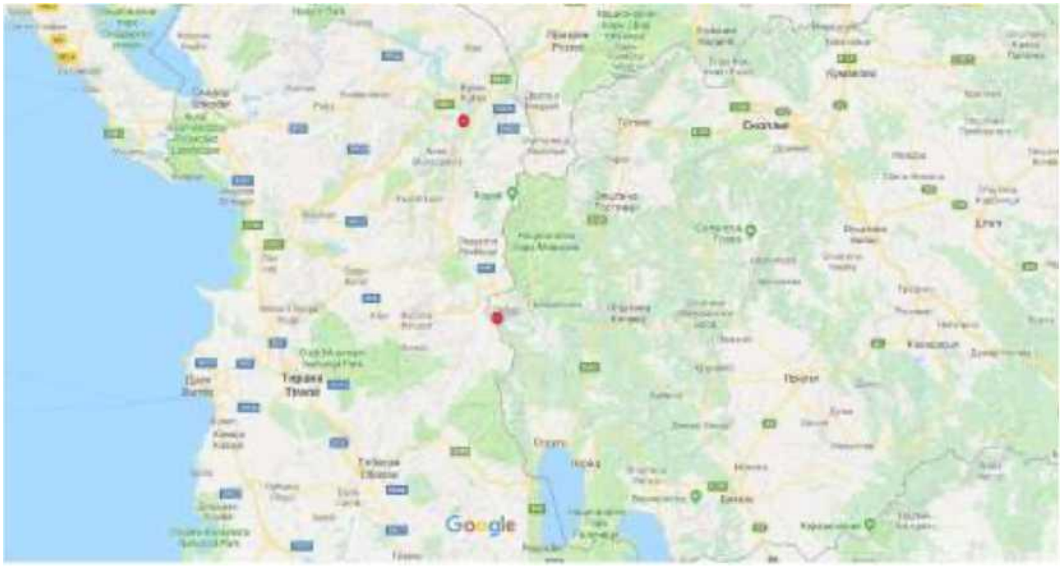
INNOVATIVE HYDRO POWER PLANTS IN ALBANIA

CHAPTER 1 RIVER CRNI DRIN – ALBANIA

2021

River Crni Drin – Albania



Crni Drin is formed at the exit of the Ohrid Lake, at an altitude og 693m.

At the upper river there are two hydro power plants with accumulations, HE Globocica and HPPCaves.

The existing accumulations will serve for the proposed new cascading hydro power plants.

The water level at the riverbed of the Crni Drin River below the dam at HPP Cave is 485 m.

The water level at the exit of HPP Cave is 482 m.

HE Caves installed power of 3 x 28 MW = 84 MW,

uses a 85 m water column,

uses water flow 3 x 36 = 108 m3 / s,

Annual electricity production 2000 = 377,000 MWh,

2003 = 378,000 MWh,

2004 = 448,000 MWh,

2005 = 426,000 MWh,

2006 = 424,000 MWh,

2007 = 356,000 MWh,

Proven hydro potential in the upper stream of the Crni Drin at HPP Cave, with installed 1 MW annual electricity generation is on average 4,000 to 5,000 MWh.

Future cascading hydro power plants may have a capacity of installing 1 MW to 1 m drop of riverbed.

There are many streams that flow into the river.

In the lower part of the river, there are 4 hydro power plants built.

The image shows the upper reservoir of Lake Fierz which has an altitude of 280 m.

