Sistem-mne d.o.o. ul. Slobode 78 81000 Podgorica | Tel/Fax.+382 20 215-250 Mob. 069 021 689
Žiro račun: ERSTE BANKA 540-5623-57 | PIB: 02919460 | PDV reg. br: 30/31-12057-7

STUDY ON UTILIZATION POSSIBILITIES OF RENEWABLE ENERGY SOURCES FOR KOTOR-CETINJE CABLE POWER SUPPLY

September 2015.

CRNA GORA
VLADA CRNE GORE
PORESKA UPRAVA
CENTRALNI REGISTAR PRIVREDNIH SUBJEKATA
U Podgorici, dana 12.03.2013.god.

Poreska uprava - Centralni registar privrednih subjekata u Podgorici, na osnovu člana 6 st. 1 i člana 21 i 22 Zakona o poreskoj administraciji ("Sl list RCG", br. 65/01 i 80/04 i "Sl list CG", br. 20/11), člana 83 i 86 Zakona o privrednim društvima ("Sl.list RCG", br.6/02 i "Sl.list CG", br. 17/07 ... 40/11), člana 196 Zakona o opštem upravnom postupku ("Sl. list RCG", br.60/03 i "Sl. list CG", br. 32/11) i člana 2 i 3 Upustva o radu Centralnog registra privrednih subjekata ("Sl.list CG", br.20/12), rješavajuci po prijavi za registraciju osnivanja **D.O.O. "SISTEM - MNE"ZA PROIZVODNJU, PROMET I USLUGE, EXPORT-IMPORT - PODGORICA** broj 197335 od 12.03.2013.god. podnosioca

Ime i prezime: Lucijana Luković
JMBG ili br.pasoša:1712991218002
Adresa:Omera Abdovića Br.11 - Podgorica

dana 12.03.2013.god. donosi

R J E Š E NJ E

Registruje se osnivanje **D.O.O. "SISTEM - MNE"ZA PROIZVODNJU, PROMET I USLUGE, EXPORT-IMPORT - PODGORICA**, SLOBODE 78 PODGORICA - registarski broj **5-0654236/ 001** .

Sastavni dio Rješenja je i Izvod iz Centralnog registra privrednih subjekata Poreske uprave.

Obrazloženje

Odlučujući po prijavi za upis osnivanja DRUŠTVO SA OGRANIČENOM ODGOVORNOŠĆU **SISTEM - MNE** , utvrđeno je da su ispunjeni uslovi iz čl. 83 i 86 Zakonom o privrednim društvima ("Sl.list RCG", br.6/02 i "Sl.list CG", br. 17/07 ... 40/11) i člana 2 i 3 Uputstva o radu Centralnog registra privrednih subjekata ("Sl.list CG", br.20/12) za osnivanje **SISTEM - MNE** , pa je odlučeno kao u izreci Rješenja.

M. P.

Ovlašćeno lice
Milo Paunović

Pravna pouka:
Protiv ovog rješenja može se izjaviti žalba Ministarstvu finansija CG u roku od 15 dana od dana prijema rješenja. Žalba se predaje preko ovog organa i taksira administrativnom taksom u iznosu od 8,00 €, shodno Tarifnom broju 5 Taksene tarife za administrativne takse.
Taksa se uplaćuje u korist računa broj 832-3161-26-Administrativna taksa.

Crna Gora

IZVOD IZ CENTRALNOG REGISTRA PRIVREDNIH SUBJEKATA PORESKE UPRAVE

Registarski broj **5-0654236/ 001** Datum registracije: 12.03.2013
Matični broj **02919460**

D.O.O. "SISTEM - MNE"ZA PROIZVODNJU, PROMET I USLUGE, EXPORT-IMPORT - PODGORICA

Datum zaključivanja ugovora: 11.03.2013
Datum donošenja Statuta: 11.03.2013 Datum izmjene Statuta:
Adresa obavljanja djelatnosti: SLOBODE 78 Mjesto: PODGORICA
Adresa za prijem službene pošte: SLOBODE 78 Sjedište: PODGORICA
Pretežna djelatnost: 7112 Inženjerske djelatnosti i tehnicko savjetovanje
Obavljanje spoljno-trgovinskog poslovanja:
x da ne
Oblik svojine:
x bez oznake svojine društvena privatna zadružna dva ili više oblika svojine državna
Porijeklo kapitala:
bez oznake projekla kapitala x domaći strani mješoviti
Upisani kapital: 1.00€
(Novčani 1.00 , nenovčani .00)

Osnivači
Ime i prezime/Naziv: **JASNA RADOVIĆ-3004971285016**
Adresa: PODGORICA

Udio: 100%
Uloga: Osnivač

Lica u društvu
Ime i prezime: **Ljubiša Bošković - 1309973280028**
Adresa: UL. MOSKOVSKA BR. 91 PODGORICA
Izvršni direktor - neograniceno( )
Pojedinačno- ( )

Ovlašćeni zastupnik - neograniceno( )
Pojedinačno- ( )

Izdato 14.03.2013.god.

Ovlašćeno lice
Milo Paunović

CRNA GORA
VLADA CRNE GORE
PORESKA UPRAVA
Područna jedinica Podgorica
Broj: 30-01-16605-8
PODGORICA, 15.03.2013. godine

Na osnovu člana 6 stav 1 Zakona o objedinjenoj registraciji i sistemu izvještavanja o obračunu i naplati poreza i doprinosa ("Sl.list RCG", br. 29/05 i "Sl.list CG", br. 75/10), člana 27 stav 3 Zakona o poreskoj administraciji ("Sl.list RCG", br. 65/01 i 80/04 i "Sl.list CG", br. 20/11 i 28/12) i člana 207 Zakona o opštem upravnom postupku ("Sl.list RCG", br. 60/03 i "Sl.list CG", br. 32/11) Poreska uprava, d o n o s i

RJEŠENJE O REGISTRACIJI

Upisuje se u registar poreskih obveznika:

Naziv: D.O.O. "SISTEM - MNE" ZA PROIZVODNJU, PROMET I USLUGE, EXPORT - IMPORT - PODGORICA

PODGORICA

Poreskom obvezniku se dodjeljuje:

PIB 02919460 302

(Matični broj) (Šifra područne jedinice poreskog organa)

Datum upisa u registar: 15.03.2013. godine.

Poreski obveznik je dužan da obavijesti poreski organ o svim promjenama podataka iz registra poreskog obveznika (član 33 Zakona o poreskoj administraciji) u roku od 15 dana od dana nastanka promjene.

Uputstvo o pravnom sredstvu: *Protiv ovog Rješenja može se izjaviti žalba Ministarstvu finansija CG - Odsjek za drugostepeni poreski i carinski postupak, u roku od 15 dana od dana prijema Rješenja. Žalba se predaje preko ove Područne jedinice i taksira administrativnom taksom u iznosu od 8,00 €, shodno Tarifnom broju 5 Taksene tarife za administrativne takse. Taksa se uplaćuje u korist računa broj 832-3161-26 - Administrativna taksa.*

M.P.

Crna Gora PORESKA UPRAVA PODGORICA

PORESKI INSPEKTOR I

Ljiljana Pavković

CRNA GORA
VLADA CRNE GORE
PORESKA UPRAVA
Područna jedinica Podgorica
BROJ: 30/31-12057-7
PODGORICA, 15.03.2013. godine

Na osnovu člana 55. Zakona o porezu na dodatu vrijednost ("Sl.list RCG", broj 65/01… 04/06 i "Sl.list CG", broj 16/07) i člana 207. Zakona o opštem upravnom postupku ("Sl.list RCG", broj 60/03 i "Sl.list CG", br. 32/11) Poreska uprava, donosi

Rješenje o registraciji za PDV

Upisuje se u registar obveznika za PDV:

Naziv ***D.O.O. "SISTEM - MNE" ZA PROIZVODNJU, PROMET I USLUGE, EXPORT - IMPORT - PODGORICA***

PODGORICA

PIB ***02919460*** ***302***
(Šifra područne jedinice poreskog organa)

Obvezniku se dodjeljuje PDV registracioni broj: ***30/31-12057-7****.*

Svojstvo obveznika za PDV se stiče: ***15.03.2013.*** *godine.*

Poreski obveznik je dužan da obavijesti poreski organ o izmjeni i prestanku obavljanja djelatnosti za koju je obavezan da obračunava i plaća PDV.

Crna Gora PORESKA UPRAVA PODGORICA

M.P.

PORESKI INSPEKTOR I

Ljiljana Pavković

UNIQA

PREPIS IZVORNE ISPRAVE

Broj polise:	**6-13035**
Zamjena polise:	9399
Vrsta osiguranja:	Opšta odgovornost
Šifra osiguranja:	1301
Poslovna jedinica:	Direkcija
Saradnički broj:	535930
Mjesto:	Podgorica
Datum:	04.03.2014

POLISA
ZA OSIGURANJE OD ODGOVORNOSTI

Ugovarač osiguranja: **Sistem - MNE, 81000 Podgorica, Ul. Slobode 78**
PIB:02919460- Matični broj:""

Osiguranik: **Sistem - MNE, 81000 Podgorica, Ul. Slobode 78**
PIB:02919460- Matični broj:""

Početak osiguranja:	22.3.2014	Prestanak osiguranja:	22.3.2015	Dospijeće:	22.03
Tarifa i tarifna grupa:	XI	Suma osiguranja:	5.000,00	Premija osiguranja:	114,25

Osiguranje je zaključeno prema priloženim uslovima: Opšti uslovi za osiguranje od odgovornosti. Posebni uslovi za osiguranje od opšte odgovornosti. Posebni uslovi za osiguranje od profesionalne odgovornosti i odgovornosti za proizvode sa manom.
Osiguranik potvrđuje da je kod zaključenja ovog ugovora primio naznačene uslove.

Redni broj	Osigurava se	Suma osiguranja (€)	Ukupan limit za trajanje osiguranja	Premija osiguranja (€)
1	Opšte odgovornosti - razne delatnosti Zakonska građansko-pravna odgovornost za štete usled smrti,povrede tijela ili zdravlja pričinjene trećim licima i njihovim stvarima.Ovim osiguranjem pokrivena je profesionalna odgovornost iz djelatnosti. Suma osiguranja 5.000 EUR Agregatni godišnji limit 5.000 EUR Učešće u svakoj šteti 10%,minimum 100 EUR	5.000,00	5.000,00	114,25
	Ukupno:			114,25

PREMIJA OSIGURANJA	114,25
Porez:	10,28
UKUPNO ZA UPLATU:	124,53

Premija osiguranja 124,53 € obračunata za period od 22.03.2014 do 22.03.2015 plaća se prema ispostavljenoj fakturi.

Osiguravač zadržava pravo ispravke računskih i drugih grešaka saradnika.Ugovarač osiguranja je saglasan da osiguravač može vršiti obradu ličnih podataka koje pribavi po osnovu ovog ugovora o osiguranju, kao i da iste može proslediti na obradu povezanom pravnom licu, odnosno pravnom licu angažovanom u cilju obavljanja poslova koji su u vezi sa predmetnim ugovorom o osiguranju.

Za Osiguravača

M.P. AKCIONARSKO DRUŠTVO ZA OSIGURANJE PODGORICA UNIQA NEŽIVOTNO OSIGURANJE 1

M.P. D.O.O. za proizvodnju, promet i usluge, export-import "SISTEM-MNE" PODGORICA

Za Ugovarača

UNIQA neživotno osiguranje A.D.
Ul. Svetlane Kane Radević 3,
81000 Podgorica; PIB broj: 02717557
Internet: www.uniqa.me

Tel: +382 (0)20 444 700
Fax: +382 (0)20 244 340
GSM: +382 (0)67 201 449
E-mail: info@uniqa.me

INŽENJERSKA KOMORA CRNE GORE
ENGINEERS CHAMBER OF MONTENEGRO

Broj:01-265/2
Podgorica, 22.03.2013. godine

Inženjerska komora Crne Gore rješavajući po Zahtjevu privrednog društva „SISTEM - MNE" d.o.o. iz Podgorice, za izdavanje licence za izradu tehničke dokumentacije, na osnovu člana 134 Zakona o uređenju prostora i izgradnji objekata ("Sl. list CG", br. 51/08 i 34/11), čl.8 Pravilnika o načinu i postupku izdavanja i oduzimanja licence i načinu vođenja registra licenci ("Sl. list CG", br. 68/08), člana 196 Zakona o opštem upravnom postupku ("Sl. list RCG", br. 60/03), člana 1 Uredbe o povjeravanju dijela poslova Ministarstva održivog razvoja i turizma, Inženjerskoj komori Crne Gore, br. 06-1016/4 ("Sl. list CG", br. 30/12), donosi

R J E Š E NJ E

Izdaje se

L I C E N C A
za izradu tehničke dokumentacije

Za izradu, PROJEKATA MAŠINSKIH POSTROJENJA, UREĐAJA I INSTALACIJA KAO I POSTROJENJA ZA EKSPLOATACIJU ALTERNATIVNIH IZVORA ENERGIJE (voda, sunce, vjetar), Privrednom društvu **„SISTEM- MNE" d.o.o. iz Podgorice.**

Licenca se izdaje na period od pet godina.

OBRAZLOŽENJE

Inženjerska komora Crne Gore postupajući po Zahtjevu br. 03-265 od 21.03.2013. godine, koji je podnesen u ime privrednog društva „SISTEM - MNE" d.o.o. iz Podgorice, za utvrđivanje ispunjenosti uslova za sticanje licence za izradu tehničke dokumentacije, na osnovu člana 83. Zakona o uređenju prostora i izgradnji objekata ("Sl.list CG", br.51/08 i 34/11) i člana 8 Pravilnika o načinu i postupku izdavanja i oduzimanja licence i načinu vođenja registra licenci ("Sl. list CG", br. 68/08), utvrdila je da:

- privredno društvo posjeduje Potvrdu o registraciji kod Centralnog registra Privrednog Suda reg.br. 5-0654236/001, za – inženjerske djelatnosti i tehničko savjetovanje;
- ima u radnom odnosu odgovornog projektanta – Ljubišu B. Boškovića, dipl.inž.maš.;
- ispunjava uslove za sticanje tražene licence.

Na osnovu izloženog, odlučeno je kao u dispozitivu ovog Rješenja.

Uputstvo o pravnom sredstvu: Protiv ovog rješenja može se izjaviti žalba Ministarstvu održivog razvoja i turizma u roku od 15 dana od dana prijema rješenja, preko Stručne službe Inženjerske komore Crne Gore.

Službeno lice:
Mirjana Bučan, dipl. pravnik

PREDSJEDNIK KOMORE
Prof. dr Branislav Glavatović, dipl.inž.geol.

Dostavljeno:
- Podnosiocu zahtjeva;
- U spise predmeta;
- Ministarstvu održivog razvoja i turizma;
- a/a

Broj:01-275/2
Podgorica 29.03.2013. godine

Inženjerska komora Crne Gore, rješavajući po Zahtjevu privrednog društva "SISTEM-MNE" d.o.o. iz Podgorice, za izdavanje licence za građenje objekata, na osnovu člana 134 Zakona o uređenju prostora i izgradnji objekata ("Sl. list CG", br. 51/08 i 34/11), čl.10 Pravilnika o načinu i postupku izdavanja i oduzimanja licence i načinu vođenja registra licenci ("Sl. list CG", br. 68/08), člana 196 Zakona o opštem upravnom postupku ("Sl. list RCG", br. 60/03), člana 1 Uredbe o povjeravanju dijela poslova Ministarstva održivog razvoja i turizma, Inženjerskoj komori Crne Gore, br. 06-1016/4 ("Sl. list CG", br. 30/12), donosi

R J E Š E NJ E

Izdaje se

L I C E N C A
za građenje objekata

Za izvođenje RADOVA NA MAŠINSKIM POSTROJENJIMA, UREĐAJIMA I INSTALACIJAMA I NA POSTROJENJIMA ZA EKSPLOATACIJU ALTERNATIVNIH IZVORA ENERGIJE (voda, sunce, vjetar), Privrednom društvu "**SISTEM-MNE" d.o.o. iz Podgorice.**

Licenca se izdaje na period od pet godina.

O B R A Z L O Ž E NJ E

Inženjerska komora Crne Gore postupajući po Zahtjevu br.03-275 od 25.03.2013.godine, koji je podnesen u ime "SISTEM-MNE" d.o.o. iz Podgorice, za utvrđivanje ispunjenosti uslova za sticanje licence za građenje objekata, na osnovu člana 106. Zakona o uređenju prostora i izgradnji objekata ("Sl. list CG", br.51/08 i 34/11) i čl.10.Pravilnika o načinu i postupku izdavanja i oduzimanja licence i načinu vođenja registra licenci ("Sl. list CG", br 68/08), utvrdila je da:

- privredno društvo posjeduje Potvrdu o registraciji kod Centralnog registra Privrednog Suda reg.br. 5-0654236/001, za djelatnost – izgradnja ostalih građevina na drugom mjestu nepomenutih;
- ima u radnom odnosu odgovornog inženjera – Ljubišu B. Boškovića, dipl.inž.maš;
- ispunjava uslove za sticanje tražene licence.

Na osnovu izloženog, odlučeno je kao u dispozitivu ovog Rješenja.

Uputstvo o pravnom sredstvu: Protiv ovog rješenja može se izjaviti žalba Ministarstvu održivog razvoja i turizma u roku od 15 dana od dana prijema rješenja, preko Stručne službe Inženjerske komore Crne Gore.

Službeno lice:
Mirjana Bučan, dipl. pravnik

PREDSJEDNIK KOMORE
Prof. dr Branislav Glavatović, dipl.inž.geol.

Dostavljeno:
-Podnosiocu zahtjeva;
-U spise predmeta;
-Ministarstvu održivog razvoja i turizma;
-a/a

INŽENJERSKA KOMORA CRNE GORE
ENGINEERS CHAMBER OF MONTENEGRO

Broj:01-384/2
Podgorica, 24.03.2014. godine

Inženjerska komora Crne Gore rješavajući po Zahtjevu privrednog društva „SISTEM - MNE" d.o.o. iz Podgorice, za izdavanje licence za izradu tehničke dokumentacije, na osnovu člana 134 Zakona o uređenju prostora i izgradnji objekata ("Sl. list CG", br. 51/08 i 34/11), čl.8 Pravilnika o načinu i postupku izdavanja i oduzimanja licence i načinu vođenja registra licenci ("Sl. list CG", br. 68/08), člana 196 Zakona o opštem upravnom postupku ("Sl. list RCG", br. 60/03), člana 1 Uredbe o povjeravanju dijela poslova Ministarstva održivog razvoja i turizma, Inženjerskoj komori Crne Gore, br. 06-1016/4 ("Sl. list CG", br. 30/12), donosi

R J E Š E NJ E

Izdaje se

L I C E N C A
za izradu tehničke dokumentacije

Za izradu, PROJEKATA ARHITEKTURE OBJEKATA, PROJEKATA UNUTRAŠNJE ARHITEKTURE, PROJEKATA UNUTRAŠNJIH INSTALACIJA VODOVODA I KANALIZACIJE I PROJEKATA UREĐENJA TERENA, Privrednom društvu **„SISTEM- MNE" d.o.o. iz Podgorice.**

Licenca se izdaje na period od pet godina.

OBRAZLOŽENJE

Inženjerska komora Crne Gore postupajući po Zahtjevu br. 03-384 od 21.03.2014. godine, koji je podnesen u ime privrednog društva „SISTEM - MNE" d.o.o. iz Podgorice, za utvrđivanje ispunjenosti uslova za sticanje licence za izradu tehničke dokumentacije, na osnovu člana 83. Zakona o uređenju prostora i izgradnji objekata ("Sl.list CG", br.51/08 i 34/11) i člana 8 Pravilnika o načinu i postupku izdavanja i oduzimanja licence i načinu vođenja registra licenci ("Sl. list CG", br. 68/08), utvrdila je da:

- privredno društvo posjeduje Potvrdu o registraciji kod Centralnog registra Privrednog Suda reg.br. 5-0654236/001, za – inženjerske djelatnosti i tehničko savjetovanje;
- ima u radnom odnosu odgovornog projektanta – Marka M. Radonjića, dipl.inž.arh.;
- ispunjava uslove za sticanje tražene licence.

Na osnovu izloženog, odlučeno je kao u dispozitivu ovog Rješenja.

Uputstvo o pravnom sredstvu: Protiv ovog rješenja može se izjaviti žalba Ministarstvu održivog razvoja i turizma u roku od 15 dana od dana prijema rješenja, preko Stručne službe Inženjerske komore Crne Gore.

Službeno lice:
Mirjana Bučan, dipl. pravnik

PREDSJEDNIK KOMORE
Prof. dr Branislav Glavatović, dipl.inž.geol.

INŽENJERSKA KOMORA CRNE GORE PODGORICA

Dostavljeno:
- Podnosiocu zahtjeva;
- U spise predmeta;
- Ministarstvu održivog razvoja i turizma;
- a/a

Broj:01-245/3
Podgorica, 25.02.2014. godine

Inženjerska komora Crne Gore rješavajući po Zahtjevu privrednog društva „SISTEM - MNE" d.o.o. iz Podgorice, za izdavanje licence za izradu tehničke dokumentacije, na osnovu člana 134 Zakona o uređenju prostora i izgradnji objekata ("Sl. list CG", br. 51/08 i 34/11), čl.8 Pravilnika o načinu i postupku izdavanja i oduzimanja licence i načinu vođenja registra licenci ("Sl. list CG", br. 68/08), člana 196 Zakona o opštem upravnom postupku ("Sl. list RCG", br. 60/03), člana 1 Uredbe o povjeravanju dijela poslova Ministarstva održivog razvoja i turizma, Inženjerskoj komori Crne Gore, br. 06-1016/4 ("Sl. list CG", br. 30/12), donosi

R J E Š E NJ E

Izdaje se

L I C E N C A

za izradu tehničke dokumentacije

Za izradu PROJEKATA GRAĐEVINSKIH KONSTRUKCIJA ZA OBJEKTE VISOKOGRADNJE, Privrednom društvu **„SISTEM- MNE" d.o.o. iz Podgorice.**

Licenca se izdaje na period od pet godina.

OBRAZLOŽENJE

Inženjerska komora Crne Gore postupajući po Zahtjevu br. 03-245/1 od 24.02.2014. godine, koji je podnesen u ime privrednog društva „SISTEM - MNE" d.o.o. iz Podgorice, za utvrđivanje ispunjenosti uslova za sticanje licence za izradu tehničke dokumentacije, na osnovu člana 83. Zakona o uređenju prostora i izgradnji objekata ("Sl.list CG", br.51/08 i 34/11) i člana 8 Pravilnika o načinu i postupku izdavanja i oduzimanja licence i načinu vođenja registra licenci ("Sl. list CG", br. 68/08), utvrdila je da:

- privredno društvo posjeduje Potvrdu o registraciji kod Centralnog registra Privrednog Suda reg.br. 5-0654236/001, za – inženjerske djelatnosti i tehničko savjetovanje;
- ima u radnom odnosu odgovornog projektanta – Rajku D. Velimirović, dipl.inž.građ.;
- ispunjava uslove za sticanje tražene licence.

Na osnovu izloženog, odlučeno je kao u dispozitivu ovog Rješenja.

Uputstvo o pravnom sredstvu: Protiv ovog rješenja može se izjaviti žalba Ministarstvu održivog razvoja i turizma u roku od 15 dana od dana prijema rješenja, preko Stručne službe Inženjerske komore Crne Gore.

Službeno lice:
Mirjana Bučan, dipl. pravnik

PREDSJEDNIK KOMORE
Prof. dr Branislav Glavatović, dipl.inž.geol.

Dostavljeno:
- Podnosiocu zahtjeva;
- U spise predmeta;
- Ministarstvu održivog razvoja i turizma;
- a/a

Broj:01-245/4
Podgorica, 25.02.2014. godine

Inženjerska komora Crne Gore, rješavajući po Zahtjevu privrednog društva "SISTEM-MNE" d.o.o. iz Podgorice, za izdavanje licence za građenje objekata, na osnovu člana 134 Zakona o uređenju prostora i izgradnji objekata (''Sl. list CG'', br. 51/08 i 34/11), čl.10 Pravilnika o načinu i postupku izdavanja i oduzimanja licence i načinu vođenja registra licenci (''Sl. list CG'', br. 68/08), člana 196 Zakona o opštem upravnom postupku (''Sl. list RCG'', br. 60/03), člana 1 Uredbe o povjeravanju dijela poslova Ministarstva održivog razvoja i turizma, Inženjerskoj komori Crne Gore, br. 06-1016/4 (''Sl. list CG'', br. 30/12), donosi

R J E Š E NJ E

Izdaje se

L I C E N C A
za građenje objekata

Za izvođenje GRAĐEVINSKIH I GRAĐEVINSKO-ZANATSKIH RADOVA NA OBJEKTIMA VISOKOGRADNJE, OBJEKTIMA SAOBRAĆAJA I OBJEKTIMA HIDROTEHNIKE, Privrednom društvu "**SISTEM-MNE" d.o.o. iz Podgorice.**

Licenca se izdaje na period od pet godina.

O B R A Z L O Ž E NJ E

Inženjerska komora Crne Gore postupajući po Zahtjevu br.03-245/2 od 24.02.2014.godine, koji je podnesen u ime privrednog društva "SISTEM-MNE" d.o.o. iz Podgorice, za utvrđivanje ispunjenosti uslova za sticanje licence za građenje objekata, na osnovu člana 106. Zakona o uređenju prostora i izgradnji objekata ("Sl. list CG", br.51/08 i 34/11) i čl.10.Pravilnika o načinu i postupku izdavanja i oduzimanja licence i načinu vođenja registra licenci (''Sl. list CG'', br 68/08), utvrdila je da:

- privredno društvo posjeduje Potvrdu o registraciji kod Centralnog registra Privrednog Suda reg.br. 5-0654236/001, za djelatnost – izgradnja ostalih građevina na drugom mjestu nepomenutih;
- ima u radnom odnosu odgovornog inženjera – Rajku D. Velimirović, dipl.inž.građ;
- ispunjava uslove za sticanje tražene licence.

Na osnovu izloženog, odlučeno je kao u dispozitivu ovog Rješenja.

Uputstvo o pravnom sredstvu: Protiv ovog rješenja može se izjaviti žalba Ministarstvu održivog razvoja i turizma u roku od 15 dana od dana prijema rješenja, preko Stručne službe Inženjerske komore Crne Gore.

Službeno lice:
Mirjana Bučan, dipl. pravnik

PREDSJEDNIK KOMORE
Prof. dr Branislav Glavatović, dipl.inž.geol.

Dostavljeno:
-Podnosiocu zahtjeva;
-U spise predmeta;
-Ministarstvu održivog razvoja i turizma;
-a/a

CRNA GORA
MINISTARSTVO UREĐENJA PROSTORA
I ZAŠTITE ŽIVOTNE SREDINE
Broj: 03-4025/3
Podgorica 10.07.2009.godine

Ministarstvo uređenja prostora i zaštite životne sredine, na zahtjev **Ljubiše Boškovića,dipl. mašinskog inženjera iz Podgorice**, za izdavanje licence za izradu tehničke dokumentacije, na osnovu člana 134 i člana 84 Zakona o uređenju prostora i izgradnji objekata („Službeni list Crne Gore" br.51/08), i na osnovu člana 196 Zakona o opštem upravnom postupku („Službeni list RCG" br. 60/03), **d o n o s i**

R J E Š E NJ E

Ljubiši Boškoviću, diplomiranom mašinskom inžinjeru iz Podgorice, IZDAJE SE LICENCA za izradu projekata mašinskih postrojenja, uređaja i instalacija, kao i postrojenja za eksploataciju alternativnih izvora energije (voda, sunce,vjetar).

O b r a z l o ž e nj e

Ljubiša Bošković,dipl. mašinski inžinjer, iz Podgorice, ul.Mitra Bakića br.128, obratio se zahtjevom br. 03-4250/1 od 30.06.2009.godine za izdavanje licence za izradu tehničke dokumentacije. Uz zahtjev imenovani je dostavio:

- fotokopiju lične karte: JMB:1309973280028; reg.br.154949450 od 02.09.04.2008.godine MUP Crne Gore PJ Podgorica;
- fotokopiju diplome o stručnoj spremi (diplomirani mašinski inženjer)-Univerziteta Crne Gore-Mašinskog fakulteta u Podgorici-broj:985 od 27.06.2008.godine;
- fotokopiju radne knjižice reg.br:513/92 od 29.05.1992.godine Opštine Bijelo Polje;
- potvrdu da je član Inženjerske Komore CG-br:05-757/2 od 04.06.2009.godine;
- potvrdu o radnom odnosu D.O.O."SISTEM"-Podgorica

Ministarstvo uređenja prostora i zaštite životne sredine razmotrilo je podnijeti zahtjev sa priloženom dokumentacijom, pa je našlo da je isti osnovan.

Naime, odredbom člana 84 Zakona o uređenju prostora i izgradnji objekata („Službeni list Crne Gore" br. 51/08), propisano je da vodeći projektant i odgovorni projektant može biti samo diplomirani inženjer ili specijalista odgovarajuće tehničke struke za izradu pojedinih djelova tehničke dokumentacije, sa tri godine radnog iskustva na izradi, reviziji, nadzoru, pregledu ili ocjeni tehničke dokumentacije, položenim stručnim ispitom i da je član Komore.

Odredbom člana 85 istog zakona je propisano da tehničku dokumentaciju može da izrađuje i strano lice pod uslovima propisanim čl.83 i 84 zakona.

Prema članu 7 Pravilnika o načinu i postupku izdavanja i oduzimanja licence i načinu vođenja registra licenci („Službeni list CG" br. 68/08), propisano je da se licenca za vodećeg

projektanta, odnosno odgovornog projektanta za izradu pojedinih djelova tehničke dokumentacije, izdaje se fizičkom licu na osnovu: ovjerene fotokopije lične karte, odnosno pasoša za strano lice; ovjerene fotokopije diplome o stručnoj spremi; dokaza o najmanje tri godine radnog iskustva na izradi, reviziji, nadzoru, pregledu ili ocjeni tehničke dokumentacije; ovjerene fotokopije uvjerenja o položenom stručnom ispitu i dokaza da je član Komore.

Budući da se iz zahtjeva **Ljubiše Boškovića,dipl.mašinskog inžinjera iz Podgorice**, nesporno utvrđuje da imenovani ispunjava uslove propisane Zakonom i Pravilnikom, to je Ministarstvo odlučilo kao u dispozitivu ovog rješenja.

Uputstvo o pravnom sredstvu: Protiv ovog rješenja može se tužbom pokrenuti upravni spor pred Upravnim sudom Crne Gore, u roku od 30 dana od dana prijema ovog rješenja.

