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MICRO HYDROELECTRIC POWER: FEASIBILITY OF A DOMESTIC PLANT RENATA ARCHETTI

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ABSTRACT

The article provides an analysis of the technical and economic feasibility of a small hydroelectric power plant for domestic use (micro-hydro), how it can be implemented in Prignano sulla Secchia (MO, Italy). The required data and information on the duration of the waste curve are recovered here directly and indirectly methods.

KEYWORDS: *water flow rate, generator, water flow rate, electricity.*

The problem of resource delivery and climate change, however, ratification of the world-renowned Kyoto Protocol [8]. Through this protocol, each participating state undertakes its commitment to reduce emissions of pollutants, the most responsible for climate change. This includes the use of incentive policies for renewable energy sources. Renewable energy sources can produce energy without sacrificing natural resources. Demirbas [4] has now emphasized the role of hydropower over other renewable sources such as wind, solar and biomass due to some important advantages of hydropower.

This typically involves a lower cost compared to equal power, higher reliability, and energy of the installation, and more intensity and consistency over time.

Currently, hydropower is the largest renewable resource at the national and global levels [9]. In 2005, in Italy, energy from hydropower plants met 10.7% of domestic energy needs and 72% of energy sources from renewable sources (Power Services Management, GSE [5]. Currently, hydropower technologies have reached full maturity in the field and after almost two centuries of exploitation, the use of water for industrial purposes has almost reached its technical limit [3].

Hydroelectric power stations in our country have already been built in the last century and water sources have been exploited and they are still working, confirming the renewal of the resource. In recent years, we have witnessed the reopening of old miniatures plants that were previously economically unviable. Indeed, today renewable energy producers due to reduced tariffs are offered green certificates and "energy sales" convention, and due to the cheapness of electronic equipment now has a generally lower impact on the budget than in the past, hydropower plants also Small and medium-sized plants can be a source of great economic income. While traditional wisdom regarding hydropower plants is of great importance in the first place, it is very well applied in plants equipped with reservoirs and in hydraulic systems of hydropower generation from small to very small irrigation canals and water currents [10]. This will not be a big innovation in the use of hydropower, but in recent years has begun to show itself as a possible direction of investment.

Since there is not always time to produce a water flow system that corresponds to that water flow, it has become customary to connect the existing system to an electrical distribution network (e.g., [7], [1]). This makes it better and easier to manage the plant, but the disadvantages of having to sell energy to the national manager at the price they set. These ideas apply to private hydropower plants in general, but play a crucial role in the economic evaluation of the system, as discussed in the example here.

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In recent years, the purchase price of energy produced from renewable sources has been set by national governments for most of the member states of the European Community. These governments have become aware of the environmental benefits of these resources. Prices are set by setting a guaranteed minimum amount. [11]. In Italy, as in other European countries, the legislation is constantly changing. Currently, the reference standard for renewable energy devices is the decree "On the promotion of electricity generation from renewable sources", which was repealed on 18/12/2008, 24/10/2005. is called the decree of the government and defines new methods of production. state benefits.

The purpose of this article is to assess the feasibility and affordability of a micro-hydroelectric power plant (installed capacity less than 100 kW) for domestic use. In this study, the author looked at a stream unofficially known as the Cunettone, which runs through the city of Modena Apennines Saltino. The article focuses on the analysis of various scenarios for the implementation of economic and planning changes in recent legislation.

This study examines one of the smaller streams that cross the Saltino region, Secchia Prignano in the province of Modena, on the right bank of the Secchia River. The question of flow was that the area, especially the part that crosses the city, was covered with concrete steps as a result of large landslides that affected the 70s. The width of the channel is about 60 cm (see Figure 1). The distance between the receiving and discharging area is 106.83 meters, the straight line and the vertical distance (head) is 25.31 meters (Figure 1).

Figure 1. Leakage location. The receiver is 360 meters high and the turbine is 334 meters high.