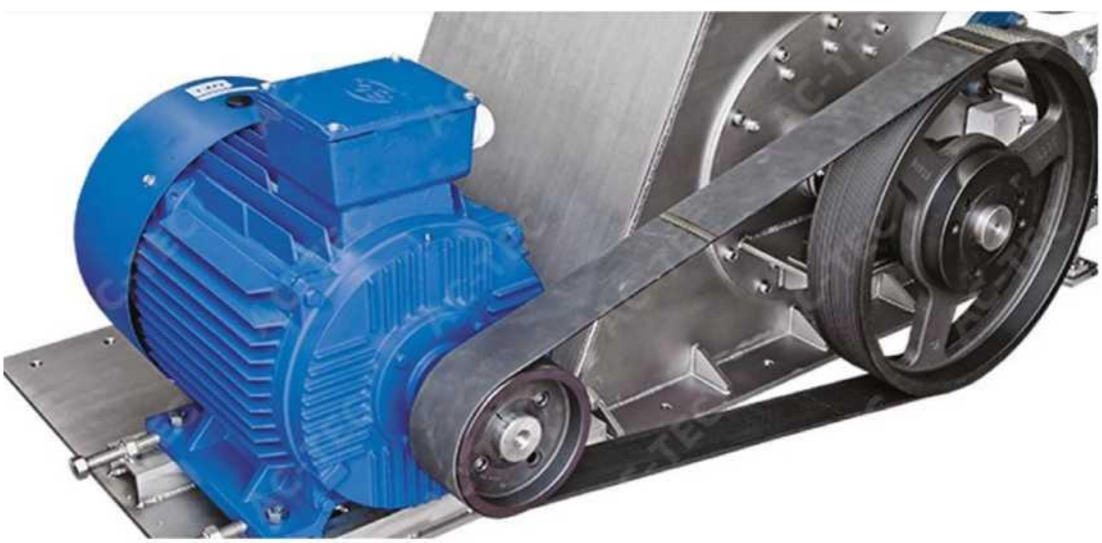
We have at our disposal unused potential of 200 m for setting 200 MW of cascading hydro power plants, At this section of the river Black Drim there would be 70 to 100 cascade hydropower plants The use a water column of 2 m to 4 m, accompanied by relief and elevation of riverbank, Cascading hydro power plant would have 3 turbines and 3 generators at one section of the riverbed The proven annual production of HPP Caves from the installed 84 MW with a water drop of 85 m is above 400,000 MWh The expected annual electricity production at this section of the riverbed with installed 200 MW cascade hydropower plants and a useful water drop of 200 m would be above 900,000 MWh.

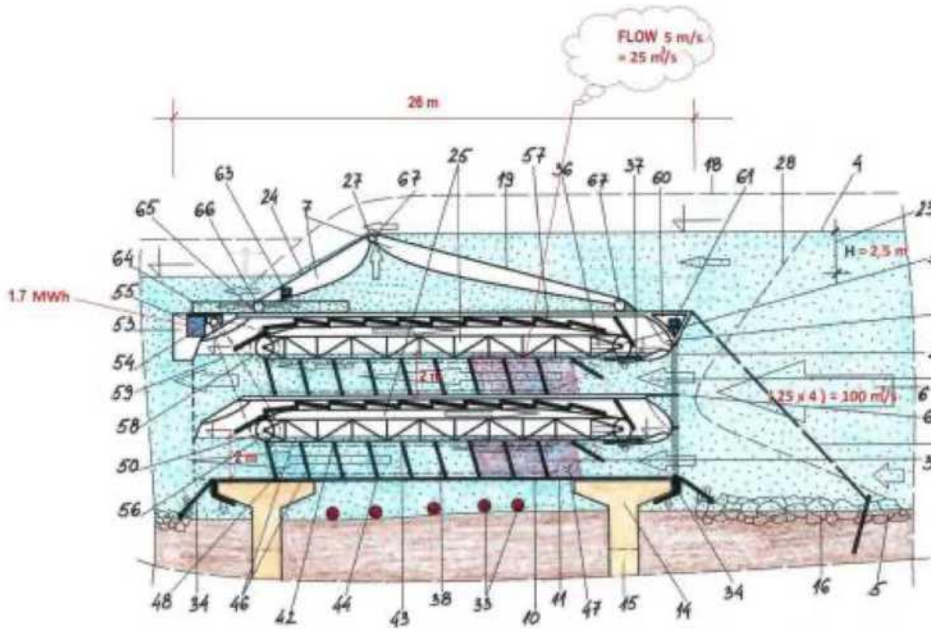
900.000 MWh x 60 euro/MWh = 54.000.000 euro/annually.