MINISTAR
Branimir Gvozdenović

Dostaviti:
-podnosiocu zahtjeva
-a/a

CRNA GORA
MINISTARSTVO UREĐENJA PROSTORA
I ZAŠTITE ŽIVOTNE SREDINE
Broj: 03-4250/2
Podgorica 10.07.2009.godine

Ministarstvo uređenja uređenja prostora i zaštite životne sredine, na zahtjev **Ljubiše Boškovića,dipl.mašinskog inžinjera iz Podgorice,** za izdavanje licence za građenje objekata odnosno izvođenje pojedinih radova na građenju objekata, na osnovu člana 134 i člana 107 Zakona o uređenju prostora i izgradnji objekata („Službeni list Crne Gore" br.51/08), i na osnovu člana 196 Zakona o opštem upravnom postupku („Službeni list RCG" br. 60/03), **d o n o s i**

R J E Š E N J E

Ljubiši Boškoviću, diplomiranom mašinskom inžinjeru iz Podgorice, IZDAJE SE LICENCA za rukovođenje izvođenjem radova na mašinskim postrojenjima, uređajima i instalacijama i na postrojenjima za eksploataciju alternativnih izvora energije (voda,sunce,vjetar).

O b r a z l o ž e nj e

Ljubiša Bošković, dipl.mašinski inžinjer iz Podgorice, ul. Mitra Bakića br.128, obratio se zahtjevom br. 03-4250/1 od 30.06.2009.godine za izdavanje licence za građenje objekata odnosno izvođenje pojedinih radova na građenju.

Uz zahtjev imenovani je dostavio:

- fotokopiju lične karte – JMB:1309973280028; reg.br.154949450 od 0209.04.2008.godine MUP Crne GorePJ Podgorica;
- fotokopiju diplome o stručnoj spremi (diplomirani mašinski inženjer)-Univerziteta Crne Gore-Mašinskog fakulteta u Podgorici-broj:985 od 27.06.2008.godine;
- fotokopiju radne knjižice reg.br:513/92 od 29.05.1992.godine Opštine Bijelo Polje;
- potvrdu da je član Inženjerske Komore CG-br:05-757/2 od 04.06.2009.godine;
- potvrdu o radnom odnosu D.O.O."SISTEM"-Podgorica

Ministarstvo uređenja prostora i zaštite životne sredine razmotrilo je podnijeti zahtjev sa priloženom dokumentacijom, pa je našlo da je isti osnovan.

Naime, odredbom člana 107 Zakona o uređenju prostora i izgradnji objekata („Službeni list Crne Gore" br. 51/08), propisano je da glavni inženjer i odgovorni inženjer za objekte za koje građevinsku dozvolu izdaje organ uprave, može biti samo diplomirani inženjer ili specijalista odgovarajuće tehničke struke, sa tri godine radnog iskustva na poslovima projektovanja, građenja, nadzora ili tehničkog pregleda objekata, položenim stručnim ispitom i da je član Komore.

Prema članu 9 Pravilnika o načinu i postupku izdavanja i oduzimanja licence i načinu vođenja registra licenci („Službeni list CG" br. 68/08) propisano je da se licenca za glavnog

inženjera, odnosno odgovornog inženjera, izdaje fizičkom licu na osnovu: ovjerene fotokopije lične karte; odnosno pasoša za strano lice; ovjerene fotokopije diplome o stručnoj spremi; dokaza o najmanje tri godine radnog iskustva na obavljanju poslova projektovanja, građenja, nadzora ili tehničkog pregleda objekata; ovjerene fotokopije uvjerenja o položenom stručnom ispitu i dokaza da je član Komore.

Budući da se iz zahtjeva **Ljubiše Boškovića,dipl.ing.mašinstva,** nesporno utvrđuje da **imenovani** ispunjava uslove propisane Zakonom i Pravilnikom, to je Ministarstvo odlučilo kao u dispozitivu ovog rješenja.

Uputstvo o pravnom sredstvu: Protiv ovog rješenja može se tužbom pokrenuti upravni spor pred Upravnim sudom Crne Gore, u roku od 30 dana od dana prijema ovog rješenja.

Rješenje obradila:
Dubravka Pešić,dipl.pravnik

MINISTAR
Branimir Gvozdenović

Dostaviti:
-podnosiocu zahtjeva
-a/a

INŽENJERSKA KOMORA CRNE GORE
ENGINEERS CHAMBER OF MONTENEGRO

Broj: 01-356/2
Podgorica, 19.03.2014.godine

Inženjerska komora Crne Gore, rješavajući po Zahtjevu Marka M. Radonjića, dipl.inž.arh., iz Podgorice, za izdavanje licence odgovornog projektanta, na osnovu člana 134 Zakona o uređenju prostora i izgradnji objekata ("Sl. list CG", br.51/08, 34/11 i 35/13), člana 196 Zakona o opštem upravnom postupku ("Sl. list RCG", br. 60/03) i člana 1 Uredbe o povjeravanju dijela poslova Ministarstva održivog razvoja i turizma, Inženjerskoj komori Crne Gore, broj: 08-1423 ("Sl. list CG", br. 32/13), donosi

R J E Š E NJ E

Izdaje se

L I C E N C A
odgovornog projektanta

MARKU M. RADONJIĆU, dipl.inž.arh., iz Podgorice, **za izradu,** PROJEKATA ARHITEKTURE OBJEKATA, PROJEKATA UNUTRAŠNJE ARHITEKTURE, PROJEKATA UNUTRAŠNJIH INSTALACIJA VODOVODA I KANALIZACIJE I PROJEKATA UREĐENJA TERENA, kao djelova tehničke dokumentacije.

O B R A Z L O Ž E NJ E

Zahtjevom br. 03-356 od 18.03.2014. godine, Inženjerskoj komori Crne Gore obratio se Marko M. Radonjić, dipl.inž.arh., iz Podgorice, za sticanje licence odgovornog projektanta.
U postupku utvrđivanja ispunjenosti uslova za sticanje licence odgovornog projektanta, shodno članu 84. stav 6. Zakona o uređenju prostora i izgradnji objekata („Sl. list CG", br. 51/08, 34/11 i 35/13) i člana 7. Pravilnika o načinu i postupku izdavanja i oduzimanja licence i načinu vođenja registra licenci ("Sl. list CG", br.68/08), utvrđeno je:

- da podnosilac zahtjeva posjeduje visoku stručnu spremu arhitektonske struke;
- da posjeduje uvjerenje o položenom stručnom ispitu broj: AP 103914 583 od 11.03.2014. godine, izdato od IKCG;
- da je član Inženjerske komore Crne Gore;
- posjeduje odgovarajuće stručne reference od značaja za izradu djelova tehničke dokumentacije, za koje se izdaje licenca.

Na osnovu izloženog, odlučeno je kao u dispozitivu ovog Rješenja.

Uputstvo o pravnom sredstvu: Protiv ovog rješenja može se izjaviti žalba Ministarstvu održivog razvoja i turizma u roku od 15 dana od dana prijema rješenja, preko Stručne službe Inženjerske komore Crne Gore.

Službeno lice:
Mirjana Bučan, dipl. pravnik

PREDSJEDNIK KOMORE
Prof. dr Branislav Glavatović, dipl.inž.geol.

Dostavljeno:
- Podnosiocu zahtjeva;
- U spise predmeta;
- Ministarstvu održivog razvoja i turizma;
- a/a

CRNA GORA
MINISTARSTVO ZA EKONOMSKI RAZVOJ
Broj: 03-440/3
Podgorica, 16.02. 2009.godine

Ministarstvo za ekonomski razvoj, na zahtjev **Rajke Velimirović iz Podgorice**, za izdavanje licence za izradu tehničke dokumentacije, na osnovu člana 134 Zakona o uređenju prostora i izgradnji objekata („Službeni list Crne Gore" br. 51/08), a u vezi sa članom 84 i na osnovu člana 196 Zakona o opštem upravnom postupku („Službeni list RCG" br. 60/03), d o n o s i

R J E Š E NJ E

Izdaje se **Rajki Velimirović, dipl. ing. građ. iz Podgorice**,

L I C E N C A

kojom se utvrđuje ispunjenost uslova za izradu **projekata građevinskih konstrukcija i drugih građevinsih projekata.**

O b r a z l o ž e nj e

Rajka Velimirović iz Podgorice, obratila se zahtjevom, broj 03-440/1 od 23.01.2009.godine za izdavanje licence za izradu projekata građevinskih konstrukcija i drugih građevinsih projekata.

Razmatrajući predmetni zahtjev sa priloženom dokumentacijom, ovo ministarstvo je ocijenilo da imenovi dostavio potrebnu dokumentaciju saglasno članu 84 Zakona o uređenju prostora i izgradnji objekata („Službeni list CG", broj 51/08) i članu 7 Pravilnika o načinu i postupku izdavanja i oduzimanja licence i načinu vođenja registra („Službeni list CG", broj 68/08), pa je našlo da je isti osnovan.

Naime, odredbama člana 84 Zakona o uređenju prostora i izgradnji objekata („Službeni list CG", broj 51/08), propisano je da vodeći projektant i odgovorni projektant može biti samo diplomirani inženjer ili specijalista odgovarajuće struke za izradu pojedinih djelova tehničke dokumentacije, sa tri godine radnog iskustva na izradi, reviziji, nadzoru, pregledu ili ocjeni tehničke dokumentacije, položenim stručnim ispitom i da je član Komore.

Prema članu 7 Pravilnika o načinu i postupku izdavanja i oduzimanja licence i načinu vođenja registra („Službeni list CG", broj 68/08), utvrđeno je da se licenca za vodećeg projektanta, odnosno odgovornog projektanta za izradu pojedinih djelova tehničke dokumentacije, izdaje se fizičkom licu na osnovu: ovjerene fotokopije lične karte, odnosno pasoša za strano lice, ovjerene fotokopije diplome o stručnoj spremi, dokaza o najmanje tri godine radnog iskustva na izradi, reviziji, nadzoru, pregledu ili ocjeni tehničke dokumentacije, ovjerene fotokopije uvjerenja o položenom stručnom ispitu i dokaza da je član Komore.

Budući da se iz zahtjeva Rajke Velimirović iz Podgorice, nesporno utvrđuje da imenovani ispunjava uslove propisane Zakonom i Pravilnikom, to je Ministarstvo odlučilo kao u dispozitivu rješenja.

Uputstvo o pravnom sredstvu: Protiv ovog rješenja može se tužbom pokrenuti upravni spor pred Upravnim sudom Crne Gore, u roku od 30 dana od dana prijema ovog rješenja.

M I N I S T A R
Branimir Gvozdenović

Dostaviti:
- Podnosiocu zahtjeva
- a/a
- u spise predmeta

CRNA GORA
MINISTARSTVO ZA EKONOMSKI RAZVOJ
Broj: 03-440/4
Podgorica, 16.02.2009.godine

Ministarstvo za ekonomski razvoj, na zahtjev **Rajke Velimirović iz Podgorice**,za izdavanje licence za građenje objekata odnosno izvođenje pojedinih radova na objektu, na osnovu člana 134 Zakona o uređenju prostora i izgradnji objekata („Službeni list Crne Gore" br. 51/08), a u vezi sa članom 107 i na osnovu člana 196 Zakona o opštem upravnom postupku („Službeni list RCG" br. 60/03), d o n o s i

R J E Š E NJ E

Izdaje se **Rajki Velimirović, dipl. ing. građ. Iz Podgorice**,

L I C E N C A

kojom se utvrđuje ispunjenost uslova za rukovođenje izvođenjem **građevinskih, građevinsko zanatskih i građevinsko završnih radova na objektima visokogradnje, hidrotehnike i niskogradnje.**

O b r a z l o ž e nj e

Rajka Velimirović iz Podgorice, obratila se ovom ministarstvu zahtjevom, br. 03-440/2 od 23.01.2009. godine za rukovođenjem izdavanjem građevinskih, građevinsko zanatskih i građevinsko završnih radova na objektima visokogradnje, hidrotehnike i niskogradnje.
Razmatrajući predmetni zahtjev sa priloženom dokumentacijom, ovo ministarstvo je ocijenilo da imenovi dostavio potrebnu dokumentaciju saglasno članu 107 Zakona o uređenju prostora i izgradnji objekata („Službeni list CG", broj 51/08) i članu 9 Pravilnika o načinu i postupku izdavanja i oduzimanja licence i načinu vođenja registra („Službeni list CG", broj 68/08), pa je našlo da je isti osnovan.

Naime, odredbama člana 107 Zakona o uređenju prostora i izgradnji objekata („Službeni list Crne Gore" br. 51/08), propisano je da glavni inženjer i odgovorni inženjer za objekte za koje građevinsku dozvolu izdaje organ uprave, može biti samo diplomirani inženjer ili specijalista odgovarajuće tehničke struke, sa tri godine radnog iskustva na poslovima projektovanja, građenja, nadzora ili tehničkog pregleda objekata, položenim stručnim ispitom i da je član Komore.

Prema članu 9 Pravilnika o načinu i postupku izdavanja i oduzimanja licence i načinu vođenja registra licenci („Službeni list CG„ br. 68/08), propisano je da se licenca za glavnog inženjera, odnosno odgovornog inženjera, izdaje fizičkom licu na osnovu: ovjerene fotokopije lične karte, odnosno pasoša za strano lice, ovjerene fotokopije diplome o stručnoj spremi, dokaza o najmanje tri godine radnog iskustva na obavljanju poslova projektovanja, građenja, nadzora ili tehničkog pregleda objekata, ovjerene fotokopije uvjerenja o položenom stručnom ispitu i dokaza da je član Komore.

Budući da se iz zahtjeva Rajke Velimirović iz Podgorice, nesporno utrđuje da imenovani ispunjava uslove propisane Zakonom i Pravilnikom, to je Ministarstvo odlučilo kao u dispozitivu ovog rješenja.

Uputstvo o pravnom sredstvu: Protiv ovog rješenja može se tužbom pokrenuti upravni spor pred Upravnim sudom Crne Gore, u roku od 30 dana od dana prijema ovog rješenja.

M I N I S T A R
Branimir Gvozdenović

Dostaviti:
- Podnosiocu zahtjeva
- a/a
- u spise predmeta

Црна Гора
МИНИСТАРСТВО ЗА ЕКОНОМСКИ РАЗВОЈ
ПОДГОРИЦА

INŽENJERSKA KOMORA CRNE GORE

81000 PODGORICA, Džordža Vašingtona 31, tel: +382 20 228 295; fax: 228 296
e-mail: ing.komora@t-com.me; www.ingkomora.me; žiro-račun: 530-1870-29

Br: 02-4315
Podgorica, 13.10.2014. god.

Na osnovu člana 140. stav 1. tačka 1. Zakona o uređenju prostora i izgradnji objekata („Sl. list CG", br. 51/08), i evidencije Registra članova Inženjerske komore Crne Gore, izdaje se

POTVRDA

Da je **LJUBIŠA B. BOŠKOVIĆ**, diplomirani inženjer mašinstva iz Podgorice, član Inženjerske komore Crne Gore do **01.08.2015.** godine.

Obradila:
Aleksandra Gvozdenović, dipl.ing.metal.
A. Gvozdenović

GENERALNI SEKRETAR
Svetislav Popović,dipl.pravnik

INŽENJERSKA KOMORA CRNE GORE PODGORICA

Dostavljeno:
- Imenovanom,
- Registru Komore,
- A/a.

INŽENJERSKA KOMORA CRNE GORE

Broj: 02-1849

Podgorica, 24.04.2015. god.

Na osnovu člana 140 stav 1 tačka 1 Zakona o uređenju prostora i izgradnji objekata
(„Sl. list CG", br. 51/08, 34/11, 35/13 i 33/14),
i evidencije Registra članova Inženjerske komore Crne Gore,
a na lični zahtjev člana Komore, izdaje se

POTVRDA

o članstvu u Inženjerskoj komori Crne Gore

MARKO M. RADONJIĆ, diplomirani inženjer arhitekture iz Podgorice,

član Inženjerske komore Crne Gore do **18.03.2016.** godine.

Obradila:

Aleksandra Gvozdenović,dipl. ing. metalurgije

A. Gvozdenović

Generalni sekretar

Svetislav Popović,dipl. pravnik

INŽENJERSKA KOMORA CRNE GORE PODGORICA

INŽENJERSKA KOMORA CRNE GORE

Broj: 02-3266

Podgorica, 16.07.2015. god.

Na osnovu člana 140 stav 1 tačka 1 Zakona o uređenju prostora i izgradnji objekata
(„Sl. list CG", br. 51/08, 34/11, 35/13 i 33/14),
i evidencije Registra članova Inženjerske komore Crne Gore,
a na lični zahtjev člana Komore, izdaje se

POTVRDA

o članstvu u Inženjerskoj komori Crne Gore

RAJKA D. VELIMIROVIĆ, diplomirani inženjer građevinarstva iz Podgorice,

član Inženjerske komore Crne Gore do **03.07.2016.** godine.

Obradila:

Aleksandra Gvozdenović,dipl. ing. metalurgije

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INŽENJERSKA KOMORA CRNE GORE PODGORICA

Contents:

1. INTRODUCTION

Pursuant to the key strategic commitments of Montenegrin Energy policy, utilization of renewable energy sources (RES) is among its priorities in order to contribute to sustainable energy development. Having regard to the fact that tourism is one of the most important business activities in Montenegro, the introduction of RES into this sector is of great importance. Apart from decreasing greenhouse gases emission, it contributes to creating favourable environment for further research, development and application of RES, not only in this sector but also in transport, agriculture, civil engineering and other sectors. Having in mind the fact that Montenegro has a wide potential for application of alternative energy sources (sun, wind, water) and developed legislative-regulatory framework, it is necessary to explore RES application possibilities for both existing and announced projects, especially in the sectors such as tourism, transport, agriculture and civil engineering. With this regard, the project of Kotor-Cetinje cable car represents a good chance for utilization of RES resources in Kotor and Cetinje municipalities. Supply of "pure" electric power to the cable car would contribute to reducing greenhouse gases emission and environment pollution, as well as to promoting low carbon tourism and alternative energy sources. Furthermore, in this way increase of RES in overall electric power consumption would be achieved, what makes one of the most important goals of Montenegrin Energy policy.

2. RES POTENTIAL ON THE TERRITORY OF KOTOR AND CETINJE MUNICIPALITIES

As emphasized before, apart from tourism, Montenegro has great potential in energy sector, especially in the utilization of hydropower and solar energy potential. In Montenegrin coastal area, insolation duration is on average 2750h, while in the mountain area it has average value from 1550 to 1900h [1]. Hydro potential is mainly related to the north part of the country. However, in the south, in Kotor and Cetinje municipalities, there are watercourses which could provide electric power necessary for the cable car. Wind potential in Montenegro has not yet been sufficiently explored, but multi-annual measuring has been done on certain sites where the construction of wind farms has begun recently.

1) *Solar energy potential*

Insolation on the territory of Kotor and Cetinje municipalities is higher in comparison to other cities located at the same latitude, what means that the solar energy potential, that is, solutions including photovoltaic system can be considered sustainable. However, insolation depends on micro-location, that is, on terrain specificity and presence of facilities which can cast their shadow on the system. Therefore, when planning installation of photovoltaic systems, it is important to take into consideration the factors mentioned above.

Furthermore, with the aim of more efficient utilization of solar radiation, the panels should face the south, at an optimal angle in relation to the horizontal.

Solar energy potential at the locations of planned stations for Kotor-Cetinje cable car is presented in the following tables. [1]

	Fixed system: inclination=34 deg., orientation=19 deg. (optimum)			
Month	**Ed**	**Em**	**Hd**	**Hm**
Jan	2.01	62.3	2.52	78.2
Feb	2.56	71.8	3.25	90.9
Mar	3.54	110	4.61	143
Apr	4.08	123	5.41	162
May	4.59	142	6.19	192
Jun	4.97	149	6.83	205
Jul	5.23	162	7.23	224
Aug	5.01	155	6.98	216
Sep	4.14	124	5.60	168
Oct	3.20	99.2	4.23	131
Nov	2.08	62.4	2.67	80.1
Dec	1.78	55.1	2.23	69.1
Year	3.61	110	4.82	147
Total for year		1320		1760

a)

	Fixed system: inclination=34 deg., orientation=22 deg. (optimum)			
Month	**Ed**	**Em**	**Hd**	**Hm**
Jan	2.02	62.7	2.49	77.0
Feb	2.54	71.0	3.15	88.1
Mar	3.59	111	4.58	142
Apr	4.12	123	5.36	161
May	4.68	145	6.22	193
Jun	5.07	152	6.88	206
Jul	5.33	165	7.29	226
Aug	5.07	157	7.01	217
Sep	4.18	125	5.58	167
Oct	3.11	96.5	4.07	126
Nov	2.09	62.7	2.63	79.0
Dec	1.79	55.4	2.20	68.1
Year	3.64	111	4.80	146
Total for year		1330		1750

b)

	Fixed system: inclination=34 deg., orientation=-6 deg. (optimum)			
Month	**Ed**	**Em**	**Hd**	**Hm**
Jan	2.30	71.2	2.76	85.6
Feb	2.90	81.2	3.52	98.5
Mar	3.79	117	4.77	148
Apr	4.30	129	5.55	166
May	4.72	146	6.24	194
Jun	5.11	153	6.90	207
Jul	5.36	166	7.31	227
Aug	5.11	158	7.02	218
Sep	4.33	130	5.74	172
Oct	3.41	106	4.38	136
Nov	2.34	70.3	2.89	86.8
Dec	1.99	61.8	2.40	74.4
Year	3.81	116	4.96	151
Total for year		1390		1810

c)

	Fixed system: inclination=33 deg., orientation=-4 deg. (optimum)			
Month	**Ed**	**Em**	**Hd**	**Hm**
Jan	2.07	64.2	2.54	78.8
Feb	2.61	73.0	3.23	90.5
Mar	3.63	112	4.64	144
Apr	4.06	122	5.32	160
May	4.52	140	6.06	188
Jun	4.93	148	6.74	202
Jul	5.22	162	7.19	223
Aug	4.96	154	6.88	213
Sep	4.12	124	5.53	166
Oct	3.25	101	4.24	131
Nov	2.15	64.4	2.70	81.1
Dec	1.78	55.1	2.18	67.7
Year	3.61	110	4.78	145
Total for year		1320		1740

d)

Picture 1.1: *Insolation at stations locations: Dub (a) , Kuk (b), Ivanova Korita (c), Cetinje (d)*

Ed – average daily generation of electric power from the installed system [kWh]

[1] 1kW photovoltaic module installation has been taken as an example.

Em – average monthly generation of electric power from the installed system [kWh]
Hd – average daily insolation per m^2 of installed PV panels [kWh/m^2]
Hd – average monthly insolation per m^2 of installed PV panels [kWh/m^2]

Data shown in Picture 1.1 are obtained through application of software PV Gis, and it can be noticed that insolation on all micro-locations of cable car stations is approximately equal, while being a bit higher at the station Ivanova Korita. Insolation on the territory of Kotor is lower than expected as the result of shadows cast by the hills above the city, thus having lower number of sunshine hours.

The tables provide values for 1kW installation with presumption that the modules are placed under ideal angle. In the next phase of the Study, technical possibilities for installation on the station facilities themselves will be considered (maximum power possible to be installed, assembly manner, storage space for other equipment, and so on), as well as environmental impact and financial justification.

2) Hydro potential

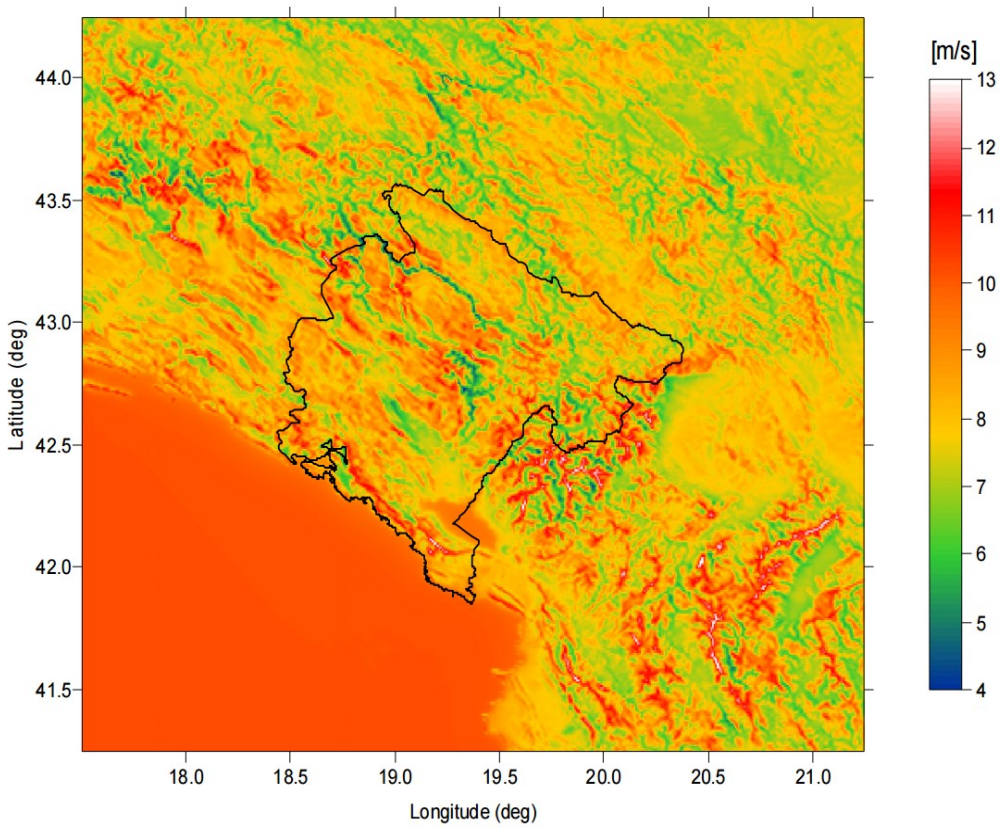
Montenegro has considerable hydropower potential of watercourse, whereof only 17% of the overall theoretical hydro potential has been used. Part of this natural resource is hydro potential of small watercourses which offers favourable possibilities for its energy utilization through construction of small hydropower plants. Within the last few years the activities in Montenegro regarding small hydropower plants have been intensified. In favour of this fact are a number of papers published in professional and scientific journals, as well as at professional conferences.

Pursuant to hydropower potential research on the territory of Cetinje and Kotor municipalities, there have been noticed a few interesting watercourses for construction of small hydropower plant. Upon their visit and analogy with other watercourses based on experience in measuring, design and construction of small hydropower plants, it has been determined that the river Kolozun (Kotor municipality) has a very good hydro potential for construction of small hydropower plant. More detailed analysis of this river shall be done in the next phase of the Study when specific data regarding this watercourse will be known and analysed in details in order to use the river Kolozun for the design of a small hydropower plant in the best possible way. Furthermore, there have been noticed few more watercourses in Kotor municipality, but they have not proved appropriate for further consideration (e.g. the river Ljuta). In Cetinje municipality there are two interesting rivers with satisfactory hydropower characteristics, the Zejcina river and the Seljanstica river, which will be proposed for consideration in the next phase of this Study.

After field visits and on the basis of design experience of the team of engineers of the company Sistem-mne, we propose the river Kolozun in Kotor municipality as the best candidate for preliminary design which shall make an integral part of the Study.

3) Wind potential

Extensive research in Montenegro that would lead to the utilization of wind energy has not been done yet. Multi-annual measuring has been done only on locations where wind farms Krnovo and Mozura are being built currently. It is important to mention that there are great differences in wind potential on the territory of Montenegro, so precise estimates cannot be given without data related to certain micro -location. According to wind speed spectrum research on weather stations in Montenegro, possible regions which could have "good" wind power are Niksic region, southwest region of Montenegro, mountain ridges above the sea and the coast [7]. In Picture 1.2 it can be seen that the region where cable car construction has been planned also has potential for wind power utilization.



Picture 1.2.: *Average wind speed [m/s] at 50 m above ground level [8]*

3. WORLD PRACTICE EXAMPLES

RES application for cable car power supply is not a new solution but the practice which gave positive results in many countries around the world, both in ecological and in financial terms.

Some well-known examples which could be used as grounds for planning of Kotor-Cetinje cable car power supply are cable cars: Langkawi (Malaysia), Tenna (Switzerland), St. Moritz (Switzerland), Green ski lift Tirol (Austria), Aspen City ski resort (USA).

a) Langkawi, Malaysia

Cable car connecting the village in the valley and tourist area in the mountain rises right above the village and is supplied through hybrid system which uses photovoltaic modules and diesel aggregates as sources.

Picture 1.3.: *Cable car Langkawi in Malaysia*

Primary power supply source is photovoltaic, that is, modules placed on the second and third (last) station. During the day solar energy is used for running the cable car engine while the excess is stored in the battery system. In case of insufficient electric power generation, additional power is obtained from the batteries. Secondary electric power source, diesel aggregate, is used when the amount obtained from photovoltaic or batteries is insufficient for engine running. Microprocessor controller controls the distribution of generated electric power, balances its generation and consumption and protects batteries against excessive discharge. Therefore, the system consists of photovoltaic modules, lead-acid batteries, regulators, inverters, controllers and remote monitoring system.

This hybrid system is completely independent from power distribution grid, the so-called Off grid principle. The advantages of such solution are reliable and continuous supply, reducing greenhouse gasses emission, energy efficiency (photovoltaic as a primary source). For rural areas without

possibility of supply from power distribution grid, this represents a financially sustainable solution which requires minimum operating costs.

The total installed capacity of photovoltaic panels is 16kW, diesel aggregate 120kVA (2 pieces), battery back-up capacity is 519kWh. One inverter of 30kVA is installed on both stations. Average daily consumption of electric power by the cable car is 100kWh. [2]

Having in mind that planned electric power consumption by Kotor-Cetinje cable car is considerably higher[2] in comparison to Langkawi, off grid system would not be a sustainable solution. In addition, Kotor-Cetinje cable car is located in the vicinity of the power distribution grid, so the connection costs would be much lower comparing to off grid system installation costs.

However, off grid system is seen as economically sustainable solution for supply of a portion of power consumed by the cable car. Depending on investor's wish, it is possible to install photovoltaic, hybrid or wind generator system for supply of certain consumer groups[3] on some (or all) stations. Depending on cable car project documentation and investor's requirements, group of consumers to be supplied in this way would be defined in order to achieve maximum efficiency, that is, RES utilization.

b) Ski lift in Tenna, Switzerland

Ski lift in Switzerland town Tenna is the first such lift in the world. It is primarily supplied from 80 photovoltaic modules arranged along the cable care and oriented so as to achieve greater efficiency [3]. For most of the time the system generates electric power sufficient for operation of cable car. However, during bad weather conditions period, the power is substituted from the distribution grid.

During sunny days the system generates almost double electric power than used by the lift, so the excess is distributed into the grid. Photovoltaic system generates 90.000 kWh annually thus greatly contributing to reduction of greenhouse gases emission.

During the summer this system functions as a solar power plant, while all generated electric power is distributed into the grid. For this reason this project represents a successful and sustainable solution.