The flow pipe in the section under consideration is made of concrete with a regular trapezoidal figure. This feature offered to take a ready - made metal box at a low price on a mobile phone, as shown in Figure 2.

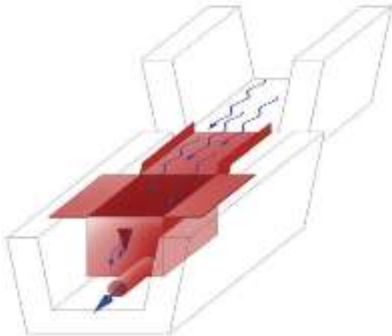

Figure 2. Mobile, low-cost metal box used for reception.

Certain advantages can be achieved with this design solution: - limited environmental impact acceptance does not require excavation and new construction work, does not change the availability of structures and can always be removed to restore it to its original state, and any maintenance can be very easily accomplished.

The storage tank is equipped with a strainer that allows excess water to be measured through the turbines or a flow reading available in the event of a machine failure. At the top of the tank is a metal fence for the following protection: to catch the coarse debris transported by the stream to prevent the risk of injury to people or animals.

The feasibility study for a hydropower plant, albeit a small one, requires information on available water resources to assess the plant’s potential energy production. The flow duration curve of the stream is derived from data published in the Italian journal Annals hydrology. The problem can be solved directly by using flow measurements made in a part of a river or by a stream that receives water from a

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source, or indirectly, by using rainwater flow models based on rainfall flow models.

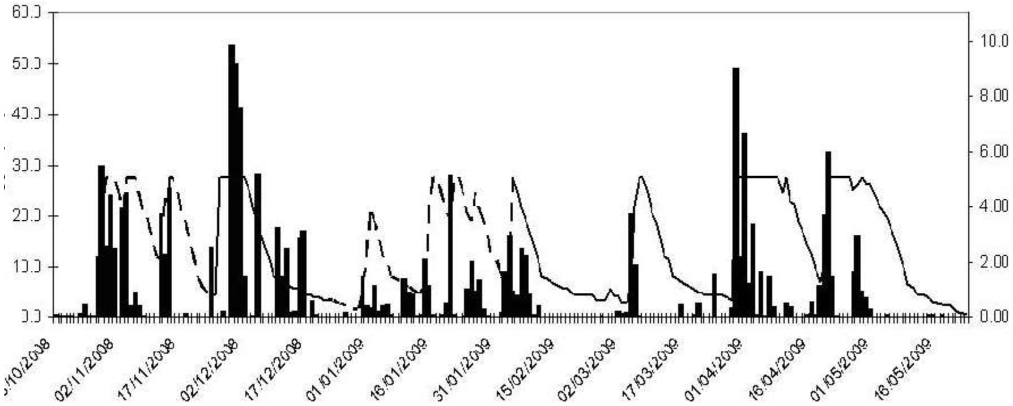
In the absence of any type of data in the basin under study, or in the absence of any information on the hydrology of the Cunettone River, some flow measurements have been made for this purpose. it was decided to do it with the device removed and adjusted. Output measurements were made by reading a triangular porous level built into the portable container wall. The maximum and minimum readable levels made it possible to measure flow rates of 5 l / s and 0.5 l / s. Measurements were performed once a day in two periods: a) November 24, 2008 to December 22, and b) February 8, 2009 to May 23, 2009. At the end of the measurement campaigns, 134 discharge data samples were taken.

An empirical model was used to allow the relationship between rainwater to be restored to fill the sample all year round. The results were confirmed by daily precipitation data recorded at the nearest rain gauge (approximately 10 km from the Montefiorino River) and the corresponding measured flow.

Flood hydrographs were predicted after a rain event recorded by a rain gauge on March 4 and 5, 2009. Details are described in Archetti et al., 2010.

From this analysis, it can be seen that the river also collects water from the soil, a very important feature that guarantees the production of the plan even in very dry conditions.