Construction of 200 MW cascading hydro power plant approximately 2 to 3 years.

The price of construction would be approximately 220,000,000 euros. Repayment of investment based on above model would be 4 to 5 years.

We will ustilise natural and existing materials for the construction.





In this solution, the hydropower plant can operate as local generator connected to a local power grid.

Production of electrical energy from cascading hydropower plant is realized in this way: Pylons (15) are fixed to the river bed (5), on them are laid band foundations (14). Two cascading turbines are interconnected (10) and laid on band foundations. (14).

Achieved water height difference “H” (23) creates pressure to cascading power plant. Regulators (20), gradually leak water (6) towards pipes (29) of the turbine with rate of inflowing water (6) Water (6) in pipes (29) accelerates, blades (38) of the turbine utilize it to convert to a mechanical energy. Pressure of trapped air (25) prevents water penetration (6). This way, flowing water (6) is directed thru pipe (29) of the turbine where is utilized on turbine blades (38).

The turbine blades (38) on return path are moving thru air almost without any undesirable environmental resistance. Direction of the movement of turbine blades (38) is achieved by “U” profiles (46) and guides (47). Such relation is balanced and stabilized with overflowing (27) water over barrier (19). In this way we accomplish stable RPM on electric energy generator (55).In total, pipes (29) have several times bigger volume than planned utilization of water flow (6) per second in the river.
This enables that water flow potential (6) is maximally utilized almost to the turbine standstill by using software control. When cascading plant is in operation, one can observe overflow of a small amount of water like a waterfall, while the majority of water is directed through the turbine. Casades are regulated by the building of an embankment made of metal net filled with local stone. Reduction is not necessary, energy is transferred directly to a generator shaft.

Wind generator	Cascading hydropower plant
Building cost approx. 1 million eur/MW	Building cost approx. 1 million eur/MW
Building place has potential, partly limited with favorable places where wind draft has variable direction and intensity	Building place has unutilized potential, at the moment there is no cuncurent technology for utilizing lowland rivers, technology is uniqe with utilization of steady intensity of water flow
No land acquiring, location is used with existing roads	No land acquiring, location is used with existing roads
Bird migration is disrupted, physically and by acoustical vibrations that influence people as well	Does not disrupt flora and fauna. Nature can undisturbedly flourish and develop with favorable water melioration.
Vibrations can damage material, wind generators are not protected from extreme winds that can tear blades and cause short circuit incineration of the generator plant.	Vibrations in water are dampened, overflow sound positive and has a relaxing influence on people. Flash floods do not influence the plant
Environment is not favorable for tourism industry	Environment is favorable for tourism, weekend zones and populated places with land melioration, sport activities and industrial zones as additional building project.
Has no additional economical effect but energy production	River bed is regulated for flash floods, cascades slow floods when needed, water flow can be sped up as required.
No additional economical effect, no possibility to store energy	Cascading plants situated in sequence/series can accumulate water during night for utilization over daytime.
Optimal and economical speed is above 6 m/s	Optimal and economical speed is above 3 m/s
Adding produced energy from series of locations	Adding produced energy from a series of locations or a single connection to a local electricity grid similar to gas generator.
Source of potential wind energy is variable in given time interval. It's more intense on the night when requirement for energy is less	Source of potential energy is constant, concentrated in daytime interval when requirements are greater
Yearly production with 1 MW plant is average 2.600 MWh, more by night.	Yearly production with 1 MW plant is average 2.600 MWh, more by day.
Yearly production on better locations with 1 MW is 3.000 MWh	Yearly production on better locations with 1 MW is 7.000 MWh if bank channels diminish part of water potential.
Lowest building cost is 1.000.000 eur per MW, If production is at rate of 2.600 MWh, investment has no economical effect, part of produced energy needs to be stored, results in economical loss.	Lowest building cost is 1.000.000 eur per MW, If production is at rate of 2.600 MWh, energy is momentarily transported to a consumer, cascading system accumulates energy by night, lowers danger from flash floods, creates better waterway, land melioration, improves ecology...