Having in mind that it is planned for Kotor-Cetinje cable car to be in function continuously during the whole year, such operation system is not applicable in our case. However, it is possible to make similar plans regarding installation of photovoltaic system which would partially supply the cable car, but without the possibility of electric power storage. In such way lower installation costs would be achieved, but it would, at the same time, reduce the supply reliability. Even though the solution regarding photovoltaic modules along the cable car is very attractive and interesting, in the case of Kotor-Cetinje cable car installation of modules on all stations or in their vicinity is recommended due to lower installation costs and easier maintenance.

[2] Maximum consumption of electric power by Kotor-Cetinje cable car on annual basis is 1,8·106 kWh, while Langkawi cable car consumes maximum 3,6 ·104kWh annually.
[3] Lightning, cameras, wireless, other low power appliances, etc.

Picture 1.4.: *cable car in Tenna, Switzerland*

c) Ski lift Aspen, USA

This cable car is supplied directly from the power distribution grid, whereby it purchases from the grid, at a special price, solely electric power generated in a nearby wind farm. When constructed, ski lift in Aspen (Colorado, USA) was the first lift supplied in such way. Such solution indirectly but efficiently contributes to reduction of environmental pollution and to promotion of RES. It is estimated that in such way reduction of CO2 emission for 37.200kg has been achieved. [4]

Picture 1.5.: *Cable car in Aspen, SAD*

Unfortunately, Montenegro still has not got legal regulations which would enable electric power purchase in such way. However, this does not exclude the possibility of building a wind farm near the cable car route. Electric power generated in the farm would be used for cable car supply, while the "excess" would be distributed into power distribution grid. However, prior to planning the construction of such power facility, it is necessary to have the results of many years of measurements and to undertake detailed analysis in order to make cost-effectiveness assessment with certainty. The same principle shall apply to small hydropower plant.

Apart from the above examples, there are more cable cars which use RES as a supply source. Some of them are cable car in Moritz, cable car in Toggenburg which is completely supplied from installed photovoltaic system, ski lift "Sonnenlift" in Tirol also supplied from photovoltaic panels.

Cable car in Tirol -Sonnenlift

Cable car in St.Moritz

Cable car in Toggenburg

Picture 1.6.: *Examples of cable cars using RES for power supply*

4. POWER SUPPLY POSSIBILITES FOR KOTOR-CETINJE CABLE CAR

Pursuant to usual world practice, RES potential in Montenegro, legal framework and location specificity of Kotor-Cetinje cable car, there are more possibilities for supplying the cable car by "pure" electric power.

Solar power

a) Solar off grid system

This system includes supplying part of consumers by power obtained from installed photovoltaic system. Having in mind the fact that it is planned for the cable car to be run by three engines with the power of 1000 kW, 500 kW, 660 kW [5], total power of cable car engine system would be 2160 kW. When started up, engines have greater power (1300 kW, 700 kW, 1000 kW) so total start power of cable car engines is 3300 kW [5]. When the total engine power (continuous and start power) is taken into consideration, it would not be cost-effective to plan photovoltaic system for engines power supply because its power should be approximately 4500 kW[4]. This would require the area of 28800 m^2 and more than 11 million Euro investment. Furthermore, additional space for batteries and inverters storage would be required. For the system of 4500 kW, necessary battery back-up would have approximate capacity of 675000 Ah/48 V, that is, 18000 pieces of battery units of 150 Ah. This would require construction of additional facilities for storage of the said equipment what would additionally increase investment and maintenance costs. In this way energy independence with regard to power distribution grid would be achieved, but it would not be a financially sustainable solution.

Instead, installation of a smaller photovoltaic system is recommended. This system would supply only certain groups of consumers. In this way, for example, supply for inside and/or outside lighting on each station could be provided. In this case, it would be necessary to provide battery back-up as well. Investment costs for such system would be ca. 2500 €[5] per installed kW. Besides the above said, it is also suggested taking into consideration other consumers operating during the day in order to minimize necessary battery back-up and increase system efficiency. Thus, chosen consumers would mainly be supplied directly from photovoltaic modules, and rarely from batteries (in bad weather conditions).

Besides the above possibilities, considering photovoltaic system with minimum battery back-up is suggested, while additional electric power required would be provided from power distribution grid. In this case, consumers predominantly operating during the day would be isolated so as to achieve maximum efficiency. Such solution is much cheaper (investment costs per installed kW ca. 2200 €) and, subsequently, more cost-effective.

Using diesel aggregate as a back-up power supply is also an option, whereof both financial and environmental justification should be considered.

[4] Calculated by using PV Gis software, taking into account that the cable car operates on average 6 hours daily and spends $1{,}8 \cdot 10^6$ kWh annually.
[5] The costs do not include VAT.

b) Solar on grid system – photovoltaic power plant

Since Montenegro has a legal framework providing for installation and commissioning of on-grid system, whereof the purchase price of electric power generated from such systems is 0,15 €/kW, considering investing into such system is recommended. Advantage of such solution is flexibility regarding the choice of installed power and the location of installation. However, pursuant to the Energy Law, modules can be installed only on existing roof structures. In this case, modules would be installed on one of the stations, while both insolation and distance from the connection spot to the power distribution grid would be taken into account. Within the range of the cable car there are three branches of 35 kV distribution grid: transmission line Skaljari – Cevo, transmission line Skaljari – Lovcen, transmission line Skaljari –Cetinje [6]. All three transmission lines are in the vicinity of planned cable car area. Pursuant to the Rulebook on criteria for issuing energy permits, contents of requests and registry of energy permits, maximum installed power of photovoltaic system must not be higher than 1 MW.

Installation costs range from 1500 € to 1800 € per kW, depending on connection spot to power distribution grid. From picture 1.1 it can be seen that repayment period for the system in Cetinje would be 7,6 to 9,1 years. This is only preliminary assessment, while detailed analysis will be carried out in the next phase of the Study on utilization possibilities of RES for Kotor-Cetinje cable car power supply.

In this case, the cable car would be completely supplied from power distribution grid, but construction of photovoltaic power plant and providing “pure” electric power would contribute to reduction of greenhouse gases emission and increase of RES in overall generation of electric power.

It is important to point out that photovoltaic power plant can be commissioned only upon obtaining complete necessary documentation, that is, upon gaining the status of a privileged electric power producer, what would enable selling electric power at the price of 0,15 €/kW. This procedure is initiated by obtaining energy permit, and then, upon drafting the Main project, necessary approvals are obtained on the base of which the power plant is put into trial operation. Afterwards, contracts are signed with Elektroprivreda and Montenegrin electric power market operator [16].

c) Combined on-off grid system

Combination of previous two options arises as a possibility for cable car power supply, whereas achieving maximum efficiency must be taken into consideration.

Such solution includes photovoltaic system with minimized battery back-up. Certain group of consumers would be supplied from the photovoltaic system, while the excess of electric power would be distributed into the grid at a lower tariff in comparison to the case under b). In such way, part of power consumed by the cable car would be supplied from the photovoltaic system, while, in case of reduced consumption or during summer months, the plan is to inject the excess of electric power into the power distribution grid.

Such operation method is defined under Article 90 of Energy Law (Exchange on the connection spot) and it provides for calculation of difference between received and delivered electric power on annual

basis. Based on this calculation follows the payment in accordance with a predetermined tariff. The tariff is in this case defined under the contract concluded with the distribution system operator.

In this way, maximum prescribed power to be installed is 20 kW. In this specific case, if maximum power would be installed, total investment would be ca. 60000 €. It is difficult to obtain accurate estimate regarding financial justification of such investment due to the fact that the tariff is defined subsequently and it ranges from 0,033 €/kW to 0,05 €/kW.

However, even though the purchase price of electric power is lower, such solution has an advantage in comparison to on grid system due to the fact that the procedure for obtaining necessary documentation is less complicated and less time-consuming. Its advantage in comparison to off grid system is the fact that it needs much smaller battery back-up and generated electric power is used more efficiently. Its disadvantage is low value of electric power, thus the financial justification of such solution shall be reviewed.

Pursuant to detailed analyses, in the following steps it will be determined which of the above solutions is the most suitable for Kotor-Cetinje cable car power supply. Besides technical feasibility and efficiency with regard to solar potential utilization, cost-effectiveness of the solution shall also be taken into consideration.

Photovoltaic systems will be elaborated in more details upon obtaining more detailed information on cable car stations facilities on which photovoltaic systems can be installed.

Hydropower

Why hydropower? – the question arises. Simply, it is clean, safe, no need for fuel and its derivates, it is reliable, renewable and provides long-term cash flow. After many years of experimental work in various countries, small hydropower plants are becoming more and more attractive and environmentally acceptable in many parts of the world, as well as in our country.

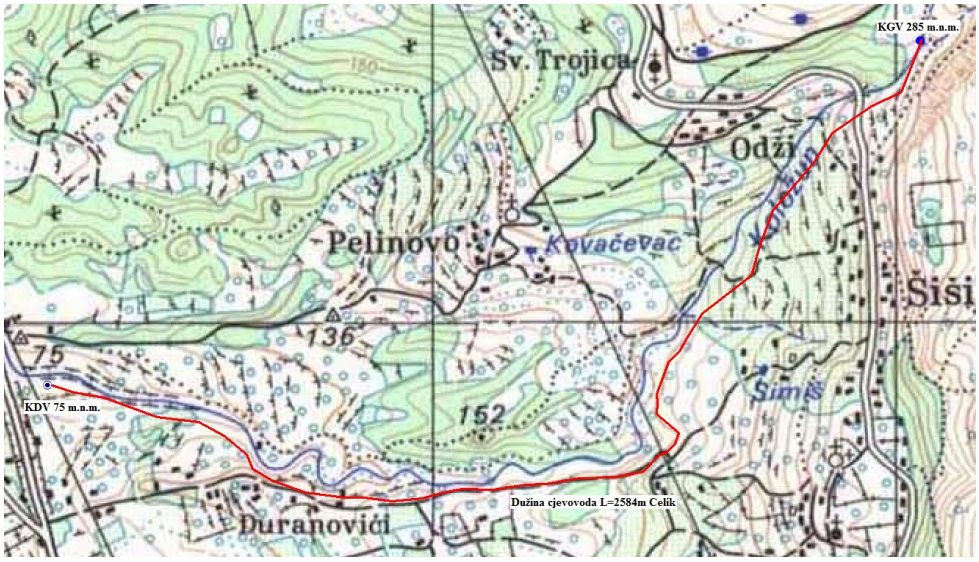
It is considered that small hydropower plants, in comparison to others RES, have the lowest negative impact on environment, unlike the big ones whose negative impact is expressed in huge ecosystem changes (construction of big dams), impact on the soil, flooding, impact on freshwater wildlife, increased methane emission and the existence of harmful emissions throughout the entire life cycle of a hydropower plant which are mainly associated with the construction period, material production and transport.

As mentioned before for the next phase of this Study, we suggest the river Koluzun for construction of a small run-off-the-river hydropower plant. Main parts of such facility would be water intake, pipeline and power building intended for storage of hydro-mechanical equipment used for conversion of hydropower to electric power.

With this type of hydropower plants, power building is not situated in the vicinity of the dam (water intake), but is built far away. On rivers with relatively low flow rates and big incline, what is the case in mountain and highland areas, construction of derivation provides adequate incline. This scheme is typical for Montenegrin conditions. Damming the river with a small dam directs the river flow outside of its natural riverbed into a certain derivation line until the spot intended for construction of the

hydropower plant. Water used for the needs of a small hydropower plant is taken back into the natural river flow without changing its composition, quality and cleanliness.

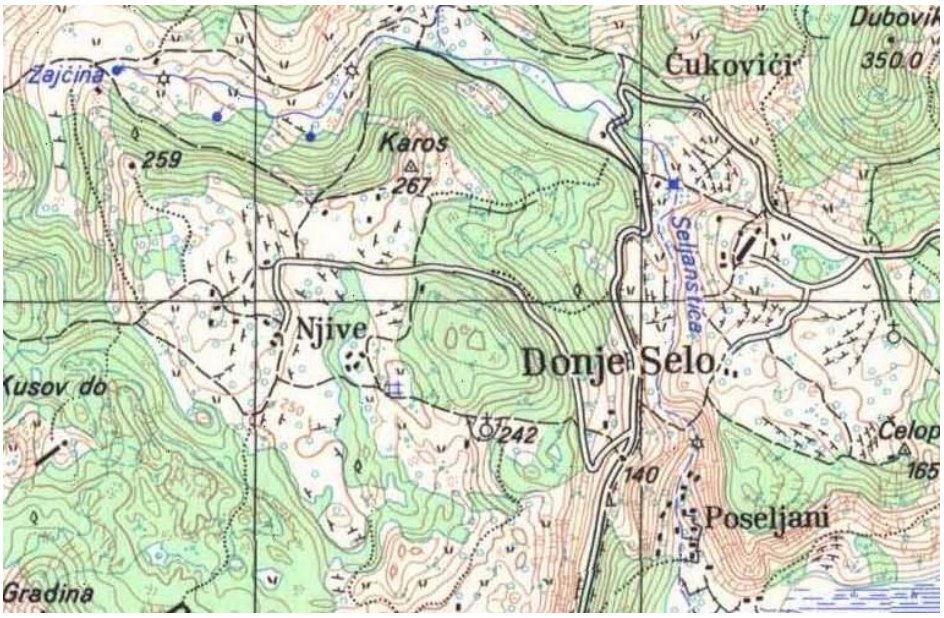
For the Kolozun river, the following concept is suggested: water intake is at the bottom with Coanda grid – by choosing this type of grid the scope of works in the riverbed is reduced, thus reducing the impact on the environment. Suitable terrain for laying the pipelines under pressure (steel) is the left bank of the Kolozun river. The route length is approximately 2584 m. The power building would be situated on the left bank. A Pelton turbine with accompanying equipment is situated in the power building. Having passed through the turbine, the water through the canal flows into the riverbed Kolozun. The upper water level is 285.00 meters above sea level, lower water level is 75.00 m above sea level, so the gross head is 210 m. Such characteristics are suitable for installation of Pelton turbine. Detailed analysis is given in chapter 5.



Picture 1.7.: *Kolozun river watercourse*

Two interesting rivers with satisfactory hydropower characteristics have been noticed in Cetinje municipality, Zejcina and Seljanstica, on whose watercourse there are thirteen water mills, out of which only one in function.

Picture 1.8.: *Zejcina watercourse*



Picture 1.9.: *Zejcina and Seljanstica topgraphic map*

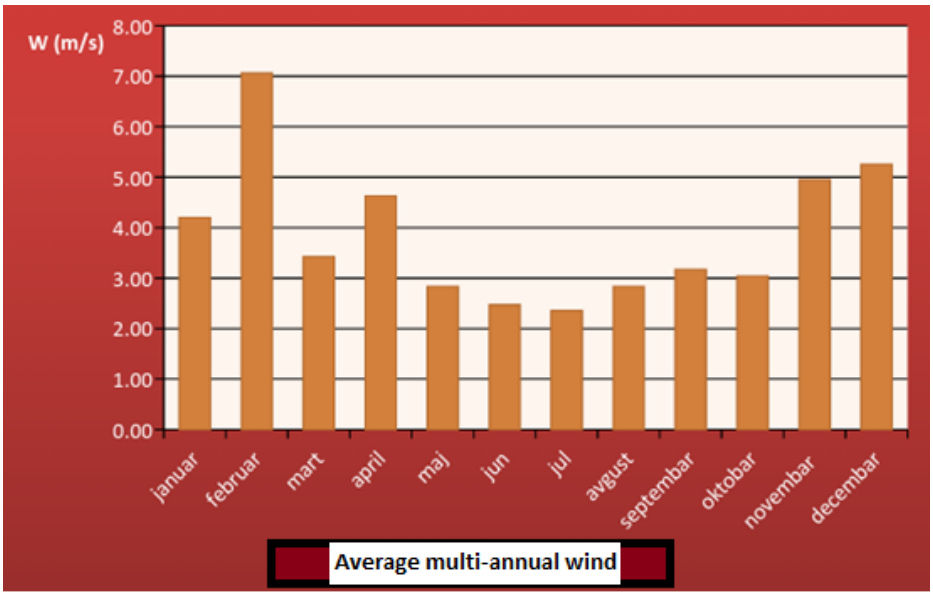
Since estimated installed power of the plant does not exceed 1 MW on any watercourse, it is possible, pursuant to the Energy Law, to obtain energy permit for using this watercourse for electric power generation and its distribution into the grid. It is recommended that the plant is connected to the local power distribution grid and that generated electric power is distributed into the grid, and to

use electric power from the grid for the cable car power supply. Purchase price of kWh from such plant would be 0.1044 € [10].

In this way increase of RES in overall electric power generation would be achieved, what is the goal of Montenegrin Energy policy. Furthermore, reliable supply from the power distribution grid would be provided for the cable car power supply.

Wind power

Even though there is no measurement for any location of planned stations for Kotor-Cetinje cable car, the company Sistem-mne has done measurement on the nearby location in Krivosije with the aim of using wind power for supply of the nearby base station. The picture below shows a graphical display of average wind speed based on a three-year measurement[6].



Picture 1.10.: *Example of measurement results – average wind speed on the location in Krivosije*

Having regard to the fact that during the greater part of the year average wind speed is higher than 3 m/s, there are good conditions for wind potential utilization. However, even though the given results are related to Krivosije location, results and analyses of multi-annual measurement on certain micro location are required for planning installation of greater power with the aim of electric power generation. Based on such results it is possible to estimate possible electric power generation and determine investment justification.

In case that measurement shows significant wind potential, wind farm could be built in the vicinity of the cable car, whereof generated electric power would be injected into the grid. On the nearby 35 kV transmission line, smaller wind farm of up to 10 MW [9] could be connected. 110 kV grid is far away

[6] Measuring done during the period from 29 October 2009 until 3 February 2013.

from all stations except for the station Kotor which, due to its position, is not suitable for the installation of wind generator. Connection to 110 kV transmission line would additionally increase the investment. Also, besides the transmission line, the price of TS 110/X kV necessary for the connection to the grid has to be taken into consideration[7].

Direct utilization of electric power generated in wind generators for cable car engine supply would not be technically justified due to the significant variability of electric power generation and due to the need for storing electric power in batteries.

Despite numerous advantages of wind farms in comparison to other RES, its disadvantage in comparison to photovoltaic systems is time required for construction and installation, and required space.

Furthermore, construction of a wind farm, even a small power one, requires access roads (for transport of wind aggregate parts and other equipment) to the spot of wind generators installation, what drastically increases investment costs.

Our company suggests setting up a pole on one micro location for measuring wind direction and speed over a period of 18 months in order to make a detailed Study on wind potential utilization possibilities in these municipalities.

Other RES

Out of other RES, biomass and thermal energy shall be mentioned. However, research in these fields has not been done yet for the territory of Montenegro. Thus, there are no studies or similar documents on the base of which we could start planning utilization of these forms of energy.

When talking about biomass potential, available data are limited to statistical data for the entire national territory, as well as the data on global vegetation cover available in specialized databases. In order to plan biomass installations, extensive and detailed research regarding certain locations are required.

[7] From the experience gained during design of wind farm Mozura (46 MW), the price of TS 110/30 kV with accompanying connecting transmission line (2x0,3 km) is estimated at 2,000,000.00 Euro.

Comparison of characteristics of different plants/systems using RES

Table 1.1.: *Characteristics of different types of power plants (1MW) using RES [19], [20], [21]*[8]

Type	**Time necessary for construction**	**Investment costs**	**Extent of terrain availability km^2/GWh**	**Negative impact on environment / pollution**	**Reliability**	**Average exploitation period**
Photovoltaic power plant	90 days	1,250,000.00 Eur0	0,005 (only on roofs)	Very small	Very high	25 years
Small hydropower plant	18 months	1,700,000.00 Euro	1,75	Very small	High	35-40 years
Wind farm	18 months	1,400,000.00 Euro	0,12	Small	High	20-25 years

[8] Besides the above said projects from which the data are taken, more extensive multi-annual design and construction experience also confirm the above data.

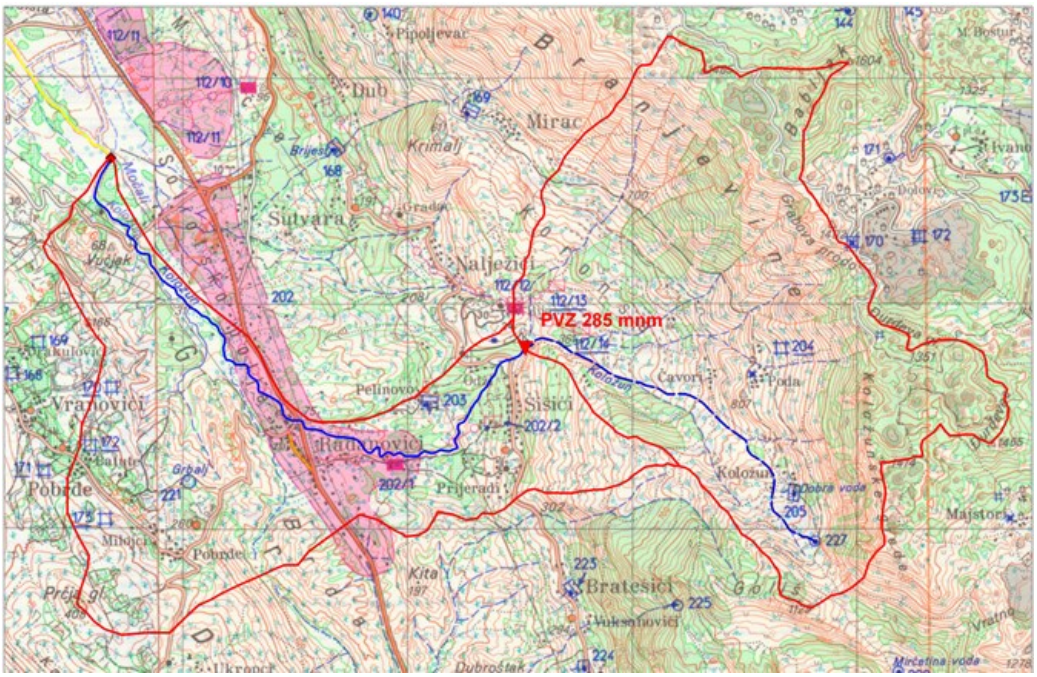
5. PRELIMINARY STUDY FOR SMALL HYDROPOWER PLANT KOLOZUN

Preliminary assessment of utilization possibilities of the river Kolozun hydropower

Small hydro power plant "Kolozun" is located in Kotor municipality on the Kolozun river. The river Kolozun flows through Grbaljsko polje. It belongs to the immediate basin of the Adriatic Sea and has a typical torrential character. In the lower part of the flow, there has been flow regulation so as to prevent negative impact on the lower parts of Tivat filed.

For the needs of this preliminary study of the river Kolozun hydropower utilization, company Sistem-mne d.o.o. (ltd) has purchased, through Hydrometeorology Institute of Montenegro, hydrologic analysis of runoff on the profile of 285 meters above sea level.

Picture 1 *Location of the Kolozun river*



Picture 2 *Presentation of the catchment area of the Kolozun river*

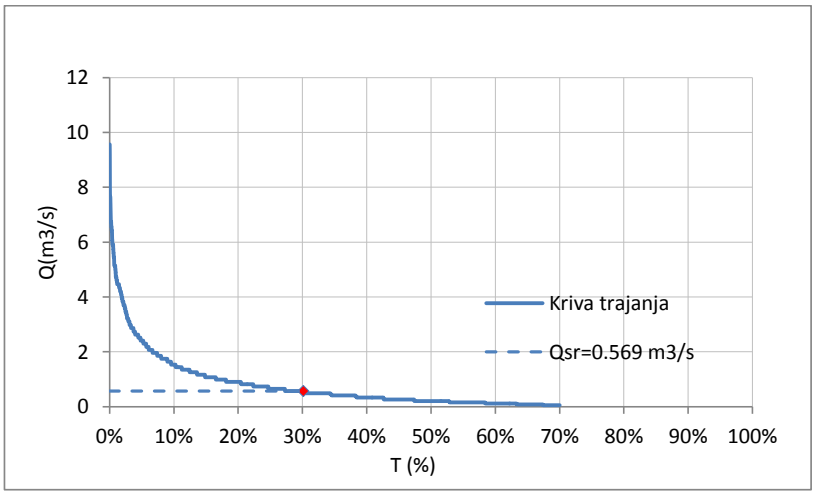
The catchment area is the area in the countryside or urban area which supplies the system of interconnected flows, so that the runoff from that area occurs at one output profile. The catchment area is determined by a watershed which can be topographic or hydrologic. Topographic watershed is a boundary line which in favourable conditions follows the spots with the highest altitude between two catchment areas.

The catchment area of the Kolozun river up to the profile on the elevation of 285 m.a.s.l. is 11.3 km^2. The catchment area to the water intake profile is fan-shaped. This implies sudden concentration, huge relevant intensity and short-term runoff.

Maximum height in the catchment area is 1604 m.a.s.l., average catchment incline is 33.8 %, while the levelled out watercourse incline is 18.6 %. Total length of the watercourse up to the observed profile is 3.483 km.

Table 1 *Physical and geographic characteristics of the catchment area and watercourse of the river Kolozun:*

1	Catchment area *F*	11.3	[km^2]
2	Watercourse length L_T	0.022(3.48)	[km]
3	Catchment length L_s	4.81	[km]
4	Catchment range *S*	16.6	[km]
5	Average catchment width $B=F/L_s$	2.35	[km]
6	Straight-line distance, source-mouth L_i	0.022(3.10)	[km]
7	Straight-line distance of the catchment centre from the mouth U_T	2.072	[km]
8	Coefficient of the watershed development K_s	1.395	[-]
9	Coefficient of catchment area extension K_σ	1.074	[-]
10	Coefficient of catchment area concentration K_c	0.657	[-]
11	Coefficient of watercourse winding K_L	1.000	[-]
12	Maximum catchment area height H_{max}	1604	[mnm]
13	Minimum catchment area height H_{min}	285	[mnm]
14	Average catchment incline I_{sr}	33.8	[%]
15	Maximum valley incline I_{max}	84.0	[%]
16	Average catchment area altitude H_{sr}	956	[mnm]
17	Averige catchment area altitude difference ΔH	671	[m]
18	Levelled out catchment incline I_t	18.6	[%]
19	Maximum flow incline I_{t1}	26.9	[%]
20	Average maximum flow incline I_{t2}	19.1	[%]



Picture 3 *Runoff curve on the profile of 285 m.a.s.l.*

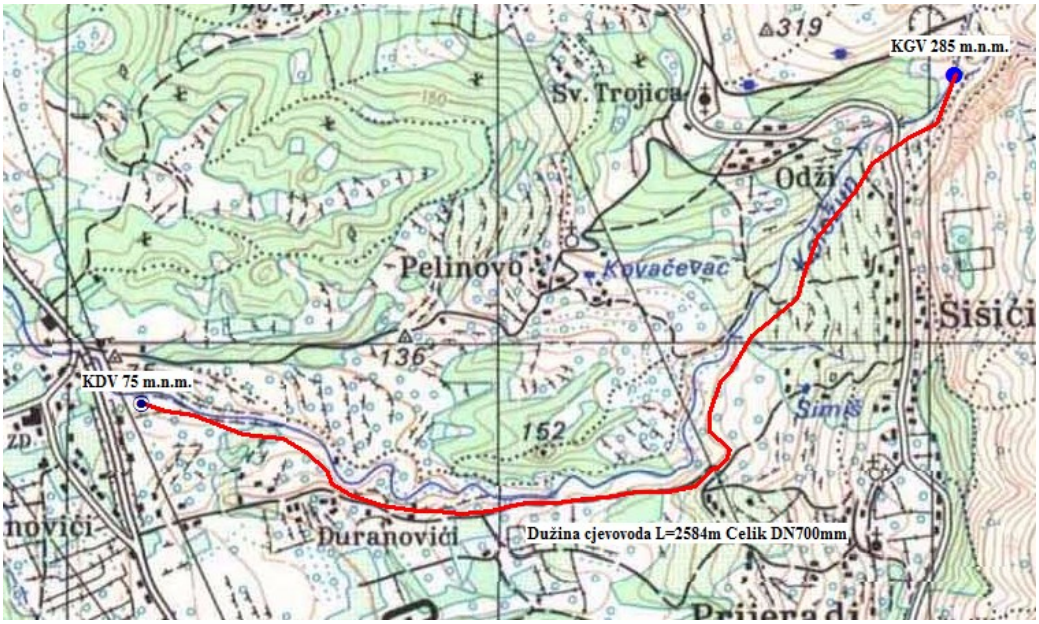
Table 2. *Typical duration curve at the level of Kolozun river water intake:*

T(%)	0%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
Q(m3/s)	9.56	2.41	1.531	1.07	0.903	0.650	0.569	0.409	0.332	0.260	0.203

T(%)	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Q(m3/s)	0.145	0.081	0.035	0.000	0	0	0	0	0	0

Average multiannual river flow Q = 0.569 m^3/s and all higher flows last on average approximately 30% of the overall flow duration of the watercourse which amounts approximately 110 days per year.

- **PRELIMINARY ASSESSMENT**



Picture 4 *Approximate pipeline route on the profile of the river Kolozun (presentation in MapInfo)*

Table 3 *The Kolozun river profile:*

Pipeline route length:	2584,00 m
Upper water level:	285,00 mnm
Lower water level:	75,00 mnm

Having in mind the watercourse character, adopted solution is a small derivative type hydropower plant with level regulation at parallel operation on the grid.

Upper water level in the water intake is 285.00 m.a.s.l. Ecologic, that is, minimum biologic flow in the Kolozun riverbed is 10% of the average multi-annual flow obtained by hydrologic analysis (Q_{sr} = 0,569 m^3/s). The value of overall biologic minimum is 0,057m^3/s.

By visiting the site, our company has located the micro location of the future water intake, pipeline route and power building. During the visit, in the middle of July, the Kolozun river was dry and this data was confirmed by Hydrometeorology Institute of Montenegro in their hydrologic analysis. Thus, in the next phase of the documents preparation special attention will be paid to determining biologic minimum of this river. With this regard, professional team of the company Sistem-mne d.o.o. is of the opinion that it is not necessary to determine 10% of the average multi-annual flow because the river gets dry and thus there are no living beings either in this period or in the period of its torrential flow. If ecologic elaborate proves that our opinion is correct, generation will be increased for approximately 10%.

Power building is located on the left bank of the river Kolozun. Small hydropower plant consists of water intake facility, pipeline under pressure and power building where the turbine and generator with accompanying equipment are stored.

Supply system is a steel pipeline under pressure. Its diameter is 700 mm, approximate length 2584.00 m. Lower water level of power building with Pelton turbine is 75.00 m.a.s.l., so the gross head amounts 210.00 m. Installed aggregate power is **P_p=991,03 kW.** After passing through the turbine wheel, water is returned through the drainage canal into Kolozun riverbed.