The described hydrograph was used to drain water even when there was no direct data, only when there was information about rain.



The results are shown in Figure 3.

The data covered the period from 18 October 2008 to 23 May 2009; the summer period was canceled because the river water was below 0.5 l / s or too short to operate the hydroelectric.

The current duration curve required to implement a mini hydropower plant (Figure 4) is shown in Figure 4.

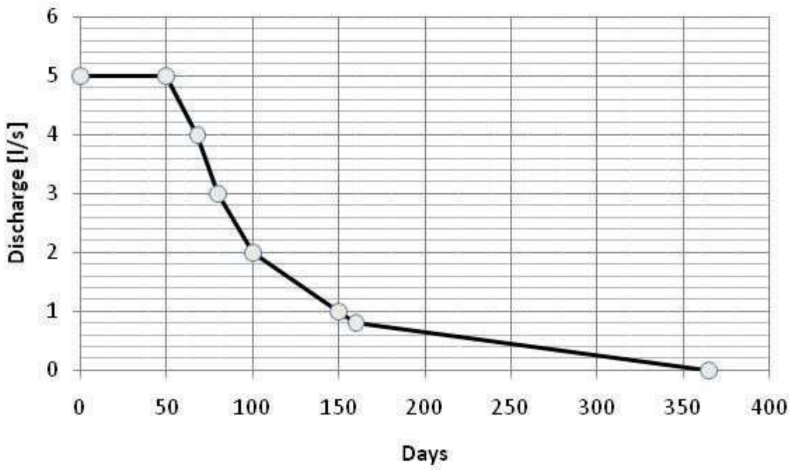


Figure 4. Current duration curve.

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Many technical choices are determined by the reduction in the waste current supplied by the currents and the resulting low size of the power plant. In particular, only Pelton or Turgo turbines are capable of operating with a head the size of the factory head described here [11]. It was decided to use polyethylene pipes in the design of the plant because they correspond to the low values of waste as in the analyzed case. They are also used for water supply and agricultural irrigation systems. This choice was ensured by the low cost and relative ease of installation of these types of pipes and the low maintenance required by them.

Various solutions and combinations of pipes, turbines and tanks were analyzed to determine the most convenient. In particular, the following alternatives were considered:

• systems with or without storage;

• Ability to sell the generated energy directly to the grid or use the energy for their own needs.

For each of the 4 project hypotheses (Table 2), costs, profitability, and depreciation periods were calculated to determine the profitability of the local plant. The analysis of the first hypothesis is described in more detail, and only the results are given for the remaining three.

In the first hypothesis, the plan uses an existing charge flowing through a water system using a Pelton turbine permanently connected to a magnetic generator, which powers a permanent inverter connected to the national grid. Feasibility study The economic benefits of renewable energy sources (green certificates) is analyzed through an agreement called "network sales" taking into account the efficiency and is 0.22 euros per kilowatt hour produced. For each combination of discharge-pipe diameters (D = 63mm, D = 90mm, and D = 110mm), the net effective head simulation was simulated, taking into account the flow-duration curve in Figure 4 as input data. , the results are summarized in Figure 5. The power plant was calculated by multiplying the number of working days expected per year. Of course, the power increases as the current increases, but the days of being charged decrease. The maximum amount of energy produced can be increased from 3 l / s to 4 l / s for a diameter of 110 mm. In fact, the pipe diameter (DN) D = 90 mm was chosen because the advantages in terms of power generation for the largest diameters were very small compared to the cost of building the plan with larger pipes.

The second hypothesis of the project is to exploit the existing waste through a plant with a small storage tank with a capacity of 2 m3 to obtain the minimum discharge regulation sent to the turbine. It is planned to use two Pelton turbines (one with a flow rate of 1 l / s and a flow rate of 5 l / s) connected axially by the same permanent magnetic generator that powers the permanent electric inverter connected to the national grid. . In this scheme, the turbine can generate energy continuously for the previous state. This scheme allows users to maximize the performance of the turbines, but at a more expensive construction cost.