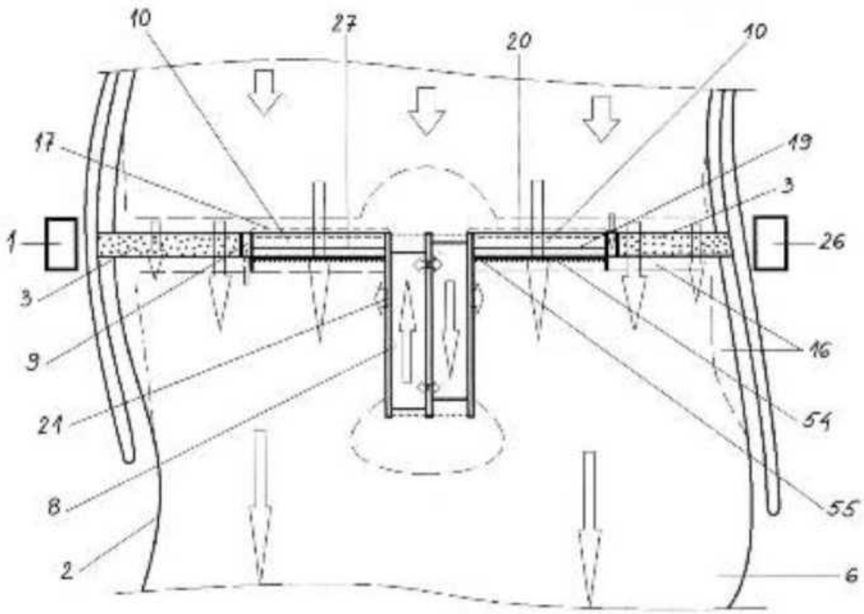
RELATION TABLE OF WATER FLOW AND ENERGY PRODUCTION ON SMALL AND MEDIUM RIVERS

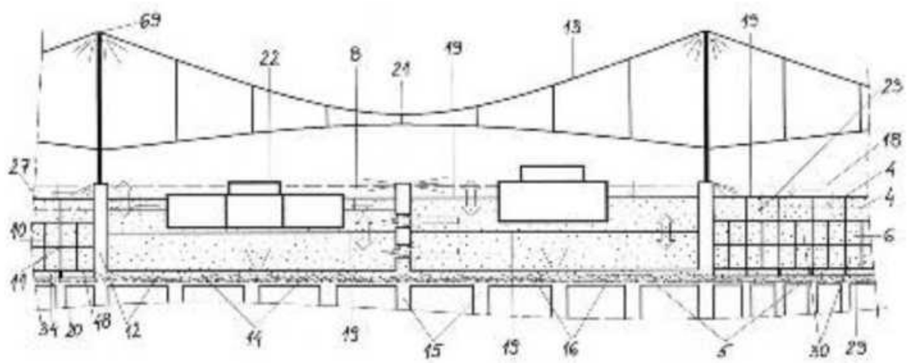
In proportion to the water flow in the observed river (m3/s) !