Preliminary analysis shows that the power is lower than 1MW what meets the first requirement from the Rulebook on issuing energy permits. The second requirement is gross energy potential which has to be lower than 15 GWh, what is met with calculation given by the Hydrometeorology Institute (page 18) in their preliminary hydrologic analysis, and it amounts 14.31 GWh on annual basis. Thus, the river Kolozun meets all requirements from the Rulebook on issuing energy permits, and it can be valorized by obtaining necessary permits in a shortened procedure, on the principle of energy permit. This study will provide the map for obtaining energy permit, and thus, construction permit.

- **DETERMINING PIPELINE DIAMETER:**

Economically justified pipeline diameter is one which for the smallest pipeline cost price gives the highest energy effect, and optimization of pipeline diameter is determined.
However, for its determination various empirical equations are used, among which an equation Bundechu for heads H_b> 100 m:

$$D = \sqrt[7]{\frac{5.2 \cdot Q_i^3}{H_b}} \quad [\mathrm{m}] \tag{1.}$$

Losses due to friction can be determined by using Darcy equation:

$$h_f = f \cdot \frac{L}{D} \cdot \frac{Q_i^2}{2 \cdot g \cdot A^2} \quad [\mathrm{m}] \tag{2.}$$

where:

- f[/] –coefficient of friction,
- A [m^2] – cross cut area of the pipeline.

Net head of the power plant can be determined from energy equation given for upper and lower water levels. With the assumption that local energy loss in the system is 10% of energy lost due to friction in the pipeline, the value of net head is obtained:

$$H_n = H_b - 1.1 \cdot f \cdot \frac{L}{D} \cdot \frac{Q_i^2}{2 \cdot g \cdot A^2} \quad [\mathrm{m}] \tag{3.}$$

The value of net head directly influences installed power of the power plant and has the function of a chosen pipeline diameter. The coefficient of friction is a function of Reynolds Number (Re) and relative pipeline roughness (δ/D) and can be determined based on the following explicit Haaland equation:

$$\frac{1}{f} = \left\{ -1.8 \cdot log \left[\frac{6.9}{Re} + \left(\frac{\delta}{3.7 \cdot D} \right)^{1.11} \right] \right\}^2 \tag{4.}$$

Reynolds Number Re is obtained from the following equation:

$$\mathrm{R_e} = \frac{w \cdot D}{\nu} \tag{5.}$$

with:

- w[m/s] – current velocity in the pipeline,
- D [m] – pipeline diameter,
- ν [m^2/s] – kinematic viscosity of water.

Absolute roughness of steel for pipes is δ = 0,012 mm, and kinematic viscosity of water for the water temperature of 10 ºC is $\nu = 1.31 \cdot 10^{-6}$ m^2/s.

Apart from equation (1.), the following criteria for indirectly determine pipeline diameter D are used in practice:

- current velocity in the pipeline should be approximately 2 m/s, and
- total energy loss in the pipeline should be lower than 5% of the value of gross head $h_g < 0.05 \cdot H_b$.

The power that water transmits to the turbine impeller is defined as input or hydraulic power and is defined through the following equation:

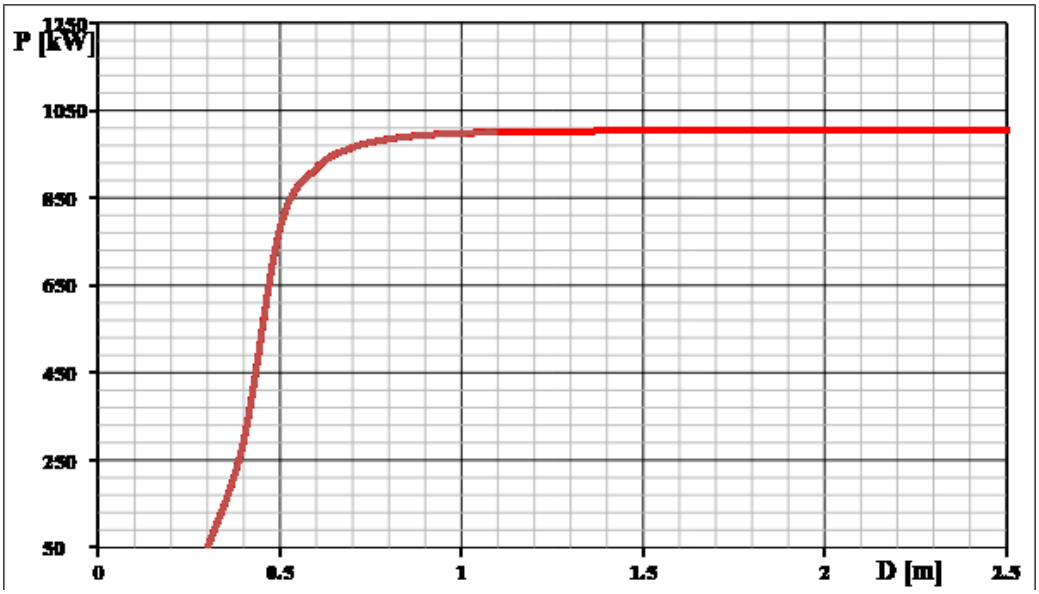
$$P_h = \rho \cdot g \cdot H_n \cdot Q_i \quad [\mathrm{m}] \tag{6.}$$

Table 4 shows analysis for a few pipeline diameters D for chosen installed flow Q_i, while the last column shows the analysis for pipeline diameter obtained by using equation (1.).

Table 4 *Net head in function of the pipeline diameter*

D [m]	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Q_i [m³/s]	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59
H_b [m]	210	210	210	210	210	210	210	210
H_n [m]	-457.31	61.39	163.45	191.91	201.84	205.90	207.76	208.69
L [m]	2584	2584	2584	2584	2584	2584	2584	2584
H_g [m]	667.31	148.61	46.55	18.09	8.16	4.10	2.24	1.31
H_g [%]	317.76	70.77	22.16	8.61	3.89	1.95	1.07	0.62
A [m²]	0.07	0.13	0.20	0.28	0.38	0.50	0.64	0.79
w [m/s]	8.35	4.70	3.01	2.09	1.53	1.17	0.93	0.75
Re	1927680	1445760	1156608	963840.2	826148.7	722880.1	642560.1	578304.1
Ph [kW]	-2646.84	355.3219	946.0538	1110.758	1168.232	1191.702	1202.47	1207.875
f	0.019814	0.018595	0.017774	0.017188	0.016757	0.016435	0.016193	0.016012

Table 4 shows that criteria on speed and energy loss are fulfilled for pipeline diameter **DN700mm**.



Picture 5 *changes of hydraulic power of small hydropower plant „Kolozun" in the function of pipeline diameter*

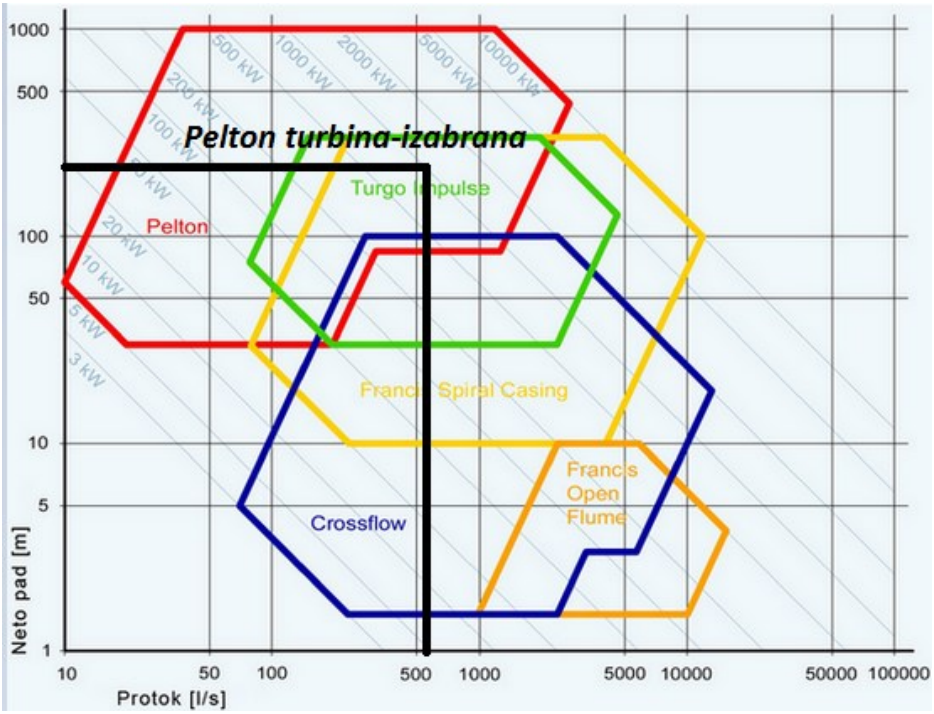
On the base of diameter value obtained by using equation (1.) and above mentioned criteria for indirect determination of pipeline diameter, the pipeline diameters for small hydropower plant "Kolozun" can be adopted:

DN700 mm,

The choice of these pipeline diameters shall be further examined by optimization of the pipeline diameter which shall be done at a higher level of project documentation.

- **TURBINE SELECTION:**

Basic parameters for selection of turbine type are installed flow Q_i and net head H_n. Picture 6 contains the diagram which is used for turbine selection on the basis of the above mentioned parameters.



Picture 6 *Diagram for turbine selection*

On the base of values Qi and Hn and the diagram in Picture 6, it can be concluded that Pelton turbine is the most suitable for utilization of available energy. This solution is chosen due to the reason that for the great part of a year the turbine will operate with the flow lower than installed. In this period it will operate with smaller number of nozzles, thus retaining high efficiency level. Francis turbine could also be taken into account, while Pelton turbine has been selected with the aim to get the highest generation of electric power.

Picture 8 *Pelton turbine (small hydropower plant "Vrelo"-Tomasevo,Montenegro)*

Picture 9 *Power building (small hydropower plant "Vrelo"-Tomasevo,Montenegro)*

- **CALCULATION OF ELECTRIC POWER GENERATION:**

Following tables ***5-7*** show calculation of electric power generation of small hydropower plant "Kolozun":

Flow duration	Total flow	Biologic minimum	Remaining amount of water	Usable amount of water	Flow through the pipeline	Water flow through the riverbed	Speed through the pipeline	Re for the pipeline	Coefficient of pipeline friction
[%]	[m³/s]	[m³/s]	[m³/s]	[m³/s]	[m³/s]	[m³/s]	[m/s]	/	/
10	1.531	0.057	1.474	1.474	0.590	0.941	1.53	826149	0.016757
20	0.903	0.057	0.846	0.846	0.590	0.313	1.53	826149	0.016757
30	0.569	0.057	0.512	0.512	0.512	0.057	1.33	717069	0.016841
40	0.332	0.057	0.275	0.275	0.275	0.057	0.72	385209	0.017355
50	0.203	0.057	0.146	0.146	0.146	0.057	0.38	204577	0.018214
60	0.081	0.057	0.024	0.000	0.000	0.081	0.00	0	0.000000
70	0.000	0.057	-0.057	0.000	0.000	0.000	0.00	0	0.000000
80	0.000	0.057	-0.057	0.000	0.000	0.000	0.00	0	0.000000
90	0.000	0.057	-0.057	0.000	0.000	0.000	0.00	0	0.000000
95	0.000	0.057	-0.057	0.000	0.000	0.000	0.00	0	0.000000

Net head	Turbine hydraulic power	η_T	Turbine power	SHP power	Total generation	Gross watercourse potential	Gross potential utilization
[m]	[kW]	[%]	[kW]	[kW]	[kWh]	[kWh]	[%]
201.84	1168.23	90.20	1,053.72	991.03	868,138.32	2,346,585.75	37.00
201.84	1168.23	90.20	1,053.72	991.03	868,138.32	1,250,101.64	69.45
203.82	1023.94	90.55	927.18	872.01	763,884.30	872,114.49	87.59
208.16	561.78	90.43	508.01	477.78	418,538.01	492,446.30	84.99
209.46	300.20	89.82	269.64	253.60	222,151.33	311,141.02	71.40
210.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
210.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
210.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
210.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
210.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Total:	mHE
Theoretical annual generation	3,140,850.28
Dropout and overhaul of SHP (10 %) [kWh/god]:	314,085.03
Annual generation [kWh/god]:	2,826,765.25
Annual gross potential [kWh/god]:	5,272,389.21
Annual utilization of gross potential [%]:	59.57
Total operating time at full power (h/year) :	3169.29
Total operating time at full power [%]:	36.18

If taken into consideration that 10% of electric power generation will be lost in aggregate dropout and overhaul of the small hydropower plant "Kolozun", overall generation of aggregate with Pelton turbine would be:

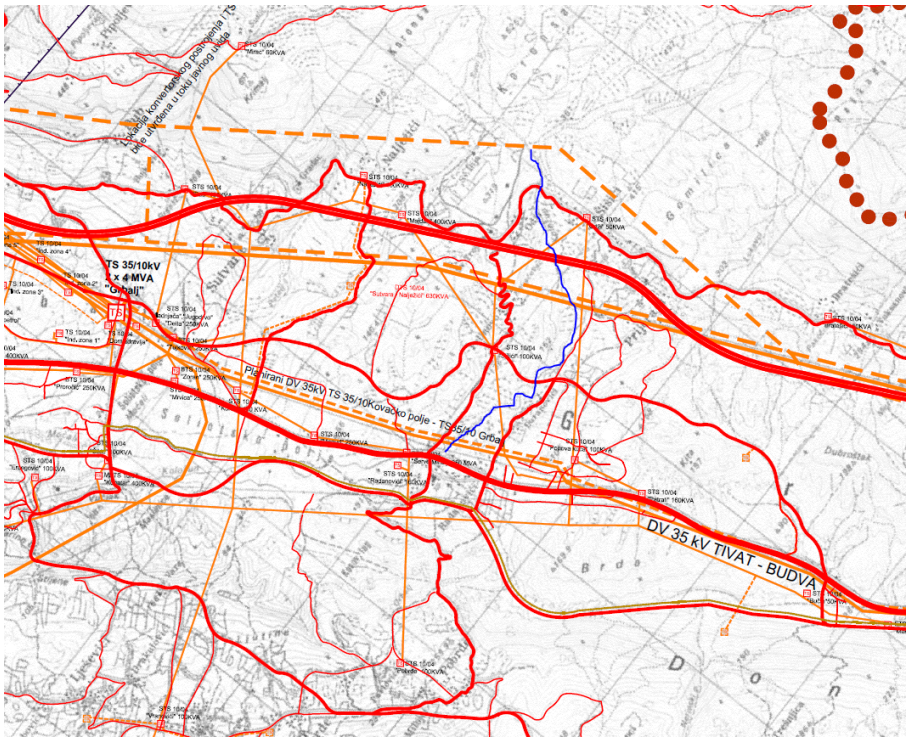
$$E_{god} = 2.826.765,25 \text{ kWh/god}$$

- **CONNECTION TO THE POWER GRID:**

When planning connection of a small power plant to the power distribution grid, it is necessary to fulfil the criteria defined in Technical recommendations for connection of distributed power sources in Montenegro:

- allowed voltage deviation,
- short-circuit power,
- flicker,
- allowed voltage and current of higher harmonics,
- secure synchronization,
- maximum allowed injection of direct current
- voltage unbalance,
- reactive power of small hydropower plants.

Connection of small hydropower plant "Kolozun" would be done in a very vicinity of the power building on the input-output principle on existing 35 kV transmission line Tivat-Budva.



Picture 10 *35kV transmission line Tivat-Budva*

Input-output connection on 35 kV transmission line is shown in the following picture:

Picture 11 *Input-output connection on 35 kV transmission line (small hydropower plant "Vrelo"- Tomasevo,Montenegro)*

Predicted electrical equipment for connection is a dry transformer 0,4/35kV, two incoming feeders, one load cell and one transformer cell; analogue equipment is shown on the following pictures:

Picture 12 *Medium-voltage switchgear (small hydropower plant "Vrelo"-Tomasevo,Montenegro)*

Picture 13 *Transformer 0,4/35kV (small hydropower plant "Vrelo"-Tomasevo,Montenegro)*

- **ECONOMIC ANALYSES:**

Financial analysis is used for assessment of investment profitability, that is, to determine payback period and thus determine whether the project is cost-effective or not. This Preliminary study provides the most basic financial analysis which will determine economic justification of construction of the small hydropower plant "Kolozun". The prices are determined based on the data obtained from available project documentation for SHP.

Parameters which determine economic and financial effectiveness of suggested solution are:

- total investment cost,
- amount of planned annual generation of electric power,
- purchase price of electric power,
- payback deadline,
- analysis of costs of electric power consumption for cable car Kotor-Cetinje power supply

Purchase price of electric power for annual generation is 0,1044€/kWh for generation E_{god}<3GWh; 0,0744€/kWh for generation 3 GWh<E_{god}<15 GWh; and the third tariff at the price of 0,0544 € / kWh for generation E_{god}> 15 GWh. Therefore, planned small hydropower plants will make a profit of approximately 295.034,40 €/year. The following tables contain costs estimates, and Picture 14 shows the percentage of investment into the structure of planned small hydropower plant.

SHP "Kolozun"

Table 8 *Estimated bill of quantities for construction works and construction material*

ESTIMATE OF WORKS	***Price (€)***
1. Water intake structure with hydro-mechanical equipment and all construction works	*100,000.00*
2. Construction of power building with drainage canal	*100,000.00*
3. Other (Coanda grid, slide gates, mud discharge, etc.)	*75,000.00*
TOTAL	***275,000.00***

Table 9 *Estimated bill of quantities for mechanical and hydro-mechanical equipment*

ESTIMATE OF EQUIPMENT	***Price (€)***
1. Turbines	*170,000.00*
2. Hydromechanics	*40,000.00*
3. Hydraulics	*20,000.00*
4. Other	*20,000.00*
TOTAL	***250,000.00***

Table 10 *Estimated bill of quantities for electric equipment of SHP "Kolozun" with connection to the grid.*

ESTIMATE OF EQUIPMENT	***Price (€)***
1. Low voltage, control	*35,000.00*
2. Generator	*80,000.00*
3. Medium-voltage switchyard and transformer in SHP	*85,000.00*
4. Connection to the grid	*30,000.00*
5. Signal and power cable	*6,000.00*
TOTAL	***236,000.00***

Table 11 *Estimated bill of quantities for works on pipeline installation*

ESTIMAMTE OF THE PIPELINE WITH RELATED WORKS	**Price (€)**
1. Inlet pipe	*12,000.00*
2. Cap	*12,500.00*
3. Pipeline and hose materials with the laying and landscaping	*420,900.00*
4. Supply channel	*80,000.00*
TOTAL	***525,400.00***

Table 12 *Design estimate*

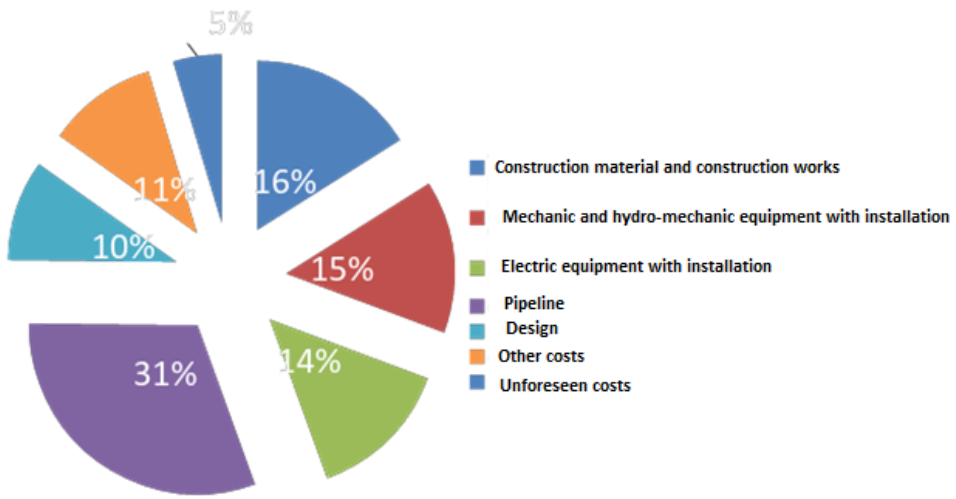
ESTIMATE	**Price (€)**
1. Geodetic measurements, hydrologic data, geological survey, environmental survey, survey evaluation Commission	*30,000.00*
2. Drafting of project documentation for SHP and transmission line, auditing	*120,000.00*
3. Implementation plan / detailed design	*15,000.00*
TOTAL	***165,000.00***

Table 13 *Other costs*

ESTIMATE OF OTHER COSTS	**Price (€)**
1. Project management	*25,000.00*
3. Multipurpose solution	*20,000.00*
4. Purchase and lease of land	*120,000.00*
5. Expropriation survey, Cadastre, Public Notary	*15,000.00*
TOTAL	***180,000.00***

Table 14 *Cumulative recapitulation of the investment*

	NAME:	Price (€)
A	CONSTRUCTION MATERIAL AND CONSTRUCTION WORKS	***275,000.00***
B	MECHANIC AND HYDRO-MECHANIC EQUIPMENT WITH INSTALLATION	***250,000.00***
C	ELECTRIC EQUIPMENT AND TRANSMISSION LINE WITH INSTALLATION	***236,000.00***
D	PIPELINE	***525,400.00***
E	DESIGN	***165,000.00***
G	OTHER COSTS	***180,000.00***
H	UNFORSEEN COSTS	***80,000.00***
	TOTAL:	***1,711,400.00***



Picture 14 *Investment structure of SHP "Kolozun" in percents*

SHP "Kolozun"	
Installed power of the hydropower plant:	P_{iu}= 991,03 KW
Rating of annual aggregate generation:	E_{god}= 2,826 GWh
Estimate of annual gross income:	295,034.40 €
Total investment:	**1,711,400.00** €

Now, we can determine specific investment cost in €/kW as a relation between total investment and total power of SHP, and specific investment cost in €/kW as a relation between total investment and total theoretical annual generation:

- 1.726,89€ / KW – specific investment in relation to power
- 0,605€ / KWh – specific investment in relation to generation

Simple pay-back period is approximately **5,8 years**. It can be concluded that the investment in such project is cost-effective.

Electric power consumed by the cable car is 1,8 kWh per year. Since the price of electric power is approximately 0,09 € / kWh, annual consumption of electric power is 162,000.00 Euro.

On the other hand, SHP "Kolozun" would generate 2,826 GWh. If we take into consideration electric power purchase price, annual income is 295,034.40 Euro.

The difference between the costs for electric power taken from the power grid and generated electric power is 133,034.60 Euro on annual basis.

Feed-in tariff period is 12 years after gaining the right of a privileged electric power producer, so the difference during this period is 1596415.20 €. In Table 7 on page 10 herein, the designer showed dropout of a small hydropower plant form the grid in the amount of 10% of theoretical annual generation, what will depend on the quality of equipment on existing 35 kV transmission line Tivat-Budva. In case the existing equipment is in a good condition, with smaller annual dropouts, malfunctions and earth-faults, it is realistic to expect higher generation than the one predicted for this economic analysis.

If proved that it is not necessary to leave biologic minimum, generation will increase for approximately 10%, what is still big advantage and it will be elaborated in the next preparation of project design documents on a higher level of this study.

- **CONCLUSION**

Expected annual income from electric power generation is 295,034.40 €, while investment estimate is approximately 2,212,400.00 €. However, the investment value will be elaborated in more details during the preparation of a preliminary design Pre-feasibility study.

Pursuant to the pay-back period of approximately 5,8 years and the value of specific investments, it can be concluded that SHP "Kolozun" is a favourable facility.

Table 9 *Basic technical characteristics of SHP "Kolozun"*

mHE „Kolož̌un”:	
Upper water level:	K_z= 285,00 mnm
Lower water level:	K_s = 75,00 mnm
Gross head:	H_b = 87,00 m
Medium flow on the profile of water intake:	Q_{sr}= 0,569 m^3/s
Minimum biologic flow:	Q_{rs} = 0,057 m^3/s
Installed flow for the turbine:	Q_i = 0,590 m^3/s
Level of installation:	i = 1,037
Net head for installed flow Q_{i1}:	H_n= 201,84 m
Pipeline diameter:	D = 700 mm
Pipeline length:	L= 2584,00 m
Installed power of aggregate with Pelton turbine:	P = 991,03 kW
Rating of average annual generation of the aggregate:	E_{god1} = 2,826 GWh

Attached to this preliminary hydropower analysis of the river Kolozun, we submit the following:

- Preliminary hydrologic analysis of the river Kolozun runoff on the profile of 285 m.a.s.l. and calculation of gross energy potential.
- Rulebook on criteria for issuing energy permits, contents of requests and registry of energy permits.
- Map of the way for obtaining construction permit.

6. ENVIRONMENTAL IMPACT OF RENEWABLE ENERGY SOURCES

In comparison to conventional energy sources, such as big hydropower and thermal power plants, renewable energy sources have much lower impact on the environment: no greenhouse gases emission during exploitation, no hazardous waste, no depletion of natural resources. The share of renewable energy sources in electric power generation in Montenegro is at the moment on a very low level (few small hydropower plants). When taken into consideration that tourism and energetics are among main business activities in Montenegro, the need for linking these two activities arises, with the aim of further development of positive feedback implementation. Kotor-Cetinje cable car project is a good chance for utilization of tourism potentials and renewable energy source potentials. As this Study has determined existence of good conditions for utilization of hydropower, sun and wind, it is necessary to take look at environmental aspect of possible RES plants on planned locations.

Hydropower

Exploitation of a hydropower facility, even a small hydropower plant, is inevitably accompanied by certain environmental impact. Thus, this aspect shall be analysed in all phases of preparation of the documentation for such facilities, including pre-investment documentation whose aim is to make preliminary decisions regarding the further course of the project.

The Law on Spatial Planning and Construction (Official Gazette of Montenegro No. 51/08) defines measures and activities which shall, in the area of spatial and urban planning, and construction, provide environment quality protection pursuant to development of Montenegro as ecological state.

Analysis of environmental protection from harmful effects of observed facility represents a multidisciplinary approach to the analysis of existing condition of environmental quality, as well as to the analysis of a new facility's impact, and it includes the following basic parts:

- - technical solution for providing biologic minimum in Qes watercourse (spillway, fish ladder, fish elevator, construction of a private hatchery for stocking, construction of a fish pond above the water intake),
- technical solution for monitoring the flow and the conditions in the area,
- planning and design of SHP taking into consideration available technology and achievements in science and technology.

Those negative effects are usually localized solely to the construction area, and rarely to immediate environment. Negative effects to those directly involved in construction are neutralized or reduced by using appropriate HTZ equipment (masks and respirators), while the impact on environment is reduced by choosing appropriate time for such type of works (wind direction, etc.).

Dust, exhaust gases of construction machinery and motor vehicles, as well as dust and gases of possible mining, can reduce the air quality in the area during the construction works. Those employed on the construction of the facility are exposed to all those effects, as well as nearby flora and fauna. These effects can be efficiently controlled through proper planning and strict implementation of safety measures.

Noise

As the result of construction works on SHP there is increased noise level. The most negative effects of noise level increase are reflected directly on the construction site.

Noise, as the consequence of operation of construction machinery and vehicles, is an unfavourable side effect of SHP construction. The most unfavourable effects of noise are at the very site, what is eliminated by using appropriate HTZ protective equipment (antiphons and ear protectors). Even though the site is quite far away from bigger residential areas, they have to be secured due to the nature of works (mining, operation of heavy machinery). Noise also affects the nearby area (people in surrounding villages, cattle), and this effect can be partially controlled by selecting activities to be carried out on the site.

Impact on water quality

- Operation of construction machinery with internal combustion engines is a possible cause of pollution with petroleum products (engine fuel, diesel fuel, lubricants, etc.). Such pollution is usually caused at those sites with no strict protective measures, where defective machinery is used and where the employees are not controlled in preparation phases and machine maintenance.
- On the occasion of doing ground works, especially with excavations for foundations, appears rinsing of smaller fractions which are taken downstream, thus creating specific type of pollution by suspended matters.
- Construction material landfills, if not sufficiently protected, represent possible pollution source, especially during periods of heavy rain.
- Access roads, used for delivery of construction materials onto the site, represent possible pollution risks, unless built in such manner that the water from them cannot be rinsed directly into the watercourse.
- Parking areas for construction machinery is a serious possible pollution source in case the water from them is rinsed towards the river without control.
- Construction developments, if not built properly with complete sanitation (collection and disposal of waste water and solid waste) can be the source of pollution.
- During the installation of mechanical and electromechanical equipment, especially while handling various types of fuels and lubricants (servo mechanisms, transformer fuel,

lubricants for turbine bearings, etc.), certain omissions can occur causing water pollution with the above mentioned dangerous substances.

Space occupation (Footprint)

During the construction of SHP on the river Kolozun (or any other mentioned in chapter 4), temporary space occupation is necessary (accompanying facilities, infrastructure on the site, borrow pits, disposal areas, etc.). Upon completion of construction works, temporary occupied areas shall be restored to their original condition.

Landscape changes

Changing of landscape as the result of pipeline installation, construction of borrow pits for materials, temporary landfills and other works requires its restoration into the original condition upon completion of construction (this refers to those landscape changes which have temporary character).

All above mentioned impacts on environment are minor ones, due to their temporary character (only during the construction period, approximately 1 year). By applying protection measures, this impact is minimized or completely eliminated.

Solar energy

Regarding the impact of photovoltaic system on the environment, if we take a comprehensive look, this impact can be observed through three phases:

- The impact of production of System elements
- The impact of System exploitation
- The impact of elements after cessation of their function

The impact of production of photovoltaic modules, batteries and electro-equipment on the environment is primarily observed through energy needs of the facilities producing the subject equipment. Having in mind that those facilities mainly use electric power generated in conventional power plants, such as thermal plants, the production process is connected with effects such as greenhouse gases emission and air pollution. However, having regard to the size of considered systems, this impact is negligible.

Having regard to the fact that photovoltaic systems use solely pure solar power, their impact on the environment during the exploitation phase is minimal, and this is one of their greatest advantages. In the very case of Kotor-Cetinje cable car project, there is no negative impact on the environment in the exploitation phase as all equipment would be stored in the existing facility and would not occupy

additional space. Furthermore, neither of system elements during their operation produces any harmful substances and has any influence on the environment. The only possibility of negative effects is in case of disasters or accidents which can damage the photovoltaic modules and batteries. In this case [22], inflammable gases, used in production of photovoltaic modules and making their integral part, can be released. In addition, having regard to the fact that in this specific case lead-acid batteries are recommended, it shall be taken into consideration that in case of their mechanical or thermal damage, these harmful substances can leak out. For the above reasons, in design and construction of the photovoltaic systems, it is necessary to store the equipment in a safe place in order to keep it safe from danger and fire.

Once the system or some of its elements stop working, the negative effect of elements such as photovoltaic modules, batteries and electrical equipment, treated as technical waste upon the cessation of their function, shall be reduced to the greatest extent. In accordance with the practice of companies which deliver the equipment and the positive EU practice, all elements shall be recycled after cessation of their operation.