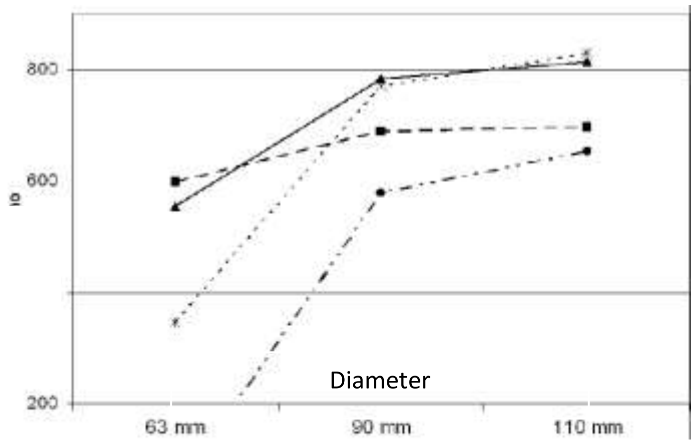

Figure 5. Energy sources with the first design hypothesis. Waste: 1) ■ 2 l / s; 2) ▲ 3 l / s, 3) x 4 l / s and 4) ● 5 l / s.

In the third version of the project, the hydraulic structure is the same as in the first hypothesis, but the economic assessment is different: in fact, the tax benefits associated with the reconstruction in order to save energy were considered. This type of solution is often used for small wind turbines that consume less electricity to reduce the amount of energy received from the national grid. The final cost of electricity from the national grid for domestic utilities is, in fact, an average of 0.29 euros per kWh, which is higher than the price of the "sell to the grid" contract that has

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been considered so far. This is because the cost structure includes various taxes and operating expenses.

The fourth hypothesis of the project is to increase the jump head by placing the turbine generator downstream. The assessment of energy resources is the same as in the first solution; the additional costs of leasing farmland should be taken into account in the economic valuation.

Costs and financial analysis

For each of the 4 production hypotheses, costs, economic profitability, depreciation period were calculated to determine the profitability of the local plant [12], [13]. Costs are divided into initial costs to build the plant (for example, shown for the first solution in Table 1) and include maintenance costs of € 35.00 per year and costs incurred by the manager costs incurred. electrical services valued at € 30.00 per year.

Table 1. Estimation of costs for Hypothesis 1

Description	Quantity	Unit cost	Total(Jami)
			€
Turbine	1	150.00	150.00 €
Generator	1	450.00	450.00 €
Inverter	1	420.00	420.00 €
Polyethylene pipeline	120 m	5.42	650.00 €
Electric cable	150 m	0.36	54.00 €
Intake work		200.00	200.00 €

Description	Quantity	Unit cost	Total(Jami)
Outflow works		150.00	150.00 €
Small building		200.00	200.00 €
Laying of pipeline	120 m	4.00	480.00 €
Eletric connection	1	150.00	150.00 €
			2904.00 €
	Taxes	20 %	580.00 €
			3485.28 €

From a financial point of view, the different options are built according to the design parameters shown in Table 2 or for the initial cost, annual net profit, return on investment, payback period.

Table.2. Synthesis of annual net profit, return on investment for the 4 hypotheses considered.

	Use of energy produced	**Plant cost**	**Annual net profit**	**Return of investment**	**Amortization time**
First hypothesis	Selling to the network	3485,28 €	229,14 €	6,5 %	25 years
Second hypothesis	Selling to the network	4049,48 €	292,51 €	7,2 %	21 years
Third hypothesis	Own consumption	3605,28 €	262,05 €	7,3 %	8 years
Fourth hypothesis	Selling to the network.	4776,24 €	520,53 €	10,9%	12 year

CONCLUSIONS

In this study, four design solutions for the generation of hydropower from a small river in the Italian city of Appenin were analyzed and compared. Measured and intended for one year, river water is low (up to 12 l / s) but relatively high. The design hypothesis considered whether the energy produced could be consumed directly or whether it could be transferred to the energy operator through a "sell to the grid" contract. This is now possible due to new laws for renewable energy.

