,47
HOURS PER DAY	6	6	6
kW OUTPUT	0,60	0,60	0,60
kWh OUTPUT: DAYS PER HOURS PER kW	432	648	648
COST PER kWh	\$ 1,22	\$ 0,97	0,51

# The economic assessment

## THE COST OF kWh, IN THE SAME AREAS, GENERATED WITH A FUEL ENGINE

TABLE 3				
MODEL	HONDA EU 10i	PRAMAC Pmi 1000	EINHELL TC- PG 10/E5	EINHELL TC- IG 1100
POWER kW	1,0	1,0	0,68	1,0
OPERATION POWER kW	0,9	0,425	0,45	0,7
TANK LITERS OIL	0,25			
TANK LITERS GASOLINE	2,1			
TANKS LITERS TOTAL	2,35	2,1	4	6,5
AUTONOMY HOURS	3,3	3,2	6,6	5,4
POWER OUTPUT WITHIN THE AUTONOMY kWh	2,97	1,36	2,99	3,60
FUEL CONSUMPTION PER HOUR	0,71	0,66	0,61	1,20
FUEL CONSUMPTION PER Kwh	0,79	1,54	1,34	1,81
COST OF FUEL PER LITER	\$ 1,43	\$ 1,43	\$ 1,43	\$ 1,43
COST OF FUEL PER kWh	\$ 1,13	\$ 2,20	\$ 1,91	\$ 2,57
AVERAGE COST OF kWh				\$ 1,95



# A economic assessment

## **DIMENSIONING OF A PHOTOVOLTAIC PLANT WITH THE SAME CAPACITIES OF A DRAFT ANIMAL POWERED ELECTRICITY GENERATOR**

TABLE 4		
<u>OUTPUT FROM A 2 ANIMALS DRIVEN ELECTRIC GENERATOR</u>		
Watts of power from a 2 animals driven generator	W	600
Operation hours per day	h	6
Wh/d output from the animal driven electric generator	Wh/d	3.600

<u>DIMENSIONING OF A PHOTOVOLTAIC PLANT WITH THE SAME CAPACITIES</u>		
Terms of comparison from the animal driven daily output	Wh/d	3.600
Sun irradiation as for well insolated areas		4
Basic Wp required (Wh per day/ sun irradiation)	Wp	900
Oversizing for no peak sun hours, Figure 12 of WB mentioned document		1,8
Oversized plant, as per Figure 12 of WB mentioned document	Wp	1.620
For 2 days storage, see paragraph 5.3.of WB mentioned document	d	2
Wp	Wp	3.240
Overall efficiency of the plant, see paragraph 5.1 of WB said document		0,774
Wp to have the same pumping services of an animal driven pump	Wp	4.186

# The economic assessment

As above, differently from the yearly cost of the animal driven electric generator - that can be of 333,47 US\$ - the yearly cost of a photovoltaic plant, with the same output, is estimated in 412,53 US\$

Calculation elaborated from:  
“Solar Pumping: The Basics”  
World Bank, 2018 Washington,  
DC

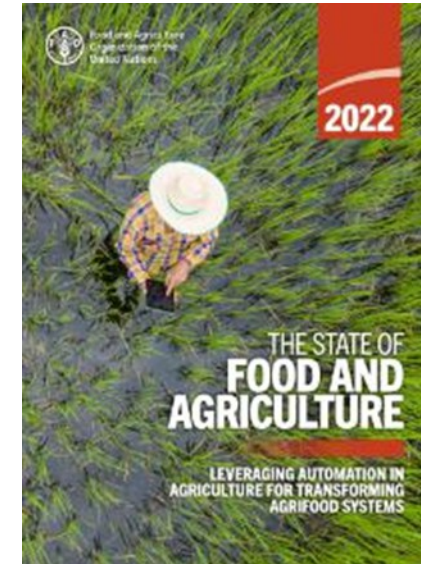
YEARLY COST OF A PHOTOVOLTAIC PLANT WITH THE SAME CAPACITY		
Modules costs for Wp (ex-factory- China)		\$ 0,20
Increase of cost from the factory to the assembler in the village		1,5
Cost of Wp delivered in the village		\$ 0,30
number of Wp required		4.186
Ex works photovoltaic modules cost		\$ 1.255,81
Masonry for the foundations		\$ 200,00
Frame and fences		\$ 400,00
Construction, assembly, installation and testing		\$ 400,00
Cables and fittings		\$ 100,00
Electrical components		\$ 250,00
<b>Gran Total</b>		<b>\$ 2.605,81</b>
YEARLY RATE FOR 15 YEARS DEPRECIATION RATE		\$ 212,53
MAINTENANCE AND INSURANCES		\$ 200,00
<b>YEARLY COST</b>		<b>\$ 412,53</b>

**Let remember that photovoltaic is not transportable, produce only in sunny hours and requires 100% foreign value**

# The framework

**The annual report of the FAO on the state of agriculture SOFA 2022, in page 45, among other says ..... *For the majority of African small-scale producers, the transition to animal draft power would mean a real progress...***

***..... In many cases, advanced manual tools and animal traction are probably the best options for increasing power supply....***



# Conclusions



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