Wind power

Although wind farms basically do not have a negative impact on the environment, before construction of a wind farm, it is important to carefully consider possible effects on immediate environment (including flora and fauna). In many cases, negative effects can be avoided or reduced by adjusting the location of the whole facility (in the planning phase), number of wind generators, or by changing the location of wind generators inside available facility boundaries. Therefore, the boundaries within which measurements show the highest wind potential shall be determined in the first place.

Overall impact of wind farms on natural habitats, birds, bats and other wildlife depends on the specific characteristics of the location itself. With this regard, construction of wind farms in the areas of migration routes of birds and bats shall be avoided. In order to avoid possible harassment of local population, installation of wind generations shall be planned at the sufficient distance from the cable car and inhabited areas. In addition, when designing the project, possible influence on the landscape where construction is planned and visual impact shall be taken into consideration.

After the expiry of the service life (20-25 years), dismantling shall be done, what shall be provided for in the project planning and design process. Thus, restoration of the environment into its original condition, to the most possible extent, is planned.

It is not necessary to question the impact on the environment when small wind generators are installed (up to a few thousand kW), intended for supply of smaller consumers on various locations.

The impact of CO2 reduced emission

The most common way of transfer of tourists from Kotor to Cetinje and back is by bus. The most favourite area for tourists coming from cruisers is an old Austro-Hungarian road Kotor-Cetinje, through Njegusi, with an unavoidable rest at the lookout for taking photographs.

Average fuel consumption per a visitor on the road Kotor-Cetinje-Kotor is approximately 1 litre per passenger. [24]

Annual CO2 emission due to generation of electric power intended for Kotor-Cetinje cable car supply is 608,36 t [24], while the CO2 emission as the result of bus transport of tourists is approximately 240 t per year. Having in mind the fact that construction of cable car icreases emission of greenhouse gases, it is suggested to use facilities which utilize RES in order to eliminate harmful effects of increased CO2 emission.

As the difference in CO2 emission caused by using electric power from the grid and motor vehicles for the transport of tourist amounts approximately 360 t annually, with the aim of compensation CO2 emission shall be reduced for 360 t annually. This can be achieved by generation of electric power from the facilities using RES. In this case, facility which would provide annual generation of approximately 1,1 GWh shall be planned.

Construction of SHP Kolozun would provide annual electric power generation of 2,86 KWh, what exceeds not only the amount of electric power needed to eliminate additional greenhouse gases emission, but also the amount needed for full supply of the cable car. Thus, the reduction of CO2 emission on the whole territory of Montenegro is achieved.

Necessary installation of photovoltaic modules for generation of 1,1 GWh of electric power annualy amounts 900 kW. With this regard, it should be mentioned that, although the generation amounts 1,1 GWh annauly, such system cannot have sufficient peak power to supply the cable car. Thus, the cable car would be supplied from the grid, while the electric power generated from the photovoltaic system would be injected into the grid.

In order to estimate necessary installation of wind aggregates for generation of 1,1 GWh of electric power, it is necessary to have detailed and precise data on wind potential and planned wind turbines.

7. CONCLUSION

The construction of Kotor-Cetinje cable car would undoubtedly contribute to the valorisation of tourist potentials of Montenegro. On the other hand, electric power to be provided for the cable car supply, which is at the same time the longest in the world, increases CO2 emission. Generation of electric power from RES arises as the solution to the above said.

Pursuant to preliminary project for Kotor-Cetinje cable car, annual consumption of electric power is 1,8 GWh. In order to compensate for CO2 emission, 1,1 GWh of pure electric energy shall be provided.

This Study presents the possibilities for cable car supply from RES. Having regard to the specific characteristics and changeability of the cable car as the consumer of electric power, it is suggested for the cable car to be supplied from the grid, while generated electric power shall be injected into the grid pursuant to the Energy Law. In this case, the owner (the Investor) acquires the status of a privileged electric power producer and sells generated electric power at the price higher than the price of the electric power from the grid.

Hydropower is distinguished as the most cost-effective due to the ability to generate great amounts of electric power (2,86 GWh) on a yearly basis, which amount exceeds the needs of the cable car. In addition, it has the shortest payback period and the longest service life (in comparison to photovoltaic plant and wind farm). For the river Kolozun, there is a preliminary study provided for small hydropower plant based on the data obtained from Hydrometeorology Institute.

Besides hydropower, Kotor and Cetinje municipalities dispose of important solar potential as well, suitable for the construction of photovoltaic plant. There is a possibility of modules installations in Montenegro, that is, installation of photovoltaic system solely on existing roof structures. Based on the data available to the company Sistem-mne, it has been determined that the station Ivanova korita is the most suitable for utilization of solar potential. However, the potential is similar on other stations as well. In order to plan the installation, it is necessary to have detailed data of both the roof structures of the stations and the facilities themselves, i.e. equipment storage space. The only financially justified solution is selling generated electric power at the price provided for in [10]. Depending on available area and equipment storage space, pursuant to Montenegrin legislation, in this case it is possible to install maximum 1 MW. This installation would provide annual electric power generation of approximately 1,3 GWh, would occupy approximately 6.400 m^2, and would cost approximately 1,250.000 Euro.

Pursuant to general data from used literature and analogies with measurements on other locations in Montenegro, it can be concluded that wind potential also deserves to be taken into consideration while planning RES utilization. The biggest problem is the lack of measurements results for specific

micro location in Kotor and Cetinje municipalities. Based on these data, it would be possible to precisely determine the wind potential and possibilities for electric power generation.

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ATTACHMENT NO.1

Preliminary hydrologic analysis of the river Kolozun runoff on the profile of 285 m.a.s.l. and calculation of gross energy potential.

September 2015.

CRNA GORA
ZAVOD ZA HIDROMETEOROLOGIJU I SEIZMOLOGIJU

Crna Gora
ZAVOD ZA HIDROMETEOROLOGIJU I SEIZMOLOGIJU
Broj 01-2302/1
Podgorica, 02-09-2015 god.

Preliminarna hidrološka analiza oticanja rijeke Kolužun u profilu 285 mnm i proračun bruto energetskog potencijala

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Sadržaj: Strana

-Uvod-

Ovaj hidrološki elaborat urađen je na osnovu Zahtjeva firme Sistem-mne iz Podgorica, br 01-2302 od 01.09.2015 g, kojim se traži određivanje bilansa rijeke Koložun u profilu 285 mnm kao i proračun bruto energetskog potencijala.

Rijeka Koložun teče Grbaljskim poljem. Pripada neposrednom slivu Jadranskog mora i tipična je bujica. U donjem dijelu toka izvršena je regulacija toka kako bi se spriječilo njegovo štetno djelovanje na niže djelove Tivatskog polja.
Režim voda ovog vodotoka je tipičan za režim sredozemne klime. Karakteristična su sušna ljeta i vlažne zime. Nije rijetka pojava odsustva padavina i po 3-4 mjeseca kada svi manji vodotoci presuše.
Presušivanje vodotoka je vezano za pražnjenje izdani u odsustvu njihovog obnavljanja padavinama, kao i za poniranje vode u krečnjake ili slojeve šljunka.
Jesenje velike vode su najizraženije i prouzrokuju najveće povodnje i poplave.
Dakle, proticaji u rijekama odražavaju u punoj mjeri režim padavina uz korekturu na račun akumulacija voda u podzemlju i u obliku snijega (Lovćen).

U dostupnoj literaturi, mogu se naći podaci nekih autora koji bilans Koložuna, za čitavu površinu sliva (oko 33 km^2) koju drenira, procjenjuju na oko 2 m^3/s. Treba naglasiti da su ti podaci dobijeni na osnovu padavina i slivne površine vodotoka.

Kako se radi o vodotoku koji nije hidrološki istražen, kao i zbog specifičnosti režima tečenja, preporučuje se da se na mjestu planiranog vodozahvata formira hidrološka stanica sa obaveznim mjerenjima proticaja koja bi sa što većim procentom pokrila amplitudu vodostaja.

Dakle, kako se radi o vodotoku bez sopstvenih osmatranja i mjerenja, da bi smo odredili srednji protok u traženom profilu primjenjuju se hidrološki postupci i metode koji podrazumijevaju:

- Prikupljanje svih informacija i podataka koje mogu biti značajne za određivanje srednjeg višegodišnjeg proticaja u profilu bez sopstvenih osmatranja i mjerenja.
- Određivanje svih fizičkogeografskih karakteristika sliva i vodotoka koje su potrebne kao ulazni parametri kod metoda koje ćemo koristiti.

Kako se ovaj elaborat radi u svrhu hidroenergetskog iskorišćenja rijeke Koložun njime je, za naveden profil, potrebno definisati sledeće veličine

- Prosječni protok u profilu vodozahvata,
- Krivu trajanja protoka u profilu vodozahvata
- Maksimalne protoke različitih povratnih perioda (T-godina), odnosno vjerovatnoća (p %).

Metode, za procjenu srednjeg višegodišnjeg režima proticaja, koje smo koristili u ovom radu su:

- Metoda analogije
- Metoda Langbein-a
- Metoda predominantnih faktora

Što se tiče definisanja velikih voda različitog povratnog perioda njih ćemo odrediti preko

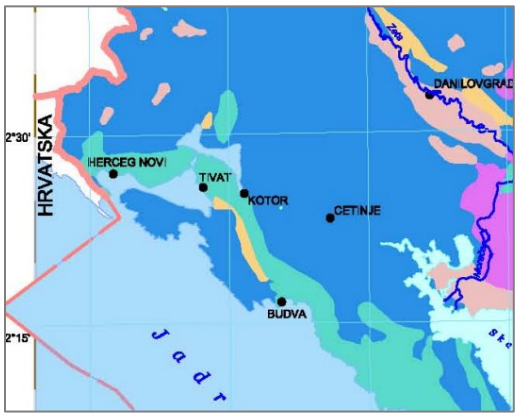
- Metoda predominantnih faktora i
- Metoda profesora Srebrenovića

Ove metode su odabrane iz razloga što pored ostalih parametara, koriste godišnje sume padavina koje se jednostavno izračunavaju. Međutim, za preciznije definisanje velikih voda potrebna je detaljnija i obimnija analiza, koja uključuje trajanje i intenzitet padavina (ITP krive).

Podaci o klimatsko meteorološkim prilikama na razmatranom slivu dobijeni su preko klimatoloških stanica iz razmatranog sliva i karte izohijeta godišnjih suma padavina koja je objavljena u "Vodoprivrednoj osnovi Crne Gore".

Za određivanje fizičko geografskih karakteristika sliva i vodotoka koristili smo georeferencirane karte razmjere R:1:25 000 i 1:50 000 a obrade su vršene pomoću softverskog paketa MapInfo.

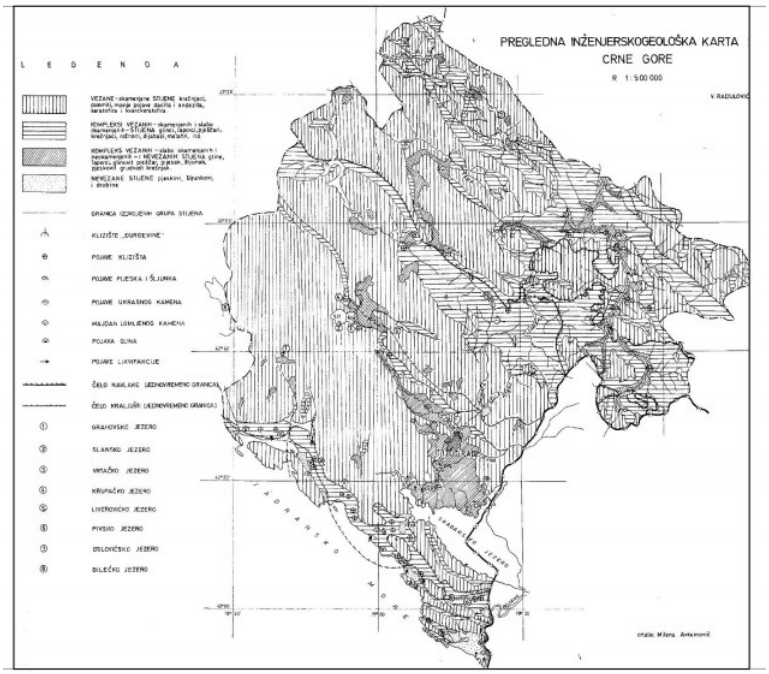
U uvodnom dijelu elaborata, samo informativno, dajemo uopšteno informacije vezane za geologiju predmetnog sliv.
Na osnovu raspoloživih hidrogeoloških podloga ("Vodoprivredne osnove Republike Crne Gore“ iz 1998 g.) može se zaključiti da su tereni rijeke Koložun, tereni sa akviferima kaverozne poroznosti.



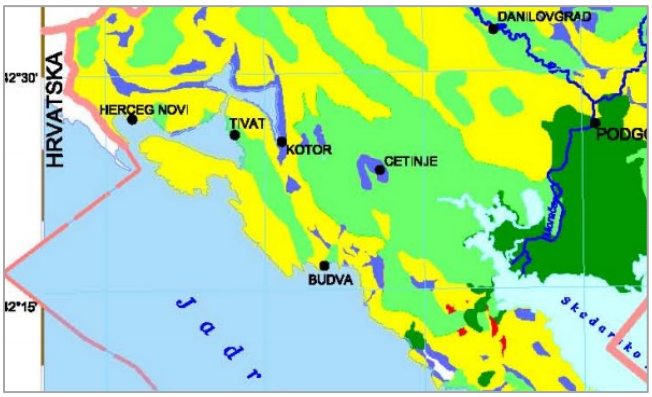
Hidrogeoloska karta Crne Gore

Hidrogeoloska klasifikacija stijena

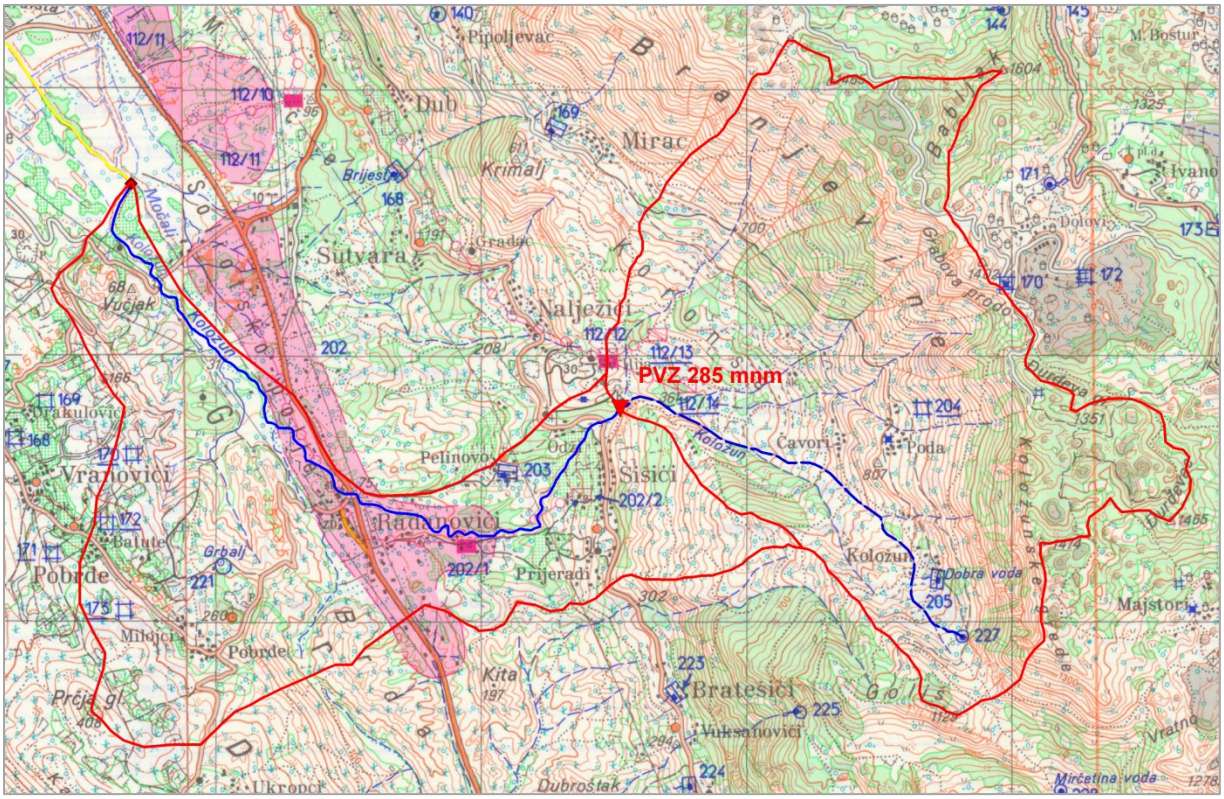
U inženjerskogeološkom smislu ti tereni predstavljaju vezane okamenjene stijene, krečnjaci i dolomiti. Takođe, vidljivo je prisustvo nevezanih stijena pjeskovi, šljunkovi i drobina. (prof. V. Radulović –Pregledna inženjerskogeološka karta Crne Gore)



Prema podacima PPCG do 2020 g. na terenima sliva Koložuna prisutna je srednja do slaba erozija.



- Fizičko geografske karakteristike sliva i vodotoka-



Pregledna karta sliva Kolžuna do kota 285 i do kote 15 mnm

Fizičkogeografske karakteristike sliva i vodotoka koje su nam potrebne pri određivanju srednjeg višegodišnjeg protoka i karakterističnih velikih voda različitog povratnog perioda, date su u tabeli na sledećoj strani.

Površina sliva Koložuna, do profila na koti 285 mnm je 11.3 km^2. Oblik sliva do profila vodozahvata je lepezast. To pretpostavlja naglu koncentraciju, velike mjerodavne intenzitete i kratkotrajno oticanje.

Maksimalna visina u slivu je 1604 mnm, srednji pad sliva 33.8 % a uravnati pad toka 18.6%. Ukupna dužina toka do posmatrang profila je 3.483 km.

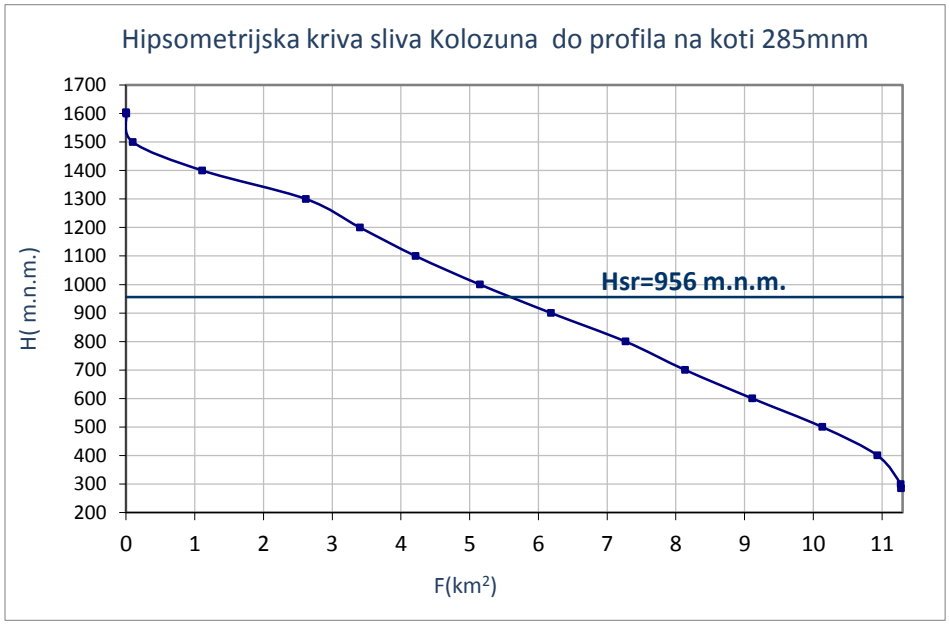
Tabela fizičko-geografskih karakteristika sliva i vodotoka

1	Površina sliva F	11.3	[km^2]
2	Dužina toka L_T	0.022(3.483)	[km]
3	Dužina sliva L_s	4.81	[km]
4	Obim sliva S	16.6	[km]
5	Srednja širina sliva $B=F/L_s$	2.35	[km]
6	Pravolinijska udaljenost izvor-ušće L_i	0.022(3.104)	[km]
7	Pravolinijska udaljenost težišta sliva od ušća U_T	2.072	[km]
8	Koeficijent razvijenosti vododjelnice K_s	1.395	[-]
9	Koeficijent izduženja sliva K_σ	(1.074)	[-]
10	Koeficijent koncentracije sliva K_c	0.657	[-]
11	Koeficijent krivudavosti toka K_L	1.0(1.122)	[-]
12	Maksimalna visina sliva H_{max}	1604	[m n. m.]
13	Minimalna visina sliva H_{min}	285	[m n. m.]
14	Srednji pad sliva I_{sr}	33.8	[%]
15	Maksimalni pad kosine doline I_{max}	84.0	[%]
16	Srednja nadmorska visina sliva H_{sr}	956	[m n. m.]
17	Srednja visinska razlika sliva ΔH	671	[m]
18	Uravnati pad toka I_t	18.6	[%]
19	Maksimalni pad toka I_{t1}	26.9	[%]
20	Srednji maksimalni pad toka I_{t2}	19.1	[%]

Jedan od potrebnih ulaznih parametara, kod metoda koje ćemo koristiti pri određivanju srednjeg višegodišnjeg protoka i karakterističnih velikih voda je i srednji pad sliva, koji se dobija na osnovu hipsometrijske krive sliva.

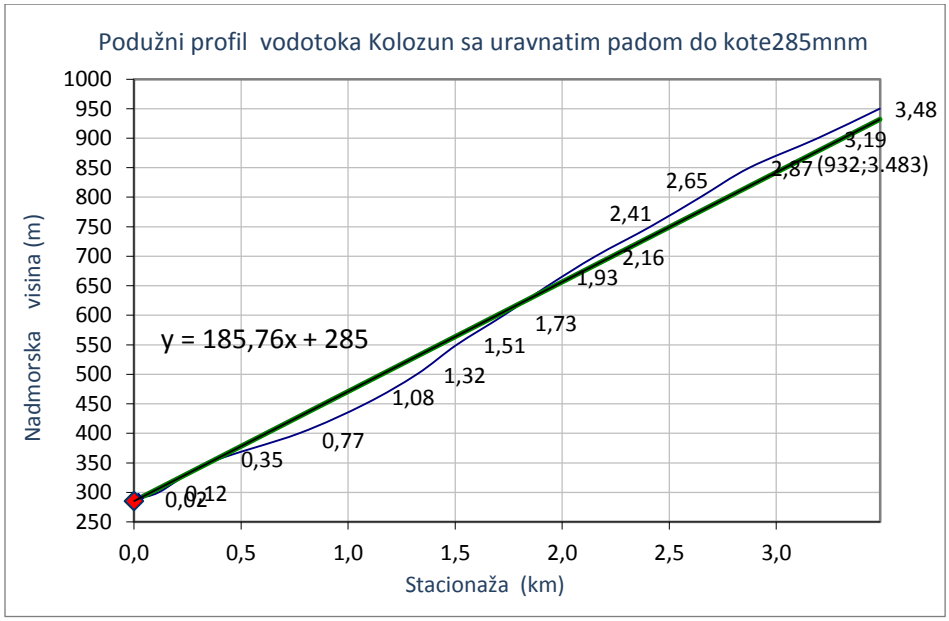
Hipsometrijska kriva sliva predstavlja zavisnost koja pokazuje zastupljenost (u % ili po površini) visine sliva iznad određenih kota i površine riječnog sliva.

Hipsometrijska kriva sliva rijeke Koložun sa srednjom nadmorskom visinom do kote 285mnm je data na sledećoj strani.

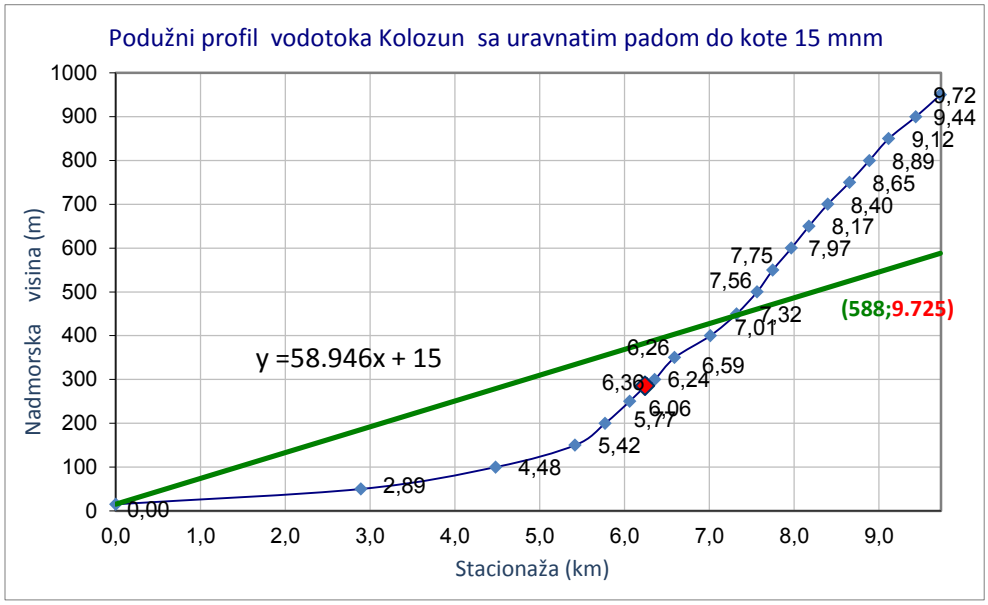


Hipsometrijska kriva sliva Koložuna do kote 285 mnm

Podužni pad Koložuna i njegov uravnati pad do profila 285 mnm za koji računamo srednji višegodišnji protok prikazan je na grafiku koji slijedi.



Podužni profil sa uravnatim padom do kote 285 mnm



Podužni profil sa uravnatim padom do kote 15 mnm

-Određivanje srednjeg višegodišnjeg protoka u profilu P 285 mnm-

-Metoda analogije-

Jedna od metoda za približno određivanje vrijednosti prosječnih godišnjih proticaja je metoda po kojoj se traži sliv analog, za koji se već raspolaže hidrološkim podacima. Ti se hidrološki podaci i analize na osnovu njih, zatim preslikavaju na hidrološki neizučen tj nemjeren sliv od interesa.
Za približno određivanje prosječnih proticaja na hidrološki nemjerenom slivu, pomoću sliva analoga koristi se sledeći obrazac:

$$Q_n = Q_a \times \frac{F_n}{F_a} \times \frac{Z_n}{Z_a} \times \frac{P_n}{P_a}$$ gdje je:

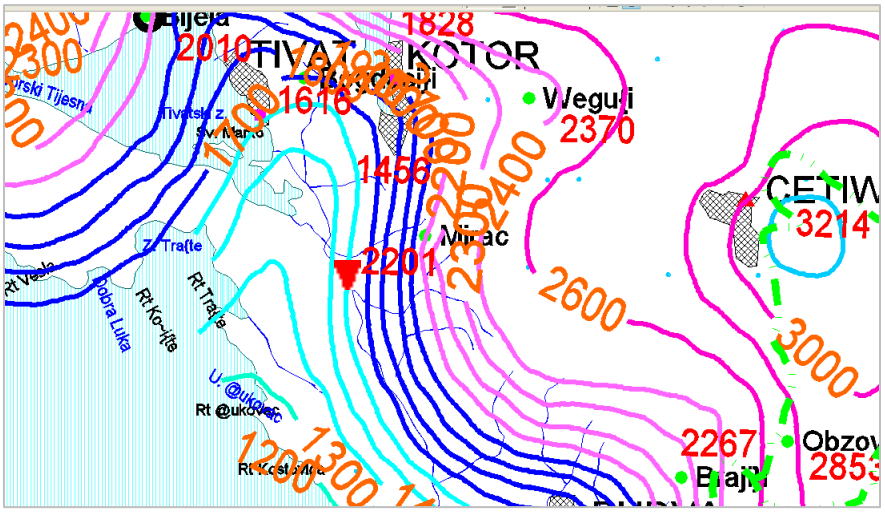
n - indeks koji označava sliv za koji se računa proticaj (nepoznato Q)
a - oznaka za sliv analog (za koji se raspolaže mjernim podacima),
Q - prosječni višegodišnji proticaj,
F - površina sliva,
Z - srednja nadmorska visina sliva (mnm)
P - prosječne padavine na slivu (mm).

Da bi se neki sliv mogao uzeti za sliv analog, mora sa slivom koji se računa ispunjavati sledeće uslove

- Da je geografski blizak sa slivnim područjem koje se analizira
- Da u svim slivovima vladaju slični klimatski uslovi
- Da su uslovi formiranja oticaja, tip zemljišta, hidrogeološki uslovi itd. su slični i
- Da se površine slivova ne razlikuju više od 5-10 puta, a razlika srednjih nadmorskih visina ne prelazi 300 m.

Za određivanja srednjeg višegodišnjeg proticaja Koložuna u traženom profilu metodom analogije nismo imali puno izbora. Po informacijama sa terena ovaj vodotok u prosjeku presušuje 3 do 4 mjeseca godišnje. Od hidrloški istraženih vodotoka iz Jadranskog sliva sa sličnim karakteristikama Koložunu i sličnim režimom padavina mogli smo da uzmemo u razmatranje samo rijeku Orahovšticu. Ona se uliva u Skadarsko jezero i ima srednju nadmorsku visinu sliva koja se uklapa u zadovoljava uslove za primjenu metode analogije.
Ostali vodotoci iz neposrednog sliva Jadranskog mora, ili su nedovoljno istraženi ili u pogledu potrebnih fizičkogeografskih uslova ne ispunjavaju potrebne kriterijume.

Što se tiče klimatskih uslova na slivu Koložuna oni je pod značajnim uticajem reljefa. Padavinski režim odlikuje se velikom varijabilnošću u vremenu i prostoru. Prema karti izohijeta godišnjih suma padavina (VORCG), prosječna višegodišnja suma padavina na slivu Koložuna kreće se od 2400 do 1600 mm/god. U ovom regionu samo 32% padavina se javlja u vegetacionom periodu najveće padavine se javljaju u tokom perioda oktobar-decembar, kada se u prosjeku izluči 36.8% godišnje sume padavina, a najmanje u periodu jun-avgust sa 9.9% godišnjih padavina.