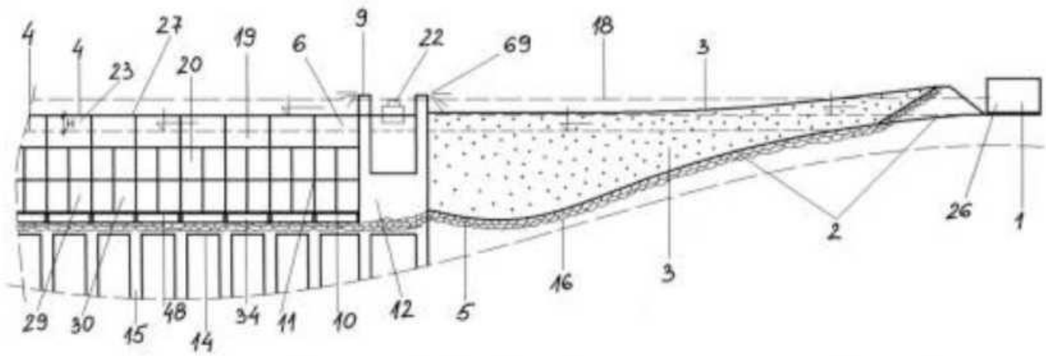
River water flow	Cascade height	1.5 m	2 m	2.5 m	3 m	3.5 m	4 m
5 (m^3/s)			70 kWh	87 kWh	105 kWh	122 kWh	140 kWh
10 (m^3/s)		105 kWh	140 kWh	175 kWh	210 kWh	245 kWh	280 kWh
20 (m^3/s)		210 kWh	280 kWh	350 kWh	420 kWh	490 kWh	560 kWh
30 (m^3/s)		315 kWh	420 kWh	525 kWh	630 kWh	735 kWh	840 kWh
40 (m^3/s)		420 kWh	560 kWh	700 kWh	840 kWh	980 kWh	1.420 kWh
50 (m^3/s)		525 kWh	700 kWh	875 kWh	1.050 kWh	1.225 kWh	1.400 kWh
60 (m^3/s)		630 kWh	840 kWh	1.050 kWh	1.260 kWh	1.470 kWh	1.680 kWh
70 (m^3/s)		735 kWh	980 kWh	1.225 kWh	1.470 kWh	1.715 kWh	1.960 kWh
80 (m^3/s)		840 kWh	1.120 kWh	1.400 kWh	1.680 kWh	1.960 kWh	2.240 kWh
90 (m^3/s)		945 kWh	1.260 kWh	1.575 kWh	1.890 kWh	2.205 kWh	2.520 kWh
100 (m^3/s)		1.050 kWh	1.400 kWh	1.750 kWh	2.100 kWh	2.450 kWh	2.800 kWh
150 (m^3/s)		1.575 kWh	2.100 kWh	2.625 kWh	3.150 kWh	3.675 kWh	4.200 kWh
200 (m^3/s)		2.100 kWh	2.800 kWh	3.500 kWh	4.200 kWh	4.900 kWh	5.600 kWh
250 (m^3/s)		2.625 kWh	3.500 kWh	4.375 kWh	5.250 kWh	6.125 kWh	7.000 kWh
300 (m^3/s)		3.150 kWh	4.200 kWh	5.250 kWh	6.300 kWh	7.350 kWh	8.400 kWh
400 (m^3/s)		4.20 MWh	5.60 MWh	7.00 MWh	8.40 MWh	9.80 MWh	11.20 MWh
500 (m^3/s)		5.25 MWh	7.00 MWh	8.75 MWh	10.50 MWh	12.25 MWh	14.00 MWh
600 (m^3/s)		6.30 MWh	8.40 MWh	10.50 MWh	12.60 MWh	14.70 MWh	16.80 MWh
700 (m^3/s)		7.35 MWh	9.80 MWh	12.25 MWh	14.70 MWh	17.15 MWh	19.60 MWh

A hydropower plant is installed with cascade height dependent on the relief of the river bed (m)!

Cascade hydroelectric power plant production in one-hour mode (kWh)!


10
27
20
10
17
19
3
1
26
3
9
16
21
54
8
55
2
6


69
22
8
21
19
13
19
23
18
4
4
27
10
6
11
34
20
48
12
14
19
15
15
16
5
30
29


4
4
27
23
20
19
6
9
22
69
18
3
26
1
2
3
16
5
12
10
11
34
14
48
15
30
29

True
Tesla
Technologies

Email: info@trueteslatechnologies.com

www.trueteslatechnologies.com