The most convenient solution among the considered solutions is the third one, which plans to use the existing flow through the water system using a Pelton turbine generator combined with a permanent magnet direct current that supports a parallel-connected inverter. directly home

This solution considers tax breaks related to redevelopment in order to save energy. With this solution, the investment will be depreciated over eight years. This solution also seems more independent of the technical solution because it does not require agreements with the electrical services manager and is not subject to the Renewable Energy Act, which can lead to unpredictable changes. Despite the initial investment, it is currently not financially viable because the depreciation period is too long. It is also true that during the energy crisis, the hydroelectric power plant, which cost several thousand euros, was built in conjunction with a large-scale work to improve energy efficiency.

In addition, given that energy costs may increase, then the payback period will be significantly reduced and the investment will be very profitable in the long run. However, the fact that the building in question consumes all the energy produced is already a good value for money. Finally, we can say that micro-hydro technology is not yet developed, but the time is not yet ripe to consider an attractive form of investment for individual investors who should expect an overall rise in energy prices and stabilization of incentives. Renewable energy policy.

REFERENCES

1. *Ackermann T, AnderssonG, e L Söder Tarqatilgan avlod: ta'rif. Elektr energiya tizimlarini tadqiq qilish 2001; 57: 195- 204.*
2. *ARPA Emiliya Romagna. Annali idrologici 2007 yil.*
3. *Kardinale A, e A Verdelli. Energia per l'industria in Italia 2008. F. Angeli, muharriri.*
4. *Demirbas A. Dunyoga e'tibor: gidroenergetika holati va kelajagi, energiya manbai, B qismi; 2007,2 (3): 237-242.*
5. *GSE (2008). Disciplina dello scambio sul posto. Regole tecniche, 1-nashr.*
6. *GSE (2009). Guida al conto energia. 3-nashr.*
7. *Xarvi A, e A Brown. Mikro-gidro dizayn qo'llanmasi: kichik hajmdagi suv quvvat sxemalari uchun qo'llanma. London, Buyuk Britaniya: Intermediate Technology Publ; 1993, p. 374. ISBN1853391034, 9781853391033.*
8. *A.A.Kuchkarov, X.A.Egamberdiyev,Sh.A.Muminov. Possibilities of getting electricity with the help of a small solar furnace.// EPRA Volume: 6 | Issue: 6 | June 2021*
9. *Kühtz S. Energia e sviluppo sostenibile: politiche e tecnologie. Rubettino, muharrir; 2005 yil.*
10. *Paish O. Kichik gidroenergetika: texnologiya va hozirgi holat. Qayta tiklanadigan barqaror energiya rev 2002; 6 (6): 537-556.*
11. *Penche C. Guida all'idroelettrico minore per un corretto approccio alla realizzazione di un piccolo impianto, ESHA; 1998 yil.*
12. *Узбеков М.О., Тухтасинов А.Г. Измерения температуры нагрева абсорбера солнечного воздухонагревательного коллектора // Universum: Технические науки : электрон. научн. журн. 2020. № 6(75). URL: http://213.159.213.14/ru/tech/archive/item/9604*
13. *Pongiluppi G. Strumenti matematici per le operazioni di stima nell'estimo civile. 2-nashr. Ed. Klyub; 2006 yil.*
14. *R.Aliyev, O.O.Bozarov, X.A.Egamberdieyv .Соплоли реактив гидротурбинали микро-гэсни лойиҳалаш ва асосий энергетик параметрлари. Scientific-technical journal (STJFerPI,ФарПИИТЖ,НТЖ ФерПИ, 2020,Т.24,спец.вып.№3)*