▼ Profil na koti 285 mnm

Podaci za Koložun do profila na koti 285 mnm, potrebni za određivanje srednjeg višegodišnjeg protoka po metodi analogije su:

F_n = 11.3 km^2
Z_n= 956 mnm
P_n = 2250 mm

- Profil analog – HS Orahovo na Orahovštici

Period obrade sa HS Orahovo koji smo uzeli u analizu je 1985-2001 g. Ova HS kontroliše sliv od 56.6 km^2. Srednje višegodišnje padavine u ovom regionu su dosta visoke kreću se od 2850 mm do 2450 mm. Za sliv Orahovštice do HS Orahovo one iznose oko 2550mm. Podaci sa ovog profila potrebni za proračun po metodi analogije su:

Q_a = 2.6 m^3/s
F_a = 56.6 km^2
Z_a= 623 mnm
P_a = 2550 mm

$$Q_n = Q_a \times \frac{F_n}{F_a} \times \frac{Z_n}{Z_a} \times \frac{P_n}{P_a} = 2.6 \times \frac{11.3}{56.6} \times \frac{956}{623} \times \frac{2250}{2550} = 0.703 m^3/s$$

-Metoda Langbein-a-

Za proračun vrijednosti srednjeg višegodišnjeg proticaja metoda Langbein-a koristi zavisnost

$$Qsr / K = f(P_{sr} / K) \quad \text{gdje je:}$$

Qsr - prosječni višegodišnji sloj oticanja u slivu u cm,
P_{sr}- prosječne višegodišnje padavine u slivu,
K - Temperaturni faktor koji se definiše preko izraza

$$K=10^{(0.027*T + 0.886)}$$

T - prosječna višegodišnja temperatura vazduha u slivu u ºC.

Na osnovu poznatih vrijednosti temperature vazduha, korišćenjem navedene jednačine dobija se odgovarajuća vrijednost promjenljive K.

Preko zavisnosti Langbeina-a (uz korišćenje nomograma) za poznati odnos prosječnih višegodišnjih padavina i promjenljive K (temperaturni faktora) određuje se odnos Q_{sr}/K, a zatim i prosječni višegodišnji sloj oticanja Q_{sr} iskazan u cm.

Za proračun srednje temperature u slivu koristili smo ***Temperaturni gradijent za C.G.*** (VOCG).

U tabeli je dat proračun srednjeg višegodišnjeg protoka po metodi Langbein-a za profil P285mnm

Rijeka,profil	F (km^2)	P_{sr} (cm)	T (ºC)	K	P_{sr}/K	Qs/K	Qsr (cm)	q ($l/s/km^2$)	Q (m^3/s)
Kološun P285 mnm	11.3	225	8	12.6	17.9	12.7	160.02	50.7	**0.573**

-Metoda predominantnih faktora (M.P.F.)-

Ovom metodom dobijamo vrijednost srednjih prosječnih voda i velike vode različitih povratnih perioda (T= 10, 20, 50 i 100 g)
Po ovoj metodi velike vode se dobijaju interpolacijom a ne ekstrapolacijom opaženih veličina, što je njena glavna odlika i vrijednost. Hidrološki parametri koji su relativno konstantni po veličini i vremenu, a utiču na režim voda su:

- Prosječne godišnje padavine,
- Topografija sliva
- Pluvio topografski indeks

$P_h = h \times I_{sl}$ h-prosječna godišnja visina padavina na slivu (m)
I_{sl} – srednji pad sliva

- Linijski pluviotopografski indeks

$$P_l = \frac{P_h \times I_t}{L} \times 10^9$$

I_t – uravnati pad toka (%)
L – dužina toka (km)

- Koeficijent godišnjeg oticanja

$$\eta = \frac{A}{\frac{\pi}{2}} \times \mathrm{arctg}\left(\frac{P_h^{0.389}}{0.833}\right)$$

A – parametar stanja sliva koji varira od 0.90 do 1.10 i uključuje u sebi nedominantne faktore, koje je inače zametnije identifikovati.

$h_0 = \eta \times h$ odnosno $q = \frac{h_0}{0.0315}$

Parametar stanja sliva računa se po osnovu zastupljenosti vegetacije i pošumljenosti zemljišta.

$$A = (a_1 x P_1 + a_2 x P_2 + a_3 x P_3 + a_4 x P_4) \times a_5$$

$a_1 = 0.95$ za šume
$a_2 = 1.02$ za livade i pašnjake
$a_3 = 1.03$ za oranice
$a_4 = 1.04$ za goleti
$a_5 = 1.02$ za kompletan sliv

P_1, P_2, P_3, P_4 procentualno učešće zastuplenosti pojedinih struktura u slivu. ($P_1 + P_2 + P_3 + P_4 = 1.0$)

- Srednji godišnji protok

$Q_{sr} = q \times F$ (m^3/s)

Srednji godišnji protok je potreban da bi se preko njega odredila prosječna velika voda Q_0:

$Q_0 = \eta_0 \times Q_{sr}$ gdje je $h_0 = 5.2 \times P_i^{0.230} + 1$

Velike vode različitih vjerovatnoća pojave dobijaju se u odnosu na prosječnu veliku vodu:

$h_{10\,g} = 0.51 \times P_i^{0.2315} + 1$
$h_{20\,g} = 0.84 \times P_i^{0.1880} + 1$
$h_{50\,g} = 1.12 \times P_i^{0.1855} + 1$
$h_{100\,g} = 1.31 \times P_i^{0.1985} + 1$
$h_{1000\,g} = 1.85 \times P_i^{0.2045} + 1$, pa je $\max Q_{n\,god} = h_{n\,god} \times Q_0$

Nakon opisa metode izvršen je proračun karakterističnih voda za Koložun u profilu P285 mnm. Potrebni ulazni podaci su:

- površina sliva do mjernog profila $F = 11.3\ km^2$

- dužina toka L = 0.022 (3.483) km
- prosječna godišnja visina padavina u slivu h = 2250mm
- srednji pad sliva I_{sr} = 33.8%
- srednji maksimalni pad toka I_t = 19.1%
- A = 1.02

Dobijene vrijednosti po metodi predominantnih faktora

Ph =	0.7605
η =	0.532
ho =	1.204
q =	38.214 l/s*km^2
Q =	**0.432** m^3/s
Pi =	417.04
ho =	21.828

Prosjecna velika voda	**Qo =**	**9.426 m^3/s**
	h_{10} =	3.061
Velika voda (T=10 g P=10%)	**Q_{10}=**	**28.855 m^3/s**
	h_{20} =	3.611
Velika voda (T=20 g P=5%)	**Q_{20}=**	**34.040 m^3/s**
	h_{50} =	4.430
Velika voda (T=50 g P=2%)	**Q_{50}=**	**41.753 m^3/s**
	h_{100} =	5.339
Velika voda (T=100 g P=1%)	**Q_{100}=**	**50.322 m^3/s**

- Metoda prof Srebrenovića -

Ova formula je izvedena na osnovu racionalne formule. Zbog dobro određenih odnosa između karakterističnih parametara od kojih zavisi oticanje velikih rijeka preporučljiva je za praktičnu primjenu. Maksimalni protoci različitih povratnih perioda definisani su izrazom

$$Q_{MP} = 0.48x\frac{\alpha}{(\beta x\omega)^{3/4}}xA^{0.96}x\Psi_P xS^{1/3}$$ (m^3/s) gdje su

A-površina sliva u km^2

$\alpha = 0.80[1 + 0.075x(\log p - \beta)]$- koeficijent oticaja

p - povratni period

β =1-3 koeficijent zavisan od pošumljenosti, propustljivosti tla...

$\Psi_P = [P(1+1.5\log p)]^{1.43}$ P-prosječne godišnje padavine (m)

S- pad sliva određen izrazom

$S = \frac{2\Delta H}{L}$ (m/km)

ΔH - je razlika između srednje nadmorske visine sliva H_0 i kote proticajnog profila H

$\Delta H = H_0 - H$ (m)

L (km) - je duža stranica zamjenjujućeg pravougaonika, čija je površina jednaka površini sliva

$L = \sqrt{\frac{A(2-K)}{K}}$ (km)

K- koeficijent koncentrisanosti sliva $K = \frac{2A}{OU}$

O (km) - obim sliva
U (km) - udaljenost težišta sliva od proticajnog profila

ω - je veličina određena izrazom $\omega = 1 + \frac{\tau_2}{\tau_1}$

$\tau_1 = \frac{20x\beta}{[P(1+1.5x\log p)]^{0.57} xS^{0.43}}$ (sati) - vrijeme površinskog sabiranja

$\tau_2 = 2.6x\left(\frac{A}{S}\right)^{1/3}$ (sati) - vrijeme tečenja duž vodotoka

Tabelarni proračun velikih voda po formuli prof Srebrenovića za usvojeno β=2.6 i P=2.25 m

Ostali parametri potrebni za proračun dati su u tabeli fizičkogeografskih karakteristika sliva i vodotoka na strani 5.

	T10	**T20**	**T50**	**T100**
α	0.704	0.72	0.75	0.764
ψp	11.82	14.99	19.51	23.15
S	279.2	279.2	279.2	279.2
K	0.657	0.657	0.657	0.657
τ_1	1.724	1.569	1.412	1.319
τ_2	0.893	0.893	0.893	0.893
ω(sati)	1.518	1.569	1.632	1.677
Q (m^3/s)	**26.57**	**33.70**	**43.99**	**52.40**

Iz tabele u kojoj su prikazane vrijednosti velikih voda različitog povratnog perioda dobijene metodom profesora Srebrenovića vidimo da se vrijeme površinskog sabiranja (padavine od kojih se formira direktni oticaj) kreće se od 1.724 h za 10-togodišnu do 1.319 h za stogodišnju veliku vodu i ove vrijednosti su u granicama za ovu veličinu sliva i njegove osobine. Vrijeme prolaska talasa velike vode duž vodotoka je 0.893 h.

-Analiza dobijenih rezultata-

-Srednje vode-

Dobijene vrijednosti za Q_{sr} po metodologiji analogije, Langein-ovoj metodi i metodi predominantnih faktora i njihovi moduli oticaja dati su u sledećoj tabeli.

Vodotok	Metoda analogije	Metoda Langbein-a	Qsr po M.P.F.	Usvojena vrijednost
Koložun mnm Q(m^3/s)	0.703	0.573	0.432	**0.569**
q (l/s*km^2)	62.21	50.71	38.23	50.35

Za vrijednost srednjeg višegodišnjeg protoka u profilu 285 mnm usvajamo Q=0.569 m^3/s. Ovaj rezultat predstavlja srednju vrijednost dobijenih rezultata.

Koeficijent oticaja u profilu P285mnm za usvojenu vrijednost srednjeg višegodišnjeg proticaja iznosi.

$$k = \frac{V_o}{V_p} = \frac{QxT}{AxP} = \frac{0.569x365x24x3600}{11.3x2250} = 0.707$$

-Velike vode (VV)-

Prikazaćemo tabelarno izračunate vrijednosti velikih voda i njihove module oticanja.

Q(m^3/s)	MPF	Formula prof. Srebrenovića	q (l/s*km^2)	
			MPF	Formula prof. Srebrenovića
Q_{10}	28.86	26.57	2.55	2.35
Q_{20}	34.04	33.70	3.01	2.98
Q_{50}	41.75	43.99	3.69	3.89
Q_{100}	50.30	52.40	4.45	4.64

Velike vode su dobijene paraktično iste po obije metode. Iako su one na prvi pogled dosta visoke treba uzeti u obzir da se radi o primorskoj regiji, gdje imamo velike intenzitete padavina koji u kratkom intervalu vremena mogu dovesti do nagle koncentracije velikih voda. Po pravilu one ne traju dugo ali mogu izazvat kratkotrajne poplave.

- Proračun krive trajanja metodom analogije u profilu P 285 mnm -

Za definisanje krive trajanja, korišćena je metoda analogije. Prvo smo za vodotok analog po kojem smo usvojili srednju vrijednost proticaja odredili krivu trajanja sa karakterističnim vrijednostima trajanja. Na osnovu nje urađena je modulna kriva trajanja za profil analog. Modulna kriva trajanja dobija se po obrascu:

$$K(T) = \frac{Q\ (T)}{Q_s}$$ gdje su

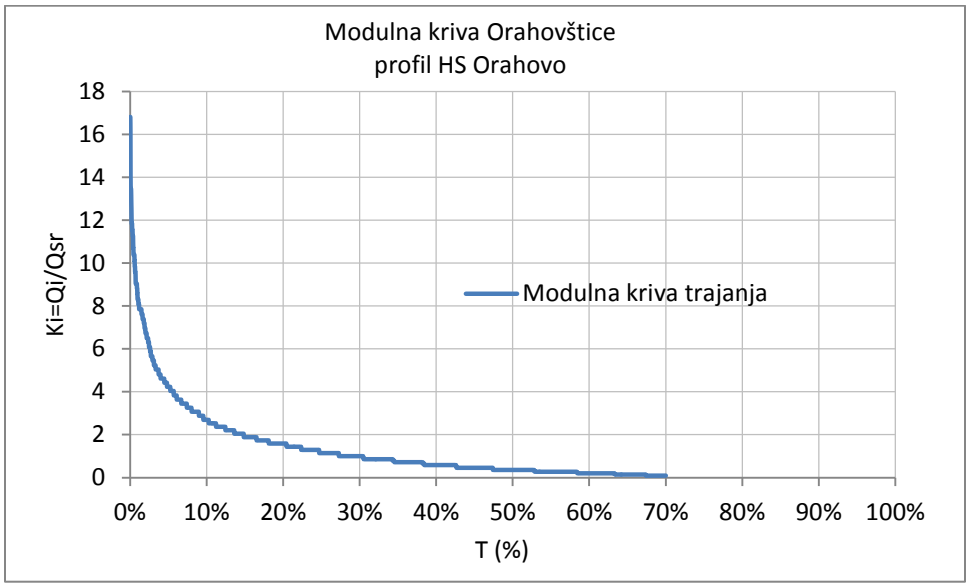
Q(T) - Proticaj u profilu rijeke trajanja T u %.

Q_s - Prosječni višegodišnji proticaj u profilu razmatranog vodotoka.

Za proračun krive trajanja srednje dnevnih proticaja u profilu vodozahvata Koložuna vrijednost ordinate krive trajanja dobijaja se pomoću sledeće formule

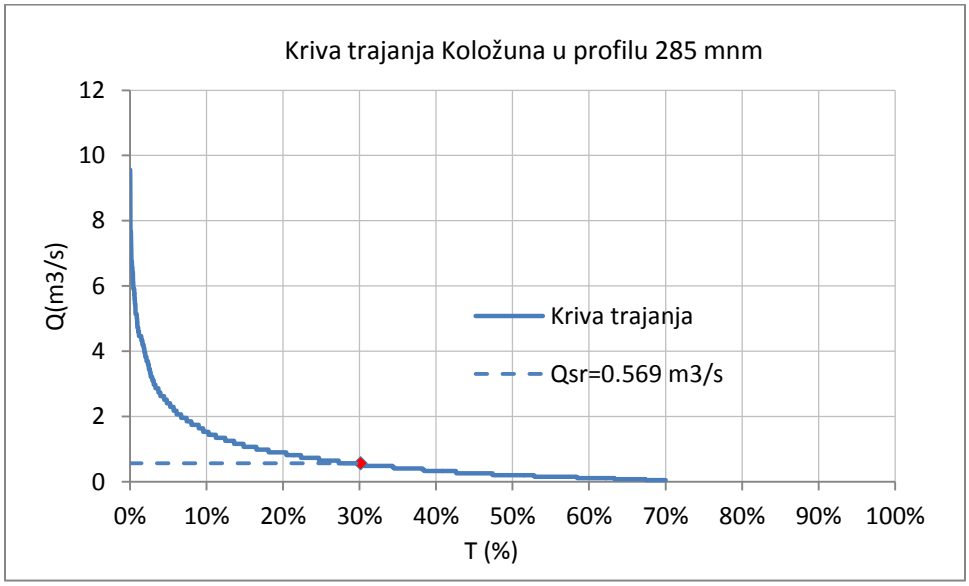
$Q_{dn,VZ} = K(T)*Q_{sr}^{VZ}$ *gdje je*

Q_{sr}^{VZ} – prosječni višegodišnji proticaj u profilu vodozahvata



Modulna kriva trajanja sliva analoga

Kriva trajanja Koložuna u profilu P 285 mnm, prikazana je na grafiku koji slijedi.



Kriva trajanja Koložuna u profilu 285 mnm

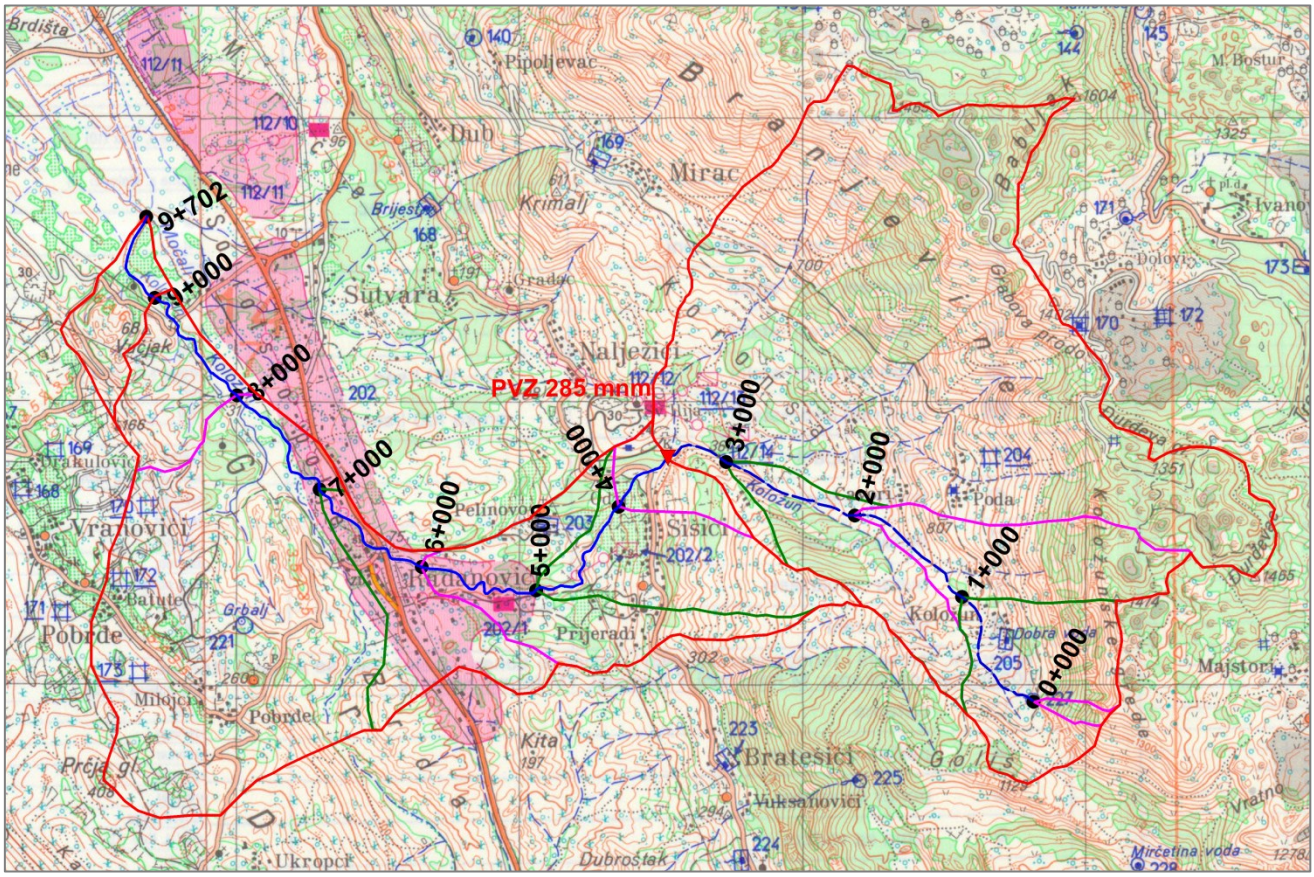
Karakteristična trajanja

T(%)	0%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
Q(m3/s)	9.56	2.41	1.531	1.07	0.903	0.650	0.569	0.409	0.332	0.260	0.203

T(%)	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Q(m3/s)	0.145	0.081	0.035	0.000	0	0	0	0	0	0

Srednji višegodišnji protok Q = 0.569 m^3/s i svi protoci veći od njega traju prosječno oko 30% od ukupnog vremena trajanja tečenja vodotoka koje iznosi oko 255 dana godišnje.

-Proračun bruto energetskog potencijala-



Pregledna karta sliva Koložuna do kote 15 mnm sa stacionažom na 1km

Određivanje hidroenergetskog potencijala je osnova za sva planirana iskorišćenja vodnih snaga u sklopu kompleksne hidroenergetike. Hidroenergetski potencijal se može proučavati nezavisno ako se znaju topografske karakteristike i vodni bilans na dovoljnom broju profila.

Međutim, njegovi iskoristivi vidovi moraju se proučavati u sklopu kompleksnih vodoprivrednih rješenja za korišćenje voda u slivu.

Konačni cilj izučavanja hidroenergetskog potencijala je određivanje stvarno tehnički i ekonomski iskoristivog potencijala.

Za sliv koji se izučava treba odrediti bruto-energetski potencijal. U našem slučaju odredićemo bruto energetski potencijal od voda koje stalno otiču, zanemarujući bruto potencijal od padavina.

Za određivanje morfometrijskih karakteristika sliva i vodotoka, koristili smo georeferenciranu topografsku kartu razmjere R: 1:50 000 a obrade su rađene u softverskom paketu MapInfo.

Dakle, da bi smo odredili BEP prvo je bilo potrebno odrediti

- Uzdužni profil vodotoka

- Pad na svaki km toka
- Prosječni proticaj na osmotrenom profilu
- Bruto-potencijal na vodotoku
- Ukupan bruto-potencijal po toku

U cilju proučavanja čitavih vodotoka uvode se pojednostavljenja, koja daju mogućnost brže procjene s manjom ali prihvatljivom tačnosti.

- Umjesto sa svim protocima približni se račun provodi sa srednjim godišnjim (Qsr)
- Umjesto pada energetske linije koristi se pad dna korita koji je dostupnan zahvaljujući geodetskim podlogama

Dionica rečnog toka na kojoj je protok Q(m^3/s), a denivelacija između ulaznog i izlaznog profila H(m) raspolaže snagom:

$$N = \gamma \times Q \times H \quad \text{(kW)} \quad \text{gdje je}$$

γ – zapreminska težina vode 9.81 kN/m^2
Q – prosječni višegodišnji protok (m^3/s)
H – denivelacija između ulaznog i izlaznog profila (m)

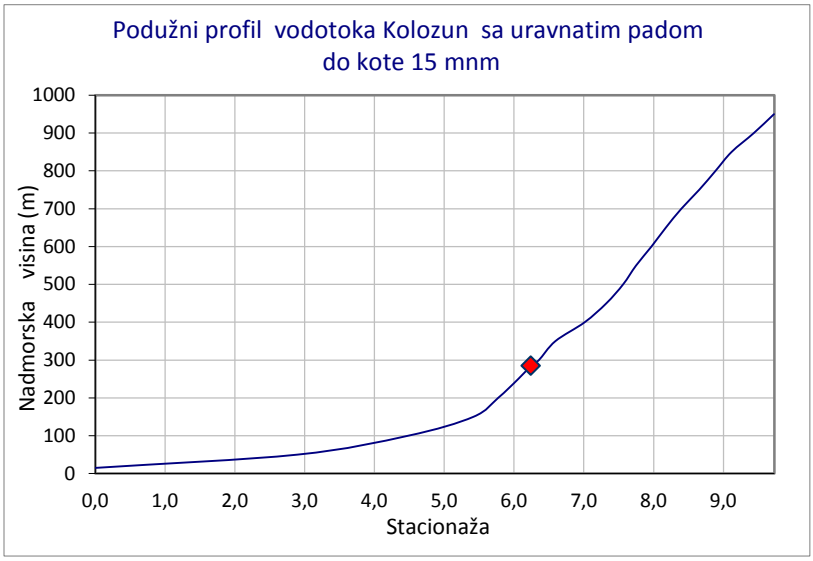
Energija razmatrane dionice rečnog toka u nekom intervalu vremena T(h) iznosi:

$$E = N \times T \quad \text{(kWh)}$$

Gornji izrazi predstavljaju teorijsku snagu i energiju (bez gubitaka koji su neizbježni pri transformaciji energije vode u mehaničku i električnu.

-Proračun bruto snage i energije duž toka-

Srednji višegodišnji proticaj rijeke Koložun u profilu 285 mnm, Q=0.569 m^3/s koji smo usvojili u prvom dijelu Analize, rasporedićemo duž toka do kote 15 mnm po stacionaži na 1.0 km, na osnovu pripadajućih slivnih površina.
U donjem dijelu toka izvršena je regulacija rijeke Koložun, kako bi se spriječilo štetno dejstvo velikih voda na Tivatsko polje. Ispod kote 15 mnm postoji mreža kanala, tako da nemamo definisan jedan stalni tok. Iz tog razloga je energija ovog vodotoka urađena do kote 15 mnm.



Podužni profil vodotoka do spajanja sa Kutskom rijekom

Detaljan proračun snage i bruto energije na godišnjem nivou dat je u tabelama koje slijede.

Tabela 1 -određivanje pripadajućeg protoka po stacionaži

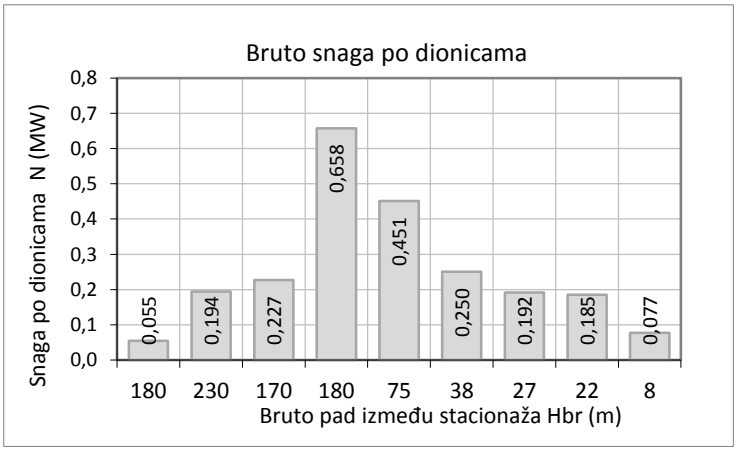
Stacionaža km	Kota (mnm)	Površina sl. između stacionaža (km^2)	∑ površina (km^2)	% učešće ∑ površina u ukupnoj površini	Q (m3/s)
0+000	950	0.05741	0.05741	0.283%	0.003
1+000	770	1.12959	1.187	5.842%	0.060
2+000	540	1.042	2.229	10.969%	0.112
3+000	370	0.949	3.178	15.640%	0.160
4+000	190	8.442	11.62	57.185%	0.585
5+000	115	1.12	12.74	62.697%	0.642
6+000	77	1.17	13.91	68.455%	0.700
7+000	50	0.93	14.84	73.031%	0.747
8+000	28	4.34	19.18	94.390%	0.966
9+000	20	0.68	19.86	97.736%	1.000
9+702	15	0.46	20.32	100.000%	1.023

Tabela 2 -određivanje snage i energije po stacionaži

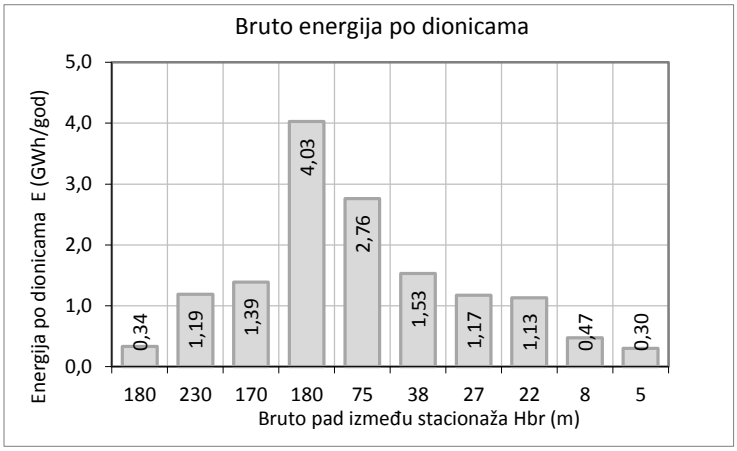
Stacionaža km	Kota (mnm)	Bruto pad (m)	Q (m3/s)	Snaga po dionicama N (kW)	Energija E (GWh)	God. ener. E (GWh/god)
0+000	950	180	0.031	54.7	0.335	0.335
1+000	770	230	0.086	194.052	1.188	1.52
2+000	540	170	0.136	227.027	1.389	2.91
3+000	370	180	0.373	657.883	4.026	6.94
4+000	190	75	0.613	451.244	2.762	9.70
5+000	115	38	0.671	250.123	1.531	11.23
6+000	77	27	0.724	191.723	1.173	12.40
7+000	50	22	0.857	184.854	1.131	13.54
8+000	28	8	0.983	77.139	0.472	14.01
9+000	20	5	1.012	49.620	0.304	14.31
9+702	15					

Na graficima koji slijede, na sledećoj strani, dati su sledeći grafički prilozi:

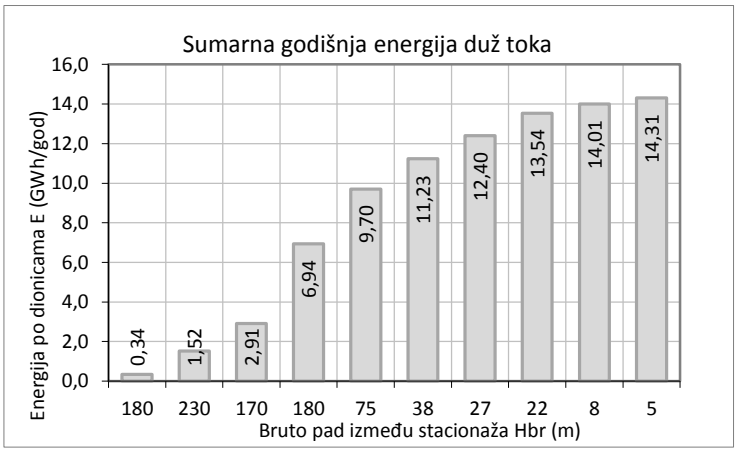
- Bruto snaga vodnog toka po dionicama (MW),
- Odgovarajuće energije po dionicama (GWh/g)
- Sumarna, bruto godišnja energija, koja je sračunata po dionicama određenim stacionažom na 1km
- Energetski uzdužni profil vodotoka EUP



Bruto snaga po dionicama

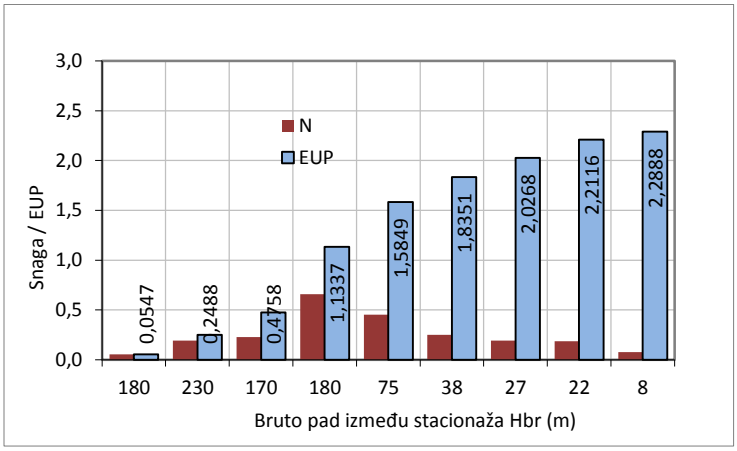


Bruto energija po dionicama



Sumarna energija duž toka

Energetski uzdužni profil (EUP) prikazuje prirast bruto snage duž cijelog toka. Na grafičkom prikazu jasno se ističu djelovi vodotoka s većim prirastom potencijala. Prema tome, to je grafička energetska karakteristika vodotoka, koja sadrži cijeli skup podataka koji se odnose na energetske karakteristike rijeke.



Energetski uzdužni profil

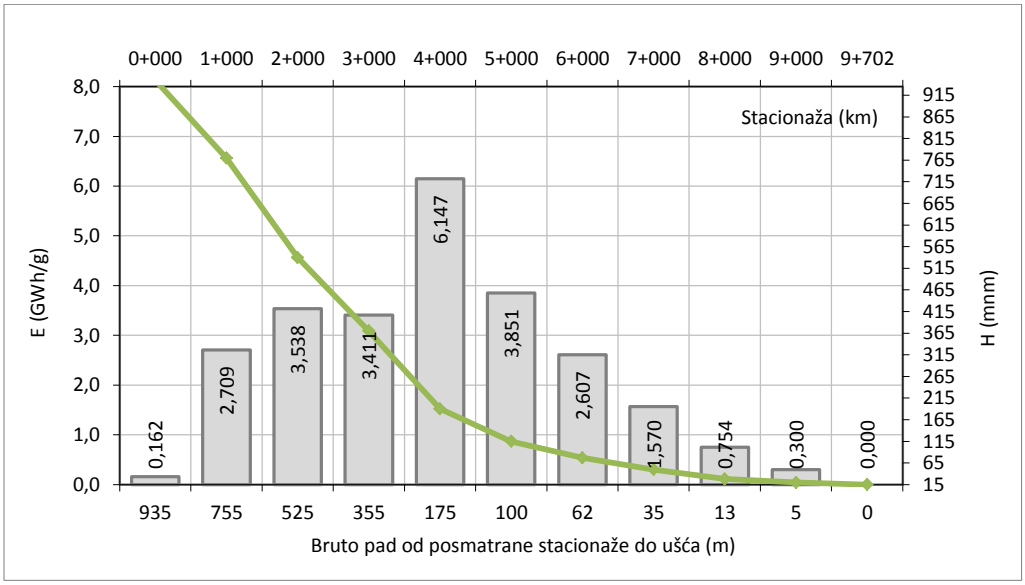
-Bruto potencijal duž vodotoka za posmatrane kote u odnosu na ušće -

U tabeli koja slijedi dat je proračun bruto godišnje energije sračunate za kote po stacionaži od 1km, u odnosu na ušće vodotoka.

Tabela 3 -određivanje snage i energije po stacionaži u odnosu na ušće

Kota (mnm)	Q (m^3/s)	Stacionaža (km)	H_{br} (m)	God. ener.E (GWh/god)
950	0.003	0+000	935	0.162
770	0.060	1+000	755	2.709
540	0.112	2+000	525	3.538
370	0.160	3+000	355	3.411
190	0.585	4+000	175	6.147
115	0.642	5+000	100	3.851
77	0.700	6+000	62	2.607
50	0.747	7+000	35	1.570
28	0.966	8+000	13	0.754
20	1.000	9+000	5	0.300
15	1.023	9+702	0	0.000

Grafik koji slijedi prikazuju bruto godišnju energiju ostvarenu od posmatrane stacionaže do ušća vodotoka.



Godišnja energija od posmatrane stacionaže do kote 15 mnm

ATTACHMENT NO.2

Rulebook on criteria for issuing energy permits, contents of requests and registry of energy permits.

September 2015.

Na osnovu člana 63 stav 5 Zakona o energetici ("Službeni list CG", broj 28/10), Ministarstvo ekonomije donijelo je

PRAVILNIK
O KRITERIJUMIMA ZA IZDAVANJE ENERGETSKE DOZVOLE, SADRŽINI ZAHTJEVA I REGISTRU ENERGETSKIH DOZVOLA
("Sl. list Crne Gore", br. 49/10 i 38/13)

Predmet
Član 1

Ovim pravilnikom propisuju se bliži kriterijumi za izdavanje energetske dozvole, sadržina zahtjeva i registra izdatih energetskih dozvola.

Objekti za koje se izdaju energetske dozvole
Član 2

Energetska dozvola se može izdati za izgradnju i rekonstrukciju objekata, u skladu sa članom 61 stav 2 Zakona o energetici (u daljem tekstu: Zakon), kao i za objekte za istovremenu proizvodnju električne energije i toplote (kogeneracije) i naftovode i produktovode.

Izdavanje energetske dozvole prema energetskom potencijalu lokacije
Član 3

Energetska dozvola za izgradnju objekta za proizvodnju električne energije iz člana 61 stav 2 tačka 1 Zakona koji koristi potencijal ili zemljište u državnoj svojini u skladu sa Strategijom razvoja energetike Crne Gore (u daljem tekstu: Strategija) može se izdati samo na lokaciji čiji je godišnji bruto energetski potencijal manji od 15 GWh.

Godišnji bruto energetski potencijal za vodotok, određuje se za vodotok od izvora do ušća.

Energetska dozvola za izgradnju male hidroelektrane instalisane snage do 1 MW može se izdati za vodotok koji je od lokalnog značaja u skladu sa zakonom kojim se uređuju vode.

Kriterijumi za izdavanje energetske dozvole
Član 4

Energetska dozvola za izgradnju proizvodnih energetskih objekata iz člana 61 stav 2 tačka 1 Zakona izdaje se ako su ispunjeni uslovi iz kriterijuma utvrđenih članom 62 stav 3 Zakona, koji se odnose na:

1) bezbjedno i nesmetano funkcionisanje energetskog sistema;
2) odrenivanje lokacije i korišćenje zemljišta;
3) zaštitu životne sredine;
4) mjere zaštite zdravlja ljudi i bezbjednosti ljudi i imovine;
5) stepen energetske efikasnosti energetskog objekta;
6) korišćenje primarnih izvora energije;
7) tehničku opremljenost i finansijsku sposobnost podnosioca zahtjeva da realizuje izgradnju energetskog objekta;
8) doprinos smanjenju emisije CO2 i
9) doprinos ispunjenju nacionalnog cilja korišćenja obnovljivih izvora energije.

Energetska dozvola za izgradnju ili rekonstrukciju objekata za skladištenje nafte, rezervoarski prostor za derivate nafte preko 50 tona i naftovoda i produktovoda izdaje se ako su ispunjeni uslovi iz stava 1 tač. 2, 3, 4, i 7 ovog člana.

Energetska dozvola za izgradnju ili rekonstrukciju objekta za prenos ili distribuciju prirodnog gasa, skladištenje prirodnog gasa ili tečnog prirodnog gasa izdaje se ako su ispunjeni uslovi iz stava 1 tač. 1, 2, 3, 4, 6 i 7 ovog člana.

Energetska dozvola za izgradnju ili rekonstrukciju objekta za proizvodnju toplote za daljinsko grijanje i/ili hlađenje ili industrijsku upotrebu ili distribuciju toplote za daljinsko grijanje i/ili hlađenje ili industrijsku upotrebu izdaje se ako su ispunjeni uslovi iz stava 1 tač. 2, 3, 4, 5, 6, 7 i 8 ovog člana, a u slučaju korišćenja obnovljivih izvora energije kao primarnog izvora i uslov iz stava 1 tačka 9 ovog člana.

Bezbjedno i nesmetano funkcionisanje energetskog sistema
Član 5

Tehničko-tehnološkim rješenjem mora da bude obezbijeđena primjena standarda i tehničkih propisa kojima su utvrneni uslovi i mjere za bezbjednost granevina, postrojenja i opreme u projektovanju, izgradnji i korišćenju energetskog objekta.

Tehničko-tehnološkim rješenjem mora biti predvinen način obezbjenivanja uslova za priključenje objekata iz člana 2 ovog pravilnika na postojeći prenosni, transportni, odnosno distributivni sistem u cilju obezbjeđivanja funkcionalne povezanosti sistema, ukoliko se priključuje na prenosni, transportni, odnosno distributivni sistem.

Tehničko rješenje iz stava 2 ovog člana mora da prati mišljenje operatora prenosnog ili distributivnog sistema (u zavisnosti od naponskog nivoa i instalisane snage energetskog objekta) o mogućnostima i uslovima priključenja planiranog objekta na elektroenergetski sistem.

Lokacija energetskog objekta
Član 6

Zahtjev za izdavanje energetske dozvole može se podnijeti za lokaciju koja ispunjava prirodne i druge odgovarajuće uslove za izgradnju energetskog objekta.

Uz zahtjev za izdavanje energetske dozvole na lokaciji iz stava 1 ovog člana dostavlja se i mišljenje nadležnog organa lokalne samouprave o uklapanju odnosno o mogućnosti uklapanja tog energetskog objekta u koncept korišćenja prostora.

Zaštita životne sredine
Član 7

Tehničko-tehnološkim rješenjem mora biti obuhvaćena i analiza uticaja na životnu sredinu (klimu, zemljište,vode, vazduh, floru i faunu) i na kulturno-istorijska dobra sa mjerama zaštite životne sredine, zaštite prirode I kulturno-istorijskih dobara.

Tehničko-tehnološko rješenje mora biti u potpunosti usklađeno sa uslovima zaštite prirode izdatim od nadležnog organa.

Mjere zaštite zdravlja ljudi i bezbjednosti ljudi i imovine
Član 8

Tehničko-tehnološkim rješenjem energetskog objekta mora se predvidjeti:

1) način sprječavanja štetnog uticaja energetskog objekta na zdravlje ljudi;
2) mjere protivpožarne zaštite;

3) mjere zaštite od eksplozija, havarija i sličnih nezgoda kojima se osigurava bezbjednost ljudi i imovine.

Stepen energetske efikasnosti energetskog objekta
Član 9

Tehničko-tehnološkim rješenjem energetskog objekta mora se predvidjeti optimalni stepen energetske efikasnosti opreme potrebne za rad energetskog objekta, kao i optimalni stepen energetske efikasnosti energetskog objekta.

Korišćenje primarnih izvora energije
Član 10

Tehničko-tehnološkim rješenjem energetskog objekta moraju se predvidjeti uslovi i način racionalnog korišćenja primarnih izvora energije (po vrstama i obimu korišćenja) tokom eksploatacije energetskog objekta.

Predloženo tehničko-tehnološko rješenje sadrži analizu energetske proizvodnje i analizu ekonomske isplativosti.

Predloženo tehničko-tehnološko rješenje za izgradnju hidroelektrane, pored elemenata iz st. 1 i 2 ovog člana sadrži i:

1) pregled svih relevantnih podloga za projektovanje postrojenja (hidroloških, geodetskih, geotehničkih itd);
2) prikaz optimizacije radnih performansi hidroelektrane i
3) razradu građevinskog, mašinskog i elektro-mašinskog dijela projekta.

Tehnička i finansijska sposobnost podnosioca zahtjeva
Član 11

Tehnička sposobnost podnosioca zahtjeva cijeni se na osnovu dokaza o tehničkoj opremljenosti, odnosno opremi koja će se koristiti za izgradnju energetskog objekta za koji podnosi zahtjev, kao i iskustvu u projektovanju i/ili upravljanju energetskim objektom.

Finansijska sposobnost podnosioca zahtjeva cijeni se na osnovu dokaza o načinu obezbjenivanja finansijskih sredstava za izgradnju ili rekonstrukciju energetskog objekta (izjava banke o spremnosti za finansiranje izgradnje energetskog objekta, sopstvena sredstva, kreditna sredstva i slično).

Podnosilac zahtjeva za izdavanje energetske dozvole za proizvodni energetski objekat instalisane snage do 1 MW, koji je upisan u Centralni registar privrednog suda, tehničku sposobnost iz stava 1 ovog člana dokazuje podnošenjem specifikacije opreme koja će se koristiti za izgradnju energetskog objekta za koji podnosi zahtjev.

Doprinos smanjenju emisije CO2
Član 12

Tehničko-tehnološko rješenje energetskog objekta sadrži proračun smanjenja odnosno povećanja emisije CO2 izgradnjom planiranog energetskog objekta.

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Doprinos ispunjenju nacionalnog cilja korišćenja obnovljivih izvora energije
Član 13

Energetska dozvola se izdaje za izgradnju ili rekonstrukciju energetskog objekta koji koristi obnovljive izvore energije, a koji doprinosi ispunjenju nacionalnog cilja korišćenja obnovljivih izvora energije.

Zahtjev za izdavanje energetske dozvole
Član 14

Zahtjev za izdavanje energetske dozvole podnosi se na:

1) Obrascu: "0-1 A" - Zahtjev za izdavanje energetske dozvole za izgradnju energetskog objekta za proizvodnju električne energije instalisane snage do 1 MW;
2) Obrascu: "0-2A" - Zahtjev za izdavanje energetske dozvole za izgradnju energetskog objekta za skladištenje nafte i rezervoarskog prostora za derivate nafte preko 50 tona;
3) Obrascu: "0-2B" - Zahtjev za izdavanje energetske dozvole za izgradnju naftovoda i produktovoda;
4) Obrascu: "0-3A" - Zahtjev za izdavanje energetske dozvole za izgradnju objekta za prenos i distribuciju prirodnog gasa;
5)Obrascu: "0-3B" - Zahtjev za izdavanje energetske dozvole za izgradnju objekta za skladištenje prirodnog gasa i skladištenje tečnog prirodnog gasa;
6)Obrascu: "0-4A" - Zahtjev za izdavanje energetske dozvole za izgradnju objekta za proizvodnju toplote za daljinsko grijanje i/ili hlanenje ili industrijsku upotrebu;
7) Obrascu: "0-4B" - Zahtjev za izdavanje energetske dozvole za izgradnju objekta za distribuciju toplote za daljinsko grijanje i/ili hlanenje ili industrijsku upotrebu.

Obrasci iz stava 1 ovog člana odštampani su uz ovaj pravilnik i čine njegov sastavni dio.

Dokumentacija za objekte za proizvodnju električne energije
Član 15

Uz zahtjev za izdavanje energetske dozvole za izgradnju odnosno rekonstrukciju objekta za proizvodnju električne energije, zavisno od vrste i namjene objekta, uključujući i objekte za istovremenu proizvodnju električne energije i toplote (kogeneracije), podnosilac zahtjeva dostavlja:

1) idejno rješenje (tehničko-tehnološko rješenje) za izgradnju odnosno rekonstrukciju proizvodnog energetskog objekta u skladu sa zakonom;
2) izvještaj pravnog lica o mjerenjima i istraživanjima potencijala obnovljivog izvora energije za objekat koji
koristi obnovljivi izvor;
3) podatke o lokaciji na kojoj treba da se izgradi energetski objekat ’’i izvod iz katastra nepokretnosti’’.
4) mišljenje operatora prenosnog ili distributivnog sistema (u zavisnosti od naponskog nivoa i instalisane snage energetskog objekta) o mogućnostima i uslovima priključenja planiranog objekta na elektroenergetski sistem;
5) mišljenje nadležnog organa lokalne samouprave o uklapanju odnosno o mogućnosti uklapanja tog energetskog objekta u koncept korišćenja prostora (namjena zemljišta);
6) izvod iz strateške procjene uticaja na životnu sredinu lokalnog prostornog plana, odnosno drugi odgovarajući akt;
6a) uslove zaštite prirode izdate od nadležnog organa uprave
7) izjavu banke da je spremna da podrži podnosioca zahtjeva u finansiranju izgradnje energetskog objekta, koja sadrži naziv i vrstu energetskog objekta za koji se izjava daje, lokaciju energetskog objekta, planiranu instalisanu snagu objekta i iznos investicije potrebne za izgradnju energetskog objekta, ili dokaz o obezbijeđenim sredstvima iz sopstvenih izvora;
8) dokaz da podnosilac zahtjeva ispunjava uslove iz člana 11 ovog pravilnika.

Ako se zahtjev podnosi za hidroelektranu podnosilac zahtjeva, pored dokumentacije iz stava 1 ovog člana, dostavlja i izvještaj o bruto energetskom potencijalu vodotoka na kojem se planira izgradnja hidroelektrane izradjenog ili verifikovanog od organa uprave nadležnog za osmatranje i mjerenje hidroloških parametara

Dokumentacija za ostale objekte
Član 16

Uz zahtjev za izdavanje energetske dozvole za objekte iz člana 61 stav 2 tač. 2, 3 i 4 Zakona i naftovode i produktovode, zavisno od vrste i namjene, podnosilac zahtjeva dostavlja elaborat o izgradnji energetskog objekta za koji se traži energetska dozvola, koji naročito sadrži:

1) podatke o lokaciji na kojoj treba da se izgradi energetski objekat;
2) podatke o vrsti, kapacitetu i energetskoj efikasnosti energetskog objekta;
3) podatke o energentima koje će energetski objekat koristiti;
4) tehničko-tehnološko rješenje i način korišćenja postrojenja;
5) podatke o planiranim finansijskim sredstvima za izgradnju energetskog objekta i načinu obezbjenivanja tih sredstava;
6) planirani rok završetka izgradnje i vijek trajanja energetskog objekta;
7) analizu mogućih uticaja na životnu sredinu u toku izgradnje i eksploatacije energetskog objekta sa predlogom mjera zaštite životne sredine;
8) analizu tržišta - način nabavke, preuzimanja i prodaje energenta ili način proizvodnje i prodaje energije, u zavisnosti od vrste energetskog objekta i
9) podatke o uslovima koji se odnose na prestanak rada energetskog objekta.

Uz elaborat iz stava 1 ovog člana dostavlja se:

1) mišljenje operatora prenosnog, transportnog ili distributivnog sistema o mogućnostima i uslovima priključenja planiranog objekta na prenosni, transportni ili distributivni sistem, ukoliko se planira priključenje objekta na sistem;
2) mišljenje nadležnog organa lokalne samouprave o uklapanju odnosno o mogućnosti uklapanja tog energetskog objekta u koncept korišćenja prostora (namjena zemljišta);
3) izvod iz strateške procjene uticaja na životnu sredinu lokalnog prostornog plana, odnosno drugi odgovarajući akt;
4) izjavu banke o spremnosti da podrži podnosioca zahtjeva u finansiranju izgradnje energetskog objekta, koja sadrži naziv i vrstu energetskog objekta za koji se izjava daje, lokaciju energetskog objekta, planiranu
instalisanu snagu objekta i iznos investicije potrebne za izgradnju energetskog objekta, ili dokaz o obezbijenenim sredstvima iz sopstvenih izvora odnosno na drugi način;
5) dokaz da podnosilac zahtjeva ispunjava uslove iz člana 11 ovog pravilnika.

Ugovor o konzorcijumu
Član 17

Uz zahtjev za izdavanje energetske dozvole, konzorcijum, kao podnosilac zahtjeva, dostavlja ugovor o konzorcijumu kojim je utvrđena:

1) solidarna odgovornost svih članova konzorcijuma za izgradnju ili rekonstrukciju energetskog objekta za koji se podnosi zahtjev;
2) djelatnost svih članova konzorcijuma, kao i
3) određen član konzorcijuma koji je ovlašćen da u ime svih članova konzorcijuma preuzima obaveze odnosno bude nosilac posla na izgradnji ili rekonstrukciji energetskog objekta.

Objavljivanje zahtjeva
Član 18

Zahtjev za izdavanje energetske dozvole objavljuje se na internet stranici ministarstva nadležnog za poslove energetike (u daljem tekstu: Ministarstvo) odnosno jedinice lokalne samouprave najkasnije 15 dana, od dana prijema urednog zahtjeva.

Na internet stranici iz stava 1 ovog člana objavljuje se način i mjesto dostavljanja sugestija i predloga povodom zahtjeva za izdavanje energetske dozvole.

Rok za prijem sugestija i predloga iz stava 2 ovog člana ne može biti kraći od 15 dana, od dana objavljivanja zahtjeva na internet stranici.

Predlog za javno nadmetanje
18a

Ako dva ili više zahtjeva za izdavanje energetske dozvole za izgradnju hidroelektrane instalisane snage do 1MW ispunjavaju kriterijume iz člana 10 ovog pravilnika, predložiće se sprovođenje postupka javnog nadmetanja u skladu sa zakonom koji uređuje koncesije.

Registar energetskih dozvola
Član 19

Izdate energetske dozvole upisuju se u registar energetskih dozvola.

U registar iz stava 1 ovog člana upisuju se:

1) naziv i sjedište, odnosno ime i adresa lica kojem je izdata energetska dozvola, (poreski identifikacioni broj PIB i matični broj);
2) broj i datum izdavanja energetske dozvole odnosno datum njenog produženja;
3) broj i datum prijema zahtjeva za izdavanje energetske dozvole;
4) podaci o lokaciji objekta (broj katastarske parcele i katastarske opštine);
5) tehničke odnosno energetske karakteristike objekta i
6) datum prestanka važenja energetske dozvole.

Član 20

Ovaj pravilnik stupa na snagu osmog dana od dana objavljivanja u "Službenom listu Crne Gore".

ATTACHMENT NO.3

Map of the way for obtaining construction permit

September 2015.

ROAD MAP FOR OBTAINING A BUILDING PERMIT FOR THE CONSTRUCTION OF A SMALL HYDROPOWER PLANT IN MONTENEGRO

December 2013., Podgorica

Contents:

Obtaining a Construction permit for construction of Small Hydro Power Plants in Montenegro-The Legal Framework

Obtaining a onstruction permit for all types of power plants in Montenegro requires detailed and complete project documentation as well as other documentation done based on number of strategies, laws and bylaws. Some of them are listed here:

- Energy Development Strategy of Montenegro until 2025,
- Action Plan for Implementation of the Energy Development Strategy of Montenegro until 2025 (in 2008-2012 period),
- Energy Law, ("Sl.list CG", number 28/10)
- Concession Law ("Sl.list CG", number 08/09),
- Law on Spatial Planning and Construction , ("Sl.list CG", number 34/11),
- Law on Ratification of Agreement between European Community and Republic of Montenegro on Formation of Energy Community, ("Sl.list CG", number 66/2006),
- Water Law, ("Sl.list CG", number 27/07),
- Forest Law, ("Sl.list CG", number 74/10),
- Law on Geological research, ("Sl.list CG", number 26/07),
- Law on Hydrometeorological business, ("Sl.list CG", number 26/10),
- Law on State Property, ("Sl.list CG", number 21/09),
- Law on Property relations, ("Sl.list CG", number 19/09),
- Expropriation Law, ("Sl. list CG", number 12/08),
- Law on State Survey and Real Estate Cadastre, ("Sl.list CG", number 32/11),
- Law on Protection and Rescue, ("Sl.list CG", number 5/08),
- Law on Enviromental protection, ("Sl.list CG", number 48/08),
- Law on Financing of Local Self-Government ("Sl.list CG", number 05/08),
- Low on Road Traffic Safety, ("Sl.list CG", number 33/12),
- Rulebook on Method of Making and Content of Technical Documentation ("Sl. list CG", number 22/02),
- Rulebook on Criteria for Issuing Energy License, Content of the Request and Registry of Energy Licenses ("Sl.list CG", number 49/10),
- Rulebook on Content of the Documentation Submitted with the Request for Determining Necessity for Assessment on Environmental Impact ("Sl.listCG", number 14/07),
- Rulebook on Content of Documentation Submitted with Request for Determining the Volume and Content of Study on Environmental Impact Assessment ("Sl.listCG", number 14/07),
- Rulebook on Content of Study on Environmental Impact Assessment ("Sl.listCG", number 14/07),
- Rulebook on Technical Conditions for Connection of Small Power Plants on Distribution Network (Sl. list CG, br. 25/07),

- Decree on Projects for which Environmental Impact Assessment is Necessary ('Sl.list CG', number 20/07),
- Decree on Tariff System for Determining Feed-in Prices of Electricity from Renewable Resources and High Efficient Eco-generation ("Sl. list CG", number 52/2011),
- Temporary Distributive Codex ("Sl.list CG", number 13/2005),
- Rules on Access of Third Party to Transmission and Distribution Networks ("Sl.list" CG, number 13/2007)
- Information on Condition and Method of Performing Detailed Geological Land Survey for Construction of Facilities

1. INTRODUCTION

Montenegro has significant hydropower potential of rivers, which is used with only 17% of the theoretical hydropower potential. Currently in Montenegro there are seven small hydropower (SHP) connected to the power system of licensed manufacturers, including: SHP "Glava Zete" , SHP "Slap Zete"– owned Zeta Energy and SHP "River Mušovića" , SHP "Šavnik", SHP "Lijeva rijeka" , SHP "Podgor" and SHP "Crnojevića River" - owned EPCG. The procedure of realization of projects of renewable energy generation from idea to the building is divided into two main steps including:

- **The authorization , or approval of the project by the Ministry responsible for Energy and the Ministry of Economy and / or local governments**
- **Obtaining the necessary approvals for a building permit from the ministry responsible for the construction and the Ministry of Sustainable Development and Tourism and / or local authorities, or procedures of construction**

The exception to the above mentioned steps, projects that do not require authorization by the Ministry of Economy are:

- **projects using renewable energy installed capacity up to 20 kW, or 50 kWe cogeneration plant, which is in accordance with *Article 90 of the Law on Energy* opt for exchange in place of connection and**
- **projects of electricity or thermal energy that do not use state resources (water, forests) or land, and the energy produced does not qualify for the sitetm electricity or district heating system, but the same for their own needs, or insular systems .**

The authorization, or approval of projects for energy production is done through:

- **public auction or tender procedure *(Law on concessions , and the Law on State Property*)**
- **allocation of energy permit (*Energy Law*)**

2. THE AUTHORIZATION

2.1. Public auction or tender procedure

Procedure for proposing the subject of public bidding can begin state agency responsible for energy affairs and the Ministry of Economy, or in the case of a resource that is given to the use of local interest, public auction procedure can lead and local government. Decision of the Government, or the decision of the Municipal Assembly defines the resources that are planned concession or right of use of the investor on the basis of a public competition.

Montenegrin legislative and regulatory framework all the water (*Water Act*) as well as certain forests (*Forest Law*) are defined as state / local resources. Concessions Act stipulates that the state / local resources may make the use of the specific time period through concessions. In accordance with the same law concessions are awarded through public bidding except in cases stipulated by *Article 20 of the Law on Concessions*. Hereby are awarded concessions on 13 streams for the construction of small power plants throughTender and and Tender II .

Public notice for granting of concessions for exploatation of water flows for the construction of small hydro power plants in Montenegro is published in Montenegrin Official Journal and in that document is presented the object of concession. The document includes a description of the object of concession, locations of concession, the public bidding procedure, basic elements of the Concessionary Act. Concessions are allocated on the basis of public bidding as defined by the *Law on Concessions.* The aim of the public tender offer is a selection of the most suitable for the construction of small hydro power plants.

Concessions Act defines a public tender procedure can be started on the initiative of investors, which suggests the same concession, and bear the costs of preparatory activities and implementation of public bidding.

According to *Law on concessions, Article 41*., any interested person may submit initiative in the process of allocating concessions. The initiative shall be submitted to the competent authority and it should contain the data and information necessary for the preparation of the Concession Act (*Article 19 of the Law on Concessions*). If the competent authority find initiative as acceptable, it will be determined the deadline to submitter of initiative for submitting the deposit of estimated resources for the development of the Concession Act, including the preparation of tender documents and draft of concession contract, the cost of the tender commission work and the cost of a public discussion organisation. The competent authority shall start preparing acts within 15 days after the deposit of the funds.

According to *Article 43. of Law on concessions,* the concession contract should be signed within 15 days from the day of bringing Decision on allocating or according to deadline from Decision on allocating concession, according to tender documentation and submitted bid.

Note: The Investor can start the initiative for granting of concessions on a Public tender, but only for the rivers which installed capacity more than 1 MW and gross energy potential of water flows do exceeds 15 GWh

2.2. Allocation of energy permit

In accordance with the *Law on Energy,* **Energy permit (*energetska dozvola*)** may be issued for four types of structure:

- facilities for the production of electricity;

-facilities to produce heat for district heating and / or cooling, or industrial uses and facilities for distribution of heat for district heating and / or cooling, or industrial use;

-facilities for the storage of oil and water storage for petroleum products over 50 tons, and

-facilities for the transmission and distribution of natural gas storage facilities for natural gas storage facilities and liquefied natural gas.

Energy permits in accordance with the *Energy Law* and the *Rulebook on the criteria for issuing energy permits, contents of the request and register of energy permi*t may be issued for facilities for the production of electricity if:

- **facility uses state resources or land, and has installed capacity up to 1 MW, or streams that are of local significance in accordance with the Water Act and the gross energy potential of water flows do not exceed 15 GWh and**
- **objects that do not use state resources or land**

If energy permit is issued for the construction of power plants with installed capacity up to 1 MW, and using state resources or land, energy permit holder should sign the standard contract of the concession, the lease of land contract and construction of the energy facility contract according to the Government's decision. After this step, it can start procedure of obtaining necessary approvals and conditions in order to obtain The building permit.

In cases where the energy permit is issued for the construction of an energy facility that does not use state resources or land, it can be sterted the procedure of obtaining the necessary

approvals and conditions for the issuance of building permits and construction based only on the energy permit.

Energy permit for the construction of a power plant can be issued only for the facilities which are in accordance with Energy development strategy and The Action plan or program of development and use of renewable energy sources (*Energy Law, Article 62*).

The validity period of an energy permit is two years. A procedure, Request form and necessary documentation which should be submitted along with the Request are determined by the *Energy Law* and the *Regulation on criteria for issuing energy permits, requirements contents and the register of permits*.

According to *Regulation on criteria for issuing energy permits, requirements contents and the register of permits*, *Article 14*., in this case Request for issuance of the Energy permit should be submitted to the Ministry of Economy. Request form (Form „0-1 A“) is available on the website of the Ministry of Economy. The documentation which should be submitted along with the Request is following (*Regulation on criteria for issuing energy permits, requirements contents and the register of permits*, *Article 15.*):

- **Conceptual design (technical design) for construction of the power plant developed in accorda nce with the Montenegrin legal framework**
- **Report by the legal person regarding the measurements and research of the renewable resource potential**
- **Basic information regarding location where was planed a construction of the facility**
- **Opinion about possibilities and requirements for connection of the planned facility on the energy system issued by the Distribution Operator**
- **opinion of the competent local authorities of the fitting or the possibility of fitting the energy facility in the concept of spatial (land use);**
- **excerpt from the strategic assessment of the environmental impact of local spatial plan, or other appropriate document;**
- **a statement by the bank that the bank is willing to support the applicant in financing the construction of the energy facility, including the name and type of energy facility for which the statement is given, the location of energy facilities, planned installed capacity of the facility and the amount of investment required for the construction of the energy facility / or proof that the Investor (the applicant) provided funds from its own resources;**

- **proof that the Investor (the applicant) meets the requirements of Technical and financial ability (Regulation on criteria for issuing energy permits, requirements contents and the register of permits, Article 11.)**

3. DOCUMENTATION NECESSARY FOR OBTAINING A CONSTRUCTION PERMIT

The procedure of construction is defined by *the Law on Spatial Planning and Construction*. Namely, to renewable energy projects began with the realization it is necessary to issueurban-technical conditions , and guidelines for the construction of the facility in accordance with the existing spatial planning documents based on that same issue. Based on the urban-technical conditions shall be prepared project documentation and Preliminary and Main design and collecting approvals necessary for obtaining a building permit .

Building permits issued in accordance with the *Law on Spatial Planning and Construction*, which defines the conditions and documentation to be submitted in the application for a building permit, including revision of technical documentation and resolving property rights issues at the location necessary for the construction of the facility scheduled , as well as a set of approval given in a next chapter.

During a process of obtaining of the Building permit for construction of a SHPP in Montenegro it is necessary to collect all neccesary documentation in accordance with the *Law on Spatial Planning and Construction, Article 91.* The building permit is issued by the Ministry of Sustainable Development and Tourism. During a process of collecting all required documentation it is necessary to develop technical project documentation and obtain all necessary opinions, permits and approvals which will be detailed discussed in this chapter.

According to the *Law on Spatial Planning and Construction*, documentation necessary for receiving **a Building permit (Građevinska dozvola)** is made up of following:

- **Preliminary design or Main design, including a report of performed revision, in 10 copies out of which 7 in protected digital form;**
- **Proof of ownership or of some other right on the construction site/ or a proof of a building permit or of some other right if facility reconstruction is being performed, and copies of the plan;**
- **Approvals, opinions and other proofs determined by specific regulation;**
- **Proof of liability insurance of the investor and the company, legal person i.e. an entrepreneur which created or revised the Preliminary Design.**

3.1. Trchnical project documentation – Preliminary design and Main design

For the purposes of issuing a Building permit it is neccesary to submit technical project documentation, that is Preliminary design or Main design. The initial document for preparing technical project documentation is Urban-technical conditions (Urban-planing).

Urban-technical conditions (*Urbanističko-tehnički uslovi*), hereinafter UTU, are guidelines for construction are the first step towards obtaining a building permit. UTU are issued in accordance with the *Law on Spatial Planning and Construction* on the adopted spatial planning documents.

The competent authority for the development of spatial planning documents or the local government where the water flow is present, is required to develop local spatial planning documents in accordance with accepted Conceptual design. In accordance with the *Law on Concessions*, the Ministry of Economy of Montenegro is preparing the Concession Act, which is the basic document for initiation of the procedure for granting a concession for the use of rivers for the construction of small hydropower plants in Montenegro. A documentation which should be submitted along with the request for issuance of UTU is determined by the Concession Act.

In case that the concession contract is signed on the basis of allocated energy permit, in order to obtain UTU, along with the Request (form according to the Regulations on the forms used in the construction procedures) it is necessary to submit following documentation to the Ministry of Sustainable Development and Tourism :

- Land lease contract
- Copies of the plan and immovable property certificate
- Energy permit
- The concession contract (if applicable)
- Conceptual design
- Official Journal of Montenegro (Službeni list Crne Gore) in which was published decision on awarding the concessions (if applicable)

Depending on the type of building, UTU contains (*Law on Spatial Planning and Construction, Article 62.*):

- Opinion on the need for assessment of environmental impact issued by the Agency of Environmental Protection

-Report of the Montenegrin Electric Enterprise (EPCG) issued by EPCG Nikšić FC Podgorica

-Water requirements issued by Department of Water

-Technical conditions issued by Agency for Electronic Communications and Postal Services

-Traffic and technical requirements uslovi issued by Transport Directorate of Montenegro
Technical project documentation is made up of textual, numerical and graphical documentation which determines concepts, terms and method of construction of the facility and should be done in accordance with UTU. The technical project documentation should be done according to *Rulebook on the design and content of the technical documentation.* According to *Law on Spatial Planning and Construction, Article 83*, Technical documentation can be developed by company, legal person or entrepreneur who is registered in the Central Registry of the Commercial Court for the activity of developing of technical documentation and meets the requirements of this law. Company, legal person or entrepreneur who produces technical documentation shall employ responsible designer. According to *Rulebook on the design and content of the technical documentation, Article 23. i Article 24.*, technical project documentation must contain general documentation regarding the project:

1) information about the name and address of the Investor of construction;
2) excerpt from the court or other appropriate register for a company or other legal entity that has developed the technical project documentation;
3) decision on compliance with the requirements for technical documentation (license);
4) authority to design for individuals who participated in developing of the technical project documentation;
5) decision on determining of the main responsible project designer and the decision on determining the responsible designers of certain phases of the project.

According to *Law on Spatial Planning and Construction, Article 86.,* Preliminary and Main design have to be audited. Prema *Zakonu o uređenju prostora i izgradnji objekata, član 86.,* idejni i glavni projekat podliježu reviziji. An audit includes: verification of compliance of the project with the urban-technical conditions, assessment of specific substrates for the foundation of the structure, verify the correctness and accuracy of the technical solutions of the facility; architectural concepts of construction, verification of stability and security; rationality engineered materials, compliance with laws and regulations, technical regulations, standards and quality; mutual compliance of all parts of the technical documentation and verification of bill of quantities of construction work on the building. The auditor is appointed by Investor. Audit costs for Preliminary design and Main design should be covered by Investor.

Idejni i glavni projekat should be completed in accordance with *Law on Spatial Planning and Construction* and with *Rulebook on the design and content of the technical documentation*.
Based on results of previous measurements and analyses it should be completed following basic technical documentation which represent base for developing of the technical project documentation:

1) Geological Study (according to *Law on Geological Research, Rulebook on the design and content of the technical documentation*);

Geological Study is prepared on the basis of soil research at the locations of interest for the construction of the SHPP. This study is used as the base for determination of the precise location of the powerhouse, intake, etc. Geological Study have to be audited.

2) Geodetic Study (according to *Rulebook on the design and content of the technical documentation*);

Geodetic Study is prepared on the basis of geodetic survey of the field in order to developing graphical view and maps of the field. For Geodetic Study it is also required audit.

3) Hydrologic Study (according to *Rulebook on the design and content of the technical documentation* and *Law on hydrometeorological business*);

Hydrologic measurements which are used to develop Hydrological Study at the request of the investor can exercise the Hydrometeorological Institute of Montenegro in accordance with the *Law on hydrometeorological business*. These measurements can be also done by legal entity in accordance with the Regulation on detailed conditions to be met by a legal entity to measure and explore the potential of renewable energy resources.

4)The decision on the conditions for the connection of SHPP to the distribution network (according to *The procedure for issuing documents for the connection of small power plants to the distribution network* and *Rulebook on Technical Conditions for Connection of Small Power Plants on Distribution Network*)

The Investor have to submit corresponding Request for issuing the conditions for the connection of SHPP to the distribution network to the Distribution Operator (FC Distribution Department in Podgorica). The corresponding form for the Request is given in *The procedure for issuing documents for the connection of small power plants to the distribution network.* On the basis of the Study on the connection of SHPP to the distribution network along with all necessary documentation, Distribution Operator have to issue The decision on the conditions for the connection of SHPP to the distribution network. The Study can be made by the Distribution Operator or or legal entity that meets the necessary requirements.

Conceptual design (*Idejno rješenje*) represents a starting point for creation of the Preliminary design. Conceptual design is a project which determines general conception, technical, technological and economic characteristics, as well as feasibility of constructing the facility.

It contains data on: facility's macro-location, the way of providing infrastructure (electricity, hydro-technical, telecommunication and other); possible variants of spatial and architectonic solutions; functionality and rationality of solution.

Conceptual design is done for the needs of the investor, as well as for purpose of checking the attractive locations in the planned documentation through public tender.

Preliminary design (*Idejni projekat*) is project which determines: position, capacity, architectural, technical, technological and functional characteristics of the facility; organizational elements of facility's construction; elements of facility maintenance, estimated value of construction works. Preliminary design contains data on: facility's micro-location; technical-technological and facility's exploitation characteristics; approximate calculation of facility's stability and security; technical-technological and organizational elements of facility's construction; analysis of variant energy systems of facilities/buildings with their energy efficiency estimate; infrastructure solution, analysis of variant, constructive and building solutions; estimated value of works on facility construction.
Preliminary design, in according to regulation, also contains data on estimation of environmental impact.
Stages of construction can also be added to the Preliminary Design (technical-technological and functional unity).
Preliminary design is created for the purpose of issuing a building permit.

Main design (*Glavni projekat*) is a project which defines the technological, architectural, constructive, technical and exploitative characteristics of facility with equipment and installation, including elaboration of all necessary details for construction of facility and value of works on the construction of the facility.
Main design particularly contains:
1) architectural i.e. building solutions, calculation of stability and safety of the facility, as well as calculations in the field of building physics and energy efficiency;
2) elaboration on technical, technological and exploitative characteristics of the facility with equipment and installations, including the energy performance of facilities / buildings;
3) elaboration on details for works performance included in the Main design , as well as technical, technological and organizational solutions for the facility construction;

4) elaboration on facility's connection to the corresponding roads and other infrastructure and site improvements
5) technical solutions for protection of the facility and neighboring buildings from fire, explosions, as well as other technical solutions for safety issues;
6) Elaboration of measures for prevention or reduction of negative impacts on the environment;
7) construction costs and maintenance;
8) other projects and studies in accordance with the purpose of the facility.

If the Main design envisages installation of parts, elements and equipment which is factory produced, it must contains proofs that the documentation connected to production of those parts, elements, equipment and its functionality exists.

Main design is created for the need of issuing building permit as well as building of the facility.

3.2. Proof of ownership on the construction land, copies of the plan

The Investor is obligated to solve the property rights on the location where is planed the construction of the small hydro power plant (*Spatial Planning and Construction Law*). In case of wining the tender and signing the concession contract, the land planed for construction of SHPP shall be expropriated, according to *Expropriation Law*. The same applies for the case that the energy permit is issued for the facility that uses state resources or land. In the case of obtaining energy permit for the facility that does not use state resources and land, property relations are solved by signing of purchase contracts or expropriation (*Law on Property Relations*). According to *Law on State Survey and Real Estate Cadastre,* Proof of ownership on the construction land and copies of the plan are issued by Real Estate Administration.

3.3. Approvals, opinions and permits

There are a number of **approvals** needed to get building permits:

1. **Electricity Approval (*elektroenergetska saglasnost*)**
2. **Water Supply Approval (*vodovodna saglasnost*)**
3. **Fire Protection Approval(*protivpožarna saglasnost*)**
4. **Enviromental Approval(*ekološka saglasnost*)**
5. **Work Safety Approval(*zaštita na radu*)**
6. **Transportation Approval(*saobraćajna saglasnost*)**
7. **Agricultural Approval(*poljoprivredna saglasnost*)**
8. **Geo-mechanical Approval(*geomehanička saglasnost*)**
9. **Approval for Protection of Cultural Heritage (*saglasnost za zaštitu spomenika*)**

Electricity Approval (*elektroenergetska saglasnost*) is given by Montenegrin Electric Enterprise in accordance with *The procedure for issuing documents for the connection of small power plants to the distribution network.* With request for giving approval, it is also necessary to submit following documents:

- preliminary design
- revised Main design
- urban and technical conditions for construction, if not contained in the facility's project for connection of power plant.

- Energy permit issued by Ministry of Economy

Water approval (*vodna saglasnost*) is received according to the *Water law, Article 15.,* by the Department of water. For receiving the Water approval following documentation should be sibmitted:

- Enviromental approval
- Design review (internal)
- Urban planning conditions (UTU);

Note: Design have to be developed in accordance with water requirements (contained in UTU)

Fire Protection Approval (*protivpožarna saglasnost*) is received based on the Fire Protection Elaborate which can be created only by companies which have appropriate licenses according to *Law on Protection and Rescue, Article 89*. This approval is issued by the Ministry of the Interior (Inspector for fire protection, explosive, damages and technical protection of the building).

Enviromental Approval (*ekološka saglasnost*)

For a plant with 300MW power Environmental Impact Assessment can be required (*Decree on Projects for which Environmental Impact Assessment is Necessary*). Therefore, according to *The Law on Environmental Protection* it is necessary to submit the Request for Determining the Need for Environmental Impact Assessment (*Ordinance on the content of documentation to be submitted with the application for making the necessary changes influence*), but only in case it has not included in UTU. If it is found that the environmental assessment is necessary, it is necessary to submit a Request for determining the scope and content of an environmental impact Study. Along with the Request it is necessary to submit documentation according to the *Rulebook on Content of Documentation Submitted with Request for Determining the Volume and Content of Study on Environmental Impact Assessment*. In preparing the Study on the assessment of environmental impact it is necessary to fulfill requests listed in the *Rulebook on Content of Study on Environmental Impact Assessment*. Enviromental approval is issued by the Agency of enviromental protection, so all requests have to be submitted to this institution.

Transportation approval (*saobraćajna saglasnost*) is issued by the Directorate of Transportation of Montenegro (*Law on Road Traffic Safety*). It is neccesary to submit the Request along with the UTU.

Water Supply Approval (*vodovodna saglasnost*) is issued by Public Utility Company (*JP Vodovod i kanalizacija*). For information regarding documentation which should be submitted it is neccesary to contact a responsible person (contact person).

Agricultural Approval *(Poljoprivredna saglasnost)* is issued by the Forest Administration. In case that during the construction of SHPP on that location occurs deforestation, it is necesary to have Approval of deforestation issued by the Forest Administration. Documentation which have to be submitted along with the request is following:

- UTU
- Conceptual design-idejno rjesenje

Geo-mechanical Approval *(Geomehanička saglasnost)* is received based on the Request of the Investor which should be submited to the Ministry of Eonomy. Required documentation:

-Geological Study
- Project of Detailed Geological Land Survey with revision clause (done in accordance with particular regulations)
- Topographic layer with appropriate scale (up to 1:100 000, rarely 1:200 000) with clearly marked borders of surveyed area and visible coordinates and side length (in 2 copies)
- Proof of 150 000€ payment in the budget of Republic of Montenegro

Approval on the submitted Geological Study is issued by the Ministry of Economy, according to *Law on geological research* and *Information on the conditions and methods of works detailed geological studies of soil for construction*.

Approval on Protection of Cultural Heritage *(Saglasnost za zaštitu spomenika kulture)* is necessary in case there is a cultural heritage landmark on the site of planned power plant. For the Consent it is necessary to send Conceptual Design on a CD or through e-mail to Ministry of Culture, Sport and Media, and they will respond after 15 days if for the given location it is necessary to get their Approval.

Permits and opinions which Investor have to obtain during the process of collecting documentation required for Building permit are following:

- **opinion *(mišljenje)*** of transmission or distribution operator (depending on the voltage level and installed power of the energy facility) about possibilities and requirements for connection of the planned facility on the energy system – attached to the request for obtaining UTU

- **opinion *(mišljenje)*** of the competent local authorities of the fitting or the possibility of fitting the energy facility in concept of spatial use (land use)- attached to the request for obtaining UTU

- **opinion *(mišljenje)*** on the need for assessment of environmental impact issued by the Agency for Environmental Protection - obtained within the UTU

- **Energy permit (*Energetska dozvola*) –** issued by the Ministry of Economy (if applicible)

3.4. Proof of liability insurance

Proof of liability insurance of the Investor and of the company, legal person or entrepreneur who has developed and revised the Preliminary design and the Main design are issued by the insurance company. This insurance covers the liability of a professional activity.

3.5. Submitting of the Request for issuance of The building permit

In accordance with the *Law on Spatial Planning and Construction, Article 92.* Request for issuance of The building permit is submitted by the Investor. The Request should contain basic informations regarding the facility and the Investor as well as all necessary documentation listed below. Submitted Request for issuance od The building permit is published on the the website of administrative authority within seven days from the date of application. According to the *Law on Spatial Planning and Construction,* following documentation have to be submitted:

- **Preliminary or Main design, including a report of performed revision, in 10 copies out of which 7 in protected digital form;**
- **Proof of ownership or of some other right on the construction site/ or a proof of a building permit or of some other right if facility reconstruction is being performed, and copies of the plan;**
- **Urban-technical conditions (UTU)**
- **Elactricity approval**
- **Water supply approval**
- **Fire protection approval**
- **Enviromental approval**
- **Transportation approval**

- **Water approval**
- **Agricultural approval**
- **Geo-mechanical approval**
- **Approval on protection of cultural heritage**
- **The decision on the conditions for the connection of SHPP to the distribution network**
- **Study on the connection of SHPP to the distribution network**
- **Energy permit (if applicible)**
- **The concession contract (if applicible)**
- **Geological Study**
- **Audit report on the Preliminary or the Main design, depending on which design is submitted in attachment of the Request for inssuance of The building permit**
- **All necessary proof liability insurance**

4. IMPORTANT ADDRESSES AND DEADLINES

Review of all relevant addresses in the process of the obtaining necessary documentation for obtaining The building permit is given below. Information regarding deadlines for issuance of neccesary documentation (approvals, opinions, permits) is given according to the laws, rulebooks, decrees and other documentation listed at the beginning of this document. From the experience of our company in a similar procedure as well as informations from the relevant websites, it was also given list of contacts.

Table 1.1.: *Important addresses and deadlines*

The competent authority	Documentation / deadlines[1]	Address	Contact
Ministry of Economy Directorate of energetics	**Energy permit**	Rimski trg broj 46, 81000 Podgorica	Contact person - **Anton Ljucović** **Phone number:** (+382)20 482 251; 482 295; **Fax:** (+382)20 234 027; **E-mail:** anton.ljucovic@mek.gov.me
	Geo-mechanical approval / 15 days		Contact person: **Goran Vušović** **Telefon:** 067/657-040
Ministry of Sustainable Development and Tourism Directorate of construction	**The building permit** / 60 days	IV proleterske brigade broj 19, 81000 Podgorica	Contact person-**Milica Abramović**, manager **Phone number:** (+382) 20 446 264 **E-mail:** milica.abramovic@mrt.gov.me
	Urban-technical conditions (UTU) / 45 days		
Real Estate Administration Department of Real Estate Cadastre	**Proof of ownership, copies of the plan**	Ul. Kralja Nikole 27/V sprat PC „Čelebic" 81000 Podgorica	**Phone number:** (+382) 20 444-015 **Fax:** (+382) 20 444 004 **E-mail:** nekretnine@t-com.me
Montenegrin Electric Eneterprise Functional Unit Distribution in Podgorica (FC Distribucija	**The decision on the conditions for the connection of SHPP to the distribution network** / 45 days	FC Distribucija, ul. Ivana Milutinovića 12, 81 000 Podgorica, Crna Gora	Contact person: **Dragan Prenučić, Velimir Strugar** **Phone number:** (+382) 20 408 400 **Fax:** (+382) 20 241 235

[1] Deadlines are valid from the date of submitting the request

Podgorica)	**Electricity approval- The decision to consent to the connection of SHPP to the distribution network** / 30 days		
	Opinion about possibilities and requirements for connection of the planned facility on the energy system		
Department of water	**Water approval** / 30 dana	Bulevar Revolucije br. 24, 81000 Podgorica	Contact person: **Ivana Bajković** **Tel**: (+382) 69 444 248 **Fax:** +382 20 224 594
Public Utility Company	**Water Supply approval**	UlicaZetskih vladara bb. 81000 Podgorica	Contact person: **Filip Markid** **Phone number:** +382 20 440 304 **Fax:** +382 20 440 308
M U P - Inspector for fire protection, explosive, damages and technical protection of the building	**Fire protection approval**	Bulevar Svetog Petra Cetinjskog 22, 81000 Podgorica	Contact person: **Vesko Mitrovic** **Phone number:** (+382) 67 284 065
Agency of enviromental protection	**A decision on the need for assessment of environmental impact** / 30 days	IV Proleterske 19 , 81000 Podgorica	Contact person: **Sava Vuletić i Ilija Radović** **Phone number:** (+382)20 618 260 **Fax:** (+382) 20 618 246
	The decision on the scope and content of the Study on the assessment of environmental impact / 70 days (this step may be unnecessary-*Decree on Projects for which Environmental Impact Assessment is Necessary*)		
	Approval on the Elaborate on enviromental impact assesment – Enviromental		

	approval/ 50-70 days		
Directorate of Transportation of Montenegro	**Transpotration approval** / 3-15 days	IV proleterske 19, 81000 Podgorica	Contact person: **Radojica Poleksić** **Phone number** : (+382) 20 655 367 **Fax:** (+382) 20 655 359
Forest Administration	**Agricultural approval** / 15-20 days	Miloša Tošića bb, 84210 Pljevlja	Contact person: **Miloš Rosić** **Phone number:** (+382) 68 872 444 **Fax:** (+382) 89 323730
Ministry of Culture, Sport and Media	**Approval on Protection of Cultural Heritage** / 15 days	Vuka Karadžića 3, 81000 Podgorica	Contact person: **Mitra Cerović** **Phone number:** 020 231 561 **Fax**: +382 20 231 540

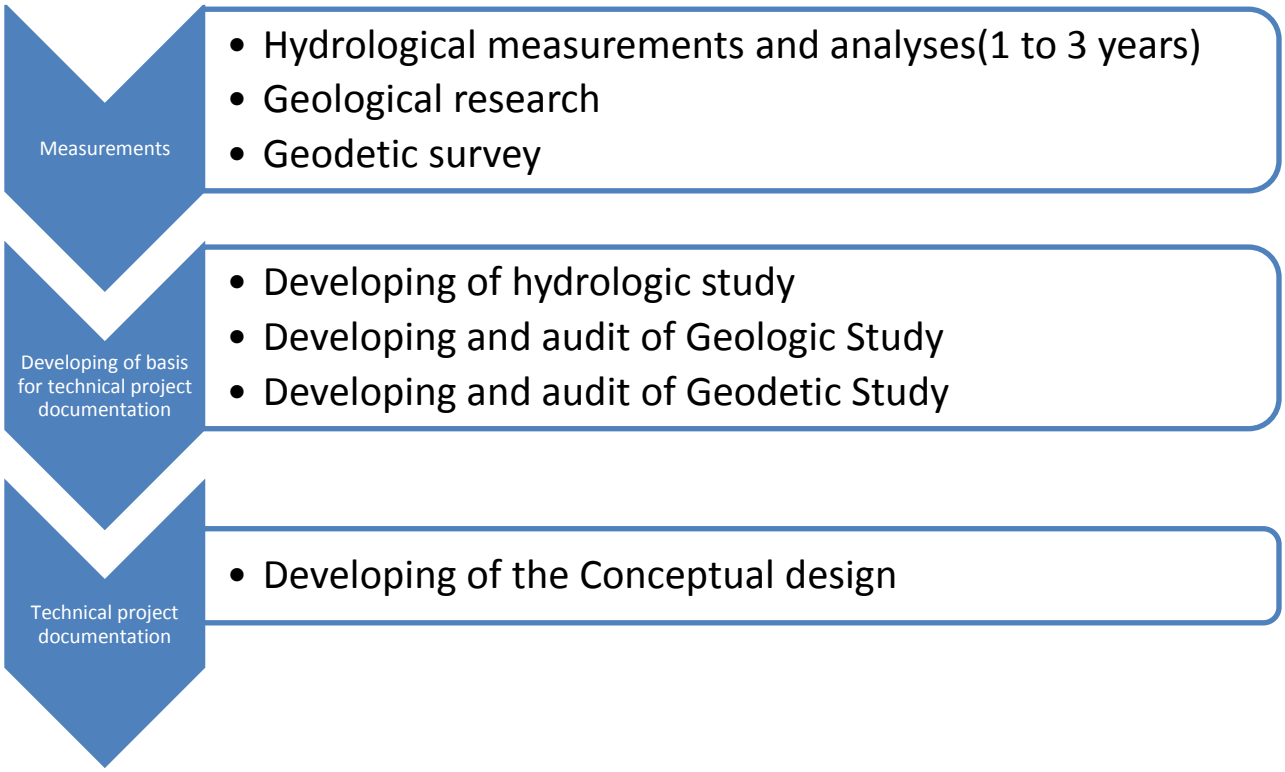
5. BLOCK DIAGRAM

The whole procedure of obtaining a building permit (necessary documentation and steps) can be presented chronologically through three steps:

- **Research and assesment of the potential**
- **Authorization**
- **Developing of the technical project documentation and obtaining of approvals**

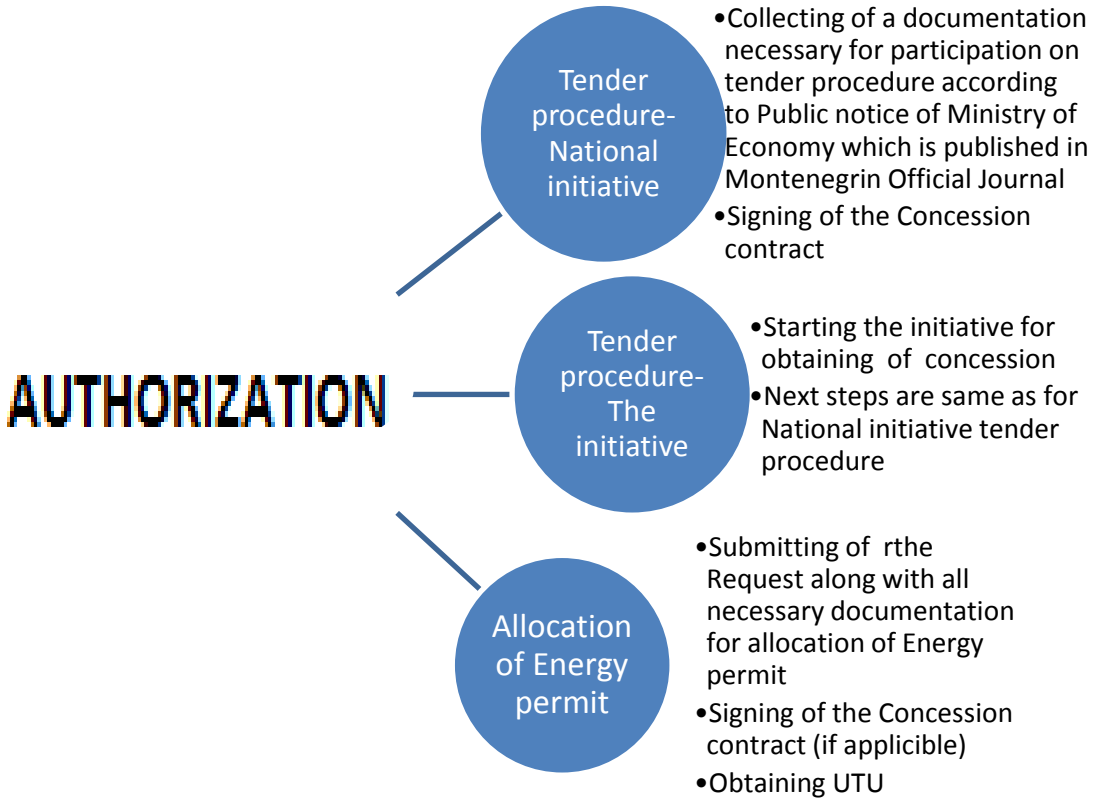
Each step is discussed separately, and finally it was listed all the necessary documentation.

Block diagram 1.1.: *Researchand assesment of the potential*



PREPARATION FOR THE PROCESS OF AUTHORIZATION

Block diagram 1.2.: *Authorization procedure*



OBTAINING A DOCUMENTATION NECESSARY FOR OBTAINING THE BUILDING PERMIT

Block diagram 1.4.: *Developing of a technical project documentation*

SOLVING OF PROPERTY ISSUES ON A LOCATION PLANED FOR CONSTRUCTION OF A SHPP

↓

OBTAINING OF URBAN TECHNICAL CONDITIONS (UTU)

↓

DEVELOPING OF THE STUDY ON THE CONNECTION OF SHPP TO THE DISTRIBUTION NETWORK

↓

OBTAINING OF THE DECISION ON THE CONDITIONS FOR THE CONNECTION OF SHPP TO THE DISTRIBUTION NETWORK

↓

DEVELOPING STUDY ON THE ENVIROMENTAL IMPACT ASSESMENT

↓

OBTAINING OF THE ENVIROMENTAL APPROVAL

↓

DEVELOPING OF A PRELIMINARY DESIGN

↓

AUDIT OF THE PRELIMINARY DESIGN

↓

OBTAINING OF APPROVALS

↓

DEVELOPING OF A MAIN PROJECT

AUDIT OF THE MAIN PROJECT

COMPLETITION OF A DOCUMENTATION NECESSARY FOR OBTAINING THE BUILDING PERMIT

Final chronological overview of completing the documentation that is necessary to submit in order to obtain the building permit:

GEOLOGICAL STUDY
ENERGY PERMIT
THE CONCESSION CONTRACT
PROOF OF OWNERSHIP AND COPIES OF THE PLAN
URBAN-TECHNICAL CONDITIONS (UTU)
STUDY ON THE CONNECTION OF SHPP TO THE DISTRIBUTION NETWORK
THE DECISION ON THE CONDITIONS FOR THE CONNECTION OF SHPP TO THE DISTRIBUTION NETWORK
THE PRELIMINARY PROJECT OR THE MAIN PROJECT
AUDIT REPORT OF THE PRELIMINARY PROJECT OR THE MAIN PROJECT
ALL OBTAINED APPROVALS
PROOF LIABILITY INSURANCE

DOCUMENTATION REQUESTED TO BE SUBMITTED IN ORDER TO RECEIVE THE BUILDING PERMIT

Documentation should be submitted along with completed Request form for issuance of The building permit. Request form is available on the website of the Ministry of Sustainable Development and Tourism (http://www.mrt.gov.me/biblioteka/obrasci)

6. LIST OF USEFUL LINKS

Below it was given the list of links which could be useful to Investor as well as to project designers and all who take a part in projects of SHPP in Montenegro:

http://www.oie-res.me/

http://www.epcg.co.me/

http://www.tso-epcg.com/nono/

http://regagen.co.me/

http://www.sluzbenilist.me/Naslovna.aspx

http://www.mrt.gov.me/ministarstvo

http://www.mrt.gov.me/biblioteka/obrasci

http://www.mek.gov.me/ministarstvo

http://www.mek.gov.me/biblioteka/zakoni

http://www.mpr.gov.me/ministarstvo

http://www.ingkomora.me/ikcg_sajt/site_cg/public/index.php/index/artikli?id=682

http://www.epa.org.me/

http://www.upravazavode.gov.me/uprava

http://www.meteo.co.me/index.php

http://www.geozavod.co.me/

http://www.gov.me/naslovna

http://www.privrednakomora.me/